THE SETTLEMENT LANDSCAPES OF THE MANGROVES: THE INDIGENOUS KNOWLEDGE ON SUSTAINABILITY AND ENERGY CONSERVATION[1]

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Abstract

It has been proved that mangroves provide a great barrier against the impact of natural disasters, especially that of the tsunami in December 2004. Villages located in mangrove areas reported no major damage. It is apparent that, if the villagers live in harmony with nature, the mangroves protect them in return.

This paper is the summary of a full research project investigating the settlement landscapes in the mangroves. The analysis concentrates on the relationships between the natural landscapes and components of the built environment, such as domestic architecture and outdoor spaces. The study shows that traditional fishing villages are climatically, ecologically, and culturally responsive.[3] *They have inherent sustainable planning and landscape features corresponding to the Western paradigm of energy conservation through passive means.*[4] *The study may provide significant potential for understanding indigenous knowledge that could be applied to future development of coastal areas and, in turn, could generate the sustainable built environments.*

The research focused on two villages on the coast of the central plain in Thailand. Ban Chai Talay Bang Krachao is situated on the coast of Samut Sakon Province, and Ban Laem is on the intertidal mud flats of the estuarine system of Petchburi River. The two villages share some similarities but mostly differ in various aspects such as geographical conditions, settlement patterns, and economic background.

The coastal and intertidal areas of the inner gulf of Thailand have been occupied by traditional fishing communities for hundreds of years. These communities have recognised the interconnection between their livelihood and mangroves. Contrary to general perceptions, traditional fishing villages are, in fact, mangrove friendly. Their spatial organisation and built forms respond to the environmental conditions of mangrove forests. New urban developments such as housing projects, industry, aquaculture, and sea dykes, on the other hand, specifically lead to the degradation of mangroves and the coastal ecosystem in general.

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[1] The full research was awarded the Outstanding Research Prize from Chulalongkorn University, 2004.

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[3] The relationships between the vernacular architecture and the ideas of energy conservation are stated in, for example, Amos Rapoport (1969); and Dean Hawkes, et.al. (2002)

[4] The notions and the principles about sustainable and energy-conserving landscape and urban design in this research are based on three books: Gray O. Robinette, ed. (1983); Michael Hough (1995); and Katie Williams, ed. (2001).

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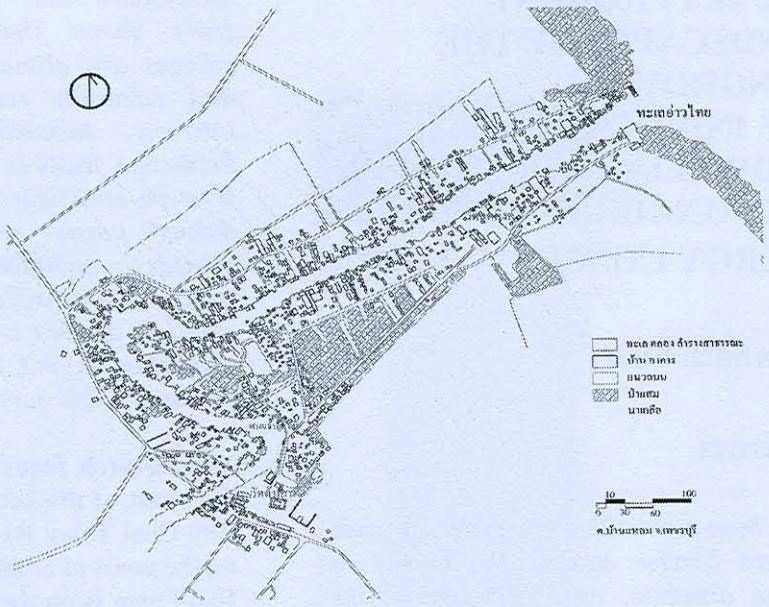


