

# Transboundary Ecological Collaborative Management in the Northern Metropolis of Hong Kong, China Under the Background of Globally Regional Restructuring

Ruixiang LIU<sup>1,2,\*</sup>

**1** Division of Landscape Architecture, Faculty of Architecture, The University of Hong Kong, Hong Kong 999077, China

**2** AECOM Hong Kong Office, Hong Kong 999077, China

\*CORRESPONDING AUTHOR

**Address:** Knowles Building, The University of Hong Kong, Pokfulam Road, Hong Kong 999077, China

**Email:** Ray1022@connect.hku.hk

## ABSTRACT

The establishment and development of the Guangdong–Hong Kong–Macao Greater Bay Area have demonstrated the collaborative relationship of the globally regional reconstructing. As a major strategy of the Greater Bay Area, Northern Metropolis faces challenges in transboundary ecological collaborative management. Based on the analysis of the ecological issues and the complexity of the transboundary management in Shenzhen Bay, this article proposes a co-governed “Special Ecological Conservation Zone” under the context of “one country, two systems” by zoning areas with varied protection levels. The development and operation framework includes: establishing an independent Joint Work Group, building consensus and standardizing collaboration procedure, conducting hierarchical management and regulating development, leveraging and motivating knowledge and technological innovation, and strengthening community engagement and emphasizing shared benefits. By case-studying three sites along the Shenzhen Bay, this article also provides place-making strategies for different levels of protection zones. Exploring innovative collaboration models for Northern Metropolis, this article is expected to provide new solutions for the sustainable development of the Greater Bay Area and creative insights for global transboundary ecological collaborative management.

## KEYWORDS

Transboundary Ecological Collaborative Management; Ecological Governance; Guangdong–Hong Kong–Macao Greater Bay Area; Hong Kong–Shenzhen Collaboration; Globally Regional Restructuring; Northern Metropolis

## HIGHLIGHTS

- Discusses the uniqueness of Hong Kong–Shenzhen transboundary ecological collaborative management under the context of “one country, two systems”
- Establishes a co-governed framework for the development and implementation of Shenzhen Bay, with detailed localized place-making strategies
- Introduces a hierarchical management model and provides guidelines for development, aiming to balance conservation and development

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## 1 Introduction

In recent years, global major changes and reterritorialization of capital have speeded up the reshapes of regional structure and the formation of new collaborative relationships<sup>[1]</sup>. Against this

background, leveraging the framework of “one country, two systems,” the Guangdong–Hong Kong–Macao Greater Bay Area becomes a vital part of China’s Domestic–International Dual Circulation Strategy<sup>[2]</sup>. To bolster this strategy, the Government of the Hong Kong Special Administrative Region has re-envisioned the planning of new towns

in the territories bordering Shenzhen and established the Northern Metropolis<sup>①</sup>. Given the significant transboundary ecosystems within the Northern Metropolis, the Hong Kong government has adopted a core development strategy of promoting urban-rural integration and balancing development and conservation<sup>[3]</sup>. Therefore, the transboundary ecological collaborative management has become an important issue for the integrated development of Hong Kong and Shenzhen, where transboundary collaboration is essential for managing spatial elements and factors of production.

## 2 Transboundary Ecological Collaborative Management

Humans set up boundaries to manage, while nature does not recognize them<sup>[4]</sup>. The rise of environmentalism reveals the complexity of transboundary collaboration of ecosystem management, which covers Ecology, Geography, Political Science, Economics, Anthropology, etc.<sup>[5]</sup>. At present, transboundary collaboration has become an effective method for harmonizing different stakeholders, enhancing ecological protection, increasing social resilience against natural disasters, and promoting economic development.

In the past decades, regional reconstructing around the world has provided a broad practice platform for transboundary ecological collaborative management. As a practical collaborative management method for biodiversity and habitat conservation, more than 220 transboundary ecological conservation zones have been established worldwide<sup>[6]</sup>. As a typical case of regional integration, the Transboundary Parks Program promoted in European Union countries has facilitated the fusion of ecological conservation, recreational uses, and community growth, contributing to the sustainable development of transboundary ecosystems<sup>[7]</sup>. In China, with the advance of the Domestic-International Dual Circulation Strategy, despite the emphasis on coordinated regional development, the discussions related to ecological management remain relatively insufficient, compared with public governance, economic and trade exchange, and industrial division.

