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Inclusive Design for All – Human and Ecology

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ABSTRACT

This paper examines the complex challenge of balancing urban development with the preservation of natural ecosystems in Hong Kong, a city with less than 25% of its land developed but facing significant housing affordability issues due to its high population density of approximately 8 million residents. Despite the city's 78.7% vegetated land area, urbanization pressures necessitate expanding urban edges into mountainous regions, presenting opportunities to integrate ecological considerations into city planning. The paper highlights two key research projects addressing these challenges. The first research project "Adaptive Landscapes" is to explore how sustainable growth and reasonable density can be achieved while allowing urban landscapes to coexist with and support natural ecosystems. The project will be sampling some recently built projects at buildings scale to landscape scales; attempt in inserting/recreating urban landscape while colonizing nature. For example, Hong Kong owns a good amount of wetlands that have been serving a rich and diverse animal ecology; how should we have sustainable growth and with reasonable density for both to co-exist? What are some opportunities that urban policy makers could review and consider under the ESG framework? The second is a research project "Human-Planet Public Objects" on documenting existing small-scale urban design projects and to reimagine more animal inclusive design ideas within our city. The project looks into the extremely close yet incredibly far relationship between human and other species within our urban landscape. The project reflects on the conventional way of user-centric design approach, which is human focused and may not be a sustainable approach in long run due to rapid urbanization and climate change. Both projects employ case studies, field observations, and interviews to gather data, aiming to develop sustainable and ecologically conscious urban environments that prioritize the coexistence of humans and nature. By exploring innovative approaches and considering the broader implications of urbanization and climate change, these projects seek to create urban landscapes that are resilient, inclusive, and supportive of diverse ecosystems.

1. Introduction

In the contemporary discourse on urban development, the concept of inclusive urban design has emerged as a critical paradigm, advocating for the integration of human and ecological needs within urban planning frameworks (Ahern, 2013; Beatley, 2011)[1] [2]. This approach is not merely about ensuring the accessibility and usability of urban spaces but extends to integrating ecological considerations into the fabric of urban planning (Fu et al., 2022; Simon, 2024) [3]. The urgency of adopting inclusive urban design is underscored by the increasing encroachment of urbanization on natural landscapes, a challenge that is particularly pronounced in regions with high population densities and limited buildable land.

Fig. 1. Wetlands in Hong Kong
Source: Hong Kong Wetlands Conservation Association (HKWCA)[1]

Hong Kong presents an exemplary case study in this context due to its unique geographic and demographic characteristics. The region encompasses a total land area of 1,118 square kilometers, with built-up areas constituting 25.5% and vegetated regions covering approximately 65.6% (Planning Department of Hong Kong, 2023) [21]. Despite its significant green coverage, Hong Kong's high population density, hosting around 7.5 million residents, presents considerable challenges. These include escalating housing affordability issues and substantial pressures on natural ecosystems, notably wetlands, which are vital for maintaining biodiversity and ecological balance (Nayak & Bhushan, 2022) [4].

The government of Hong Kong recognizes these challenges and is actively seeking to redefine and expand the urban edges within its mountainous terrain. This strategy involves developing areas that have previously been minimally urbanized to create new residential, commercial, and public spaces. Such expansions are essential for accommodating the growing population but also pose potential risks to the region's ecological networks. Therefore, this paper aims to explore sustainable urban growth strategies that accommodate human needs while preserving and enhancing these critical ecological networks.

The objectives of this research are twofold: firstly, to outline and evaluate strategies that enable the coexistence of urban development and natural ecosystems in a manner that supports both ecological integrity and urban liveability; secondly, to address specific research questions about how urban spaces can be designed to support sustainable cohabitation between humans and other ecological entities. By focusing on Hong Kong's unique spatial and demographic challenges, this study intends to provide

[1] http://hkwca.org.hk/wetlands-in-hk/nggallery/image/tin-shui-wai-managed-wetland-fish-ponds-channels-mangrove-and-mudflat

insights that could guide other cities facing similar pressures, emphasizing development strategies that are ecologically oriented.

