Sustainable design for compact city living

Edward Ng

Yao Ling Sun Professor of Architecture

Chinese University of Hong Kong

Sustainable design for compact city living

CONTEXT

IMPACT

POLICY

PLANNING

DESIGN

FUTURE

Edward Ng

Yao Ling Sun Professor of Architecture

Chinese University of Hong Kong

Sustainable design for compact city living

CONTEXT

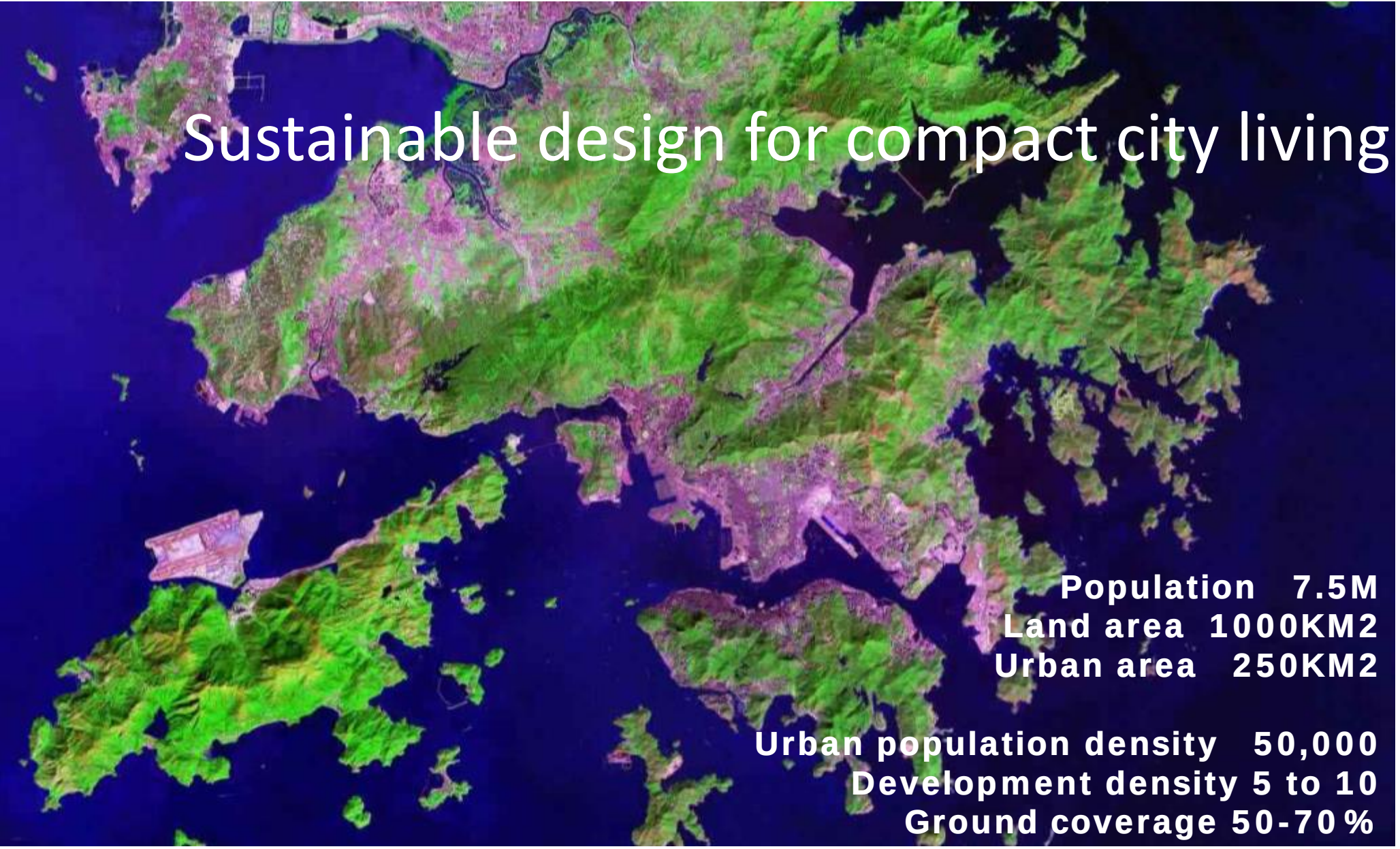
Hong Kong

Sustainable design for compact city living

CONTEXT

Hong Kong

Sustainable design for compact city living



CONTEXT

Hong Kong

Sustainable design for compact city living

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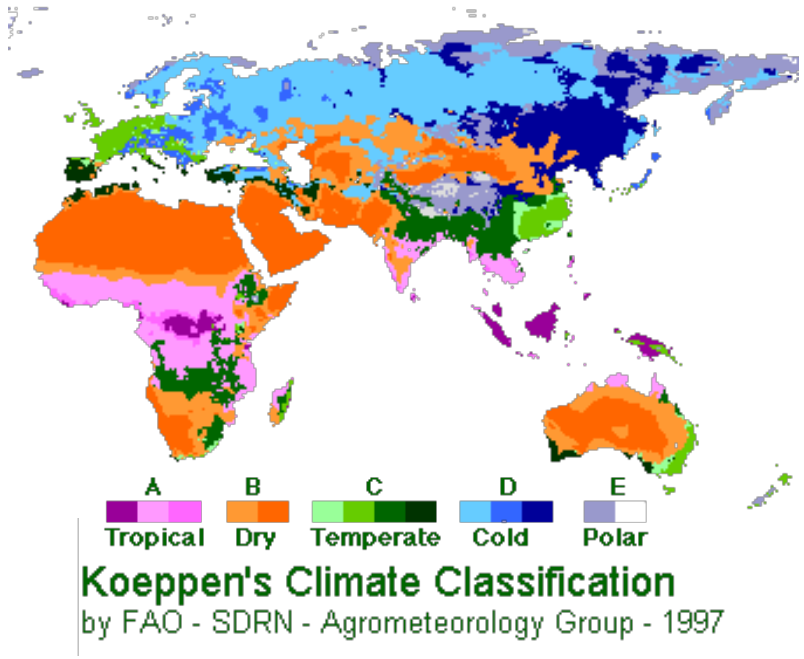
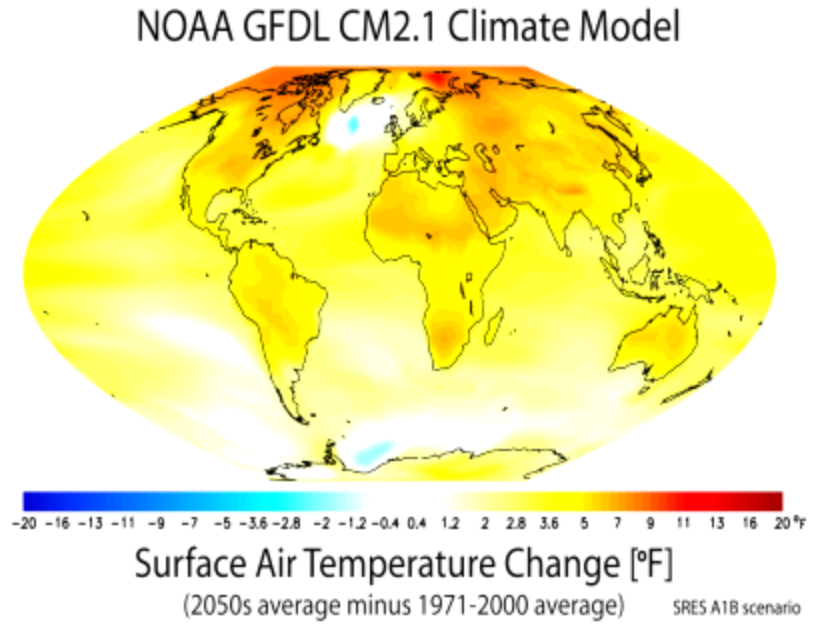
Climate Zones





Climate Change

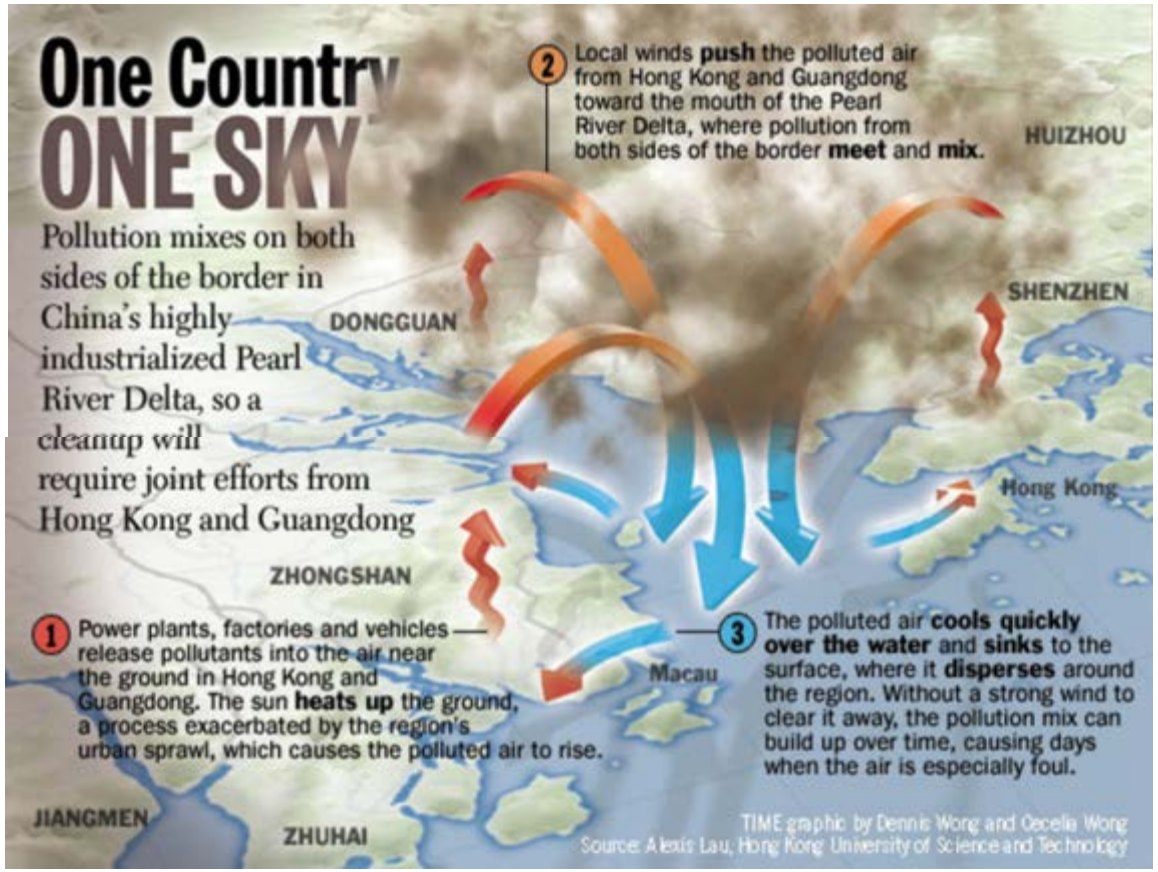
(source: FAO-SDRN and NOAA)

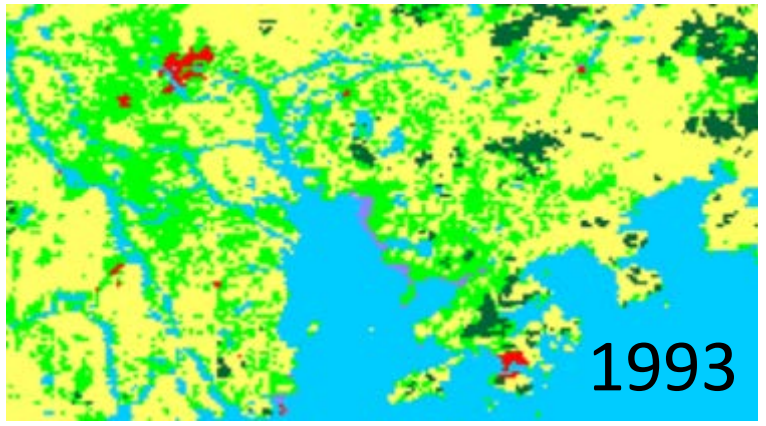
The city's boundary conditions

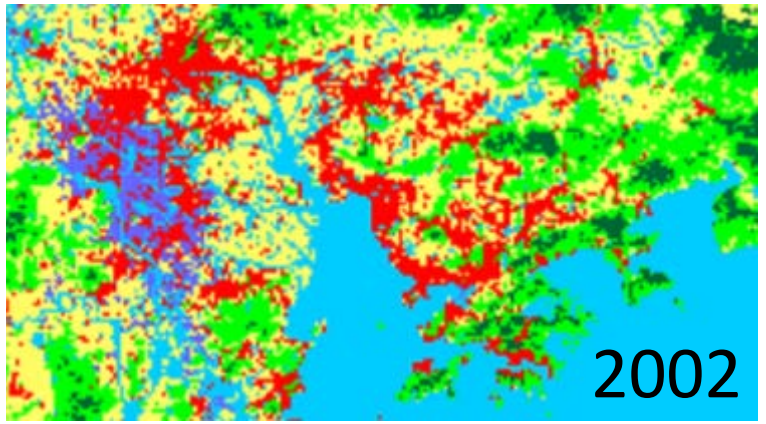
REGIONAL

CONTEXT

SCALES



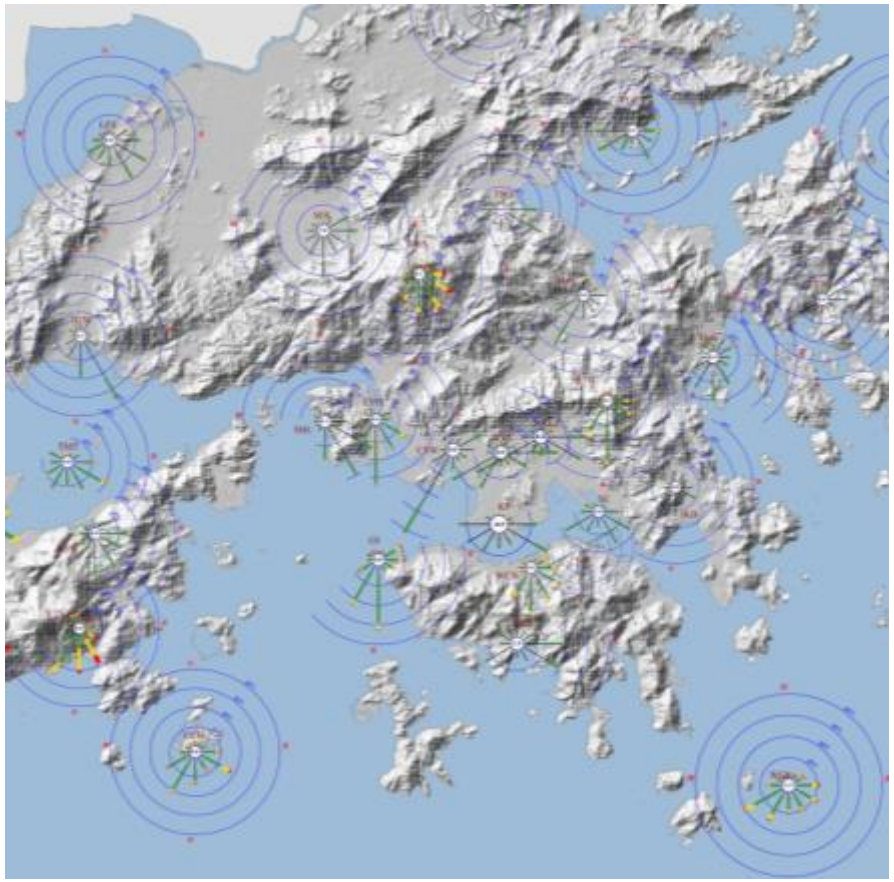


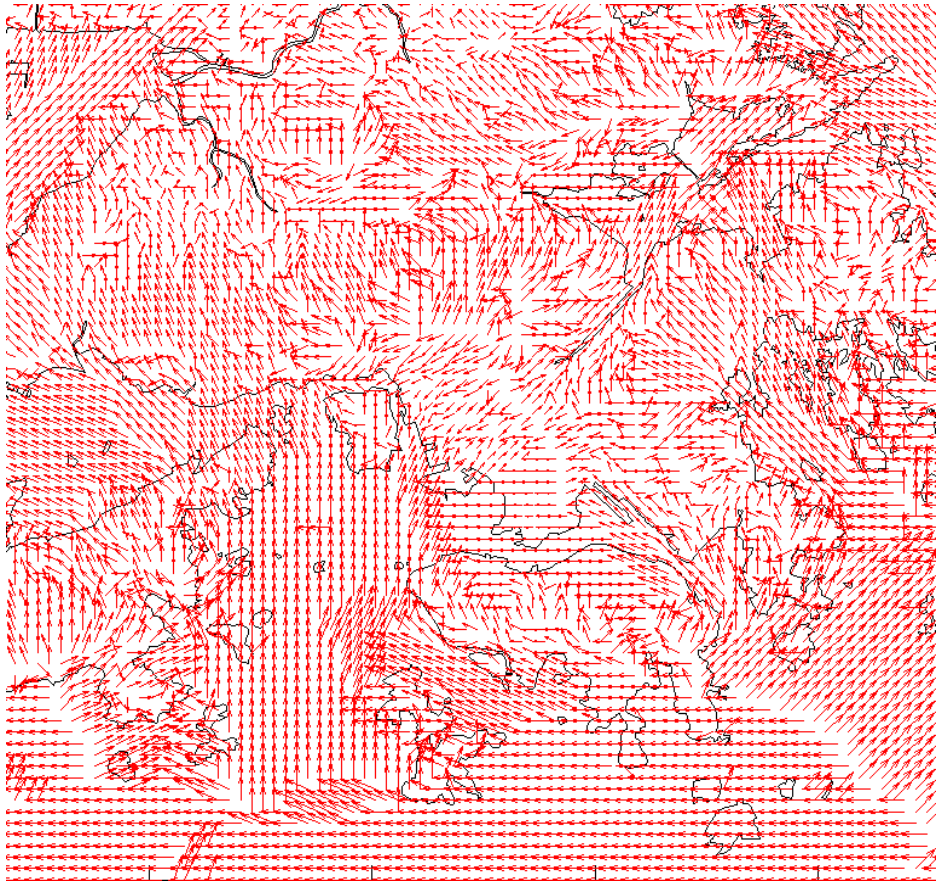


≈ 200 KM x 200 KM

(source: Prof Jimmy Fung/SCMP and USGS land use dataset)

The city's territorial morphology



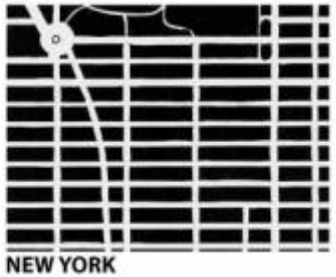


≈ 40 KM x 40 KM

(source: Prof Ren Chao/HKO and Prof Jimmy Fung/MM5-CALMET)

NEIGHOURHOOD

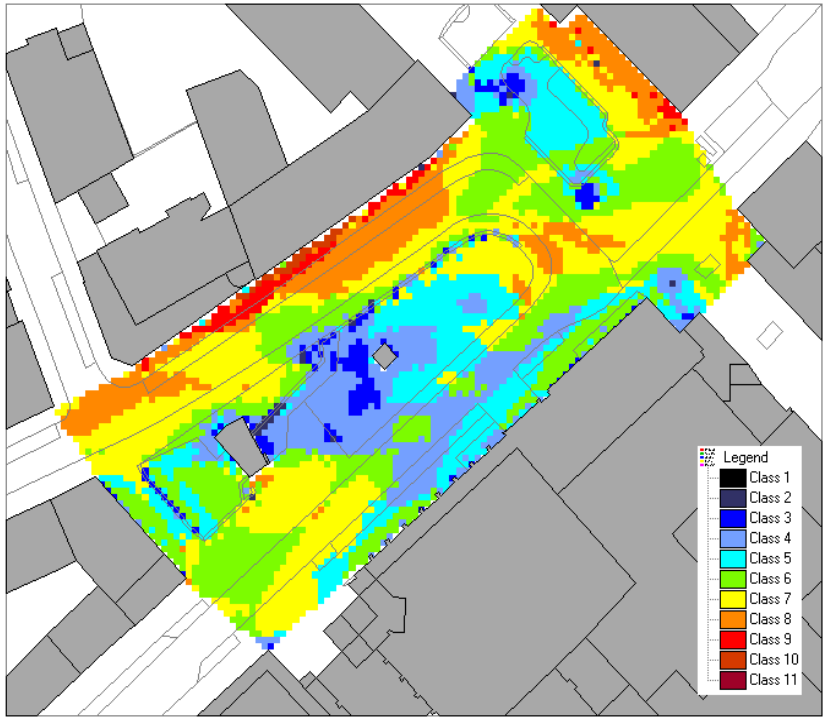
The city's urban pattern and morphology



≈ **2** KM x 2 KM

(source: theStar-beyond density and tour mapGoogle)

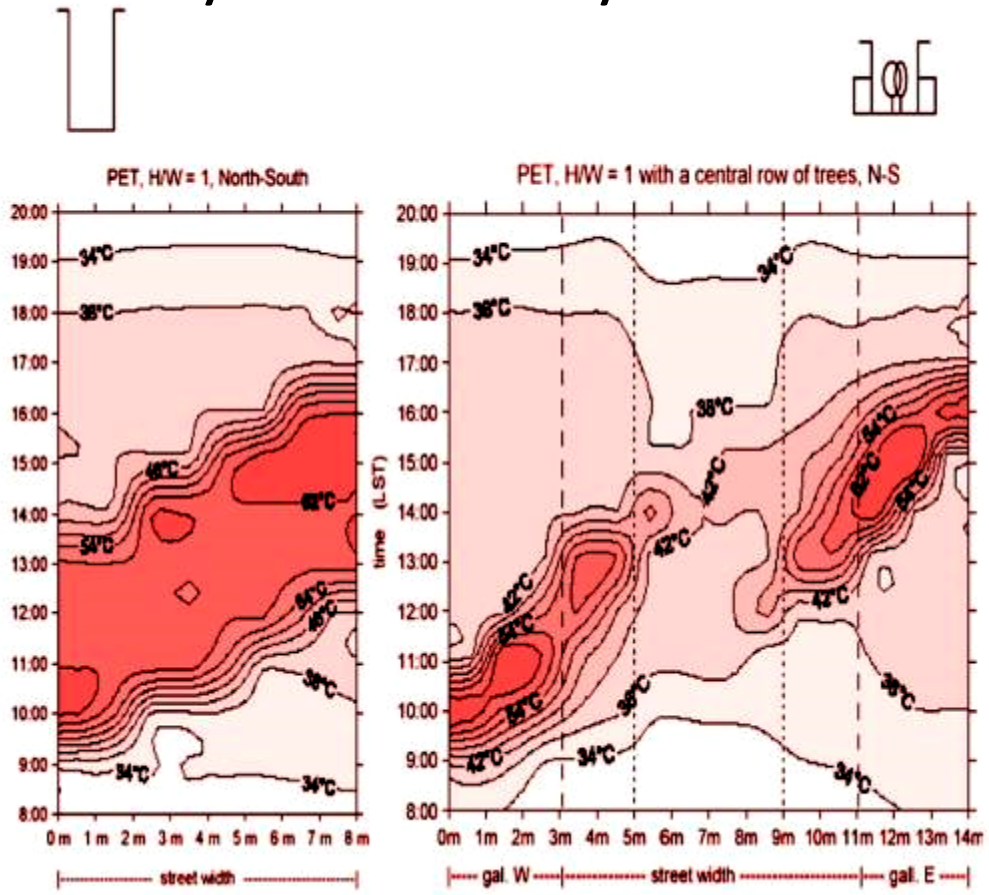
The city's spatial morphology



≈ **100m** x 100m

(source: Prof Lutz Katzschner)

