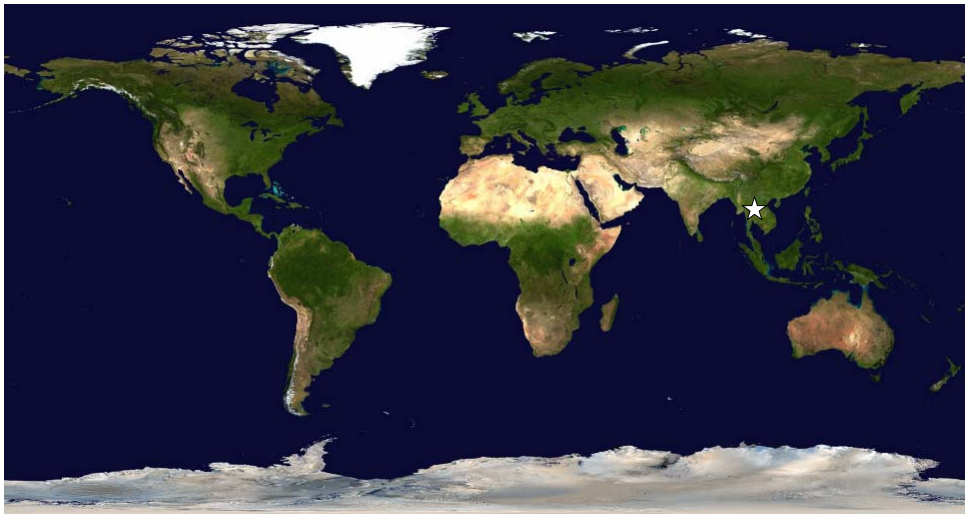
Green Design & Planning of Urban Infrastructure in Asian Cities.

Asso Prof Ariya Aruninta, PhD

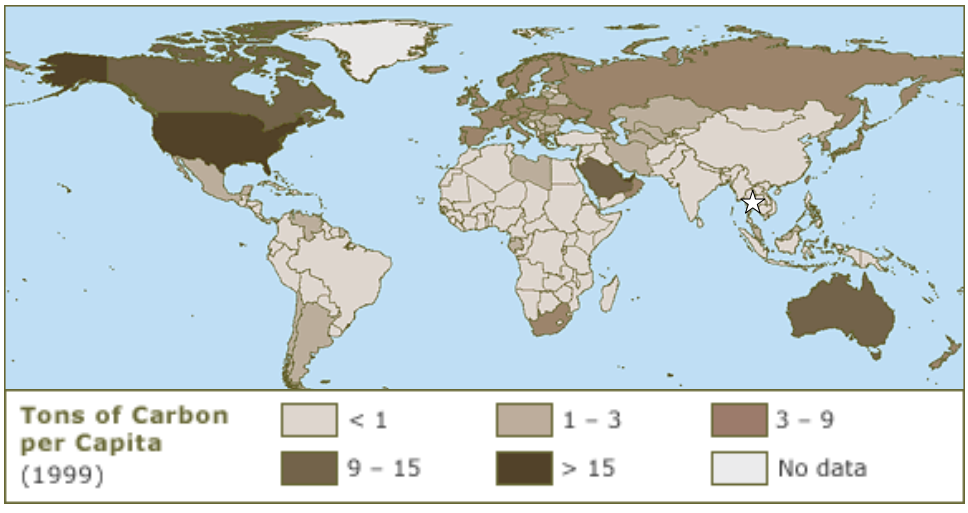
Dialogue between Policy Makers and Researchers: Demands and Roles of Sustainablr Low Carbon Development Researchers from Policy Perspective



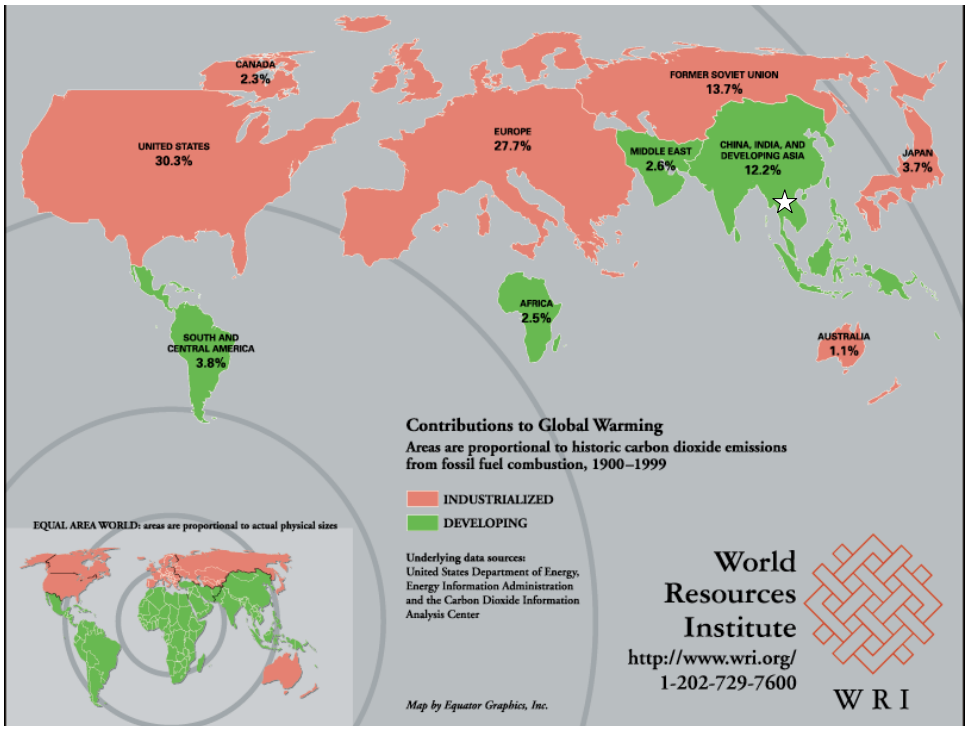
NASA Map

This spectacular “blue marble” image is the most detailed true-color image of the entire Earth to date. 2

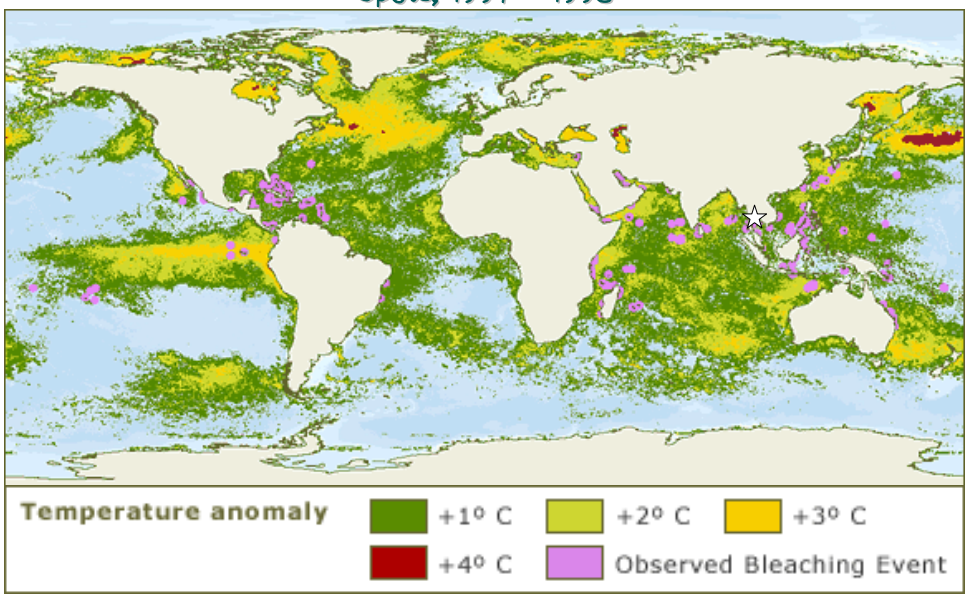
Carbon Emissions Per Capita, 1999



World Resources Institute [http://earthtrends.wri.org] 3

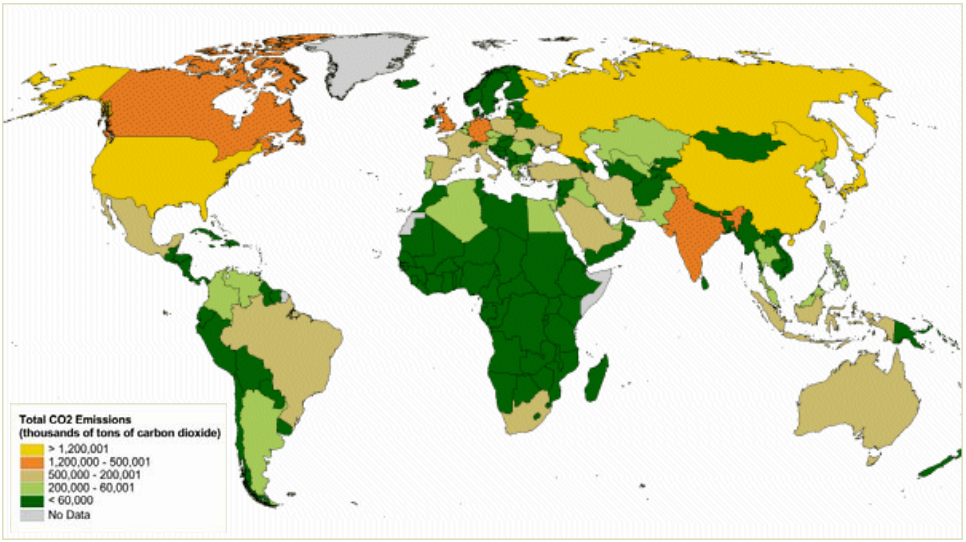


Coral Bleaching Events and Sea Surface Temperature Anomaly Hot Spots, 1997 - 1998



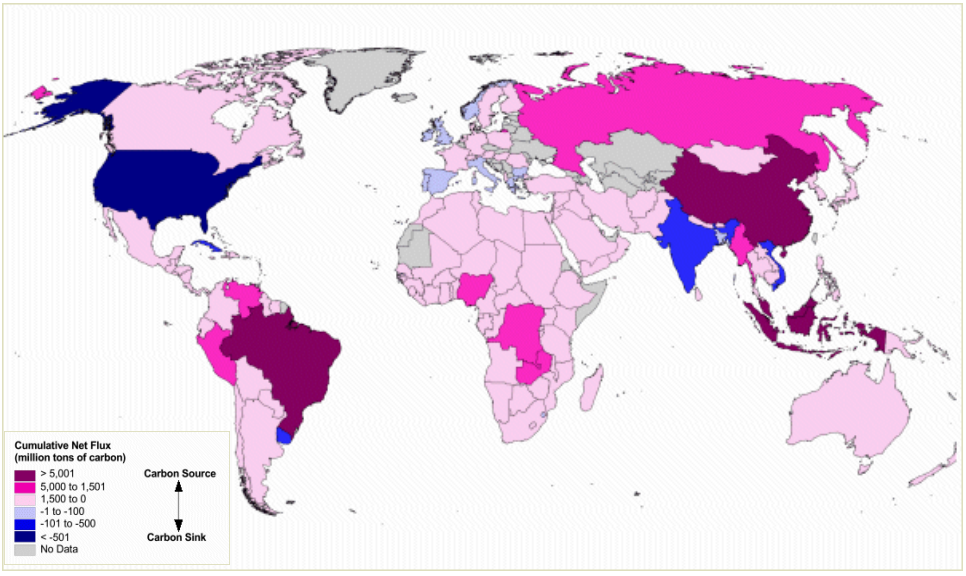
World Resources Institute [http://earthtrends.wri.org]