This paper is structured as follows: The first part introduces the concept of inclusive urban design and its relevance to contemporary urban challenges. The literature review synthesizes global and regional research on the interaction between urbanization and ecological conservation, examining policies and practices that have successfully navigated these challenges. A detailed case study of Hong Kong follows, analyzing the effectiveness of current initiatives in balancing urban expansion with nature preservation.

The second part is a research project "Human-planet Public Project" (Leung & Tsang, 2022) [5] which demonstrates the possibilities to initiate meaningful interactions between humans and other living beings in small-scale urban intervention. Through documentation of existing urban furniture and building facade designs in the city of Hong Kong, together with interviews with local ecologists and development of design prototypes, the project reflects on the conventional way of user-centric design approach in urban design, and attempts to open up more animal inclusive design ideas within our city.

The paper concludes with a discussion of the findings and offers recommendations for future urban planning strategies, aiming to contribute to the broader discourse on sustainable urban development and ecological conservation.

2. Literature Review

2.1 Global Frameworks for Integrating Ecology into Urban Planning

The integration of ecological considerations into urban planning is a global imperative, guided by several pivotal international standards and frameworks. The Ramsar Convention on Wetlands highlights the critical need for the conservation and wise use of wetlands as essential to global environmental health (Halls, 1997; Matthews, 1993) [6]. Additionally, the European Union's Biodiversity Strategy for 2030 ambitiously seeks to weave biodiversity considerations into both urban and rural planning, aiming to restore ecosystems and embed green infrastructures within cities, promoting sustainable urban environments (Hermoso et al., 2022) [7].

The United Nations Sustainable Development Goals, especially SDG 11, emphasize the necessity of creating cities that are inclusive, safe, resilient, and sustainable, advocating for an approach that inherently includes environmental impact mitigation and preservation of natural habitats (Giannetti et al., 2020) [8]. These international directives serve as foundational guides, yet they require careful adaptation to local contexts to address varied ecological needs and governance structures effectively.

2.2 Regional Practices in Wetland Conservation

Wetland conservation efforts vary significantly worldwide due to differing topographical, biological, and socio-economic factors (Irvine et al., 2022; Sharma & Singh, 2021) [9]. This variance has prompted a call for enhanced policies and governance frameworks aimed at minimizing damage to wetlands and preserving their functionality across the globe (Kumar et al., 2023) [10].

In regions like the Americas, environmental protection frameworks integrate specific strategies for wetland restoration and are supported by robust federal and state legislation (Costa & Aubert, 2022) [11]. Europe maintains its ecological quality through comprehensive directives such as the EU's Habitats Directive and Water Framework Directive. In contrast, Asian countries like China enhance wetland conservation through national legislation and extensive projects, while African nations align their efforts with the African Convention on Conservation of Nature and Natural Resources, focusing on sustainable development in harmony with environmental protection.

The varied approaches underscore the necessity of region-specific strategies while reflecting a common commitment to integrating ecological preservation with urban development. For example,

Australia's strict adherence to the Ramsar guidelines under the Environment Protection and Biodiversity Conservation Act exemplifies a focused effort to protect extensive coastal and inland wetlands. Table 1 provides a comparison of regional approaches to wetland conservation, reflecting the diverse strategies used to integrate ecological protection with urban development needs across different geopolitical contexts.

Table 1. Comparative Analysis of Wetland Conservation Policies by Region

Region	Key Practices and Policies	Notable Countries/Regions
Americas	Integrated environmental protection frameworks; specific wetland restoration and protection strategies; use of federal and state legislation to manage and conserve wetlands.	United States, Canada, Latin America
Europe	EU directives (Habitats Directive, Water Framework Directive); emphasis on maintaining ecological quality of water bodies; strong legislative backing and pan-European initiatives.	European Union countries
Asia	National legislation enhancing wetland conservation; large-scale conservation projects; Ramsar provisions influencing local policies.	China, India, Southeast Asian countries
Africa	Alignment with the African Convention on Conservation of Nature and Natural Resources; integration of environmental protection with economic development; emphasis on utilizing international guidelines like Ramsar.	Various African countries
Australia	Conservation actions under the Environment Protection and Biodiversity Conservation Act; close adherence to Ramsar guidelines; focus on protecting extensive coastal and inland wetlands.	Australia

