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Envisaging a world with greener cities

Urban Scenarios

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Urban Scenarios

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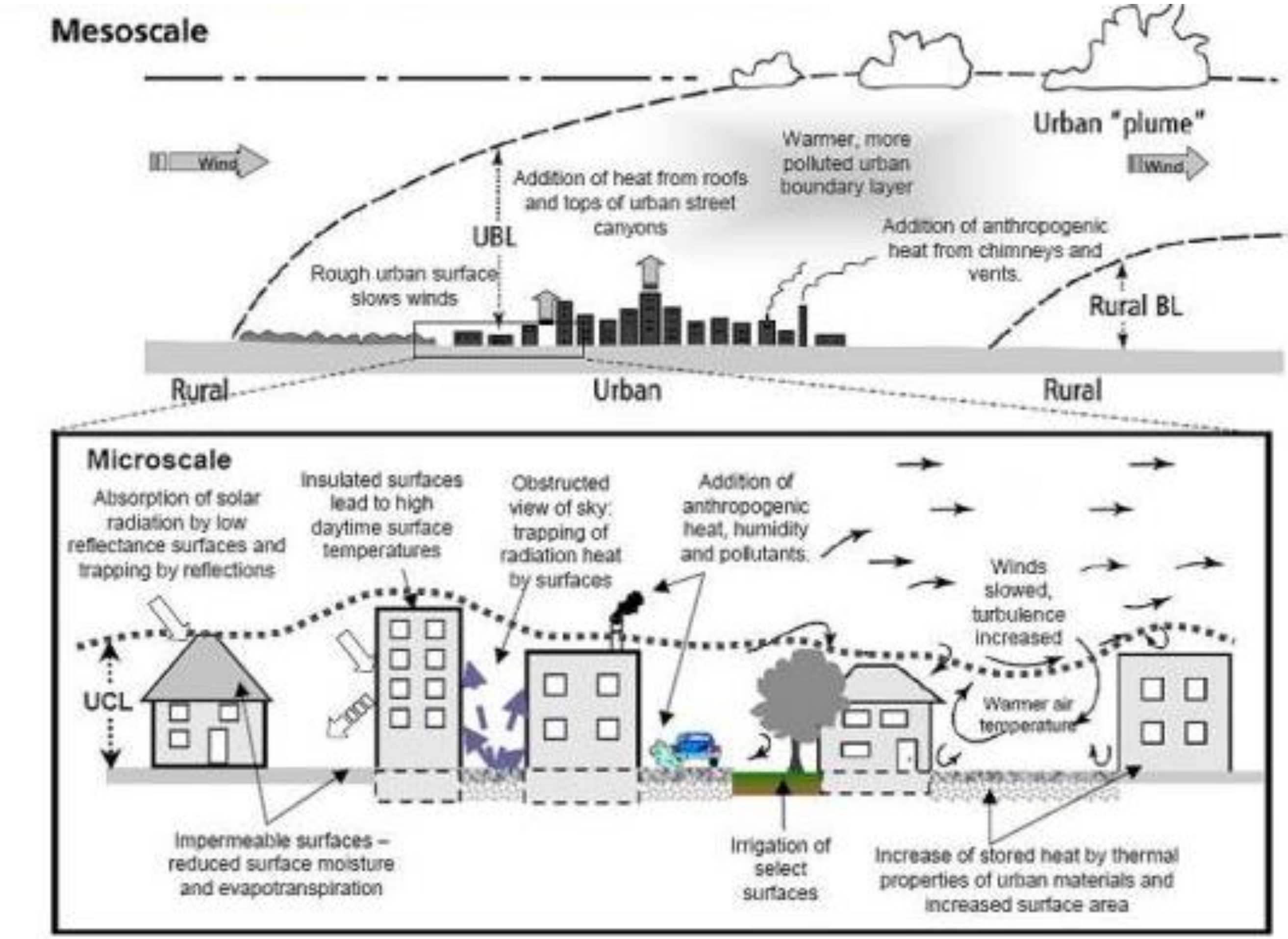
Urban micro-climate in street canyons

Potential influence of urban microclimate on indoor ventilation

Real-life natural ventilation status in flanking buildings



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Scenario 1. The impact of green and blue spaces

Scenario 2. The impact of urban form

Scenario 3. The impact of traffic patterns

MAGIC: An integrated suite of models and an associated management and decision support system for key aspects of greening inner-cities, such as natural ventilation and integration of green and blue spaces.