Total CO2 Emissions, Excluding Land Use Change, 2000



6

Net Flux of Carbon to the Atmosphere from Land-Use Change, 2000



7

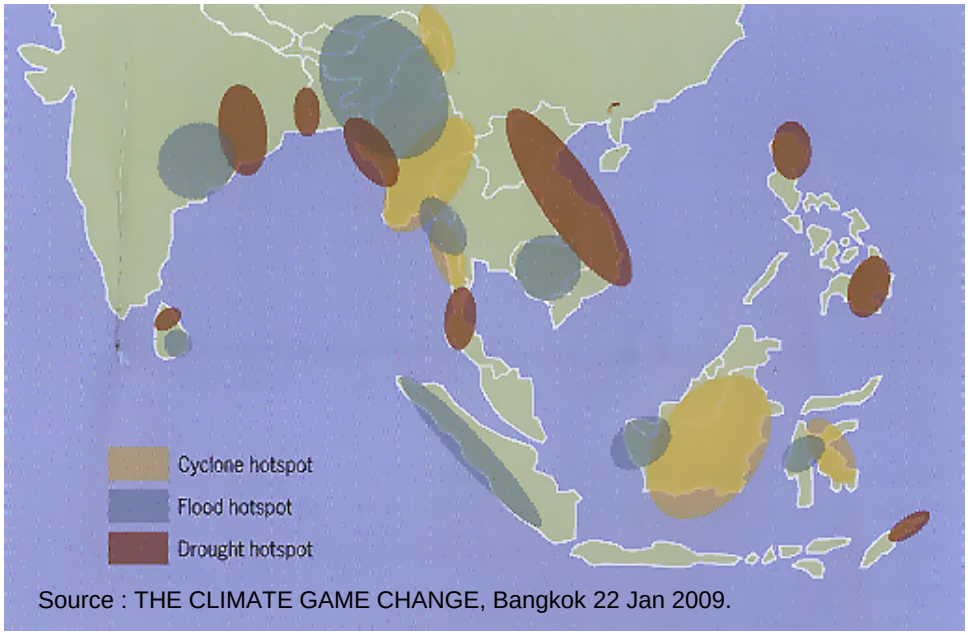
Result of man-made land use changes

While the majority of global CO2 emissions are from the burning of fossil fuels, rougly a quarter of the carbon entering the atmosphere is from land-use change.

Together, CO_2 from fossil fuels and cement manufacture, CO_2 from land-use changes, and the emissions of five non-CO_2 gases--methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6)--constitute the main sources contributing to climate change.

- Deforestation,
- Shifting cultivation,
- Vegetation re-growth on abandoned croplands and pastures)

[https://earthtrends.wri.org]



Source : THE CLIMATE GAME CHANGE, Bangkok 22 Jan 2009.

Climate hotspot in south and south-east Asia 9

Thailand – Country 'env' profile

- **Length of coastline** 7066 km
- **Per capita CO_2 emissions:** 1998 3 thousand metric tons of CO_2(**Percent change since 1990 :** 85 % ,while the world : -2%, and Asia (excl mid east) : 19%)
- **Percent of GDP earned** by: Agriculture : 10 % Industry :40 %, Services 49 %
- **Area of Mangrove Forests:** 5092 km^2
- **Total forest area:** 14,762,000 ha (Natural forest area 9,842,000 ha, Plantations area 4,920,000 ha)
- **Forest area in 2000 as a percent of total land area Thailand:** 29 %, Asia 20 %, World 29 %
- **Change in forest area:** Total, 1990-2000 Thailand -7 %, Asia (excl mid east) -1 %, World -2 %)
  - **Natural 1990-2000** Thailand -26 %, Asia -1 %, World -4 %
  - **Plantations 1990-2000** Thailand 6 %, Asia 5 %, World 3 %
- **Percent of total land area covered by: Forests:** 31 % (17 %24 %) **Shrublands, savanna, and grasslands:** 9 %(37 %37 %) **mosaic:** 59 % (34 %20 %) **Urban and built-up areas:** 0.2 % (0.2 %0.2 %) **Sparse or barren vegetation; snow and ice:** 0 % (10 %16 %) **Wetlands and water bodies:** 2 % (2 %3 %)

10

World Resources Institute http://earthtrends.wri.org

THAILAND

Asia

- **Bangkok Metropolis and its vicinity towns have constituted the national base economic, political and cultural activities serving the international community as the country's main focal point throughout the years and ranked as *the world's 15th largest metropolitan capital*. Furthermore, Bangkok is considered *the largest center for international airlines in the Southeast Asian region.***

http://www.lonelyplanet.com/

Inconvenient truths

- South and Southeast Asia are climate change **"hotspots"** at particular risk from **cyclones, flooding, and drought.**
- Climate change will likely kill around 30% of **Asia's coral reefs** in the next 30 years, making coastlines more vulnerable to **storm surges.**
- Insect populations will thrive in warmer weather, making crops **more vulnerable and carrying diseases** like dengue to new locations.
- With a 1 meter rise in sea level, 2 500 km2 of **mangroves in Asia are likely to be lost, increasing storm damages.**
- The United Nations predict that the global **cost of adaptation** will be $86 billion per year by 2015.
- **Insurance companies** worldwide are already raising premiums and changing policies to reflect **new risks from climate change.**

Source : THE CLIMATE GAME CHANGE, Bangkok 22 Jan 2009.
http://www.climategamechange.org/facts.html

12

Potential climate-related disasters in Thailand

- Extreme weather
- Increase in strength/frequency of typhoons
- Heavy rainfall → La Nino
- Storm surge
- Sea level from glacial retreat and Arctic shrinkage
- Salt water evades to the Chao Phraya river
- Sea temperature → El Nino / ENSO (El Nino - Southern Oscillation)
- Drought (5-10% less than average) → El Nino / ENSO
- Health and diseases
- Bio diversity

13

Affects

- Gay Typhoon in 1989
- Indian Tsunami in Dec 2004 - impact on settlements in the Coastal area
- Coastline erosion : Wat Khun Samut Chine, Samut Prakarn 20-25 m/yr,
- Bangkuentian 130,000 rai all over Thailand and the controversies on T-groins (Sand Sausage / Geo-tube) technology vs Local wisdom coastline protection in Bangkuentian

14

Lesson learned from Typhoons track

Source :

ค คน Magazine Oct 2008

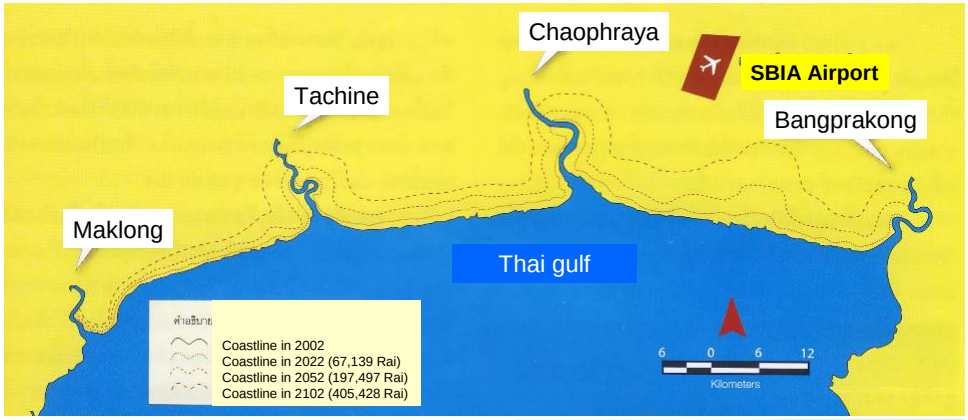
15

Khao Lak before and after Dec 2004 Tsunami

16

Khao Lak before and after Dec 2004 Tsunami

17



Coastline erosion

Source : (excerpted)

ค คน Magazine Oct 2008

Coastline erosion

Wat Khun Samut Chine




Recent mitigations



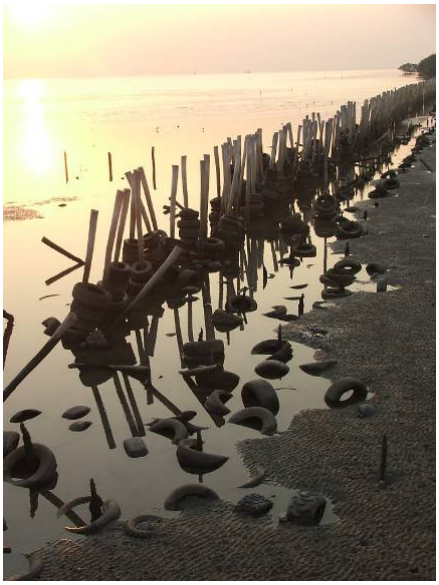


Climate Change Crazy / The Fear?!

Source :
ค คน Magazine Oct 2008

23

Muddy Delta Coastline protections



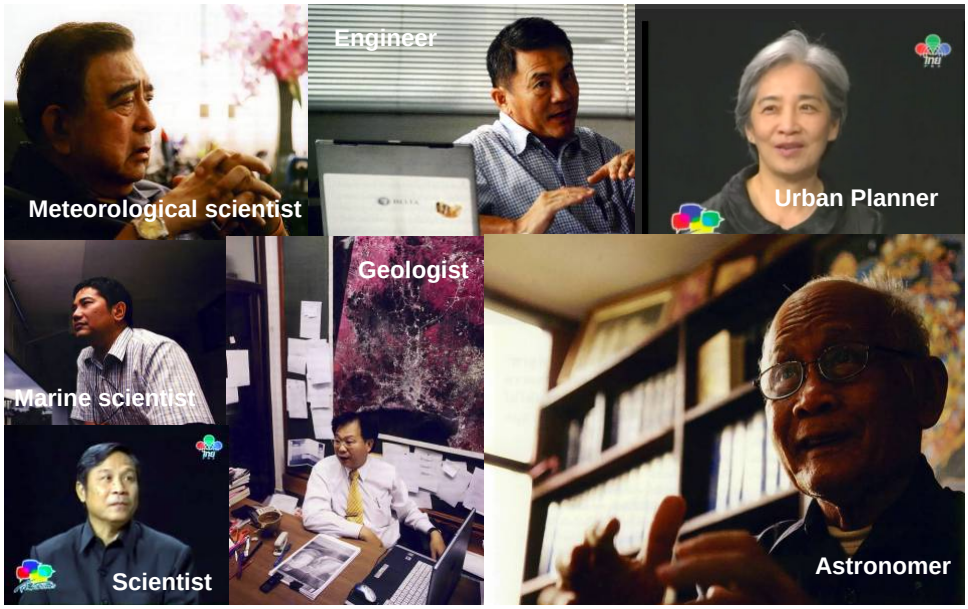
How about built env designers /planners should do for Green Design & Planning of Urban Infrastructure ?