## 3 Challenges and Opportunities of Transboundary Ecological Collaborative Management Between Hong Kong and Shenzhen

Comprised of “Two Bays, One River”—Shenzhen Bay, Mirs Bay, and the Shenzhen River—the special geographical configuration of the Northern Metropolis has shaped its unique transboundary urban ecosystem<sup>[3]</sup>. Shenzhen Bay, as a mangrove wetland with

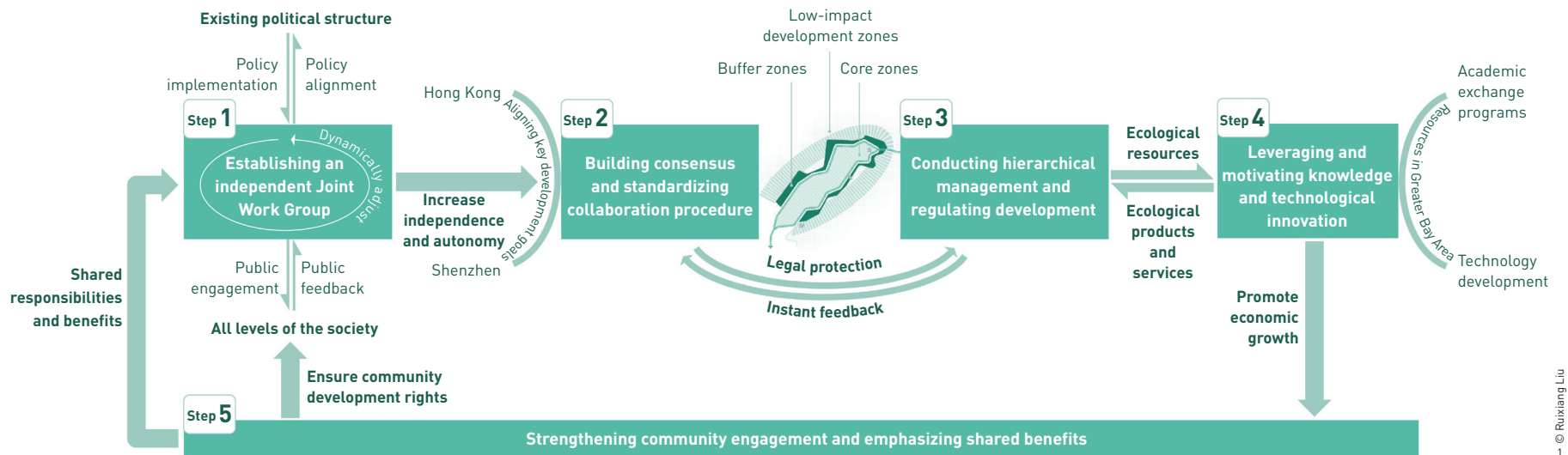
international significance, attracts two to three million migratory birds every year and serves as an important stepping stone in their global migration routes. However, the biodiversity of Shenzhen Bay has been long-term challenged. In the past five decades, land reclamation and unregulated sewage water discharge threatened the habitats of mangroves and migratory birds. At the same time, the accumulated sediment at the estuary of Shenzhen River increases the potential risks of waterlogging. Thus, the transboundary ecological collaborative management admits no delay.

Different from the typical modes of transboundary collaborations, the ones between Hong Kong and Shenzhen rely on the leadership of the Central Government of China, which facilitates the reduction of transaction costs and efficient allocation of resources<sup>[8][9]</sup>. Despite this, the impact of institutional differences to transboundary collaborations should be considered. Firstly, highly relying on the platform provided by the Central Government and Guangdong Province, the cooperation between Hong Kong and Shenzhen lacks independence and autonomy. Secondly, the disparities between the two city governments’ roles, status, and efficiency in urban development would hinder their coordinated development<sup>[9]</sup>. Additionally, environmental protection in the cities faces challenges from inconsistent legal systems that may obstacle joint legislation and law enforcement<sup>[1]</sup>. Most importantly, the slow economic and social returns of ecological investment make both two sides step onto the same road of “treatment after pollution,” which increases environmental risks. Therefore, this article holds that through the innovation of institutions and the application of place-making concepts, Hong Kong and Shenzhen should seize the development opportunities of the Northern Metropolis and make it a demonstration zone for resilient, secure, and sustainable metropolitan development by synergically managing transboundary ecological resources.

## 4 The Development and Operational Framework for the Co-Governed and Shared “Special Ecological Conservation Zone”

This article proposes the establishment of a co-governed and shared “Special Ecological Conservation Zone” in Shenzhen Bay,

① The Northern Metropolis, officially proposed in 2021, covers the Yuen Long District and North District of Hong Kong, including new towns in Tin Shui Wai, Yuen Long, and Fanling/Sheung Shui, as well as various new development areas in different planning and development stages and their neighboring areas, with a total area of 30,000 hm<sup>2</sup>, about one third of the total area of Hong Kong (source: official website of Northern Metropolis).



beyond the conventional administrative boundary line. The development and operation framework consists of five aspects (Fig. 1).

1) Establishing an independent Joint Work Group. The Joint Work Group should on one hand, seamlessly integrate with the existing political structure to ensure efficient policy implementation, while on the other hand, keep flexible and open to ensure all levels of society with rights of participation and decision-making<sup>[10]</sup>. The work group should also dynamically adjust its work based on real-time situations.

