Nature-based Solutions in the Northern Metropolis

A Model for 21st-century Cities in Addressing Global Climate Challenges

The Nature Conservancy 大自然保護協會

思匯 CIVIC EXCHANGE

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Contents

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Abbreviations

3RS	Three-Runway System
AAHK	The Airport Authority Hong Kong
ACS	Asia Climate Solutions
ADB	Asian Development Bank
AIIB	Asian Infrastructure Investment Bank
APLMA	Asia Pacific Loan Market Association
BEC	Business Environment Council
BGI	Blue-green Infrastructure
BSAP	Biodiversity Strategy and Action Plan
CAP	Climate Action Plan
CEDD	The Civil Engineering and Development Department
COP16	The 2024 United Nations Biodiversity Conference of the Parties
COP29	The 2024 United Nations Climate Change Conference
CPP	Coastal Protection Park
EIA	Environmental Impact Assessment
ESG	Environmental, Social and Governance
FSC	Forest Stewardship Council
GBA	Greater Bay Area
GCF	Green Climate Fund
GLP	Green Loan Principles
HKIA	Hong Kong International Airport
HKILA	The Hong Kong Institute of Landscape Architects
HKMC	Hong Kong Mortgage Corporation
HKU	The University of Hong Kong
HKUST	The Hong Kong University of Science and Technology
I&T	Innovation and Technology
IPCC	Intergovernmental Panel on Climate Change
ISSB	International Sustainability Standards Board
KPI	Key Performance Indicators
LMA	Loan Market Association
LSTA	Loan Syndications and Trading Association
MAS	Monetary Authority of Singapore
NbS	Nature-based Solution/s
NBSAP	National Biodiversity Strategy and Action Plan
NDA	New Development Area
NM	Northern Metropolis
NMCO	Northern Metropolis Coordination Office
OECM	Other Effective Area-based Conservation Measures
PBAF	Partnership for Biodiversity Accounting Financials
PCAF	Partnership for Carbon Accounting Financials
PDB	Planning and Design Brief
PPP	Public-Private Partnership
PPPP	Public-Private-Philanthropy Partnership
RECOFTC	The Regional Community Forestry Training Centre for Asia and the Pacific
REDD+	Reducing Emissions from Deforestation and Forest Degradation in Developing Countries
RWA	Risk-Weighted Asset
SEA	Strategic Environmental Assessment
SLLP	Sustainability-linked Loan Principles
TCFD	Task Force on Climate-related Financial Disclosures
TNFD	Taskforce on Nature-related Financial Disclosures
TNC	The Nature Conservancy
UNEP	United Nations Environment Programme

FOREWORD

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Prof Debra Roberts

Urban Practitioner; Intergovernmental Panel on Climate Change (IPCC) AR6 Working Group II Co-chair and Co-ordinating Lead Author of the IPCC's Special Report on Climate Change and Cities

Being an urban practitioner is a grounding experience as it teaches you about the infinite complexities and possibilities in the city landscape. Urban situations are multidimensional, created through intersecting axes of politics, power, environment, infrastructure, society and economy.

So, when thinking about the role of nature in our cities it is clear there could be many alternative pathways that lie ahead. One possibility is decision-makers and stakeholders proactively prioritising the use of blue and green infrastructure in cities, facilitating ambitious climate change adaptation and mitigation with a view to achieving sustainable development for all.

Another option, which grows more likely as we approach an overshoot of 1.5°C of global warming, is a growing decline in the feasibility and effectiveness of Nature-based Solutions (NbS) in the world's cities. Evidence presented in the sixth assessment reports of the Intergovernmental Panel on Climate Change shows that a temporary period of 1.5°C overshoot will be a time of irreversible change, especially for natural ecosystems. Breaching these environmental thresholds could transform urban systems in ways that are not yet fully understood.

This is why coming together at the 2025 Nature-based Solutions for Climate Conference, co-hosted by The Nature Conservancy and Civic Exchange on 14–15 January in Hong Kong, was such a critical and timely opportunity to discuss the science and practice of NbS in urban landscapes. It was an invaluable opportunity to look beyond the usual narratives of urban transformation and to consider the possibilities that major drivers of urban development such as the Northern Metropolis offer us to do something completely different, potentially creating global lighthouses of sustainable and resilient urban development in the 21st century.

This report summarises the outcome of our discussions in Hong Kong, and I hope it will inspire others to begin talking about the possibility of urban areas being transformed through developing a new relationship with nature during a climate changed future.

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Prof Wong Kam Sing, GBS, JP

Former Secretary for the Environment (2012-2022)

In a time when the global community faces unprecedented environmental challenges, it is imperative that we adopt holistic strategies to combat climate change and biodiversity loss. Hong Kong, a dynamic city known for its resilience and innovation, stands at the forefront of integrating climate action with biodiversity conservation. This report is a testament to our city's commitment to fostering sustainable development through synergistic approaches.

This report arrives at a pivotal moment, following the recent process of updating the city-level Biodiversity Strategy and Action Plan and providing insights for the next update of the Hong Kong Climate Action Plan. These comprehensive blueprints underline our dedication to addressing the intertwined issues of climate change and ecological decline through strategic, evidence-based actions.

The report highlights the significance of NbS in building climate resilience and promoting biodiversity. These solutions leverage natural processes to provide cost-effective and sustainable interventions, addressing urban challenges such as air quality, the heat island effect and flood risk. By integrating blue-green infrastructure, enhancing urban forestry and conserving our mangroves and wetlands, we not only mitigate environmental impacts but also promote co-benefits for our community's health, well-being and economy.

As we look forward, it is essential that we embrace the principles of urban-rural symbiosis and innovation. Through collaborative efforts involving government, academia, industry and the public, we can create a more sustainable and carbon-neutral future for Hong Kong. The insights and recommendations within this report will serve as crucial guides in our ongoing efforts to integrate NbS into both existing and future development projects.

I extend my gratitude to the experts, stakeholders and young talents who have contributed to this report. Your dedication fuels our collective ambition to make Hong Kong a leader as a carbon neutral and nature-positive city that thrives.

Together, we can chart a path towards a greener, more resilient Hong Kong for generations to come.

Ms Pecvin Pui Wan Yong, JP

Deputy Director, Northern Metropolis Co-ordination Office, Development Bureau, The HKSAR Government

The Northern Metropolis (NM) is not merely a project—it is a visionary initiative aimed at integrating development with conservation to create a harmonious coexistence between people and nature. With a vast geographical expanse of 30,000 hectares, the NM represents one-third of Hong Kong's total area, offering a space where innovation, sustainability and community coexist.

The vision for the NM is to build a sustainable, liveable and resilient metropolis that embraces the natural beauty of our region while fostering modernity and prosperity. This is not just about building infrastructure; it is about nurturing a vibrant ecosystem that includes diverse habitats and thoughtfully designed urban spaces.

Our approach to sustainability is twofold: preserving our precious natural resources and embracing sustainable urban design. Initiatives like the establishment of the Robin's Nest Country Park and the Long Valley Nature Park exemplify our commitment to ecological preservation while providing green spaces for public enjoyment.

Moreover, our urban planning strategy prioritises thoughtful design to reduce carbon footprints and promote healthier lifestyles through extensive cycling routes, accessible public amenities and green transportation solutions.

The NM initiative is a testament to our collective responsibility to create a future that honours both innovation and environmental stewardship. We invite all stakeholders to join us in this monumental effort and contribute to a legacy that future generations will cherish.

Thank you for your shared commitment to this grand vision, and we look forward to the continued success of this transformative journey.

Prof Ling Kar Kan, SBS

Former Director of Planning (2012-2016) and Strategic Planning Advisor on HK/SZ Cooperation (June 2021- Feb 2022)

The Northern Metropolis Development Strategy (NMDS) is a groundbreaking and visionary strategic plan and action agenda. For the first time in the city development history of Hong Kong, the northern part of the New Territories (NT) is accorded with the same importance as the Victoria Harbour. It has clearly established the strategic "dual metropolis" (Northern Metropolis & Harbour Metropolis) spatial structure of Hong Kong and completely changed the city's inherent development pattern of "focusing on the south neglecting over the north". The unbalanced distribution of public resources will be fundamentally adjusted.

It is also for the first time that Hong Kong has linked spatial development planning and industry development planning, allowing innovation and technology industry development in the NM to become Hong Kong's second economic engine. This will rebalance strategically the spatial distribution of our jobs and homes, enhancing Hong Kong's overall competitiveness and sustainable development.

NMDS advocates for "the integration of urban and rural areas, the coexistence of development and conservation" as overarching planning principles, and "implementing active conservation policies that create environmental capacity" as one of the key action directions. It thus provides a unique spatial platform for all stakeholders to explore and implement a wide range of NbS.

The NM development indeed provides Hong Kong with unprecedented opportunities for governance reforms to integrate siloed policies and overcome regulatory regime inefficiency. This will enable and empower all of us to create a metropolis that balances social, economic and environmental needs through effective collaboration of the community and the government.

The 2025 Nature-based Solutions for Climate Conference convened to brainstorm the transformative roles of the NbS approach that can contribute to the NM development. This was timely, as envisioning innovation, imagination and creativity should be encouraged not only for technological adoption, but perhaps more importantly, also to trigger mindset and institutional breakthroughs.

As such, at the conference, I laid out a challenge: Can we, through the co-operation between the governments of Hong Kong and Shenzhen, develop Shenzhen Bay into a place as prosperous and vibrant as our Victoria Harbour, while maintaining and enhancing its ecological capacity and environmental value? To achieve this, let's work shoulder-to-shoulder with our collective wisdom to derive "out-of-the-box" solutions for advancing the NM development.

Prof Christine Loh, SBS, OBE, JP

Chief Development Strategist, Institute for the Environment, Hong Kong University of Science and Technology; Former Under Secretary for the Environment

We are living through a silent crisis – one where the destruction of nature is often rationalised as the cost of progress, and where concrete and steel spread over landscapes as if nature were an afterthought. Yet, nature is not optional. It is the bedrock of our well-being, our climate stability, our sense of belonging, and the very future we are trying to secure. When we ignore nature, we create risk. When we restore them, we create value.

This report speaks to a deep truth: that we cannot continue to design cities as if we are separate from nature. The Northern Metropolis is not just another development plan. It is a test of whether a wealthy modern city can heal the damage of the past and choose a new path – one that restores wetlands, reimagines slopes and fishponds as vital infrastructure, and gives space back to forests, rivers, birds, and people.

The vision here is bold, not because it ignores economic realities, but because it sees clearly that true prosperity cannot come at the expense of nature. Nature-based Solutions are not decorations for our cities; they are essential systems that protect us from heat, flood, and collapse. In this dense and already fragile urban environment, the challenge is greater – but so is the potential to inspire.

We must move beyond passive conservation. We must rethink our planning, our financing, our laws, and our habits. What this report offers is a blueprint for that transformation, rooted in science, practical experimentation, and collaboration. It gives voice to a growing understanding: that restoring nature in cities is not only possible, but urgent, and that Hong Kong can lead.

The report lays out practical pathways for how we can finance Nature-based Solutions through public-private partnerships, blended capital, biodiversity credits, and better valuation of ecosystem services. We need financial systems that reward resilience, and planning frameworks that treat nature as an asset class. If we get this right, Hong Kong's Northern Metropolis can become a global model: a place where development and ecology coexist, where business helps drive environmental stewardship, and where nature is not sidelined but centred.

Let us not be remembered as the generation that paved over the wetlands, drained the fishponds, and ignored the warning signs for the sake of cramming in a few more buildings. Let us instead be known as those who chose to act, to reconnect, and to regenerate.

This is not just a report – it is an invitation to rethink the future, lead with vision, and act for the long term.

Executive Summary

The 2025 Nature-based Solutions (NbS) for Climate Conference, co-hosted by The Nature Conservancy (TNC) and Civic Exchange on 14–15 January in Hong Kong, brought together over 200 experts to explore the transformative role of NbS in addressing climate change. With a special focus on the Northern Metropolis (NM), the conference emphasised the importance of embedding ecological principles into urban development. The event positioned Hong Kong as a potential leader in climate resilience and biodiversity conservation, aligning with global frameworks such as the Paris Agreement, the Kunming-Montreal Global Biodiversity Framework and China's national "ecological civilisation" strategy, all of which increasingly recognise nature as central to climate action.

As the 2024 UNEP Emissions Gap Report warns of a possible 3.1°C rise in global temperatures by 2100, we urgently need to implement holistic climate strategies that address both the causes and consequences of climate change. This starts with reversing biodiversity loss and restoring ecosystems. NbS – such as wetland restoration and urban greening – can mitigate the impacts of heatwaves and flooding on urban populations, especially when properly integrated into urban planning.

The NM presents an unprecedented opportunity to embed NbS within its planning and development fabric. The area's rich ecosystems act as natural infrastructure for stormwater management, reducing urban heat and enhancing liveability. Strategic reforestation and the expansion of urban green spaces could further improve air quality, reduce flood risk, and alleviate heat-related health risks.

I. Urban Planning: Integrating Nature-based Solutions in the Planning Process

While the potential for NbS in the NM is huge, realising these benefits requires coordinated efforts among government agencies, urban planners, ecologists, local communities, conservation NGOs, and private developers to ensure that ecological preservation and sustainable urban development go hand in hand. However, a lack of understanding of ecosystem services, insufficient strategic planning, fragmented policies, a piecemeal approach to New Development Area (NDA) planning, an outdated outline zoning plan regime, and a lack of high-level institutional commitment to NbS currently compromise this outcome. Holistic, landscape-level planning – supported by early-stage Strategic Environmental Assessments that incorporate climate projections and evaluate NbS pathways – is needed to guide sustainable development of the NM.

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Recommendation:
Planning a Climate-Resilient Future City

1. **Adopt a multi-level landscape network approach** that connects natural ecosystems with urban infrastructure and human-centred features to enhance biodiversity, thermal comfort, and walkability.

2. **Institutionalise Strategic Environmental Assessments (SEA)** to guide early-stage, system-wide planning and align land use with ecological performance.

3. **Mainstream NbS in planning guidelines** by embedding them as core design standards, supported by KPIs, compliance mechanisms, and regular reviews.

4. **Elevate government leadership and reframe the narrative** as part of a broader effort to preserve Hong Kong's biodiversity and urban identity – reflected in strategic visions that position the NM as a model for environmental innovation.

5. **Integrate long-term climate resilience into urban planning** by treating NbS as essential infrastructure and planning for overshoot climate scenarios.

6. **Ensure a Whole-of-Government approach** through empowered interdepartmental taskforces, shared tools, and aligned decision-making.

7. **Advance a Whole-of-Society approach** by embedding public engagement and co-creation into NbS projects, and incentivising private sector participation.

8. **Bridge knowledge gaps through capacity building** by updating education, certifying NbS professionals, and expanding access to green finance.

9. **Retrofit existing urban areas with NbS** through urban renewal, mandating green infrastructure and climate-responsive design.

10. **Leverage smart technologies** to optimise NbS performance using sensors, AI, and citizen platforms, with guidance updated dynamically.

11. **Align NbS with policy and climate target**s by classifying nature-based assets as OECMs and integrating them into ESG metrics and reporting systems.

12. **Position NM as a global NbS showcase** by integrating comprehensive NbS, collaborating internationally, and branding it as Asia's first climate-adaptive, nature-positive urban region.

II. Regional Collaboration:

Cross-border collaboration can further enhance the impact of NbS. Since 2012, China's "ecological civilisation" policy has mainstreamed environmental goals across national development strategies, supported by robust environmental legislation. In the Greater Bay Area (GBA), particularly Shenzhen Bay, joint initiatives between Hong Kong and Shenzhen can advance NbS through holistic bay-scale planning.

Despite differing legal frameworks and the pressures of rapid urbanisation, the GBA—particularly Shenzhen—holds immense potential to pioneer scalable, integrated urban-ecological models. Joint initiatives between Hong Kong and Shenzhen offer a unique opportunity for bay-scale NbS planning. By aligning ecological goals with urban development, such cross-border collaboration can significantly enhance climate resilience and environmental sustainability across the region.

Recommendations:
Roadmap for NbS in the Region

Short-Term (1–3 Years)	**Launch a joint taskforce**, pilot restoration projects, and establish a cross-border ecosystem monitoring hub.
Mid-Term (3–5 Years)	**Develop a regional NbS financing model** and expand pilot projects that connect blue-green infrastructure.
Long-Term (5+ Years)	**Institutionalise an NbS governance framework** across the GBA to embed nature-positive planning.

III. Financing NbS

Conservation finance remains a critical enabler of NbS. Scaling NbS requires a strong and sustained flow of capital. While interest from the private sector is growing, challenges such as perceived risk, limited awareness, and unclear returns continue to inhibit investment. This report also highlights the opportunities, constraints, and untapped potential of innovative financial instruments—including green bonds, climate funds, blended finance and public-private partnerships (PPPs).

Establishing an enabling environment through supportive policies, valuation of ecosystem services, and capacity building measures is vital to attracting both public and private capital, ensuring scalable and sustained investment in NbS. To unlock the full potential of conservation finance, Hong Kong must create an enabling environment that aligns financial incentives with ecological outcomes.

Recommendations: Strategies to Attract Investment in NbS

1. **Integrate risk modelling, monitoring, and scenario planning** into investment frameworks to demonstrate the long-term value and resilience benefits of NbS, helping to de-risk projects for investors.

2. **Establish a multi-stakeholder taskforce** to foster cross-sector collaboration, align business objectives with sustainability goals, and position Hong Kong as a regional leader in NbS and biodiversity finance.

3. **Strengthen regulatory frameworks and expand financial incentives,** moving beyond minimal sustainability-linked loan discounts to include tax benefits, subsidies, and preferential financing for nature-positive projects.

4. **Adopt a landscape-level investment strategy** that considers ecosystem interdependencies and reduces exposure to climate-related risks across portfolios.

5. **Develop clear, quantifiable metrics for NbS investment,** aligned with global climate finance standards, to assess ecological impact, carbon sequestration, and risk mitigation.

6. **Launch a pilot-scale demonstration fund** to build investor confidence, showcase replicable models, and attract larger-scale capital through proof of concept.

7. **Build capacity across the finance and development sectors** by offering training, certification, and knowledge-sharing platforms to deepen understanding of blended finance and nature-based investment models.

8. **Centralise NbS investment through a lead coordinating entity**, capable of aggregating funds, streamlining administration, and franchising implementation to smaller operators—improving cost efficiency and scalability.

Introduction

Hong Kong is a vibrant global city with rich biodiversity. As the local government and citizens look to the future, it is crucial to consider the development trajectory of Hong Kong and how it can address the challenges of the 21st century. NM represents a unique opportunity for Hong Kong to capitalise on its unique natural infrastructure and create a global leading example for sustainable urban development.

In recent years, momentum for NbS has grown significantly as cities around the world seek innovative ways to mitigate climate risks while promoting liveability and sustainability. In Hong Kong, the inaugural NbS forum co-hosted by TNC and Civic Exchange in 2023 marked a key milestone in recognising the urgency of adopting NbS for both climate mitigation and adaptation. This momentum continues, fuelled by strong support from the Hong Kong government and active participation by a diverse range of stakeholders, including urban planners, businesses and conservationists.

This report reflects on the NbS for Climate Conference 2025, held from 14 to 16 January 2025 in Hong Kong, co-hosted by TNC and Civic Exchange. The conference brought together key stakeholders to explore the potential of NbS, with a special focus on the NM development and its integration with the GBA. With adequate planning, the NM has the potential to set a benchmark in climate resilience and biodiversity conservation for cities worldwide.

Purpose of the report

This report captures discussions and expert insights shared during the 2025 NbS Conference. It highlights the critical role of NbS in shaping a sustainable and resilient future for the NM, and the need for continuous cross-sector collaboration, innovation and policy support to ensure that the NbS approach is mainstreamed as an effective strategy for climate action.

Key themes include integrating NbS into urban planning, cross-border collaboration, building the business case for NbS and exploring conservation finance mechanisms, particularly in the context of the NM and its integration with the GBA. The report offers guidance on cross-sector collaboration and advancing measurable climate resilience actions, and it provides a roadmap for embedding NbS into the region's urban development.

> *"Nature-based solutions are not just about conservation—they are about building a future where people and nature thrive together".*
>
> **Ms Lulu Zhou, Director, Strategic Partnerships for Climate Resilience, TNC Asia Pacific Region**

Global Developments Driving NbS Adoption

Several global developments underscore the timeliness of these efforts. At COP29, the agreement on carbon market rules, particularly the approval of REDD+, has provided growth opportunities in the forest carbon market, a key mechanism for mitigating climate impacts. Similarly, COP16 emphasised the synergies between nature and climate, advocating for a portion of climate finance to be dedicated to nature to maximise the co-benefits.

China's National Strategy and Its Impact on NbS

At the national level, China's climate strategy—aiming for carbon peak before 2030 and carbon neutrality before 2060—recognises nature as a core component of its climate action plan. The *National Climate Adaptation Strategy* for 2035 identifies the GBA as a strategically significant region for developing ecological corridors and protecting coastal wetlands, providing a strong framework for NbS integration.

Hong Kong's NM: An Opportunity for NbS Integration

Locally, Hong Kong's NM Development Strategy is a prime opportunity for sustainable urban development. By applying an ecosystem-based approach, NbS can enhance both climate adaptation and biodiversity conservation, particularly through the creation of a conservation wetland park system and implementation of hillside reforestation at scale. However, preserving ecological connectivity and function will also be critical to achieve climate benefits.

Hong Kong's Policies: A Key Driver of NbS Integration

Hong Kong is currently updating two policies that could see better integration of NbS: its Climate Action Plan (CAP) and Biodiversity Strategy and Action Plan (BSAP). This presents an opportunity for increased synergy between biodiversity conservation and additional solutions to address climate change. In its previous iteration, The CAP focused on strategies to achieve carbon neutrality before 2050, with little recognition of the role biodiversity plays in tackling climate change and no mention of NbS. The update to Hong Kong's climate policy should put stronger emphasis on NbS that provide both climate mitigation and adaptation benefits, which can also drive more funding for biodiversity conservation activities.

> *"We highlight the importance of multiple co-benefits with NbS, understanding that preserving biodiversity is essential in the fight against climate change".*

Prof Wong Kam Sing, GBS, JP, Former Secretary for the Environment (2012-2022)

The BSAP, first launched in 2016, aimed to protect biodiversity and promote the sustainable management of Hong Kong's natural resources from 2016 to 2021. However, the original plan fell short in recognising the complex challenges biodiversity conservation faces due to intensifying climate change effects. In May 2025, the government launched a formal public consultation for updating the 2025-2035 BSAP, with the objective of finalising the policy by end 2025. The four year delay (2015-2021) underscores the gap between stated commitments and follow-through on implementation, seemingly placing biodiversity protection as a low priority on the government agenda.

Looking ahead, the upcoming BSAP and CAP present a clear opportunity to integrate climate, human well-being and biodiversity policies, ensuring that ecosystem protection, restoration, management and climate resilience are mutually reinforcing. The alignment of these two policies through a NbS narrative is the key to address both climate change and biodiversity protection simultaneously, while generating stronger societal and financial support for biodiversity conservation. Consultation with NbS experts within the CAP update framework will be essential to ensure coherent and effective action across both agendas.

By adopting ecosystem-based approaches at the heart of NbS, the government can also support urban development that aligns with long-term sustainability goals. This is particularly timely as Hong Kong looks to the NM as a flagship opportunity to put these principles into practice on a large scale.

Northern Metropolis: An Overview

The NM, a mega-development project proposed by the Hong Kong government in 2021, aims to transform the northern part of Hong Kong into a new economic powerhouse with a modern and sustainable community, while conserving the Shenzhen Bay (Deep Bay) wetland ecosystem[1]. This ambitious project, covering approximately 30,000 hectares—one-third of Hong Kong's total area—will accommodate a projected population of 2.5 million. The NM Coordination Office (NMCO), established under the Development Bureau to oversee the project, is mandated to ensure that development and conservation happen in tandem.

> *"The Northern Metropolis project is not only about land development. We put a strong emphasis on conservation, making sure that development and conservation actually proceed together".*

Ms Pecvin Yong Pui Wan, Deputy Director, Northern Metropolis Co-ordination Office, Development Bureau, The HKSAR Government

In addition to development, a key focus of the NM is conservation, including the preservation and management of natural resources within the northern New Territories. Historically, Hong Kong has employed planning restrictions, such as Conservation Area and Coastal Protection Area zoning designations in statutory town planning, to safeguard natural habitats. However, in the absence of an overarching strategic plan or comprehensive conservation policy, zoning designation alone has proved to be ineffective for privately owned land and water bodies such as fishponds and wetlands, resulting in ecological degradation. Recognising these omissions, the NM project aims to adopt a more proactive approach to conservation, including government-led land resumption, active management and the development of wetland conservation parks to enhance ecological capacity alongside urban expansion.

1 Hong Kong Special Administrative Region Government. 2023. *Northern Metropolis Action Agenda 2023*. https://www.nm.gov.hk/downloads/NM_Eng_Booklet_Web.pdf

Country Parks

One of the notable conservation efforts within the NM is the upholding of the country park system. The NM region is home to four country parks, with Robin's Nest being the most recent addition, established in 2024. The Robin's Nest area, in particular, is significant for its ecological connectivity with Wutong Mountain in Shenzhen, forming an ecological corridor between Shenzhen and Hong Kong. This cross-border collaboration between Hong Kong and Shenzhen allows for the movement of wildlife between the two regions, strengthening the ecological health of both areas.

Wetlands

Located in the northwestern part of the NM, 1500 ha of wetland in the Mai Po and Inner Deep Bay are wetlands of international importance, including areas designated in 1995 under the Ramsar Convention. The government has invested in the feasibility study for a wetland conservation park system, which will be developed to preserve these and surrounding important habitats while accommodating future urban development.

Coastal Areas

Further west, Lau Fau Shan, located along the coastline of Deep Bay, is another area where the government plans to set up a Coastal Protection Park. This park will help protect the unique coastal ecology while supporting ecotourism development.

Urban Blue and Green Space

On the urban design front, the NM emphasises the integration of green and sustainable urban development. The new development areas within the NM will prioritise green space, with open space provision higher than the current level set out in the Hong Kong Planning Standards and Guidelines. Cycle-friendly infrastructure and green transport modes will also be incorporated into the design to promote a low-carbon, healthy lifestyle for residents. Additionally, the government is working to transform rivers and drainage channels into blue-green networks that serve multiple purposes, including flood mitigation, public enjoyment and ecological restoration. For example, the San Tin Western Main Drainage Channel will be transformed into one capable of acting as a floodable landscape and a water feature corridor.

Case study: Long Valley Nature Park

Long Valley Nature Park, opened in November 2024, is a 37-hectare freshwater agricultural area that was converted into a nature park. Located near the future Kwu Tung North New Development Area (NDA), this park is designed to preserve and enhance the area's freshwater habitat and ecological environment, compensate for the habitat loss due to development of Fanling North and Kwu Tung North, and provide green space for public enjoyment.

The park features three zones: a Biodiversity zone, an Agriculture zone, and a Visitor zone. The Biodiversity Zone includes efforts to convert abandoned agricultural land into freshwater habitats, making it a critical stopover for migratory birds. The Agriculture Zone supports traditional local farming communities, including those affected by the nearby development, by revitalising agricultural land through improving irrigation systems. Lastly, the Visitor Zone offers ecotourism facilities for bird watching and public education and outreach.

As a conservation project adjacent to a planned NDA, Long Valley Nature Park serves as a practical example of how early planning can conserve key habitats and contribute to sustainable development while providing high-quality public and educational spaces.

The Future City Model: Integrating Conservation into Urban Development

The sustainable development vision for the NM focuses on creating a resilient and liveable urban environment that integrates conservation within the development process. The government aims to make the NM a model for sustainable urban design and environmental stewardship in the GBA region.

To be a climate resilient city, the NM must use a comprehensive approach to building a sustainable, integrated urban ecosystem, where conservation is embedded into development strategies. Through proactive conservation, thoughtful urban design and cross-border collaboration, the NM has the potential to offer a new approach to urban development, serving as a valuable example for other cities facing similar challenges.

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Part I:
What Societal Challenges Can NbS Solve?

Global:
Increasing Threats from Climate Change

Accelerated Rates of Global Warming

Climate change is advancing at a faster rate than experts had predicted, with global surface temperatures increasing faster since 1970 than at any other time in the last 2,000 years. In 2023, the IPCC AR6 Synthesis Report indicated that global temperatures have already risen by 1.15°C above pre-industrial levels[2]. By 2024, this was estimated to be 1.3°C[3]. This rapid warming is a direct result of over a century of fossil fuel use and unsustainable land and energy use, creating a highly unequal and unsafe world. The top 10% of the highest-emitting households are responsible for about 40% of global greenhouse gas emissions, while the poorest 50%, primarily in the global south, contribute less than 15%—demonstrating a stark inequality.

The Increasing Frequency of Extreme Weather Events

The world is already seeing the impacts of climate change in real time. Extreme weather events such as wildfires, floods and typhoons have become more frequent and intense. For example, in 2024, the Philippines experienced a record-breaking typhoon season with six typhoons in just 30 days[4]. Meanwhile, Hong Kong faced three typhoons in November 2024 alone[5]—well beyond the typical typhoon season, which usually peaks between July and September. These events are symptomatic of broader changes in global weather patterns. Heatwaves and rising temperatures are contributing to a range of impacts, including heat-related deaths, and increasingly, biodiversity loss.