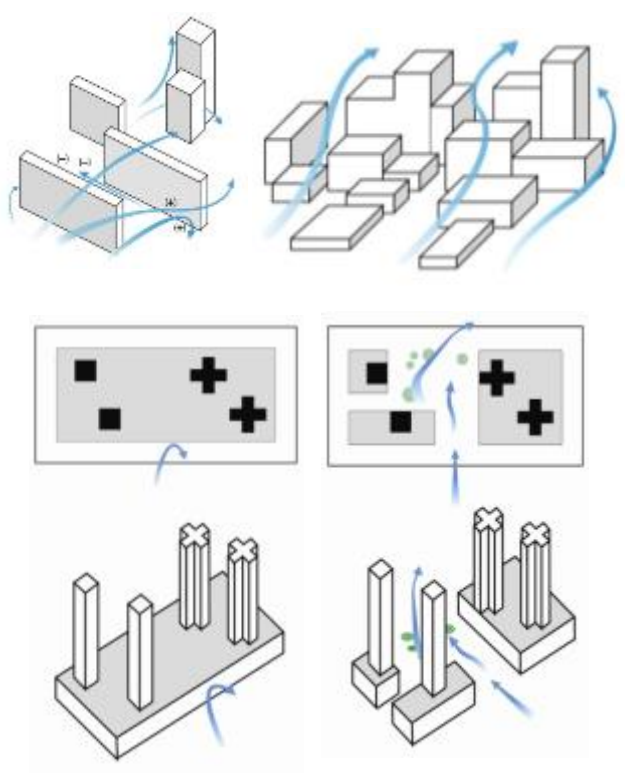
The city's street canyons

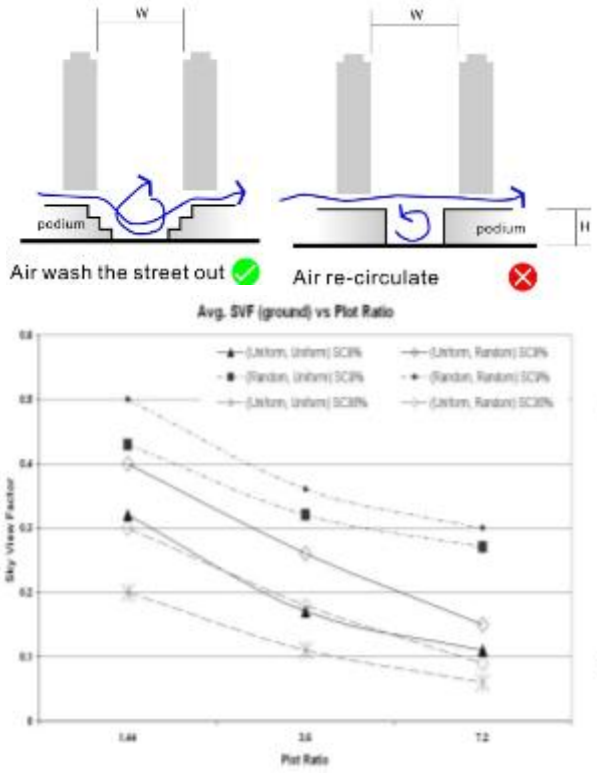


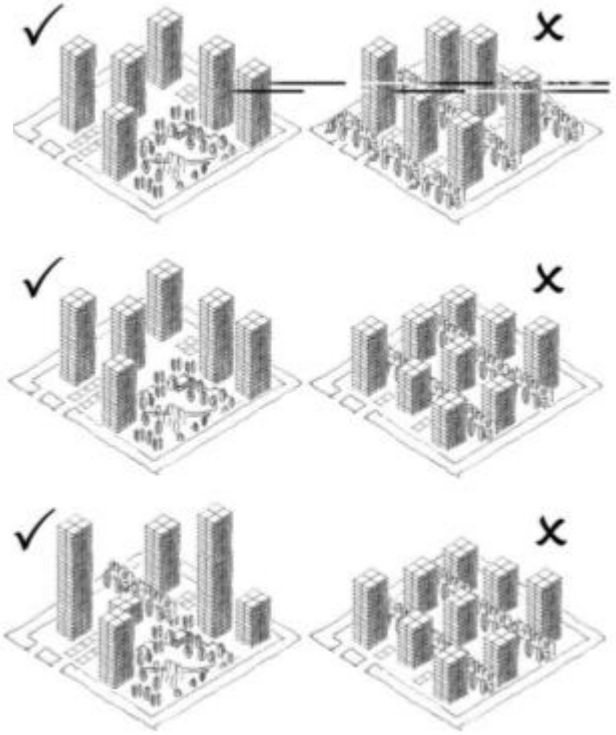
≈ 25m x 50m

(source: Prof Helmut Mayor)

The city's building forms & dispositions







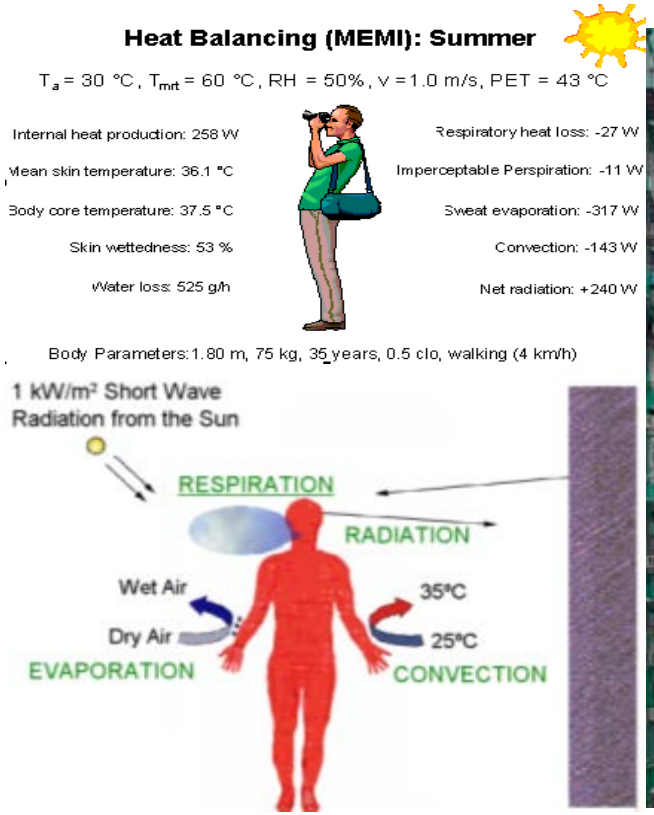
(source: HKPSG and Dr Vicky Cheng)

SYSTEM + SURFACE

The buildings' characteristics, indoor and outdoor

CONTEXT

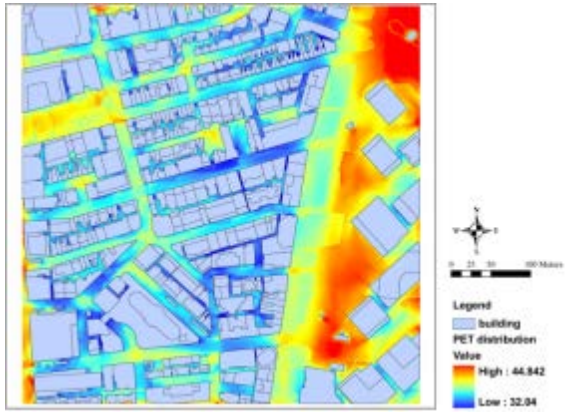
SCALES

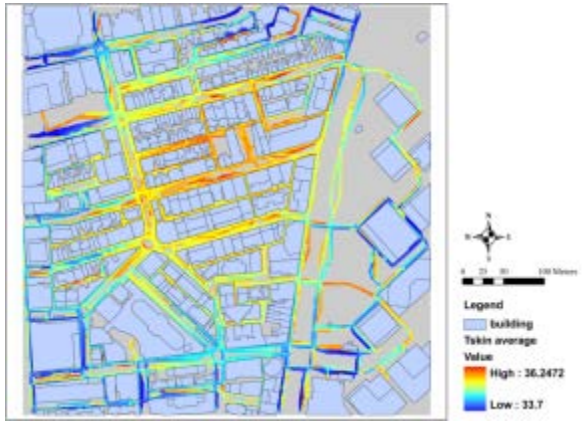


(source: Hoppe, Michael Wolf, Signalhuset House and inhabitate.com

The citizen's personal characteristics

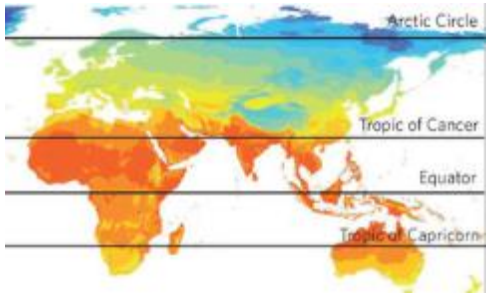
Physical



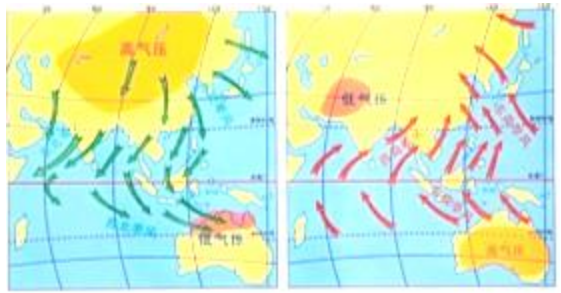


Experienced

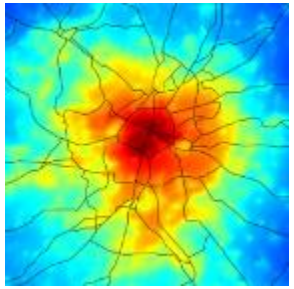
The Scales of Design



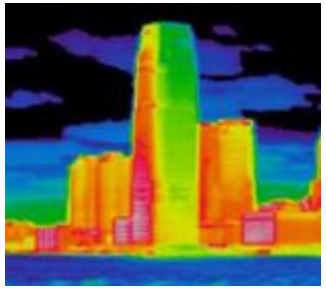
Global



meso
regional



city
district
urban
neighbourhood

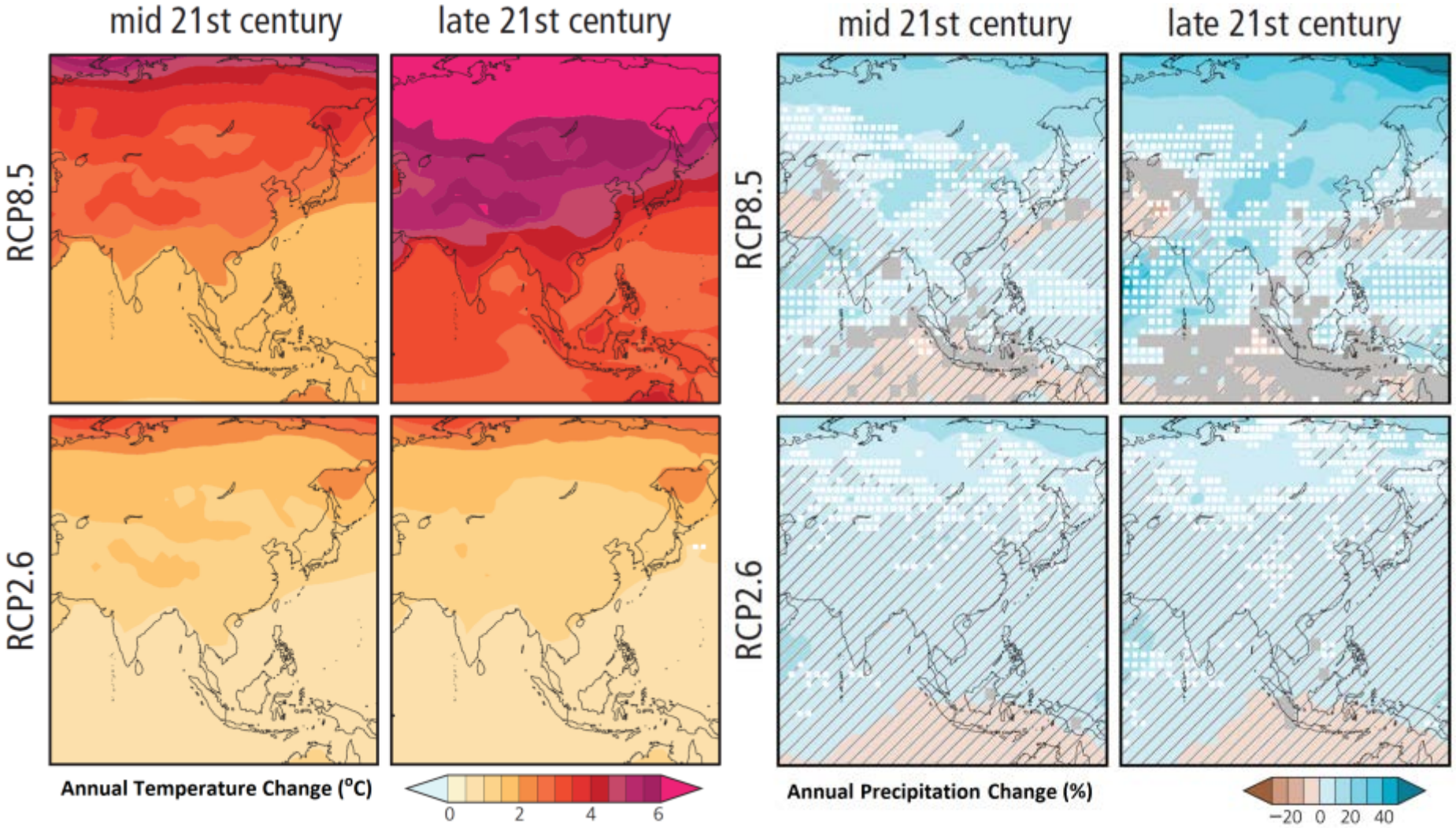


building
material
system

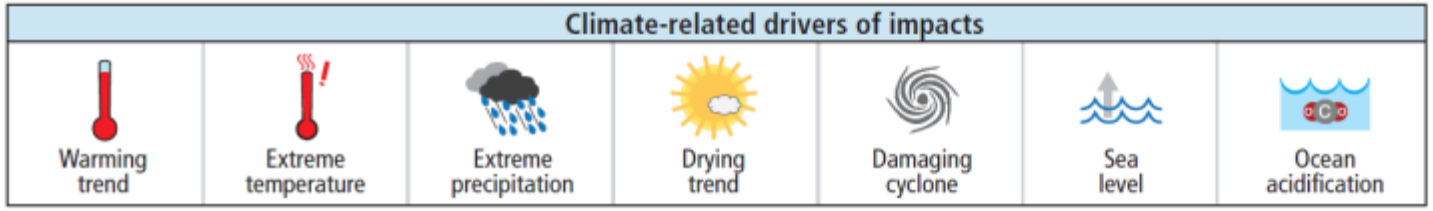
community
human
biology

CONTEXT

CHALLENGES



Hijioka, Y., E. Lin, J.J. Pereira, R.T. Corlett, X. Cui, G.E. Insarov, R.D. Lasco, E. Lindgren, and A. Surjan, 2014: Asia. In: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Barros, V.R., C.B. Field, D.J. Dokken, M.D. Mastrandrea, K.J. Mach, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 1327-1370.



CONTEXT

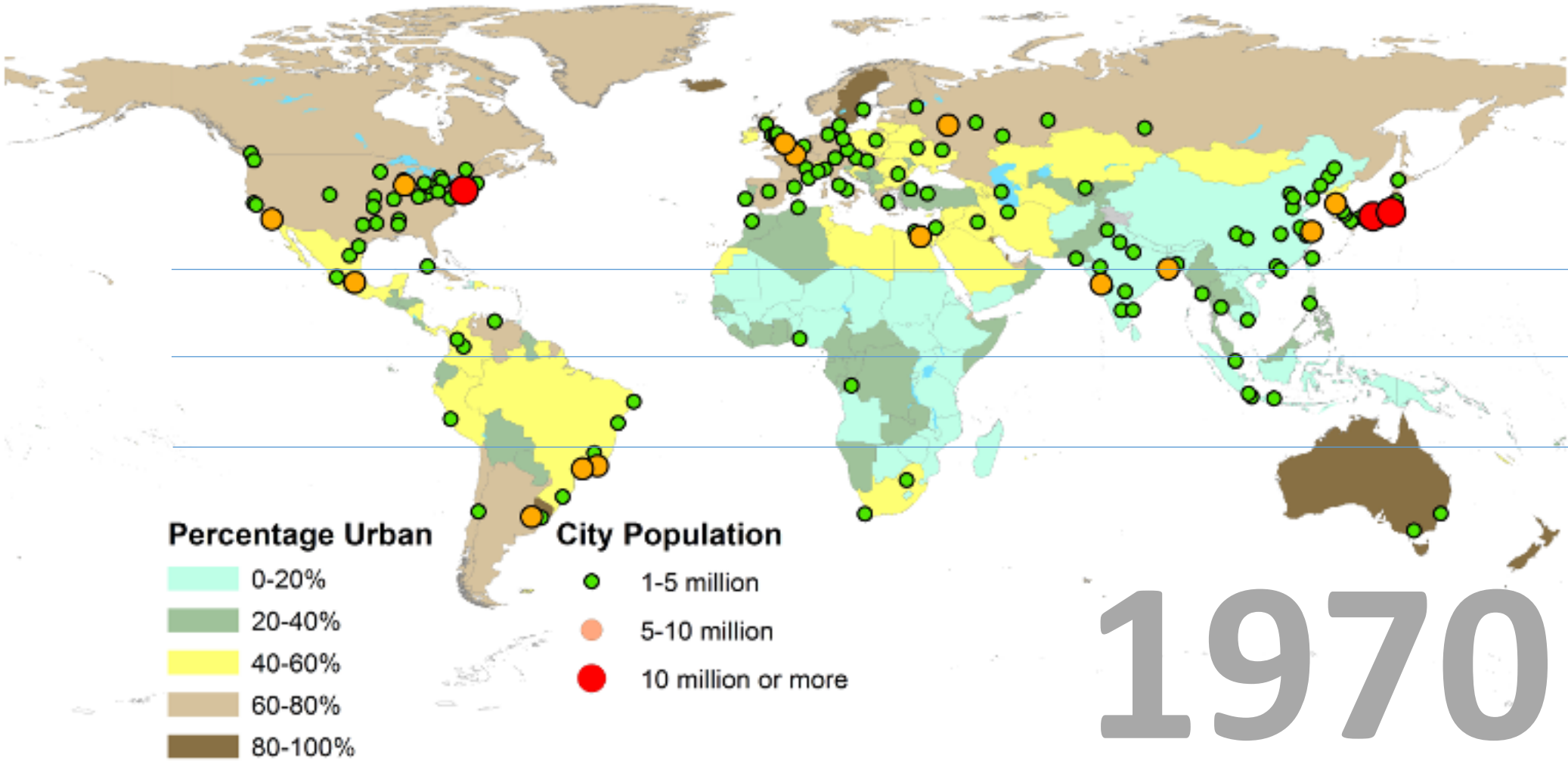
CHALLENGES

Key Risks	Climate Drivers	Timeframe	Urban Climate Strategy
Heatwave and heat-related mortality			Urban Land Use Building Design Urban Vegetation
Flooding and related deaths, injuries, diseases			Urban Infrastructure Seawall and Drainage Water Supply Network
Food and water security			Urban Planning Population Control
Urbanization and Urban Poverty			Urban Governance City Planning and Design

Global Climate → **Urban Climate**

CONTEXT

CHALLENGES

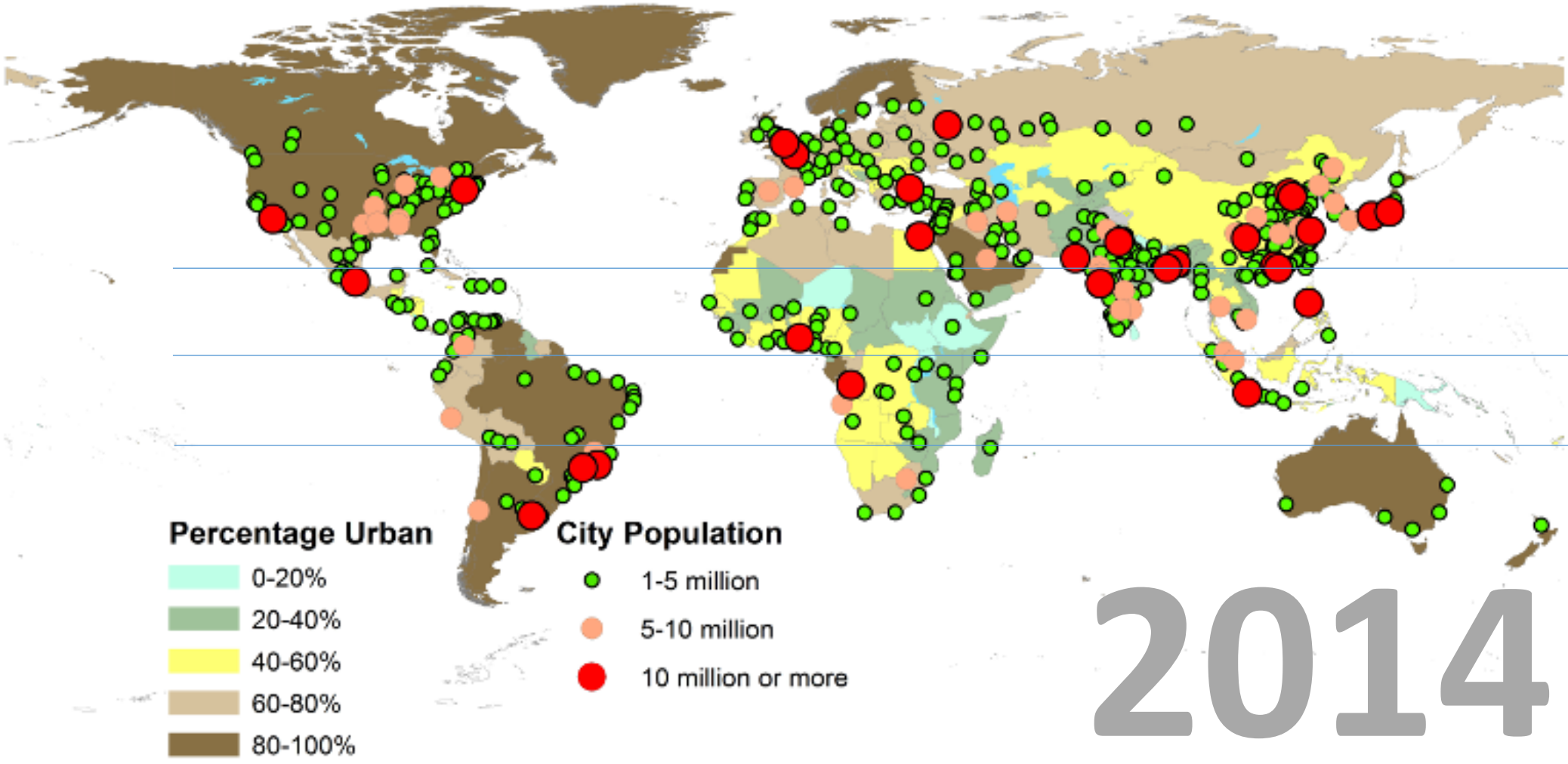


Note: Designations employed and the presentation of material on this map do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations concerning the legal status of any country, territory or area, or of its authorities, or concerning the delimitation of its frontiers or boundaries.