- What are the origins of problems? → ETC'
- No ad-hoc reactions, no holistic approach
- Need National agenda /campaigns / programs
- 'the game of negotiations'.
- Time for physical planners to collaborate with policy Makers and researchers.

Key actors in Green Design & Planning of Urban Infrastructure

- Architecture and Interior architecture
- Landscape architecture
- Urban design and planning
- Engineering : civil, sanitary, architectural systems, transportation, urban engineering, etc.

Thailand's Climate change people

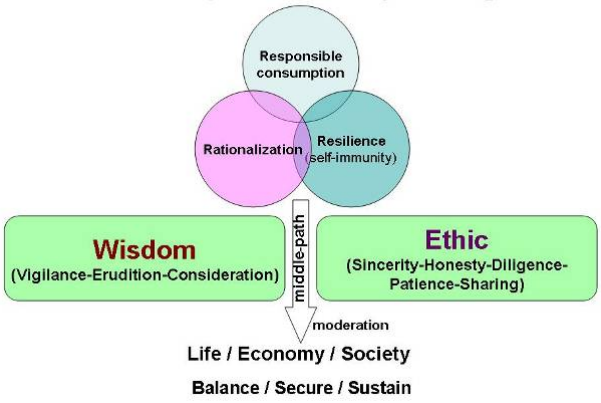


Innovations to cope with/adapt to

- King's Philosophy : Sufficiency economy
- Royal project initiatives → Royal rain, 3 waters projects (Fresh water, flooding water, waste water), Bio diesel, E-ternol, slope protection using Vetiver grass, etc
- Ecological approaches in design and planning, Green architecture → Green roof, permeable surface, rain garden, etc
- Disaster preparedness and National Disaster Warning Center
- Alternative Energy
- Agriculture and food security
- Public awareness → cloth shopping bag, reduce energy consumption, reforestation, sufficiency economy life style
- Private sector and their CSR programs

29

'Sufficiency Economy' diagram

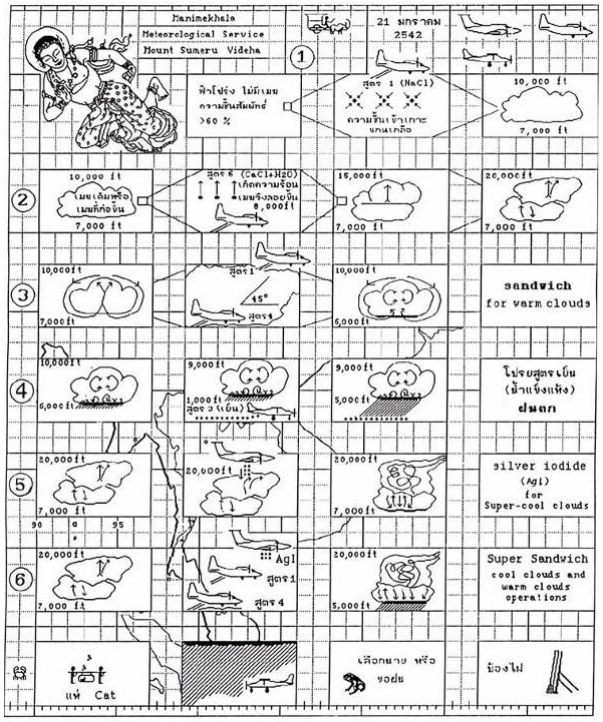


'Sufficiency Economy' : the United Nations first Human Development Lifetime Achievement award philosophy developed by the recent King of Thailand; Bhumibhol Adulyadej. It focuses on development integration with people as the centre and balance with economic, social, politics and environment aspects. It help promote the production sector and the awareness of the necessity of changing attitude and some consumption habits have aimed to more self-reliance, morality, efficiency, quality, modernization, and better income.

30

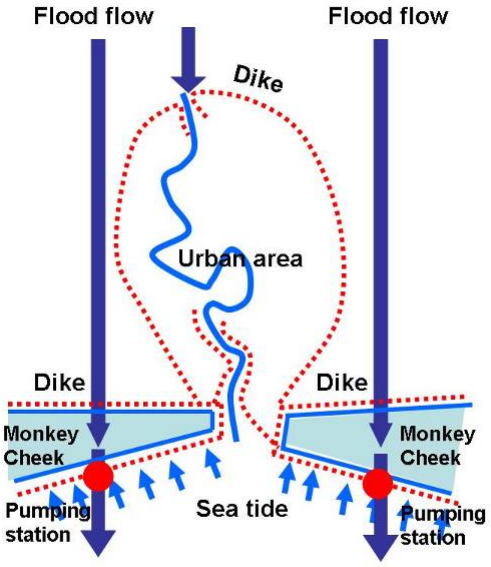
Megaproject vs Sufficiency economy?

31



Royal Rain Initiative

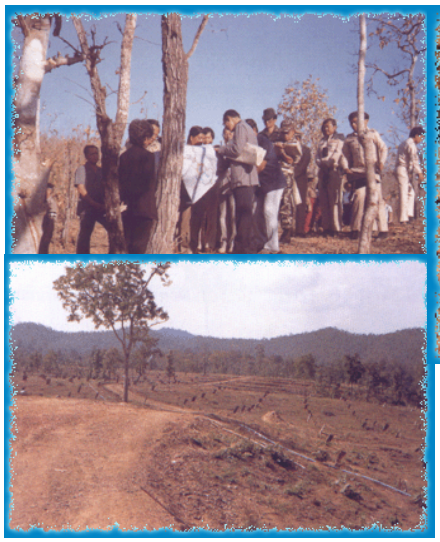
32



Flood protection : Monkey Cheeks

33

From... Drought



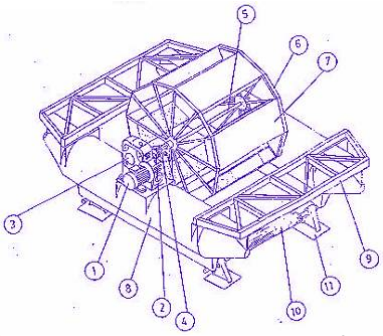
Check dam (weir) and wet fire barrier

34

3# Water – Waste water

- waste water treatment :
  - 1) The Lagoon Treatment System,
  - 2) The Artificially Constructed Wetland System,
  - 3) The Grass Filtration System,
  - 4) The Red and White Mangrove System
- ไม้ประดับ พวกพุทธรักษา ธรรมรักษา กล้วยก้ามกุ้ง (Canna, Heliconia) สำหรับ waste water treatment area (Konnerupa, Koottatepb, and Brix, 2008)
- **กังหันชัยพัฒน์ Aerator :** low speed surface aerator paddle-wheel machine.

Waste water treatment



37

Vetiver grass

38

Civic plaza, Bangkok Metro. Admin.

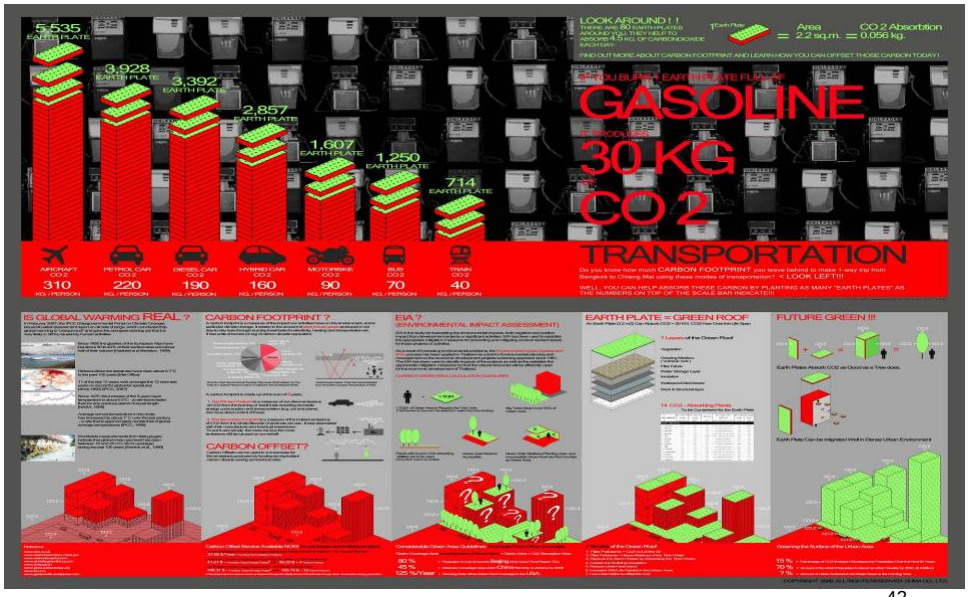
Lighting and ventilation

40

A Popular CSR activity : Mangrove reforestations

41

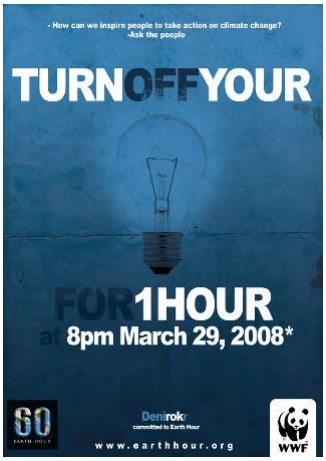
Innovation from Landscape Architects : Earth Plates



Source : Exhibition at TALA Landscape Expo09 - by Shma Company Limited [42]

Activities by NGOs and private sectors' CSR

Local Government :
BMA (Bangkok Metropolitan Administration)



- 22 September Bangkok join the World Car Free Day
- March 29, 2008. Bangkok joined other major cities of the world in a campaign to raise awareness about global warming by turning off lights.
- Green Bangkok → to reduce heat island, etc.