- Develop set of scenarios that can be used to test and guide MAGIC approach
- These should illustrate the types of situations where MAGIC tools might be used to support decision making
- They will inform us on what we need to prioritise in order to make MAGIC more useful in a practical context.

Scenario 1. The impact of green and blue spaces

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This scenario should be designed to assess the role of turquoise (green + blue) space on the conditions external to a building. We expect peak temperatures to be reduced, and RH to be increased in the vicinity of such spaces. Questions that could be addressed include:

1. **What are the changes in peak temperature and RH for indoors in the vicinity of a turquoise space?**
2. **How big does the space have to be to have a significant impact in the indoors?**
3. **Does the type of space (percentage of tree cover, amount of open water) matter?**

Parameters:

Spatial location features:
- distance to park (DP)
- distance to water (DW)

Land cover features:
- green plot ratio (GnPR),
- total tree leaf area (TREE)
- percentage of green area (GREEN) or Pervious surface fraction
- building plot ratio (BPR), or Building surface fraction
- percentage of pavement (PP) or Impervious surface fraction

Scenario 2. The impact of urban form

This scenario should assess the role of building form on the conditions both outside and inside a building. Questions that could be addressed include:

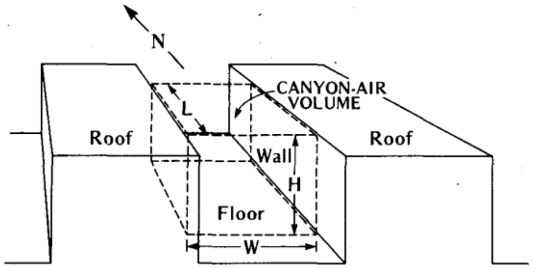
1. **How do external conditions change with building height and separation?**
2. **Is it possible to design building ventilation strategies (e.g. location and use of openings) that optimise the use of natural ventilation?**
3. **Are there synergies between built form and turquoise spaces that enhance the performance of both?**

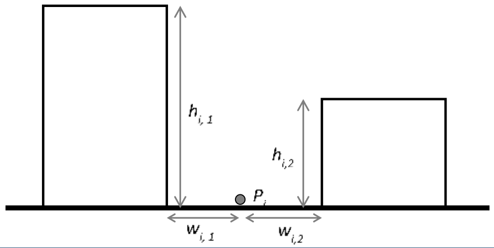
Parameters:

Site geometry features:

- Sky View Factor (SVF) and its STDEV
- Aspect Ratio or H/W ratio and its STDEV
- Building Surface to Volume Ratio
- Form Factor
- Height of roughness element
- Terrain roughness class
- Thermal capacity of building materials
- Urban albedo

Building height/ street width ratio





Sky View factor

Scenario 3. The impact of traffic patterns

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1. **What are effects of pedestrianisation of a street or set of streets?**

2. **What are the effects of using electric vehicle?**

3. **What are the linkages with turquoise spaces and built form (e.g. are some street layouts, building types, proximity of turquoise spaces that provide the most beneficial results)?**