http://esa.un.org/unpd/wup/

CONTEXT

CHALLENGES



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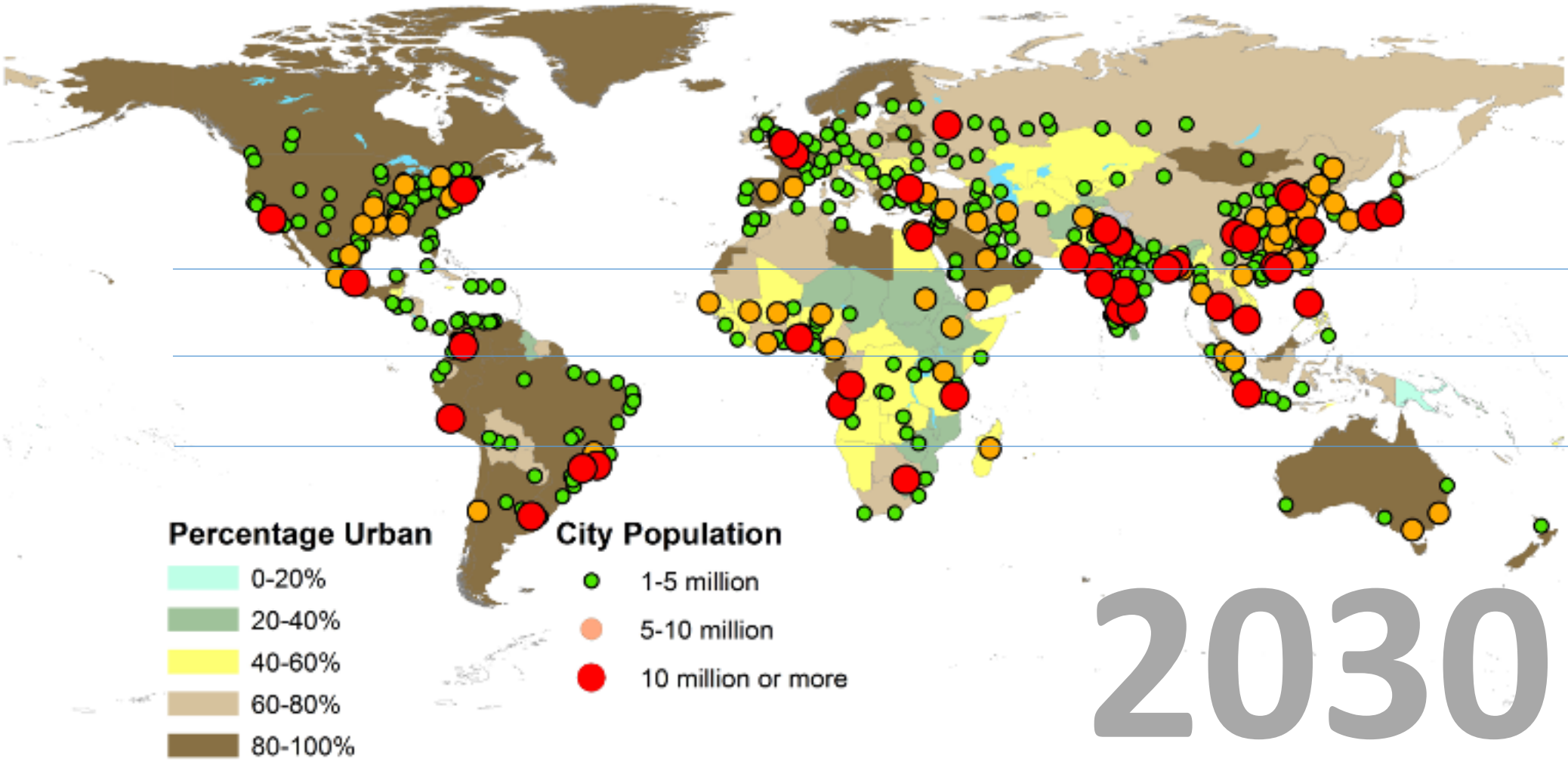

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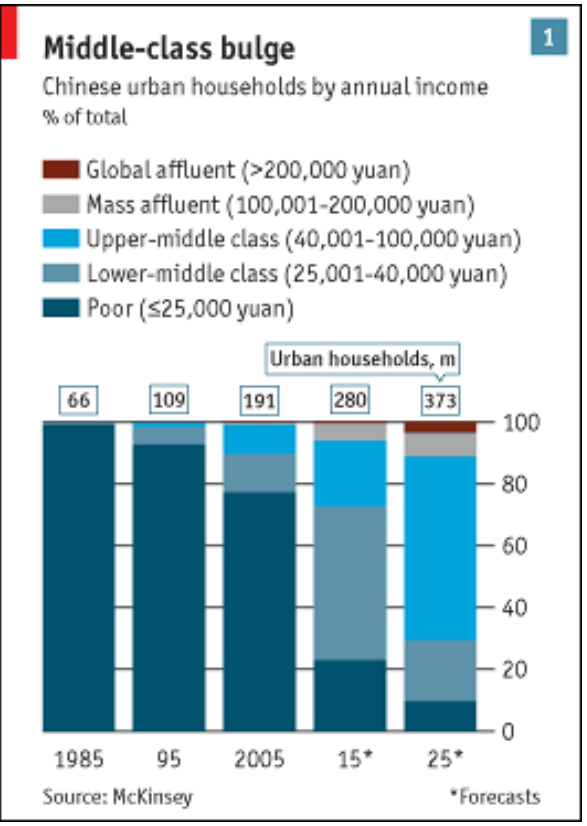
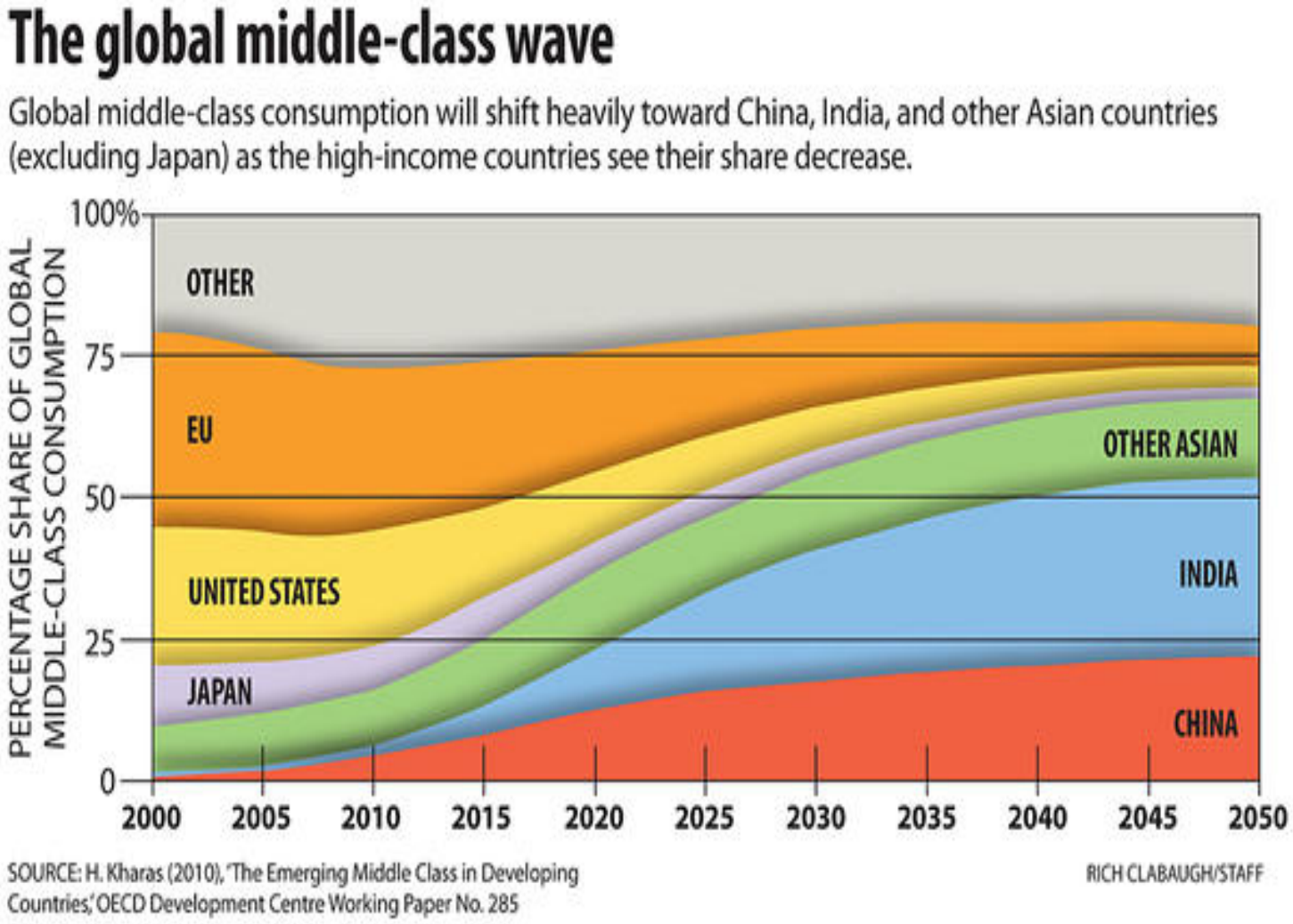
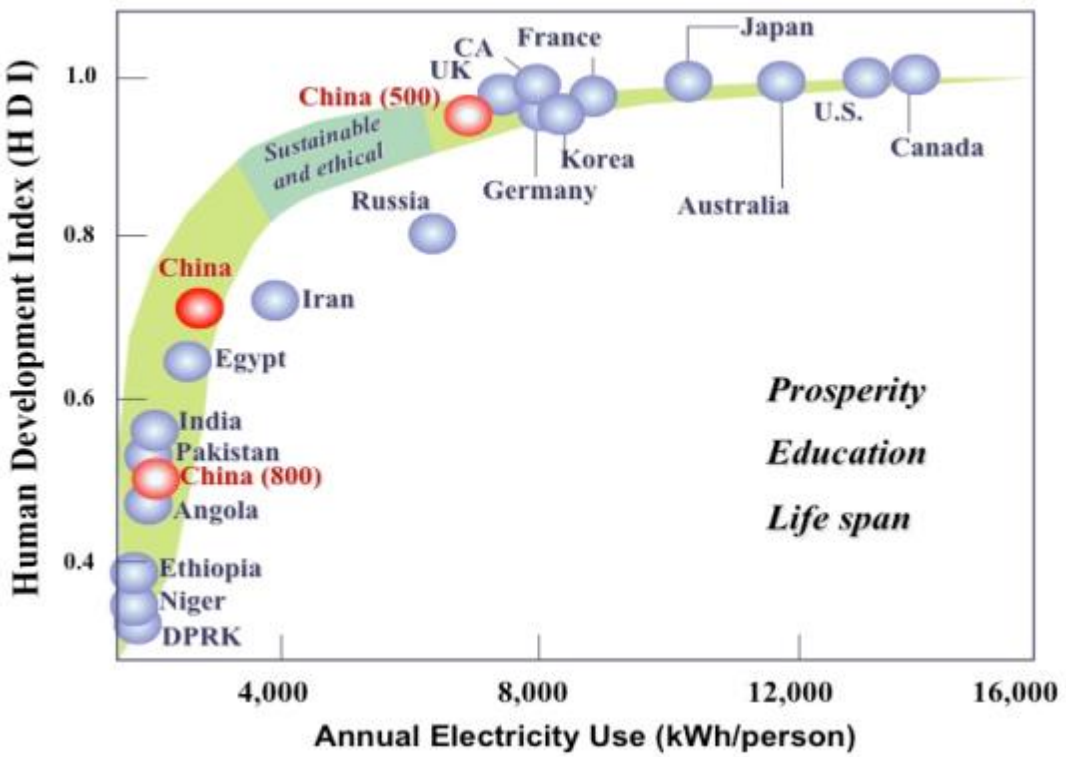
CHALLENGES



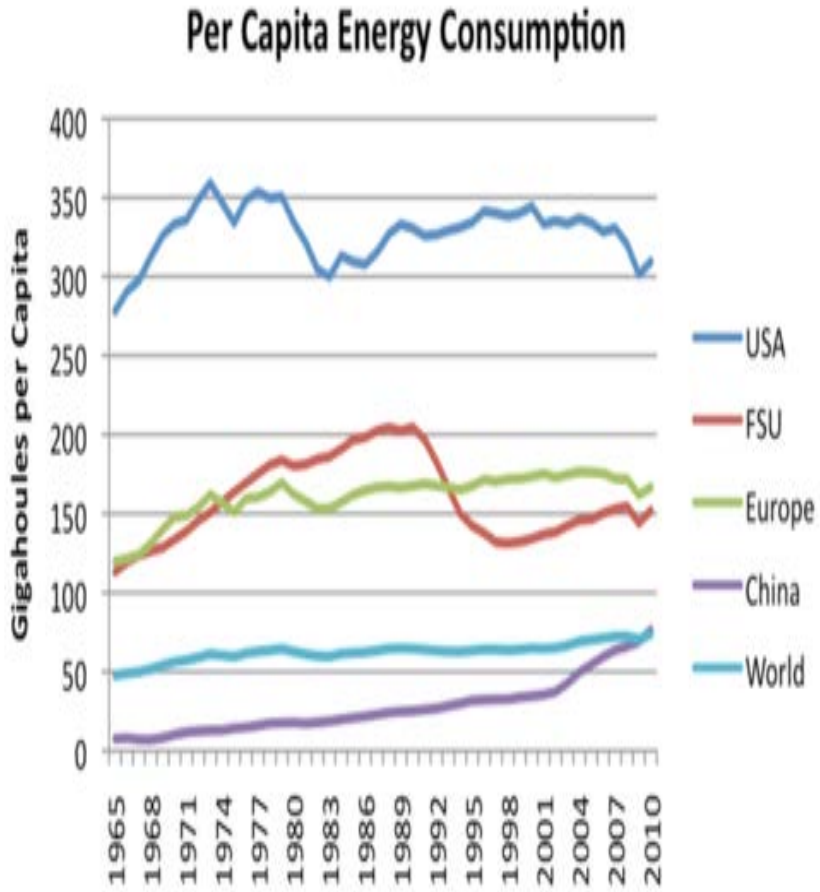


CONTEXT

CHALLENGES

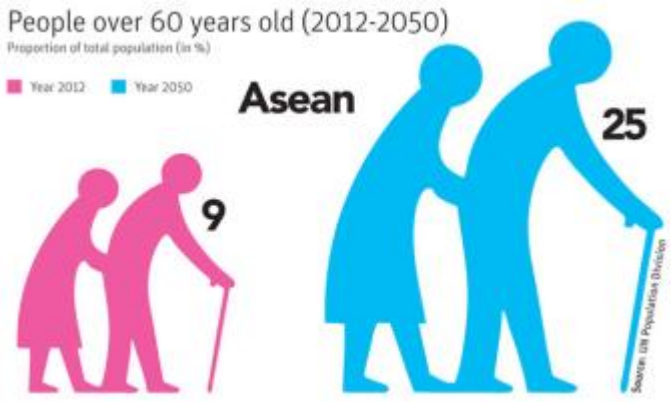


China 500 = "composite of 500 million" of the population.
China 800 = "composite of 800 million" of the population.



The United Nations Human Development Index (HDI) relates energy use to the quality of life to which most humans aspire. The middle class averages about 0.8 on the HDI and requires access to over 3,000 kWhrs per person per year. 80% of the world's population of over 7 billion people is below 0.8 on the HDI. Source: Wright and Conca, 2007).

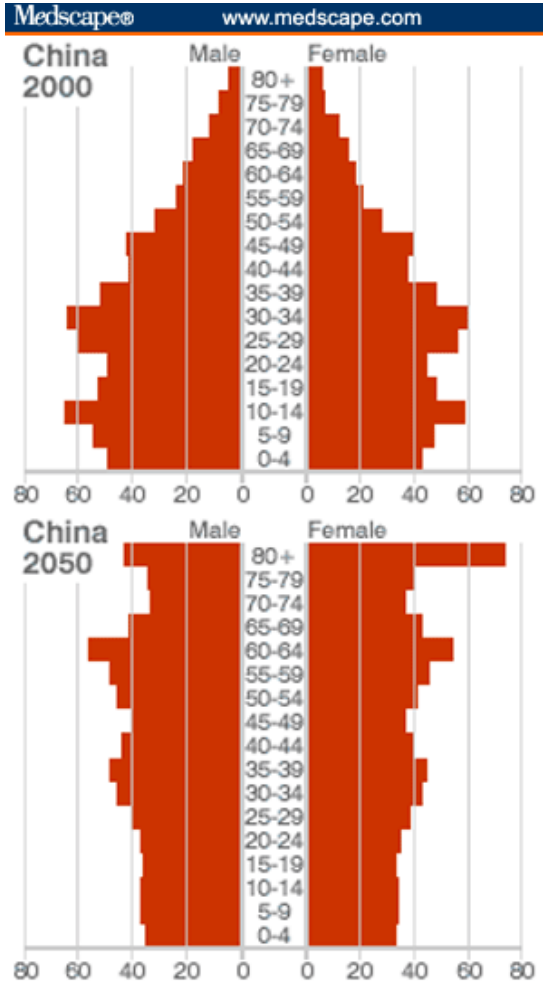
http://www.forbes.com/sites/jamesconca/2012/09/18/the-middle-class-energy-and-terrorism/



CONTEXT

CHALLENGES

Asia's elderly population is projected to reach 922.7 million by the middle of this century. As a result, Asia is on track in the next few decades to become the oldest region in the world.



http://www.adb.org/features/asia-s-growing-elderly-population-adb-s-take
http://www.medscape.com/viewarticle/550417_2

CONTEXT

CHALLENGES

Climate Change

Rapid Urbanisation

Increasing energy and resources needs

Ageing

In November 2013, the Philippines was struck by typhoon Haiyan, one of the most powerful ever recorded and a devastating event that immediately captured the world's attention.

While natural disasters tend to dominate the headlines, there is also another story to be told about the Philippines. The country recorded GDP growth of 7.2% last year, compared with 5% in other emerging countries, and 6.5% in Asian nations. The economy has become more robust, diverse and resilient over the years – proof that was related to domestic and foreign demand, as well as solid and balanced manufacturing industry and service sector. In step with the rest of Asia, the Philippines has become more dynamic today.

Today, Asia is the engine of the world's economic growth. The region's GDP accounts for 30% of global GDP (and could increase as much as 50% towards 2050) and it is no overstatement to say that growth in Asia means growth for the world. A generation ago, Asia was a marginal region; now it's at the centre of the global economy.

As Asia steps further into the limelight, it is clear to me that its politicians and people alike must take on more responsibilities. Once content to follow, Asia must now take the lead. That is why I believe the World Economic Forum on East Asia is taking place at a key moment in time. Participants will consider how best to balance economic growth, responsible business expansion, political and social development, as well as how the people of the region can enjoy better lives.

This is made all the more pressing by our current situation. In the 21st century, we face what I see as a 'trilemma', three pressing issues that must be solved simultaneously if we are to secure a workable, sustainable future; securing economic growth and accommodating population expansion; working with increasingly limited resources; and raising environmental awareness in order to deal with devastating weather events linked to climate change.

This must be done at a time when the pace of social and political change has never been greater, and economic uncertainties and risk have never been greater; a time when "leveraging growth for equitable progress" – the theme of the Forum's event in East Asia – is a vital concept for the business sector to embrace and cultivate.

Over the course of the meeting, I hope to see participants from government, businesses, academia and independent organizations come together to identify the key challenges of our shared future, and to work towards securing sustainable growth in East Asia, and the wider world.

Of course, no single meeting can be expected to deliver all the solutions. I believe that to resolve our trilemma and secure fair, sustainable growth, we must boost innovation and productivity. And by 'we' I mean both governments and (most of all) private enterprises.

Having said that, I also believe that collaboration across all sectors of society will play a significant role in the region's development.

We are all familiar with the concept of networking and the potential of cloud computing. I tend to see these meetings as the coming together of a human cloud that draws on the power and reach of a global network. I have every confidence that the interaction of this cloud will enlighten us as to how to achieve equitable progress for today's world and the generations yet to come.

Author: Atsutoshi Nishida is Chairman of the Board, Toshiba Corporation, Japan, and a co-chair of the 2014 World Economic Forum on East Asia.

https://agenda.weforum.org/2014/05/three-big-issues-facing-east-asia/

IMPACT


Heatwave

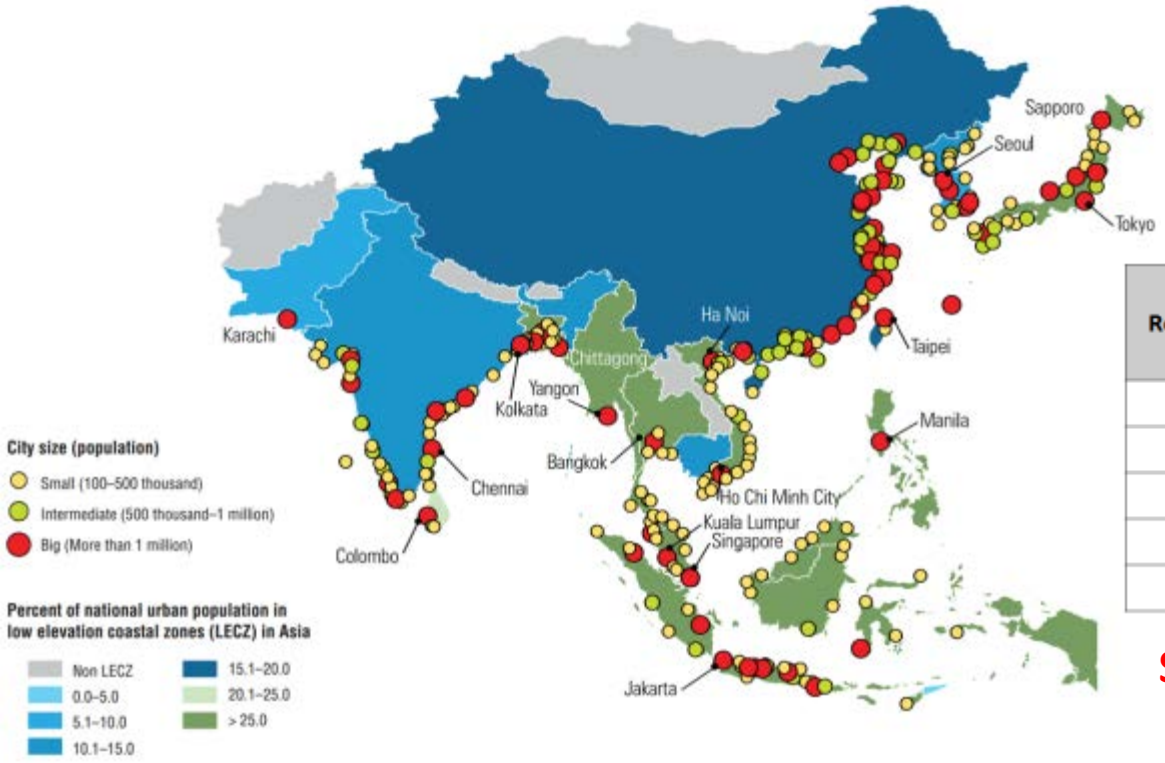

Flooding / Drought / Water


Sea Level Rise
Stop Global Warming
(Or we're all sunk!)


