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Stakeholder perspectives on the role of the street verge in delivering ecosystem services

A study from the Perth metropolitan region

Clean Air and Urban Landscapes Hub

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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 by the Australian Government's National Environmental Science Program. 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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Acknowledgement of Country

We would like to acknowledge that this research, conducted as part of the Clean Air and Urban Landscapes Hub, has taken place on Country belonging to the Whadjuk Noongar people of the Noongar Nation in Whadjuk Boodja (country), metropolitan region of Perth.

We respectfully acknowledge the sovereignty of all of Australia's first peoples, their ancestors, and Elders, past, present and emerging and that their lands and waters of Australia have never been ceded.

Foreword

This publication has arisen from [Project 6](#), one of the seven projects conducted within the Clean Air and Urban Landscapes Hub, which aimed to establish a network of urban greening study sites across Australian urban centres to understand and measure the multiple benefits of urban greening, focussing on outcomes for biodiversity, culture and human health and wellbeing. An important output from this project is to share the methods and approaches that can be adapted by researchers and practitioners for future use at urban greening projects at a range of different sites and scales. The use of a network of study sites has provided opportunities to study the process of how urban greening initiatives are implemented, how to study them from a socio-ecological perspective, and how or why they are successful. This knowledge can inform future urban greening projects and research designed to understand the benefits and outcomes. In doing so it will provide an evidence base and methodology for measuring and understanding social, cultural and biodiversity benefits of urban greening initiatives according to landscape context, and scale.

The report was produced in concert with a companion report investigating residents' values of native verge gardening titled *The social and ecological values of native gardens along streets: A socio-ecological study in the suburbs of Perth* (Pauli et al., 2021). Together the two reports present the views of major stakeholders in the greening of Perth's urban streetscapes. This knowledge can inform future urban greening projects by highlighting potential benefits, challenges and outcomes.

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Table of Contents

Executive Summary	vii
1 Introduction	1
1.1 Ecosystem services and urban nature	2
1.2 Planning for greenspace and urban nature.....	4
1.3 The evolution of the verge: from neglected to contested	5
1.4 Analysing stakeholder interactions with social network analysis	7
1.5 Research aims.....	7
2 Methods	9
2.1 Case study characteristics	9
2.1.1 The Perth Metropolitan Region: Biophysical and cultural setting	9
2.1.2 Governance context	12
2.1.3 Identifying and categorising stakeholders	12
2.2 Data collection.....	15
2.2.1 Semi-directed interviews of key stakeholders	15
2.2.2 Local Government Authorities as a unique stakeholder category	16
2.3 Data analysis.....	17
2.3.1 Interview and stakeholder social network mapping analysis	17
2.3.2 Stakeholder network mapping	18
3 Results and key findings.....	19
3.1 Policy and governance of verges	19
3.1.1 Synthesis of LGA policies on verge gardening.....	19
3.1.2 The influence of increasing urban density and loss of private green space	26
3.1.3 The role of the individual in driving policy and behavior change	29
3.1.4 Particular issues of policy contention for verge stakeholders	31
3.2 Networks and relationships among verge stakeholders	34
3.2.1 Stakeholder network characteristics.....	34
3.2.2 Information and resource sharing within networks.....	36
3.3 The values of street verges.....	37
3.3.1 Functions of street verges	37
3.3.2 Ecosystem services of vegetated verges	39
3.3.3 Verge size, scale and social-ecological connectivity.....	50
3.4 The process of transforming verges with native plants	55
3.4.1 Inspiration and motivation.....	55
3.4.2 Resources required.....	58
3.4.3 Species selection	60
3.4.4 Enabling factors supporting residents to undertake verge native gardening	64

3.4.5 Barriers in undertaking native vegetation planting along verges	70
3.4.6 Perceived risks associated with native verge greening.....	75
3.5 Changing trends in verge greening.....	77
3.6 An ‘ideal’ verge	82
3.7 Future preferences.....	84
3.7.1 LGA policies and management.....	84
3.7.2 Other issues.....	86
4 Conclusions, recommendations and further research	88
4.1 Key findings and recommendations	88
4.1.1 Policy and governance of verges	88
4.1.2 Verge stakeholder networks	89
4.1.3 Stakeholders’ valuing of verges.....	89
4.1.4 Stakeholders’ views on verge transformation with native plants.....	90
4.2 Further Research	91
4.2.1 Design, species selection and maintenance.....	91
4.2.2 Information sharing.....	92
4.2.3 Quantitatively assessing change in ecosystem service provision	92
4.2.4 Financial evaluation of the provision of ecosystem services	92
4.2.5 Understanding community preferences	92
4.3 Conclusions.....	92
References	94
Appendix 1: List of contributing stakeholders.....	98
Appendix 2: Stakeholder interview question guide.....	99
Appendix 3: Short questionnaire role of urban street verges	101

List of Tables

Table 1: Stakeholders directly involved in determining the regulations for verges	12
Table 2: Categories of stakeholders and example participating organisations with their role	13
Table 3: Ecosystem services potentially provided by urban verges.....	15
Table 4: Criteria used for classifying LGA Verge gardening ‘adoption status’	17
Table 5: Themes used for coding interview material in NVivo	18
Table 6: Selected characteristics and urban greening policies of Perth metropolitan LGAs	21
Table 7: Permissible verge treatments across LGAs in the Perth Metropolitan Area.....	22
Table 8: Overview of verge transformation information and incentives.....	24
Table 9: Snapshot of incentives offered by Perth LGAs for residential native verge gardens, 2019	68

List of Figures

Figure 1: Examples of some ‘typical’ verge treatments in suburban Perth	2
Figure 2: Illustration of categories of ecosystem services	3
Figure 3: An example of a ‘living swale’ in a median strip	4
Figure 4: Street views of medium-density developments in suburban Perth.....	6
Figure 5: Map of the Perth metropolitan region and LGA boundaries	11
Figure 6: An ‘interest-influence’ conceptual schematic for stakeholder categories	14
Figure 7: Relative importance of verge functions for all stakeholders combined	38
Figure 8: Relative importance of verge functions for LGA online survey respondents	38
Figure 9: Perceived importance of verge ecosystem services, all stakeholders	40
Figure 10: Perceived importance of verge ecosystem services, online survey of LGAs.....	40
Figure 11: Perceived importance of verge ecosystem services, per stakeholder category.....	41
Figure 12: Stakeholder rating of factors motivating verge gardening by Perth residents.....	55
Figure 13: LGA respondents’ rating of factors motivating verge gardening by Perth residents.....	55
Figure 14: Envisaged demand by residents for native verge garden support and incentives.	59
Figure 15: Stakeholders’ perceptions of factors influencing understorey species selection.....	61
Figure 16: LGA perceptions of factors influencing understory species selection	61
Figure 17: Stakeholder perceptions of barriers for residents to use native plants on verges	71
Figure 18: LGA perceptions of barriers for residents to use native plants on verges.....	71
Figure 19: Significance of barriers within LGAs to planting native species on street verges.....	72
Figure 20: Relative frequency of complaints fielded by LGAs relating to street verges	75

Executive Summary

This report documents the views of a cross-section of stakeholders on the functions and values associated with urban street verges, in the Perth Metropolitan Region. In this report, we refer to street verges as the area of land between the road reserve and the front boundary of the adjacent residential property. In Australia and the case study city of Perth, verge land is generally owned by the Crown and vested with the Local Government Authority (LGA). Residents are usually responsible for managing the verge understorey vegetation in front of their property, while LGAs are generally responsible for managing street trees. Various State Government authorities manage the vegetation along major road and train arterial networks. In addition, verges provide space for multiple essential utility services, as well as footpaths and other assets linked with public mobility (such as bus stops and cycle paths).

Ecosystem services are a means of categorising the societal benefits provided by ecosystems into a range of services underpinning human health and well-being. In urban contexts with growing population density, attention has turned to previously neglected, ‘in-between’ public spaces as offering potential to support greater ecosystem services.

Roadside vegetation on street verges can play an important role in contributing to urban ecosystem services and public greenspace. While the majority of residential street verges in Perth are covered with grass, sand, mulch, or gravel, a steadily growing number of residents are converting their street verges into low-growing gardens, often using native plants. The consequences and impacts of these ‘verge conversions’ have not previously been explored across all potentially affected stakeholders. Street verges represent a unique area of potential contention given the variety of functions and interests inherent in this strip of public land.

The overall aim of this research was to document the diversity of perspectives and preferences across a range of stakeholders with interests in urban verge greening. Stakeholders’ verge-related interests spanned utility maintenance, the provision of urban canopy cover, vegetation design, installation, maintenance and management, and as an element of urban design and planning for new and retrofitted developments. For the purposes of this report, respondents were classified into eight key stakeholder categories: Local Government Authorities, State Government, Peak Bodies, Utilities, Horticultural and Irrigation Industries, Environmental Consultancies, Developers and Champions of Change. Residents are also an essential stakeholder category and their preferences and experiences in transforming verges with native gardens are provided in a companion report (see Pauli et al. 2021).

This research used a mixed methods approach, sourcing empirical data using qualitative and quantitative methods. The following formed the major components of the study:

- A review of 31 Perth LGA’s publicly available (online) verge policies, treatment regulations and support for verge gardening was carried out to understand the status of permissible verge activities and supportive verge gardening policies.
- An online questionnaire was used to gain a broad understanding of Perth LGAs’ perspectives on streetscape vegetation management practices and their activities supporting residential verge greening activities (20 respondents).
- Semi-directed interviews (30 participants) were used to source qualitative data on the major values, concerns or issues associated with verge management and greening activities. Likert-type scales were used to provide quantitative data on the relative importance of a range of verge functions, ecosystem services and variables influencing verge transformation across stakeholder categories. Respondents participated in a social network mapping exercise (qualitative and quantitative data) to illustrate the influential connections and pathways of information sharing associated with their verge-related work.

Despite these stakeholders' diverse interests in Perth's urban verges, there was an encouraging degree of consensus, with respondents across all stakeholder groups recognizing vegetated verges, including predominantly native vegetation, had a significant role in providing a range of urban ecosystem services, including social, ecological and economic benefits.

The findings of this research are relevant for all urban centres and cities across Australia, and contribute to the growing global interest in greening our cities as the benefits to humans of living with urban green space become increasingly well documented.

Major findings are highlighted at the end of each section and in the conclusions and recommendations. Here, we present a synthesis of the major findings, under the themes of stakeholder's perspectives on policy and governance, verge networks, functions and values of verges, and verge transformation with native plants.

Policy and governance

- There has been a recent and rapid increase in LGA verge policies permitting verge gardens, as well as most LGAs having some form of verge treatment (surfacing) regulations, for public safety, urban water and urban heat management purposes. The majority of LGAs now have Urban Forest Strategies (20 out of 31 LGAs). The diversity of these polices and strategies (and their implementation) can be a challenge for some stakeholders working across the Perth region, including the varying compensation requirements among LGAs for street tree loss and damage.
- Demand for garden and verge-suitable (i.e. meeting verge height restrictions) native species has increased to be sufficient to influence the choice, and form, of species native nurseries are growing and supplying.
- Individuals were found to be very influential as 'Champions of Change' driving policy and organisational behaviour change at State and Local government levels. Local government elected members were identified as central in determining an LGA's uptake and implementation of native verge gardens/urban forest policies.
- There remains a spectrum among proponents of urban verge greening for the preferred kinds of living vegetation making up the verge, which can be contentious, given the variety of livelihood interests and preference for varying degrees among exotic-endemic plant spectrum. However most stakeholders recognised the need for accommodating a diversity of preferences, with no one-size-fits-all verge garden, but being highly context dependent, reflecting the character and biogeography of the particular area.

Verge stakeholder networks

- Networks commonly comprised multiple local and state government authorities and agencies, multiple allied industries and their peak/representative bodies, a variety of consultants spanning design, development, landscaping and environmental planning. Many respondents also engaged with a variety of not-for-profit community and advocacy groups and individuals, research institutions.
- There were examples of strong and effective partnerships identified across stakeholder groups generating new or best practices in urban greening/development or verge policies, for example between Champions of Change, Developer (State Government) and Environmental Consultants, and the Water Corporation (Water efficiency partnerships program) engaging across multiple stakeholder categories.

- Effective pathways for information sharing were important for all stakeholders, though they engaged in diverse means of information sharing, depending on their role and the nature of their organisation (e.g. peak body memberships, committee participation, social media platforms).

Functions and values of verges

- Space for street trees, pedestrian access and visual amenity were the three most important functions of verges respondents collectively identified.
- Car parking, although rated toward the bottom of the scale of important functions provided by verges, was still important to some degree, for 82% of respondents, reflecting the highly car-dependent nature of Perth's urban sprawl.
- Respondents collectively ranked the most important ecosystem services provided by the vegetated verge as urban temperature regulation, urban storm water management (regulating services), aesthetics, and recreation and mobility (cultural services) and rainwater infiltration and plant diversity (supporting services). The provision of food for people was rated collectively as the least important ecosystem service.
- LGAs are increasingly applying amenity values to street trees, including placing street tree retention conditions on development approval processes, in economic recognition of the ecosystem services street trees provide to the whole community.
- Connectivity was a significant factor influencing the potential of the verge to provide ecosystem services. The social and ecological benefits of verge connectivity were identified as occurring at a variety of scales: within a single verge/house garden, across adjacent or clustered verges within a street, along arterial roads or most broadly connecting suburban biodiversity to larger parks and bushland areas. Social benefits could be generated within a street and were supported within a neighbourhood more broadly where green corridors encouraged walkability. Ecological benefits are species specific and require a variety of scales to support a diverse range of species.
- There was widespread desire among many respondents for more aesthetically interesting, locally-representative native verge gardens along suburban streetscapes and major transit areas, to enhance the communities' local sense of place and well-being.

Verge transformation with native plants

- Respondents identified major motivating factors for residents to engage with native verge gardening as reducing water use, attracting wildlife, generating aesthetically pleasing streetscapes, having incentives from their LGAs, and saving time on reduced maintenance.
- Critical sources of inspiration identified by Champions of Change or Environmental Consultants were demonstration gardens and native gardening workshops. Respondents who had personally engaged in verge gardening were inspired by an enjoyment of gardening, lack of their own verge space (adopting a verge/public space instead), dislike of neglected verges and streetscapes, wanting to bring joy, colour, and evidence of care to their neighbourhood. Engaging with media gardening personalities was found to be influential in assisting with supporting LGA policy and maintenance/gardening behaviour change.
- Several respondents had observed the documented clustering or 'contagion' effect of neighbourly influence encouraging several verges to be converted in one street.
- Resources required for verge gardening varied among stakeholders, with environmental consultants and nursery respondents specifying greater cost and effort than Champions of Change. Industry specific constraints for native plant nurseries included the cost and difficulties in securing quality soil, seed, and reliability in propagating processes. LGAs reported the Water Corporation's

water wise verges partnership program provided essential financial resourcing to support the verge gardening programs they could offer their residents, and often demand still outstripped their capacity. The majority of LGAs surveyed online and in interviews envisaged demand from residents for verge gardening support to grow.

- Major enabling factors identified were LGA offered incentives, educational opportunities and the provision of practical, evidence-based information, as lack of knowledge were critical factors limiting uptake cited by many respondents across almost all stakeholder categories. Workshops were described as very effective for sharing knowledge and respondents across multiple stakeholder groups believed LGAs were best placed to deliver this education. As key influencers of residents' engagement with the verge, some respondents felt LGAs could play a greater role in positive messaging regarding the benefits of verge vegetation (including street trees).
- Major barriers or constraining factors to verge gardening included the use of verges for car parks, lack of personal interest, and a preference for grass, as well as limited understanding of the work required to establish and maintain a healthy native verge garden. Interestingly, LGA respondents surveyed online rated the importance of supportive LGA policies and incentives as less important than did all respondents collectively across stakeholder categories.
- For LGAs, barriers for implementing native streetscapes and effective vegetation management included limited resources, entrenched vegetation management practices, high staff turnover and verge related responsibilities being diffused across an LGA organisational structure.
- The process of native plant verge gardening and streetscaping is not without safety and future-proofing considerations. It requires appropriate consideration of species selection and maintenance for addressing issues of public safety, climate change resilience, weed, disease and fire risk management, particularly when planning for connective green corridors.
- In terms of future trends, among the surveyed LGAs the majority felt residents' interest in native verge gardening would increase in the future, though this was more mixed among the other stakeholder categories. An increased focus on incorporating stormwater management practices and in using WA native species in verge design and streetscapes were also identified.
- An unexpected finding from across stakeholder categories who expressed a particular vegetation preference (ie all with the exception of Utilities) was the observed trend of increasing installation of artificial turf. These respondents unanimously expressed a strong dislike of artificial turf as a verge treatment. They cited artificial turf as amplifying the urban heat island effect, not supporting any biodiversity or water cycling functions (e.g. soil health, water infiltration), impracticality (easily damaged by vehicle verge parking) and the shedding of plastic fragments into the environment.
- Respondents' 'ideal' verge ranged from 'something green and living', a mix of lawn and a tree to retain the option of parking, to more complex vegetation descriptions, including the preference for flowering plant species to reflect the local Indigenous Whadjuk Noongar six-season calendar, as well as to provide bird habitat and suppress weeds. Several respondents noted that following the strong establishment of Urban Forest strategies, it was time to increase the focus on understorey/ground cover vegetation.

1 Introduction

The ‘verge’, ‘road easement’, ‘nature strip’ or ‘street verge’¹ is the area of land between the roadway and the front property boundary. These strips of land serve an important utilitarian purpose, providing space for services such as electricity, gas, water and telecommunications, and facilities such as footpaths and bus stops. Verges are also recognised as ‘informal urban greenspace’ (Rupprecht and Byrne 2014a) that can provide multiple ecosystem services (Davison and Kirkpatrick 2014, Brown et al. 2013). Verges provide opportunities for passive recreation, food production, connection with nature, and social interaction, thus contributing to human well-being. They also provide shading and microclimatic amelioration, water infiltration and run-off management, and habitat for wildlife.

In common with many Australian cities, Perth has a low population density with a sprawling suburban footprint. Perth is the 72nd largest city in the world² in terms of physical area, but ranks 998th in terms of population density (Demographia 2020). Continued population growth and urban sprawl has driven policies to increase urban housing density in Australian cities. Concurrently, tree canopy loss, climate change and urban heat island impacts have influenced the development of strategies to maintain urban forests and tree canopy cover. At the nexus of these changes, there is a rapidly evolving area of policy development, stakeholder viewpoints, and community interest in the way that verges are used in Australian cities. The extent of verges can be significant, accounting for around one-third of public greenspace in Melbourne (Marshall, Grose and Williams 2019). The humble verge has become a contested space where (utilitarian) function and (aesthetic) form must exist alongside one another, governed by a wealth of policies.

