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当代基塘景观的空中观察

SEEING FROM ABOVE: OBSERVATION OF CONTEMPORARY DIKE-POND LANDSCAPE

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摘要

基塘景观由渔农复合耕作系统和人类聚落共同组成，承载着活跃的水土共生与互动关系。在河网丰富的珠江三角洲，此类景观中拼贴状的人工鱼塘和弯曲的自然河道相结合，展现了人工环境与自然环境的交融，也为景观赋予了更强的韧性。而在当代，伴随着城镇化与工业发展对土地资源需求的增加，基塘景观正在不断萎缩，并被蔓延的城市所包围。人类聚落的扩张不仅改变了水土关系，也使基塘景观呈现出新的肌理。通过历史卫星影像、Google Map图片和无人机照片等一系列基于空中视角的图像，本研究尝试观察并记录珠江三角洲地区基塘景观的变化，并主要将其归纳为聚落的扩张与变形、基面萎缩与基塘比的失衡，以及基塘原有机拼贴肌理的逐步标准化三个方面。这些发现可作为反思城镇化与生态问题之间辩证关系的依据，并为进一步探索珠江三角洲景观可持续发展的潜力提供基础。

关键词

基塘景观；珠江三角洲；水土关系；渔农复合生态系统；卫星影像；无人机照片

ABSTRACT

A dike-pond landscape is characterized by a symbiotic and interacted relationship between water and land and considered an integration of human settlements with an aquaculture-agriculture system. The Pearl River Delta has historically enjoyed a rich river network and been shaped by the mosaic-like constructed ponds with the meandering natural river systems, where the boundary of the constructed and the natural blurred and a resilient dike-pond landscape prevailed. However, the increasing demand for land resource during urbanization and industrial development has made such a landscape shrunk and surrounded by urban sprawl. The expansion of human settlements has not only changed the water-land symbiosis but also reshaped the pattern of the dike-pond landscape. This article, as an ongoing work, intends to observe and document the changes of such water-related landscapes from a different perspective, "seeing from above," with historical satellite photos, Google Map images, and contemporary aerial drone photography. It discovered three important transformations: the settlement sprawl and transformation, the shrinking dike surfaces and imbalanced ratio of dike to pond, and the disappearance of the organic pond pattern. These findings can evoke critical studies on the dialectical relation between urbanization and ecology, and offer possibilities of re-creating a sustainable landscape in the Pearl River Delta.

KEYWORDS

Dike-Pond Landscape; Pearl River Delta; Water-Land Relationship; Agriculture-Aquaculture Ecosystem; Satellite Image; Drone Photo

1 引言

珠江三角洲（下文简称“珠三角”）的基塘系统是在当地多水易涝的自然环境下，结合生产和生活需求而演化出的渔农复合生态系统[1]。数个世纪以来，随着越来越多低洼的河滩沙田被改造成可渔可耕的复合生产用地，基塘的水土环境已经与当地聚落紧密结合在一起，形成了基塘景观。除了自然环境与人工环境的协调共存带来的农业与生态效益外，基塘景观的有机拼贴肌理也具有较高的景观价值（图1）。

然而，随着珠三角的快速发展，这里的基塘景观已逐渐被城市建设活动包围、侵蚀（图2），为人们提出了一系列问题与挑战，例如：建筑物与聚落在水网密集的环境条件下是如何扩张的？水土共生的复合农业系统如何应对市场需求的变化？以及在目前城市蔓延、环境退化的背景下，主动或被动发生转变的基塘景观的生态效益如何？

本文是在研究珠三角基塘景观历史与当代境遇的过程中，进行田野调查与无人机航拍记录的阶段性成果。不同于置身在村落中对乡村生活或孤立的水塘景观进行碎片化的感知，空中的整体视角可使我们看到水系、土地与聚落的交织关系及其多样而独特的肌理。航拍照片在区域尺度上呈现了基塘景观与周边环境的关系，从而揭示出自然、水环境与城市间的互动。

2 基塘的发展历程

珠三角拥有丰富的水网和大面积低洼易潦的渍水地。历史上珠三角的居民在一些多水的低地挖塘养鱼，并堆土筑墩或挖土围基以提高地势栽种荔枝（*Litchi chinensis*）、龙眼（*Dimocarpus longan*）等果树，成为早