2.3 Challenges in Balancing Urban Growth with Wetland Conservation

Wetland conservation remains a contentious issue worldwide, particularly as economic incentives often drive land conversion in high-value coastal regions, overshadowing the enforcement of protective environmental policies (Brown et al., 2021; Hardy et al., 2020) [12] [13]. The rapid evolution of policies designed to protect these vital areas has struggled to keep pace with the demands of population growth and urban development. This is evident in developed regions like New York, USA, where despite the New York Tidal Wetlands Act in 1973, urban expansion has significantly reduced tidal wetland areas, undermining their ecological functions (Hettiarachchi et al., 2014) [14].

The management of wetlands now aims to balance environmental, social, and economic objectives, a complex endeavor that requires integrated approaches across multiple sectors (Everard & McInnes, 2013; Maltby, 2006) [15] [16]. However, in developing countries, this challenge is compounded by socio-economic disparities and deficiencies in planning, which exacerbate environmental degradation (Cobbinah et al., 2015) [17]. The situation is critical in South Asian cities like Colombo, where rapid real estate development has permanently altered wetland landscapes, reflecting broader socio-environmental shifts in land use and ecosystem service management (Dasgupta et al., 2009; Wimalaweera, 2024) [18] [19].

These observations underscore a pressing need for comprehensive studies that examine the long-term effectiveness and adaptability of conservation policies in diverse urban settings. Such research is crucial not only for assessing the sustainability of current practices but also for understanding their socio-economic impacts, which are particularly pronounced in rapidly urbanizing cities with volatile governance structures.

3. Methodology

This research employs a mixed-methods approach, utilizing qualitative and quantitative techniques to investigate sustainable urban growth strategies in Hong Kong. The primary focus is on two detailed case studies, Adaptive Landscapes and Human-Planet Public Objects, which provide

insights into the integration of ecological considerations within urban environments. The methodology encompasses field observations, interviews with experts, and the development of design prototypes, enabling a comprehensive understanding of how urban spaces can support both human and ecological needs. Figure 2 illustrates the research methodology used in this research.

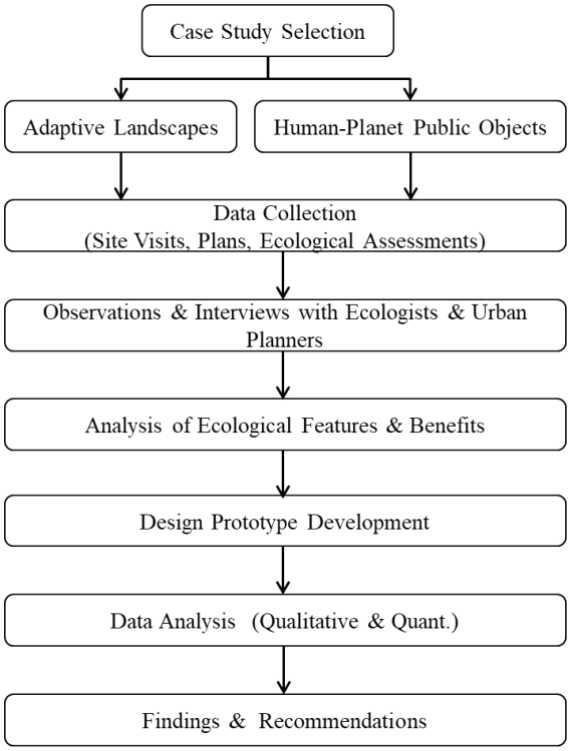

Fig. 2. Methodology Flowchart

3.1 Field Observations

Field observations form a critical component of the research, conducted in areas with high wildlife activity, particularly in the Sham Shui Po district. These observations focus on documenting patterns of wildlife behavior and interactions with urban elements such as planters, lampposts, and building facades. The aim is to identify conditions that attract wildlife to urban areas and to understand how these animals adapt to human-made environments. Data from these observations help evaluate the effectiveness of urban design in supporting biodiversity and inform the development of design prototypes.

