

**URBAN  
SH/FT**

**LOW-CARBON AND BIOCLIMATIC BUILT  
ENVIRONMENT  
FRAMING SESSION**

**SERGE SALAT**

Urban Morphology and Complex Systems Institute

*China City Academy 2025*

Green and Thriving Neighbourhoods

[www.shiftcities.org](http://www.shiftcities.org)

# STRUCTURE OF THE PRESENTATION

- **Section 1. Why Urban Form Matters for Climate**  
Understanding how spatial structure drives emissions and shapes long-term carbon trajectories
- **Section 2. Designing Bioclimatic Neighbourhoods**  
Climate-responsive strategies for hot-humid, hot-arid, and temperate/cold contexts
- **Conclusion:** Lessons learned



# SECTION 1: WHY URBAN FORM MATTERS FOR CLIMATE

Understanding how spatial structure drives emissions and shapes long-term carbon trajectories

*Hammarby Sjöstad. Source : Creative commons.*

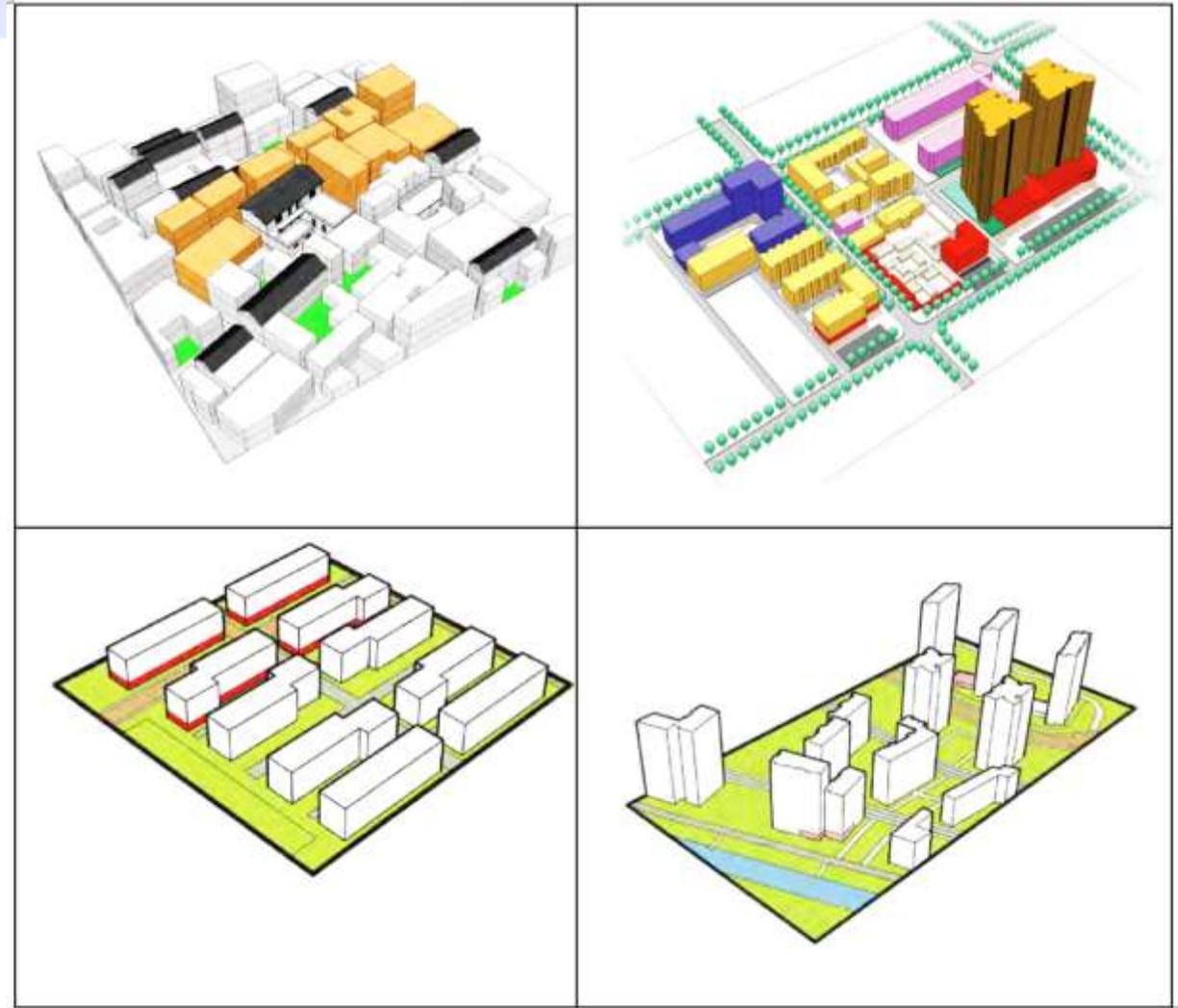


# URBAN FORM = EMISSIONS ENGINE

- The spatial structure of cities is one of the strongest predictors of carbon emissions.
- Cities with compact, walkable, and transit-connected forms emit 2 to 3 times less CO<sub>2</sub> per capita than sprawling car-dependent ones. This is true across both high-income and emerging economies.

## The form of a city dictates:

- How far people must travel
- Whether they can walk, cycle, or use public transport
- How much energy buildings consume through exposure or shading
- The land lost or preserved as carbon sinks



Four typical urban forms in China. Source: MIT, Energy Foundation, Tsinghua University

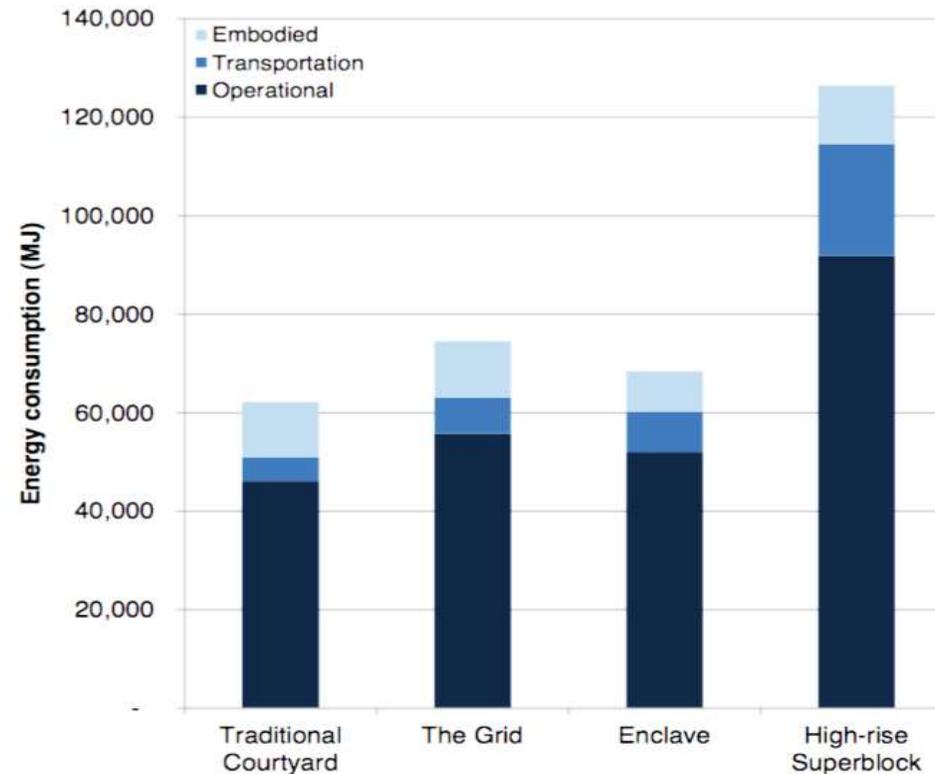
# WHY URBAN FORM DRIVES HOUSEHOLD ENERGY USE

**High-rise superblocks consume up to twice as much energy as other forms**

Among the nine Jinan neighbourhoods studied, **tower-in-park superblocks** show the **highest per-household energy use** across all categories—operations, travel, and embodied energy.

**Traditional and low-rise enclave neighbourhoods** (like Dong-Cang and Zhang-Jia) show the **lowest overall energy consumption**, though differences among all non-superblock forms are modest.

The study confirms that **urban form—density, mix, layout—significantly shapes household energy patterns**, with direct design implications.



*Energy consumption by prototype. Source: Energy Foundation, MIT, Tsinghua University*

# DISSECTING THE ENERGY DIMENSIONS

## 1. Operational Energy (71–79% of total)

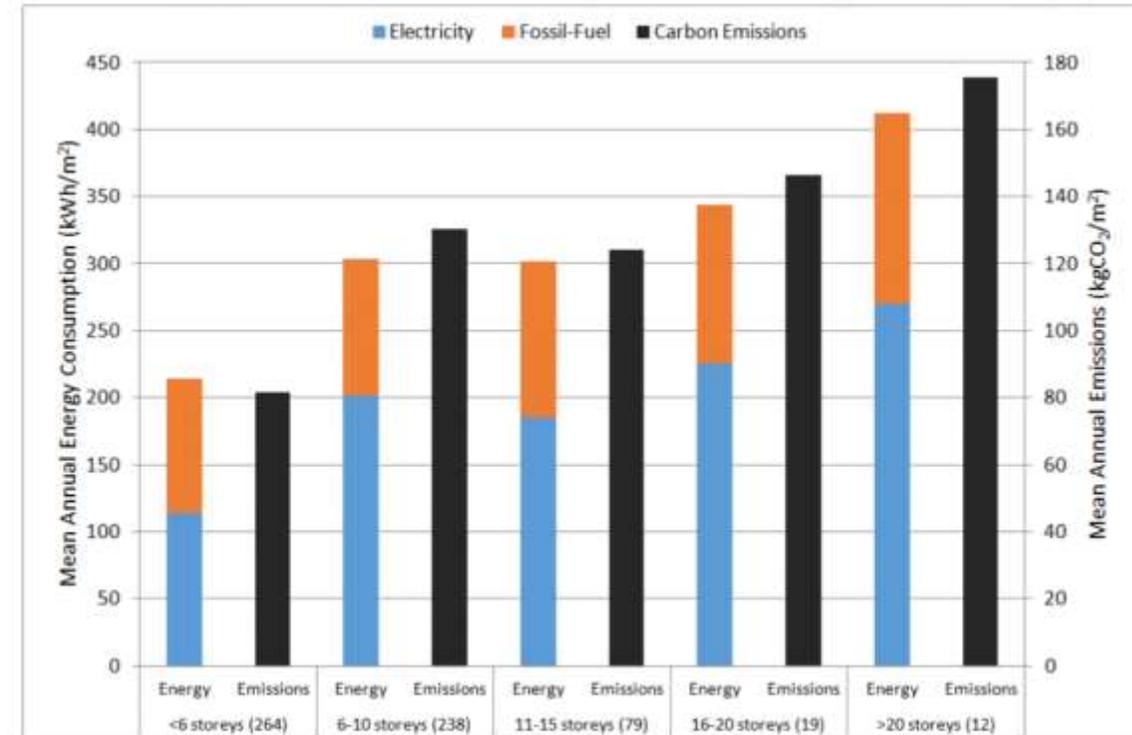
- High in superblocks due to **elevators, pumping systems, parking ventilation, and unused open spaces**.
- Lower in low-rise enclaves thanks to **usable outdoor areas**, reducing A/C and lighting needs.

