



Clean Air and Urban Landscapes Hub

National Environmental Science Programme

An Urban Forest Horizon Scan in Canberra, Australia

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Clean Air and Urban Landscapes Hub

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Catherine Elliot¹, Dave Kendal¹, Judy Bush², Giuliana Leslie², Cathy Oke², Kate Auty³, Guy Barnett⁴, Cris Brack⁵, Anthea Brecknell⁶, Serena Farrelly⁷, Meg Frawley⁸, Phil Gibbons⁵, Karen Ikin⁵, Joshua Ryan⁵, David Salt⁵, Tim Sides⁹, Leigh Staas¹⁰

¹ University of Tasmania

² the University of Melbourne

³ ACT Commissioner for Sustainability and the Environment

⁴ CSIRO

⁵ Australian National University

⁶ Commonwealth Department of Environment and Energy

⁷ Office for the Commissioner of Sustainability and Environment

⁸ 2020 Vision

⁹ ACT Government

¹⁰ Macquarie University

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Clean Air and Urban Landscape Hub

The University of Melbourne

VIC 3010 AUSTRALIA

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About the Clean Air and Urban Landscapes Hub

The Clean Air and Urban Landscapes Hub (CAUL) is a consortium of four universities: the University of Melbourne, RMIT University, the University of Western Australia and the University of Wollongong. The CAUL Hub is funded under the National Environmental Science Program of the Australian Government's Department of the Environment. The task of the CAUL Hub is to undertake research to support environmental quality in our urban areas, especially in the areas of air quality, urban greening, liveability and biodiversity, and with a focus on applying research to develop practical solutions.

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1. Introduction

To support urban forest managers to plan for the future, CAUL's *Urban Greening for Liveability and Biodiversity* project team held three horizon scanning workshops in Melbourne, Canberra and Perth, Australia and a fourth workshop in Lund, Sweden during 2018.

The goal of the workshops was to engage practitioners, managers and academics in a creative process of reflection and exploration of the diversity and complexity of future opportunities and challenges facing the urban forest. Large scale challenges such as mass migration, urban densification and climate change are forecast to affect the urban forest, as well as systematic challenges in our understanding of urban forests and how they are managed and planned. By framing the workshops as imagining the city in the year 2100, participants were asked to put aside a focus on current problems, and instead scan the urban horizon for new ideas. The creative process allowed participants to reflect on new directions, to provoke and provide challenging insights, as well as to question assumptions, away from the constraints of their regular day-to-day contexts. Working in dynamic conversations, people raised ideas that were then expanded and tested by their colleagues in ways that could not have been possible in a desk-top-analysis. The collaborative workshop process provided a space for practitioners and academics to discuss unusual ideas in-depth in creative and transdisciplinary conversations.

Defining Horizon Scanning

Horizon scanning is a method employed by governments, researchers and organisations in the United Kingdom, Europe, Japan, Singapore, and Australia (Sutherland and Woodroof 2009, Rij 2008). The method offers a unique approach to tackling complex challenges that cross national borders and affect diverse groups of people, such as globally invasive species (Roy et al. 2014). Originally used to assess security concerns, horizon scanning has been used in areas as diverse as medicine, employment and artificial intelligence. The United Kingdom Foresight Horizon Scanning Centre (HSC) defines horizon scanning as:

the systematic examination of potential (future) problems, threats, opportunities and likely future developments, including those at the margins of current thinking and planning.

Horizon scanning may explore novel and unexpected issues, as well as persistent problems, trends and weak signals. Overall, horizon scanning is intended to improve the robustness of policies and to identify gaps in the knowledge agenda (derived from UK Foresight Horizon Scanning Centre (HSC) / Horizon scan Netherlands in Rij 2008)

Horizon scanning aims to identify emerging or 'weak signals' that are yet to become the focus of research or management plans. These weak signals could be signalling risks, challenges or opportunities. The horizon scanning process is creative and invites innovative ideas and bringing together otherwise separate or disparate trends and indicators. For example, Schultz (2016) suggests that issues may arise from minority groups or appear unusual as they are yet to be supported by research. By involving practitioners, researchers and other organisations, horizon scanning can be used to identify research questions and policy needs or directions. The complexity of current challenges and the rate of change means that researchers need innovative methods for assessing research priorities and understanding practitioners' needs (Schultz 20016).

