

A Water Field Civilization: The Shifting Rural Territories of Taiwan

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ABSTRACT

The Taiwanese countryside is representative of Asia's 'hydraulic civilization' and has a society based upon a water-orientated productive landscape. Its irrigation system of paddy fields and fish ponds is strongly interrelated to society's collective units, such as families or unions, which, in turn, structure social morals and behaviors. In a comparison of three different agriculture plains in Taiwan, interpretative maps reveal differences in the settlement patterns related to topography and water resource management. The critical reading of historical documentation and creation of interpretative maps reveals how early settlers solved water threats and managed to stabilize water sources. The study proposes a present-day reorganization of the water structure and re-valuation/utilization of the ecological value of paddy fields, through a design research proposal of a new r/urban landscape model that combines high density food production, flood control and water purification.

Keywords: agriculture, paddy fields, water management, urbanism, Taiwan

INTRODUCTION

One may claim that water is the most crucial factor in an agricultural civilization. Before modern technologies, paddy fields were traditionally cultivated collectively, and the supply of water greatly influenced the communal relationships of rural societies. Landscape chronicler J.B. Jackson described the classical landscape as "a place where men and environment were in harmony with one another and an environment where an overall design was manifest in every detail" [Jackson1984:135]. In the case of Taiwan, such details refer to the interaction between man and his use of water.

Indeed, Taiwan is part of what the well-known Frankfurt School historian and sinologist Karl Wittfogel referred to as a 'hydraulic civilization' [Wittfogel 1956]. For Wittfogel, Asia (and the Chinese culture in particular) boasted a juxtaposition of

urban and rural, a specific type of social formation founded upon centralized state authority with its own forces and relations of production emerging out of water engineering and control. Wittfogel set forth a thesis that 'hydraulic societies' and despotism were functionally connected. From him, there is a clear link between the forms of settlement structures in relation to the engineered water catchments: "Thus, as the political patterns of hydraulic civilization spread far beyond the areas of hydraulic economy, so the techniques of irrigation farming spread far beyond the irrigation fields. These techniques established an agronomical relation among man, soil, and plants, that, in terms of a given amount of land, was much more rewarding than the agriculture of pre-industrial Europe. Whatever its deficiencies, this method of farming produced great quantities of food on a given acreage, and it permitted the individual peasant to support his family on a very small farmstead. For this reason the areas of intensive hydraulic farming came

to support extremely dense populations" [Wittfogel 1956: 159].

Water management has driven Taiwan's societal development and the comprehensive system of the 'hydraulic civilization' which employed extensive *corvée* labour (which placed a constant upward pressure in the level of population growth) to not only to create productive water works (for irrigation and drainage) and protective water works (for flood control), but also to provide drinking water and communication conduits. Digging, dredging and damming led to significant remoulding of the ground-plane. The historical geography of urban water control in Asia reveals highly structured rural and urban (territorial) systems that are physically and symbolically linked to technologies, religious beliefs, cultural and social practices and power structures all related to water [Shannon 2010: 133-4].

Three rural Taiwanese settlements in different agriculture plains reveal distinctive settlement patterns – determined by their respective topographies and water sources. In all three cases, the indisputable historical influence of hydrology on the spatial configuration of the rural territory has progressively disappeared from the landscape mosaic as the country has modernized and urbanized. Disappearing farm towns and rural landscapes are the result of an economic shift from agriculture towards an industrial and service economy. The transition occurred after significant growth during the 70s and 80s, well before the formalization of a standard urban planning process. Therefore, the majority of development followed the traditional rural construction processes instead of adhering to new urban laws and resulted in a fragmented landscape with an unbalanced infrastructural support. New development areas were not properly serviced and household and industrial sewage was unhygienically discharged into the agricultural channels; the mixture of the irrigation and sewage systems quickly became a critical challenge for rural waters. At the same time, during heavy rains, storm water runoff overflows to agricultural drainage systems and often leads to massive rural flooding. The design of new settlements has proven incapable of maintaining a balance between water and land, production and consumption.

The second stage of segregation between farmers and their land occurred after 2002, when Taiwan joined the World Trade Organization (WTO). The government began to subsidize farmers more than their earnings from actual cultivation, resulting in the abandonment of a great number of the fields.

Holiday villas now occupy the countryside, and a weak urbanization of dispersal has led to a further fragmentation of the territory. Hand-in-hand with the vanishing paddy fields has been a significant loss in the maintenance of surface water bodies. Since Taiwanese agriculture has developed with small and independent holdings, an abundance of residual land is abandoned as individual farmers retire. The disintegration of the rural landscapes signifies a lack of maintenance and cultivation. Consequently, the Taiwanese countryside is left without long-range goals, structure, and social order.

