



Human-Nature Relations in the Urbanizing Landscape of the Deep Bay Wetlands, Hong Kong

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Abstract

Traditional activities, including aquaculture, of communities living on the edge of the Deep Bay Wetlands in Hong Kong transformed the landscape into a semi-artificial ecosystem that supported local wildlife, briefly enhancing its ecological value. However, since the 1970s, rapid urbanization has disrupted these human-nature interdependencies through habitat loss, fragmentation and the decline of traditional occupations. Today, the Northern Metropolis Development Strategy (NMDS) further threatens this unique eco-cultural landscape. This article considers how village-based practices have contributed to the wetland's biodiversity over time. It argues that Deep Bay should not be seen as a passive ecological site but as a dynamic cultural landscape where human activity has historically sustained ecological functions. Wetland protection requires more than ecological conservation – it demands an integrated approach that values cultural heritage as a vital component of ecological sustainability.

Policy Recommendations

- Wetland conservation strategies should include local voices and offer culturally grounded economic alternatives to reduce land conversion pressure.
- Wetland conservation strategies should integrate cultural heritage into ecological planning by recognizing and supporting human practices that contribute to biodiversity in dynamic wetland landscapes. To do that, a comprehensive assessment of historical water management, land-use patterns and socioeconomic transitions should be conducted, with findings integrated into environmental impact assessments – particularly in light of upcoming NMDS development.

KEYWORDS

Wetland
Cultural landscape
Urbanization
Socio-ecological system
Fishponds

WATER ICONS



CLIMATE



Cwa: Humid subtropical climate



Introduction

The Inner Deep Bay catchment is a low-lying area in southern China. Located in the north-western New Territories (NT) of Hong Kong, across the Yuen Long and North districts, it comprises marshlands, mudflats, mangroves, fishponds and 6,640 ha of peri-urban estuarine wetland (Agriculture, Fisheries and Conservation Department 2023; figs. 1–3). This includes 1,540 ha designated as the Mai Po Inner Deep Bay Ramsar Site, collectively known as the Deep Bay Wetlands (DBW). Hong Kong's DBW exemplify a relatively short but dynamic transformation of the landscape and evolving human-nature interactions, reflecting a broader global pattern in which nearly three-quarters of terrestrial ecosystems have been altered by human activity (Ellis et al. 2021; Perry 2021).

The first inhabitants arrived in the Deep Bay area in the late tenth century; however, significant landscape modifications did not begin until the twentieth century, when local communities introduced aquaculture ponds that eventually became part of the region's cultural heritage (HKICHDB 2021). These ponds enhanced biodiversity by attracting both migratory and resident birds, fostering a distinctive interdependence between human activity and ecological support and contributing to the formation of an ecologically and culturally unique landscape. However, since the 1970s, rapid urbanization and socioeconomic changes in the NT have altered land cover, reduced the distance between wetlands and urban zones (fig. 7) and contributed to the decline of traditional livelihoods.