Workshop Design

Many horizon scanning projects begin with a desktop analysis undertaken by a range of participants, over a period of time, to identify and collate the range of emerging issues. In contrast, this research 'flipped' the process by starting with a workshop to which a range of participants were invited, to bring the creative and collaborative elements to the start of the process. While this approach may not elicit the range of independent ideas that an individual, desktop approach could generate, it had other benefits in terms of generating creative thinking that can emerge through the clash of ideas.

The Canberra Horizon Scanning Workshop was held on a Friday before a long weekend at the Canberra Institute of Technology. The workshop was held in a room on the third floor of a building surrounded by trees, providing an outlook to the horizon with a mix of bushland and housing, an apt location to be discussing the future of our urban forest.

Participants included a range of researchers, policy makers and urban forest managers. The researchers (from the Clean Air and Urban Landscapes Hub) received minimal risk social science ethics approval from the University of Tasmania (Reference H0017323). The workshop was led by Dave Kendal, with table facilitators Cathy Oke, Judy Bush and Catherine Elliott, and note taker Giuliana Leslie, who moved amongst table-based discussions to record snippets of conversations and reflections. As the only person to hear all table discussions, Giuliana provided an invaluable understanding of how different groups tackled different topics.

The workshop space was set up with four large tables with 5-6 chairs, and participants chose where to sit in the room. On each table were large pieces of butchers paper, coloured pens and a range of coloured note pads. These were intended to move people from a formal office environment to a creative space. Photos of trees and green spaces in urban environments were hung on the walls. The diversity of images was intended to prompt reflection on challenging green spaces, every day or incidental, unplanned green spaces, different tree species and the different ways people use and interact with green spaces.

The workshop was split into sessions to focus on key steps in the horizon scanning process. The first session provided a welcome and introduction to horizon scanning processes, aims and objectives, and participants were challenged to imagine what the urban forest might be like in 80 years' time (the year 2100).

Following this, the second session focused on brainstorming issues, themes and topics. Participants at each table were asked to raise ideas, 'wild cards' and emerging issues and write them on the notepaper. These discussions included challenging participants' understandings of the future urban forest. At each table a member of the research group participated in the group discussion, noting ideas and contributing to the discussion.

During the morning tea break, the research team collected the notes from each table and hung them on the wall, and participants were invited to start sorting the notes into related themes. The themes that emerged were:

- Ecology and Biodiversity
- Design and Planning
- Governance, management and economics
- Health
- Technology, social media and the sharing economy

During the third session, a theme was allocated to each table group, for participants to explore and elaborate. Participants were invited to move around the room during this session to participate in different discussions. On each table a series of worksheets were used to guide and record the conversations. The key focus involved developing scenarios for the future urban forest related to the themes and issues.

Following the workshop, worksheets, together with the table facilitators' and notetaker's notes, were thematically analysed by the research team, to identify the common themes. The following section presents a record of these explorations, through experiments and scenario developments.

2. Emerging issues and scenarios

Ecology and Biodiversity

Diversity of tree species and age classes

When urban areas are established, many trees are planted simultaneously. This almost always leads to reduced genetic diversity, as plants are sourced from only a few nurseries, and perhaps more importantly, reduced age-class diversity, with all trees of a similar age. This can mean the whole area becomes susceptible to catastrophic loss through disease, pests, or changing environmental conditions such as drought or flooding when large areas of homogenous forests fail.

Lack of species diversity can also be caused by planting 'fashion' and trends and people's preferences such as the patriotism of planting eucalypts in the 1960s. Failure is increasingly likely given climate change, but also given natural life cycle of trees. Today, in new developments we are planting the same species at the same time, meaning by 2100 all the trees will be 80 years old and increasingly (and equally) unreliable.