Extreme Weather

More than half of the world population lives here

IPCC Assessment Report No. 5 projects that in the last decades of 21st century, global sea level rises by 0.26-0.82m



香港天文台
HONG KONG OBSERVATORY

Return period (yr)	Extreme sea level above chart datum (m)		
	With current sea level	Mean sea level rises by 0.26m	Mean sea level rises by 0.82m
2	2.9	3.2	3.7
5	3.1	3.4	3.9
10	3.3		4.1
20	3.4	3.6	4.2
50	3.5	3.8	4.4

Storm surge risks increase with sea level rise

IMPACT

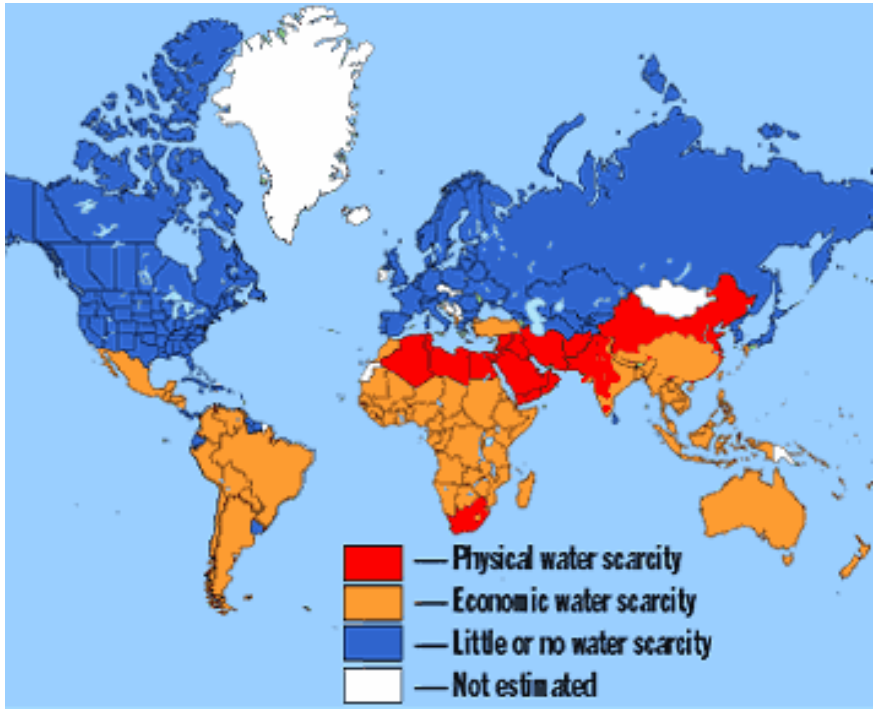
SEA LEVELS

Fuchs (2010), Cities at risk: Asia's coastal cities in an age of climate change. Asia Pacific Issues 96: 1–12.
Church, J.A. et al., 2013: Sea Level Change. In: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

The United Nations world water development report 2015: water for a sustainable world:

In Asia, over 500 million are undernourished.

By 2050, global water demand is projected to increase by 55%, mainly from demands related to growing urbanization in developing countries.

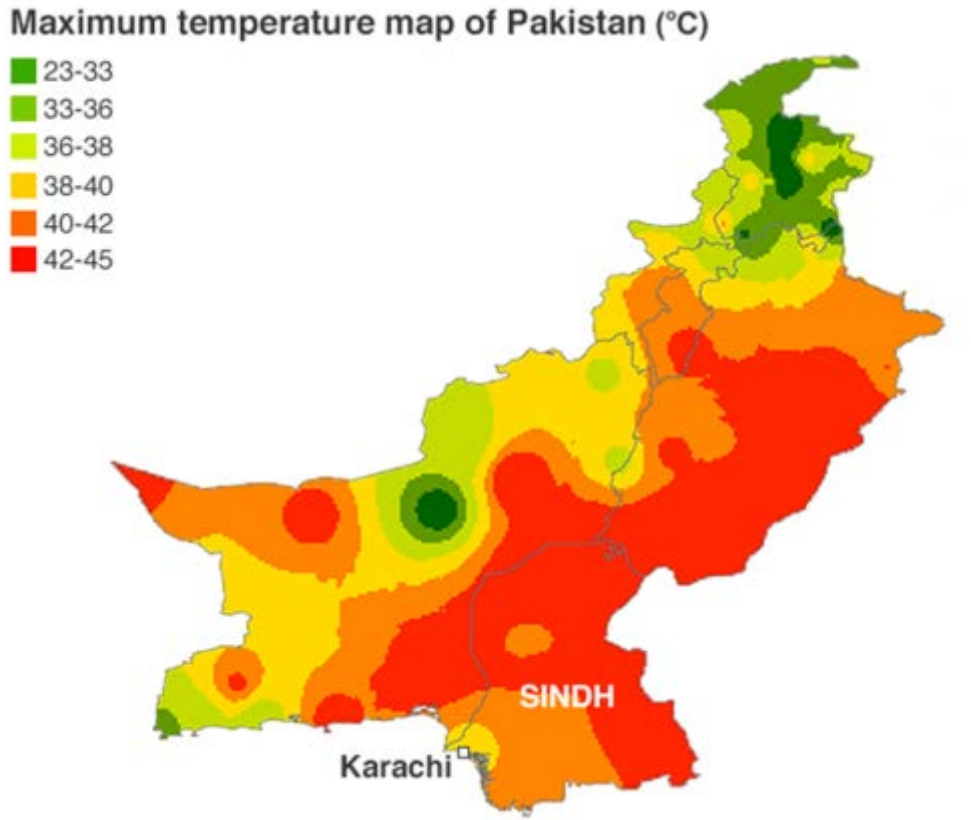


IMPACT

WATER

http://www.unesco.org/new/en/loginarea/natural-sciences/environment/water/wwap/wwdr/2015-water-for-a-sustainable-world/
http://www.unwater.org/publications/publications-detail/en/c/281166/
http://asiafoundation.org/in-asia/2015/03/25/south-asias-water-crisis-a-problem-of-scarcity-amid-abundance/

- Death toll: >2500 in India, >1000 in Pakistan
- Causes: delayed monsoonal rain, attributed to climate change
- Increase in PM2.5 due to hot dry wind from desert



Picture source: http://www.bbc.com/news/world-asia-33236067

IMPACT

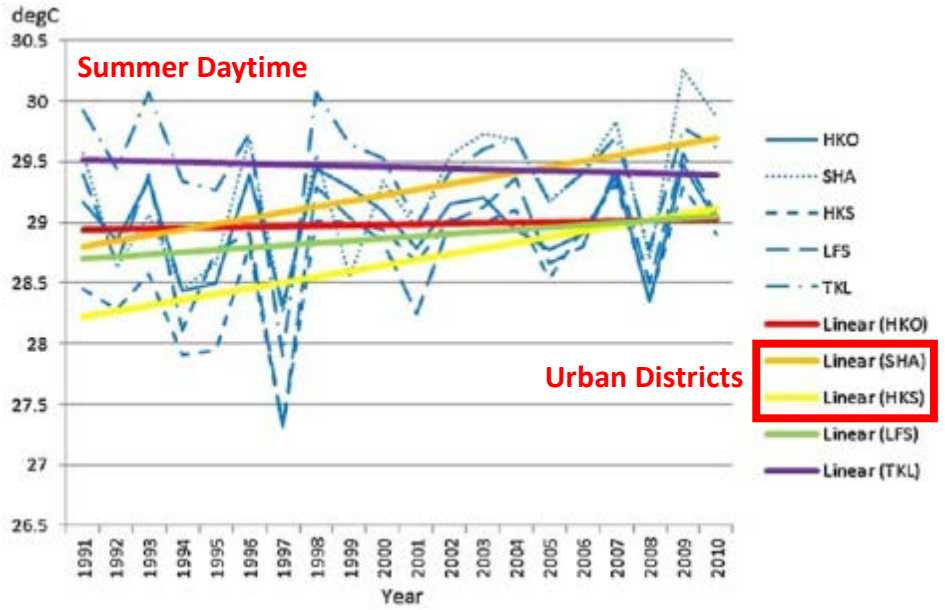
HEAT

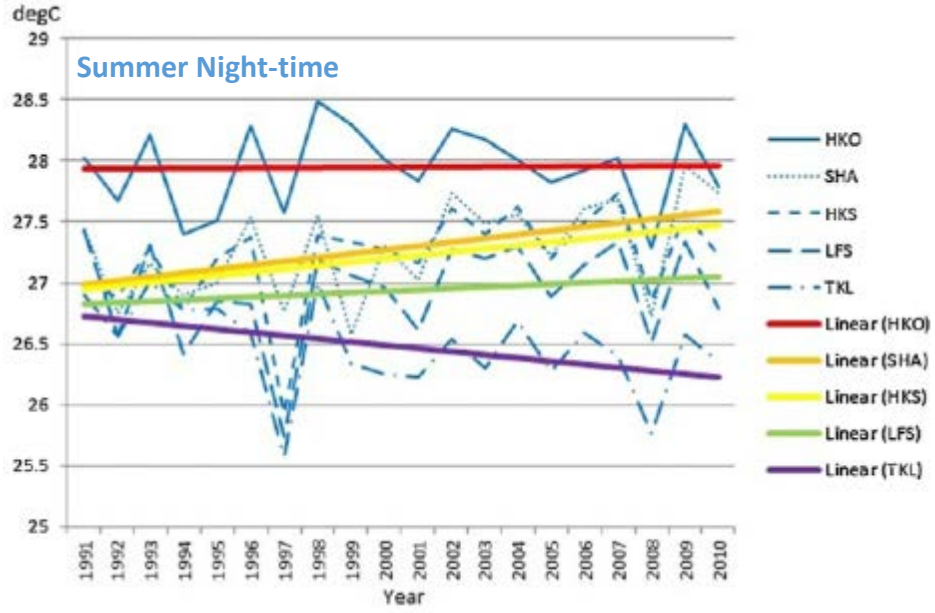
Hong Kong

- 40-year air temperature record
- Higher increasing rate in urban areas, particularly during night-time

IMPACT

HEAT





Lau K.L. and Ng E., 2013. An investigation of urbanization effect on urban and rural Hong Kong using a 40-year extended temperature record. Landscape and Urban Planning 114: 42–52.

… An average of 1 degree C increase in daily mean temperature above 28.2 degree C was associated with and estimated 1.8% increase in mortality. Heat-related mortality varied with sociodemographic characteristics …

(Chan et al 2012)

IMPACT

HEAT

"When you go to sleep, your set point for body temperature -- the temperature your brain is trying to achieve -- goes down, … Think of it as the internal thermostat. If it's too cold, or too hot, the body struggles to achieve this set point. (H. Craig Heller 2012)

Sleep deprivation alters the expression of hundreds of genes, including some whose activity normally varies depending on the time of day.

(Derk-Jan Dijk et al 2013)

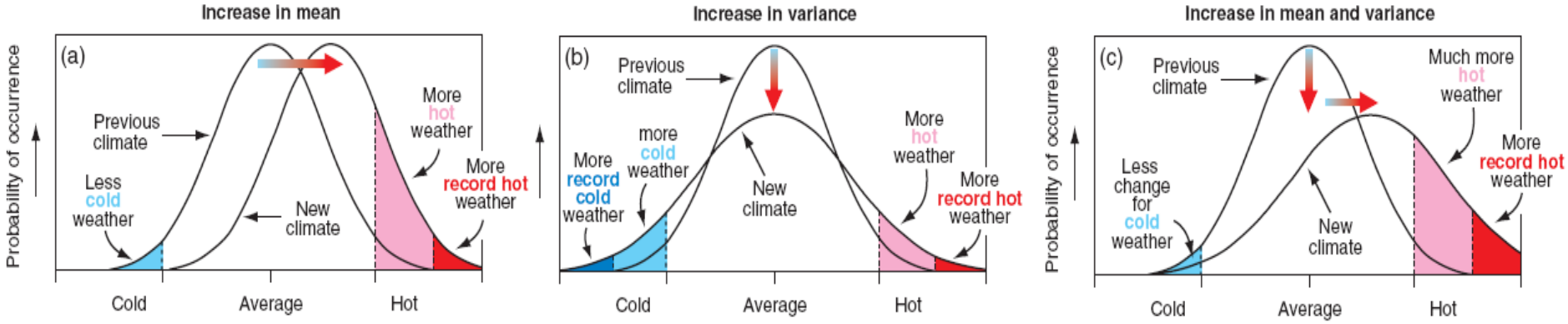
Derk-Jan Dijk et al . Sleepless nights affect gene activity. Nature 495, 9 (07 March 2013) doi:10.1038/495009d

H. Craig Heller, 2013. Secrets of Sleep Science: From Dreams to Disorders. The Teaching Company, USA.

Emily Ying Yang Chan, William B Goggins, Jacqueline Jakyoung Kim, Sian M Griffiths, 2012. A study of intracity variation of temperature-related mortality and socioeconomic status among the Chinese population in Hong Kong. J Epidemiol Community Health 2012;66:322-327 doi:10.1136/jech.2008.085167.

IMPACT

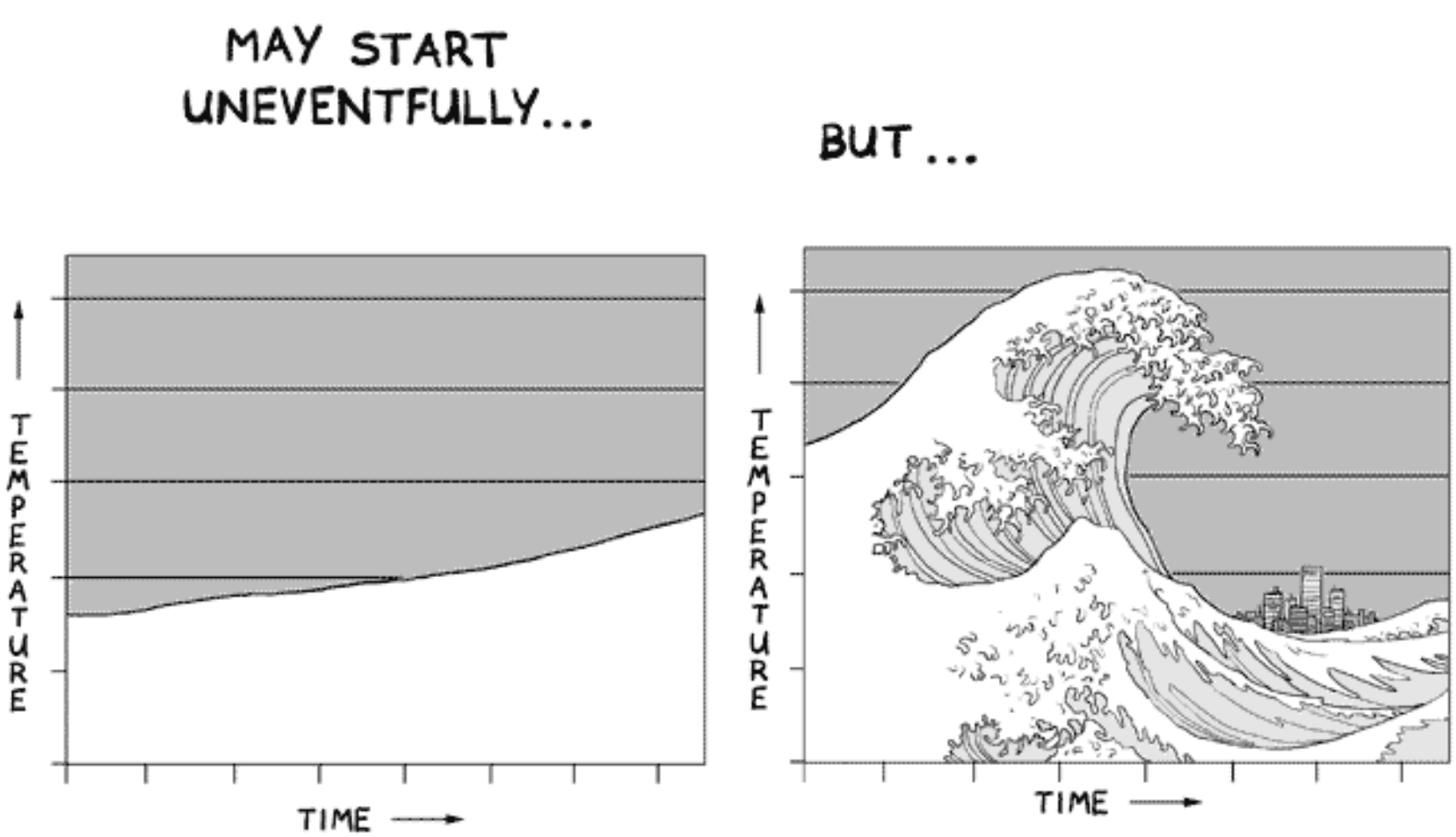
HEAT



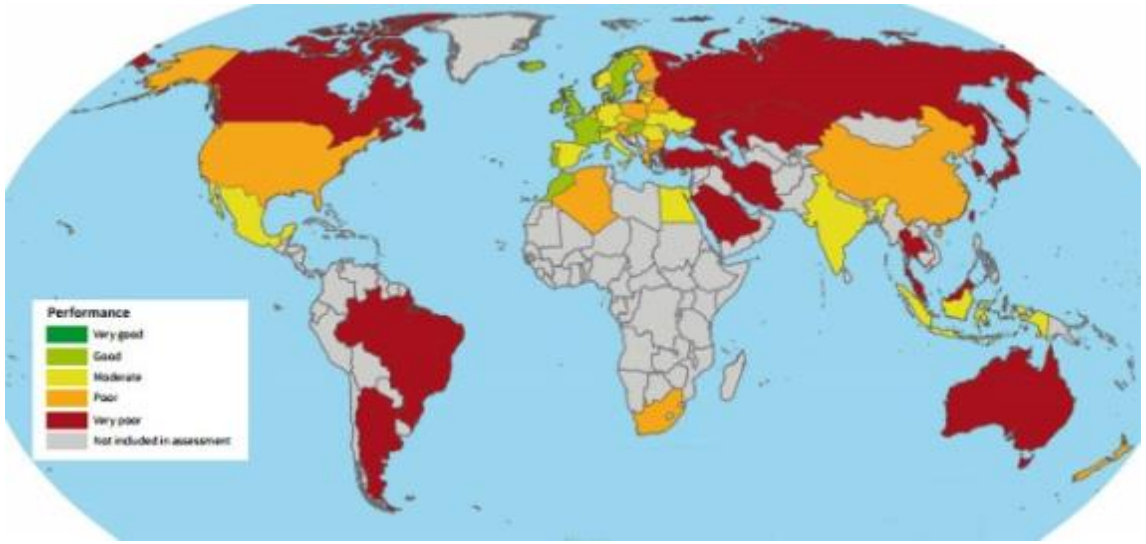
HKO data	**Very hot days**		Hot days	Hot nights		**Very hot nights**
	(Tmax>=33)	(Tmax>=32)	(Tmax>=30)	(Tmin>=25)	(Tmin>=27)	**(Tmin>=28)**
T_{iu} increase	T_{iu}= 0	T_{iu}= +1	T_{iu}= +3	T_{iu}= +3	T_{iu}= +1	T_{iu}= 0
	No., of very hot days			No., of very hot nights		
2008	**15**	42	74	115	48	**15**
2007	**25**	61	117	121	52	**23**
2006	**3**	25	82	117	53	**15**
2005	**12**	33	93	135	51	**26**
2004	**6**	26	94	123	47	**19**
2003	**14**	40	91	139	62	**20**
2002	**10**	32	93	133	45	**17**
2001	**9**	38	90	121	41	**16**
2000	**10**	40	99	124	51	**22**
1999	**6**	49	113	133	55	**17**
average	**10.6**	38.2	96.9	127.3	50.8	**19.5**

Ng, E., (2009) Wind and Heat Environment in Densely Built Urban Areas in Hong Kong, (invited paper) A special issue on Wind Disaster Risk and Global Environment Change, the Association of International Research Initiatives for Environmental Studies (AIRIES), Journal of Global Environmental Research, Vol.13, No.2, 2009, pp169-178.

IMPACT


MAY START UNEVENTFULLY...
TEMPERATURE
TIME
BUT ...
TEMPERATURE
TIME

The Climate Change Performance Index 2015



https://germanwatch.org/en/download/10407.pdf

POLICY

World bank assessment report

National plan not filtered down and implemented strategically

Actions are slow, Piecemeal and not comprehensive

Not effective and long-lasting, short-termism

Not high up in the Govt's agenda, no sense of urgency, lack cost-benefit and evaluative assessment.

Reactive, not proactive

LAND USE

Risks

Land sensitivity factors:

- Natural setting, Urban form, Built environment
- Extent of heat island effect
- Adaptive capacity -- urban land management system including: legal/political, planning, land regulations, infrastructures and urban services, land markets, and fiscal systems

Adaptation and Mitigation strategies

- Reduce sprawl, increase densities and mix uses to reduce auto use and increase public transit use
- Change in building codes to reduce energy use for heating and cooling
- Land use restrictions in areas subject to climate change impacts such as sea level rise
- Changes to building codes/land regulations to reduce damage from climate change hazards, e.g., elevating buildings in flood-prone areas
- Increase urban trees and vegetation to reduce the heat island effect

ARC3
First UCCRN Assessment Report on
Climate Change and Cities

Source: Marco Schmidt, 2003

Informal settlements on steeply sloped public land in Rio de Janeiro, Brazil

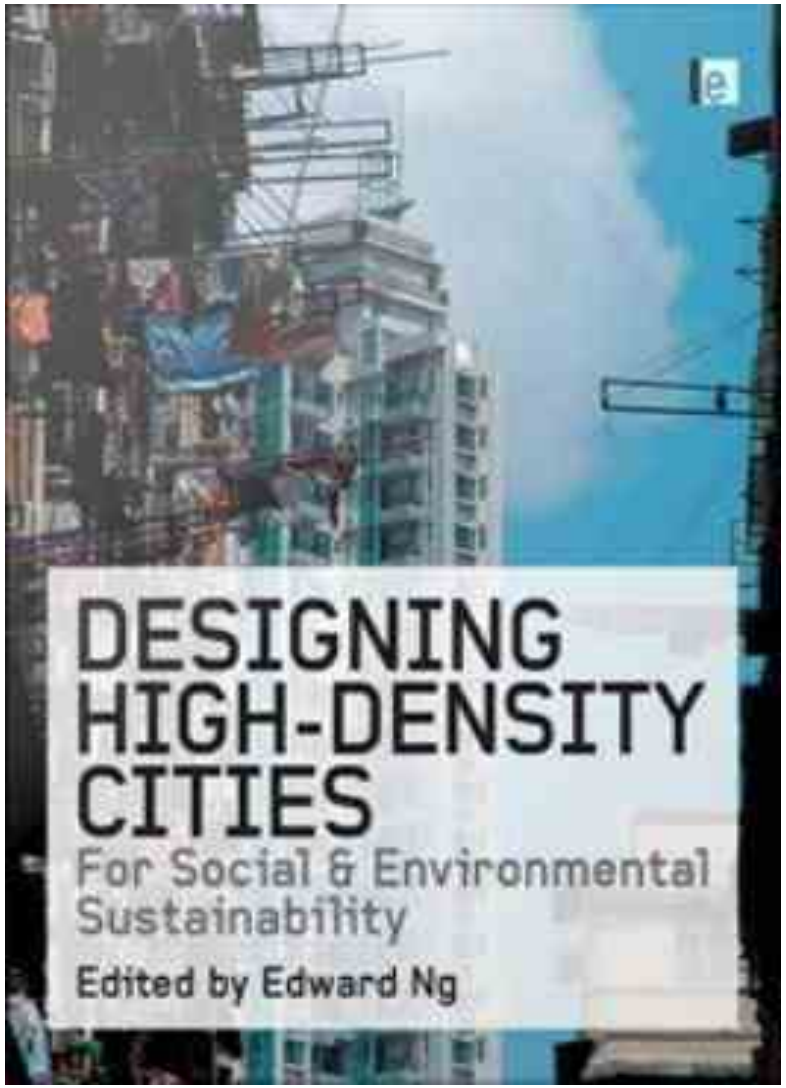
POLICY

Key takeaway

Urban land strategies highly dependent on coordination and effectiveness of planning and management systems in politically fragmented metropolitan areas

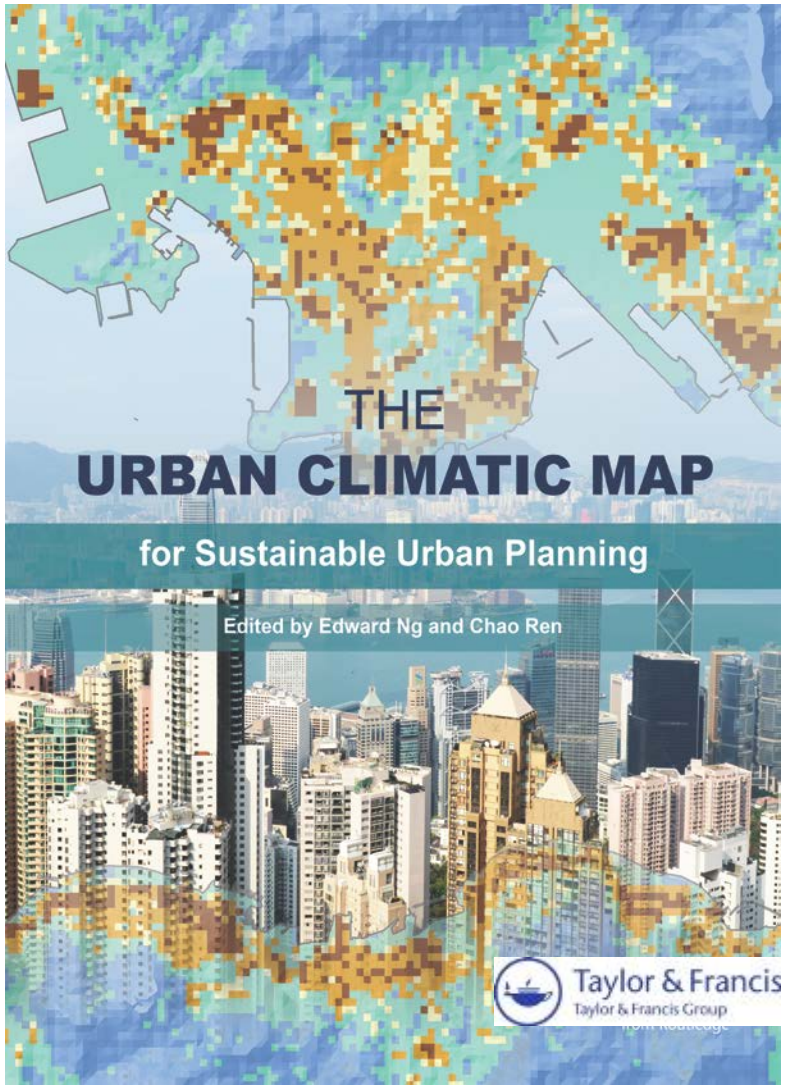
Compact living is sustainable living. High-density cities can support closer amenities, encourage reduced trip lengths and the use of public transport and therefore reduce transport energy costs and carbon emissions. High-density planning also helps to control the spread of urban suburbs into open lands, improves efficiency in urban infrastructure and services, and results in environmental improvements that support higher quality of life in cities.