3.2 Interviews

Interviews with local ecologists, urban planners, and residents provide qualitative data on the importance of biodiversity in urban areas and the challenges and opportunities associated with integrating ecological considerations into urban planning. These interviews capture expert insights and community perspectives on current design practices and potential solutions for enhancing biodiversity. The qualitative data is analyzed using thematic coding to identify key themes related to urban ecology and design.

3.3 Case Study Analysis

The research involves an in-depth analysis of two case studies, each exemplifying different scales of urban design intervention:

Adaptive Landscapes: This case study examines large-scale residential developments like Wetland Seasons Park, which incorporate features such as green roofs, water management systems, and landscape connectivity. The analysis evaluates these features for their ecological and residential benefits, providing insights into sustainable urban development practices.

Human-Planet Public Objects: This case study focuses on small-scale urban design interventions that enhance biodiversity and facilitate human-animal coexistence. It involves documenting existing urban furniture and building facades to assess how these structures interact with local wildlife. Observations reveal how urban elements serve as habitats or resting places for animals, highlighting the importance of considering ecological interactions in urban design.

3.4 Design Prototype Development

Based on insights from field observations and interviews, design prototypes are developed to explore innovative urban solutions that promote human-animal coexistence. Prototypes, such as the "Bee Hotel Signage," are conceptualized to combine functional urban elements with habitats for wildlife. These prototypes are iteratively refined through stakeholder feedback and assessed for their ecological benefits and feasibility in urban contexts.

3.5 Data Analysis

Data collected from case studies, field observations, and interviews are analyzed using a combination of qualitative and quantitative methods. Qualitative data, such as wildlife interaction patterns and design effectiveness, are analyzed through thematic coding to identify key themes and insights related to urban biodiversity and design practices. Quantitative data from ecological assessments are used to evaluate the impact of urban design on biodiversity and ecological health.

4. Finding and Discussion

4.1 Case Study I: Adaptive landscapes (Wetland Seasons Park)

Hong Kong, located along the southeastern coast of China, is a quintessential high-density metropolis and serves as a global hub for economics, finance, trade, and foreign investment (Gottlieb & Ng, 2017) [20]. Characterized by a subtropical maritime climate, Hong Kong experiences hot, humid summers and mild winters. The architecture and urban form of Hong Kong present a vibrant and layered template, marked by high-rise and high-density characteristics. This urban form is shaped not merely by design concepts but is significantly influenced by the geographical constraints of the region.

Hong Kong has a population of over seven million people and covers a total area of 1,118 square kilometers, most of which is mountainous. Only 25.5% of the land is developed (Planning Department of Hong Kong, 2023) [21], leading to high-density residential and other development projects that typically feature buildings ranging from 40 to 60 stories, aligned along narrow streets 15-25 meters wide. To acquire more land for development near existing urban areas, the Hong Kong government has also undertaken extensive land reclamation projects since the 1980s. Overall, the urban spatial form of Hong Kong has evolved from a concentrated to a more dispersed configuration, transitioning from a ribbon structure centered around Victoria Harbor to a “concentrated yet relatively loose” multicentric cluster structure centered around the Kowloon and Hong Kong Island metropolitan area (Figure 3).