WATER MANAGEMENT OF TAIWAN'S THREE AGRICULTURE PLAINS

Taiwan (Figure 1) is an island located in the Pacific Ocean southeast of China. Two-thirds of the island is occupied by rugged mountains covered by tropical and subtropical vegetation. Taiwan's highest point is Yu Shan Mountain (3,952 meters) and the combination of extreme topography and concentrated rainfall means that many rivers are torrents and have unstable water levels. During normal periods, the land suffers from a shortage of water, while during the typhoon season flash flooding is a regular threat. The mountains roll gently towards the flat plains on the west side, which is home to most of the island's population. Here ninety-one large and small rivers run towards the Taiwan Strait through the two largest agricultural plains in the country: the north, Tao-Yuan plain and the south,

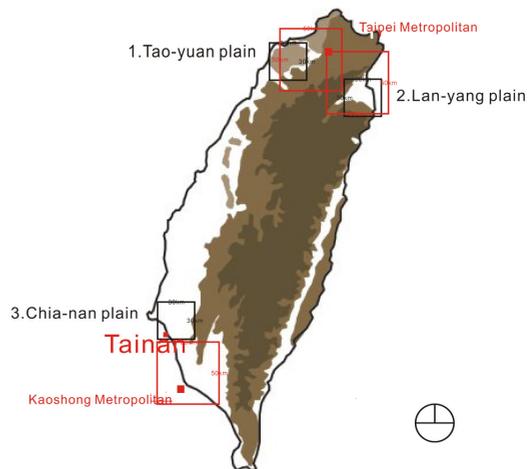


Figure 1: The Three Agriculture Plains in Taiwan

Chia-Nan plain. To the east of the mountains is the Lan-Yang plain, in the valley of Lan-Yang River. Water forms the landscape patterns differently in the three regions, due to varying topography, soil, and water source. The spatial experiences and relationships of landscape, infrastructure and urbanization in the three plains are quite diverse.

Compact and dispersed villages are the two main forms of settlement in Taiwan and although we can find both types of towns in the three plains, the water supply was the crucial factor behind the formation of the rural settlements. According to scholar Y. Tomita, Taiwan's settlement prototype was initially structured by the irrigation system, with progressive developments and nuances made by adjustments to the original landscape, rhythms of agriculture production, conflicts between the Han-Chinese and aborigines, and most of all, by the native water source [Tomita 1933]. T.F. Shi also brought the factors of climate and topography into the discussion on village typologies. Shi noted that although Taiwan is a small island, its complex topography and cultures have led to extreme diversity in village morphologies. In general, the rural settlement form differs between north and south Taiwan, which is divided by the Zhuoshuixi River. In the north, the dispersed villages are located in a rich land with abundant irrigable water, such as the Tao-Yuan plain, where three to four families gather as a unit to manage the farm ponds. Towards the south, in the Chia-nan plain area, there is a regular rhythm of compact villages, caused by their collective cultivation behavior due to the limited water supplies. All these factors reiterate that the landscapes of water have the most critical impact on rural settlement structures.

Tao-Yuan Plain

The farm ponds of Tao-Yuan plain (Figure 2) form a unique landscape compared to other irrigation systems in Taiwan, due to the region's special soil type. The washout of Gu-Shi-Men River first composed the table of the Tao-Yuan plain, however due to shifts in the riverbed, the streams in the alluvial fan lost their stable water source. The land has difficulty retaining water due to the loam soil in this area as well, which results in major challenges during dry season. In response, the earliest settlers dug thousands of reservoir ponds that created a particular landscape in the region. The ponds were dug following the contour lines, and as the gradient runs gentler, the ponds are broader. Historically, rain collected in the ponds was the region's main water source. However, after the construction of the Shihmen Dam in 1960s, water was provided by centralized channels. The ponds functioned as

a chain system where the water upstream fed the ponds downstream, forming a branch structure. Three to four families managed a single pond, and the entire water chain was a social relationship unit. Small clusters of dwellings were dispersed in the landscape, due to the rich land with an abundant irrigation water system. Today, Taiwan's main international airport is located in this region, and Tao-Yuan is strongly connected to the Taipei metropolitan area. There is a strong real estate pressure in the area as airport industries are established, and ponds

