

# **URBAN TOWER GARDEN**

**the  
evolution  
of an  
urban  
structure**

Master of Landscape Architecture  
**practicum**

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**"Urban Tower Garden: The Evolution of an Urban Structure"**

**BY**

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'A fundamental consequence of urban growth is the increasing alienation between mankind and the natural world.'<sup>1</sup>

## **preface:**

Urban landscape fabric is a complex weave of objects and spaces; solids and voids. The individual elements that collectively form the strands of physical structure are diverse and unique – and the relationships between these elements are dynamic. Urban space is in a constant state of flux<sup>2</sup> as we change our cities to accommodate our specific demands. The design of urban landscape structure must also be dynamic. It must change as the city changes, or risk becoming detrimental to urban function and subsequently derelict. There is a delicate balance that maintains the utility and meaning of a landscape.

The methods that are utilized in the forming of cities consume resources and produce waste in quantities that change entire ecosystems<sup>3</sup>. As cities develop, expand and intensify the structure and function of the natural environment changes dramatically. The physical and biological pressures that are applied to regional environments in the form of urban development<sup>4</sup> have definite effects.

The global population has become a society of waste; wasting resources and space in a manner that defies the logic that distinguishes humans from many other species. The understanding and ability to change the environment has led to a global tendency to discard rather than repair. The evolution<sup>5</sup> of western cities has been witness to a paradoxical shift towards the simultaneous decentralization of urban form and function, and the re-centralization of commercial and residential development through the conglomeration of 'megastores' in suburban landscapes. City centers are abandoned for suburbia while intensifying new commercial districts and sprawling residential communities. This practice is becoming a pattern followed around the globe.

The manipulation of the landscape<sup>6</sup> form and function in any manner or scale can be considered the process of architecture; the manifestation of spatial demand and supply is a product of architecture. The provision of structure through architecture allows the city to function. Landscape architecture can perform a critical role in the evolution of the city structure with respect to the relationship between biotic

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<sup>1</sup> Goode, 'A Green Renaissance', *Green Cities*, p.2

<sup>2</sup> flux: definition of terms, p.54

<sup>3</sup> ecosystem: *ibid*, p.54

<sup>4</sup> development: *ibid*, p.52

<sup>5</sup> evolution: *ibid*, p.54

<sup>6</sup> landscape: *ibid*, p.54

organisms and abiotic<sup>7</sup> elements. The role of landscape architecture specifically is the mediation of human systems with environmental systems where the routine of civic activity produces an alternative form and function in the existing landscape. It is through the application of landscape architecture that urban structure may develop a symbiotic<sup>8</sup> relationship with the environment within which it exists.

Urban form can be viewed as a complex organism that develops from the synthesis of social programs and agendas, and the physical demands of the collective residents. The sensitivity and responsiveness to existing environmental conditions, and the effects of human intervention, is where landscape architecture maintains an interest and responsibility.

The environmental conditions of most urban centers are in a precarious state.<sup>9</sup> We must continually invent and engineer mechanisms to supplement the resources available in the urban environment. Within many cities, increasing amounts of materials and energy travel through a static infrastructure and inflexible space that is incapable of accommodating the changing demands. The situations that exist within cities have been generated from the pressures of socio-economic development, where the ecological consequences have arisen from a lack of public foresight. A 'new' urban landscape typology and methodology must emerge – or rather evolve – from the existing fabric of contemporary urban space.

This practicum is a manifestation of a concept of urban evolution; a metaphor of the lifecycle<sup>10</sup> of a city. It was inspired by the urgency of the need to recognize the unsustainable processes and functions of contemporary urban life and change the manner in which people live. The efficiency of the use of urban space is in question and concepts of density and utility are explored. In the development of urban space it is the association of individual structures that creates the definitive character of the space. The lifecycle of the individual structure has definite affects upon the evolution of the space within which it exists.

The evolution of the urban structure occurs through the application of thematic layers and physical form. Urban sustainability, urban habitat, building lifecycles, urban agriculture, vertical landscape structure, derelict landscape reclamation, and commercialism in landscape form provide the platforms from which the design of the structure evolves. The platforms create layers of structure and function in the landscape that determine the pattern of evolution.

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<sup>7</sup> abiotic: definition of terms, p.51

<sup>8</sup> symbiosis: ibid, p.55

<sup>9</sup> Brown, *State of the World*

<sup>10</sup> lifecycle: definition of terms, p.54

This practicum is not a prescriptive model<sup>11</sup> for urban design solutions. It is a specific solution for a specific context; a unique place in a particular time. The project site is an anomaly in the urban center of Kuala Lumpur, Malaysia. The intentions are to illustrate potential forms and functions of urban structures to provide opportunity for intensive development in both landscapes and buildings simultaneously. Landscapes and buildings must not be perceived, or designed, as separate, adjacent spaces, but rather as juxtaposed spaces that provide definition and context to their surroundings. Landscape and building form contribute to the pattern within which they exist. The design of objects alone is not the utility of architecture; it is the space created by the objects that people use. The connections<sup>12</sup> between landscape and building do not require rigid definition. The transitions between interior and exterior space may become ambiguous and fluid. Landscape and building spaces do not exist as in the past – the flexibility and elasticity of space can provide for multiple functions and forms to occur simultaneously. The demands placed upon spaces become more complex and inherently problematic as the structure and function of the city evolves.

Alternative solutions to the problems of current urban development are essential to the vitality and sustainability of a city – as new and more complex problems develop continuously. No perfect solution to urban problems exists, only divergence from the effects. Typical solutions to urban space forming may no longer be relevant in contemporary cities. Social relationships and individual demands are continually changing. People want buildings and spaces to accommodate immediate function and imminent change. The existing stock of urban structure, which in the recent past did not exist in most cities, is vast and the opportunities for re-utilization and reformation are virtually unlimited. The space within the bounds of walls and the respective surfaces of walls and roofs is a part of the urban landscape, and provides an incredible volume for urban landscape growth. A landscape can occur at any scale. There is no space too small for organisms to live within; there is only the accommodation of the other inhabitants.

The simplification of a landscape into a rigid, inflexible form with a linear function<sup>13</sup> is problematic – as the process of landscape evolution is somewhat chaotic<sup>14</sup>. While environmental processes may allow humans to predict the evolution of a system, unknown variables can easily alter a pattern. Landscapes that have a

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<sup>11</sup> model: definition of terms, p.54

<sup>12</sup> connectivity: ibid, p.52

<sup>13</sup> A linear function can be understood as a prescribed and predicted function with definite stages of development.

<sup>14</sup> A chaotic process is one that involves a web of interrelated actions and reactions without definite stages of development.

singular structure and perform a singular function within an ecosystem are useful in their own right for the production of resources or the provision of a specific habitat or amenity. However, a landscape with a complex, multivalent structure and function produces a significantly different space with a potentially greater depth of utility. The juxtaposition of leisure activity, or amenity, and resource production, for example, develops new perceptual and experiential connections between humans and the environment within which they exist. The composite of landscape and social functions within a single structure can evoke a deeper meaning to the individual user of the space, making the experience of the space of greater significance.

'It is ironic that humankind's habitat – our cities – is the major destroyer of the ecosystem and the greatest threat to humankind's survival on the planet.'<sup>15</sup>

## introduction:

Evolution: a cumulative genetic change in a population of organisms related by descent, over time. It is typically the result of natural selection but can also be due to random genetic drift. Evolution has no determined endpoint.<sup>16</sup>

The urban landscape is a dynamic phenomenon that continuously evolves. The entire change of a landscape is the product of interacting natural processes and orchestrated actions by humans. The cause, or reasoning, of change is the reorganization of the existing structures to optimize their functioning in the future. The changes are recognized and evaluated by people as improvement or deterioration of the previous or existing condition. The conclusion, however, is predominantly founded by a particular opinion of utility or in relation to achieving a particular objective or condition.<sup>17</sup>

The human species, in the same manner as any other, has a method by which it exists. The human organism has a life cycle; and the individual human has a specific life 'style'. And, as do many other species, humans live in communities<sup>18</sup>. The community is essentially a social structure. The success and evolution of the human species has produced the organization and collection of individuals into physical communities that occupy specific spaces that we recognize as villages, towns, and other settlement types. Global populations inhabit urban communities in larger proportions than in the past. These massive urban communities are cities and will be the focus of the following discussion.

The cities we inhabit have evolved into structures of staggering proportions and populations. As the technologies for resource production and social organization developed, the population of cities began to climb exponentially. 'The first city of one million people was Peking in about 1800. By 1900, there were 16 cities with over one million people, and by 1980 the number of such cities had risen to 235. By 2025 there will be (predicted) 135 cities with over 4 million, which will represent over 25% of the world population (including cities with 20-30 million).'<sup>19</sup>

As enormous as many contemporary cities may be, their stability remains uncertain from many perspectives. Changes in environmental conditions, such as air, water and soil quality, can occur that create living situations that are difficult to endure for

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<sup>15</sup> Rogers, *Cities for a Small Planet*, p.4

<sup>16</sup> Dunster and Dunster, *Dictionary of Natural Resource Management*

<sup>17</sup> Antrop, 'Landscape change: plan or chaos?', *Landscape and Urban Planning*, p.155

<sup>18</sup> community: definition of terms, p.52

<sup>19</sup> Goode, 'A Green Renaissance', *Green Cities*, p.2

all biotic organisms. 'Cities are fragile creations balanced on the earth's crust, exposed to the slow but inexorable pace of erosion and sedimentation, vulnerable to every tremor of the violent forces beneath, and dependent upon dwindling mineral resources.'<sup>20</sup> The creation and evolution of cities forms an extraordinary impression upon a landscape; cities can evolve into any form imaginable, and not necessarily in a manner that responds to form and function of the existing environment.

Cities are complex systems. The organization of human settlement has evolved throughout time, beginning with a simple association of familial groups and developing into a broad range of civic structures with expanding populations and increasing densities. 'Natural processes seem no longer relevant to a society dependent on the technology fix. Yet one only has to scratch the surface to reveal how distorted is the ecology and economy of most western cities. Daily functions depend almost entirely on import of energy and raw materials and export of wastes outside the city limits.'<sup>21</sup> The inevitability of the evolution of the city, as well as the species, must be realized and embraced. It is not the fact that the global environment is changing over time that should concern us, but rather the direction of the change and how we might effect the change in a sensitive manner, so as to ensure the sustainability of the planet. Urban landscape structure can adopt ecologically responsive principles that can in turn induce a widespread change of urban habits<sup>22</sup>.

Locally influenced development of community structure and function might provide more energy efficient urban systems, rather than economically driven global systems. Some aspects of existing global systems are parasitic, influenced by the wealthy commercial corporations for the perpetuation of the benefits produced for these organizations. Locally influenced systems are potentially more responsive to the context of a specific place than global systems and can respond to environmental conditions in a more sensitive manner with respect to context and scale. The stability of a local system, at any scale, provides stability for the regional system within which it exists.

The stability of local ecosystems is a necessary goal for global environmental rejuvenation. The ecosystems must be balanced on an individual level. 'An ecosystem is more than the sum of its parts. The components of an ecosystem, the energy and physical materials, flow in cycles through the urban ecosystem, linking

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<sup>20</sup> Spirn, *The Granite Garden*, p.91

<sup>21</sup> Goode, 'A Green Renaissance', *Green Cities*, p.2

<sup>22</sup> habit: definition of terms, p.54

air, land, water, and living organisms in a vast network.<sup>23</sup> The interaction, and effects of the interactions, of the various individual components of a given ecosystem, whether biotic or abiotic, are tangible and significant. The disruption or interference of the interactions has the potential to lead to the extinction of other components. The extinction of one species, or the removal of one element from a system, can induce a condition unsuitable for many other species to inhabit.

Cities are unique ecosystems. Irrespective of the specific context in which a city develops, the effective cumulative change or impact on the surrounding environment occurs without regional specificity. Cities are similar in the fact that all of the interactions between human activities and the natural environment produce an ecosystem very different from the one that existed prior to the city.<sup>24</sup> The city is not an ecosystem void of life. The place is simply changed; the patterns have changed, the processes have changed. A new place has emerged.

Buildings and landscapes in the urban setting can be realized as 'mini' ecosystems. The pipes and wires and corridors that link every building to the city's water supply, utilities, and sewage system act in the same manner as the water and nutrient cycling system of a plant and animal system. Every building and space in the urban landscape contributes to the character and structure of a local system and is influenced by that system in turn.<sup>25</sup> Demolishing a building or clearing a lot in a city changes the structure and function – as a void is produced – acting as both a barrier and linkage depending upon the species, element, or condition discussed. To remove a component of a building structure such as a column or wire would cause specific functions to fail; to remove an individual plant from a system has a similar effect, where the operation of the system changes – the scale of the disturbance is the crucial aspect to observe.

Urban environments create an ecological challenge. The challenge is the sustenance of an enormous, dense and growing population with specific limitations. The limits are the energy and material resources available to the population within the surrounding environment. The relationship between the 'natural' world and the 'built' world is complex. The interaction of human activities with other ecosystem functions has become less symbiotic through time, as the human species consumes the reserve of global resources. The urban landscape has always been regarded as an exception as though ecology and ecosystems describe the environment beyond the boundaries of urban areas. Excuses of spatial constraints and conditions created by population density are given, where

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<sup>23</sup> Spirn, *The Granite Garden*, p.243

<sup>24</sup> *ibid*, p.13

<sup>25</sup> *ibid*, p.246

environmental responsibility has become a difficult endeavor. 'There has been an overwhelming propensity to focus on the problems of the larger environment while ignoring the one where most of us live.'<sup>26</sup> Cities have developed into ecological parasites – feeding from the available adjacent resources – continually expanding the territory of dependence, and contributing no benefit to the ecosystem in return. Cities must become symbiotic partners with the adjacent ecosystems. Landscape corridors need to be developed to facilitate the relationship between cities and their environs. It is through the connectivity<sup>27</sup> of individual landscape systems that interdependence and mutual benefit can occur.

Arguments may be formed against the feasibility of ecological corridors and environmental 'responsibility' within cities. Who will pay for the preservation, creation, or maintenance of urban green space? Developed properties generate tax revenue for the city, while public green space requires public funding. Within the existing parameters of typical urban development, in order to increase the quality of urban space additional public and private sector funding must occur.

The present economic situation in Malaysia, a developing country in southeast Asia, is unstable. The nation is recovering from the dramatic low point of a dynamic 'boom and bust' typical of the region. Reductions in available economic resources have become commonplace; providing more for less is the standard demand placed on public and private organizations. Urban development, however, does not necessarily require that a single organization be entirely responsible for a given project. The collective association of public and private organizations has the potential of confronting the economic problem of urban development through mutually beneficial investment. The integrity of the public realm is uncertain.

Questions of scale are continually raised as to whether an urban context can actually support any plant and animal populations of a significant proportion. Cities do not prevent many species from inhabiting their spaces, but there are many inhabitable characteristics that prevent species from surviving. Although many of the small fragments of urban landscape<sup>28</sup> that may be found in any city do not fulfil spatial requirements of a typical biotic system, the existence of any biotic material may be seen as a type of system. The individual unit has a role within the collective. Where the situation exists in an urban environment that does not provide opportunity for expansive areas of green space, networks of small spaces must be formulated to accomplish similar goals.

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<sup>26</sup> Hough, 'Formed by Natural Process – A Definition of the Green City', *Green Cities*, p.15

<sup>27</sup> connectivity: definition of terms, p.52

<sup>28</sup> The urban landscape includes all fragments of space; it is all the space in between the buildings.

Too often when the 'environment' and ecology are discussed, the distinction between people and the remainder of the natural world is clearly made. It seems that we find people in a state of continual conflict with 'nature', where our apparent or perceived needs, which in many situations are actually desires and demands, produce devastating effects on the ecological condition of the environment or ourselves. Humans provide themselves comfort through technologies. If the technology to satisfy a demand does not exist, then it is conceived and constructed.

Urban development tends to be concerned with demands of the recent past, the changing present, and the immediate future with respect to the human population. It is the provision of a structure upon demand. But, the development of cities has been more concerned with accommodating the demands of people than considering the effects upon the surrounding environment; the other abiotic elements of the ecosystems. Urban landscape development can accommodate the holistic<sup>29</sup> demands of an ecosystem without negatively affecting the potential for future development. It does not need to predict the distant future, but it has the potential to realize the uncertainty of the future demands.

Urban landscape and building structure can, and will, change over time. As physical objects occupying a given space, buildings and landscape structures are subject to the various environmental conditions relative to the specific global context within which they are found. While most structures can endure 'normal' environmental conditions for extended periods, it is the decisions of humans to demolish buildings and landscape structures that are the greatest threat that urban fabric tends to face. The evolution of urban form and function does not necessarily mean the degradation of the physical condition – it simply means change.

Proactive landscape architecture has the ability to react to environmental change and sustain utility. Environments can be designed to assume that physical and social conditions will change through time, and to modify the structure and function to accommodate change. The essential character trait for a proactive architecture will be the regional specification of theory and concept. The abandonment of globalization is not the answer, however, as the connectivity of the global community is essential for the balance of the human species. It is the local applicability and environmental sensitivity that will produce appropriate design solutions.

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<sup>29</sup> holism: definition of terms, p.54

## context: Malaysia

Malaysia has an ancient forest – Taman Negara (National Park) – which has been deemed the oldest rainforest on the planet, not being affected by the last ice-age. Taman Negara as an ecosystem is a carefully protected landscape that has very little interference from human activities.