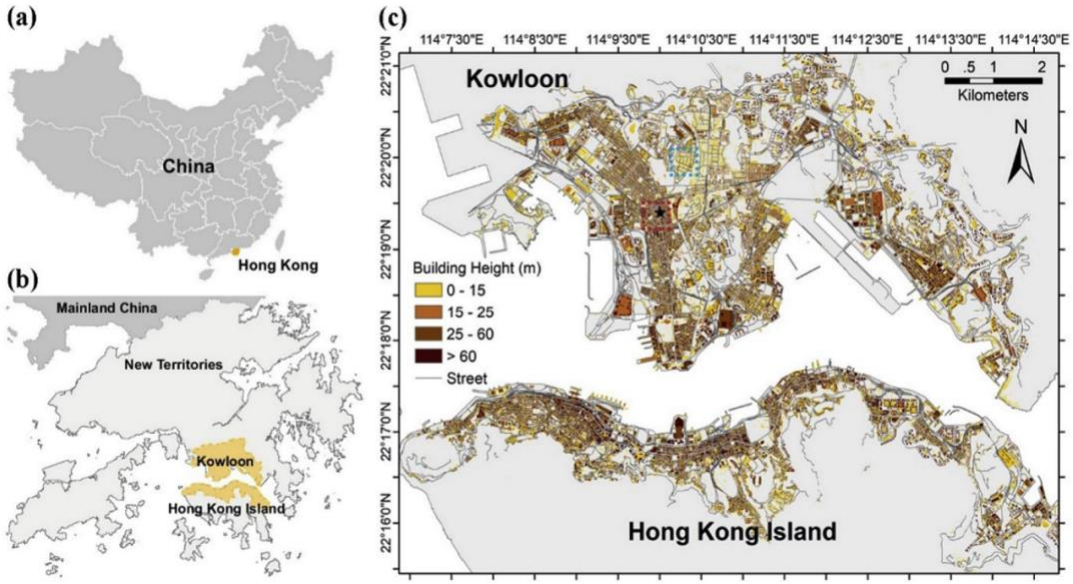

Fig. 3. (a) Location of Hong Kong (yellow circle) in south-eastern China; (b) High-density urban areas in Hong Kong, as outlined in yellow, including Kowloon and northern Hong Kong Island; (c) Building density map, including distribution and height, overlaid with streets in grey. The building and street data are extracted from the B5000 maps series by the Hong Kong Lands Department.
Source: Gong et al. (2018)

In Hong Kong, the limited availability of buildable urban land, along with challenges like traffic congestion and environmental degradation, demands innovative solutions for low-carbon and sustainable architectural developments. The residential development - The Wetland Seasons Park stands as a prime example of how strategic urban design can successfully integrate residential living with natural ecological systems. Situated next to the Hong Kong Wetland Park, this project strengthens the connection between urban spaces and natural habitats. It features 20 ten-story residential towers, 10 five-story villas, and 10 two-story houses, providing a total of 1,727 units (Figure 4). This development is not just a residential area but a vibrant community with its retail spaces and recreational facilities, creating a holistic habitat for both humans and local wildlife.

Fig. 4. Block plan
Source: LWK & PARTNERS (HK) Architects

The project's proximity to the Wetland Park allows residents to enjoy unspoiled natural landscapes, contributing significantly to the quality of urban life and supporting biodiversity. The design integrates ecological considerations by minimizing environmental impact and enhancing the area's ecological value. This approach not only supports local flora and fauna but also offers residents a unique living environment that promotes sustainability and ecological awareness. In terms of ecological impact, the project employs an integrated design that aims to sustain the local ecosystem. The buildings are planned to ensure that they do not obstruct natural water flow and that the local wildlife can thrive alongside human residents. The architectural layout and the choice of materials aim to reduce the carbon footprint, conserve energy, and utilize sustainable resources. Table 2 summarizes the key aspects of the Wetland Seasons Park project, highlighting how it integrates architectural innovation with ecological sensitivity. This project exemplifies sustainable urban development, showcasing effective strategies that enhance both the well-being of its residents and the health of the environment.

Table 2. Detailed Features and Ecological Impact of Wetland Seasons Park

Feature	Description	Ecological Benefits	Residential Benefits
Location Proximity to Wetland	Adjacent to the Hong Kong Wetland Park.	Provides a buffer zone, enhancing local biodiversity and ecosystem health.	Offers unspoiled natural views, promoting a serene living environment.
Ecological Design Integration	Use of sustainable materials and construction methods that are sensitive to the local ecosystem.	Minimizes environmental footprint, supports habitat conservation.	Enhances quality of life through eco-friendly surroundings.
Water Management	Systems designed to manage stormwater and reduce runoff.	Reduces impact on local waterways, helps maintain natural water cycles.	Reduces flood risk, ensuring safer residential areas.
Green Roofs and Walls	Buildings incorporate green roofs and living walls.	Increases urban greenery, aids in air purification and provides thermal insulation.	Provides aesthetic benefits and potential energy savings.
Landscape Connectivity	Green corridors connect residential areas with the Wetland Park.	Facilitates wildlife movement and enhances ecological corridors.	Provides residents with direct access to green spaces for recreation and relaxation.
Building Orientation	Buildings are oriented to maximize natural lighting and ventilation.	Reduces reliance on artificial heating and cooling, lowers carbon emissions.	Improves living comfort and reduces energy costs for residents.
Material Selection	Use of low-impact, locally sourced materials.	Reduces transportation emissions and supports local industries.	Promotes sustainability and contributes to the local economy.
Community Engagement	Facilities and programs designed to educate residents and visitors about ecological conservation.	Increases environmental awareness and stewardship.	Enhances community cohesion and resident satisfaction.

