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United Cities and Local Governments
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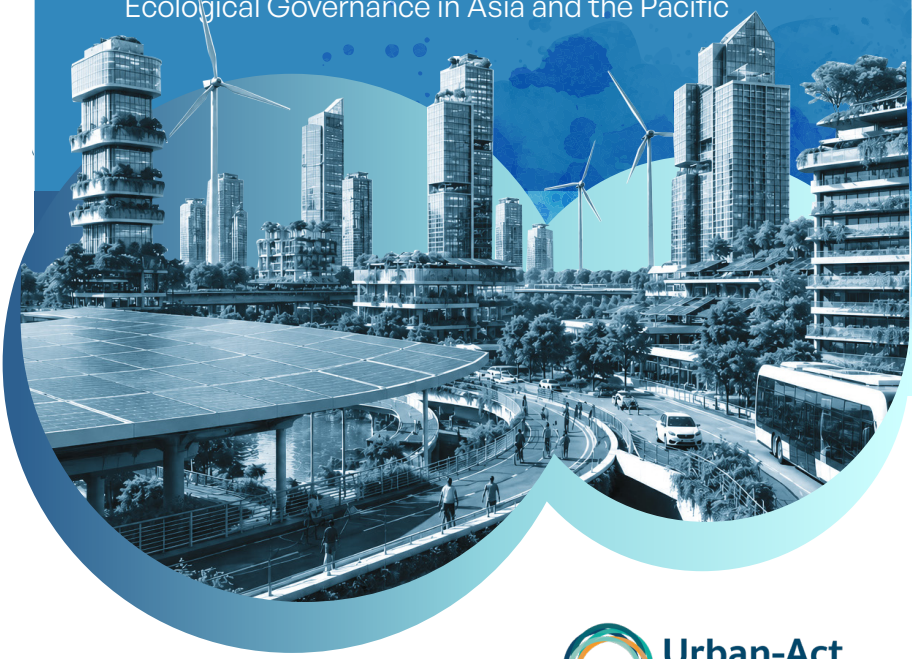
Learning Note

#2

Nature-Based Solutions in Intermediary Cities

Rethinking Urban Resilience through Ecological Governance in Asia and the Pacific



Urban-Act
Integrated Urban Climate Action
for Low-Carbon & Resilient Cities

Nature-Based Solutions in Intermediary Cities

Rethinking Urban Resilience through Ecological Governance in Asia and the Pacific

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FOREWORD

Across Asia and the Pacific, cities are learning an important lesson: resilience cannot be built by concrete and technology alone. As climate risks intensify, urban areas are increasingly exposed to floods, heat, water stress, biodiversity loss, and environmental degradation. These pressures remind us that the future of cities depends not only on how we build, but also on how we protect, restore, and work with the natural systems that sustain urban life. Nature-based solutions provide a practical and transformative pathway for this transition. Wetlands, urban forests, rivers, lakes, green corridors, and water retention landscapes are not empty or unused spaces; they are living infrastructure that can reduce risks, improve public health, support livelihoods, strengthen biodiversity, and create more liveable communities.

This Learning Note brings together experiences from the Learning and Pairing Session on Nature-Based Solutions, held under the Urban-Act Project in the context of the Tenth United Cities and Local Governments Asia-Pacific Congress in Goyang, Republic of Korea. Through city-to-city exchange, local governments shared how they are applying ecological approaches to address flooding, urban heat, lake restoration, water retention, urban greening, and circular resource management. The cases presented in this publication show

that nature-based solutions are not small environmental add-ons, but strategic urban interventions that require leadership, planning, financing, technical capacity, and sustained community participation.

More importantly, these experiences point to the need for a change in mindset: cities must begin to see nature as an ally in development, not as land waiting to be converted. UCLG ASPAC remains committed to supporting local governments in this transition through peer learning, decentralised cooperation, and regional knowledge exchange. We will continue to help cities strengthen their capacity to design solutions that are locally grounded, ecologically sound, and socially inclusive. The path ahead is clear: the resilient city of the future will be one that grows with nature, not against it.

Dr Bernadia Irawati Tjandradewi
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INTRODUCTION

Cities across Asia and the Pacific are increasingly facing complex urban challenges driven by rapid urbanisation, climate change, and growing demands for sustainable infrastructure. For intermediary cities, nature-based solutions offer a practical pathway to strengthen resilience by integrating rivers, wetlands, lakes, urban forests, green corridors, and water retention landscapes into urban planning and governance. These ecological assets can help regulate floods, reduce urban heat, improve water quality, support biodiversity, and enhance public wellbeing, especially in cities with limited institutional capacity and technical resources.

In this Learning Note, ecological governance refers to how local governments recognise, plan, finance, manage, and protect natural systems as part of urban development. It means treating wetlands, rivers, lakes, forests, green spaces, and water retention landscapes not as leftover land, but as ecological assets that provide essential urban services and support climate adaptation, environmental regulation, and community-based management.

Recognising these challenges, the Learning and Pairing Session on nature-based solutions was convened during the 10th UCLG ASPAC Congress, held from 24 to 26 September 2025 in Goyang, Republic of Korea. Organised by UCLG ASPAC in collaboration with UCLG World Secretariat under the Urban-Act Project, the session brought together local governments, experts, practitioners, and development partners to exchange experiences and explore how nature-based approaches can be integrated into urban development strategies.