> *"The complex feedback loops between climate change and biodiversity loss are mutually reinforcing, and addressing and tackling these issues requires coherence in policies and actions."*
>
> **Marine Thomas, Associate Director of Conservation, TNC**

> *"You don't even need to read IPCC reports to know that the climate is changing. You've just got to be living in this world. And we now have to start dealing with compound and cascading risks."*
>
> **Prof Debra Roberts, Co-chair, AR6 Working Group II, IPCC**

2 Intergovernmental Panel on Climate Change (IPCC). 2023. *Sixth Assessment Report (AR6)*. https://www.ipcc.ch/assessment-report/ar6/

3 World Meteorological Organisation (WMO). 2025. *WMO confirms 2024 as warmest year on record at about 1.55°C above pre-industrial level*. https://wmo.int/news/media-centre/wmo-confirms-2024-warmest-year-record-about-155degc-above-pre-industrial-level

4 World Weather Attribution. 2024. *Climate change supercharged late typhoon season in the Philippines*, highlighting the need for resilience to consecutive events. https://www.worldweatherattribution.org/climate-change-supercharged-late-typhoon-season-in-the-philippines-highlighting-the-need-for-resilience-to-consecutive-events/

5 Hong Kong Observatory (HKO). 2024. *The Weather of November 2024* – A wet November with three tropical cyclone episodes. https://www.hko.gov.hk/en/wxinfo/pastwx/mws2024/mws202411.htm

Climate Impacts on Agriculture, Cities and Infrastructure

The global impact of climate change is felt across all regions and sectors, particularly climate-exposed sectors such as agriculture, forestry, fisheries and energy. Agricultural productivity has declined significantly in regions like Africa, where productivity has dropped by 34% since 1961, exacerbating food insecurity.[6] Urban areas are experiencing more intense heatwaves, leading to infrastructure damage and economic losses in climate-exposed sectors. However, despite growing recognition of these challenges, current adaptation efforts are still largely fragmented and incremental, insufficient to address the scale of the crisis.

The Limits to Adaptation and the Need for Nature-based Solutions

Adaptation efforts have been progressing, but they remain fragmented and incremental, with much of the response limited to specific sectors. While ecosystem-based adaptation has seen some success, adaptation alone is no longer a viable solution. Hard limits to adaptation are already being reached, particularly in ecosystems that are at immediate risk. Coastal wetlands, rainforests and polar ecosystems are just some of the critical natural systems that could be lost due to the ongoing climate crisis. NbS are thus becoming essential to address both climate change and biodiversity loss. NbS—such as wetland restoration, urban greening and reforestation—offer effective strategies to mitigate climate impacts and restore biodiversity and ecosystem services.

> *"Every tenth of a degree really matters. And the problem was we found that the high risks are in fact occurring at lower temperatures than we previously thought".*
>
> **Prof Debra Roberts, Co-chair, AR6 Working Group II, IPCC**

6 World Meteorological Organisation (WMO). 2023. *Africa suffers disproportionately from climate change*. https://wmo.int/news/media-centre/africa-suffers-disproportionately-from-climate-change

Rethinking our Approach: ‘Radical Realism’ for the 1.5°C Overshoot Scenario

Radical Realism (R.R) is a pragmatic climate planning framework that assumes we are likely to overshoot the 1.5°C target and must prepare for both mitigation and adaptation at once. Coined by Prof Debra Roberts, R.R urges policymakers to move beyond idealistic pathways and plan for realistic risks while still pursuing long-term decarbonisation.

The Insufficient Pace of Mitigation Efforts

The current response to mitigation, which is aimed at reducing greenhouse gas emissions and increasing carbon sinks, is insufficient. Even if governments fully implemented all their pre-2025 climate plans under the Paris Agreement, global emissions would only decrease by 2.6% by 2030, far short of the 43% reduction needed to stay on track for a 1.5°C pathway[7]. The recent United Nations Environment Programme (UNEP) Emissions Gap Report further highlights that current policies are not on track to meet the Paris Agreement targets[8], and without much more ambitious action, global warming will likely exceed 1.5°C by the early 2030s[9].

> *“The bad news is, because of our lack of ambition in the mitigation space, our assessment was that we were more likely than not to reach that aspirational level of 1.5°C of global warming in the first half of the 2030s”.*
>
> **Prof Debra Roberts, Co-chair, AR6 Working Group II, IPCC**

7 Intergovernmental Panel on Climate Change (IPCC). 2023. Climate Change 2022: *Mitigation of Climate Change*. https://www.ipcc.ch/report/ar6/wg3/

8 United Nations Environment Programme (UNEP). 2024. *Emissions Gap Report 2024*. https://www.unep.org/resources/emissions-gap-report-2024

9 World Meteorological Organisation (WMO). 2024. *Global temperature is likely to exceed 1.5°C above pre-industrial level temporarily in next 5 years.* https://wmo.int/news/media-centre/global-temperature-likely-exceed-15degc-above-pre-industrial-level-temporarily-next-5-years

The Urgency for Nature-based Solutions

The climate system is already showing signs of irreversible damage, with permafrost now acting as a source of carbon rather than a carbon sink, accelerating global warming.[10] Furthermore, sea-level rise and biodiversity loss are becoming unavoidable consequences, with over a billion people expected to be living in low-lying cities and small islands that are increasingly vulnerable to sea-level rise by the middle of the century.[11]

As the world moves closer to higher global temperatures, the risks of extreme events will only increase. Every additional tenth of a degree of warming leads to amplified risks of heatwaves, flooding,[12] biodiversity loss and food production loss. The IPCC emphasises that these compounding risks will become increasingly difficult to manage, particularly using ecosystem-based solutions where the limits of adaptation are already being reached.

The urgency of wider application of NbS cannot be overstated in this context. NbS provide vital co-benefits, including carbon sequestration, flood mitigation and enhanced biodiversity. As the IPCC clearly indicates, climate impacts, from rising sea levels to biodiversity loss, will escalate with each additional 0.1°C of warming. As we approach 1.5°C, 2°C, and possibly even 3°C of global warming, ecosystems such as coastal wetlands, mangroves, warm-water corals and rainforests will become increasingly vulnerable and could even vanish.

Considering these challenges, we must adopt R.R.—acknowledging that NbS are not only vital to mitigate the impacts of climate change, but also essential for adapting to the inevitable changes already underway. However, as ecosystems face increasing threats, we must think carefully about how to manage nature moving forward, as some of these solutions may no longer be viable in a greatly warmed world. Therefore, we must focus on ambitious mitigation strategies, using nature to help us adapt, while minimising the loss of these invaluable NbS.

> *“We could still con ourselves that limiting global warming to 1.5°C is possible. It’s time to own the fact that we haven’t met that goal and talk about moving forward. It is not time to give up. So instead of doom scrolling, what we need to be doing is ‘do more’”.*
>
> **Prof Debra Roberts, Co-chair, AR6 Working Group II, IPCC**

10 Virkkala, A.-M., Rogers, B.M., Watts, J.D., Arndt, K.A., Potter, S., ..., and Natali, S.M. 2025. *Wildfires offset the increasing but spatially heterogeneous Arctic-boreal CO2 uptake*. Nature Climate Change 15, 188-195.

11 Intergovernmental Panel on Climate Change (IPCC). 2023. Climate Change 2022: *Mitigation of Climate Change*. https://www.ipcc.ch/report/ar6/wg3/

12 Ibid.

Local:
Risks to The Northern Metropolis

Extreme Heat

As climate change accelerates, one of the most pressing issues Hong Kong faces is the extreme heat expected in the northern and northwestern parts of the territory by the end of the century. The NM, because of its geographic setting, is predicted to experience some of the worst heat impacts in Hong Kong, making it increasingly challenging for human habitation. As temperatures rise, urban heat island effects will intensify, particularly in densely built-up areas. Planning for a town layout that maximises the summer prevailing winds through the new town is essential. Conserving and restoring natural landscapes such as wetlands, fishponds and forested hillsides also plays a vital role in mitigating this heat. These NbS help regulate local climate conditions—not only through their natural cooling effects, but also by maintaining wind corridors that allow cool monsoon air to flow inland from the sea. Strategic conservation and reforestation in areas like country parks, as well as barren hillsides can therefore support both thermal comfort and climate resilience for urban populations in Hong Kong and Shenzhen.

Sea-level Rise

In addition to risks associated with warming temperatures, sea-level rise poses a threat to the NM. The government must account for rising sea levels when planning infrastructure; it will need to anticipate a 200-year return period for sea-level rise. By the end of the century, even high tide levels in spring could reach nearly four metres,[13] impacting frontline areas such as wetlands, fishponds and coastal regions.

13 Low, C.T. 2022. IPCC AR6 WG2 Demands *We Build A Climate Resilient Northern Metropolis. China Water Risk (CWR).* https://cwrrr.org/resources/analysis-reviews/ipcc-ar6-wg2-demands-we-build-a-climate-resilient-northern-metropolis/

The NbS of preserving wetlands are crucial for managing flood risks associated with sea-level rise and more frequent storm surges. These ecosystems serve as natural buffers, absorbing excess rainwater and tidal overflow, which helps protect vulnerable low-lying areas such as Yuen Long, Kam Tin and Ma Tso Lung. Converting these flood-prone landscapes into urban development not only eliminates their protective functions but also increases the extent of impermeable surfaces—thereby exacerbating flood risks for both existing and future communities.

> *"Hong Kong should worry about heat and sea flooding, which are unavoidable. Nothing we do now could stop those rising, and they will keep on rising for 200, 300 years. I would advocate that the four-metre line should be our first draft boundary for no development for the welfare of Hong Kong".*
>
> **Mr Lam Chiu Ying, Former Head of Observatory, Senior Advisor of Hong Kong 2050 is Now**

Hill Fires

The NM faces elevated hill fire risks—particularly in areas near cemeteries, villages and grassland-dominated slopes. Recent research using 34 years of satellite imagery shows that over 5,500 detectable hill fires occurred across Hong Kong during this period, with fire-prone zones often concentrated in specific hotspots.[14] These fires are almost exclusively human-induced, commonly triggered by grave sweeping rituals and careless cigarette disposal.

However, the risk is not only linked to ignition sources—vegetation type plays a critical role. Hong Kong's subtropical secondary forests are remarkably fire-resistant, with a 20-fold lower chance of burning compared to grasslands. Frequent fires degrade forested areas into more flammable grassland and shrubland, creating a self-reinforcing "fire trap". Recovery back to fire-resistant woodland can take decades, especially in fire zones located far from seed sources.

For the NM, this highlights the importance of using NbS for fire risk mitigation. Landscape-level planning that maintains and restores forested buffers, coupled with targeted afforestation in fire-prone areas, can help disrupt this feedback loop—enhancing ecosystem resilience and protecting both people and nature.

14 Chan, A. H. Y. et al. 2023. Reconstructing 34 years of fire history in the wet, subtropical vegetation of Hong Kong using Landsat, *Remote Sensing* 2023, 15(6), 1489, doi: 10.3390/RS15061489.

Flooding

In recent years, extreme rainfall events have caused severe flooding across Hong Kong. As a low-lying area, the NM warrants increased concern. Statistics from the Drainage Services Department reveal over 40 flood-prone locations in the NM over the past two years.[15] A particularly vulnerable area is San Tin, where the Innovation and Technology Zone of NM is currently being planned. Given that the area is a mix of mountainous terrain and low-lying land, and its proximity to rivers and coastlines, flooding can occur easily due to confounding factors—including mountain runoff, impervious urban surfaces, overwhelmed drainage systems and storm surges exacerbated by typhoons.

The intensifying impacts of climate change pose a significant threat to the NM. Hong Kong experienced 800 millimetres of rain within 24 hours in 2023, leading to severe flooding.[16] Another underreported yet pressing concern are tidal surges caused by typhoons, with Super Typhoon Hato in 2017 generating over two-metre-high surges, flooding coastal areas adjacent to the NM such as Mai Po Nature Reserve and Lau Fau Shan.[17] Despite these challenges, the *gei wai*—traditional shrimp ponds in Cantonese—and their surrounding mangroves served as natural buffers and wave energy brakes,[18] helping to protect nearby residential areas such as Fairview Park from severe damage. The stormwater storage capacity can be increased further by restoring tidal *gei wai* and actively lowering the water level in advance of a storm surge or heavy rainfalls.

> *"Integrating physical flood modelling with stakeholder engagement is essential for formulating actionable, equitable and affordable Nature-based Solutions".*
>
> **Ms Mengru Li, PhD candidate in Environmental Science, Policy, and Management, The Hong Kong University of Science and Technology (HKUST)**

Flood risk modelling

To measure the effectiveness of NbS in flood mitigation, a new flood simulation model has been developed by HKUST to develop actionable, evidence-based NbS strategies. This model:

- Simulates essential flood processes, including water level boundaries influenced by Deep Bay.
- Analyses flood points, affected areas and flood duration under different scenarios.
- Compares various NbS planning strategies against the present state to quantify reductions in flood risks to the NM.

15 Drainage Services Department. 2024. *Flooding Blackspots*. https://www.dsd.gov.hk/EN/Flood_Prevention/Our_Flooding_Situation/Flooding_Blackspots/index.html

16 Hong Kong Observatory (HKO). 2024. *The Year's Weather - 2023*. https://www.hko.gov.hk/en/wxinfo/pastwx/2023/ywx2023.htm

17 Hong Kong Observatory (HKO). 2019. *Super Typhoon Hato (1713) 20 to 24 August 2017*. https://www.hko.gov.hk/en/informtc/hato17/report.htm

18 Agriculture, Fisheries and Conservation Department (AFCD). 2023. *General Information About Wetland*. https://www.afcd.gov.hk/english/conservation/con_wet/con_wet_abt_gen/con_wet_abt_gen.html

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Economic Viability Assessment

One of the key challenges in implementing NbS is determining who benefits and who should bear the cost of these solutions. To address this, HKUST will conduct a series of stakeholder group interviews to refine NbS strategies, ensuring they are both practical and financially viable. Key stakeholders include:

Fishpond owners or operators
to understand their land-use priorities and explore opportunities for conservation partnerships.

Real estate developer
to assess their willingness to contribute to NbS initiatives as part of sustainable urban planning.

Government agencies
to align policy incentives and regulatory frameworks with NbS investment, ensuring long-term implementation and support.

Landslides

The mountains surrounding the NM are particularly vulnerable to landslides due to increased temperatures and excessive rainfall, exacerbated by limited tree cover in some areas. Hong Kong's steep terrain and intense seasonal rainfall make landslides a major geotechnical and environmental challenge. The city has a history of catastrophic landslides, particularly in the 1970s and 1990s, which resulted in major casualties and infrastructure damage.[19] The risk is further amplified by urban development on hilly landscapes, where excavation and slope modifications can destabilise the land. [20]

Climate change is worsening the situation, with extreme rainfall events becoming more frequent and intense.[21] To address these risks, Hong Kong has implemented a comprehensive Slope Safety System, which includes engineering interventions, regular slope maintenance and public awareness programs.[22] However, traditional concrete slope stabilisation methods are being re-evaluated in favour of NbS. Strategies such as reforestation, soil bioengineering and sustainable slope design not only enhance slope stability but also contribute to urban biodiversity and climate resilience.

19 Civil Engineering and Development Department (CEDD). 2025. *Past Notable Landslides*. https://hkss.cedd.gov.hk/hkss/en/facts-and-figures/past-notable-landslides/index.html

20 Holcombe, L., Beesley, M., Vardanega, P. and Sorbie, R. 2016. *Urbanisation and landslides: Hazard drivers and better practices*. *Proceedings of the ICE - Civil Engineering 169* (3), 137-144.

21 Hong Kong Observatory (HKO). 2024. *The Year's Weather - 2023*. https://www.hko.gov.hk/en/wxinfo/pastwx/2023/ywx2023.htm

22 Civil Engineering and Development Department (CEDD). 2023. *Slope Safety System in Hong Kong*. https://www.cedd.gov.hk/eng/about-us/achievements/geotechnical/safety-system/index.html

Part II:
Accelerating Scaled NbS implementation

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"The wonder of nature is part of what makes us human. How would it be to be human if we were not embedded in nature? We as engineers always need to be looking at how we can protect and restore those functions in nature".

Prof Jim Hall, President, Institution of Civil Engineers

Opportunity:
Nature-based Solutions in NM

The NM presents a unique opportunity to integrate NbS early in planning process and pioneer a new framework for sustainable urban development. With its diverse ecosystems, the region holds immense potential for climate resilience, ecological restoration and inclusive economic growth. In particular, ecotourism, plus sustainable and regenerative aquaculture, offer promising avenues for aligning environmental protection with economic development.

These opportunities not only enhance ecosystem services and biodiversity, but also support community livelihoods and create long-term, nature-positive capacity and value. The unique ecological landscape of the NM is further explored in the following section to illustrate how these assets can be leveraged through NbS.

Natural Ecosystems

Hillside Forests

Hong Kong's hillside forests play a crucial role in maintaining ecological balance, protecting biodiversity and enhancing climate resilience. Covering over half of Hong Kong's land area, these forests are primarily found within country parks and nature reserves, serving as critical habitats for diverse flora and fauna.[23] They act as natural buffers against extreme weather events, reducing the risk of landslides, soil erosion and flooding by stabilising slopes and absorbing excess rainfall. [24]

Additionally, these forests contribute to carbon sequestration, mitigating urban heat island effects by cooling surrounding areas. [25] However, deforestation, urban expansion and climate change pose increasing threats to these ecosystems. To ensure their sustainability, reforestation efforts, and fire prevention measures are essential. By integrating NbS into urban planning, Hong Kong can leverage its hillside forests as a key natural defence against climate change while helping to enhance local biodiversity.

> *"I've been promoting biodiversity in urban areas. Do you know that there are more than 60,000 man-made slopes in the city? If you connect these and transform them into biodiversity habitats, they could become a valuable asset to the city".*
>
> **Prof Dr Billy Hau, Programme Director, MSc Environmental Management, The University of Hong Kong**

Rural / Feng Shui Woodland

Feng shui woodland or forests, traditionally planted near villages to provide wind protection, shade and good fortune, are small yet ecologically significant woodlands that harbour native tree species, birds and insects, enhancing local biodiversity.[26] These forests, often found near temples, ancestral halls and villages, serve as important carbon sinks and water regulators, further strengthening their role in climate adaptation and disaster mitigation.[27]

23 Global Forest Watch. 2024. *Hong Kong*. https://www.globalforestwatch.org/dashboards/country/HKG/

24 Jenkins, M. and Schaap, B. 2018. *Forest Ecosystem Services: Background study prepared for the thirteenth session of the United Nations Forum on Forests*. https://www.un.org/esa/forests/wp-content/uploads/2018/05/UNFF13_BkgdStudy_ForestsEcoServices.pdf

25 *Ibid.*

Coastal Wetlands

Prior to being transformed into fishponds, the coastal areas of the Northwestern new territories were dominated by intertidal mangroves and oyster reefs. Today, the NM remains home to some of Hong Kong's most ecologically important wetlands—including Mai Po Nature Reserve, the intertidal flats along the Deep Bay Coast and the broader Inner Deep Bay wetland system—all vital ecosystems that support migratory birds along the East Asian–Australasian Flyway, as well as native fish, amphibians, mammals and plant species. These wetlands play a critical role in flood mitigation, acting as sponges that absorb excess stormwater and protect inland communities. At the same time, they provide essential habitats for biodiversity, climate stabilisation, environmental education and ecotourism.[28]

However, these wetlands face increasing development pressures, making their protection and management a top priority. Recognising and enhancing the flood risk reduction and ecological functions of wetlands is crucial for long-term climate resilience. With proper management, the NM wetlands can also contribute to green finance opportunities, including carbon or biodiversity credits and various other investments that link to conservation outcomes.

26 Yip, J.K.L., Ngar, Y.N., Yip, J.Y., Liu, E.K.Y. and Lai, P.C.C. (2004) *Venturing Fung Shui Woods*. Friends of the Country Parks, Agriculture, Fisheries and Conservation Department, Cosmo Books.

27 Coggins, C. and Minor, J. 2018. *Fengshui forests as a natural reservoir in the face of climate change and environmental transformation. Asia Pacific Perspective 15*(2), 4–29.

28 Agriculture, Fisheries and Conservation Department (AFCD). 2023. *General Information About Wetland*. https://www.afcd.gov.hk/english/conservation/con_wet/con_wet_abt_gen/con_wet_abt_gen.html

Oyster Reefs

Oyster reefs play a critical role in marine ecosystems, acting as natural water filters, shoreline stabilisers and biodiversity hotspots.[29] In Hong Kong's western waters, historical natural oyster reefs have declined significantly due to overexploitation and coastal reclamation. Collaborative projects, such as those between the Airport Authority Hong Kong (AAHK) and TNC, have deployed oyster reefs along the new runway seawalls, utilising recycled oyster shells and locally sourced larvae to regenerate habitats.[30] These initiatives demonstrate the potential for NbS to align ecological restoration with urban infrastructure, improving water quality, fostering marine biodiversity and mitigating coastal erosion.

Oyster reefs help stabilise shorelines, reduce wave energy and buffer against storm surges and sea-level rise—making them a valuable NbS for coastal protection. As part of a broader marine conservation strategy, scaling up oyster reef restoration in the NM could provide long-term benefits for the ecosystem health of coastal waters, fisheries sustainability and climate adaptation.

Mangroves

Mangroves serve as a crucial natural defence against coastal erosion and extreme weather events by stabilising shorelines, reducing wave height from storm surge and providing critical habitat for marine biodiversity.[31] Beyond their protective functions, mangroves also contribute to carbon sequestration, water filtration and fishery productivity, making them a key component of Blue Carbon and other NbS strategies.[32]

In the NM, where coastal development and rising sea levels pose significant risks, projects such as the proposed Coastal Protection Park (CPP) and wetland restoration initiatives [33] emphasise the need to preserve existing mangrove forests and restore oyster reefs, as well as integrate them into urban planning as natural buffers. Ensuring their conservation in the NM will require coordinated efforts between government agencies, conservation groups and developers to align ecological preservation with sustainable development, particularly within the realm of ecotourism.

29 National Oceanic and Atmospheric Administration (NOAA) *Fisheries. 2022. Oyster Reef Habitat*. https://www.fisheries.noaa.gov/national/habitat-conservation/oyster-reef-habitat#the-value-of-oyster-reef-habitat

30 Airport Authority Hong Kong. 2024. *Turning Trash into Treasure through Oyster Shell Recycling*. https://www.hongkongairport.com/en/sustainability/environment/greenest-airport-updates/202410-GAU-OysterRecycle

31 Spalding, M., McIvor, A., Tonneijck, F.H., Tol, S. and Van Eijk, P. 2014. *Mangroves for coastal defence: Guidelines for coastal managers and policy makers*. Wetlands International and The Nature Conservancy.

32 Food and Agriculture Organisation of the United Nations. 2025. *Mangrove Management*. https://www.fao.org/forestry/mangrove/ecosystem-services/en

33 Hong Kong Special Administrative Region Government. 2023. *Northern Metropolis Action Agenda*. https://www.nm.gov.hk/downloads/NM_Eng_Booklet_Web.pdf

Modified Natural Systems

Traditional Aquaculture: Fishponds and Oyster farms

While man-made, traditional fishponds (including *gei wai*) and oyster farms have become an integral part of the NM landscape. These semi-natural systems provide multiple biodiversity benefits, support traditional livelihoods and preserve cultural heritage[34]. Fishponds are critical for storm-water retention and provide vital habitats for migratory birds: when drained, fish ponds create shallow water environments rich in small fish and shrimp, an essential food source for birds such as black-faced spoonbills and egrets[35]. Oyster farms mimic natural oyster reefs and play a crucial role in water quality regulation for the nutrient-rich waters of Deep Bay. However, several challenges have led to the industries' decline:

Economic pressure

Increased competition from cheaper imports from mainland China.

Aging workforce

Many fishpond operators and oyster farmers are over 60 years old, with few successors in younger generations.[36] Finding sufficient labour is a major challenge.

Climate risks

Rising temperatures, extreme heat and flooding events increase the likelihood of fish and oyster die-offs or stock escapes, making operations increasingly unpredictable and financially unsustainable.[37]

34 Agriculture, Fisheries and Conservation Department (AFCD). 2023. *General Information About Wetland*. https://www.afcd.gov.hk/english/conservation/con_wet/con_wet_abt_gen/con_wet_abt_gen.html

35 Hong Kong Bird Watching Society (HKBWS). 2025. *The Value and Functions of Fishponds*. https://cms.hkbws.org.hk/cms/en/hkbws/work/habitat-management/fishpond/knowing-fishpond/learn-fishpond/value-function-en

36 Hong Kong Bird Watching Society (HKBWS). 2025. *Threats to the Pondfish Culture Industry*. https://cms.hkbws.org.hk/cms/en/hkbws/work/habitat-management/fishpond/knowing-fishpond/learn-fishpond/threat-en

37 Schulder-Battis, K. 2024. *Heritage under threat: The Hong Kong fish farmers set to lose their way of life to the Northern Metropolis development*. https://hongkongfp.com/2024/12/22/heritage-under-threat-the-hong-kong-fish-farmers-set-to-lose-their-way-of-life-to-the-northern-metropolis-development/

Traditional Aquaculture *Gei Wai*

Historically, the coastal wetlands of Deep Bay were dominated by *gei wai,* traditional aquaculture systems that leverage the estuarine environment. Unlike modern freshwater fishponds, *gei wai* are self-sustaining, low-input systems integrating ecological processes with human needs, offering a model for sustainable, regenerative aquaculture.

Table 1 Climate Resilience of *gei wai* Compared to Fishponds

Aspect	Fishponds	*Gei Wai*
Definition	Artificial or modified freshwater bodies for intensive fish farming	Traditional, tidal, mangrove-fringed shrimp ponds leveraging natural ecological processes
Input Requirements	High input: artificial stocking, supplemental feeding, aerator to increase dissolved oxygen	Low input: rely on natural growth processes, no artificial feeding
Water Management	Enclosed system: drain the water to harvest the fish, then replenish the pond using water from adjacent ponds and rainwater	Dynamic: tidal integration with sluice gates allowing nutrient-rich water
Biodiversity	Focus on fish farming, attracts migratory water birds when pond is drained during fish harvest, simple community with low diversity but high abundance of aquatic species	Supports diverse aquatic community, enhancing ecological value
Environmental Impact	Can degrade water quality	Minimal infrastructure and natural water exchange reduce environmental footprint
Harvesting	Limited species production for commercial yield	Up to 80 shrimp harvests per year, mud crabs and additional fish harvests in winter
Maintenance	High operational costs due to the need to sunbake pond mud annually to oxidise accumulated organic waste, and bulldoze pond mud every 1-2 years to reinforce the bund	Low maintenance with the need to desilt every 5-7 years
Climate Resilience	Low resilience to environmental stressors and saltwater infiltration from increasing flood risk	High resilience due to integration with natural processes

> *"There are over 1,000 hectares of traditional fishponds within the NM, but they face intense competition from imported freshwater fish. By restoring and actively managing some of them as productive tidal gei wai, the biodiversity, fishery production, climate resilience and storm water storage capacity can be further enhanced".*
>
> **Dr Michael Lau, Founding Member, Hong Kong Wetlands Conservation Association**

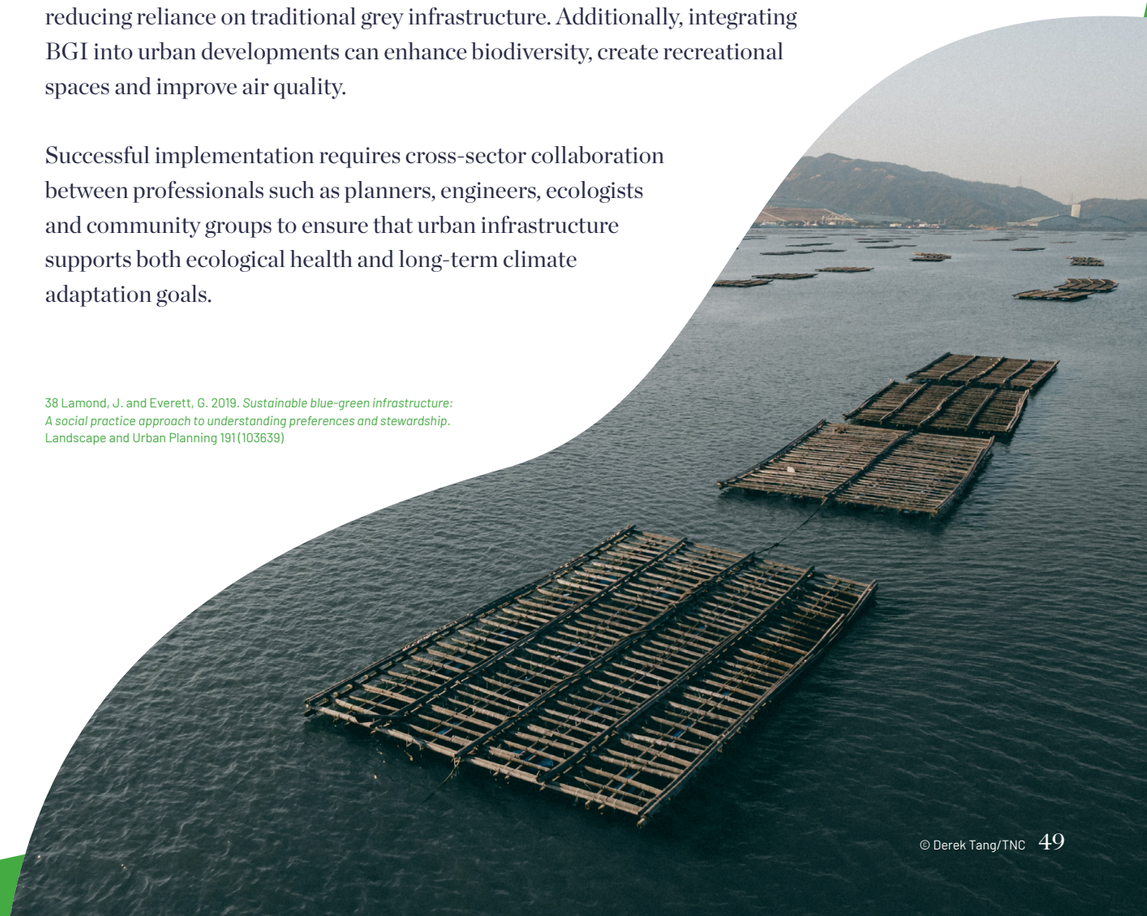
Blue-green Infrastructure

Blue-green infrastructure (BGI) integrates natural and engineered solutions to enhance climate resilience, manage water resources and improve urban liveability.[38]

In the NM, BGI strategies such as rain gardens, bioswales, permeable pavements and revitalised riparian systems can mitigate flood risks, reduce urban heat and improve water quality. By incorporating NbS into drainage and stormwater management, these systems mimic natural hydrological processes, reducing reliance on traditional grey infrastructure. Additionally, integrating BGI into urban developments can enhance biodiversity, create recreational spaces and improve air quality.