Cambridge

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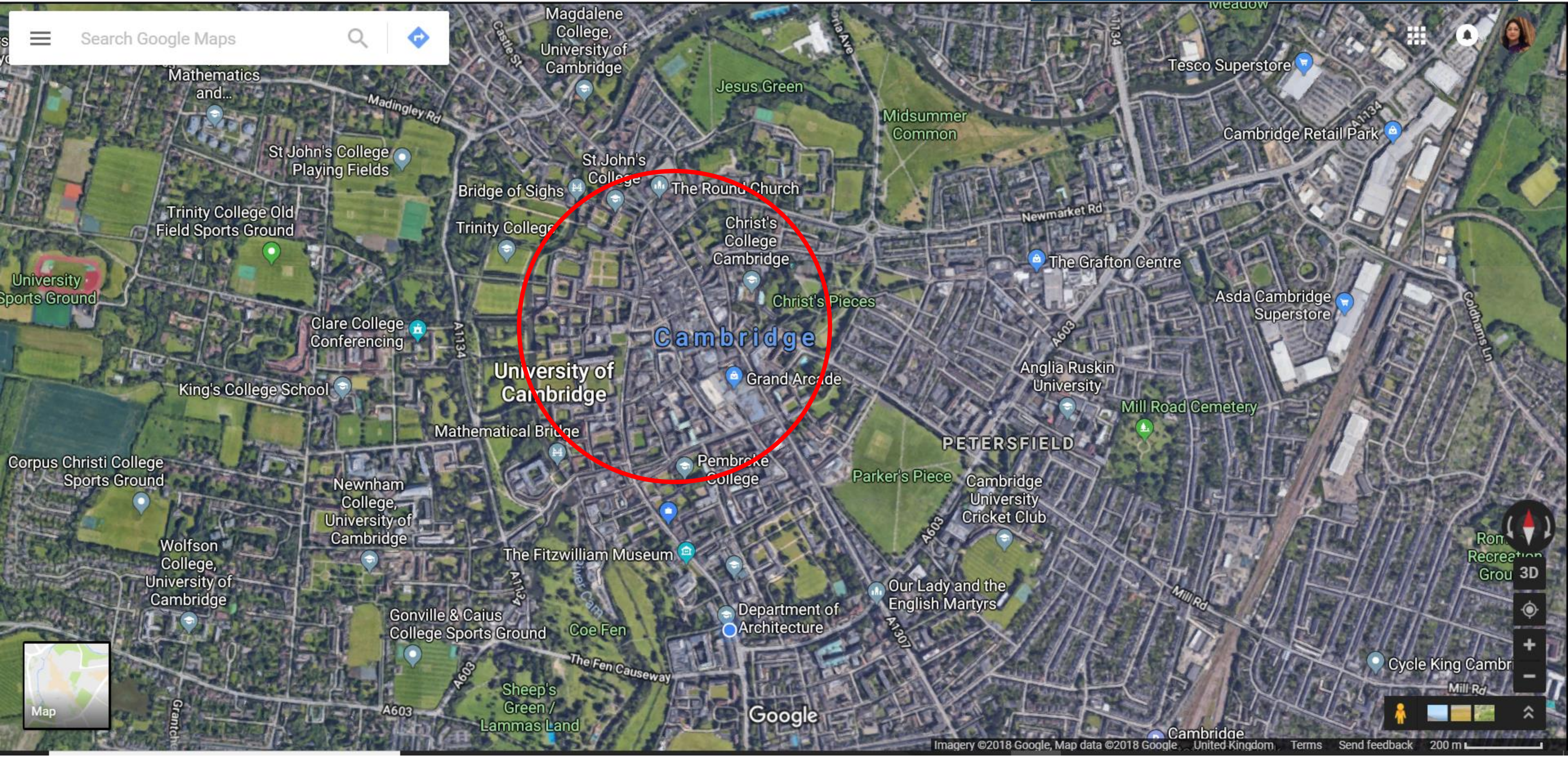

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Local climate zones for urban temperature studies (Cited by 740)

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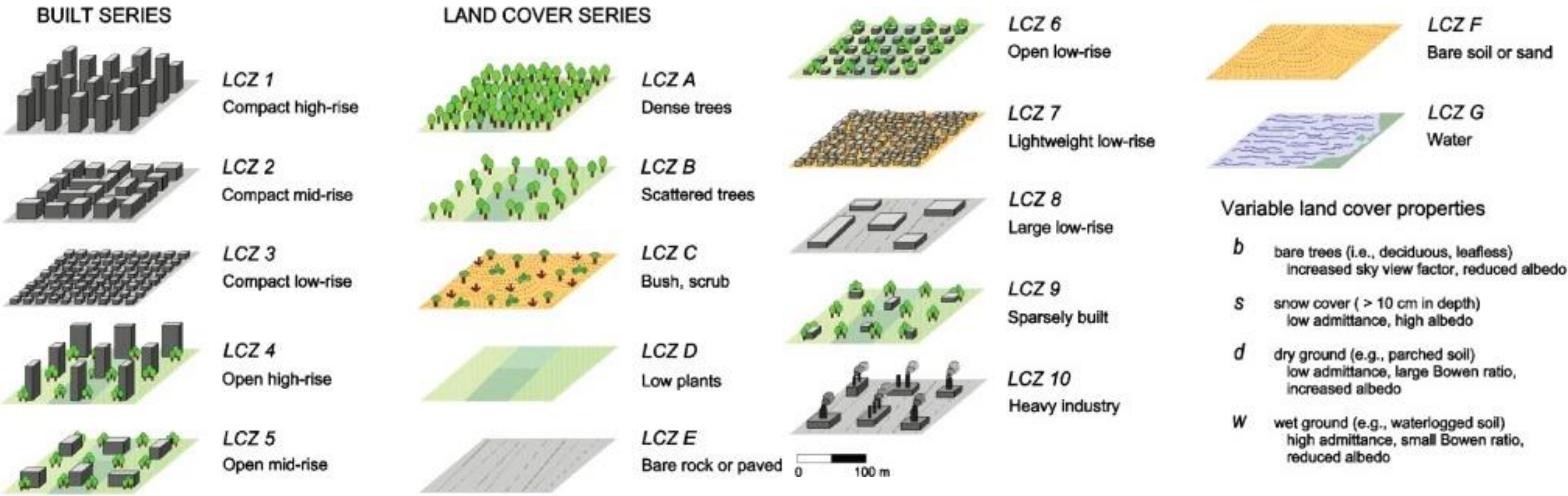
Stewart & Oke (2012, p. 884) suggested a new system of climate-based classification of cities, called "local climate zones" (LCZs), that is: "inclusive of all regions, independent of all cultures, and, for heat island assessment, quantifiable according to class properties that are relevant to surface thermal climate at the local scale". The main variables of the LCZ system include sky view factor, aspect ratio, building surface fraction, roughness length, surface cover (pervious or impervious) and anthropogenic heat output.



