Resilient Landscape in Southeast Asian Cities

Urbanization and its impacts on ecological services of Bangkok’s urban ecosystem.

Danai Thaitakoo
1) Landscape and Urban Ecology Laboratory, Department of Landscape Architecture, Chulalongkorn University, Phyathai Rd., Bangkok, Thailand.

2nd TOT for Urban Climate Change Adaptation in Southeast Asia
International Meeting on Building Capacity for Urban Climate Change Adaptation in Southeast Asia
31 July – 4 August 2017
EGL Hotel
Bangkok, Thailand
Bangkok’s Waterscape Urbanism

Landscape and Landscape Changes and Ecosystem Services

Liquid Perception and Water Resilient Communities

Coping with Un-anticipated Futures
Bangkok’s Waterscape Urbanism
Takaya’s Hydro-ecological view of Chao Phraya River Basin (Takaya, 1975:191)
The watery Chao Phraya River Delta and Bangkok

The lower Chao Phraya River Delta and the city of Bangkok: the watery Chao Phraya Delta with Bangkok sprawling into rice fields to the east and fruit orchards on the west bank.
Bangkok circa 1890 (left) and 2004 (right): the two views show how the Bangkok urban morphology follows the pattern of water-based rice and fruit farming.
The Chao Phraya River and the city skyline of Bangkok.
Landscape, Landscape Changes and Ecosystemservices
Bangkok circa. 1932-33
COVERING THE NURTURING EARTH WITH CEMENT: “EXPLOSIVE” EXPANSION OF BANGKOK SINCE 1900

(Source: Sternstein 1982)
Landscape Hydro-Ecological Infrastructure,

Landscape and people evolved together through rice cultivation with indispensable water into a rice-economy. The rice-economy was significantly influence by water availability, thus traditional water management, was in place for distribution of water and flood control at a small scale in according to hydrological and topographical characteristics with unique local social organization

Functions

“The center of the geographical living space” (Takaya 1987), the capability of the landscape to provide functions or potentials for human inhabitation and exploitation, such as the capacity to produce foods and resources, the capacity to build human’s habitat and places, a self-regulated environment, based on the resilience of the landscape’s ecosystem and the capability to link with aesthetic, scientific, cultural and other interest of human kind
Changes

Land reclamation for rice culture and human settlement. The construction of vast canal networks was the process of turning the swampy land into the prolific producer by the way of irrigation and drainage. One of the major losses through the rapid urbanization of the city is Bangkok's unique vast canal network. The network once considered a lifeline has been neglected and abandoned.
Ecosystem services are the benefits people obtain from ecosystems. These include provisioning, regulating, and cultural services that directly affect people and supporting services needed to maintain the other services.

<table>
<thead>
<tr>
<th>Provisioning Services</th>
<th>Regulating Services</th>
<th>Cultural Services</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Products obtained from ecosystems</strong></td>
<td><strong>Benefits obtained from regulation of ecosystem processes</strong></td>
<td><strong>Nonmaterial benefits obtained from ecosystems</strong></td>
</tr>
<tr>
<td>• Food</td>
<td>• Climate regulation</td>
<td>• Spiritual and religious</td>
</tr>
<tr>
<td>• Fresh water</td>
<td>• Disease regulation</td>
<td>• Recreation and ecotourism</td>
</tr>
<tr>
<td>• Fuelwood</td>
<td>• Water regulation</td>
<td>• Aesthetic</td>
</tr>
<tr>
<td>• Fiber</td>
<td>• Water purification</td>
<td>• Inspirational</td>
</tr>
<tr>
<td>• Biochemicals</td>
<td>• Pollination</td>
<td>• Educational</td>
</tr>
<tr>
<td>• Genetic resources</td>
<td></td>
<td>• Sense of place</td>
</tr>
</tbody>
</table>

| Supporting Services                          |                                                          |                                                          |
| **Services necessary for the production of all other ecosystem services** |                                                          |                                                          |
| • Soil formation                             | • Nutrient cycling                                       | • Primary production                                     |
| • Nutrient cycling                           |                                                          |                                                          |
| • Primary production                         |                                                          |                                                          |
The vanishing land and waterscape: rapid changes brought the number of land based infrastructure and other constructions that resulted in a rapid increase in built up area at the expense of cultivated land and the hydrological matrix. (adapted from Sternstein 1982)
The city canals and cityscape: vanishing waterscape and vanishing flow.
The waterscape: places for life, water and foods, fishing traps and edible morning glory plant, a flood gate and fish cages - new waterscape and vanishing flow.
A. Aerial Photograph 1952, Royal Thai Survey

B. Google Earth Image 2008, Google Earth

Source: Palopakon, Y., 2009: Landscape Ecological Structure and Ecological Services, Case Study: The Irrigation Ditches and Orchard Ditches in a canal Network, Omm-Nont Canal, Bang Yai, Nontaburi
Where the flyover soars across the old course of the Chao Phraya River, a new public beach has formed over Khlong Bangkok Noi. Sisters are rowing home slowly against the wave created by a speedy long-tail boat carrying several commuters from the heart of the city.
Landscape Changes in Bang Yai From 1952-2007

Agricultural Areas
Landscape Changes in Bang Yai From 1952-2007

Built up/Urbanized area
Porous mixed-fruit orchards transformation
Porous mixed-fruit orchards transformation, 1952-2002-2006
Urbanized lands in mixed-fruit orchards area: vegetation cover vs. built up area and vegetation index and surface temperature comparison
The loss of porosity of hydro-agricultural landscape patches such as paddy rice fields, mixed-fruit orchards and water matrix of canal networks and orchards affected ecological functions or ecological services such as:

- Food production
- Water resource regulation – retarding basin and regulation pond
- Water retention and in filtration
- Water quality and conservation – reservoir and filter
- Soil erosion protection
- Oxygen production
- Microclimate control
Coping with Changes/Disaster
Ecological Flow + Socio-Economic Flow + Cultural Flow

Co-Evolution

Resilience
Co-Evolution - Resilience - Adaptation - Water Livelihood
Resilience – Persistence and Adaptation
Liquid Perception

and

Water Resilient Communities
Solid Perception
Rigidity
Static
Stagnant
Resistance
Incoherent
Hazard
Disjointed Land-Human-Waterscape

Solid and Liquid Perception

A) A flood wall and a water gate and a house behind the flood wall.
C) A new house construction site on a raised piece of land and protective wall.
E) A city trunk canal with concrete beams cut across the canal.
G) A city canal and a city street in a business district.