Successful implementation requires cross-sector collaboration between professionals such as planners, engineers, ecologists and community groups to ensure that urban infrastructure supports both ecological health and long-term climate adaptation goals.

38 Lamond, J. and Everett, G. 2019. *Sustainable blue-green infrastructure: A social practice approach to understanding preferences and stewardship.* Landscape and Urban Planning 191 (103639)



Urban Green Space

Trees

Trees play a crucial role in mitigating urban heat and managing stormwater. According to a European study across 293 cities, urban trees can reduce temperatures by up to 4°C,[39] with even greater benefits in high-density areas like the NM. A remote sensing study in Hong Kong found that trees can lower maximum temperatures by 6°C, with an average cooling effect of 3°C, similar to findings in Singapore. [40] Additionally, trees intercept stormwater, reducing flooding risks and removing pollutants from runoff, offering multiple ecosystem benefits at no cost. [41]

By integrating tree-based NbS into urban planning, Hong Kong can enhance its climate resilience, reduce urban heat and manage stormwater effectively, while providing leisure and recreation opportunities to the community. This will set a new benchmark for nature-driven infrastructure solutions in compact cities.

39 Schwaab, J., Meier, R., Mussetti, G., Seneviratne, S., Burgi, C. and Davin, E.L. 2021. *The role of urban trees in reducing land surface temperatures in European cities*. Nature Communications 12(6763).

40 Jia, S. and Wang, Y. 2021. *Effect of heat mitigation strategies on thermal environment, thermal comfort, and walkability: A case study in Hong Kong*. Building and Environment 201(107988).

41 Woodland Trust. 2025. *Can Woods and Trees Reduce Flooding?* https://www.woodlandtrust.org.uk/trees-woods-and-wildlife/british-trees/flooding/

"An important type of NbS is street trees, which offer numerous benefits ranging from mitigating urban heat island effects and intercepting stormwater, to purifying runoffs. Considering the limited space for growing stable and healthy street trees in Hong Kong, novel infrastructure needs to be developed to accommodate the special needs of street trees in Hong Kong".

Prof Yuhong Wang, Professor, Department of Civil and Environmental Engineering, Hong Kong Polytechnic University

Challenges in Implementing Tree-based NbS in Compact Cities

Despite their benefits, large-scale tree planting in high-density cities like Hong Kong faces several challenges:

Space constraints

In compact urban areas, trees are often confined to small planting spaces and limited soil depth, severely hampering their growth and reaching full potential.

Infrastructure damage

Tree roots can damage roads surface and underground utilities, resulting in resistance from civil engineers.

Adaptation challenges

Studies show that downtown trees have an average lifespan of only 13 years, compared to 37 years in residential areas and 150+ years in natural conditions, highlighting the difficulty of sustaining trees in urban potential environments.[42]

Innovative Engineering Solutions for Urban Tree Growth

To overcome these challenges, new engineering solutions are being developed:

Breathable concrete

Traditional pavement materials restrict oxygen diffusion, affecting tree root health. Researchers are developing permeable concrete to support tree-fungi symbiosis, ensuring healthier growth.

Utilising road space

With roads occupying one-third of Hong Kong's urban land, there is a significant opportunity to expand roadside planting. By designing underground spaces to accommodate tree roots, urban trees can thrive without compromising infrastructure integrity.

Stormwater absorption

Simulations indicate that using road pavements for water storage could reduce urban flooding by 20%, further reinforcing the resilience benefits of tree-based NbS.[43]

42 Roman, L.R. and Scatena, F.N. 2011. *Street tree survival rates: Meta-analysis of previous studies and application to a field survey in Philadelphia,* PA, USA. Urban Forestry & Urban Greening 10(4), 269-274.

43 Hu, M., Zhang, X., Siu, Y.L., Li, Y., Tanaka, K., Yang, H. and Xu, Y. 2018. *Flood mitigation by permeable pavements in Chinese sponge city construction. Waters* 10(2), 172.

Pilot Research Could Occur in the NM

The NM could serve as a valuable living laboratory for piloting tree-based NbS in high-density urban settings. Researchers at The Hong Kong Polytechnic University, for example, are already developing promising technologies such as breathable concrete, root-friendly pavement systems and stormwater-absorbing road designs. These innovations could be tested and scaled within the NM—provided there is strong government commitment to supporting research and implementation. Realising the full potential of NbS in the NM will require dedicated funding mechanisms and policy support. Without this, research institutions may be left to compete for limited grants through conventional channels, potentially slowing progress on much-needed climate resilience innovations.

38 Lamond, J. and Everett, G. 2019. *Sustainable blue-green infrastructure: A social practice approach to understanding preferences and stewardship.* Landscape and Urban Planning 191 (103639)

Potential NbS Pathways in NM

- ***Ecosystem Restoration & Conservation***
- ***Sustainable Land and Water Use***
- ***Urban Greening & Biodiversity Enhancement***
- ***Blue-Green Infrastructure***

Provide benefits

- Biodiversity
- Carbon Sequestration
- Climate Resilience

Mangrove & Oyster Reef Restoration
Inter-tidal shoreline
- Buffers storm surges
- Improves water quality
- Carbon sequestration

Wetland Conservation Parks
Deep Bay Wetland Network
- Recreation and well-being
- Environmental education

Smart *Gei Wai*
Fishpond Clusters
- Combines traditional aquaculture with smart water control for reduced flood risk

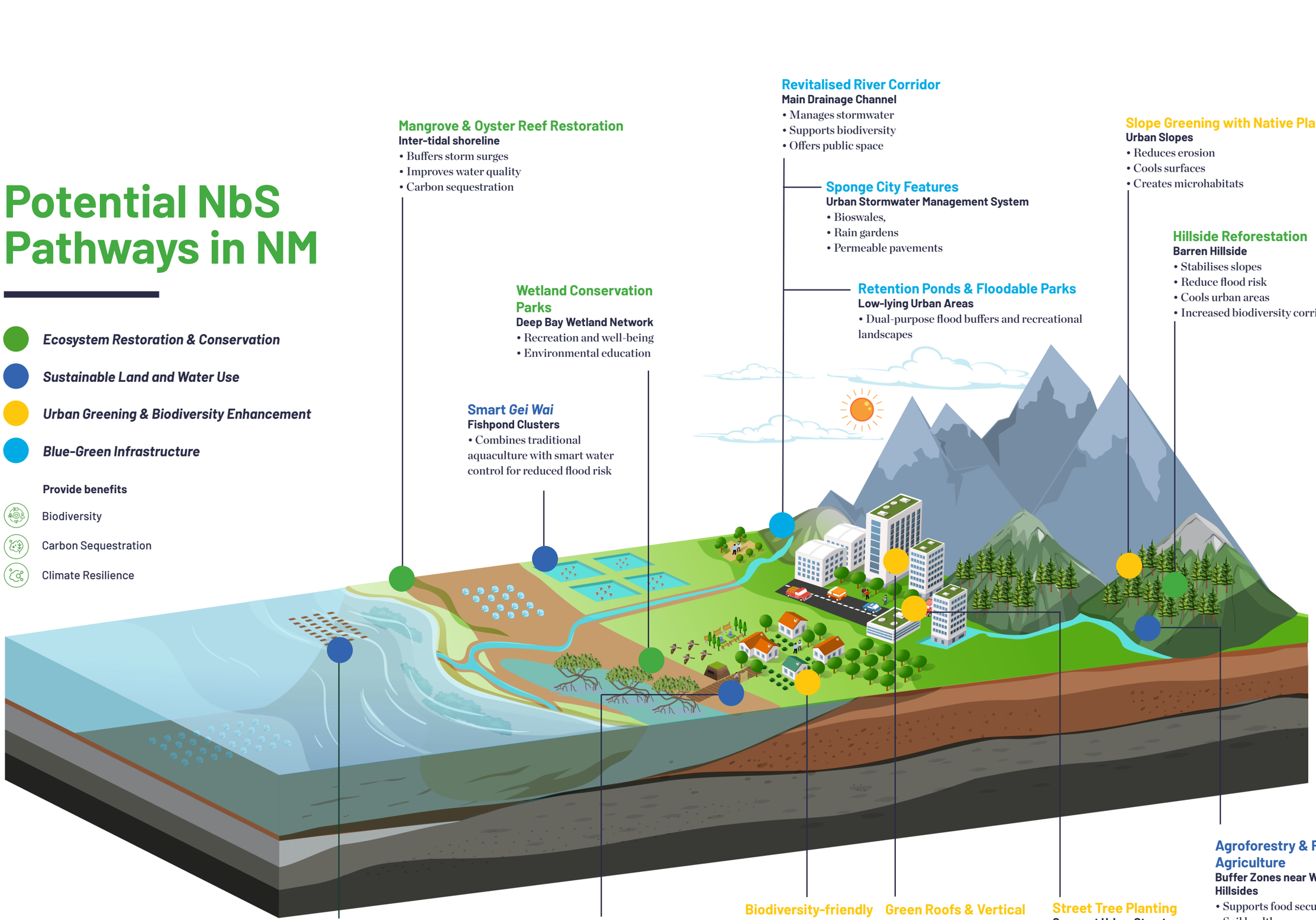
Revitalised River Corridor
Main Drainage Channel
- Manages stormwater
- Supports biodiversity
- Offers public space

Sponge City Features
Urban Stormwater Management System
- Bioswales,
- Rain gardens
- Permeable pavements

Retention Ponds & Floodable Parks
Low-lying Urban Areas
- Dual-purpose flood buffers and recreational landscapes

Slope Greening with Native Plants
Urban Slopes
- Reduces erosion
- Cools surfaces
- Creates microhabitats

Hillside Reforestation
Barren Hillside
- Stabilises slopes
- Reduce flood risk
- Cools urban areas
- Increased biodiversity corridors



Regenerative Oyster Aquaculture
Oyster Farm
- Water filtration

Ecotourism
Coastal Protection Park
- Sustains traditional livelihoods
- Provides funding for Conservation

Biodiversity-friendly Parks
Urban Parks
- Native plants & water features enhance ecological connectivity

Green Roofs & Vertical Greening
High-Density Developments
- Increases green cover
- Reduces heat
- Supports pollinators

Street Tree Planting
Compact Urban Streetscapes
- Absorb air pollutants
- Urban cooling
- Reduce runoff

Agroforestry & Regenerative Agriculture
Buffer Zones near Wetlands and Hillsides
- Supports food security
- Soil health
- Carbon storage

The Nature Conservancy
大 自 然 保 護 協 會

Urban Planning: Integrating Nature-based Solutions in the Planning Process

As plans for the NM take shape, urban planning must evolve to address the realities of the 21st century—the need for a better living environment and resilient public facilities in the face of rising climate risks, biodiversity loss and intensifying socio-economic pressures. NbS offer a strategic opportunity to future-proof the NM, ensuring that environmental resilience and human wellbeing are fully integrated.

Yet, current planning practices remain compartmentalised, responsive, conventional and overly reliant on traditional zoning frameworks and traditional infrastructure centred models. To build a climate-adaptive, biodiverse and liveable metropolis, NbS must be mainstreamed into the early stage and be the foundations of urban planning integrated into different planned infrastructures and land uses or developments.

This chapter identifies key barriers to implementation, showcases case studies of successful integration of NbS into urban development and outlines a way forward through flexible planning systems, landscape-level strategies and whole-of-government and society collaboration. With the appropriate vision and more progressive institutional frameworks, together with the necessary commitment by Hong Kong government, the NM could set a new global benchmark for nature-positive urbanisation.

Barriers to Implementing NbS

Fragmented Planning and Lack of Early Integration

The NM is currently shaped by parallel and compartmentalised development proposals efforts—ranging from IT parks to conservation areas, education and technical institutes—all moving forward independently to meet their respective goals and timelines. While Environmental Impact Assessments (EIA) are applied to evaluate projects, they often occur late in the planning process. This sequencing limits their ability to address broader ecosystem interconnections. As a result, siloed decision-making dominates the early planning stages, when integrated thinking—especially around NbS—is most needed. Without a unified strategic vision, opportunities to embed climate adaptation and biodiversity considerations from the outset are frequently missed.

Lack of a Holistic Planning Framework

Despite the scale of development—across over 30,000 hectares—there is no unified top-down strategy that incorporates climate adaptation, biodiversity and ecosystem resilience. Without a holistic, cross-cutting planning approach, the region risks falling short of sustainability goals.

Lack of High-level Government Commitment

High-level government discourse often prioritises economic growth while overlooking the importance of environmental sustainability, biodiversity and NbS to Hong Kong as an international city striving to attract investment and talent, plus foster a quality living environment. Climate action should be embedded into Hong Kong's broader planning and development narrative.

Unfortunately, Hong Kong's exceptional biodiversity is rarely recognised as a core asset in how the city presents itself globally—whether in its branding, policy agenda or economic positioning. Elevating nature-based planning to the same level as its ambitions for technological and infrastructural development would help create a more balanced and future-ready strategic vision for Hong Kong, one that is aligned with global ESG priorities.

Outdated and Inadequate Urban Planning Approach

Hong Kong's reliance on traditional outline zoning plans—designed to separate land uses into rigid compartments—is no longer fit for purpose due to unprecedented climate challenges. Similarly, the Hong Kong Planning Standards and Guidelines (HKPSG)—a key reference for planners—is dated and lacks integration of contemporary climate science, biodiversity considerations or NbS. While strategic documents like 2030+ promote a green and resilient city real-world implementation remains fragmented, with a noticeable lack of valid town planning tools and mechanisms, and with environmental considerations receiving only marginal attention. Planning remains peripheral and reactive, relying on piecemeal amendments rather than systemic reviews. Instead, the system needs a dynamic and holistic planning approach informed by updated climate science, ecological expertise and long-term sustainability goals.

Sequencing Challenges in Development

Nature-based elements are often introduced late in the planning process, well after key infrastructure decisions have been made. Unlike in other major cities, key infrastructure planning in Hong Kong, such as roads and railways, is still conducted outside the town planning system. This "retrofitting" approach limits the ecological benefits of NbS and risks irreversible habitat degradation. True integration requires a "nature-first" sequencing model where green infrastructure precedes hard development, benefiting the community as well as nature.

Institutional Fragmentation

In the absence of clear policy and commitment at the top government level, government departments remain divided between planning, infrastructure and environmental management, lacking clear mandates or cross-departmental coordination that would allow the mainstreaming of NbS, climate action and biodiversity conservation. Without a fundamental policy and structural realignment, nature-inclusive urban planning will remain fragmentary and difficult to scale up.

Way Forward:
A Multi-level Landscape Network Approach

A multi-level landscape network approach considers entire ecosystems rather than isolated projects, ensuring that NbS function coherently across both existing and planned urban and rural environments. This strategy integrates ecological connectivity, biodiversity conservation and sustainable land management to enhance climate resilience while supporting social and economic development.

In the NM, adopting a multi-level landscape network strategy—one that considers ecosystems at a regional scale—can help connect green corridors, wetlands, forests and urban blue-green infrastructure to maximise ecological benefits. This holistic perspective helps balance competing land-use demands by integrating ecological resilience into the planning framework, ensuring that conservation, development and climate adaptation are not treated as trade-offs but as mutually reinforcing goals. Such an approach also supports biodiversity connectivity, flood mitigation and public wellbeing. By moving beyond fragmented project-by-project planning, a landscape-scale strategy encourages coordinated action across departments and jurisdictions. It also provides a strong foundation for embedding NbS early in the planning process, encouraging multifunctional land uses that contribute to Hong Kong's carbon neutrality and biodiversity targets.

Effective implementation requires:

- Multi-stakeholder collaboration to ensure integration of scientific, technical and community perspectives.
- Evidence-based decision-making through shared ecological monitoring platforms, incorporating both appraisals and evaluations to inform adaptive planning and policy refinement.
- Adaptive monitoring and management that incorporates updated knowledge over time, especially in response to climate risks.

A pathway to operationalising the landscape network approach will be will be adopting the Strategic Environmental Assessment model. SEA is a forward-looking planning tool that evaluates ecological trade-offs at the policy and programme level, rather than merely justifying project-level decisions. Unlike standard Environmental Impact Assessments (EIAs), SEA allows for scenario-based planning and helps decision makers identify optimal land-use patterns before major development parameters—such as road layouts or zoning—are locked in. For landscape-level NbS to be effective, SEA must be institutionalised as a core step in early-stage urban planning, guiding how infrastructure and ecological priorities are sequenced.

> *"The Northern Metropolis is the perfect testbed to deploy NbS in a grand and holistic manner."*
>
> **Mr Jasper Hilkhuijsen, East Asia Senior Innovation and Sustainable Development Manager, Arup**

Example: Flood Management through Landscape-scale NbS

Flood management in the NM must evolve from a purely engineering-based model to a landscape-scale NbS approach that works with natural hydrological systems. This method not only enhances resilience but also promotes a healthier and more sustainable water cycle, complementing traditional grey infrastructure.

Key NbS components of a holistic flood management strategy include:

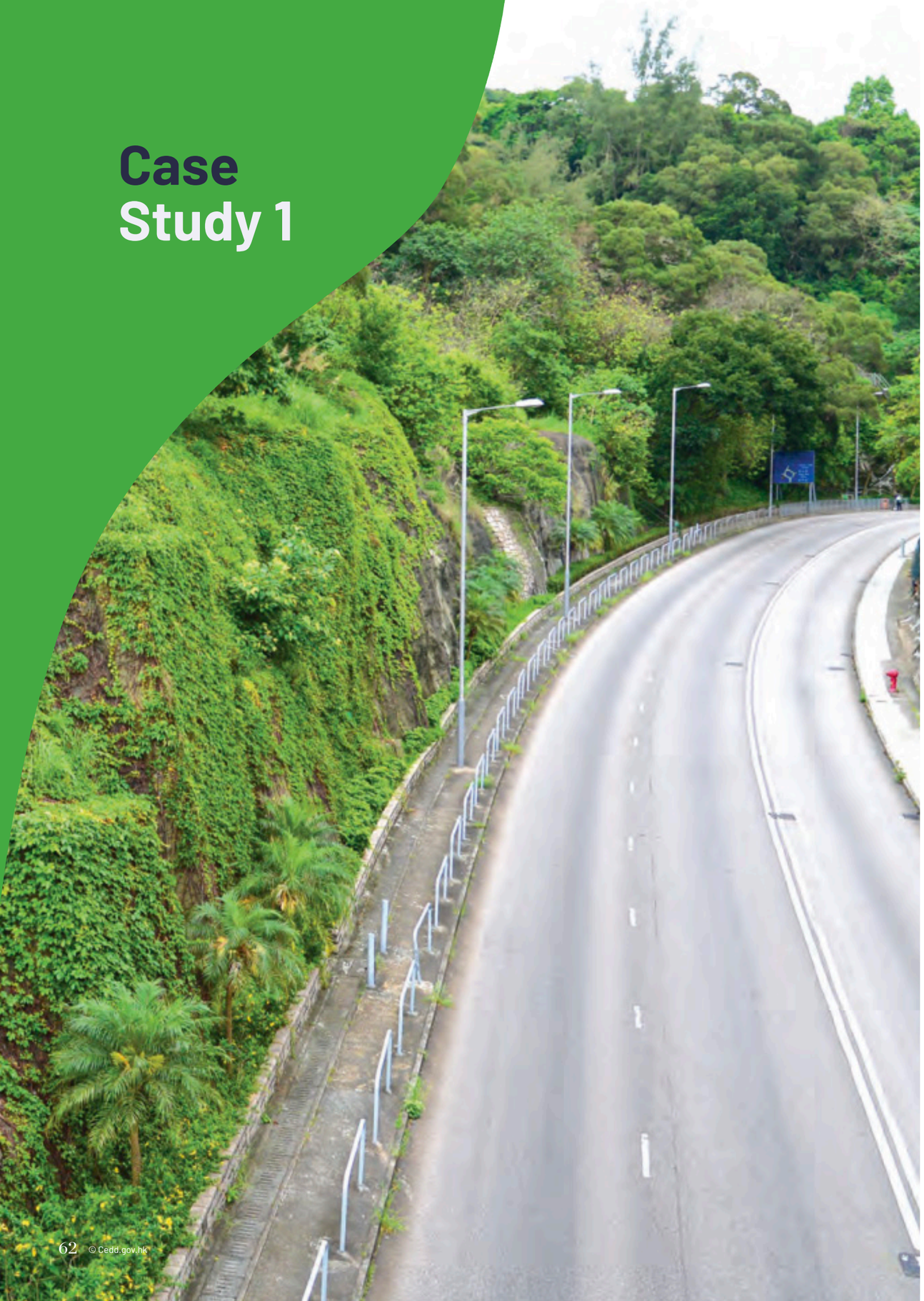
Reforestation in mountain areas to absorb excess rainfall, reduce surface runoff and prevent landslides—protecting both natural systems and built infrastructure.

Wetland & Fishpond restoration to act as natural reservoirs that regulate floodwaters, improve water retention and reduce peak discharge during storms.

Smart *Gei Wai* and traditional *gei wai* rehabilitation, inspired by successful examples like the Mai Po Nature Reserve, which showcases the ecological and hydrological value of hybrid traditional-innovative NbS in a Hong Kong context.

By embedding SEA into the flood resilience planning process, authorities can better identify suitable areas for wetland restoration and natural buffer zones while assessing potential land-use conflicts early. This will ensure that both development and flood mitigation efforts are ecologically informed, spatially coordinated and more climate-resilient, while contributing to biodiversity conservation over time.

Case Study 1



Case Study 1:
Urban Slope Greening

In response to severe landslides in the 1990s that resulted in significant casualties, Hong Kong established a robust slope safety system. Traditionally, concrete covers were used for slope stabilisation to prevent erosion and rainfall infiltration. However, with increasing concerns about climate resilience, environmental sustainability and urban biodiversity, the Civil Engineering and Development Department (CEDD) sought to incorporate NbS into slope management.[44]

Recognising the potential of greening to enhance both safety and biodiversity, CEDD initiated collaborations with the University of Hong Kong (HKU) over 15 years ago. This partnership aimed to develop research-backed standards for urban slope greening, moving beyond conventional engineering solutions to more ecologically adaptive approaches.

> *"I would like to emphasise that collaboration is not enough. The most important thing is that, after collaboration, we should have a standard of good practice. That is the rulebook. So, after we publish the rulebook, practitioners in Hong Kong must follow this rulebook".*
>
> **IR Dr Raymond Cheung, JP, Head of Geotechnical Engineering Office, Civil Engineering and Development Department, The HKSAR Government**

44 Civil Engineering and Development Department (CEDD). 2024. *San Tin Technopole: A sustainable nature-based new I&T hub - Received "Outstanding Planning Award" at The Hong Kong Institute of Planners Greater Bay Area Planning Awards 2024*. https://www.cedd.gov.hk/eng/media-corner/awards-and-recognition/index-id-40.html

Collaboration Between Engineers and Ecologists

While engineers focused on slope stability, ecologists contributed expertise in biodiversity conservation and plant species selection. The key milestones in this collaboration include:

One of the most successful case studies was a slope reforestation project in Tai Lam Country Park, where native tree species were planted and monitored. Over time, the site developed into a thriving mini-ecosystem, providing both slope stabilisation and enhanced urban biodiversity.[45]

1990s
Initial efforts to incorporate greening into slope design.

2000
The publication of GEO Publication No. 1/2000, which set initial greening guidelines.

2003–2010
Experimental planting of native trees and shrubs, demonstrating the feasibility of biodiversity-friendly slope restoration.

2011
The publication of GEO Publication No. 1/2011, which expands the 2000 greening guidelines to cover natural terrain mitigation works and landslide repairs.

2015–Present
Research expansion into enhancing urban biodiversity on slopes, including habitat enrichment techniques.

© Cedd.gov.hk

45 Civil Engineering and Development Department (CEDD). 2009. *Planting trial at Yuen Tun and performance assessment of vegetation species on 44 man-made slopes.* https://www.cedd.gov.hk/filemanager/eng/content_457/er248links.pdf

Lessons Learnt

1 .Mainstreaming Biodiversity into Engineering Practices

Beyond individual projects, the long-term impact of this collaboration has been the integration of biodiversity considerations into engineering design. Key strategies implemented include:

- **Development of standardised guidelines**
  The research findings were incorporated into technical manuals, ensuring that biodiversity-enhancing practices became standard procedure for government projects.

- **Capacity building**
  Knowledge-sharing sessions between ecologists and engineers facilitated greater cross-disciplinary understanding. CEDD held technical seminars and training workshops to educate contractors and government staff on biodiversity-sensitive slope management.

- **Integration into early-stage planning and design**
  By embedding biodiversity principles into early-stage design, project proponents could maximise ecological benefits while ensuring slope stability.

2. Exploring New Frontiers: Urban Biodiversity Enhancement

In recent years, the collaboration has expanded to explore new ways of enhancing biodiversity in urban areas. Key initiatives include:

- **Direct seeding for landslide recovery**
  To accelerate natural regeneration, drone-assisted seed sowing techniques were tested on landslide-prone slopes.[46]

- **Artificial habitat features**
  Small, lightweight biodiversity enhancement structures, such as water pans for insects and salt pans for wildlife, are being introduced to encourage species diversity on urban slopes.

- **Modernised greening techniques**
  Moving away from short-term greening solutions that rely on thin layers of growth medium, efforts are now focused on long-term vegetation sustainability.

46 Law, Y.K., Lee, C., Pang, C.C., Hau, B. and Wu, J. 2022. *Vegetation regeneration on natural terrain landslides in Hong Kong: Direct seeding of native species as a restoration tool.* Land Degradation & Development 34(3), 751-762.

3. Challenges and Opportunities

While progress has been made, the project faces ongoing challenges, including:

- **Scaling implementation**
  More systematic application of biodiversity-friendly practices across all public works projects is needed.

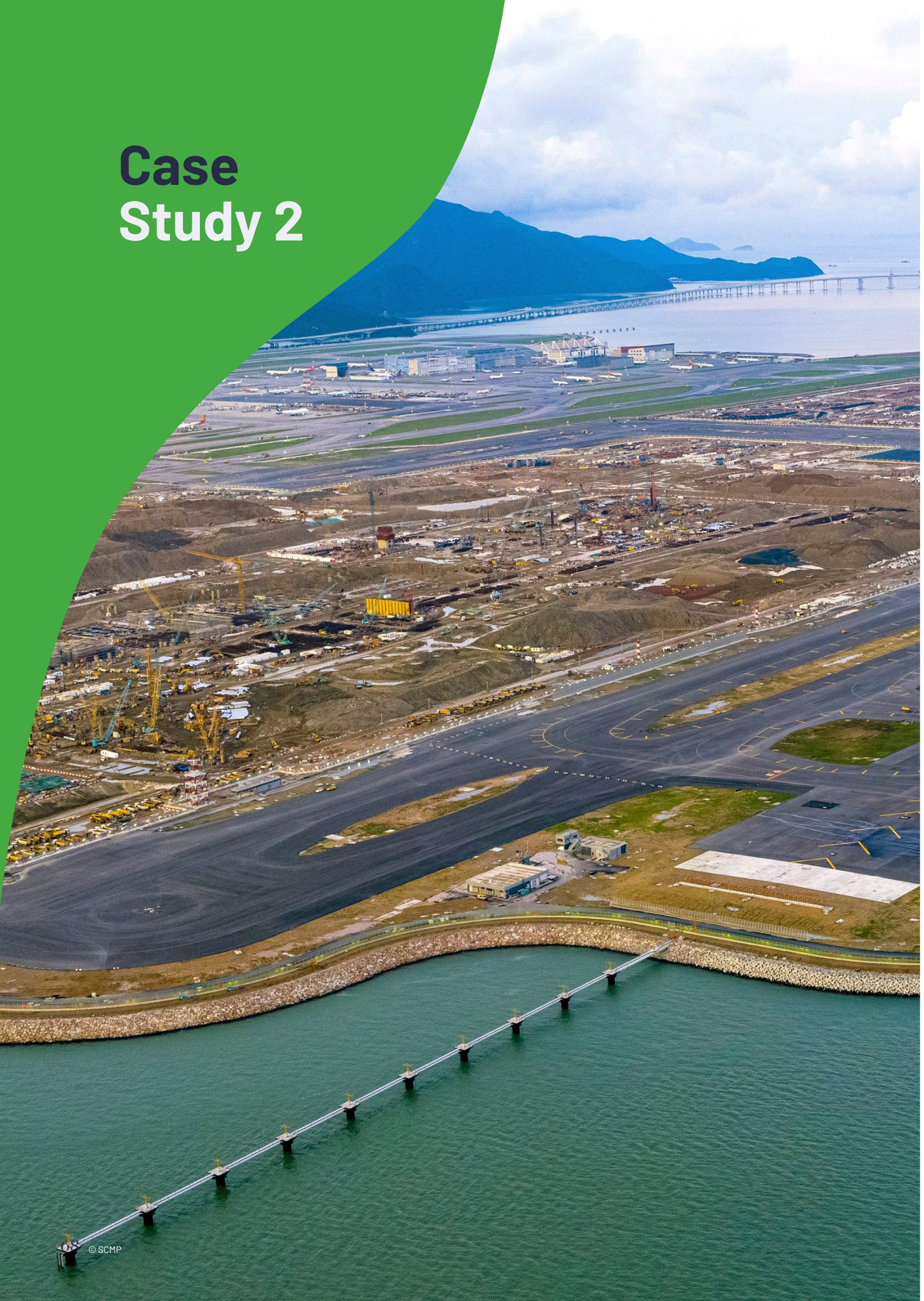
- **Long-term monitoring**
  Extended tracking of biodiversity outcomes will provide valuable data for refining best practices.