Local climate zones and generic urban forms

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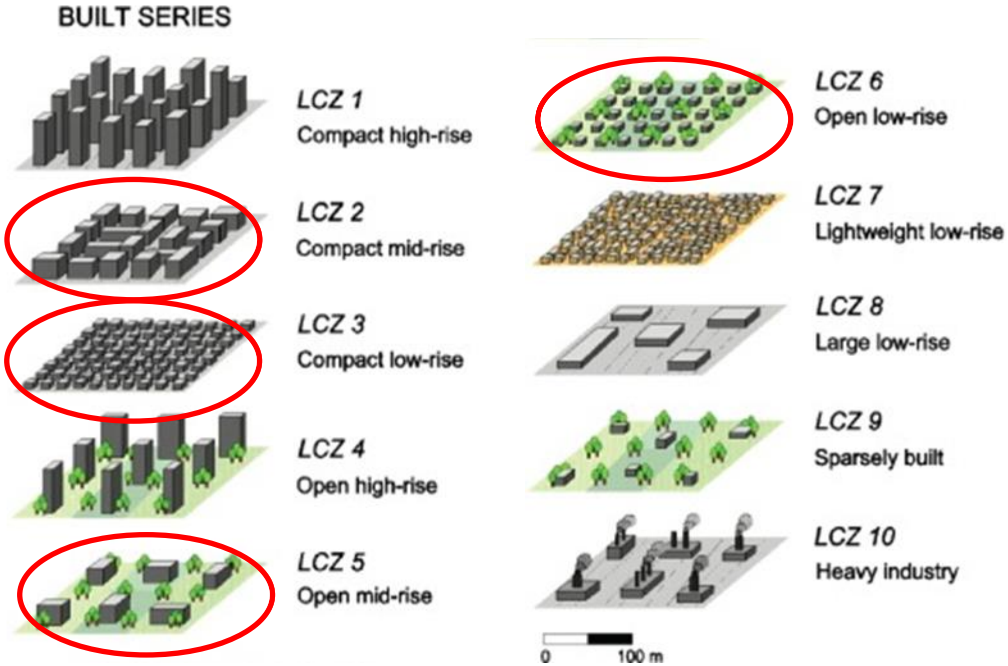
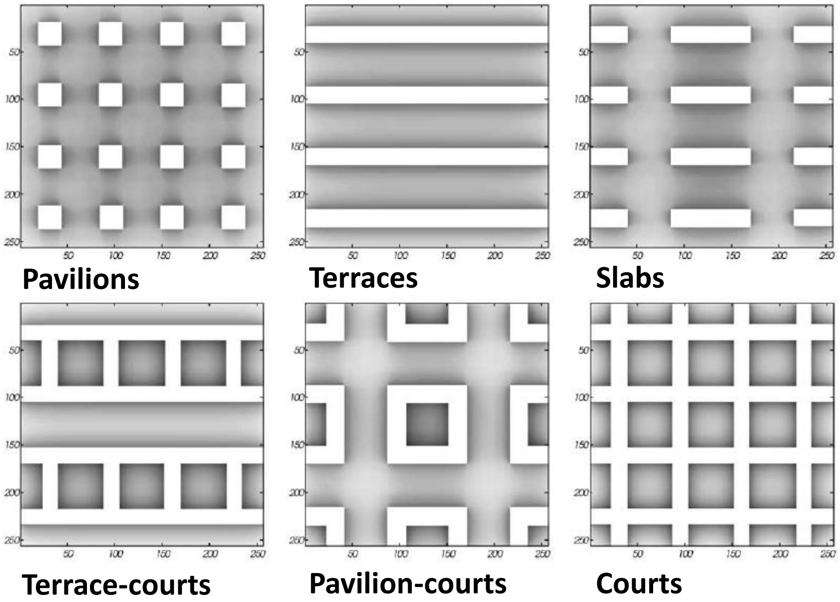
Local climate zones