2) Building consensus and standardizing collaboration procedure. By aligning the key development goals and pursuits, Hong Kong and Shenzhen should transform ecological advantages into developmental advantages, and emphasize the establishment of reward and punishment mechanisms for potential conflicts of interest.

3) Conducting hierarchical management and regulating development. A tiered management approach and development guidelines will be provided for three different levels of protection zones: core zones, buffer zones, and low-impact development zones, to ensure the balance between development needs and natural conservation (Fig. 2).

4) Leveraging and motivating knowledge and technological innovation. Relying on the academic exchange programs in the Greater Bay Area and the rich ecological resources in Shenzhen Bay, the Special Ecological Conservation Zone will promote knowledge- and technology-driven development, and form a sustainable development model of advanced ecological technologies supporting industrial development and ecological conservation<sup>[11]</sup>.

5) Strengthening community engagement and emphasizing shared benefits. By integrating community resources with ecological protection strategies, the Special Ecological Conservation Zone will ensure community development rights, promote economic growth, improve residents' living quality, and build a prosperous transboundary entity of shared responsibilities and benefits<sup>[10]</sup>.

1. The development and operational framework for the co-governed and shared Special Ecological Conservation Zone.
2. Zoning of areas with different protection levels.



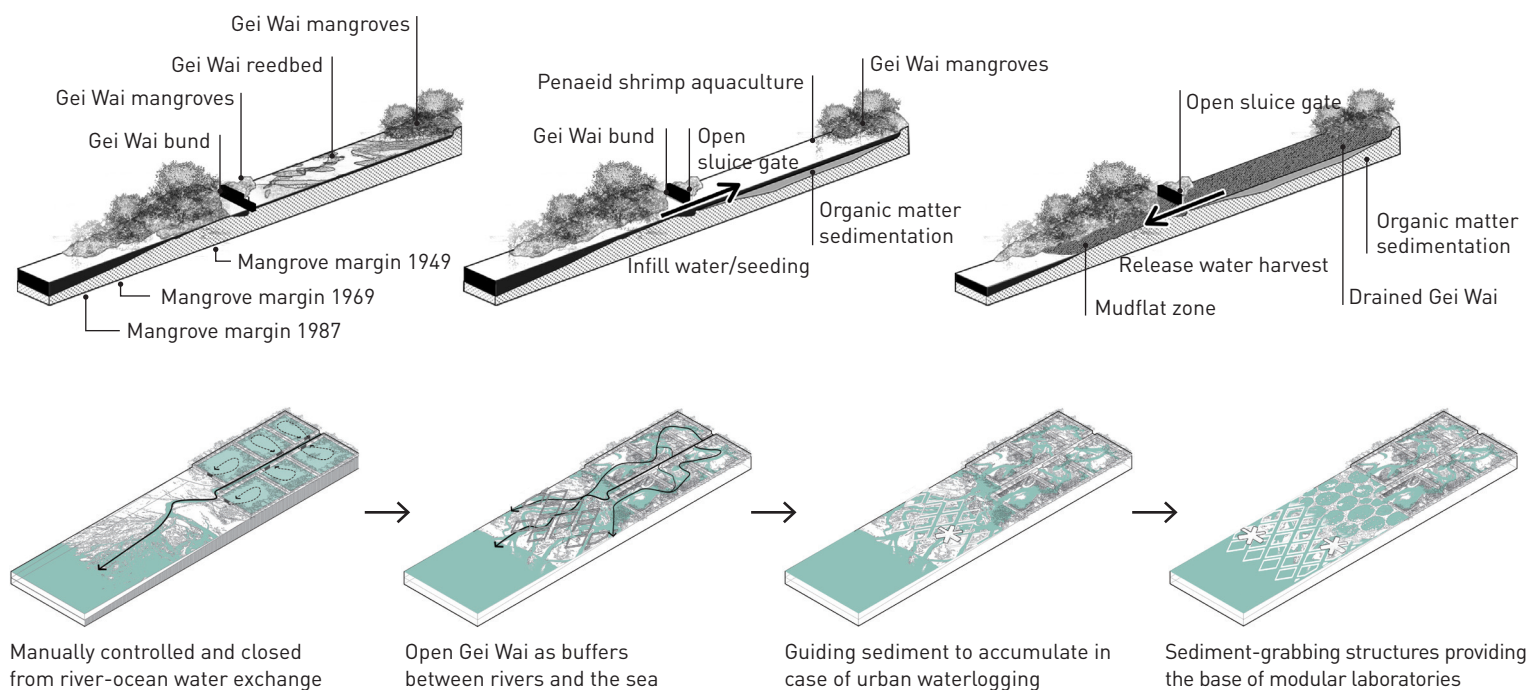
## 5 Place-making Strategies Under Different Protection Levels

Through the detailed planning and design visions for three sites along Shenzhen Bay, this article explores the development strategies for different levels of protection zones within the Special Ecological Conservation Zone.