A key feature of the session was the city pairing approach, which connected Urban-Act pilot cities with knowledge cities and partners. Through presentations, expert reflections, and structured dialogue, cities shared project ideas, discussed local challenges, and received feedback linked to the development of Capstone Projects. The session generated regional learning on how intermediary cities can integrate nature-based solutions into planning, governance, financing, and implementation to strengthen resilience across Asia and the Pacific.

BACKGROUND

Nature-Based Solutions in Intermediary Cities: Global Trends and Policy Context

Urbanisation is transforming the global landscape at an unprecedented pace. According to the United Nations Department of Economic and Social Affairs, around 55 per cent of the world's population currently lives in ur ban areas, and this share is projected to increase to approximately 68 per cent by 2050, adding nearly 2.5 billion people to cities worldwide. Much of this urban growth will occur in Asia and Africa, which together are expected to account for nearly 90 per cent of future urban population growth.[1]

While megacities often dominate global discussions on urbanisation, a significant share of this expansion is occurring in intermediary cities and medium-sized urban centres. These cities play an increasingly important role as regional economic hubs,

[1]United Nations, Department of Economic and Social Affairs. (2018). 68% of the world population projected to live in urban areas by 2050, says UN.

https://www.un.org/development/desa/en/news/population/2018-revision-of-world-urbanization-prospects.html

connecting rural economies with national and international markets. According to global urban development assessments, most urban population growth in developing regions is expected to occur in small and intermediate cities, where governance capacity, infrastructure provision, and environmental planning often lag behind the pace of expansion.[2]

At the same time, rapid urbanisation is placing increasing pressure on natural ecosystems and urban infrastructure. Urban land area worldwide is expected to expand dramatically as cities grow outward to accommodate population and economic activities. The expansion of built environments often results in the loss of wetlands, forests, and other ecosystems that historically provided critical environmental services such as flood regulation, cooling, and biodiversity support. Cities are also responsible for a significant share of global environmental impacts, generating over 70 per cent of global carbon dioxide emissions and consuming most of the the world's energy and resources.

Environmental and Urban Resilience Implications

The transformation of natural landscapes into dense urban environments has profound consequences for environmental sustainability and urban resilience. One major effect is the intensification of the urban heat island phenomenon, where built surfaces such as asphalt and concrete absorb and retain heat, leading to significantly higher temperatures in cities compared with surrounding rural areas. Studies show that urban temperatures can be 3 to 7 degrees Celsius higher than nearby rural environments due to this effect, increasing energy demand and exposing urban populations to heat-related health risks.

[2] United Nations. (2023). Goal 11: Make cities and human settlements inclusive, safe, resilient and sustainable. *https://unstats.un.org/sdgs/report/2023/goal-11/*

The degradation of natural ecosystems also contributes to rising flood risks. Flooding remains the most common natural disaster worldwide, accounting for approximately 43 per cent of all recorded disasters globally. In many rapidly urbanising cities, the replacement of permeable soil with impervious surfaces such as roads and buildings increases stormwater runoff and overwhelms existing drainage systems, resulting in more frequent and severe urban flooding.

These environmental pressures have direct implications for public health and urban quality of life. Higher temperatures increase the incidence of heat stress and cardiovascular diseases, while flooding can contaminate water supplies and damage critical infrastructure. Reduced access to green spaces also affects mental health and social wellbeing, particularly in densely populated urban neighbourhoods where residents have limited access to natural environments.

Nature-Based Solutions as an Urban Development Strategy

In response to growing urban climate risks, nature-based solutions have emerged as an important approach for strengthening resilience while supporting sustainable development. They refer to actions that protect, restore, or sustainably manage ecosystems to address societal challenges while generating benefits for people and the environment. In cities, this means using natural systems not as passive landscapes, but as functional assets that help manage risks and improve urban quality of life.

Urban nature-based solutions can include urban forests, green corridors, wetland restoration, green roofs, vegetated buffers, retention ponds, and vegetation-based stormwater systems. These interventions work with natural processes to provide ecosystem services such as cooling, flood regulation, water filtration, carbon storage, and biodiversity

conservation. Evidence shows that urban greening and tree cover can reduce local temperatures, with some studies finding reductions of around 3 degrees Celsius, and up to 5 degrees Celsius under certain conditions depending on urban form, vegetation density, and local climate.

For intermediary cities, the potential of nature-based solutions is particularly significant. Many still retain rivers, wetlands, agricultural land, forested areas, lakes, and open spaces within or near their urban boundaries. If these assets are protected and integrated into urban planning early, they can function as natural infrastructure that reduces climate risks, supports public health, improves liveability, and lowers long-term pressure on conventional infrastructure.

International Policy Frameworks

The importance of integrating environmental sustainability into urban development is increasingly reflected in global policy frameworks. The 2030 Agenda for Sustainable Development calls for cities to become inclusive, safe, resilient, and sustainable, with Goal 11 emphasising the need to reduce urban environmental impacts and improve access to safe, inclusive, and accessible green spaces. These priorities are closely linked to nature-based solutions, which connect urban resilience with environmental protection and public wellbeing.

