
Attachment: Research and Case Study Analysis Framework

Considering Costs and Benefits of Biophilic Urbanism

To investigate the costs and benefits associated with biophilic urbanism in Australian cities, the research team proposes a series of questions regarding the various stages of implementation, from 'pre-construction' through to 'construction', 'operation' and 'end of design life', as follows:

Pre-Construction:

- Was an economic case presented to demonstrate the viability of the intended installation? If so, what were the key elements?
- Was financial support received for the project (i.e. a government grant)? If so, what was the compelling element?

Construction:

- What were the direct and in-direct costs of the installation?
- Were unanticipated costs experienced during construction?

Operation

- Was an in-operation cost-benefit analysis (financial and non-financial) conducted? If so, what were the key findings?
- What was the return on investment period?
- Where economic multipliers identified and quantified for the operation of the project?
- Have studies on occupant or pedestrian experience been undertaken? And if so what were the key findings?
- What are the ongoing maintenance costs? Were unanticipated maintenance costs experienced?

End of Design Life

- Was there any consideration of hand-over or decommissioning at the end of the design life of the element?
- Were there any cost calculations that addressed end of life considerations?

Considering Policy Implications for Biophilic Urbanism

Complimentary to the investigation of the costs and benefits of biophilic urbanism, the research team will develop a planning and policy framework to inform the application of biophilic urbanism in Australian cities, considering potentials barriers, limitations, and constraints. The framework will be informed by a review of policy and planning literature, and by an investigation and interrogation of leading Australian and international case studies.

The following questions will guide the investigation of case studies:

- How was the biophilic element applied in this case study (when it was developed, and for what purpose)?
- What was (were) the principle driver(s) for the development of this biophilic urbanism element (i.e. mitigate urban heat island, mitigate stormwater runoff impacts etc)?
- What were the biggest challenges in developing this biophilic urbanism element, and how were these overcome?
- What were the greatest opportunities/benefits that catalysed the development of this biophilic urbanism element, and how were these capitalised on?
- What policy tools, planning frameworks or legislative measures were used in causing the development of this biophilic urbanism element? How effective were these policy tools?
- Did any sectors or groups benefit in particular from the policy or initiative?
- Were any disadvantaged? If so, what mechanisms (if any) were used to mitigate this disadvantage?
- To what extent has the policy and initiative been successful?
- Have there been any unexpected benefits, or consequences?
- Has this lead to the development of further policy or initiatives?

These questions will be used to capture the key learnings and considerations for policy development to enable the application of biophilic urbanism in Australian cities.

Listing of Key Case Studies

Denmark – Green Roofs (Copenhagen): Copenhagen, Denmark, has introduced a mandatory requirement for new roofs with a pitch of 30 degrees or less to be vegetated. Already, around 30 buildings in Copenhagen have green roofs, and financial assistance is being offered for the retrofit of existing roofs. This is an important case study as it shows how high level policy can provide the foundation for policies requiring the application of biophilic urbanism, such as green roofs. Copenhagen is further interesting due to the broader environmental policies, such as those encouraging cycling and pedestrian activity, which may be indirectly providing support to policy for biophilic urbanism.

Canada – Green Roofs (Toronto): The Green Roof By-Law, introduced in Toronto in May 2009 is part of the broader Climate Change, Clean Air and Sustainable Energy Action Plan, which outlines an environmental framework that sets the goal of reducing Toronto's greenhouse gas emissions by 2050. This is an important case study as the By-Law may provide a model that could be replicated in Australia, including how this was designed to fit in with other existing legislation. Further, the By-Law is based on a thorough cost benefit analysis, which may provide insights into considerations for a similar analysis in Australia.

USA - Millennium Park (Chicago): Millennium Park remains one of the most famous examples of the urban transformation of a paved parking and rail yard area into potentially the world's largest green roof, creating a 24.5 acre (close to 10 hectares) park incorporating performance venues, art, sculpture, architecture and landscape architecture. This case study is important as it is regarded as a success with economic, social and environmental benefits to the city.

USA - Green Alleys Program (Chicago): Alleyways were retrofitted with permeable pavements, high albedo pavements, proper pitching to ensure draining of excess stormwater to the street sewers, and energy efficient lights which only shine downwards towards the alley rather than up towards the sky. Since the initial pilot program in which 6 alleys were retrofitted, more than 80 of Chicago's alleys have been retrofitted as part of the program.

USA - The High Line Park (New York City): The High Line Park was developed on a disused elevated freight line on the lower west side of Manhattan, New York, and when completed will run for 2.4 kilometres and cover 2.7 hectares. The park is an important case study of a community-led initiative stimulating significant economic development and investment, revitalising urban areas, and helping create a new identity for suburbs and cities.

USA – Green Streets (Portland): The City of Portland, Oregon, has been converting traditional streets into green streets over several years, using water sensitive urban design elements such as bio infiltration pits and rain gardens built into stormwater curb extensions and sidewalks to capture and infiltrate runoff from the road and pavement. The use of vegetation throughout Portland to primarily assist in stormwater management is of key interest, as fluctuations in precipitation is a key expected impact of climate change in many Australian cities.

USA - Street Edge Alternative (Seattle): Seattle completed a pilot 'Street Edge Alternatives' project (SEA Streets) in 2001, in which residential streets were redesigned to reflect the natural drainage patterns through the use of bioswales, evergreen trees and shrubs. The program met the technical aims, however problems were encountered with verbal agreements with residents over the maintenance of the vegetation; some residents kept these agreements whilst others did not. Subsequent efforts to

engage residents were met with limited success, and in 2008 the city began to investigate alternative maintenance arrangements, making this an important case study.