44

National government

- **The Thailand Strategic Plan on Climate Change, approved by the Cabinet in January 2008,** incorporates 6 strategies on capacity building, research and development, awareness and public participation, and international cooperation, addressing both climate change mitigation and adaptation.
- **New Bldg code and ministerial regulations**
- **Energy saving Label**
  - Site location
  - Landscape
  - Bldg skin
  - A/C
  - Lighting system
  - Alternative Energy management
  - Sanitation
  - Bldg Materials
  - Other energy conservation and env concerns
- **Green building design competitions**

กรมพัฒนาพลังงานทดแทน
และอนุรักษ์พลังงาน
กระทรวงพลังงาน

International green lebels

EU's BREEAM [BRE Environmental Assessment Method]

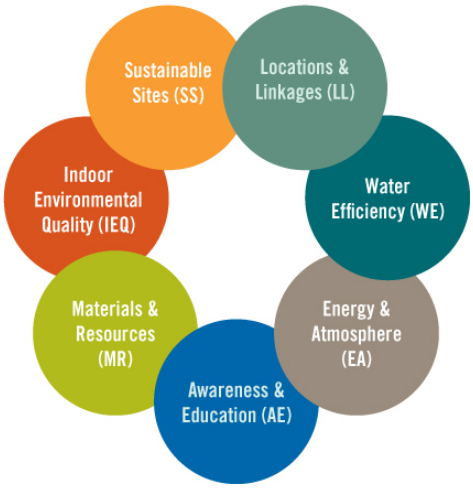
BREEAM Rating	% Score
Unclassified	< 30
Pass	≥ 30
Good	≥ 45
Very Good	≥ 55
Excellent	≥ 70
Outstanding*	≥ 85

BREEAM Section	Weighting %	
	New builds, extensions and major refurbishments	Building fit out only (where applicable to scheme)
Management	12	13
Health & Wellbeing	15	17
Energy	19	21
Transport	8	9
Water	6	7
Materials	12.5	14
Waste	7.5	8
Land Use & Ecology	10	N/A
Pollution	10	11

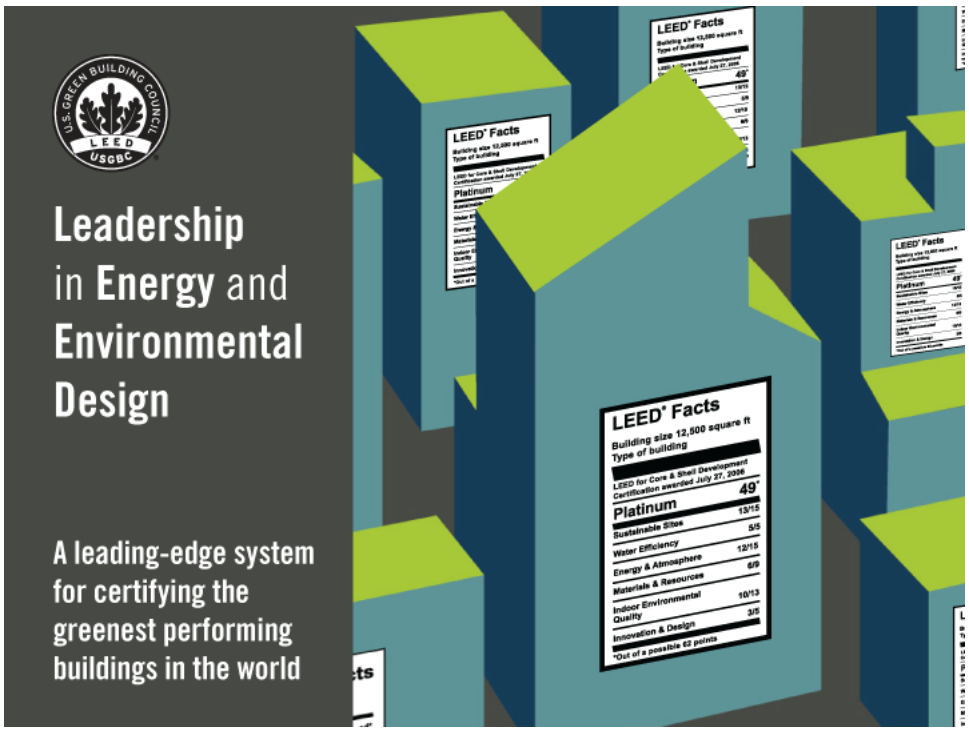
LEED

- LEED องค์กรนานาชาติที่ริเริ่มระบบ green building certification
- พัฒนาโดยหน่วยงาน the U.S. Green Building Council (USGBC)
- โดยเน้นวัตถุประสงค์
  - ด้านการปรับประสิทธิภาพ: energy savings, water efficiency, CO_2 emissions reduction,
  - ช่วยให้ environmental quality ภายในอาคารดีขึ้น,
  - การใช้ทรัพยากรอย่างเหมาะสมและลดผลกระทบ.

Credit Categories




Architects
Product Manufacturers
Federal, Local, and State Governments
Building Owners
Non Profit Leaders
Planners
U.S. GREEN BUILDING COUNCIL USGBC
Engineers
Financial Planners
Interior Designers
Landscape Architects
Building Tenants
Utility Managers
Property Managers
Code Officials


U.S. GREEN BUILDING COUNCIL LEED USGBC
Leadership in Energy and Environmental Design
A leading-edge system for certifying the greenest performing buildings in the world
LEED® Facts
Building size 12,500 square ft
Type of building
LEED for Core & Shell Development
Certification awarded July 27, 2006
49*
Platinum
Sustainable Sites 13/15
Water Efficiency 5/5
Energy & Atmosphere 12/15
Materials & Resources 6/9
Indoor Environmental Quality 10/13
Innovation & Design 3/5
*Out of a possible 82 points

Consensus-Based Standards
USGBC has four levels of LEED:

LEED® Facts

[Your Project Here]
[City, State, County]

LEED for New Construction

Platinum	**110***
Sustainable Sites	26
Water Efficiency	10
Energy & Atmosphere	35
Materials & Resources	14
Indoor Environmental Quality	15

**Out of a possible 100 points + 10 bonus points*

Innovation & Design	6
Regional Priority	4

examples

Roof Garden

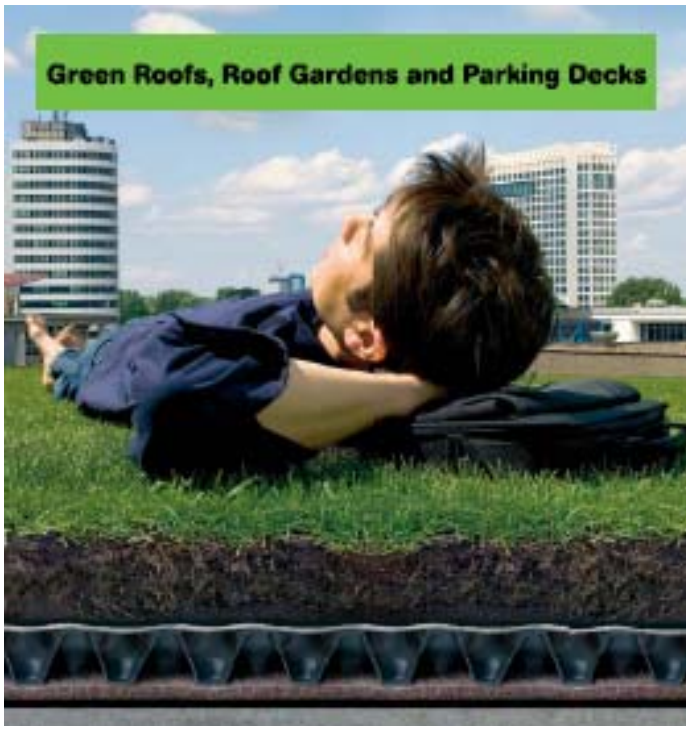
- Not only roof garden for functions and esthetic
- But aims to deal with 'climate change' as indicated in US Green Building Council, LEED (Leadership in Energy and Environmental Design) certification program
- National agenda/Policy → EX. URA (Urban Redevelopment Authority) "Skyrise Greenery for green roofs bonus gross floor area (GFA) / LUSH (Landscaping For Urban Spaces And High-Rises)

Benefit of roof garden

- reduce urban heat island effects
- Storm water run-off management
- Functions, esthetic, economic benefits
- Absorb noise 40dB
- Energy efficiency
- Air and water purification

components

- Sub grade
- Protection Fabric
- Insulation
- Drain Boxes / Drainage Composite
- Edging / Root Barrier
- Growth Media / pavement /ground cover material
- Other Structure / furniture



Rain garden

- Integrate structure with landscape rain water harvesting

Singapore

Conceptual guideline of Landscape Replacement in LUSH

(Landscaping For Urban Spaces And High-Rises)

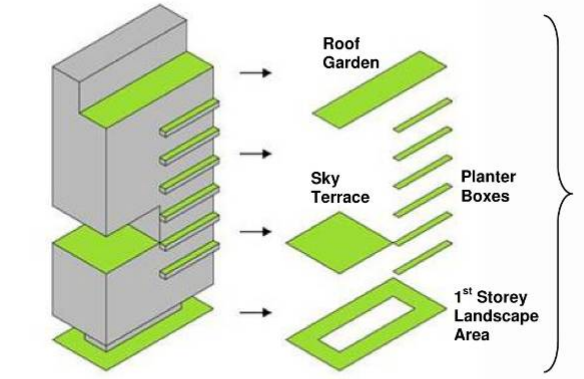


Diagram showing the various types of Landscape Replacement Areas that could be incorporated within a development

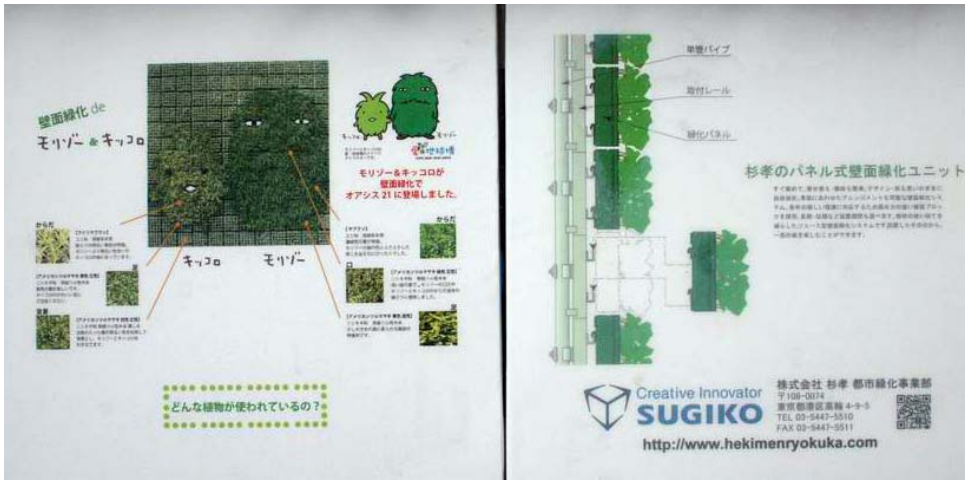
Landscape Replacement & LUSH policy

Car Park LUSH

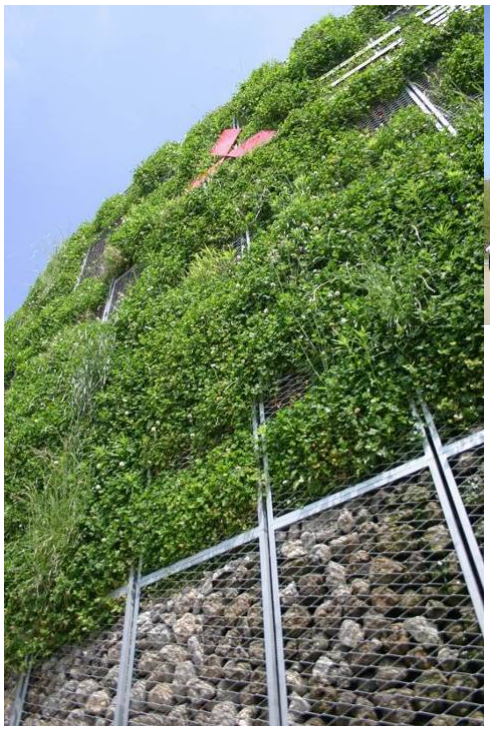
45-Degree Skyrise Greenery terrace or ORAs (Outdoor Refreshment Areas) from GFA (Gross Floor Area) exemption