- **Expanding collaboration**
  Additional partnerships with research institutions and international experts can enhance further Hong Kong's leadership in nature-based urban infrastructure solutions.

The Way Forward

The partnership between CEDD and HKU has demonstrated the power of cross-disciplinary collaboration in transforming Hong Kong's approach to slope management and the importance of setting clear standards for future projects. By integrating engineering, ecology and urban planning, Hong Kong is setting a precedent for climate-resilient and biodiversity-positive urban development. With continued research, capacity building and policy integration, **Hong Kong's man-made slopes could evolve into a network of urban ecological corridors.**

Case
Study 2



Case Study 2:
The Hong Kong International Airport Three-Runway System Expansion

The expansion of Hong Kong International Airport (HKIA) into a Three-Runway System (3RS) was subject to a comprehensive Environmental Impact Assessment (EIA) process and required an Environmental Permit (EP) prior to construction.
The EIA and EP necessitated the implementation of wide-ranging mitigation and compensation measures to ensure the residual environmental impacts of airport expansion were acceptable. While the Airport Authority Hong Kong (AAHK) met all statutory mitigation requirements during expansion, a range of additional nature-based enhancements were explored voluntarily, intended to further improve biodiversity and marine ecology in the vicinity of the airport.

One notable example is the collaboration between AAHK and TNC on a pioneering shellfish reef restoration project. This initiative emerged from an ongoing stakeholder engagement process, during which TNC proposed the concept. The idea gained traction and ultimately led to a formal partnership to bring the project to life.[47]

47 Airport Authority Hong Kong. 2021. *Three-runway System Project – Pilot Study of Shellfish Reef Deployment*. https://www.hongkongairport.com/en/media-centre/news-stories-updates/Shellfish_Reef_Deployment

"It's a win-win for us to develop meaningful Nature-based Solutions as part of this major project when an initiative has recognised environmental impacts; this initiative is a practical way to enhance the marine environment around us in the long term".

Mr Martin Putnam, Senior Manager, Biodiversity, Sustainability, Airport Authority Hong Kong

Shellfish Reef Restoration: A Collaborative Model

Shellfish reef restoration is a globally-recognised NbS that improves water quality, enhances biodiversity and protects coastlines.[48] The restricted waters surrounding the airport provided an ideal sanctuary for restored oyster reefs, shielding them from wild-harvesting while supporting long-term ecosystem recovery. The collaboration between AAHK and TNC focused on:

Site selection

Identifying a suitable restoration area along the expanded airport seawall, ensuring minimal interference with aviation operations.

Material sourcing

Using limestone and recycled concrete as reef base substrate, along with recycled oyster shells collected from restaurants and local oyster farmers, to help promote natural larval settlement.

Scaling up

After identifying the ecological value through a pilot shellfish reef trial, expanding to a significantly larger deployment, extending to half a kilometre of restored reef habitat.

Local Partnerships

Working with Lau Fau Shan oyster farmers to introduce native oyster species on the reef, supporting traditional aquaculture communities.

48 Nature-based Solutions Initiative. 2018. *Oyster Reefs as Natural Breakwaters Mitigate Shoreline Loss and Facilitate Fisheries.* https://www.naturebasedsolutionsinitiative.org/publications/oyster-reefs-as-natural-breakwaters-mitigate-shoreline-loss-and-facilitate-fisheries/

"NbS are only as good as the ecosystem services they provide, and ecosystem services are provided by functioning ecosystems. Preserving or restoring functioning ecosystems must be the main goal of NbS to be effective".

Ms Marine Thomas, Associate Director of Conservation, TNC Hong Kong

Lessons Learnt

1. Regulatory barriers

The legal classification of reef deployment as seabed reclamation under Hong Kong law complicates permitting processes, more cross department collaboration is needed for permitting.

2. Standardisation of NbS

A lack of clear guidelines and definitions for marine NbS creates uncertainty in project design, implementation and outcomes. Guidelines with clear methodologies and ecological outcomes need to be developed for Marine NbS.

3. Adaptive management and long-term monitoring

Ecological restoration takes time and can be a bumpy road. This requires embedding adaptive management into project planning and extended monitoring time-frames to assess effectiveness.

4. Scaling and funding

While AAHK provided funding for the pilot trial and scale-up, securing ongoing financing for further expansion across Hong Kong water remains a challenge.

The Way Forward

Develop clear NbS standards
Establish technical guidelines and certification frameworks for marine and terrestrial ecosystems.

Expand regulatory support
Align environmental policies with biodiversity net gain principles, ensuring NbS projects receive necessary approvals and and cross-department support for permitting.

Encourage public-private collaboration
Leverage partnerships between government, businesses, and NGOs to scale conservation efforts.

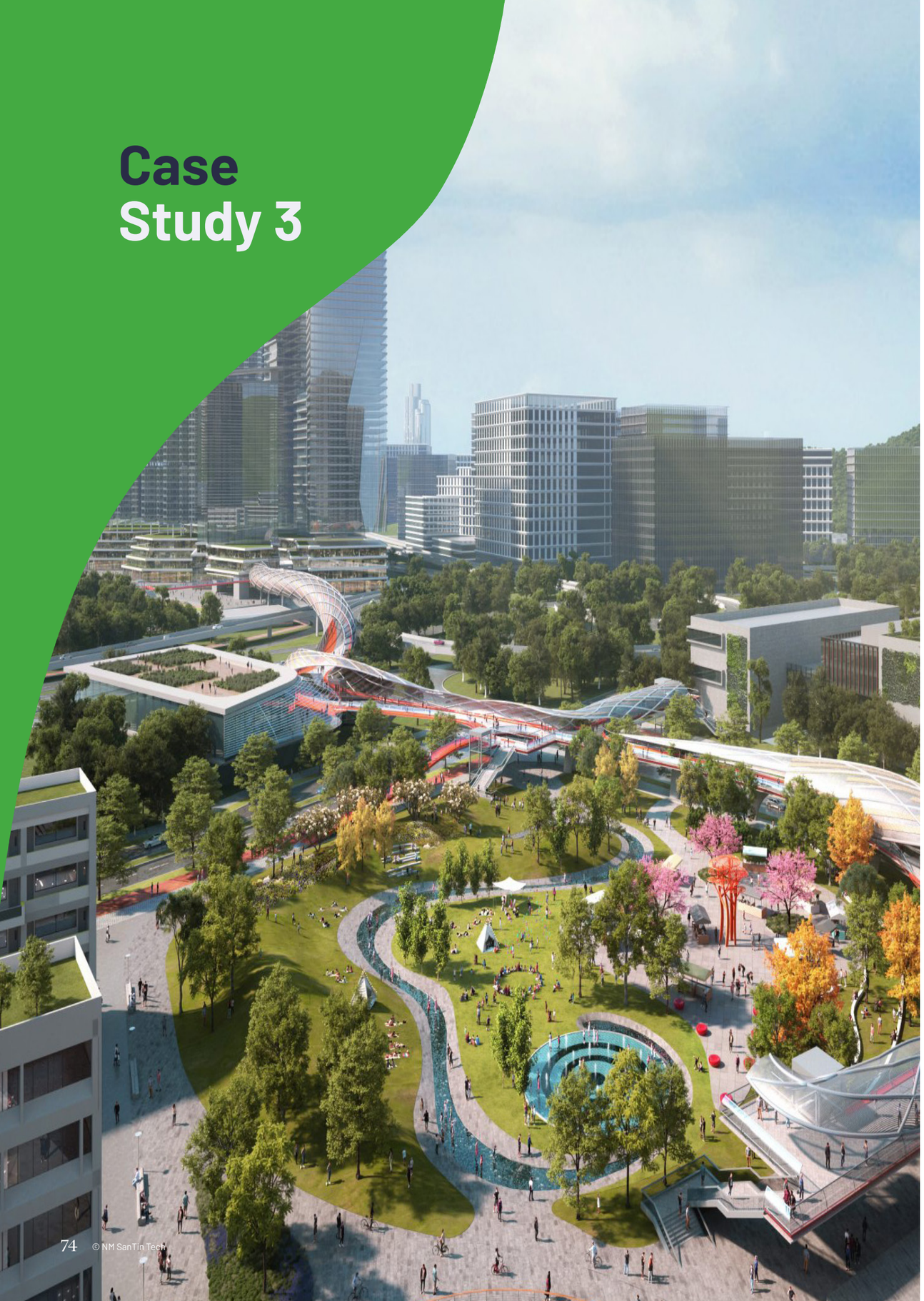
Adopt an Adaptive Management framework with long-term monitoring
Incorporate adaptive management principles and long-term monitoring to respond to uncertainties of the restoration process.

Enhance cross-sector knowledge sharing
Integrate ecological expertise into engineering and urban planning to maximise biodiversity benefits.

The AAHK-TNC collaboration serves as a pioneering example of how NbS can be integrated into major infrastructure projects. By restoring shellfish reefs and enhancing coastal habitats, this initiative not only helps to mitigate ecological impacts but also sets a precedent for sustainable urban coastal development.

As Hong Kong moves forward with the urban development of the NM, there is an opportunity to explore how ecological protection and enhancement can be better integrated into large-scale planning. While trade-offs between development and ecosystem protection are inevitable, thoughtful planning and the application of NbS can help minimise impacts and **position Hong Kong as a leader in climate-resilient coastal management.**

Case Study 3



Case Study 3: San Tin Technopole Development

San Tin Technopole is positioned as a key development within the NM, aiming to create a green, smart and sustainable innovation and technology (I&T) hub. Given its proximity to Shenzhen, the area is rich in ecological and cultural significance, necessitating an integrated planning approach that balances urban development with nature conservation.

Collaboration between Conservation Group and Landscape Architects

Conservation efforts often face challenges due to being perceived as anti-development. However, sustainable urban planning can balance economic growth with ecological preservation. By working alongside landscape architects from the Hong Kong Institute of Landscape Architects (HKILA), conservation group WWF-Hong Kong (WWF) has engaged in meaningful dialogues with urban planners, developers and policymakers to advocate for an NbS-driven approach.

> *"The fact that we are facing a global biodiversity crisis shows that working in silo is not effective. So we have been looking for opportunities to collaborate with others".*
>
> **Dr Bosco Chan, Director, Conservation, World Wide Fund For Nature Hong Kong**

This partnership has yielded five key recommendations (Appendix 1) targeting improved biodiversity, flood management and community integration within the Technopole. These proposals have been successfully incorporated into the latest Town Planning Board recommendations, ensuring that NbS principles are embedded in the planning and design framework. Table 2 compares the key recommendations with the central elements of the NbS approach adopted in San Tin by CEDD (Appendix 2).

> *"Nature forms the basis of life, which humans are a part of. Landscape architects of the modern world carry the mission to help cities responding to the global threat of climate change and vast biodiversity loss through Nature-based Solutions (NbS). We are keen to continue working with partners and stakeholders to facilitate wider adoption of NbS at impactful scale".*
>
> **Mr Paul Chan, President, Hong Kong Institute of Landscape Architects**

Table 2 San Tin Technopole Development NbS

Comparison Between Recommendations from the Collaboration Between Conservation Groups and Landscape Architects and CEDD's Adoption

Recommendations from WWF and HKILA	Adopted NbS Elements by CEDD
Enhancing Ecological Connectivity	300-metre-wide bird flight corridor, non-building zones, height restrictions, wildlife corridors for otters
Retaining Existing Watercourses for Sustainable Drainage	Retaining natural watercourses, introducing river revitalisation, using sustainable drainage system
Integrating Rural and Cultural Heritage into Urban Design	Integration of urban farming and aquaculture, eco-interface zones
Establishing a Wetland Park for Climate Resilience	Establishing Sam Po Shue Wetland Conservation Park and developing a riverside park
Implementing Bird-friendly Urban Design	Bird-friendly building guidelines, non-building areas, convert existing egretry into open space, height restrictions to preserve flight paths

Lessons Learnt

This collaboration between WWF and HKILA demonstrates the potential of interdisciplinary cooperation in shaping policy and promoting sustainable urban development. By combining on-the-ground conservation expertise with urban planning principles, the team influenced policy recommendations that were endorsed by the Town Planning Board and partially adopted by CEDD—without reducing land allocation for housing or innovation and technology development. These developments mark a step forward in promoting nature-inclusive planning within the NM. While the San Tin Technopole shows promise as a potential flagship for integrating ecology, urban resilience and sustainable growth, no construction has taken place yet. The true test lies in whether these policy intentions translate into tangible, nature-friendly outcomes on the ground.

The Way Forward

As the NM development proceeds through planning to implementation, collaboration among government agencies, conservationists and urban planners will be essential to translating these recommendations into actionable strategies that enhance biodiversity while benefiting future residents. CEDD is currently drafting the Planning and Design Brief (PDB) for future Innovation and Technology (I&T) sites. This document will define detailed planning and design requirements, presenting a key opportunity to integrate ecological and sustainability principles.

Key next steps:

Mandatory compliance

All future land leases and master plans will be required to adhere to PDB guidelines, which will be reviewed and approved by a dedicated committee under the Development Bureau.

Stakeholder engagement

A consultation process will be conducted before finalising the PDB, ensuring input from professional institutions, conservationists and the business sector to enhance the effectiveness and feasibility of the guidelines.

By establishing clear guidelines, the PDB will help ensure that new developments align with nature-positive objectives, **fostering climate resilience, biodiversity conservation and sustainable urban growth in Hong Kong**.

> *"We hope to adopt the NbS approach to develop our San Tin Technopole, such that it will become a green, smart and sustainable I&T centre, setting a new benchmark for future cities".*
>
> **IR Carrie Leung, Chief Engineer, Civil Engineering and Development Department, The HKSAR Government**

Recommendation:
Collectively Plan a Climate-resilient Future City

1. Adopting a Multi-level Landscape Network Approach with Human and Ecology Connectivity

Hong Kong currently lacks high-profile NbS projects that can demonstrate sustained success. The NM offers a pivotal opportunity to pioneer a connected, climate-adaptive blue-green network. Such a network must not only function ecologically and benefit biodiversity, but also socially—creating cooler, healthier and more walkable environments.

Connect hillside woodlands (country parks, fengshui forests), wetlands (*gei wai*, fishponds, mangroves) and estuarine habitats with urban infrastructure (bioswales, sponge city elements, green roofs) into a seamless connected landscape.	Include human-centred linkages such as shaded walkways, urban farms, tree-lined boulevards and nature-based "cool spines" that double as biodiversity corridors and climate buffers.	Position urban greenery and water features as co-benefits for thermal comfort, pedestrian mobility and public health, especially under rising heat risks.

2. Embedding SEA into Urban Planning Frameworks

The current EIA-driven, piece-meal planning is outdated and reactive. Instead, SEA should guide early-stage, system-wide planning, evaluating climate and biodiversity trade-offs before finalising infrastructure or land-use plans.

Institutionalise SEA as a planning prerequisite for all NM projects, with transparent alternative scenario assessments.	Align zoning and land-use with ecological performance indicators—not just population density or transport efficiency.	Use SEA to strategically locate natural buffers before hard infrastructure is built, avoiding irreversible ecological degradation or biodiversity loss.

3. Reviewing Planning and Development Guidelines

NbS must be built into the planning system—not merely as add-ons, but as core design elements. This will require certain additions to the existing framework.

Develop actionable, interdepartmental NbS guidelines tailored for both planning and implementation stages for new and redevelopment areas.	Ensure planning authorities, contractors and developers use these guidelines consistently, with aligned key performance indicators (KPIs) and compliance mechanisms.	Periodically review these guidelines to keep pace with evolving climate risks and science.

4. High-level Government Commitment and Narrative Shift

Climate resilience and biodiversity must be elevated in public discourse, championed by top leadership and featured prominently in strategic visions that promote and develop Hong Kong.

Embed NbS and environmental innovation into the branding and strategic positioning of the NM—alongside tech and talent.	Celebrate Hong Kong's unique biodiversity as a global asset, integrating it into urban identity and global-city marketing.

5. Integrating Long-term Climate Resilience into Urban Planning

NbS are not just 'green enhancements'—they are core infrastructure for climate resilience. Planning should assume overshoot climate risks (1.5–3°C), not best-case scenarios.

Map climate vulnerability hotspots in NM—e.g., areas affected by the urban heat island effect, low-lying flood-prone zones—and prioritise NbS investment accordingly.	Design for layered, both horizontal and vertical, risk mitigation: wetland buffers, reforested hills, green buildings and emergency flood detention zones.
Retain fishponds, mangrove buffers and space for coastal retreat; avoid development that pushes to the water's edge.	Integrate NbS strategies into planning for slope stabilisation, extreme rainfall and heat stress.

6. Whole-of-Government Approach

Built on the existing resources developed by the government (Appendix 3), planning, transport, environment, housing and drainage departments must co-design and co-implement NbS.

Establish interdepartmental NbS task forces with authority to shape land use and budget decisions.	Provide in-house training and shared platforms to equip public officers, elected officials and the public with NbS literacy and implementation tools.

7. Whole-of-Society Approach

For NbS to succeed, they must be co-developed and maintained by those who will implement them, not imposed.

Institutionalise awareness, public engagement and participatory design in all major NbS projects.	Involve schools, youth, women, local groups, business, ethnic minorities and elderly in park management, food growing and climate storytelling.
Leverage physical flood models and co-learning spaces to raise awareness and encourage stakeholder buy-in.	Mainstream corporate engagement through ESG incentives and recognition for private NbS champions.

8. Bridging the Knowledge Gap Through Capacity Building and Policy Innovation

NbS adoption is hindered by limited familiarity in the building, construction and finance sectors.

Update tertiary curricula to include ecological urbanism, sustainable materials and climate-adaptive design.	Create an NbS hub for Hong Kong and develop professional training and certification schemes for NbS project delivery.	Offer green finance instruments and design incentives to lower market entry barriers for nature-integrated projects.

9. Providing a Roadmap for Existing Urban Areas and Redevelopment Zones

NbS must be retrofitted into high-density areas and older urban cores through urban renewal strategies.

Require Urban Renewal Authority (URA) and housing agencies to embed NbS—green roofs, pocket parks, vertical gardens, green façades—into their planning, design and operation of developments.	Mandate sustainable drainage, full water cycle integration (greywater reuse, rainwater harvesting) and climate-responsive greening for all large-scale projects.	Use redevelopment as a catalyst for environmental upgrade—not just development capacity expansion.

10. Leveraging Smart Technology and Adaptive Urban Management

Smart city infrastructure can enhance NbS efficiency and visibility.

Deploy real-time environmental sensors (e.g., temperature, soil moisture) and AI tools for predictive management of green assets.	Integrate smart irrigation, remote biodiversity tracking and citizen reporting platforms.	Make NbS guidance 'living' and dynamic documents—updated regularly based on climate projections and local trial results.

11. Aligning NbS with Existing and Future Policy Instruments

NbS must align with existing strategies such as BSAP and climate action plans.

Classify nature-enhancing urban elements (e.g., rivers, parks, fishponds, sponge city zones) as OECMs to support 30x30 goals.	Ensure NbS projects contribute directly to climate targets—carbon sequestration, flood risk reduction and cooling—and are counted in reporting systems.	Integrate biodiversity indicators into sustainability-linked bonds and ESG metrics.

12. Positioning the NM as a Global Demonstration Zone for Nature-integrated Urbanisation

The NM has the scale and political visibility to become a global showcase for nature-based climate resilience.

Target 1.5°C overshoot readiness through comprehensive NbS integration.	Host international forums and publish progress metrics with open-access dashboards.
Create a platform for collaboration with international cities, design networks and scientific bodies to pilot, measure, study and showcase scalable NbS.	Champion NM as Asia's first climate-adaptive, nature-positive urban region—bridging quality living, urban design, nature and the necessary financial arrangements.

> *"The government has been doing more to share its views and listen to what the community has to say. We need to keep going to make this happen".*
>
> **Mr Lawrence lu, Executive Director, Civic Exchange**

Regional Collaboration

"Can we, through the co-operation between the governments of Hong Kong and Shenzhen, develop Shenzhen Bay into a place as prosperous and vibrant as our Victoria Harbour, while maintaining and enhancing the ecological capacity of Shenzhen Bay and its environmental value?"

Prof KK Ling, Director, Jockey Club Design Institute for Social Innovation, The Hong Kong Polytechnic University

Evolution of China's Environmental Policies and Progress

Since 2012, China has embarked on a new phase of environmental governance through its commitment to building an "ecological civilisation". This shift marks a fundamental departure from previous GDP-centric development models, placing greater emphasis on sustainability and ecological integrity.

One of the key changes is the transformation in governance philosophy. Rather than relying on ad hoc campaigns or reactive environmental crackdowns, China now promotes systematic, institutional reforms. These include the integration of environmental goals into economic and social planning, the adoption of mandatory indicators for carbon and energy intensity, and a holistic approach to ecosystem and watershed governance. A dynamic planning system is central to this transformation, requiring ongoing adaptation to reflect evolving environmental conditions and policy needs.

Key Legislative and Institutional Developments

Under the ecological civilisation framework, China has developed a natural resource asset management system and introduced ecological compensation mechanisms to promote conservation[49]. National land-use planning has helped clarify land functions, but it also poses challenges—such as rigidity and potential over-standardisation.

49 Wang, S., Xing, L., Chen, X. and Song, M. 2024. *Evaluating and enhancing natural resource asset management efficiency in China: A data envelopment analysis study*. Resources Policy 92(105000).

Under the framework of ecological civilization, China has gradually constructed a robust environmental legislative system to guide sustainable development. A cornerstone of this system is the evolving "1+N+4" legislative model, which provides a multi-layered approach to environmental protection:[50]

1 "1" refers to the foundational and comprehensive national Environmental Protection Law, which serves as the legal bedrock for China's ecological governance system.

N "N" represents a growing number of specialised laws that address specific environmental elements such as air, water, solid waste, soil, noise, oceans, wetlands, grasslands, forests and desert ecosystems. These laws allow for targeted governance across different ecological domains and reflect a commitment to systematic environmental management.

4 4" denotes innovative legislation focused on key regions and watersheds, including:
- The Yangtze River Protection Law
- The Yellow River Protection Law
- The Black Soil Protection Law
- The Tibetan Plateau Ecological Protection Law, which is currently under development.

For example, the *Land Protection Law* (2022) introduced a "total loss control" mechanism, which sparked public debate due to its high implementation costs and questions about feasibility. These concerns reflect the ongoing evolution of land and ecological policy in balancing environmental integrity with development goals.

Looking ahead, a comprehensive *Environmental Law Code* is expected to be reviewed by the National People's Congress in 2025. This code will likely consolidate laws related to pollution control, ecological protection and green development, providing a more integrated legal structure.

Despite these advancements, challenges remain. Many ecological indicators—such as biodiversity health and ecosystem service values—are still difficult to quantify, creating obstacles in policy implementation, ecological compensation and green financing.

50 The National People's Congress of the People's Republic of China. 2023. 在黃河保護法實施座談會上的講話. http://www.npc.gov.cn/npc/c2/c30834/202302/t20230222_423630.html

Over the past decade, China has made significant strides in environmental governance. Improvements in air and water quality, enhanced soil management and a growing network of protected areas underscore the country's progress. The expansion of renewable energy and the implementation of carbon reduction targets reflect a growing commitment to green development.

The 20th National Congress Report highlighted four key strategic directions[51]:

- A comprehensive green transition across the economy and society.
- Deeper and more targeted pollution control measures.
- Strengthening ecosystem diversity, resilience and sustainability.
- Achieving the "dual carbon" goals—peaking carbon emissions and reaching carbon neutrality—in a steady and orderly manner.

Two Critical Policy Shifts for the Future

1. **Holistic Green Transformation:** Future environmental policy will focus on systemic change, integrating sustainability into all aspects of the economy and society—not just within individual sectors. Carbon neutrality will be driven by economic restructuring and green innovation, not just energy consumption control.

2. **From Energy to Emissions Control:** China is transitioning from managing energy consumption alone to controlling actual carbon emissions. This shift will open new opportunities for emissions trading, carbon pricing and the development of biodiversity credits, as well as expand the role of market mechanisms in climate action.

51 International Department, Central Committee of the Communist Party of China (IDCPC). 2023. *Full text of the report to the 20th National Congress of the Communist Party of China*. https://www.idcpc.org.cn/english2023/tjzl/cpcjj/20thPartyCongrssReport/

Future Directions for NbS

China's development of a three-tiered nature conservation system—comprising national parks, nature reserves and nature parks—lays an important foundation for advancing NbS at scale. While primarily focused on conservation, this system supports the integration of NbS by safeguarding critical ecosystems and providing natural infrastructure for climate resilience, carbon sequestration and sustainable livelihoods. The inclusion of urban ecological zones and community-led green spaces offers opportunities to scale NbS in cities, aligning with international goals under the Kunming-Montreal Global Biodiversity Framework.

To fully realise the potential of NbS, future directions should focus on:

- Incorporating Other Effective Area-based Conservation Measures (OECMs) into spatial planning to enable multifunctional landscapes.
- Enhancing the economic valuation of ecosystem services to attract market-based investment in NbS.
- Strengthening land-use governance to balance nature conservation with carbon, water and food security objectives.

Challenges for NbS Implementation in China

While the benefits of NbS are widely recognised, implementation remains uneven due to several structural and institutional challenge:

- **Lack of standardisation**—NbS is not yet embedded in China's national legal or planning frameworks, making it difficult to scale.
- **Interdepartmental coordination**—Multiple agencies must work together to ensure effective delivery, which remains a bureaucratic hurdle.
- **Data and monitoring limitations**—Ecological data is fragmented, and the assessment of natural capital remains underdeveloped.
- **Urban planning integration**—While many cities invest in green infrastructure, there is no consistent strategy for integrating NbS into urban redevelopment or ecological restoration plans.
- **Cross-border legal and financial barriers**—Collaboration between Hong Kong, GBA and greater China on transboundary ecosystems such as mangroves is still limited by regulatory gaps.

Why Are NbS Essential For the GBA?

NbS provide an integrated and adaptive response to the growing environmental, climatic and development challenges facing the GBA—particularly within the Shenzhen Bay (also known as Deep Bay) and NM.

In the short term, the region urgently needs coordinated action to protect and restore its vulnerable coastlines, which are increasingly at risk from sea-level rise and extreme weather events. By conserving natural coastlines and rehabilitating artificial ones using NbS—such as mangrove restoration and wetland expansion—governments can strengthen natural flood defences while enhancing biodiversity and water quality. Joint policies between Hong Kong and Shenzhen can institutionalise this approach, supported by a shared coastal management framework and a cross-border climate resilience fund that pools resources from governments, corporations and financial institutions.

Furthermore, to effectively manage climate-related threats like flooding and storm surges, a twin-city NbS strategy will expand adaptive capacity. This calls for transparent governance through a high-level, institutionalised decision-maker forum that includes public engagement, ensuring that cross-border restoration efforts are both inclusive and accountable.

In the long term, the goal of building the 'Golden Inner Bay' aligns with China's broader 'Beautiful Rivers and Lakes (美丽河湖)' initiative—emphasising ecological civilisation and urban-nature integration. NbS are uniquely suited to realise this vision, as they not only mitigate risk but also contribute to long-term ecosystem health, climate resilience and sustainable economic growth. Through NbS, the GBA can become a global model for how rapidly urbanising regions can harmonise infrastructure, community well-being and ecological integrity.

> *"With the implementation of ecological civilisation, through the governance approach, for example, we try our best to reduce the number of new constructions, but also to maintain the original environment, of course, to bring out the history and value of Shenzhen."*
>
> **Prof KK Ling, Director, Jockey Club Design Institute for Social Innovation, The Hong Kong Polytechnic University**

The Role of Hong Kong and Opportunities for Regional Collaboration

Hong Kong has a unique role to play in advancing regional NbS efforts—not just as a bridge to mainland China, but as a platform for international ecological governance and cooperation. For instance, mangrove conservation is a transboundary issue that extends beyond national borders to Southeast Asia. Protecting these critical coastal ecosystems requires cross-border scientific cooperation and financing mechanisms that include actors from Indonesia, Vietnam and beyond. Hong Kong is well-positioned to take the lead in convening such initiatives, leveraging its expertise in ecological science, finance, urban planning and policy.

Future Priorities for Hong Kong and GBA Partners

To realise the potential of NbS, the following actions are recommended:

- **Move from concepts to implementation** - Translate discussions on NbS into enforceable policies and actionable frameworks.
- **Address structural barriers** -Reform planning, legal and financing mechanisms to enable cross-sector and cross-border collaboration.
- **Pilot key projects** -Identify and invest in demonstration projects that show the viability of NbS in both urban and natural landscapes.

Implementing NbS for Climate Resilience in Shenzhen Bay and the GBA

> *"Biodiversity and climate change governance are synergised and can be mutually reinforcing. Nature-based Solutions, as a multi-function solution, can be used not only as an effective means of sustainable development and addressing a range of social challenges, such as food security or natural disasters, but also as a concrete measure to address climate change and biodiversity conservation".*
>
> **Ms JiangWen Guo, Senior Research Fellow, Environment and Society Centre, Chatham House**

The GBA, particularly Shenzhen Bay, offers a unique opportunity to implement NbS that drive climate resilience, ecological conservation and sustainable urban development. As Hong Kong's NM Plan seeks to align with Shenzhen's eco-urban strategies, the need for cross-border coordination has become increasingly urgent. The shared goal is to balance urban development with environmental protection, ensuring that Shenzhen Bay evolves into a "Golden Inner Bay"—a globally recognised zone of both economic vitality and ecological integrity.