Within metropolitan Perth, many local government authorities (LGAs) now permit residents to convert the publicly owned land along the street in front of their dwelling from ‘traditional’ verge treatments³ such as grass to low growing, native gardens, providing certain conditions are met (Figure 1). ‘Verge gardens’ are perceived to require less water and better reflect a local sense of place by using plants endemic to the biodiversity hotspot in which Perth is situated (Pauli et al. 2021). Landscaping around arterial roads and key intersections⁴ has also shifted towards the incorporation of native vegetation. While community interest in native verge gardens is growing, there is relatively little information documenting the viewpoints and concerns of stakeholders across community, government and industry on the shifting policies and practices on roadside vegetation in Perth.

In this research project, we set out to understand the viewpoints of key stakeholders on the ecosystem services that can be provided by street verges. We chose ecosystem services as a frame of reference as it encompasses a wide range of services that are connected with social, economic, and ecological values. Perth presents a particularly interesting case study for the research, due to its location in a biodiversity hotspot, and public policy initiatives to lower water consumption. Further, verges have fragmented governance arrangements in Perth, with more than 30 distinct LGAs in the metropolitan region, and different state government agencies and utilities having responsibility for particular functions provided by verges.

¹ The phrases ‘street verge’ and ‘verge gardens’ are more commonly used in Perth than the term ‘nature strip’, which is more prevalent in other parts of Australia and understood globally. ‘Road easements’ and ‘easement gardens’ are equivalent terms, most commonly encountered in the US. Where appropriate, the term ‘verge’ is used in this report, although some quotes may use ‘nature strip’ or similar.

² Based on cities with populations of >500,000 people.

³ In Perth, residential street verges on the Swan Coastal Plain are typically covered with lawn, or a mix of grasses and weeds. Some verges may have no grass and be covered with mulch, while in the Perth hills, a common substrate is lateritic gravel. Although most LGAs do not permit residents to pave or convert to ‘hardstand’ more than one-third of the total area of the verge (except where the dwelling is adjacent to an arterial road), many verges have been paved or have synthetic turf.

⁴ The responsibility for vegetation along arterial roads often lies with a state or local government agency.



Figure 1: Examples of some ‘typical’ verge treatments in suburban Perth

Clockwise from upper left: maintained grass and street tree (one of the most common verge treatments in suburban Perth, particularly on the Swan Coastal Plain); gravel (common in suburbs of the Perth hills) and shrubs; low-growing ornamental (non-native) plants; synthetic turf (showing wrinkled appearance); mix of low-growing succulents, native plants and mulch; native plants showcasing kangaroo paws (*Anigozanthos spp.*). Note that some elements depicted in the photos above are not permitted in some local governments within metropolitan Perth (particularly large rocks or boulders, and large expanses of synthetic turf). Entirely paved street verges are not depicted, and neither are weedy, sandy, or intended verges; all of which are commonly encountered.

1.1 Ecosystem services and urban nature

The Millennium Ecosystem Assessment described ‘ecosystem services’ as a means of categorising the societal benefits and values provided by ecosystems, into a range of services underpinning human health and well-being (MA 2005). **Provisioning services** include the products obtained from ecosystems such as food, fibre, fuel. **Regulating services** are the benefits obtained from regulation of ecosystem processes such as a stable climate and clean water. **Supporting services** include ecosystem processes such as nutrient cycling, primary productivity and soil formation. **Cultural services** are the nonmaterial benefits obtained from ecosystems such as recreation, aesthetics, spiritual values and cultural heritage (MA 2005). All ecosystem services are underpinned by biodiversity. Figure 2 illustrates the categories of ecosystem services.

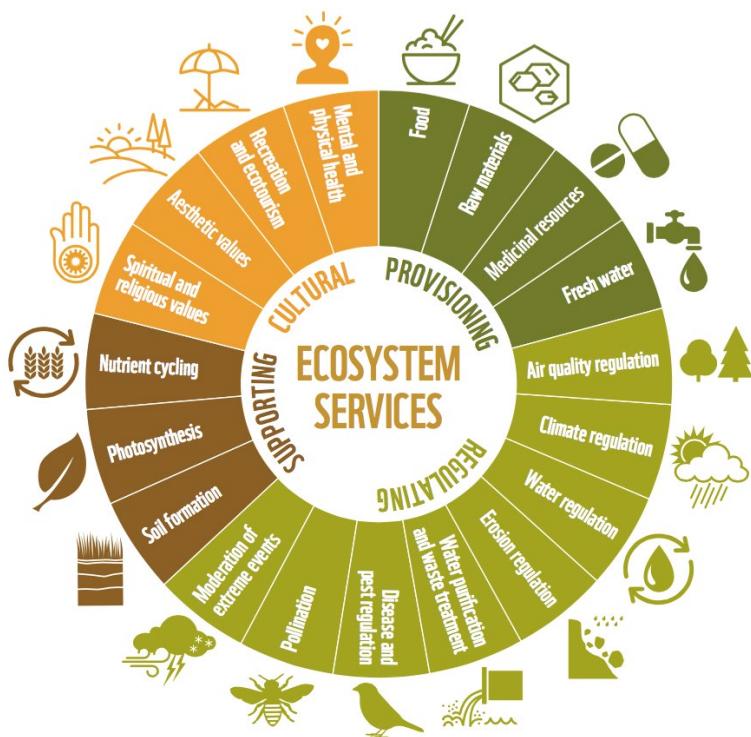


Figure 2: Illustration of categories of ecosystem services

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Since the ground-breaking work of the Millennium Ecosystem Assessment, the ecosystem services framework has been increasingly explored as a means of understanding the benefits of urban green spaces, as well as how these spaces support human-nature interaction (Elmqvist et al. 2013, Luederitz et al. 2015, Livesley, McPherson and Calfapietra 2016, Gómez-Baggethun and Barton 2013). Much of this work has taken place in a European setting, where urban nature has often been fundamentally altered to accommodate dense urban settlements that have grown over centuries, or even millennia. Australian cities typically retain higher vegetation cover within the suburbs, as well as often substantive remnant bushlands and wetlands within the city limits, providing an opportunity for the provision of a wealth of ecosystem services to residents. Existing research has demonstrated how urban green spaces have contributed to regulating ecosystem services (e.g. Pataki et al. 2011, Duncan et al. 2019), cultural ecosystem services and social justice (e.g. Bryan et al. 2010, Dickinson and Hobbs 2017, Milcu et al. 2013, Ernstson 2013), and supporting services including biodiversity and habitat provision (e.g. Lin, Philpott and Jha 2015, Ignatieva, Stewart and Meurk 2011, Mumaw and Bekessy 2017, O'Sullivan et al. 2017).

Within urban areas, vegetation along road corridors (including verges) can make significant contributions to the provision of urban ecosystem services (O'Sullivan et al. 2017, Säumel, Weber and Kowarik 2016, Rupprecht and Byrne 2014a, Rupprecht and Byrne 2014b, Jansson 2013). The importance of roadside vegetation may be particularly notable in neighbourhoods with limited green space. Roadside vegetation can aid in regulating local air quality and temperature, noise reduction, and water quality (Säumel et al. 2016, O'Sullivan et al. 2017). Provisioning services include local food production, maintenance of genetic resources (e.g. heritage trees), and groundwater recharge. Biodiversity benefits can include habitat provision and corridors to aid movement and dispersal, although poorly designed or managed road reserve vegetation can also act as a dispersal corridor for invasive species and pests (Säumel et al. 2016). The potential for ecosystem 'disservices' have also been noted, where some trees have found to produce biogenic volatile organic compounds or create allergic problems from wind-borne seed or pollen dispersal, which can be managed through appropriate species selection.

Cultural services provided by roadside vegetation remains understudied, however, benefits include perceived improvements in quality of life (Sheets and Manzer 1991; Weber et al 2008), and in fostering less car-dependent, healthier lifestyles by making urban streets more welcoming for walking and cycling through shade and pleasing aesthetics (Cervero and Duncan 2003, de Vries et al 2013). Roadside trees and understorey vegetation can contribute to a city's cultural heritage, where iconic trees are celebrated for their age, appearance or cultural significance. Green streetscapes including street trees have been shown to enhance property values (Pandit et al. 2013).

1.2 Planning for greenspace and urban nature

Similar to many cities around the world, Perth must adapt to inter-related transformative changes, including population growth and climate change, both of which place pressure on urban green spaces and biodiversity. Numerous planning strategies have been enacted to increase population density, including infill development which has been associated with a loss of tree canopy on private land (Brunner and Cozens 2013).

In recognition of the detrimental environmental effects of past initiatives to increase density, new Western Australian planning guidelines and strategies such as [State Planning Policy 7.2 - Precinct Design](#) (finalised in December 2020), and proposed amendments to [State Planning Policy 7.3 - Residential Design Codes Volume 1 - Medium Density](#) highlight the importance of active planning for green space and tree canopy cover, amongst other elements. The new and amended guidelines reflect contemporary best practice, such as biodiversity sensitive design (Garrard et al. 2017) and 'rewilding' (Sweeney et al. 2019), allowing local flora and fauna species to flourish, as well as the inclusion of water sensitive urban design concepts such as rain gardens, swales and stormwater biofiltration within greenfield developments (Figure 3).



Figure 3: An example of a 'living swale' in a median strip
This 'living swale' constructed and vegetated as a strip in the centre of a road in a new residential development allows for the retention of stormwater on-site, and slow infiltration.
Image credit: Leah Beesley

Allied greenspace planning initiatives such as [Better Urban Forest Planning](#) support LGAs to monitor tree canopy cover, and produce their own urban forest strategies. A number of LGAs in Perth have recently published Urban Forest Strategies, which often establish goals for canopy cover and planning for green corridors, alongside preferred species for new plantings, and the role of lower vegetation strata in the overall urban forest. Indeed, broader-scale urban greening and planning strategies such as the [202020 Vision Plan](#) (with the goal of achieving 20% more urban greenspace by 2020) have explicitly highlighted the role of street verges in urban forests.

While the more well-known public gardens, parks and bushlands are often conceived as the main components of urban greenspace, a further category known as ‘informal urban greenspaces’ (IUG) can provide a significant yet underrepresented contribution to urban greenspace (Rupprecht and Byrne 2014a). In Australia, IUG are often linear in form, in the open spaces adjacent to suburban streets, arterial roads, railway lines, and urban riparian or drainage networks (Bolleter 2017, Scott Shafer et al. 2013, Rupprecht and Byrne 2014a). These are areas of land in the public domain but may have less clearly defined boundaries in terms of land ownership and/or management responsibilities. Street verges belong to the broader category of IUG.

Informal urban greenspaces often provide a range of functional purposes alongside their potential for hosting nature and elements of the urban forest. These functions include provision of utility services, allowing for population mobility through footpaths and bus stops, as well as parking space in car-dependent cities. Given the diversity of potential uses for IUG, plus their ubiquity and visibility in cities, a range of stakeholders hold interests and management perspectives for these spaces.

1.3 The evolution of the verge: from neglected to contested

Verges fall within highly contested urban planning contexts. Land value and space is at a premium, stakeholders are close to centres of power (vocal and less easily dismissed), while biodiversity is often positioned as an additional bonus rather than an integral element of planning and development. The contestation of urban greenspace has been explored in diverse contexts (e.g. Hubacek and Kronenberg 2013, Robinson et al. 2019, Weber, Kowarik and Säumel 2014). Access to green space is distributed unevenly among city residents (Wolch, Byrne and Newell 2014) and under increasing pressure with growing urban population densities. Access and engagement with green space is increasingly becoming an environmental justice issue (Ernstson 2013, Wolch et al. 2014) adding urgency to the need to investigate diverse stakeholder perspectives on the values of informal green space.

In cities around the world, interest in urban greening and gardening activities on unused or neglected pockets of land is growing (Säumel et al. 2016, O’Sullivan et al. 2017, Rupprecht and Byrne 2014a). This trend has complex roots, including the growing recognition of the human physical and mental health benefits arising from interacting with nature (e.g. Ward Thompson et al. 2012, Ulrich 1981, Fuller et al. 2007, Kahn and Kellert 2002), combined with growing urban population density which is reducing the opportunity for private gardening space (e.g. Hall 2010 in Australia) (see Figure 4). Verges represent often-neglected areas of land which have attracted growing attention as potential spaces for native gardens, edible gardens, and ornamental gardens (Figure 1). The rise in verge gardening has recently travelled from the fringes, where gardeners have often had to act outside existing local administration’s verge policies. Such gardeners have come to public prominence attracting labels like ‘guerrilla’ or ‘gangsta gardeners’, and successfully pushing to change local policy (Weston 2020, Young 2018).

In Australia there is a recent history of strong contestation regarding the establishment of gardens on verges; this practice which was not actively encouraged by many metropolitan Perth LGAs until relatively recently (i.e., prior to ~2010). The City of Bayswater, in Western Australia, led the way in LGA policy reform, becoming the first LGA in Australia to remove restrictions on residential verge gardening (within safety and water management limits) (Young 2017). At present, the overwhelming majority of metropolitan Perth LGAs now have guidelines for acceptable verge gardens, with many offering rebates and incentives to residents. National and state-based gardening television programs continue to mainstream verge conversions, in featuring ‘verge gardening’ segments. These segments highlight a range of gardening options suitable for the verge, as well as the environmental and social benefits of gardeners extending their green thumbs into this space, and has no doubt increased public awareness and appetite for verge gardening. Community-led verge gardening groups continue to spring up and mobilise through social media (e.g. the Facebook Verge Gardening Australia community group).

In Perth today, the usual view of street verges as an under-utilised space occupied by grasses, weeds, sand or gravel is being challenged by more novel approaches that include greater plant structural and species diversity (see for example some of the images in Figure 1), as well design elements that encourage the provisioning of ecosystem services. In this report, the roles of various stakeholders are explored in influencing and encourage the verge gardening movement. Some of these key stakeholders include the Western Australian state water utility (the Water Corporation)⁵, LGAs, government agencies and departments, developers, community ‘champions of change’ and organisations across the horticulture and environmental consulting industry.



Figure 4: Street views of medium-density developments in suburban Perth

With pressure to increase residential density, developments such as these (from the western suburbs of Perth) are becoming more common. Upper image: A rear laneway allows vehicle access to individual houses. Very few households have private back garden space, with the dwelling extending to the rear boundary. Lower image: This streetscape features a number of native verge gardens in close proximity, and limited space for private front gardens.

⁵ See: <https://www.waterrcorporation.com.au/Waterwise/Waterwise-programs> for further details of the Water Corporation’s Waterwise programs with local councils, business, developments and office buildings.

1.4 Analysing stakeholder interactions with social network analysis

In the context of global environmental change requiring local behavioural change, understanding stakeholder social networks is an important element of natural resource management (Fazey et al. 2012, Reed et al. 2014). Social network analysis (SNA) is a tool employed to better understand how information flows between people or organisations. SNA does so by identifying nodes of a network, where nodes represent people, organisations or even knowledge types. Nodes are connected via the exchange of resources (which can include ideas, financial resources, materials and more) to form a matrix of flows between nodes. This matrix can then be mathematically analysed using SNA to understand: how nodes are positioned within a network and how this relates to nodes' power and influence; the degree of interactions between various nodes; and the communities and sub-networks that are formed. Such information provides a powerful visual and mathematical tool for uncovering otherwise hidden relationships, power structures, and community interactions. The interpretation of these SNA outputs can be enriched by interview data, allowing a deep understanding of the complexities of network relations.

SNA has been widely applied in sociology, social and behavioural sciences as well as economics and business studies (Wasserman and Faust 1994). It has more recently been applied in human geography to unpack how complex economic and social relations extend and are formed across local and global space (Martinus and Sigler 2018, Martinus et al. 2015, Searle, Sigler and Martinus 2018). As such, SNA is a method well suited to be applied to this research project as it can provide greater nuance to understanding the relationships and interactions between the stakeholders involved with verges. In the context of this study, SNA could prove particularly useful in understanding the power differentials or competing interests of stakeholders (Prell, Hubacek and Reed 2009) as well as to highlight shared interests and opportunities for resource sharing, which can in turn reduce the risk of conflict (Barnes et al. 2020). SNA has been applied in various natural resource management contexts (Prell et al. 2009, Guerrero et al. 2020, Bodin and Prell 2011) with limited application to date in urban greening (some examples being Ernstson, Sörlin and Elmquist 2008, Guenat, Dougill and Dallimer 2020). In this research project, SNA techniques were used an exploratory tool to qualitatively understand stakeholder interactions and resource flows.

1.5 Research aims

This study sought to examine the perspectives of a diverse range of major (non-residential) stakeholders with an interest in the management of informal urban greenspace adjacent to streets in metropolitan Perth, particularly in relation to landscaping these spaces with native plant species. Informal linear greenspaces and bluespaces such as riparian zones and drainage networks were outside the formal scope of this study but worthy of future focus. This research is the first, to the authors' knowledge, to provide a detailed examination of stakeholders' perspectives on urban verges, beyond the views of residents and local municipal authorities.

The primary objectives of this research were to:

- 1) Capture a snapshot of Local Government Authority (LGA) policies and perspectives on verge transformation with native species, as the primary stakeholder managing this land area.
- 2) Understand the network of interactions between stakeholders, particularly in terms of information sharing.
- 3) Understand the range of stakeholder perspectives and preferences (across community, industry and government) regarding the provision of ecosystem services by verges, and particularly in relation to transformation of verges with native species.

Our research demonstrated that while street verges may well be ‘liminal’ spaces that intersect the public and private realm, they are no longer ‘at the margin’ of greenspace. A complex network of stakeholders and residents are taking an active interest in street verge landscaping, with a variety of desires for the future of these strips of lands, not all of which are compatible. Street verges can fulfil multiple objectives for utility provision and ecosystem service delivery, requiring careful planning and compromise among a range of actors.

Although presently uncommon, the use of native plants in street verge gardens is expected to expand in most suburban local government areas in Perth. Indeed, most local councils now provide guidance for residents to create verge gardens without requiring additional layers of approval from local authorities. Our report provides a timely snapshot of the different stakeholder perspectives over the current and future use of the ubiquitous suburban ‘front verge’, and provides information that may assist with future policies and programmes affecting urban greening.

2 Methods

2.1 Case study characteristics

2.1.1 The Perth Metropolitan Region: Biophysical and cultural setting

Climatically, Perth enjoys a Mediterranean-type temperate climate with hot, dry summer periods (Köppen classification Csb (Kottek et al. 2006)). Most rain falls between May and October, and July and August are the coolest and wettest months. Annual rainfall has declined since the mid-1970s, with a continued drying trend projected under future climate change (Bates et al. 2008, Hope, Drosdowsky and Nicholls 2006).

