Clean Air and Urban Landscapes Hub

National **Environmental Science** Programme

An Urban Forest Horizon Scan in Melbourne, Australia

Report of a workshop held in Melbourne, Australia, June 2018

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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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Executive Summary

A horizon scanning workshop was held in Melbourne in June 2018, with participants from academia and institutions such as City of Melbourne, the Nursery and Garden Industry Victoria and the Royal Botanic Gardens Victoria. The workshop aimed to explore the future challenges, issues and opportunities for urban forests, in the context of climate change, urbanisation and demographic changes and uncertainties.

Through a series of semi-structured activities, the following themes and future scenarios emerged as challenges and opportunities for Melbourne's urban forest:

- The urban forest is a term that is yet to be well defined in research and practice, but could form the basis of a diverse, inclusive and dynamic approach to urban vegetation management on public and private land, for a wide range of meanings, functions and services.
- Data will be important for planning and managing the urban forest effectively, but will management focus narrow to the things that are easily measured, and devalue the many aspects of the urban forest that are difficult or impossible to quantify?
- Technology will be more important, and genetic engineering could expand the urban forest's functions and services to provision of glow-in-the-dark trees and air pollution filtration, but how will virtual nature and technological nature allow for the multi-dimensional sensory nature of human nature interactions?
- Land use change in response to emerging technologies may generate new opportunities for urban greening. Fleets of autonomous cars may reduce the need for parking and distributed, wireless infrastructure could free up linear corridors, providing new space for the urban forest. Could flying cars free up roads, allowing us to "peel back the concrete"?
- Risk aversion is a major brake on the urban forest, resulting in removal of large trees and limiting new plantings; will this lead to treeless, low-risk cities? Alternative futures may embrace risk, by giving urban dwellers the 'dignity of risk' or by mitigating risk in the built environment.
- Participatory approaches to urban forest planning and management may recognise the multifunctional nature of the urban forest, and the heterogeneous communities that dwell in it. Yet how can we ensure good decision making and the inclusion of expert opinion?
- Adapting the urban forest to changing community values and attitudes is needed for success, reducing inequity and increasing access to the urban forest by diverse communities.
- Reconciliation between Indigenous and non-indigenous Australians will underpin increasing recognition and involvement of traditional owners in urban forest management.
- The environment will continue to change, with increasing risks from hotter temperatures, rising sea levels and storm surges. Adapting to these changing conditions could also create unintended consequences if the effects of species change on urban forest meanings, services and ecologies are not well understood.

The key recommendations for policy and management to better plan for the future urban forest are:

- Manage and plan at the urban forest scale, rather than the individual tree scale.
- Plan for future social and biophysical environments, rather than past ones. Learn from success and failure.
- Increase diversity to reduce future risk – including genetic, species, age-class diversity, and cultural meaning.
- Increase participation in urban forest decision making to better represent the diverse views of the community.
- Foster capacity within land managers to better plan and manage the forest, through internal resourcing and collaboration across management authorities.
- The multifunctional benefits of the urban forest need to be acknowledged and managed.
- Facilitate acceptance of risk in the urban forest.

New research questions to help smooth transition to future urban forests include:

- Increase social science research on public opinions, attitudes and values of the urban forest and its management.
- Understand the effects of artificial lighting on the urban forest.
- How can we use the urban forest to reconnect people with nature, and increase the acceptability of risk from natural systems?
- How can we have a dense city and an outstanding urban forest?
- What will the outcome of using 'climate ready' tree species be on urban forest meanings and ecology? Understand the effects on the urban forest of other dimensions of global environmental change such as sea-level rise.
- How can we secure water for irrigating the urban forest?
- How will pests and diseases change in future environments and future regulatory environments e.g. banning insecticides.

Contents

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 sperate 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.

Participants included a diverse range of people working in the urban forest space in Melbourne. 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, Cristina Ramalho 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 venue chosen for the workshop had high ceilings and an open spacious layout. The elevation of the room meant that people were literally looking out at the 'horizon' and this, together with the sunny weather, gave the workshop a positive atmosphere. 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 four main sessions. 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:

- Definitions and meanings
- Technology
- Design, engineering and planning
- Governance
- Economy, society and culture; attitudes, values and benefits
- Ecology and biodiversity

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.