### 5.1 Core Zones—Eco-tourism and Research Bases

To address the threatened habitats of mangroves and migratory birds due to the pollution carried by Shenzhen River, and the increasing

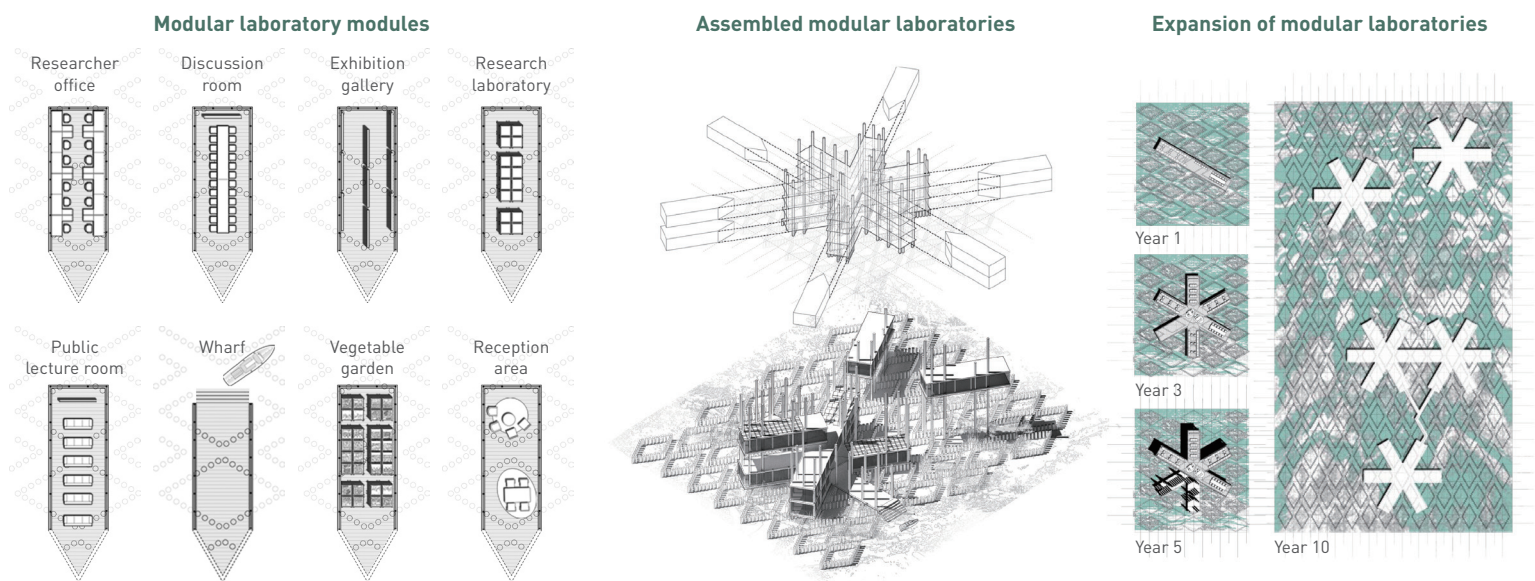
risk of urban waterlogging caused by sediment accumulation at the estuary, this article suggests that, by opening the gate of Gei Wai (traditional shrimp pond) near the river estuary on the Hong Kong side, this agricultural heritage will function as a buffer between freshwater and saltwater systems, facilitating material exchanges and purifying water before it reaches the mangroves (Fig. 3). The strategically placed wooden stakes at the estuary will guide the sediment accumulation process and form certain topography, decreasing the risk of urban waterlogging (Fig. 4). The reinforced wooden stakes would also serve as the ground-based structure for temporary and modular laboratories (Fig. 5), minimizing the impact



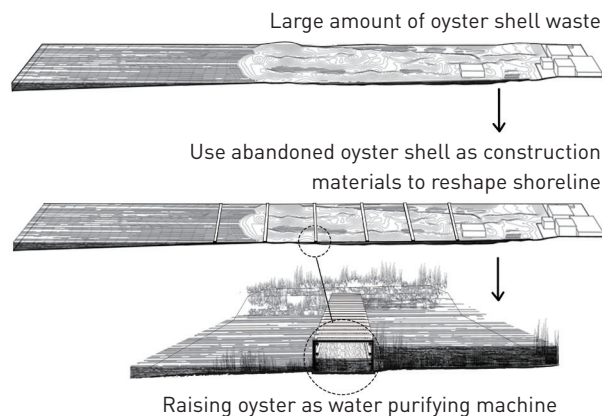
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3. Agricultural heritage: Gei Wai as ecological buffers, filters, and habitats.
4. Gei Wai is reused for ecological recovery by guiding sediment accumulation.
5. Modular laboratories that can be flexibly assembled according to specific needs.