'This is the forest primeval. The dappled splotches of sun and shade filtering through the leafy canopy 200 feet above wash over a rain forest that has been here since before humans appeared on earth. Beneath the tall and perfectly vertical trunks of the great tualong and merbau trees flourishes a dense world of palm fronds and rattan, ferns and figs and mosses, climbers, creepers, and suckers – so many different types of plant life that you can find hundreds, even a thousand, different species in a single acre in the heart of Malaysia. It is a world in such careful balance that the mix of vegetation in these undisturbed jungle tracts has been essentially the same, according to fossil records, for millions and millions of years.'<sup>30</sup>

Developing countries in southeast Asia have had a dramatic economic and social progression manifest in large-scale urban and rural construction. However, the nations remain relatively poor, with limiting capital, unbalanced development and unstable growth patterns.<sup>31</sup>

The geography, including the dramatic topography, of the country significantly influences the development of the urban pattern. The Malay peninsular extends 740 km from Thailand in the north to the Straits of Johor in the south to Singapore. A mountain range creates a spine known as the Main Range, or Barisan Titiwangsa, runs from the Thai border southwards to Negri Sembilan, effectively separating the eastern region of the peninsular from the western region. The country (including Sabah and Sarawak, the two states on the island of Borneo) has a total area of approximately 330,433 sq. km of which about four-fifths are covered by tropical rainforest.<sup>32</sup> The urbanization of the Malaysian peninsula has been concentrated in two main areas: Kuala Lumpur, the largest city and capital, and Johor Bahru, on the southern edge of the peninsula on the border of Singapore.<sup>33</sup>

It can be recognized that lingering fragments of Modernist architecture and the International Style have been indiscriminately used to create a universally applied architecture throughout urban centers of the developing world. 'There is now a search in the architecture of these countries for cultural continuity – a quest for identity, which has been described as an integrative process and not a diversive

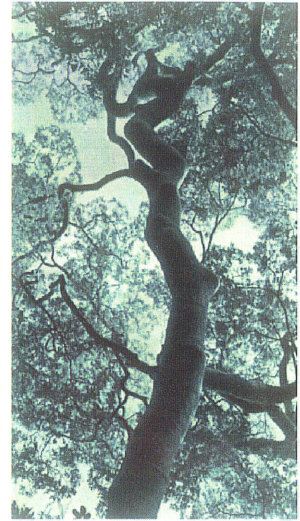


figure 1: forest canopy -  
Taman Negara



figure 2: jungle trail -  
Tioman Island

<sup>30</sup> Reid, 'Malaysia: Rising Star', *National Geographic*, p.104

<sup>31</sup> Liangyong, 'Towards a Theory of Regional Reality', *Habitat International*, p.3

<sup>32</sup> Yoong, *Post-Merdeka Architecture*, p.13-14

<sup>33</sup> Smith, 'Asia: developing planned communities', *Urban Land*, p.22

one.<sup>34</sup> In the creation of a sense of place, the peoples of southeast Asia can recognize their distinct character, understand the place within which they live, and find an architecture that accommodates their needs. If not, then the characteristics of their culture and place may evolve in a direction that no longer accommodates their individual demands. The evolution of a culture and place is the determination of the people; it is an expression of freedom and choice.

### **southeast Asian cities:** patterns of urban development

'In 1975, 22 percent of the region's (southeast Asia) population was in urban areas; by 2000, it will have increased to over 37 percent; and by 2025 will exceed 55 percent (UN, 1995).'<sup>35</sup>

The development of the cities of southeast Asia began with colonization of one manner or another. Unlike the populations of northern and western Asia, the peoples of the southeast had not evolved into the structures we recognize as cities. The opportunity to develop cities in this region, and benefit from their development, was realized by the various colonists and the emergence of cities soon followed.

After the Second World War, the determination to de-colonize allowed cities to become porous to rural-urban migration. 'In the 1950s and 1960s, evidence of urban breakdown marked by the overloading of infrastructure, congestion, overcrowding, poverty and pollution appeared overwhelming. By the 1960s, southeast Asian cities had come to look like other Third World cities and to be regarded as a distinct urban category.'<sup>36</sup> Southeast Asian cities provided the infrastructure for the nations to develop at an international scale. The rapid succession of Singapore from Malaysia forced Kuala Lumpur to develop as a capital in a similarly rapid manner.

During the 1960s, attention was drawn towards the explosive population growth of southeast Asian cities. The focus was placed upon the patterns of rural-urban migration. The concept of 'parasitic cities' developed when urban centers began to demand incredible quantities of resources from the surrounding environment.

The 1980s witnessed a change in the structure of the city pattern. In the extended metropolitan area, development began to move beyond the recognized urban boundaries, especially along the main transportation routes. It was no longer



figure 3: automobile overpass - Singapore

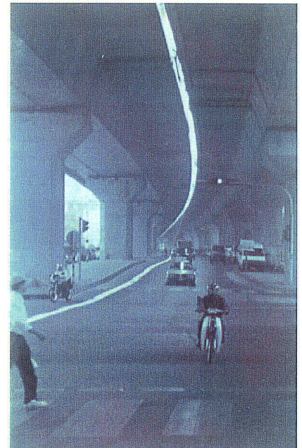


figure 4: automobile overpass - Bangkok

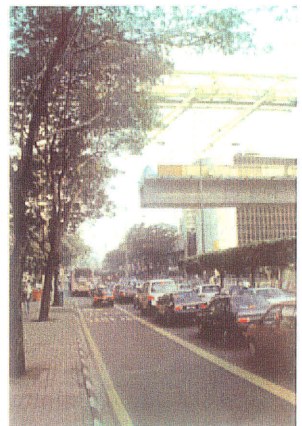


figure 5: LRT overpass - Kuala Lumpur

<sup>34</sup> Powell, Ken Yeang: *Rethinking the Environmental Filter*, p.9-10

<sup>35</sup> Dick and Rimmer, 'Beyond the Third World City: The New Urban Geography of southeast Asia', *Urban Studies*, p.2303

<sup>36</sup> *ibid*, p.2308

'functional' to bring labor into the city. It became more efficient to relocate the work into rural areas so as to avoid social overhead costs as the swollen cities overload their modest infrastructure. And throughout the 1980s, the attention had moved to emerging 'global cities' which were the manifestation of the international division of labor, the internationalization of finance and the global network strategies of multinational corporations. Isolation and independence of nations was disappearing.

The innovation of the 1980s was the realization by the economic powers of southeast Asia that increased profitability would flow from clustering interdependent facilities into massive integrated complexes. These complexes comprise hotels, restaurants, shopping malls and office towers.<sup>37</sup> A new building and planning typology had emerged. The scale of building in the cities had paralleled that of the developed western nations.

At the beginning of the 1990s, the effects of these global forces on local cultural identity, social structure, and urban form in southeast Asia were realized. The cultural boundaries that existed between the east and the west had ceased to be obstacles, and globalization was no longer a concept, but a reality. The cities of southeast Asia had begun to mimic those of developed western nations. The internationalization of urban form was beneficial to the development of global markets – and a detriment to regional evolution.

Kuala Lumpur, Singapore, Bangkok and Jakarta are all relatively 'new' cities from a global perspective. And of all of the cities in the region, Singapore is the only Asian city which has strictly planned and implemented its various masterplans that govern civic development. 'The city-state of Singapore, which is 100 percent urbanized, represents the zenith of government-controlled planning and development in the region.'<sup>38</sup> It is uniquely devoid of a 'rural' or non-urban region surrounding the city.

The ideological framework of its plans is significantly based on various Western planning theories and practices. These include the use of zoning, height and plot-ratio control, and the building hierarchy from the central downtown core to new towns and community centers. Singapore has an efficient transportation system and a 'clean-green image' that have won international acclaim. However, the city-nation is perceived by many residents and visitors as being over-regulated by the government.<sup>39</sup> Singapore utilized western cities as examples to develop an urban

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<sup>37</sup> Dick and Rimmer, 'Beyond the Third World City', *Urban Studies*, p.2309-2312

<sup>38</sup> Smith, 'Asia: developing planned communities', *Urban Land*, p.22

<sup>39</sup> Lim and Beng, *The New Asian Architecture: Vernacular Traditions and Contemporary Style*, p.16

structure and function that are strictly engineered. It is a rigid and comprehensive system that removes the possibility of chaotic influence – even at the scale of individual properties. The opportunities for the unexpected are less evident, and the casual or temporary appropriation of space is simply not permitted.

Bangkok, the capital of Thailand, another immediate neighbor of Malaysia, experiences the problems of contemporary urban growth significantly more than Kuala Lumpur. Approximately ten times the population size of Kuala Lumpur, Bangkok has transformed itself within three decades from a composed city of winding canals to one which is polluted, hard and unforgiving. While it was never actually colonized, Bangkok has been developing to accommodate the demands of a western infrastructure system. The city has been built up with massive structures and congested by automobile traffic.<sup>40</sup> In essence, Bangkok has been colonized in an indirect manner.

Comparable to Venice, Italy with its system of canals and lack of 'green' spaces, Bangkok has developed many ecological afflictions. Unlike Venice, however, Bangkok has introduced the automobile that has changed the physical structure and function of the city. A lack of emissions regulations and an enormous population utilizing petroleum-fueled vehicles has significantly impacted the environmental quality of the city. There no longer exists a blue sky above the city.

Kuala Lumpur, which lies between Bangkok to the north and Singapore to the south, in many ways may be perceived literally as a city of mediation. In Kuala Lumpur there exist many attributes of both its northern and southern counterparts including the problems of pollution and poor physical planning, and the benefits of an emerging global position. Kuala Lumpur can learn from the opposite growth patterns of Bangkok and Singapore and develop a civic structure that has the flexibility to remain in balance; exist as its own place and not follow the paths already taken.

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<sup>40</sup> Ngiom, 'Kuala Lumpur: An Asian City of Change', *Architecture Malaysia*, p.13

## Kuala Lumpur:

### global position:

latitude: 3°07'n

longitude: 101°42'e

elevation: 38.000m<sup>41</sup>

### temperature:

mean: 27°C

high: 36°C

low: 19°C

### precipitation:

annual: 2499mm

monthly range: 117-289mm

### days precipitation:

annual: 163

monthly range: 9-19

### sunshine (daily):

mean: 50%

monthly range: 41%-62%

### relative humidity (mean):

0700 hrs: 96.5%

1300 hrs: 62%<sup>42</sup>



figure 6: context



figure 7: Kuala Lumpur

figure 8: K.L. 1997



Kuala Lumpur (K.L.), as a settlement, came into existence as a Chinese tin trading post around 1860. The settlement was established at the junction of the Klang and Gombak rivers. As Kuala Lumpur evolved within the Klang River Valley, it attracted a portion of the population away from Klang, the port-town located approximately 45 minutes to the west via the automobile.<sup>43</sup>

By 1987, Kuala Lumpur had expanded its boundaries to cover 96 square miles and had a population of nearly one million. An Asian city that has experienced successive periods of intense and hyperactive growth, K.L. is now facing another period of economic recession. In the past five years after apparently recovering

<sup>41</sup> Ulack, *Atlas of southeast Asia*

<sup>42</sup> Rudloff, *Climates of the World*

from the previous recession, the core of the city has evolved into a cosmopolitan realm of concrete, steel, and glass. The tremendous growth of the urban center, along with the constituent residential and commercial areas, has devastated the existing ecological conditions of the valley.

Urban areas contain over one-third of the nation's population of over 25 million. The precise population figures are unknown as the number of illegal immigrant workers living within the country are estimated to exceed one million, with the majority living in and around urban centers. The immigration to the capital city of rural farm laborers seeking a higher standard of living has produced an increase in population for which the government has not been able to provide satisfactory housing and infrastructure. The result has been the development of squatter settlements not unlike those of other developing nations.

**architectural typology:** the composition of city fabric

The majority of the older commercial buildings in the cities and towns in Malaysia generate their characteristic appearance from the common verandahed shop-houses. The solid form of the commercial structures wind along both sides of the streets like the banks of the rivers. The buildings are two stories with the ground floor for commercial use and the upper floor for residential use. Elongated narrow shop-houses completely cover the entire building site. The standard width of the early shop-houses is approximately 13 to 20 feet with a depth at least 2 to 3 times their width. The front space of the ground floor is designated by law as a public walkway with a minimum 5-foot depth, and is generally referred to as the 'five-foot-way' or 'pavement'. The uniform appearance of the commercial districts in Kuala Lumpur is due to these pedestrian corridors with the regularly spaced columns and upper floors with repetitive window patterns.<sup>44</sup>

The conflicts of urban evolution and cultural<sup>45</sup> traditions are physically evident in the patterns of the city. Contemporary K.L. contains a large collection of internationalist high-rises and post-modern skyscrapers. Malay roof forms have been superimposed to the predominantly modernist building types in an attempt to introduce Islamic elements in key government buildings.<sup>46</sup>

'Kuala Lumpur typifies the emergence of the new Asian Cities, with its urban morphology determined largely by economics alone. K.L. is becoming a city which

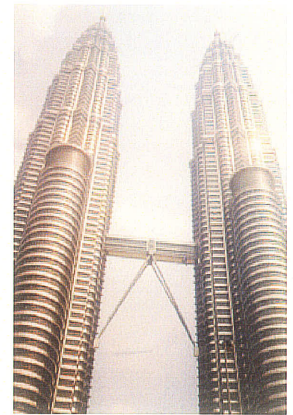


figure 9: Petronas Towers - Kuala Lumpur



figure 10: commercial building - Kuala Lumpur



figure 11: Malay residence

<sup>43</sup> Yoong, *Post-Merdeka Architecture*, p.15

<sup>44</sup> Yoong, *Post-Merdeka Architecture*, p.17-18

<sup>45</sup> culture: definition of terms, p.52

<sup>46</sup> Yoong, p.18

allows the market forces to determine the built forms with the domination of corporatism over humanism, built largely on private patronage. . . The difference between Kuala Lumpur and the post industrial revolution new cities lay at the micro level where mechanistic urban planning, although attempted several times through the Structure Plan (1985), has not worked at all in Kuala Lumpur - none of the policies have been implemented.' <sup>47</sup>

The city, which Yoong (1988) suggests as a metaphor of the Malaysian future, remains focused on the development of high-rise structures with a few heroic movements towards a tropical regionalist ideal<sup>48</sup>. The city has begun to evolve without concern for the physical and social context within which it exists. It has grown and developed into a city that no longer relates to the person in the street.<sup>49</sup>

### **the indigenous Malay house: deriving form through function**

The traditional Malay house is typically built in stages over a period of time. The building system is based on a temporary structure that can be constructed at one time only to be replaced at a later time. The central core of the main structure is constructed, and the addition of other spaces occurs over a period of years. The range of house types in any given village is the result of the individual buildings in various stages of development.<sup>50</sup> There is not necessarily a final vision of the house; rather the spaces are added to the structure as needed and afforded by time. As the family structure changes over time with additions so too does the building. The structure evolves through the necessity of space and the availability of adjacent resources.

'The construction method of the Malay house is derived from the need to build in stages. Any additions can be attached without interference to the existing structure, and can be dismantled without causing any damage.'<sup>51</sup> The realization that built structures must evolve with the demands of the residents informs the methodology of building development. The building materials are resources found within the immediate surroundings. The Malay understand the limits of the physical resources of the surrounding environment, and the resources are not wasted.

The environment influences the development of the cultural and social life of the traditional kampong, the Malay village. The indigenous Malay culture has a respect

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<sup>47</sup> Ngjom, 'Kuala Lumpur: An Asian City of Change', *Architecture Malaysia*, p.10

<sup>48</sup> A tropical regionalist ideal strives for a specific regional architecture appropriate to the context of southeast Asia.

<sup>49</sup> Yoong, *Post-Merdeka Architecture*, p.28

<sup>50</sup> Gibbs, *Building the Malay House*, p.2

<sup>51</sup> *ibid*, p.33

for the environment based upon spiritual beliefs. There is a balance between each house and the surrounding vegetation – coconut trees, fruit trees, grasses and vegetables. The plant material that exists within the bounds of the village is essential to the Malay lifestyle, and it is this dependence that brings their culture close to nature.<sup>52</sup> There is a symbiotic relationship between the elements of the Malay village. The village does not simply use the resources from the surrounding environment, it recycles and regenerates them in a sustainable manner. The utility of all things is realized. The energy and nutrients are cycled within a relatively small system where there is no waste – only resource.

It is with this premise of efficient utility and waste minimization that all development in Kuala Lumpur should be designed. The western city structure does not necessarily apply to the people of K.L. with respect to form and function. It has become a city from the perspective of the developed world, but remains a village in the eyes of many of its people. The urban landscape should reflect the place.

**the people:** dynamic variables in urban evolution

The population of the Kuala Lumpur city region has been a relatively uncertain quantity, especially over the past five years. During the economic boom of the 1990s, before the devastating collapse of the Malaysian economy in 1997, the immigration into the city was overwhelming and largely unknown. While many of the citizens had moved from rural areas and smaller towns, and another group of foreign professionals and skilled workers arrived, there was an enormous population of illegal immigrant workers from Indonesia, Bangladesh, and India predominantly. Casual estimates illustrated in the city newspapers suggested that the number of illegal ‘aliens’ in the country was as much as ¾ million – with 200 thousand within the city of Kuala Lumpur. The massive population of unaccounted residents applied tremendous pressures upon the existing resources and infrastructure of the city that was insufficient to accommodate the growth. The supersaturated K.L. developed problems associated with the overcrowding of many third world cities such as air, water and land pollution, intense traffic congestion, increased density of urban housing, and a declining number of trees and green spaces.

The Malaysian population is culturally diverse<sup>53</sup> collection of people, comprising approximately 60% Indigenous Malay, 30% Chinese, 8% Indian, and remaining 2% a mixture of Eastern and Western peoples. The cosmopolitan population of the

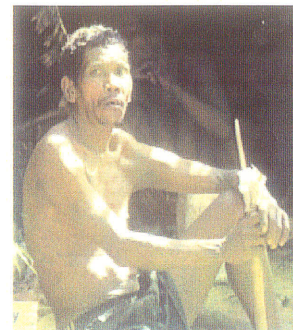


figure 12: Orang asli - Taman Negara



figure 13: Hindu women - Thaipusam

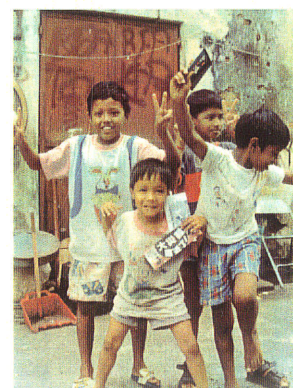


figure 14: children - Penang



figure 15: family transport - Kuala Lumpur

<sup>52</sup> Gibbs, *Building the Malay House*, p.13

<sup>53</sup> diversity: definition of terms, p.53

capital city, Kuala Lumpur, however, has a more balanced diversity, where the proportions of Malay, Chinese, and Indian cultures are less disparate.