The final session, following lunch, focused on identifying current research and policy needs and priorities by backcasting to the present day from the scenarios developed in the previous session. The aim of this final session was to consider the implications for policy, management and research of the issues raised.

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. These are discussed in the following sections.

2.   Emerging issues and scenarios

Defining and understanding the urban forest

At the start of the workshop, some participants were interested in defining and understanding the use of the term 'urban forest', and pointed to a lack of clarity when compared to terms such as 'resilience' or 'sustainability'. These latter terms were seen as related as they 'traverse policy to onground actions but [the urban forest] lacks the clarity and body of evidence'.

Understandings of the urban forest were broad and not restricted to trees, parks or street plantings. Urban forests were seen as diverse: both intentional plantings, seed dispersed plants, plants owned by people and also those 'un-owned', ornamental plants and those that are food producing, fungi and large trees. People are part of the forest, and the forest is in part determined by cultures, heritage, politics and population movements including who created the urban forest and who owns it. The 'meaning' of the urban forest is changing and will continue to change over time. One example is the current interest in food security from the urban forest.

Interestingly, there were few comments about the context of the urban forest, the city itself. While, the workshop was focused specifically on *Melbourne's* urban forest, there was little mention of Melbourne's buildings, urban planning, streetscapes, landmarks, land features, weather patterns. Similarly, there was little reflection on which parts of the forest have survived the last 100-200 years or longer. Future changes were considered, framed by discussions of lifestyle patterns, service provision, governance, rights and values.

Technology

How are technologies affecting people's relationships with nature and biodiversity?

Technologies could facilitate the creation and curation of new habitats, such as Singapore's Gardens by the Bay. But these new opportunities also present challenges: how will unplanned interactions and nature experiences be presented and valued? How will the aesthetics, smells, sounds, tactile sensations and emotional connections be allowed or planned for in these built habitats? Workshop participants considered the implications of artificially managed habitats for people and human-nature interactions:

> *Will new habitats like Singapore's create new connections with nature or replace living trees*?

Virtual experiences of nature are likely to become more important in the future and may have positive psychological health and wellbeing benefits. They could allow people with limited physical mobility to experience diverse environments through visual images, sounds, smells and the sensation of touch. However, how we interact with different environments is culturally mediated, for example people have different aesthetic and emotional connections to groundcovers, to the physical sensation of lying on grass or rocks. How does the creation of artificial habitats interact with our ability to learn in environments, and our socio-cultural interpretation of different environments and physical sensations? And will the push for a more sanitized world increase the separation between people and their environment, particularly during childhood?

Artificial intelligence will play an increasingly important role in the future urban forest, and from several perspectives. In understanding the urban forest needs of the future, there is still much we can learn from plants about how they communicate and send messages. For instance, little is known about their communication through sound vibrations. Micro monitoring sensors will be able to identify when trees or plants on walls or green roofs need resources such as water or sunlight and be able to remotely target delivery through drones, a drip-fed system, moving shade or even moving the plant themselves. The development and use of these sensors and the managed environment

raises questions about how trees and plants communicate, adapt to live in unusual or extreme conditions and our role within that 'conversation'.

While plant breeding has a long history of genetic manipulation to promote ornamental and environmental traits, dramatic and rapid changes in the genetic engineering of plants could lead to new traits such as 'glow-in-the-dark' trees, or plants that can even more effectively remove pollution and therefore manipulate environmental conditions.

Data

Reliance on data or remote sensing of environmental conditions could have perverse outcomes, for instance where the focus on known models of the environmental benefits of the urban forest limit the generation or identification of new or unexpected benefits.

> *When data drives the conversation, we manage for the data that is available, for example if a sensor detects a tree branch has fallen and automatically sends a person or piece of equipment to 'clean up' the broken branch, how does the loss of the rotting branch impact potential habitat for small animals and insects.*

Not all values of the urban forest are recognised and quantified in currently used frameworks. Many benefits are difficult to quantify or not recognised in a quantifiable way and therefore not included in decision making or are outweighed by other quantifiable issues.