4.2 Case Study II : Human Animals Co-Living In The City (Human-Planet Public Objects)
4.2.1 The dissolving boundary

As human populations and demand for urban areas continue to grow, people and wildlife are increasingly interacting and competing for resources, which can lead to increased human-wildlife conflict such as loss of property, livelihoods etc.

In the case of Hong Kong, a city with high population density and extremely limited area of built land, the confrontation between human and wild animals is ever more obvious. Reports like wild boars and monkeys trespassing residential areas have become more frequent in recent years, causing the government to take actions to limit the populations of wild animals.[22] Seeing the traditional way of conservation and zoning may not be enough to solve this complex issue, it forces architects to rethink the concept of the city as an enclosure.

4.2.2 The inevitable relationship between human and wildlife

The French landscape architect Gilles Clément [23]suggests that all enclosures are an illusion. The planet is a territory where species are constantly moving and evolving. Human activities over the past decades have made enormous contributions into this planetary intermingling, that human-beings are constantly moving, and making everything else move.

Clément's idea on the "Planetary Garden" (Clément, 2021) [23] stated that the entire planet is one big garden and humans are all gardeners. Nature is not at the service of man: humans exist within her, submerged in her, intimately associated with her. The goal of the planetary garden is to exploit diversity without destroying it, perpetuating the "planetary machine" and ensuring the existence of the garden – and hence the gardener.

Nowadays, due to climate changes, there is more awareness of human's impacts to nature. The sustainable movement has further led to concepts like New Economy which focuses on the integrity of human and nature, and not only on economic growth alone. Also, Regenerative Design which has been developed from sustainable design, emphases on creating design solutions with positive impact to the planet rather than merely doing 'less bad'. (Lin, 2021) [24]

4.2.3 Ecology starts in small-scale

"Human-planet Public Objects" is a research project which begins with the reflection on human's impact on Earth and the interactive effects of human's influence based on the concept of anthropocene. Since the city is the centre of all human activities, instead of focusing on the entire planet and all its problems human-beings have created, the research project brings the focus back into human's daily living environment. Starting from the scale of mundane street objects (i.e. lamppost, benches, bins etc.) and building facades, the research tried to observe and understand how other species have been accommodating the living habits of human- beings in the context of a micro-urban environment.

The study is structured into 4 main parts: field observation, dialogues with ecologists, guided tours to arouse public attention and design prototype development. Field observation has been done to map out the areas where wild animals are active and have interacted with human artefacts, so as to understand which are the conditions that may attract wild animals and adapt to their living habits. Figure 5 shows the mapping of one of the study areas, Sham Shiu Po Nam Cheong Street. Figure 6 shows the urban section which demonstrates how building heights and urban greenery can form a complete ecosystem from nesting, food hunting to resting.