Encouraging, even requiring, higher density urban development is a major policy and a central principle of growth management programmes used by planners around the world. However, such density creates design challenges and problems. A collection of experts in each of the related architectural and planning areas examines these environmental and social issues, and argues that high-density cities are a sustainable solution. It will be essential reading for anyone with an interest in sustainable urban development.



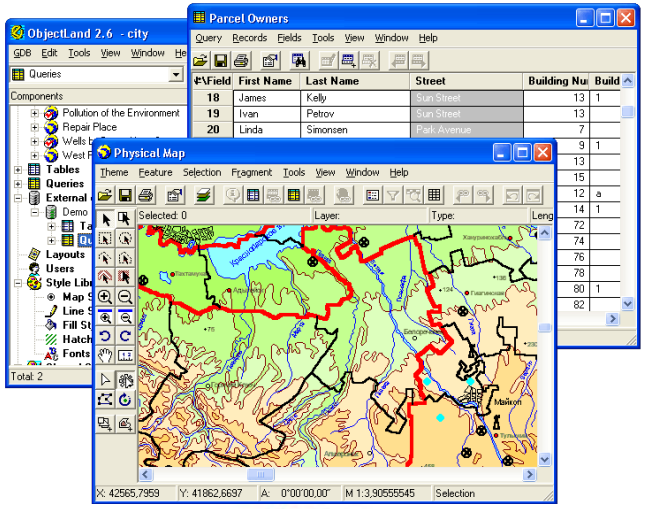
PLANNING

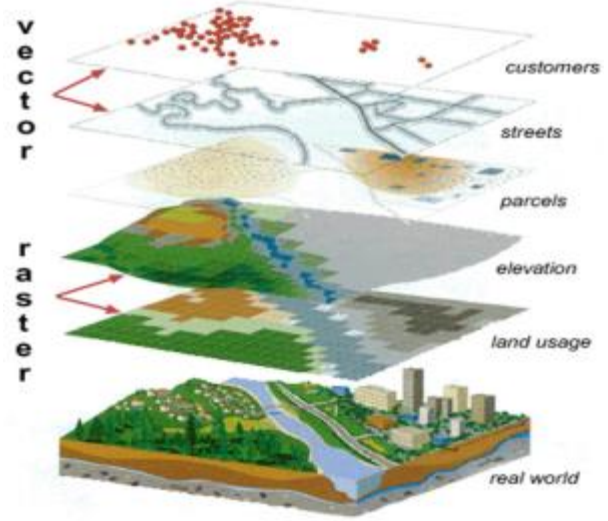
Rapid urbanization, higher density and more compact cities have brought about a new science of urban climatology. An understanding of the mapping of this phenomenon is crucial for urban planners. The book brings together experts in the field of Urban Climatic Mapping to provide the state of the art understanding on how urban climatic knowledge can be made available and utilized by urban planners. The book contains the technology, methodology, and various focuses and approaches of urban climatic map making. It illustrates this understanding with examples and case studies from around the world, and it explains how urban climatic information can be analysed, interpreted and applied in urban planning. The book attempts to bridge the gap between the science of urban climatology and the practice of urban planning. It provides a useful one-stop reference for postgraduates, academics and urban climatologists wishing to better understand the needs for urban climatic knowledge in city planning; and urban planners and policy makers interested in applying the knowledge to design future sustainable cities and quality urban spaces.



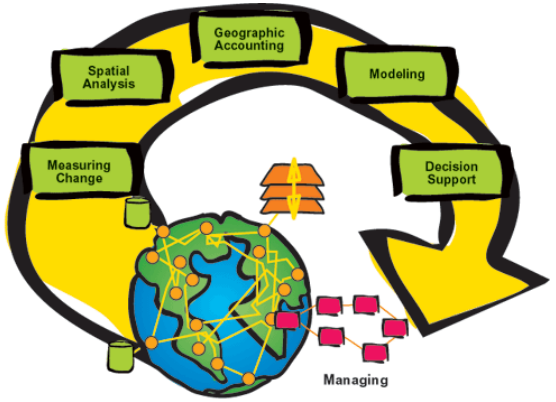
PLANNING

Information embedding

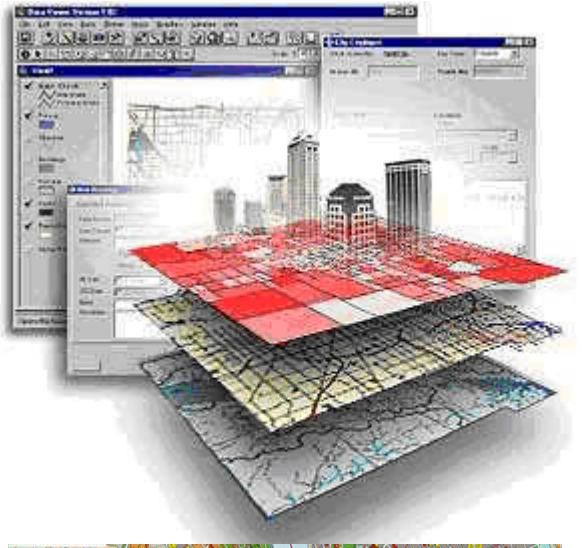


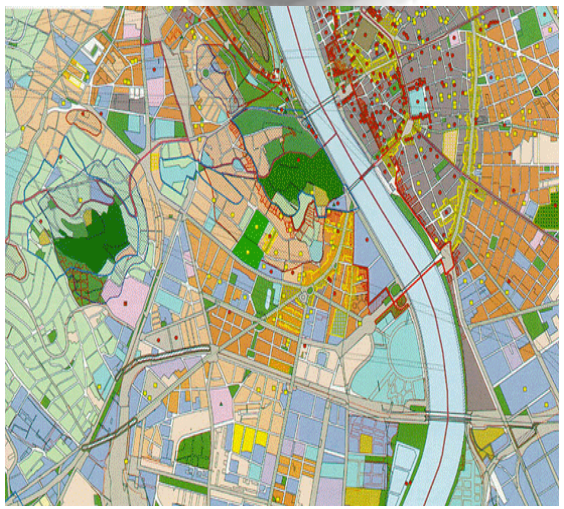


Assess and Process



Support and Decision



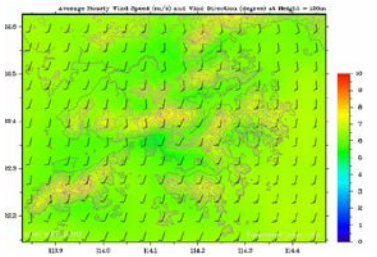


PLANNING

Urban Climatic Maps and HK's Planning Framework

Urban Climatic Analysis Map

+



Wind information

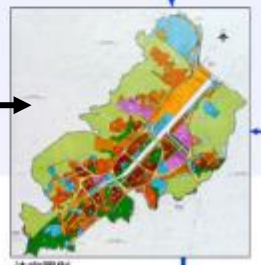
Urban Climatic Planning Recommendation Map

inform

Provide boundary conditions and background understanding for

Detail further additional studies: Micro-climatic and AVA

全港發展策略
Territorial Development Strategy



法定圖則
Statutory Plan

香港規劃標準與準則
Hong Kong Planning Standards & Guidelines

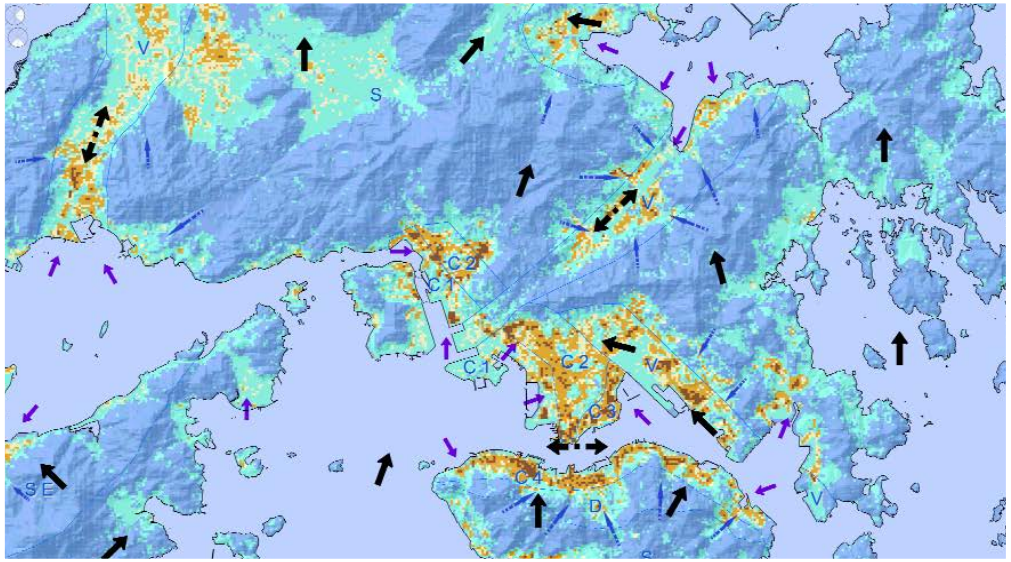
發展大綱圖
Outline Development Plan

詳細藍圖
Layout Plan

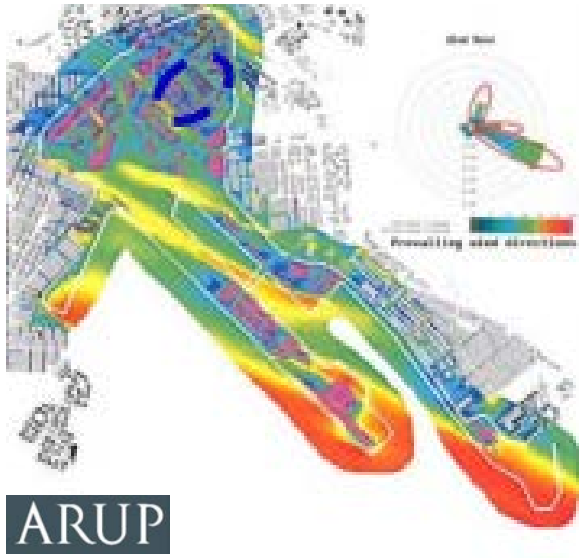
PLANNING APPLICATION

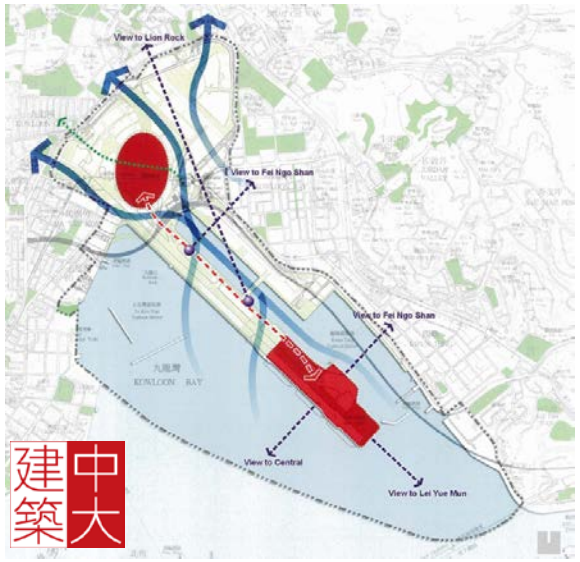
PLANNING

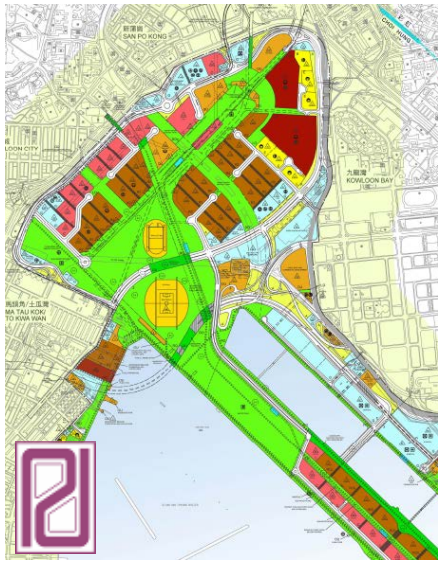
Legislative Council approved the old Kai Tak Airport site (300 ha) zoning plan (OZP) based on Air Ventilation Assessment and Urban Climatic recommendations



PLANNING








NGAU CHI WAN
KOWLOON CITY
KOWLOON BAY
TO KWA WAN
HUNG HOM
KAI TAK APPROACH CHANNEL
KWUN TONG TYPHOON SHELTER

PLANNING

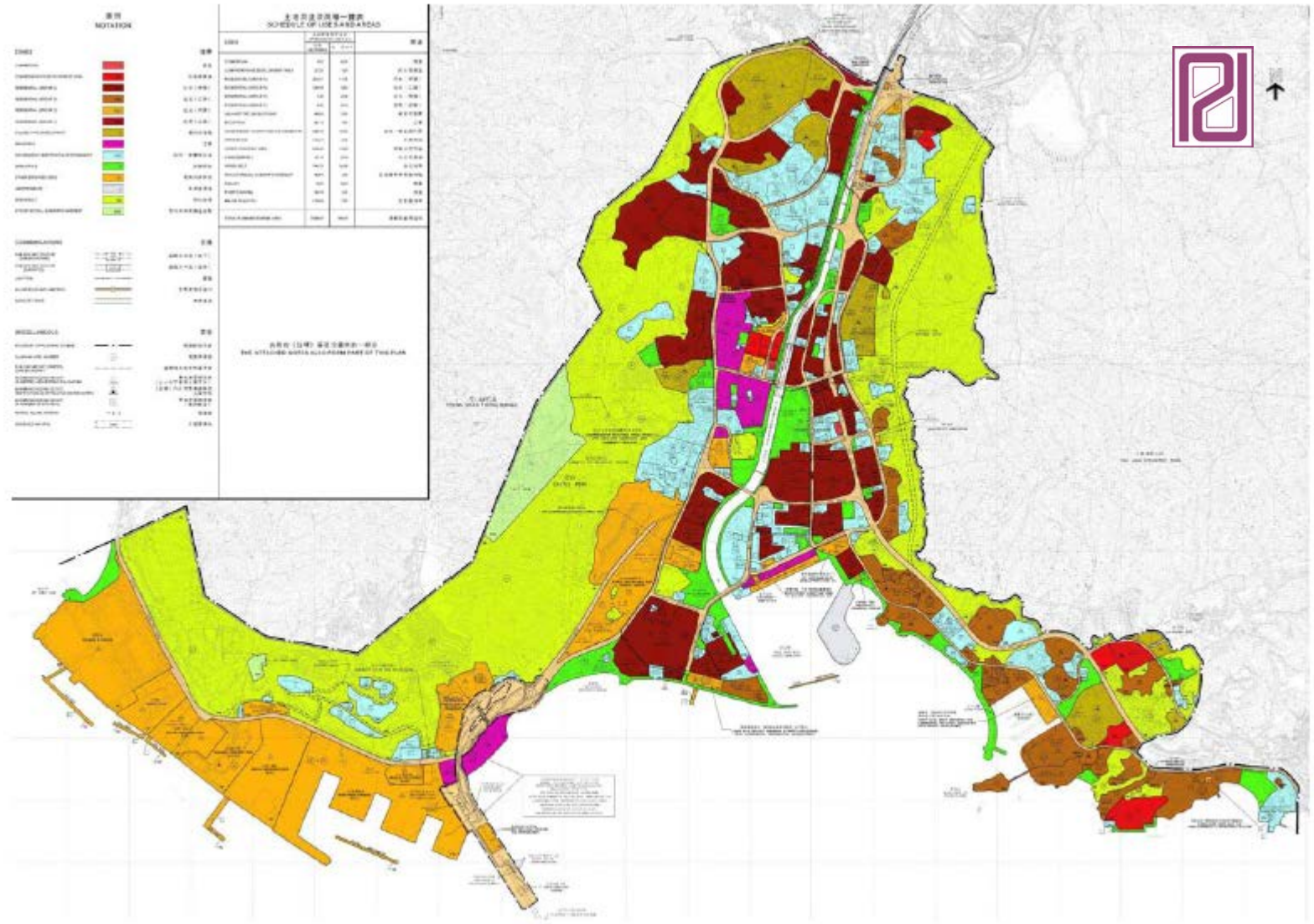
Hong Kong housing shortage: Leung Chun-ying plans to increase land supply

Jan 19, 2015 | 0 Comment(s)

Tweet G+1 0 Like 0

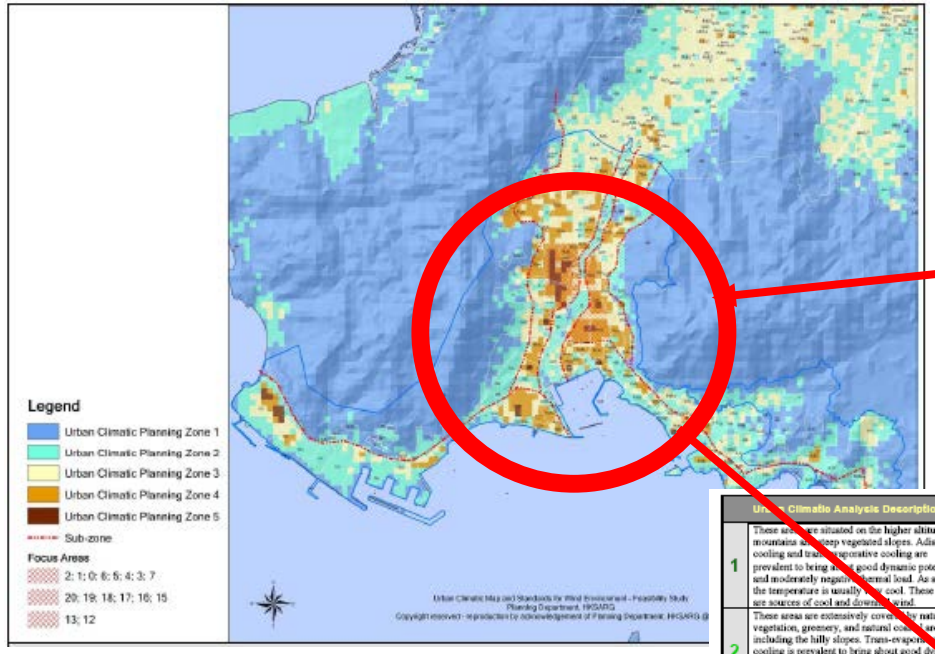
Hong Kong will increase its land supply to deal with the housing shortage, promised Chief Executive Leung Chun-ying in his recent policy address. His government will relax out-dated restrictions and streamline procedures to facilitate building new homes.