> *[What happens if] ecosystem services are quantified into economic value, without cultural and social dimensions, without ways to measure those dimensions then they aren't planned for, when we only focus on measurable data we create a perverse outcome, [rather we need to consider] what data would we want to have in 100 years' time?*

Roads and wires were 20th century ideas: autonomous flying cars and future utilities

Currently, cities are framed by and planned around transport and utilities through and along road corridors. There are likely to be dramatic changes to this approach as systems become more decentralised, self-contained and wireless – this could potentially have a large positive effect on the urban forests as space becomes available both on the surface ("peeling back the concrete"), underground and in the air:

> *What if by 2100 wired energy, internet, services (water, sewage) were replaced by wireless technology and nodes, an apartment or block of space might generate their own energy, be connected wirelessly and source and recycle their own water and sewerage. Buildings would have bigger building footprints, loss of privately owned cars and an increase in public transport, batteries leading to shared systems of energy transfer, transitioning to energy provision for the masses, community solar hubs, physical buildings capture solar.*

Trees in nature strips currently do much of the 'heavy lifting' in providing urban ecosystem services. Large street trees increase urban canopy cover, provide cooling and shade. With changes in the use of public road spaces, including air space, what would this mean for the urban forest and particularly for large street trees? The rise of vehicle automation and car sharing could lead to roads becoming service spaces no longer dominated by cars, particularly parked cars. Autonomous vehicles might be shared rather than individually owned, constantly circling (similar to public transport), and parking in compact sidings to be used on demand, or be able to be shrunk on command. Car parking spaces may no longer be needed on streets, or even in car parks and garages.

> *Current lifestyles are two dimensional. In the future flying cars pose three dimensional challenges in terms of competition for space, pursuit of technology at the expense of tall trees or the height trees are allowed to grow. In the future, what if tree height was being determined by flying car pathways?*

If we no longer need roads for transport then how does our physical space change? If roads aren't dominated by the need to move between two locations, if we instead travel for health, recreation or social reasons how would the design of these spaces change to reflect the changing preferences?

Design, engineering and planning

What if physical buildings and spaces were flexible or adaptive like plants?

In both public and private landscapes, trees, and particularly large trees, have been increasingly perceived as a risk to both human safety and the integrity of infrastructure. Governments are often risk-averse leading to pressure for removal of large trees across Melbourne, and people avoiding planting new large trees. If this current trajectory of risk aversion persists, could Melbourne become a treeless city by 2100? What if that framing was reversed and infrastructure was instead designed to minimise risk: beds could be made with reinforced canopies to prevent injury from falling trees. What if buildings have airbags big enough to stop a tree or roof trusses had a crumple zone? How do we learn to live with risk so we do not create a too highly controlled or sterile urban environment?

Another approach would be to embrace risk. How can we allow, or even encourage people to take risks in the society of 2100? The urban forest may be a key facet in allowing and encouraging our future urban citizens to take risks: by climbing trees or getting their hands dirty. And how can this be communicated to risk-averse insurers and engineers? In aged and mental health care there is a movement towards allowing people being cared for the "dignity of risk", and to avoid overprotective care. Can these ideas be translated into the urban forest realm?

Governance

Balancing intrinsic, intergenerational and private/public rights

In Melbourne, individual private interests and concerns often prevail at the expense of the urban forest and the needs of present and future communities. Decisions, particularly those related to safety and risk management, are often focused on or limited to single trees, with the cumulative negative impacts on cooling, flood risk, environmental quality, biodiversity and human health and wellbeing overlooked in the decisions to remove individual trees.

> *Trees are guilty until proven innocent through rarity or significance.*

Plants, ecosystems and landscapes are not valued intrinsically or given rights of their own. In 1972, Christopher Stone asked 'Should trees have [legal] standing?'. This idea has yet to take hold, but in 2018 rivers, glaciers and mountains were given legal rights in New Zealand and India. By 2100, could trees have achieved legal standing?

