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# A Traditional Community in the Chao Phraya River Basin: Classification and Characteristics of a Waterfront Community Complex

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**Abstract**

Traditional waterfront communities are extremely significant in understanding the role and influence of the daily lives of an indigenous amphibious culture and are considered to be a counterpart of the contemporary community that would have existed in the past. This study gives a systematic overview of the traditional waterfront community complex in the Chao Phraya River Basin to identify the phenomenology and salient features characterizing the waterfront community through the analysis of the following: 1) features of geography and waterbodies; 2) cultural landscapes and agricultural activities; 3) urban components; and 4) architectural features. A total of 138 traditional waterfront communities were selected using the purposive sampling method.

Quantitative data collection was conducted using field investigation to collect and evaluate the validity of properties in actual conditions. The data were analyzed using a statistical analysis program to examine the similarity and correlation of the data set. To identify characteristics, hierarchical clustering and decision-tree analysis were used to group similar communities together and classify the complexity of a traditional waterfront community. Principal component analysis was then used to detect the true association between the relevant variables. In addition, qualitative assessment of secondary document collection, legislation, previous and present public policies, research, and criticisms were used to support the argument for statistical analysis.

The results provided seven clusters based on common preferences consisting of a market town, paddy village, raft community, waterfront market, comprehensive estuarine agricultural village, orchard village, and fishing village. These clusters show diversity in the cultural landscape, with agricultural activities exerting influence on the community complex, creating both direct and indirect association, with several significant variables.

**Keywords:** traditional waterfront community, Chao Phraya River Basin, classification, characteristics

## 1. Introduction

Human settlements have constantly adapted to climatic and environmental changes. However, the intensity and speed of such changes are challenging for complex urban environments (UNESCO, 2011). The traditional waterfront community, with its diverse vernacular features, was formed by the rich amphibious culture of an aquatic environment. It is regarded as a unique housing standard, reflecting the surrounding environment and living behavior of everyday life (Kwansuwan, 2014). This association between socio-environmental activities and physical structure carries a milestone of the social transition from past to present cultures.

A complex set of transnational problems have been brought about by global environmental issues. Several communities are being threatened by serious physical alterations and inappropriate developmental controls. Rapid urban growth poses crucial cultural questions for modern society. Urban development has grown, leaving the remaining riverside ruinous, neglected, and abandoned. A similar tendency has occurred in multiple locations. New socio-economic activity means that communities are seemingly more prone to losing their authenticity. As a consequence, the cultural values of communities are gradually disappearing.

Despite the fact that the study of a traditional settlement in its natural environment offers an outstanding example of human adaptability to the contemporary environment, there is limited existing research on the monitoring and management of the waterfront community in the Chao Phraya River Basin to provide an overall picture.

This study aims at giving a systematic overview of the traditional waterfront community complex in the Chao Phraya River Basin, to identify the phenomenology and salient features that characterize it, on the basis of historical literature and field survey investigations. Macro-scale analysis was used to focus on the bigger picture of community complexity and vernacular architecture throughout the river basin to encode the association of socio-economic activities, environmental features, and physical structure.

## 2. Overview of History and Development

The Chao Phraya River, including its tributaries, is one of the major river systems in the Indochina continent, as its basin defines the regions of Central and Northern Thailand, primarily defining the central flood plains. Its cultural landscape has been shaped by regional geo-body and topographical features. The upper basin is monopolized by paddy fields and forest, while the lower Chao Phraya River delta sprawls over an urban agricultural market landscape dominated by fruit orchards to the west, rice fields to the east, shrimp farms along the coast, and fish farms in the lowlands (Thaitakoo & McGrath, 2008). The geo-body of the Chao Phraya River Basin has affected architecture and settlement planning here, as the natural setting dictates design.

The "good old days" of Siam were recalled in "The Environment and Culture of Thailand" (Wichiencharoen, 1993), which depicts an identical cultural pattern of Thai life assimilated with nature. The waterfront community is significant in understanding the role and influence of traditions in the daily life of an amphibious culture. Communities were primarily clustered close to the river; the living quarters were then raised in order to prevent and respond to annual flooding and high tides (Panin, 1999). In the commercial community, rafts and boathouses were used as shophouses to coincide with dwelling units for easy travel and trade along the river. This practice has continued since the Rattanakosin period. Unfortunately, these utopian scenes of Thai culture have now disappeared.

In Ayutthaya, the Venice of the East, only bricks and ruins remain, whereas Bangkok is undergoing modernization, contributing to greater economic expansion and unlimited urban growth. The urban heritage of water-based settlements is fragile and has lost its identity as a result of uncontrolled urbanization and rapid economic growth.