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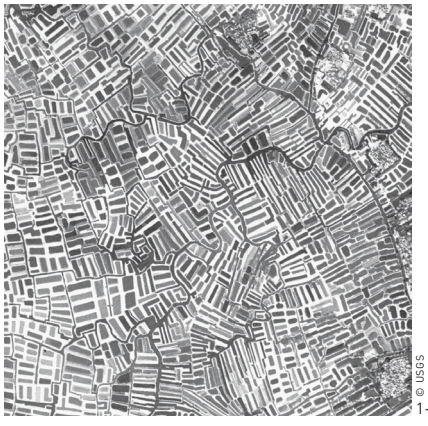


1-1

1-2

① 此处“丘陵”指分布于大面积低洼渍水地中，海拔在100~350m的丘陵；“高地”则指渍水地中地势略高的小块土地。在这些区域内建造的聚落受洪水影响较小。

1-1. 广东省佛山市桑园围基塘景观的卫星影像，可见自然河流从基塘的拼贴肌理中蜿蜒而过（1969年）。
1-2. 用无人机拍摄的桑园围基塘景观拼贴肌理（2018年）。
2. 当代扩张的城市边缘已开始侵占基塘景观。

1-1. A satellite image of the mosaic-like pattern of the dike-pond landscape in Sangyuanwei of Foshan, Guangdong Province in 1969, showing a natural river meander through the dike-pond system.
1-2. A drone photo of the dike-pond landscape in Sangyuanwei in 2018.
2. The expanding urban fringe begins to wrap the contemporary dike-pond landscape.

2

期的果基鱼塘，并逐渐将当时毗邻河道的低地改造成了基塘。16世纪初，丝绸贸易的繁荣推动了珠三角蚕桑养殖业的发展，在珠三角的核心地带顺德、南海等地区，种桑养蚕逐渐与塘鱼养殖联系起来，果基鱼塘转变为桑基鱼塘。[2]生丝贸易的高利润和这种复合农业系统的高生态效益促进了基塘景观的发育。18世纪初期，桑基鱼塘规模进一步扩大，一些地区甚至出现了“弃田筑塘，废稻树桑”的情形。到20世纪10年代，桑基鱼塘已经广泛分布于珠三角地区。[3]然而，随着20年代末生丝市场和丝绸贸易开始走向低迷，依托蚕丝业而兴盛的桑基鱼塘逐渐衰退，取而代之的是产业价值更高的蔗基、蔗基鱼塘（图3）。

3 传统基塘系统的水土共生与生态效益

在基塘系统中，水土共生并相互促进，组成了人工与自然相结合的水环境（图4）。整体来说，基塘系统由基（土）和塘（水）两大要素构成，二者又各自形成生态小循环。以桑基鱼塘为例，桑叶喂蚕，蚕沙入塘养鱼肥水，塘泥上基成为桑树的肥料，形成了“基养塘，塘养基”的生态循环。一个环节的废弃物成为下一个环节的原料，从而在系统内完成了能量传递与物质循环。[4]一个基塘系统能产生的最大生态效益与其基塘比（即土与水的比例）和水土之间的能量与物质转换密不可分。一般来说，“五基五水”或“四基六水”的比例可以较好地发挥基塘系统水土共生的潜力。同时，由于与自然河流紧密相连，基塘系统也具有蓄水、下渗等类似湿地的生态调节功能，可在一定程度上起到蓄洪防旱的作用[5]。