> *A desirable scenario could be a citizen's jury executive for managing the urban forest, removing division between public and private interest, removal of property rights and instead joint custodianship. Rights of the forest [and] public food outweigh the rights of a private individual.*

There have already been rapid changes in the public/private interface and composition of Melbourne's urban forest in response to densification, increasing house sizes and changing cultural identity. These changes are likely to continue, perhaps increasing the reliance on dwindling public open space. When the consequences of decisions about trees will have implications for future generations, how do we bring explicit consideration of intergenerational equity into planning?

Managing the future urban forest and increasing participation

There has been a shift from an expert arboricultural view of planting the 'right tree in the right place' to more participatory processes and greater involvement of the community in urban forest decision making. This is likely to increase, with less centralised planning and more individual or local power. Codesign will become more common in the future. However, there are many challenges to effective public participation in the urban forest. For example, how are the complex and plural values of the public incorporated into decision making? This leads to allied concerns about inadequate knowledge and skills in the community, and therefore poor-quality data and decision-making.

What is the role of citizen science in monitoring the urban forest? Potential for inaccurate data, poor analysis in contrast to capacity building, learning, sharing knowledge, open access data stewardship, intergenerational, leveraging skills.

The transition away from the arboricultural model of urban forest management with a focus on street and park trees and expert knowledge raises many new challenges for management. The urban forest is fragmented – in a literal sense but also by its location across the public and private realm, and across land owned and managed by a diverse group of public agencies and private entities. This fragmentation is likely to increase, encompassing more vertical heterogeneity (green roofs and facades) and different kinds of uses, including an increased need for community gardens in a denser city. Will the increasing number of residents of high rise developments demand views of greenery?

Economy, society and culture; attitudes, values and benefits

Change in communities, values, ownership and mobility

Communities are also changing rapidly; the global movement of people and plants can change urban forests, as much through shifting ecological ideas and cultural perceptions as through changing species compositions.

Cities as experimental labs where global and local issues interact in a myriad of ways and quickly demand addressing, education is important to help people adjust to the fast evolving reality of urban environments which in the era we live are ever changing.

People's reactions to the same trees and environments can be strongly positive or strongly negative, and are particularly polarised for certain species and issues. As urban demographics change, planning for the future is more challenging. We need to better understand the meaning of different species for different people, the emotional connections people have with species, and how these might be changing.

Shifts towards a post-industrial society have also led to increasing environmental values and increased mobility that is changing the relationship between the global and the local, increasing homogenisation and reduced differentiation between places. While these trajectories are likely to change, the importance of utilitarian values for urban nature is likely to decrease, and other emotional and spiritual dimensions increase. Private stewardship of the broader urban forest will become more important as these value shifts combine with reduced private open space and higher density living.

Are we embracing or resisting these changes (opening or closing borders) and the movement of people and plants? Change seems inevitable, with the introduction of new plants, disease invasion, developing new of 'novel' ecosystems and streetscapes.

Equity is also an increasingly important consideration for urban forest managers. This has many dimensions including reconciliation (sharing, Caring for Country), access (affordability, distribution), recognising non-human (legal rights) and decision making (community knowledge, participation and engagement). There are potentially serious social and ecological consequences if equity and power relations are not thought through or dealt with adequately. Equity underpins engaging and addressing human and non-human rights, diversity of opinions, cultural beliefs, economic status and the provision, location and quality of housing.

We anticipate large technological changes in future, but our perspective towards trees and the urban forest seems to assume that the capacity and function of plants and trees will remain the same as it is today. Yet perhaps plants will adapt and change in ways that some have speculated is within their capacity, such as suggested by Peter Wohlleben in 'The Hidden Life of Trees'?

Reconciliation between cultures and with non-humans

Ownership of the urban forest will increasingly be recognised for Australia's traditional owners such as the Boon Wurrung and Woiwurrung (Wurundjeri) peoples of the Kulin Nation in Melbourne. Dedicating time for building trust and understanding between Indigenous and non-indigenous peoples is important, as well as cultural competency training embedded in urban forest education and in organisational training. This will lead to changing terminology in the urban forest and place stewardship, and incorporation of different kinds of knowledge and values into urban forest planning and management. Language and communication will need to change, reinforcing the power of ideas and values. 'Custodianship' includes concepts of cultural preferences, Indigenous knowledge and responsibility, care and protection.