The dominant religions in K.L., and Malaysia, are Islamism, which is practiced by the Indigenous Malay and a portion of the Indian population. Islamism is also the religion that controls the government system; Buddhism, which is practised by a portion of the Chinese population; Hindu, which is the religion of the majority of the Indian population; and Christian, which is practised by a portion of the Chinese and most of the Western peoples. Cultural celebrations and religious events are strongly expressed within the contemporary context of Kuala Lumpur through individual and corporate expression. Through the juxtaposition of the distinct cultures a unique cultural pattern has emerged. Kuala Lumpur is distinguishable from other Southeast Asian cities due in part to its heterogeneity, where the blend of cultures creates the balance.

### **the finding of place in the city:** developing meaning in urban space

Urban development has been an indication of 'progress' and economic strength of cities in the contemporary global context, and K.L. has not diverged from the trend. The clearing and flattening of a site has been a sign that a new structure was soon to be erected; the removal of a line of trees has marked the coming of a transportation corridor project. The city continues to grow into the typologically modern urban center that K.L. is today. While the buildings generally do not at first appear to be indigenous in character, there are elements of each of the respective cultural groups found in many of the built forms and facades. The design and planning of the individual buildings within the city express the character of the people who inhabit this place, and the articulation of the building components reflect the heritage of the cultural traditions as well as the aspirations of the future.

There is an underlying conflict within the structure and components that collectively form the city, however, as the effects of the globalization process continues to influence the development of cities around the planet. In the wake of the economic and subsequent developmental recession, K.L. has an opportunity to rediscover the notion of place, where the city may function within the global system, while creating and maintaining a distinct character that only this particular place, and its specific conditions could produce.

'Technical gadgetry, electronic signboards, ephemeral spaces, light and sound, made possible by the spread of the microchips now make up the new Kuala Lumpur urban environment, with ephemerality expanded by the new form of



figure 16: street market - Penang



figure 17: covered market - Hadyai



figure 18: night market - Kuala Lumpur



figure 19: commercial building - Kuala Lumpur

leisure.’<sup>54</sup> There is a curiosity for new experiences in all cultures. In contemporary K.L. the electronic technologies attract people into experiencing virtual ‘places’. Technology and induced demand promote the conditioning of internal spaces creating new urban ‘square’ typologies that exist within closed structures without the need to contend with the uncertainty or discomfort of weather. The social and cultural structure of the city is gradually moving from the exterior environment to interior spaces. Street markets and independent vendors are conglomerated into ‘efficient’ commercial centers. The air-conditioning of interior spaces has also dramatically changed the use of urban space. It is this dependence upon mechanical systems for environmental control and spatial quality that creates a demand for energy in quantities not previously required.

‘Change is also a condition of life in the in-between places and the in-between times. In the twilight hours, parts of the city which are open car parks in the day are turned into night markets, with the air filled with blaring music and the aroma of cooked food lit by temporary poles and powered by portable diesel generators.’<sup>55</sup> And before midnight, the temporary installations are dismantled and removed, leaving behind litter and cardboard boxes as the only trace of the life which had happened in the previous evening and which would reoccur again in the following day. The temporary, spontaneous, and somewhat transient activities of the street vendors are essential attributes of the character of the city. It is this character that is being decidedly changed by new initiatives inspired by the policies of Singapore. The intrinsic qualities of the life that exists in the streets of Kuala Lumpur are being unwound by globalization.

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<sup>54</sup> Ngiom, ‘Kuala Lumpur: An Asian City of Change’, *Architecture Malaysia*, p.11

<sup>55</sup> *ibid*, p.12

## the urban tower garden: instigating the evolution of a building

The types of structures and functions that might exist within the urban fabric to benefit the health and vitality of the citizens of K.L. are questioned in this project – and potential solutions must be explored for the potential of urban form to be realized.

What types of structures and functions ‘currently’ exist within the city form; what conditions are present – and what processes created these specific conditions? The conditions of a given site, including the history and proposed future, are essential in understanding the needs of a given place. Understanding what exists within the bounds of a site, as well as what conditions surround it, will promote responsive and inclusive solutions to the problem demands.

The project site is a ‘suspended’ architectural project comprising 5 structurally complete levels of a 22-storey hotel and service apartment, including the adjacent surface parking lot. The structure is one of many newborn relics, which has remained derelict in the recession of the recent building development that began in the latter portion of 1997. The economic devastation halted the construction of numerous developments within the city at various stages of completion. The structure has become an urban ruin before it was able to reach the intended form; a stunted or impeded growth; a changed cycle of life.

The intention of this practicum is to design a compact and intensive landscape development for a dense urban context that utilizes principles of sustainability<sup>56</sup>, leisure, and commercialism. The vertical dimension has been realized by building architecture as a solution to problems of density and proximity; it is now essential for landscape architecture to realize the potential of verticality if it is to accommodate growth in urban landscape form. The program of the project will involve the utilization of micro-scale agriculture, or cultivation<sup>57</sup>, to provide resources and ‘green’ spaces for the immediate urban population.

The vertical dimension provides surface area and volume not previously realized. The constraints of the problem are to provide a reasonable ratio of useable public and private (exterior) floor space, including greenspace and productive landscape components that promote an increased capability<sup>58</sup> in the land use pattern in an urban context. Ken Yeang’s concept of the ‘bioclimactic skyscrapers’ (Malaysia)

<sup>56</sup> sustainability: definition of terms, p.55

<sup>57</sup> cultivation: ibid, p.52

<sup>58</sup> capability: ibid, p.52

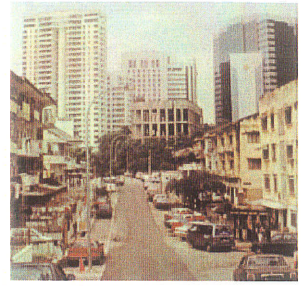


figure 20: site approach



figure 21: south elevation

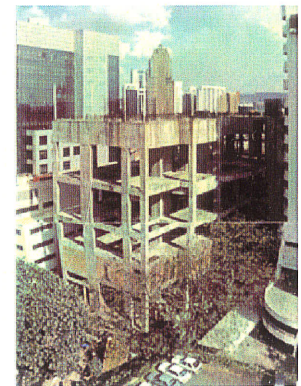


figure 22: west corner



figure 23: interior - ground level

integrate materials and forms that passively utilize the environmental conditions of the specific context to accommodate interior demands. Lawrence Halprin's innovative Freeway Park (Seattle) utilizes the 'air' rights above the freeway to develop urban park space and connect two formerly divided spaces. The urban tower garden will utilize the principles of both projects in an application from the perspective of social and environmental evolution.

The concept of sustainability involves the realization that all things are connected in complex direct and indirect ways. If this premise is accepted, then we may assume that all actions, and the affects of these actions, directly determine the composition of the environment. The sustainability of the planet is dependent upon the total action of every aspect of human and non-human interaction. This concept is simple; it is chaotic. All actions have an undetermined, however definite, reaction or set of reactions. The actions of all things have significance to the entire system within which the action occurs. The addition or removal of any single element from a system affects the elements that are adjacent to, or dependant upon, the given element. Developing a humble understanding of the connections, whether linear or cyclical, between the actions and reactions is essential and it is with this that we might inhabit the globe in a responsive and symbiotic nature.

Another level of complexity to the design of the Urban Tower Garden is the synthesis of sustainable design components within the confines of a dense development where the spatial opportunities for horizontal development are significantly limited. Many situations that affect the overall sustainability of a given project and constrain the potential design decisions develop in urban contexts that do not exist in suburban and rural areas. The complications soon become evident.

The practicum project is intended as an illustration of a solution for a specific context; it is not a template for global application. No two project sites are the same – and no two projects have the same programmatic requirements. Therefore, it is essential to be aware of the limited role of the methodology and the prototype when providing comparison. The project will develop urban volumes from both a horizontal and vertical perspective while creating physical and conceptual connections between both dimensions and the users of the spaces.

The design intentions are to weave the site and structure into the urban volume where it currently exists in a state of uncertainty; physically incomplete and socially useless. Energy will move into and through the spaces and structure in the form of water, light, wind and biotic organisms. The structure will acquire resources through collection devices, then transfer, manipulate and utilize the resources to

generate other resource types for the urban population. The processes are to occur under the premise of providing amenity spaces simultaneously – the juxtaposition of work and play. The space for urban meditation is limited in most cities. The structure will provide a dense collection of spaces for a range of meditative experiences. The experiences of alternative spatial forms provide opportunity for escape from urban conditions. The design intention is to instigate meaning for the people who experience the spaces by producing conditions that would weave the site and structure to the place. The interaction with the conditions of any context, whether parallel or tangential, creates a tension that can develop into meaning.

The urban tower garden is a space to look back into the city – a place to look back into one's self.

## **the concept:** urban tower garden: Kuala Lumpur

### **(1) anomaly<sup>59</sup>:** the instigation of green city philosophy

'Landscape ecology has been defined in a variety of different ways, but a common theme is the study of patterns, processes and changes. Landscape structure, or pattern, can be considered to be the spatial relationship between landscape elements or patches. Landscape function, or process, is, then, the interaction between these spatial elements, and landscape change is the alteration in structure and function occurring through time.'<sup>60</sup>

A 'green' city is an ambiguous concept; it is subjective and relative. The notion of a green city is one that embraces ecology and promotes the overall health of urban plant and animal communities through diversity<sup>61</sup>. Green cities, in theory, do not emerge from an urban fabric in a single comprehensive development, but rather progress in a manner similar to the evolution of a biotic organism. Sustainability is as much a process of learning how the environment functions from the perspective of the human species as it is about how to solve the problems that exist in contemporary global culture.

The structural and functional inadequacies of urban fabric exist in most cultures. The urban population of Kuala Lumpur is no different. The government solutions tend to respond through initiating radical programs of physical change. The programs typically involve a significant amount of construction and engineering, and often the cost of improving the existing built-up areas is determined too great, so the development occurs on green-field sites. There exists within Kuala Lumpur an enormous number of opportunities in derelict sites for re-development. There is merit in the developmental approach of 'tuning' the existing systems and mediation in incremental but effective ways.<sup>62</sup> The urban landscape is a rigid fabric that accommodates incremental growth. The typical masterplan is far too rigid for a redevelopment scheme to work in Kuala Lumpur. An objective and methodology approach to urban renewal is more appropriate, where the individual site programs and urban pattern is not pre-determined, rather the philosophy of the green city provides for the evolution of the space. As potential for urban landscape development is realized, it is approached from a contextual perspective. The program of the site is determined entirely by the structure and function that exists around it.

The urban landscape is a dynamic phenomenon that is in a constant state of flux. The evolution of the urban landscape is the result of many complex and interwoven

<sup>59</sup> anomalous: definition of terms, p.51

<sup>60</sup> Hobbs, 'Future landscapes and the future of landscape ecology', *Landscape and Urban Planning*, p.3

<sup>61</sup> diversity: definition of terms, p.53 and biodiversity, p.51

<sup>62</sup> Turner, 'Urban Planning in the Developing World: Lessons from Experience', *Habitat International*, p.123

natural and spontaneous processes and managed activities by humans. The main social purpose of change in urban form is the reorganization of the existing structure to optimize the function of the city. The individual purposes for urban development do not necessarily coincide with social purpose, and this creates a conflict. The existing landscape and building structure create a framework, and 'constrain' the processes and activities within the geographical space.<sup>63</sup> The broad changes that might occur within a city are planned and implemented over a period of time that does not accommodate the changes in the urban function during the process. New problems can arise before the initial problems have been resolved.

The rate of environmental degradation produced by human civilization far exceeds the rate of sustainable practices. The trends of human development require a change; the perspective of our role in the evolution of the planet is in need of realignment. The social and philosophical evolution that would produce a green city has been developing at a rate that has not been able to manage the global environment in a sustainable manner. The problems that our cities create for the environment to compensate have not yet reached a point of universal concern. The support for broad-scale changes to urban structure and function does not currently exist. The 'greening' of cities needs to develop in a more realistic manner.

A new direction must be taken with respect to urban development where humans maintain a symbiotic relationship with the environment within which their existence is sustained. The Urban Tower Garden is a conceptual allusion to the potential directions of urban landscape development in the immediate future. It develops a methodology and illustration of adaptive re-use of existing urban fabric that involves a re-evaluation and reorganization of urban forms and functions.

'The impact of accelerating change on the physical form of the city is radical. Institutions have shorter and shorter lives – railway stations are converted into museums, power plants into art galleries, churches into nightclubs, warehouses into homes – and it is now commonplace to anticipate that a building will outlive the purpose for which it is built in a matter of a few years. Modern life can no longer be defined in the long term and consequently cannot be contained within a static order of symbolic buildings and spaces. Buildings no longer symbolize a static hierarchical order; instead, they have become flexible containers for use by a dynamic society. However, it is the arrangement of buildings in space – the network of the city as a whole – that has come to be the dominant reflection of modern urban society.'<sup>64</sup>

The Urban Tower Garden is an illustration for micro-scale landscape development that promotes a potential distribution strategy for green spaces, both productive

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<sup>63</sup> Antrop, 'Landscape change: plan or chaos?', *Landscape and Urban Planning*, p.155

<sup>64</sup> Rogers, *Cities for a Small Planet*, p.163-164

and consumptive. The green spaces collectively provide considerable proportions of urban 'land' area that is not recognized as potential landscape. It utilizes the concepts and methods of building architecture that have provided opportunities for dense urban populations to develop. The design project site is specific in nature – the application of the solution could be global. The geographical location of the conceptual application may change, but the typologies of environmental problem associated with urban centers will not. 'Environmental problems do not recognize any frontier and are global in nature.'<sup>65</sup>

The instigation of the green city philosophy can occur with a single project. The illustration of alternative and flexible solutions for urban re-development is essential to the evolution of the city. The concept of the masterplan for a city is typically a rigid and prescriptive methodology, and it needs to change. A traditional masterplan limits invention and can potentially deter progress. The significance of the individual solution in a specific context is intrinsic to the re-development of an urban fabric.

**(2) pattern:** association of (anomalies) within the urban fabric

'Holism is a fundamental characteristic of the landscape. It means that all composing elements only receive their real meaning or significance by their context, their position in the whole. The holistic approach of the landscape is based upon the Gestalt concept and by definition states that the whole is more than the sum of its composing parts. Studying changes of individual landscape components and combining these still does not necessarily reflect the landscape change as a whole.'<sup>66</sup>

Anomalies, by nature, are singular in character, and do not resemble the context within which they are recognized. By the association of a collection of anomalies, the individual no longer exists as a singular distinguishable object in the context of a growing perspective, but rather as a recognizable constituent of a pattern or fabric. The anomaly does not lose any particular attribute, other than its perceived singularity, as each 'anomaly' within the pattern would be a unique development comprising of the components demanded by the immediate context.

The instigation and association of the anomalies, or urban open spaces, throughout the city has the potential to regenerate the urban environment in a more sustainable manner without the demolition of the existing structures. The use of existing structure allows for a more immediate change to occur within a given context. The satisfaction of demands can be realized before the demands themselves change. It is not sustainable to destroy the infrastructure that exists,

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<sup>65</sup> di Castri, 'Landscape ecology in a changing globalized environment', *Landscape Ecology*, p.4

<sup>66</sup> Antrop, 'Landscape change: plan or chaos?', *Landscape and Urban Planning*, p.157

but rather to reconstitute what resources are available. The implementation of the (anomalies) can occur over time so as to allow the city to evolve at a manageable rate and in sites that become less useful in their existing state and which provide the opportunity for sustainable re-development.

The application of the anomaly and pattern concept to urban contexts around the globe could develop a new typology of landscape space. The principles and methodology could be utilized on a global scale – recognizing the imperative of regional application. 'The rules have changed. And a new paradigm is vital. Marcel Proust once said that the voyage of discovery consists not in seeking new lands but in seeing with new eyes. It is in pursuing a globe of villages and not a global village that we begin to create that new paradigm.'<sup>67</sup> The sustainable city of the immediate and distant future will be one that evolves from the contemporary form; one that has been retrofitted with the attributes of self-sufficiency. It will not be a city that abandons the existing urban landscape and emerges from the untouched environs of suburbia. The acquisition of 'new' space as a replacement for unused space is, in fact, in opposition to sustainable theory. We should develop a new urban community typology based upon evolution rather than demolition and imposition.

Patterns are found in the association of similar objects in a given context. Patterns are found in both building and landscape structure and in broad scales ranging from individual species type and building typology, to plant communities and building districts, and to landscape regions and urban centers. Whether bounded with an existing urban context or creating a 'new' urban center, there exists two methods of producing a pattern in the landscape.

One method of urban pattern formation is to develop a scheme of social, economic, and physical relationships, and then impose a pattern on a city. The objects are then inserted into the designated locations within the pattern. This method is simple in conception and problematic in manifestation. The conception relies upon 'sound' planning whereby zones, and objects, are created and distributed evenly through proximity calculations. It is, in essence, an engineering solution. The development of zones, or districts, within cities has become common around the globe with the arrival of automation in personal transportation. It is this approach that has formed the globalization of city planning, where city patterns develop less through social and regional influence, and more through western typologies. In an existing urban context, this method involves the deformation of existing structure in order to

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<sup>67</sup> Morris, 'The Ecological City as a Self-Reliant City', *Green Cities*, p.26

facilitate the development of the new pattern. It is a re-development of urban space. The former solution is rejected, and another is accepted; it is the creation of a new place. The city inevitably expands with new districts emerging and abandoned districts destined to become derelict. 'The proposition of re-planning and re-building all of today's cities on a clean slate, based on ecological principles, may mean whole-scale waste of existing building stock and infrastructure.'<sup>68</sup> This method can produce a physical urban revolution.

