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Cooling cities using green open spaces

Rising temperatures in expanding cities

Our urban centres are growing and becoming more densely populated. The urban heat island effect occurs when temperatures increase in urban areas relative to surrounding natural or rural environments.[1]

More and more people are experiencing the public health, social, environmental and economic impacts of extreme temperatures on urban populations as temperature records are broken in cities around the region[2] and the number of extreme heat days increase.

Escalating global extreme heat

A recent reported collated the number of extreme heat days between May 2023 and May 2024, and compared that result with the number of extreme heat days that would have occurred without climate change.[3]

This analysis shows climate change increased the number of extreme heat days countries experienced:

	Days of extreme heat	Without climate change
Cambodia	75.1	20.2
Lao PDR	92.2	34.6
Thailand	83.4	24.2
Viet Nam	68.7	11.5
Australia	35.1	18.1

Green open spaces can play a significant role in cooling cities.[4] They can reduce the urban heat island effect by creating cooler microclimates within cities with vegetation providing shade and facilitating evapotranspiration. They also offer a range of co-benefits that build resilience to other climate related challenges and improve our quality of life.

Other benefits of green open space

- Flood management – by detaining and absorbing stormwater and reducing runoff
- Liveability – by providing recreation and amenity services
- Improved health – through physical and mental health benefits
- Biodiversity – through vegetation and by providing habitat
- Cleaner air – by filtering pollutants (e.g. dust, soot, nitrogen, sulfur)

[1] These higher urban temperatures can be caused by factors such as reduced shading, abundance of materials that absorb heat, reduced evapotranspiration and waste heat from infrastructure and vehicles.
[2] Livingston (2024).
[3] Climate Central et al. (2024).

[4] Coutts et al. (2013); Coutts et al. (2014); CRCWSC (2020); CRCWSC (2021a); CRCWSC (2021b); Norton et al. (2015); Schuch et al. (2017).

Valuing the cooling benefits

Although important, it is often difficult to value these health and other benefits in economic terms, because there is no direct market price. In such cases, the value of benefits can be estimated by taking information captured at one place and time to make inferences about the economic value of goods and services at another place and time.

To estimate the value of cooling benefits, we need to know:

- How much cooling can reasonably be expected of parks of different sizes?
- How far does this cooling extend beyond the park boundaries?

A recent rapid review by Alluvium and Water Sensitive Cities Australia showed the potential impact green spaces can have on both temperate zone cities in Southern Australia and tropical cities, similar to those in Mekong countries.

Results for Australia

- A small, irrigated 1.5 ha park in Melbourne provides an average 1°C air temperature cooling effect (up to 3°C) during a hot summer, compared with surrounding streets. This cooling effect extended 0.5 'park widths' beyond the park.[5]
- The Royal Botanical Gardens reduced air temperature by 3.5°C during heatwaves. The gardens are a 'high level of service' so a 3.5°C cooling may not be achievable for other parks.[6]
- Mawson Lakes (in Adelaide) reduced surrounding (within 50m) air temperatures by 1.8°C.[7]

Results for tropical cities

- 2.7°C ↓ in land surface temperature (Range 0.02°C to 6.63°C)[8]
- 2.8°C ↓ in air temperature (Range 0.4°C to 10.6°C)[9]
- Cooling effects extend ~ 150m downwind of the park (or 1 'park width' for a larger park)[10]
- Tree canopy a commonly reported cooling factor

Fitzroy Gardens, Melbourne Australia

Benchakitti Park, Bangkok Thailand

[5] Motazedian (2017); Motazedian et al. (2020).
[6] Lam and Hang (2017).
[7] Broadbent et al. (2017).

[8] Best et al. (2023); Das et al (2022); Estoque et al. (2017); Huang and Chen (2020); Lu et al. (2023); Shi et al. (2023); Shih (2017).
[9] Huang and Chen (2020); Hwang et al. (2018); Jauregui (1990); Jhumur (2021); Lin and Lin (2010); Priya and Senthil (2021); Srivanit and Iamtrakul (2019); Wong and Yu (2005); Yarnvudhi et al. (2022); Yu and Hien (2005).
[10] Das et al. (2022); Jauregui (1990); Li et al (2022); Shi et al (2023); Shih (2017).

About the review

- Reviewed 27 papers
- Cities included in the review are found in Bangladesh, China, Hong Kong, India, Indonesia, Malaysia, Mexico, Philippines, Singapore, Suriname, Thailand and Taiwan.
- Studies included existing parks, natural areas and green spaces ranging from lot scale, small parks (1–20 ha) to large parks (hundreds of ha).
- The studies commonly reported changes in land surface temperature (e.g. when using Landsat methods) or air temperature (e.g. when reporting more localised benefits of shading). Several studies investigated human comfort, but used a proprietary index which limits transferability to the INFFEWS database.

Limitations of the review

- Definition of 'park' or 'green space' not standardised.
- Potential for surrounding land use to influence the cooling results not removed.
- Spatial form of surrounding urban landscape not accounted for.
- Seasonal variations not accounted for.
- Temperature monitoring location within each park is likely to affect results.
- Cooling effects analysed by Landsat are influenced by pixel size.
- Few studies on human thermal comfort.

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