> *Can the urban forest be a site of decolonisation? Can the urban forest be part of reconciliation efforts towards Indigenous culture, reinstatement and giving back of land? Can we have native title for urban areas? What if there is a constitutional referendum for Aboriginal sovereignty and environment?*

How might our interactions change if the Uluru Statement from the Heart is broadly adopted by organisations around Australia or by the Federal Government? Examples of new ways of formalising environment and Indigenous people's rights include *Advancing the Treaty Process, Yarra River Protection (Wilip-gin Birrarung murron) Act 2017, Uluru statement from the heart*[1], and New Zealand's legal rights for the *Whanganui River*[2].

Governance timeframes need to be stretched to match custodianship timeframes that require longer term thought and planning. Indigenous participation requires expanding approaches to participation in decision making, based more on relationships than merely consultation.

The tree or the forest? Meanings and values

Communities are complex, and people's preferences and attitudes vary from person to person and from tree to tree. There are tree phobias and tree obsessions. Some people are afraid of trees in general or certain trees or tree species in particular. Attitudes and values have shifted over time, including towards preferences for native trees and productive trees. Discourses shift with social changes (e.g. mobility, cultural diversity) and environmental changes (e.g. urban heat and climate change). The 'rightfulness' (or righteousness) of selecting native species for urban plantings in places can bring sclerophyllous, highly flammable plants close to residential areas. With increasing temperatures and declining rainfall, will this create increased fire risk for urban and peri-urban areas? On the other hand, native trees can increase sense of place, contribute to connection to land, as well as make meaningful contributions to biodiversity conservation and ecosystem function, and provide habitat for native animals.

The range of attitudes, values and meanings associated with the urban forest is increasing, or at least some previously 'hidden' values and meanings are emerging in more public ways. These meaning and values are being shaped by changing social-ecological dynamics, such as increasingly dense urban lifestyles and increasing knowledge of urban biodiversity.

> *The costs of the loss of urban forest in cities will be greater than is currently understood, as the benefits of the urban forest are poorly defined and understood. This is particularly true in the context of a changing social-ecological context, such as the densification that is occurring in Melbourne. Community valuations and perceptions of urban vegetation do not reflect all the tangible and intangible benefits of the urban forest. There are obvious benefits from better valuation and understanding of multifunctional values of the forest.*

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[1] https://www.referendumcouncil.org.au/sites/default/files/2017-05/Uluru_Statement_From_The_Heart_0.PDF
[2] https://www.theguardian.com/world/2017/mar/16/new-zealand-river-granted-same-legal-rights-as-human-being

Ecology and biodiversity

The effects of climate change and urban heat on the urban forest are not just distantly viewed 'on the horizon' – they have been happening in Melbourne for the last 20 years. They have resulted in droughts and water restrictions and increasing temperatures that have led to some species starting to disappear from Melbourne's landscape and new species appearing. Recent research by CAUL has provided a template for managing the risk of increasing temperatures and identified opportunities in new species that may be better suited to future climates.

However, we have yet to fully comprehend other effects of climate change. Management responses to climate change could lead to maladaptation where drought tolerant species provide less shade and less cooling through evapo-transpiration leading to increasing urban temperatures. Sea level rise and storm surges are likely to have significant impacts near coastal zones, as well as loss of coastal open space and trees near the coast. More substantial effects could be caused by interactions with groundwater through intrusion of saltwater into freshwater aquifers and rising water tables. Environmental change may also have positive outcomes if for example, elevated CO_2 levels lead to increased vegetation growth.

3. Policy and management priorities

A variety of urban forest policy and management issues were identified as helping to set a trajectory towards better outcomes for Melbourne's future urban forest:

1. What is good for the tree might not be good for the forest

Goal: Moving away from managing individual single trees to whole forest systems

Management of individual trees without consideration of forest-level effects can have large negative implications for forest structure and diversity. Maximising the health and performance of individual trees (and reducing risk) can lead to early removal which can reduce canopy cover, age class diversity and habitat structure. Tree planting and removal programs should explore (and model if capacity is available) the cumulative effects of individual tree decisions on species and age-class diversity, habitat/resource availability and total canopy coverage. Individual trees can have substantial (disproportionate) value to the community and as habitat; social and ecological surveys can be used to identify this. Forest-level planning is also critical for the provision of ecosystem services, such as slowing floods from storms, and providing cooling.