Most of the Perth metropolitan area (see Figure 5) lies on the Swan Coastal Plain, a region with distinct physiographic and biogeographic characteristics. The coastal plain is of low elevation and gently undulating. The sediments of the coastal plain were laid down through marine, alluvial and aeolian processes (Commander 2003). Three major ancient dune systems run roughly parallel to the coast. The Quindalup dunes are the youngest, and are closest to the present-day coastline. The Spearwood dune system is intermediate in age, with the older Bassendean dunes lying furthest to the east. The dune-derived sands are generally nutrient-poor with low clay content and consequently low moisture-holding capacity. The Pinjarra Plain formation at the western base of the Darling Scarp consists of alluvial soils, formed by sediments deposited by drainage systems (Seddon 1972). In the eastern extent of the Perth metropolitan area, suburbs in the ‘foothills’ region straddle the Darling Scarp, which separates the coastal plain from the deeply weathered surface of the Precambrian crystalline rocks (such as granite) of the Yilgarn Craton. Less densely populated suburbs lie east of the Scarp, along the dissected valleys of the plateau (Commander 2003).

Wetlands and rivers are integral to Perth’s setting. The Swan River-*Derbal Yerrigan* is the largest river in the Perth region. The river holds great spiritual and cultural significance to the Noongar people as the link between the land and sea, and as the location of a sacred sites recognising the activity of the *Waugul*, a giant serpent who created waterways and valleys along the length of the river (Graham-Taylor, 2009) (Graham-Taylor 2009). Prior to European colonisation, the Swan Coastal Plain contained an enormous diversity of basin and plain wetlands (Davis and Froend, 1999). Chains of lakes occur along the interdunal depression between the Quindalup and Spearwood dunes, and between the Spearwood and Bassendean dunes. Many of these wetlands are surface expressions of the unconfined superficial aquifers. These aquifers are also drawn on for supplying Perth’s drinking water.

The Perth Metropolitan Area is located in the South West Australian Floristic Region, a global biodiversity hotspot with exceptionally high plant species diversity and endemism that is also under significant threat (Hopper and Gioia 2004, Myers et al. 2000). Within this biogeographic region, the Perth Metropolitan Area is one of the richest (Gioia and Hopper 2017), with over 2,000 species of vascular plants recorded (Environmental Protection Authority 2015).

Banksia woodlands are the predominant plant community across Perth. ‘*Banksia* woodlands of the Swan Coastal Plain’ have recently been recognised as a Threatened Ecological Community (TEC) under the EPBC Act, given the extent of clearing for urban and agricultural development (Threatened Species Scientific Committee 2016). These woodlands have an open canopy dominated by *Banksia attenuata* and *B. menziesii*, and other less abundant tree species, including *Eucalyptus marginata* (jarrah), *Corymbia calophylla* (marri) and *Allocasuarina fraseriana* (sheoak). The species-rich understory is dominated by sclerophyllous shrubs and perennial herbaceous plants. *Banksia* woodlands are also the habitat of a diverse range of birds, insects, reptiles, and even amphibians (Threatened Species Scientific Committee 2016). Tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain have also recently been listed as a TEC, given the extent of clearing of this vegetation type.

Urbanization has been the main driver of *Banksia* woodland fragmentation in recent decades. These woodlands persist in a few large conservation and Crown Land areas on the current metropolitan boundaries, and in urban reserves (most of which are small and isolated), linear strips on roadside verges, and rural private properties (Ramalho et al. 2014). The extensive and rapid fragmentation of these woodlands has had large impacts on its plant communities and wildlife, through habitat loss, introduction of non-native species and plant diseases, introduction of predators, and alteration of the disturbance regimes (Ramalho et al. 2018, Ramalho et al. 2014, Stenhouse 2005)

Over 500 species of vertebrate animals are found in southwest Western Australia (more than 330 species have been recorded in the Perth metropolitan area), with a high degree of endemism recorded for reptiles and frogs in particular (Mittermeier et al. 2005, Valentine 2009, Environmental Protection Authority 2015). Invertebrate biodiversity is also high, particularly in eucalypt woodland and forest vegetation, however it is largely undocumented (Majer et al. 2001), as is common for invertebrates worldwide (Clark and May 2002). Around 200 species of native bees have been recorded from the Perth metropolitan region.

Perth's bushlands, wetlands, and coastlines embody important cultural and social values. The natural spaces that remain in Perth hold great cultural, social and economic importance for Noongar people (McDonald, Coldrick and Christensen 2008, Collard and Bracknell 2012) and for non-Indigenous residents of the Perth metropolitan area. Perth has a distinct 'Sense of Place' (Seddon 1972), which has influenced urban planning and landscaping, as well as decisions around which species are planted in public streets and parks, and in private gardens.

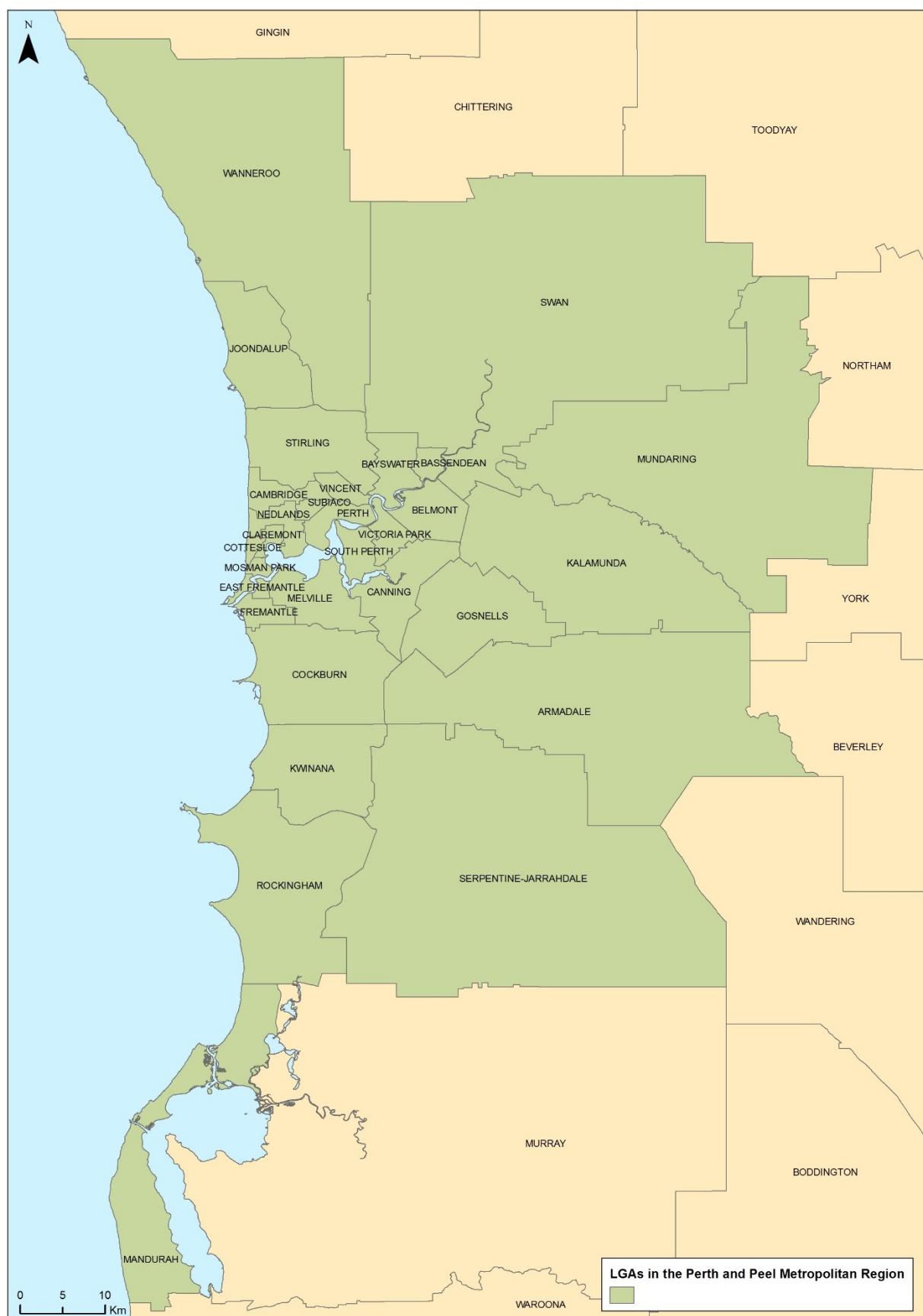


Figure 5: Map of the Perth metropolitan region and LGA boundaries

2.1.2 Governance context

Informal urban greenspaces can be characterised as ‘messy’ or ‘contested’ spaces, where multiple stakeholders exert some form of management authority, activity or interest. Verges are no exception, with an array of agencies and entities involved. The major stakeholders directly involved in setting regulations for verge characteristics, and their roles and responsibilities, along with the relevant planning legislation or policies, are summarised in Table 1.

Table 1: Stakeholders directly involved in determining the regulations for verges

Stakeholders	Role and responsibilities	Selected relevant legislation, policy, guidelines or codes of practice
• Department of Planning, Lands and Heritage (government)	Responsible for issuing planning approvals, setting and enforcing the minimum verge and road reserve widths for new developments and approving property subdivisions within existing suburbs.	<ul style="list-style-type: none"> • Neighbourhoods and Development • <i>Planning and Development Act 2005</i>; • WAPC Street Trees and Utility Planning Discussion Paper (2009) • <i>WAPC Strategic Plan (2018-21)</i> • <i>Liveable Neighbourhoods</i> (2009; 2015-draft, will become <i>Neighbourhood Design</i>) • <i>Better Urban Forest Planning (with WALGA)</i> • <i>Precinct Design</i> (2020)
• Western Australian Planning Commission (Statutory Authority)		
• Department of Transport (government)	Responsible for the management of vegetation alongside major arterial roads, major public transport assets.	<ul style="list-style-type: none"> • <i>Vegetation Placement within the Road Reserve</i> (2013)
• Main Roads WA (Statutory Authority)		
• Local Government Authorities (Individual City, Town and Shire councils)	Primary responsibility for managing urban verges, street trees and broader streetscape.	<ul style="list-style-type: none"> • LGA-specific planning codes, street verge policies, Street Tree Planting Programmes and Urban Forest Strategies
• Utility Providers Services Committee	Ensuring gas, power, water and telecommunications services are provided and maintained.	<ul style="list-style-type: none"> • <i>Utility Provider's Code of Practice for Western Australia</i> (2016) • <i>Dial before you Dig</i> www.1100.com.au

In Western Australia, verges are owned by the Crown, and are vested in and managed by the respective Local Government Authorities. Main Roads WA manages the verge adjoining arterial roads. While ownership is thus relatively straight forward, legitimacy in managing verges is the more contested grey space. The Department of Planning, Lands and Heritage sets out policies and guidelines on the width of verges within greenfield and infill urban developments. Once approved, the implementation of these guidelines within new subdivisions becomes the responsibility of LGAs, in concert with developers. Residents are responsible for the general upkeep of any garden or surface on the verge immediately in front of their properties, however they are still subject to a variety of LGA-specific requirements regarding surfacing, tree removal and general landscaping. Street trees are the responsibility of the LGA and are often considered as an asset. Generally speaking, residents may not prune or remove street trees; in some LGAs residents may plant street trees after seeking and receiving approval. Utility providers maintain access rights in the event of any work required, and thus may destroy sections of a verge garden in the process of undertaking works.

2.1.3 Identifying and categorising stakeholders

In addition to the stakeholders above, several major stakeholder categories were identified for inclusion based on the authors’ experience with Perth’s urban natural resource management policy and planning context. In total 30 stakeholder organisations or individuals were interviewed. The final list of stakeholder research participants are provided in Appendix 1.

Stakeholders were differentiated and categorized largely prior to interviews, using a top-down approach (Reed et al. 2009). The roles and the interests of these stakeholder groups, in terms of verge ecosystem services, along with the respondent organisations are provided in Table 2. Also shown are abbreviations used throughout the report for each stakeholder category.

Table 2: Categories of stakeholders and example participating organisations with their role

Stakeholder category (Abbreviation)	Examples	Role or influence in urban streetscapes
State Government Departments (State Gov't)	<ul style="list-style-type: none"> Main Roads WA Department of Planning, Lands and Heritage (DPLH) Water Corporation (WC) - Water Efficiency Partnerships 	<ul style="list-style-type: none"> Owns and manages major arterial road reserve verges (Main Roads) Prescribes verge land size requirements- both new developments and subdivisions (DPLH) Promote Water Wise councils, including waterwise verge policies (WC)
Local Government Authorities (LGAs)	<ul style="list-style-type: none"> Various LGAs (early adopter, emerging adopter, minimally engaged) 	<ul style="list-style-type: none"> Set local LGA verge use/management regulations and responsible for management of verge trees and local streetscapes.
Peak Bodies (PBs)	<ul style="list-style-type: none"> Urban Development Institute of Australia (UDIA) Irrigation Australia (IA) Turf Growers Association (TGA) Western Australian Local Government Association (WALGA) - Infrastructure 	<ul style="list-style-type: none"> Umbrella organisations advocating for the interests of their member constituents. Raise latest professional/industry issues or developments.
Horticultural/ Irrigation Industry (H&I Industries)	<ul style="list-style-type: none"> Turf consultant Irrigation supplier 	<ul style="list-style-type: none"> Turf and irrigation consultants or suppliers - supplying residents and LGAs with verge related materials and/or education (providing workshops etc.)
Utility providers (Utilities)	<ul style="list-style-type: none"> Native plant nursery Plantrite Wholesale Native Nursery 	<ul style="list-style-type: none"> Horticulturalists/ nurseries - native plant suppliers, involved in propagation, commercialisation sales and marketing, education
Urban Developers (Developers)	<ul style="list-style-type: none"> Satterly (Private developer) Development WA (previously LandCorp – state government-sponsored development agency) 	<ul style="list-style-type: none"> Property development, suburb and community hub development and land sales - which incorporate and define the character of verges
Environmental consultancies (Env. Consult)	<ul style="list-style-type: none"> Arbor Centre Western Wildflower Gardens Sustainable Outdoors Josh Byrne & Associates Ecoscape 	<ul style="list-style-type: none"> Arborists engaged in management and maintenance of LGA network of street trees Native gardening, design and landscaping, education through workshops. Larger firms combine environmental and urban planning. Diverse spectrum of clients, from residents to private or government developers, LGAs or State Government departments.
Individual 'champions of change' or urban greening advocacy groups (CoC)	<p>Individuals working in volunteer, consultancy or public office capacity (e.g. councillor) who have been influential in advocating verge gardening, or representatives of urban greening advocacy groups, e.g.:</p> <ul style="list-style-type: none"> Beyond Gardens Green Space Alliance 	<ul style="list-style-type: none"> Advocates for locally or resident led verge gardening and urban greening more broadly. May also be educators, workshop providers.

Respondents were selected through accessing expert knowledge networks within academia, industry, and related peak bodies. In addition, snowball sampling (Reed et al. 2009) during interviews further identified relevant individuals or organisations to approach. Residents are clearly an important stakeholder group, however were not included in this study, having been the sole focus of a complimentary verge greening study (Pauli et al. 2021). Traditional owners were another important stakeholder group identified, but were not explicitly engaged for this research project. Interview questions did probe stakeholders' own engagement with any Noongar Wadjuk stakeholders, and asked for stakeholder perspectives on including culturally valued species (for Noongar Wadjuk country) in verge gardening. Not all stakeholder organisations approached were able or willing to participate and equally, project resourcing meant it was only possible to approach a small subset of potential individuals or organisations within each stakeholder category. As such the analysis of verge stakeholder perspectives was designed to be as representative as possible within project resourcing.

An 'interest-influence' conceptual schematic (after Reed et al. 2009) was constructed to illustrate respective positions of stakeholder categories in terms of their power (influence) and interest in the verge space (Figure 6). Power is highest with land ownership rights (e.g. vested in LGA and State government for residential and arterial road verges respectively) or overriding access permission (e.g. utilities), followed by direct verge management responsibilities (residents), through to low power (no ownership or direct management responsibility). At this end of the power spectrum there is still interest and ability to influence verge related policy or management behaviour, e.g. through the education and advocacy of peak bodies, but no direct power in terms of regulatory compliance. In terms of 'interest' in native verge gardening, for several stakeholder categories there is clearly a spectrum ranging from high interest to little interest, represented by the bi-directional arrows for peak bodies, horticulture businesses, developers, residents and LGAs. Within these stakeholder categories, there are individuals or organisations highly interested in transforming verges through native gardens or other forms of gardening, as well as those with little interest, for whom it is far from core business or who are not at all engaged in this activity.

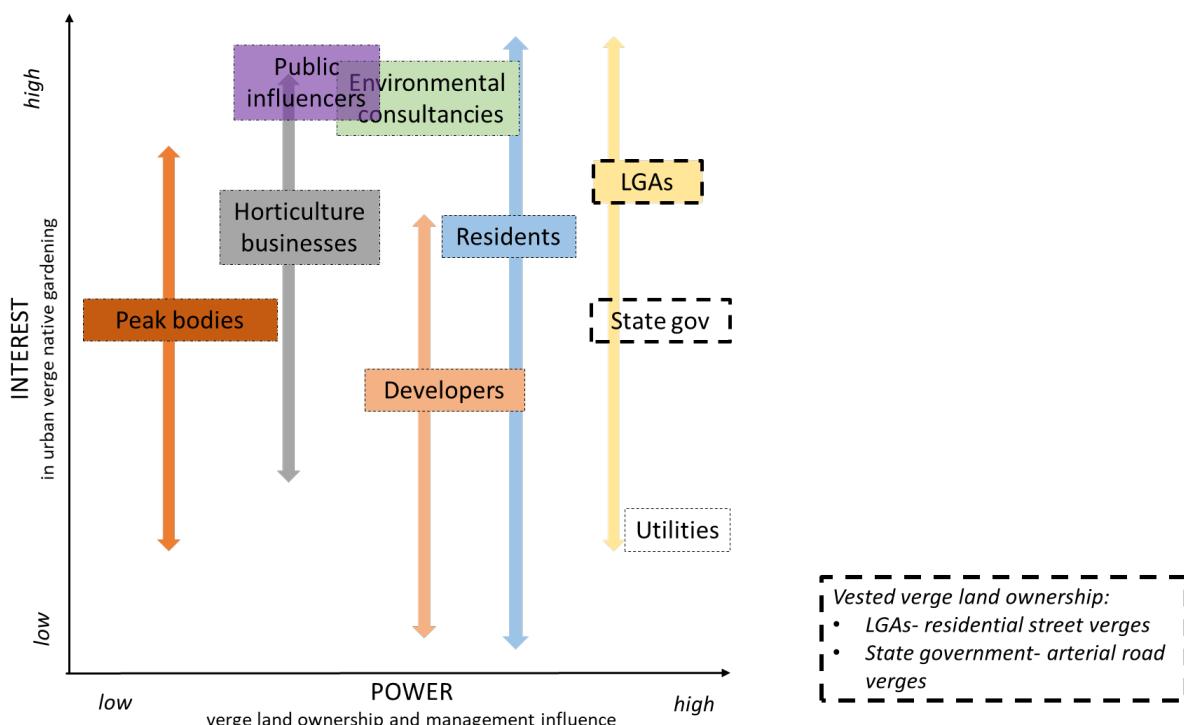


Figure 6: An 'interest-influence' conceptual schematic for stakeholder categories
Stakeholders represented are those with an interest in verge management (after Reed et al. 2009).