Another method of pattern formation is to develop a concept and methodology for the insertion of objects into an existing district within a city fabric. This method is simple in conception and efficient in manifestation. The conception relies upon the specific demands of a given context whereby a district utilizes the existing structure and function to inform the development of the object. It is based upon principles of regionalism and community where design solutions are developed by specific social and environmental conditions of the given place. This method promotes regionalism and spatial character that existed in urban centers before the saturation of global patterns. Proximity and juxtaposition of relative structures and functions is the primary constraint for the design solution. The existing relationships are essential, and form the basis for the additions to the structure and function. The former solution is supplemented to improve the efficiency of the structure and function. The utilization of existing structure prevents city sprawl and increases in infrastructure demands while rebuilding and reforming underused structures. This method can produce an urban evolution.

In either case, the inevitability of change within the bounds of urban centers must be realized. The preservation of buildings through historic designation has the potential to transform a city into an expensive museum with an indefinitely expanding periphery of new development.

'If cities are undermining the ecological balance of the planet, it is our patterns of social and economic behaviors that are the root cause of their development in ways that produce environmental imbalance. In both developed and developing worlds the 'carrying' capacity of cities is being stretched to their limit. Cities are increasing in size and at such a rate that conventional patterns of accommodating urban growth have become obsolete. In the developed world the migration of people and activities from city centers to the dream world of suburbia has led to massive suburban development, widespread road-building, increased car use, congestion and pollution.'<sup>69</sup>

The urban patterns that we have created do not accommodate the demands of our social evolution or the structure and function of the biosphere. Our patterns and habits need to change.

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<sup>68</sup> Yeang, *The Skyscraper Bioclimatically Considered*, p.247

<sup>69</sup> Rogers, *Cities for a Small Planet*, p.5-7

'The evocation of meaning is not realized through some established hierarchy, but is an active state evoked in the process of relation.'<sup>70</sup>

## **metaphor and meaning:** deriving landscape form and creating place

Experience of space and environment induces memory; the memory of an experience of a specific space can evoke emotion. The metaphors suggested in a landscape can induce a memory of both specific places and typical spaces so as to evoke an emotion and thus connect an individual to a space and give it a particular meaning. The metaphor creates a dualistic experience where the individual directly perceives the immediate environment while indirectly realizing the connections to surrounding context. Associating a space to the context within which it exists through metaphor produces relevance and meaning – this is the creation of place.

Places throughout the world are given meaning from experiences through the perspective of culture. To ignore the culture of a given place in the creation of architecture, in theory and practice, is to ignore the place. Architecture reflects culture – it is simultaneously the physical manifestation of the concept of place and the demand for shelter. Landscape architecture is the mediation of culture and context; it must have relevance to both the people and the landscape form. Kuala Lumpur is a city with a relatively brief history, but the diverse cultures that inhabit this place, and the river valley that it develops within, create a distinct and storied context.

The place in which we exist helps to define us as individuals, and collectives, as we have invested time in this place. In the same manner as we are a product, result, and reflection of a given place, this place also becomes the same to us, as our involvement in this place contributes to the shaping of the continually changing place. As a place changes, its meanings evolve. 'If a place has no specific meaning for an individual, then it may induce a search for meaning of self within the individual.'<sup>71</sup> A place can have meaning in a direct and indirect manner. We generate meaning as we experience a place. The realization that we as individuals create the place within which we exist is the fundamental component of attachment to place. The 'attachment' to a place is derived from meaning.

The meanings we associate with objects and spaces are complicated. The communication of meaning in a landscape does not occur in a prescribed manner or over a specific period. 'Meaning develops over time. It condenses at the intersection of people and place. The design constitutes a filter between designer

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<sup>70</sup> Kurokawa, *The Philosophy of Symbiosis*, p.248

<sup>71</sup> Treib, 'Must Landscapes Mean?: Approaches to Significance in Recent Landscape Architecture', *Landscape Journal*, p.55

intentions and visitor experience.<sup>72</sup> Meaning in landscape architecture can not be manufactured like semantics – it is realized; it is discovered in the forms and processes that we manifest in the physical world. Meaning can be found in any form of social utility, cultural symbols, and natural phenomenon and processes.

'Mood, feeling and atmosphere can each be described as a symbolic order without an established structure. It is through a variety of dynamic, intersecting relationships and juxtapositions – the relationship between one sign and other symbolic elements with which it stands; the existence of a medium, an intermediary space introduced between different elements; the relation of the parts to the whole – the mood, feeling and atmosphere are created.'<sup>73</sup>

The landscape metaphor can have a significant symbolic meaning to both a specific individual and a culture in general. Symbols are the method, through which we communicate, and the expression of a landscape symbol induces a memory; an experience develops. The symbolic metaphor can provide an opportunity for a common experience and at the same time allow for an individual to interpret and appreciate an experience on a personal level. However, the symbols of a didactic landscape alone are not enough. We can not produce meaning in a place through simple explanation. A space requires aesthetic intention.<sup>74</sup> The materiality of space provides significant emotional connections to a space. The characteristics of form and the subtlety of detail provide specific aesthetic contributions to the meaning of place.

The metaphor can make allusions to other places and experiences. The urban tower garden utilizes metaphor to generate form. It uses layering of symbols within a spatial volume and intends to develop a variety of meanings for the individual; structure for the collective. This practicum utilizes three interwoven metaphors to develop form and function within the existing urban fabric.

#### the geographic metaphor

- the human settlement and the oceanic environment
- the city in the hills; the junction of the rivers
- the building structure within the web of urban corridors

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<sup>72</sup> Treib, 'Must Landscapes Mean?: Approaches to Significance in Recent Landscape Architecture', *Landscape Journal*, p.58

<sup>73</sup> Kurokawa, *The Philosophy of Symbiosis*, p.246

<sup>74</sup> Treib, p.53

### the evolution metaphor

- the structure as an incomplete; a ruin under construction
- the concrete form as an abiotic component of the ecosystem
- the space in flux; the inevitability and embrace of change

### the cultural juxtaposition metaphor

- regional application and global methodology
- ethnic appropriateness and universal understanding
- traditional continuity and contemporary expression

The project structure becomes a physical and ephemeral collage; an illustration of time and place. The past is often revealed by the context; the surrounding environment, as a derivative of urban process. The materials and spaces that can be found within K.L. tell a story of the people, their relationships, and the influences of other peoples within the city. The present is found in the experience of human and environmental activity; the life that occurs in and through the space. The future is suggested by the growth of form; the change that both biotic and abiotic components undergo through respective and simultaneous lifecycles. The concept of time is manifest in the layering of materials and spaces.

## **(urban) symbiosis:** environmental interdependency

Symbiosis: (1) generally, a long-term association between two different species living together. (2) may be restricted to organisms that have mutually beneficial relationships (mutualism), but can also include commensalism and parasitism that would be harmful to one of the organisms.<sup>75</sup>

'The concept of symbiosis is basically a dynamic pluralism. It does not seek to reconcile binomial opposite through dialectic, nor does it search for a unified principle that transcends two opposing elements. At times it is a binomial opposition; at times a unified principle; and it can also be neither. It can only be described as a dynamic, pluralistic principle that can take many different forms.'<sup>76</sup>

Symbiosis in an urban landscape can be a relationship between any of the biotic components that form the city. It is that which exists between people, plants, and organisms. Symbiosis is the provision of habitat and resources, and the utilization of waste. The intrinsic quality of the relationship is a mutual need; a dependence upon another organism for survival.

The presence of intermediary space is a condition necessary to accommodate a symbiotic relationship. An intermediary space is essential because it allows the two opposing elements of the dualism to relate to a common entity. 'Intermediate space can occasionally act as a stimulus for metamorphosis. Metamorphosis is one of the special features of the life process. A larva is transformed into a butterfly, an egg into a bird, or a fish. There is no life principle more sudden or extreme.'<sup>77</sup> The intermediary space accommodates the mutual growth of the two elements; it is the space in which the relationship occurs. The movement corridors of the UTG are the intermediary spaces where the (visitor) and the (resident) may coexist and interact. The porous space surrounding the UTG also becomes intermediary between the structure and the context; accommodating the exchange of energy through the site.

The space that exists between two objects provides as much definition to the individual objects as do the intrinsic characteristics that have been attributed to them – it is often more clear to realize what something is not, than to recognize what something may be. The concepts of intermediary space and ambiguity are important keys to understanding the philosophy of symbiosis. Symbiosis instead creates a dynamic equilibrium<sup>78</sup> between the two elements while allowing them to remain in opposition. The objectives of the individual element are selfish in nature;

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<sup>75</sup> Dunster and Dunster, *Dictionary of Natural Resource Management*

<sup>76</sup> Kurokawa, *The Philosophy of Symbiosis*, p.74

<sup>77</sup> Kurokawa, *The Philosophy of Symbiosis*, p.30

<sup>78</sup> dynamic equilibrium: definition of terms, p.53

it is a coincidental mutual benefit that induces the relationship. A relationship between two opposing elements can be achieved by placing spatial distance, or a neutral region, or temporal distance as a period of reflection and realignment between them. The space does not force opposing elements into compromise or harmony, rather it provides the opportunity for living in symbiosis.<sup>79</sup> The intermediary space is where the exchange occurs; the changes in the natural evolution of all things.

Cities are collectives in nature, whether mixtures of unique cultures or social groups, the inherent qualities of a city are diversity and heterogeneity. 'The collision of different cultures, and their introduction as 'noise', creates a new culture. This is the discovery of meaning by means of our sensitivity to differences. In architecture, the conscious manipulation of elements from different cultures evokes meaning through difference and disjunction, and this distinguishes it fundamentally from a simple hybridization.'<sup>80</sup> Some cities may be diverse on multiple levels, whereas others may have apparently significant homogeneous attributes. In both situations, juxtaposition occurs beyond the perspective of the human population, and is the relationship between humans and the environment.

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<sup>79</sup> Kurokawa, *The Philosophy of Symbiosis*, p.164

<sup>80</sup> *ibid*, p.240

'Water is a source of life, power, comfort, and delight, a universal symbol of purification and renewal. Like a primordial magnet, water pulls at a primitive and deeply rooted part of human nature.'<sup>81</sup>

### **water and life:** the fluid energy conduit

Water is essential for all biotic life. Most cultures have developed settlements within the immediate vicinity of a water source. Whether an ocean, lake, or river, people and animals will gravitate towards water, and biotic organisms will emerge around it. In essence, water is a biological magnet; it is vitality. It has a different meaning to each individual – as each will have had unique experiences and encounters with water throughout a lifetime. Water has the potential to forge an emotional link between people and nature in the city.

'The movement, or flow, of water into and through the city – including the source from which it comes, how and where it is used, treated and released, and the seasonal variation of this pattern – varies from city to city. The variation of water system patterns depends upon factors such as regional climate, topographic setting, pollution sources, and urban form.'<sup>82</sup>

Urban civilizations have long grappled with the problems of water supply and use, sewage disposal, storm drainage, and flood prevention. The water cycle of a given urban environment is an altered one, where the system that existed previously has changed dramatically. Water is the single most important (essential) resource of a city or any other human settlement. And the supply is not unlimited. For the most part, the people of a city do not understand the entire process of water acquisition, use, and dispersal. Cities import enormous quantities of fresh water and export (in the form of storm runoff, gray-water and sewage) a similar amount into 'clean' water systems. The cycle of water through environments is unrealized and underutilized. The utilization and understanding of water resources in cities requires re-evaluation.

'Changes in the distribution, abundance, and quality of water and freshwater resources in this century now represent a strategic threat to the quality of human life, the environmental sustainability of the biosphere, and the vitality of human cultures. Fresh waters are central to societal and landscape vitality. The landscape is shaped by the quality, form, and timing of water availability and water shapes societal vitality by affecting patterns of human demography, culture, economics.'<sup>83</sup>



figure 24: rocks in water

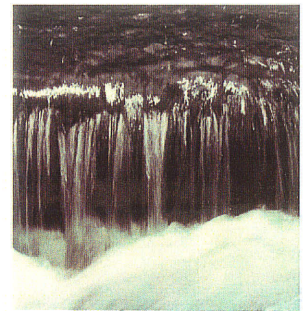


figure 25: water in motion



figure 26: grass in water

<sup>81</sup> Spirn, *The Granite Garden*, p.142

<sup>82</sup> *ibid*, p.166

<sup>83</sup> Naiman, 'Water, society and landscape ecology', *Landscape Ecology*, p.193

Water may be collected from various sources in the urban landscape; virtually all of the surfaces of buildings and properties. The utilization of water in an urban context is virtually limitless. In Malaysia, and specifically Kuala Lumpur, great volumes of rainwater may be utilized to irrigate urban agriculture, micro-scale fish farms, and operate water works and infrastructure. The movements of water through 'green' systems can also regenerate and purify the resource through phytoremediation, a process in which the plant material removes and de-constitutes proportions of toxins and metals from water bodies.

The project intends to collect, manipulate and discharge water as a recycled constituent of an ecosystem. The majority of the water that falls upon Kuala Lumpur is swiftly channeled into a rigid, engineered drainage system and is then discharged in multiple, point intensive locations into the natural water system. The water that is used in the city is mechanically introduced via underground pipes for the purposes of drinking, bathing, and other urban ceremonies. It is chemically treated on the way into the urban system, and follows a similar path on the way out of the system. Natural hydrologic systems operate in a more gradual and complex manner where water moves through topographic structure nourishing biotic life and leaching back into the water table through organic and inorganic filters. An intermediary hydrologic system form and function for urban environments must be developed if we are to sustain the vital resource.

**water** (as the unifying element of the metaphors)

**still water:**

reflects spirit and form;  
it is an elevation;  
a place from which to measure.

**moving water:**

is erosion in the past,  
dynamic energy in the present,  
and future deposition.

**falling water:**

divides space as a wall,  
it connects one vertical plane to the next,  
carrying vision and moving energy.

**urban leisure space:** a place to meditate; a place to consume

Within the bounds of city centers there must be spaces and places where people may 'regenerate' both mind and body. The acquisition of physical and spiritual comfort is a need of the individual. People desire health of various types and expend their resources to find it. Health facilitates a prolonged and more manageable life; it provides opportunity to search for the self, and it is valued by most cultures.

The space and opportunity for leisure has become a commodity. It has a cost and it is available to consumers. People exchange significant proportions of their disposable income for the experience of various leisure activities. While the market has been established for centuries, themed environments have become a significant experience of daily life.

Kuala Lumpur, a city of over 2 million, has very little urban park and leisure space. Interior commercial spaces of massive proportions have been the most significant social, and subsequent construction, explosion in the recent economic success. The leisure of consumerism has been embraced fully – the experience of consuming has become a marketing strategy. We are a culture of consumers. We do not merely consume for the purposes of sustenance, but for other social reasons. Fun is for sale. Products are for sale. Fun while consuming products is for sale, but at a much greater cost.

Urban landscape space has a cost. The relative publicity and privacy of a 'green' space does not change this condition. In the same realm as transportation systems, water and electricity services, healthcare, and entertainment activities, a landscape has an economic cost and a subsequent monetary value.

The urban landscape is already subject to the pressures of the corporate commercial advertisement. Commercial icons and images may be found in almost any context conceivable; from micro-scale advertising ranging from logos on clothing to product names on vending machines, and macro-scale advertising including billboards and corporate sponsored entertainment facilities.

Urban landscapes have significant potential to be utilized as the vehicle for commercial experiences. And the opportunity exists to provide environmental benefit from the commercial experience. Commercialism can be woven into the structure and function of a landscape. An 'new' urban ecosystem typology can be marketed as an experience to be consumed.

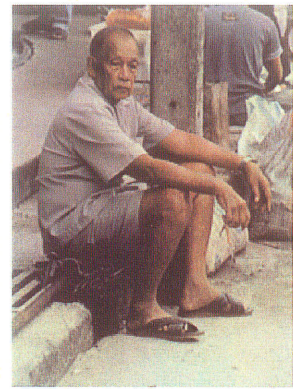


figure 27: street market consumer - Hadyai

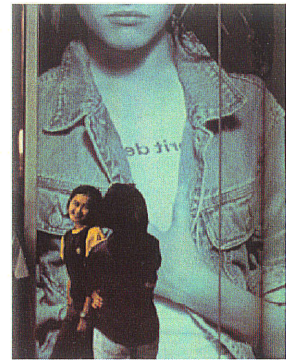


figure 28: LOT10 mall entrance - Kuala Lumpur



figure 29: Coca-Cola logo (tm) - everywhere

## **energy and nutrient cycling:** sustaining the urban population

Urban populations simultaneously demand enormous quantities of resources and produce massive amounts of waste. We need energy to maintain urban functions and sustain life. 'Cities have become very dependent entities. A city of one hundred thousand people imports two hundred tons of food per day, one thousand tons of fuel per day, and sixty-two thousand tons of water per day. That is one side of the equation. The other side of the equation is that it dumps one hundred thousand tons of garbage per year and forty thousand tons of human waste per year.'<sup>84</sup> The movement of materials into, through, and out from cities requires an intensive infrastructure and consumes energy. The movement and utilization of resources, including bio-chemical cycles<sup>85</sup>, can occur in a more efficient manner.

## **wastewater recycling:**

An urban wastewater system is one method to transform disposal into production, wastes into resources, and potential losses into gains. The significance of the system is that it can be developed at any scale. The water and organic nutrients found in wastewater are plant food. They become toxic when treated with chemicals and costly contaminants to our environment when discharged into inappropriate areas, such as surface waters, stagnant and anaerobic soil environments, or ground water systems. The wastewater becomes a hazard when it is concentrated and discharged at point intensive locations.