## 2. Travel Energy (up to 3× higher in superblocks)

- Driven by **car dependence**: isolated tower blocks lack walkable access to daily needs.
- Enclave, grid, and traditional forms enable **walkability and transit access**, cutting transport energy use.

## 3. Embodied Energy (from construction materials)

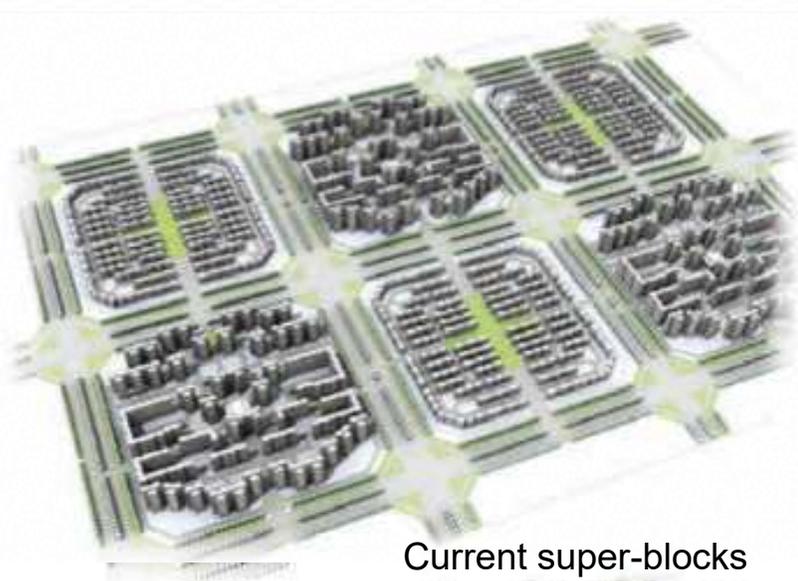
- Highest in superblocks like Shanghai Garden (12,000 MJ/HH/year).
- Enclaves consume less, but traditional forms like Zhang-Jia may be high due to **dense coverage with low household numbers**.



*A study of 600 office buildings in the UK found that energy use and carbon emissions per square meter of floor space were twice as high in buildings of more than 20 stories than in buildings of less than 6 stories. (Source: UCL)*

# URBAN FORM SCENARIOS

## *Huge Mitigation Potential*



### Compact Growth Transforms Chongqing's Future

#### Two modelled scenarios—only one leads to a liveable, low-carbon global city

- **Compact Growth vs. Trend:** A polycentric, transit-oriented scenario saves **200 km<sup>2</sup> of land**, boosting **density, productivity, and future flexibility**.
- **30% infrastructure savings:** Reduced road, water, and sewage costs save **RMB 34 billion** by 2035.
- **Household affordability improves:** Transport and home energy costs cut by **32%**, saving **RMB 5,100/year** per household.
- **Mobility and access improve:** Car travel drops **40%**, public transit share rises **9 points**, easing congestion and job access.
- **Cleaner air, lower emissions:** Transport-related **CO<sub>2</sub> and pollutants fall 39%**, supporting public health and sustainability goals.

# URBAN FORM DIRECTLY AFFECTS BUILDING ENERGY USE

**Building energy use is shaped not only by materials and systems—but by where and how buildings are placed.**

**Key factors include:**

- **Orientation relative to sun and wind**
- **Surface-to-volume ratio of blocks**
- **Degree of shading and thermal mass**
- **Open space for ventilation and cooling**

**In warm climates, compact, shaded neighbourhoods can reduce cooling loads by 25–50% compared to exposed layouts.**

*NbS and shading/ventilation strategies in Kampung Admiralty, WOHA Architects, Singapore. Traditionally, South-East Asian communities have gathered underneath huge trees, which provide shade and shelter.*

*Source: WOHA Architects.  
Image credit: Patrick Bingham Hall*



*In this project, tropical community spaces – naturally lit and cross-ventilated – are at ground level or at intermediate levels. Large open public spaces beneath or within – and gardens in the sky provide more than ventilation; they encourage sociability.*

*Source: WOHA Architects  
Image credit: Patrick Bingham Hall*



# DESIGN IMPLICATIONS AND PATHWAYS FORWARD

## High-rise superblocks are energy-intensive by form, not just function

- Despite modern appearance, they **underperform** in all energy dimensions.
- Grid and enclave forms enable **low-carbon performance**, already adopted in **international best practices**.

## Embedded energy can be reduced through site-sensitive urbanism

- Peripheral locations (typical of superblocks) require **new infrastructure**, raising embodied energy.
- Traditional and infill forms adapt to **existing networks**, lowering construction energy.

## Potential for solar and clean energy

- Studies show **low-rise, high-density** neighbourhoods offer **more rooftop area for solar hot water**.
- These forms dominate clean energy prototypes globally and are now being further studied in China.



*French Dream Town, Hangzhou. Architect: Serge Salat*

# FROM VISION TO DESIGN LOGIC

In the remainder of this session, we will explore how to design bioclimatic neighbourhoods tailored to climate context:

- **Hot-humid climates: cooling by ventilation and shade**
- **Hot-arid climates: thermal mass and sun control**
- **Temperate/cold climates: passive solar gain and compactness**

The strategies differ. The logic is the same:  
**Urban form is climate strategy.**



*French Dream Town, Hangzhou. Architect: Serge Salat*

# SECTION 2: DESIGNING BIOCLIMATIC NEIGHBOURHOODS

Climate-responsive strategies for hot-humid, hot-arid, and temperate/cold contexts

*Hammarby Sjöstad, Sweden. Source: Creative Commons*



# INTRODUCING THE BIOCLIMATIC NEIGHBOURHOOD



*French Dream Town, Hangzhou. Architect: Serge Salat*

A bioclimatic neighbourhood uses design to work with climate, not against it.

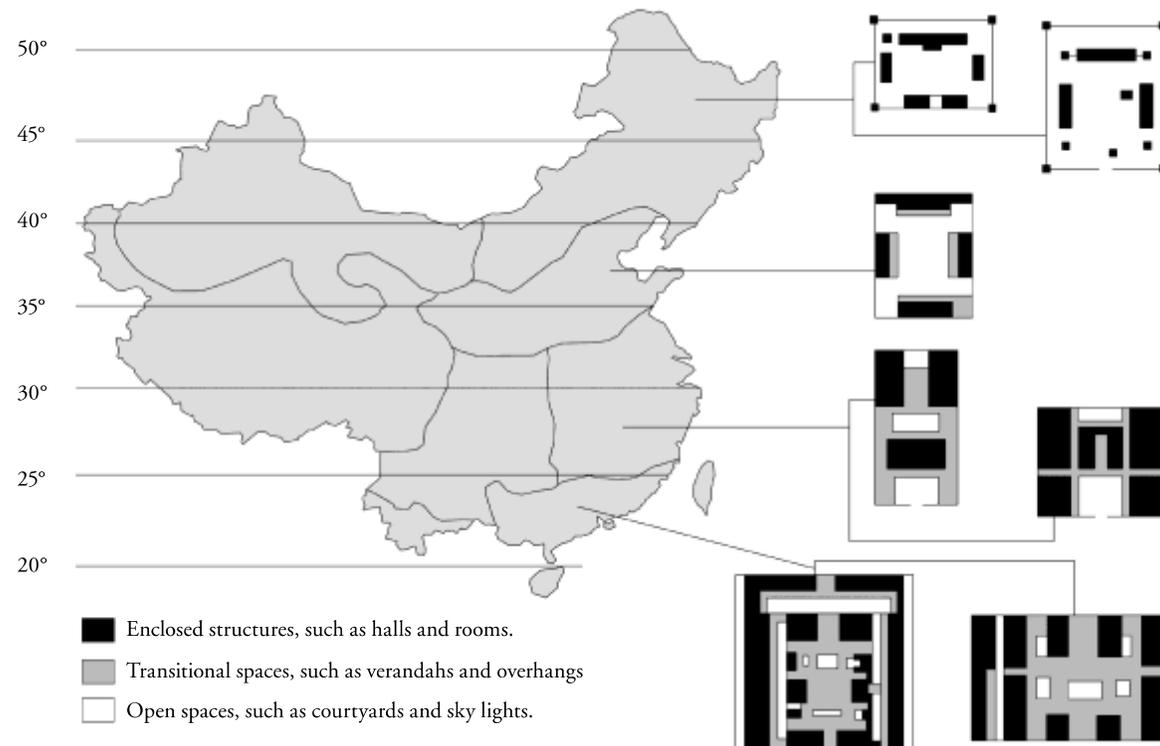
Its elements are not high-tech—but high-intelligence:

- Buildings oriented to optimize sun and wind
- Shading from trees, arcades, and roof forms
- Surface materials chosen for reflectivity or absorption
- Courtyards that channel air, not trap heat
- Green roofs, planted facades, permeable pavements

These are not add-ons. They are design fundamentals that reduce energy demand, increase comfort, and build resilience.