Japan

Aichi expo



Vertical planter



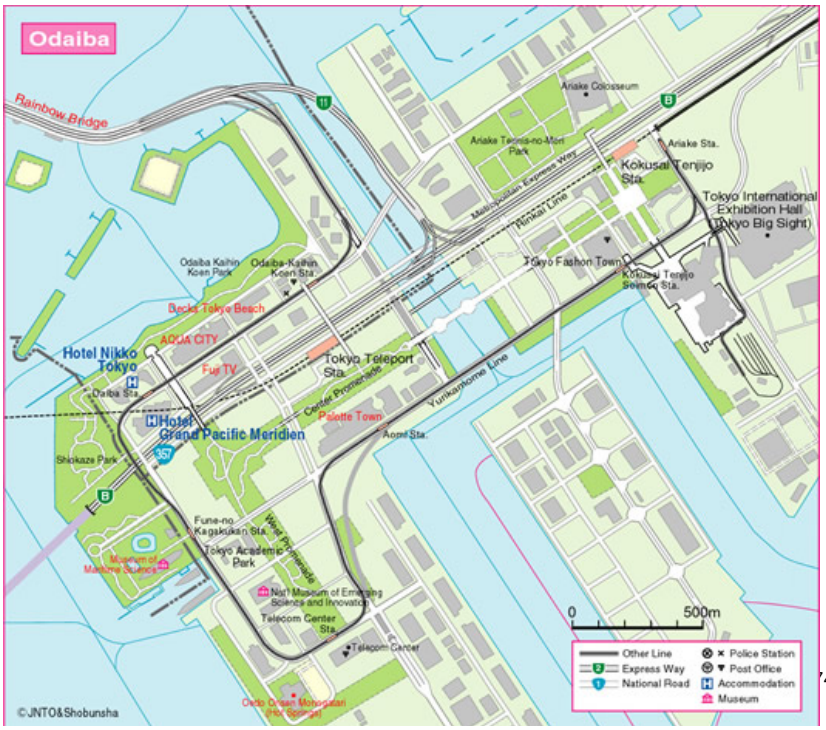
Vertical planting 68

Vertical planting

Vertical planting

Design vs
NO Design

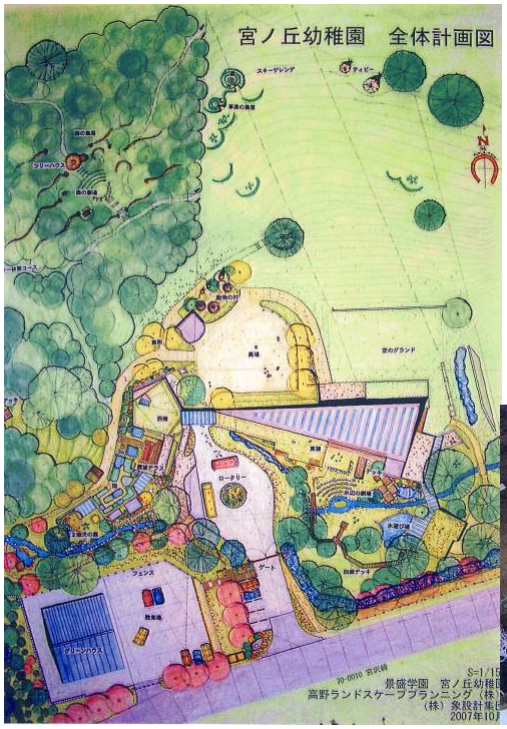
Balance and sustainable



74

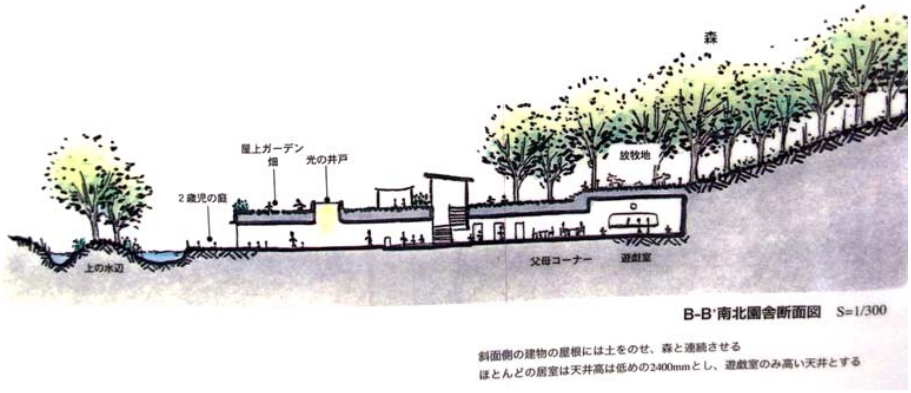
Dialogue with nature

75



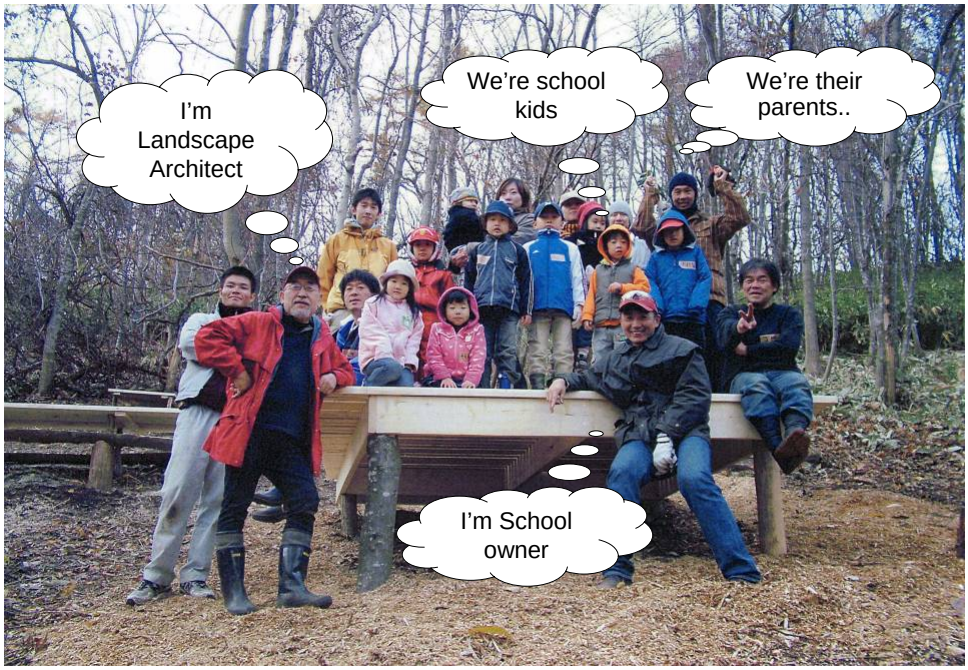
Kindergarten -
Miyanooka
Youchienn

Modestly blending with its environment

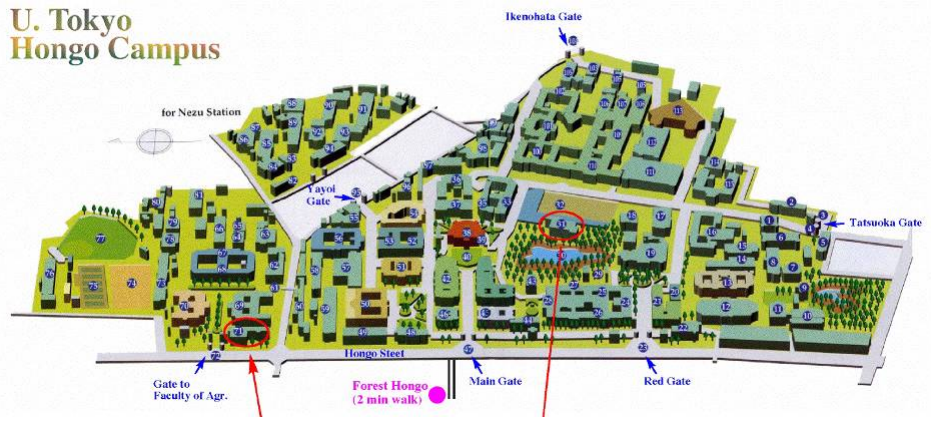


B-B'南北園舎断面図 S=1/300

斜面側の建物の屋根には土をのせ、森と連続させる
ほとんどの居室は天井高は低めの2400mmとし、遊戯室のみ高い天井とする



Todai - Campus planning



81

@ Sanshiro Pond

Takahachi Construction Company

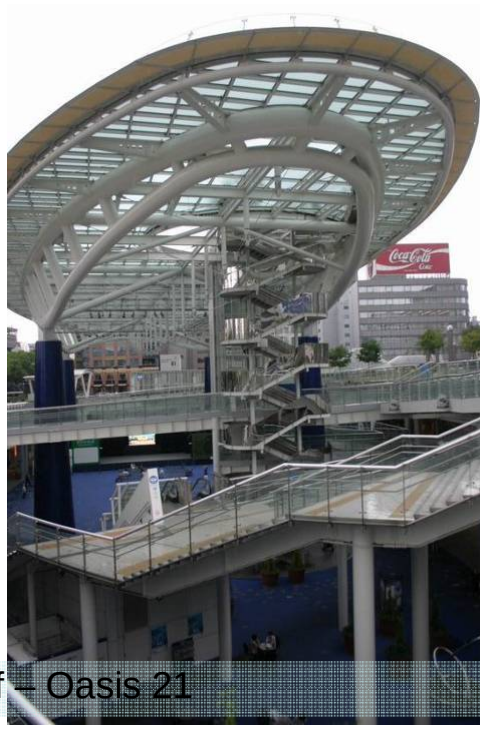
Concept:
Green roof

Millennium Forest

Millennium forest

Ecology park

88



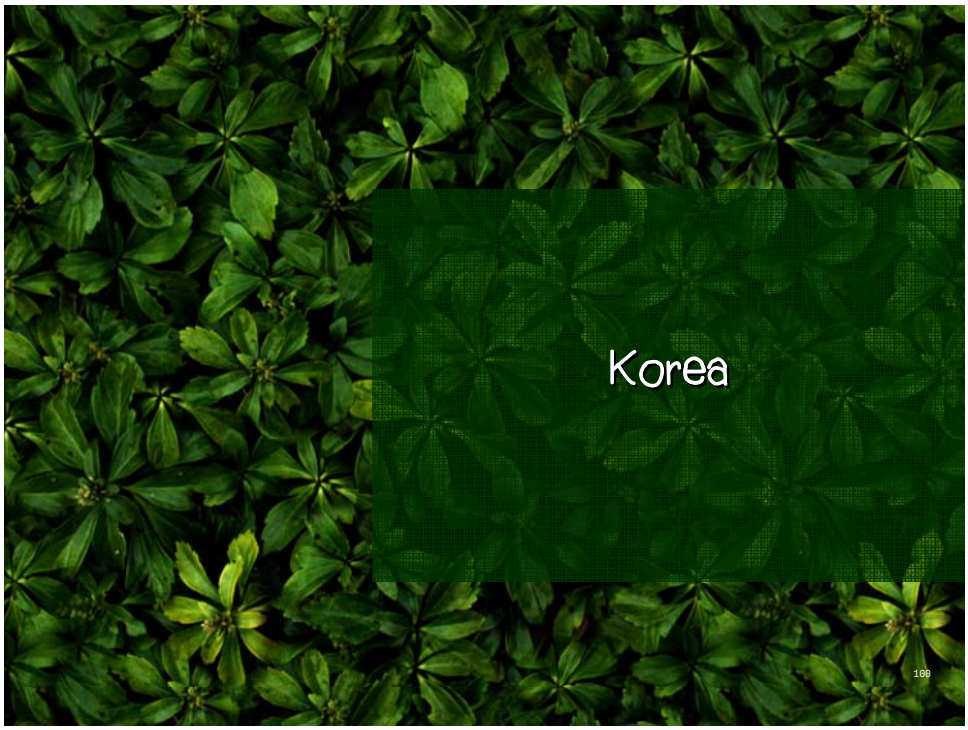
Water roof – Oasis 21


Malaysia
93

Sentul, KL.