2. The future urban forest will be different to the historical or current urban forest

Goal: Plan for the future city

We are increasingly realising that future environments will be different enough to challenge the persistence of some, if not many species. While adopting more 'climate ready' species is needed, this cannot be the only approach to tree selection and removal decisions. For instance, species may be 'climate suitable' but not be suitable for a site's specific sunlight or water availability. Culturally or ecologically important trees may be worth preserving and replanting for many years, irrespective of climate suitability. Uncertainty and adaptability need to be built into decision-making: we should allow some species that do not appear to be climate suitable to be planted. There is still much we do not know about the suitability of species to future climates – perhaps we should randomly choose some species to trial. We must also learn from successes and failures of particular species, cultivars and provenance selections. Publicly managed spaces such as the Royal Botanic Gardens Victoria have important roles in bringing, curious, strange and surprising plant experiences to people.

Beyond temperature, there are many other risks and changes we can anticipate now. Sea-level rise and more extreme weather events such as storm surges and bushfires are likely. Social and urbanisation trends are also apparent: population density, cultural diversity, participation in public decision-making are all increasing in Melbourne. In high-density cities, perhaps any plant is better than no plant. Urban forest planning needs to adapt to these new realities, including succession planning to stage transitions to new realities.

3. Diversity is key

Goal: Increase diversity of the urban forest

Increasing diversity is a well-known strategy for managing risk in the urban forest, particularly from pests and diseases. Diversity is also a key plank of resilience thinking, where response diversity and functional redundancy increase the chances of functions being maintained in a system with an uncertain future. Response diversity occurs when the same species respond in different ways to external stressors, such as increasing temperatures. Functional redundancy occurs when more than one species performs the same function, reducing the likelihood of catastrophic loss from external shocks. While the benefits of taxonomic diversity are fairly well understood, age-class diversity is also a critical component of whole-of-forest planning to avoid catastrophic loss of canopy and ecosystem services due to many trees senescing together. Urban forest planning should consider increasing diversity in species (and other taxonomic levels), age-class, location, habitat, and also other functions and services such as aesthetics and cultural meaning.

4. *Alone, we no longer know what is best for the urban forest*

Goal: Identify who should be included in decisions about the urban forest, and include them!

With large scale changes likely, how can the governance of the urban forest be adaptive to change when governance and management is fragmented across jurisdictions? The scale at which the urban forest is managed is important for the health of the urban forest.

An established practice in urban forestry is of arboriculture experts choosing the 'right tree for the right place' but this does not take account of different opinions on what makes a tree the 'right' one. While arboriculture attitudes such as good growth form and tolerance of available conditions are still important, the community values trees for many different reasons. While we may make assumptions about aesthetics and heritage values, we cannot really know the meaning of trees to a particular community without speaking with them. Particular species have special meaning for some cultural groups, and the same species can have different meanings for different groups in the community.

Perhaps more importantly, community engagement can be used to foster greater support for urban forestry programs. Many of the future forests imagined in these workshops are dystopian, and draw on assumptions about the fears people might have about the urban forest. Engaging with the community in urban forest decision-making is a pathway to avoiding some dystopian futures, such as the absence of trees due to concerns about public risk. Engaging the community is potentially a pathway to increasing people's connection to nature in our densifying cities.

5. *The way we did things is not the way we will do things*

Goal: Increase management capacity and capability

How do we allow the forest to drive change, rather than new technology justifying changes to the urban forest planning? How do we prioritise planning for the urban forest in a constrained resource and capacity environment? New innovations, such as flying cars, pose both opportunities and challenges including social justice and ecological conflicts over access to air space. Urban densification through vertical living will affect our access to sunlight, drones and flying vehicles could also affect sunlight availability for forests.

Many of the aspirations for a healthy and resilient future urban forest can be achieved if land managers have sufficient capacity, capability and resources. Some larger councils and land management organisations may have these: they can model future social and ecological environments, engage the community, plant many trees and monitor biodiversity. However, this may be beyond the reach for less well-resourced land managers, yet ensuring adequate capacity, capability and resources will help achieve better outcomes for the whole city in the future.