Rural areas have been greatly impacted by agricultural reformation since the Bowring Treaty with Britain in 1855, with the attendant significant large-scale expansion of the canal system to form an agricultural frontier. Housing and land development along the new waterway transportation facility (Boonnak, Noppakhun, & Thadaniti, 1982) then boomed and became a commercial hub connecting the agricultural network to the capital.

Following modernization and industrialization, the socio-economic pattern changed. Thailand turned into a new developing country, dependent on the export of agricultural products. Land transportation became a more important feature, as a result of improvements in safety standards and accessibility. New urban areas grew along the modern communication axis. The old riverside centers were gradually abandoned and left unused.

Yet another threat to traditional waterfront community concerns the change of stream flow. Since 1900, several large dams have been constructed on the main tributaries of the Chao Phraya River, upstream from the Chao Phraya Barrage. These dams have the multi-purpose functions of flood control, electricity production, and providing water supplies for agricultural, domestic, and industrial purposes in the Chao Phraya River Basin. As a result, in the late 1960s, floods became less frequent in the eastern part of the delta, causing problems with acidity in the soil and consequently with fewer floods, the soil eventually became acidic. As a consequence, agricultural lands were then abandoned. A significant outcome of the construction of roads and dams to produce electricity concerns the proliferation of many new industries and modern factories along a section of the Phaholyothin Road (Jarupongsakul & Kaida, 2000). At the same time, the western part of the delta is supplied by the Mae Klong River. Agriculture is nevertheless in competition with the hydropower sector, since, when water is released for electricity generation, sufficient consideration is not always given to inter-seasonal regulation, which has resulted in occasional shortages in the past (Molle, 2005).

As a consequence of rapid economic development and uncontrolled urban expansion, the traditional social structure seems to have collapsed. The adult population tends to move to the city for economic reasons. Houses and associated agricultural landscapes were left behind and threatened by decay with the passage of time. It has proved difficult to maintain riverside heritage, as it is costly and labor-intensive, which may be the reason for its loss of authenticity. Reminders of the past have started to disappear.

Since 2009, the boom in nostalgia-motivated tourism has revived the economy of the newly bustling waterfront community once again (Suntikul, 2013). New tourism provides economic opportunities for local residents after several decades of economic stagnation. With the development of tourism, waterfront communities have once again proved attractive, drawing the working population back home. However, there are clashes between modern requirements and traditional available resources, prompting the need to satisfy contemporary socio-economic activities.

However, several communities are threatened by the nature of contemporary society. New socio-economic activities affect local communities, which are seemingly prone to losing their authenticity. As with encroachment onto public watercourses and physical structures, such environments remain ruinous and turn into slums.

The conservation of the historic urban heritage was first initiated in the 1970s by the Fourth and Fifth National Economic and Social Development Plans .Several mega projects for the conservation of historic urban heritage were first initiated by focusing on national historic monuments and important structures in ancient towns and historic core areas. Several royal palaces, Buddhist monasteries, forts, and national historic structures were conserved during this period. Unfortunately, the ways of life of local dwellers and minority heritage issues have been overlooked (Issarathammanoon & Nishimura, 2006).

Public awareness of Thailand's national heritage has grown concomitantly with the dramatic transformation of both physical and social structures. As in western countries, the heritage industry is fueled by collective nostalgia of the not-too-distant rural past, as a result of the emergence of a new middle class engendered by rapid economic growth during the 1980s (Peleggi, 2002). The heritage of the common people was not recognized until the late 1990s, when the first local heritage conservation project was initiated by local communities with the support of the academic sector. Since then, the momentum of historic district conservation in Thailand has turned towards the local community whose heritage it belongs to (Yodsurang, 2013).

The number of authentic traditional communities and historic towns with cultural value are seriously decreasing, and therefore remaining historic communities have received more recognition. Two national agencies have begun primary surveys for the registration of historic communities. In 2010, the National Housing Authority commissioned a study to investigate traditional communities in order to maintain their identity and values in a report entitled "Housing and Communities Standard." Throughout the country, information on 140 historic communities was archived (Faculty of Architecture and Planning Thammasat University [APTU], 2010). Two years later, 622 historic communities were tentatively listed for Historic Community Registration in the "Cultural Environment Standard Project for the Historic Community" by Office of Natural Resources and Environmental Policy and Planning [ONEP] (ONEP, 2012). From the 762 communities listed, information on 138 riverside communities in the Chao Phraya River Basin was archived.