Generic urban forms, environmentally reviewed by Steemers et al. (1997)



Urban Form: Medieval core

Compact mid-rise

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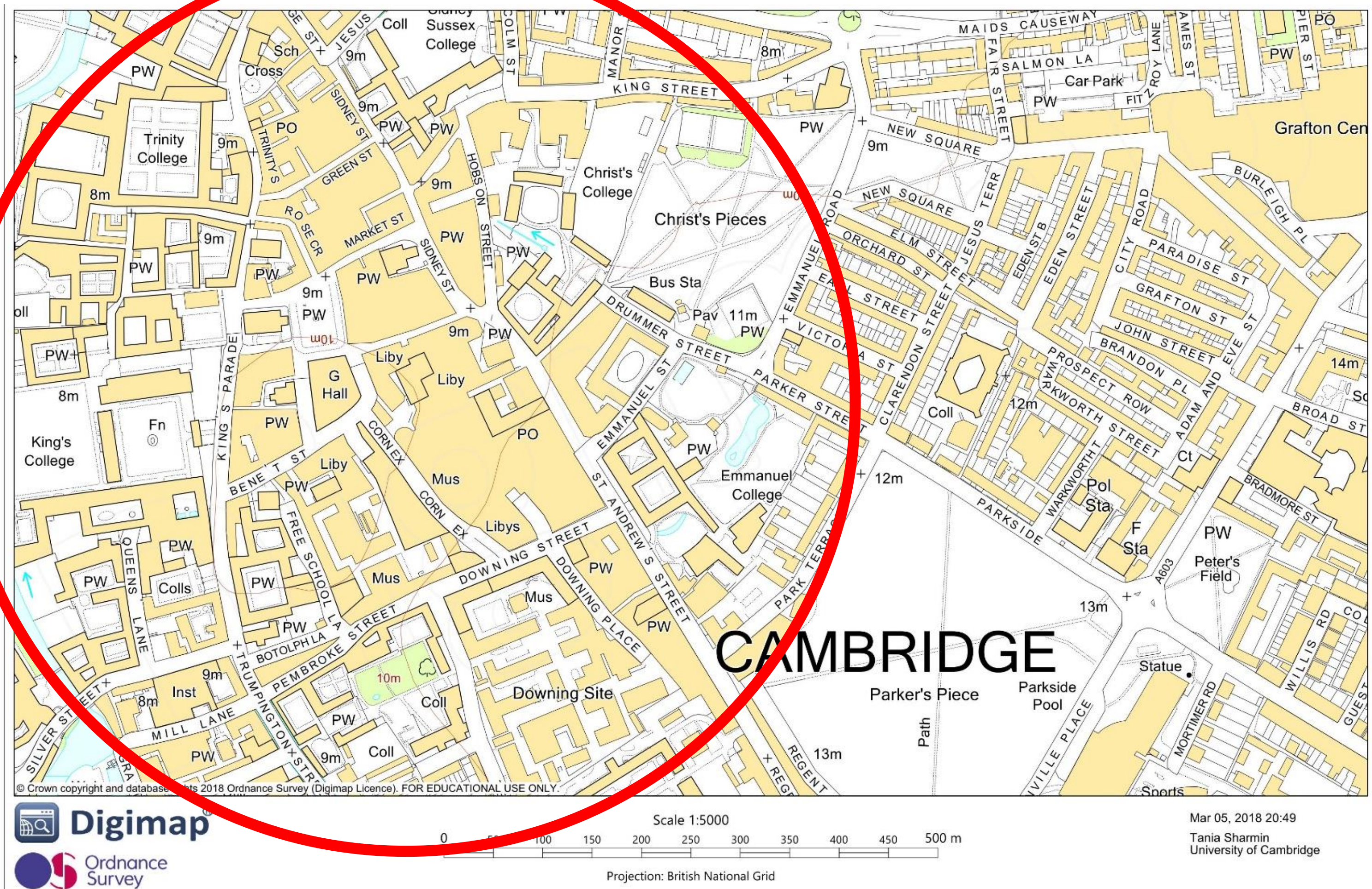

Courtyard

1. Courts are an archetypal urban form prevalent not only in hot-
mates but also in cooler climates in cities, such as Cambridge, UK.

