Tree cover and urban land development: Assessing the impact of building demolition on tree removal

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Building Demolition

- Continual process
- Rates of demolition vary
  - 1.5 buildings per **day** in Hong Kong from1987 – 1997[1]
  - 1.5 buildings per **year** in Glasgow from 1946 – 1969[2]
- Part of redevelopment cycle, which can last between decades and centuries[2]

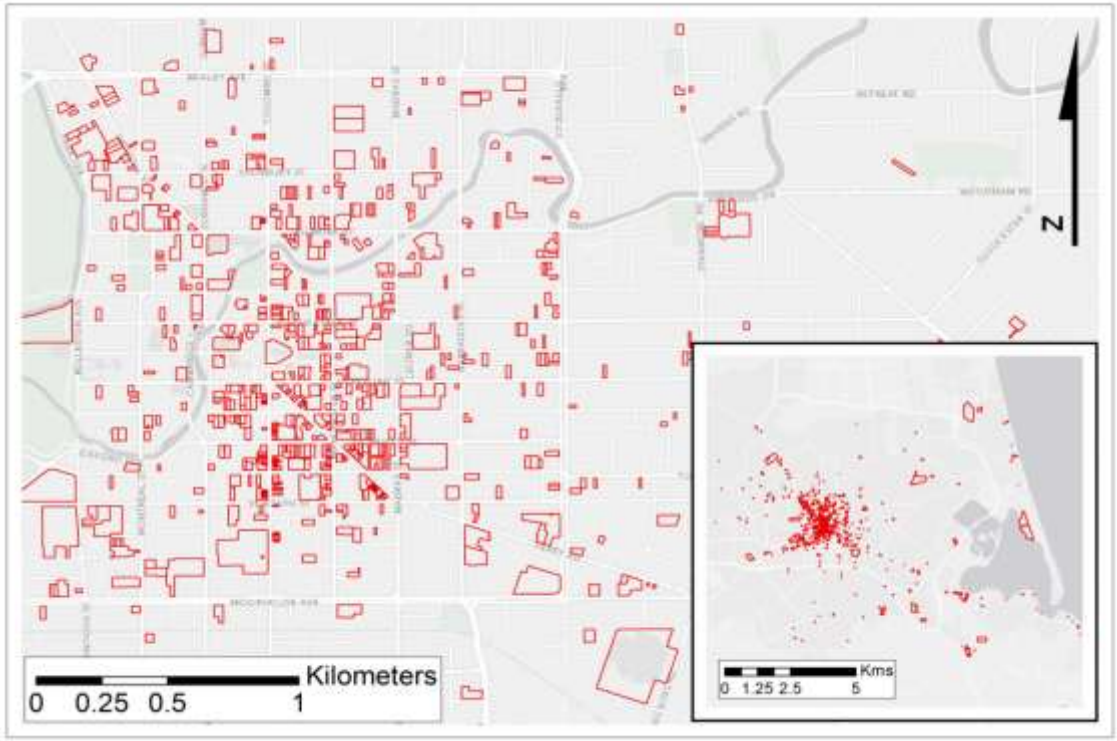
1. Susnik, A., and Ganesan, S. 1997. Urban renewal and displacement in Hong Kong. Urban Geography 18(4): 324-346.
2. Whitehand, J.W.R. 1987. The changing face of cities: a study of development cycles and urban form. The changing face of cities: a study of development cycles and urban form.

Impact of Demolition on Trees

- Because redevelopment cycle can last centuries, trees on demolition sites can be centuries old
- What happens to trees during demolition of buildings?
  - Some anecdotal information, but little empirical knowledge
  - Very difficult to study due to slow rate of demolitions

Our Methods

- We needed ***lots*** of demolition sites
- Christchurch earthquake resulted in more than 1000 building demolitions



Our Methods

- Aerial imagery captured 2 days after EQ provided snapshot of tree cover
- Canopy Cover extracted from aerial images using Trimble's eCognition software

Caption - Example of canopy cover classification using Trimble eCognition software