Figure1. The village layout plan of Ban Laem, Petchburi

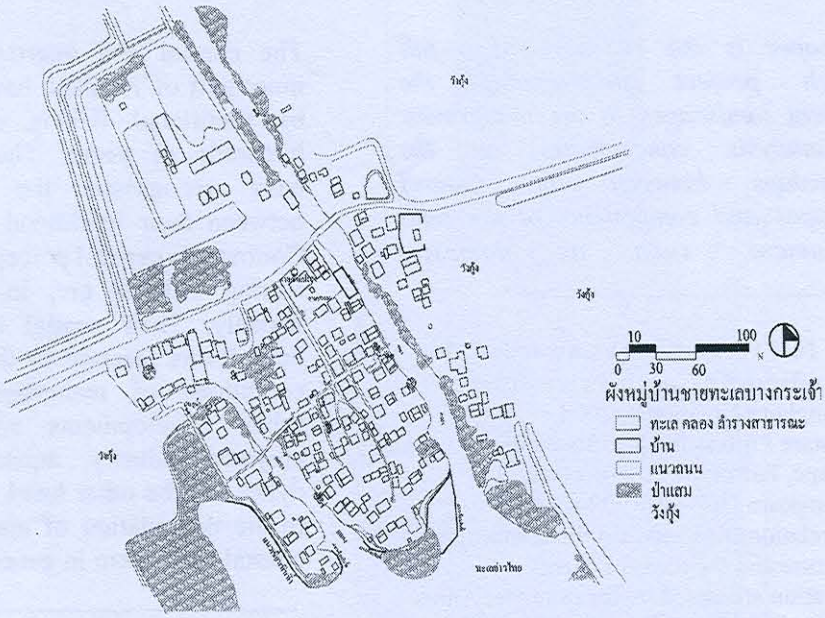


Figure2. The village layout plan of Ban Chai Talay Bang Krachao, Samut Sakorn

Cultural Background

It has long been postulated that mangrove areas are not suitable for human settlement because of the strong maritime influences. But according to archaeological excavations on the eastern coast of the inner gulf of Thailand, prehistoric settlements are found in former mangrove areas at Khok Phnom Dee and Nong No in Chonburi.[5] On the west coast, from Samut Sakon to Petchburi, ancient artefacts and local legends indicate that the areas have been inhabited by settlers from the Chinese diaspora at least since the 13th century. The resettlement of the Chinese was prominent in the period between Kings Rama II and Rama V, due to political complications and natural catastrophes in southern China. Now the residents of the two villages are of mixed Thai and Chinese ancestries and make their living from fisheries and related occupations such as dried fish processing and making shrimp paste.

Upon settling down, the Chinese immigrants built a shrine to mark the ritual centre of their village and to remind people of their connection to the spirits which were revered in their original homeland. The shrines were built on locations considered auspicious based on *fengshui* beliefs and often raised on a platform. In the areas studied, the shrines are oriented toward the south or toward adjacent watercourses, and the domestic architecture follows this pattern.

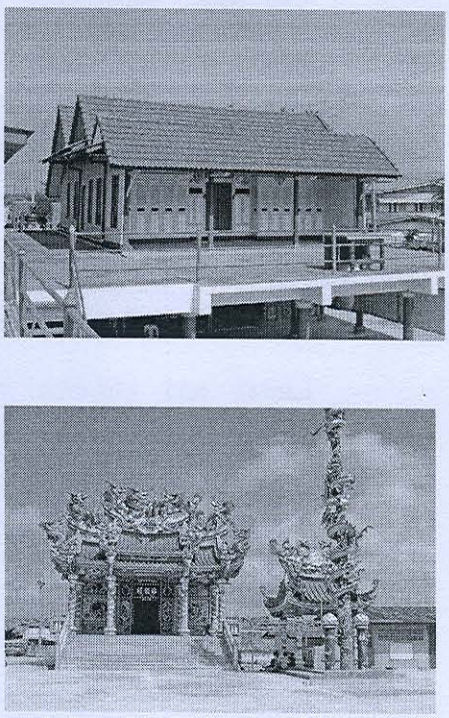


Figure3. Ritual architecture: The village shrines in the areas studied have different architectural haracteristics. (Top) In Ban Laem, the shrine has several features similar to Thai domestic architecture. (Bottom) The shrine at Ban Chai Talay Bang Krachao has been rebuilt in Chinese style