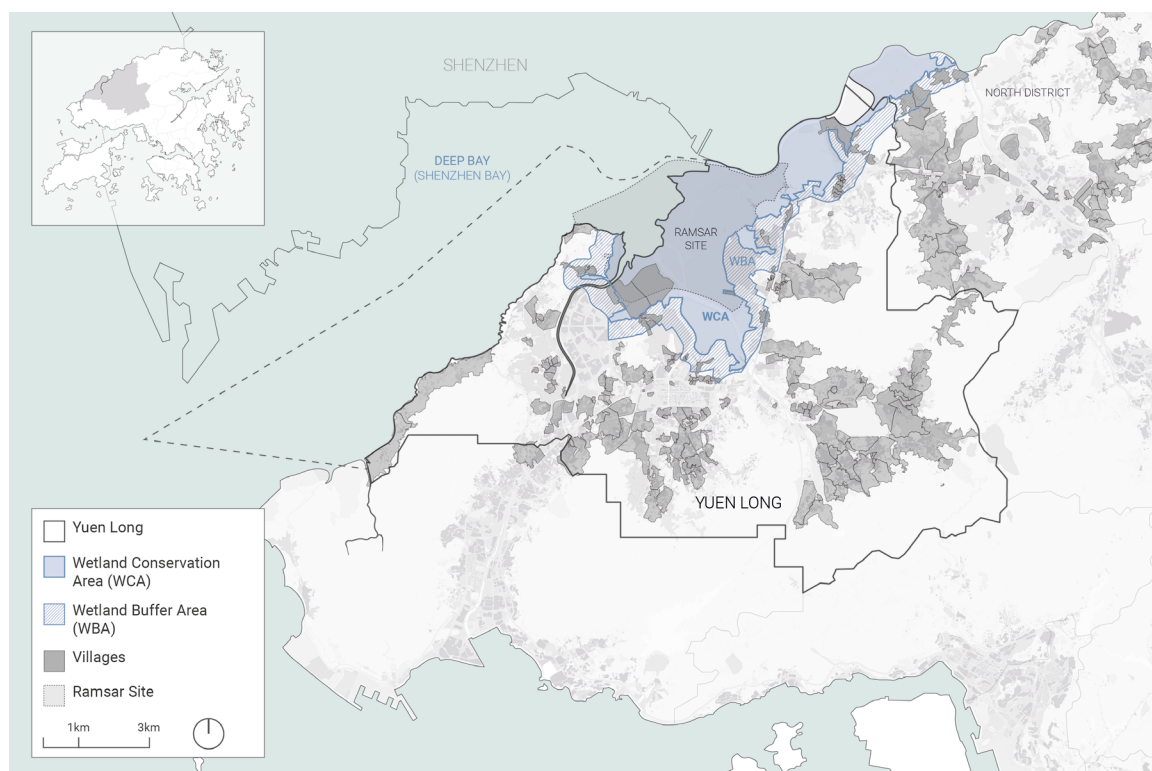
This article identifies two layers of human-nature engagement in the DBW: a traditional, livelihood-based relationship and a more recent urban-driven one that has reshaped local industries and practices. While conceptually dis-

tinct, these layers are historically intertwined. The study explores how overlapping ecological, cultural and urban development forces have shaped the wetland and advocates conservation strategies that integrate historical land-use practices and cultural heritage into sustainable planning. The analysis draws on historical and socioeconomic data supplemented by anecdotal insights from local residents.

Ecological and Cultural Importance

About 75 per cent of Hong Kong is undeveloped or natural land, including mainly woodlands, shrublands and grasslands (65 per cent). Only a small area is covered by an estuarine ecosystem – such as mangroves and swamps (0.5 per cent) and aquaculture (1.4 per cent) (Planning Department 2023). As the largest remaining tidal mudflat and mangrove habitat in the Pearl River Estuary, the DBW represent a rare and ecologically significant example of this ecosystem type in Hong Kong, helping to stabilize shorelines, reduce coastal erosion, and contribute to carbon sequestration.

The area includes 1,135 ha of fishponds (as of 2016) (Hong Kong Bird Watching Society, n.d.) – man-made aquaculture sites now integrated in the wetland landscape. The ecological value of fishponds in Hong Kong began to be recognized in the 1990s due to their flood mitigation and habitat-support functions (Planning Department 1997), and their importance has grown with rising sea levels and shifting hydrological patterns linked to climate change. Extreme precipitation events in the Pearl River Delta are expected to increase significantly under high-emission scenarios (RCP 8.5); meanwhile, flood risks in low-lying urban areas like Hong Kong's northwest NT are also growing (Chen et al. 2021). In this context, fishponds serve as



^ Fig. 2 Yuen Long district, including wetland conservation and buffer areas, village outlines and Ramsar Site (Source: Zuzanna Sliwinska, 2024).

buffers that retain stormwater and reduce runoff, helping protect adjacent residential areas (Hong Kong Bird Watching Society n.d.).

Well-maintained fishponds contribute to the wetlands' ecological value. Seasonal practices like pond draining during harvest create nutrient-rich environments that benefit migratory and resident birds. Each winter, 40,000 to 90,000 birds along the East Asian-Australasian Flyway stop here, including 35 globally threatened species (Leung et al. 2023). These birds rely on organic matter – fish feed, waste and silt – accumulated in and around the ponds (Leung et al. 2023). However, fishponds func-

tion as an interconnected system and require active management to maintain their ecological value (Planning Department 1997). Abandonment leads to stagnant water, habitat degradation and their eventual drying up. When they lose their ecological function, it becomes more difficult to advocate their conservation, increasing the risk of urban encroachment (Bolchover 2016). This illustrates the link between declining cultural practices and environmental degradation.