The Paris Agreement also reinforces the role of cities and local governments in climate mitigation and adaptation. Many national climate strategies now recognise urban action through ecosystem-based adaptation, sustainable land use, green infrastructure, and resilience-building measures. This provides local governments with opportunities to align nature-based solutions with national climate commitments and access broader policy and financing support.

Other frameworks further strengthen this agenda. The Sendai Framework emphasises resilience to climate-related hazards, while the New Urban Agenda promotes environmentally sustainable urban planning and the protection of urban ecosystems. Together, these commitments show that nature-based solutions are not separate from global development agendas, but offer a practical pathway for combining climate adaptation, disaster risk reduction, biodiversity protection, and sustainable urban development.

The study visit to Janghang Wetland provided participants with a practical example of how ecological conservation can be integrated into urban resilience planning. Located in Goyang Special City near the lower basin of the Han River, the wetland forms part of the broader Han River estuary ecosystem and supports reed beds, tidal flats, and riparian vegetation. As a Ramsar Wetland of International Importance, it plays a key role in biodiversity conservation, particularly as a feeding and resting area for migratory birds along the East Asian–Australasian Flyway.

Beyond its ecological value, Janghang Wetland demonstrates how natural ecosystems can function as nature-based infrastructure in urban and metropolitan contexts. Wetlands help absorb excess rainfall, reduce flood risks, filter pollutants, improve water quality, and store carbon in soils and vegetation. These functions show that wetlands are active ecological systems that support climate adaptation,

disaster risk reduction, and environmental sustainability.

The visit also highlighted the importance of governance in protecting ecological assets near dense urban settlements. Effective wetland management requires regulatory protection, ecological monitoring, institutional coordination, and community engagement. In Janghang Wetland, collaboration among local authorities, national agencies, research institutions, and civil society organisations has helped preserve the site while supporting environmental education and sustainable tourism.

For participating cities, particularly intermediary cities facing rapid urban expansion, the key lesson is that ecological assets should be protected before development pressures make conservation or restoration more difficult. Janghang Wetland shows that wetlands, river corridors, lakes, and green corridors should be treated not as leftover spaces, but as strategic urban infrastructure that strengthens flood management, climate resilience, biodiversity conservation, and urban liveability.

Learning Note #2

CASE STUDY

Food waste management and low-cost circular solutions in a dense mountain city

Baguio City, Philippines

Baguio City, a rapidly growing mountain city in the northern Philippines, faces increasing pressure on its waste management system due to tourism growth, dense settlements, and limited landfill space. Organic waste constitutes a significant portion of the city's municipal waste stream, particularly from households, food establishments, and public markets. In response, the city launched a Black Soldier Fly (BSF) Pilot Programme, a decentralised organic waste management initiative that converts biodegradable waste into valuable products such as organic fertiliser and protein-rich animal feed.

The programme uses Black Soldier Fly larvae (BSF larvae) to rapidly decompose organic materials, especially food waste, which accounts for around 93 per cent of biodegradable waste generated in the city. Each BSF facility can process up to 300 kilograms of organic waste per day, transforming it into nutrient-rich compost and high-protein larvae suitable for livestock and aquaculture feed. By diverting organic waste at the community level, the initiative significantly reduces the volume of waste transported to landfills while creating new opportunities within the local circular economy.

To support decentralised waste treatment, Baguio City established three barangay-level BSF facilities, enabling organic waste to be processed directly at the source. This approach reduces transportation costs, improves waste segregation, and increases community participation in sustainable waste practices. With an investment of approximately USD 26,000, the pilot project demonstrates that low-cost technological solutions can generate multiple environmental and economic benefits, including reduced methane emissions from landfills and the development of new local revenue streams.

Revenue is generated through tipping fees from food establishments and the sale of organic fertiliser, helping ensure financial sustainability. More importantly, the programme reflects a broader shift in the city's waste management strategy—from a reactive system focused on waste disposal toward a proactive resource-recovery approach that transforms organic waste into economic value while addressing urban capacity constraints.

CHALLENGES

Despite progress, Baguio City continues to face several structural challenges in waste management.

The city's steep topography limits the availability of land for waste treatment infrastructure and increases the logistical complexity of waste collection.

Rapid urban growth and tourism also contribute to rising volumes of food waste. In addition, public awareness and compliance with waste segregation policies remain uneven, making it difficult to maintain consistent supply chains of clean organic waste for treatment facilities.

STRATEGIES

To address these challenges, the city has adopted several strategic approaches:

- Adoption of Black Soldier Fly technology as a low-cost, scalable biological solution for processing organic waste at the barangay level.
- Decentralised waste management systems, enabling treatment directly within communities to reduce transport costs and landfill dependence.
- Partnerships with cooperatives and farmers, linking BSF production with agricultural demand for organic fertiliser and animal feed.
- Community engagement and awareness programmes to promote proper waste segregation and participation in circular waste initiatives.

LESSONS

Baguio City's experience offers several lessons for intermediary cities seeking practical approaches to waste and climate challenges:

- Low-cost biological technologies can reduce organic waste while producing useful resources such as fertiliser and animal feed.
- Decentralised waste treatment reduces landfill pressure and lowers transport needs by processing waste closer to its source.
- Community participation is critical to ensure proper waste segregation and sustained implementation.
- Linking waste management with agriculture creates circular economy benefits for both urban and rural communities.

