mainstreaming green infrastructure in australia

Barbara Norman and **Jason Alexandra** look at three cases of recent Australian experience with green infrastructure, drawing out some challenges, opportunities and future directions

City f Melbourne

Greening techniques demonstrated through the City of Melbourne's greening laneways programme

The transformation of cities is one of the great global imperatives of the 21st century, with worldwide interest in green infrastructure as part of the climate-responsive and biophilic cities movement.[1,2] This movement uses green infrastructure's transformative potential and capacity for generating multiple benefits to enhance the form and function of urban systems.[2,3] However, there are big challenges in managing urban growth while also growing green cities.[4]

Green infrastructure is both a movement and a suite of functional, ecological and social strategies for reconnecting urban systems to the biosphere.[5] Systemic integration and management of biological elements and ecological processes – for example trees and plants, waterways and wetlands – can deliver ecosystem services, including climate modification, carbon sequestration, water and wastewater filtration, and habitat provision.[5] These elements can be incorporated with built infrastructure at a range of scales, from individual buildings – green walls and roofs, for example – through to city-wide water-sensitive urban design and urban forestry strategies and broader bioregional spatial planning – for example green belts and the protection of water catchment areas.[2]

For several generations, Australia's sprawling car-based cities have been seen as environmentally destructive, but this is changing with the adoption of green infrastructure strategies, as profiled in the next section.

City of Melbourne

Melbourne is Australia's second-largest city, with a legacy of significant urban parks from preceding centuries. These provide a strong foundation for

a new wave of urban greening based on an integrated approach to green infrastructure that aims to deliver critical action on climate change, biodiversity, and the health and wellbeing of communities. It is the multiple co-benefits that makes green infrastructure a powerful investment in liveability.

The City of Melbourne's plans for green infrastructure involve education and community involvement, demonstration projects, and long-term investment in green infrastructure.[6] Key elements are:

● The *Growing Green Guide* provides practical advice to community and business groups on the planning, design and maintenance of green infrastructure.[7] This collaboration between sub-national government, the community and a leading university is designed to build capacity within the community in greening the city.
● The greening laneways programme[8] builds on the transformational revitalisation of laneways (narrow roads, or lanes) in Central Melbourne over the last three decades. The City of Melbourne mapped laneways with greening potential given their physical attributes and sponsored four laneway projects that demonstrate greening techniques and the benefits of vibrant cool green spaces for business, tourists and locals to enjoy.
● The City of Melbourne's *Urban Forest Strategy* is a critical plank in the greening of Melbourne. The overall target of 40% canopy cover by 2040 is supported by local urban forest precinct plans developed with neighbourhood communities. For the greater metropolis, the strategy focuses on expanding tree populations from 5 million to 8 million trees over coming decades. Other major objectives include a target to improve tree health, with the aim that '90% of the City of Melbourne's tree population will be healthy by 2040'.[9]

Australian Capital Territory

Canberra, the national capital, lies inland within the Australian Capital Territory (ACT). Its higher altitude, hot dry summers and cold winters bring special considerations for green infrastructure.

The ACT Government has committed to action on climate change, legislating targets of 100% renewable electricity by 2020 (which it is on track to meet) and carbon neutrality by 2045. As part of these commitments, the ACT is developing a 'living infrastructure' (LI) plan. Canberra, often described as 'a city within a landscape' and the 'bush capital', has unique environmental qualities. However, as in many cities its tree canopy is ageing, and city managers are facing the prospect of managing this asset into a hotter and drier climate. Wildfire represents a significant risk, with Canberra experiencing a tragic event in 2003.[10] Within this

context, 'living infrastructure' needs to 'cool the city' in warmer months while not escalating wildfire risk.[2]

The first step to developing an LI plan has been the release of an LI 'information paper',[11] outlining its attributes and the broader planning context, including climate plans. Key messages for the community and decision-makers in this formative step include the following:

● Living infrastructure applies to both public and private lands.
● Four basic components are proposed – plants, open spaces, lakes, ponds and waterways, and soils and surfaces.
● Living infrastructure provides multiple benefits.