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of research activities on the ecosystem. Ecological resources will be transformed into the ecological services and products mentioned above, providing new motivations for transboundary ecological collaborative management. In the next step, core zones will allow limited public access and eco-recreational activities, building the consensus of transboundary ecological collaborative management between all levels of society.

## 5.2 Buffer Zones—Ecological Agriculture Practice

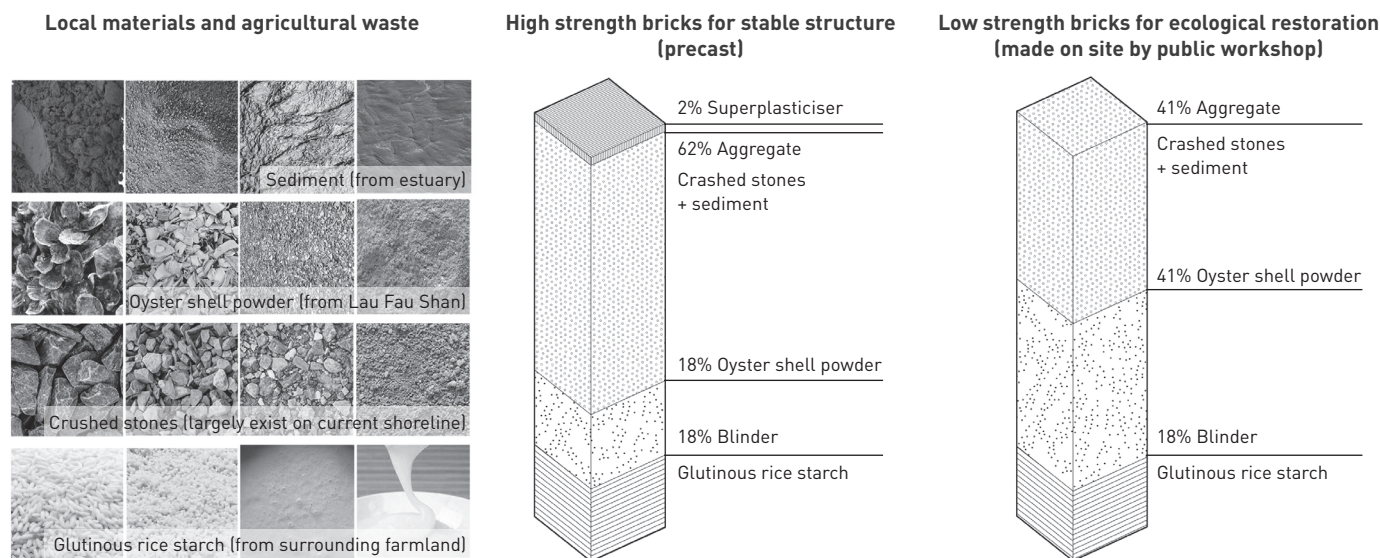
Taking Lau Fau Shan as an example of the buffer zones, by reshaping the abandoned and polluted finger-like shorelines, low-quality oysters harvested from Shenzhen Bay can be raised in the terraced finger-like low ground, functioning as a natural water purification system. This will not only increase the productivity of

nearshore oyster farming but also provide habitats for fish, crabs, and algae. More importantly, this kind of oyster-covered shoreline will mitigate the impact of storm surges and function as natural defences (Fig. 6). By integrating ecological conservation strategies with local traditional agricultural production modes, the abandoned and polluted shorelines can be transformed into ecological and resilient shorelines, as community-scale landscape infrastructure for agricultural production.