Hybrid flood management through nature-based water retention systems

Hat Yai City, Thailand

Bat Yai City, located in Songkhla Province in southern Thailand, is one of the region's most important economic and transportation hubs. With a resident population of nearly 160,000 people and a significantly larger floating population, the city plays a vital role in regional commerce, logistics, and tourism. However, its location on a low-lying floodplain makes Hat Yai highly vulnerable to flooding, particularly during periods of intense rainfall. Historical flood events, notably in 2000 and 2010, caused extensive damage to urban infrastructure, disrupted economic activities, and highlighted the limitations of conventional flood control systems.

In response to these recurring disasters, the city began shifting its flood management strategy from a purely structural approach toward a hybrid system combining engineered infrastructure with nature-based solutions. Rather than attempting to completely control or divert floodwaters, the new approach focuses on managing water flows more naturally by temporarily storing excess runoff within designated areas across the city. Central to this strategy is the application of the “Kaem Ling” or “Monkey Cheek” concept, a flood management principle inspired by natural water storage systems.

The concept works by designating specific urban landscapes—such as parks, open spaces, reservoirs, and natural depressions—as temporary water retention areas during heavy rainfall events. These “water buffers” absorb and store excess runoff before gradually releasing it back into rivers and drainage systems once water levels recede. This approach significantly reduces pressure on the city’s drainage infrastructure while minimizing flood risks in densely populated areas.

Hat Yai has strategically incorporated multiple multi-functional urban spaces as retention zones within the broader watershed system. These areas collectively provide substantial water storage capacity, enabling the city to manage intense rainfall events more effectively. Evidence of the strategy’s success emerged during recent extreme rainfall events when flood impacts were dramatically reduced compared to previous disasters. By integrating natural absorption systems with conventional flood control infrastructure, Hat Yai has developed a more adaptive and resilient urban water management system.

CHALLENGES

Despite these improvements, Hat Yai continues to face ongoing climate and urbanisation challenges. Rapid urban development has increased impermeable surfaces across the city, reducing natural water infiltration and increasing runoff during storms.

Climate change has also intensified rainfall variability, producing extreme precipitation events that exceed traditional drainage capacities. Maintaining coordination across multiple agencies responsible for water management and urban planning remains an additional institutional challenge.

STRATEGIES

To address these challenges, Hat Yai has implemented several key strategies:

- Applying the “Kaem Ling” water retention concept by designating parks, reservoirs, and open spaces as temporary floodwater storage areas.
- Combining grey infrastructure with nature-based solutions, integrating engineered drainage systems with natural water absorption landscapes.

- Strengthening watershed-level planning, linking rivers, canals, and retention areas into a coordinated flood management network.
- Engaging communities and technical experts through dedicated working groups that guide flood management strategies and monitoring systems.a

LESSONS

Hat Yai's experience provides several important lessons for cities facing increasing climate-related flood risks:

- Hybrid approaches that combine infrastructure and ecosystem-based solutions offer greater resilience than purely engineered flood control systems.
- Urban open spaces can serve multiple functions, providing recreational value while also acting as critical water retention infrastructure.
- Watershed-based planning is essential for effective flood management in rapidly growing urban areas.
- Collaboration among government agencies, experts, and communities strengthens the long-term sustainability of climate adaptation initiatives.

Restoring urban ecosystems through the revitalisation of Danau Sipin (Sipin Lake)

Jambi City, Indonesia

Jambi City, located along the Batanghari River basin in Sumatra, Indonesia, has increasingly recognised the importance of protecting and restoring urban water ecosystems as part of its climate resilience strategy. One of the city's most prominent natural assets is Danau Sipin, an oxbow lake formed from an ancient meander of the Batanghari River. Covering approximately 78 hectares, the lake has long served multiple ecological, economic, and cultural functions for the surrounding communities. It supports freshwater fisheries, small-scale aquaculture, and local tourism, while also acting as an important environmental regulator within the urban landscape.

Over time, however, urban expansion and increased human activity around the lake have placed pressure on its ecological balance. Pollution from domestic wastewater, sedimentation from upstream drainage, and increasing microplastic contamination have gradually degraded water quality. The lake's proximity to dense residential areas and commercial activities has also intensified environmental pressures, threatening both ecosystem health and the livelihoods of communities that depend on the lake.

In response, the Jambi City Government initiated a programme to revitalise Danau Sipin through nature-based solutions that restore ecological functions while supporting sustainable urban development. Rather than relying solely on conventional engineering interventions, the initiative emphasises ecosystem restoration and community participation as central components of lake management. The programme focuses on improving water quality, rehabilitating riparian ecosystems, and strengthening the lake's natural capacity to regulate urban hydrological systems.

Key interventions include the establishment of vegetated buffers along the shoreline, wetland restoration, and the introduction of green infrastructure that helps filter pollutants before they enter the lake. These measures not only improve environmental conditions but also enhance the lake's capacity to absorb excess rainfall and regulate water flows during heavy precipitation events. By integrating ecological restoration with community engagement and urban planning, the initiative aims to transform Danau Sipin into a resilient urban ecosystem that supports both environmental sustainability and local livelihoods.