Phytoremediation is one method of utilizing wastewater on a site. It is the simple process of allowing plants to take up 'pollutants' and use the otherwise wasted water to promote growth. 'Phytoremediation operates through three principal mechanisms: by extracting, containing, or degrading the contaminants. Extraction involves planting species that take up and accumulate contaminants in their shoots and leaves. Containment uses plants to immobilize the contaminants, where trees sequester large concentrations of metals in their root systems. Degradation is a process in which contaminants – principally hydrocarbons and other organic compounds – are broken down so that, in fact, they are no longer toxic. Some plants may take in organic toxins and, in the process of actually using some chemical elements of the toxins as food, detoxify them.'<sup>86</sup>

Employing plants to grow away pollutants is ecological. Composting the plants is ecological. Utilizing those plants as a material resource has economic benefits.

<sup>84</sup> Morris, 'The Ecological City as a Self-Reliant City', *Green Cities*, p.22

<sup>85</sup> bio-chemical cycles: definition of terms, p.51

<sup>86</sup> Thompson, 'Botanical Remedies', *Landscape Architecture*, p.40



figure 30: Klang River - Kuala Lumpur

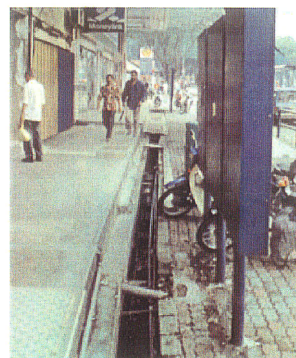


figure 31: street sewer - Kuala Lumpur



figure 32: suburban drainage channel - Kuala Lumpur

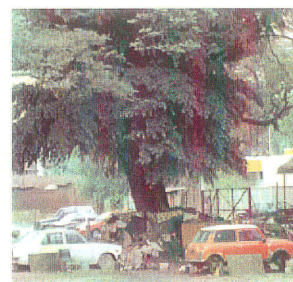


figure 33: typical garbage pile - Kuala Lumpur

The public perception of a phytoremediation component on a project site can be positive due to the provision of the urban aesthetics, shade, air quality improvement, and bird and wildlife.

A wide range of plants, both grasses and trees, has proved effective in phytoremediation. An attractive feature of phytoremediation is its low installation cost; and the operation of the plants as a mechanism is derived from solar energy. The wastewater system is an enhanced evapotranspiration system, capable of handling all wastewater from both residence and commercial sites. It is a community of especially thirsty plants grown in optimum conditions. The system is essentially a reproduction of the model existing in nature, in which the decay of one organism provides the sustenance of another.<sup>87</sup>

### **solid waste resources:**

A significant proportion of the solid urban waste material in Kuala Lumpur is organic and useable in the development of soil for the propagation of plant material. The organic matter content contributes to the success and productivity of urban soils in tropical environments. The soil organic matter positively affects physical structure, aggregation, porosity, microbial activity, pore size distribution and water retention capacity of the soil. It is within the soil organic matter that the majority of nutrients are stored in the low-activity-clay soils of the tropics. This affects the nutrient retention capacity, as well as the availability and mobility of macro- and micro-nutrients in the soil. It increases productivity of the soil through the efficient use of water by reducing the rate of runoff and erosion.<sup>88</sup>

The use of an organic waste recycling system in Kuala Lumpur can occur at any scale. The urban tower garden utilizes a carousel-type composting waste system. The system consists of a fixed outer container and a revolving inner drum, divided into separate composting chambers. The excrement, toilet paper and vegetable waste are placed in one chamber at a time. When one chamber is full, the next chamber is simply rotated into position. The accumulated matter in the filled chamber remains to compost while other chambers are filled. The odors associated with this process are reduced with natural ventilation. In the warm, moist environment, aerobic microbes gradually transform the solids into valuable oxidized and dry humus, a stable nutrient for plants. The process improves with the supplement of small amounts of organic matter such as vegetable waste. The humus can then be utilized as fertilizing material for the production of edible plants

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<sup>87</sup> ecological-engineering.com

<sup>88</sup> Thurston, *Slash/Mulch Systems – Sustainable Methods for Tropical Agriculture*, p.8

or aquaculture feed. The excess liquid, which is rich in nitrogen, can then be used as plant fertilizer after dilution with fresh or gray-water before application.<sup>89</sup> The entire volume of waste is utilized. The material does not leave the site – it is cycled within the system. And unlike the engineering of the closed system of contemporary urban waste removal, the landscape structure and function accommodate the free movement of nutrients and energy.

### **wind and solar power:** passive energy production

The power of the wind and the sun are truly sustainable resources. The quantity and quality of the source may differ from place to place, but the lack of environmental degradation involved with the acquisition of the energy is consistent. Advances in wind and sun energy technology will continue to reduce the economic cost to the point where it can compete with traditional energy sources.

A 1998 Danish study argues that 10% of the world's electricity needs can be met with wind energy in the next two decades.<sup>90</sup> A reduction of demands upon hydroelectric stations by this proportion could significantly improve many hydrologic systems devastated by engineering manipulations of water movement. This could accommodate the natural regeneration of displaced native plant and animal communities.

The energy that reaches the surface of the earth in the form of light from the sun is a relatively inexhaustible source. It is also a relative constant. 'The earth receives energy from the sun at a rate of 100,000 trillion KJ per minute. Utilizing only 1% of the available sun energy would provide enough power to sustain all of our global energy demands.'<sup>91</sup> We do not actually need to use fossil fuels for the production of energy. We choose to use it because the infrastructure already exists.

The introduction of small-scale passive energy production systems for individual building and landscape structures can contribute to the partial independence of the urban ecosystem. A complete independence from the surrounding environment is impossible with the density of a city such as Kuala Lumpur. The development of interdependence between city and environs is the ideal condition. It promotes the symbiotic relationship between the city and the region that encourages the energy cycling and species flow that produces environmental stability.

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<sup>89</sup> ecological-engineering.com

<sup>90</sup> awea.com

<sup>91</sup> Stamenic, *Solar Photovoltaics Revolution*, p.1.1

## **edible plants:** urban agriculture

The urban landscape structure of Kuala Lumpur is typically an amenity. The species of plants are generally chosen for their aesthetic qualities, canopy density for the provision of shade, and manageability. Urban amenity space provides a genuine service to the population. The potential for the urban landscape to be utilized in a productive manner has been unrealized in many urban environments. Although the space for macro scale agricultural production does not usually exist within urban centers, the opportunity for micro scale agriculture exists almost everywhere. Urban agriculture practices can change landscape space from singular amenity functions to include resource production.

The production of useful plant material in urban structure can develop from that of the indigenous home garden of the Malaysian peoples. The premise of the urban garden is the utilization of the physical structure that exists within the city for the continuous production of human food. The synthesis of urban function and agricultural operation occurs in the specific design of the individual spaces.

Leaf vegetables are simple to grow and require minimal attention or labor with the highest yield of edible product. One square meter of amaranth in the full sun can produce 3kg of leaves in a period of two months. An individual, requiring approximately 100g of leaves per day, needs one bed of 2sqm of amaranth. A surface of about 10sqm of different types of leaf vegetables is sufficient for an individual. A hedge that occupies 10sqm can produce approximately one kilogram of young leaves per week for several years.<sup>92</sup>

### **species description:**

The plant materials were chosen for their use as a local agricultural resource and their utility in the landscape structure as an amenity.

**amaranth** (*Amaranthus tricolor* L.), **jute** (*Corchorus olitorius*),  
**kangkong** (*Ipomoea reptans*) creeper, **taro** (*Xanthosoma sagittifolium*)

The erect annuals prefer sun and are utilized on the top level of the structure in a rotating pattern. The structure remains constant while the plant material changes from season to season.<sup>93</sup>



figure 34: amaranth



figure 35: aquatic plant



figure 36: kangkong

<sup>92</sup> Oomen & Grubben, *Tropical Leaf Vegetables in Human Nutrition*, p.63

<sup>93</sup> Oomen & Grubben, *Tropical Leaf Vegetables in Human Nutrition*

**wing bean** (*Psophocarpus tetragonolobus*), **yardlong bean**

The climbing perennials are utilized as environmental filters - visual screens, shading devices, sound barriers, and air filters.

**taro** (*Colocasia esculenta*)

The natural habitat is the tropical rainforest. The species is shade tolerant and requires large amounts of water. This plant is utilized as the material for the planting beds throughout the 'interior' structure. Its mature height ranges from 90-180cm tall and has a dense form providing spatial enclosure to the internal spaces.

**kangkong** (*Ipomoea aquatica*)

An aquatic plant that provides structure for fish and habitat for other organisms, the plant is utilized as a natural filter to supplement the mechanical water system.

**passion fruit** (*Passiflora edulis*, var. *flavicarpa*)

A climbing plant grown on a trellis of 2.5m in height on the top level of the structure, the dense form creates a sculptural green wall.

<b>plant material:</b>	<b>yield: kg/10sqm (range)</b>	<b>growth period</b>
amaranth ( <i>Amaranth tricolor</i> )	10 (25-40)	30-90
kangkong ( <i>Ipomoea aquatica</i> )	80 (8-120)	60-360
taro ( <i>Xanthosoma sagittifolium</i> )	20 (10-30)	60-270
jute ( <i>Corchorus olitorius</i> )	8 (3-10)	45-80

94

**aquaculture:** urban fish cultivation

During the 1950s, during a social, political and cultural crisis in Malaysia, tens of thousands of Chinese residents were displaced by the colonial government to segregate the populations. One common method of re-establishing their farming business was to excavate fishponds combined with an adjacent pigsty for the production of food. The pigs were raised on a cement slab sloping towards the pond so that the water was fertilized with the pig manure. The pigs were fed on large boiled taro leaves and the fish, rapidly growing Tilapia, were nourished by the animal waste. On the water of the ponds, kangkong was grown. The symbiotic system produced food resources in a confined space with a minimum input of energy.<sup>95</sup> The system utilized an efficient, natural cycle that sustained the population without producing any waste.

'World population will continue to increase but at a declining rate, from the present level (1983) of about 1.8% to about 1.5% annually by the end of the century. Nevertheless, in spite of the declining rate of world population increase, the annual increment of the total demand of fish products will continue to grow from their present level of some 75 million tons to a peak of nearly 90 million tons. By the year 2000, a world population of about 6.1 billion people will, according to 1980 levels of consumption, require an additional 19 million tons of fish.'<sup>96</sup>

The Malaysian Ministry of Agriculture and Fisheries calculated the export of 247,839.38 tons and the import of 260,567.98 tons of fish annually. (Malaysia Fisheries) The country requires the supplement of 12,728.60 tons of fish to its production for consumption. There is a resource deficiency.

Selangor, the state in which Kuala Lumpur is located, accounts for approximately 6% of the total number of freshwater fish cultures in the country, and only 1% of the total hectares. (Malaysia Fisheries) The aquaculture resource demands of Kuala Lumpur are extended around the nation. The increased aquaculture production in the Klang River Valley, and specifically within the boundary of Kuala Lumpur would contribute to the reduction of fish import.



figure 37: tilapia

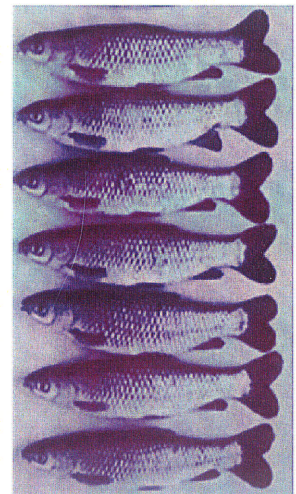


figure 38: grasscarp



figure 39: koi

<sup>95</sup> Oomen & Grubben, *Tropical Leaf Vegetables in Human Nutrition*, p.45

<sup>96</sup> Shilo & Sarig, *Fish Culture in Warm Water Systems: Problems and Trends*, p.2

## species description:

### **tilapia** - *Oreochromis n. niloticus* (Linn.) :

Tilapia (and carp) were amongst the earliest freshwater fish to be cultured. And it is generally accepted that species of tilapia have been cultivated for approximately 2000 years.<sup>97</sup> From the perspective of human nutrition, tilapia has historically been one of the world's most important fish. And with significantly increased emphasis on fish cultivation, plus the development of modern transportation methods, tilapia has become even more valuable a resource. Presently, there is no fish, with the probable exception of the common carp (*Cyprinus carpio*), that is more widely cultured.<sup>98</sup>

The Tilapias are essentially tropical lowland fish and are not typically inhabitants of flowing waters. Both the Java tilapia (*T.mossambica*) and Nile tilapia (*T.nilotica*) can be cultured in environments with large amounts of organic enrichment that make it less possible for other edible fish to survive. In reproduction, tilapia simply require a pond, and prefer a loose, sandy bottom. 'Research on fertilization of tilapia ponds involving Java tilapia and the use of phosphates, which are the most effective group of fertilizers for enhancing phytoplankton production. Phosphatic fertilization applied to Malaysian ponds containing Java tilapia and *Barbus gonionotus*, both plankton feeders, raised the total yield of fish by 261 – 1260 kg/(ha)(yr).'<sup>99</sup>

*Tilapia mossambica* (now *Oreochromis mossambicus*) consumes filamentous algae, a principal habitat for many species of mosquito larvae.<sup>100</sup> The prevention of mosquito reproduction is a serious concern in southeast Asia with the threat of Malaria transmission.

The density of fish populations in urban cultivation is a concern, as smaller volumes of water that are more feasible in dense urban fabric may not be appropriate for many species. The tilapia, however, do not require large volumes of water. Experiments illustrated that only 20% of the fish in low-density tanks (five fish per 40 liters of water) survived, whereas 99% of the fish in high-density tanks (20 fish per 40 liters) were able to survive and mature. The fish behavior and stress changes with environmental changes such as density.<sup>101</sup> Another experiment indicated that for optimal production results water temperature must be kept above

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<sup>97</sup> Michaels, *Carp Farming, Carp Farming*, p.162

<sup>98</sup> Bardach, *Aquaculture*, p.351

<sup>99</sup> *ibid*, p.373-74

<sup>100</sup> *ibid*, p.375

<sup>101</sup> Meske, *Fish Aquaculture – Technology and Experiments*, p.184

24°C. The best feed conversion ratio of 1.61 was achieved in this experiment at 28°C, where 32°C showed a decline.<sup>102</sup> The urban context of Kuala Lumpur is a suitable environment for the cultivation of tilapia.

**grass carp - *Ctenopharyngodon idella* :**

Carp cultivation accounts for approximately 90% of the total world freshwater fish culture. The largest producer of table carp is China where there are carp ponds found in various scales and throughout most regions – anywhere with a surplus of suitable water. There is an estimated production exceeding 100,000 tons per year.<sup>103</sup>

Carp is a warm water fish and feeds best in waters with temperatures between 18-25°C, but will tolerate temperatures as high as 40°C and as low as freezing. To develop a fish from egg to C3 table carp takes about 2.5 years and achieves a weight of 0.9 – 1.1 kilograms. To produce 1 ton of carp in this period of time requires 0.61-0.81 hectares of pond space. And generally, 1 hectare of water surface requires 7.4-14.8 tons of manure per season.<sup>104</sup>

*Cyprinus carpio* L. is a variety tolerant of extreme water temperature and will grow throughout the year; reaching a weight of 0.7-0.9 kg in one year. Yields of 2 tons per hectare may be achieved. Natural waste products of any kind, including human and animal feces and vegetable refuse, can be used for supplementary feeding.<sup>105</sup>

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<sup>102</sup> Meske, *Fish Aquaculture – Technology and Experiments*, p.187

<sup>103</sup> Michaels, *Carp Farming*, p.66

<sup>104</sup> *ibid*, p.67

<sup>105</sup> *ibid*, p.161

## **bamboo:** the noble plant

'The origin of the word 'bamboo' is unclear: the accepted explanation proposes agreeably enough that it derives from an onomatopoeic Malay word imitating the explosive noise bamboo makes when burning.'<sup>106</sup>

Bamboos can be subdivided into two categories classified according to growth pattern as sympodial, or clump, and monopodial, or runner bamboos. All bamboos come up from rhizomes, underground stems that send up shoots. The clump types multiply symmetrically outward in a circle and are typically tropical.<sup>107</sup> The clump formation in the tropics develops from the fact that bamboo generally prefers some shade – which is naturally produced in a group of culms.<sup>108</sup>

Bamboo is a fast growing grass species that exists in an environment with a year-round growing season. 'No other living thing grows so tall so fast.'<sup>109</sup> The sympodial bamboo is slower in development and takes from 80 to 120 days to reach its full height.<sup>110</sup> It matures in approximately six years and requires relatively little energy to harvest, and a low total embodied energy. Bamboo is native to southeast Asia and is, therefore, an ideal plant to harvest and utilize, as it has the ability to thrive in the local environmental conditions.<sup>111</sup>

No other plant or tree provides the same amount of vertical height, biomass, and canopy with such modest requirements for food, water, and soil. Plants as tall as 20 meters can be grown in as little as four feet of soil. Bamboo is a hardy plant and is relatively free of pests and disease.<sup>112</sup> As an agricultural resource it is simple and efficient. The production of bamboo as a resource occurs throughout Asia. 'In Guangdong, China the province farms 42,000 acres of tea stick bamboo and produces approximately 40,000 tons each year.' This is a production ration of approximately one ton per acre annually. 'In India, 66 percent of all paper used comes from the giant grass.'<sup>113</sup>

Bamboo consumes large volumes of water in high light situations, but can drown if the roots remain in water for extended periods. The solution is the provision of good drainage. 'A minimum of a 2-4 inch layer of gravel between the subsurface and the bottom of the planting is typically sufficient. A concern is the leaching of

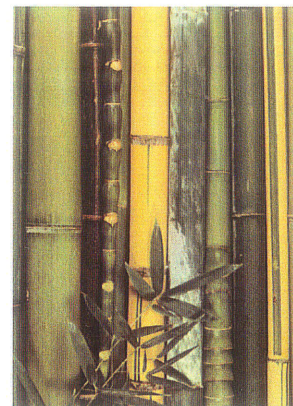


figure 40: bamboo culms - various



figure 41: bamboo leaves



figure 42: bamboo leaves

<sup>106</sup> Austin & Ueda, *Bamboo*, p.10

<sup>107</sup> Marden, *Bamboo, the Giant Grass*, p.511

<sup>108</sup> Austin & Ueda, p.15

<sup>109</sup> Marden, p.504

<sup>110</sup> Austin & Ueda, p.193

<sup>111</sup> www.bamboo.org

<sup>112</sup> Steadman, *Bamboo*, p.74

<sup>113</sup> Marden, p.528

nutrients that occurs due to frequent watering. And stone mulch can retard the ability of the plant to breathe and thus regenerate.'<sup>114</sup> The most common edible bamboo (moso) prefers soil with a higher moisture content and greater proportion of clay. All species of bamboo grow successfully on steep slopes and do not prefer strong sun.<sup>115</sup>

### **species description:**

#### **Schizostachyum brachycladum Kurz (buloh padi)**

A native species of Malaysia with a mature height ranging from 8-13m, green or yellow culms with narrow stripes and a diameter of 4-10cm; recognized as an attractive ornamental. This species will be utilized on the ground level and adjacent parking lot to provide shade and vertical mass, and to filter the water acquired from the adjacent sites.