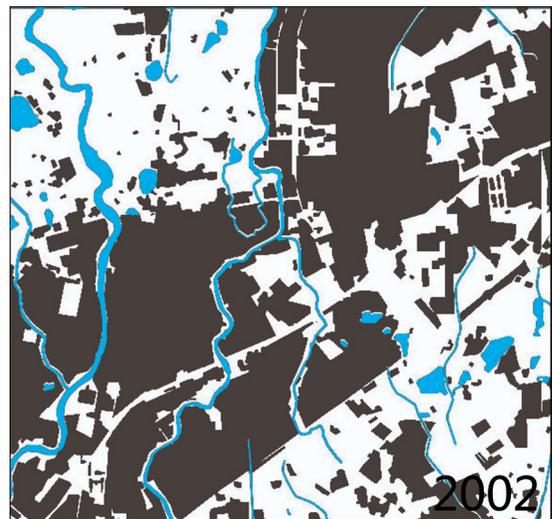
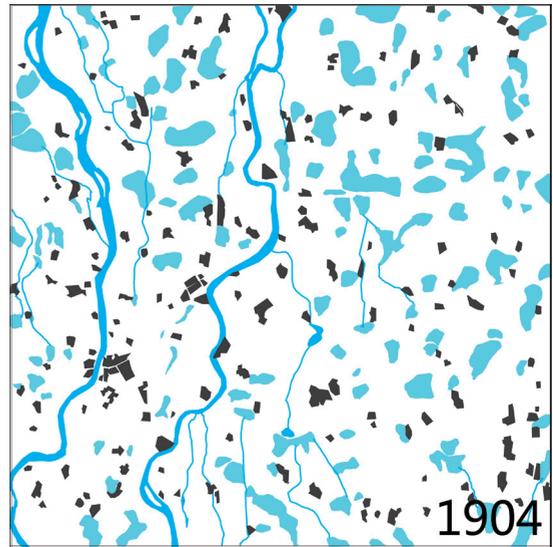


Figure 2:
Tao-yuan plain (source: National Geographic Information System, "Basic and topography map, Version 1982"; "台灣堡圖 (Taiwan Bao-Tu)" Yuan-Liou Publishing Co., Ltd., Taipei, 1996. redrew by author, redrew by author)

are filled to create more land for such development. The radical transformation of the landscape is translating to the erasure of its once unique water system.

Lan-Yang Plain

The Lan-Yang plain (Figure 3) is an alluvial fan located on the east side of the Central Range of Taiwan, surrounded by mountains in three directions.

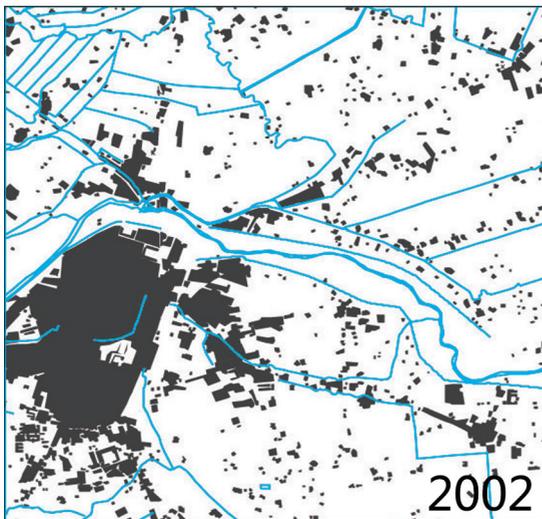
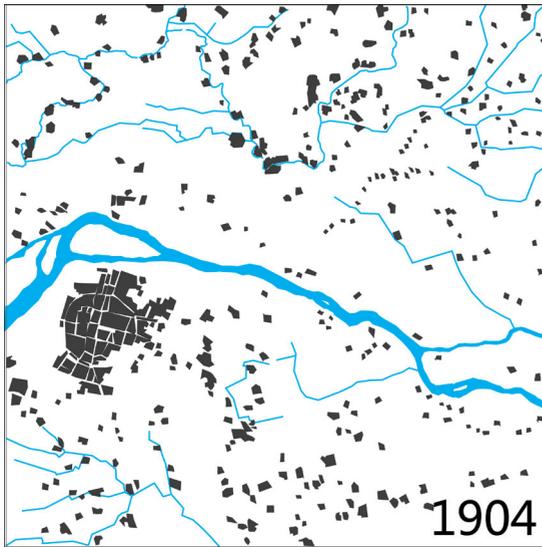