## 3. Method

The procedure of sample selection was carried out using the Housing and Communities Standard (APTU, 2010) and the Cultural Environment Standard Project for the Historic Community (ONEP, 2012). In the Chao Phraya River Basin and its neighbors the Bang Pakong and Meaklong River Basins, 138 traditional waterfront communities (Figure 1) were selected for survey and analysis by the purposive selection method. The sample represents all archived traditional communities authorized by the government. Thus, there are no sampling errors due to the completeness of the sample.

Quantitative data collection was conducted using field investigations based on empirical data in the period from October 2014 to March 2015. The survey was designed to collect and evaluate the validity of properties using binary measurements (yes/no) in actual conditions to avoid any bias caused by inequality. The evaluation criteria covered four domains, 13 categories, and 51 measurements to reveal the complexity of urban organisms (Bandarin & Van Oers, 2012), including the broader urban context in the setting of its geographical waterfront community.

1) Features of geography and waterbodies
    - Water features (dug canal/natural canal/river)
    - River basin (three major river basins)
    - Region (mountainous area/central plains upstream/ upper delta/lower delta)
2) Cultural landscape and agricultural activities
    - Orchard/paddy field/salt paddy/forest/fishing agricultural landscape/estuarine and coastal landscape
3) Urban components
    - Functional settings (raft/commercial/residential)
    - Settlement pattern (linear/dispersed/nucleated)
    - Important urban feature components (wooden bridge/elevated walkway/urban pier/water front corridor/fishing and agricultural structure/central market/flea market/shrine/temple)

4) Architectural features
   - Building typology (row house/traditional Thai house/vernacular house/raft house)
   - Construction material (bamboo mixed/hardwood)
   - Durability (temporary/permanent)
   - Flooring (single floor on high stilts/single floor on ground/double floor on ground)
   - Basement structure (on land/amphibious structure/raft structure)
   - Important architectural features (waterfront pavilion/fully open front facade/enclosed walkways/movability/granary, barn, and storage structure/processing plant/pier)

The study was performed using a two-step analysis.

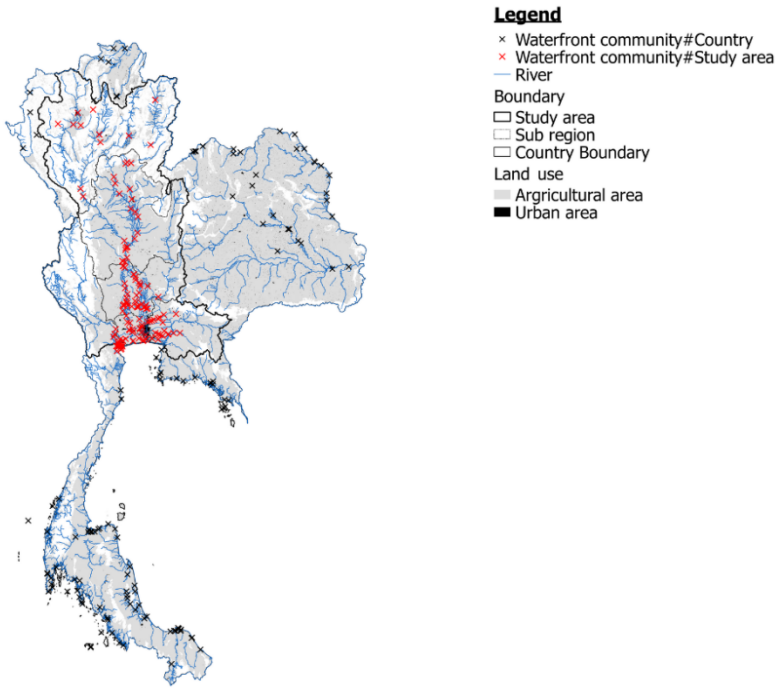


Figure 1. Map showing location of traditional waterfront communities
Base map: Thailand land use oriented to agricultural area, urban area, and waterbodies from Landsat TM satellite image in 2000 (Royal Forest Department of Thailand, 2001)

### *3.1 Hierarchical Clustering and Decision-Tree Analysis*

Hierarchical clustering was the main tool used to group similar communities as a starting point towards understanding the complexity of the traditional waterfront community in a specific geographical area. These conceptually meaningful community groups share common characteristics that play an important role in how the community is described and analyzed (Pang-Ning, Michael, & Vipin, 2005).

Based on clustering results, decision-tree analysis is used to interpret characteristics of cluster membership and to specify influential classification factors. The decision tree consists of nodes and branches representing sequential decisions. The first node is divided in accordance with the most influential factor. Furthermore, the decision-tree model is applicable to predict the target cluster for further archived communities based on input variables.