2.2 Data collection

This research was carried out under UWA Human Ethics approval RA/4/20/4465. Prominent stakeholders (non-residential) in the verge management, urban greening and the native gardening space were invited to participate in the research through several methods.

2.2.1 Semi-directed interviews of key stakeholders

A face-to-face, semi-directed interview process was used to elicit stakeholder knowledge, experiences and preferences in relation to verge values and management issues. An interview guide (Appendix 2) was used to maintain common thematic lines of inquiry across all stakeholder subsets, as well as including specific questions tailored for particular stakeholder groups. With consent, interviews were audio recorded for transcription.

The qualitative data were complimented by quantitative ranking data collected through a short questionnaire based on Likert ranking (Appendix 3). These questions asked the respondents to rate the relative importance for them/their organisation of: i) specified verge functions; ii) specified ecosystem services provided by urban verges incorporating native vegetation; iii) the factors influencing their tree and understorey species selection; and iv) the motivators/enabling factors and barriers for residents in undertaking verge gardening. There was variation in the number of respondents providing scores as some topics (e.g. species selection) fell outside the scope of the interviewee's role or experience. The ecosystem services included in the short questionnaire, with accompanying descriptions are provided in Table 3.

Table 3: Ecosystem services potentially provided by urban verges

The description of ecosystem services below were used in stakeholder interviews.

Ecosystem Service Category	Ecosystem service	Example description
Regulating	Storm water management	Processes to manage rainfall and storm water run-off in urban areas
	Water quality improvement	Processes to mitigate against contaminants entering receiving water bodies
	Air quality improvement	Processes to mitigate against air borne pollutants
	Temperature regulation	Shading to reduce urban heat island effect
	Carbon sequestration	Processes to trap carbon in soil or vegetation
Supporting	Soil nutrient cycling	Processes to support biogeochemical cycling and mitigate against excessive nutrients entering water bodies
	Rainwater infiltration	Processes allowing infiltration for aquifer recharge and water cycling
	Soil formation and soil biodiversity	Processes retaining and supporting healthy soil
	Plant diversity	Ecological processes supporting diverse plant communities
	Animal diversity	Ecological processes supporting diverse animal communities
Cultural	Food for urban wildlife	Providing food through habitat retention
	Aesthetic pleasure	Beauty, inspiring interest, wonder and wellbeing
	Recreation and mobility	Gardening, children playing and facilitating movement (walking, cycling, public transport access)
	Social interaction	Contributing to resident's sense of community
Provisioning	Augmenting residential property values	Adding financial value to adjacent residents' property
	Food for people	Supporting edible plants

2.2.2 Local Government Authorities as a unique stakeholder category

As the primary stakeholder directly responsible for managing the majority of urban verges in the Perth metropolitan region, LGA engagement with native vegetation in streetscapes and verge gardening warranted investigation on several fronts:

- i) a desktop literature review of all LGA online material relating to verge gardening and management,
- ii) an online questionnaire sent out to a knowledgeable respondent at all Perth Metropolitan LGAs
- iii) semi-directed interviews (see Section 2.2.1) were carried out with a small group of LGAs involved to various degrees in verge greening using native plants.

Desktop review of online material

A desktop review of material available on individual LGA websites (up to date as of early January 2021) was undertaken to: assess the kinds of information supplied to residents regarding native verge gardening; understand the diversity of regulation of verge modifications; and the spectrum of support provided by Perth LGAs for residential urban greening along verges.

Information gleaned from LGA websites included the following:

- Availability of policies or guidelines for residents interested in verge gardening;
- Information available to residents for verge gardening (such as recommended species lists, demonstration gardens, consultant advice, ongoing maintenance advice);
- A snapshot of the diversity of financial or material incentives offered to residents (e.g. subsidised/free native plants, earthworks, tree planting) (snapshot undertaken in July 2019); and
- The status of Urban Forest Strategies.

Additionally, the current (January 2021) status of each LGA with regard to the Water Corporation's 'Waterwise' Council initiative was gleaned from the Water Corporation website.

Online questionnaire for all Perth Metropolitan LGAs

An online questionnaire was developed to rapidly engage with as many Perth Metropolitan LGAs on their verge management practices as possible (given that with 31 metropolitan LGAs, project resourcing was not sufficient to interview representatives from all LGAs). The questionnaire comprised sections on i) the functions and ecosystem services provided by the verge; ii) policies, incentives and support tools for residential verge gardening, budgets, barriers and motivating factors related to residential verge gardening; and iii) LGA verge management more broadly (budget, factors determining species selection, barriers for LGAs implementing native greening programs for their verges). The Qualtrics survey software platform was used to design, issue and retrieve the responses.

Semi-directed interviews of a subset of LGAs along a spectrum of engagement with verge greening.

Based on the online information review, the results of the LGA online questionnaire and commentary during stakeholder interviews, a subset of LGAs were extracted that represented a range of engagement with urban verge greening. The subset selection comprised LGAs defined broadly categorised as 'early adopters', 'emerging adopters', and 'minimally engaged' (Table 4). Ideally, several councils from each category would be interviewed, however, not all invitations were accepted and due to time constraints, a total of five LGAs participated in semi-directed interviews.

Table 4: Criteria used for classifying LGA Verge gardening ‘adoption status’

Categories used were Early Adopters, Emerging Adopters, and Minimally Engaged, representing a broad spectrum of engagement with urban verge greening, as of mid-2019. See text for explanation of methods used.

Category	Policy permits native verge gardening	Information provision to support native verge gardening	Incentives to support native verge gardening	General comments on engagement with urban verge greening (as of mid-2019).
Early Adopter	Yes	Yes	Yes	Several years of active engagement in supporting residential verge gardening, including offering incentives since at least 2017 (or longer). Typically have some measure of uptake and adaptive management for incentive program.
Emerging adopters	Yes (or under review)	Yes - some	Yes - recently added or considering	Permits verge gardening, some information provision or some limited incentives, or where no incentives have expressed interest in adopting some. Verge policy may be under revision with the intention to incorporate greater engagement in verge greening
Minimally engaged	May or may not	None, or maybe information only	None	No prior engagement, no related policy or minimal information (i.e. verge restrictions/ basic verge information only)

2.3 Data analysis

2.3.1 Interview and stakeholder social network mapping analysis

A total of 30 semi-directed stakeholder interviews, ranging from 45 minutes to 2.5 hours in length (an average of 1.5 hours) were audio recorded and transcribed. Interview data were thematically coded in NVivo. Coding categories included pre-defined, expected themes aligning with research questions, as well as new, emergent themes where multiple stakeholders referred to the topic (for example, influence of the individual on governance/policy design or uptake, opinions on artificial turf, native plant gardening and sense of place) (Table 5). Discussion referring to the social network mapping exercise and any relationship discussion in the interview were coded in ‘social network interactions’ and used to validate the translation of the hand-drawn mapped networks to excel spreadsheets.

The hand drawn social network maps were cross-referenced with interviews and annotated to identify:

- An overall snapshot of the collective stakeholder social network engaged in verge management;
- A description of the networks within each stakeholder category;
- The most important/dominant stakeholders with whom each category appears to engage;
- Unique (occurring only rarely) stakeholders vs stakeholders recognized widely;
- The primary sources of information/knowledge provision drawn upon by each category; and
- Any strengths and weaknesses in relationships/information flows identified through the mapping.

Table 5: Themes used for coding interview material in NVivo*Themes were largely pre-defined, with several emergent (noted with *) themes.*

<i>Theme</i>	<i>Topic</i>	<i>Sub-topic</i>
<i>Stakeholder role</i>	History and interest in verge	
<i>Policy and governance</i>	Influential policies and regulations Verges undergoing in-fill Verges in new developments LGA policy related Influence of individuals* Conflict	
<i>Verge values- function and ecosystem services</i>	Regulatory services Supporting services Social-cultural services Provisioning services	Sense of place* Economic value Edible plants (European and local Indigenous values)
<i>Social network interactions</i>	Relationships Resource flow	Direction, frequency
<i>Process of transformation (native gardening on verges)</i>	Resources required Inspiration History of transformation Enabling factors Constraints	Species selection Education* Maintenance*
<i>Outcomes from verge native planting/gardening</i>	Observed outcomes for respondent Evidence of change in ES provisioning Advantages/disadvantages for respondent Risks Ongoing management or monitoring	
<i>Change over time</i>	In values relating to verge space In attitudes towards native species verge gardening Species selection and availability	
<i>Community feedback</i>	Challenges/complaints arising Positive feedback	
<i>Future preferences</i>	Policy improvements Ideal verge Future research interests	Effective scale Composition Artificial turf opinions*

2.3.2 Stakeholder network mapping

Stakeholder interviews incorporated mapping of the stakeholder's social networks relating to their engagement with the verge space. Stakeholder social network maps (Prell et al. 2009) were hand drawn and built upon throughout the interview. The map and illustrating process were filmed throughout the interview to capture the verbal explanations provided during mapping additions. Stakeholders were invited to map their professional social networks, in relation to their involvement with verge management and urban greening from the outset, with opportunities to add and update the map as the interview progressed.

Stakeholder social network mapping primarily sought to identify:

- i) Who is interacting with who (pattern of network, presence/absence of relationship, any distinctive patterns identifying different stakeholder categories?)
- ii) The nature of the interactions? (resource type/strength/frequency?)
- iii) Between who and what major pathways is information or knowledge shared?

Preliminary qualitative results of the network maps are presented in this report.

3 Results and key findings

The results presented in this report integrate material from the semi-directed interviews, stakeholder network mapping, questionnaire to local government authorities (LGAs) and the review of verge policies. To preface the overall results section, we present several comments from respondents that echoed the lack of attention and value paid to street verges to date, emphasising the timely nature of this research. For example:

'I think the problem is we don't have a clear strategy about what we want the verge to be and what we want it to be in different locations. We've got a road hierarchy [with defined purposes] and a network, but we don't quite have the same for verges...So, what is the purpose? A verge, maybe, in a more of a higher density type context...will be very different to suburban settings or to an activity centre, where maybe there are cafes and restaurants. Maybe there'll be some instances where it is perhaps a good connection corridor between areas of valuable habitat... I don't really think we've actually calculated what the value of our verges are, what they could be, what's the best possible use for that. I think it just falls out of whatever the leftover bit of development is.' (Peak Body)

And:

'I think we've undervalued it from the biodiversity point of view, we've undervalued it from a water capturing and storage point of view, we've undervalued it from a biodiversity corridor point of view, and we've undervalued from how it can build cultural capacity or social capacity.' (Champion of Change)

And:

'It [urban greening] is a complicated space, and what makes it complicated is that it, particularly Perth, is a car society. And the network is just expanding so much. Only in the last few years [name of stakeholder agency] has come to the realisation that the green stuff on the side of the road actually does help us and we've gotta start doing something about it.' (State Government)

Results are presented for policy and governance issues (3.1), verge stakeholder networks (3.2), stakeholder values of verges (3.3), stakeholder understandings of the process of undertaking verge gardening (3.4), changes over time (3.5), what stakeholders feel constitutes an 'ideal' verge (3.6), and their future preferences for verges (3.7). The online questionnaire results from LGAs are integrated within this material in the relevant sections. Stakeholder categories (Table 2, Methods) are used to represent and attribute respondents' quoted material throughout the results.

3.1 Policy and governance of verges

Among the 31 LGAs in the Perth Metropolitan Region, there is a variety of verge management policies (for earlier analysis of Perth verge policies see Josh Byrne & Associates (2016)). Section 3.1.1 presents a review of publicly available material (policies and guidelines) provided by LGAs online. Section 3.1.2 outlines respondents' views on the influence of changing urban landscapes that are shaping the interest and activity in verges. Section 3.1.3 focuses on the influential role of the individual in shaping verge policy at both Local and State government levels. Section 3.1.4 presents issues relating to stakeholders' engagement with the verge policy or governance.

3.1.1 Synthesis of LGA policies on verge gardening

The results presented here are based on the information available on the LGAs websites at the time this review was finalised (January, 2021). Verge transformation programs are often reviewed towards the end of each calendar year, with changes made for the following year (for example, altering the number of plants made available to residents, or modifying the terms of rebates provided for transformations).

All but two LGAs had a publicly available verge policy online (Table 6). In addition, 20 of the 31 LGAs had Urban Forestry or Greening plans or strategies (including two in draft status). Of the 31 LGAs, only nine LGAs currently require residents to obtain permission to install a native verge, while 21 allow residents to install native verge gardens without special permission, providing that the LGA guidelines are followed (Table 6). Regarding restrictions on plant height, four set a 50 cm limit, nine set a 60 cm limit and 11 set a 70-75 cm limit, and five simply require that plant height allows for clear lines of sight at all times for pedestrians, motorists and cyclists without stipulating a specific height (Table 6).

LGAs specify a range of regulations on verge treatment (surfacing and vegetation cover) (Table 7). Low growing native gardens, grass, mulch and irrigation are permitted in almost all LGAs. Artificial turf is restricted in 11 LGAs, permitted in five LGAs, not specified in seven LGAs, and in all others subject to approval and usually only permitted in 20-50% of the verge area. Similarly, low-permeability surfaces such as paving, asphalt and concrete are generally restricted in terms of the allowable area. Loose aggregate material is permitted in four LGAs, while raised garden materials (such as furniture/seating, boulders, and garden beds) are allowed in some form by nine LGAs.

Table 8 presents a snapshot of the information available to support residents considering transforming their verge to a native garden (including incentives and rebates), as at July 2019. About half of the LGAs provided an online, in-house resource detailing potentially suitable native plant species, while some LGAs provided links to external information, waterwise native plants, or recommended seeking information from specific sources. Results from interviews with residents (Pauli et al. 2021) indicated that many would like more information about the plant species suitable for verge gardening (i.e., resilience, suitability to local soils, bird or insect attracting, and naturally occurring nearby).

Verge management is handled by different sections within different LGAs. Among the 20 LGAs that completed the online survey, there was a wide range of approaches to managing street verges. The majority of responding LGAs handled verge management issues under 'green space' and/or 'parks management operations', while a minority handled verge management under sectors such as 'operations', 'assets', 'works or engineering'. Of the 18 responses to the optional 'job title', 14 respondents reported that they had job titles that included the terms 'parks', 'environment', 'tree services', 'landscape' or 'natural areas'. The other four respondents had non greening officer or manager related titles, including 'works', 'city operations', 'engineering compliance' and 'operational asset'.

Table 6: Selected characteristics and urban greening policies of Perth metropolitan LGAs

Local Government Authority	Pop'n (2016)	Urban Forest Strategy	Verge garden policy available online (January 2021)	Permission required for (policy-compliant) native verge garden	Maximum plant height (cm) (nominally at 1.5 m from road kerb)
Armadale	79,602	Urban Forest Strategy 2014	Yes	Yes	Maintain sightlines
Bassendean	39,492	Urban Forest Strategy 2016-2026	Yes	No	70
Bayswater	64,677	Urban Forest Strategy 2017	Yes	No	75
Belmont	39,682	The Canopy Plan 2019-2024	Yes	No	50
Cambridge	26,783	Urban Forest Strategy 2020	Yes	No	75
Canning	90,184	Urban Forest Strategy 2019	Yes	Yes	70
Claremont	10,054	-	Yes	Yes	50
Cockburn	104,473	Urban Forest Strategy 2018-28	Yes	No	60
Cottesloe	7,597	-	Yes	Yes	60
East Fremantle	7,376	-	Yes	Yes	60
Fremantle	28,893	Urban Forest Plan 2017	Yes	No	70
Gosnells	118,073	-	Yes	No	60
Joondalup	154,445	-	Yes	No	60
Kalamunda	57,449	Urban Forest Strategy (Draft)	Yes	No	Maintain sightlines
Kwinana	38,918	-	Yes	No	Maintain sightlines
Mandurah	80,813	Urban Tree Canopy Strategy (Draft)	Yes	No	Maintain sightlines
Melville	98,083	The Urban Forest Strategic Plan 2017-2036	Yes	No	60
Mosman Park	8,757	-	Yes	Yes	60
Mundaring	38,157	-	Yes	Yes	75
Nedlands	21,121	Urban Forest Strategy 2018-2023	Yes	No	60
Peppermint Grove	1,636	-	No	Not permitted	N/A
Perth	21,792	Urban Forest Plan 2016-2036	No	Yes	No formal guidelines
Rockingham	125,114	Greening Plan 2017	Yes	No	75
Serpentine-Jarrahdale	26,833	Urban and Rural Forest Strategy 2018-2028	Yes	No	75
South Perth	41,989	Urban Forest Strategy 2018-2023	Yes	No	75
Stirling	210,208	Urban Forest Plan 2019	Yes	No	75
Subiaco	19,359	Urban Forest Strategy 2018-2022	Yes	No	50
Swan	133,851	-	Yes	No	50
Victoria Park	34,990	Urban Forest Strategy 2018	Yes	Yes	75
Vincent	33,693	Greening Plan 2018-2023	Yes	No	Maintain sightlines
Wanneroo	188,212	-	Yes	Recommended	60

Table 7: Permissible verge treatments across LGAs in the Perth Metropolitan Area*Information in the Table below current as of January 2021, and based on material available online in verge management policies.*

* Hard surfaces are considered those with low permeability; individual LGAs have specific requirements and characteristics of allowable hard surfaces; table represents a simplification only. Note also that some LGAs consider % area of hardstand to include driveway crossovers, and other LGAs exclude crossovers from the % calculation.

§ These LGAs will allow verge paving only where there is insufficient on-site parking for two cars.

¥ Note that no additional hardstand surfaces are permitted in Housing Opportunity Areas (areas rezoned to allow higher residential density in City of Joondalup)

Ø Shire of Serpentine-Jarrahdale has different policies for suburban and rural areas. Table below covers suburban policy.