Figure 3: Lan-yuan Plain (source: National Geographic Information System, "Basic and topography map, Version 1982"; "台灣堡圖 (Taiwan Bao-Tu)"Yuan-Liou Publishing Co., Ltd., Taipei, 1996.redrew by author, redraw by author)

The rivers flow from the mountains towards the Pacific Ocean. When the rivers reach the gravel fields, they run underground until the foothills, and surface again as springs, formulating a sequence of large and small rivers running throughout the plain. Over time, the inhabitants have developed methods to block rivers in order to store water for cultivation. This area is abundant in rain and has a fine drainage system, so the plain is very suitable for agriculture production. The first Han-Chinese settlers cultivated the land in collectives. However, since the Lan-Yang plain was the most recent territory to be cultivated, modern farming techniques and societal structures led to the land being divided and farmed in smaller and individual plots. This, coupled with the area's rich water source, resulted in a dispersed pattern of settlement, where a single family household corresponds to an agriculture plot. In 2006, the highway from Taipei to Lan-Yang was opened, shortening the transportation time from 2 hours to 40 minutes, and thereby effectively turning an agricultural backwater into a suburb of the capital city.

Chia-Nan Plain

The Chia-Nan plain (Figure 4) was the first area that the mainlanders settled and cultivated 400 years ago. The farmland here was known as "the fields relying on heaven", since rainfall fluctuates radically and there is an inconsistent water source. In Chia-Nan, the settlements are compact and lands alternate between intense cultivation and lying fallow. The villages also created a defense line for the Han-Chinese against the aborigines. Thus, the notions of survival and the uneven water supply influenced the settlement typology, where these small collective towns formulated a network. Clusters of ten or more dwellings formed a collective and compact unit, almost isolated in the field, with no formal infrastructure connecting the villages [Tomita 1933].

The morphology of settlements also varies from the diverse landscapes within the Chia-nan plain, its coastline, center plains, and near the base of its mountains. (Figure 5) The richest water source exists along the mountain base, where there are small clusters of collective villages with paddy fields. Along the coastline, there is less land suitable for agricultural cultivation and the main economy is derived from aquaculture. Larger settlements can be found along the coast since the required infrastructural investments for the productive landscape are less capital intensive. In the central

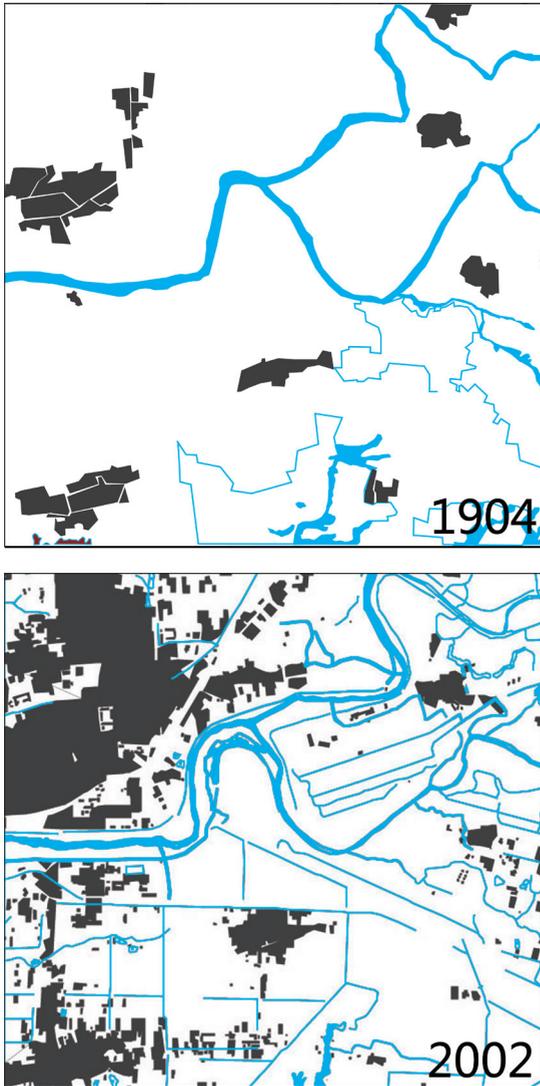


Figure 4:
Chia-nan Plain (source: National Geographic Information System, "Basic and topography map, Version 1982"; "台灣堡圖 (Taiwan Bao-Tu)" Yuan-Liou Publishing Co., Ltd., Taipei, 1996. redrew by author, redrew by author)

plains, sugar cane production was positioned near the rivers, as they were suitable for the transport of the products. During the Japanese colonization period (1895-1945), the Wu-Shan-Tou Dam and the Great Chia-Nan Waterway network was constructed which significantly elevated the production output and established the Chia-Nan plain as the main rice provider in Taiwan. From that moment (until Taiwan's entry to the WTO), agricultural production sustained the region's economy.