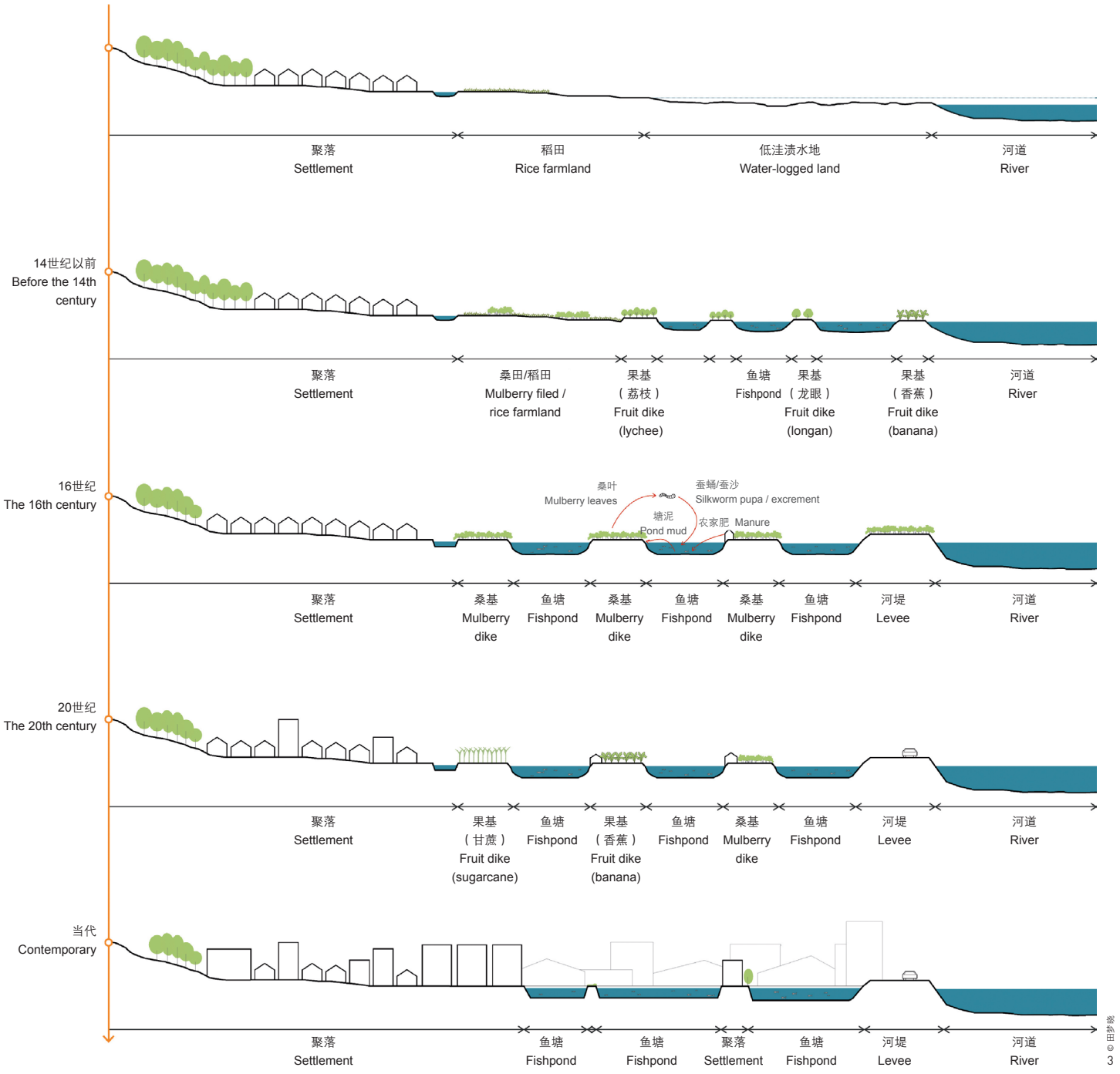
4 当代基塘的转变

4.1 聚落扩张与变形

与历史时期相比，当代基塘景观中的聚落已大幅增加。换言之，建成环境对基塘生态环境的影响程度显著提高。在基塘兴盛之前，珠三角一些丘陵的边缘地带或“高地”①上已经有大量居民聚集，并结合地形和天然水网，形成了呈典型梳式布局的广府聚落。由低洼渍水地发展而来的大片基塘则环绕在聚落斑块周边，只有零星的单体建筑散布于塘基边缘，并多采用塘泥及桑枝、竹木等植物材料建造。[6]聚落中的生活与劳作并未对基塘系统中水土之间的生态循环造成明显干扰。如今，由于人口增加等诸多因素，斑块状的聚落开始蔓延，逐步转变为包裹池塘的镶边（图5）。在一些邻近城市边缘工业区的基塘区，基面甚至已经完全丧失了农业种植用途，成为建筑基地。

