

Urban green space provision: the case for policy-based solutions to support human health

As one of the world's most urbanised nations, Australia¹ is particularly vulnerable to diseases causally linked with urban living.² Further urban growth requires systemic health policy solutions. Urban green spaces (UGS) are dynamic contributors to the wellbeing of our cities, offering benefits to the health of humans, society, and natural and managed ecosystems. Here we define UGS to encompass planned and intentional green spaces such as parks, curated gardens, sports and recreation areas as well as urban forests and nature reserves, and unconventional green zones such as easements, road and infrastructure routes, streetscapes and commercial precincts.

Increasing urban infill and expansion of housing across Australian major cities is placing greater pressure on green assets as both places of recreation and refuge for communities.³ The expansion of essential grey infrastructure is important for ensuring equity of access to services and facilities for all residents but, nevertheless, increases pressure on UGS.

Here we explain the public health benefits of UGS. We identify barriers to the provision of sufficient, equitable UGS and describe the disconnect between the resourcing required to achieve this and the health and productivity gains resulting from it. In doing this, we make a case for policy-based solutions.

The health benefits of urban green spaces

Exposure to UGS has a powerful impact on physical and mental health and overall social wellbeing, with concomitant benefits also for the health sector in terms of reduced burden and significant cost savings.⁴ It achieves these health benefits through interlinked adaptive pathways.⁵

UGS can provide spaces to enjoy and engage in sports and recreation and can encourage active transport use such as cycling and walking.⁶ It provides amenity through shading, cooling and exposure to the benefits of biodiversity and the mitigation of air pollution and noise, all which contribute to positive health impacts.⁷ Australian studies have demonstrated that people residing within 1.4 km of large, attractive green spaces were more likely to engage in recreational walking and meet the minimum physical activity guideline than those who lived further from such spaces.⁸ Green space, particularly tree canopy, has also been associated with reduced rates of morbidity from cardiometabolic diseases, lower psychological distress, and lower risks of dementia diagnosis.⁹⁻¹²

Emerging research also indicates that natural spaces support biodiverse and healthy soil, which shape the human microbiome, and promote immune fitness.¹³ Access to green space has also been linked to reduction

in crime¹⁴ and increased social cohesion and social capital.^{15,16}

Evidence of the positive mental health effects of UGS continues to build.¹⁷ Green space provides places for social interaction and facilitates community connections and wellbeing. This is important for feelings of safety, neighbourhood satisfaction and positive mental health, and can help to reduce social isolation.¹⁸ The dose of UGS experienced by people is also important, with an exposure of at least 30 minutes per week lowering rates of depression and anxiety, reducing stress levels, and enhancing mood.^{19,20} Further, spending two hours or more per week in natural environments is associated with higher levels of self-reported good health and wellbeing.²¹

Increased urban greening facilitates resilience to heat by providing shade and evaporative cooling. Australia's air temperature is predicted to increase in the range of 0.6–2.5°C by 2050 (relative to 1995–2014²²). In addition, higher urbanisation and densification are increasing the proportion of the population exposed to urban heat island effects. Mitigating these effects through urban greening is an essential requirement for vouchsafing human health. A study in Adelaide, South Australia, found that urban greening can provide up to 2°C cooler urban climates.²³

Importantly, these benefits are not experienced by everyone in the same way. The psychologically restorative benefits of nature contact are dependent on the severity of cognitively stressful demands felt — more need entails greater potential for benefit.^{5,24} This is seen in the mental health of adolescents who tend to be more introverted or prone to chronic rumination benefiting disproportionately more from access to green spaces, in comparison to their more extraverted and contented peers.¹²

External factors might also constrain levels of health benefit beyond the issue of accessibility, with recent evidence indicating that residents of apartments are constrained to do regular exercise outdoors due to small and overcrowded nearby green space and are thus more likely to experience a major cardiovascular event compared with people who live in houses.²⁵

The urban green space deficit and the unknown quality standards

Increasing recognition of the value of UGS and its equitable availability to residents has led to the creation of green infrastructure strategies and management plans (eg, City of Melbourne's Green our City²⁶). Others are in development at the time of writing (eg, Urban Greening Strategy for metropolitan Adelaide²⁷). These strategies contain aspirational targets for green space provision through

Craig Williams¹ 

Christie Byrne¹

Shannon Evenden²

Veronica Soebarto³

Stefan
Caddy-Retalic^{3,4}

Carmel Williams³

Yonatal Tefera^{3,5}

Xiaoqi Feng⁶

Andrew Lowe²

¹ University of South
Australia, Adelaide, SA.