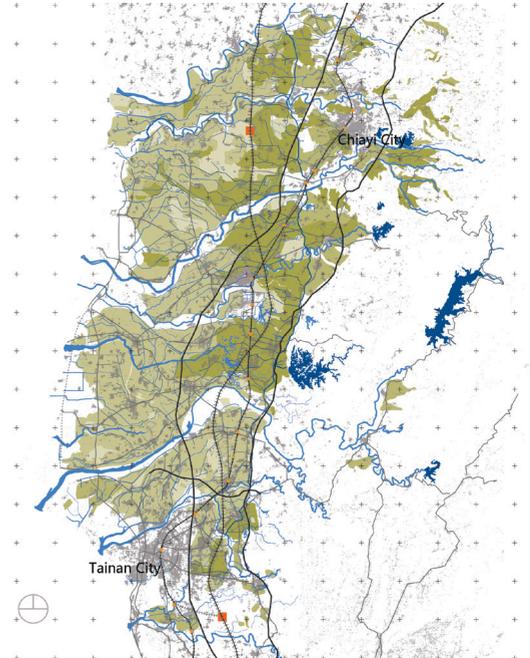


Figure 5:
Agriculture Map of Chia-nan Plain
(source: Chia-Nan irrigation institute, redrew by author)

Agriculture production once was the staple economy that supported this region, however, industrialization soon took over and led to the region being the most polluted in the country. With the decrease of agriculture production, the Chia-Nan plain has suffered both environmentally and economically. Therefore, the government established the Southern Taiwan Science Park in 1997 to elevate Chia-nan plain's industrial structure, and the new hi-tech industry zone became a new attraction for the population and the region's development.

SHIFTS IN THE HYDRAULIC SYSTEMS

(R)evolutions of the Taiwanese hydraulic system have always led to major transformations in society. The first immigrants to Taiwan were the Han-Chinese, who came around the 17th century. They transplanted their cultivation practices onto the new land. Since they had the custom of living in compact villages, the area they first settled, the southern area of Taiwan, developed with compact villages. During Japanese colonization, from 1895 until 1945, great strides were made in the nation's water management planning and development. Their engineers

controlled the water flows from the mountains to the sea with the development of an extensive network of canals, dams and reservoirs. They established Taiwan's first systematic hydrological system: the "Great Chia-Nan Canals", which greatly increased crop production in the plains. The engineering works were a radical juxtaposition upon the vernacular water landscape and the imposed, colonial, central-managed water system no longer had a direct relationship to settlement typologies. The stable supply of water also lessened the conflict between farmers and thus stabilized society. In the later era of colonization, the social structure in rural areas shifted from individual villages to networks that were based on water supply zones of 140 hectares, and managed by water resource institutes. Such an institutional frame fundamentally changes the spatial (not to mention the social) relations of Taiwan's rural society.

The half-perspective Japanese maps that were drawn during the 1930s, mainly for the "Taiwan Exposition: the 40th anniversary of colonization" [Zhuang1996], are extremely revealing with regard to the relationships created among landscape, infrastructure and urbanization. Although the maps are not scientifically precise in terms of dimensions, they are clear and even poetic in terms of interplays of topography, settlements, productive landscape, etc. The maps of the three agriculture fields emphasize the hydrological order of their respective territories: the northern Tao-Yuan plain (Figure 6),

with the fragmented farm pond system in the fields; the eastern Lan-Yang plain (Figure 7), with the concentrated streams, where the rivers run parallel to one another and framing the grid system; and the southern Chia-Nan plain (Figure 8), with the Yu-Shan-Tao Dam depicted at an exaggerated size.

Although the most important hydrological projects in Taiwan were planned during the Japanese period, many were built by the Nationalist government between 1950 and 1957. The nation's first leap of economic growth went hand-in-hand with the completion of these important waterworks. Thereafter, massive urbanization took over in Taiwan and although the imprints of the irrigation system remained ingrained in the landscape, its impact in the economy and everyday life lessened dramatically. Many ponds are now hidden behind houses or abandoned as wastelands. The channels are framed by concrete and are ecologically stagnant. Pump stations and sluices stand as engineering feats, but rarely as civic monuments. Today, transportation infrastructure guides development, and water no longer influences the urban structure.