LGA	Low-growing plants	Street tree planted by resident	Edible plants	Mulch	Lawn	Irrigation	Hard surfaces* (e.g. brick paving, permeable paving, bitumen, concrete. Allowable % of verge area)	Artificial turf (% of verge area)	Loose aggregate (gravel, bluestone metal)	Raised materials (boulders, garden beds etc)
Armadale	Subject to approval	Subject to approval	Not mentioned	Subject to approval	Permitted	Permitted	Not mentioned	Not mentioned	Subject to approval (fine gravel only)	Not mentioned
Bassendean	Permitted	Subject to approval	Permitted	Permitted	Permitted	Permitted	Up to 33%, must be 20% porous	Not permitted	Not permitted	Raised garden beds, street furniture permitted within guidelines
Bayswater	Permitted	Not permitted, can request tree	Permitted	Permitted	Permitted	Permitted	Up to 30%	Not mentioned	Permitted within guidelines	Raised garden beds permitted
Belmont	Permitted	Not permitted, can request tree	Permitted	Permitted	Permitted	Permitted	Up to 33%	Not permitted	Not permitted	Not permitted
Cambridge	Permitted	Not permitted, can request tree	Permitted	Permitted	Permitted	Permitted	Up to 10%, subject to approval §	Not permitted	Not permitted	Not permitted
Canning	Subject to approval	Not permitted, can request tree	Not mentioned	Subject to approval	Permitted	Permitted	Up to 30%, subject to approval	Not permitted	Not permitted	Not permitted
Claremont	Subject to approval	Not permitted, can request tree	Not mentioned	Subject to approval	Permitted	Permitted	Up to 33%, subject to approval	Not permitted	Not permitted	Not mentioned
Cockburn	Permitted	Not permitted, can request tree	Permitted	Permitted	Permitted	Permitted	Up to 25%	Up to 25%, subject to approval	Not permitted	Subject to approval
Cottesloe	Subject to approval	Subject to approval	Subject to approval	Subject to approval	Permitted	Subject to approval	Up to 33%, subject to approval	Not mentioned	Not permitted	Subject to approval
East Fremantle	Subject to approval	Not permitted, can request tree	Subject to approval	Subject to approval	Subject to approval	Subject to approval	Subject to approval, must be permeable	Not permitted	Subject to approval	Subject to approval
Fremantle	Permitted	Not permitted, can request tree	Permitted	Permitted	Permitted	Permitted	Up to 33%	Not permitted	Not permitted	Garden beds permitted, furniture subject to approval
Gosnells	Permitted	Not permitted, can request tree	Permitted	Permitted	Permitted	Permitted	Up to 33%	Permitted	Not permitted	Not permitted
Joondalup ¥	Permitted	Subject to approval	Permitted	Permitted	Permitted	Permitted	Up to 50%	Up to 50%	Not permitted	Not permitted
Kalamunda	Permitted	Not permitted, can request tree	Not mentioned	Permitted	Permitted	Not mentioned	Up to 50%	Up to 50%	Not permitted	Street furniture permitted
Kwinana	Permitted	Subject to approval. Can request tree	Not mentioned	Up to 33% of verge area	Permitted	Permitted	Up to 33%	Not mentioned	Not permitted	Not permitted

LGA	Low-growing plants	Street tree planted by resident	Edible plants	Mulch	Lawn	Irrigation	Hard surfaces* (e.g. brick paving, permeable paving, bitumen, concrete. Allowable % of verge area)	Artificial turf (% of verge area)	Loose aggregate (gravel, bluestone metal)	Raised materials (boulders, garden beds etc)
Mandurah	Permitted	Not permitted, can request tree	Not mentioned	Permitted	Permitted	Not mentioned	Up to 50%, cannot be used for parking without approval	Up to 50%	Not permitted	Not mentioned
Melville	Permitted	Can request street tree, can plant following consultation	Not mentioned	Not mentioned	Permitted	Permitted	Up to 50%	Up to 50%	Permitted within guidelines	Not permitted
Mosman Park	Subject to approval, only local species	Not permitted, can request tree	Must be local natives	Subject to approval	Subject to approval	Subject to approval	Subject to approval	Subject to approval	Not permitted	Not permitted
Mundaring	Subject to approval	Not permitted, can request tree	Not mentioned	Not mentioned	Permitted	Permitted	Up to 33%, subject to approval	Up to 33%, subject to approval	Not permitted	Not mentioned
Nedlands	Permitted	Not permitted, can request tree	Permitted	Permitted	Permitted	Permitted	Up to 40%, subject to approval	Up to 20%, subject to approval	Not permitted	Not permitted
Peppermint Grove	Not permitted	Not permitted	Not permitted	Not permitted	Permitted	Permitted	Up to 33%, subject to approval	Not mentioned	Not permitted	Not permitted
Perth	Subject to approval	Subject to approval	Not mentioned	Subject to approval	Permitted	Not mentioned	Subject to approval	Not mentioned	Not mentioned	Not permitted
Rockingham	Permitted	Not permitted, can request tree	Permitted	Permitted	Permitted	Permitted	Up to 50%, subject to approval	Up to 50%, subject to approval	Not permitted	Not permitted
Serpentine-Jarrahdale ^⑥	Permitted	Permitted if of an approved species	Permitted	Permitted	Permitted	Permitted	Permitted subject to specifications	Not permitted	Not permitted	Not permitted
South Perth	Permitted	Not permitted, can request tree	Not mentioned	Permitted	Permitted	Permitted	Up to 50%, subject to approval	Up to 50%, subject to approval	Not permitted	Not permitted
Stirling	Permitted	Can participate in community street tree planting. Can request tree.	Permitted	Permitted	Permitted	Permitted	Up to 30%, subject to approval	Up to 30%, subject to approval	Not permitted	Not permitted
Subiaco	Permitted	Subject to approval	Permitted	Permitted	Permitted	Permitted	Up to 30%, subject to approval [§]	Not permitted	Not permitted	Not permitted
Swan	Permitted	Subject to approval	Subject to approval	Permitted	Permitted	Permitted	Subject to approval	Subject to approval	Not permitted	Not permitted
Victoria Park	Subject to approval	Not permitted, can request tree	Subject to approval	Subject to approval	Permitted	Permitted	Up to 25%, subject to approval, for decoration not parking	Not permitted	Not permitted	Subject to approval, plant containers, street furniture permitted within guidelines
Vincent	Permitted	Not permitted, can request tree	Permitted	Permitted	Permitted	Permitted	Subject to approval	Not permitted	Not mentioned	Permitted
Wanneroo	Permitted	Not permitted, can request tree	Not mentioned	Subject to approval	Not mentioned	Permitted	Permitted (residential only), <3 m width across length of verge	Not mentioned	Not permitted	Not permitted

Table 8: Overview of verge transformation information and incentives

Notes: ^ - Working Toward Endorsement, *(Year) - Council awarded Platinum status for Waterwise Council of the Year

LGA	Guidance on species selection	Incentives or rebates offered for verge transformation	Examples of incentives offered (~2019)	Waterwise council status (January 2021)
Armadale	Online plant list	✓	Native plants provided (free)	WTE^
Bassendean	Online plant list	✓	Plant subsidy scheme, free mulch, adopt-a-tree program	Gold
Bayswater	Online plant list	✓	Free street trees, free native plants	Gold
Belmont	Link to external information	✓	Free mulch	Endorsed
Cambridge	Link to external information	✓	Waterwise verge makeover rebate (max \$500)	Gold
Canning	Online plant list			Gold*(2019)
Claremont	Online plant list	✓	Native plant subsidy scheme	WTE
Cockburn	Online plant list	✓	Native plant subsidy scheme	Gold
Cottesloe	Online plant list	✓	Waterwise verge rebate (maximum \$500)	Gold
East Fremantle	None provided	✓	Native plant subsidy scheme	Endorsed
Fremantle	Online plant list	✓	Assistance with verge preparation pre-planting, free mulch, native plant subsidy	Gold
Gosnells	None provided			WTE
Joondalup	Online plant list			Gold
Kalamunda	None provided	✓	Native plants provided (free)	Endorsed
Kwinana	Phone City's Bushcare officers	✓	Free mulch, subsidised native plants, free street trees, workshops	Gold
Mandurah	Speak to local nursery	✓	Waterwise verge makeover program	Gold*(2017)
Melville	Link to external information	✓	Native plants provided (free)	Endorsed
Mosman Park	Online plant list	✓	Native plant subsidy scheme	Gold
Mundaring	Link to external information	✓	Native plants provided (free)	Gold
Nedlands	Online plant list	✓	Native plant subsidy scheme	Endorsed
Peppermint Grove	Online plant list			Endorsed
Perth	None provided			Gold
Rockingham	Online plant list	✓	Native plants provided (free)	Gold
Serpentine-Jarrahdale	Online plant list	✓	Native plants provided (free)	Gold
South Perth	Online plant list			Endorsed
Stirling	Online plant list	✓	Native plants provided (free) & rebate scheme (up to \$500)	Gold
Subiaco	None provided	✓	Full verge makeover (remove and replace materials), plant subsidies, design advice	Gold*(2018)
Swan	Link to external information	✓	Free mulch in exchange for recyclable goods	Gold
Victoria Park	Online plant list	✓	Adopt-a-Verge program rebate (\$500)	Gold
Vincent	Link to external information	✓	Native plants provided (free as well as subsidised)	Gold*(2017)
Wanneroo	Request by phone		None	Gold

In terms of stakeholder experiences of engagement with LGA verge policies there was a spectrum of responses. Many respondents (drawn from Developers, Utilities, Peak Bodies, State Government, Horticulture and Irrigation Industry) commented on the diversity of LGA policies as being a potential challenge, particularly those stakeholders frequently working across multiple jurisdictions, or negotiating compensation (e.g. street tree removal). For example:

'It's more the disparity between local governments. We find that one will say the cost is X dollars, and the other will be double that. And I suppose that interaction between them both, they run their own internal policies, and we've sort of got to navigate those individually, as the project crops up...The project management and the budget, and the expectation of what will be imposed or expected of [us]. And the variable reasonableness of one approach to the other.' (Utility Provider)

'I think the regulations currently are a bit restrictive and it varies from local government to local government I think...Because I think some of them will allow you to do certain things that others won't. I know the native verges has been a big issue in some councils, whereas others sort of openly encourage it.' (Developer)

Another respondent was more forthright:

'What needs to happen is consistency across councils. That's the problem with local government, is that there's different policies.' (Peak Body)

One entity commented on the diversity of ways LGAs are applying the non-statutory [Better Urban Forests Planning Guide](#):

'Different councils are applying it [Better Urban Forests Planning Guide] in different ways. So, most councils are mapping how much canopy cover they have in their shire. And they're saying, right, well, if you're removing this canopy cover then you need to replace it. But we're going to multiply it. So, we've had some councils...who've said to us, we want you to replace it four for one... So, I think the policy is well-intentioned but there is still some thought processes to be worked through in terms of how that policy is applied.' (State Government)

Environmental and planning consultants engaged in verge design and installations were familiar with complying with their client's LGA requirements and did not raise variation in LGA verge policy as a significant issue. For example:

'The councils have a recommended guideline for doing a verge development. They usually have a height restriction, generally 0.5m. They also have a setback requirement from the road so that they don't end up with an overgrowth burden onto the roads, which is pretty logical, and I think the policies are really easy to comply to because it makes sense.' (Environmental Consultant)

[In response to a question about variation]: 'They're roughly all the same. Some of them have slightly higher height restrictions or a bit more lax on their height restrictions and I know some councils have this 2 m setback so the first plant can't be put in as 2 m from the verge. It is quite far, and I find it leaves this bare patch, which is kind of annoying because you lose so much of your verge. If you've only got a small verge, you lose a third of it straight away...The reason for any council having a setback is so that you don't end up with the overgrowth but also so that people can step off the road. But given that the type of plants that you would naturally put at the front would be low and groundcover in nature anyway, you know, if people needed to step off the road then stepping on plants probably wouldn't be an issue anyway.' (Environmental Consultant)

The height restriction was described, however, as influencing horticulture practices in some nurseries, and species selection by some environmental consultancies (see section 3.4.3). For example, the emphasis on growing flat forms of a species, or verge suitable species:

'The height limit for line of sight for cars, is rather limiting. This led to a lot of people breeding flat plants. Flat Melaleuca, flat Acacias, flat everything. They then put a PBR [Plant Breeder's Rights] on it and we're not allowed to grow it unless we pay. So what we're doing is growing flat plants that are not under PBRs but also because our philosophy is that we want to grow the natural form of the plant.' (Horticulture and Irrigation Industry)

Key Findings:

- All but one of the 31 LGAs specify a verge garden or treatment policy online (as of January 2021). Almost all provide allowance for residents to plant low growing vegetation, with nine requiring specific permission from the council to install a native verge. Remaining LGAs simply require residents to comply with guidelines rather than apply for permission.
- 20 Perth LGAs have a current or advanced draft Urban Forest Strategy.
- The diversity of urban verge and forest policies among LGAs was raised as a complicating factor by many stakeholders in their work on verges, although some respondents were familiar with working with different LGA requirements.
- Verge plant height restrictions set by LGAs influence the native plant species recommended and the growing and supply practices of nurseries.

3.1.2 The influence of increasing urban density and loss of private green space

Respondents raised changing urban density and greenspace trends as influencing the renewed interest in verge greening. With Perth's population projected to reach 3.5 million by 2050 (Environmental Protection Authority 2015), verge space will continue to attract interest, as new developments will maximize lot yields and residential infill reduce the size of backyards.

'There's a huge amount of pressure on verges. Particularly with the push for increased density in established suburbs. Because you lose all your trees out of your backyard when you subdivide. And then you've all of a sudden got another driveway in the verge, so you lose your verge as well.' (Environmental Consultant)

'I think by default, with the way the planning commission is and the way the trends are going, it's [the verge] basically, that's going to be your last place to plant. And the urban tree canopy then becomes the responsibility of the council, because there's no other land to plant on.' (Champion of Change)

In terms of any differences between pressure on verge space from infill or in new developments, one respondent said verge space under infill was under more pressure because the verge is needed for parking. This respondent also commented that:

'low grade kind of infill has also been seen as not delivering great outcomes in terms of amenity and has negative impacts such as increasing urban heat...So almost in a way in greenfields it might be easier to do the...more ecologically valuable]...end of verge treatment.' (Developer)

However, this also requires the developer to reduce lot yield, which would be unlikely, unless a specified requirement. Additionally, one respondent noted:

[There is a] trend for developers to try to use drains and catchments and verges as public open space, so therefore I think that drives them to basically get rid of verges if they can't include as public open space... I think verges need to be considered something else other than public open space.' (Champion of Change)

Regarding allowable block size, which in turn influences the potential size of the verge in new developments, respondents widely recognised the rapid reduction in allowable size:

'It also comes down to how big they are as well [the new developments]...a lot of the lot product now is so narrow, almost a pocket handkerchief of nothing really... So effectively, you've pretty much done away with the backyard. I don't think people have really thought about what the implications of that are yet.' (Developer)

For reduced block sizes (in both new and infill development), the loss of the backyard has arisen as people find ways around the permissible percentage of a block one can develop:

'But I still don't know how you can get approval for ... You're supposed to be able to develop, is it 60% of the lot? I think. But still, you look at that and it's completely maxed out, but all you've got is this narrow strip down the sides and maybe a little bit at the back and somehow ... I think it's because they don't include anything that isn't enclosed by walls, so you can get your alfresco and maybe your garage and your driveway all included as well. But it's not really, it's not a true reflection [of retaining private open or green space]'. (Developer)

This then generates additional pressure for what verges can provide by way of urban greening:

'You know, and I don't think we should destroy the backyards and that's what I get concerned about is that, you know, we'll green up the verge spaces and destroy the private spaces, which you can see the developer logic in that can't you?' (Champion of Change)

As a result of the pressures of suburban subdivision and decreasing block size, several respondents believed regulation was required to mitigate the impacts of this. For example:

'The infill development is eliminating our oxygen, eliminating our canopy. And it's been talked about for a long time and the urban heat island has been talked about for a long time... In terms of priority, the loss of the big tree is something that's, it's marching toward urban heat island effect, making Perth hotter, why would you do that? Why would you consciously not regulate that issue?' (Champion of Change)

Loss of street trees was attributed to poor planning policy, poor design, and lack of information regarding the requirements for tree survival. For example, subdivision design challenges such as the desire for 'double crossover' driveways (effectively doubling with battle-axe subdivisions) was raised by both Peak Body and LGA respondents as impacting the size of verges and the retention of trees. This has since prompted several LGAs to refuse requests that involve removal of a street tree:

'People want a double crossover, which is up to 6 m. And they want us to take out street trees in order for them to be able to do that. They get quite emotional about it and sometimes aggressive and pushy about it all. But we say, well, the tree is actually public property and no, you can't do that, you can have a single crossover which expands out to a double on your property.' (LGA)

An example was provided of an LGA ultimately refusing subdivision development applications requesting the removal of a street tree, given their growing frequency:

'Because it was happening all the time, I kid you not, every council agenda, we would have had five or six applications for a house being built and they wanted to remove the verge tree. And it dawned on me, well that tree's got value. It's not owned by the neighbouring property, it's owned by the entire community. You're not going to allow me to go in and knock over an ablution block or take out a sign are they? Why are they not valuing trees? ... Those trees had value, they're an asset. Why are we gifting that asset...? So now, I tell you, it's great, and it took me years to turn this ship around. Now, the planning staff started refusing applications. And they started saying, no, if you flip your house designs, you can retain that tree.' (Champion of Change)

Loss of trees to infill was also attributed to a lack of knowledge by one respondent:

'We've got these infill targets that make sense in a lot of contexts to stop the urban sprawl but by the same token, if everyone fills up their backyards with houses, there's no space for any trees. And that becomes two things, how much space is there and how much knowledge and awareness is there around what can be done to retain the tree. So sometimes, people have a proposal and the layout, it's perfectly achievable to retain the trees and either people don't realise that, or they're put off by the fact that there will be a cost and they're worried about that. And so, the end result is that the tree or the vegetation is lost because it's just easier. ...A lack of knowledge and lack of understanding. It's the path of least resistance, in some ways, you just get rid of it and then just take it from there. It's a bit of a challenging situation that one.' (Environmental Consultant)

However, more respondents attributed the pattern of urban tree loss to poor planning:

'Suburban infill is not being well done, it's obliterating plant spaces so that means that that couch [grass] out the front may be the only piece of greenery on the land... But that's because we haven't got the new regulations in force that require more greenery within the infill buildings.' (Champion of Change)

An LGA respondent also noted instances for infill increasing competition for accessing a shared verge space, resulting in LGAs having to address conflict between neighbours, for example:

'If there are multiple dwellings on the one address, we've had issues between neighbours. The one at the back says, I want to park my car on the verge or something like that. Someone else says, no they can't do that, because I want to do this or no, I'm not happy with that or something else. It can be tricky. But we, we were forced to get legal advice last year on who gets preference over what happens on the verge. And it turned out that, according to our local law, the property that is touching the verge gets the say on who parks the car on the verge. They can have someone issued with a parking fine. Or they can ask for a tree to be planted... Ahead of what the other people say, unless there is a strata agreement. So, that was interesting and it has helped us settle some of these disputes.' (LGA)

Utility providers also had perspectives on how growing urban density reduces block and verge sizes, also impacting their works program:

'So when you do a subdivision, there's a continual pressure to reduce the size of the road reserve, squash everything up, reduce the size of the blocks. That's why half of these detailed pictures here [referring to technical maps] are how to get everything in without electrocuting the guy working on the meter, but only take up a small spot in the corner, because everything's being squeezed.'