² Environment
Institute, University of
Adelaide, Adelaide, SA.

³ University of Adelaide,
Adelaide, SA.

⁴ University of Sydney,
Sydney, NSW.

⁵ South Australian Health
and Medical Research
Institute, Adelaide, SA.

⁶ University of New
South Wales, Sydney,
NSW.

craig.williams@
unisa.edu.au

doi:10.5694/mja2.52569

the proportion of canopy coverage and urban heat reduction, but their efficacy in the absence of mandated commitments has yet to be demonstrated.

There are many metrics available for defining green space availability, with most describing accessibility (eg, access to green spaces within a 15-minute walk) and the per capita green space area (m²) available.²⁸ In this way, defining UGS deficit depends on the metrics chosen, and, in the absence of an internationally agreed standard, it is difficult to resolve.

The scale at which accessibility is measured is also critical, with most cities containing suburbs with greater and lesser access to green space that are masked when accessibility is measured at a municipal or regional scale.²⁹ Beyond quantity-related metrics, the quality of these green spaces is crucial in maximising their positive impacts on public health.¹⁷ There are many ways to measure UGS abundance, accessibility and quality.³⁰

There is inequity in the distribution of green space as well as canopy coverage across Australian cities.²⁸ Inner suburbs (typically with higher land values and household income) had much greater UGS compared with outer suburbs and peri-urban areas (typically with lower land values and income).²⁸ This pattern represents significant health inequities, which are also recorded in other countries (eg, New Zealand³¹). There is also variation in UGS between major Australian cities, with Sydney and Brisbane providing more green space area per capita than Melbourne and Adelaide.

Rectifying the inequitable distribution of green space within cities will require changes to the policy development process of governments. Addressing complex public policy issues requires joined up and collaborative approaches to policy development, where the breadth of issues affected by the policy can be considered. These changes to the policy process can be supported with the development of legislation and regulations that embed agreed measures to evaluate existing UGS and their health benefits. Although some countries have such standards (eg, the United Kingdom³²), most do not. The application of the “3–30–300 rule” — namely, that all people should be able to see 3 established trees from their home or workplace, have at least 30% tree canopy in their residential neighbourhood, and live within 300 m of high quality green space³² — might form the basis for an agreed future standard. This is founded on the consistent association between 30% of tree canopy and better mental, cardiometabolic and cognitive health.⁴ The absence of a standard creates difficulty in planning and financing UGS provision.

Overcoming barriers to urban green space development

Significant barriers to ensuring equitable UGS distribution to a standard that equates with better health and wellbeing outcomes include:

- **Competing land-use interests.** With population growth and a well documented shortage of housing,

green space provision is in conflict with land for housing.

- **Physical barriers.** There is limited public space in existing urban areas, and including more might not be possible when combined with grey infrastructure needs. Private green space is being lost through infill development and limited incentives and legal barriers to encourage private landowners to retain established trees.³³
- **Restricted financial capacity.** UGS development requires financial investment, for which there is limited capacity in local government. This is exacerbated by low levels of community awareness, ecological literacy and engagement³⁴ and limited expertise within government to develop green spaces, particularly if it is perceived as low priority and/or expensive to maintain without an appreciable return.
- **Bureaucratic challenges to democratic decision making and effective collaboration.** Weak environmental protection laws are commonly combined with regulations that readily permit tree removal or radical pruning for protecting vital network infrastructure and enable urban development at the expense of UGS.³⁵
- **Lack of urban planning decision support tools and processes that account for the health, environment, and economic benefits of green space.** In Australia, there is still a lack of clear frameworks and decision support tools that can assist local governments and decision makers to take into account the health benefits of UGS.²⁰ Without clear frameworks and processes that all relevant stakeholders agree upon, and without easy-to-use tools that can assist decision makers to consider all the benefits of green space versus costs of establishment, maintenance and replacement, it will be difficult to realise quality green space.