DESIGN SCENARIOS

Design scenarios for Asian "agricultural cities" were already proposed decades ago by Kisho Kurokawa in his "Exhibition of Visionary Architecture", held in 1961. He diverged from the thinking that farm

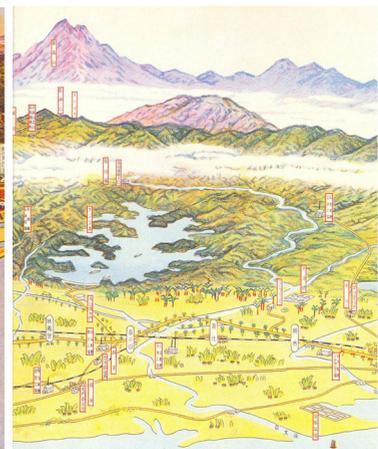
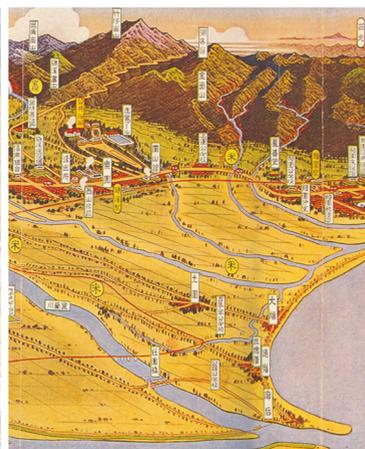
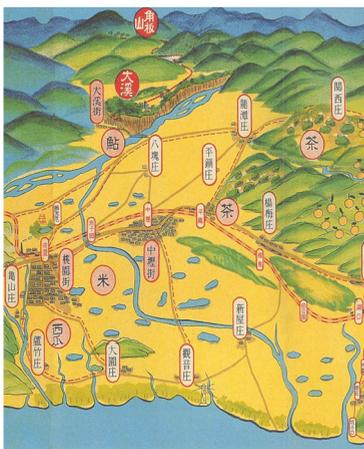


Figure 6: Japanese map of Tao-yuan plain (source: Zhuang, Y.M. etd., "台灣鳥瞰圖(Arial portraits of Taiwan)", Yuan-Liou Publishing Co., Ltd., Taipei, 1996.)

Figure 7: 1936 Japanese map of Lan-yuan plain (source: Zhuang, Y.M. etd., "台灣鳥瞰圖(Arial portraits of Taiwan)", Yuan-Liou Publishing Co., Ltd., Taipei, 1996.)

Figure 8: 1933 Japanese map of Chia-nan plain (source: Zhuang, Y.M. etd., "台灣鳥瞰圖(Arial portraits of Taiwan)", Yuan-Liou Publishing Co., Ltd., Taipei, 1996.)

villages and cities are inherently distinct, and maintained that future lifestyles could contain both an urban realm for work and a country realm for living (which is very similar to what is happening today). He proposed homogeneous living spaces constructed on pillars standing in the middle of rice fields (Figure 9). More recently, policies and designs that integrate productive landscapes into urban areas have been designed. China's Kongjian Yu has utilized corn and rice cultivation in projects such as the Chicago Art Field and Shenyang Architectural University Campus, and the rich configuration of the productive landscape inspired connections to the countryside for citizens and students. Karin Bohn and André Viljoen have introduced the notion of 'Continuous Productive Urban Landscape (CPUL)' as an essential element of sustainable urban infrastructure⁷. Through such projects and examples, the productive landscape is clearly becoming an integral component of the urban space network. An urban-rural hybrid structure has emerged as a state-of-the-art urban strategy.

In Taiwan, although the process towards urbanization varies between different regions, rural territories are all challenged by water usage, food production and pollution. This requires a new lifestyle where daily living coexists with the landscape. Therefore, the research presents two scenarios that take account of food production that correlates to different context's historical settlement patterns. What if the new urbanization process could create

new and sustainable relationships between the landscape, its water structures and infrastructure?

The Dispersed Town

Taiwan's dispersed and collective towns represent the cultivation culture of the three different plains. However, the current approaches of economic development, combined with a relative weakness of the urban design and territorial planning professions has resulted in a chaotic and sprawling environment. At the same time, there is an embedded potential in the dispersed town, where the density is low, and there is a rich mixture of dwelling culture, transportation and production. In a dispersed town scenario, the rural landscape could be more strongly rooted to public transportation nodes, bus stops that are connected to the local train stations, with dispersed dwellings scattered in-between the fields (Figure 10). Such a fine-grain network scale would then be indicative of the dimensions of public space, water purification areas, and water retention surfaces. The proportion of residential units in relation to water production landscapes, such as paddy fields and lotus fields would be calculated according to the existing rural development laws; the water bodies would also double as water retention ponds (Figure 11). The water fields mainly exist on loamy soil, so this scenario is most suitable in the Luan-yuan plain.