PLANNING



PLANNING

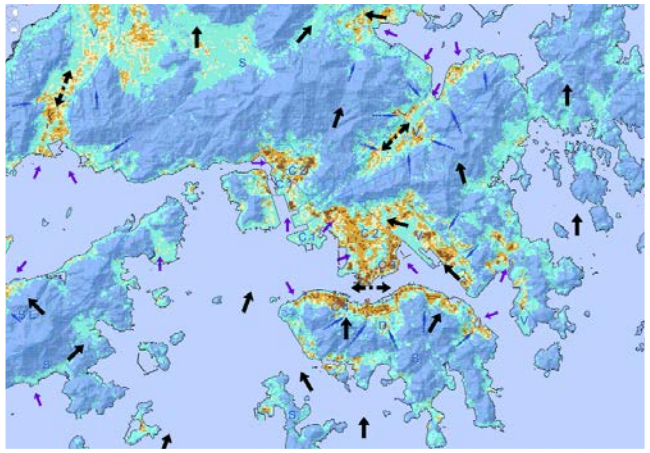
Hong Kong: Tuen Mun District Outline Zoning Plan

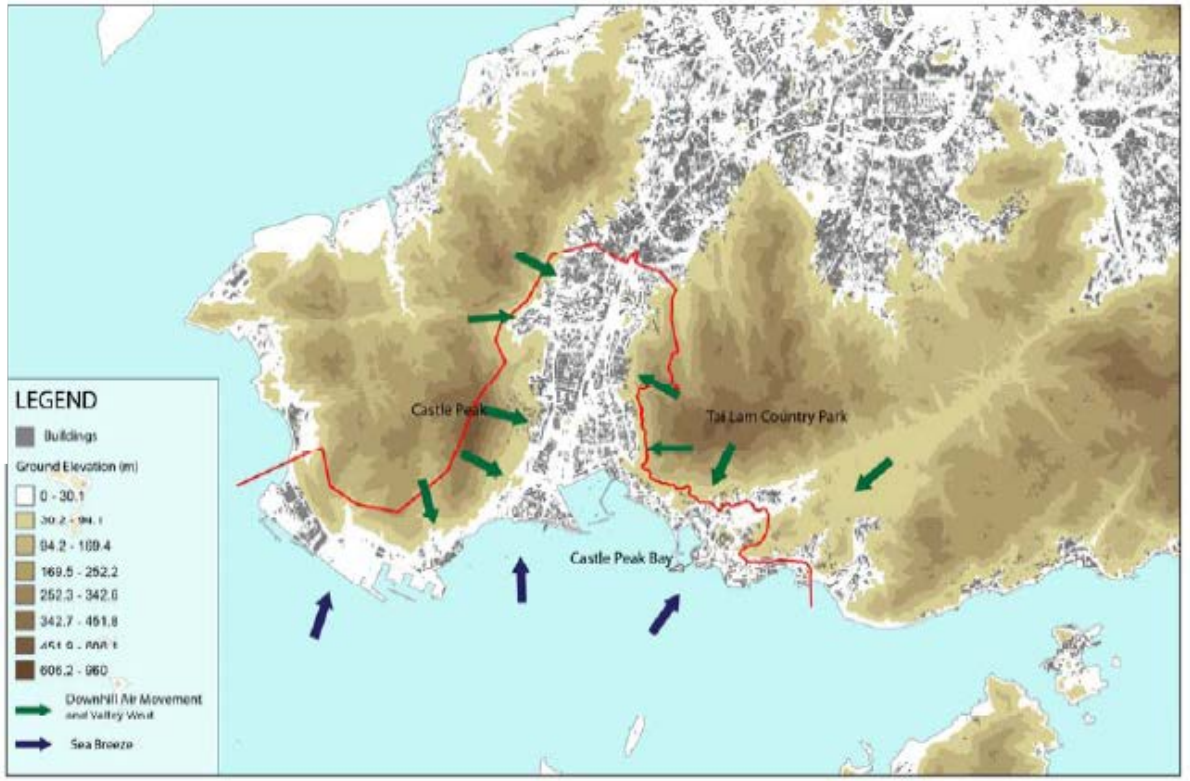


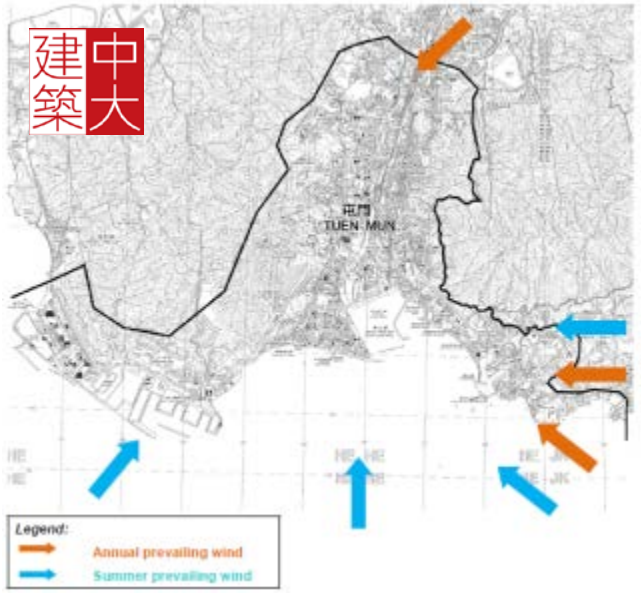
Urban Climatic Analysis Description	Urban Climatic Classes	Impact on Thermal Comfort	Urban Climatic Value / Sensitivity Zone		Urban Climatic Planning Zones and General Planning Recommendations
1 These areas are situated on the higher altitudes of mountains and steep vegetated slopes. Adiabatic cooling and trans-evaporative cooling are prevalent to bring about good dynamic potentials and moderately negative thermal load. As a result, the temperature is usually very cool. These areas are sources of cool and downslope wind.	Moderately negative Thermal Load and Good Dynamic Potentials	•• Moderate	Urban climatically valuable area	Positive	1 1 Preserve 2 These zones are extensively covered with natural vegetation, at higher altitude and with few obstructions to wind. Their can provide a cooler and more conducive thermal comfort environment. Their cool air production capability can also be beneficial to nearby urban areas. 3 Natural areas especially cold air production and drainage areas beneficial to other areas (e.g. vegetated hill slopes adjacent to urban areas) should be preserved. No sealing (paving) or development should be allowed. 4 Minor but essential development may be possible in areas other than in natural areas identified in 3 above. Careful planning and design is necessary to minimise disruption. 5 Major but absolutely essential and necessary development (e.g. new town), other than in natural areas identified in 3 above, may be exceptionally considered. Very careful planning and design is necessary to minimise disruption. Breezeways and air paths must be carefully designed. Street grids and building disposition must respect prevailing wind directions, Building Volume and Ground coverage must be kept low. Maximise greenery and open spaces and minimise sealing must be practised.
2 These areas are extensively covered by natural vegetation, greenery, and natural coastal areas including the hilly slopes. Trans-evaporative cooling is prevalent to bring about good dynamic potentials and slightly negative thermal load. As a result, the temperature is generally cooler. These areas are sources of cool and fresh air.	Slightly negative Thermal Load and Good Dynamic Potentials	• Slight	Slightly urban climatically sensitive area	Neutral	2 1 Preserve and enhance 2 These zones are currently urban climatically "neutral" in terms of urban thermal comfort. It is important to maintain their urban climatic characteristics. Desirable features like areas with lower building volume, open spaces and so on should be preserved. 3 Further development is possible. 4 Existing air paths must be identified and respected. The prevailing wind directions and air mass movement must be considered when buildings are positioned. 5 Higher Building Volume is permissible should 4 above is respected. 6 Consider reducing ground coverage to improve ground level air volume; 7 consider greening to the open spaces.
3 These areas usually consist of more spaced out developments with smaller ground coverage and more open space very near the sea. As a result, the temperature is mild.	Low Thermal Load and Good Dynamic Potentials	- Neutral			
4 These areas usually consist of low to medium building volumes in a developed yet more open setting, e.g. in the sloping areas with a fair amount of open space between buildings. As a result, the temperature is slightly warm.	Some Thermal Load and Some Dynamic Potentials	• Slight			
5 These areas usually consist of medium building volumes situated in low-lying areas further inland from the sea or in areas fairly sheltered by natural topography. As a result, the temperature is warm.	Moderate Thermal Load and Some Dynamic Potentials	•• Moderate	Moderate Urban climatically sensitive area	Moderate	3 1 Some action encouraged 2 These zones are currently urban climatically "moderate in terms of urban thermal comfort. Some impact on thermal comfort is expected. As such, it is encouraged to consider installing some mitigation measures. 3 Further development is possible and should be carried out with care. 4 Existing air paths must be identified, respected and enhanced. The prevailing wind directions and air mass movement must be considered when buildings are positioned. 5 Higher Building Volume is permissible should 4 above is respected, and it is necessary to balance it with a reduction of ground coverage to improve ground level air volume; 6 Greening to the open spaces and streets is highly recommended
6 These areas usually consist of medium to high building volumes located in low-lying development areas with relatively less urban greenery. As a result, the temperature is very warm.	Moderately High Thermal Load and Low Dynamic Potentials	••• Moderately strong	High urban climatically sensitive area	High	4 1 Action desirable and recommended 2 These zones are already densely built. Thermal Load is high and Dynamic Potential is low. Some strong impact on thermal comfort is expected. 3 Further development is possible and should be carried out with care. A balance consideration of adding Building Volume and reducing Ground Coverage must be considered so that at least a "no worse than existing" scenario could result. 4 Existing air paths must be identified, respected, enhanced and widened. The prevailing wind directions and air mass movement must be considered when buildings are positioned. 5 Greening to the open spaces and streets is essential. 6 Addition greenery and tree planting on streets in these zones is essential and is strongly recommended. Intensify greening in O and GIC zones are also recommended.
7 These areas usually consist of high building volumes located in low-lying well-developed areas with little open space. As a result, the temperature is generally hot in these areas.	High Thermal Load and Low Dynamic Potentials	•••• Strong			
8 These areas usually consist of very high and compact building volumes with very limited open space and permeability due to shielding by buildings on many sides. Full and large ground coverage is prevalent and air paths are restricted from the nearby sea or hills. As a result, the temperature is very hot in these areas.	Very High Thermal Load and Low Dynamic Potentials	••••• Very strong	Very highly urban climatically sensitive area	Very high	5 1 Mitigation action necessary 2 These zones are already very densely built. Thermal Load is very high and Dynamic Potential is low. Very strong impact on thermal comfort is expected. A high frequency of occurrence of thermal stress is also anticipated. 3 No further adding of Building Volume and Ground Coverage should be allowed. 4 Existing air paths must be identified, respected, enhanced and widened. New air paths may need to be created. The prevailing wind directions and air mass movement must be considered when buildings are re-developed and re-positioned "to improve" the existing situation. Strategic mitigation measures (air paths, open spaces, urban greenery, street widening, building set back, and so on) must be considered "to improve" the existing situation. 5 A strategy to utilise all GIC sites to relief the existing condition is recommended. No further tall structure is encouraged on all these GIC sites. Intensify greening is recommended. 6 Addition greenery and tree planting on streets in these zones is essential and is essential recommended. Intensify greening in O zones is strongly recommended.

Based on the Urban Climatic Planning Recommendation Map of HK, the re-zoning sites were reviewed by the Town Planning Board.

PLANNING







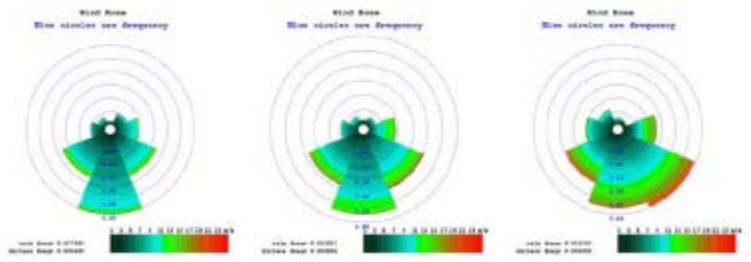
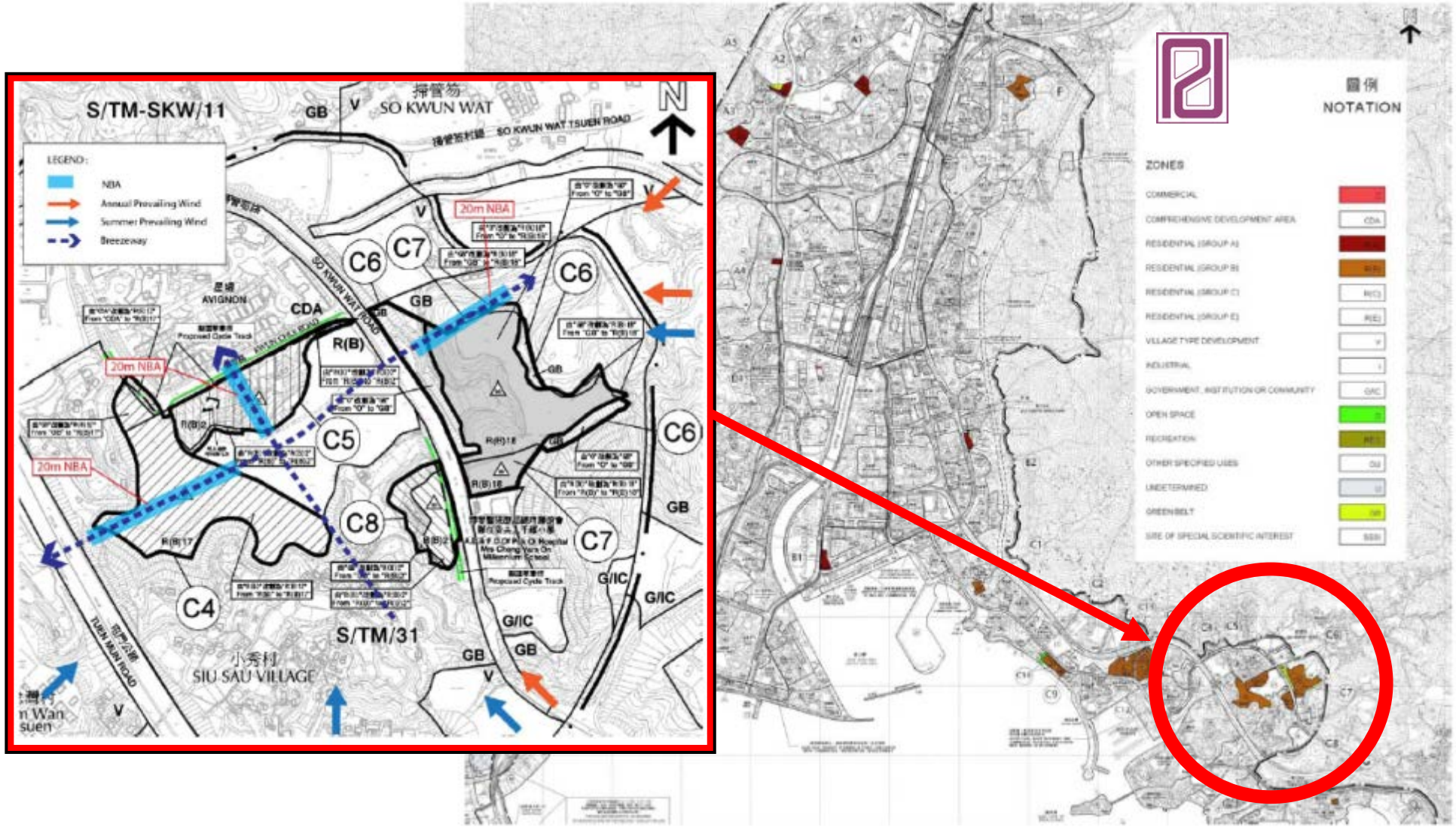


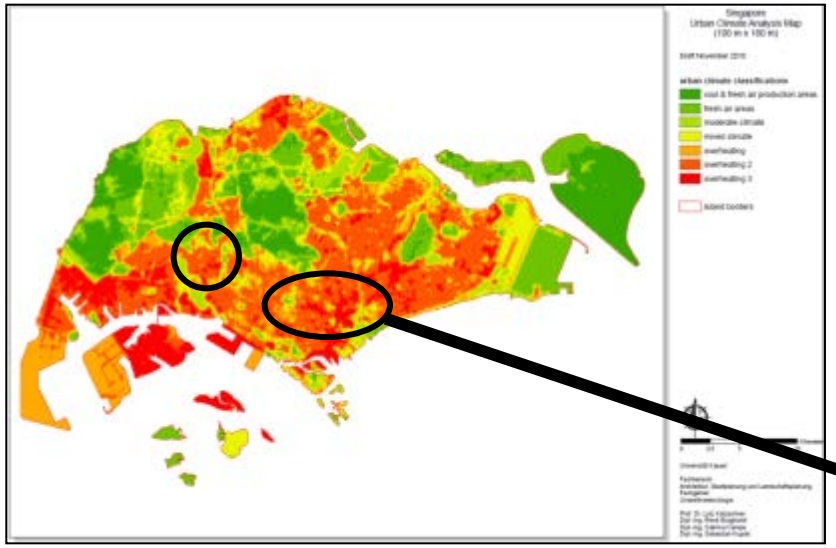
Figure 3.17 Summer Wind roses (2005) at A (left: 60 m; middle: 120 m; right: 450 m).

PLANNING


S/TM-SKW/11
SO KWUN WAT
SO KWUN WAT TSUEN ROAD
LEGEND:
NBA
Annual Prevailing Wind
Summer Prevailing Wind
Breezeway
20m NBA
C6
C7
C5
C8
C4
CDA
AVIGNON
R(B)
GB
G/IC
S/TM/31
SIU SAU VILLAGE
TUEN MUN ROAD
NOTATION
ZONES

PLANNING

Singapore's heat map aligns with URA's Landscape Replacement Policy (2009)



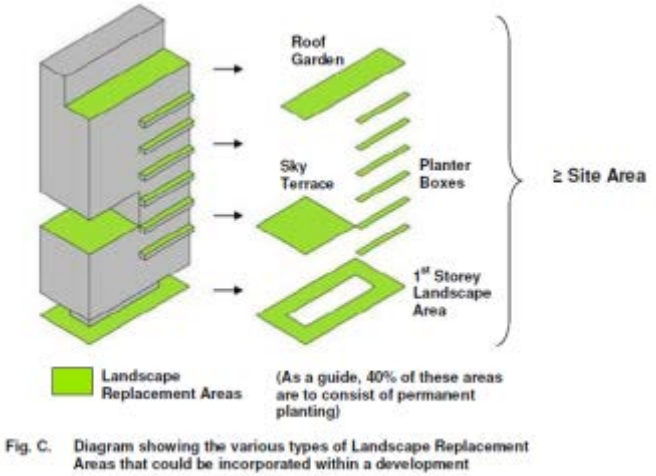
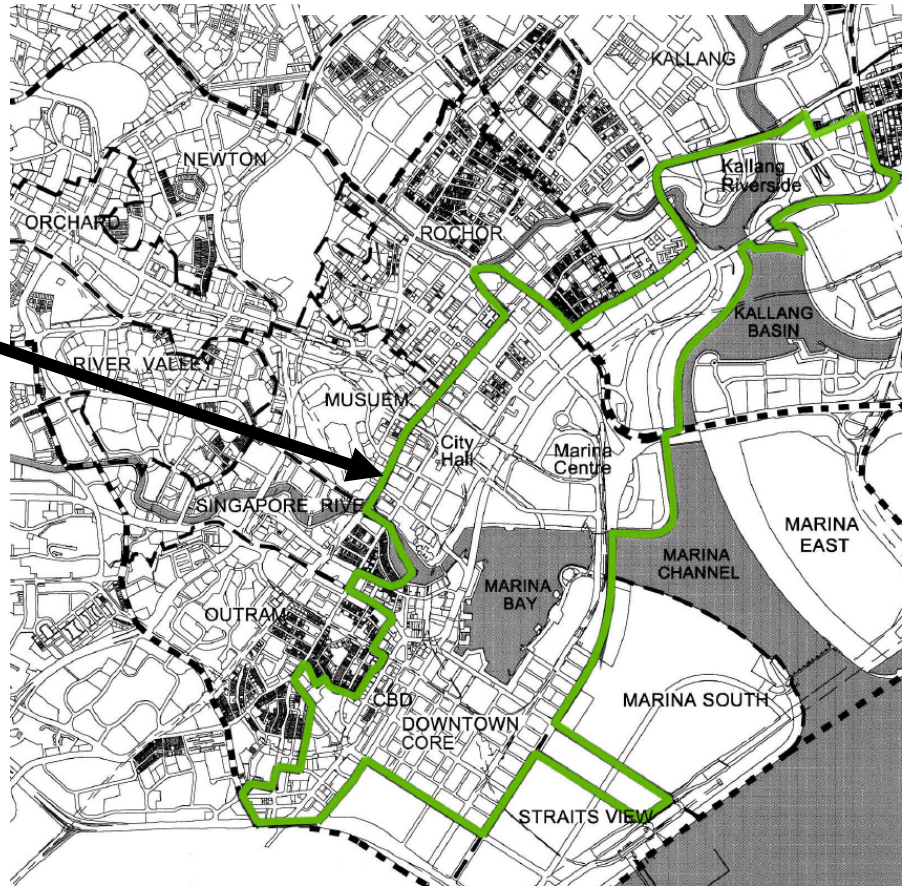


Fig. C. Diagram showing the various types of Landscape Replacement Areas that could be incorporated within a development

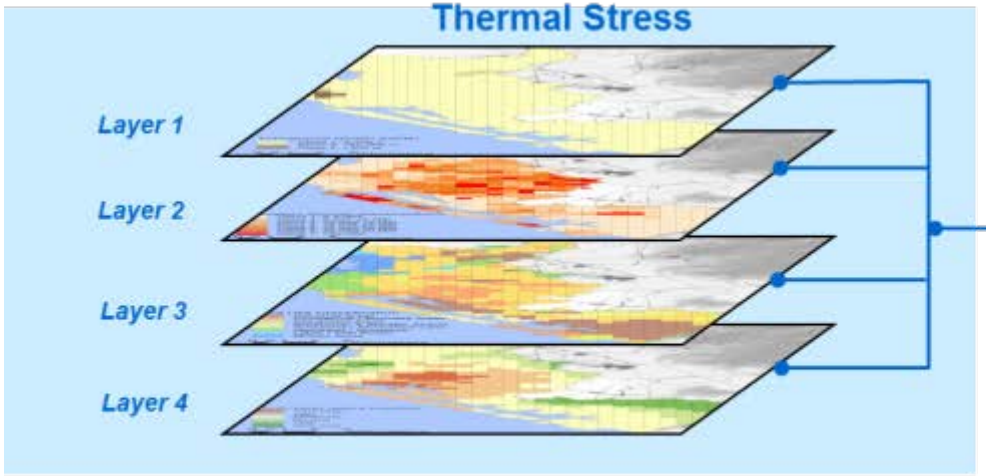
Areas where new developments will be providing Landscape Replacement Areas

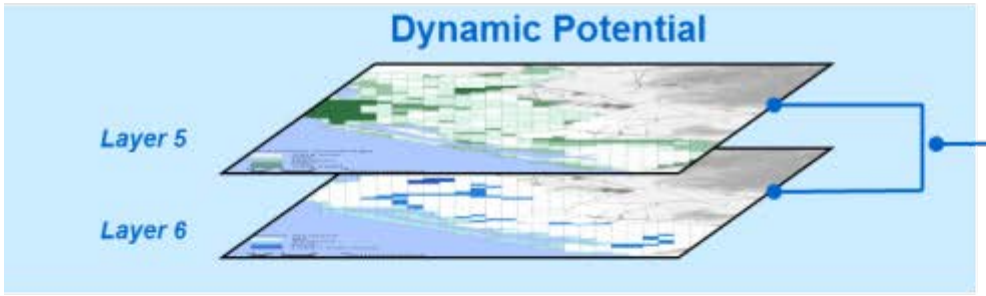


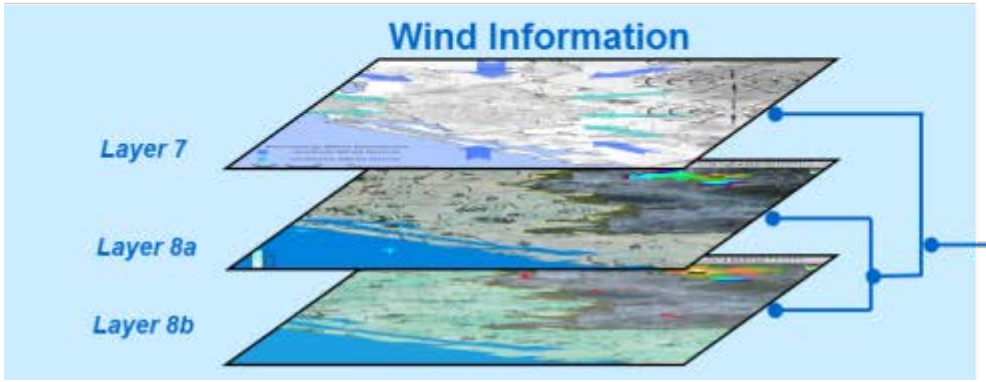
PLANNING

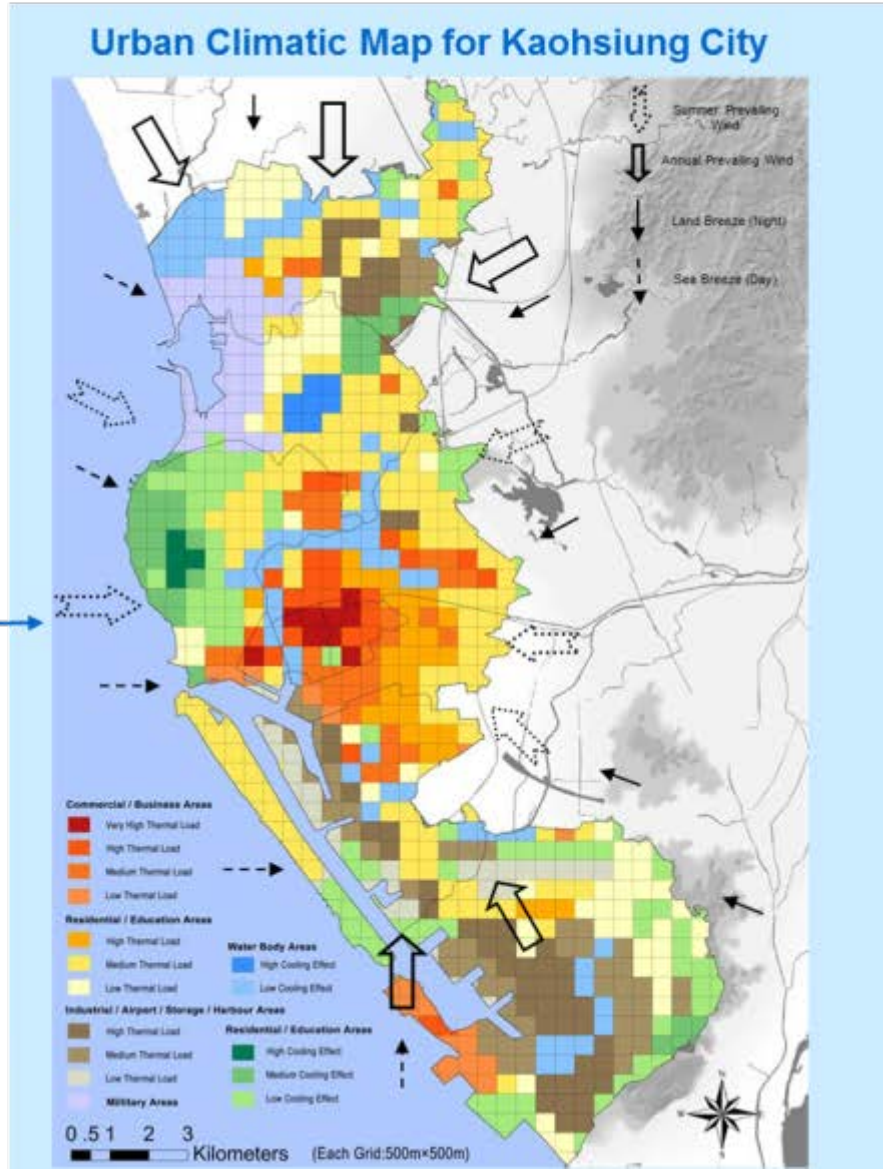
URA landscape replacement policy http://www.ura.gov.sg/pr/graphics/2009/pr09-19a1.pdf
http://www.ura.gov.sg/circulars/text/dc09-09.pdf