### *3.2 Principal Component Analysis (PCA)*

The analysis extracted observed the data of 51 binary variables (from observed data) with seven cluster binary variables (from clustering results) to examine the correlation of actual variables measured. Since the data consists of a large number of variables, they may be too unstable for proper interpretation. It is therefore essential to reduce the number of variables to a linear combination corresponding to a principal component.

At this stage, the PCA coefficient was complemented to describe the correlated variables of each PCA, which was then interpreted and labeled according to its outstanding characteristics and preferences. However, a larger correlation was considered with strong importance for each component. This was necessary for the identification of the hidden structure and pattern in the data set. In addition, the qualitative assessment of secondary document collection, legislation, previous and present public policies, research, and criticisms was used to support the argument for statistical analysis.

## 4. Results

The result reported qualitative components through quantitatively based surveys. Each domain contained several detailed empirical evaluations to explore the validity of a traditional waterfront community complex.

### *4.1 Identifying Community Characteristics using Hierarchical Clustering and Decision-Tree Analysis*

Hierarchical clustering was employed by the survey data set to identify similarities in data distribution patterns among communities. Clustering was implemented using the complete linkage method in order to find similar clusters. To determine the number of clusters, the results complement the qualitative assessment of each cluster inspected. As a consequence, seven major clusters (Clusters A to G) were identified based on their distinguishing features in the data set.

The sets of clusters were used as target variables in generating the decision tree (Figure 2). The result consisted of 14 nodes and 9 terminal nodes in three-layer depths. In the first node, the cultural landscape and agricultural activities were the most influential factors in classification. Subsequently, functional settings, sub-region, and settlement patterns were assigned to the leaf node, and water features were added at the end. This information is a key point for labeling the clusters in the next section.

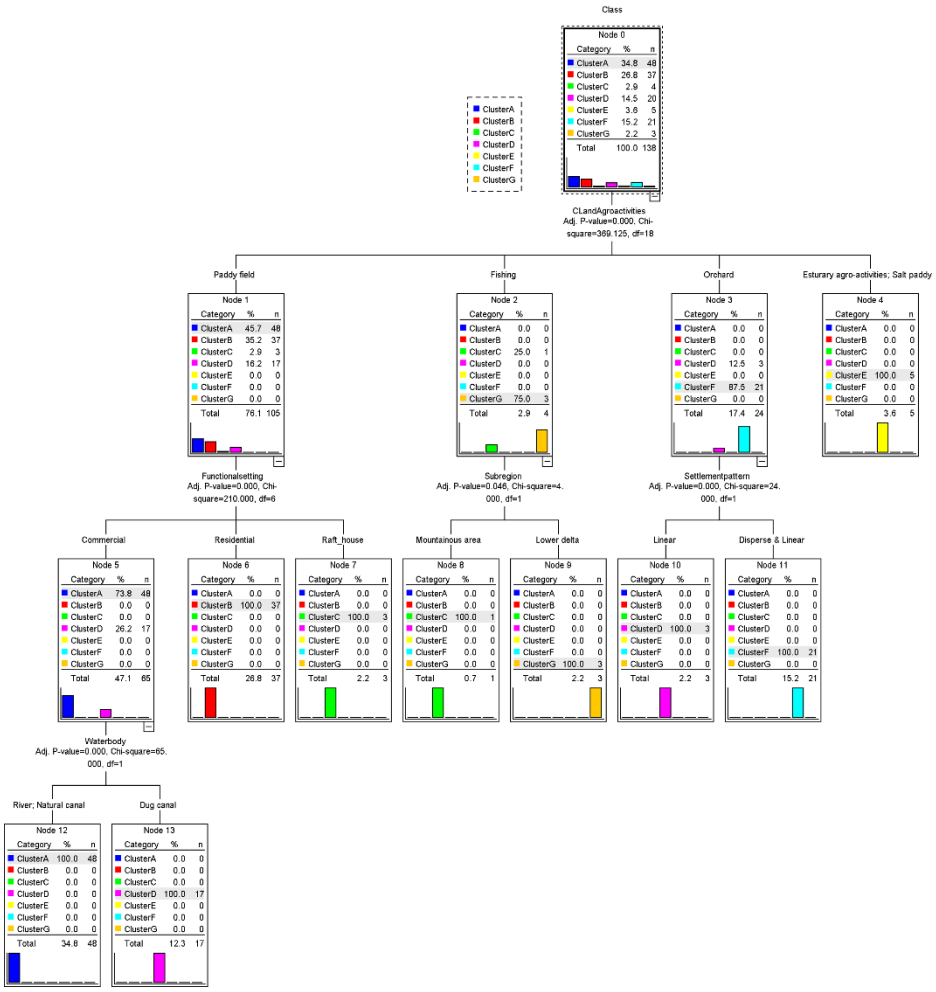


Figure 2. Tree diagram using the CHAID growing method

Table 1. Principal Component Index (correlation value above 0.17)