#### **Schizostachyum zollingeri (buloh nipis)**

A native species of Malaysia with a mature height ranging from 5-13m, culms with a diameter of 3-10cm; used for paper making. This species will be utilized on the ground level and adjacent parking lot to provide shade and vertical mass, and to filter the water acquired from the adjacent sites.

#### **Ochlandra rheedii**

A native species of southeast Asia with a mature height of 4-5m, the leaves are broad and long. This species will be utilized on the second and fourth levels of the structure in the double volumes to provide vertical structure, shade and bird habitat.

#### **Arundinaria suberecta**

A native species of southeast Asia with a mature height of 30-50cm; elegant, grasslike-like with delicate drooping foliage, stands sun and drought well. This species will be utilized as the understory for the taller bamboo species and general ground cover.<sup>116</sup>

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<sup>114</sup> Steadman, *Bamboo*, p.76

<sup>115</sup> Austin & Ueda, *Bamboo*, p.203

<sup>116</sup> MacMillan, *Tropical Planting and Gardening*

## the design solution:

evolution of an urban structure

## site program:

developing urban village systems

## sustainable urban agriculture:

water collection/retention/irrigation  
waste collection/decomposition/recycling  
solar/wind energy collection and utilization  
cultivation: bamboo/fish/fruit/vegetables

## urban garden spaces:

meditation spaces  
movement spaces  
observation spaces  
habitat (sanctuary)

## commercial spaces:

advertising spaces / surfaces  
product vending machines  
adjacent market (situational)

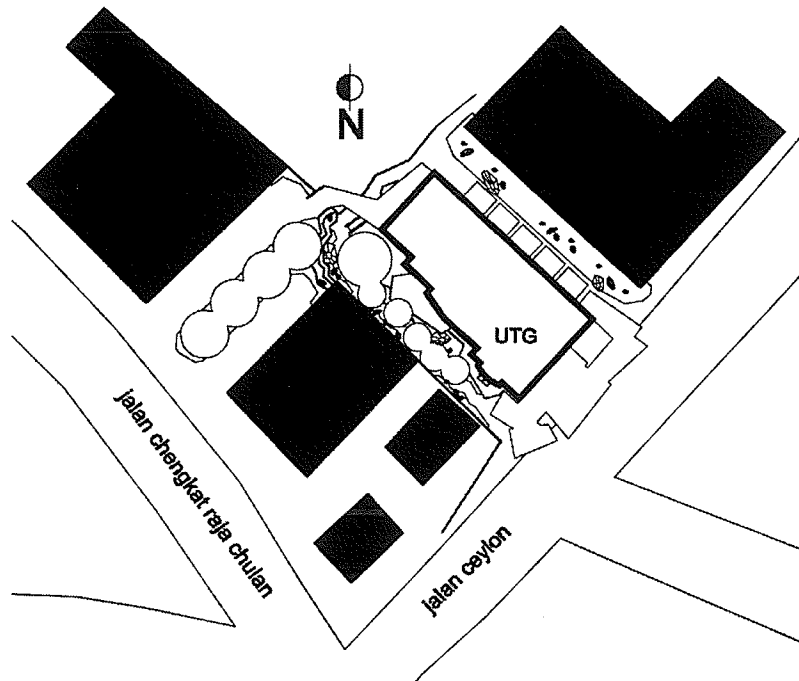
## amenities:

motorcycle parking  
bus / taxi / pedestrian shelters  
recyclable resource collectors  
public washrooms / telephones



KL urban district – figure/ground

figure 43

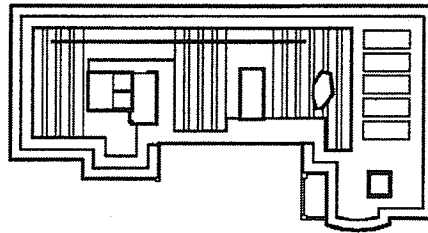


site plan

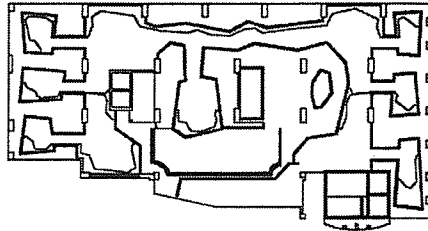
figure 44

## floor programs:

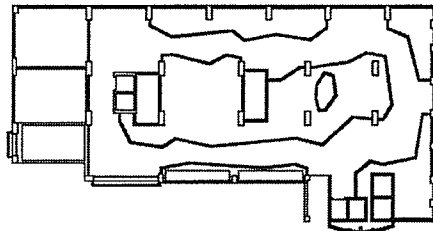
**L5** ± 875m<sup>2</sup>  
 vertical circulation = 54m<sup>2</sup>  
 plant material = 445m<sup>2</sup>  
 photovoltaics = 70m<sup>2</sup>



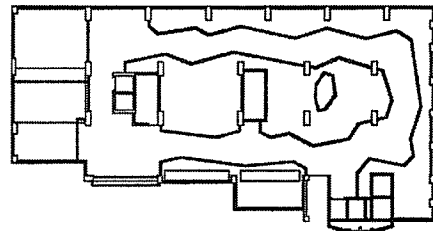
**L4** ± 998m<sup>2</sup>  
 vertical circulation = 92m<sup>2</sup>  
 plant material = 228m<sup>2</sup>  
 fish pond = 207m<sup>3</sup>  
 water storage = 48m<sup>3</sup>



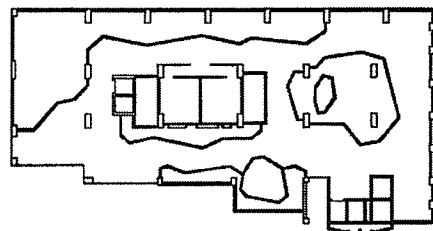
**L3** ± 870m<sup>2</sup>  
 vertical circulation = 78m<sup>2</sup>  
 plant material = 103m<sup>2</sup>  
 fish pond = 155m<sup>3</sup>  
 water storage = 48m<sup>3</sup>



**L2** ± 980m<sup>2</sup>  
 vertical circulation = 78m<sup>2</sup>  
 plant material = 232m<sup>2</sup>  
 fish pond = 140m<sup>3</sup>  
 water storage = 48m<sup>3</sup>



**L1** ± 975m<sup>2</sup>  
 vertical circulation = 78m<sup>2</sup>  
 plant material = 147m<sup>2</sup>  
 fish pond = 145m<sup>3</sup>  
 water storage = 48m<sup>3</sup>



**LG** ± 2300m<sup>2</sup>  
 vertical circulation = 78m<sup>2</sup>  
 plant material = 213m<sup>2</sup>  
 fish pond = 1,894m<sup>3</sup>  
 water storage = 48m<sup>3</sup>  
 mechanical = 50m<sup>2</sup>