# CLIMATE RESPONSIVE URBAN FABRICS IN CHINA 1/2

**An example of climate responsive urban fabric is Chinese traditional courtyards. They are modulated according to the latitudes and climates.**



*City fabric according to climatic zones in China.*

*Source: Source: Serge Salat, Cities and Forms, 2011, adapted from Knapp, Chinese Houses, 2005*

From north-east to south-east China, courtyards become smaller:

- In the dry, colder areas of North and North-Western China, open spaces are generous portions of the house – courtyard complex, while the walls block cold winter winds and the south orientation increases the solar gains.
- Throughout central China, where winters are mild and summers hot, transitional spaces, such as verandahs, increase in extent.

# CLIMATE RESPONSIVE URBAN FABRICS IN CHINA 2/2



*Left courtyards in Beijing cold climate. Right: Pavilions in Suzhou hot and humid climate in summer. Source: Serge Salat.*

- *Courtyard urban fabrics in China are all weaved with small green spaces that shade them while providing Nature-based solutions benefits.*
- *In Beijing walls create continuous enclosures to protect the courtyards from the cold winds. In Suzhou walls open to let the urban fabric breathe.*

- In hot and humid areas of South-eastern China, open spaces shrink in size while transitional 'grey' spaces increase.
- Special attention is paid to natural ventilation and to blocking sunlight from penetrating the urban texture.

# SECTION 2A : BIOCLIMATIC STRATEGIES IN COLD CLIMATES

**In temperate or cold climates, compact blocks and passive solar orientation reduce heating needs while maintaining daylight and walkability.**

*Viikki eco neighbourhood, Finland. Source: Françoise Labbé*



**DO NOT WRITE IN BLACK BOX. PLACE  
YOUR RECORDED VIDEO HERE.**

# STRATEGIES FOR COLD CLIMATES DESIGN

## PLANNING PRINCIPLES

DENSIFICATION

GREENIFICATION

RETAINING HEAT GAIN

LINKAGES

AESTHETICS

HUMAN SCALE

COMMUNITY

## GOALS

Warm the microclimate and retain heat gain

Design outdoor public space to be comfortable in cold climates

Promote sustainable greenification and densification

Use SUDS and use water with open space

## STRATEGIES

1. Minimizing wind flow within site
2. Designing for maximizing winter sun
3. Designing buildings to retain heat
4. Designing buildings matching the weather conditions
5. Breaking up outdoor spaces with comfort stations
6. Designing for active winter programming
7. Extending the microclimate considerations to aesthetics
8. Managing water as a sustainable amenity



*Kalasadama, Finland. Source: Françoise Labbé.*

# CREATING PLACES THAT BLOCK WIND 1/2

- In winter months, wind can make cold climates feel 10 to 20 degrees colder than they really are.
- For people to feel comfortable outside during winter months they have to be protected from cold winter winds.
- Cities can provide that protection with street patterns and structures that break up and block the wind.



Example of urban design in cold climates. **Left:** Climate Responsive Design adapted from Blatchford Redevelopment in Edmonton City's Winter Design Guidelines. **Right:** Wind breaker in Kalasatama, Finland. Source: Françoise Labbé.

## CREATING PLACES THAT BLOCK WIND 2/2

Blocking wind can be achieved by:

- Using trees as natural wind barriers or buffers by planting them near windows to block cold air from entering the buildings
- Designing a slightly distorted street grid to shelter constructions from the wind and design streets with an orientation that is away from the prevailing wind
- Reducing the impact of winter wind with gradual height transitions allowing the cold wind to pass over the top of buildings.



*Wind diagrams for Perkins+Wills Chaudière Island project in Ottawa. When designing Chaudière Island, Perkins + Will analysed the prevailing wind patterns that were acting on the island. To protect plazas from the harsh winter winds, they designed the streets that led to them so they were oriented away from the prevailing wind. They designed streets that were not straight, but instead meandered to prevent the wind from channelling down the streets. This helped create calm, sunny plazas on the island.*

*Source: Chris Foyd and Perkins-Will.*

# CREATING PLAZAS THAT RECEIVE WINTER SUN 1/2

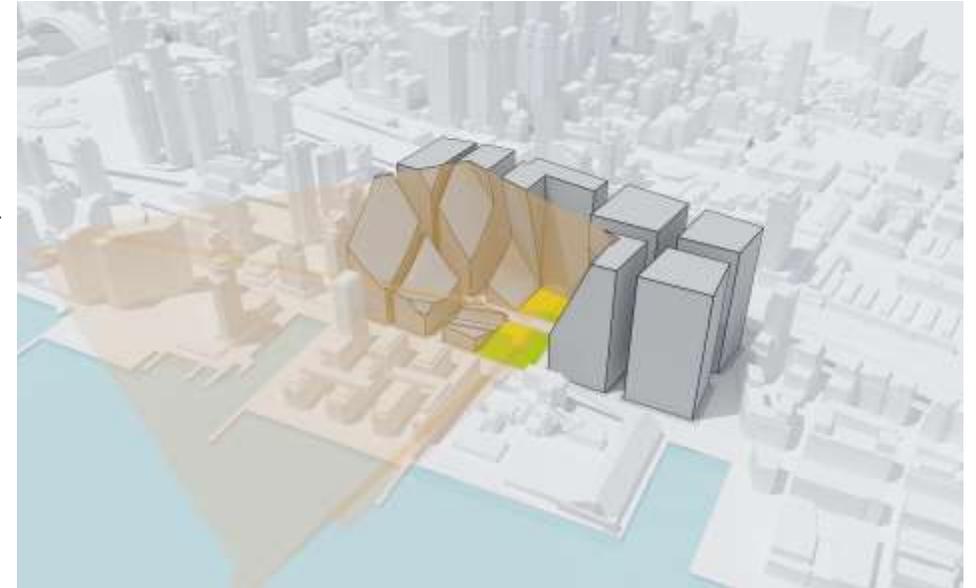
Planning for sun access comprises:

- Orientating buildings to the south for maximum winter sun penetration
- Protecting access to winter sun in public spaces.



*Yongle project in Toronto. To protect access to sun in public spaces, planners located a public park there. Source: Chris Foyd and Perkins-Will.*

*Lower Yonge project was the last piece of undeveloped waterfront near Toronto's downtown area. Before beginning the project, Perkins+Will analysed the site's winter sun patterns. This helped identify a patch of winter sun in the middle of the site from 10 am to 2 pm on December 21, the shortest day of the year, when the least amount of sun is available.*



*3D digital design tools helped to shape the urban form of this new development ensuring this patch of winter sun will be protected. Source: Chris Foyd and Perkins-Will.*

# CREATING PLAZAS THAT RECEIVE WINTER SUN 2/2



*Plazas that receive winter sun for Chaudière Island project in Ottawa.  
Source: Chris Foyd and Perkins-Will.*



*Solar diagram for Chaudière Island project in Ottawa.  
Source: Chris Foyd and Perkins-Will.*

Like the work they did in Toronto, the planners surveyed Chaudière Island before they designed anything and identified several plazas that receive winter sun.

# EXTENDING THE MICROCLIMATE CONSIDERATIONS TO HUMAN NEEDS



*Malmö Bo01 aerial view. Source: Creative Commons.*

In Malmö Bo01, taller white buildings define the edges of the scheme and break the cold winds while smaller light colored buildings and small open spaces in the interior create human scale.

Ever-changing building direction and arrangement avoid winds to channel along streets and create a dynamic character, full of unexpected spaces and views within a walkable environment. The diverse and beautiful design responds both to the environmental context and to human needs.

## SECTION 2B: BIOCLIMATIC STRATEGIES IN HOT AND DRY CLIMATES

In hot-arid cities, the key challenge is not humidity but solar radiation and temperature swings. The answer lies in compact, high albedo and high thermal inertia forms.

*Street in Hammamet medina. Source: Françoise Labbé.*



# STRATEGIES FOR HOT AND ARID CLIMATES DESIGN 1/2

In hot and arid climates, extreme heat may result in stressful street level conditions, to the extent that it has a negative impact on the development of a pedestrian-friendly environment.

Acceptable levels of outside thermal comfort can be achieved through an integrated approach that includes:

- streets and buildings' proportions
- architectural and natural shading
- air movement
- open space
- urban forestry
- use of water
- building design
- thermal inertia
- building reflective materials.



*Aghazade mansion. Source: Amir Salehkhah. Creative Commons.*

# STRATEGIES FOR HOT AND ARID CLIMATES DESIGN 2/2

## PLANNING PRINCIPLES

DENSIFICATION

GREENIFICATION

PREVENTING URBAN HEAT ISLAND (UHI)

LINKAGES

AESTHETICS

HUMAN SCALE

COMMUNITY

## GOALS

Prevent UHI\* during the summer while allowing the warming effect of the sun during the winter.