CHALLENGES

The restoration of Danau Sipin faces several challenges related to urban growth and environmental management. Pollution from surrounding residential areas and drainage channels continues to affect water quality, while sedimentation reduces the lake's depth and ecological function. In addition, coordination among multiple institutions responsible for environmental management, urban planning, and tourism development remains complex. Ensuring sustained community participation in conservation efforts is also essential for maintaining long-term ecological improvements.

STRATEGIES

To address these challenges, Jambi City has implemented several key strategies:

- Restoring riparian vegetation and ecological buffers to improve water quality and strengthen natural filtration systems.
- Introducing wetland-based treatment systems that help absorb pollutants and regulate water flows entering the lake.
- Promoting community-based environmental stewardship, encouraging residents and local businesses to participate in lake conservation activities.

- Integrating ecosystem restoration into urban development planning, ensuring that infrastructure projects consider environmental protection and climate resilience

LESSONS

The experience of Jambi City offers several lessons for intermediary cities seeking to protect urban water ecosystems:

- Vegetated buffers, wetland restoration, and green infrastructure can strengthen natural filtration systems by helping reduce pollutants before they enter urban water bodies.
- Lake restoration should be linked to wider urban planning and community engagement, rather than treated as an isolated environmental project.
- Nature-based solutions can simultaneously improve environmental quality and economic opportunities, particularly in cities were ecosystems support tourism and fisheries.
- Integrating ecological restoration into urban planning frameworks helps ensure long-term protection of natural assets.

Managing floods and drought through the "Monkey Cheek" nature-based water retention system

Prik Subdistrict Municipality, Thailand

Prik Subdistrict Municipality, located in Songkhla Province in southern Thailand, has increasingly faced environmental pressures associated with climate variability and changing hydrological conditions. The municipality is situated within a landscape that includes lowland plains, forested foothills, and several interconnected waterways, most notably the U-Tapao Canal and Khlong Prik, which serve as major water sources supporting agriculture, household water supply, and local ecosystems. Despite the presence of these water resources, the city experiences both seasonal flooding during the rainy season and water shortages during dry

periods, creating significant challenges for local livelihoods and infrastructure management.

Historically, repeated flood events have caused considerable damage to agricultural land, residential areas, and transportation infrastructure. In some instances, floodwaters have reached depths of several metres, isolated communities and disrupting economic activities. The impacts have been particularly severe for residents whose primary income depends on agriculture, including rice cultivation and rubber plantations, which are highly sensitive to extreme hydrological conditions. These recurring disasters highlighted the limitations of conventional flood control systems and prompted the municipality to explore alternative approaches to water management.

To address these challenges, Prik Municipality adopted a nature-based water management strategy inspired by the "Monkey Cheek" concept, a Thai approach that uses designated landscapes to temporarily store excess rainwater during heavy rainfall events. Instead of allowing runoff to flow immediately downstream and intensify flooding, the system retains water in selected areas and releases it gradually or reuses it during dry periods.

This approach allows the municipality to manage water not only as a hazard, but also as a resource. By combining natural retention areas with canal improvements and local water management infrastructure, Prik Municipality aims to reduce flood risks, maintain water availability during dry seasons, and strengthen the resilience of agricultural and residential areas.

CHALLENGES

Despite ongoing efforts, Prik Municipality still faces environmental and governance challenges linked to increasingly unpredictable rainfall, which intensifies both flood and drought risks. Effective water management requires sustained coordination across agriculture, urban planning, and environmental protection, as well as continued community participation.

The municipality must also manage water across wet and dry seasons by retaining excess rainfall, regulating its release, and supporting reuse during periods of scarcity.

STRATEGIES

To address these challenges, Prik Municipality has implemented several strategic actions:

- Establishing “Monkey Cheek” water retention areas that temporarily store excess rainwater during heavy rainfall events and allow gradual release or reuse during dry periods.
- Expanding canal capacity and improving drainage networks to regulate water flows and reduce flood risks in residential and agricultural areas.
- Combining natural retention landscapes with water management infrastructure to strengthen hydrological resilience across the municipality.

- Integrating renewable energy solutions, including solar-powered water supply systems that support sustainable water management.
- Strengthening environmental monitoring and community engagement, including water quality monitoring and educational programmes on environmental stewardship.

LESSONS

The experience of Prik Municipality highlights several lessons for intermediary cities facing complex water management challenges:

- Nature-based water retention systems can effectively address both flooding and drought, providing flexible solutions to climate variability.
- Managing water as a resource rather than a hazard allows cities to transform flood risks into opportunities for water storage and reuse.
- Integrating ecological approaches with infrastructure improvements can strengthen long-term water resilience.
- Community awareness and local participation are critical for maintaining sustainable water management practices.

Urban flood resilience through integrated drainage and nature-based solutions

Banda Aceh, Indonesia

Banda Aceh, the capital city of Aceh Province in Indonesia, faces persistent challenges related to urban flooding and waterlogging. Located in a low-lying coastal area near the Aceh River basin, the city is highly exposed to heavy rainfall, tidal influences, and drainage congestion. Rapid urban expansion and increasing built-up areas have reduced natural infiltration capacity, intensifying runoff and placing pressure on the city's drainage infrastructure. As a result, seasonal flooding and standing water in residential areas have become recurring issues affecting mobility, public health, and urban services.