How can we respond? Remove some trees early, plan for end of life and engage the community. Is there also the potential to introduce multiple vegetation layers in streets: species combinations, companion planting, shelters and management options, spatially distributed large trees or other significant characteristics?

Design and Planning

Will trees be part of our playing fields?

Increasing urban temperatures will see changes in plant species selection and the role of urban forests will alter accordingly. Increased average temperatures could lead to people going outside less, and perhaps clear, unshaded open spaces for active sports will be less suitable in the future. This could affect sports for leisure, professional sport, active kids, active health and so on. Tree and plant selection criteria for sports fields could change as a result of changing land use and changing climate. Transformation could happen with tree-lined football fields and rules of play adapted to be amongst the trees. Could the urban forest be a roof canopy hanging off structures covering the field? Alternatively, open spaces could be turned into buildings to house vertical indoor sports fields. There are likely to be large consequence for urban forest regrowth. Which sports could be played amongst the trees? Maybe football isn't the code of 2100?

The urban forest as entertainment space

Urban forest areas are increasingly important as entertainment precincts and communal places. There are changing community expectations of the role, function and the utility of the urban forest. With increasing demand for the urban forest there are growing challenges in integrating infrastructure such as electricity and transport with the urban forest. The impacts on the community of these changes are, like the urban forest itself, multidimensional. While there are local issues to be addressed, these issues are multiplied over many different urban settings.

The role of the urban forest may continue to shift with communities seeing public green spaces increasingly as a place to congregate in densifying urban settings. Within urban sprawl, the urban forest becomes a primary point for people to access nature. However, planning and maintenance needs to understand the changing types of community engagement and lifestyles, such as increasing outdoor entertainment, and the loss of access to other areas of nature.

How can practitioners and policy makers best facilitate these changes and develop an urban forest that encompasses new roles and functions? At what scale do these functions and roles need to be provided? In every green space? Or at the municipality level, aggregated across a complex and diverse urban forest?

Equity, affordable access and multicultural values

Lack of access to the urban forest can compound disadvantage, reinforcing inequities in health and wellbeing. A push for affordable housing is creating more and more basic housing developments that aren't prioritising liveability. Disadvantaged people are increasingly stuck inside in small houses without opportunities to socialise and be active. This can be addressed by minimum green space standards across all developments, retrofits etc, as well as importantly a strong communications campaign to better educate the broader public, politicians and decision makers of the range of benefits of greenspaces.

Who 'deserves' access to the urban forest and green open spaces? In the inner-city, the urban forest is used by picnic-ers and families, cyclists (both recreational and commuter), joggers, but also for 'less desirable' activities (drug use, etc); could we think of designing the urban forest to better support the dark side of green space use (for example homeless people) and to better service the community safely?

Cultural attitudes to green space differ and cultural diversity is increasing in many Australian cities. Different cultures value species and urban forest types in different ways, and there are complex differences within cultures that are not yet understood. A better understanding of how and why Australia's diverse communities value and enjoy these spaces is vital to the success of our future urban forests. These understandings could contribute to more comprehensively informed species selection, green space design and planting practices in the future. This will likely lead to an increase in the value of green spaces, increased community support for and use of the urban forest, and hopefully more diversity in the urban forest itself. In the future it isn't simply that communities will change but as the cultural backgrounds of managers and nursery staff diversify, this will itself change plantings, design and species patterns.

Who is researching our urban forests? The roles of citizen science

Improving biophysical and social data around the urban forest engenders stronger nurturing of the urban forest, and education for everyone, the young and older people. Young children and older people may be underrepresented in the process of designing research questions on the urban forest which may sway the type and scope of research we are undertaking. Australia has an aging but educated population; cultural concepts of grey nomads and active oldies are prevalent in our society, and there is an opportunity to tap into this demographic to support and generate data on biodiversity and forests for research. There is also opportunity to tap into this sector for their views, lobbying skills, volunteering. Children and youth are often excluded from social research on urban environments due to increased ethical hurdles.