Fig. 5. Mapping of wildlife in NamCheong Street, Hong Kong
Source: Leung & Tsang

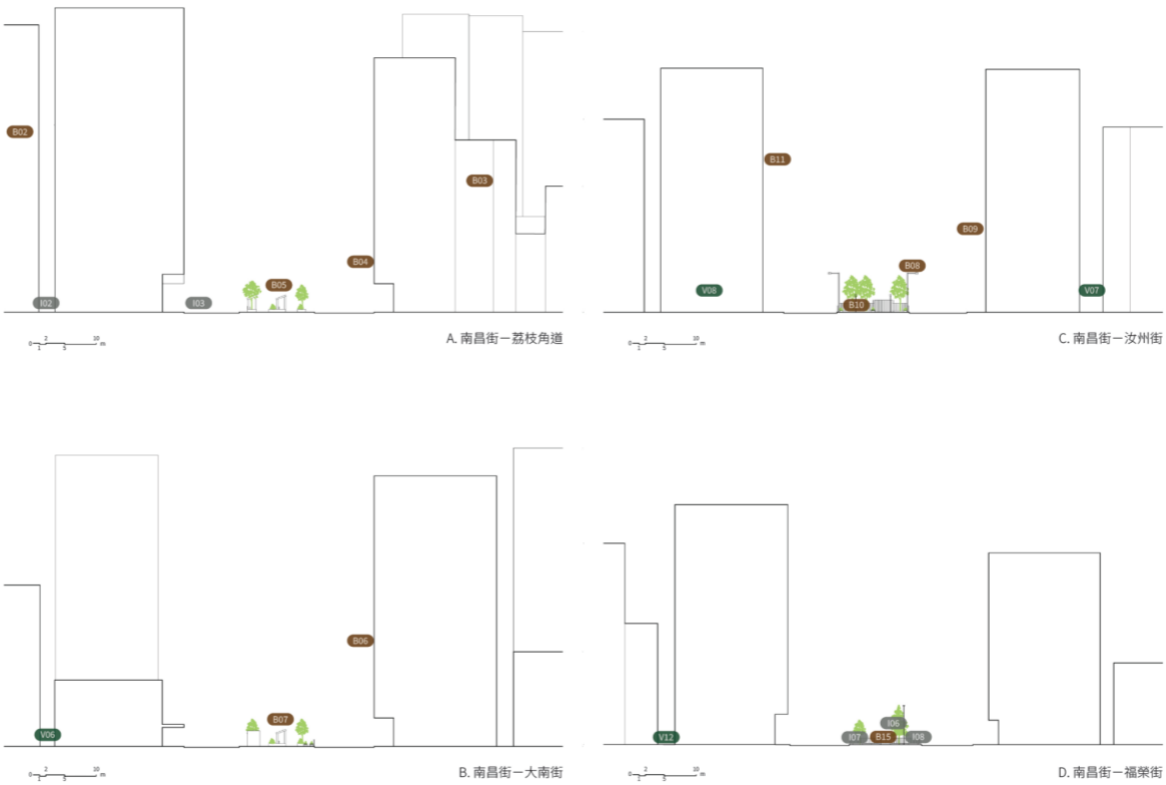

Fig. 6. . Urban section of Nam Cheong Street, Hong Kong, Mapping of wildlife
Source: Leung & Tsang

In-depth observation has been done to review existing street objects design and to understand how wildlife has tried to adapt and incorporate into those human artefacts and to analyze the potential and danger of the existing situations (see figure 7 & 8). Very often street objects which were not meant to design for wild animals ended up becoming places to hang out or rest due to the lack of living space for wildlife in the urban environment.

Fig. 7. Documentation of how wild birds adapt to the design of brick planters for food hunting
Source: Leung & Tsang

Fig. 8. Documentation of how wild birds use facade features (cloth hanger) as a resting spot in the city
Source: Leung & Tsang

4.2.4 The importances of biodiversity and its public education in urban areas

Dialogues and interviews have been conducted with local ecologists to explore the importance of having biodiversity not only in rural or natural reserves but in urban areas. According to ecologist Bond Shum, the founder and conservation director of Outdoor Wildlife Learning Hong Kong, "Biodiversity is like playing Tetris, the more creatures we can preserve, the more blocks we have in the Tetris. If we remove one species in an urban area, we are removing one block from the Tetris. We

never know how many more blocks we can pull out until the whole system collapses. (...) The reason why our city is human-centric is mainly due to our education. There is not enough emphasis on environmental education and we tend to see the city from the human point of view. (...) If we can be more caring and have more understanding, most issues can be solved in a better way. In the end, it is us who have urbanized their original living area, we should be the ones who adapt to their basic needs." (Leung & Tsang, 2022) [25]

In order to raise public attention on the importance of biodiversity in our urban environment, guided tours and bird watching have been organized in April 2024, in an exhibition funded and supported by the Hong Kong Conservancy Association.