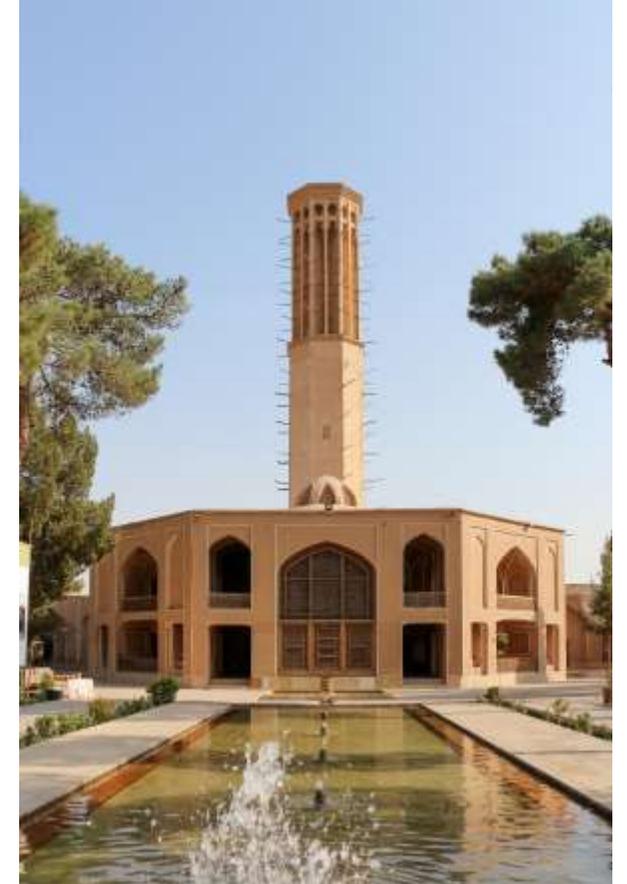
Design outdoor public space to be comfortable in hot and dry climates

Integrate Nature-Based Solutions, green and water features within open spaces

## STRATEGIES

1. Optimizing street proportions to create shade during the day and release heat at night
2. Shading streets with buildings' shadows, canopies, trees
3. Designing thin buildings for cross and vertical ventilation
4. Building with 'cold materials' (high albedo) to reflect radiant energy out of surfaces
5. Building with high thermal inertia materials
6. Enhancing air flow in public spaces with a 'rough urban texture' with corner towers and openings in blocks to create passages for wind movement
7. Creating cool green pockets on a micro-planning scale for pedestrian comfort, connecting them in a network and extending the microclimate considerations to aesthetics
8. Enhancing and cooling air flow with green and water features

\* *Urban Heat Island*



Water and wind tower in the Dolat Abad Garden, Yazd, Iran.  
Source: Bernard Gagnon. Creative Commons.

# TRADITIONAL COURTYARD FORMS



*The urban fabric in the central area of Tunis medina illustrates the climatic optimization of courtyard textures.*

*Source: Serge Salat, Cities and Forms.*



*Courtyard house in Sfax.*

*Source: Françoise Labbé.*

## Advantages of continuous courtyard textures for hot arid climates include:

- Greater envelope surface area and thermal mass
- Greater access to daylight thanks to the courtyard and shallow plans
- Providing shade and enhanced thermal comfort during hot days
- Releasing heat at night because of thermal inertia
- Limiting the use of air conditioning

# HOT AND ARID CLIMATES DESIGN

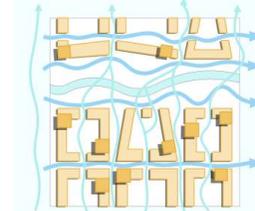
## SHADING

Trees shading facades



## WIND CORRIDORS

Major and minor breezeways



## GREEN URBAN FABRIC

Green facades and roofs



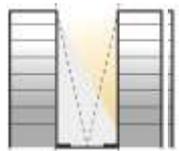
## CONNECTED OASIS

Green and blue corridors



## SHADING

Narrow tall streets



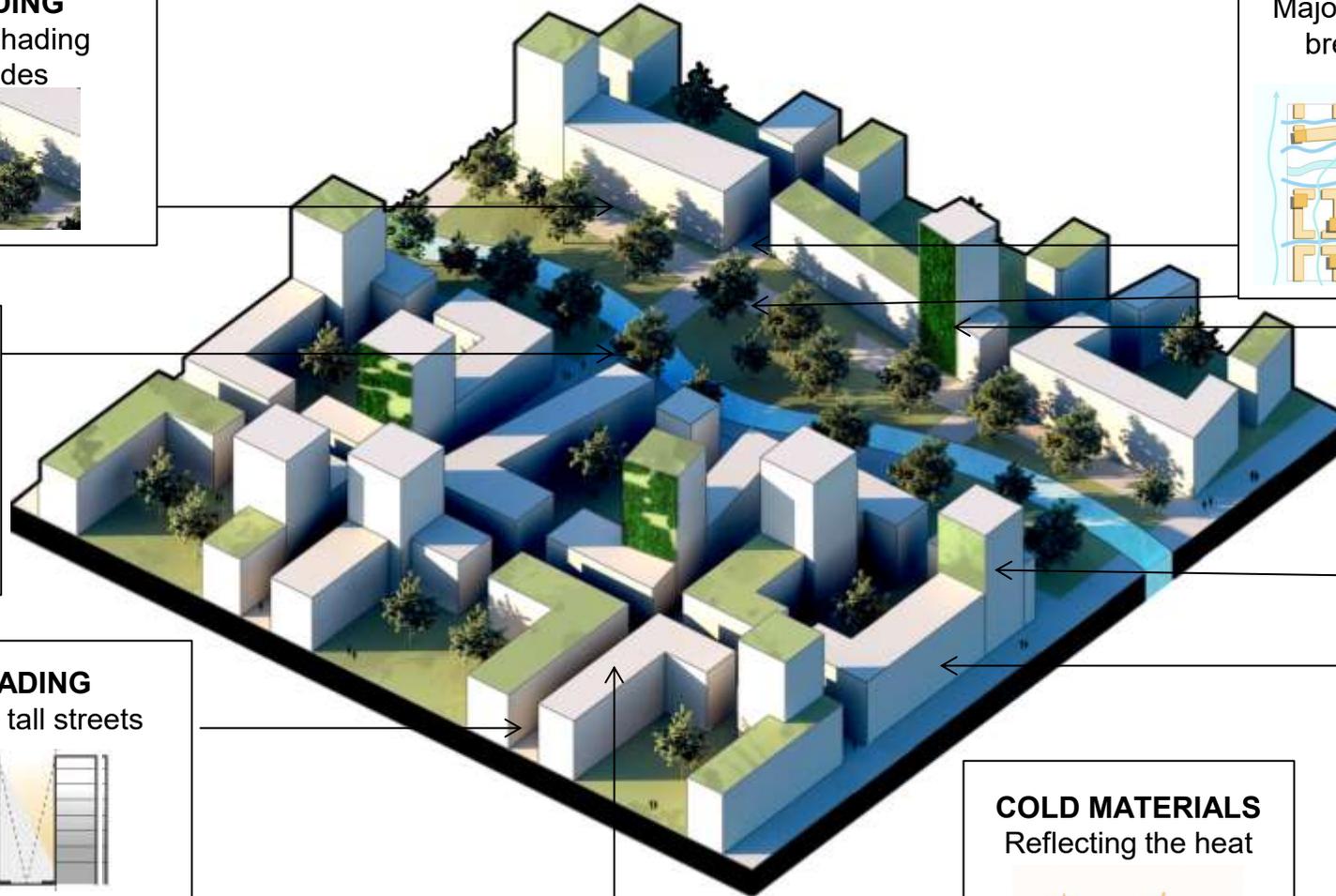
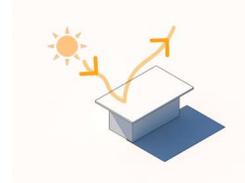
## WIND CATCHERS

Buildings with cross and vertical ventilation



## COLD MATERIALS

Reflecting the heat



Source: Project and drawings Serge Salat with Tristan de Luze and Marie-Alix Martinat. Urban Morphology Institute.

# SHADING

Shade is the first consideration in mitigating excessive heat from the sun.



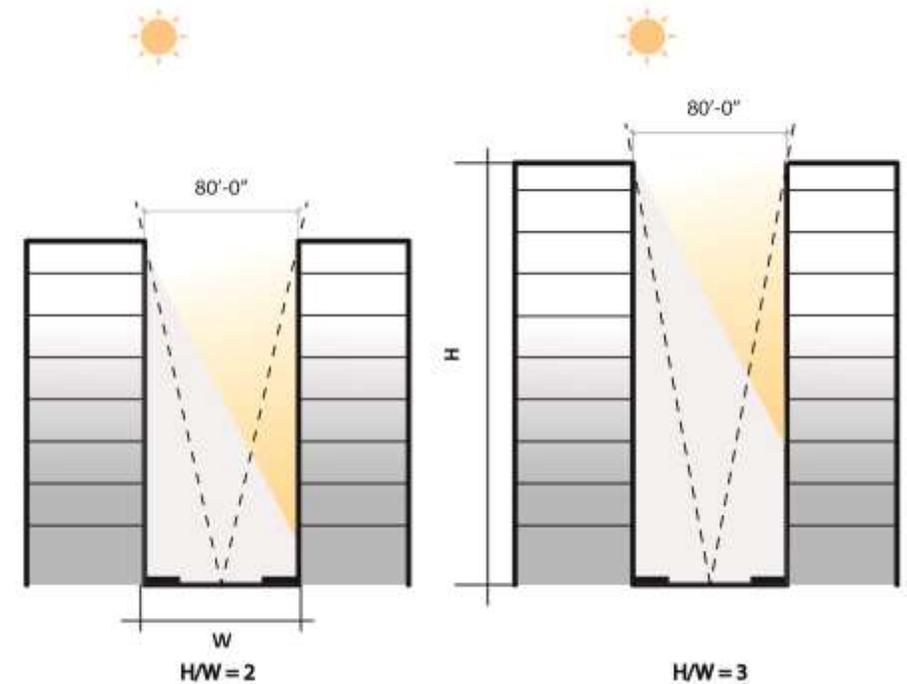
Source: Tristan de Luze. Urban Morphology Institute.

It comprises

- Building wall shade
- Covered walkway shade
- Tree shade

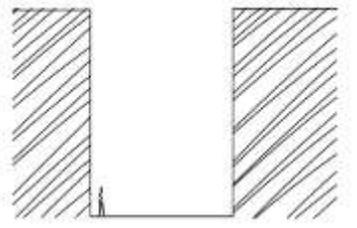
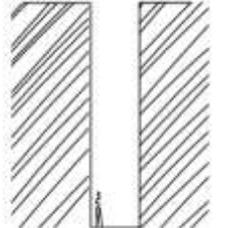
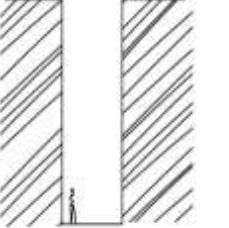
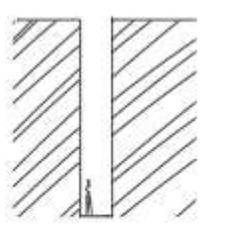
Simulations show that a street canyon proportion of 2:1 H:W balances thermal comfort and Urban Heat Island (UHI), providing a cooler pedestrian environment during the day while permitting an acceptable amount of heat release during evening hours.