These barriers highlight the tension points between the need for housing, infrastructure and amenities and the health and societal benefits of UGS. Overcoming such barriers will require new thinking combined with mandated standards to ensure sufficient UGS provision to maintain human health.

Economic studies might prove persuasive in overcoming financial challenges, such as a recent study providing economic valuation for street trees in Greater Adelaide.³⁶ The initial findings indicate the average present value benefit of planting a tree is \$11 236, compared with an estimated cost of \$6980, translating to a benefit–cost ratio of 1.6. Costed benefits include health improvements from reduced risk of heat-related illness. Including health care cost savings could be a compelling motivation for action, with recent longitudinal evidence from New South Wales indicating that increasing tree canopy from less than 10% to 30% or more reduces the risk of cardiovascular disease-related hospitalisations, leading to \$20 million savings per 100 000 adults per year.⁴

Conclusion: urban greening standards as a health measure using a Health in All Policies approach

We contend that UGS should be a policy imperative for all governments, requiring joined up and multisectoral solutions to overcome sectoral silos. The Health in All Policies approach, supported by the World Health Organization Health in All Policies Four Pillars Model,³⁷ offers evidence-based guidance for cross-sector collaboration to achieve positive health outcomes. This model provides a framework for incorporating UGS in the decision making of all government agencies.³⁸ The new Australian Federal Climate and Health Strategy identifies Health in All Policies as one of key objectives for action and this may create the space and opportunity to elevate trees and green space in the political decision-making process.³⁹ Such an approach would better link the health cost and benefits of green space (principally enjoyed at the state and federal level) with the expenditure for green space creation at the local government and community level.

Moving the UGS for health agenda forwards will require a coordinated approach involving government, lobbyists, researchers and law makers. Clear and evidence-based UGS standards can be used to set the vision and direction for whole of government policy action and create the opportunity for the legislative reform required. Such standards must include scientifically determined dose–response provisions, along with considerations for equity and accessibility.⁴⁰ There is already an abundance of evidence about green space exposure dose and health. Only by inclusion of accessibility for economically disadvantaged communities will such standards be effective and avoid the well documented failure of previously applied park standards that lead to underutilised UGS.⁴⁰ The Health in All Policies approach can support whole government decision making that leads to embedding of UGS standards within legislation and regulation and can include compliance with standards incentivised by new financial instruments, such as the newly developed Nature Repair Market designed to support biodiversity.⁴¹

Acknowledgements: We acknowledge the HEAL (Healthy Environments And Lives) National Research Network, which receives funding from the National Health and Medical Research Council Special Initiative in Human Health and Environmental Change (Grant No. 2008937). Support was also provided by the Environment Institute at the University of Adelaide. The funding source was not involved in the authoring of this work. The work of the Dynamic State Summit (2022) in catalysing this work is acknowledged.

Competing interests: No relevant disclosures.

Provenance: Not commissioned; externally peer reviewed. ■

© 2024 AMPCo Pty Ltd.

- 1 United Nations, Department of Economic and Social Affairs, Population Division. World Urbanization Prospects: 2018 revision [website]. UN, 2018. <https://population.un.org/wup/Publications/> (viewed Dec 2024).
- 2 Flies EJ, Mavoa S, Zosky GR, et al. Urban-associated diseases: candidate diseases, environmental risk factors, and a path forward. *Environ Int* 2019; 133: 105187.
- 3 Bolleter J, Ramalho CE. Greenspace-oriented development: reconciling urban density and nature in suburban cities. Cham, Switzerland: Springer Nature, 2020.