'There's a push to put possibly services under pavement, which most utilities are opposed to, because when you access them, you've got an argument with the council, because they look after pavement. We don't feel that we're being displaced by trees or anything like that. And in fact, I think they would probably get rid of the trees when they're squeezing first, which doesn't help with the heat island thing. But as things have been squeezed...my perception... is that it's very much squeeze, squeeze, squeeze, because they're trying to knock them out for a price.' (Utility Provider)

Where works are adjacent to busier roads, it can be more difficult to reduce the footprint on verge vegetation:

'The bigger the road, the harder it is to get traffic management, to be able to park and do your work from on the road. So you increasingly get pushed into the verge with your equipment, which then means your footprint of the works increases.' (Utility Provider)

While a respondent (Environmental Consultant) went to great lengths to retain mature trees wherever possible in the design of new developments, they described experiences with some developers less committed to the retention of mature trees:

'Greenfield developers in particular, and some infill developers where it is purely money driven. So profit driven. So a lot of this stuff [techniques to retain mature native trees] falls by the wayside and becomes a perception of developable land, saleable land. So whilst there are mandates around percentage of green space and so forth, that is quite often done very ad hoc and with very little meaningful response to that requirement.' (Environmental consultant)

And a developer's response to the issue of retention of trees:

'We keep trees where we can. It can be difficult in that urban environment in terms of keeping them everywhere, in terms of density requirements and average 400 m² blocks, for example. And also, in terms of the tree canopy and making sure we're not actually impacting roots etc. They're installed in front of every house obviously, it's just whether before the house is built or after. And the other part now I guess is whether we dictate where people put their garages, so we actually say the street tree is going to be here and we do that on some projects, rather than having it the other way around and they're just left with a little bit of verge afterwards.' (Developer)

While no form of development is issue-free, often greenfield developments are out of sight and their impacts are easily overlooked. The irony of the attention being given to urban greening while areas of bush continue to be levelled was not lost on this respondent:

'The biggest thing with new developments is, don't clear all the bush. I mean, it's a serious issue that we have. We're trying to develop green space when we've got it already, and then we clear it out. And then we're gonna try and grow something back in, in one of the most inhospitable environments that you could possibly get, why not just leave some of it? ... There's a lot of it that's got better, no doubt. But there's a long way to go. When you're clearing areas of bush that you'll never grow again.' (Horticulture and Irrigation Industry)

Key findings:

- Planning permissions increasing urban density requirements have seen decreasing residential block sizes and reductions in proportion of residential block area owners are required to retain for private green space. This has had the effects of i) increased the demand for verges to provide public green space and ii) driven a reduction in available verge area.
- Respondents raised lack of knowledge and poor planning as reasons for the avoidable loss of some street trees with infill and some wanted to see better regulation to reduce the loss of canopy cover in Perth's urban areas.
- Some LGAs are responding through their subdivision approvals process, to ensure street trees are retained, as public assets.
- Urban density is also squeezing utility space and utilities are having to be creative in fitting their services into smaller verge sizes, or potentially explore other locations (e.g. under pavement or via rear lane access).

3.1.3 The role of the individual in driving policy and behavior change

This research identified many instances of individuals who significantly influenced or drove change in verge policy and/or management, across multiple stakeholder categories. Given that verge transformation or gardening generally involves aspects of behavior change, individuals (within community groups, advocacy groups and consultancies) promoting new ways of engaging with native vegetation, providing education, or strong networks for knowledge sharing, can prove highly influential.

At the State Government level, several staff directly involved in verge greening programs reported the role of individuals as being influential to their programs (which often require behavioural change either

within an organisation or in the community). These individuals included Ministers and professionals working within Departments. For example, one particular professional supporting the [former] Department of Planning was highlighted as influential in engaging the support of key State government parliamentary leadership for what became the Wildflower Capital Initiative (harnessing the use of West Australian plant species to help define Perth's identity). The initiative was then instigated across numerous State government agencies:

'I guess before it came to [our agency]...[person's name]'s the one that whispered into politicians' ears and the Director General, I think it was, or the Commissioner General, anyway there was someone at the top level, and then it filtered down to the ministry level and then it came to [our] committee.' (State Government)

The role of influential individuals or 'champions of change' in Perth's local gardening scene prompting responses from LGAs were also evident. There had been a recent history of LGA and resident conflict over verge gardening, installing particular verge surfaces or the presence of a street tree. Given LGAs bear the weight of legal responsibilities for verge land, they can tend to be risk-averse. This requires motivated individuals to push against established boundaries. For example, an individual 'guerrilla' gardener inspired a local councillor to push for LGA policy change.

'A known resident had converted a small park and just started doing some guerrilla gardening to it and I thought, well, this is pretty cool. It's illegal though. And I thought, well, this is cool and it's good for the community, for everyone, there's nothing bad about what he's doing but it's illegal. So part of my verge motion had a second and, in fact, a third limit to it. So the second limit was that we develop a policy to allow people to plant in parks and that's now been delivered as well, but after the verge policy. And that's had international attention. No one has had the courage to go after that one yet.'

'So in 2015 that I moved a motion for us to adopt a policy and framework for residents to pretty much have control over the verges. Previous to that, we had these ... rules, which all local governments have, like you couldn't plant much on there. I mean, they were just totally flipped over. So the first step was to move a motion at council. And then the second step was to get the councillor support to get it through council. And then it was a couple of years before the officers, the actual council, the administration, the employees, delivered on the policy.'

'[Our LGA], we were, and are still, up there in terms of verge management, allowing residents to make use of it. And that's in the country [Australia-wide]. So we've had national recognition of what we've done. And now we've had other local governments copy us. We've fielded phone calls, the administration, has fielded phone calls from around the country, local governments... But we are at the vanguard and others are now moving up to us.' (Champion of Change)

The influence of information sharing platforms through social media is profound in terms of its demonstrated capacity linking hundreds of small local residential and community groups to a source of information, inspiration and encouragement, and troubleshooting. Social media platforms were seen as a useful means of drawing attention to verge gardening and suggesting improvements in LGA verge policy, particularly when verge gardeners tend to be a 'quiet cohort'.

'So, councillors will only get engaged in things that...represent the cohort, right? So if their cohort's not vocal about this [nothing will change], they [the vocal cohort] probably want a dog park, or they want the local roundabout fixed, or something else happening, the verge garden is really a bit of a quiet cohort of introverts. So, I guess that's part of the motivation also, is to, if we can over time, demonstrate that there's a cohort with a voice, and a legitimate... how to say? A legitimate cause, then perhaps we can help fairly lobby or at least give voice to the side that doesn't want everything sprayed, bulldozed or paved. (Champion of Change)

Several Champions of Change noted the benefits of engaging with Perth-based or nationally-recognised gardening personalities, to raise the profile of new gardening practices or behaviours.

Leveraging media (newspaper, radio and local TV) was also a feature for several Champions of Change to extend their reach.

Individual LGA councillors (elected members) were described as having a significant influence on LGA verge management and urban greening policies:

'You need the council resolution to get anything to happen, which is why I say with the verges, you need a councillor to get a council resolution.' (Champion of Change)

'I'd love to see an initiative pushed through from probably the mayor or one of the councillors about ...verge gardens... I think, even if it came from internally [i.e., from the staff], I still don't think it would get any traction. So yeah, I do think the elected members are probably the ones that would push that.' (LGA)

One LGA respondent described a situation where a councillor instigated an investigation into a verge gardening program and then supported the plan that staff provided. Another LGA respondent described the influence of the individual in the context of staff turnover. A very motivated individual had pushed for a particular change or program and when they left, the program was at risk of petering out or drifting from its intended purpose.

Key Findings:

- Individuals can be tremendously influential as 'Champions of Change' in prompting policy change, at Local and State government levels, particularly when organisational behavior change is required.
- Individuals activate change (e.g., embracing greater use of native species) in verge policy and practice across and within Local and State government agencies, as well as in the private/semi-private sector, for example with environment and planning consultants able to demonstrate best practice in sustainable developments in partnerships with DevelopmentWA (formerly LandCorp).
- The viewpoints of elected members are central in determining verge policies.

3.1.4 Particular issues of policy contention for verge stakeholders

Given the diverse stakeholder interests in verge management, it was unsurprising there were particular issues that arose repeatedly between certain categories of stakeholders. The examples highlighted here, preferences for particular verge treatments (see species selection for more details), compensation for verge vegetation loss and damages (local or state government and utilities or developers), and enforcement issues for LGAs, seek to raise awareness of the diverse issues which certain stakeholders contend with while engaging with verges.

3.1.4.1 Preferences for particular verge vegetation

Verge treatments (comprising the surface cover and species selection) is a topic for which many stakeholders have strong preferences. Even among those stakeholders for whom urban greening is the priority in their professional work or advocacy, there was a wide spectrum of preferences for the type of 'green' on verges. These ranged from irrigated turf, to a mix of edible and non-edible garden plants, to only endemic native plant species (see species selection (Section) 3.3.3 and multiple layers of vegetation (see 'An ideal verge' Section 3.5)). Despite this diversity, all respondents recognised the value of a tree on the verge and the need for species with reduced water use (several also added reduced fertiliser use). All were unanimous in their disapproval of artificial turf as an appropriate verge surface (see section 3.6). The sector was clearly familiar with articulating strong preferences, however, such that one respondent felt a call for listening and balance was timely:

'The one thing that I really believe is that [regarding] green open space, we don't need factions, we don't need one people saying, "We need to get rid of all the grass" and then other people saying, "Oh well, why would you plant bush, or why would you do this?" We need a balance, we certainly need a balance and we need to learn to listen to each other and learn off each other and take the good parts of it...I think we need to listen...and we will pick stuff up so that we can do it better.' (Horticulture and Irrigation Industries)

3.1.4.2 Compensation for loss/damages to verge vegetation

Between individual utilities, or a utility and an LGA, the utility code of practice (Utility Providers Services Committee 2018) has a section on tree replacement and compensation. A utility provider described the process:

'It's tricky, isn't it? So this causes a great deal of consternation. So I believe people on this committee do see trees as assets. So if a utility puts something randomly in the wrong place and then another utility comes along and says, "Well, I need to get my pipe through there and that's my alignment," then there's a discussion. And the underlying rule is usually if assets are already in place, the person that wants to change that pays. So same kind of deal with trees. I think we do look at them as assets. So we do pay a lot of extra money to do trenchless underneath the big heritage listed things...We try very hard not to damage the roots and all of that, there's experts involved to make sure we don't do that. (Utility Provider)

Instances also arise where the requirement to clear comes from needing to have significant earth working equipment on site, rather than the actual footprint of the item being installed. For example:

'An underground pit is usually two meters by two meters, or approximately that. But it took a four meter long, four meter wide truck to dig it, access and bring in all the cabling and everything. And that had to be parked up on the verge where the large tree was. And you can't really avoid it ... And those competing uses, you look at the arterial roads of Canning Highway and Leach Highway, and South Street, and those ones, there's almost no ability to shut down and operate on the road surface itself.' (Utility Provider)

There were also reported issues of unbalanced power between local governments and national telecommunications carriers:

'this issue of the authority that the federal legislation gives the carriers, the power that it gives them is unbalanced. And it leaves the local authorities in a difficult position to actually manage their road reserve when basically a carrier's got permission to do almost whatever they like. I mean, the legislation doesn't actually say that, but it gives the impression that they can just do these notices and go in and do whatever they like...' (Peak Body)

Developers and LGAs also frequently had discussions over damage occurring to verges before hand-over (where builders may have damaged verge vegetation), as well as the ease of maintenance of particular design features in the planning approvals stage. Putting a cost on the street trees proved influential in reducing loss and damage during the construction phase. For example:

'So, one of the issues that they had was that when there was a development on a block, say knocking down a house and building three or four, all the street trees on the verge, you could write them off from that day, they were gone. So, they put a value on it. They then insisted that the contractor, the building contractor took out insurance to cover the cost of replacing the tree at worst or fixing it up if they damaged it. And that went straight down the line to all of the contractors so instead of driving their ute up next to the tree for parking and [damaging it], they had structures around them and they knew the story, if they were found out, there was a serious dollar to pay. And overnight, that just changed the story.' (Champion of Change)

3.1.4.3 Enforcement issues within LGAs

Several respondents raised challenges in enforcing LGA verge policy. These challenges included lack of staffing resources and lack of support from elected members. Several Champions of Change believed that LGA compliance could take either end of the spectrum, from complete absence, to being overzealous in response to a neighbour's complaint. Examples include:

"Oh, well, [they might say] we have [a] verge policy, but we never enforced it. No one complained." The officers and councillors...they've only got so much time in their day, so they're not going to actively seek out things to create paperwork and animosity between them and the residents.' (Champion of Change)

'So if you have quite a restrictive policy, then, if someone complains, then the council can default and go, "Well, you're not complying. So therefore, you must comply to this height. We'll come and chop everything down to 200 mm, or 400 mm." Because across Australia, that height varies. Some councils are 400, some are 500, some are 600...So if you have a kangaroo paw, the leaves may only go to 200 mm, but the flowers can go to a metre or 1.5 [metres], right? So therefore, they may just come and chop the tops off them. Is it obstructing the view? No.' (Champion of Change)

Several respondents reported examples where enforcement of contravened verge policy (e.g. an illegal verge treatment, street tree removal against development approval policy) was undermined after the ratepayer(s) contacted elected members. Such examples made it difficult for staff to then keep the rules consistent for all ratepayers. In contrast, one respondent described how critical the council's support was in supporting the implementation of new policy to retain street trees in new development applications:

'The planning department, all of a sudden were on board and saying no to these developments... And for the first few months... council kept overriding the officers and saying, yes ok, you can have it [the development and removal of the tree]. Because the residents were there applying some pressure. And so that was a really, really bad situation because I don't think it would have been too much longer before the officers said, well...we're going back to how it used to be. But luckily, somehow, council stopped doing that and started supporting the officers and being firm.' (Champion of Change)

Key Findings:

- There is a diversity of verge greening preferences, in terms of vegetation choice and composition among advocates and practitioners.
- Compensation for loss or damage of verge vegetation (i.e. street trees) can be contentious between local and state governments, and between local or state government with utilities or developers.
- There was a spectrum of LGA application of their policies and regulations regarding verge treatments and street trees, ranging from rigorous enforcement to limited resourcing capacity and/or political will to support enforcement.

3.2 Networks and relationships among verge stakeholders

Given the potential for contested street verge management priorities among such a diverse range of stakeholders, understanding the relationship network of stakeholders is valuable. During interviews respondents were asked to draw their stakeholder network related to their work in the urban greening space, particularly focusing on street verge greening. A qualitative analysis of these networks is presented here, with ongoing quantitative analysis underway.

3.2.1 Stakeholder network characteristics

The research demonstrated that there are numerous, diverse actors in the street verge space. Actors span all levels of government, including multiple state government departments, private businesses and government trading enterprises, across a wide set of industries, many represented by peak bodies. Numerous community groups, not-for-profit organizations (e.g. Southeast Regional Centre for Urban Landcare, SERCUL) and greening advocacy groups engage in this space. Research groups and institutions (e.g. the Cooperative Research Centre for Water Sensitive Cities (CRC-WSC), various universities) also appeared, as well as influential individuals - such as ministers, local government councillors or citizen champions of change. Stakeholders interacted with citizens under various roles: as the public, residents, community or clients. Influential projects, events, key processes, and program drivers (e.g. [202020 Vision](#)) also appeared in many network maps as a key part of the participant's network.

For most respondents, LGAs were their most important and influential organization in their network. For example, in providing consultant and developer work and setting guidelines (consultants, developers, horticulture and irrigation industries), as pivotal in design, planning and approvals processes (utilities, developers, state government), as influencing resident engagement in verge gardening (champions of change, horticulture and irrigation industries) and influencing the verge policy and programs of other LGAs.

Utility stakeholder respondents all interacted with other utilities, multiple state government departments, individual LGAs and WALGA, contractors and various Peak Bodies. The **Developer** stakeholders had relatively similar networks, the main distinction being the State government developer noted more links with Peak Bodies and with research driven-organisations (e.g. CRC-WSC – Water Sensitive Transition Network). Perhaps unsurprisingly, Utility, Developer and State Government respondent networks featured regulatory relationships more prominently than other stakeholder groups.

State Government stakeholders were also similar; engaging with multiple other state government agencies, LGAs and WALGA, Water Corporation, community groups, planning consultants and Peak Bodies. The Peak Bodies were related to different functions of each agency, such as planning and design, nurseries, irrigation, turf, landscaping and urban greening. Several State Government maps directly noted the influence of their Ministers.

Local Government Authorities all listed other LGAs as part of their network (comparison/ inspiration/ guidance) and for two LGAs, elected members appeared as an influential part of their network. The networks of 'early adopter' and 'emerging adopters' all had substantially more connections with external organisations than the 'minimally engaged', such with not-for-profit environmental advocacy and local community groups. The Water Corporation was a significant element of the network for the majority of LGAs.

Peak Bodies, by the very nature of their purpose, as a representative, members-based entity generally have extensive, well-established networks. This was the case for all Peak Body stakeholders in this study. They were all WA representatives of their Industries connected with a National umbrella

association/institute and all had multiple State government departments and LGAs, related Peak Bodies and very diverse membership. Representative networks sometimes additionally included state government agencies, various road-related peak bodies, engineering associations and utilities, urban designers, planners, environmental and civil consultants.

The networks of respondents within **Horticulture and Irrigation Industry** stakeholder group reflected the diversity of this grouping. All linked with their respective peak bodies and often allied ones as well, all interacted with LGA and State government agencies and all networks features the Water Corporation. Training, education and community engagement and other not-for-profits sometimes featured as mapped network connections.

The networks of **Champions of Change** (CoC) were quite diverse, mostly large, with one relatively small. CoC networks often featured key individuals in the public space garden, and also branched out to state and local government, national partnerships industry, research institutions, community garden groups, educational institutions and more.

The networks across the **Environmental Consultants** respondents were quite varied, reflecting the different expertise and scale of their applied work. Those engaged directly with native verge garden design, installation and landscaping, had somewhat smaller networks, as they operated primarily at the residential scale but also for local governments and occasionally as consultants for state or the development industry. Their networks included suppliers, nurseries, LGAs and community group connections, including with community educators. Environment and planning consultancies worked for state and private urban developers, with heavy interaction with local and State levels of government, as well as the community and ongoing relationships with research institutions. Interestingly, one environmental consultant drew their map using a 'Western Australian plant' as their center point, with all interactions flowing from this plant, also including, soil, insects and water. This reflects more a relational worldview, and demonstrates a recognition of our human-environment interactions. This was a novel but welcomed result, arising from a respondent interacting with a space as innocuous as a street verge.