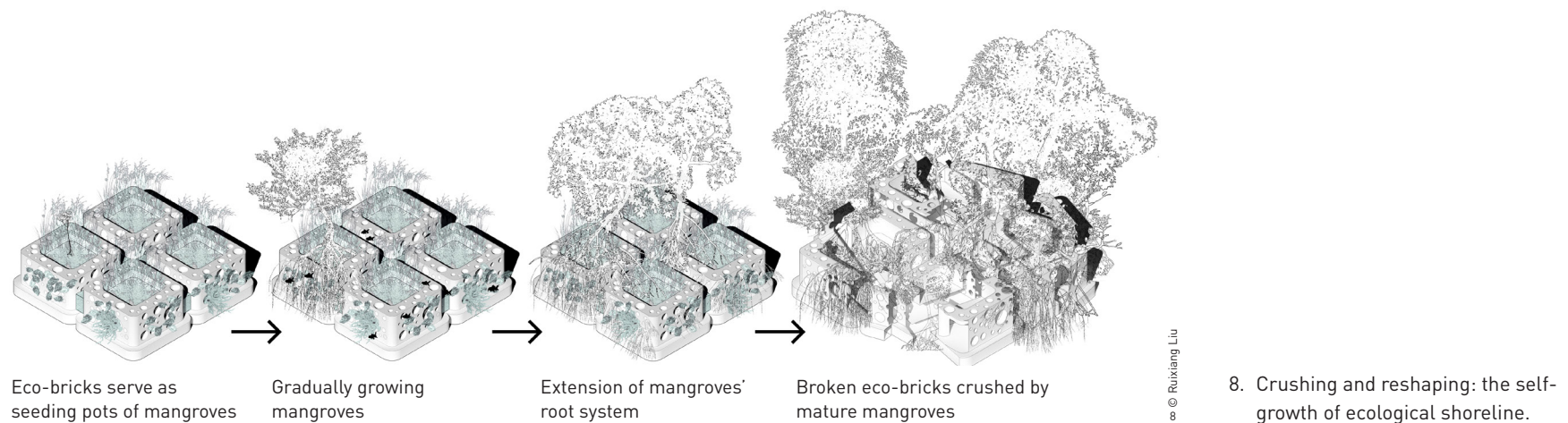
## 5.3 Low-impact Development Zones—Recycling and Conversion of Local Materials and Agricultural Waste

This article also suggests introducing ecological industry to low-impact development zones. Taking the Y·Park<sup>②</sup> in the Northern Metropolis as example, by utilizing existing waste treatment and material conversion facilities, the excessively accumulated sediment in Shenzhen Bay and agricultural waste from oyster farming will be recycled. The sediment, ground oyster shell powder, and glutinous rice starch from surrounding farmland will be used as a mixture for the production of low strength eco-bricks which will serve as seedling pots of mangroves to stabilize roots in the beginning and help the core zone to restore its ecosystem (Fig. 7). Over time, the extensive root system of mangroves will gradually break eco-bricks

② Y·PARK (Yard Waste Recycling Centre) is located in Tsang Tsui, Tuen Mun and adjacent to West New Territories (WENT) Landfill. Its aim is to promote recycling of yard waste into useful materials, reducing disposal at landfills and relevant carbon emission, realizing “zero landfill” and facilitating carbon neutrality in the long run (source: official website of Y·PARK).



6. Reorganizing the finger topography to purify the water and increase productivity of oyster farming.
7. Eco-bricks: reusing local materials and agricultural waste.



Eco-bricks serve as seeding pots of mangroves

Gradually growing mangroves

Extension of mangroves' root system

Broken eco-bricks crushed by mature mangroves

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8. Crushing and reshaping: the self-growth of ecological shoreline.

into gravel, forming an ecological shoreline (Fig. 8). By introducing sustainable and ecological industry, a virtuous cycle of mutualism will be formed between core zones, buffer zones, and low-impact development zones, balancing development and conservation.

## 6 Conclusions

Under the global background of regional reconstructing, transboundary ecological collaborative management has attracted wide attention. In China, Hong Kong and Shenzhen have always been the pioneers in experimenting with innovative political systems and social development models. By establishing the Special Ecological Conservation Zone, the Northern Metropolis becomes a key mediator to enhance Hong Kong–Shenzhen integration, showcasing the uniqueness and representativeness of transboundary collaboration—by combining ecological conservation strategies with traditional agricultural heritage, Shenzhen Bay will become a shared ecological and cultural platform for fusion. This article aims to provide innovative solutions for the sustainable development of the Guangdong–Hong Kong–Macao Greater Bay Area under the framework of “one country, two systems,” and unique insights into the global transboundary ecological collaborative management.

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**Competing interests** | The author declare that he has no competing interests.

# 全球区域重构背景下的 中国香港北部都会区跨境生态协作管理

刘瑞祥<sup>1,2,\*</sup>

\*通讯作者邮箱: Ray1022@connect.hku.hk

1 香港大学建筑学院园境建筑学部, 香港 999077

2 艾奕康中国香港办公室, 香港 999077

## 摘要

粤港澳大湾区的建设发展顺应了全球区域重构协作的趋势。作为大湾区的一大重要战略, 北部都会区面临着跨境生态协作管理的挑战。本文针对深圳湾生态问题及跨境管理的复杂性, 提出在“一国两制”框架下构建共治共享的“特别生态保护区”, 并划分分级保护区域。其发展及运营框架包括成立独立的联合专责小组、建立共识和规范协作、分级管理和控制开发、知识引领和科技驱动, 以及联动社区和利益共享五大策略。本文通过对深圳湾沿岸三个特定场地的深入研究, 提出了不同保护等级下的空间概念建议。本文通过探索北部都会区的创新协作模式, 旨在为粤港澳大湾区的可持续发展与全球跨境生态协作管理提供新思路。