- 4 Feng X, Navakatikyan M, Eckermann S, Astell-Burt T. Show me the money! Associations between tree canopy and hospital costs in cities for cardiovascular disease events in a longitudinal cohort study of 110 134 participants. *Environ Int* 2024; 185: 108558.
- 5 Astell-Burt T, Hartig T, Putra IGNE, et al. Green space and loneliness: a systematic review with theoretical and methodological guidance for future research. *Sci Total Environ* 2022; 847: 157521.
- 6 Bates D, Partington J. Physical activity and community resilience. In: Cherrington J, Black J; editors. Sport and physical activity in catastrophic environments. London: Routledge, 2022; pp. 88–99.
- 7 Woodward A, Hinwood A, Bennett D, et al. Trees, climate change, and health: an urban planning, greening and implementation perspective. *Int J Environ Res Public Health* 2023; 20: 6798.
- 8 Mavoa S, Badland H, Learnihan V, et al. The Australian National Liveability Study final report: development of policy-relevant liveability indicators relating to health and wellbeing and recommendations for their dissemination. Melbourne: University of Melbourne, 2016. <https://preventioncentre.org.au/wp-content/uploads/2021/10/FINAL-The-National-Liveability-Study-Report.pdf> (viewed Dec 2024).
- 9 Astell-Burt T, Feng X. Association of urban green space with mental health and general health among adults in Australia. *JAMA Network Open* 2019; 2: e198209.
- 10 Astell-Burt T, Feng X. Urban green space, tree canopy and prevention of cardiometabolic diseases: a multilevel longitudinal study of 46 786 Australians. *Int J Epidemiol* 2020; 49: 926–933.
- 11 Astell-Burt T, Navakatikyan MA, Feng X. Urban green space, tree canopy and 11-year risk of dementia in a cohort of 109 688 Australians. *Environ Int* 2020; 145: 106102.
- 12 Feng X, Astell-Burt T, Standl M, et al. Green space quality and adolescent mental health: do personality traits matter? *Environ Res* 2022; 206: 112591.
- 13 Sun X, Liddicoat C, Tiunov A, et al. Harnessing soil biodiversity to promote human health in cities. *Urban Sustain* 2023; 3: 5.
- 14 Lin J, Wang Q, Huang B. Street trees and crime: what characteristics of trees and streetscapes matter. *Urban Forest Urban Green* 2021; 65: 127366.
- 15 Jennings V, Bamkole O. The relationship between social cohesion and urban green space: an avenue for health promotion. *Int J Environ Res Public Health* 2019; 16: 452.
- 16 Sukartini NM, Auwalin I, Rumayya R. The impact of urban green spaces on the probability of urban crime in Indonesia. *Develop Stud Res* 2021; 8: 161–169.
- 17 Nguyen PY, Astell-Burt T, Rahimi-Ardabili H, Feng X. Effect of nature prescriptions on cardiometabolic and mental health, and physical activity: a systematic review. *Lancet Planet Health* 2023; 7: e313–e328.
- 18 Mavoa S, Davern M, Breed M, Hahs A. Higher levels of greenness and biodiversity associate with greater subjective wellbeing in adults living in Melbourne, Australia. *Health Place* 2019; 57: 321–329.
- 19 Shanahan DF, Bush RA, Gaston KJ, et al. Health benefits from nature experiences depend on dose. *Sci Rep* 2016; 6: 28551.
- 20 Tefera Y, Soebarto V, Bishop C, et al. A scoping review of urban planning decision support tools and processes that account for the health, environment, and economic benefits of trees and greenspace. *Int J Environ Res Public Health* 2024; 21: 48.
- 21 White MP, Alcock I, Grellier J et al. Spending at least 120 minutes a week in nature is associated with good health and wellbeing. *Sci Rep* 2019; 9: 7730.
- 22 Intergovernmental Panel on Climate Change. Summary for policymakers. In: Masson-Delmotte V, P Zhai, A Pirani, et al; editors. Climate Change 2021: the physical science basis. contribution of Working Group I to the sixth assessment report of the Intergovernmental Panel on Climate Change. Cambridge (UK) and New York, NY (USA): Cambridge University Press, 2021. <https://www.ipcc.ch/report/ar6/wg1/about/how-to-cite-this-report/> (viewed Dec 2024).
- 23 Soltani A, Sharifi E. Daily variation of urban heat island effect and its correlations to urban greenery: A case study of Adelaide. *Frontiers Arch Res* 2017; 6: 529–538.
- 24 Rigolon A, Browning MH, McAnirlin O, Yoon HV. Green space and health equity: a systematic review on the potential of green space