Recognizing the ecological value of these semi-artificial landscapes, in 1999, the Town Planning Board¹ established the Wetland Con-

1. The Town Planning Board in Hong Kong is a statutory body responsible for developing and implementing urban plans to ensure the orderly and sustainable development of the territory.



^ Fig. 3 Mangroves exposed along the Kam Tin River's muddy edges on the Nam Sang Wai's east side (Source: Zuzanna Sliwinska, 2023).

servation Area (WCA) and Wetland Buffer Area (WBA) to regulate land use and development around Hong Kong's DBW. WCA covers existing fishponds within and around the Ramsar Site² together with the 500 m WBA along the landward side of the WCA (Agriculture, Fisheries and Conservation Department, and Environmental Protection Department 2019). Today, several peri-urban villages still exist in the WBA area (fig. 4), remnants of Hong Kong's traditional society – lineage villages established by Indigenous inhabitants of the NT – with ancestral halls, burial grounds and shrines.

The fishponds demonstrate that human-shaped landscapes are not inherently

ecologically inferior and that cultural engagement with land and water can support ecological health. Wetland protection, therefore, requires an integrated approach that values cultural heritage as part of ecological sustainability. While some local initiatives acknowledge this, the decline of traditional practices continues to threaten the landscape.

Historical Transformations of the Wetland

The Tang clan, from southeastern China, arrived in the Kam Tin area (today the district of Yuen Long) in the late tenth century. They planted freshwater rice on slopes near the marshes and mudflats. Over the next four

2. In 1995, the 1,500 ha of Mai Po wetlands, including the neighboring Inner Deep Bay area, were designated Wetlands of International Importance under the Ramsar Convention.

centuries, several other major clans settled nearby, attracted by the fertile land surrounding the wetland and the interaction between freshwater streams and tidal saltwater inflows (Bolchover 2016). As the fertile grounds inland became occupied, some farmers moved closer to the bay's edge and reclaimed mudflats by separating them from the tidal zone (Bolchover 2016). These practices allowed water to drain through the soil until it became less salty. Alternatively, residents planted red rice, which could grow in brackish water. This, in turn, led to the intake of estuarine water containing shrimp larvae, later harvested for food on a subsistence level (Bolchover 2016).

In the NT, the local lifestyle has remained unchanged for several centuries. Farmers altered the landscape to some extent to create paddy fields and support agricultural practices; however, it wasn't until the British takeover in 1898 that substantial changes occurred.

In the early 1900s, fishponds emerged around the Tung Tau village cluster and slowly expanded in the following decades; however, agricultural practices still dominated throughout the first half of the century. In 1953, rice fields covered 9,466 ha (70 per cent) of Hong Kong's farmland. At the same time, *gei wai* – a traditional shrimp farming technique practiced in intertidal zones near mangrove stands – was introduced by migrants from mainland China in the 1940s and initially coexisted with other agricultural activities in the wetland landscape.

In the 1950s, a trade embargo led to shifts in farming policy, promoting vegetable farming, livestock rearing and fish breeding. This shift led to a decline in rice production in the NT. By 1988, rice cultivation had nearly disappeared, with less than one ha dedicated to it (Lee and DiStefano 2002).



^ Fig. 4 Shan Pui Tsuen, with a few preserved ancient buildings (foreground) and modern architecture typical of today's peri-urban villages (background), is an example of a village within the Wetland Buffer Area. The first fishponds in this area were established around the Shan Pui and the Tung Tau village cluster to which this village belongs (Source: Zuzanna Sliwinska, 2023).

During the second half of the twentieth century, the economic context and the establishment of "New Towns" in the 1970s and 1980s by the Hong Kong Planning Department greatly changed the morphology of the NT landscape. New Towns were part of a strategic government initiative to decentralize the population and develop self-contained residential and industrial hubs. While effective in accommodating urban growth, their construction significantly altered rural landscapes.