6. *What the forest will do is not what it once did*

Goal: Acknowledge and manage multifunctionality

Urban forests have typically been planned, governed and managed by single purpose organisations, for a few related benefits (e.g. amenity). Future urban forests will have more competing demands both for ecosystem services and from diverse groups within communities. How can policies from single purpose-focused institutions embrace the multiple meanings and values of the multifunctional urban forests?

7. *A riskier future*

Goal: Increasing acceptance of risk in the urban forest

Current risk-averse trajectories could lead to a treeless future. How can we plan and manage urban forests that permit and even embrace risky landscapes, particularly those containing large trees? Can we build risk mitigation into the built environment? How can we communicate risk, and the benefits of risk at the urban forest level rather than the individual tree level.

4.   Research priorities

1. Urban forest meanings and cultural values

Future planting decisions could be supported by more and better social science research to understand urban forest meanings, particularly for different cultural groups, participatory research that gives voice to different perspectives, and applied research with decision makers. Consider the experience of walking or lying on the ground, the 'ground' could be a lawn, grass, sticks, mud or dirt, a different kind of space (the ability to sit or lie down) and visual plane (long range perspective or closely packed, dense foliage), these provide different forms of comfort and discomfort. How can we reconnect people with the biosphere through the urban forest?

2. Artificial and indoor lighting for healthy plants and people

With increasing urban densification, how will artificial lighting affect the cycles of plants and animals? Will there be advances in genetic modification of plants and how they respond to light or in how sunlight is provided to plants in indoor environments?

3. Algae and fungi

When we consider the urban forest, it is not only plants and trees but also fungi, mould and algae. Investigations are already underway on algae's potential for food, biofuel and energy. Pushing this question further, what if wall structures were more porous to nature, if future structures were living walls of algae or fungi? Instead of putting a hanging climber on the wall, the wall itself could be a living plant. There are negative messages related to health risks and mess, yet there may be some algae or even mould species that bring wellbeing. Bringing surprise and excitement of the unknown into public spaces has benefits for community engagement and wellbeing.

4. Densifying cities and space for the forest

How can we accommodate more people in urban environments and still have an outstanding urban forest? How can we build in vertical living for people and plants while retaining the connection to ground spaces? What can we learn from looking to examples from overseas: Vienna, Barcelona, Chinese cities? Similarly, how can we increase the acceptability of risk to land managers and the general public? How much risk will the public tolerate?

5. Environmental changes

How will continuing environmental change affect the urban forest? How will changing to 'climate ready' tree species affect the meaning and ecology of urban forests. Sea level rise, and residual salty soils from storm surges, threaten to damage current trees. Research is needed to understand change for plantings, how coastal areas can be restored, which trees are adaptable to salt or the use of marine plants that can live in the sea, and novel ecosystems in urban environments such as mangroves.

6. Water

Securing water availability is a key question for the future urban forest, capturing run off water reduces flood risk and can be used for green space management and to fight fire risks. However, not all land managers have the capacity to invest in waterway health and run off capture; research is needed to plan for large scale water management.

7. Pests and diseases

With increasing globalisation and changing climate patterns, the spread of pests and diseases affecting the urban forest will also change, requiring rapid diagnostics and diversity within the urban forest to ensure resilience to threats. For example, these changes may mean inability to use certain insecticides in the future. Similarly, climate resilient species may be restricted from importation due to biosecurity concerns.

5.   Conclusions

The workshop generated active and engaged discussions amongst participants on future scenarios for urban forests, threats and opportunities, as well as key priorities for current research and policy to better prepare for uncertain futures. The workshop created a forum for researchers and policy makers to meet and discuss interests and ideas, as well as opportunities for further collaboration as part of potential transdisciplinary and integrated research and project implementation.

Key concerns for policy and research to address the scenarios focused on recognising and deepening understandings of urban forests as complex systems, both ecologically as well as socially and politically. Developing research understandings and policy responses that address the urban forest system's diversity and resilience, and that engage with urban forest management capacity and capability are key priorities.

6.   References

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