与此同时，新的基础设施也开始影响基塘区聚落形态的演变。诸如公路、河渠等线性元素的介入引导建筑肌理顺势延展，逐渐形成鱼骨状的空间格局：首先沿公路或河渠方向形成单侧或双侧的“脊骨”，随后沿垂直于主干的堤围呈放射状延伸至基塘水域内部（图6）。

曾经包裹着斑块状聚落的大片基塘景观被城市和乡村建设包围、



3. 基塘景观发展时间轴（未按实际比例绘制）
4. 佛山市西樵山地区基塘景观中自然与人工水环境的结合。传统的梳式布局聚落或坐落于山地周边，或镶嵌于基塘景观之中。这一景观正在逐渐被大规模的当代城市建设包围。

3. Timeline of dike-pond landscape development (not a real-scale drawing)
4. Natural and constructed water systems together compose the dike-pond landscape of Xiqiao Mountain, Foshan. The traditional grid-like villages are surrounding the mountain or inlaid within the dike-pond systems, which are increasingly wrapped up by massive contemporary urban construction.

切割至碎片化；大块补丁般的工业用地被镶嵌进马赛克状的原始基塘肌理中（图7）。在岌岌可危的基塘景观内部，虽然分散在基面上的聚落看似仍与水网环境结合得较好，但事实上，硬质化建筑材料的广泛运用已阻断了基、塘之间的能量流动与物质循环；高密度的建筑与人口所带来的生活与生产废弃物也引起了水体的富营养化。这些当代的基塘景观虽然仍保留着部分原本的空间形态，但其中曾经高效的生态循环却已经不复存在。

4.2 基面的退化与基塘比的失衡

除了工业用地、基础设施、居民住宅建设对基塘系统的侵占，社会经济环境的变迁也使得基塘系统本身不断萎缩与退化——基塘种养结构发生了转变，出现“重养殖，轻种植”及“种养分离”等问题。例如在某些以塘鱼养殖为主业的基塘区，基面上原本的果树与桑树种植被改为自产自销的粗放式蔬菜瓜果种植，降低了基塘系统的初级生产力；一些区域的种植基面被不断压缩、荒废以至消失，部分水中的

小块基面甚至成为了附近居民的墓葬之地（图8）。

更大的影响来自于基塘比的变化。从20世纪七八十年代开始，随着塘鱼养殖经济效益的提升，曾经拥有较高生态效益的“五基五水”或“四基六水”的基塘比被压缩为“两基八水”甚至“一基九水”。如果说20世纪60年代末卫星图中的鱼塘呈现出马赛克般的拼贴肌理，基围则是马赛克间宽阔的“镶边”；而现在，许多“镶边”已经萎缩成了一条条细线。原本宽阔的基面成为分割池塘的塘埂，几乎完全丧失了种植功能（图8）。

这种转变看似满足了水产养殖的需求，实则在基塘的水土生态循环中并无优势。失衡的基塘比和萎缩的基面引发了一系列生态问题：一方面，狭窄的基围通常更容易坍塌，在发生暴雨或洪水时，由于土壤覆盖量减少，其抵抗雨水径流冲刷的能力也降低了。基面崩塌后造成的水土流失不但使塘底泥沙淤积增多、鱼塘变浅，还会导致水体富营养化；[7]另一方面，基面种植功能的衰退甚至消失、种植与养殖功能的分离，使基塘系统丧失了水土之间相互调控及自我净化的能力，在城市建设与工业生产带来的环境冲击面前变得愈加脆弱。

4.3 基塘肌理的标准化：从有机到几何

除了基塘比，基塘景观有机的马赛克式肌理也发生了改变，越来越多形状不规则的基塘被整合成了人工痕迹明显的几何形。在20世纪50年代末，许多基塘区的土地与水塘已经高度破碎化，河涌越发弯曲，不利于雨洪调蓄。因此，在20世纪六七十年代实施了第一次基塘整治行动，使效益较差的基塘区“鱼塘规范化，禾田格子化，河渠系统化，水位标准化”，以利排灌。例如，顺德的西便塱在1975年的整治中平整了土地，重新排布了基塘，将鱼塘统一整修为规格化的长方形（图9）。[8]在20世纪90年代末以提高经济效益、发展集约化养殖为目标的整治中，部分残存的有机形态基塘肌理被进一步修整为标准化的方格网（图10），有些地区还将塘岸与塘底进行了硬化。