Our Methods

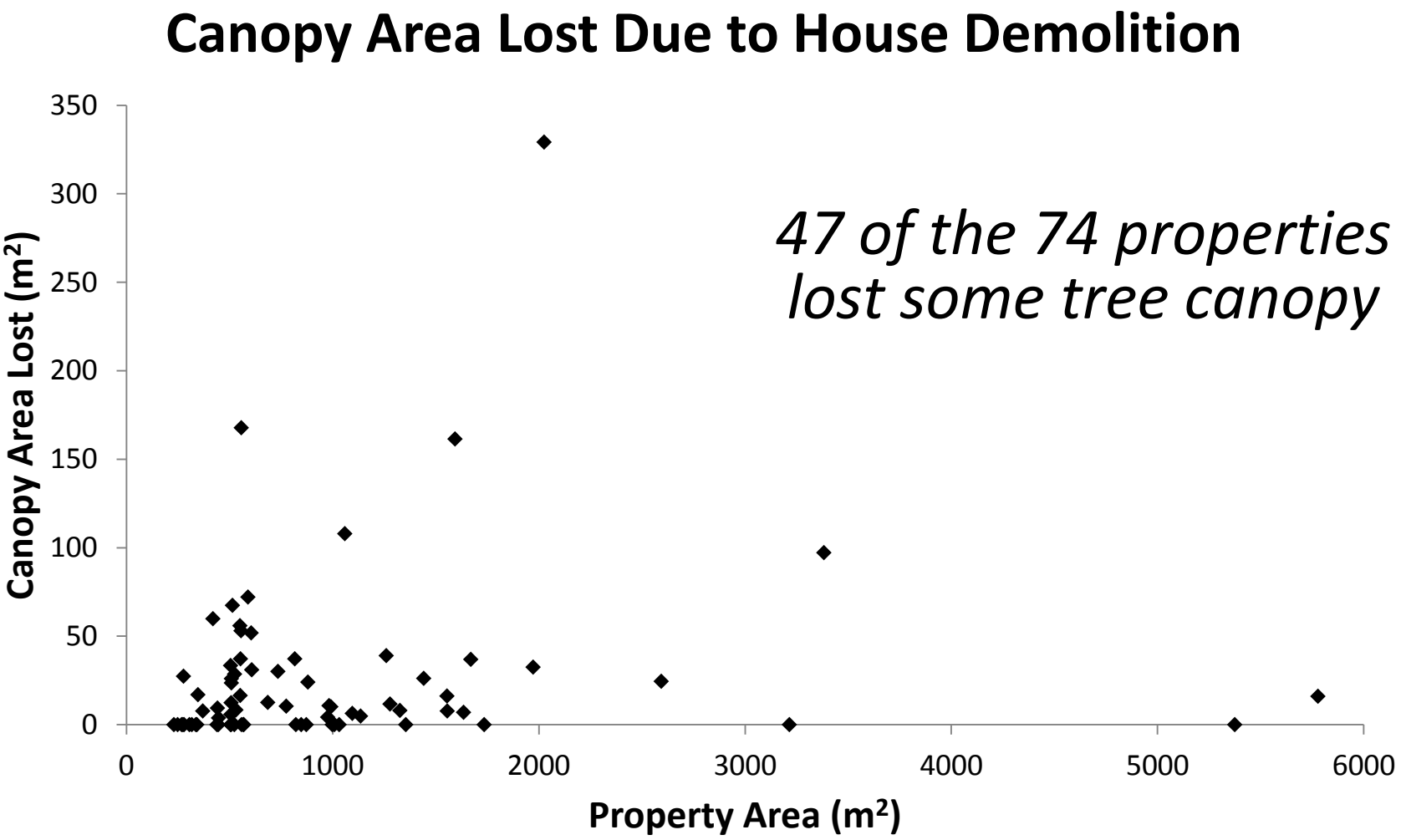
- Site visits used to survey tree cover following demolition

- Difference between aerial imagery and post-demo survey used to quantify tree cover loss