Is academic research too removed from the complex and multi-faceted ways people use and interact with urban forests? Can academic research contribute to normalising observation and engagement with our natural environment?

Encouraging participation in urban forest planning and management through volunteer projects or citizen science can build a sense of ownership and capacity in the urban forest. Citizen science contributes to data collection and monitoring and increasing people's engagement with urban environments. Can academia support and embrace citizen science in research activities?

A culture of experimentation

We don't know what the future holds for our urban forests both in terms of their growing conditions or community expectations. We need continued diversity, experimentation, monitoring and learning. If we create an experimental culture we will create new options, some successful, some failing, which may help us prepare for an uncertain future. Local government and city scale experimentation could have national and international impact when replicated on a broad scale.

Without a culture of experimentation, we increase vulnerability to uncertainty (trees failing, not being able to adapt to failure or an urban forest not valued by the community). With a strong experimentation culture we learn and are increasingly reflective about what our urban forest is,

what we want from it and what's happening over time as conditions change, a community more engaged in a changing world, a community that is actively learning. An important component of a culture of experimentation is the permission to fail, to acknowledge that experiments are risky, they can't all succeed, some approaches (and some plantings) will fail. But would tree failure be unsettling for people? Would tree failure be confronting if trees are seen as stable time-markers or as indicators of the health of the local environment? Engaging people in the testing or experimentation of trees may ease this uncertainty.

Another major consideration is the challenge of adaptive management and experimentation over long time frames (and multiple policy cycles), requiring broad support and ongoing investment from government, community, industry and academia. This could also be achieved through a program of diverse tree plantings with input from community and academia, active support of a citizen science effort to monitor the results of these plantings over time and communicate the results to the broader community. A survey of urban tree plantings across Australia (and around the world) could be used to examine the diversity of plantings, which might be correlated with other measures of general resilience and provide a guide to how much capacity different communities have to deal with an uncertain and challenging future.

Governance and management

Urban forest stewardship

With changing work patterns and changes in home ownership, urban residents may spend more time as stewards of the informal public pockets of the urban forest. If this stewardship involves planting or weeding, biodiversity will be changed. Differences between groups (on the basis of green space preferences or special interest/focus) could lead to conflict over decision-making in these areas. Changes to areas that are viewed frequently, such as from train windows, may either encourage people to feel part of a place, or may be isolating for people if they feel a lack of control or connection. These reactions may be mediated through whether or not people see others caring for an area of land. There may also be conflict if people have invested in an area and it is then taken over by another group. Some spaces that are not 'beautiful', on the fringe of road ways or carparks, are important for biodiversity; if these then become parklets which are curated and managed by people, the diversity of the plantings and biodiversity may be reduced.

Sharing the urban forest

Will future urban open space be shared outdoor spaces, not individual ownership of land, for example people sharing backyards that are managed by a vegetable growing farmer across land boundaries. Trees are shared ownership by community of place (with citywide decision making about plantings), and trees are considered public rather than private, reflecting how trees contribute to increasing the property values on neighbourhood land.

Who is investing in the urban forest?

Without investment in 'natural capital' (new trees) and the maintenance of existing trees into the future, it is not only the trees themselves that will be at risk, but the soil, water, fauna and their wider role within the urban environment. We won't have enough diversity in the living infrastructure for the future. Trees continue to be lost because of urban renewal/infill subdivision in established areas. Land managers often consider trees a cost, and may not place a value on the ecosystem services they provide (mitigating the urban heat island effect, provision of amenity, mental health, tourism, biodiversity, heat refuges, etc.). If trees are not replaced, or are replaced by unsuitable species, by 2100 instead of a better urban forest there will be less urban forest and what is left may not be 'fit for purpose', or provide useful ecosystem services. Investing in the urban forest requires a long-term view across a larger spatial and temporal scale, not reliant on annual budgets and the 3-4

year political process. Short term planning increases the disconnect between people and the urban environment. Political action and decisions are made for high profile issues such as health, welfare, education at the expense of chronic underinvestment in the urban forest, which could help reduce the severity of some these issues in the long term. There are health benefits for people engaging with nature; increased understanding of these benefits may increase investment in urban forests.