To address these challenges, the municipal government has initiated a comprehensive approach to urban flood management that combines conventional infrastructure improvements with nature-based solutions. The strategy focuses on enhancing stormwater management capacity while restoring ecological functions that help regulate water flows. This includes the development of infiltration wells, retention ponds, green open spaces, and improved drainage networks designed to slow runoff and increase water absorption across the urban landscape.

A key component of the city's strategy is the integration of green infrastructure into flood mitigation planning. Rather than relying solely on engineered drainage systems, Banda Aceh is incorporating natural elements such as vegetated areas and water retention landscapes into its urban design. These interventions help reduce peak runoff during heavy rainfall events while contributing to improved environmental conditions within the city.

In addition to physical infrastructure improvements, the initiative emphasizes institutional coordination and long-term planning. Flood mitigation efforts are integrated into broader urban development policies and environmental management frameworks, ensuring that climate resilience considerations are embedded in city planning processes. By aligning drainage improvement projects with nature-based approaches, the city aims to strengthen its ability to manage increasing climate variability and urban growth.

CHALLENGES

The restoration of Danau Sipin faces several challenges related to urban growth and environmental management. Pollution from surrounding residential areas and drainage channels continues to affect water quality, while sedimentation reduces the lake's depth and ecological function. In addition, coordination among multiple institutions responsible for environmental management, urban planning, and tourism development remains complex. Ensuring sustained community participation in conservation efforts is also essential for maintaining long-term ecological improvements.

STRATEGIES

To address these challenges, Jambi City has implemented several key strategies:

- Restoring riparian vegetation and ecological buffers to improve water quality and strengthen natural filtration systems.
- Introducing wetland-based treatment systems that help absorb pollutants and regulate water flows entering the lake.
- Promoting community-based environmental stewardship, encouraging residents and local businesses to participate in lake conservation activities.

- Integrating ecosystem restoration into urban development planning, ensuring that infrastructure projects consider environmental protection and climate resilience

LESSONS

The experience of Jambi City offers several lessons for intermediary cities seeking to protect urban water ecosystems:

- Vegetated buffers, wetland restoration, and green infrastructure can strengthen natural filtration systems by helping reduce pollutants before they enter urban water bodies.
- Lake restoration should be linked to wider urban planning and community engagement, rather than treated as an isolated environmental project.
- Nature-based solutions can simultaneously improve environmental quality and economic opportunities, particularly in cities were ecosystems support tourism and fisheries.
- Integrating ecological restoration into urban planning frameworks helps ensure long-term protection of natural assets.

Enhancing urban resilience through integrated urban greening strategies

Khon Kaen Municipality, Thailand

Khon Kaen Municipality, located in northeastern Thailand, is an emerging regional centre for commerce, education, and public services. With a municipal area of approximately 46 square kilometres and a registered population of over 100,000 residents, the city functions as a strategic hub connecting surrounding provinces within the region. Rapid urban expansion and economic growth, however, have introduced new environmental pressures, including rising temperatures, increasing flood risks, and prolonged periods of drought associated with climate variability.

Recognising these challenges, Khon Kaen Municipality has begun incorporating urban greening as a core nature-based solution strategy to strengthen climate resilience and improve urban environmental quality. The initiative focuses on integrating green infrastructure into urban planning processes to address environmental, social, and economic challenges simultaneously. Rather than treating urban greenery solely as aesthetic elements, the city views green spaces as functional ecological infrastructure capable of delivering multiple ecosystem services.

The strategy promotes the creation of a connected network of green spaces, including street trees, pocket parks, neighbourhood parks, urban forests, wetlands, and vegetated corridors. These green assets are designed to perform multiple roles, such as absorbing excess rainwater, reducing urban heat, improving air quality, and enhancing biodiversity.

By connecting individual green spaces through corridors and ecological networks, the city aims to strengthen ecological connectivity while providing accessible recreational spaces for residents.

Urban greening is also integrated into broader land-use planning and urban development strategies. Through policy alignment with national climate commitments and sustainable development frameworks, Khon Kaen has positioned nature-based solutions as a key component of long-term urban management. The municipality is also exploring innovative financing mechanisms—including national climate funds, international development grants, and public–private partnerships—to support the implementation of large-scale greening initiatives.

CHALLENGES

Despite the growing recognition of the benefits of urban greening, Khon Kaen faces several challenges in implementing large-scale nature-based initiatives. Urban land availability remains limited in rapidly developing areas, and competing land-use priorities can constrain the expansion of green spaces. Financing constraints and technical capacity gaps also pose challenges for designing and managing complex green infrastructure systems. In addition, maintaining public participation in urban greening initiatives is essential to ensure the long-term sustainability of these

STRATEGIES

To address these challenges, Khon Kaen Municipality has adopted several strategic approaches:

- Integrating urban greening into city planning and zoning policies, ensuring that green infrastructure becomes a formal component of urban development strategies.
- Developing a multi-scale green infrastructure network, including street-level vegetation, neighbourhood parks, and larger ecological corridors.