Beginning in the 1960s – and especially during the early 1970s – many of the *gei wai* systems, along with surrounding farmland and mudflats, were converted into freshwater fishponds,



^ Fig. 5 Fish are collected, weighed and sold in the Yuen Long and Kowloon local markets by farmers near Shan Pui village (Source: Zuzanna Sliwinska, 2023).

which eventually covered 2,255 ha to meet the rising demand for food from Hong Kong's growing urban population (Lau 2022; fig. 6).

The construction of New Towns and the development of neighboring Shenzhen in the 1980s, while initially increased the demand for fishpond cultivation, later triggered the expansion of urban boundaries into the wetland and a fast decline of fishpond cultivation and the ecosystem (Leung et al. 2023) through habitat destruction and fragmentation, and sociocultural changes.

Yuen Long, originally a market township, was formally expanded through government planning, and Tin Shui Wai developed primarily onto reclaimed marshes and fishponds. Designated

as New Towns in 1972 and 1987, respectively, both areas grew rapidly, further encroaching onto the wetland (fig. 7). Apart from habitat destruction, urbanization has impacted wetlands through changes in the hydrological regime and interventions to the morphology of the land. For example, the designation of the Shenzhen Special Economic Zone and New Towns in the DBW area impacted the estuary through mud dredging to infill fishponds to allow for development and the increasing amount of construction waste deposited in the river and the sea (Bolchover 2016); it also pushed the urban edge further toward the coast with projects like Fairview Park (1970s) and Palm Springs (1990s). In the 1990s, studies conducted by the Planning Department confirmed that land use changes leading to the loss of fishpond



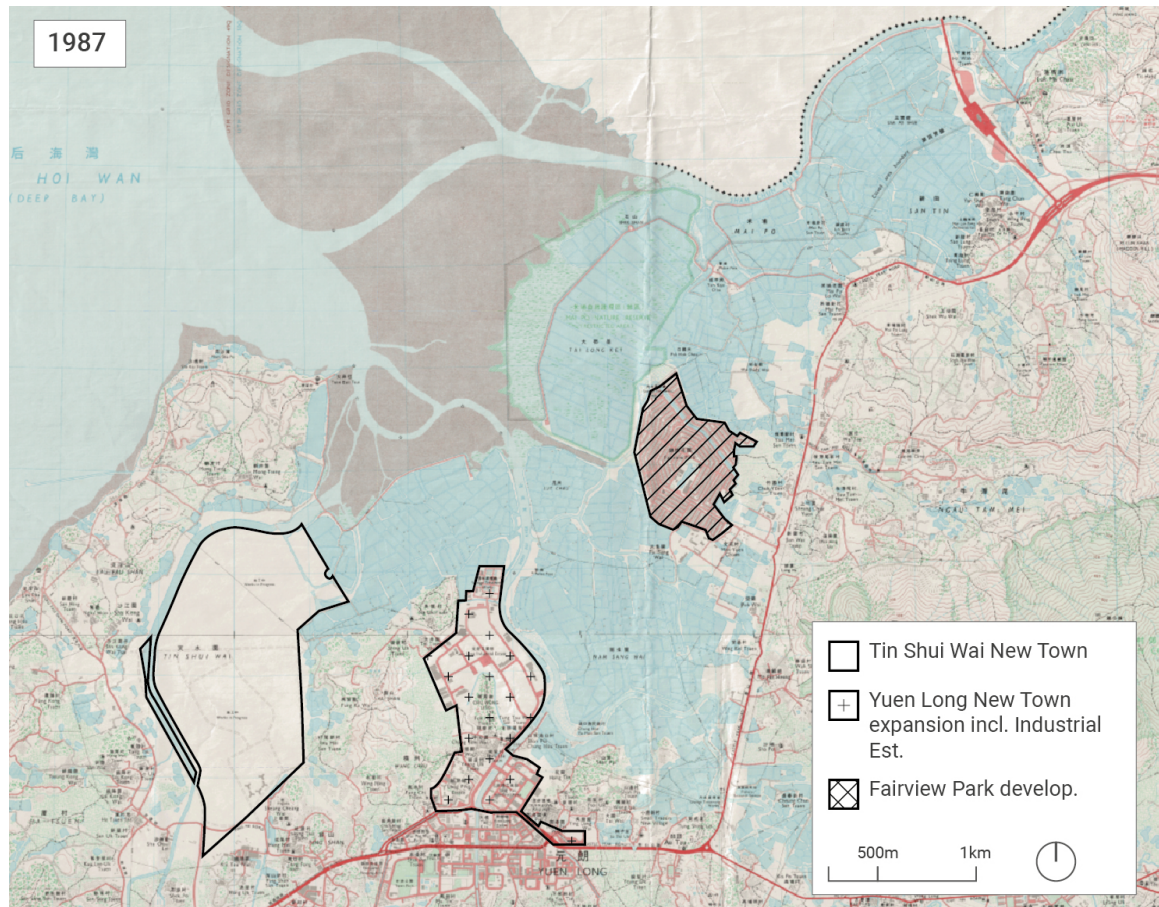
^ Fig. 6 Marshes and fishponds seen from the border between Hong Kong and Shenzhen, 1978 (Source: Urbain J. Kinet. Flickr.com, no known copyright restrictions).