Hong Kong's NM Strategy, released in 2021, reimagines the city's spatial configuration by placing equal strategic value on New Territories North and Victoria Harbour. Simultaneously, Shenzhen's "Mountain-Sea City Connection" Plan prioritises ecological connectivity, mangrove rehabilitation and integrated green infrastructure. As urban expansion in both cities converges along Shenzhen Bay, this zone becomes a powerful testing ground for transboundary NbS integration, blending high-impact urban innovation with long-term ecological goals.

Key Challenges for NbS Implementation in the GBA

While the NM and the wider GBA presents enormous opportunities for advancing NbS, several pressing challenges must be addressed to achieve successful and sustained implementation, as follows:

Cross-border Governance and Policy Alignment

A major barrier to coordinated NbS implementation is the divergence in regulatory frameworks. Hong Kong follows an established legal and administrative framework based on the common law system, while Shenzhen adheres to China's centralised planning and governance model. These institutional differences create fragmentation in environmental standards, land-use planning and project approval processes:

- Difference in definitions and standards, both legal and administrative, hinder joint planning and complicate the design of cross-border NbS projects.
- A unified or interlinked policy and regulatory framework is needed to align land-use and ecological regulations across jurisdictions.

Fast-paced Urban Development vs. Conservation Goals

The rapid pace of new development across the GBA often prioritises short-term economic gains over long-term ecological sustainability, or the biodiversity enhancement that is a necessary component for the success of NbS. As large-scale infrastructure and real estate projects proliferate, the cumulative impact of multiple developments can erode ecosystem health and reduce the space available for NbS.

- Conservation efforts are often overwhelmed by short-term economic, convenience or commercial priorities.
- The region must address the accumulating environmental degradation resulting from unchecked, piecemeal development.

Balancing Urbanisation Pressure and Ecological Integrity

Urbanisation pressures are unevenly distributed—Shenzhen's north shore is highly urbanised, while Hong Kong's northern wetlands and fishponds retain important natural functions. The challenge lies in balancing economic growth with ecological integrity.

- Intensifying development pressures threaten the ecological functions of critical natural habitats.
- Harmonised land-use planning is required to support urban growth while preserving biodiversity and ecosystem services.

Lack of Public Awareness and Community Engagement

Public understanding and support for NbS remain limited, which affects both political will and private sector uptake. Without strong community awareness, nature-positive policies often fail to gain traction or face resistance during implementation.

- Community buy-in is critical for successful on-the-ground implementation.
- Targeted education and awareness campaigns are needed to increase societal understanding of NbS benefits.

Funding Mechanisms for NbS

Currently, there is no dedicated cross-border financial mechanism to support NbS at scale. Carbon markets and biodiversity credit systems are still developing, and the absence of structured, investable models deters private-sector participation.

- Without institutionalised funding pathways, NbS remains dependent on fragmented and limited project-based financial support.
- A robust financing framework that includes concessional capital, blended finance and biodiversity-linked credits is necessary.

Insufficient Knowledge and Information Sharing

NbS planning is hindered by a lack of integrated ecological monitoring systems. Fragmented datasets on biodiversity, carbon storage and environmental risks prevent data-driven decision-making and limit long-term impact assessment.

- Establishing a cross-border, open-access data platform is critical to support evidence-based NbS planning.
- Coordinated monitoring can improve transparency and effectiveness of ecological outcomes.

Opportunities For Strengthening NbS in the GBA

"There's so much practical work to be done. We can tackle the problems of the law, planning, implementation and prioritisation of NbS. I truly believe that we have a wealth of opportunities ahead of us, and by working together and leveraging our collective strengths, we can ensure the success and sustainability of our endeavours."

Prof Wang Yi, Member of the Standing Committee of the National People's Congress, member of the Environment and Resources Committee of the National People's Congress

Positioning Shenzhen Bay as a 'Golden Inner Bay'

A shared vision between Hong Kong and Shenzhen could transform Shenzhen Bay into a global exemplar of nature-positive urban development. With large-scale adaptation needs, high population density and strong governmental innovation on both sides, the region is uniquely positioned to pioneer bold, cross-boundary NbS initiatives. Importantly, Shenzhen Bay's valuable wetland ecosystems offer a sizable ecological base for applying NbS at scale.

The concept of the 'Golden Inner Bay' was first introduced in Chinese planning discourse to highlight the strategic economic and ecological potential of the inner arc of the Pearl River Estuary. Shenzhen Bay lies at the heart of this vision—framing it as a high-value corridor for sustainable growth and regional cooperation.

The GBA also benefits from plentiful public resources, accumulated experience and an openness to experimentation, creating fertile ground for piloting new models of ecological finance and governance. By integrating native species conservation, local community engagement and performance-based ecological restoration, Shenzhen Bay could set a precedent for how megacities can grow sustainably while enhancing biodiversity and resilience.

- Promote Shenzhen Bay as a global model for urban-ecological integration.
- Leverage strong government innovation and public investment to scale NbS.
- Highlight native species conservation and evidence-based NbS tracking as core strengths.

NbS for Urban Flood Resilience and Climate Adaptation

Mangrove restoration and wetland expansion form powerful natural buffers against rising sea levels and climate-induced weather extremes. Their integration into urban development—through sponge city principles[52]—enhances resilience by allowing cities to absorb, store and reuse stormwater while cooling the urban microclimate.

The GBA's extensive low-lying coastal zones make this integration urgent. Nature-based infrastructure, when deployed alongside traditional grey infrastructure, can provide adaptive solutions that are cost-effective, regenerative and aligned with long-term resilience goals.

- Expand mangrove restoration and wetland buffers to protect the coast against sea-level rise and storm surges.
- Integrate sponge city principles into urban design for improved flood mitigation.

Scaling Cross-border Ecological Connectivity

The GBA is not just a zone of economic integration—it is an area with interdependent ecosystems that need holistic environmental planning and management to ensure connectivity, sustainability, liveability and climate resilience. Joint conservation efforts—such large-scale ecoregion planning, cross-border monitoring platforms and ecological restoration projects—are essential to maintain ecosystem connectivity, environmental integrity and climate resilience in the GBA.

The resilience of GBA's ecosystems depends on maintaining ecological connectivity, integrity and function. This includes incorporating buffer areas that account for sea-level rise projections, allowing space for ecosystems to adapt to climate change. As urbanisation fragments habitats, establishing cross-border ecological corridors will be key to preserving wildlife movement, genetic diversity and ecosystem health. These corridors enable species to adapt to shifting climatic conditions and increase the resilience of the region's ecosystems and their ability to deliver ecosystem services.

52 Chan, K.S.F., Griffiths, J.A., Higgitt, D., Xu, S., Zhu, F., ..., and Thorne, C.R. 2018. *"Sponge City" in China – A breakthrough of planning and flood risk management in the urban context*. Land Use Policy 76, 772-778.

- Holistic Shenzhen Bay-level planning across the NM and the Shenzhen municipality can increase NbS performance, particularly in terms of watershed management and flood control.
- Building a regional database for NbS performance will further enable evidence-based planning and policy innovation.
- Linking Shenzhen's Kunpeng Trail with Hong Kong's MacLehose Trail not only promotes eco-recreation and tourism but also helps maintain the ecological connections and exchange of species that underpin long-term conservation.

Legal and Policy Coordination

Effective NbS implementation across jurisdictions requires aligned legal frameworks and governance tools. While Hong Kong and Shenzhen operate under different political and regulatory systems, shared ecological concerns necessitate cooperative policy instruments. Unified or interchangeable metrics for evaluating biodiversity and ecosystem services can facilitate project approvals, risk assessments and shared responsibilities.

Embedding NbS within all levels of planning—from strategic planning frameworks and municipal zoning to national climate goals—will strengthen institutional coherence and allow for seamless execution of transboundary ecological initiatives.

- Create a joint NbS legal framework under the GBA's ecological governance strategy.[53]
- Embed NbS into multi-level planning—from municipal to national— thereby facilitating institutional coherence.

Financing Nature: Carbon Markets and Green Investment

With growing attention being directed to biodiversity and climate risks, the GBA has an opportunity to develop regional carbon and biodiversity credit markets. Quantifying and capitalising on the ecological performance of NbS projects—such as blue carbon captured in mangroves or improved habitat quality—can convert nature's benefits into tradable assets. These credit systems would offer financial incentives for both conservation and innovation.

53 Constitutional and Mainland Affairs Bureau. 2019. *Outline Development Plan for the Guangdong-Hong Kong-Macao Greater Bay Area*. https://www.bayarea.gov.hk/filemanager/en/share/pdf/Outline_Development_Plan.pdf

Blended finance structures, combining concessional capital with private investment, are essential to scale projects while managing risk. Public-private partnerships (PPPs), supported by transparent metrics and credible verification systems, can attract institutional investors while ensuring that ecological outcomes remain central.

- Develop regional biodiversity and blue carbon credit markets.
- Incentivise private capital through Public-Private Partnerships (PPPs) and impact finance.

Ultimately, by integrating nature and community, and treating ecosystems as strategic assets, Hong Kong and Shenzhen can co-create a resilient urban future grounded in sustainability and shared prosperity that has potential as a global showcase for NbS.

Recommendation:
Roadmap for NbS Implementation in the GBA

> *"We want to set up a network to talk about climate change. This network will be made up of government, planning, design, scholars and think tanks. We will all work together to guide mutually benefitting actions and policies. Then we can also better coordinate and implement NbS projects".*
>
> **Ms Fan Zhang, Climate and Energy Director, TNC China**

Short-term
1-3 Years

Launch a Joint Hong Kong-Shenzhen NbS Task Force for Shenzhen Bay

The foundation for regional NbS must begin with the formation of a joint Hong Kong–Shenzhen task force. This platform should institutionalise multi-level communication between governments, technical experts, and local communities—helping to identify and address the real obstacles to cross-border collaboration. A communication platform should also be developed to support ongoing dialogue and coordination. Hong Kong's strengths in ecological research, environmental monitoring and management should be strategically leveraged to enhance joint planning, information sharing and adaptive management across the bay.

Initiate a Pilot Ecosystem Restoration Initiative with Shared Monitoring Between Hong Kong and Shenzhen

To demonstrate the value of partnership, a pilot restoration initiative that has implications for climate adaptation across Shenzhen Bay should be launched along the Shenzhen Bay coastline and watershed. This could include smart *gei wai*, hillside reforestation, oyster reef restoration, etc. This initiative would not only enhance resilience but also serve as a practical case study for integrating ecological and urban planning approaches across jurisdictions.

Develop a Cross-Border Information Hub Mechanism for Ecosystem Monitoring

In parallel, a shared data platform on ecosystem health should be developed, integrating applied science and multidisciplinary knowledge. This platform will consolidate biodiversity, water quality, carbon sequestration and climate risk data to inform joint decision-making and enable evidence-based policies across both jurisdictions.

Mid-term
3-5 Years

Create a Regional NbS Financing Model, Incorporating Biodiversity Credits and Carbon Sequestration Markets

Building on short-term successes, the medium-term focus should be directed towards scaling investment and infrastructure. A regional NbS financing facility should be established—designed as a joint climate resilience fund. This fund will pool resources from government, philanthropic and private sectors, and potentially community-based or crowdfunding mechanisms, enabling diversified and sustained capital flows. In the medium term, this fund should support high-impact NbS initiatives that enhance climate resilience, urban liveability and ecological health across the region. Innovative financing tools—such as biodiversity credits, carbon sequestration markets and green bonds—should be integrated into the model to incentivise nature-positive investments. By aligning financial innovation with ecological value, the region can build a replicable model for urban NbS financing in high-density, cross-border contexts.

Expand Urban NbS Pilot Projects in Both Cities, Integrating Green-blue Infrastructure, Wetland Conservation and Sustainable Urban Design

Concurrently, expansion of ecological corridors and sponge city infrastructure should be prioritised, linking fragmented green and blue networks across the border and embedding nature-based flood mitigation into urban development. Technical-to-technical partnerships will be critical here, enabling knowledge exchange and the co-development of applied innovations that enhance ecological functionality and infrastructure design.

Long-term
5+ Years

Institutionalise an NbS Governance Framework Under the Wider GBA

In the long run, institutionalising cross-border NbS governance is essential. This includes embedding nature-positive planning into the broader GBA planning and development blueprint and harmonising land-use, environmental and climate policies. Formal mechanisms should also be introduced to support long-term community-to-community engagement—ensuring that local voices are part of the regional resilience strategy.

Ultimately, by aligning technical expertise, scientific data, inclusive governance and climate finance under one cohesive framework, Shenzhen Bay can emerge as a global benchmark for nature-integrated, climate-resilient urban development.

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Financing NbS

This section explores:

- **Business and nature**
- **Challenges in financing NbS projects**
- **Valuing NbS and natural capital**
- **Financial mechanisms to support NbS in Hong Kong**
- **Bankable NbS project ideas in the NM**
- **Strategies to attract investment in NbS**

"I think once things get into the finance sector and once the financial regulators to get on board, things start to move. That's when the banks will start to put pressure on the corporates".

Mr Ben Ridley, Partner, ERM Hong Kong

Business and Nature

Why is Nature Important to Business?

> *"Nature and biodiversity loss clearly presents substantial risks to businesses globally. The degradation and destruction of ecosystems could majorly disrupt supply chains, drive up operational costs and impact long-term business continuity".*
>
> **Mr Simon Ng, Chief Executive Officer, Business Environment Council**

Nature is an essential economic asset, underpinning global supply chains and providing critical ecosystem services on which industries depend. For example, agriculture relies on fertile soil and freshwater; renewable energy needs natural resources; and construction depends on sustainably sourced materials. Even in urban innovation zones like San Tin, where most businesses are IT and tech firms based in the Technopark, ecosystem degradation can increase flood risk, reduce liveability and undermine long-term economic resilience.

The 2024 United Nations Biodiversity Conference (CBD COP16) signalled growing recognition of this link, with corporate participation tripling from the previous summit. Discussions highlighted the Kunming-Montreal Global Biodiversity Framework, especially Target 15, which urges corporates and financial institutions to monitor and disclose their nature-related risks and dependencies.[54]

54 Convention on Biological Diversity (CBD). 2025. *Target 15: Businesses Assess, Disclose and Reduce Biodiversity-Related Risks and Negative Impacts*. https://www.cbd.int/gbf/targets/15

Closer to home, China's National Biodiversity Strategy and Action Plan (2023–2030) recognises the private sector as a key player in achieving conservation goals.[55] Hong Kong is now updating its own BSAP, with expert-led recommendations identifying five priorities—among which mainstreaming biodiversity into business decision-making is critical.[56] This reinforces the urgent need for enterprises, large and small, to integrate NbS and biodiversity considerations into core operations and risk management.

The five priority areas include:

- Large-scale restoration of degraded ecosystems.
- Scaling up coastal ecosystem protection.
- Strengthening mechanisms to recover endangered species.
- Reducing biodiversity impact from unsustainable consumption and wildlife trade.
- Mainstreaming biodiversity in business decision-making.

The Business Environment Council (BEC) led the Business for Biodiversity Focus Group comprising 21 corporate and finance sector representatives from the local business community.[57] Through several focus group sessions, the group identified several barriers to greater biodiversity action in the private sector, including:

- A lack of clear top-level direction signalling to strengthen the business and finance case for biodiversity.
- An absence of a mainstream corporate disclosure framework to assess and monitor nature-related risks, impacts, dependencies and opportunities.
- Limited local capacity building to help businesses understand their role in supporting and impacting biodiversity conservation.
- Insufficient communication and collaboration between key stakeholders, including public, private and research sectors.

55 Convention on Biological Diversity (CBD). 2013. *China National Biodiversity Conservation Strategy and Action Plan (2011-2030)*. https://www.cbd.int/doc/world/cn/cn-nbsap-v2-en.pdf

56 Hong Kong Biodiversity Expert Group. 2024. *Hong Kong Biodiversity Strategy & Action Plan 2025-2035: Initial Recommendations to the Hong Kong SAR Government*. https://www.admcf.org/wp-content/uploads/2024/09/BSAP-2025-HKBEG-Initial-Report-19.09.24.pdf

57 Business Environment Council. 2024. *Submission on the Hong Kong Biodiversity Strategy and Action Plan 2025-2035: Views from Business Environment Council Limited*. https://bec.org.hk/sites/default/files/policy_submissions/BSAP%20Policy%20Submission_FINAL_0.pdf

Risks to Business Operations in NM

The urban heat island effect is projected to raise temperatures in densely built areas, increasing heat stress for both residents and workers. Sea level rise and heavier rainfall events heighten the risk of coastal inundation and waterlogging, particularly in low-lying zones. Landslides also remain a concern, as rising temperatures and extreme rainfall can destabilise slopes—especially in areas with sparse vegetation. While new developments in the NM are likely to be situated away from high-risk slopes, some existing businesses, particularly those near villages or at the urban fringe, may face elevated landslide risks.

These risks will lead to significant business impacts:

- Higher operational costs due to energy costs for cooling, heat-related health issues and infrastructure damage.
- Rising insurance premiums as businesses face increased exposure to extreme weather events like storm surges and flooding. Compensation costs for tenants in the real estate sector due to climate-related disruptions, even without direct physical damage. Increased management fees and retrofitting expenses as businesses invest in climate resilience strategies.

Nature-based Solutions as a Key Strategy for Businesses

> *"Nature-based Solutions are more than conservation strategies. They are viable investments – resilient infrastructure that can reduce flood risk, improve air quality, mitigate heat, and store carbon. The returns may not always be immediate or linear, but they are real, measurable, and increasingly essential in an age of compounding climate risk."*
>
> **Prof Christine Loh, Chief Development Strategist, Institute for the Environment, Hong Kong University of Science and Technology; Former Under Secretary for the Environment**

NbS offers a proactive approach to mitigating these risks while unlocking new opportunities for businesses and policymakers. By integrating NbS into urban planning and corporate strategies, companies can enhance the climate resilience of their assets and operations while tapping into financial incentives and realising additional business opportunities. Business strategies in relation to NbS should consider that:

- Opportunities from reporting alignment with nature-related disclosureframeworks such as the Task Force on Climate-related Financial Disclosures (TCFD) and the Taskforce on Nature-related Financial Disclosures (TNFD) help businesses future-proof their operations and businessmodelswhile ensuring they meet evolving regulatory requirements.
- The potential development of biodiversity credits gives businesses an opportunity to invest in conservation while generating financial returns, supporting corporate participation in nature conservation efforts.
- Innovative win-win solutions can emerge, such as companies funding afforestation projects in exchange for advancements in satellite technology R&D, creating synergies between environmental sustainability and commercial innovation.

One of the key enablers of corporate action is disclosure and transparency. The TNFD framework mentioned above provides a way for businesses to assess, disclose and integrate biodiversity-related risks into financial decision-making. In Hong Kong, 11 companies have now committed to the TNFD framework, signalling a shift towards greater corporate responsibility and nature-positive investments.[58]

58 Taskforce on Nature-related Financial Disclosures (TNFD). 2025. *TNFD Adopters*. https://tnfd.global/engage/tnfd-adopters-list/?_sfm_adoption_year=2024-%2C-2025&_sfm_hq-country=Hong%20Kong

Case Study: Swire Properties

Swire Properties demonstrates how biodiversity investment can align with sustainable finance and urban development goals. Through its Sustainable Development 2030 Strategy, Biodiversity Policy and use of green bonds, the company integrates NbS into large-scale projects like Taikoo Place. This redevelopment transformed a previously urbanised site into biodiverse public spaces that enhance climate resilience, reduce the urban heat island effect and improve microclimates. With over 260 native and exotic plant species inspired by Hong Kong's feng shui woodlands, and regular biodiversity monitoring conducted in partnership with Kadoorie Farm and Botanic Garden, the project shows how ecological design can generate environmental, social and long-term financial value. More details on this project can be found in Appendix 4.

"All businesses rely on natural resources and it's more important than ever to examine closely how we affect nature, especially in the face of climate change. TNFD provides an internationally-recognised framework for businesses to assess and manage nature-related risks and opportunities, and to set priorities to enhance resilience. It is crucial for the business community to integrate nature considerations into their investments and operations, so that collectively we can bring about lasting positive change".

Mr Patrick Ho, Head of Sustainable Development, Swire Properties & TNFD Taskforce Member

Example: Contractors

Unlike investors or asset owners, contractors are directly responsible for the on-the-ground execution of NbS. As such, project guidelines must clearly articulate performance metrics and technical requirements-covering tasks like habitat creation, maintenance and long-term ecosystem management-to ensure feasible, accountable delivery.

- Early contractor engagement is critical. Involving contractors during the project planning or conceptual design stage allows for practical input on buildability, execution feasibility, and, importantly, costing. This is particularly relevant for NbS projects where even EIA-driven mitigation measures—such as ecological mitigation bonds—include detailed specifications for maintenance frequency, monitoring thresholds and performance outcomes, all of which directly influence cost estimates. These considerations are just as important for small-scale efforts as they are for complex ecological infrastructure.

- Accurate construction cost estimation is essential for securing financing. When contractors provide input early, cost assessments become more realistic and transparent. This gives financial institutions greater confidence in the project's viability, helping to reduce risks of underfunding, cost overruns or delays. Upfront precision in budgeting thus plays a foundational role in de-risking NbS investments and attracting capital.

- Standardised criteria and outcome-based contracts help ensure that ecological work is carried out effectively and that compensation is aligned with verified results.

- Establishing clear financial and operational frameworks at the implementation stage enhances efficiency, supports accountability and improves the overall success of NbS projects.

"It's pivotal to follow the hierarchy of 'avoid, reduce, restore, regenerate and create' in developing Nature-based Solutions at the planning, design, construction, operation and maintenance stages".

Mr Eddie Tse, Group Sustainability Manager, Gammon Construction Limited

Overall, the NM presents a unique opportunity to integrate NbS into urban planning and climate adaptation strategies, one that reflects the increasingly crucial interdependencies between business and nature. Businesses, developers and financial institutions should play an active role in implementing NbS within infrastructure projects, corporate risk management frameworks and green financing mechanisms. This will not only strengthen Hong Kong's climate resilience but also ensure long-term sustainability for businesses and communities.

Challenges in Financing Projects Involving NbS

The urgency to address climate change and biodiversity loss requires substantial financial investment, particularly in NbS that leverage ecosystems to reduce risks, mitigate climate impacts and enhance resilience. However, financing NbS remains a challenge due to the lack of high-quality, investable projects that meet the necessary criteria for scalability, risk-return profiles and long-term impact.

"And fundamentally, there's a misalignment of interests when you're working across for-profit groups and non-for-profit groups. And so that does create a friction. It takes time to build trust. And it does create challenges on the day-to-day work".

Mr Tom Holland, Co-founder and Managing Partner, Development Finance Asia

1. Lack of Financing for NbS Projects

While climate change and renewable energy funding is steadily increasing, NbS remains underfunded, making large-scale implementation difficult. One of the key barriers to scaling NbS is securing long-term investment from financial institutions. While many banks and asset managers express interest in investing in NbS, there is often a gap between policy-level commitments and tangible financial flows. Private sector investment in biodiversity is still minimal.

- The $2.5 trillion annual financing gap for Sustainable Development Goals (SDGs)[59] contrasts sharply with the $6.7 trillion spent on environmentally harmful industries, including $5 trillion from private sector funding contributing to environmental degradation.[60]

- Recent analysis by the Climate Policy Initiative estimated that only $70 billion of the $1.3 trillion in annual climate finance is allocated to adaptation, highlighting a severe funding gap.[61] Given the increasing frequency and intensity of extreme weather events, there is an urgent need to scale up financial mechanisms that can support nature-based adaptation and strengthen the resilience of vulnerable ecosystems.

- Large climate finance funds typically target investments of $30–$100 million, making it difficult for small-scale NbS projects to secure financing. Positive financing for NbS remains disproportionately low, amounting to only $200 billion, with the majority coming from the public sector.[62]

59 United Nations Sustainable Development Group. 2018. *Unlocking SDG Financing: Findings from Early Adopters*. https://unsdg.un.org/resources/unlocking-sdg-financing-findings-early-adopters

60 United Nations News. 2023. COP28: *UN says staggering $7 trillion spent every year on investments that fuel climate change*. https://news.un.org/en/story/2023/12/1144597

61 Climate Policy Initiative. 2023. *Global Landscape of Climate Finance 2023*. https://www.climatepolicyinitiative.org/wp-content/uploads/2023/11/Global-Landscape-of-Climate-Finance-2023.pdf

62 Nature4Climate. 2024. *Nature-based solutions receive only 37% of the financing needed to reach global climate goals*. https://nature4climate.org/nature-finance/

2. Lack of High-quality, Bankable Projects

The absence of high-quality, market-ready and bankable projects hinders private sector investment, making it difficult to secure long-term funding. Without investable projects, private sector involvement remains minimal, further constraining mechanisms such as project finance for permanence and payments for ecosystem services.

Asset managers face structural challenges when integrating NbS into investment portfolios. Unlike traditional investments in public markets or debt instruments, nature-based investments require longer time horizons and higher risk tolerance. To attract institutional investors, projects need to be aggregated and standardised into larger investment pools with clear risk-return models. [63]

Unlike built infrastructure, which begins generating economic output immediately, NbS projects are capital expenditure intensive and typically require large upfront cost, and they take decades to reach full ecological and financial potential. This misalignment with traditional investment timeframes has led to the systematic undervaluation of nature. [64]

- Financial models must adapt to nature's timescales, potentially by reversing discount rates to reflect the long-term gains from ecosystem restoration.
- Imbalanced risk and return expectations hinder investment in NbS, largely due to a lack of understanding of nature-based investments. Unlike traditional projects, investing in nature requires a long-term commitment, with returns that may not be immediate.
- Assembling a blended finance structure is time-intensive, requiring multiple layers of grants, debt and private equity to de-risk the project.
- Narrow perceptions of climate solutions persist among government and developer stakeholders, where the default approach equates solutions with concrete-based infrastructure rather than integrating NbS as viable, scalable alternatives.
- There are not enough tree saplings readily available for a large-scale reforestation.

63 European Investment Bank. 2023. Investing in nature-based solutions: *State-of-play and way forward for public and private financial measures in Europe*. https://www.eib.org/attachments/lucalli/20230095_investing_in_nature_based_solutions_en.pdf

64 European Investment Bank. 2023. Investing in nature-based solutions: *State-of-play and way forward for public and private financial measures in Europe*. https://www.eib.org/attachments/lucalli/20230095_investing_in_nature_based_solutions_en.pdf

3. Lack of Standardised Financial Frameworks and Metrics

Banks are generally supportive of financing NbS, but the lack of standardised frameworks, clear metrics and KPIs makes it challenging for financial institutions to assess and justify investments. While green and sustainability-linked finance principles exist, issues such as transition washing and greenwashing remain prevalent, complicating decision-making. Without a structured approach to NbS financing, banks struggle to quantify risks, returns and long-term benefits, which hinders their ability to step in confidently.

Ecosystem services, such as carbon sequestration, flood protection and biodiversity conservation, provide immense public benefits, but translating these benefits into financial cash flows remains a challenge. Therefore, it leads to uncertainty about ensuring a return on investment, thus limiting investment incentives.

- The absence of standardised frameworks for assessing the financial viability of NbS further restricts large-scale private sector involvement and financial flows into nature-positive projects.
- The difficulty of valuing natural capital—our ecosystems and the essential services they provide.
- Successful implementation requires collaboration with environmental NGOs and community specialists, which can create friction between for-profit and non-profit stakeholders.

Valuing NbS and Natural Capital

“There’s a big difference between pricing and valuing. It doesn’t mean that when we value and even monetise something, this is the price that we are willing to sell this for. I highly value some things that I will never sell, and I think we can all relate to that”.

Ms Mieke Siebers, Executive Director, Foundation for Sustainable Development (FSD); Strategic Lead, Ecosystem Services Valuation Database (ESVD) and Ecosystem Services Partnership (ESP)

As global temperatures continue to rise, the urgency of transitioning towards NbS and sustainable land management has never been greater. However, traditional economic and financial models have struggled to properly account for the full value of ecosystems, leading to underinvestment in natural capital. Transformative change is necessary—not just in policy and finance, but also in how we perceive and integrate nature into our economic systems.

The phrase **“We can’t manage what we can’t measure”** highlights the urgency of assigning economic value to natural resources such as clean water, clean air, sustainable fisheries and climate stability.

- Without a clear understanding of their worth, these resources risk remaining invisible in economic decision-making, making it harder to justify conservation and restoration efforts.
- Natural capital often suffers from the tragedy of the commons, where private interests extract benefits from public resources without accounting for their broader social and environmental costs.
- This imbalance leads to over-extraction, pollution and degradation, exacerbating climate risks and biodiversity loss.

Recognising the full value of nature can help shift economic incentives, ensuring that NbS become a fundamental component of sustainable development strategies rather than an afterthought.

“Ecosystem service valuation provides a clear language. This is not about money in the bank, this is about understanding the order of magnitude and aligning the language we use for our allies, so we can inform our due diligence efforts”.

Ms Mieke Siebers, Executive Director, Foundation for Sustainable Development (FSD); Strategic Lead, Ecosystem Services Valuation Database (ESVD) and Ecosystem Services Partnership (ESP)

Establishing a business case with standardised performance tracking will be essential in securing financial sector engagement and enabling widespread adoption of NbS financing. Historically, NbS design has focused on qualitative assessments, but there is now a pressing need to quantify outcomes using clear, measurable metrics. This is because:

- NbS projects have longer return-on-investment periods, and therefore they require justifiable and measurable financial outcomes to attract private capital.
- Once a comprehensive framework is in place, financial institutions can integrate NbS investments into structured financing models, de-risking projects and ensuring long-term economic viability.