| PCA1 | *r* | PCA2 | *r* | PCA3 | *r* |
|---|---|---|---|---|---|
| Commercial | 0.91 | Cluster C | 0.99 | Cluster F | 0.92 |
| Fully open front facade | 0.90 | Movable | 0.99 | Orchard | 0.90 |
| Shrine | 0.90 | Raft | 0.99 | Waterfront pavilion | 0.89 |
| Central market | 0.87 | Temporary | 0.99 | Disperse | 0.88 |
| Row house | 0.85 | Raft house | 0.99 | Processing plant | 0.79 |
| Double floors on ground | 0.82 | Raft structure | 0.99 | Mae Klong River Basin | 0.73 |
| Cluster A | 0.80 | Elevated walkways | 0.69 | Lower delta | 0.59 |
| Urban pier | 0.67 | Wooden bridge | 0.69 | Pier | 0.54 |
| Nucleated | 0.48 | Single floor on ground | 0.41 | Flea market | 0.48 |
| Enclosed walkways | 0.43 | Central plains upstream | 0.31 | Urban pier | 0.44 |
| River | 0.24 | Pier | 0.22 | Waterfront corridor | 0.44 |
| Paddy field | 0.23 | Fishing | 0.21 | Residential | 0.27 |
| Central plains upstream | 0.23 | Shrine | -0.17 | Granary and storage structure | 0.27 |
| Pier | 0.22 | Granary and storage structure | -0.18 | Amphibious | 0.26 |
| Cluster D | 0.21 | Commercial | -0.18 | Fishing and argricultural structure | 0.23 |
| Amphibious | 0.19 | Fully open front facade | -0.18 | Temple | 0.22 |
| On land | -0.17 | Temple | -0.18 | Single floor on ground | 0.22 |
| Mountainous area | -0.20 | Urban pier | -0.21 | Dug canal | 0.21 |
| Cluster F | -0.21 | Single floor on high stilts | -0.23 | Row house | 0.21 |
| Processing plant | -0.23 | On land | -0.33 | Bamboo | 0.19 |
| Waterfront pavilion | -0.24 | Permanent | -0.99 | Linear | 0.17 |
| Disperse | -0.24 | | | Enclosed walkways | -0.17 |
| Natural canal | -0.41 | | | Nucleated | -0.18 |
| Linear | -0.46 | | | Cluster A | -0.18 |
| Vernacular house | -0.48 | | | Double floors on ground | -0.20 |
| Traditional Thai house | -0.61 | | | Mountainous area | -0.21 |
| Temple | -0.61 | | | Commercial | -0.23 |
| Single floor on high stilts | -0.66 | | | On land | -0.24 |
| Cluster B | -0.77 | | | River | -0.25 |
| Fishing and argricultural structure | -0.87 | | | Shrine | -0.25 |
| Granary and storage structure | -0.88 | | | Upper delta | -0.41 |
| Residential | -0.91 | | | Cluster B | -0.48 |
| | | | | Chao Phraya-Thachin River Basin | -0.60 |
| | | | | Paddy field | -0.84 |

| PCA4 | *r* | PCA5 | *r* | PCA6 | *r* |
|---|---|---|---|---|---|
| Cluster D | 0.88 | Cluster E | 0.88 | Cluster G | 0.87 |
| Dug canal | 0.77 | Salt paddy | 0.67 | Fishing | 0.83 |
| Amphibious | 0.69 | Estuarine and coastal landscape | 0.56 | Vernacular house | 0.41 |
| Enclosed walkways | 0.66 | Nucleated | 0.50 | Amphibious | 0.36 |
| Single floor on ground | 0.64 | Wooden bridge | 0.39 | Waterfront corridor | 0.36 |
| Waterfront corridor | 0.57 | Elevated walkways | 0.39 | Mae Klong River Basin | 0.20 |
| Lower delta | 0.56 | Natural canal | 0.35 | Processing plant | 0.18 |
| Bang Pakong River Basin | 0.35 | Lower delta | 0.25 | Cluster F | -0.17 |
| Pier | 0.35 | Traditional Thai house | 0.18 | Paddy field | -0.18 |
| Linear | 0.31 | Disperse | 0.18 | Chao Phraya-Thachin River Basin | -0.18 |
| Fully open front facade | 0.21 | Processing plant | 0.17 | Waterfront pavilion | -0.20 |
| Shrine | 0.18 | Cluster B | -0.18 | Linear | -0.24 |
| Urban pier | 0.18 | Row house | -0.21 | Urban pier | -0.27 |
| Granary and storage structure | -0.17 | Paddy field | -0.28 | Traditional Thai house | -0.32 |
| Mountainous area | -0.18 | River | -0.34 | On land | -0.36 |
| Temple | -0.24 | Linear | -0.51 | Hardwood | -0.62 |
| Upper delta | -0.24 | | | | |
| Chao Phraya-Thachin River Basin | -0.27 | | | | |
| Single floor on high stilts | -0.29 | | | | |
| Nucleated | -0.31 | | | | |
| Central plains upstream | -0.32 | | | | |
| Double floors on ground | -0.41 | | | | |
| Cluster A | -0.48 | | | | |
| On land | -0.66 | | | | |
| River | -0.66 | | | | |