很难说这种标准化的几何状鱼塘是否还称得上是“基塘景观”。作为一种介乎于自然水环境与人工水环境之间的生态系统，曾经的基塘具有调节小气候、蓄洪防旱、补充地下水等多种生态功能，这种具有韧性的环境缓冲作用来自于水土间的协作。而基塘整治过程中使用的水泥和其他硬化材料则将其人为地切断了。同时，较之原本有机形态的基塘系统，标准化基塘系统的边缘效应也更弱。整合措施提升了当代基塘的经济效益，却也使其生态效益下降。

5 结语

通过上述观察与分析，可以总结出当代基塘景观的若干新特征，包括建筑聚落分散化、建成环境介入基塘水环境、基面萎缩、水土比例失衡以及基塘肌理几何化。即便许多基塘的形态与空间格局看似并未发生显著改变，但从生态功能的角度看，它们已经或即将失去以往那种可持续的韧性农业景观特性。而另一方面，基塘景观通过被动转变与自我调节，也在一定程度上满足了社会经济和城市建设的需求，并形成了自然与人工结合的新形态，仍然具有景观价值（图11）。尽管当代基塘景观愈加人工化，但与高度硬质化的城市空间相比仍具有生态调节的潜力，如何对其加以利用？面对仍在持续推进的城镇化进程，如何通过生态治理与修复手段，重新赋予当代基塘新的景观价值及环境效益，使其成为服务于城市空间的生态缓冲区？这些问题均有待进一步探索。**LAF**

1 Introduction

The dike-pond system of the Pearl River Delta (PRD), China is an integrated agriculture-aquaculture ecosystem that has been born and developed in the flood-prone natural environment under living and production demands[1]. For centuries, through continuous reclamation of the low-lying water-logged land for integrated production, the symbiotic water-land environment of the dike-pond system has closely combined with local settlements and shaped the region into a dike-pond landscape. In addition to the agricultural and ecological efficiency brought by the natural-artificial symbiosis, the unique and organic collage pattern of such a landscape also reflects a great scenic value (Fig. 1).

The rapid development of PRD has made the region dramatically change and face challenges while the surviving dike-pond landscape has been increasingly surrounded by urban construction (Fig. 2), which forces us to explore issues like how buildings and settlements have expanded in areas with dense water networks? How does this water-land symbiotic environment respond to the market-driven changes? In the context of urbanization, as well as environmental degradation, does this dike-pond landscape undergoing passive or spontaneous changes maintain its high ecological efficiency?

This article is an ongoing work that documents a series of fieldworks and drone surveys to examine the historical and contemporary morphologies of the dike-pond landscape. The intertwining water system, land, and settlements assume distinct and diverse patterns when the landscape is read holistically from an aerial view, which cannot be discovered easily with isolated images of rural life or a single pond in a village — the aerial photos show the relation of the dike-pond landscape and its surroundings, which reveals the interaction among nature, the water environment, and the city at a regional scale.

2 The History of Dike-Pond System

Given the interlacing river networks and the water-logged-prone terrain, the ancient generations in the PRD reclaimed low lands, constructed ponds and dikes, and planted fruit trees such as lychee (*Litchi chinensis*) and longan (*Dimocarpus longan*) with the dug-out mud. This practice gradually reshaped the low-lying area along the rivers into a fruit dike-pond system. In the early 16th century, the prosperity of silk trade incentivized a large demand of mulberry farming and sericulture, resulting in more and more fruit dike-pond systems being transited into mulberry dike ones in the central PRD area, such as Shunde and Nanhai counties.[2] The high profit of raw silk trade and the efficient integrated agriculture-aquaculture system both promoted the popularity of the dike-pond landscape. Since the early 18th century, farmlands of rice had even been increasingly replaced with such mulberry dike-ponds, which became prevailing in PRD until the 1910s.[3] However, this landscape began to shrink due to the decline of silk trade in the early 20th century; under greater market calls, new types of dike-pond system, such as banana dike-pond and sugarcane dike-pond emerged (Fig. 3).