Source: Tristan de Luze. Urban Morphology Institute.



WITH ASPECT RATIO ( $H/W = 2$ )

# STREET DESIGN

			
Boulevard <b>H/ W = 1.28</b> L=7m; W = 8 to 9m	Derb Jama' Zellij <b>H/W=4</b> L = 2m; H= 8m	Derb Nekhaline <b>H/W = 3.2</b> L=2.50m; H=8m	Derb Sid L'Aouad <b>H/ W=7</b> L=1m; H=7m

*Examples of aspect ratio (H/W) of typical streets in Fez medina.*

*Source: Urban Morphology Institute.*

In hot arid climates, night temperatures are significantly lower than day temperatures.

- Narrow and tall streets avoid heat penetration daytime and allow heat to radiate to the cold sky night-time.
- Buildings shade each other to reduce the façade's surface temperatures.
- Streets and sidewalks are shaded in summer, thus improving comfort for pedestrians.

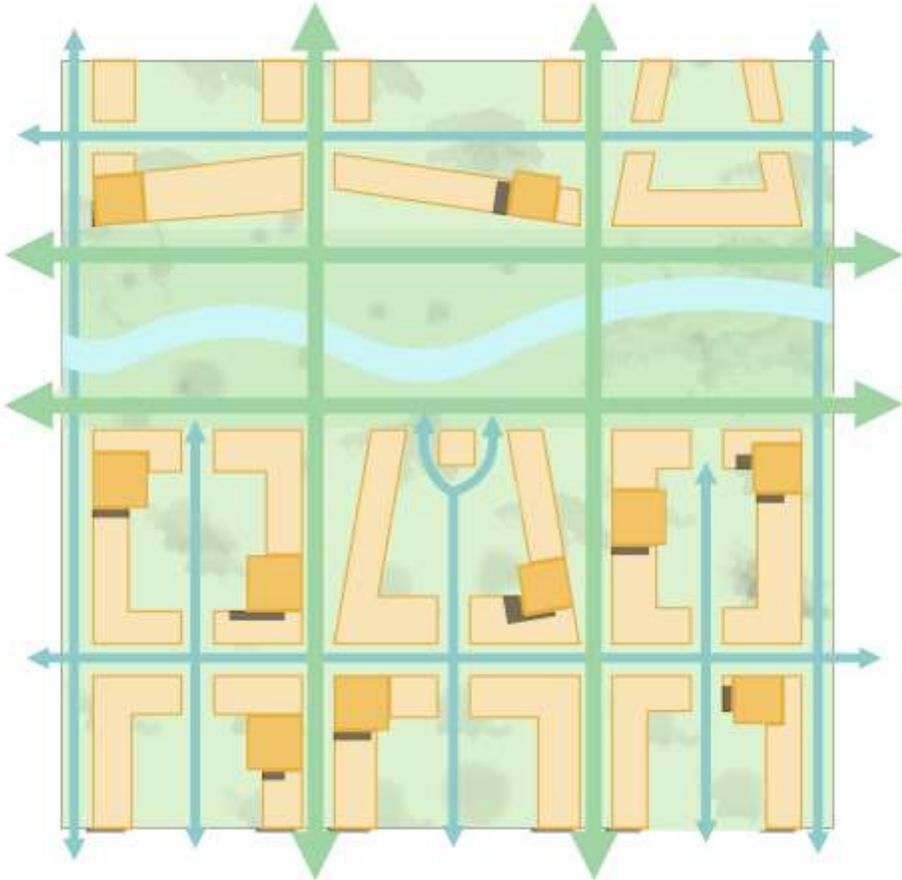


*Narrow streets create shade in Casablanca medina.*

*Source: Hamza Belhamer.ESA.*

# COOLING WITH GREEN AND BLUE SPACES

The 'connected oasis' consist in distributing a network of open green and blue spaces offering 'cool pockets'



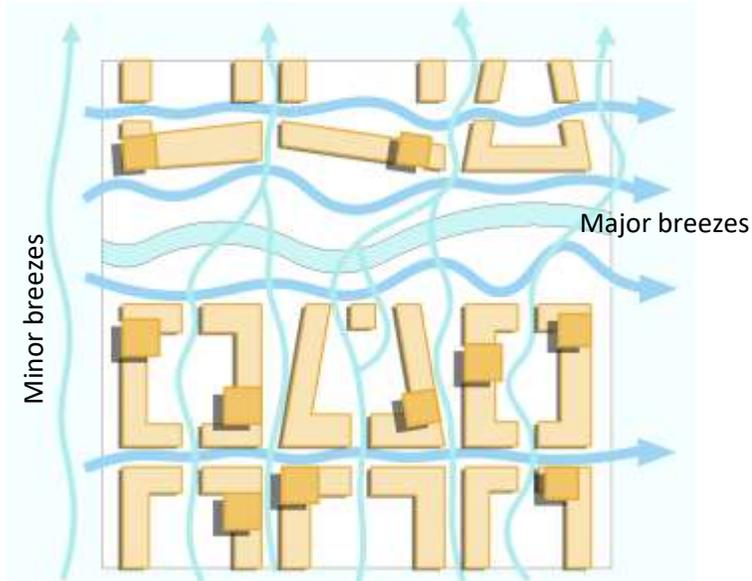
Source: Tristan de Luze. Urban Morphology Institute.

*The open space distribution enhances air movement. It creates spatial variety. It can be enhanced through the development of porticoes, pocket parks, courtyards and through-block connectors.*



*In Sidi Bou Saïd, Tunisia, narrow streets are naturally shaded. Lush vegetation in the courtyards and streets provides additional shade and cools the air by evapotranspiration. Source: Françoise Labbé.*

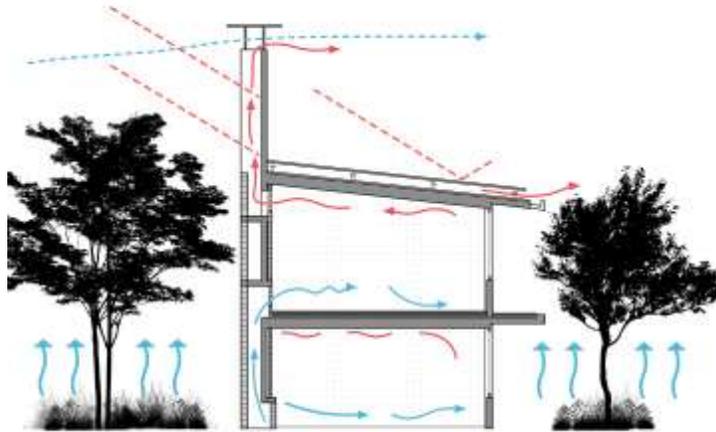
# ENHANCING WIND FLOWS



Increased turbulence and vertical flow is produced when the wind is permitted to flow through open channels roughened by the removal of significant portions of the street wall volume, including entire blocks. Additional turbulence is produced by the location of diagonally placed towers at the corners of the blocks.

Tower placement and open space erosion of the base block creates passages for wind movement direction as well as creating turbulence within the urban canopy layer. This movement enhances heat exchange and the removal of air pollution.

Source: Tristan de Luze. Urban Morphology Institute.



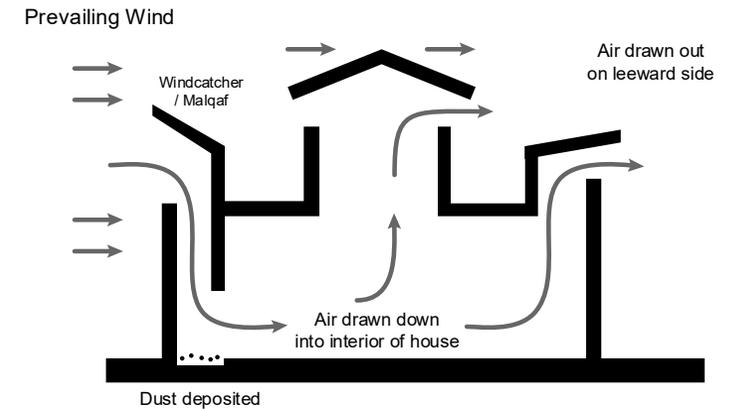
Buildings designed with adequate cross and vertical ventilation can remove heat and cool down the interior mass, reducing the need for mechanical cooling during the day.

Blue curved lines: cools air.

Red curved lines: hot air.

Dotted lines: light and heat reflected by high albedo material.

Source UMI adapted from Atelier Yves Lyon



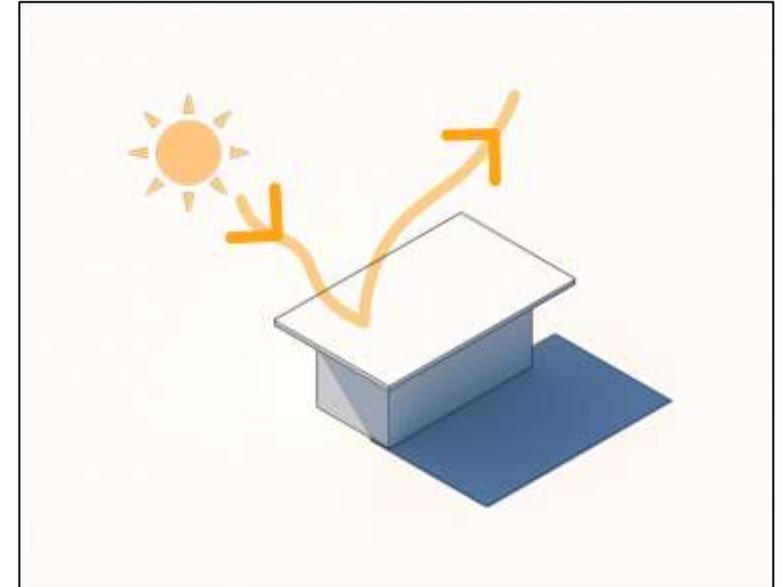
A pair of short traditional windcatchers (malqaf); wind is forced down on the windward side and leaves on the leeward side. In the center, a shuksheika (roof lantern vent), used to shade the qa'a below while allowing hot air rise out of it. Source: Creative Commons.