“Unless we have a sense of the value being provided to us by ecosystems and their services, it risks remaining invisible to us and it makes it hard to really reckon with what we can potentially lose”.

Ms Laura Whitford, Global Adaptation Finance and Partnership Lead, TNC

The Role of Externalities

In this context, pricing externalities refer to the true cost of environmental degradation, and the need for businesses to account for it as part of their operating expenses. In principle, this would embed the value of ecosystem services into the cost structure of industries such as mining, agriculture and urban development, ensuring that corporations contribute financially to maintaining biodiversity.

However, challenges remain in making this concept mainstream:

- How can we determine fair pricing mechanisms for biodiversity?
- How can we ensure revenues generated from biodiversity credits are reinvested into conservation?
- How can we avoid shifting the cost entirely onto consumers or creating financial barriers for development?

The Growing Interest of the Financial Sector in Nature

Momentum is increasing within the financial sector to incorporate nature-based considerations into investment decisions. This trend has been accelerated by several key factors:

Corporate demand for NbS

Businesses are increasingly looking to NbS as a means of offsetting environmental impacts, supporting supply chain resilience and aligning with sustainability targets.

Banking sector engagement

Banks are following the capital flow, meaning as corporations commit to nature-positive strategies, financial institutions are also stepping in to support these initiatives.

Green finance regulation

With the rise of frameworks such as the Taskforce on Nature-related Financial Disclosures (TNFD), financial institutions are under pressure to evaluate and disclose nature-related risks and opportunities, reinforcing the need for biodiversity-inclusive financing model.

Insurer-led innovation

The insurance sector has been a first mover in integrating nature considerations, given the direct impact of biodiversity loss on climate risk modelling, natural disaster mitigation and financial forecasting.

Moving Beyond Carbon: A More Holistic Approach to Natural Capital

Historically, nature finance has been dominated by carbon markets, with investors primarily focused on monetising carbon sequestration projects such as afforestation, reforestation and blue carbon initiatives. However, a growing number of financial actors now recognise the importance of valuing broader ecosystem services beyond carbon,[65] including:

Water security and catchment management ensuring sustainable access to freshwater resources.

Biodiversity resiliience integrating species and habitat preservation into investment criteria.

Soil regeneration and agricultural sustainability, driving nature-positive farming practices.

The financial sector is moving towards sustainability-linked finance that ties investment returns to measurable environmental outcomes, rather than focusing solely on emissions reductions.

Biodiversity Credits

A major challenge in NbS financing is biodiversity credits, which remain poorly understood by investors. Even carbon credits, despite their maturity, still face challenges related to avoidance vs. removal debates. Introducing biodiversity credits prematurely could confuse investors and damage the credibility of nature-based investments. Instead, the priority should be to establish clear, measurable methodologies for tracking biodiversity improvements. Only with robust measurement frameworks can biodiversity credits be positioned as a viable financial instrument.

Challenges of Modelling Biodiversity Credits After Carbon Markets

While the concept of biodiversity credits is often modelled after carbon credits, this approach presents fundamental challenges. Biodiversity value is inherently localised, meaning that unlike carbon, which can be offset globally, biodiversity restoration efforts must occur in the same ecosystem where the impact is made. For example, a Hong Kong-based company investing in biodiversity projects overseas does not mitigate local ecological risks tied to urban development or land use changes in Hong Kong. As such, the concept needs to be re-framed.

65 The Oxford Institute for Energy Studies. *2022. The evolution of carbon markets and their role in climate mitigation and sustainable development. Oxford Energy Forum 132.* https://www.oxfordenergy.org/wpcms/wp-content/uploads/2022/06/OEF-132.pdf

Reframing Biodiversity as an Investment Rather Than an Offset

Given the site-specific nature of biodiversity, credits may not function as widely tradable financial instruments in the same way carbon credits do. However, this does not mean they lack investment value. Rather than positioning biodiversity purely as an offset or compliance expenditure, there is growing interest in treating biodiversity and carbon credits as part of long-term nature portfolio assets—with the potential for appreciation in value as global demand for nature-positive outcomes increases. This approach offers a compelling investment narrative, particularly in markets like Hong Kong, where tradable biodiversity credit markets are still emerging.

At the same time, policy mechanisms such as the UK's Biodiversity Net Gain requirement—integrated into the development planning process—may serve as a more practical model for linking biodiversity action with land-use governance. [66]

In this context, embedding biodiversity considerations directly into planning regulations and corporate project cycles can align conservation outcomes with localised ecological risks and broader sustainability goals. Overall, the shift should be toward site-specific, nature-positive investments that create measurable, long-term value—financially and ecologically—rather than relying solely on offsetting frameworks.

> *"The concept of offsetting stifle ambition, encourage shortcuts, and overly prioritise costs rather than results. In contrast, in-setting advocates for the elevation of nature by recognising it as a robust asset that can enhance corporations and even individuals' investment portfolios. The value of nature uplift should correspond directly to the financial commitment made to attain it".*
>
> **Mr Stephen Suen, Design Director, AECOM**

66 Department for Environment, Food & Rural Affairs. 2024. *Understanding biodiversity net gain. The UK Government*. https://www.gov.uk/guidance/understanding-biodiversity-net-gain

Understand The Risk Landscape

For decades, financial institutions have primarily viewed nature through the lens of risk management—whether in relation to environmental liabilities, regulatory compliance or credit risks associated with land-use change and resource extraction. Until recently, discussions around nature investment were largely focused on de-risking projects rather than recognising nature as a financial opportunity. However, as financial regulators begin to prioritise biodiversity and ecosystem health, the investment landscape is shifting towards valuing natural capital as an asset class rather than a liability.

A key challenge for financial institutions is navigating the complexity of integrating NbS into their portfolios, especially given that climate change is already a more mainstream focus. Biodiversity, by comparison, is still emerging as a priority. As financial institutions are increasingly pressured to act on nature-related issues, the TNFD has provided a risk framework that outlines physical and transition risks that could affect companies heavily dependent on ecosystem services. For example, the loss of pollination services could significantly impact agricultural businesses, affecting both operations and profitability. [67]

> *"A high dependency on ecosystem services is not necessarily a financial risk. It becomes a financial risk when the services are at risk, and when nature loss leads to the loss of ecosystem services".*
>
> **Mr Wijnand Broer, Partner, CREM; Programme Manager, Partnership for Biodiversity Accounting Financials (PBAF)**

67 Breeze, T.D., Garrat, M.P.D., Senapathi, D., Willcox, B.K. and Potts, S.G. 2022. *Economic Benefits of Pollination to Global Food Systems - Evidence and Knowledge Gaps: Final Report*. https://www.ukri.org/wp-content/uploads/2022/10/NERC-281022-EconomicBenefitsPollinationGlobalFoodSystems-FullReport.pdf

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Integrating Natural Capital into Financial Reporting

Companies must rethink how they account for natural capital and hidden contingent liabilities related to environmental exposure. Developing a framework that integrates offsets for corporate exposure into financial reporting could:

Improve investor confidence by providing a clearer picture of long-term sustainability risks and returns.	**Ensure better risk management** for businesses exposed to climate and biodiversity risks.	**Align financial decision-making** with nature-positive business strategies.

However, monetising NbS remains a challenge due to:

Complex cash flow structures Many NbS projects, such as reforestation and underground water storage, require upfront capital but generate returns over a long period.	**Delayed capital recovery** Unlike traditional investments, NbS projects often lack immediate revenue streams.	**Dependence on lump-sum payments** Many projects require large initial investments, limiting their scalability unless structured financing mechanisms are introduced.

TNFD:
A Key Framework for Addressing Challenges

The TNFD framework is emerging as a critical tool for businesses to assess and manage their environmental dependencies. [68] While still in early adoption stages, TNFD is gaining global momentum and is shaping how companies and financial institutions:

- Assess, report and act on their nature-related impacts and dependencies.
- Internally evaluate risks and opportunities related to NbS investments.
- Integrate biodiversity considerations into financial decision-making.
- Align with broader sustainability and ESG frameworks.

Table 3:
Pros and Cons for Companies Adopting TNFD

Pros	Cons
• Provides a structured approach for companies to evaluate dependencies and impacts on nature.	• Sensitivity around data disclosure—Companies fear that revealing too much about their nature-related risks could impact valuations and share prices.
• Encourages greater transparency in financial and sustainability reporting.	• Lack of standardised financial metrics—Businesses struggle to quantify biodiversity risks and opportunities in concrete financial terms.
• Helps align investments with global sustainability goals (e.g., biodiversity protection, climate resilience).	• Regulatory uncertainty—While TNFD is gaining traction, it is not yet a mandatory disclosure framework, leading to inconsistent adoption.
• Helps companies realise opportunities from managing nature-related risks.	

68 Taskforce on Nature-related Financial Disclosures (TNFD). 2025. *The Taskforce on Nature-related Financial Disclosures*. https://tnfd.global/

The International Sustainability Standards Board (ISSB) is developing a biodiversity standard that may eventually incorporate TNFD principles.[69] However, as nature is a shared resource, full transparency of nature-related risks is critical to safeguarding public interest. That said, companies have raised concerns about disclosing site-specific data—such as exact locations of sensitive supply chains or dependencies on specific ecosystems—due to fears of revealing commercially sensitive information or exposing operational vulnerabilities. To address this, Hong Kong must fast-track regulatory efforts to enhance disclosure standards while establishing clear guidelines that balance the need for transparency with legitimate confidentiality concerns. Ultimately, disclosure frameworks must ensure that protecting nature is prioritised over short-term competitive advantage, aligning private interest with the common good.

Table 4:

Next Steps for Businesses and Regulators

For Business	For Regulators
• Refine definitions and create standardised impact assessments to align with TNFD, with TNFD's guidance on its LEAP approach a good starting point.	• Ensure TNFD aligns with broader existing sustainability reporting frameworks.
• Develop structured cash flow mechanisms to ensure scalability of NbS investments.	• Address confidentiality barriers to facilitate meaningful disclosure.
• Balance transparency with risk protection to maintain investor confidence.	• Provide incentives for companies integrating natural capital into investment decisions.

By standardising financial impact metrics and aligning TNFD with global ESG frameworks, the financial sector can better integrate natural capital into investment decision-making, ultimately improving long-term sustainability outcomes.

69 Taskforce on Nature-related Financial Disclosures (TNFD). 2024. *TNFD welcomes the ISSB's decision to commence work on nature-related issues*. https://tnfd.global/tnfd-welcomes-the-issbs-decision-to-commence-work-on-nature-related-issues/

From Risk to Asset

The transition from nature as a risk to nature as an asset represents a fundamental shift in financial markets. There has been increasing interest in biodiversity credits as a mechanism for monetising and protecting ecosystem services. Inspired by the carbon credits model, biodiversity credits aim to quantify and trade the value of ecosystem conservation, encouraging investments in NbS.

However, while the concept is gaining traction, the biodiversity credit market faces similar pitfalls to carbon markets. In carbon trading, lack of standardisation, weak governance and voluntary participation have led to credibility concerns, with varying levels of impact depending on the verification standards used. Additionally, unlike carbon, biodiversity benefits cannot simply be offset elsewhere. This means that a key challenge for biodiversity markets is location specificity. A forest cleared in one location cannot be fully compensated by replanting trees in another. Ensuring local ecological integrity is crucial in designing biodiversity credit frameworks.

As such, though biodiversity credits and natural capital valuation present new opportunities, they must be carefully designed to avoid reinforcing exploitative economic models. Governments, businesses and financial institutions must collaborate to ensure that nature-based investments are both profitable and environmentally effective, fostering long-term sustainability, resilience and ecosystem integrity.

Integrating Nature Metrics into Investments

By integrating nature-based financial metrics, the sector is shifting towards outcome-driven financing, where investment success is measured not just in profit but in ecological and societal benefits. A fundamental challenge in scaling nature investment has been the lack of standardised metrics for evaluating the financial value of biodiversity and ecosystem services. However, this is beginning to change, as:

- Development Finance Institutions and impact investors are exploring new methodologies to quantify and monetise nature-based investment returns.
- Banks and asset managers are expanding their ESG frameworks to integrate biodiversity and ecosystem-related KPIs.
- Insurers are incorporating ecosystem health into risk models, recognising that biodiversity loss directly affects long-term financial stability.

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Building a Scalable Investment Model

The following steps in building a scalable investment model showcase the importance of a clear understanding and valuation of ecosystem goods and services.

STEP 1:

Establish High-performance Ecosystems

To create a successful and investable NbS, the foundation lies in ensuring good-quality nature through high-performance ecosystems.

These ecosystems must be:

1. Science-driven and measurable, ensuring that NbS projects are backed by research and data-driven methodologies.
2. Accountable and transparent, leveraging digital monitoring tools and blockchain technology to track progress and validate environmental outcomes.

A high-performance ecosystem provides real, quantifiable environmental benefits, making it attractive for financial investment while delivering long-term sustainability gains.

STEP 2:

Develop Universal and Agreed-upon Metrics

For NbS to be a viable asset class, investors need standardised metrics to evaluate project performance. A clear, quantifiable framework should be established using key indicators that reflect both environmental and financial returns.

A proposed set of universal performance metrics includes:

1. Carbon sequestration
   Measuring the capacity of ecosystems to absorb and store carbon.
2. Biodiversity gain
   Using biodiversity accounting methods to track improvements in ecological health.
3. Air quality improvements
   Quantifying the reduction of pollutants due to NbS.
4. Water resource management
   Assessing water retention, purification and flood prevention benefits.
5. Soil health restoration
   Measuring improvements in fertility, erosion prevention and land stability.

By aligning these metrics with global reporting standards, NbS projects can gain broader acceptance and attract investment at scale.

STEP 3:

Create a Clear and Effective Data Presentation Model

To facilitate investment and encourage participation, NbS outcomes must be communicated in a simple yet effective manner. A Natural Capital Digital Twin can serve as a visual and interactive tool that allows investors to track real-time and projected performance.

Such communication could include:

- A graphical representation of environmental impact, enabling investors to understand NbS contributions clearly.
- A financial-grade platform that translates nature benefits into measurable financial assets.
- A shift from offsetting to insetting, ensuring that financial contributions directly correlate to tangible environmental gains.

Lessons Learnt from Financial Valuation Models:

A case study from the Netherlands illustrates how monetary valuation can inform investment decisions. 70 By comparing conventional agriculture with sustainable farming practices, researchers quantified the gains and losses across different ecosystem services, revealing critical insights:

- Sustainable farming increases regulating services such as erosion prevention, water retention and air quality, benefiting society as a whole.
- However, private landowners often bear financial losses due to reduced crop yields or shifts in agricultural output, highlighting the need for compensation mechanisms.
- While public benefits from ecosystem restoration are substantial, the challenge remains in monetising these benefits and creating financial incentives for sustainable land management.

As this example shows, the way we value and invest in nature must change. Monetary valuation provides a common language to integrate ecosystem services into economic decision-making, financial due diligence and corporate sustainability strategies.

However, it is important to note that while monetary valuation of ecosystem services helps integrate nature into economic decision-making, it does not necessarily translate into a clear financial market price. Not all values can or should be commodified—certain ecological benefits, such as cultural heritage, ecosystem integrity and local community well-being, cannot be reduced to a market-based transaction.

70 Horlings, E., Schenau, S., Hein, L., Lof, M., de Jongh, L. and Polder, M. 2020. *Experimental monetary valuation of ecosystem services and assets in the Netherlands*. https://www.cbs.nl/-/media/_pdf/2020/04/monetary-valuation-ecosystems-final-report-jan-2020.pdf

Innovative Financing Mechanisms for NbS

"Finance has a critical role to play. We need new tools to unlock investment in nature: innovative public-private partnerships, blended finance, biodiversity credits, and regulatory signals that reward long-term resilience over short-term gains. Business as usual is no longer safe. Financial systems must adapt to recognise the systemic risks of nature loss, and the opportunities of nature restoration".

Prof Christine Loh, Chief Development Strategist, Institute for the Environment, Hong Kong University of Science and Technology; Former Under Secretary for the Environment

"Making nature-based solutions commercially viable is to turn those into businesses and to get investment into those so we can then scale them and attract the investment that we need".

Mr Jean-Marc Champagne, Managing Director, Seneca Impact Advisors

The growing emphasis on the climate-nature nexus has increased interest in leveraging NbS to address climate challenges. There is a rising recognition of how NbS can reduce climate risks, such as restoring ecosystems to mitigate flooding or using coastal mangroves as natural buffers against storm surges. Many financial institutions are now aligning their nature strategies with climate goals, addressing both climate change and biodiversity conservation in parallel.

To accelerate the flow of private capital into NbS, innovative financing mechanisms must be devised to create investable and scalable opportunities that contribute to climate resilience, biodiversity conservation and economic returns. By implementing strategic financing mechanisms, limited resources can be effectively leveraged to maximise the impact of NbS.

Challenges in Current Financial Incentives:

- **Limited Business Participation**—High interest rates deter businesses from seeking sustainability-linked financing, as they often prioritise cost savings over long-term environmental benefits.

- **Insurance and Risk Management Limitations**—Parametric insurance, where premiums are shared among multiple stakeholders, faces financial viability challenges due to unclear cost-benefit ratios and lack of market adoption.

- **Regulatory Gaps in NbS Financing**—Without government-backed incentives, financial institutions struggle to scale sustainability-linked financial products for biodiversity conservation.

- **High Capital Cost for Banks**—Limit their ability to provide affordable financing for sustainability-linked projects. Unlike Europe, where mechanisms such as 501A allow for a 25% value adjustment discount for such projects, Hong Kong lacks similar risk-adjusted incentives, making it difficult for financial institutions to integrate NbS into their portfolios without higher capital allocation requirements.

"We can transform natural capital as a financial asset for business community, of course, with three simple steps. First, we need good quality nature, we call it high-performance ecosystem. Second, we need to be able to quantify that, have a metric that everyone can agree on. And the final step, we need a simple and effective way to present the set of data".

Mr Stephen Suen, Design Director, AECOM

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Private Sector Investments:

Currently, much of the heavy lifting in environmental action in Hong Kong is led by green groups, charitable initiatives and government efforts. However, for NbS to scale effectively, corporations and financial institutions must be at the centre of the process. Their involvement is essential to:

- Mobilise large-scale investment in NbS through structured financing mechanisms.
- Ensure sustainable revenue models that drive continuous reinvestment in ecosystem restoration.
- Leverage the financial sector's influence to incentivise corporate participation in nature-positive strategies.

Corporations:

With Environmental, Social and Governance (ESG) frameworks gaining momentum, businesses are increasingly looking beyond compliance and reporting. Sustainability-linked finance is emerging as a catalyst for corporate investment in natural capital, offering a win-win-win scenario for financial institutions and NbS.

Key Advantages for Corporates Investing in NbS:

- **Long-term asset growth**—NbS investments offer enduring financial value and environmental resilience.
- **Immediate financial returns**—Green finance incentives, such as preferential loan rates and sustainability-linked financing.
- **Branding and market positioning**—Strong corporate reputation and alignment with biodiversity and sustainability commitments.

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Natural Capital as a Transformative Asset:

Reframing nature as an asset rather than an expense is a game-changer for businesses. This shift enables companies to:

- Diversify asset portfolios and strengthen long-term financial resilience.
- De-risk operations by integrating NbS that mitigate climate and environmental risks.
- Create tradable assets, such as biodiversity credits, carbon credits or tokenised environmental services, ensuring long-term financial value.

Immediate Financial Benefits for Businesses:

While long-term sustainability is critical, businesses also seek immediate financial incentives. Investing in natural capital presents opportunities such as:

- Sustainability-linked loans tied to environmental performance indicators, offering lower interest rates for companies meeting NbS-related KPIs.
- Integration of natural capital KPIs into ESG rating frameworks, helping businesses enhance their sustainability scores and access green finance more easily.
- Enhanced market positioning, as nature-based investment aligns with growing consumer and investor demand for corporate sustainability leadership.

Example: Corporate-driven Biodiversity Funding:

The RIMBA Collective, initiated by Lestari Capital in Singapore, demonstrates how multinational corporations like Procter & Gamble and Unilever are willing to go beyond compliance by investing additional capital—beyond what is required for sustainable certification—to generate positive ecological and community outcomes.[71] This model presents an opportunity for Hong Kong-based projects, particularly those involving reforestation and biodiversity enhancement.

Key Takeaways:

- Corporate investment in biodiversity does not have to be purely compliance-driven. Instead, companies can be incentivised to pay for measurable biodiversity gains that enhance their sustainability credentials and mitigate supply chain risks.
- This dual-benefit approach not only funds NbS projects but also strengthens corporate reputation and due diligence processes, particularly for companies with global supply chains.
- By demonstrating success in Hong Kong, such models could also serve as proof of concept for corporate-backed biodiversity initiatives in other regions.

71 Rimba Collective. 2025. *Collective action to deliver individual corporate sustainability commitments*. https://rimbacollective.com/


©Lori Cheung/TNC

No industry can escape from the risk related to nature.

Ms Crystal Geng, Asia ESG Research Lead, BNP Paribas Asset Management; Co-leader of TNFD and Biodiversity Workstream, HKGFA

Financial Institutions:

The private sector plays a crucial role in financing NbS. However, many financial institutions remain hesitant to invest due to perceived risks, a lack of standardised frameworks and limited scalable opportunities. Despite these barriers perceptions, NbS investments can be both scalable and profitable, providing viable financial returns while supporting biodiversity conservation and climate resilience.

Some financial institutions have already started developing investment products that integrate NbS principles, demonstrating the potential for biodiversity financing to become a mainstream, profitable sector.

Key Advantages For Financial Institutions Investing in NbS:

1. **Lower-risk lending**—Sustainability-linked finance supports high-quality, low-risk loan portfolios.

2. **Increased profitability**—Attractive financial returns from structured natural capital investments.

3. **Enhanced brand positioning**—Demonstrating leadership in sustainable finance and driving positive societal impact.

Derek Tang / TNC

Case Study: BNP's Responsible Management

NbS-focused financial products are being designed to bridge the gap between sustainability and investment growth opportunity. A structured approach is being used to incorporate biodiversity and NbS opportunities into portfolio management and new investment products design. This includes:

- **Forward-looking investment strategies**—Aligning portfolios with future growth sectors, such as:
  - **Energy Transition**—The global shift towards renewable energy is already driving substantial GDP growth, particularly in Asia, where China is leading the transformation.
  - **Biodiversity and NbS**—Biodiversity conservation, including NbS and environmental sustainability, is a key pillar in addressing climate challenges while creating long-term investment opportunities.
  - **Equality and Inclusive Growth**—Ensuring equitable economic development and inclusive growth is essential for building resilient, future-proof economies that support both people and the planet.
- **Filtering out high risk investments**—Implementing responsible business conduct policies and sector-based exclusions to reduce exposure to companies with high biodiversity risks (e.g., deforestation-linked industries such as palm oil, wood pulp and agriculture).
- **ESG integration**—Embedding biodiversity-focused KPIs into proprietary ESG scoring across all sectors to assess and guide investment decisions.
- **Engagement and stewardship**—Actively engaging with investee companies, encouraging sustainable practices and fostering long-term impact.

Some new NbS-focused financial products include the following funds launched by the French multinational bank and financial services holding company, BNP.

The BNP Future Forest Fund[72]:

- This fund offers an opportunity for investors to align environmental and social benefits with financial objectives, with demand for wood continuing to grow, driven by mega-trends including population growth, urbanization, increase in per capita income and a green transition, while offering environmental benefits from sustainable forestry such as addressing climate change by removing and storing carbon, safeguarding and improving terrestrial biodiversity, and offering protection against deforestation.
- It is classified Article 9 according to the SFDR regulation, meaning it pursues a sustainable investment objective, in this case the sustainable and integral management of forests.
- The fund will only invest in forests located in mature geographical areas (United States, Oceania, Europe) and certified by the Forest Stewardship Council (FSC), which guarantees the planning of sustainable forest and land management, the preservation of the ecological functions of the forest, respect for workers' rights and working conditions, and the social and economic well-being of local communities.

72 BNP Paribas Asset Management. 2025. *BNP Paribas Aqua*. https://www.bnpparibas-am.com/en-sg/individual/fundsheet/equity/bnp-paribas-aqua-classic-c-lu1165135440/?tab=story

©Lori Cheung/TNC

The BNP Aqua Fund[73]:

- **Actively investing in environmental solutions**—BNP Paribas Aqua offers exposure to a diverse set of long-term growth opportunities across the water theme. The fund primarily targets companies tackling global water and water-related challenges in areas such as infrastructure, treatment and utilities.

- **Exposure to global water value chain**—Selectively invested across regions, end-markets and sectors, the fund provides investors with broadly diversified exposure to the fast-developing water value chain. This approach allows the investment team to construct a balanced portfolio containing both defensive and cyclical stocks, often with high exposure to fast-growing mid-cap stocks.

- **High-conviction portfolio**—The team maintains a high-conviction, concentrated equity portfolio of carefully selected theme-related names, with a high active share. It combines a top-down macro and theme-specific perspective with disciplined fundamental bottom-up analysis—which integrates ESG factors—to identify environmental solutions with attractive long-term growth prospects.

73 Partnership for Biodiversity Accounting Financials (PBAF). 2025. *The PBAF Standard enables financial institutions to assess and disclose impact and dependencies on biodiversity of loans and investments*. https://www.pbafglobal.com/

Understand the Relationship Between Biodiversity and Business Operations

For financial institutions—including impact investors, development banks, asset managers and insurers—it is critical to assess the materiality of biodiversity within their portfolios and identify impact and dependency hotspots. By doing so, they can make informed investment decisions and effectively incorporate NbS into their strategies.

Why Biodiversity Matters for Financial Institutions

- **Risk and Opportunity Assessment**—Understanding the impact of biodiversity loss on business operations helps institutions manage risks and identify investment opportunities.

- **Biodiversity Footprinting**—Similar to carbon footprinting, biodiversity footprinting enables financial institutions to quantify their environmental impact.

- **Regulatory and Market Standards**—Emerging standards such as the Partnership for Biodiversity Accounting Financials (PBAF) aim to standardise biodiversity accounting,[74] much like the Partnership for Carbon Accounting Financials (PCAF) has done for carbon emissions.

74 Partnership for Biodiversity Accounting Financials (PBAF). 2025. The PBAF Standard enables financial institutions to assess and disclose impact and dependencies on biodiversity of loans and investments. https://www.pbafglobal.com/

Position NbS as Infrastructure Finance

One of the key challenges in mobilising funding for NbS is how they are categorised within financial and policy frameworks. Branding NbS as infrastructure finance—rather than a standalone environmental initiative—could significantly enhance its attractiveness to investors and policymakers.

Why Branding NbS as Infrastructure Matters

- **Integration with Climate Resilience and Urban Development**—Adaptation projects often overlap with infrastructure and research, making them easier to fund under existing climate resilience and urban development initiatives.
- **Risk of Being a Low Priority**—If NbS continues to be framed solely as an environmental measure, its implementation may lack financial and regulatory backing, remaining a distant priority.
- **Investment Pathway**—Aligning NbS with infrastructure finance mechanisms, such as green bonds, sustainability-linked loans and concessional finance, creates a clearer investment strategy for financial institutions.

As illustrated in Figure 1, green bond issuance channels investment into environmental projects through collaboration between the government, investors and a conservation trust. The trust then allocates funds to NbS projects such as flood mitigation, habitat restoration and climate adaptation.

Green bond issuance: An illustration

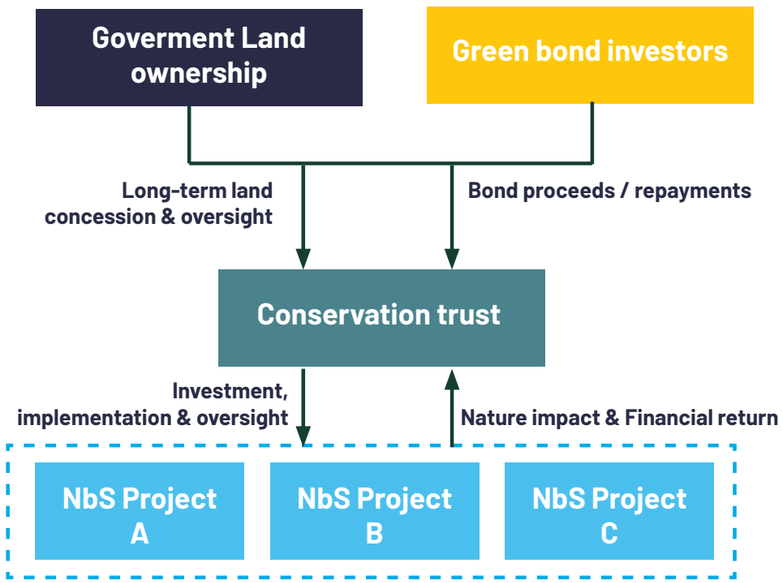

Figure 1 Green Bond Issuance (*Source: Seneca Impact Advisors)*

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The Way Forward:

Position NbS as Essential Infrastructure

Demonstrating the role of NbS in urban resilience, flood mitigation and ecosystem-based adaptation will attract investment.

Leverage Existing Financial Tools

Integrating NbS into structured investment portfolios via sustainable finance mechanisms can increase investor confidence.

Enhance Policy Alignment

Governments and financial regulators should recognise NbS as critical infrastructure to unlock greater funding opportunities.

By strategically positioning NbS within infrastructure finance, the financial sector may be more inclined to invest, ensuring long-term viability and scalability for nature-based projects.