5-1

5-2

5. 聚落的蔓延：建筑成为了池塘的镶边。
6. 在佛山市杏坛镇的基塘区，建筑物沿公路、河渠等线性元素延展而形成的典型鱼骨状聚落空间布局。

5. Human settlement sprawl: buildings define the borders of ponds.
6. In the dike-pond area of Xingtan, Foshan, buildings develop along with the linear elements like roads and canals, and become a typical fishbone-like settlement pattern.

3 Traditional Water-Land Symbiosis and Its Ecological Efficiency

The water-land symbiosis of dike-pond systems shapes a combination of the constructed and natural water environments (Fig. 4). Ponds (water) and dikes (land) are the two major roles that complement and interact with each other in the whole ecosystem while working independently as subsystems. In the mulberry dike-pond system, for example, mulberry leaves are used for feeding silkworms, fish feeds on silkworm excrement, and mulberry trees are fertilized with pond mud, thus forming a self-maintaining and recycling ecosystem based on energy flows and nutrient circulation.[4] To a dike-pond system, the ratio of land to water (namely the "dike-pond ratio") and energy and material transformation determine its ecological benefits — usually, a dike-pond ratio of 5:5 or 4:6 works the best. Connecting with natural rivers, such dike-pond systems can also store and infiltrate water to mitigate floods and droughts, providing regulating ecosystem services like wetlands[5].

4 Changes of Contemporary Dike-Pond Landscape

4.1 Settlement Sprawl and Transformation

The massive construction of contemporary settlements has dramatically changed the dike-pond landscape and its ecosystem. Historically, taking advantage of the topography① and river networks, a large number of traditional Guangfu grid-like villages had already formed in the PRD region far before the popularity of dike-pond system. The vast dike-pond systems reclaimed from the water-logged low lands had surrounded the human settlement patches, with only a few buildings constructed with mud and plant materials (i.e., branches of mulberry trees and bamboos) dotting along the dikes.[6] The living and production activities in human settlements had not largely disturbed the eco-flows between water and land of the dike-pond systems. Resulting from the population growth and other causes, today's human settlement patches have gradually grown into the continuous "edges" around the ponds (Fig. 5). In some dike-pond areas adjacent to the industrial plots in outskirts, dike surfaces have been fully occupied for building constructions, no longer providing agricultural utilizations.

The construction of new infrastructures also plays a role in the transformation of settlements: Buildings have developed along highways or canals, eventually forming a fishbone-like layout. It usually consists of a unilateral or bilateral "backbone" paralleling the highway or canal with "branches" against the dikes (Fig. 6).

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Therefore, the previous dike-pond landscape with human settlement patches in it now has been wrapped and fragmented by urban and rural constructions and partly replaced with large industrial plots (Fig. 7). Within the surviving dike-pond landscape, the broad utilization of impervious building materials has cut off the energy flows and nutrient cycles between land and water despite the seeming co-existence of the settlements and the water environment. Domestic and industrial pollution caused by intensive development and high residential density further leads to water eutrophication. Although the contemporary dike-pond landscape retains part of the original patterns, the efficient ecosystem has collapsed already.

4.2 Dike Surface Degradation and Poor Dike-Pond Ratio

In addition to the external reasons like the invasion of urban construction, the dike-pond landscape itself has shrank and degraded under the background of social-economic changes. The agriculture-aquaculture mode has been restructured, resulting in problems such as more aquaculture while less agriculture, and a separation of planting cultivation and fish farming. For example, in some villages which pay more attention to pond fish farming, fruit tree planting on

① There are several hills with a height of 100 ~ 350 m locating in the water-logged low lands within the dike-pond landscape of the PRD region. "Taking advantages of topography" here means that many settlements were built around the foot of such hills or on the small pieces of land slightly higher than the water-logged area, which are less prone to flooding.