PLANNING

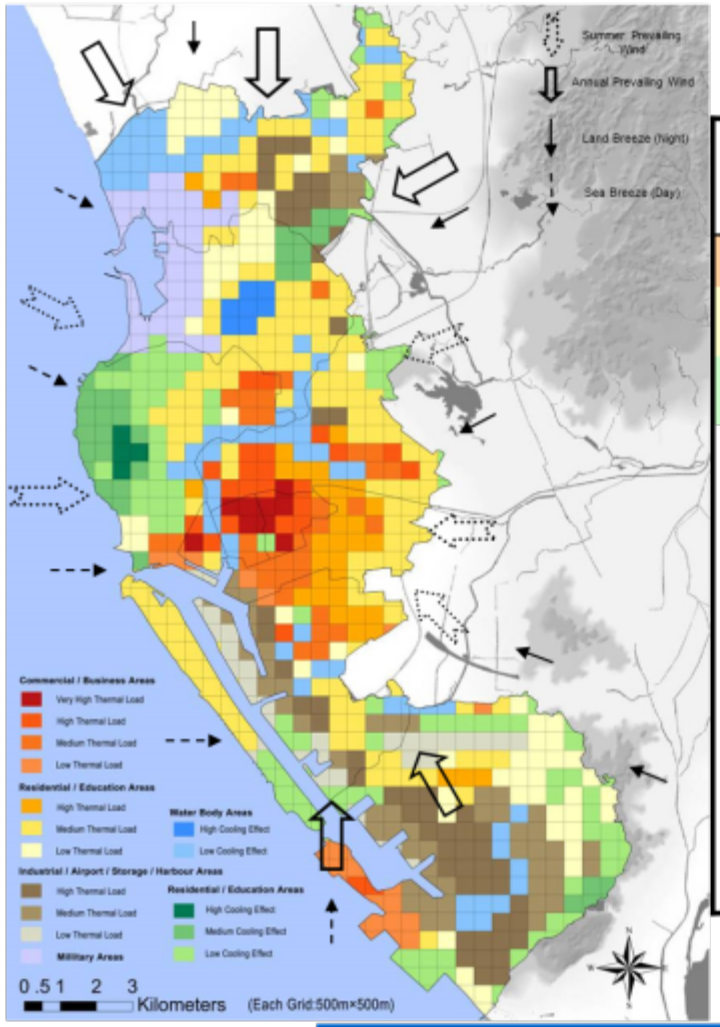

Thermal Stress
Layer 1
Layer 2
Layer 3
Layer 4


Dynamic Potential
Layer 5
Layer 6

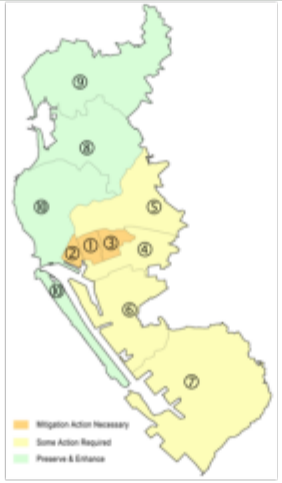

Wind Information
Layer 7
Layer 8a
Layer 8b


Urban Climatic Map for Kaohsiung City
Summer Prevailing Wind
Annual Prevailing Wind
Land Breeze (Night)
Sea Breeze (Day)
Commercial / Business Areas
Very High Thermal Load
High Thermal Load
Medium Thermal Load
Low Thermal Load
Residential / Education Areas
High Thermal Load
Medium Thermal Load
Low Thermal Load
Water Body Areas
High Cooling Effect
Low Cooling Effect
Industrial / Airport / Storage / Harbour Areas
High Thermal Load
Medium Thermal Load
Low Thermal Load
Military Areas
Residential / Education Areas
High Cooling Effect
Medium Cooling Effect
Low Cooling Effect
0 .5 1 2 3
Kilometers
(Each Grid:500m×500m)

PLANNING



Urban Climatic Map & General Recommendations for 11 Districts

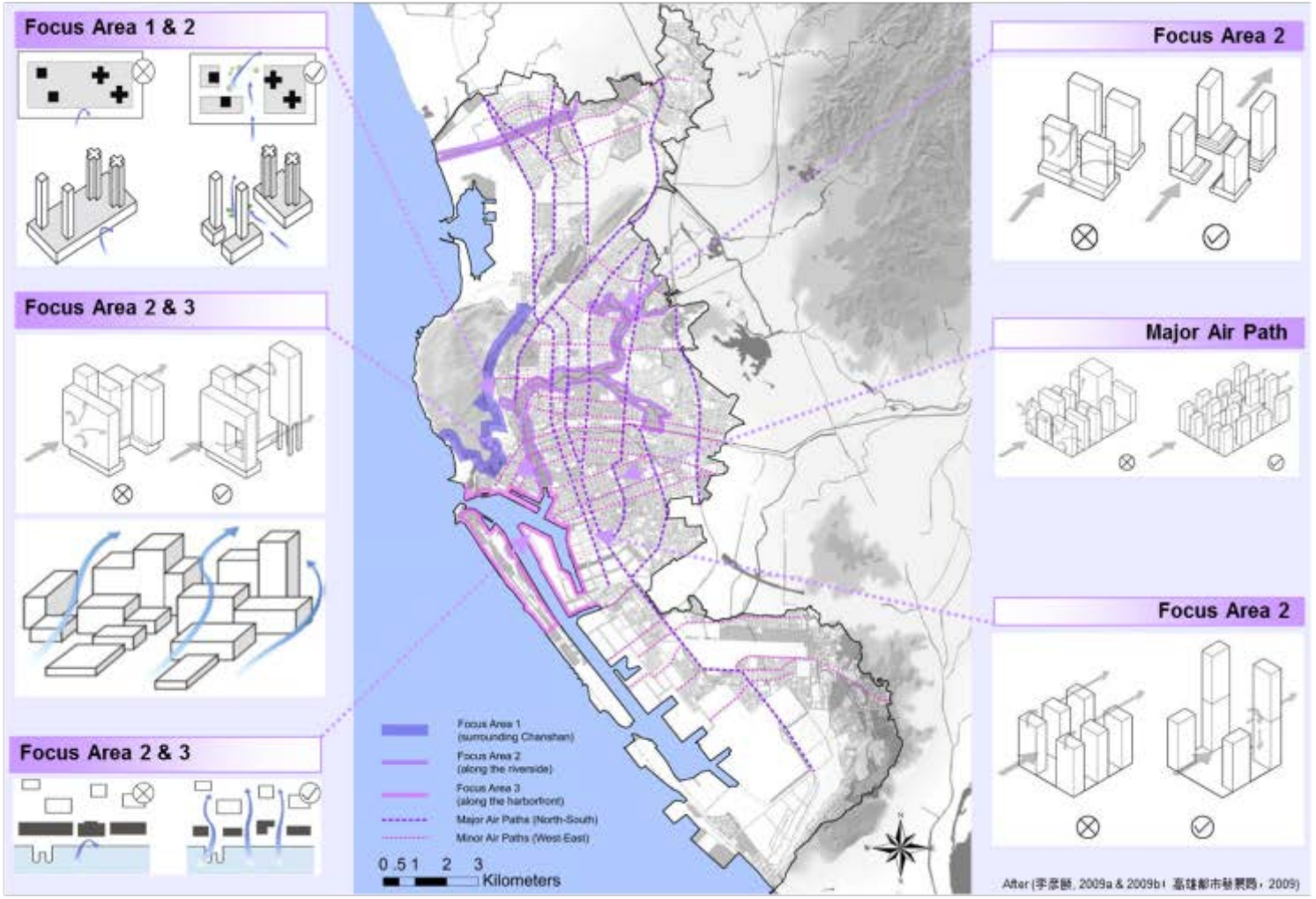
The Level of Plan Action	District Name	Urban Climatic and Environmental Characteristics	Menu of Effective Control Measures					
			Greenery	Shading	Cool Albedo	An-Heat Release	Air Exchange	Air Pollution
Mitigation Action Necessary	Cianjin	High to very high thermal stress and low dynamic potential due to high ground coverage, high Anthropogenic Heat (An-Heat) Release, various commercial activities and low greenery coverage;	▲▲	▲	▲	▼▼	▲▲	▼
Some Action Required	Yancheng		▲▲	▲	▲	▼▼	▲▲	▼
Preserve & Enhance	Sinsing		▲▲	▲	▲	▼▼	▲	▼
	Lingya	High to medium thermal stress and low to medium dynamic potential due to low to medium ground coverage, medium An-Heat Release, some commercial activities, lots of industrial activities and low greenery coverage;	▲▲	▲▲	▲	▼▼	▲▲	▼
	Sanmin		▲▲	▲	▲	▼	▲	▼▼
	Cianjhen		▲▲	▲	▲▲	▼▼	▲	▼▼
	Siaogang		▲▲	▲	▲▲	▼▼	▲	▼▼
	Zuoying	Medium to low thermal stress and medium to high dynamic potential due to low to medium ground coverage, low An-Heat Release, some commercial and industrial activities and medium to high greenery coverage;	▲	▲▲	▲	▼	▲▲	▼
	Nanzih		▲	▲	▲▲	▼▼	▲	▼▼
	Cijin		▲	▲	▲▲	▼	▲▲	▼
	Gushan		—	▲	—	—	▲	—

▲: Recommend to improve the existing condition;
▲▲: Strongly recommend to improve the existing condition;
▼: Recommend to mitigate the existing condition;
▼▼: Strongly recommend to mitigate the existing condition;
—: Maintain or Protect the existing condition.

PLANNING

Recommendation on Wind Aspect

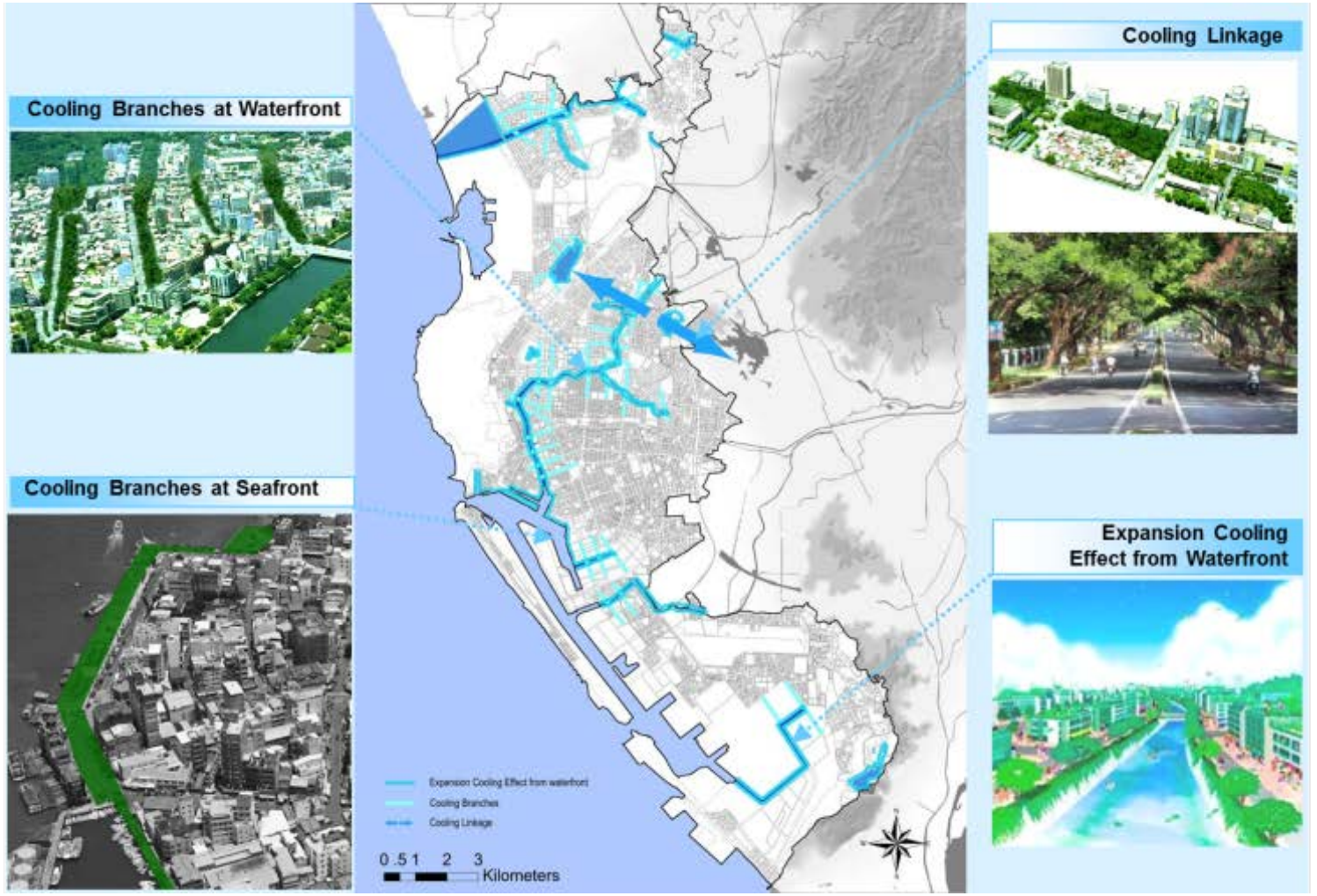
1. Respect the cooling effect from the Eastern Chanshan; minimize the development's impact; and form air path from hillside to downtown areas.
2. Respect the cooling effect from the river; Building blocks with various height to allow the penetration of cooling effect from riverside to inner urban areas;
3. Respect the sea breeze penetration; Do not form the Wall Effect Buildings at the Harbour front;
4. N-S orientated main roads are important major air paths; Buildings should be orientated with respect to the major air paths (annual & summer).
5. W-E orientated main roads are important minor air paths, esp. in summer; Building should be orientated with respect to the minor air paths.



PLANNING

Recommendation on Water Aspect

1. Respect the cooling effect from water systems, including river, lake, ponds & seafront; minimize the development's impact at waterfront and landscape the waterfront.
2. Form cooling branches along major transportation links highlighted in light blue color in the right map; appropriate greenery or landscape designs along these branches are strongly recommended.
3. Link the Lian Chinh Pond, Jinshih lake and Chengcing Lake by using greenery or vegetations to benefit the surround areas of these water bodies and mitigate the urban heat island intensity;



PLANNING

Recommendation on Greenery Aspect

1. Green rail track can be adopted to mitigate the anthropogenic heat release and air pollution along railways in dense urban areas;
2. Form green circles in the central urban areas to mitigate urban heat island intensity and anthropogenic heat releases. Provide shading at pedestrian level to create comfortable walking systems.
3. Form green circles around the industrial areas to mitigate the distribution of air pollution;
4. Create Green linkage between Chanshan, Lianchih Pond and Banpinshan to maximize the cooling effect;
5. Develop Green Fingers to let the cooling effect from Chanshan East hillsides to high-dense centre urban areas;
6. Create Green Belt to bring sea breezes to inner areas and improve the air exchange;

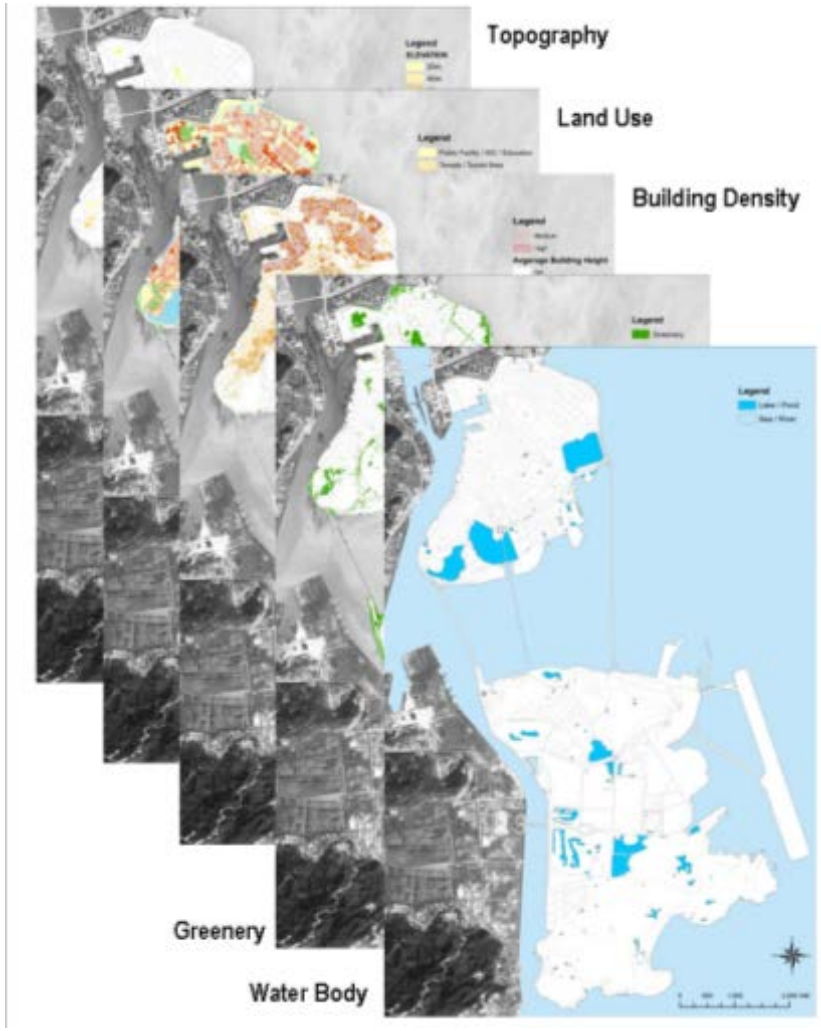
PLANNING

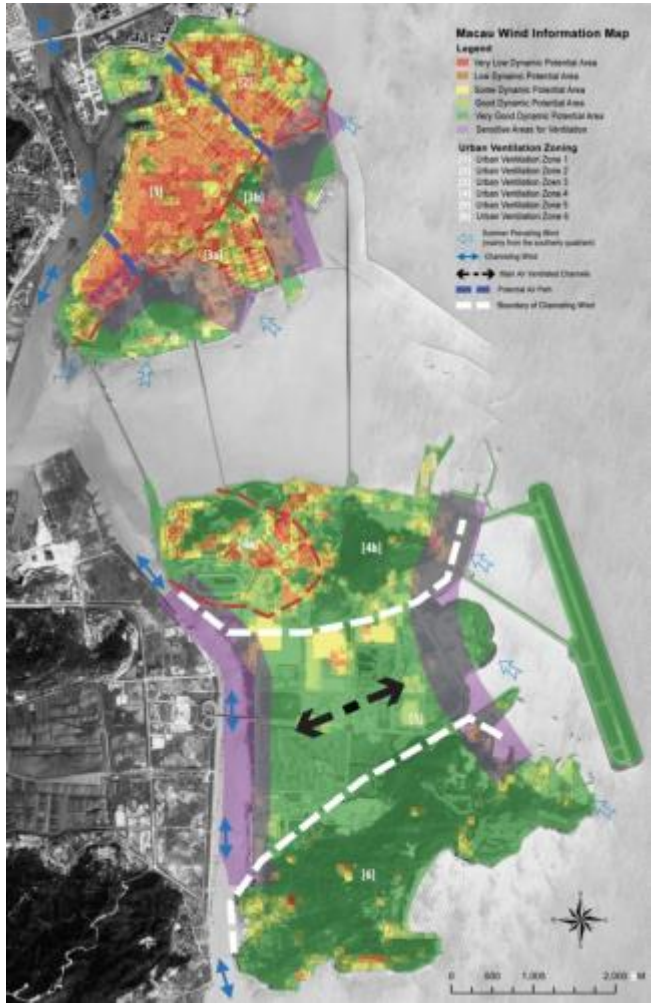
家園


Urban Park
Green Rail Track
Building Height / Position Control Area
Major Air Path
Cooling Branch
Green Line
Greenery Conservation Area
Detail Planning