Health

The urban forest as part of critical health infrastructure

Urban forests provide services (e.g. climate mitigation) that improve health outcomes, yet are not formally recognised; for example, the health department does not invest in urban green space. Lack of 'ownership' or oversight of urban open space by a diversity of agencies and a lack of recognition that it plays a central role in public health, climate mitigation or biodiversity conservation means that we are willing to trade away the urban forest as our cities grow. We wouldn't tear down hospitals to build apartments, but we are happy to build on urban open space. As populations grow within urban areas we forgo greenspace to accommodate homes, reducing access to greenspace by a greater percentage of the population. This potentially impacts population-scale mental health, physical health, opportunities for communities to meet and interact, as well as increasing the urban heat island effect and the loss of biodiversity. Less well-resourced areas of a city may not be able to maintain street trees, green spaces or treed schoolyards. However, green spaces could be reframed to be valued as critical components of a city's or country's health, energy and conservation infrastructure; advocacy and funding for green space comes from health, climate and conservation government departments and lobby groups.

What could drive change? A crisis in mental health or housing affordability, ongoing decline in biodiversity and growing urban populations. Change in policy requires an improved evidence base that demonstrates the cost effectiveness and multifunctional benefits of urban green space compared with conventional infrastructure. This type of change requires change within different policy areas, not just the agencies that directly manage open space.

Technology, social media and the sharing economy

The rise (and fall) of the clones

The use of clonal (genetically identical) plants is common practice within the horticulture industry. However, a lack of genetic diversity creates a system susceptible to changing climate, pathogens, pests and diseases. While these clones may perform well in current environments and in the face of current pest and disease loads, climate change and urban heat are increasing temperatures, and increasing the movement and virulence of pests and diseases. Genetic uniformity means that all individual plants are likely to respond in similar ways to new environments, potentially leading to catastrophic failure – as seen with the destruction of Elms by Dutch Elm Disease in many cities in the USA and Europe. In response, there is a need to increase genetic diversity of species sold within the nursery industry, and help growers and land managers understand the risks of low genetic diversity.

The end of commuting for work

If, in 2100, people no longer need to physically commute to work on a daily basis, transport corridors could be for goods rather than people. When people do travel over physical spaces, it is for recreation or fun. How does this change travel priorities and travel corridors from efficient to experiential? For example, pathways through a space for health or recreation values rather than commuting could be designed differently. Could people have walking meetings with a hologram colleague or be bike riding through different environments while taking part in a meeting?

In the future, goods, utilities and services may be sent by drones, and land around houses used for multiple smaller recreational paths. Changing land use from main road arteries to smaller paths creates opportunities for new urban forest ground cover and plantings.

Services may be provided and generated locally, rather than transported vast distances. However, there is a risk of this leading to increased inequality in access to services. The virtual meeting lifestyle may not be available for everyone. 'Communities of interest' may grow, with people in virtual communities, reducing daily incidental interactions in the physical world. Do people feel connected if there are holograms, do people feel they can understand each other and build connection and community? With people spending time in virtual worlds, is it possible to foster diversity, to encourage or facilitate diverse groups of people to live and work together?

Virtual worlds and connection with place

If we are creating virtual worlds or the increased ability to travel to exotic places, how do we still encourage people to care about the mundane, everyday areas that help create places, and make cities different from each other? Could the increased communication lead to an oversupply of normalised environments, such as English landscape type park spaces (i.e. grass and trees), or a few popular cultural interpretations of landscape.