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7-1. 1969年佛山市顺德县基塘景观的卫星影像，其中斜线填充区域为碎片化后目前仍残存的基塘肌理。
7-2. 2018年顺德县基塘景观的卫星影像。新的居住与工业用地将原有的基塘景观切割得愈加破碎。
8. 基塘系统的退化，图8-1至图8-3依次为：位于鱼塘之间的菜地，失去种植功能、被改用作墓地的基面，以及萎缩成狭窄线形的塘基。

7-1. A satellite image of the dike-pond landscape in Shunde, Foshan in 1969. Today this landscape has been fragmented dramatically, only the slash-filled parts remaining the original pattern.
7-2. A satellite image of the same area in 2018. New residential and industrial plots fragment the dike-pond landscape.
8. Degradation of the dike-pond system, showing the vegetable plots between fish ponds (Fig. 8-1), the dike surface transformed into a burial ground which no longer provides agricultural services (Fig. 8-2), and the dikes which have shrunk into narrow lines (Fig. 8-3).

the dike has been replaced with the extensive vegetable farming, thus decreasing the system's primary productivity; in some other areas, more and more agricultural surfaces are decreasing, abandoned or disappearing, while some little surfaces within the pond are even occupied as burial grounds (Fig. 8).

Worse, the ratio of dike to pond becomes poorly distorted. Since the 1970s and the 1980s, for higher profits of pond aquaculture, the locals have sharply reduced the dike-pond ratio to 2:8 or even 1:9. As a result, the wide dikes around the mosaic-like fishponds shown in satellite photos of the 1960s have now shrunk into narrow borders and no long been used for any agricultural uses (Fig. 8).

A fact is that such a transformation has broken the balance of eco-flows between water and land. On one hand, the narrower dike surfaces with thinner soil cover are more vulnerable to erosion by runoff and prone to collapse during heavy rainfall and floods, which would aggravate the pond sedimentation, reduce the pond's capacity of flood retention, and cause water eutrophication.[7] On the other hand, the decline or even disappearance of cultivable surfaces and the separation of

9. 1975年基塘整治前后顺德西便塱的鱼塘形态对比。
10-1. 20世纪60年代的卫星影像展示了蜿蜒的河流与有机形态的基塘景观。
10-2. 2018年同一地区的卫星影像，图中西侧区域的基塘已被整治为统一的网格状。

9. The pond forms in Xibianlang, Shunde before and after the standardization in 1975.
10-1. A satellite image in the 1960s showing the meandering river and the irregular mosaic-like dike-pond landscape.
10-2. A satellite photo of the same area in 2018, showing the ponds in the west standardized as geometric grids.

agriculture and aquaculture damage the mutually regulating and self-purification capacity between land and water, making the system much less resilient to environmental impacts.

4.3 Standardization of Dike-Pond Pattern: From Organic to Geometric

Besides, more and more ponds of irregular shapes are being standardized as geometrically rectangular ones, leading to the disappearance of the typical mosaic-like pattern. In the late 1950s, many dike-pond landscapes faced a high fragmentation of land and pond and increasingly curving waterways, which led to a lower flood storage capacity. Therefore, from the 1960s to the 1970s, a dike-pond system improvement initiative was launched to facilitate the irrigation and drainage in the poor-efficiency dike-pond areas by "standardizing fish ponds and fields, systemizing rivers and canals, and controlling pond water level." For example, in 1975, the dike-pond landscape in Xibianlang, Shunde County was reshaped into rows of uniform rectangles (Fig. 9).[8] In the late 1990s, parts of the remaining irregular pond pattern were further transformed into geometric grids in a name of "increasing economic efficiency and developing intensive aquaculture" (Fig. 10); in some areas, the pond banks and bottoms are coated with concrete.