The major environmental constraints of mangrove areas are a shortage of fresh water and soil that is unsuitable for agriculture. Traditional fishing communities, therefore, need to make social and economic contacts with outside communities through a network of canals and along the coastline. With its prime location and abundant coastal resources, the village of Ban Laem developed into a centre of maritime trade. Physical evidence of past affluence, such as Chinese shrines, Buddhist temples, and timber houses, remains until today. The village of Ban Chai Talay Bang Krachao, on the other hand, is based more on

[5] See Charles Higham (1998)

traditional subsistence economy. The fishermen exchanged their products with inland settlements of Chinese and Mon descendants for rice, fresh water, fruits, vegetables, and some building materials. The domestic architecture of the village appears simple, made of thatch, bamboo, and palm leaves.

Settlement Pattern and Form

Linear and clustered settlements are ubiquitous in the mangrove areas. Each type of settlement has a different pattern of open spaces and circulation system. Ban Laem, a village on the outflow of Petchburi river, is formed in a linear pattern and benefits from the outward accretion of mud flats every year. Houses are arranged according to kinship. The parental houses were mostly built on the river bank and the next generation houses extend in a perpendicular direction to the river. Each neighbourhood is accessed by a narrow walkway, which is paralleled by closely spaced houses. This narrow walkway serves to channel and increase ventilation. Typically, the walkway terminates at a platform on the river bank, which serves as a common space for daily activities and recreation.

The clustered settlements, usually built on sand ridges, have an interconnected spatial pattern. In Ban Chai Talay Bang Krachao, each neighbourhood encompasses a large open space, which is continuously joined to the next open space and is normally used for sun-drying shrimp. After being unloaded and rinsed, shrimp will be spread out on blue plastic mats on the ground. In addition to performing socio-economic functions, the series of open spaces also facilitates air flow and creates a cooler microclimate protecting against strong radiation.

As mangrove areas are intertidal, open spaces, the walkways have to be graded with base materials. In the past, villagers used biodegradable materials such as *krasa* (Krasaa) or sea debris because they are water-infiltrative and posses elastic qualities. At present, packed gravel are replacing the traditional materials due to their greater durability.

The villages along the coast of the inner gulf of Thailand were, in the past, located hundreds of metres behind a dense growth of mangroves. However, for the last several decades, the abundant mangroves have been severely depleted as a great deal of coastal lands have been transformed into shrimp farms and urban developments. The changes in land use are causing an increase in coastal erosion. The villages have lost their natural protection and are suffering from more frequent floods.

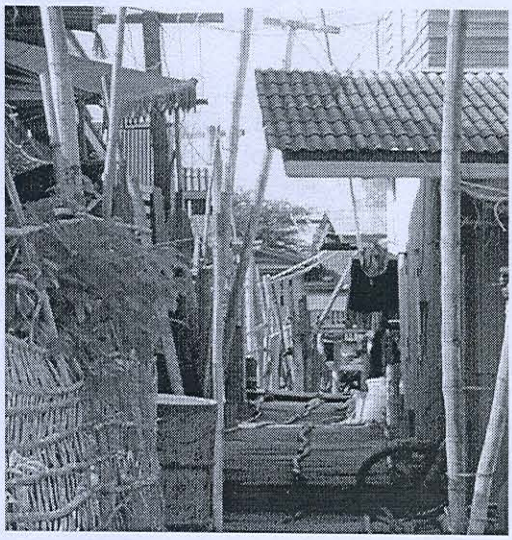


Figure4. A narrow shaded walkway paralleled by houses. Typical pattern for linear settlements