# COLD MATERIAL WITH HIGH ALBEDO



*Narrow streets with shade and high albedo (clear reflecting colours) in Sidi Bou Said, Tunisia.  
Source: Françoise Labbé.*

“Cold materials” are characterized by a high reflectivity factor to short wave radiation (direct sunlight) and their ability to release heat into the environment during the evening hours.

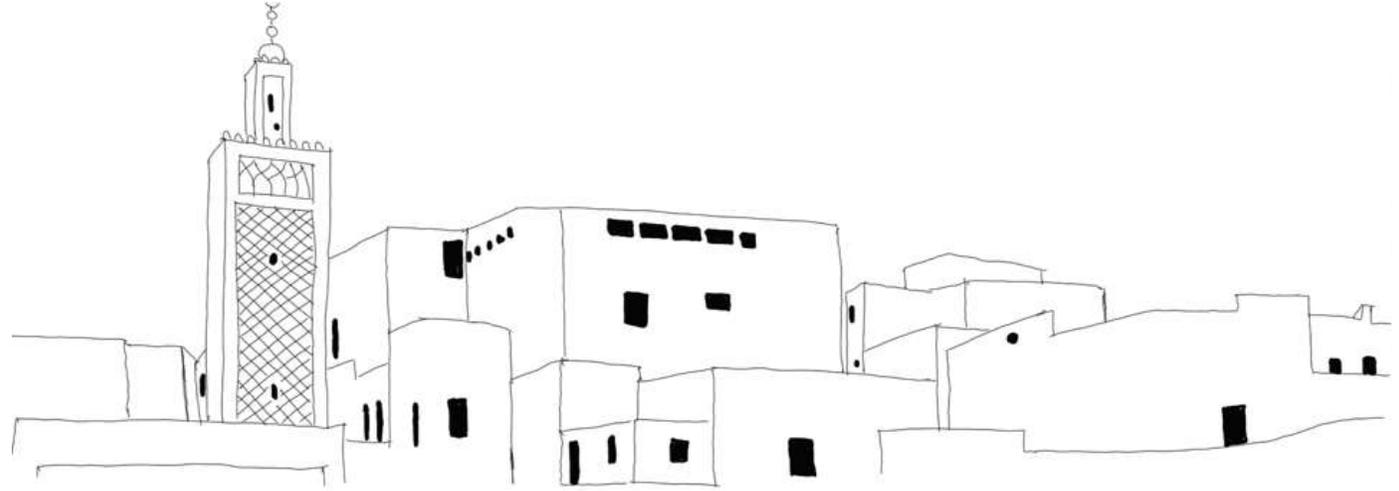


*Source: Tristan de Luze. Urban Morphology Institute.*

# THERMAL INERTIA

Hot and arid climates present a great thermal amplitude: the diurnal thermal range can be as much as 22 °C.

- Massive walls with high thermal inertia help damping those variations.
- They allow the heat to be transmitted with a roughly twelve-hour delay, so the structure slowly conducts heat during the day and the cold nights.
- At sunrise, the structure is cool and has achieved thermal equilibrium, then it heats slowly during the whole day, providing cool interior temperatures for the inhabitants.



*Compact urban blocks in Casablanca medina ensure a high thermal inertia. Morocco.  
Source: Hamza Belhamer.ESA, Paris.*

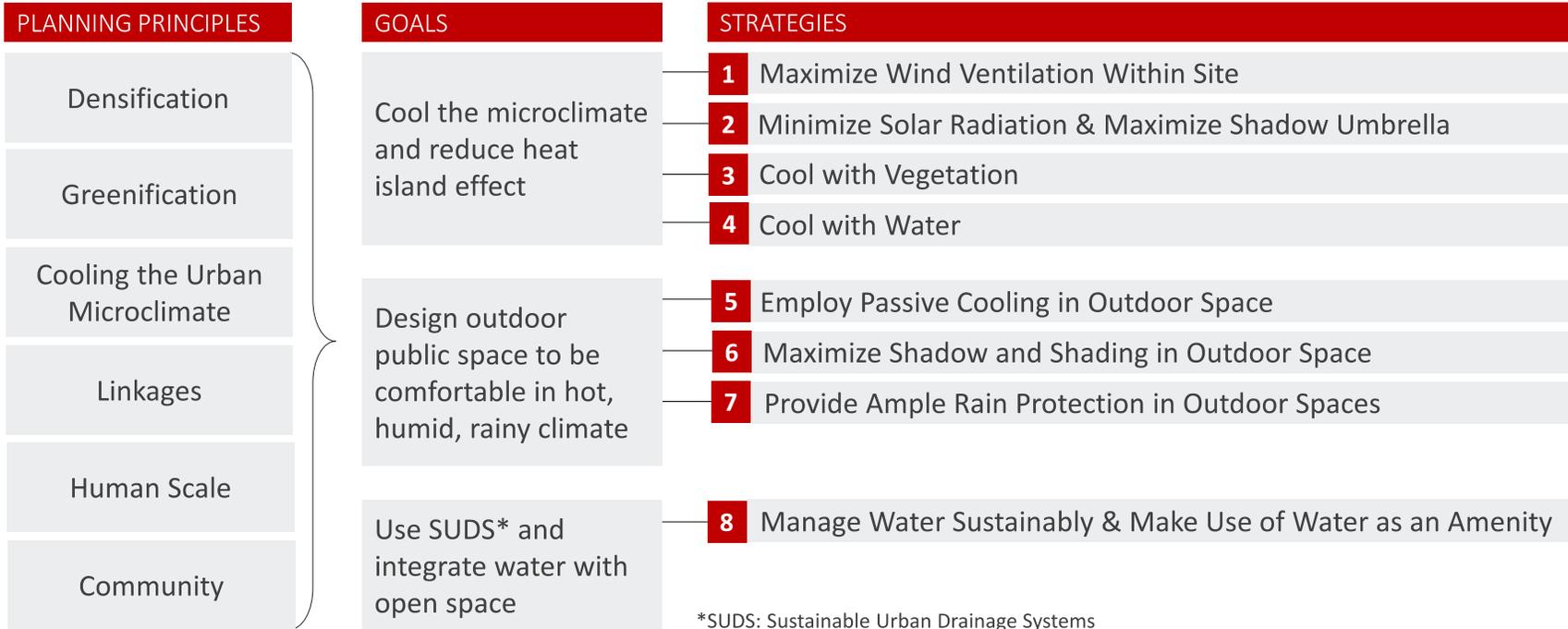
# SECTION 2C: BIOCLIMATIC STRATEGIES IN HOT AND HUMID CLIMATES

In hot-humid climates, comfort is won not through insulation, but through air and shade.

*Park Royal Singapore. Source: WOHA Architects.  
Image credit: Patrick Bingham Hall*



# STRATEGIES FOR HOT AND HUMID CLIMATES DESIGN

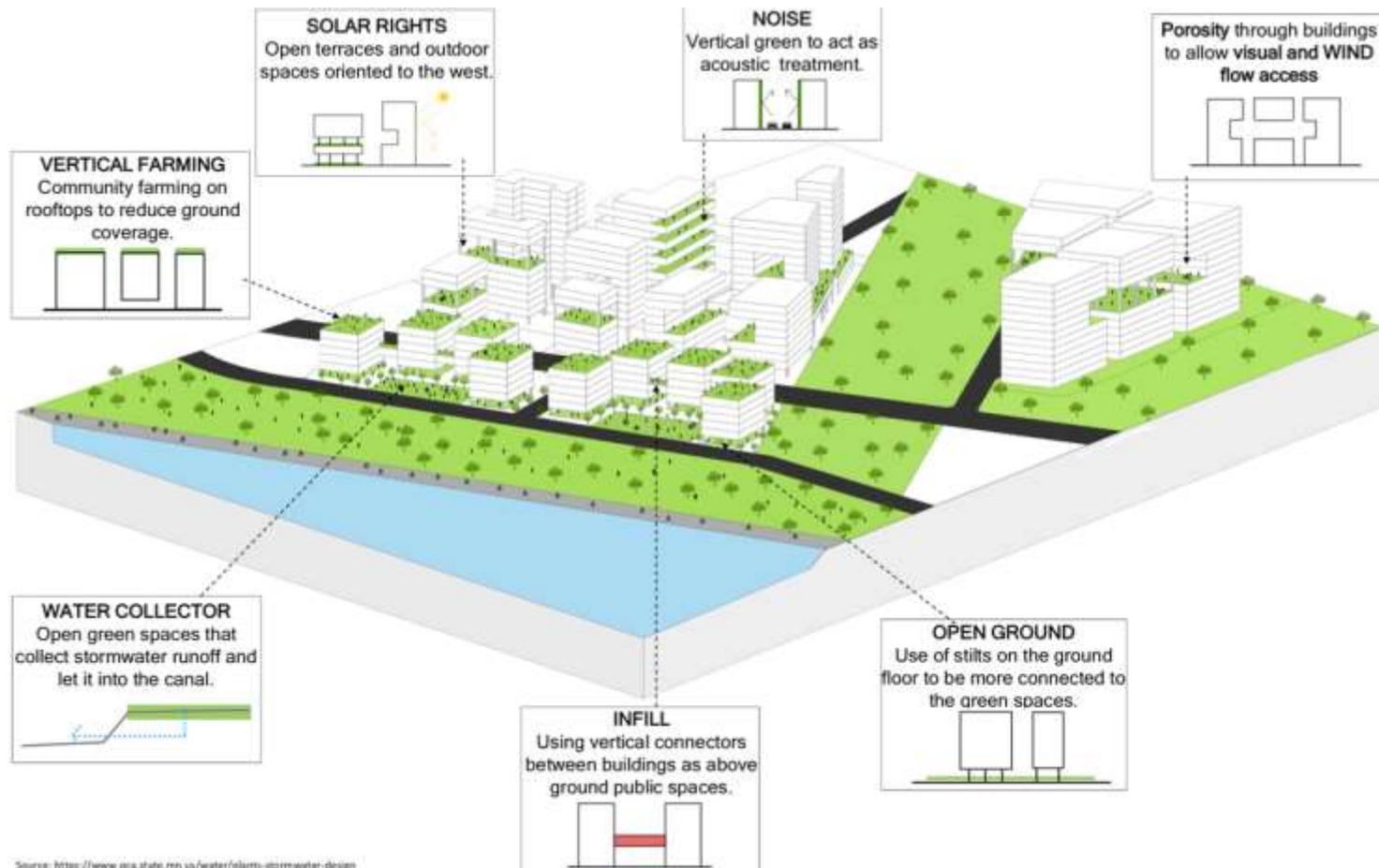


\*SUDS: Sustainable Urban Drainage Systems



Community Town Hub in Singapore.  
Source: WOHA Architects.