Cheonggyecheon

highway → river

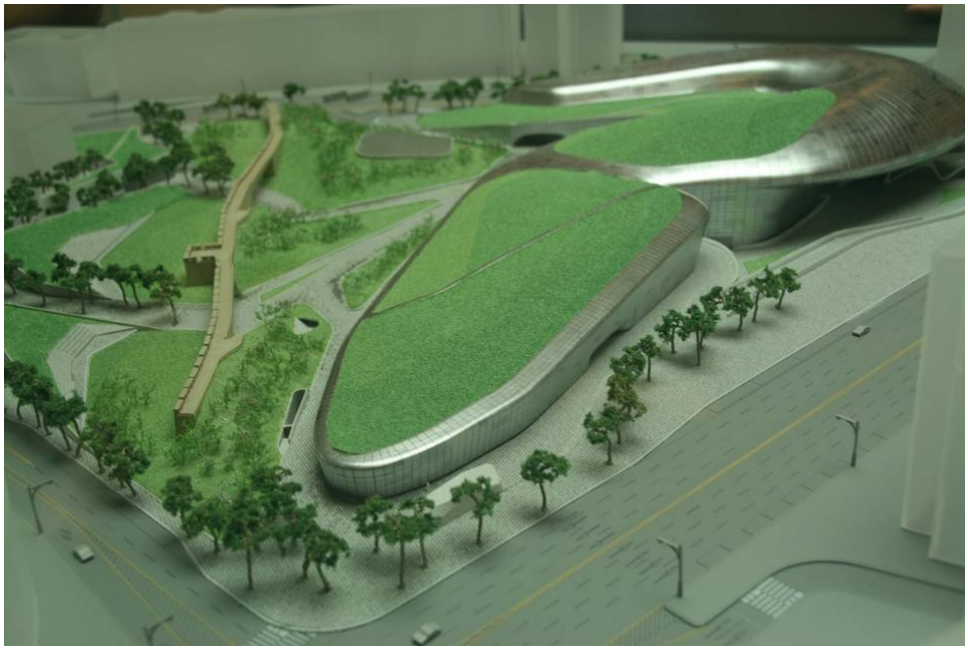


- Cheonggyecheon stream, Seoul, Korea


己巳大渡

Seonyudo Park, Korea

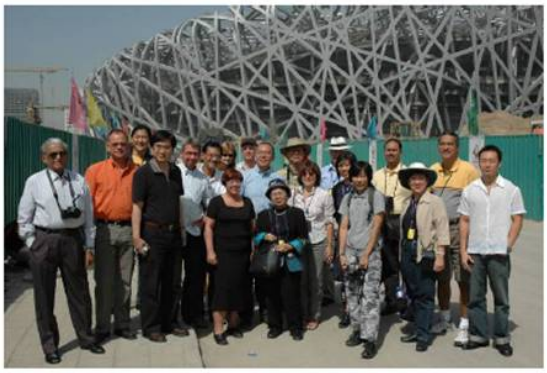
Dongdaemun Design Plaza and Park , Seoul by Zaha Hadid



China

111

IFLA delegates visit to Beijing Olympic Green in 2007



IFLA delegates outside the Bird's Nest National Stadium

Visit Prof HU Jie @ Beijing Tsinghua Urban Planning & Design Institute in 2008

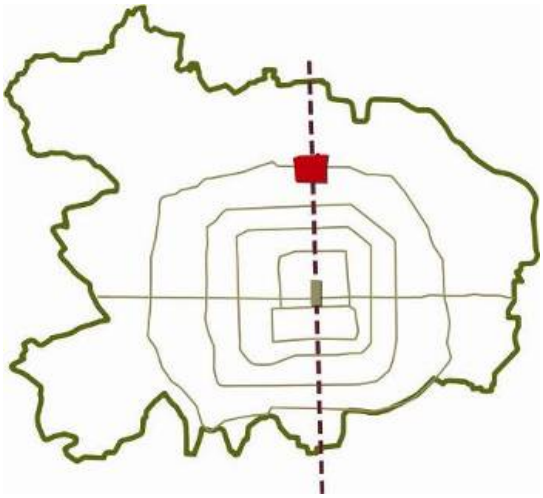
北京清华城市规划设计研究院
BEIJING TSINGHUA URBAN PLANNING & DESIGN INSTITUTE