Bringing Corporations and Financial Institutions into the NbS Workflow

A potential model involves a three-way loan relationship between nature, corporations and banks. If a standardised nature metric is established, corporations investing in NbS—such as reforestation—could receive measurable KPIs for ecosystem improvements. These KPIs could then be used to secure sustainability-linked loans from banks, similar to how corporations leverage ESG performance to negotiate favourable financial terms. If structured correctly, this approach could provide direct financial incentives for corporate contributions to biodiversity and ecosystem restoration, while offering banks a clear, risk-mitigated framework for nature-positive investments.

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Philanthropy

In Hong Kong, property developers—often large family-owned businesses—control significant pools of capital, including philanthropic foundations. Unlike Western markets, philanthropy in Asia is often closely tied to business operations, presenting a unique opportunity to channel private capital into de-risking NbS.[75] Learning from Singapore's model, where family offices receive financial incentives to engage in blended finance, [76] Hong Kong could implement tax incentives for philanthropic arms that directly fund NbS projects.

To shift the perception of nature and climate philanthropy, the government and financial sector must frame NbS investment as a tool for reducing long-term social inequality—especially as climate risks, such as extreme heat, disproportionately impact low-income communities. Scientific evidence shows that urban greening mitigates heat islands, improving public health and reducing energy costs, making NbS not only an environmental strategy but a social equity solution.

NbS require clearer definitions and structured financial frameworks to gain traction in Hong Kong. Currently, the absence of well-defined economic models and risk assessments makes it challenging to attract private investment. To address this, pilot demonstration projects are essential to establish baseline economic data and financial structures. Family offices and private funders should take the lead in pioneering these projects, generating the necessary evidence to create scalable investment frameworks suited to Hong Kong's financial landscape.

For biodiversity financing to scale effectively, a collaborative funding ecosystem must be established, involving government, private investors, financial institutions and philanthropic organisations. Philanthropy plays a critical role by providing the initial concessional capital needed to de-risk investments, particularly in the initial stages of a project, to position NbS projects as a more appealing investment to mainstream financial markets.

75 World Economic Forum. 2025. *Accelerating Impact Investments for Climate and Nature in Asia*. https://reports.weforum.org/docs/WEF_Accelerating_Impact_Investments_for_Climate_and_Nature_in_Asia_2025.pdf

76 Monetary Authority of Singapore. 2024. *Fund Tax Incentive Schemes for Family Offices*. https://www.mas.gov.sg/schemes-and-initiatives/fund-tax-incentive-scheme-for-family-offices

Opportunities for Philanthropic Investment

- **Risk Mitigation for Private Capital**—Early-stage philanthropic funding lowers the perceived risk of NbS investments, making them more attractive to institutional and private investors.
- **Bridging the Finance Gap**—Philanthropic contributions can cover early-stage project costs that commercial investors might avoid due to uncertain returns.
- **Catalyst for Mainstream Adoption**—A successful model of philanthropic-driven biodiversity funding could accelerate capital deployment and attract larger pools of investment.

Potential Game-changer

- The Jockey Club is reportedly exploring biodiversity financing, presenting a major opportunity to catalyse NbS investment in Hong Kong.[77]
- If entities like the Jockey Club provide concessional funding, they could serve as early-stage financial catalysts, reducing entry barriers for private investors.
- This model would bridge the gap between high-level commitments and actual capital deployment, transforming biodiversity finance from an emerging concept into a mainstream investment strategy.

77 The Hong Kong Jockey Club. 2025. *Enabling Sustainable Development*. https://charities.hkjc.com/charities/english/community-contributions/sustainability/index.aspx

Blended Financing

Blended finance is not just about providing grants but about leveraging them to attract private investment and scale up projects. Instead of relying solely on public or philanthropic funding, grants can be strategically used to de-risk projects and crowd in private capital.[78] This is particularly crucial in places like Hong Kong, where funding adaptation projects remains a challenge.

One of the biggest challenges in commercial NbS projects is structuring finance to attract private investment while ensuring long-term sustainability. The financial model relies on a blended capital approach:

- **Grants**—Multilateral institutions such as the Asian Development Bank (ADB) offer early-stage grants to de-risk projects.
- **Debt financing**—Programmes like the Green Climate Fund (GCF) provide low-interest loans for sustainable forestry projects.
- **Private equity**—High-net-worth individuals and family offices are often key sources of early-stage equity investment, as nature-based investment funds in the region are still underdeveloped.

This approach includes the following key components:

- **De-risking early-stage projects**—Combines seed funding and grant support to reduce financial risks and make NbS more attractive to private investors.
- **Integrating multiple funding sources**—Leverages a mix of donations, grants and private capital to lower investment risks and encourage scalability.
- **Providing a structured investment model**—Helps financial institutions navigate investment complexities by offering a clear framework for funding NbS projects.
- **Enabling scalability through policy and standards**—Requires effective policy frameworks, transparent investment standards and innovative financing mechanisms to scale NbS solutions globally.

78 The London School of Economics and Political Science (LSE). 2022. *How can 'blended finance' help fund climate action and development goals?* https://www.lse.ac.uk/granthaminstitute/explainers/how-can-blended-finance-help-fund-climate-action-and-development-goals/

Current blended finance models often place disproportionate risk on public funding, while private investors reap the rewards with minimal exposure. A more equitable model would:

- Differentiate who benefits from which ecosystem services and allocate financial responsibility accordingly.
- Ensure that public financing is not solely absorbing risks but rather leveraging private capital for long-term environmental returns.
- Align financial mechanisms with ecosystem recovery timelines, ensuring that returns are structured to increase over time as NbS mature.

As illustrated in Figure 2, blended finance channels investment into projects through collaboration between commercial investors and concessionary capital providers. Concessionary capital acts as a loss buffer, encouraging commercial participation, while financial guarantees further protect commercial capital, reducing risk.

Blended finance: An illustration

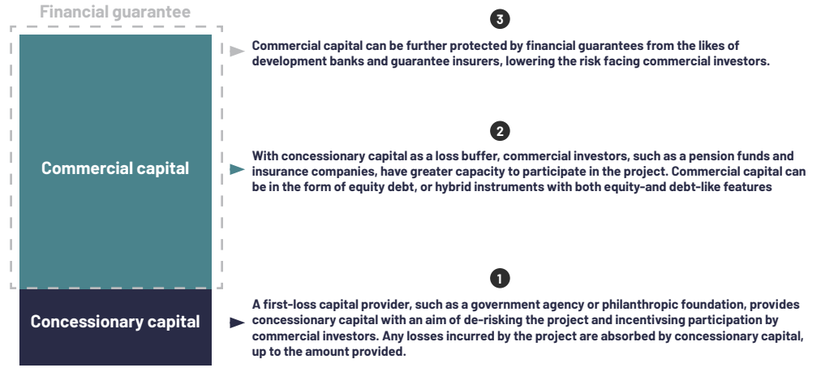

Figure 2 Blended Finance (*Source: Seneca Impact Advisors*)

Case Study:
DFA. Business-oriented Approach to Forest Restoration in Community Forest

For commercial actors in NbS, identifying scalable, revenue-generating models is essential to funding long-term forest restoration efforts. One effective approach pioneered by DFA through its NbS partnership Vana involves restoring degraded land through a structured reforestation process:

Year 1
Plant nitrogen-fixing pioneer species to restore soil health.

Year 4
Introduce native forest species to enhance biodiversity and ecosystem stability.

Year 6-10
Thin out pioneer species to generate sustainable timber revenue, making the project financially viable.

The community forest model provides a clear land tenure framework, which is crucial for securing investment and ensuring long-term benefits for local communities. Under this approach:

- **Local employment opportunities**—Communities are directly employed for reforestation activities, including nursery work, planting and ranger services.
- **Immediate financial benefits**—Wages provide livelihood opportunities from the project's start, helping boost local economies.
- **Long-term sustainability**—Benefits extend beyond wages, including carbon credits and improved water security, reinforcing the link between forest health and community resilience.

This model was successfully piloted in Myanmar with support from TNC and The Regional Community Forestry Training Centre for Asia and the Pacific (RECOFTC). It is now being scaled up in Cambodia, with RECOFTC reprising its role as a technical assistance partner, paying communities to reforest degraded land within community forests, producing immediate and long-term environmental and social benefits. [79]

79 Tint, K., Springate-Baginsky, O., Macqueen, D. and Gyi, M.K.K. 2024. *Unleashing the potential of community forest enterprises in Myanmar*. https://www.iied.org/sites/default/files/pdfs/migrate/13571IIED.pdf

© Kyle Obermann/TNC

Securities

Traditionally, nature investments have been treated as costs, but a shift in financial accounting could redefine them as capital assets, making them more attractive to investors. By establishing agreed-upon KPIs—such as biodiversity improvements or carbon sequestration gains—NbS projects could be positioned similarly to forestry companies preparing for IPOs. This would allow corporations to invest in shares of nature-based assets, enabling organisations to recognise NbS contributions in financial statements as capital assets rather than operational expenditures.

Integrating NbS into Financial Markets

- **Asset Recognition**—NbS investments could be accounted for as capital expenditures rather than expenses, increasing their attractiveness to investors.
- **Sustainability-linked Financing**—Established KPIs could secure green or sustainability-linked financing, reinforcing the economic value of nature while ensuring measurable ecological outcomes.
- **Scalability and Liquidity**—By structuring NbS investments as securities, these projects become easier to integrate into financial portfolios and more liquid for institutional investors.

Leveraging Securities and Guarantees for Institutional Investment

There are significant opportunities to attract private sector capital into NbS through mechanisms such as insurance, bonds and pension funds, which align with the long-term nature of these initiatives. However, due to regulatory constraints, many institutional investors can only allocate funds to securities. To address this, natural assets could be securitised within a guaranteed financial structure, potentially backed by entities like the Hong Kong Mortgage Corporation (HKMC). Some options are:

- **Credit-rated Securities**—Structuring NbS investments as securities with strong credit ratings (e.g., AA or AA-) would attract institutional investors while meeting regulatory and capital requirements.
- **Risk Mitigation through Guarantees**—A guarantee structure similar to Hong Kong's SME financing schemes, where HKMC provides guarantees covering 80-100% of the principal,[80] could help de-risk NbS investments and encourage greater participation from banks and insurers.
- **Cost Control and Stability**—A centralised guarantee scheme managed by HKMC could ensure stable insurance premiums and prevent fluctuations that could arise if multiple private insurers competed for coverage.

80 The Hong Kong Mortgage Corporation Limited. 2024. *SME Financing Guarantee Scheme*. https://www.hkmc.com.hk/eng/our_business/sme_financing_guarantee_scheme.html

Privately Held Fund

The establishment of a natural capital fund or a centralised NbS financing platform in Hong Kong presents a significant investment opportunity, but also several operational and structural challenges. A key hurdle is determining who will manage and operate the fund while ensuring it has the necessary expertise and capacity to attract diverse investors and stakeholders.

Pilot-scale Demonstration Fund as a First Step

Before launching a large-scale investment vehicle, a pilot-scale demonstration fund can serve as a proving ground to refine financing mechanisms and investment strategies.

- **Early-stage Capital**—The fund should be seeded with philanthropic contributions, concessional finance and early-stage investment from select financial institutions.
- **Portfolio-based Approach**—Structuring the fund around a portfolio of NbS projects will create a diversified investment framework and demonstrate economic viability.
- **Scalability Pathway**—Establishing clear investment criteria during the pilot phase will provide insights before formally expanding the fund.

Integrating Scientific Expertise into Financial Decision-making

For the fund to deliver both financial returns and measurable environmental impact, investment decisions must be scientifically informed.

- **Collaboration with Experts**—Bringing scientists and on-the-ground experts into investment discussions ensures alignment between investment goals and ecological realities.
- **Data-driven Decision-making**—Reliable impact measurement frameworks should be in place to quantify biodiversity and climate benefits.
- **Simplified Reporting Standards**—Streamlining data disclosure and impact reporting will enhance transparency and encourage private sector participation.

Ensuring Credibility and Long-term Sustainability

A step-by-step approach is essential to build credibility and encourage widespread adoption.

- **Multi-stakeholder Collaboration**—Engaging government agencies, financial institutions and conservation experts ensures balanced governance.
- **Regulatory Integration**—Aligning the fund with Hong Kong's broader sustainability and green finance frameworks will enhance legitimacy.
- **Gradual Market Development**—Starting with a smaller fund that can scale up as investor confidence and market interest grow.

New Asset Class

While the establishment of a Natural Capital Fund for Hong Kong seems like a logical step, its feasibility depends on actual market demand and the necessary financial infrastructure to support it. Rather than creating an entirely new industry, integrating NbS financing into existing structures, such as incorporating a subcategory within the Hong Kong Exchange Fund, could be a more practical approach.

However, before structuring such a fund, a more fundamental issue needs to be addressed: Does Hong Kong have a high-level policy framework that fully supports nature and biodiversity investment?

- Currently, existing sustainability taxonomies and the Sustainable Environment Action Agenda are heavily focused on decarbonisation, with biodiversity and nature largely absent from the conversation.
- Without explicit policy backing, securing long-term financial commitment to a dedicated nature capital fund remains a challenge.

Lobbying efforts should aim to integrate biodiversity and NbS into Hong Kong's financial and sustainability policies. By embedding nature within existing frameworks, policymakers can create a stronger foundation for mobilising investment, ensuring that NbS projects receive the same level of institutional and regulatory support as climate mitigation initiatives.

Public-Private Partnership:

While carbon credits have struggled with market development due to integrity issues, supply-demand imbalances and lack of clear validation standards, biodiversity credits face even greater hurdles. The key challenges include uncertain demand, unstable supply and the absence of standardised frameworks to ensure credibility and consistency.

To move forward, a Public-Private Partnership (PPP) approach is recommended. Rather than relying solely on government-driven or private sector-led initiatives, a structured financing model should be layered:

1. Government and regulatory bodies absorb the first-loss position, de-risking investments.
2. Private investors contribute at a secondary level, providing scalability.
3. Banks and financial institutions support the final investment layer, ensuring long-term financial sustainability.

By starting with pilot projects and gradually scaling up, a PPP framework can de-risk investments, establish credibility, and attract broader market participation. Without such a collaborative structure, relying solely on government or private funding would likely be unsustainable and slow-moving.

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Public-Private-Philanthropy Partnership (PPPP):

Expanding on the PPP framework, the Public-Private-Philanthropy Partnership (PPPP) model introduces a vital philanthropic dimension—one that brings long-term vision, community alignment and funding flexibility. This is especially important in contexts like Hong Kong where high land costs and spatial limitations pose major implementation barriers for NbS. Several charitable foundations have already shown interest in supporting NbS within the Northern Metropolis.

To fully realise the potential of these philanthropic contributions, strong government leadership is essential. By providing clear strategic direction—such as prioritising NbS as a focus area—the government can act as a convener and coordinator, aligning public, private and philanthropic actors around shared goals. This guidance ensures that charitable funding is not fragmented but strategically deployed to complement infrastructure investments and ecological objectives.

Public-private partnership: An illustration

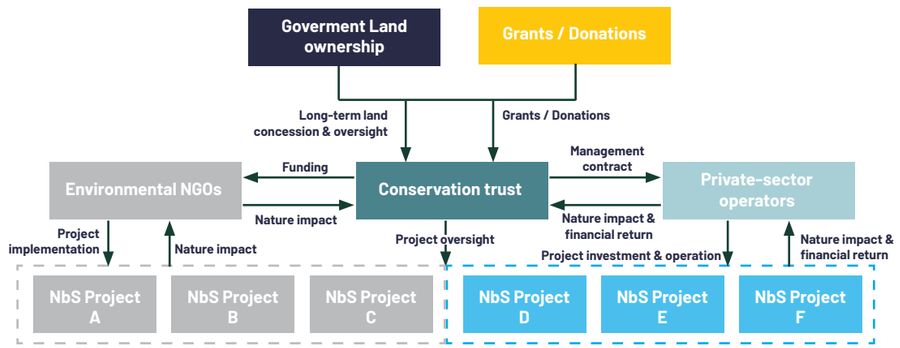

Figure 3 Illustration of PPP as an enhanced version of PPP (Seneca Impact Advisors, 2025)

Under a government-led PPPP model, the collaborative potential is significantly amplified:

- Philanthropic organisations can bring in early-stage, flexible capital to fund innovation, pilots or non-commercial components.
- Private investors can follow with scalable models once viability and impact are demonstrated.
- Public institutions can provide policy coherence, technical guidance and long-term stewardship to integrate these efforts into urban planning and climate frameworks.

As illustrated in Figure 3, PPP channel investment into NbS projects through collaboration between government entities, private-sector operators and environmental NGOs. Enhanced with grants and donations, this PPPP further de-risks the projects. The conservation trust then oversees implementation and ensures sustainable impact.

Unlike blended finance, which often focuses on risk-return structures, PPPPs explicitly leverages shared values and mission alignment—which is particularly suited to public goods like wetlands, biodiversity and urban resilience. With the government taking a lead role, this model not only mobilises more diverse resources but also fosters deeper, trust-based collaboration. In turn, this ensures that NbS are implemented not just efficiently but equitably and with long-term impact.

Blue Finance

NbS are often seen as long-term investments, yet certain interventions—such as coastal and wetland restoration—can yield significant biodiversity benefits more quickly. Unlike reforestation projects that take decades to mature, marine and aquatic restoration projects can deliver measurable ecological improvements within one to two years, making them attractive for near-term investment returns.

To capitalise on these shorter-term benefits, there is an opportunity to integrate blue finance mechanisms, such as blue bonds or sustainability-linked financing, to support ocean and coastal restoration efforts. Establishing a blue taxonomy could provide a structured approach to financing these projects, ensuring that investments align with climate resilience and biodiversity conservation goals. Additionally, leveraging climate tax incentives for marine restoration—similar to those available for carbon offset projects—could further attract private capital and accelerate implementation.

Risk Transfer Mechanism

The insurance sector has emerged as a key enabler in financing NbS, largely due to its reliance on long-term risk modelling. As insurers quantify the financial impacts of biodiversity loss, they are leading the way in:

- Developing nature-inclusive insurance policies that incorporate ecosystem health into pricing models.
- Supporting climate resilience through natural capital investments, particularly in coastal protection, flood prevention and wildfire mitigation.
- Driving corporate and financial sector participation by linking nature-based risk reduction to financial performance.

Insurance plays a crucial role in managing climate and biodiversity risks, yet many insurance providers struggle to price nature-related risks accurately. In some markets, insurers have withdrawn entirely due to the inability to quantify and hedge risks effectively.

However, new models, such as parametric insurance, provide innovative ways to protect natural assets by offering pre-agreed payouts based on predefined climate thresholds, ensuring rapid response and recovery for ecosystems such as coral reefs and coastal mangroves.

As illustrated in Figure 4, parametric insurance plays a crucial role in supporting NbS projects. It channels investment through collaboration between government entities, conservation trusts and environmental NGOs. Parametric insurance offers claims payouts based on trigger events (e.g., temperature, rainfall), providing financial protection and stability for NbS projects.

Parametric insurance: An illustration

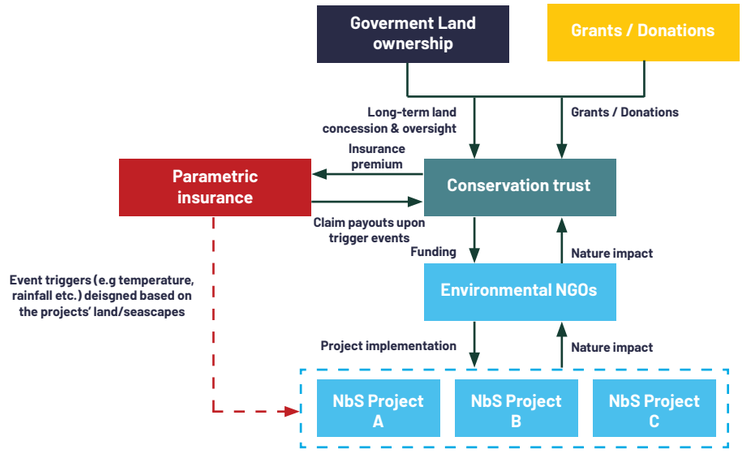

Figure 4. Parametric Insurance: An Illustration (Seneca Impact Advisors, 2025)

Insurance can play a crucial role in ensuring that areas designated for biodiversity conservation remain protected. By requiring developers to take out insurance policies that guarantee the long-term maintenance of biodiversity sites, there is a built-in financial incentive to properly manage and uphold conservation commitments. This approach not only safeguards ecological integrity but also holds developers accountable for their environmental responsibilities. Additionally, insurance can provide a safety net in cases where projects underperform or fail to meet biodiversity targets, offering financial support for restoration or adaptive management measures.

Reef Restoration

An innovative financial tool for adaptation is reef insurance, developed in partnership between TNC and Swiss Re. First launched in 2019 in Cancun, Mexico, this parametric insurance policy insures 160 kilometres of coral reef, providing financial protection for its role in coastal defence against storms and hurricanes.[81]

The insurance policy was purchased by a Coastal Zone Management Trust, a public-private partnership involving the state government, local tourism operators and TNC. The policy covers the protective value of the reef, ensuring rapid response and restoration efforts after storm damage.[82]

Unlike traditional indemnity insurance, which requires a damage assessment before funds are released, parametric insurance triggers an automatic payout when a specific event threshold is met—in this case, wind speeds exceeding 100 mph. This allows for immediate deployment of funds, allowing for rapid restoration efforts to protect the reef's long-term viability.

> *Immediate deployment of funds in the first few days after the event, makes a really significant difference in terms of the ability of that reef to repair and recover and to go on providing those protective services.*
>
> **Ms Laura Whitford, Global Adaptation Finance and Partnership Lead, TNC**

Proof of Concept: Successful Implementation After Hurricane Delta

- In 2020, Hurricane Delta met the wind speed threshold, triggering an $800,000 payout for reef restoration.[83]
- The funds were used to mobilise reef brigades—local divers trained in coral recovery—to stabilise 15,000 coral colonies over four months.
- Restoration efforts included clearing debris, reattaching coral fragments and reducing sedimentation, ensuring that the reef continued to provide coastal protection and ecosystem services. [84]

81 Swiss Re. 2025. *Protecting the world's second biggest coral reef with an innovative parametric solution*. https://www.swissre.com/our-business/public-sector-solutions/case-studies/mexico-windstorm-cover.html

82 The Nature Conservancy. 2018. *Launch of the Coastal Zone Management Trust: Quintana Roo, Mexico*. https://www.nature.org/content/dam/tnc/nature/en/documents/TNC_Mexico_CoastalManagementTrust_Factsheet.pdf

83 Insurance Information Institute. 2020. *Hurricane Delta triggered coral reef parametric insurance*. https://insuranceindustryblog.iii.org/hurricane-delta-triggered-coral-reef-parametric-insurance/

84 The Nature Conservancy. 2024. *Insuring Nature to Ensure a Resilient Future*. https://www.nature.org/en-us/what-we-do/our-insights/perspectives/insuring-nature-to-ensure-a-resilient-future/

To replicate and expand this model to other regions and ecosystems, several critical elements must be in place:

- **Strong governance frameworks**—Clear structures, such as trust funds, should outline funding allocation, decision-making processes, and long-term sustainability.
- **Preparedness and response protocols**—A well-defined action plan ensures that trained responders can be deployed immediately after an event to maximise restoration effectiveness.
- **Diversification of financial tools**—Insurance should be one of many financial instruments used for adaptation, combined with public funding, private investment and ecosystem service payments.

Reforestation

Since less than 10% of reforestation funding comes from carbon markets, it is essential to explore more innovative financial mechanisms, such as insurance-backed investments. By paying an insurance premium of 1-5% of the total project value, investors can mitigate financial risks, ensuring long-term sustainability. These innovative approaches are key to making nature-based solutions more attractive to investors and scaling them effectively.

Given the long-term nature of NbS projects, early wins must be identified to make these investments more attractive. Investors need clear milestones to gauge progress before the full return on investment materialises. In reforestation projects, success could be demonstrated through early biodiversity restoration, carbon sequestration progress or local economic benefits. This aligns with the role of insurance companies, which can help de-risk projects by covering potential underperformance. By addressing these concerns, NbS financing can evolve into a structured and scalable investment class.

Developing a Bankable NbS Project in the NM

When considering NbS investments in sustainable agriculture, ecotourism or wetland restoration, funders must set realistic expectations regarding financial returns. While these projects generate environmental and social value, their capital investment returns often do not rank at the top compared to traditional infrastructure projects. Instead, the primary financial gains come from operational revenue streams, such as eco-tourism fees, sustainable agricultural yields and ecosystem service payments.

To attract investment, there needs to be a reassessment of return models, focusing on long-term environmental resilience and blended financing approaches. While private investors may seek market-rate returns, a combination of public funding, concessional finance and impact-driven capital can help de-risk these projects, making them viable for larger-scale implementation. Defining target return percentages will depend on the financial structure, but realistic expectations should balance profitability with sustainability outcomes.

When considering impact investment in NbS, it is essential to distinguish between two categories of investors:

- **Impact-first Investors**—These investors prioritise environmental and social outcomes over financial returns. While they still expect some financial payback, they are willing to accept longer-term, lower-yield returns if the project delivers tangible climate adaptation benefits, such as coastal resilience, biodiversity conservation or sustainable seafood production.

- **Finance-first Impact Investors**—These investors require commercially competitive returns, making it challenging to attract them to NbS projects unless clear revenue models and risk mitigation mechanisms are in place.

Given the urgency of integrating NbS into Hong Kong's NM Development, engaging impact-first investors and leveraging financial incentives like carbon tax credits—which have been successfully implemented in Singapore—could enhance attractiveness.

Conference participants brainstormed two early-stage ideas during the interactive workshop (see Appendix 5).

Recommendation: Strategies to Attract Investment in NbS

"If we get it right, it will not only help make Hong Kong a model for nature-positive urbanisation – it will also show the world that investing in nature is not philanthropy, but foresight."

Prof Christine Loh, Chief Development Strategist, Institute for the Environment, Hong Kong University of Science and Technology; Former Under Secretary for the Environment


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1. Integrating Risk and Impact Assessments and Monitoring

To secure investment in NbS, financial institutions must integrate risk and impact assessments into their investment strategies and monitoring mechanisms. Ensuring that investors can accurately measure and report long-term benefits and financial returns from biodiversity projects will help reduce perceived risks and build confidence in nature-based investments.

- **Risk management**—Financial institutions must integrate NbS within their risk management strategies by recognising the dependencies and impacts of their portfolios on ecosystem services and developing risk mitigation tools.
- **Digital twin development**—Developing a digital twin of the project area can enhance decision-making by simulating different scenarios, such as extreme rainfall or flooding events. This visual representation helps stakeholders better understand the climate mitigation and resilience benefits of NbS, strengthening investor confidence and facilitating funding opportunities.
- **Data sharing and financial viability**—Data sharing with financiers and investors is crucial in establishing the financial viability of NbS. Projects should integrate scenario modelling, stress testing, and pathway analysis to assess potential outcomes.
- **Public accessibility of coastal ecosystem study**—A comprehensive study on Hong Kong's coastal ecosystems has been completed but remains inaccessible to the public. Making this data publicly available would enhance understanding of local coastal habitats, enrich knowledge on potential NbS approaches and inform evidence-based decision-making. It will also help reduce perceived risks and build confidence in nature-based investments.

2. Establishing a Multi-stakeholder Task Force

Cross-sector collaboration is essential to unlocking the full potential of NbS financing. Strong cross-sector partnerships can help align commercial objectives with sustainability goals and position Hong Kong as a leader in regional biodiversity conservation and sustainable business practices.

- Establish a dedicated multi-stakeholder task force to strengthen partnerships between NbS specialists, ESG consultants, financial strategists, businesses, NGOs and governments.
- A governance board or committee should be formed, comprising expert academics and scientists to guide strategic decision-making.
- Key focus areas of the task force:
  - **Project validation**—Assess and review new NbS project applications in the NM.
  - **Implementation standardisation**—Classify and validate NbS projects to create a clear benchmark and standard for implementation.
  - **Impact alignment**—Integrate NbS efforts with both commercial interests and community-driven goals. Ensure ecosystem connectivity across urban and rural landscapes for lasting environmental impact.
  - **Investment framework refinement**—Refine investment frameworks to align corporate goals with nature-positive outcomes.
  - **Insurance development**—Develop scalable insurance solutions that incorporate NbS into climate risk management frameworks.
  - **Policy integration**—Embed clear criteria into policy frameworks to encourage developers and investors to back NbS initiatives.
  - **Knowledge and research**—Increase investment in natural capital accounting and biodiversity-specific research to better comprehend Hong Kong's economic dependence on ecosystems.

3. Enhancing Regulatory Frameworks and Financial Incentives for NbS Investment

To mobilise finance for NbS and increase private sector participation, Hong Kong must strengthen its regulatory framework and provide clear financial incentives. Currently, sustainability-linked loans offer only minimal interest rate reductions (3-7 basis points), fully funded by banks without government subsidies or structured incentives. This lack of policy-driven support discourages businesses from integrating sustainability into their financial strategies.

To scale NbS investments, financial incentives must be multi-layered rather than relying on a single incentive structure. Interest rate reductions (3-7 basis points) alone are insufficient, as some companies do not require traditional loans. A broader incentive package should include branding value, tax relief, compliance benefits, and risk mitigation strategies to drive private sector adoption.

A key missing element in unlocking large-scale investment is reclassifying NbS investments as financial assets rather than operational expenses. This shift would allow corporations to account for NbS projects as capital investments or intangible assets, similar to the approach taken by BlackRock with venture capital.