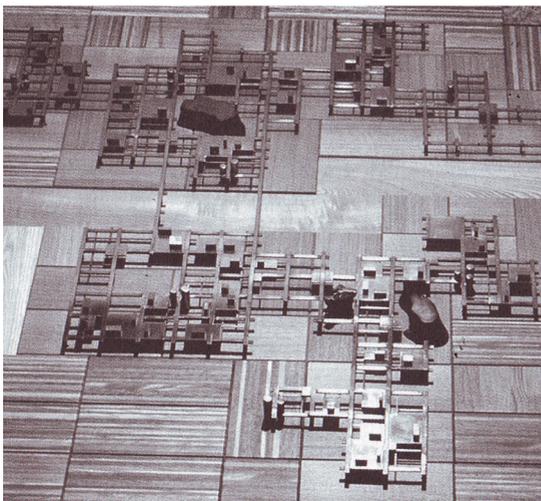


Figure 9:
Kisho Kurokawa, "Exhibition of Visionary Architecture"
(source: Kisho Kurokawa, "Metabolism in Architecture",
Littlehampton Book Services Ltd, 1977.)



Figure 10:
The new dispersed landscape of dwellings, purification
systems, and production fields

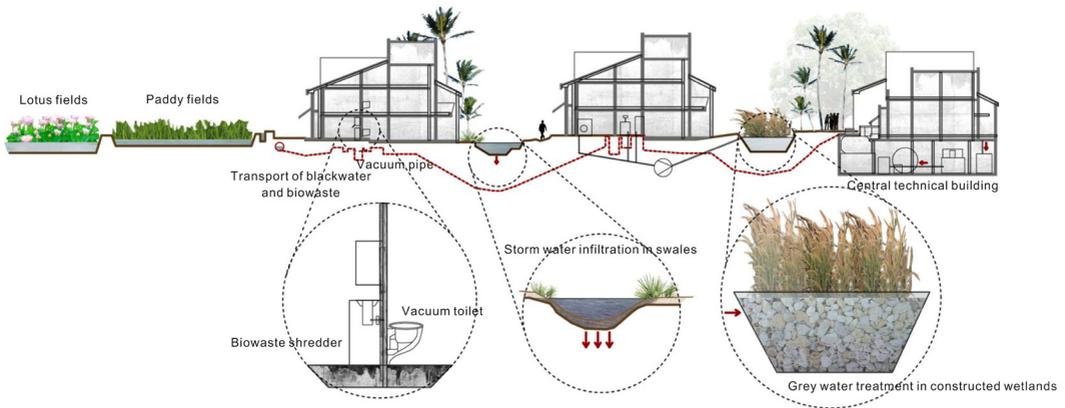


Figure 11:
Section of dwellings and production landscape

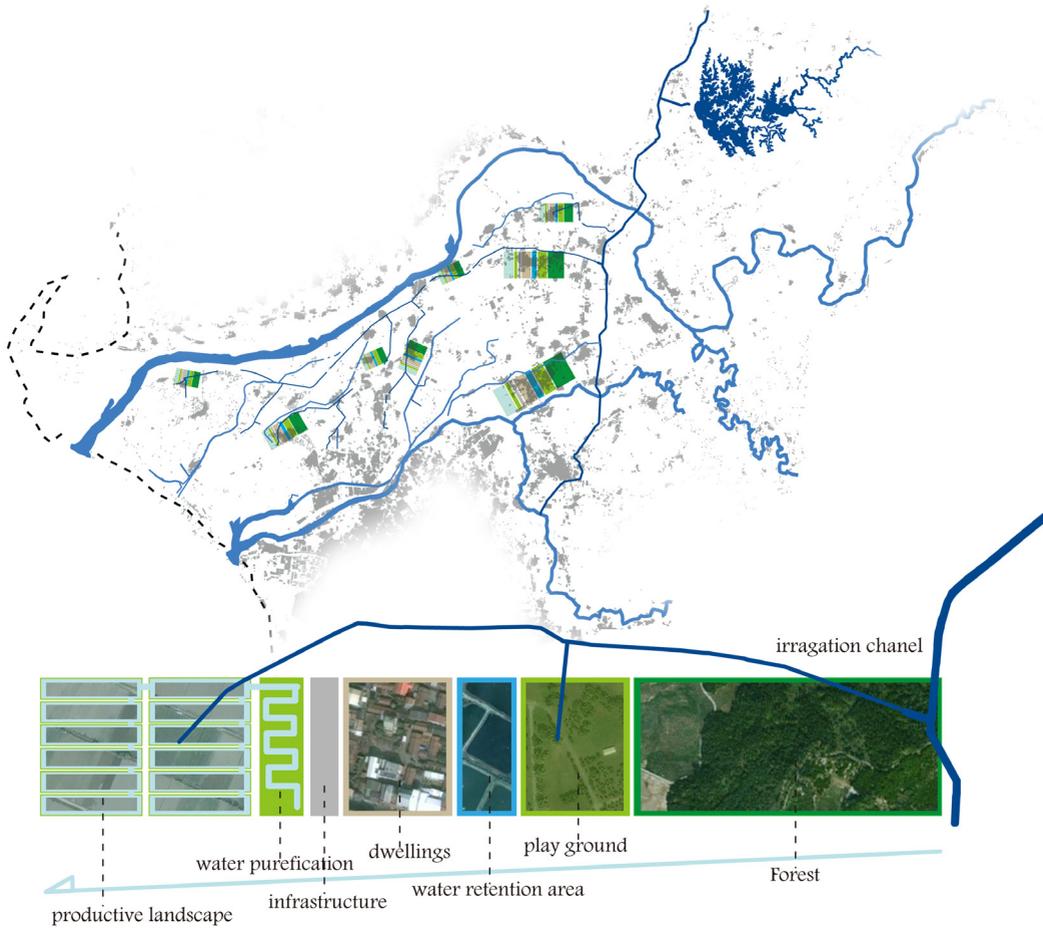


Figure 12:
Regional scheme for collective settlements

The Collective Town

The collective town scenario introduces a more general layout that takes into account the irrigation system's ecological role, which can be found in collective villages of the Chia-nan plain. (Figure 12) As described above, the Chia-nan irrigation canal is an impressive water structure that stretches throughout the territory, feeding the paddy fields; the isotropic collective town is structured in-between the agriculture plots. This second scenario proposes to expand the cluster of settlements, and to create new ecological networks of forests and parks to complement that of the irrigation system and infrastructure. Each new sector would form a conceptual model where the water would flow through a sequence of land-use types: from clean to polluting and purified before it is released into the rivers. The polycentric centers would work as a territorial network that complements the existing local train network, and each collective town would become a walk-able city.

Ecological Value of Water Fields

Water fields can adjust the temperature in the microclimate, absorb waste carbon, and stabilize the underground water. Most of all, the water fields can retain the overflows in peak rain seasons to buffer excess flooding. It is indicated that the paddy fields could reside in 60cm depth of water and still maintain their productivity. On the other hand, since the dry fields are based on sand and clay, their main production can be corn or vegetables, and be mostly located at the end of the irrigation channels where the water source is