Figure5. Interconnected open spaces in a clustered

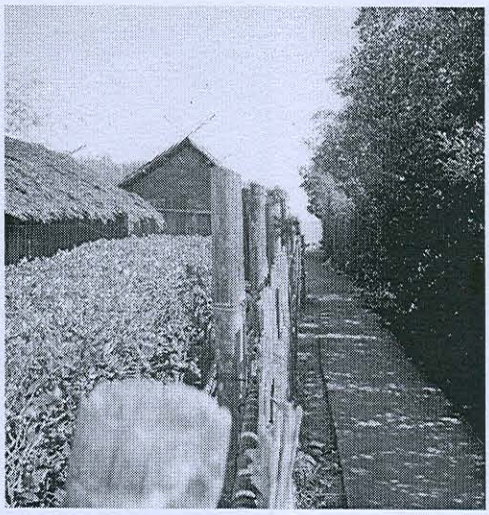
Figures7-8. Aerial photographs taken in 1952 (above left) and 1994 (above right) show the transformation of the landscape and environment of Ban Chai Talay Bang Krachao

Landscape Features

The major genera of mangroves found in the two villages are *Rhizophora* (Kong-Kang) and *Avicennia* (Samae), which have been used for building materials and firewood. Basically, the villagers control their use of mangroves at a sustainable level. Only mangroves uprooted or falling after storms are exploited.

The mangrove forests play an important role in controlling the microclimate of the areas and in preserving the stability of the coastline. Rows of *Avicennia* are trimmed to form hedges for protection against the sun and strong winds as well as for indicating house domains. In summer, the mangroves are pruned for better ventilation from the southern winds.

One significant characteristic of the mangrove forests is the network of small canals and creeks which are used as thoroughfares and drainage. They are natural means of minimising concentrations of water and delaying runoff and erosion, as soils in the mangrove areas have low infiltration. In addition, along the banks of these small canals and creeks, a group of mangroves and ground-cover plants such as *Suaeda maritima* (Cha-Khram) and *Portulaca oleracea* (Phak bia) are preserved to protect against erosion. However, in some built-up areas, there have been attempts to construct retaining structures along the coast and along the banks of canals where the erosion problems occur. Unfortunately such rigid structures are not suitable for the mangrove areas because the silts and clays in coastal areas have low value as foundation materials.



Figures9-10.
(Top) A row of Avicennia provides shade and serves as a wind break along the periphery of Ban Chai Talay Bang Krachao

(Bottom) A small canal in the middle of the village performs many functions, including drainage, channeling wind, and providing berthing spaces for boats

Domestic Architecture

The complete research project explores the ways in which traditional structures were adapted to the climate, ecology, and topography of mangrove areas. The design of houses in each locale reflects differences in geography and way of life. Many elements in domestic architecture, such as form, size, shape, and orientation in fishing villages, help provide comfort through natural ventilation and protection against strong radiation.

Fishing villages in the mangroves are dominated by single-family houses. Traditionally, a newly married couple tends to build their new house close to their parental houses. This social norm engenders comfortable environments for residents, since a single house allows better ventilation than multiple or clustered houses.

There are two types of housing construction in the fishing villages found in mangrove areas: raised on stilts and on grade. Houses built on piles are commonly found in estuarine areas. They mainly rely on natural ventilation and are adapted to the geographical conditions of the sites, where ebb and flood tides predominate. The prominent characteristic of houses on piles is seen in traditional timber houses, which have twin-gabled roofs and a large verandah.

Houses built directly on the ground are mostly found in clustered settlements on sand ridges. Culturally speaking, residents in Ban Chai Talay Bang Krachao still maintain up to the present day the belief that houses should not be built higher than the village shrine. This probably follows southern Chinese tradition. Houses on grade in the study areas consist of two structures. The main structure is living quarters oriented toward the south. The adjacent structure is a kitchen. It is positioned perpendicular to the main structure, facing east. The living quarters are enclosed without windows to prevent direct solar penetration.