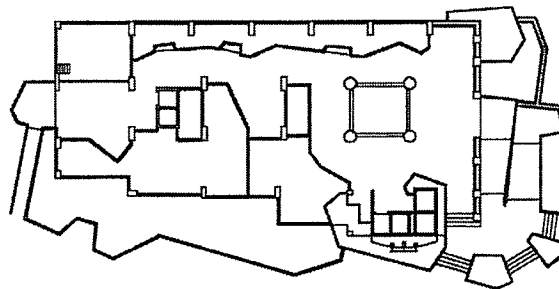


figure 45

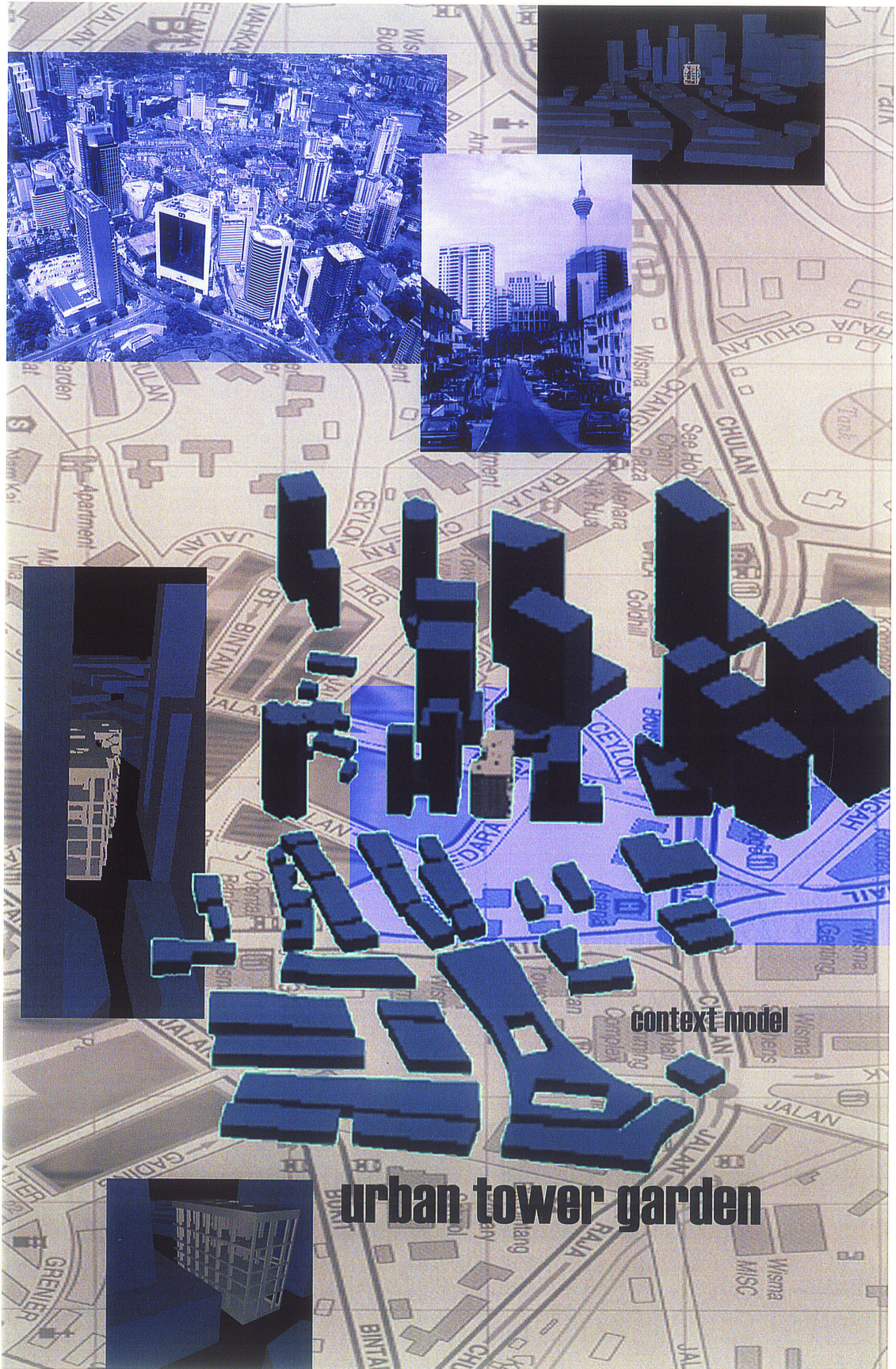


Figure 46





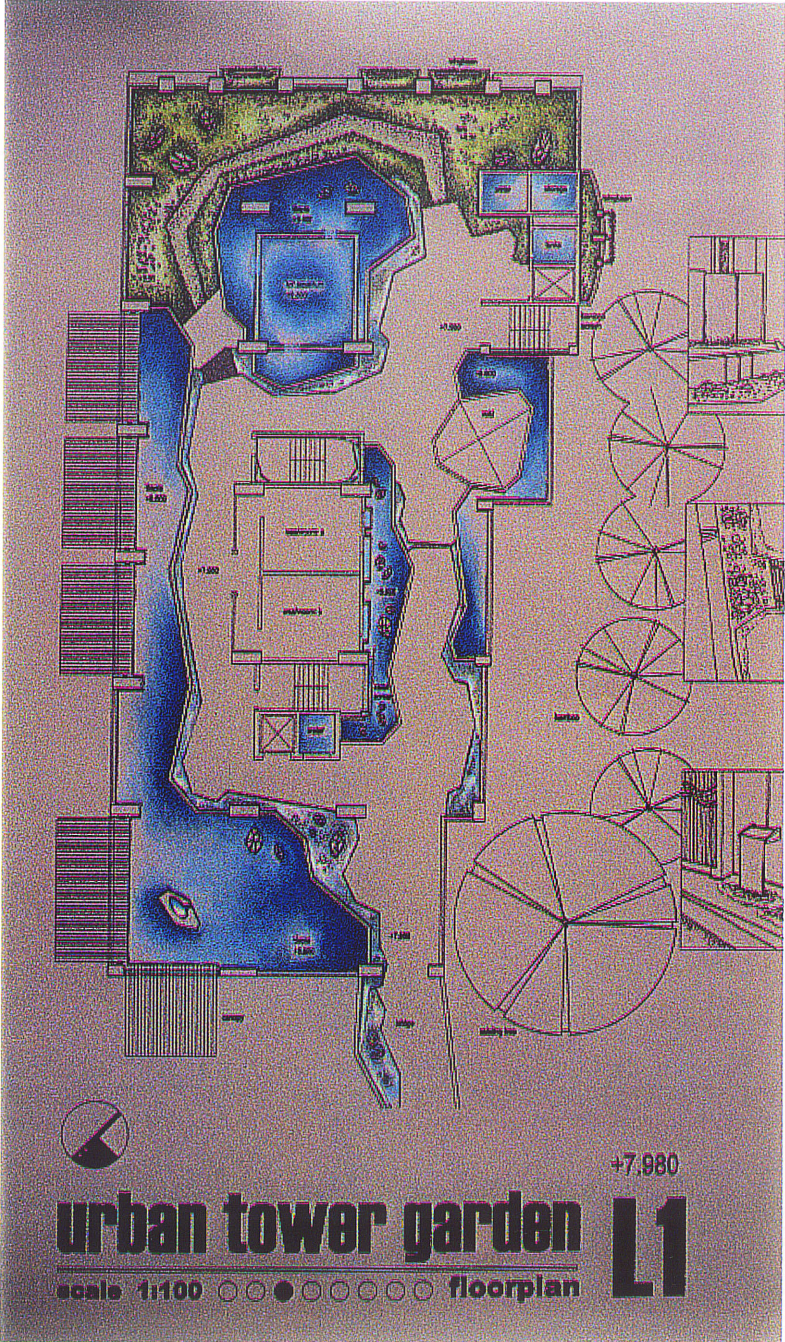


Figure 49



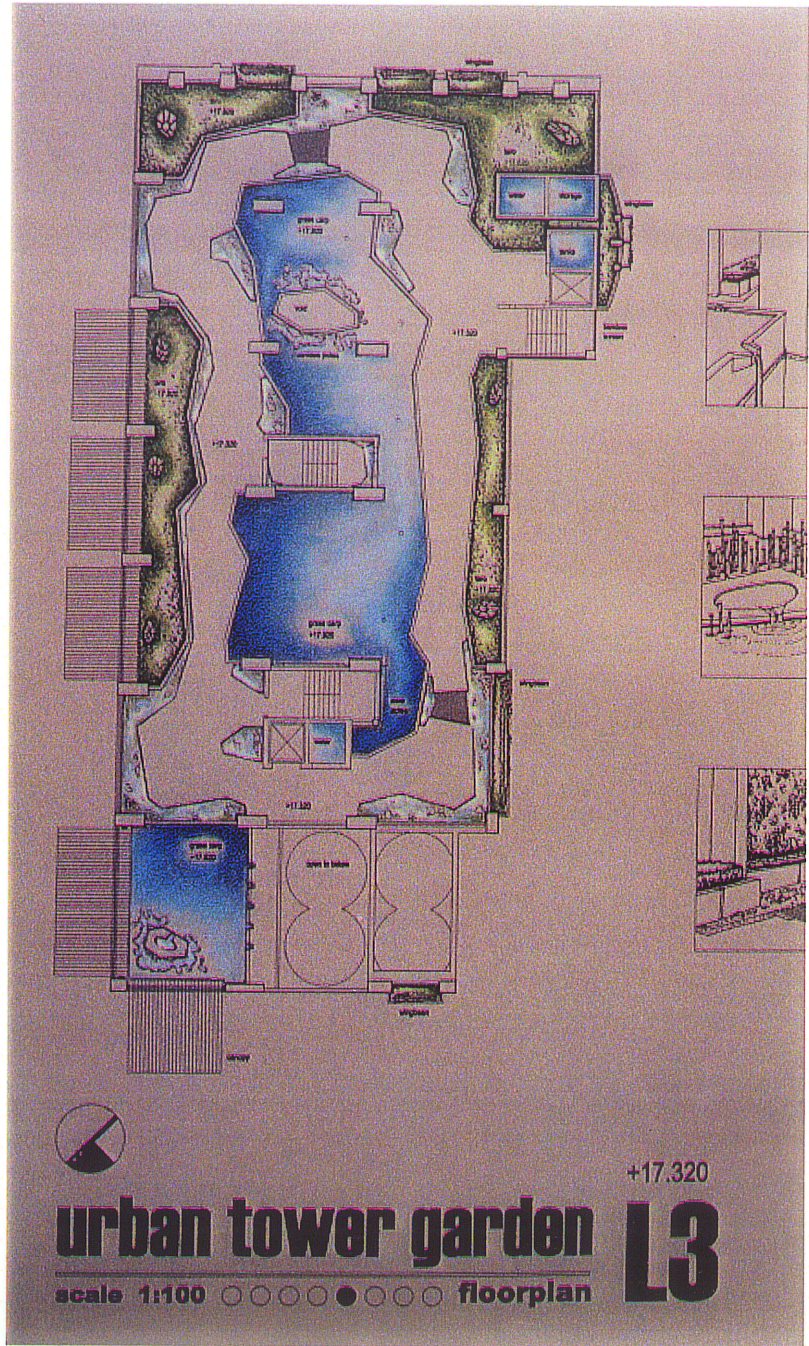


Figure 51

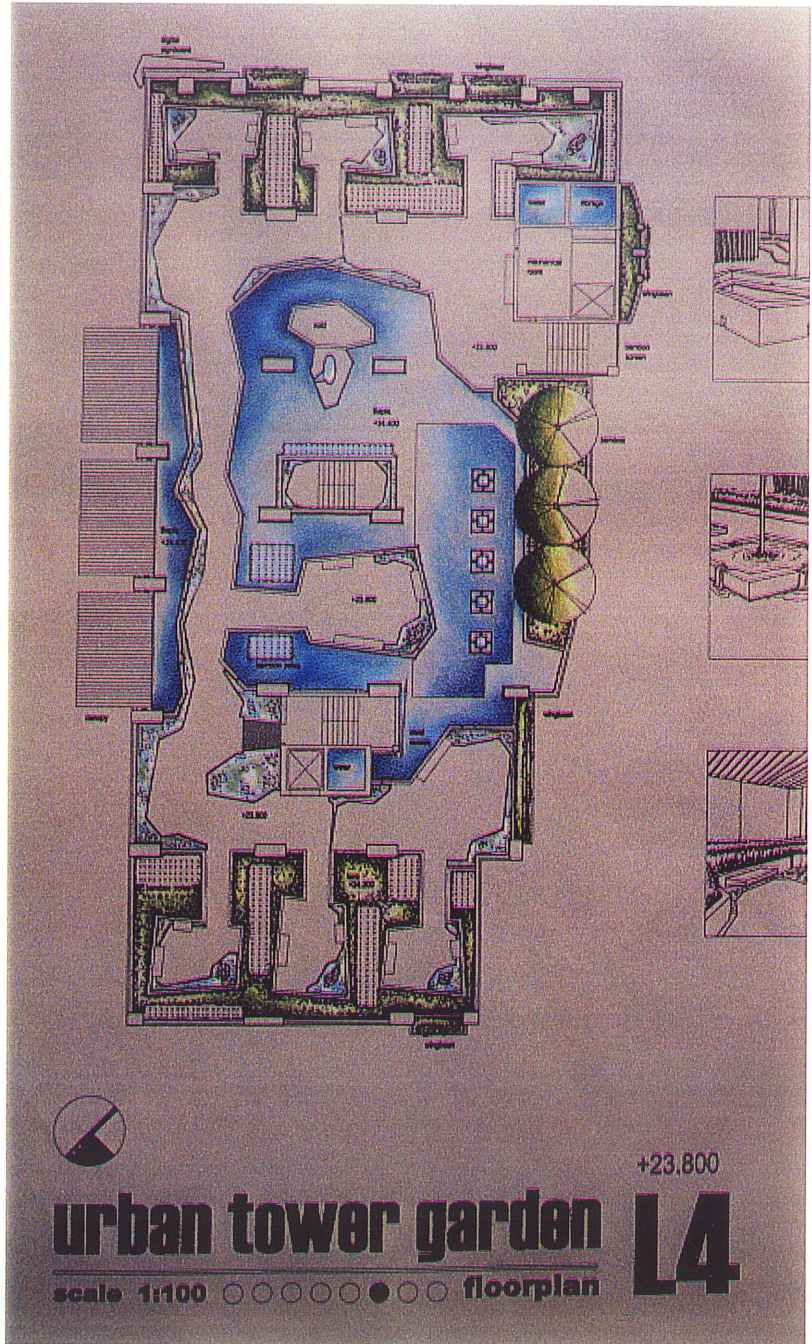


Figure 52

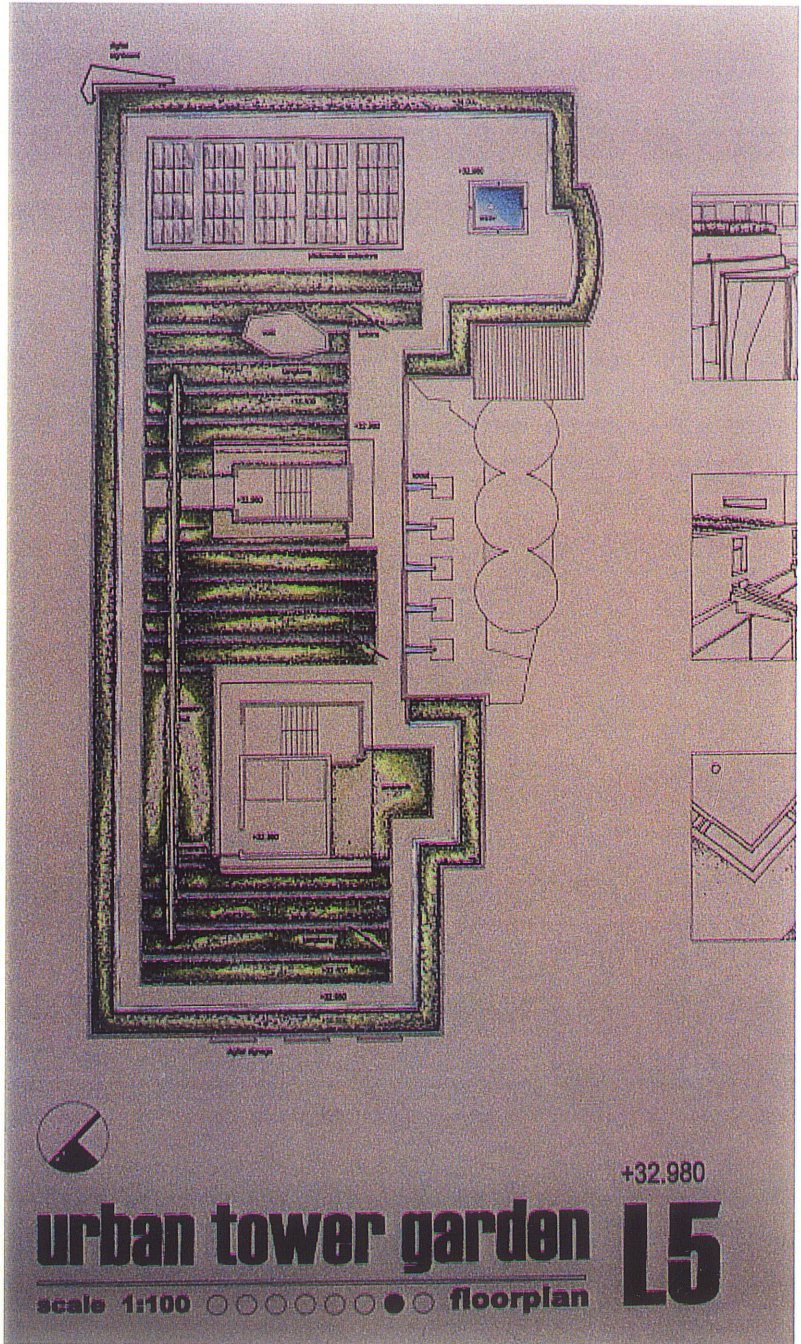


Figure 53

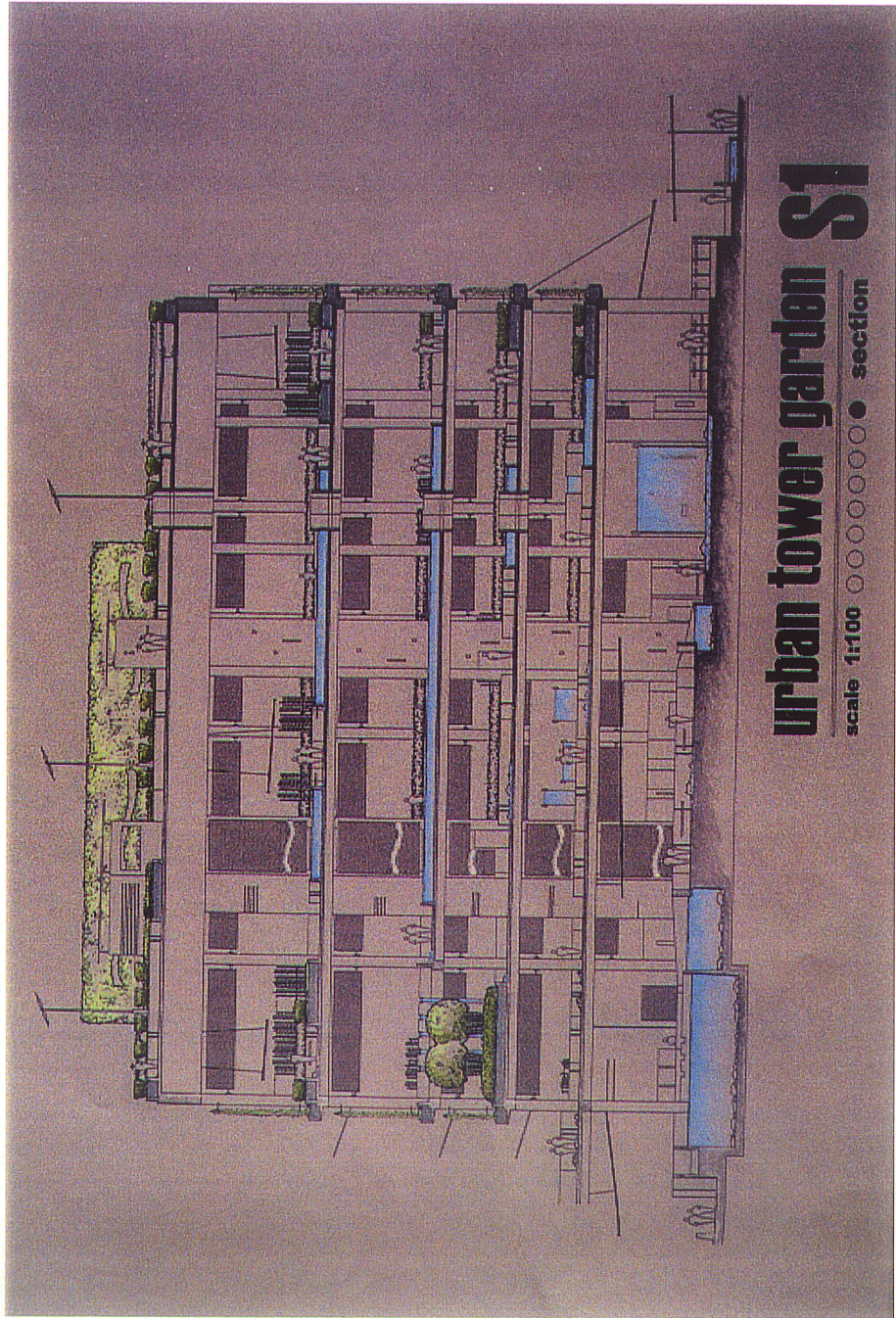


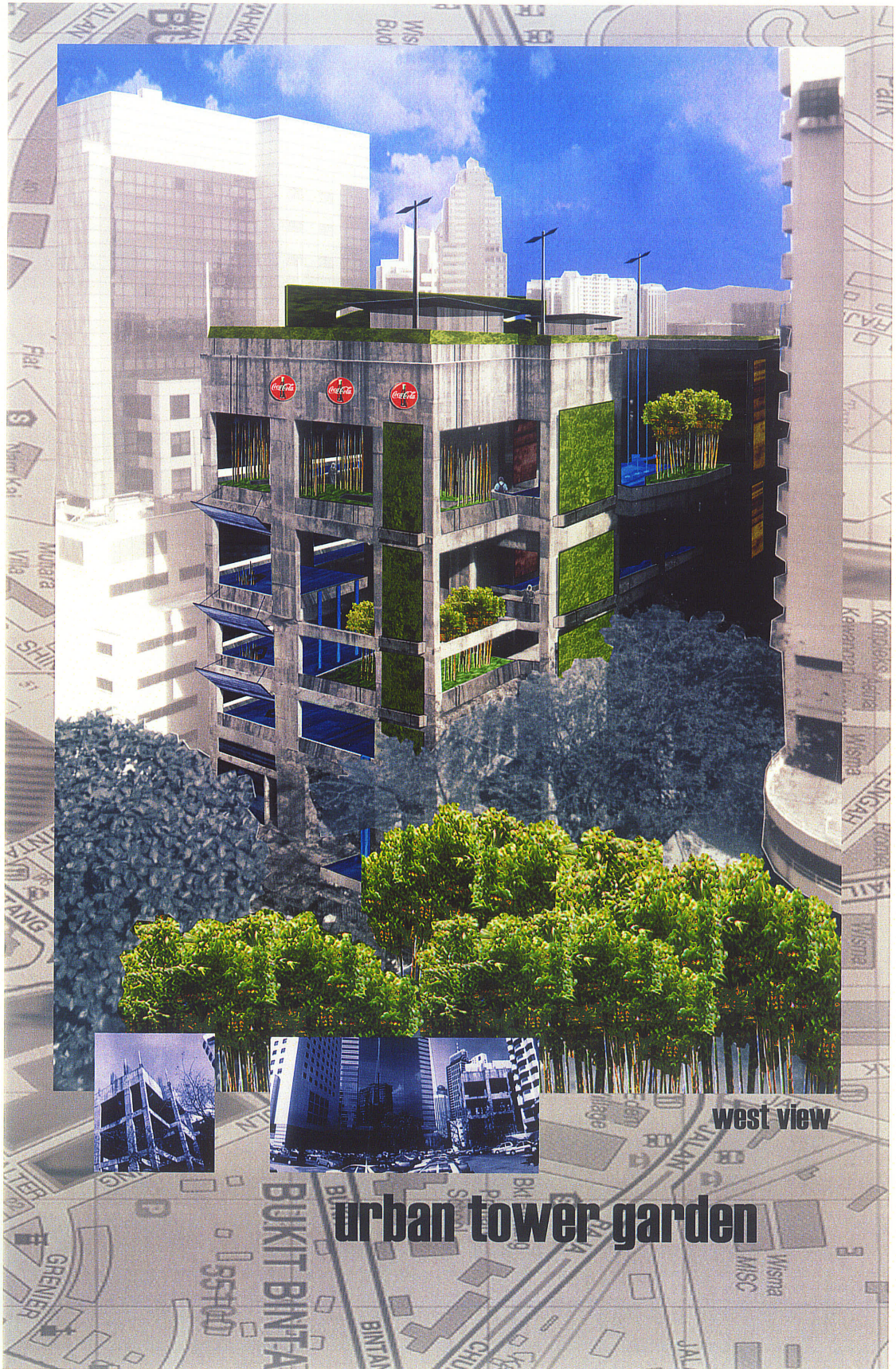
Figure 54



southeast elevation

**urban tower garden**

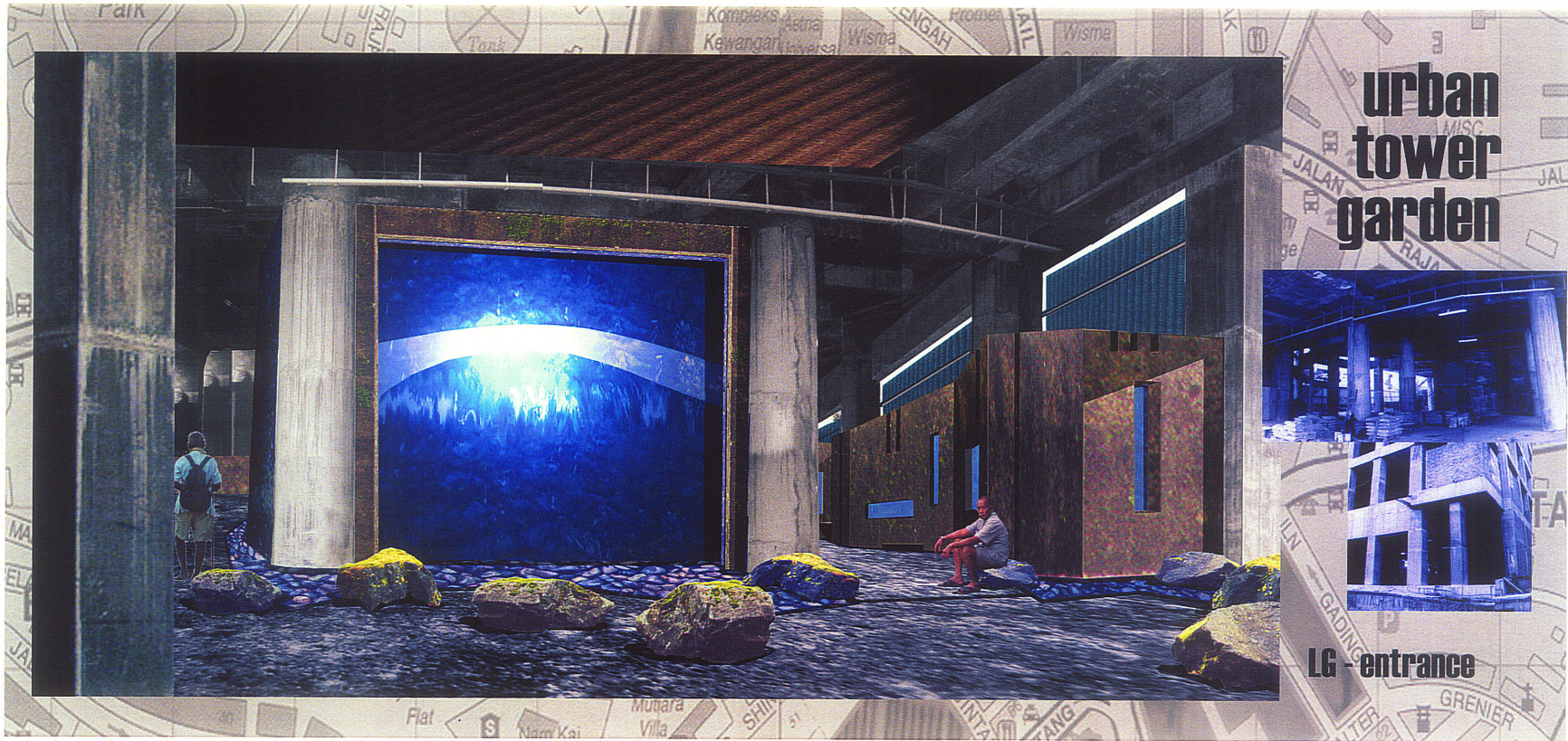
Figure 55



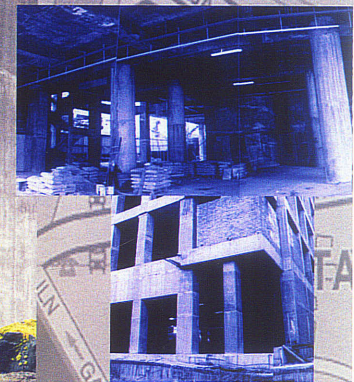
west view

# urban tower garden

Figure 56



**urban  
tower  
garden**



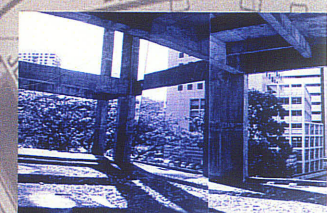
**LG - entrance**

Figure 57

Figure 58



# urban tower garden



L2 - north pool

Figure 59



## **conclusions:**

Human society has created an ecological situation that threatens the health of the planet. Many people regard a shift toward a more sustainable lifestyle as essential. Landscape architecture can develop structures and spaces in which this process of change can occur. The change in the composition of the urban fabric can be introduced into all scales of land development. Landscape architecture can provide the structure within which urban function can occur parallel to natural processes with or without the intervention of humans. However, if the ecological stability of the global environment is to be improved, then the changes introduced by landscape architecture cannot occur for the benefit of humans alone. The human population, in the same manner as any other species, is dependent upon the sustenance of the ecosystem. An holistic approach to urban development needs to be employed. The design solution proposed in this practicum illustrates the potential of urban structure to accommodate an evolution that utilizes space in a more efficient, environmentally sensitive, and culturally meaningful manner. Landscape architecture can develop a proactive initiative to the planning of urban form.

The evolution of the form of each urban area is unique. Identical development cannot occur in two places because cultural, economic and physical contexts are different. Landscape architectural solutions must evolve from the specific nature of a given place. Even if the design objectives and methodologies of developments are similar, solutions must be distinct.

Urban spaces do not need to have a singular and definite purpose or utility. The singular function of many contemporary spaces is often the limiting factor that leads to their dereliction. Humans have become agents of rapid change where new methodologies, technologies, and ideologies place increasing demands to adapt upon urban areas. If a structure no longer suits our specific demands, then it is frequently abandoned and replaced by another structure. The lifecycle of buildings and landscapes is not predictable. This practicum does not prescribe a form for urban development. It provides specific solutions in a specific context. It is flexible in both form and character. The Urban Tower Garden is an illustration of a potential alternative for urban landscape architecture that could be applied in any global context. The illustration recognizes the complexity of urban form and function, and attempts to synthesize the utility of structure with the dynamics of spatial evolution. Urban structures are often developed with inflexible, rigid forms and yet they are required to accommodate fluid and changing function. Urban form needs to provide for spaces to change; to

move in directions not predicted or predetermined. This is universal. The evolution or weathering of a building could be embraced by architecture in such a way that the building's inevitable and gradual change over time is not only realized, it is predicted and managed. Similar to the methods that an engineer employs to determine material dimensions and load applications, building designers can develop structures and forms that accommodate plant growth and spatial evolution. Landscape architecture can help to accommodate the evolution of the built structures within any urban context. The methods, applications, forms and materials change from place to place. The adaptation of the context derives from the character of the place.

There are no physical constraints that restrict landscape architecture. There are only social, cultural, and political obstructions that interfere with intensive urban landscape evolution.

The form of an urban structure is a document of time and place. If a structure is removed from a given place, then a record is lost. Societies have the ability to preserve old structures, but should do this with caution. The preservation of a structure is an action of choice; there is a cost similar to any other material, object or service. A balance between history and vitality needs to be found if there is to be utility and meaning in urban landscapes.

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## **definition of terms: Dictionary of Natural Resource Management**

Julian and Katherine Dunster

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**abiotic:** the nonliving components of the planet, not currently part of living organisms, such as soils, rocks, water, air, light and nutrients.

**acculturation:** the processes and results of contact between two or more different cultures. Acculturation induces diffusion of cultural traits in one or more directions, the development of new intercultural roles, the growth of new customs not found in either culture, or the disintegration of older cultural traditions.

**adaptation:** (1) evolutionary changes in structure, morphology, or physiology of populations that enhance their ability to survive and reproduce in prevailing environmental conditions. These changes are genetic modifications that occur over long periods of time. (2) shorter term behavioural modifications in response to changed or changing conditions.

**aerobic:** (1) environmental conditions in which oxygen is present. (2) organisms requiring atmospheric oxygen as a gas or dissolved in water in order to survive.

**aesthetics:** generally, the study, science, or philosophy concerning judgements made about beauty. An evaluation or consideration concerning sensory quality of resources (sight, sound, smell, taste, touch, and movement) evoked by phenomena, individual elements, or configurations of elements in the landscape surrounding humans, especially with respect to judgements about their pleasurable qualities.

**albedo:** the ratio of shortwave radiation energy reflected back by a surface relative to the amount falling on that surface. Albedo, expressed as a percentage, is thus:  $So / Si \times 100$  where  $So$  = reflected radiation and  $Si$  = radiation coming in. Surface roughness, water content, and daily and seasonal sun angles affect the albedo. Typically, darker, rougher materials have a lower albedo than lighter, smoother materials (e.g. forest=5-10%, grass=25%, snow=55-80%).

**anomalous:** describes an object or process that deviates from the general rule; irregular or atypical.

**anthropocentric:** an attitude that sees humanity at the center of the universe (i.e. more important than any other biotic form).

**bio-chemical cycles:** the cycling of elements such as carbon, nitrogen, oxygen, hydrogen, calcium, sodium, sulphur, phosphorus, and other elements, between the abiotic and biotic components of the environment, including the atmosphere, terrestrial, aquatic, and vegetative systems, by the processes of production, assimilation, and decomposition.

**biodiversity (biological diversity):** the variety, distribution, and abundance of different plants, animals, and microorganisms, the ecological functions and processes they perform, and the genetic diversity they contain at local, regional or landscape levels of analysis. Biodiversity has five principle components: (1) genetic diversity (the genetic complement of all living things); (2) taxonomic diversity (the variety of organisms); (3) ecosystem diversity (the three-dimensional structures on the earth's surface, including the organisms themselves); (4) functions or ecological services (what organisms and ecosystems do for each other, their immediate surroundings, and for the ecosphere as a whole (i.e. processes and connectedness through time and space); (5) the abiotic matrix within which the above exists (the unity of the soil, water, air, and organisms, with each being interdependent on the continued existence of the other).

**biotrophic:** an organism that is entirely dependent upon another for its nutritional needs.

conditions, and by site conditions such as climate, slope, landform, soils, and geology. In the case of water, capability is affected by ambient temperature, pollution inputs, buffering (dilution) capacity, and biochemical oxygen demand. Capability is also affected by season. Capability can be of two forms. (1) Intrinsic capability is the land's capability as it stands without further modification by human activities. (2) Managed capability is the potential capability that is anticipated after human-induced changes have been implemented.

**commensalism:** a relationship between two organisms, where one (the commensal) lives in or on the other, to the benefit of one without harm or benefit to the other (e.g. epiphytes). Commensalism lies in between mutualism and parasitism. See also Parasitism; Symbiosis.

**commodity:** a transportable resource product with commercial value. The resultant products of resource extraction and processing that are utilized in commerce.

**community:** (1) in an ecological sense, the living organisms in a particular ecosystem: the plants, animals, fungi, and microbes of a given seral stage, typically interacting within a framework of horizontal and vertical linkages such as competition, predation, and mutualism. (2) in a geographic sense, the sense of place defined by human activities, such as a village, neighborhood, or region. Such areas may have distinctive ethnic or cultural characteristics, or may be more psychological within the area residence. (3) the area of land occupied by people within the larger (unoccupied) landscape.

**connectivity:** a measure of how well different areas (patches) of a landscape are connected by linkages, such as habitat patches, single or multiple corridors, or 'stepping stones' of like vegetation. The extent to which conditions among late successional/climax forest areas provide habitat for breeding, feeding, dispersal, and movement of late successional- or climax-dependent wildlife and fish species. Natural landscapes often tend to be better connected than those that have been heavily influenced and disturbed by human activities. Consequently, there is a body of opinion that the best way to avoid fragmentation of landscapes is to maintain, or re-establish, a network of landscape linkages. At a landscape level, the connectivity of ecosystem functions and processes is of equal importance to the connectivity of habitats.

**cultivation:** the practice of growing and nurturing plants outside their wild habitat (i.e. in gardens, nurseries, arboreta).