## 关键词

跨境生态协作管理; 生态治理; 粤港澳大湾区; 港深协作; 全球区域重构; 北部都会区

## 文章亮点

- 探讨在“一国两制”语境下港深跨境生态协作管理的独特机遇与挑战
- 构建深圳湾共治共享的发展及运营框架, 并给予详细的空间设计策略
- 提出分级管理并对开发进行指引, 以实现自然保育与城市发展的平衡

编辑 田乐

## 1 引言

近年来, 全球变局和资本的再地理化推动了区域结构的重塑和新型协作的形成<sup>[1]</sup>。在此背景下, 粤港澳大湾区凭借“一国两制”的优势成为国内国际双循环战略的重要支点<sup>[2]</sup>。为加强这一战略, 香港特别行政区政府重新规划与深圳毗邻的北部新市镇, 打造北部都会区<sup>①</sup>。鉴于北部都会区内涉及大量跨境生态系统, 香港政府将“城市与乡郊结合, 发展与保育并存”作为其核心发展理念<sup>[3]</sup>, 因此跨境生态协作管理成为了港深融合发展的重要议题, 而空间及生产要素的管理更加需要依赖跨境协作。

## 2 跨境生态协作管理

人类设立边界以进行区域管理, 而自然却不受这些边界的限制<sup>[4]</sup>。环保主义的兴起揭示了跨境生态系统管理的复杂性, 其涵盖了生态学、地理学、政治学、经济学、人类学等多个学科<sup>[5]</sup>。当前, 跨境协作已成为协调各方利益、促进生态保护、增强社会对自然灾害的防御能力, 以及推动经济发展的关键策略。

在过去的几十年中, 全球范围内的区域重构为跨境生态协作管理提供了广泛的实践平台。作为行之有效的协作手段, 全球已经建立了超过220个跨境生态保护区, 以促进生物多样性及栖息地保护<sup>[6]</sup>。特别是在欧盟, 作为区域一体化最为深入的例证, 跨境公园计划有效促进了生态保育、休闲利用与社区发展的融合, 实现了跨境生态系统的可持续发展<sup>[7]</sup>。在中国, 随着双循环新发展格局的推进, 虽然区域协同化发展受到重

① 2021年, “北部都会区”被正式提出, 其范围覆盖香港元朗区和北区, 包括天水围、元朗及粉岭/上水等新市镇、多个处于不同规划及建设阶段的新发展区及其相邻地区, 面积约3万公顷, 约为香港总面积的三分之一(来源: 北部都会区官方网站)。

视，但在跨境协作管理的讨论中，生态管理相比公共治理、经贸互动和产业分工等方面，仍显得较为薄弱。

### 3 港深跨境生态协作管理的挑战及机遇

“两湾一河”的地理形态——深圳湾、大鹏湾与深圳河——塑造了北部都会区独特的跨境都市生态系统<sup>[3]</sup>。作为全球重要红树林湿地之一，深圳湾每年吸引200~300万只候鸟，是全球候鸟迁徙的重要落脚点之一，但其生物多样性却遭受着长期挑战：在近50年来的填海开发与无序排污对红树林和候鸟栖息地的生态环境造成严重影响的同时，大量堆积在深圳河河口的淤泥也加剧了城市防洪压力。因此，北部都会区跨境生态协作管理迫在眉睫。

区别于常规的跨界协作，港深协作基于中央政府的领导，这种模式有助于降低交易成本及高效管理资源<sup>[8][9]</sup>。尽管如此，两地之间的制度性差异可能会对跨境协作带来潜在障碍。首先，港深的市级协作主要依靠中央和省级平台，缺少独立性和主导权。其次，在城市规划方面，两地在开发中的角色、地位，以及效率上的差异妨碍了发展步调的一致性<sup>[9]</sup>。再者，两地法律体系的差异也将阻碍环境治理共同立法和执法的效力<sup>[1]</sup>。更为关键的是，生态保护的经济回报周期长，牵涉众多利益方，导致两地政府往往陷入“先污染、后治理”的被动局面，增加环境风险。因此，本文认为，港深应抓住北部都会区的发展契机，通过制度和空间概念的创新，探索跨境生态资源发展与保护的平衡，以建立一个韧性、安全、可持续的都会发展示范区。

### 4 共治共享的“特别生态保育区”的发展及运营框架

本文提出，基于突破传统行政边界划分的理念，在深圳湾设立共治共享的“特别生态保育区”。其具体发展及运营框架包含如下五个方面（图1）。

1) 成立独立的联合专责小组。专责小组既需与现有行政架构高度融合以确保决策的有效执行，又需具有必要的灵活性和开放性以确保各方社会成员的参与和决策权利<sup>[10]</sup>。专责小组还需根据实时情况动态及时调整工作方向。