The maps of several stakeholders reflected on the complexity both within and outside their organization. For example, the one project team working on the Wildflower Capital Initiative, listed seven branches within their own agency with which they were required to interact. LGAs also noted their verge-related management programs spread across several sections such as parks, engineering, environment and sustainability.

Examples of strong cross-sector partnerships emerged. There were examples of partnerships between environmental and planning consultants, State Developers and research institutions which were generating development industry best-practice in sustainability, using evidence based approaches, such as the 'Innovation through Demonstration' project model at White Gum Valley, Fremantle.

Many respondents cited the strong influence of the Water Corporation's Waterwise program (via Water Efficiency Partnerships) as inspiring increasing demand for verge gardening among the public. The Water Corporation and/or the Waterwise program featured in the network maps of 19 from 30 respondents. The Water Corporation's Water Efficiency Partnerships program has grown to encourage and support LGA Waterwise accreditation (and support LGAs across Western Australia). One element of accreditation is that LGAs must have in place a waterwise verge policy (which may include native verge gardens). The Water Corporation will then offer a set amount of matched funding to LGAs per residential verge transformation, which is generally passed on to the resident as a rebate for works undertaken. Regarding the waterwise verge program:

'The main impacts to date have been an increased sign-on from local government to look at subsidising for the residents to deliver something in that space. ...by offering the incentives more widely, because there was a serious lack of uniformity out there amongst local governments and there still is ... I think it's helped to level the playing field a little bit, bring in a little bit more uniformity. ... So, it's a really positive experience, not just for the community, but for local government as well.' (State Government)

3.2.2 Information and resource sharing within networks

In terms of information sharing, major avenues for the various stakeholders were highlighted through social network discussions. Peak Body stakeholders, as active proponents of disseminating information through their membership already used a diverse means of sharing information - social media, regular in-person networking events (e.g. lecture breakfasts/lunches), newsletters, and conferences were all raised by these respondents as a means of engaging with their membership. Utilities and State government agencies had representation across shared committees/ specialty sub committees, as well as being part of research-informed practitioner networks (e.g. Water Sensitive Transition Network). Developers, Horticulture and Irrigation industries and Environmental Consultants had their respective Peak Bodies facilitating communication and some engaged with marketing representation. LGAs engaged with residents directly through a variety of different means, e.g. website information, some through being active on social media (others were prohibited from doing so), while those with verge gardening support programs all used workshops for education to great success.

Several Champions of Change, characterised by their own driving interest in generating social/environmental change, emphasised the critical need to look for other examples nationally and around the world. These individuals were keen to see where their experiences and ideas around verge management fitted with those applied elsewhere and to leverage off these experiences.

'Well, it's one of those things of looking abroad, or looking outside of your sphere, and thinking outside the box, and looking at what other states are doing, what challenges have they got? So, because more often, with anything you do in life, someone's done it before. So what are they... why are other people doing stuff more efficiently than maybe someone else that you know? And it could be, yes, they've got experience, or they've learnt from someone else's experience.' (Champion of Change)

Champion of Change respondents reported engaging heavily with social media (e.g. Facebook, Instagram, blogging) as a means of sharing information, inspiration, challenges and solutions, as well as seeking opportunities for change:

'And then anecdotally, I had someone say, "Oh, the ranger told me I couldn't have a Verge garden," and they were just planting some little flowers. So then the person joins my group and says, "Well..." So then ... I contact the mayor and say, "Well, can you check? Can you see what's going on here?" On Facebook ... I just tag them. ...if you have some social media savvy people, then they will respond to it. ... So, it's just an easy tool. And it's probably a lazy tool, but it saves you writing the letters to the council!' (Champion of Change)

Champions of Change were also proponents of engaging with personalities and public figures to draw attention to their cause and utilize mainstream gardening media (TV, radio, newspaper) to share nature strip gardening stories and experiences.

In terms of stakeholder interactions going forward, several respondents recognised the room for improvement in collaborations, but that the very nature of the growing importance of retaining and fostering urban vegetation is one that will continue to drive unavoidable interaction, requiring ongoing, adaptive improvements in the way stakeholders engage:

'...the more emphasis that is put on retaining trees and installing trees and getting a greener urban area, the more those different sort of fields are forced into a space where they have to deal with that. I think that a lot of people find that quite uncomfortable - of being informed that they can't necessarily do things they always have. There will need to be compromise and change and adaptation. There's a human nature element in that and the more we get into the space of wanting more and trees in urban spaces, the more there is going to be interaction and the more there is going to have to be a collaborative approach..' (Champion of Change)

Key Findings

- Diverse entities comprised stakeholders' verge-related networks, including: all levels of government, multiple state government agencies, multiple industries and their representative bodies, consultants spanning design, development landscaping, and environmental planning, community and advocacy groups and individuals, not-for-profit organisations, multiple media forums and personalities, research institutions, and even insurance and risk quantifiers.
- There was considerable overlap in stakeholder networks among the interviewees, suggesting the sample of respondents interviewed was sufficiently representative and Perth's verge-related stakeholder networks are relatively well connected.
- Examples of strong and effective partnerships were identified across stakeholder groups for generating new urban greening policy or practices, including verge gardening.
- Network pathways for effective information sharing were important for all stakeholders, though they engaged with diverse means of information sharing.

3.3 The values of street verges

Stakeholders were asked to rate the importance of various verge functions (3.3.1) and ecosystem services (3.3.2) for them/their organization. They were asked their thoughts on the effects of size, scale and social-ecological connectivity within and between verges on ecosystem services (3.3.3).

3.3.1 Functions of street verges

Stakeholders' perspectives on the relative importance of verge functions is shown in Figure 7 and, for online surveyed LGA respondents only, in Figure 8. The most important verge functions for both groups were provision of space for street trees, for pedestrian paths or pedestrian access, and visual amenity (aesthetically pleasing), and all these rated moderately to extremely important for most respondents. All LGA-only respondents also rated provision of space for street trees as very or extremely important. The relatively high importance attribute to verges for transport (including footpaths, public transport access and even bicycle paths) and utilities was unsurprising, given these are generally accepted features of the verge. The need for aesthetically pleasing streetscapes was also widely recognized and facilitated by the presence of street trees. For example, an Environmental Consultant described that in their community consultation sessions there was an:

'Absolutely clear request for the street scape to be green and beautiful...Nobody likes a grey environment. It's just completely uninverting, and people don't want to be there. And if you have those grey environments in the city scape, if you've got grey paving, grey seats, grey walls, people don't use it.' (Environmental Consultant)

Approximately half of the stakeholders deemed verges as very important or extremely important for social interaction. Recreation, reserved space for future road widening and off-road car parking were the least valued functions (Figure 7). Respondents who scored these functions as slightly or not at all important, generally felt that parks and reserves should provide sufficient opportunities for recreation, and that space for car parking on the verge should be unnecessary, but rather provided through appropriate planning.

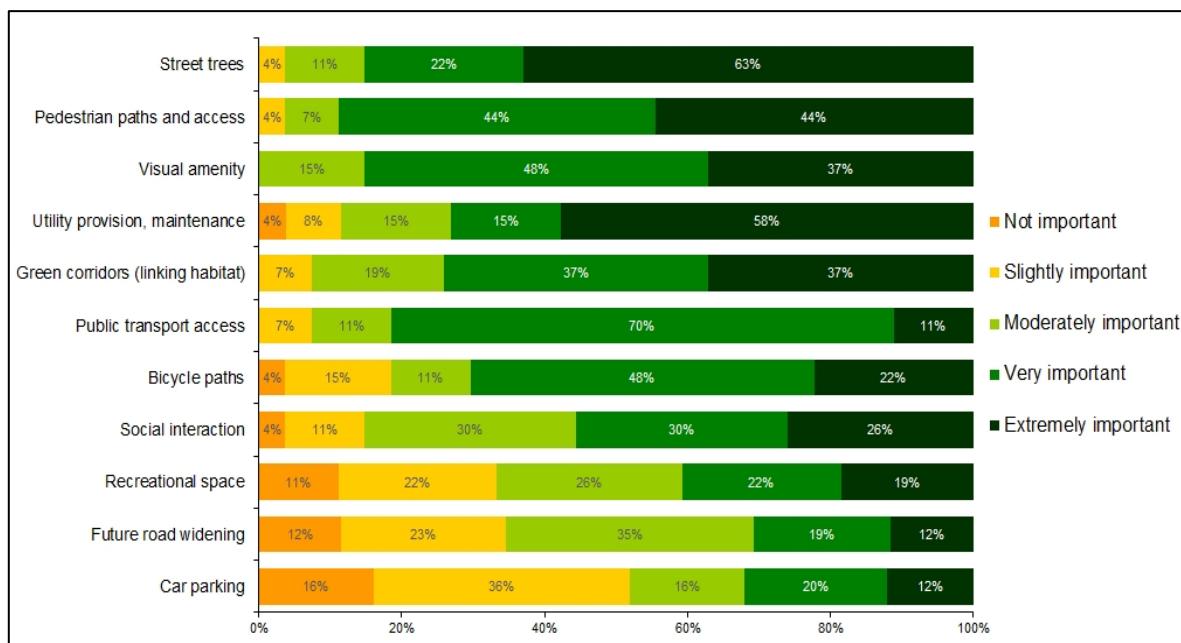


Figure 7: Relative importance of verge functions for all stakeholders combined

Graphic represents respondents' ratings of the importance of different functional characteristics of street verges against a 5-point Likert scale (n=28). Functions are ranked in order of highest mean score (street trees) to lowest mean score (car parking). X-axis denotes proportion of respondents.

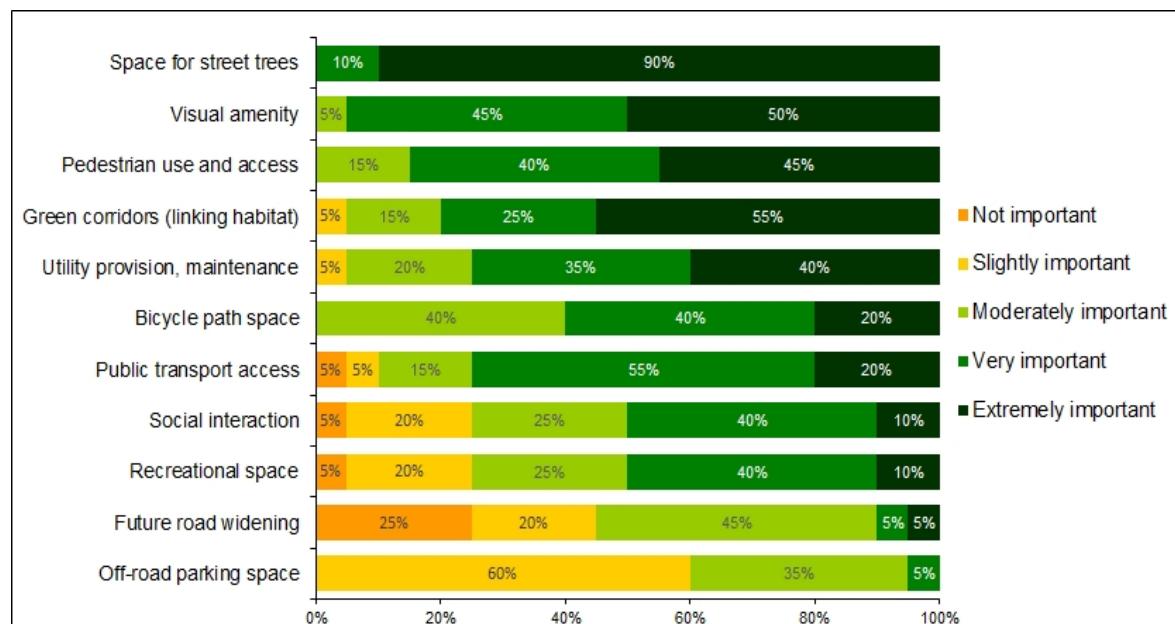


Figure 8: Relative importance of verge functions for LGA online survey respondents

Graphic represents respondents' ratings of the importance of different functional characteristics of street verges against a 5-point Likert scale (n=20). Functions are ranked in order of highest mean score (street trees) to lowest mean score (car parking). X-axis denotes proportion of respondents. Note that the respondents to this questionnaire were from individuals within urban greening-related sections of each LGA.

While many respondents cited an assumed future reduction in car dependency, they recognized that the current reality is still one of major car usage. Current planning challenges around inner city areas, areas of increasing density and even outer suburbs with much smaller residential block sizes and the frequency of multiple car households were all cited acknowledging this function. For example:

'We got too many cars parked on verges. ... if you're within 600 m of public transport, you can just have 0.75 car bays per dwelling, 0.75. So if you've got 10 dwellings, that's 7.5, round it up to 8. So you've got two dwellings without any car park. And even then, it's not as if everyone's just a one car household, so theoretically, those ten dwellings with eight car bays could have 20 cars and that [messes] it up for all the neighbouring residents and the streetscape. Maybe we've got utopia just around the corner where no one has a car anymore but currently, people are suffering from the state government's decision on that and that is impacting on verges, because verges should not be a car park.' (Champion of Change)

In contrast, a stakeholder from the Horticulture and Irrigation Industry noted that a car parking space could co-exist within a verge (of sufficient size) and didn't exclude capacity for a verge garden:

'So, if I thought there was something that needed to be done, was to integrate the parking on the verge with the vegetation and design of what you're doing. Whether that be single tracks to park a car on or put plants in between or underneath, whatever.' (Horticulture and Irrigation Industry)

Utility provision and green corridor functions (see section 3.3.3) were also important to various degrees for all LGAs and almost all other stakeholders combined. One environmental consultant explained their 'moderately important' rating:

'So provision of maintenance and utilities whilst it's extremely important, we also acknowledge that modern infrastructure services are incredibly robust as well. So I'm going to actually just say moderately important for that sort of stuff. We'd prefer that utilities don't influence the landscape to a dramatic degree. It's noted in our verge policies, particularly around existing older suburbs where there might be old infrastructure, then that [utilities] absolutely needs to influence it, but we're talking about new modern subdivisions and developments, where there's new services going in it becomes less important.' (Environmental Consultant)

A State Government respondent described their perspective on achieving multiple goals:

'Our goal is to maintain the multifunctional values of verges. [In the past] It's just been stripped down to utilities. We want to reverse this trend and emphasise multiple values.' (State Government)

Key Findings:

- Space for street trees, pedestrian access and visual amenity were the three most important functions for stakeholders collectively
- All listed verge functions were at least slightly, to extremely important for more than 75% of respondents.
- The least important was providing space for future road widening and car parking. Car parking was still rated from either slightly important through to extremely important for 82% of respondents.

3.3.2 Ecosystem services of vegetated verges

Stakeholders were asked their views on ecosystem services, actual or potential, provided by vegetated verges (Table 3). All respondents (both interviewed stakeholders and online LGA respondents) rated temperature regulation, rainwater infiltration, and aesthetics as the most important ecosystem services provided by verges (Figures 9 and 10). This was closely followed by storm water management services. Approximately 80% of the interviewed stakeholders identified temperature regulation and rainwater infiltration as very important to extremely important. Temperature regulation (shading) was the only ecosystem service recognized as moderately to extremely important by all respondents.

Overall, the least valued ecosystem services provided by verges were food provision, soil nutrient cycling, improving property value and mitigating road noise (note that the latter two were not included in the online questionnaire to LGAs). While providing food for people had the largest 'not at all important' value rating (16%), it was still valued as moderately to extremely important by approximately half of respondents.

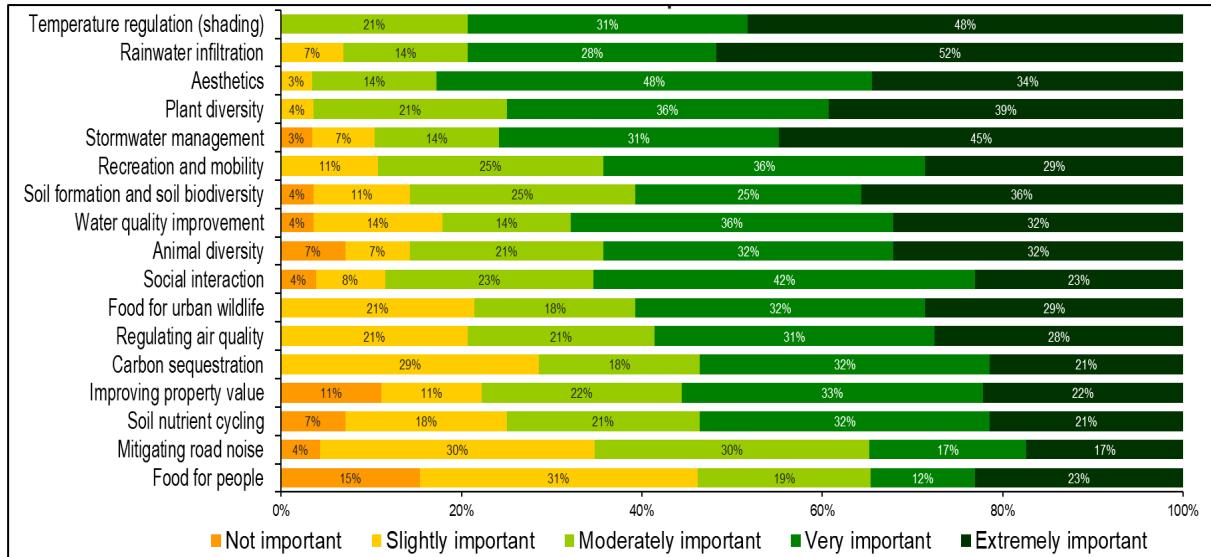


Figure 9: Perceived importance of verge ecosystem services, all stakeholders

Graphic represents responses from all interviewed stakeholders combined ($n=30$). Graphic depicts respondents' ratings of the importance of different functional characteristics of street verges against a 5-point Likert scale. Functions are ranked in order of highest mean score (temperature regulation) to lowest mean score (food for people). X-axis denotes proportion of respondents.