# PRINCIPLES OF HOT AND HUMID CLIMATES DESIGN



This drawing shows how the integration of strategies shapes the urban fabric. Buildings are porous with ample openings to create a 'breathing' urban fabric allowing light and air to penetrate with Nature-based Solutions to cool naturally.

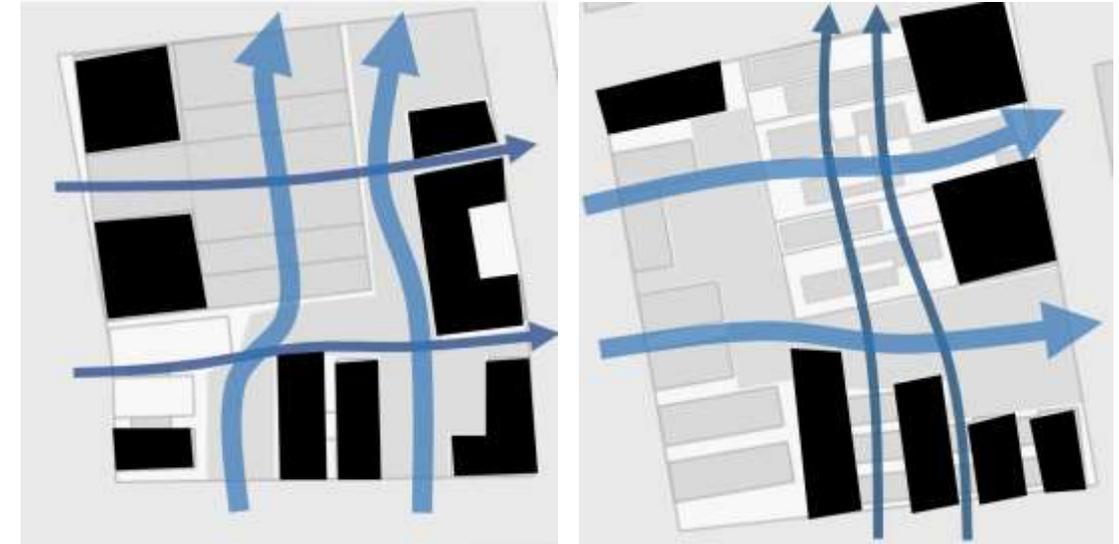
*Ecological and Bioclimatic Densification Strategy in Sungei Kadut redevelopment project in Singapore.*

*Source: Workshop led by Serge Salat at NUS.*

# DESIGNING A BREATHING URBAN FABRIC

Good ventilation removes excess heat from streets and open spaces, and provides cross-ventilation in buildings.

- Major and minor breezeways and orientating breezy streets to the prevailing wind maximizes air movement and cross-ventilation inside and outside buildings.
- Linking open spaces into ventilation corridors allows the prevailing wind to penetrate the city fabric.
- Wind flows can be enhanced by creating buildings separations.

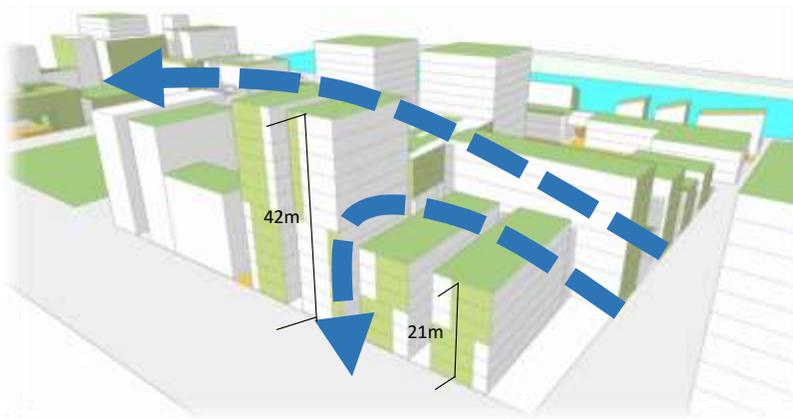


LEGEND — Major Breezeways  
— Minor Breezeways

*Major breezeways indicate open spaces and linear roadways where the wind flows along, minor breezeways indicate building separations which allow wind flows..*

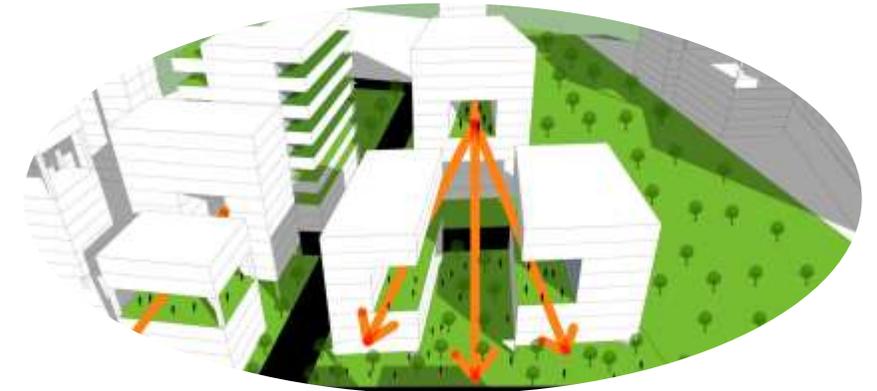
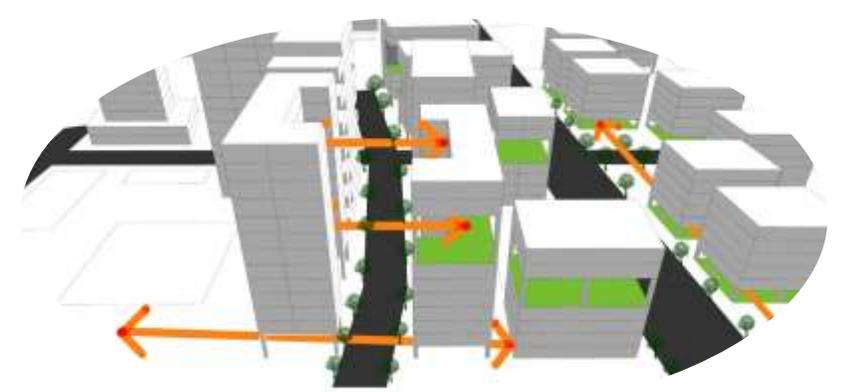
*Source: Qin Shuxu. Workshop led by Serge Salat at NUS.*

# ENHANCING WIND FLOWS



*Stepped building height profile. Source: Qin Shuxu.*

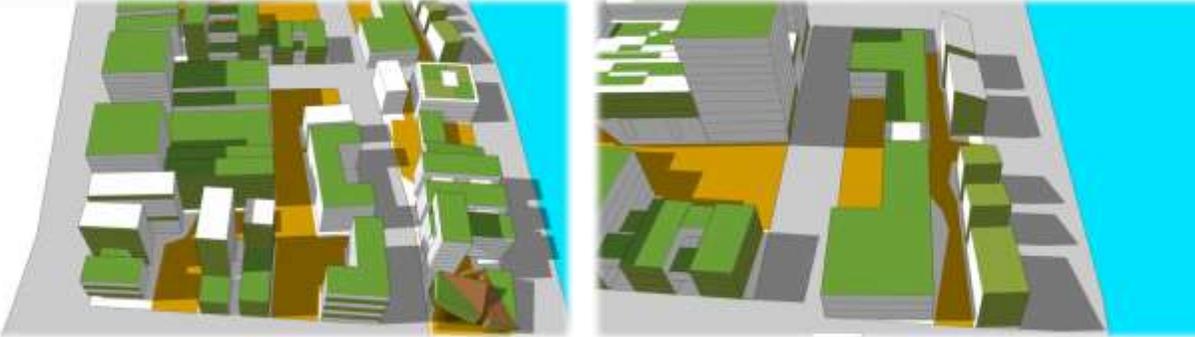
- High variation between building heights accelerates wind flows when taller buildings are two times higher than lower buildings.
- Reducing building frontage enhances wind penetration.
- Creating voids between and in buildings with gaps and sky gardens increases permeability



*A porous and green urban fabric with sky gardens enhances wind flows and cools naturally the city. Sungei Kadut redevelopment project in Singapore.*

*Source: Qin Shuxu. Workshop led by Serge Salat at NUS.*

# MINIMIZING SOLAR RADIATION AND MAXIMIZING SHADOW



- Shading lowers the sun exposure and minimizes solar heat gains through the façades.
- Orientation and good distribution of buildings can provide shade on nearby outdoor structures and spaces