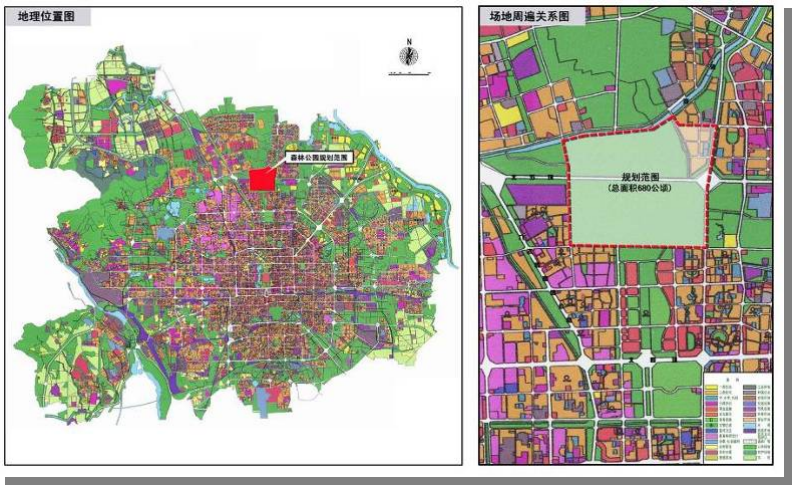
113

Bird's nest stadium by Herzog & de Meuron

Water cube by PTW and Ove Arup

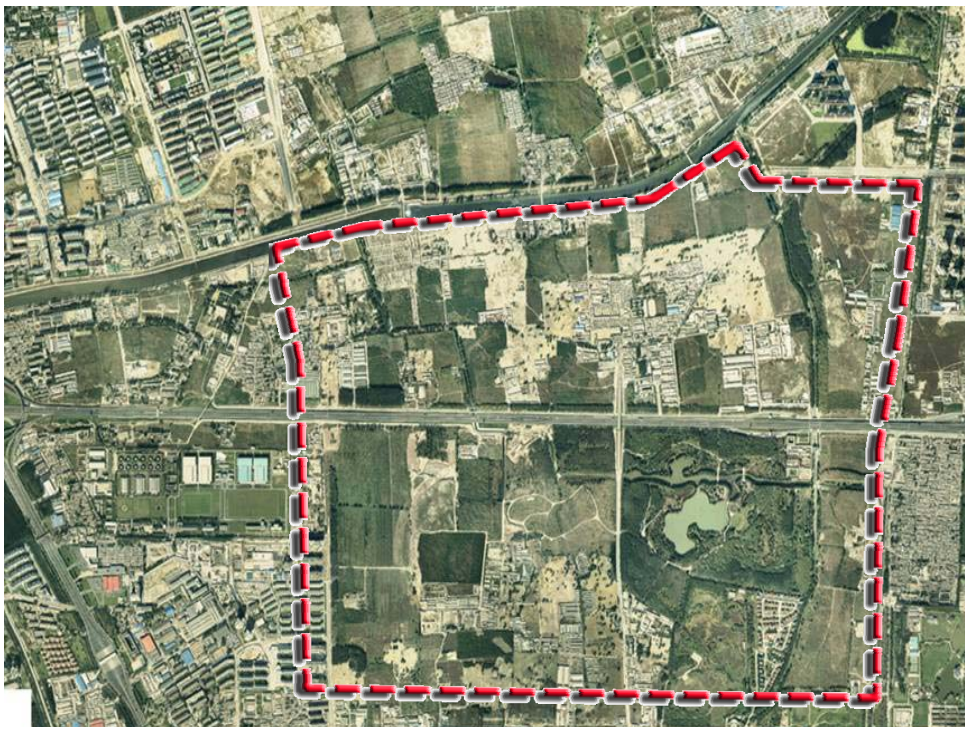
The Axis

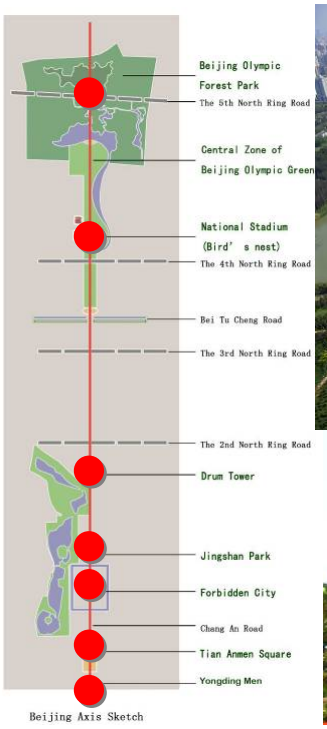




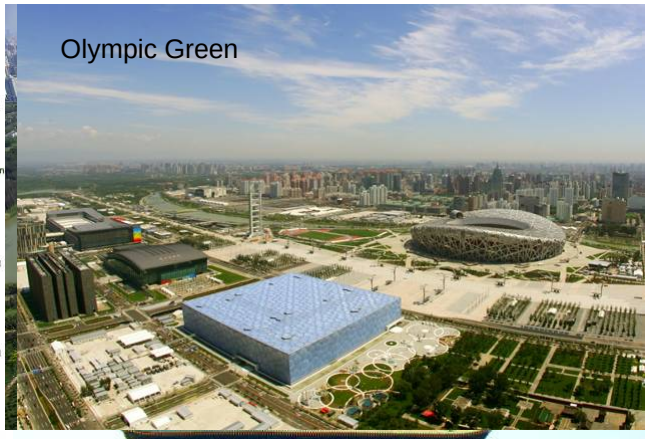
Location

118





Beijing Axis Sketch

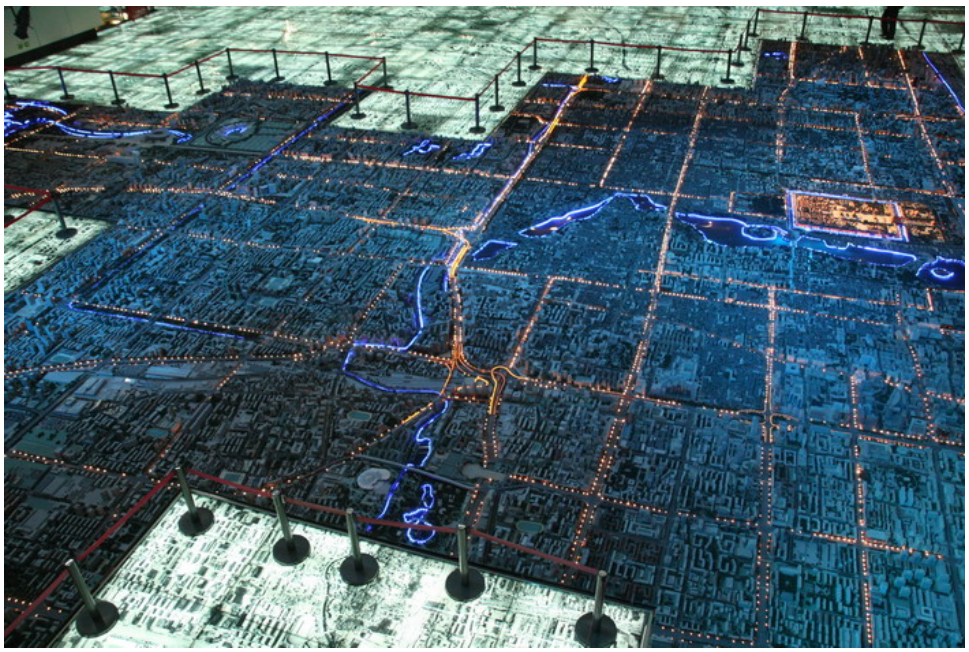


Olympic Green Plan

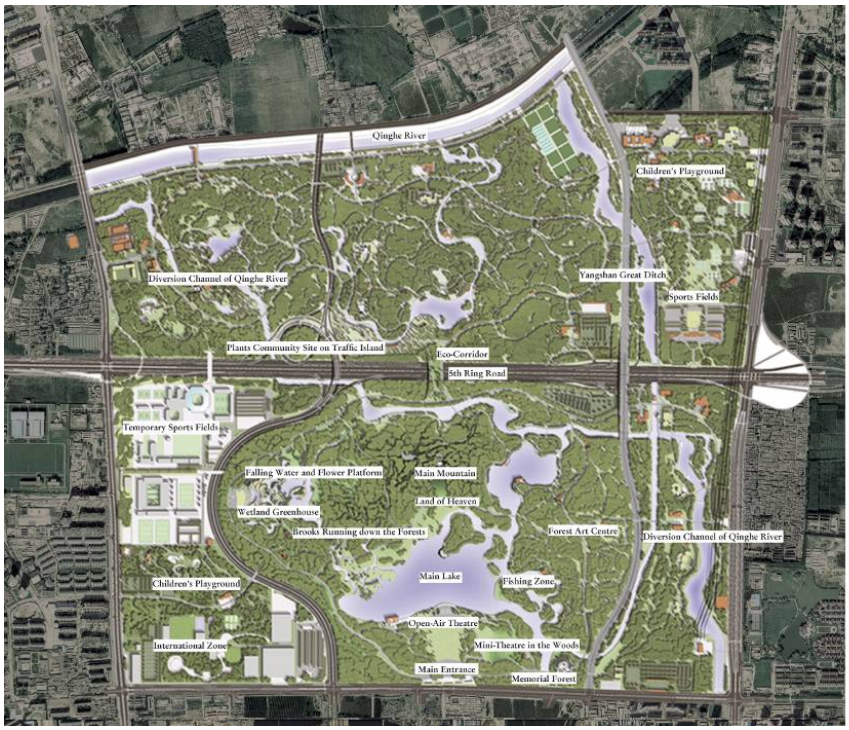
- From Jan. 2004 to Oct. 2005, Beijing Tsinghua Urban Planning & Design Institute finished the implementation plan of Olympic Forest Park
- Olympic green
  - Olympic forest park
  - Olympic Central Area
  - Olympic Sport Center

121

Transportation & Terminal facilities

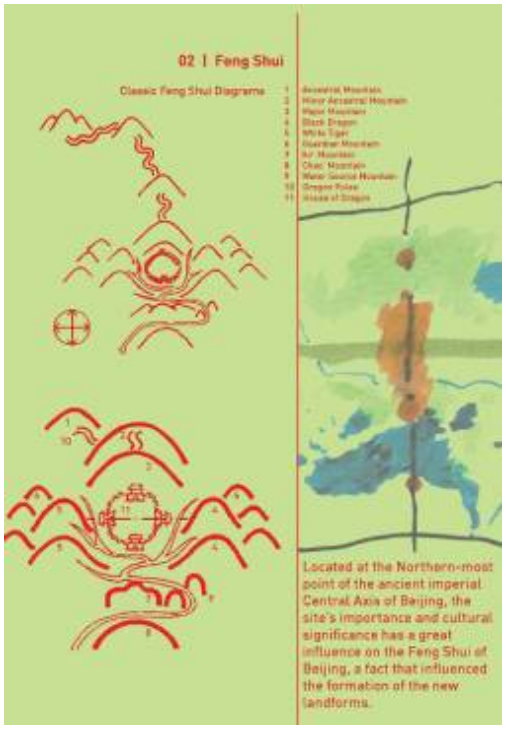


123



Olympic Forest Park MasterPlan

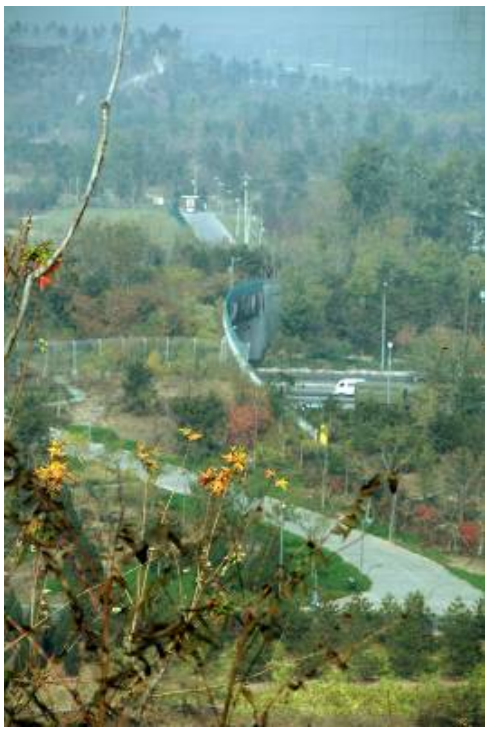
Olympic Forest Park is the largest green space ever to be built in Beijing.



Olympic Forest Park

- Concept - Green Infrastructure amd "Green Lung" with Fengsui
- Zones
  1. The Main Mountain
  2. The Water
  3. The Celestial World
  4. The Center of the Heaven
  5. Finding Pleasure in the Forest Stream
  6. Wetland Flower Terraces

126



Ecological Corridor

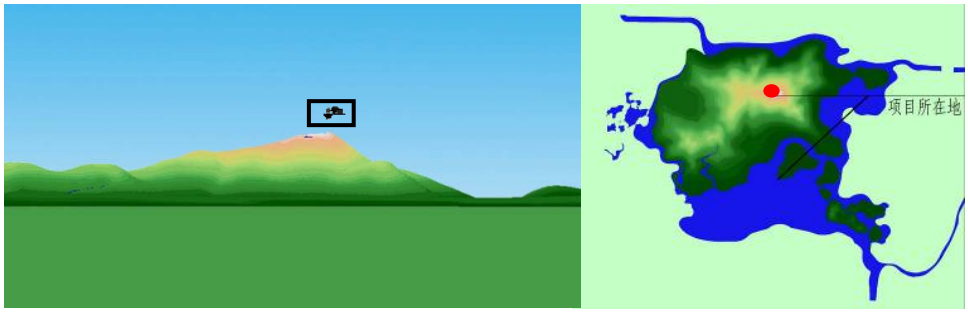
- Green space >450 ha
- >530,000 trees
- Shrubs >60 species
- Ground cover >80 species

127

Yangshan : The Main Mountain

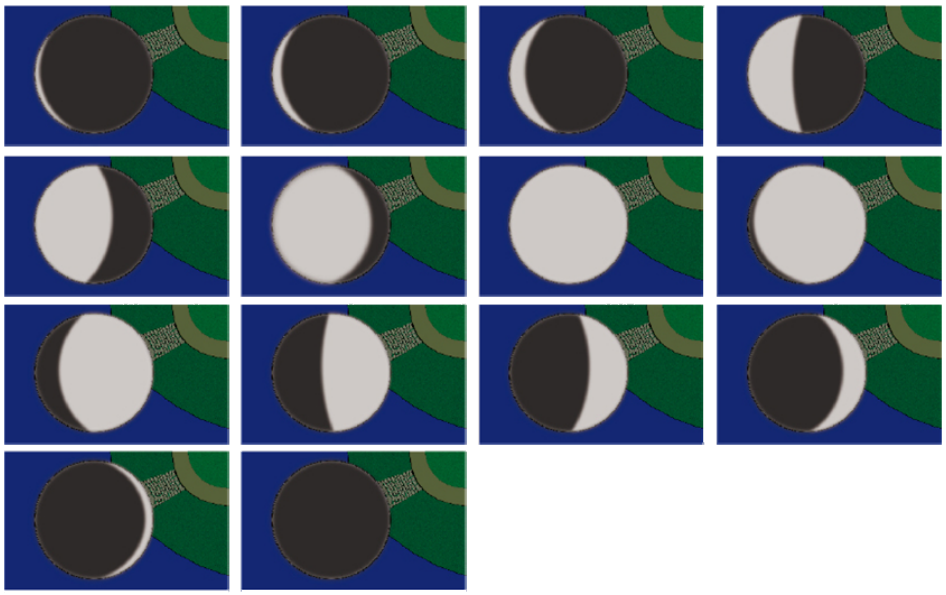
Yangshan : at night

Design of the man-made mountain



130

Tien Jing : The peak of Yangshan Mt



Island Changes with Moonlight LED

132

133

Ecology Research : Contribution of the Forest Park as Urban Forest to Beijing

- O_2 : 5400t/yr
- Absorb CO_2 : 7200t/yr
- Absorb SO_2 : 32t/yr
- Dust particle : 4905t
- Water : 67.5m^3
- Humidity : 27% higher than the surrounded area
- Temperature : 3-5℃ cooler in summer,
  - 2-4℃ higher in winter