Detail Planning

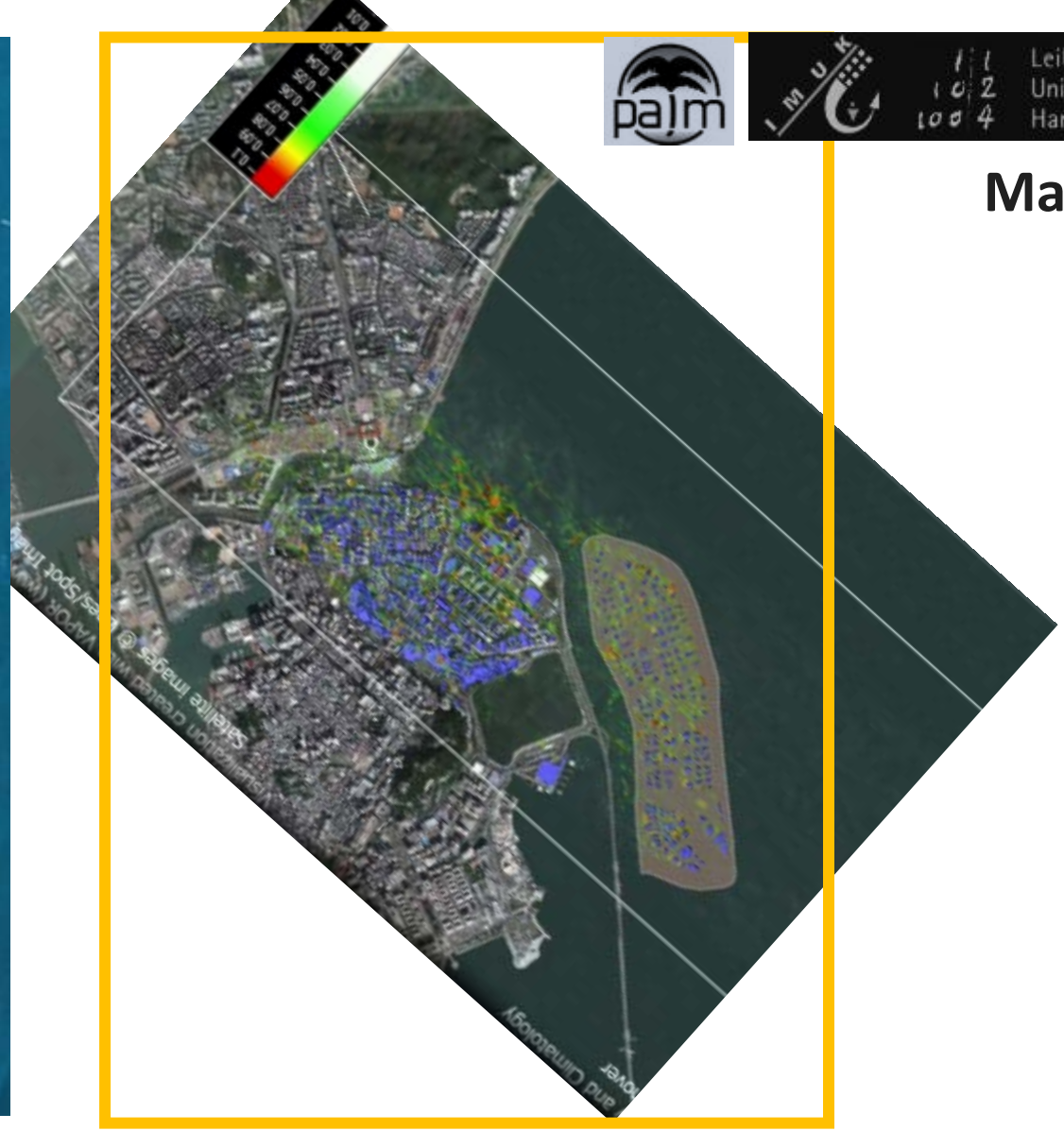
PLANNING





Macau

PLANNING



Macau

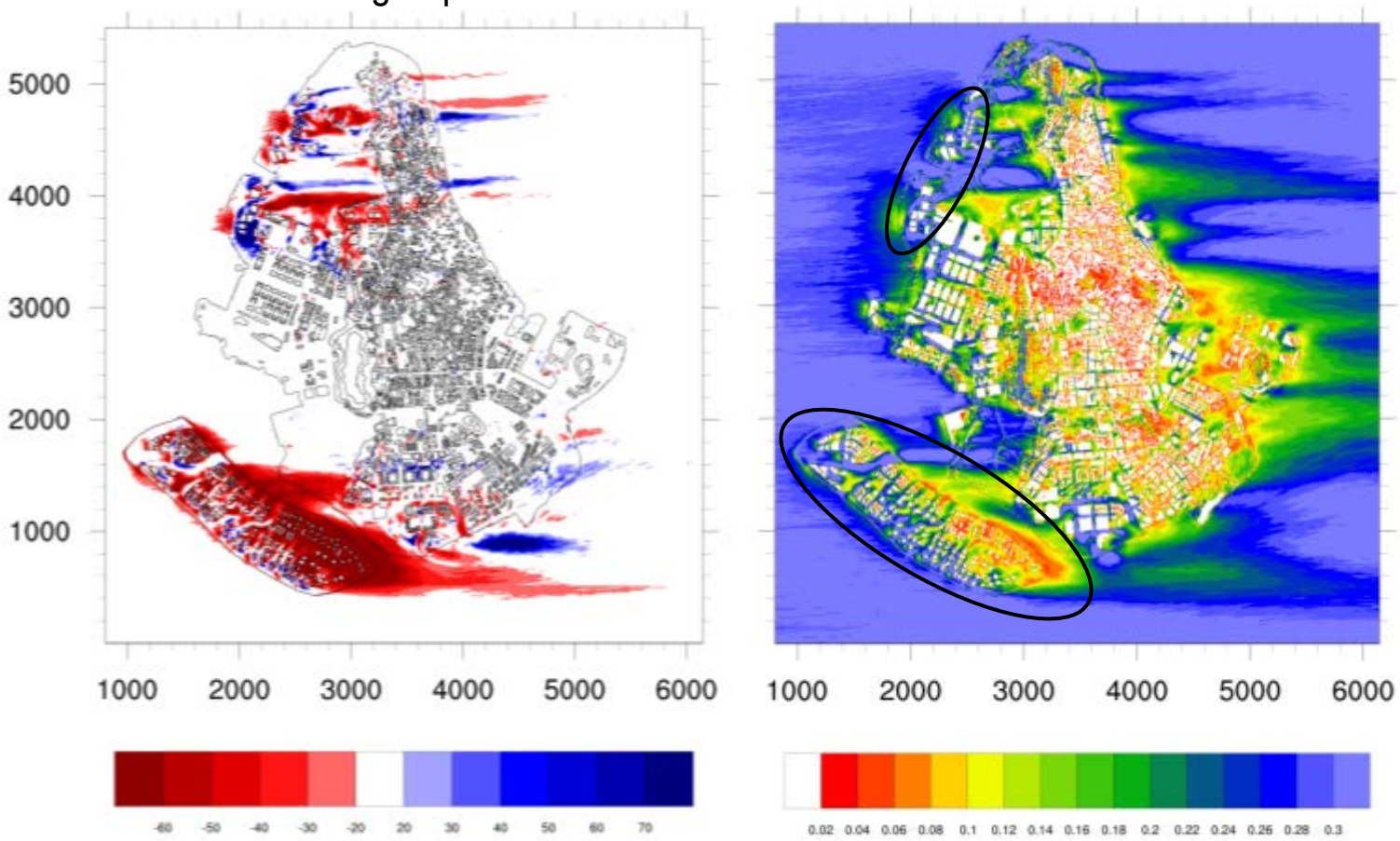
PLANNING

PALM simulations

Δ = 2m

5000*3000*500 grid points

Macau

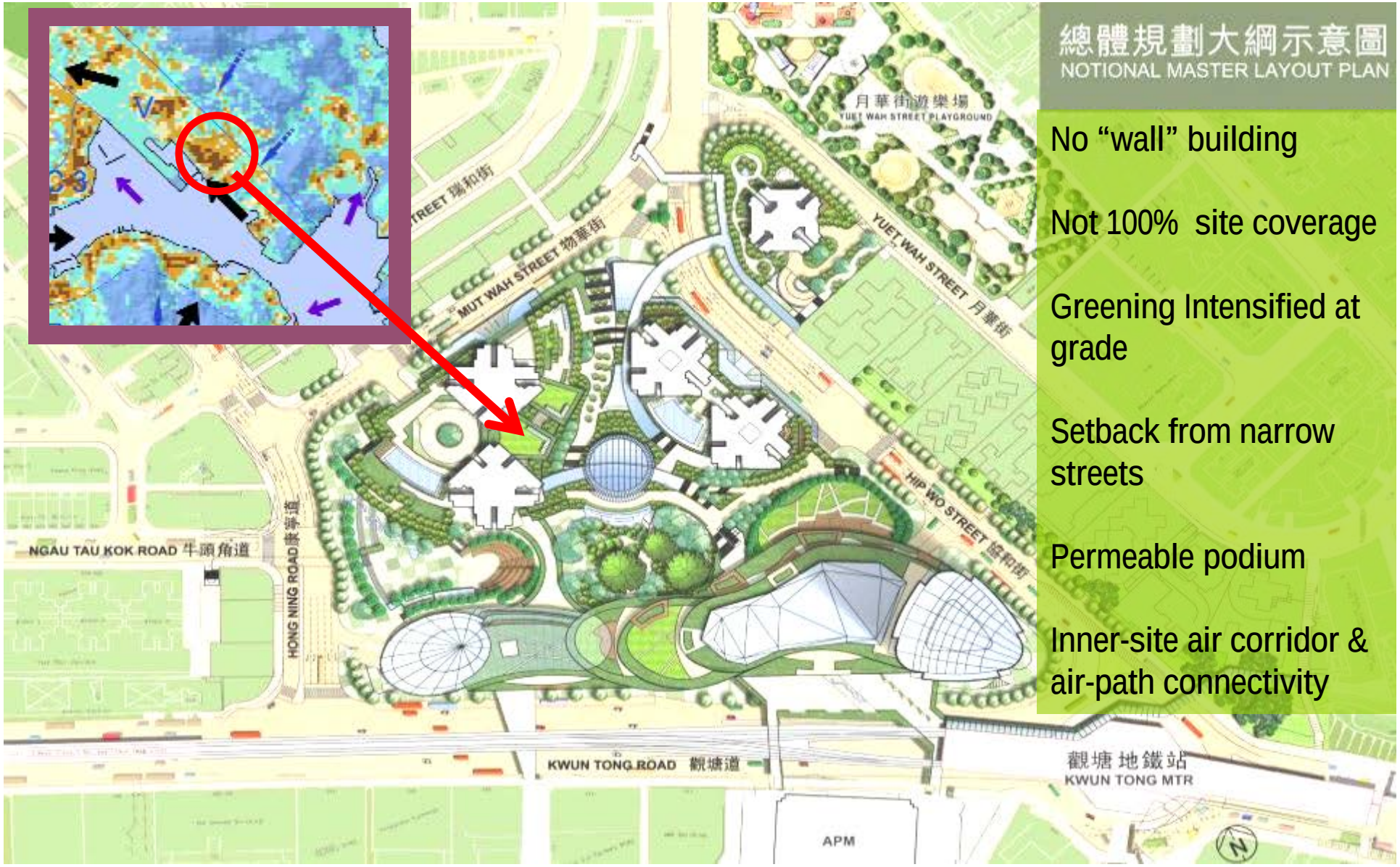


change of v_r in %

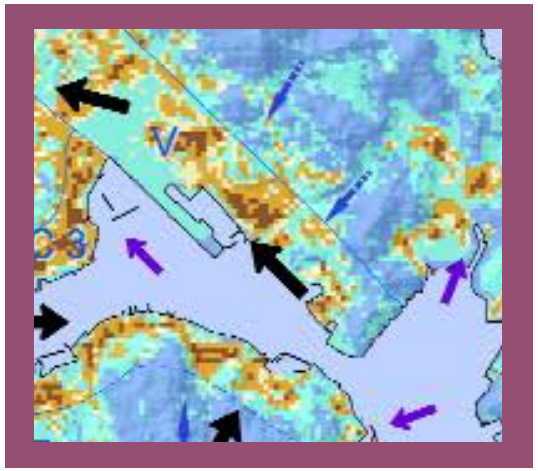
PLANNING

Macau

PLANNING


總體規劃大綱示意圖
NOTIONAL MASTER LAYOUT PLAN
No “wall” building
Not 100% site coverage
Greening Intensified at grade
Setback from narrow streets
Permeable podium
Inner-site air corridor & air-path connectivity
月華街遊樂場
YUET WAH STREET PLAYGROUND
MUT WAH STREET 物華街
YUET WAH STREET 月華街
HIP WO STREET 協和街
NGAU TAU KOK ROAD 牛頭角道
HONG NING ROAD 康寧道
KWUN TONG ROAD 觀塘道
觀塘 地鐵站
KWUN TONG MTR
APM

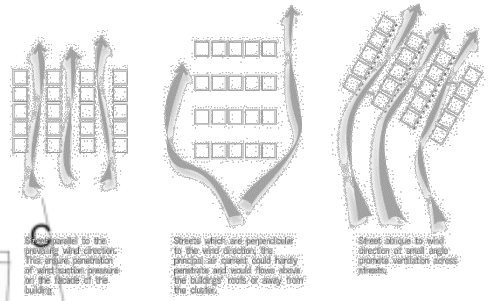
DESIGN



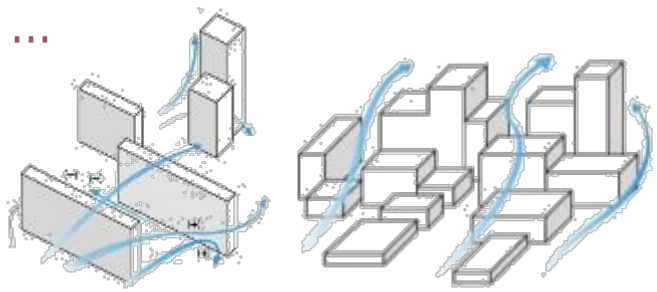
KWUN TONG
TOWN CENTRE PROJECT

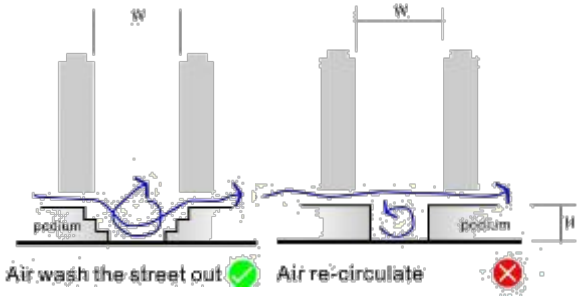
DESIGN

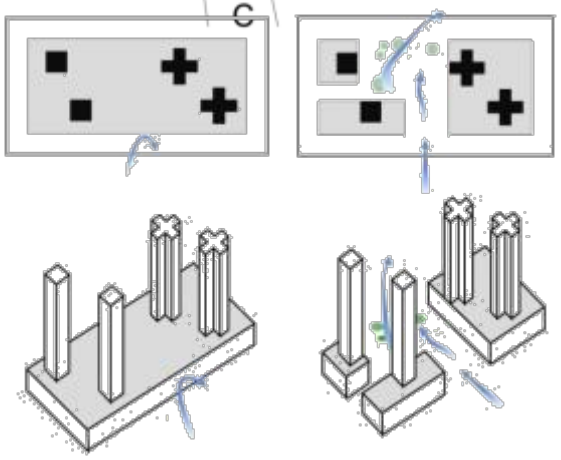
香港規劃標準與準則
HONG KONG PLANNING STANDARDS AND GUIDELINES



- Breezeway / Air path
- Orientation of Street Grids
- Linkage of Open Spaces
- Non-building Area
- Waterfront Sites
- Building Heights
- Building Disposition
- Shading and greenery
- …







DESIGN

空氣流通評估方法

Air Ventilation Assessment System

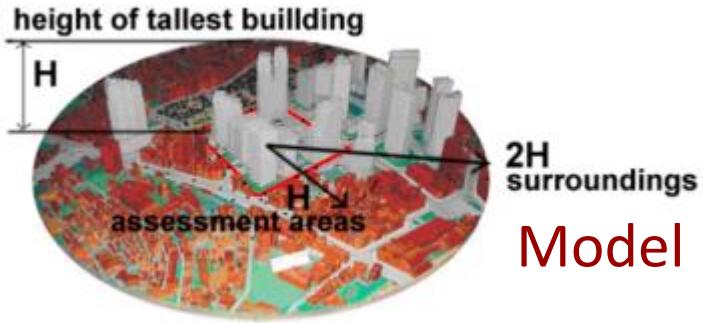
Design → Compare designs ← Report SVR & LVR

new

SVR – site spatial average VR

LVR – local spatial average VR

Evaluate, select, alter and improve design



Model

Work out VR

$$VR_i = \frac{V_{pi}}{V_{\infty i}} \quad \text{and} \quad VR_w = \sum_{i=1}^{16} F_i \times VR_i$$

Further studies

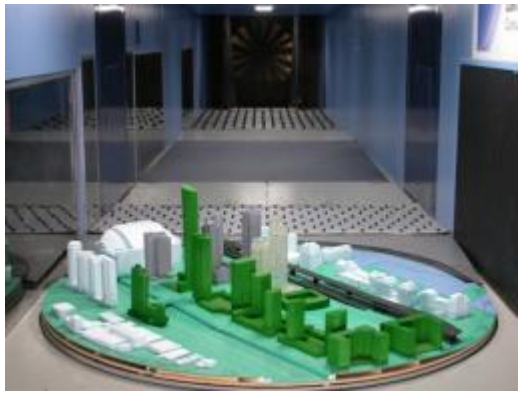
DESIGN

Test points

Perimeter test points

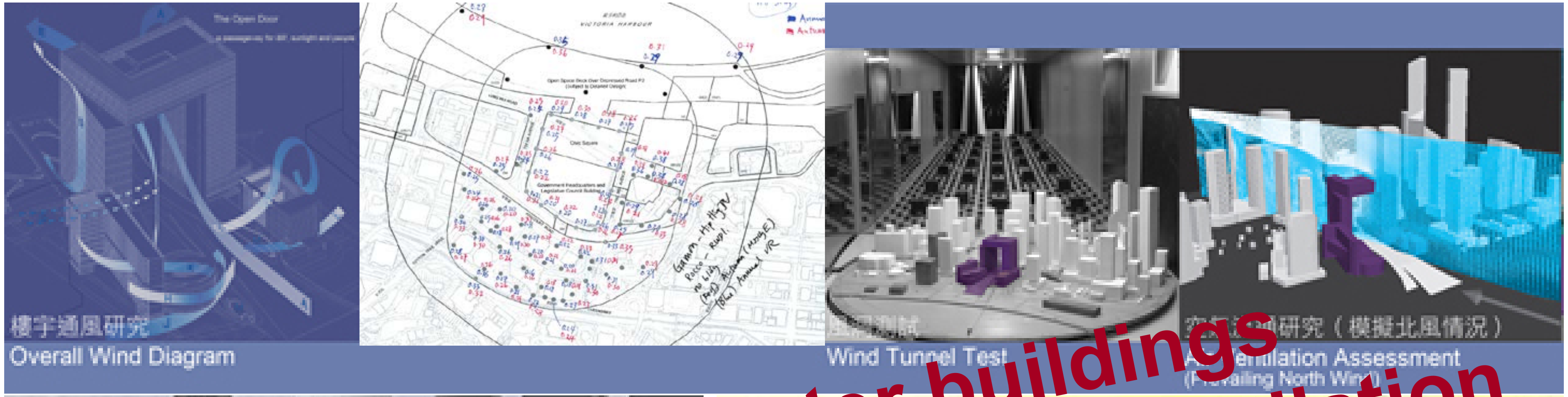
Overall test points

Special test points



Testing

Use appropriate wind profiles and characteristics, test 16 directions



新政府總部減高度 造價49億

自由黨民主黨表支持

料總部樓高26至32層

07年批標書 2010竣工

添馬艦政府總部工程時間表

時間	項目
今年第四季	政府發出招標資格預審文件
明年首季	完成招標第一階段的預審
明年第二季	向立法會財委會申請49億撥款
明年第三季	發出招標文件
07年初	批出標書
2010年	添馬艦政府總部及立法會大樓落成

資料來源：行政署

New Govt Headquarter buildings designed to improve urban ventilation

城規會通過添馬艦 新政府總部 New Govt HQ 規劃，有助改善通風效果

DESIGN

DESIGN

Urban Oasis in Central

DESIGN

High urban climatic class (stressed) areas dominate Sheung Wan in general. Heat stress frequency in high urban climatic class areas is about 96 per year.

Maintain low built volume

Maintain air paths

Intensify greening

Create green corridors

Provide tree shades

The nodes (oases) and the inter-connected paths will lower the urban climatic class of the 7 cells by 1, thus reducing heat stress frequency from 96 to 38 per year.

Now *Strategy* **Result**

The provision of a Green Oasis where it is most needed

DESIGN

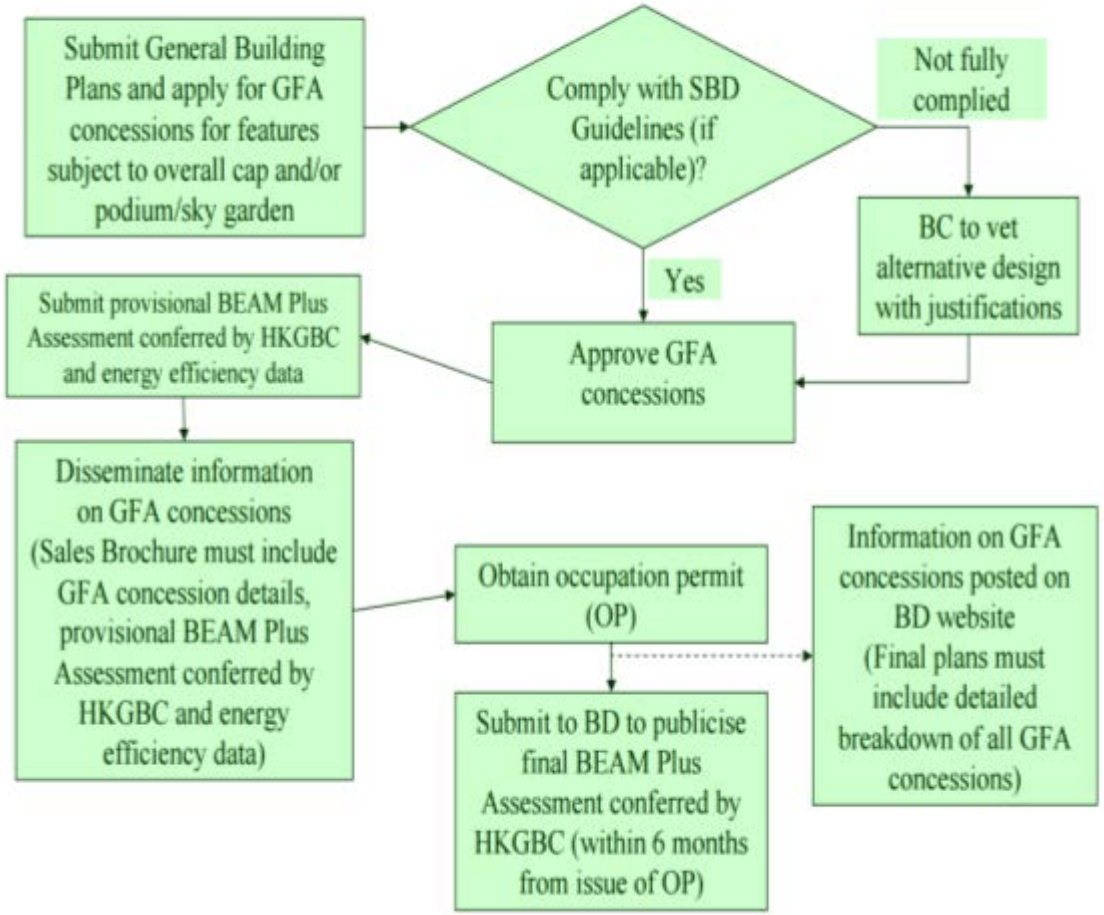

Building Design to
Foster a Quality and Sustainable
Built Environment
Your views are welcome!
Invitation for Response Document 2009

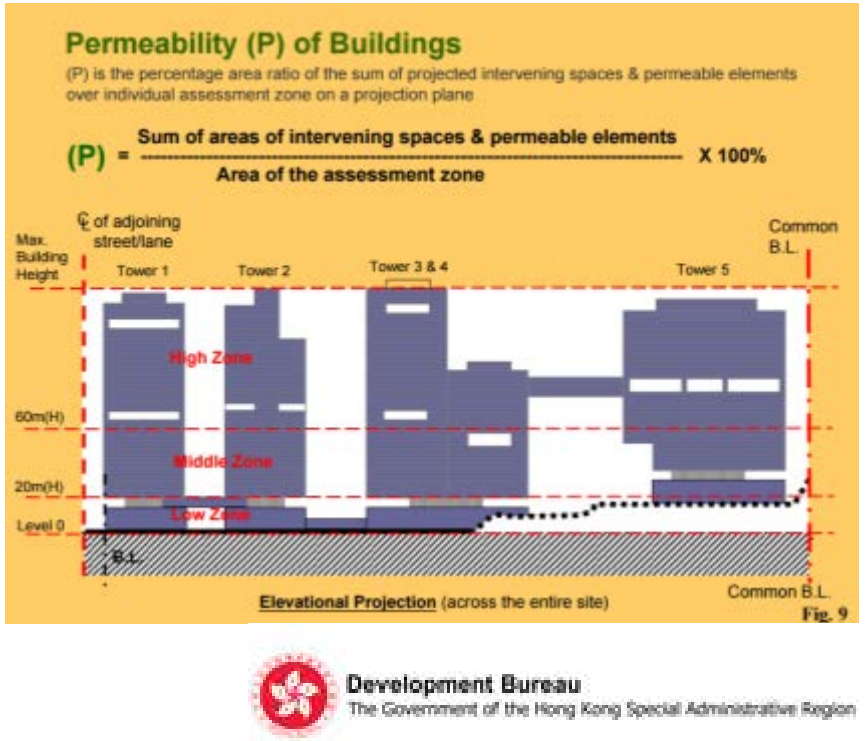
DESIGN

Measures to Foster a Quality and Sustainable Built Environment

Development Bureau (revised February 2011)

Implementation Flow





DESIGN

Thank you