**culture:** (1) a laboratory-produced association of organisms, typically growing on an artificial medium and under controlled conditions. Usually, but not always, of one species or strain, especially fungi or bacteria. (2) a complex body or assemblage of human beliefs, art, morals, customs, religion, and laws, which has evolved historically and is handed down through the generations as a force that determines the behavior and standard social characteristics of a society.

**development:** (1) the advancement of the management and use of natural resources to satisfy human needs and improve the quality of human life. (2) in embryology, the process where eggs, embryos, or young organisms progress toward maturity.

**diversity:** diversity is an assessment of the number of species present, their relative abundance in an area, and the distribution of individuals among the species. Some people consider diversity to be an indicator of ecological complexity or quality, where high species diversity is equated to higher complexity or quality, and declining species diversity is an indication of declining complexity or quality, but this is highly dependent on the potential of the site and the management of objectives being used. However, whether increasing diversity as a result of management activities is automatically an indicator of increasing ecological quality remains subject to debate.

Diversity is a measure of the complexity of an ecosystem; newly established communities are low in diversity; older, more stable communities have higher diversity. Indicators of diversity need to include genetic characteristics, species populations, plant and animal

communities, ecosystems, special habitats, and the principle landscape level elements. Vegetation is the most widely used indirect indicator of diversity.

The issue of diversity is rapidly gaining social and political recognition. It is generally recognized that hypothetical diversity indices can be used to model diversity, but actually creating and/or maintaining biologically diverse ecosystems is a much more difficult problem, and the transition from theory into effective practice is still evolving. One of the most important aspects of diversity is to retain a diversity of diversities in the landscape, thus leaving many options for the future, rather than maximizing one form of diversity that precludes other forms of diversity, possibly of equal or greater importance in the future. Thus, the broad goal of maintaining diversity, now increasingly common in management plans, requires a very detailed knowledge and understanding of the structure, functions, and processes of ecosystems and species populations at all levels, and not just the stand or local level as was common in the past.

A problem of equal importance is that the retention of diversity is now seen to require a major change in societal, cultural, and all resource management attitudes. Such a shift, reflecting an increasing awareness of humanity's impacts on planetary ecosystems, poses huge challenges to the established status quo methods of operating.

Diversity can be measured in several ways. Alpha diversity is the number of different species in a local area, often called species richness. Beta diversity is a measure of the degree of change in species composition, or vertical and longitudinal structure of communities along an environmental gradient – the diversity occurring between habitats or ecosystems. Delta diversity is the diversity of entire plant communities within the vegetational mosaic of management units at a landscape level. Gamma diversity is the species diversity across a variety of ecosystems. It depends upon alpha diversity in each habitat and beta diversity among them.

The term species diversity has been subsumed in recent years, not always correctly, under the term biodiversity. Other forms of diversity include: Genetic, Habitat, Horizontal, Landscape, Structural, Taxonomic, and Vertical Diversity. See also Abundance; Evenness; Species Richness.

**dynamic equilibrium:** the balance point in a non-static system where opposing activities, processes, or inputs and outputs of energy, counteract each other to yield a period of stability (no change). In ecosystems, the balance point between plant and animal densities.

**ecological niche:** an organism's actual place within a community, including its tolerances for the physical environment, its interactions with other organisms, and the manner in which the organism utilizes the component parts of its habitat.

**ecosystem:** (1) a complex system of living organisms (plants, animals, fungi, and microorganisms), together with their abiotic environment (soil, water, air, and nutrients) that function together to circulate nutrients and create a flow of energy which creates biomass, a trophic structure in the living community, and a change in ecosystem form and function over time. (2) a unit of land or water comprising population of organisms considered together with their physical environment and the interacting process between them; for example, marsh, watershed, or lake ecosystem. Any one ecosystem has relative uniformity in the composition, structure, and properties of both the biotic and abiotic components and their interactions. Ecosystems do not have boundaries fixed in time or space, since their components parts are in a constant state of flux and can change rapidly or slowly, depending on prevailing environmental factors.

**entropy:** the degree of chaos or disorder within a system. In thermodynamics, entropy is related to the portion of the energy contained in a system that can be converted into useable work.

**environment:** the combination of climatic, physical, chemical, and biotic conditions that may effect the growth and welfare of an organism or group of organisms.

**evolution:** a cumulative genetic change in a population of organisms related by descent, over time. It is typically the result of natural selection but can also be due to random genetic drift. Evolution has no determined endpoint.

**exploitation:** (1) the consumptive use of resources in order to provide benefit either individually or for a wider range of individuals. In a pejorative sense, the consumptive use is considered to be selfish, that is, of benefit to a few at the expense of many. (2) in wildlife management, the removal of individuals or biomass from a population by predators or parasites.

**flux:** (1) the flow of energy in one or more forms, from a source to a sink. It can be continuous or a series of defined changes. (2) the rate of flow or change of a liquid, gas, or radiation across the landscape.

**habit:** the characteristic appearance, shape, posture, and mode of growth of an organism, as opposed to the organism's size or color. In plants the form of arrangement of stem, roots, and branches, or of the entire plant. It is also termed growth form. Such features are typically possessed in common by a given species in a given habitat.

**habitat:** (1) those parts of the environment (aquatic, terrestrial, atmospheric), often typified by a dominant plant form or physical characteristic, on which an organism depends, directly or indirectly, in order to carry out its life processes. (2) the specific environmental conditions in which organisms thrive in the wild.

**holism:** the idea that a whole is more than the sum of its parts.

**landscape:** (1) an expanse of natural or human-made scenery, comprising landforms, landcover, habitats, and natural and human-made features that, taken together, form a composite. (2) a mosaic of habitat types occupying a spatial scale intermediate between an organism's normal home-range size and its regional distribution.

**life cycle:** (1) the series of changes in form (stages) through which an organism develops from spore or fertilized ovum all the way through to the spore or fertilized ovum of the next generation. (2) the length of time taken by a given organism to go through this set of changes.

**model:** an idealized representation of reality developed to describe, analyze, or understand the behavior of some aspect of it; a mathematical representation of the relationships under study; the quest to find a subset of variables and a function between them that adequately predicts one or more dependent variables. The term model is applicable to a broad class of representations, ranging from a relatively simple qualitative description of a system or organization to a highly abstract set of mathematical equations.

**reclaim:** v.t. bring back (from wrong); make fit for cultivation. –reclamation n. reformation; regaining, as of land from the sea. (Webster's New Dictionary & Thesaurus)

**sustainability:** (1) sustainability in the meaning of husbandry. In this sense, it is related to such terms as continuity, durability and exploitation of natural resources over long periods of time. It is also referring to certain methods in which humans manage their lands: crop rotation systems, the application of following, etc. They are all meant to create possibilities for soil and water systems to restore in terms of good and sufficient water, healthy soil structures, etc. This meaning actually refers strongly to the physical, and therefore also to the economic, sustainability on the long run. (2) sustainability in terms of interdependence. This meaning described, by Bryden is strongly related to the spatial dimension of sustainability. It refers to such aspects as fragmentation (which has contradictory meanings for farming, nature, and outdoor recreation and is therefore an important land use planning aspect), and relations between different land uses (e.g. cropped areas and semi-natural vegetation). It is this meaning of sustainability that gets a great deal of attention in land use planning studies, since there still is a great lack of knowledge, many

uncertainties, and often lack of clear policies in this regard. (3) sustainability in terms of ethical obligations to future generations. This refers to the many observed losses and depletions of the natural resources in combination with the expected increase in population. Particularly known ones are fossil fuels, forests, soil-losses, water and air pollution, losses of nature areas and of old landscape etc. It is clear that, both in the field of better management and of restoration, much needs to be done for our future mankind.' (Van Lier, 79-80)

**sybiosis:** (1) generally, a long-term association between two different species living together. (2) may be restricted to organisms that have mutually beneficial relationships (mutualism), but can also include commensalism and parasitism that would be harmful to one of the organisms.

**urban:** an area in which residences and other human developments form an almost solid covering of the landscape, including most areas within cities and towns, subdivisions, commercial and industrial parks, and similar developments whether inside the city limits or not.

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