Clear targets and action on climate change frame the ACT Government's approaches. The legacy of a bush capital is highlighted by the fact that there are 800,000 trees in the ACT – twice as many as there are residents – but caring for these key landscape features requires appropriate responses to the increased risks of drought and wildfire.[11]

Smaller local councils

At local levels the development of green infrastructure appears more formative. While the term 'green or living infrastructure' is not widely used, action on waterway and landscape restoration in urban and rural areas is widespread.[12]

In many regions a major challenge is protecting coastal areas from urban development and the impacts of climate change (storms, sea level rise and coastal erosion). The Peron Naturaliste Partnership is an innovative approach to coastal protection in South West Australia, with nine councils collaborating on climate change action.[13] In this award-winning example, these largely rural councils are using green infrastructure to protect small towns and coastal villages from coastal flooding. The use of soft barriers, such as beach and dune restoration using the native flora of the coastal landscapes, is a key strategy, although in some parts coastal retreat and buyback of coastal lands is also recognised as required in the longer term.[14] As Australia is a dry continent, water-sensitive urban design strategies, including community involvement, are common within green infrastructure plans.[15]

Challenges and opportunities

Green infrastructure initiatives may be constrained by technical and institutional complexities and the embedded institutionalised procedures and rationalities of agencies with responsibilities for different elements within urban systems, such as water, housing, energy, parks, and planning.[16] Importantly, the examples profiled above demonstrate commitment to transforming the form and functions of urban systems by combining

Canberra – 'a city within a landscape'
Source: Sustainable Pathways for Our Cities and Regions: Planning within Planetary Boundaries[4]

technical and social innovations. Usefully they illustrate:

- the integration of urban planning and development with climate mitigation and/or adaptation strategies;
- institutional and professional capacity building, political commitment, and active community participation; and
- strong policy and resourcing commitments that ensure continued support for programmes and strategies with multiple diffuse benefits.

These examples demonstrate that the introduction of green infrastructure requires integration of the technical, social and governance dimensions, and the bringing together of different theoretical and practical traditions from 'new urbanism', urban spatial planning, energy, transport and water systems, and biodiversity conservation. Importantly, green infrastructure offers material and symbolic expression of commitments to address climate change, contributing to climate adaptation and mitigation strategies.

While the implementation of much green infrastructure is technically feasible, its wider application confronts many traditional and established practices within the techno-social regimes of urban systems.[2] Social and institutional dimensions and governance arrangements enable or constrain transformative techniques and technologies.[17] For example, stormwater can be reconceived as a resource for enhancing amenity through wetlands and urban forests, and while a wide range of viable and proven technologies enable stormwater to be redirected towards biologically productive uses – ponds, dams, water gardens, wetlands and soakage pits – their wider adoption requires institutionalisation and socialisation of green infrastructure thinking, learning and governance.[16,18] Therefore the transformation of urban systems requires action research focused on understanding:

- adoption processes, including the cultural aspects of transformative innovations and their social involvement and social learning strategies;
- the catalytic impacts of transformative urban strategies that concurrently address climate adaptation and mitigation; and
- the multiple synergistic benefits and ecosystem services of green infrastructure.

Given the intrinsic uncertainty about urban socio-ecological processes and the fuzziness of valuation metrics, we suggest outcome-focused guidelines or guiding design principles, because the promise that detailed ecosystem services valuation studies lead to better policy decisions appears doubtful, owing to the types of decision-making processes involved.[19]

The most important benefits of green infrastructure accrue to community wellbeing and economic gains arising from the vibrancy, attractiveness and competitiveness of 'liveable' cities. However, attempts to monetise benefits can weaken the case for green infrastructure, especially if there is a focus on narrow costs at the expense of broader benefits for individuals, the community, and the environment.

Finally, in order to overcome the frequently stated constraints on green infrastructure, we propose that it is important to learn from and scale up success stories, even if these are small in scale and local in their initial impact. From each of the Australian examples provided above, we distilled the following factors critical for success:

● leadership and champions in both the political and professional arms of governments involved, leading to high-level commitments;
● longer-term partnering with diverse stakeholders, including residents, industries and universities;
● the tying together of green infrastructure with wider programmes of urban renewal, climate adaptation and urban greening;
● a willingness to learn about and explore innovative methods of addressing core urban infrastructure responsibilities, including through pilot programmes and research and development partnerships; and
● networking with other cities and agencies with similar responsibilities.

● *Barbara Norman is the Foundation Chair and Professor of Urban and Regional Planning and Director of Canberra Urban and Regional Futures (CURF) at the University of Canberra, Australia, and **Jason Alexandra** is Managing Director at Alexandra and Associates, Melbourne, Australia, and an adjunct fellow at Charles Darwin University, Australia. The views expressed are personal.*

Notes

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8 See the City of Melbourne's 'Greening laneways' webpages, at www.melbourne.vic.gov.au/community/greening-the-city/green-infrastructure/Pages/greening-laneways.aspx

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