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Urban Form: Terraced houses

Compact low-rise

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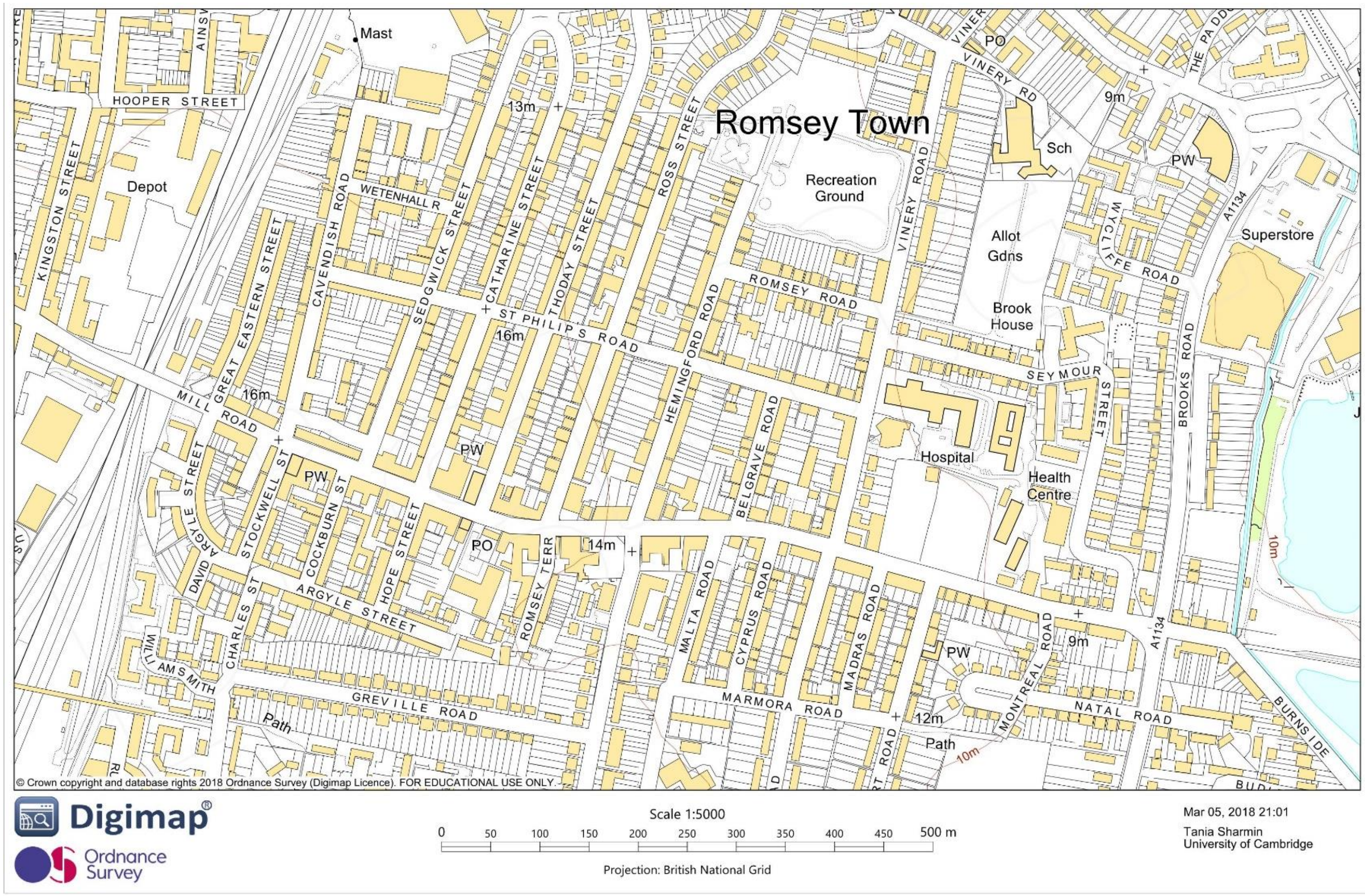

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Urban Form: New development around the station