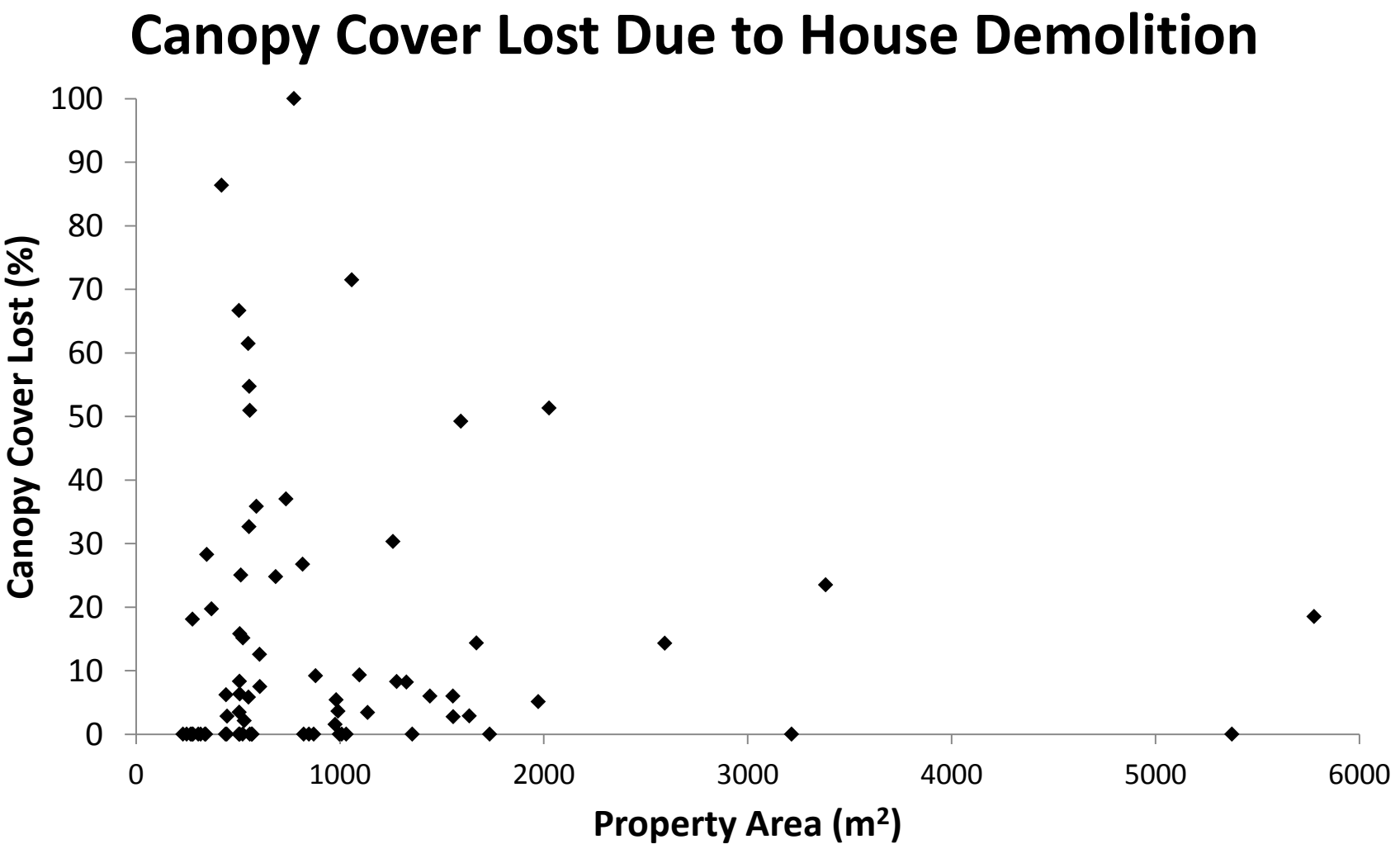
Results

- Total Area of 74 properties = 74,172 m^2
- Canopy Area prior demolition = 13,395 m^2
  - 18.1% Canopy cover
- Canopy cover after demolition = 11,481 m^2
  - 15.5% Canopy cover
- 14.4% of existing canopy cover lost

Results


Canopy Area Lost Due to House Demolition
Canopy Area Lost (m²)
350
300
250
200
150
100
50
0
0
1000
2000
3000
4000
5000
6000
Property Area (m²)
47 of the 74 properties lost some tree canopy

Results


Canopy Cover Lost Due to House Demolition
Canopy Cover Lost (%)
100
90
80
70
60
50
40
30
20
10
0
0
1000
2000
3000
4000
5000
6000
Property Area (m²)

The Good, The Bad, The Ugly

- Good - 36% of properties had no CC loss
- Good – 47% of properties had < 5% CC loss
- Bad – 28% of properties had 5 – 20% CC loss
- Ugly – 24% of properties had > 20% CC loss

The Good

The Bad

The Ugly

Reason for Tree Removal

- Reasons for removal:
  - Site clearing for development
    - Properties often sold
  - Access for demolition
- Reasons to leave trees on site:
  - Cost of removal
  - Flexibility for future landowner

Removal for Future Development

- Cost of land is high ~ $1000 - $1500/$m^2$

Removal for Site Access

- Minimal tree cover removal
- Flexibility of choice for rebuilding landowner
- Reflects the economic, social, environmental benefits of mature tree cover

Removal Reason Unknown

What happens after demolition?

- Where trees remain on site, the demolition and subsequent construction activities often leave them in a dismal state[3]

3. Jim, C.Y. 1998. Impacts of intensive urbanization on trees in Hong Kong. Environmental Conservation 25(2): 146-159.

What happens after demolition?

- Land remains vacant
  - Recolonization by woody species uncommon in first 5 years[4]
  - If seed trees are retained, site may be recolonized
- Rebuilding
  - Densification/intensification of buildings
  - Reduction in available planting space
  - Tree canopy cover declines with site 'intensity' and increases with time since development[5]

4. Clemens, J., Bradley, C., and Gilbert, O.L. 1984. Early development of vegetation on urban demolition sites in Sheffield, England. Urban Ecology 8(1-2): 139-147
5. Berland, A. 2012. Long-term urbanization effects on tree canopy cover along an urban-rural gradient. Urban Ecosystems: 1-18.

Thank You

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