- Mobilising diverse financing sources, including municipal budgets, national environmental funds, and international development support.
- Engaging communities and local stakeholders, encouraging participation in the planning and maintenance of urban green spaces.

LESSONS

Khon Kaen's experience highlights several key lessons for intermediary cities pursuing climate resilience:

- Urban greening can function as critical ecological infrastructure, providing environmental services such as cooling, flood mitigation, and air purification.
- Integrating nature-based solutions into formal planning systems strengthens their long-term implementation and policy support.
- Multi-functional green spaces provide both environmental and social benefits, improving urban liveability while addressing climate risks.
- Innovative financing and partnerships are essential to scale up nature-based solutions in rapidly growing cities.

KEY LESSONS

Across the city experiences, nature-based solutions are most effective when integrated into urban infrastructure, planning, governance, and service delivery. The cases show that resilience depends on combining ecological systems, technical interventions, financing, institutional coordination, and community participation.

Nature should be treated as functional urban infrastructure

Wetlands, lakes, green corridors, urban forests, retention ponds, and biological treatment systems can regulate water flows, reduce heat, filter pollutants, support biodiversity, and improve public wellbeing. Cities should therefore integrate ecological assets into land-use planning, infrastructure investment, and environmental management.

Hybrid grey-green-biological systems strengthen resilience

The cases show that cities need to combine engineered infrastructure with ecological and biological processes. Hat Yai and Prik use water retention landscapes, Banda Aceh combines drainage with infiltration and retention systems, while Baguio applies Black Soldier Fly technology to process organic waste. These hybrid systems reduce dependence on single-purpose infrastructure.

Early protection of ecological assets reduces future risks

Intermediary cities often still have rivers, lakes, wetlands, agricultural land, and green spaces that can support resilience. Protecting these assets before they are converted by urban development is cheaper and more effective than restoring them after degradation.

Governance, financing, and maintenance determine scale

Nature-based solutions require institutional coordination, clear mandates, budgets, and long-term maintenance. To move beyond pilot projects, cities need to demonstrate multiple benefits, including reduced flood damage, lower waste costs, improved health, livelihood support, tourism potential, and climate adaptation value.

Community ownership and peer learning sustain implementation

Community participation is essential for waste segregation, waterway protection, green space maintenance, and behavioural change. Peer learning also helps cities adapt tested approaches to their own ecological, institutional, and social contexts, rather than copying models directly.

THE WAY AHEAD

The next phase for nature-based solutions in intermediary cities should move from demonstration and learning toward systematic implementation. The cases in this Learning Note show that NbS can support flood management, heat reduction, water retention, waste reduction, biodiversity protection, public health, and local livelihoods. However, these benefits will only be sustained if cities treat NbS as part of core urban planning and infrastructure systems, not as isolated environmental activities.

A first priority is to identify and protect existing ecological assets before they are lost to urban expansion. Intermediary cities often still retain wetlands, rivers, lakes, forests, agricultural land, and open spaces within or near their urban areas. These assets should be mapped, assessed, and incorporated into spatial plans, zoning regulations, and infrastructure investment frameworks. The experience of Janghang Wetland reinforces the importance of early protection: conserving ecological assets

before development pressure intensifies is usually more effective and less costly than attempting restoration after degradation has occurred.

Second, cities need to integrate NbS into infrastructure planning rather than treat them as alternatives to conventional systems. The cases from Hat Yai, Prik, and Banda Aceh show that flood resilience is strengthened when drainage systems are combined with retention areas, infiltration wells, green open spaces, canals, reservoirs, and watershed-based planning. Similarly, Khon Kaen demonstrates that urban greening becomes more effective when parks, street trees, wetlands, and ecological corridors are planned as a connected system. The practical direction is not to replace grey infrastructure, but to design hybrid systems that combine engineered, ecological, and social functions.

Third, cities need governance arrangements that can manage NbS across sectors. Nature-based solutions cut across urban planning, public works, environmental protection, water management, waste management, parks, tourism, agriculture, and community development. Without clear mandates and coordination mechanisms, NbS will remain fragmented pilot projects. Local governments should assign institutional responsibilities, establish cross-agency working arrangements, and embed NbS into development plans, climate strategies, land-use controls, and maintenance systems.