Compact mid-rise

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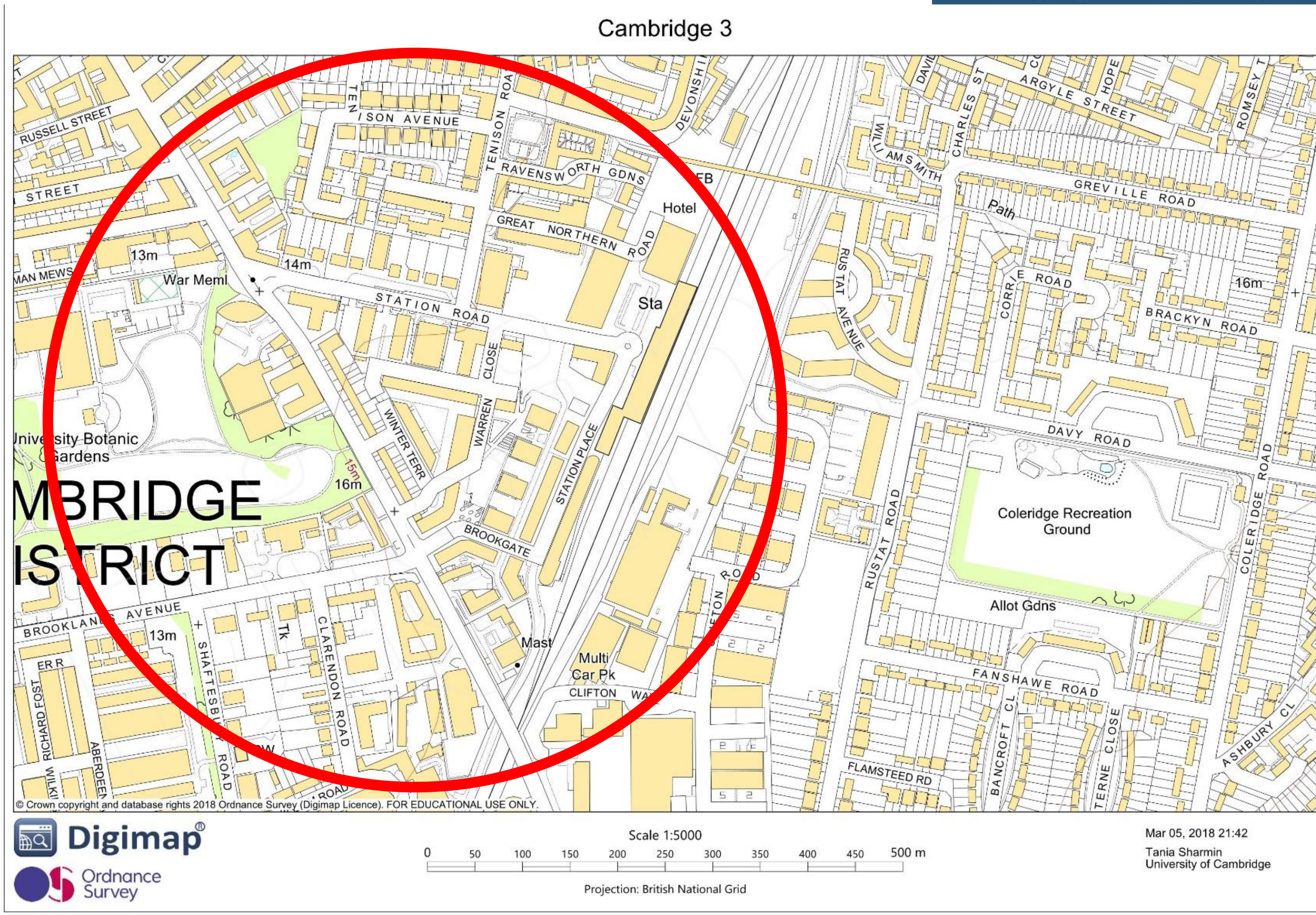

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Urban Form: Development around the green and blue spaces