If people are spending time through gaming or entertainment in dystopian 'end of the earth' virtual worlds, will that lead them to expect dystopian landscapes? How do virtual worlds affect how we invest in, interact with and care for local places? Do virtual worlds make us transient, with the mindset that we can move on to a new world if there is trouble in this one? Does it make us want to curate our environment and choose our own environments as we would in a virtual world? Do we prioritise colourful visual beauty over textures, smells or other plant choices? We may be superficially interacting, presuming everything to be a virtual world that we can choose when to hop in and out of.

Novel virtual ecosystems

Do novel ecosystems have to be real? Is it possible to incorporate messy habitat structures into architecture? What does it mean to create holograms of trees, insects and birds within built spaces, or to use piped sounds and smells? Could office spaces of the future be virtual, novel landscapes experienced differently by each person moving through the space. A meeting space could have a moving waterfall, mist and moss to make the space feel calm for a meeting, with virtual birds flying through the space to give a sense of time passing. One person could be sitting in a desert yurt, while others feel they are part of a jungle. How does a moving office (with insects crawling, birds flying, clouds passing overhead) change how work is done in comparison to artificially neutral office with no changes (white walls and consistent lighting).

Creating virtual nature and novel ecosystems will be influenced by social values, governance, climate and design, and will change the provision of resources for urban biodiversity. We will increasingly be designing the outcomes that we want, and we will need to take a whole of landscape approach to be able to understand how small scale changes affect the large scale social-ecological systems. This requires better understanding of the ecology of the urban forest (including plant-human interactions), and how diverse groups of people understand the urban forest so there are some broad targets and priorities.

Managed urban forests differ from unmanaged vegetation with different structure, different species, different diversities, but these patterns are also changing and will change in the future due to changing climate and multifunctional demands on the urban forest. Ecology is messy with many unknowns and complexity, which makes it unrealistic to plan for guaranteed outcomes. Interactions are complex; for example one new species can alter ecosystem services, change fire dynamics, and nutrient availability. While urban forest planning may be local, changes may occur at larger scales if replicated across different places and could affect different urban areas in similar ways.

Instagram-able green spaces and fashion plants

Social media's role in communicating urban forest spaces as desirable, fashionable, fun, popular could be an important communication tool that activates some places. Fashion is already a key driver in garden design (including 'outdoor entertainment areas'). Communications such as Instagram are already impacting daily life by speeding up fashion trends. How will this affect the urban forest, and what changes will there be in 80 years' time? Are we already seeing a drive for the next big thing, similar to fast fashion, in which landscapes are ripped out and replaced with instant gardens? Could striving for the most Instagram-worthy image lead to transient landscapes? What is the relationship with the longevity of plants and the speed of social media? How will social competition affect planting, nursery business sustainability and investment in urban forests?

Through these same social media channels, there are also opportunities for communicating about and with urban forests more widely. Through imagery, there are opportunities to connect people with urban forest places they have never visited, and to communicate place values (for example wilderness campaigning). People who might not otherwise be connected with spaces are exposed to images of their 'social' (and ecological) desirability. Crowds flock to the latest Instagram-able green space. What are the implications for planning and management of these rapid changes in use?

The topic of visual desirability, and visual performance, raises questions of equity. Parks may provide places of refuge for people on the fringe, such as those facing unemployment, homelessness, addiction, those experiencing loneliness or teenagers not at school. Green spaces are important for these groups, but will they be written out of these spaces if the focus is on visual appeal or beauty?

3. Conclusions

In attempting to glimpse the possible futures for the urban forest, insights can be gained into key current policy and research needs that will better prepare the urban forest, and its managers and users, for these future scenarios. The horizon scanning workshop provided the forum and opportunity for researchers and policy makers from a range of backgrounds to come together and for one day imagine scenarios for future forests.

These discussions generated new conceptions of future cities and the roles of the urban forests within them. Discussions pointed to both opportunities and threats for urban forests, associated with technological developments, increasing climate change impacts, globalisation and population growth. These scenarios could be further developed to identify key research and policy priorities that can better prepare our cities to capitalise on the opportunities and manage the threats. The workshop also opened possibilities for increased transdisciplinary collaborations between workshop participants and their colleagues.

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