habitat were likely to be detrimental to birds (Planning Department 1997). Leung and colleagues (2023) found that these large-scale landscape alterations in the last forty years in the Deep Bay area have led to significant changes in water quality, hydrodynamics and the loss of wetland habitats.

Beyond their physical development, the creation of New Towns also triggered socioeconomic and political changes, including the relocation of villages from areas designated for development to newly built settlements on the fringes of the New Towns (Hayes 2006). Policy changes – such as the introduction of the Small House Policy in 1972 – further increased demand for land and contributed to the expansion of village boundaries, often in the direc-

tion of the wetland. Together, these dynamics brought what Lee and DiStefano (2002) describe as “gradual but irreversible changes to local society” in the northwestern NT.

By the 1970s, local village economies could no longer rely solely on traditional resources. The opening of factories in Tuen Mun, Yuen Long and Tin Shui Wai offered alternative livelihoods, leading many to abandon fishpond cultivation. Some pond owners informally repurposed their land into container yards, storage sites or housing, fragmenting the wetland and weakening ecological connectivity. Today, an estimated 200–300 ha of ponds lie inactive or abandoned (Lau 2022), with most remaining ponds managed by elderly fishers averaging 60 years old. The lack of regular maintenance

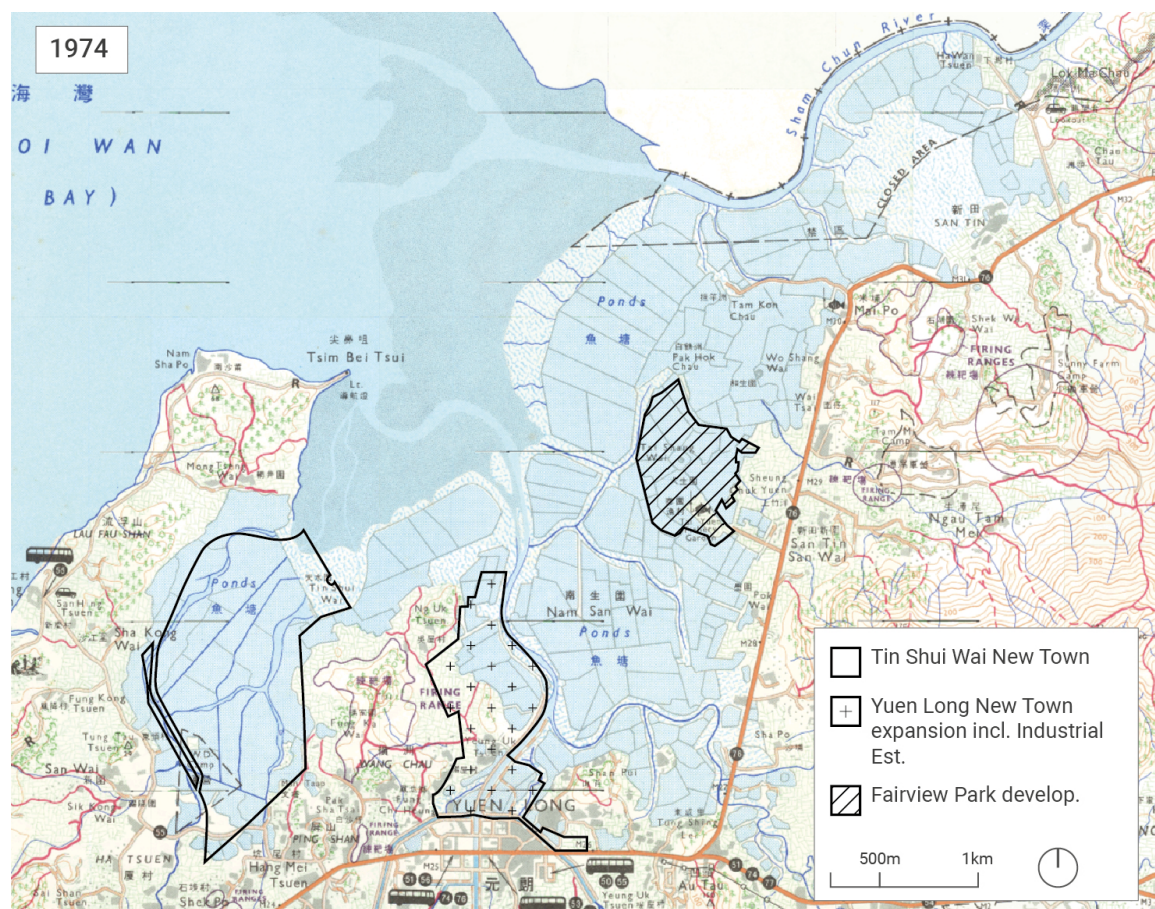


^ Fig. 7 The wetland area near the Yuen Long township (today Yuen Long New Town) in 1974 (left) and 1987 (right) after the expansion of Yuen Long New Town with Industrial Estate and construction of Tin Shui Wai New Town (Source: www.hkmaps.hk, modified by Zuzanna Sliwinska, 2025).

leads to stagnant water, reduced biodiversity and eventual ecological degradation, raising concerns about the long-term viability of the practice (Lau 2022).

Globally, cultural change threatens wetland biodiversity, particularly the decline of traditional aquaculture and land stewardship practices. These threats have increased significantly in the latter half of the twentieth century (Rotherham 2013). In Hong Kong, land use shifted from subsistence, and emerging economic conditions in the DBW prompted a decline in