2) 建立共识，规范协作。通过统一核心诉求和发展目标，港深需要将生态优势转化为推动发展的动力，并研究法律惩罚及补偿机制，防范潜在利益冲突。

3) 分级管理，控制开发。通过设立核心保护区、缓冲区及低影响开发区，并给予相应开发指引，对深圳湾及周边地区进行差异化分级管理，以平衡保护与开发需求（图2）。

4) 知识引领，科技驱动。依托粤港澳大湾区的学术交流项目和深圳

湾丰富的生态资源，推动知识和科技驱动的发展，形成高端生态技术支持产业发展与生态保护的可持续发展模式<sup>[11]</sup>。

5) 联动社区，利益共享。通过融合社区资源与生态保护策略，保障社区发展权益，促进经济增长、提升居民生活质量，构建共荣共进的跨境利益共同体<sup>[10]</sup>。

### 5 不同保护等级下的空间概念建议

本文通过对深圳湾沿岸三个特定场地的案例研究，详细探讨了“特别生态保育区”中不同保护等级保护区的空间发展建议。

#### 5.1 核心保护区——生态游憩及科研基地建设

本文关注深圳河向深圳湾输送的污染物对红树林和候鸟栖息地的威胁，以及深圳河河口泥沙堆积所带来的城市内涝风险问题。本文提议通过开放香港一侧靠近深圳河河口的基围闸口，将传统农业遗留下来的基围转变为淡水和盐水系统间的缓冲区，促进物质交换，从而在河水流至红树林保护区前完成净化（图3）。同时，在河口以特定排列方式设置木桩，引导泥沙堆积，防止城市内涝（图4）。加固的木桩还可作为临时实验室的架空结构，降低科研活动对生态系统的影响（图5）。红树林的生态资源将转化为上述生态产品和服务，为跨境生态协作管理提供新动力。本文计划逐步允许公众有限度地进入核心保护区，参与沉浸式的休憩活动，以促进公众对跨境生态协作管理的认知。

#### 5.2 缓冲区——生态农业实践

以流浮山为例，本文建议重塑被遗弃及污染的指状岸线。原本深圳湾养殖的低质量牡蛎可改在指状梯田中养殖，并形成天然净水系统。这不仅提升了近岸牡蛎养殖场的生产效率，还为沿岸区域的鱼、蟹和藻类提供了生长基地。更重要的是，这种由牡蛎覆盖的岸线能够作为自然防护岸线缓解风暴潮带来的威胁（图6）。通过将生态保育与当地传统生产方式相结合，遗弃的生产型岸线将逐步转变为韧性的生态型岸线，并作为景观基础设施服务于社区的农业生产。

#### 5.3 低影响开发区——本土材料与农业废料的利用转化

本文建议在低影响开发区引入生态产业。例如，北部都会区内的“林·区”<sup>②</sup>可以通过利用现有废弃物处理及材料转化设备，将深圳湾过

②“林·区”园林废物回收场位于屯门曾咀，毗邻新界西堆填区，旨在推动园林废弃物的回收再利用，减少弃置堆填区及相关的碳排放，从而实现“零废堆填”及碳中和的长远目标（来源：“林·区”官方网站）。

度堆积的淤泥和牡蛎养殖产生的农业废料回收再利用。淤泥、研磨后的牡蛎壳粉末和附近地区生产的糯米粉将作为生产低强度生态砖的坯料，这种生态砖可用于培育红树林幼苗、帮助幼苗固定根系，并有助于促进核心保护区的生态修复（图7）。随着红树林不断生长，其庞大的根系将逐渐把生态砖瓦解为碎石，最终形成生态岸线（图8）。通过引入可持续型生态产业，核心保护区、缓冲区及低影响开发区间将在平衡发展与保育需求的前提下形成互利共存的良性循环。

## 6 结论

在全球范围内区域重构的大背景之下，跨境生态协作管理愈发受到广泛关注。在中国，香港与深圳一直被视为创新政治体制与社会发展模式的先锋和试验田。鉴于此，本研究提议通过构建特别生态保护区，在北部都会区内推动港深深度融合，彰显跨境合作的独特价值与示范作用——通过将生态保育与传统农业遗产相结合，深圳湾将转变为港深共享的生态和文化平台。本文旨在为“一国两制”背景下粤港澳大湾区的持续发展，以及全球跨境生态协作管理提供新的思路与见解。

- 图 1. 共治共享的特别生态保育区的发展及运营框架
- 图 2. 分级保护分区
- 图 3. 农业遗址：基围作为生态系统缓冲带、水质净化器和生态栖息地。
- 图 4. 重新利用基围并引导泥沙堆积，作为生态修复的手段。
- 图 5. 可根据具体需求灵活组装的模块化实验室
- 图 6. 重塑指状地形以净化水质、提升牡蛎生产力。
- 图 7. 利用本土材料与农业废料制作的生态砖。
- 图 8. 瓦解与重塑：自生长的生态海岸。