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 6 iterations.

*4.2 Principal Component Analysis*

PCA grasps complex variations in the traditional waterfront community. The result revealed the emergence of 6 sets of components of 7 clusters. The *p*-value was used to determine the correlation value, which has a significant importance for data sets. A correlation value above 0.17 ($p$-value $\leq 0.05$) is deemed important to give tangible meaning to association. The principal component index (PCI) is reported in Table 1. Variables were arrayed and correlated within their components. PCA emphasizes the validity of the characteristics commonly found in each cluster. PCA1 considers as many of the variables as possible in the data set, and the other components (PCA2 to PCA6) explain the remaining variables. However, it is necessary to exercise caution on these points, since on the basis of the correlation coefficient alone, no matter how large, it cannot be said that one variable creates another. In order to do that, logic, additional evidence, and/or analysis must be applied as the measure states the degree of the relationship and nothing more (Deutschmann & McNelly, 1964). The interpretation of the PCI with respect to the values is described in the next section.

**5. Discussion**

To label the clusters, PCA and qualitative assessment were used to extract the main characteristics of the traditional waterfront community comprising each cluster, and these were then described according to their cluster preferences (Table 2). The combination of clusters depicts the richness of data in the process of the ongoing transformation of the waterfront community. This is characterized by the wave of transformation caused by changing socio-economic requirements over the years. These forces reflect the "spirit of place" and are crucial to the understanding of contemporary society, together with the scenic environmental surroundings of the waterfront community.

Table 2. Description of clusters

| *Cluster* | *n* | *Description* |
|---|---|---|
| Cluster A | 48 | Market town |
| Cluster B | 37 | Paddy village |
| Cluster C | 4 | Raft community |
| Cluster D | 20 | Waterfront market |
| Cluster E | 5 | Comprehensive estuarine agricultural village |
| Cluster F | 21 | Orchard village |
| Cluster G | 3 | Fishing village |

Figure 3. Market town of Sriprajan community (image by author)

Figure 4. Paddy village of Bangbaan community (image by author)

Since paddy fields dominate a large part of the basin, *rice cultivation clusters* represented the majority of the cluster population, commonly located in the central plains. Wide varieties of indigenous architectural detail and material have been invented to suit endemic economic and environmental conditions. The *market town* (Cluster A,

PCA1 positive, Figure 3) is characterized by traditional double-floor wooden row houses with a central market at the public pier on the waterfront. The cluster is settled in a single-centric (nucleated) plan surrounded by agricultural areas of paddy fields and post-agricultural products (rice mills) and is the center for trading along the main river. The settlements are along the main transportation route running through the north–south corridor of the Chao Phraya River and are influenced by activities seeking economies of scale. Since the early Rattanakosin period, market clusters have been associated with Chinese immigrants, who made a significant contribution to the development of the waterfront markets and agricultural product distribution network (Tachakitkachorn & Shigemura, 2005). Thus, there is a Chinese shrine in the center of the commercial community. The combination of Thai–Chinese culture has created unique architecture to coincide with the cultural landscape.

These market communities are bonded in the *paddy village* (Cluster B, PCA1 negative, Figure 4) of the central plains to the corridor. Granary stores, barns, and other structures related to agriculture (including fish trapping) are the main features of the community cluster. Buildings related to agricultural activities associated with housing and environment were built using vernacular and/or traditional Thai house structures on land with raised floors on high stilts. The houses were clustered around the community space, which contained a Buddhist temple.