traditional jobs associated with the wetland ecosystem. As fishpond cultivation is increasingly seen – especially by younger generations – as a less viable economic option, the practical knowledge required to manage these systems is no longer being passed down. This has led to the erosion of local expertise and a decline in interest among village residents in activities on the village periphery. Without cultural incentives to maintain these landscapes, conservation efforts depend entirely on regulations rather than community participation. Hence, integrating cultural heritage with wet-



land conservation is crucial to avoiding further land fragmentation and ensuring that conservation efforts are holistic rather than purely regulatory.

New Development Plans - Northern Metropolis

The DBW represents Hong Kong's largest remaining flat land. Today, this region sits at the heart of Hong Kong's development agenda, particularly within the Northern Metropolis Development Strategy — a large-scale urban expansion plan encompassing the Yuen Long and North districts. The NMDS envisions New Development Areas matching existing New

Towns with an expansion of urban centers and major public transport infrastructure. The project covers an estimated 600 ha, extending up to the edge of the wetlands.

Within the San Tin Technopole boundary alone — the first phase of the project — 150 ha of fishponds are included, raising concerns. First, converting fishponds into urban land reduces habitat connectivity for migratory birds and disrupts wetland hydrology. Further fragmentation, already an issue, weakens the ecosystem's ability to sustain biodiversity, as isolated wetland patches are more vulnerable to degradation. Second, the announcement of this project in 2021 has already led to the relocation of

several villages and could further affect the use of the wetlands. Therefore, the project raises the potential for consequences similar to those experienced during the 1970s and 1980s when New Towns were constructed in the NT.

Past developments in the area show that once development reaches wetland boundaries, land speculation and informal urbanization often accelerate – undermining not only ecological integrity but also the cultural practices that sustain the landscape. Such pressures will likely intensify without proactive conservation strategies that account for environmental and cultural value, weakening long-term efforts to protect the DBW.