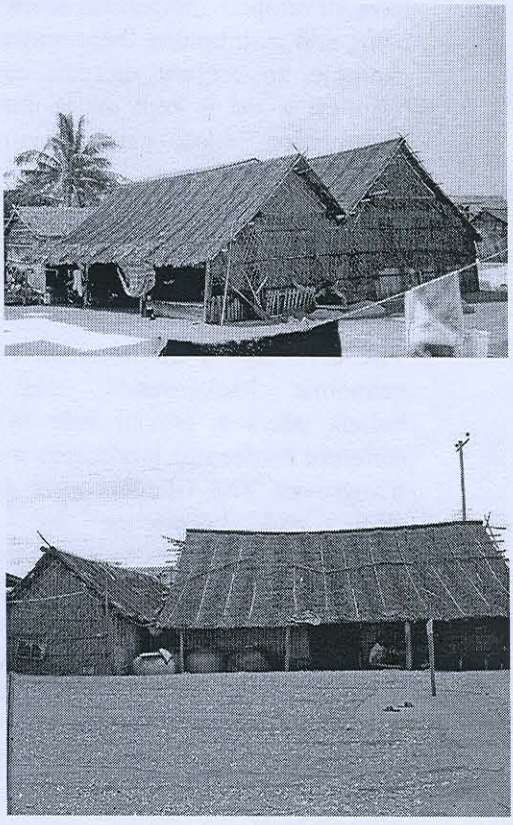


Figure11.
Houses built on the ground are often made of bamboo and palm leaves. An open space in front of the house is for sun-drying fish and shrimp as well as for increasing ventilation. The structure may have a single or twin roofs, but the kitchen is always separate. A row of big jars storing fresh water are common among houses in mangrove areas

The appropriate choice of materials can assist in conserving a great deal of energy by cooling down structures. Building materials found in the villages studied include bamboo, palm leaves, timber, and mangroves. These natural materials help minimise solar absorption at the surfaces of walls and roofs. In addition, villagers have developed indigenous knowledge in using and maintaining these materials. For example, to prevent damage caused by termites, wood is kept under mud before construction. Also, bamboo is recycled from fishing stakes.

Modern Implications of the Vernacular Landscapes

The diversity of environmental settings, economic backgrounds, and cultural beliefs plays a crucial role in shaping different settlement landscapes among the mangroves. The villagers have developed skills and knowledge by adapting themselves to such extreme environmental factors of the areas as strong solar radiation, high humidity and temperature, daily tides, low soil infiltration, erosion, high salinity, etc. These skills and knowledge are reflected in site selection, village layout, architectural forms, and the use of landscape elements, especially native plants.

Urban development within or near mangrove areas does not necessarily demand a complete change, In fact, the alterations to such sensitive environments should aim to minimise the use of resources and energy, as well as to promote ecological stability, diversity, and aesthetics. Below are some general principles, not a clear-cut paradigm, for future development in mangrove areas.

1. Site Selection

- Proper site selection may facilitate energy conservation more than planning does. To preserve mangrove forests as natural buffers, no construction should be permitted within, at least, 200 metres of the high-tide mark.

2. Site Planning and Design

- Preserve natural drainage patterns, including small canals and creeks, and avoid blocking drainage from roads or parking.
- Create open spaces, thoroughfares, and house groupings in response to development patterns and the environmental conditions of the site. For example, narrow walkways help channel winds and increase ventilation. A network of open spaces, on the other hand, is more suitable for clustered or compact planning on coastal areas.
- Grade the areas for construction as necessary in order to preserve mangroves and leave enough area to absorb runoff. Use paving materials that allow water seepage.
- Utilise mangroves in landscape design as natural buffers, shade, and decorative plants. Dense mangroves are more effective in protecting against erosion than concrete retaining walls.

3. Architectural Forms

- A single, well-proportioned building allows better natural cross-ventilation than large or multiple structures, as size determines the ventilation conditions of the building.
- Openings may be minimal or shaded in order to avoid strong solar radiation penetrating into the

interior of the building and elevating the indoor temperature.

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