Key Regulatory and Financial Reform Recommendations

To attract more investors and businesses, Hong Kong should align with global regulatory efforts such as TNFD and develop a comprehensive NbS financing framework:

a. Tax and Financial Incentives

- **Tax Incentives for Philanthropic Investment**—Introduce tax deductions or credits for businesses and family offices that allocate capital toward NbS financing and conservation efforts.
- **Incentivise Private Sector Engagement**—Implement tax incentives, subsidies and regulatory benefits for businesses investing in NbS.
- **Expand Regulatory Incentives**—Introduce sustainability-linked bonds, tax credits and concessional financing to enhance the appeal of NbS in capital markets.

b. Financial and Investment Frameworks

- **Clarifying Cost-Benefit Analysis** —Clearly articulating risk factors and financial benefits of NbS adoption is crucial for securing investment. Businesses need structured financial modelling to demonstrate the long-term economic value of NbS.
- **Developing Insurance Models for NbS**—The insurance sector in Hong Kong has not yet fully developed sustainability-linked risk coverage. Encouraging regulatory bodies such as the IAEA to establish NbS-linked insurance mechanisms could significantly de-risk investments and increase corporate adoption.
- **Blended Finance Mechanisms**—Create structured opportunities where philanthropic funds help de-risk investments, making projects more attractive to commercial investors.
- **Standardise NbS investment frameworks**—Establish clear financial instruments, risk assessment criteria, and green financing models to reduce investment uncertainty.
- **Basel III Implementation**—The Hong Kong Monetary Authority is expected to finalise Basel III adjustments, which could create opportunities for capital cost reductions in green and NbS financing.
- **Strengthen climate and nature-related financial supervision** — The HKMA has advanced climate risk supervision by enhancing stress tests, integrating climate into prudential assessments, and aligning with global standards like the IFRS Sustainability Disclosure Standards and the Basel Committee's Pillar 3 consultation. Building on this momentum, regulators should expand their scope to include nature-related financial risks by supporting TNFD-aligned disclosure, incentivising biodiversity-positive investment, and developing supervisory tools that account for natural capital.
- **Risk-Weighted Asset (RWA) Adjustments**—Lower RWA ratings for sustainability-linked loans could encourage banks to allocate more capital to NbS without compromising financial stability.
- **Global Risk Rate Adjustments**—Explore how banking regulators across Asia treat green finance and microfinance, and lobby for risk rating adjustments that lower capital costs for NbS projects, similar to how China's People's Bank of China supports green loans.
- **Aligning with Global Practices**—Following the European Union's approach, Hong Kong should explore similar frameworks that allow for reduced capital charges for verified NbS investments.

c. Regulatory and Compliance Standards

- **Ensure Alignment with Global Standards**—Integrate TNFD disclosure frameworks with existing financial reporting standards such as IFRS S3 to raise corporate participation and involvement.
- **Leverage TNFD for Business Compliance**—Align NbS investments with TNFD reporting frameworks to enhance transparency, accountability and ESG performance.
- **Create an NbS-enabling Environment**—Develop a market ecosystem with third-party verifiers, assurance services and licensed professionals to enhance investor confidence.
- **Strengthen Governance Structures**—Prevent misuse of biodiversity credits as offsets for unsustainable development and align them with tangible ecological gains.
- **Provide Public Access to Government Targets and Data**—Ensure baseline ecological and financial data is publicly available for private sector alignment with city-wide sustainability goals.

d. Policy and Institutional Support

- **Addressing Policy Gaps**—Unlike other global markets, Hong Kong lacks a structured policy framework that mandates NbS investment or provides financial relief for sustainability initiatives. Without such favourable policy incentives, private sector participation will remain limited.
- **Public-Private Partnership (PPP) Model Adaptation**—Study and adapt international models, such as Singapore's PPP frameworks, to enable cross-sector collaboration in NbS development.
- **Enforce Minimum Environmental Standards**—Implement command-and-control regulations to prevent ecosystem degradation and ensure sustainable urban development.

4. Adopting a Landscape-level Strategy for Portfolio Risk Management

To prevent short-sighted development that may be compromised by climate change, scenario planning must be integrated into NbS and urban planning strategies. The IPCC projects that sea levels could rise by up to five metres by 2150 under a low-likelihood but high-impact scenario, a risk that is becoming increasingly probable.[85]

Given that much of the NM is close to sea level, its development must incorporate multiple climate adaptation scenarios to ensure long-term resilience. By shifting from isolated NbS initiatives to landscape-scale resilience planning, Hong Kong can establish a comprehensive, climate-adaptive development model that benefits both investors and communities in the long run.

- **Evaluate multiple climate scenarios**—Assess different degrees of sea-level rise and flood risks to inform urban planning and infrastructure decisions.
- **Integrate climate adaptation into planning and development**—Ensure that projects incorporate coastal defences, flood mitigation strategies and NbS to withstand long-term environmental shifts.
- **Embed climate risk assessments into urban policies**—Strengthen regulatory frameworks to future-proof investments and prevent unsustainable infrastructure decisions.
- **Adopt a holistic, multi-level landscape network NbS strategy**—Manage ecosystems comprehensively to maximise climate resilience and biodiversity conservation.
- **Implement multi-functional and multi-financed projects**—Integrate various NbS approaches, such as:
  - Urban agriculture combined with agroforestry
  - Flood mitigation wetlands linked with biodiversity corridors
  - Coastal defence systems paired with blue-carbon sequestration
  - Leverage blended finance models and PPP or PPPP to enhance financial viability and scale NbS adoption.

85 Intergovernmental Panel on Climate Change (IPCC). 2023. *Sixth Assessment Report (AR6)*. https://www.ipcc.ch/assessment-report/ar6/

5. Establishing Quantifiable Metrics for NbS Investment

To accelerate private sector investment in NbS, alignment with global climate finance structures—such as TCFD and TNFD—will be essential. These voluntary frameworks provide structured approaches to assessing dependencies, impacts, risks and opportunities, making them familiar and more attractive to investors. By incorporating biodiversity and ecosystem services alongside carbon footprint assessments, NbS can be embedded into established sustainability reporting mechanisms. This ensures that nature investments receive the same level of financial consideration as decarbonisation initiatives.

Key Recommendations:

a. Establishing Standardised Performance Metrics:

- NbS projects typically have longer return-on-investment periods, requiring measurable and justifiable financial outcomes to attract capital.
- A comprehensive framework will allow financial institutions to integrate NbS into structured financing models, reducing risk and increasing economic viability.
- Contractors responsible for NbS implementation must have clear guidelines for performance metrics, ensuring that tasks such as habitat creation and long-term ecosystem management are properly measured and compensated.
- The CEDD is developing a simplified, yet representative KPI framework based on five core environmental metrics—carbon, biodiversity, air, soil and water—with flexibility on other indicators to suit different project conditions is allowed.
- Streamlining biodiversity assessments into a single-digit scoring system (inspired by carbon credits) will help bridge scientific assessment with financial decision-making.

b. Establishing an Internationally Recognised Nature-linked Principles (NLP) Framework:

- **Top-down Approach: Global Nature-linked Principles Framework**—A globally coordinated effort is needed to establish a Nature-linked Principles (NLP) framework, similar to the Sustainability-linked Loan Principles (SLLP) and Green Loan Principles (GLP) that originate with the Loan Market Association (LMA), Asia Pacific Loan Market Association (APLMA) and Loan Syndications and Trading Association (LSTA). Regulatory bodies must lead this effort, ensuring standardisation and consistency across markets to facilitate financial sector engagement.
- **Bottom-up Approach: Industry-led Data and Pilot Projects to Support NLP Implementation**—Industry research and pilot projects should focus on developing KPIs that demonstrate scalable, evidence-based NbS investment models. These real-world case studies will support financial institutions in refining NLP implementation and aligning regulatory goals with investable opportunities.
- **Bridging the Gap: A Unified Strategy for NbS Finance** —Pilot projects must demonstrate the measurable financial and environmental returns of NbS investments. Regulatory bodies should adopt an adaptive policy development approach, refining investment standards based on industry-driven research and data.

c. Expanding ESG Frameworks Beyond Carbon:

- Most ESG rating systems heavily emphasise energy and carbon, sidelining other key environmental factors such as biodiversity, water and ecosystem resilience.
- Instead of developing entirely new standards, a more practical approach would be to integrate NbS considerations into existing ESG rating structures, ensuring alignment with investor expectations and regulatory developments.

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6. Launching A Pilot-Scale Demonstration Fund

Singapore's approach demonstrates the importance of proof-of-concept funding to de-risk private sector investments in NbS before commercialisation. By supporting pilot initiatives through grants, credibility and scalability can be established, making it easier to attract additional investment.

In markets such as Malaysia, where NbS development and funding mechanisms are more advanced, provide valuable insights. Starting with pilot projects can help build momentum for larger-scale investment. However, for widespread adoption, financial institutions must align with international standards to ensure consistency and credibility across markets.

- **Reframe NbS as infrastructure financing** —Position NbS as long-term, large-scale and multi-stakeholder infrastructure investments to unlock new funding pathways.
- **Expand access to concessionary funding** —While uncertainty remains around concessionary funding in Hong Kong, ongoing lobbying efforts aim to integrate it into NbS financing.
- **Introduce a model similar to Singapore's Asia Climate Solutions (ACS)** — The Monetary Authority of Singapore (MAS) allocated $5 million USD to fund proof-of-concept projects.[86] A similar mechanism introduced by the Hong Kong Monetary Authority (HKMA) could demonstrate leadership and ensure promising NbS projects receive early-stage funding.
- **Leverage the Hong Kong Mortgage Corporation (HKMC)** — The HKMC currently manages a substantial financing guarantee scheme. Extending this scheme to cover NbS projects, such as securing fishponds as collateral, could enhance financial security and attract private investment.
- **Develop financial guarantee mechanisms for NbS**— Categorising NbS projects within climate adaptation and risk mitigation frameworks could incentivise financial institutions to allocate capital toward sustainable infrastructure. This would help de-risk investments and ensure long-term economic and environmental benefits.

86 Convergence. 2023. *Convergence launches multi-donor funding window for climate blended finance solutions in Asia*. https://www.convergence.finance/news/58qYhp6Ylug5e6XhYk0OOQ/view

7. Building Capacity for NbS Investment

Blended finance is increasingly recognised as a key tool in sustainable investment, often discussed alongside green bonds and sustainability-linked loans. However, despite the growing use of the term, there remains a fundamental lack of understanding among key stakeholders regarding how blended finance structures function. Unlike a simple funding source, blended finance is a structuring mechanism that requires expertise in capital markets, debt structures, concessional financing and equity investments.

A major challenge in scaling blended finance for NbS is the knowledge gap among potential players, including investors, family offices, philanthropists, government agencies and financial regulators. Many decision-makers lack an in-depth grasp of how different financing structures function and align with investor requirements.

- **Increase financial literacy on blended finance**—There is an urgent need to build foundational financial education for a broader audience, equipping stakeholders with knowledge on financing models, investor expectations and risk-return structures.
- **Expand engagement beyond financial professionals**—Currently, discussions on NbS investment, including return on investment and discount rates, remain limited to a small group of financial experts.
- **Develop a Blended Finance 101 Framework**—Establishing a basic-level financial education framework will help bridge knowledge gaps, ensuring that key players, including government agencies, philanthropists and private investors, can effectively engage with and apply blended finance solutions to NbS projects.

8. Scaling NbS Through Centralised Mode

One of the major challenges in NbS financing in Hong Kong is achieving economies of scale. Instead of funding multiple small-scale operators individually, an effective strategy could involve centralising investment through a single off-taker model.
This approach would:

- Establish one lead entity responsible for aggregating financing, resources and implementation.
- Franchise or decentralise project execution back to multiple smaller operators, ensuring widespread participation.
- Improve cost-efficiency by centralising capacity-building, training and administration.

Given Hong Kong's policy landscape, before expanding participation to involve the private sector, government leadership in initiating this model by establishing an umbrella framework will be essential. The government could take the lead in early-stage risk mitigation, then, as financial mechanisms mature, progressively transition management to private entities.

Appendix

Appendix 1.

Five Key Recommendations for the San Tin Technopole

1. Enhance Ecological Connectivity

- Strengthen wetland habitat connectivity in the northeast of the site to prevent bottlenecks in bird flight paths.
- Create an ecological corridor linking Mai Po Nature Reserve with nearby habitats.

2. Retain Existing Watercourses for Sustainable Drainage

- Preserve natural water channels and fishponds to maintain existing flood storage capacity.
- Avoid complete site formation and concrete drainage systems, which would require costly re-provisioning.

3. Integrate Rural and Cultural Heritage into Urban Design

- Utilise existing agricultural landscapes and village structures as cultural hubs.
- Encourage eco-tourism and agro-tourism by promoting a rural-urban integration model.

4. Establish a Wetland Park for Climate Resilience

- Propose and implement a nature-based wetland park along the Shenzhen River to serve as a buffer against flooding.
- Enhance recreational, educational and ecological functions of wetland areas.

5. Implement Bird-friendly Urban Design

- Ensure flight paths are preserved within the Technopole.
- Adopt bird-friendly building designs to minimise impacts (such as bird strike) on migratory species.

Appendix 2.

Key Elements of the NbS Approach Adopted in San Tin

1. Blue-green Network for Flood Resilience and Biodiversity

Recognising the importance of water management, San Tin Technopole will implement sustainable drainage systems to improve water quality and flood control. A connected blue-green network will act as the lifeline of San Tin Technopole, integrating revitalised rivers, wetlands and green corridors to enhance flood resilience,

- River revitalisation will be implemented along two major drainage channels, ensuring natural flood absorption while maintaining existing wetland habitats.
- Riverine islands will be introduced to support bird species, while gentle embankments will allow for tree planting and water retention.
- A riverside park with a multi-functional retention pond will serve as a stormwater buffer during heavy rainfall and provide public recreational space in dry seasons.
- Retaining existing watercourses will help manage urban runoff without excessive concrete-based interventions.
- Smart, nature-based water purification systems will be integrated to filter pollutants and enhance biodiversity.
- Blue-green infrastructure will connect urban areas with natural water bodies, promoting a water-friendly culture.

2. Ecological Connectivity and Habitat Protection

San Tin Technopole is located within an important migratory bird corridor, necessitating a strategic ecological design to safeguard flight paths and natural habitats.

- About 338 hectares of Sam Po Shue Wetland Conservation Park will be established to preserve the fishpond and wetland in-situ and enhance ecological value through active conservation.
- A 300-metre-wide east-west bird flight corridor will be preserved to connect the Loop and nearby wetlands.
- Non-building zones and height restrictions will ensure minimal disruption to bird migration patterns.
- A bird-friendly building design guideline is being developed to reduce risks of bird collisions with urban structures.
- An existing Egretry at Mai Po Lung Village and the brownfield in the vicinity will be converted into green open space.
- Non-building area as wildlife corridors for mammals, such as otters, will connect wetland habitats with designated conservation areas.

3. Urban Greening

The transition from nature to urban areas will be carefully designed to blend green spaces with urban landscapes, maximising both environmental and social benefits.

- Modernised aquaculture and urban farming will be promoted to support sustainable food production and public engagement.
- Transition zones will be designed to create seamless connections between wetlands, urban parks and public spaces, allowing the unfettered movement of wildlife and people.

Appendix

Appendix 3.

Existing Resources for Planning and Execution of NbS Developed by the Hong Kong Government

- AFCD – Hong Kong Biodiversity Information Hub: Provides a local species database and biodiversity information.
  https://bih.gov.hk/en/bgis/index.html

- EPD – Central Environmental Database: Hosts environmental and ecological baseline data, including information from Environmental Impact Assessment (EIA) reports.
  https://hked.epd.gov.hk/

- Development Bureau and Lands Department – Common Spatial Data Infrastructure (CSDI): Offers standardised spatial data from various government departments.
  https://www.csdi.gov.hk/

- EPD – EIAO New Website: Features improved navigation and useful resources related to the EIA process.
  https://www.epd.gov.hk/eia/en/index.html

- Good Practices and Achievements on Ecology through the EIA Process in Hong Kong:
  https://www.epd.gov.hk/eia/ebook/web/viewer.html

- 3D EIA Platform:
  https://www.epd.gov.hk/eia/en/3deia/index.html

Appendix 4.

Swire Properties Case Study

Swire Properties has established the Sustainable Development 2030 Strategy to foster sustainable communities that thrive in harmony with nature. Central to this vision is the company's Biodiversity Policy, which guides efforts in minimising environmental footprint while promoting urban biodiversity and sustainable resource use. The company has also introduced Biodiversity Guidelines for building development and management, which provides specific recommendations on topics such as conducting biodiversity assessment, design for good quality woodland patches for landscape, native plant species selection, micro-habitat consideration, sustainable use of natural resources and use of NbS. The best practices in the guideline are also tailored to the regions in which the company operates, which empowers their project development and building management teams to integrate nature considerations in buildings.

A practical example of the adoption of NbS was exemplified in the redevelopment of Taikoo Place. In this project, the company has transformed a previously developed urban site into a vibrant landscape, called Taikoo Square and Taikoo Garden, which enhances both biodiversity and community well-being. By investing in green spaces, supported by the company's green bonds, it aims to deliver substantial ecological and social benefits. These green areas not only foster biodiversity but also significantly boost the portfolio's climate resilience. The green spaces at Taikoo Place help mitigate flooding by absorbing rainwater during intense rainfall events, reducing the risk of urban flooding—a critical concern in densely populated areas. Additionally, these spaces improve the microclimate, creating more thermally comfortable areas for visitors and workers alike, contributing to a cooler environment and combating the urban heat island effect.

Also by integrating over 260 native and exotic plant species that drew inspiration from Hong Kong's "feng shui woodlands"—areas of biodiversity hotspots where villagers traditionally preserved native plant species and created rich habitats for wildlife—the company aspires to mimic natural ecosystems in their landscape areas at Taikoo Square. The landscape also features a higher-than-average ratio (over 20%) of native species, compared to the city's urban areas. This makes these spaces more attractive to birds, butterflies, other insects and animals by providing suitable habitats and food sources.

The company's commitment to enhancing biodiversity is also evident in the design of Taikoo Square, where it has created green corridors that facilitate the movement of wildlife between urban areas and nearby natural habitats. This connectivity is essential for maintaining biodiversity and ecosystem services. Regular biodiversity assessments, in partnership with Kadoorie Farm and Botanic Garden have shown promising results, including sightings of rare migratory birds like the orange-headed thrush, highlighting the ecological value of the designed gardens.

In summary, integrating NbS into project design not only creates business value but also leads to healthier, more resilient communities. By investing in green spaces, the company promotes urban biodiversity while preparing the urban environments for climate challenges, making them better places for both people and nature.

Appendix 5.

Potential NbS Project Idea Brainstormed in the Workshop

Idea 1: Algae Cultivation for Heat and Flood Risk Reduction

Algae cultivation as a NbS can help mitigate heat and reduce surface temperatures in urban environments, leading to cost savings through reduced cooling expenses and lower insurance premiums. This approach enhances corporate reputation, fosters regulatory compliance and aligns with sustainability goals.

Appendix

By functioning as a heat absorber, algae cultivation panels can be integrated into urban environments to reduce ambient temperatures.[87] Green roofs with algae systems provide additional benefits such as mitigating the urban heat island effect, improving stormwater management and enhancing energy efficiency while creating green spaces.

Prioritising algae cultivation and green roofs as NbS solutions can create a scalable, bankable model for addressing the urban heat island effect and flood mitigation in NM. By integrating these strategies into urban planning and financing models, stakeholders can unlock both environmental and economic benefits while fostering climate resilience.

Key Benefits of Algae Cultivation in NM

- **Heat absorption and energy efficiency** – Algae panels and green roofs reduce surface temperatures, leading to lower cooling costs for buildings.
- **Carbon sequestration** – algae actively absorbs CO^2, contributing to greenhouse gas reduction efforts.
- **Potential for biofuel production** – cultivated algae can serve as a renewable energy source, creating an additional revenue stream.
- **Stormwater management** – Green roofs and algae systems help absorb excess rainwater, reducing flood risks in urban areas.

Key Stakeholders for Implementation

- **Real estate developers** – Integrating algae cultivation and green roofs into new and existing developments.
- **Technology providers** – Startups and greentech firms offering algae cultivation solutions and performance tracking.
- **Consultancy firms** – Assisting in feasibility studies, regulatory compliance and integration into urban planning.
- **Local communities** – Engaging residents in the adoption and maintenance of algae-based NbS.
- **Governmental bodies** – Providing policy support, incentives and regulatory frameworks to facilitate implementation.

Challenges and Considerations

- **Policy support and regulatory alignment** – Land preparation and planning standards may need revisions to integrate NbS effectively. Government engagement is essential to ensure alignment with existing policies.
- **Innovative financing and business viability** – Identifying revenue streams for long-term sustainability is crucial. Green loans, sustainability-linked financing and partnerships with technology providers can help attract investors. Third-party evaluations and performance metrics should be incorporated to validate environmental and financial returns while mitigating risks of greenwashing.
- **Project risks and technical challenges** – Operational risks include the maintenance of algae tanks and the need for skilled technical support. Securing offtake agreements for biofuel production is critical to ensuring financial stability.

Idea 2: Smart *Gei Wai* to Revitalise Traditional Aquaculture with Smart Systems

This initiative aims to retrofit existing fishponds with smart systems, reintroducing traditional *gei wai* techniques while enhancing productivity and sustainability. The project will focus on producing high-value fish and shrimp products, such as locally sourced premium shrimp, catering to the local and high-end markets.

Additional components include:

- **Integrating green-grey infrastructure by** repurposing nearby village houses to support climate resilience and sustainable water management.
- **Implementing a neighbourhood absorption plan** that utilises the strategic location of gei wai and fishponds to mitigate flood risks.
- **Revegetating the surrounding environment** such as hillside or previously used farmland, incorporating agroforestry principles and exploring mycelium (mushroom) cultivation as a potential crop variety.
- **Cost-sharing models** to make retrofitting existing areas more financially viable.

By combining traditional aquaculture practices with modern smart systems, smart *gei wai* offers a scalable NbS that enhances local food security, promotes biodiversity and strengthens climate resilience, all while providing tangible economic opportunities for businesses and investors.

Key Stakeholders for Implementation

- **Implementation Partners ("Doers")**
  - NGOs and academic/scientific experts to provide expertise and guide best practices.
  - Government departments, such as Agriculture, Fisheries and Conservation Department for implementation support and Environment and Ecology Bureau for policy development.
  - Tree planting companies and agroforestry specialists to support revegetation efforts.
  - Credit scheme developers to integrate NbS into financial markets.
  - Local communities and volunteers to foster engagement and ownership of the project.

87 U.S. Department of Energy. 2017. *Algae Cultivation for Carbon Capture and Utilization Workshop Summary Report*. https://www.energy.gov/eere/bioenergy/articles/algae-cultivation-carbon-capture-and-utilization-workshop-summary-report-0

Appendix

- **Funding and Investment Partners ("Payers")**
  - Tech firms in the NM area, particularly those seeking to invest in sustainability initiatives.
  - Asian Development Bank (ADB) and Asian Infrastructure Investment Bank (AIIB) for financing sustainable development.
  - Corporations committed to green solutions and nature-based investments.
  - Biodiversity credit buyers interested in supporting high-impact conservation projects.
  - Government to explore potential subsidies and tax incentives.
  - Downstream beneficiaries, such as property developers and landowners, who can benefit from improved climate resilience such as flood and storm surge retention.
  - Companies from the European Union.

- **Financing and investment incentives**
  - IT companies could be key financial backers, given their strong presence in NM and their energy-intensive operations.
  - Attracting Chinese government support, especially for state-owned enterprises, given its emphasis on corporate social responsibility and environmental leadership abroad.

- **Policy and regulatory alignment**
  - Conducting policy analysis to understand the drivers behind mainland China's environmental policies and exploring opportunities for Hong Kong's NbS projects to align with national sustainability goals.
  - Positioning Smart *gei wai* as an attractive investment by demonstrating its alignment with climate resilience, sustainable food production and biodiversity conservation.

Appendix 6.
List of Conference Speakers

1. **Wijnand Broer** - Partner, CREM; Programme Manager, Partnership for Biodiversity Accounting Financials (PBAF)
2. **Jean-Marc Champagne** - Managing Director, Seneca Impact Advisors
3. **Dr Bosco Chan** - Director, Conservation, WWF-Hong Kong
4. **Jessica Chan** - Head of Sustainability, MTR Corporation
5. **Paul Chan** - President, Hong Kong Institute of Landscape Architects
6. **Dr Yin-Lun Chan** - Head of the Department of Design and Architecture, Technological and Higher Education Institute of Hong Kong (THEi)
7. **IR Dr Raymond Cheung** - Head of Geotechnical Engineering Office, Civil Engineering and Development Department, The HKSAR Government
8. **Crystal Geng** - Asia ESG Research Lead, BNP Paribas Asset Management; Co-leader of TNFD and Biodiversity Workstream, HKGFA
9. **Jiangwen Guo** - Senior Research Fellow, Environment and Society Centre, Chatham House
10. **Prof Jim Hall** - President, Institution of Civil Engineers
11. **Prof Billy Hau** - Programme Director, MSc Environmental Management, University of Hong Kong
12. **Jasper Hilkhuijsen** - East Asia Senior Innovation and Sustainable Development Manager, Arup
13. **Patrick Ho** - Head of Sustainable Development, Swire Properties Limited
14. **Tom Holland** - Co-founder and Managing Partner, Development Finance Asia
15. **Lawrence Iu** - Executive Director, Civic Exchange
16. **Jing Wanli** - Deputy Chief Planner, Urban Planning & Design Institute of Shenzhen
17. **Richard Kendall** - Chief Executive, Hong Kong Maritime Museum
18. **Lam Chiu Ying** - Former Head of Observatory, Senior Advisor of Hong Kong 2050 is now
19. **Dr Michael Lau** - Founding Member, Hong Kong Wetlands Conservation Association
20. **IR Carrie Leung** - Chief Engineer, Civil Engineering and Development Department, The HKSAR Government
21. **Mengru Li** - PhD Candidate in Environmental Science, Policy, and Management (ESPM), The Hong Kong University of Science and Technology
22. **Prof Kar-kan Ling** - Director, Jockey Club Design Institute for Social Innovation, The Hong Kong Polytechnic University
23. **Prof Christine Loh** - Chief Development Strategist, Institute for the Environment, Hong Kong University of Science and Technology; Former Under Secretary for the Environment
24. **Johanna Lovecchio** - Director, Impact Programs, Columbia University Climate School and Adjunct Faculty
25. **Simon Ng** - Chief Executive Officer, Business Environment Council
26. **Martin Putnam** - Senior Manager, Sustainability, Airport Authority Hong Kong
27. **Ben Ridley** - Partner, ERM Hong Kong
28. **Prof Debra Roberts** - Co-chair, AR6 Working Group II, IPCC
29. **Mieke Siebers** - Executive Director, Foundation for Sustainable Development (FSD)
30. **Stephen Suen** - Design Director, AECOM (Hong Kong)
31. **Marine Thomas** - Associate Director of Conservation, TNC Hong Kong

Appendix

32. **Carol Tse** - Group Senior Manager - Sustainability, Vitasoy International
33. **Eddie Tse** - Group Sustainability Manager, Gammon Construction Limited
34. **Prof Wang Yi** - Member of the Standing Committee of the National People's Congress, member of the Environment and Resources Committee
35. **Prof Yuhong Wang** - Professor, Department of Civil and Environmental Engineering, Hong Kong Polytechnic University
36. **Laura Whitford** - Global Adaptation Finance and Partnership Lead, Asia Pacific, TNC
37. **Prof Wong Kam-sing**, GBS, JP - Former Secretary for the Environment (2012-2022), The HKSAR Government
38. **Ms Pecvin Pui Wan Yong** - Deputy Director, Northern Metropolis Co-ordination Office, Development Bureau, The HKSAR Government
39. **Ronald Young** - Head of Sustainable Banking Development, Hong Kong Monetary Authority
40. **Claudia Yu** - East Asia Landscape Architecture Leader and Regional Lead – Nature Positive Design, Arup
41. **Fan Zhang** - Director of Climate Change Strategy, TNC China Programme
42. **Lulu Zhou** - Director, Strategic Partnerships (Asia Pacific) and Hong Kong Program Lead, TNC Hong Kong

Appendix 7.
Conference Agenda

Day 1: Identifying Climate Risk & Incorporating Nature-based Solutions in Urban Planning (Jan 14, 2025)

- **09:30-10:05:** Welcoming Remarks by Lulu Zhou and Richard Kendall
- **10:05-11:10:** Speaker Session 1: Assessing climate risk and the opportunity of NbS in urban areas
- **11:10-12:15:** Speaker Session 2: Regional approach in implementing NbS for climate across Shenzhen Bay & GBA (conducted in Putonghua with real-time English interpretation)
- **12:15-13:40: Lunch Break (arranged for speakers)**
- 13:40-15:15: Speaker Session 3: Cross-sector collaboration in developing and implementing NbS: lessons learned from local case studies
- **15:15-15:20:** Closing Remarks by Lawrence Iu
- **15:20-15:30: Break**
- **15:30-17:00:** Concurrent Break-out Sessions (by invitation only)
    - **Workshop 1:** Improving NbS integration into town planning
    - **Workshop 2:** Fostering cross-border collaboration for climate adaptation planning across Shenzhen Bay

Day 2: Building the Business Case for NbS and Conservation Finance Mechanisms (Jan 15, 2025)

- **09:30-10:05:** Keynote 1: Why is nature important to business? by Simon Ng
- **10:05-11:00:** Speaker Session 1: Understanding business actions contributing to nature conservation
- **11:00-11:15: Break**
- **11:15-12:15:** Speaker Session 2: Investing in nature: innovative solutions for financing conservation
- **12:15-13:40: Lunch Break (arranged for speakers)**
- **13:40-14:45:** Speaker Session 3: Valuing NbS and natural capital
- **14:45-15:00:** Closing Remarks by Lawrence Iu
- **15:00-15:10: Break**
- **15:10-17:00:** Interactive Workshop (by invitation only)
    - **Part 1:** How financial institutions can contribute to NbS
    - **Part 2:** NbS relevance to the protection of physical assets


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