Discussion

Fishponds lose ecological function when the cultural and economic incentives to manage them disappear, increasing their vulnerability to development. This is particularly evident in villages within the WBA, which sit at the boundary between the wetland and expanding urban zones. Perspectives on conservation in these communities are not uniform: while some residents and environmental groups resist further development due to concerns about ecological degradation and cultural loss, others see urban expansion as an economic opportunity – especially amid rising land values. Informal conversations revealed that not all villagers feel a strong attachment to the wetland landscape. Some appreciate aspects of recent develop-

ment, such as the shade cast by nearby high-rise buildings, making outdoor areas more comfortable for elders. These differing views show that conservation must be ecologically sound and socially grounded in peri-urban realities. Effective wetland conservation requires engaging local communities, especially landowners, and providing culturally rooted alternatives that reduce pressure to convert wetlands into urban or commercial developments.

Although wetland conservation policies exist, they often separate ecological protection from cultural continuity. For instance, the WCA and WBA offer physical boundaries (ecological zoning) but do little to address the cultural and economic disconnection from the land. Additionally, mechanisms like the “no-net-loss”³ principle have encouraged the creation of artificial mitigation zones treating fishponds as interchangeable units, lacking the cultural and ecological depth of real aquaculture systems, and failing to address the underlying sociocultural and ecological dynamics that sustain wetland biodiversity. This principle also facilitates building more in areas suitable for development while promising to compensate in other areas, with ecological effects that are not the same. The NMDS is an example of this, as is Hong Kong Wetland Park, originally built to offset Tin Shui Wai, which now serves more educational than ecological functions.

Future conservation efforts need to move beyond viewing wetlands as static ecological assets. Instead, they should be recognized as dy-

3. The “no-net-loss in wetland” principle was introduced by the Hong Kong Town Planning Board as part of its planning guidelines in response to growing concern over wetland degradation in the Deep Bay area. It was formalized in the 1997 Town Planning Board Guidelines (TPB PG-No.12B), which apply to the WCA and the WBA. The policy stipulates that any development proposal that involves a loss of fishponds or wetland area must demonstrate ecological compensation of an equivalent or greater value, often through habitat creation or enhancement.

dynamic cultural landscapes where human activity can – and has – contributed positively to biodiversity. Such an approach can move beyond the binary of development versus biodiversity and toward more holistic, sustainable planning.

Conclusion

Lung and colleagues (2005) note that the NT's heritage value as a cultural landscape is declining. The evolution of the NT landscape across the twentieth century reveals how cultural priorities, driven by socioeconomic changes and developmental pressures, can influence wetlands' health. The case reveals two intertwined dynamics: traditional aquaculture supporting biodiversity and more recent urbanization and cultural detachment. Initially, traditional fishpond activities supported the wetland's ecosystem, which became partially dependent on their continued use. However, as urban expansion accelerated, pollution increased, economic realities shifted and traditional occupations declined, land-use priorities changed, leading to wetland fragmentation and lower ecological value.

This study demonstrates that the DBW are not passive ecological sites but dynamic cultural landscapes. While minimizing the level to which the NT is urbanized would benefit the wetland, limiting that process is probably unrealistic. Without addressing the cultural disconnection accompanying physical development, conservation efforts will remain reactive and fragmented. The example of DBW shows that sustainability cannot be achieved through zoning alone – it requires the reintegration of cultural values into land use and conservation to move beyond a binary of development versus biodiversity. This is especially important amid ongoing climate and biodiversity loss.

Ensuring the long-term viability of the Deep Bay Wetlands requires policy approaches that acknowledge and support the interplay between ecological functions and cultural practices. Wetland conservation strategies should include local voices and offer culturally grounded economic alternatives to reduce land conversion pressure. They should also integrate cultural heritage into ecological planning by recognizing and supporting human practices that contribute to biodiversity in dynamic wetland landscapes. To achieve this, a comprehensive assessment of historical water management, land-use patterns, and socioeconomic transitions should be conducted, with findings integrated into environmental impact assessments – particularly in light of the upcoming Northern Metropolis Development Strategy.

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