Fig. 9. (left) Guided tour in Sham Shui Po district on biodiversity in a public park
Fig. 10. (right) Bird watching in Sham Shui Po Nam Cheong Street
Source: Leung & Tsang

4.2.5 Design prototype to reconnect human and ecology in urban environment

Through studying how animals and other living-beings use and adopt urban space in the scale of street objects, the project has extended the current design trend from human-centric to human-planet centric for a sustainable urban environment. By exploring design prototypes which can be beneficial to both humans and other beings, the project has developed ideas such as bee hotel signage which combines street signage with habitation for solitary bees in an urban context.

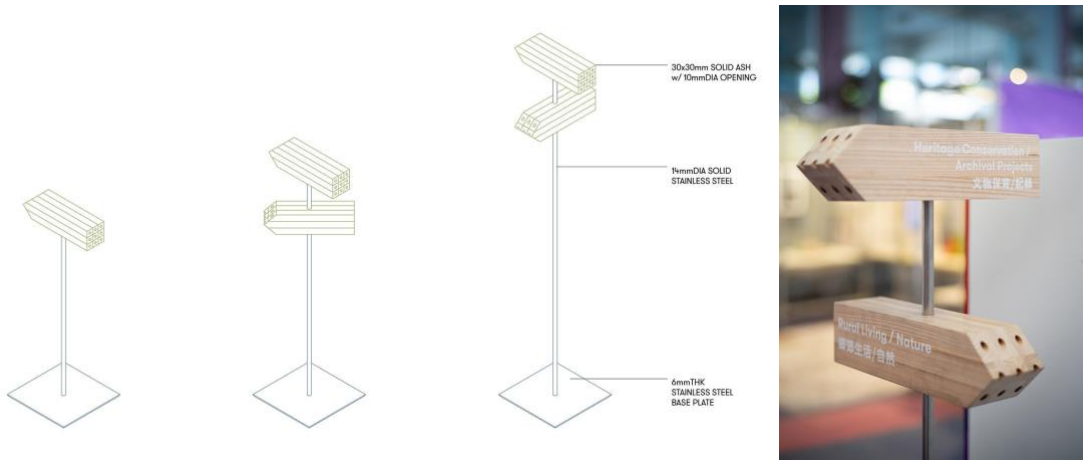

Fig. 11. Bee Hotel Signage: a street signage which can also serve as habitation for solitary bees, exhibited in the 2022 Hong Kong Shenzhen Bi-City Biennale of Urbanism / Architecture (Hong Kong) 'Seeds of Resilience'
Source: Leung & Tsang

Through field research, interviews, public engagement and design prototype, the objectives of the project "Human-planet public objects" is to raise attention on co-living between humans and wildlife on an object scale and further enlarge and be impactful to the urban scale.

5. Conclusions

This research highlights the critical importance of integrating ecological considerations into urban planning to foster sustainable urban growth in high-density cities like Hong Kong. Through the analysis of two case studies, this study illustrates the potential for urban design to facilitate coexistence between human and natural ecosystems, enhancing biodiversity while meeting human needs. The Adaptive Landscapes project demonstrates how large-scale residential developments can effectively incorporate ecological features, such as green roofs and landscape connectivity, to support both human and ecological well-being. Meanwhile, the Human-Planet Public Objects project underscores the significance of small-scale urban design interventions in promoting biodiversity and raising awareness about the importance of ecological integration in urban environments.

Despite the valuable insights provided by these case studies, several limitations should be acknowledged. The research primarily focuses on specific projects in Hong Kong, which may limit the generalizability of findings to other urban contexts with different geographic, cultural, and socio-economic conditions. Additionally, the scope of the study is constrained by the availability of data and the relatively short timeframe for observations and interviews, which may not capture long-term ecological impacts and changes in urban biodiversity.

The findings from this research have significant implications for urban planning and design practices. By demonstrating the benefits of integrating ecological considerations into urban development, this study supports the argument for adopting more inclusive and sustainable design approaches that prioritize the coexistence of humans and nature. Policymakers and urban planners can use these insights to inform the development of guidelines and regulations that encourage ecologically sensitive urban growth. Furthermore, the research underscores the importance of public education and engagement in fostering a broader understanding of biodiversity's role in urban environments, which is crucial for gaining support for ecological initiatives.

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