least sufficient. So with the differentiations of water fields and dry fields, the production landscape defines the spatial quality and image of the countryside. Regardless, in the two scenarios, both new forms of urbanity take into account the water production landscape. So the element of water penetrates through the fields and shifts as a part of production, a part of the purification systems, and a part of water retention pockets.

CONCLUSION

It is clear that urban design and planning can have a profound role in shaping our future by re-qualifying and re-utilizing hydraulic structures in the Taiwanese territory. Following a critical and interpretative reading of three representative plains, it is evident that the nation's water morphology has been a structuring foundation for both productive landscapes (and

hence the economy) and for urbanization. The careful reading of the layered development of the territory and the ever-changing interplays of landscape, infrastructure and urbanization can provide lessons for future layers and interventions on the territory – the creation of new interplays. The rich land/water/culture dynamic of Taiwan's landscape is without a doubt a great experimental field to test the present-day notion of 'landscape urbanism' and create a new complex adaptive system of productive landscapes that may define the new spatial dimensions with new densities. The re-conceptualization and re-configuration of the urban and rural could lead to the identification of a new unit of development that goes beyond the present-day zoning categories in Taiwan. A hybrid urban-rural tissue could create an entire new range of possibilities for typological invention. The agricultural heritage of the nation, and its articulation in its various plains, could be modified to meet contemporary needs and take advantage of the extensive hydrological network that remains as a strong infrastructural imprint on the territory.

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Map source:

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