Maybe such geometrically constructed fishponds can no longer be called a dike-pond landscape — an ecosystem that enjoys a semi-natural and semi-constructed water environment and provides ecosystem services like micro-climate regulation, flood storage, and groundwater recharging. The resilience of such dike-pond systems is defined by the water-land symbiosis, which has been cut off, however, by the utilization of impermeable construction materials. The geometric ponds also perform a

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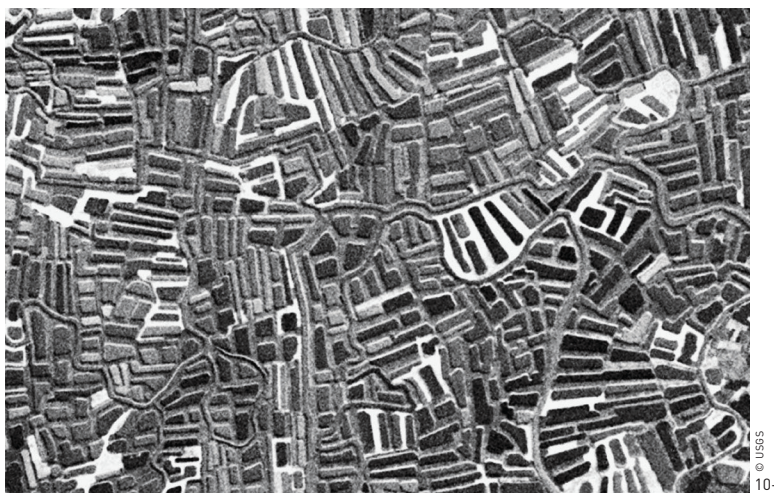
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much poorer edge effect compared with the typical irregular ones. A higher economic return of aquaculture through the improvement measures has badly compromised the ecological benefits of the dike-pond system.

5 Conclusion

This article examines several new features of the contemporary dike-pond landscape, namely the settlement sprawl, disturbance of water environment by urban development, degradation of dike surfaces, poor water-land ratio, and geometrized dike-pond pattern. Although many dike-pond landscapes remain their appearance and spatial structure, they have lost, or will lose, the high sustainability and resilience of the previous agriculture-aquaculture landscape in terms of the functioning of ecosystem. At the same time, however, through both the passive transformation and self-regulation, the contemporary dike-pond landscape might meet the socio-economy needs and urbanization demands, establish new forms of combination of natural and constructed environments, and still have a scenic value (Fig. 11). Compared with the intensively impermeable urban developments, the contemporary dike-pond landscape sees a potential for delivering ecological services, where future efforts are needed. It is also worth exploring that how to improve the scenic value and ecological benefits of the contemporary dike-pond landscapes as eco-buffers for urban areas through ecological management and restoration measures against the backdrop of the on-going urbanization. **LAF**

REFERENCES

[1] Ruddle, K., & Zhong, G. (1988). Integrated Agriculture — Aquaculture in South China: The Dike-Pond System of the Zhujiang Delta. Cambridge: Cambridge University Press.

[2] Zhong, G. (1980). Mulberry-Dike-Fish-Pond on the Zhujiang Delta — A Complete Artificial Ecosystem of Land-Water Interaction. Acta Geographica Sinica, 35(3), 200-209.

[3] Guo, S. (2007). Mulberry Dike-Pond in Shunde. Beijing: People's Publishing House.

[4] Zhong, G., Wang, Z., & Wu, H. (1993). Water-Land Interaction of Dike-Pond System. Beijing: Science Press.

[5] Nie, C., Luo, S., Zhang, J., Li, H., & Zhao, Y. (2003). The dike–pond system in the Pearl River Delta: Degradation following recent land use alterations and measures for their ecological restoration. Acta Geographica Sinica, 23(9), 1851-1860.

[6] Howard, C. W. (1925). Survey of the Silk Industry of South China. Hong Kong: Commercial Press. Retrieved from https://digitalrepository.trincoll.edu/cgi/viewcontent.cgi?article=1056&context=moore

[7] Yang, Y. (1995). Problems and Solutions to the Sustainable Development of Agricultural Ecology of the Dike-Pond System in the Pearl River Delta. Guangdong Agricultural Sciences, (5), 14-16.

[8] Editorial Group of Water Conservancy Records of Shunde County, Guangdong Province. (1990). Water Conservancy Records of Shunde County. Library of The University of Hong Kong, Hong Kong, China.

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11. 城镇化进程中的当代基塘景观

11. The contemporary dike-pond landscape in urbanization