Liquid Perception
Flexibility
Dynamic
Flow
Resilience and Adaptability
Coherent
Vulnerability
Jointed Land-Human-Waterscape

Solid and Liquid Perception

B) Raised houses above flood level and a normal level house with flood mark just above the house floor on the wooden door.
D) Finding a higher level, a raising house in progress.
F) An urban fringe canal with a walk way and a fish trap.
H) An urban fringe canal and shop houses.
Solid state/perception and liquid state/perception in comparison. The land under the house on the left was filled by rubble and soil and is less adaptable to changing flood levels than the house on the right. While the house on the left gives the perception of the city in a stable-solid state, in fact the structure obstructs the natural flow of water and limits the accommodation and retention of high volumes of water. On the other hand, the house on the right is, still, in the water. The structure allows the natural flow of water and provides a lot of space for a higher volume of water. The house on the left is bracing for flood hazard and the new ground creates a new environment – land-scape instead of water-scape that is prone to flooding. There is always vulnerability and risk in relation to water for the house on the left but excess water is always manageable as a part of life in the house on the right.
Lesson Learned: Towards Water Resilient Communities and Ecosystems

- Comprehending the city as an ecosystem - the biophysical and socio-cultural life-support conditions of a city
- Localized strategies must be deployed on the ground
- Revaluation of pockets of the city’s agri- and aquacultural fringe in order to provide breathing space, temperature moderation, water-quality maintenance and new perspectives is critical
- Cultural production of localities within such disjunctive flows is quite complicated work, and requires new collaborative tools developed between design, education, ecology, and social research.
- Careful reexamination of the historical resilience and adaptability of living with nature of indigenous knowledge and local wisdom would be crucial for dealing with future uncertainty such as climate change
• A bottom-up approach for emerging democracies and sustainable community development

• Recognizing patchy rather than centralized urban development, localized air-, water- and food-quality management could be strung among the under-utilized open spaces concentrated on the orchard meanders and the long, ancient irrigation canals, made visible and publicly accessible

• Physical connections provide feedback loops between farmers, consumers and policy-makers

• This is not just an engineering solution towards sustainability, but the recognition of a patchy new symbolic realm as well as a sensual and seductive new cultural space where water and agricultural lands can become the fuel source for the mobile culture on both roads and canals to reweave the geo- and aqua-bodies into a new cultural landscape.
• Indigenous knowledge and traditional systems: Indigenous knowledge and traditional systems of water management and governance structure and function has been through a long history of co-evolution.

• Adaptive Capacity: Learning, Education and transferring of Indigenous knowledge and traditional systems are critical elements of adaptive capacity of a community to recognize and respond to environmental changes.

• Strong social capital such as trust, cooperation, profound partnership and commit volunteerism,

• Effective facilitator, coordination and participation,

• Trans-boundary learning, sharing and transferring of knowledge and experiences across all level, stakeholders and generations.
Coping with Un-anticipated Futures

Traditional/Technological-Engineering Infrastructures + Landscape-Ecological Infrastructure

Landscape/Waterscape + Flowscape
(Adapted from Pickett et al. 2004)

3 Ecologies
(Guattari, 2000)

3 Geometries
(Evans, 1995)

Symbolic

Projective

Socius

Compositional

Environment

(McGrath et al. 2007)
Fig. 1  Tributary system and distributary system


Fig. 2  Three core places in Thai history; Chiang Mai of the pre-Ayutthaya period (→1349), Ayutthaya of the Ayutthaya period (1350→1767) and Bangkok of the Bangkok period (1768→)
Fig. 1 Physiographic classification of paddy land of the Chao Phraya river basin
The cross sections and profile are shown in Fig. 2.
Fig. 1  The physiographic map of the deltaic area of the Chao Phraya

Fig. 2 A map and a chart showing the distribution of plant height of rice in the deltaic area of the Chao Phraya

Fig. 3 Cross Section AB—Evolution of Land and Water Use

Thank you very much.
References


Iamtom, P. 2010: Landscape Changes in Bangyai From 1949 A.D. To Present (2010), a Master Thesis in Landscape Architecture, Department of Landscape Architecture, Faculty of Architecture, Chulalongkorn University, Bangkok, Thailand.


Pictures/Maps Credits


Bangkok ASTER VNIR image: The acquisition of ASTER data was supported by a research project, ‘Investigation of Rapid Urbanization Processes Using ASTER, MODIS, and Landsat Data’, by Dr Philip Christensen, Principal Investigator, NASA Grant number: EOS/03-0000-0502.

Slide 9, Terdsak tachakitkachorn and Siriwat Sarakhet

Slide 17, The triptych of maps from 1935, 55 and 75, adapted from Sternstein 1982.

Slide 20,29,30 Ying Palopakon

Slide 24-25 Panu Iamtom

Slide 31 Suebsiri Srithanyarat

Slide 34-35 Geo-Informatics and Space Technology Development Agency, Thailand