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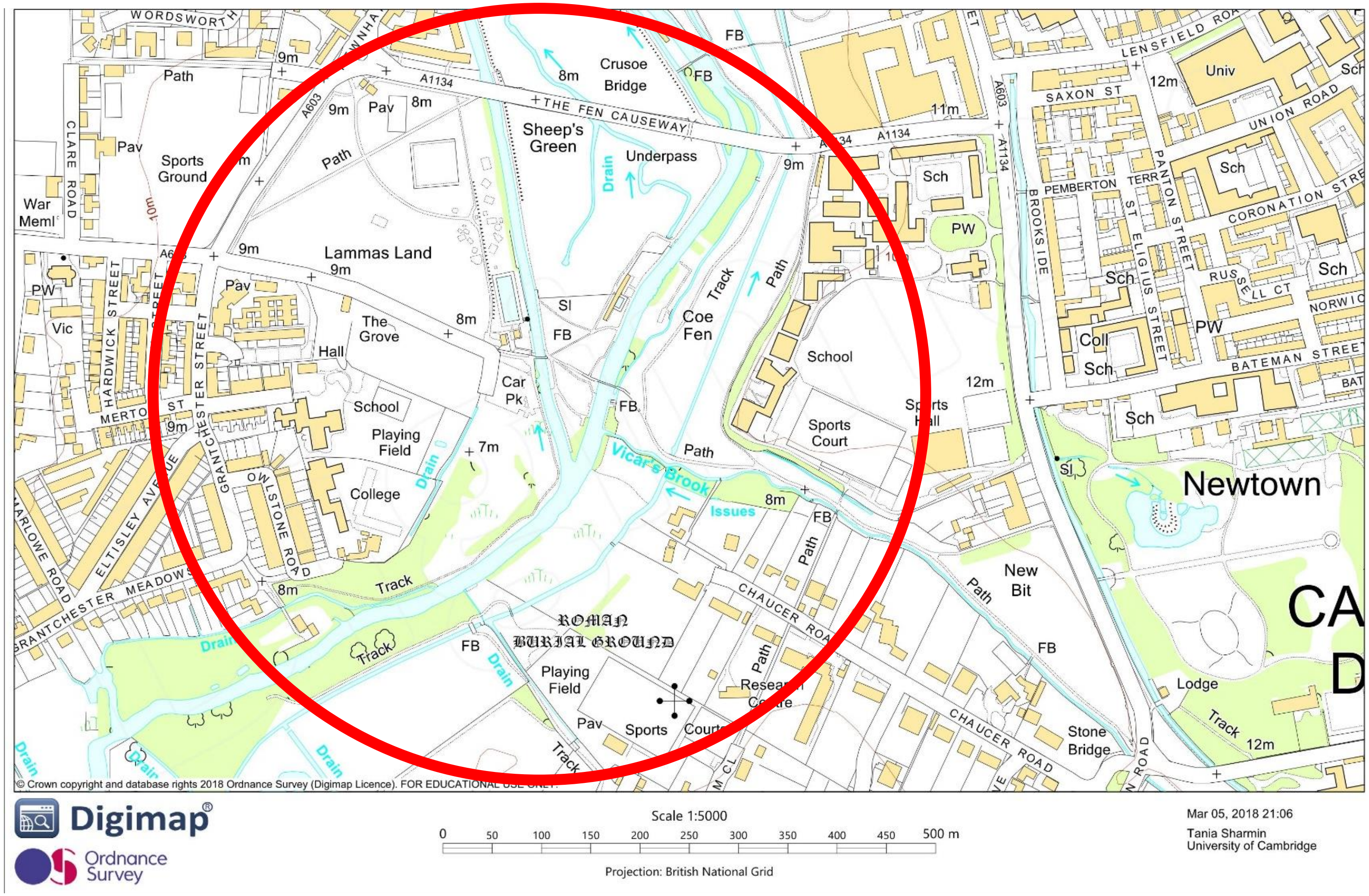
Open low-rise

Open mid-rise



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Near to green areas – low vehicular traffic

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Owlstone Croft, Cambridge, CB3 9JJ

College accommodation for Queens’ College Cambridge facing Lammas Land or Sheep’s Green.

LCZ Category: Open low-rise (LCZ): Open arrangement of low-rise buildings (1–3 stories). Abundance of pervious land cover (low plants, scattered trees). Wood, brick, stone, tile, and concrete construction materials.

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Highly urbanised – heavy vehicular traffic – medieval core

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St Andrew's St, Cambridge, CB2 3AR

This road is flanked by 4-6-storeyed commercial buildings in Cambridge City Centre. Located next to the Central Bus Station, this road is subjected to heavy vehicular traffic, mainly buses and taxis.

LCZ Category: Compact midrise (LCZ): Dense mix of midrise buildings (3–9 stories). Few or no trees. Land cover mostly paved. Stone, brick, tile, and concrete construction materials.

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Mostly pedestrianised – low vehicular traffic – medieval core

Trinity Street, Cambridge, CB2 1TB

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A pedestrian road next to Trinity College, Cambridge flanked by 4-5 storeyed, mostly residential buildings with commercial use at the ground floors.

LCZ Category: Compact midrise (LCZ): Dense mix of midrise buildings (3–9 stories). Few or no trees. Land cover mostly paved. Stone, brick, tile, and concrete construction materials.

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Discussion

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- Are these scenarios: green/blue spaces, urban form, traffic appropriate?
  - If so, which has priority?
  - If not, what other factors should we consider?
- Are long term measurements necessary or would a series of shorter term studies be better?
- What levels of accuracy/uncertainty are needed in practice?
- What levels of computation are appropriate in practice?

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Thank you!

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