Technology Projects

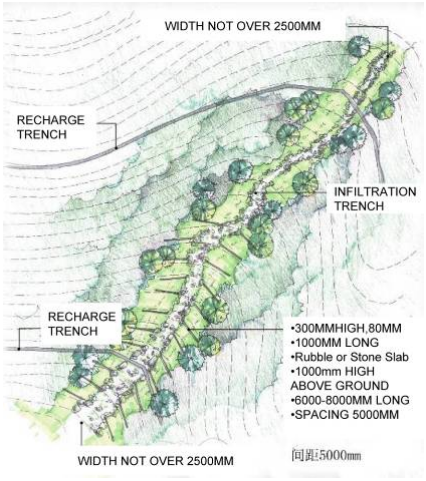
- **Project 1.** Advanced Water Simulation and Maintenance System in the World
- **Project 2.** Exhibition Greenhouse of water quality ecological purification and maintenance technology of adding water
- **Project 3.** Rain and Flood Recovery and Utilization System with an Utilization Ratio of 95%
- **Project 4.** Resource Recovery System of Solid Waste
- **Project 5.** Zero Sewage Drainage in the Park
  - 1Membrane Bioreactor (MB)
  - Fast Bio-degradation Treatment (FBT)
  - Bio-Degradation of Dejection Treatment (BDT)
- **Project 6.** LED Shi Xian Li Bai's poem : Lunar Platform
- **Project 7.** Ecological Corridor Straddling the Super Highway
- **Project 8.** Ecology Research : Contribution of the Forest Park as Urban Forest to Beijing
- **Project 9.** Swift Pagoda Tower : Bird tower
- **Project 10.** Soundscape Plan of Forest Park
- **Project 11.** Solar photovoltaic station : Megawatt-class program of photovoltaic panels
- **Project 12.** Green Energy VS. Ecological Energy Saving Buildings Design : Geothermal Pump System

All the roads in north park use graded sand gravel with 100% permeability.

The roads in south park adopt different measures

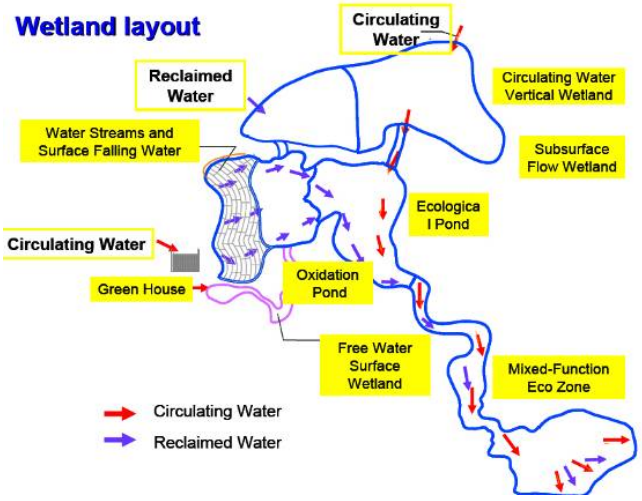
139

Infiltration Trench design – prevent soil erosion



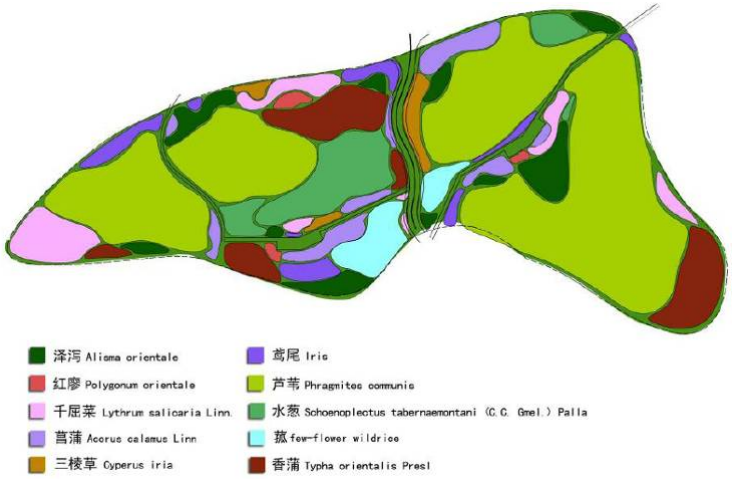
140

Constructed Wetland



141

Wetland
(Sub-surface flow wetland planting plan)

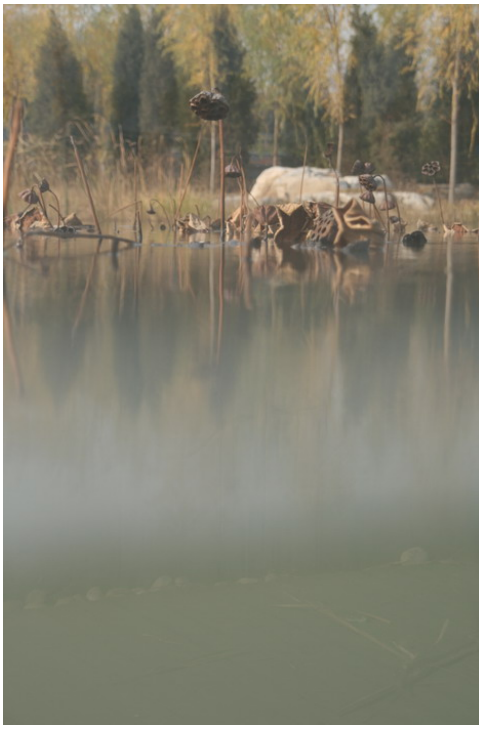


142

Wetland Flower Terraces




Underwater walk



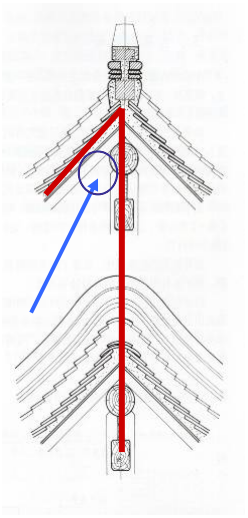
Education

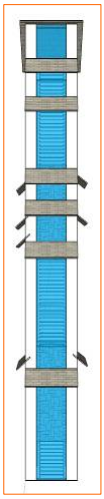
Ecology learning center

Site furniture

- Design Characters Featuring 3 Concepts
  - Green
  - High-Tech
  - Human-oriented

Inventions





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150

Bird swift tower

151

Example Images of the Nest of Swifts





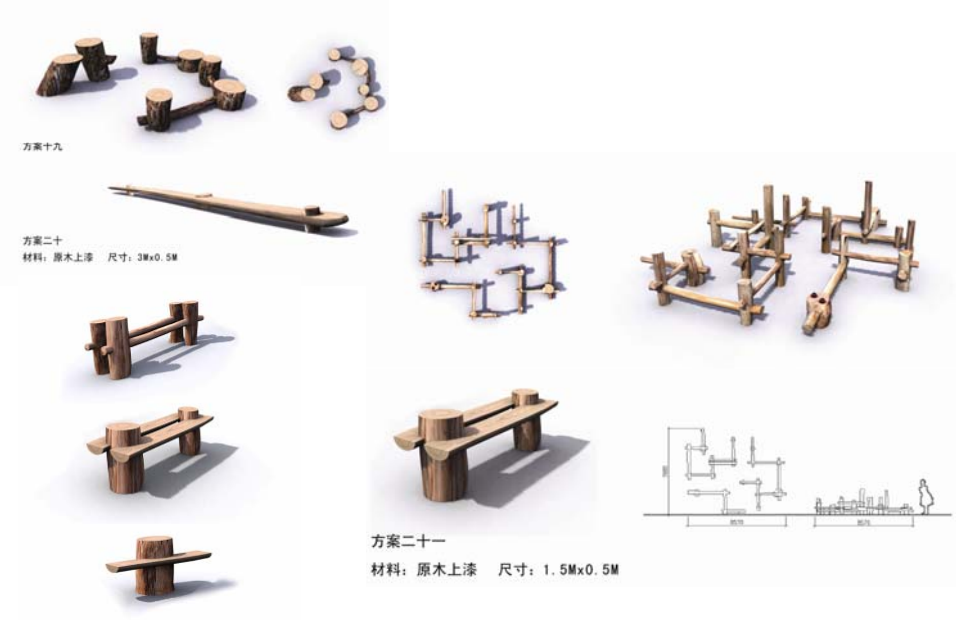



152

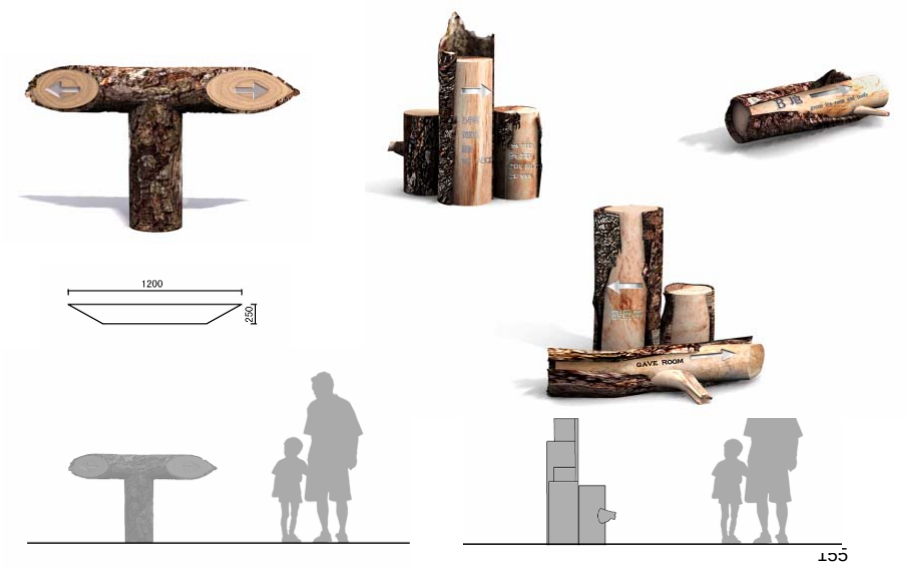
Regular Seat Design

153

Seat Design Plans

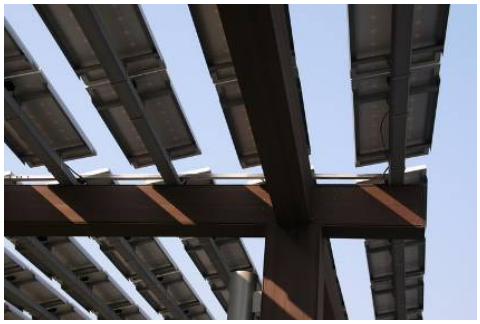


Temporary Guide System



Seat Design Plans

Solar energy lighting



158

Bio-degradation Treatment

159

Applauses

- GTZ (German Development Cooperation) on Sustainable development
- Mr Achim Steiner, UN Undersecretary General Executive Director of the UNEP on Waste water treatment
- Greenpeace on energy and waste water management "Environmental Performance project"
- 2nd Prize- Torsanlorenzuo International Prize 2007 : Landscape Design and Protection (Section: Urban Green Spaces)
- President's Award - 2008 IFLA Landscape Planning Category

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