- to reduce health disparities. *Int J Environ Res Public Health* 2021; 18: 2563.
- 25 Feng X, Navakatikyan MA, Toms R, Astell-Burt T. Leafier communities, healthier hearts: an Australian cohort study of 104 725 adults tracking cardiovascular events and mortality across 10 years of linked health data. *Heart Lung Circ* 2023; 32: 105-113.
- 26 City of Melbourne. Green our City Strategic Action Plan. Melbourne: City of Melbourne, 2023. <https://www.melbourne.vic.gov.au/community/greening-the-city/green-infrastructure/Pages/green-our-city-action-plan.aspx> (viewed Sept 2024).
- 27 Green Adelaide. Urban Greening Strategy for metro Adelaide. Adelaide: Green Adelaide, 2023. <https://www.greenadelaide.sa.gov.au/projects/adelaide-greening-strategy> (viewed Sept 2024).
- 28 Hsu YY, Hawken S, Sepasgozar S, Lin ZH. Beyond the Backyard: GIS Analysis of Public Green Space Accessibility in Australian Metropolitan Areas. *Sustainability* 2022; 14: 4694.
- 29 Labib SM, Lindley S, Huck JJ. Spatial dimensions of the influence of urban green-blue spaces on human health: A systematic review. *Environ Res* 2020; 180: 108869.
- 30 Konijnendijk CC. Evidence-based guidelines for greener, healthier, more resilient neighbourhoods: introducing the 3-30-300 rule. *J Forestry Res* 2023; 34: 821-830.
- 31 Richards D, Polyakov M, Brandt AJ, et al. Inequity in nature's contributions to people in Ōtautahi/Christchurch: a low-density post-earthquake city. *Urban For Urban Green* 2023; 86: 128044.
- 32 Pauleit S, Slinn P, Handley J, Lindley S. Promoting the natural green structure of towns and cities: English nature's accessible natural greenspace standards model. *Built Environ* 2003; 29: 157-170.
- 33 Lin B, Meyers J, Barnett G. Understanding the potential loss and inequities of green space distribution with urban densification. *Urban For Urban Green* 2015; 14: 952-958.
- 34 Clark DG, Sorensen AE, Jordan RC. Characterization of factors influencing environmental literacy in suburban park users. *Current World Environment* 2016; 11: 1-9.
- 35 Belder RL, Delaporte KD, Caddy-Retalic S. Urban tree protection in Australia — review of regulatory matters: a report for the South Australian Attorney General's Department Planning and Land Use Services. Adelaide: Government of South Australia, 2022. https://dit.sa.gov.au/_data/assets/pdf_file/0011/1087886/Urban_tree_protection_in_Australia.pdf (viewed Dec 2024)
- 36 Kandulu J, Soebarto V. Estimating the net benefit of street trees in Greater Adelaide Metropolitan, Australia. Adelaide: Environmental Institute, University of Adelaide; 2023. <https://hdl.handle.net/2440/140808> (viewed Dec 2024).
- 37 World Health Organization. Working together for equity and healthier populations: sustainable multisectoral collaboration based on Health in All Policies approaches. Geneva: WHO, 2023. <https://www.who.int/publications/i/item/9789240067530> (viewed Dec 2024).
- 38 Baum F, Lawless A, Delany T, et al. Evaluation of Health in All Policies: concept, theory and application. *Health Promot Int* 2014; 29 (Suppl): i130-i142.
- 39 Australian Government, Department of Health and Aged Care. National Health and Climate Strategy. Canberra: Commonwealth of Australia, 2023. <https://www.health.gov.au/resources/publications/national-health-and-climate-strategy> (viewed Dec 2024).
- 40 Byrne JA, Sipe N, Searle G. Green around the gills? The challenge of density for urban greenspace planning in SEQ. *Aust Planner* 2010; 47: 162-177.
- 41 Australian Government, Department of Climate Change, Energy, Environment and Water. Nature Repair Market. Canberra: Commonwealth of Australia, 2023. <https://www.dcceew.gov.au/environment/environmental-markets/nature-repair-market> (viewed Sept 2024). ■