Figure 5. Raft house of Sakeakrang River
(image by author)

Figure 6. Waterfront market of Raheang canal
(image by author)

The *raft community (*Cluster C, PCA2, Figure *5)* was quite well known, especially during the Ayutthaya and early Rattanakosin periods. Raft houses were very practical for the flooding conditions of the central flood plain (Panin, 1999). As a structure only on the surface of the water, it can be easily transported up and down the river. Owing to the temporary nature of the raft house, it can easily be destroyed. Since 1945, raft house clusters in Bangkok have disappeared (Denpaiboon, Tohiguchi, Matsuda, & Hashimoto, 2000). Only four authentic raft house clusters have been accepted as traditional settlements under threat. As a consequence of socio-economic transformation, raft houses are not suitable for the safety and hygienic standards of modern urbanization. This, therefore, presents a predicament for the continuation of raft culture. Raft house clusters intrude on public waterways and offer extremely poor housing and environmental conditions. After the enactment of Thailand's environmental law in 1992, raft house clusters were deemed undesirable. The government considered the existence of the raft house cluster as a pollutant, going against the policy of a "healthy city." Raft-house dwellers were offered resettlement on land.

The expansion of dug canals along the east–west corridor from Bangkok to the peri-urban agricultural frontier was initiated in the 1860s and new banks of waterways were claimed for agriculture and housing development. Soon after, during construction of the new canal, trading began, turning the canal network into a commercial hub for agricultural and agro-industrial products. Agricultural land was connected to the network system by the *waterfront market* (Cluster D, PCA3, Figure 6). Typical single-floor wooden row houses were clustered on the east–west corridor of the lower basin. The houses were positioned along one side or both sides of the waterways of the commercial hub. The cluster was built adjacent to the canal, with the walkway running in-between. This corridor served as a common/shared veranda, one of the smallest public spaces, and connected to the row houses. Functionally, such housing combined a shophouse and residential unit, connected to the agricultural landscape and product suppliers at the rear.

Figure 7. Comprehensive estuarine agricultural village of Bangkeaw salt paddy (image by author)

Figure 8. Pradoo canal orchard village (image by author)

In the lower delta, the diversity of the cultural landscape influenced agricultural activities. The wide variety of agricultural activities was caused by the nature of estuarine water circulation. In general, the area has been influenced by the tides and seawater covering most of the lower delta. Estuarine agricultural activities and associated structures, including shrimp farm shelters, coconut farms and processing plants, nipa shingles, mangrove wood charcoal plants, and salt paddy plants, were important features of the *comprehensive estuarine agricultural village* (Cluster E, PCA4, Figure 7). A community of single-centric wooden houses were built on land and clustered around a Buddhist temple, surrounded by agriculture.

The *orchard village* (Cluster F, PCA5, Figure 8) combined orchards, shophouses, row houses, and a market. The clusters subsisted on agricultural activities of the orchard landscape complex, which exerted influence on material cultural design. Dispersed settlements were associated with the orchard agricultural landscape and salt paddy agricultural areas. Land use and area consumption based on function illustrated a long-distance association between agricultural areas, processing plant, community, and market. Agro-processing activities incorporated local-made machinery and factories, such as mills, stoves for stewing coconut sugar, traditional sweets, etc., and were scattered throughout the canal network. The agro products were usually self-marketed within the market cluster in the collection/distribution hub of the tributaries.

Figure 9. Leam yai fishing village (image by author)

The amphibious vernacular community housed on high stilts in the *fishing village* (Cluster G, PCA6, Figure 9) demonstrated outstanding fishing activity in the lower delta and related estuarine areas. Fishing and structures related to fish processing were a result of important activities related to wetland culture. They were primarily used for wetland resources vulnerable to conversion for global environmental reasons. A series of wooden houses with an attached pier were aligned along the canal network, connected to offshore fisheries and *krateng*. *Krateng* architecture involves a wooden shelter for local fisheries built on high stilts to monitor the cockle farms. However, most remote and isolated *krateng* are currently used by tourists as exotic destinations.

Community-based agricultural clusters were culturally landscape-oriented, where clusters and associated structure ensembles took a different form, depending on the specific agricultural activity. The cluster accommodated a variety of agriculture and storage structures characterized by the diverse cultural landscape, especially in the lower basin. The diversity of the cultural landscape and agricultural activities exerted an influence on settlement patterns and architectural design. The remaining traditional villages and communities were settled in the agro-rural area associated with the immediate agricultural landscape, as shown in Figure 10.