Germany - Vauban Ecological Traffic and Mobility Concept (Freiburg): Vauban has extensive, connected green space throughout the district. Residents played an active role in directing and designing the development of the green space, which include intensive local food gardens, parks, old growth pockets and public green spaces. This is an important case study as it highlights the interaction between various aspects of urban environments, namely transport, green space and density, and how policy measures can be implemented to provide synergistic solutions maximising, and enabling, the benefits of all three.

Germany – BAF System (Berlin): In Berlin, Germany, new building developments are required to leave a certain proportion of the development area as green space, with the proportion referred to as the Biotope Area Factor (BAF). One key advantage of the BAF system is that it allows the developer to decide how to incorporate the green space, providing flexibility while still achieving the goal of greater city green space. This is an important case study showing an effective policy measure to increase green infrastructure and green space in urban areas.

Singapore – City in a Garden (Singapore): Singapore is highly urbanised, yet almost half of the country is covered by greenery. Singapore has had a relatively long history of urban greening through policy measures, with Prime Minister Lee Kuan Yew launching Singapore’s first tree-planting campaign in 1963. The case study of Singapore is important as it provides insights into a holistic, city-wide movement to increase biophilic urbanism through a number of mechanisms.

Brazil - Reduced Road Infrastructure (Curitiba): Alongside the now famous transportation developments, Curitiba now boasts a large network of parks and wooded areas. From humble beginnings in 1970 with less than one square meter of green space per resident, the city now provides 52 square meters per person. Residents have planted 1.5 million street trees throughout the city, while the city government provides tax breaks to builders who provide green space with developments. This sizeable case study is important for this research as it highlights the opportunity for cost effective public transport innovations that can subsequently create space for city-greening initiatives.

Korea – Daylighting an Urban River (Seoul): In Seoul, Korea, a ten-lane freeway that had been built over a major river was removed and replaced with a six kilometre long urban park that runs alongside the restored Cheonggyecheon River. The project was initiated by the local community due to widespread concerns over the health impacts from the large volumes of traffic using the freeway, and the decreasing stability of the structures. The case study is important because it highlights how community concern over the impacts of industrialisation and the lack of urban nature can be harnessed to gain traction for urban renewal projects incorporating biophilic elements.

Sweden – Minimum Green Space Requirements (Malmo): In the Western Harbour project of Malmo, Sweden, new developments are required to have an average ‘green space factor’ of 0.5, with each surface covering scoring a green rating between 0 and 1. Malmo is an important case study of a regulatory model for increasing urban green space without mandating the form this must take.

UK – Urban Greenspace Access (National): In the UK, ‘Natural England’ provides advice to the government on the natural environment, providing research and evidence of the need to provide access to urban residents to greenspace. This is an important case study for investigation as it highlights data, a process, and considerations for estimating the quantity, quality and rationale for urban

greenspace. It provides insights to a potential pathway towards policy for biophilic urbanism, and may give indications for components to be included in an economic argument for biophilic urbanism in Australian cities.

USA – Backyard Commons (National): Backyard commons are an emerging framework for creating open green spaces in urban environments by merging private, residential backyard space or reclaiming underutilised urban space such as alleyways or vacant lots. This is an important case study as it provides a model for community engagement and cooperation to enhance urban green space. It furthermore points at the multiple benefits obtained from green space, prominently including enhanced social interaction and the physical and psychological benefits obtained from daily contact with nature.

Canada - Green Links Project (Vancouver): Habitat fragmentation in Greater Vancouver was a significant problem, with population growth and accompanied urban development threatening the viability of natural ecosystem fragments in the urbanised areas. Green Links used a holistic approach involving the community and environmental education, as although wildlife habitat can be found in cities, land use decision making tends to be focused on economic, social and cultural values, and frequently does not take into account the ecological considerations. This is an important case study that details a pathway for integrating community and government to create and preserve biodiversity corridors.

Canada – Urban Forest (Toronto): The city of Toronto has a goal of increasing the tree canopy from approximately 20 per cent, representing approximately 10.2 million trees (2005), to between 30 and 40 per cent by 2055, with specific goals including to increase annual tree planting rates, and to protect and enhance the urban forest. This is an important case study as the research conducted in Toronto may provide both data and a framework for a similar investigation here. It also highlights policies and pathways towards increased urban tree cover.

Australia – City of Brisbane (Brisbane): The City of Brisbane has implemented several programs to support and enhance the urban forest and biodiversity within the city. This is a valuable case study as it is an Australian example, giving insights into the current Australian policy context, as well as public expectations and acceptance of policy related to biophilic urbanism. It is interesting as it does not appear to be based on an economic argument, suggesting that there may be a non-economic argument for biophilic urbanism that would gain traction in Australia.

Australia - Collingwood Childrens' Farm (Melbourne): The Collingwood Children's Farm in Melbourne produces food in inner city Melbourne, and actively seeks to encourage children (and adults) to get involved through milking cows, petting sheep and gardening. Weekly markets sell fresh food from the farm and directly from other farmers in Victoria, and holiday programs are offered to children to come and spend time on the farm. This is an important case study that shows how inner city areas can be used for urban agriculture, and furthermore how such urban agriculture can provide biophilic benefits to urban residents by encouraging interaction with nature.

Australia - Urban Forest Biodiversity Program (Adelaide): The City of Adelaide promotes urban biodiversity through the SA Urban Forest Biodiversity Program (UFBP), which was established in 1997 to redress the loss of biodiversity across Metropolitan Adelaide by conserving our indigenous flora and fauna. This is an important case study from an Australian city, which provides background to the policy context that will need to be considered in developing a policy framework to increase the application of biophilic urbanism in Australian cities.