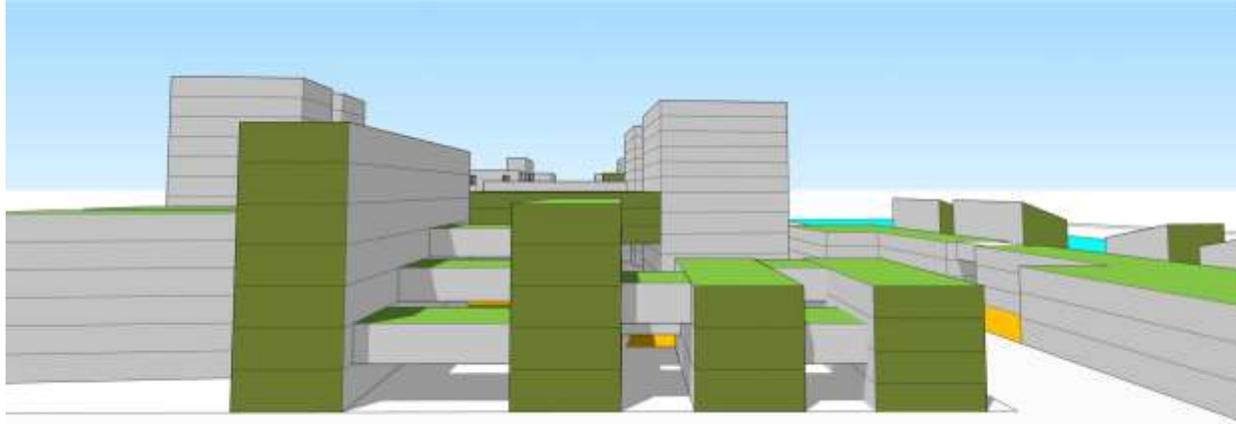
*Building Block Shade: part of open spaces and pedestrian walkways along the edge of buildings are shaded by the block.*

*Building Structure Shade: 'Inner' open spaces are shaded by building structures.*

*Bottom right: Kampung Admiralty, WOHA Architects. Image credit: Patrick Bingham Hall*

*Source: Qin Shuxu. Workshop led by Serge Salat at NUS.*

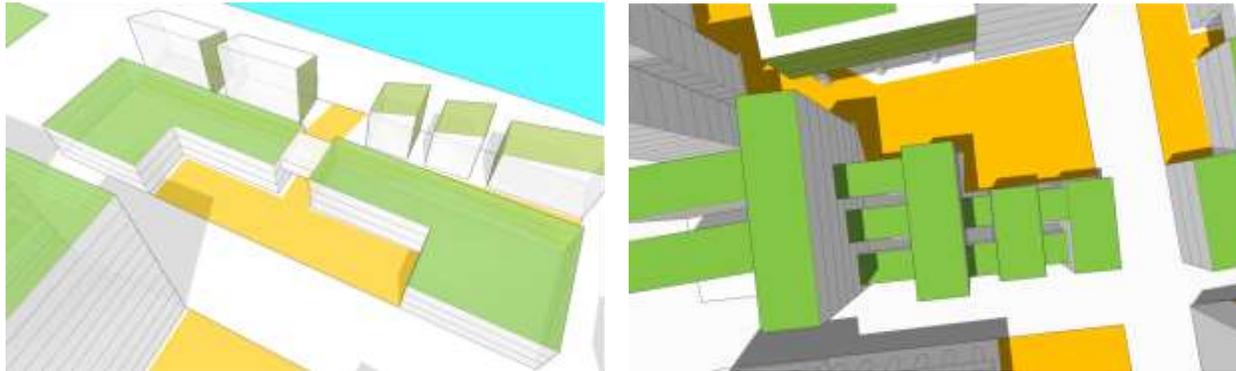
# MULTIPLYING GREEN LINKAGES AND GREEN COMMUNITY SPACES



*An example of layout where buildings shade each other.*

*Source: Anna Kleinsasser. Workshop led by Serge Salat at NUS.*

- Layering and hollowing urban blocks recreates street life and community space with gardens and parks in the sky becoming naturally ventilated clusters of occupation.
- Vertical deciduous climbing plant canopies act as dynamic solar shading devices responsive to the seasonal climatic change and enhance biodiversity.



*To improve the accessibility and connectivity, sustainable design suggests many elevated linkages between buildings.*

*Source: Qin Shuxu. Workshop led by Serge Salat at NUS.*

# GREENING THE URBAN BLOCK

In hot and humid climates, layering, hollowing and greening urban blocks in 3-D has the potential to recreate street life and community space.

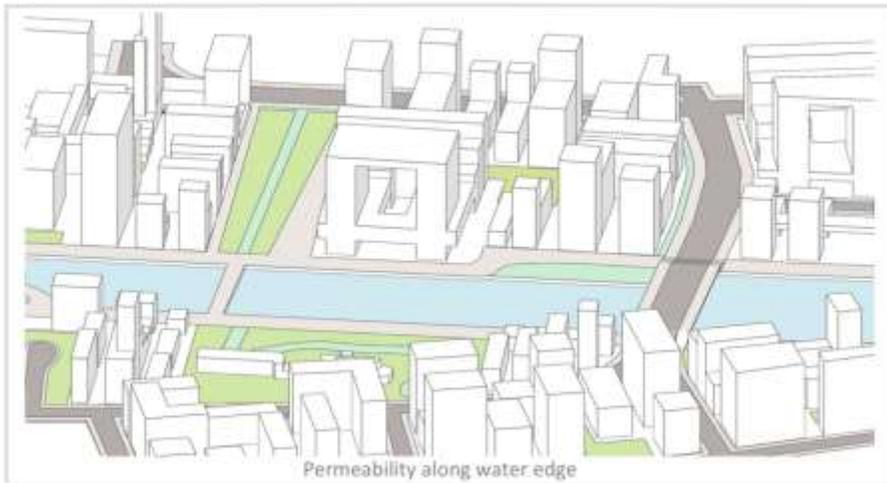
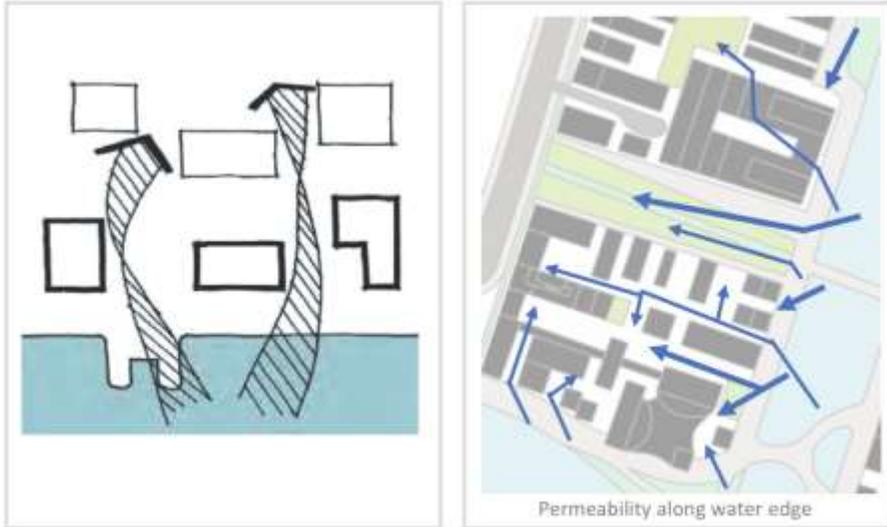
These open-air precincts offer new street levels as part of a three-dimensional matrix.

- **Blocks with a 3-D micro urbanism** allow integrating solar energy, urban agriculture, commercial and recreational space, and housing in stacked structures.
- **Three-dimensional greening allows reaching a green plot ratio above 100%.** This mitigates the urban heat island effect, saves cooling energy and provides shading for communal spaces.



*Breathing urban fabrics can offer outdoor community spaces at many scales and at multiple levels within a '3-dimensional green matrix'. In Kampung Admiralty, the various components are stacked and layered within a single building: markets, shops, food court, plazas, health-care facilities, children's playground and elderly facilities, sky gardens and a rooftop urban farm are integrated, not segregated.*  
Source: WOHA Architects

# COOLING WITH WATER



Water acts as a natural cooling device.

- Open spaces along the seashore contribute to cooling: at night, the cool sea breezes ventilate hot air trapped in the city fabric.
- Low-rise, permeable urban blocks along the sea and perpendicular wind corridors enhance wind flows.
- Preserving wetlands contributes to flood control, carbon sink and shoreline stability.
- Water catchment areas, ponds on roofs/ground floor and evaporative cooling systems cool the ambient temperature.

*Example of water strategies.*

*Source: Anna Kleinsasser. Workshop led by Serge Salat at NUS.*

# WORKING WITH THE NATURE WATER CYCLE

For water, replacing engineered infrastructure by solutions that work with nature, in which water recycles and supports life at local scale, provides many benefits:

- **Softening the built environment**, naturally absorbing storm water and diverting it from the sewers and wastewater treatment plants.
- **Improving overheated building environments.** Water acts as a cool sink and wind circulation patterns develop.



*Water features in Hammarby Sjöstad. Source: Françoise Labbé.*

# CONCLUSION: LESSONS LEARNED

*Kampung Admiralty, Singapore. Source: WOHA Architects.  
Image credit: Patrick Bingham Hall.*



# COMMON LOGIC, CONTEXTUAL FORMS

- Though the expressions differ, the logic is shared:
- Use urban form as a buffer between people and climate
- Reduce energy demand through passive means
- Adapt form to enhance comfort and resilience
- This is not style. It is performance through morphology.
- In all contexts, bioclimatic neighbourhoods are a foundation for mitigation, adaptation, and equity.



BRAC University, Dhaka, Bangladesh. Source: WOHA Architects.

# WHAT THIS SESSION HAS SHOWN



Hammarby Sjöstad

- Urban form is not neutral—it's a major driver of emissions.
- We've seen how:
- Neighbourhood design shapes mobility and energy use
- Bioclimatic strategies can drastically reduce cooling and heating loads
- Spatial decisions today lock in carbon outcomes for decades