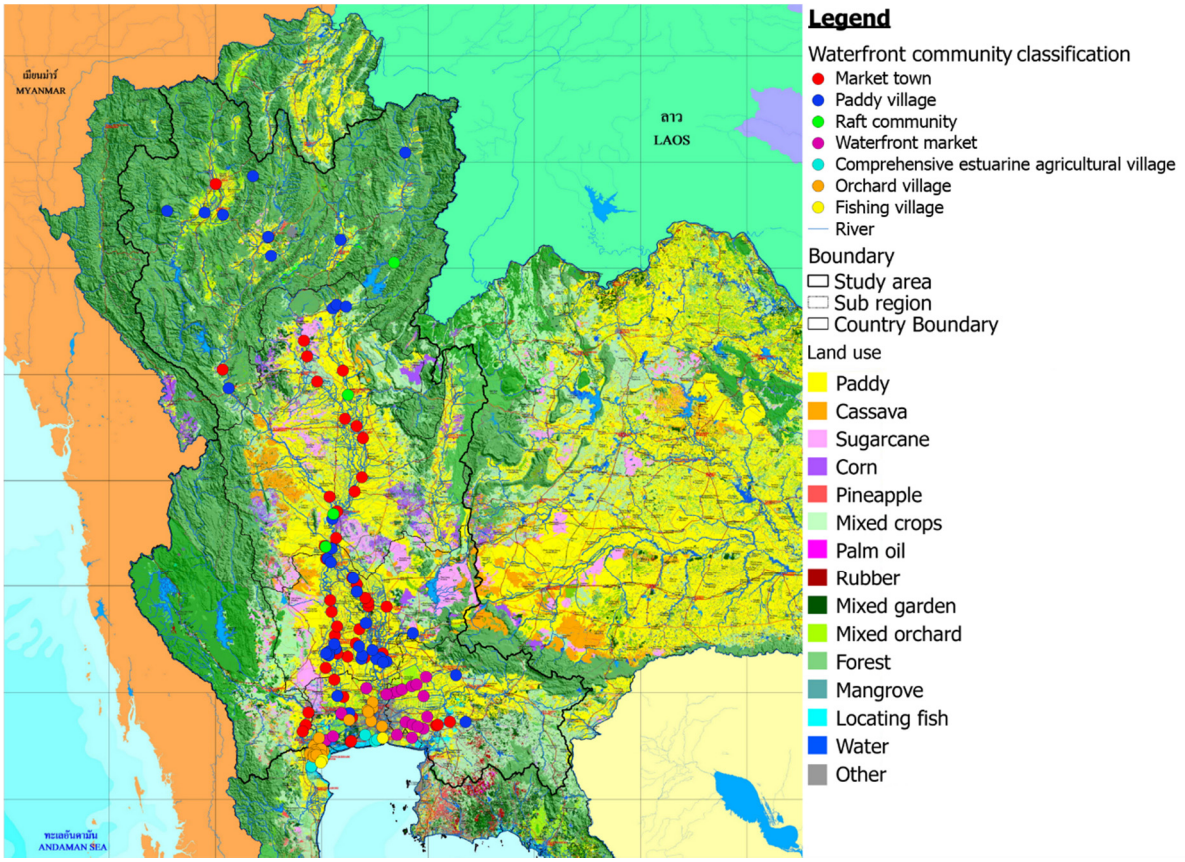


Figure 10. Land use map showing location of traditional waterfront cluster
Base map: Thailand land use oriented to agricultural area cover from Lansat 5 satellite image in 2005 (Ministry of Agriculture and Cooperatives, 2006)

## 6. Conclusion

The traditional waterfront community in the Chao Phraya River Basin was classified into seven clusters, based on common preferences, consisting of a market town, paddy village, raft community, waterfront market, comprehensive estuarine agricultural village, orchard village, and fishing village. These clusters show the diversity of the cultural landscape and agricultural activities exerting influence on the community complex.

Since rice paddies dominated most of the agricultural land in the river basin, the majority of the cluster population contained a rice-cultivation community. The center for rice trading along the north–south corridor was a market town where the rice-cultivating residential community of the paddy village was bonded to the corridor. Along the line, raft communities were able to travel up and down the river; however, since the 1950s these unique housing communities have gradually disappeared as a consequence of modernization. Cluster typology diversity was assembled in the lower delta. The trading center along the east–west corridor was characterized by the wooden row houses of the waterfront market at the collection/distribution hub of the tributaries supplying an agricultural landscape-oriented vernacular community of a comprehensive estuarine agricultural village, orchard village, and fishing village.

The results express the identity of the regional geography, not merely the physical structure and agricultural landscape associated with local practices representing the evidence of past indigenous water-based settlements in

Ayutthaya and Bangkok. The remaining physical structures share a common appearance in regional vernacular architecture. This reflects a mixture of influences, creating a unique architecture, culture, and townscape. The clusters share common features but maintain their uniqueness. Each cluster is associated and considered a counterpart, representing an ensemble of the cultural diversity of man, architecture, urban development, and the environment.

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