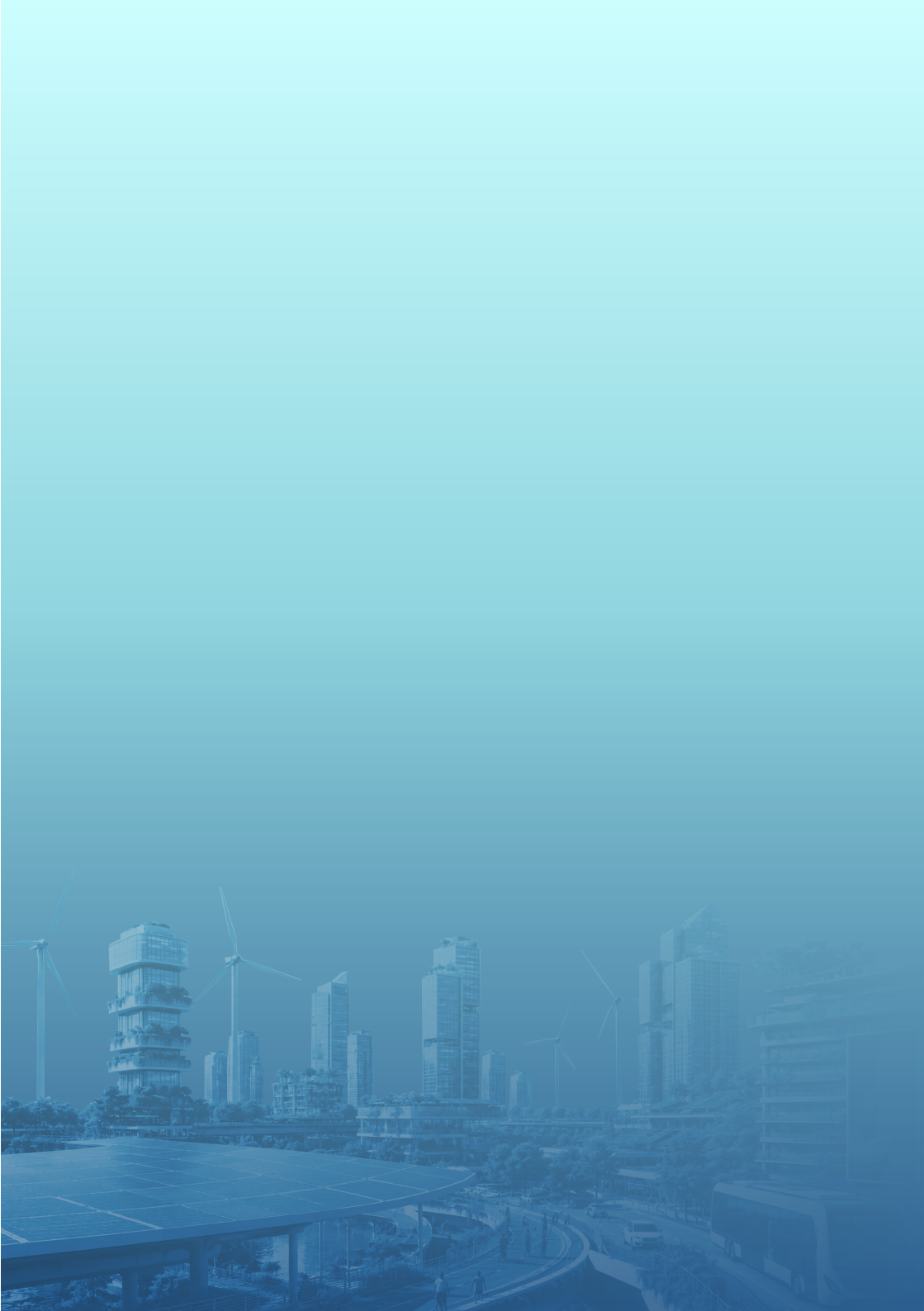
Fourth, financing must be made more realistic and implementation oriented. Many intermediary cities have limited fiscal space, so NbS should first be linked to municipal budgets, infrastructure pipelines, and existing development programmes. Cities should also quantify benefits where possible, including avoided flood damage, reduced waste transport costs, improved water quality, lower heat exposure, tourism value, livelihood support, and reduced pressure on drainage or landfill systems.

This evidence can strengthen proposals for national funding, climate finance, development grants, public–private partnerships, and blended finance. Financing should also cover long-term operation and maintenance, not only initial construction or pilot activities.

Fifth, community participation must be built into the full project cycle. The cases show that NbS depends on everyday behaviour: waste segregation in Baguio, waterway protection in Jambi, drainage maintenance in Banda Aceh, and stewardship of green spaces in Khon Kaen. Participation should therefore go beyond consultation. Cities need practical mechanisms such as community-based monitoring, maintenance agreements, local stewardship groups, awareness programmes, and partnerships with schools, businesses, farmers, and neighbourhood organisations.

Finally, peer learning should continue, but with a focus on adaptation rather than replication. The Learning and Pairing Session shows that cities can learn from one another's approaches, but each model must be adjusted to local geography, institutional capacity, fiscal conditions, land availability, and community practices. Hat Yai and Prik offer lessons on water retention, Jambi on lake restoration, Baguio on biologically grounded circular waste management, Banda Aceh on drainage-infiltration systems, and Khon Kaen on urban greening. The task ahead is to translate these lessons into locally grounded actions, supported by monitoring, financing, institutional coordination, and long-term political commitment.

For intermediary cities, the opportunity is clear but time sensitive. They still have ecological assets that can be protected, restored, and integrated into future urban growth. The resilient city of the future will not be one that relies only on building more infrastructure, but one that plans, invests, and governs in ways that allow natural systems to strengthen urban life.



Regional Learning Note

#2

Nature-Based Solutions in Intermediary Cities

Rethinking Urban Resilience through Ecological Governance in Asia and the Pacific

Urban-Act
Integrated Urban Climate Action for Low-Carbon & Resilient Cities

UCLG ASPAC
United Cities and Local Governments Asia-Pacific

Federal Ministry for the Environment, Climate Action, Nature Conservation and Nuclear Safety
IKI International Climate Initiative
giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH
ESCAP
UCLG ASPAC United Cities and Local Governments Asia-Pacific
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