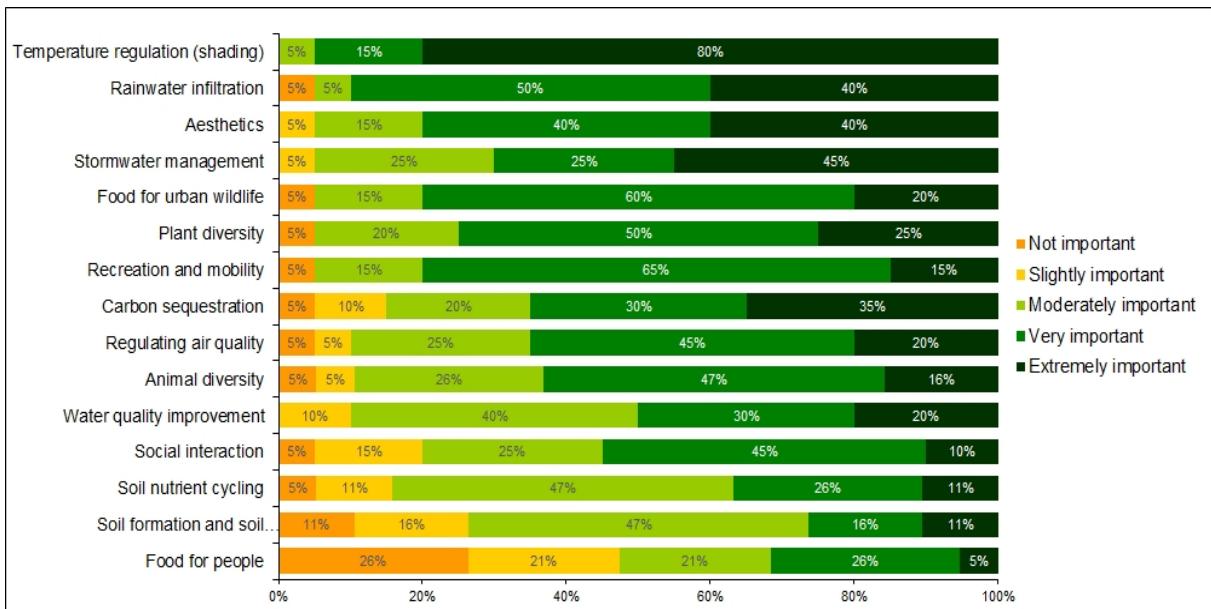


Figure 10: Perceived importance of verge ecosystem services, online survey of LGAs

Graphic represents respondents' ratings of the importance of different functional characteristics of street verges against a 5-point Likert scale ($n=20$), based on an online survey administered to representatives of LGAs. Functions are ranked in order of highest mean score (temperature regulation) to lowest mean score (food for people). X-axis denotes proportion of respondents. Note that the respondents to this questionnaire were from individuals within urban greening-related sections of each LGA.

Different stakeholders value the ecosystem services provided by verges in different ways (Figure 11). Champions of Change and Peak Bodies value almost all ecosystem services at a moderately to extremely important level. Utility Providers followed by Developers place the least importance on most ecosystem services. Developers consider aesthetics, improving property value and mobility (walkable neighborhoods) as extremely important verge ecosystem functions.

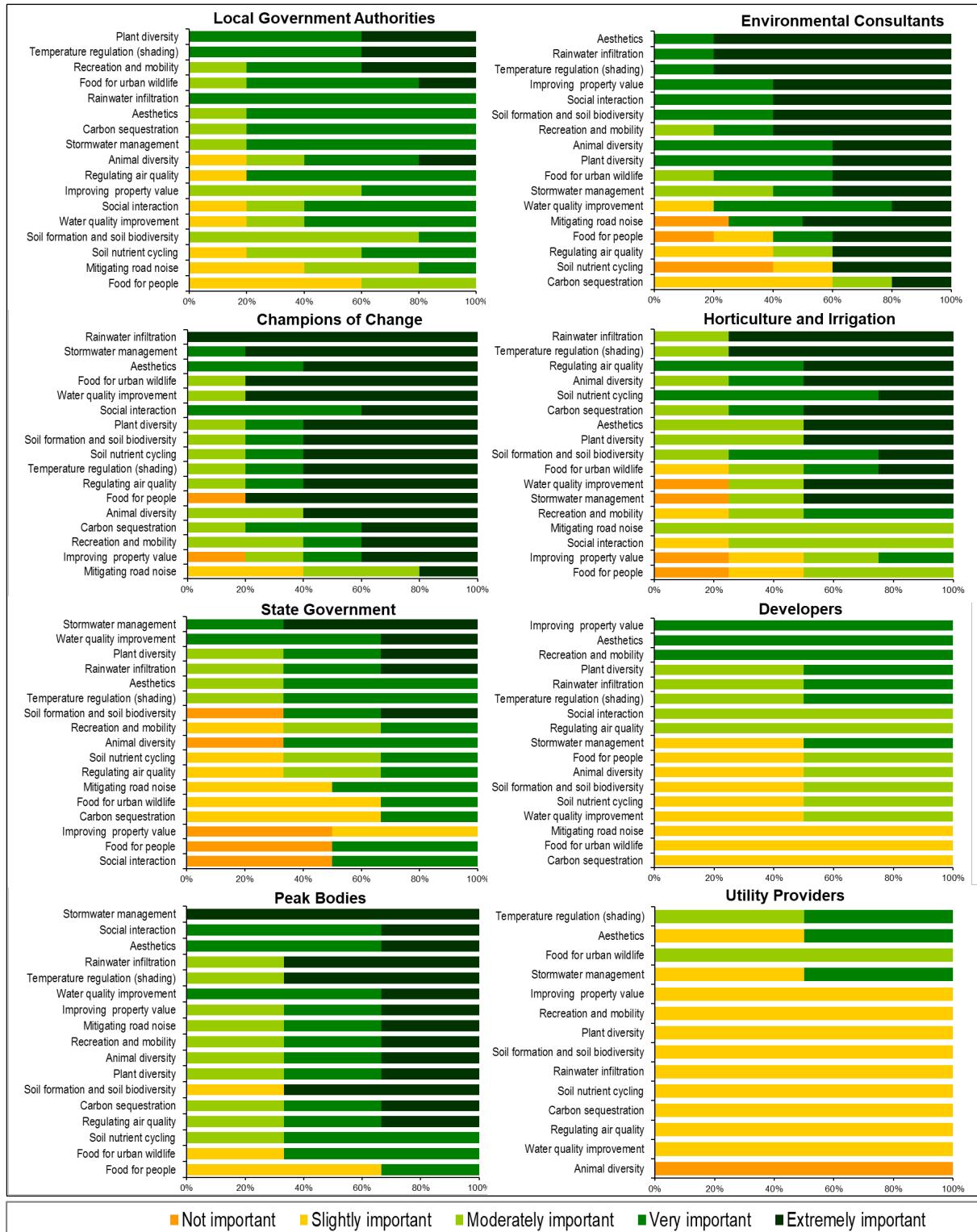


Figure 11: Perceived importance of verge ecosystem services, per stakeholder category

Local Government Authority n=5, Environmental Consultants n=5, Champions of Change n=5, Horticulture and Irrigation Industry n=4, State Government n=3, Developers n=2, Peak Bodies n=4, Utility Providers n=2.

This comment from a Champion of Change effectively summarized an array of potential ecosystem benefits they saw verges providing:

'I guess [verges are] the last bastion of revegetation. So, you have the ability to bank some of your local biodiversity if possible. You provide refuge for native fauna and insects. You provide flowering plants for the insects, you provide a cooling space, and living space, you provide an amenity, you potentially slow down traffic, you potentially have a place for refuge for humans to stop and talk ... it shields heat, it shields noise, it slows down wind. Any value of nature is what can be utilized on that verge, depending on its space. And obviously, depending on how the custodians/people nurture that.' (Champion of Change)

3.3.2.1 Regulating ecosystem services provided by native verges

Living vegetation on verges was recognised by all respondents as important for **temperature regulation**. Yet, there was a spectrum of ideas of what constitutes the best green cover for this purpose. For example, one respondent said it didn't matter what the green surface was, as long as it was living and not paved. Several respondents suggested turf and irrigated gardens as being the most efficient vegetation cover to reduce urban heat island effect. Respondents also highlighted that countering high urban temperatures was critical to people's ability to access and use public corridors and places. For example:

'That is absolutely front and centre for us. Again...people won't go there if it's not shaded. You know, heat is becoming a real health issue. So street tree policy, which links into verge policy as well, is really important.' (Environmental Consultant)

Many LGAs regulate the percentage of hard surface cover permitted on verges (Table 7), primarily to regulate rainfall run-off. Champions of Change, LGAs, Environmental Consultants, State Government, and half of Developers and Utility providers perceived verges to be *very to extremely important* for **stormwater management**. For example:

'And we have to put more into these verges, they can be very effective drainage easements... It's not so much the verge as the traffic island in the middle of the street, which is where the stormwater drainage system operates and instead of running at high speed to the nearest river, which is the old dynamic, now we want to slow it down. And the reason for that is the faster water moves, the more it carries so you get erosion and also you get transportation of hydrocarbons from cars, all the usual rubbish, goes straight into the river ... now we're creating these 'living streams', which is a euphemism for drains. But it's more than a euphemism, it's turning them into living places that slow the water down and you've got reeds to catch the nutrients and basically turn that into clean water. (Champion of Change)

Stormwater management and water quality improvement are interconnected services, as the rate water travels through and the materials it carries, impact water quality in receiving environments, including wetlands and rivers. **Water quality improvement** was rated *very to extremely important* by Peak Bodies, State Government, Champions of Change and most Environmental Consultant respondents (Figure 11). For example, Environmental Consultants are frequently tasked with using water sensitive urban design to manage stormwater and water quality.

'Sometimes, we often do sumps and then it filters through the groundwater. Very occasionally, we do linear wetlands, so the water goes through the reeds, stripping the nutrients out, very occasionally you know, the water basin is designed to be like that' (Environmental Consultant)

Interestingly, Utility Providers also raised the potential for verges to assist with managing assets:

'[Road verges] do everything from prevent small erosion and act as a stabilizer ... And then the infiltration of ground water, and also the rising of the ground water can bring with it the salts. So if the cabling underground isn't sheathed or the pit isn't well lined to prevent that coming it, that

'poses those risks. So they provide a buffer, so those reduce the risk of those impacts occurring.' (Utility Provider)

It is also important to note the interactive effects of ecosystem services, for example, holding water at source for longer helps to reduce heat effects, as an Environmental Consultant noted:

'So water control, so water sensitive urban design, where we keep the first 15 mm of a rainfall event at source or on a verge, and that not only assists with treatment of that water before it goes in the groundwater, but it also assists in urban cooling, keeping moisture at the surface, as opposed to delivering down into a storm water network and away it goes, it's gone.' (Environmental Consultant)

'Certainly urban cooling is a priority from a human liveability perspective. From an environmental perspective, we look for opportunities for roadside swales, which enhance biodiversity on that front.' (Environmental Consultant)

Other regulating services potentially provided by vegetated verges (air quality, carbon sequestration and soil nutrient cycling) were considered less important, and were also rarely raised during interview discussions. For example regarding **air quality regulation**:

'I think it would be pretty minimal. I haven't done the modelling, but I suspect it would be very minimal. So, if you think about it, transport, the air quality in Perth from transport is improving enormously. And it's improving enormously from the improvement in fuel and the improvement in engine technology.' (State Government)

'Probably in terms of particulates, but it's not front and centre for us, so I'd say it is important but it's not a priority.' (Environmental Consultant)

For **carbon sequestration**:

'The plants that take it up fastest, generally, are the things that are really fast growing. We tend to select and plant things by the side of the road for ... safety, so those that grow very quickly, such as blue gums and things- we don't want that sort of vegetation to grow by the side of the road. So, I think it's, without, doing the modelling, looking at the numbers, I suspect it's pretty low.' (State Government)

In regards to **soil nutrient cycling**, Environmental Consultants did not rate it as an important service, rather a natural process that occurs in vegetated verges. Some respondents spoke of applying soil amendments (e.g. for moisture retention), while others stated their preference for not doing so in natives verges, or only when sites had been heavily modified during the construction process. However, soil nutrient cycling was rated very to extremely important for respondents from the Horticulture and Irrigation Industry and for 80% of Champions of Change respondents, which likely reflects their efforts to address the issue of nutrient run-off from fertilised lawns and gardens.

3.3.2.2 Supporting ecosystem services provided by native verges

Rainwater infiltration, contributing to on-site water use and the broader water cycle through aquifer recharge, was considered moderately to extremely important to 93% of respondents. For example:

'Water in our profile is what we need. We need aquifer connection, it's what we're relying on. As soon as water goes on the road, it gets oil on it and everything else. And then it's [gone], but if we could keep our aquifers charged, not let it run off to the ocean...it'd be good.' (Horticulture and Irrigation Industry)

All respondents from Environmental Consultants, Horticulture and Irrigation Industry and LGAs rated verge contributions to **soil formation and biodiversity** as moderately to extremely important.

'Very important. It's probably becoming more and more important now I think. Traditionally landscape architects would probably see it as being moderately important and I think it's certainly stepped up more now.' (Environmental Consultant)

Plant and animal diversity were considered highly important for Environmental Consultants and Peak Bodies. Other stakeholder categories all rated the capacity of the verge to support plant diversity more important than support to animal diversity. Also, LGA respondents rated supporting plant diversity and temperature regulation as their most valued verge ecosystem services (Figure 11). The ability of the road verge to support plant diversity was also seen as highly place-based:

'The Wildflower Capital Initiative, so, we are planting natives from around Western Australia. However, our primary objective for that is not biodiversity. It's amenity. Visual amenity/aesthetics. Because in that environment, it seemed to be the most important value... Oh, and I should say, if you've got [native vegetation] which abuts the road reserve, the primary focus there is probably biodiversity rather than aesthetics. So, it really is place-focused.' (State Government)

An LGA respondent noted emergent work on creating 'meadow gardens' which could prove influential:

'I'm not the hugest fan of that terminology [meadow garden] yet, but it is to recognise a style of garden that's both biodiverse and is really easy to maintain. It's a project that started over at Melbourne Uni and facilitated by Naturelink Perth. We're actually putting in some demonstration gardens.' (LGA)

Several respondents felt the verge was only moderately important in supporting native plant diversity, perhaps given their understanding of the relative small number of species available to garden with, compared with the local native plant diversity.

'Supporting plant diversity: I think we're limited. I think whilst we would like to think that a verge could play a crucial role in plant biodiversity, the reality is it's not necessarily the case, in terms of what's available and perception of 'low maintenance' as well.' (Horticulture and Irrigation Industry)

'I don't think the verge has got a major role to play there, but still, to have local plants for birds and everything else, I think that's important.' (Horticulture and Irrigation Industry)

Plant species were discussed in terms of their capacity to support wildlife. For example, prickly shrub species were identified as important potential sheltering habitat for wildlife from cats and dogs (Horticulture and Irrigation Industry respondent). It was recognised among Champion of Changes, Environmental Consultants and LGA respondents that shrubs are very important for wildlife, including as food and shelter resources:

'Nothing's up the top of the tree. You know, it gets all the credit, but no bird lives up the top of the tree, it's down in the shrubs eating stuff.' (Champion of Change)

'And part of that is a lot of our parks just have grass and big trees. So from a bird life point of view, you only end up with your magpies, your crows, all that sort of ... your bigger birds and you never see smaller birds because they don't have somewhere to live and somewhere to feed and somewhere to nest and those sorts of things...So I think verge gardens can actually provide a little bit of that, although our rules are a bit stiff as far as it's either a tree or it's got to be cut to 600 mm in height. I know a lot of the other suburbs you go to and there's all sorts of different layers and levels. So you have understory stuff and you have mid-story and you've got trees. So yeah, I think the biodiversity thing is really good as far as fauna and creating some sort of food, some sort of habitat for them. Not necessarily even fauna people always consider -you have geckos and insects, all that sort of stuff.' (LGA)

Research around the new installation of fauna bridges across the freeway was reported as beneficial

innovation. Larger birds, like magpies and cockatoos, were frequently observed foraging on grassed verges but several respondents also raised the risk of car strike, when birds forage along roadsides.

'You've got to take into consideration black cockatoo habitat where the cockies are going to land, where they potentially could land because they love weeds [like Erodium spp.] So they're often growing right next to pavement. So there's a real issue for those because of the way in which they take off in sort of a gentle flight path, they're big birds and they get whacked by cars and killed. So we've been looking at all of those issues to ensure that, you know, whatever, particularly black cockatoos come in, we've got to make sure that we're developing the right sort of feeding habitat for them and ensuring mortalities don't increase through the use of the verges.' (Environmental Consultant)

'I just worry about green corridors which is another thing, where we've had them, you see bobtails squashed on the road and birds being smashed going from one side of the road to the other. I think it's very important, but we've got to refine it.' (Champion of Change)

Other stakeholders, such Utilities ranked 'food for urban wildlife' as their third most important ecosystem service (moderately important) provided by verges. One respondent described their efforts in maintaining mature trees, as required to protect threatened species, like Carnaby's Cockatoo, which also have flow-on effects for all the other species using that mature tree along its lifetime. Several environmental consultants also raised the importance of considering food for cockatoo species (Carnaby's and Red Tailed) in the verge environment:

'It's important that we consider those within the verge environment as well. So whilst we attempt to put foraging endemic native species in, particularly trees in those environments, when we get into residential areas, quite often those trees that would normally be seen, the Marri and Tuart, are too big a species to be planting in residential areas. Particularly when we're down to lot sizes of anywhere down to 200, 150 m² lot sizes. So there's very little room for significant trees like that. So any remnant trees, bigger trees like Tuart and Marri- we go to huge efforts to retain those on verges and if that means eliminating blocks, potentially saleable blocks in those areas then that's what happens.' (Environmental Consultant)

3.3.2.3 Social-cultural ecosystem services of native vegetated verges and verge gardening

Stakeholders identified a range of social and cultural services verges can provide to individuals and community. Aesthetic pleasure was rated moderately to extremely important amongst all stakeholder categories (Figure 11). Social interaction was ranked more highly by Environmental Consultants, Champions of Change, Peak Bodies and Developers. Potential recreation and mobility functions of verges were particularly valued by Peak Bodies and Developers. Social and cultural services that respondents raised and discussed at length during interviews included aesthetic and wonder, sense of place, community engagement, place to play or contemplate, and support to culturally valued species, including both European and native species.

Beauty, wonder and wellbeing

There was consensus among all stakeholders that people enjoy and need visually interesting urban green spaces. Many respondents across the majority of stakeholder categories linked green and aesthetically beautiful gardens with sparking interest and wonder. For example:

'I think aesthetically, it would be nice [native gardens on verges]. It'd be interesting. Like, you're driving down the street and you go, "Oh." I went to Willagee yesterday. I had to pick something up, and I was driving down the street. All of a sudden, there's a brilliant couple of gardens, native gardens. I went, "Wow, that's nice." You know?' (Horticulture and Irrigation)

Several respondents elaborated on how interesting and aesthetically pleasing verges can elevate the mood and generate a sense of individual and community wellbeing:

'Because I think it's far more soothing to look at an aesthetically pleasing verge than a standard piece of grass, you know. I mean, if you look at, it's not even yours, the whole community can enjoy the garden, not just the person that lives there.'

'When you've got people that actually have quite vibrant, interesting verges, it creates a little bit more of an amenity to an area... it creates an atmosphere of somebody actually looking after it rather than somebody just living in the house and the verge is something they don't care about...I certainly think that it changes the mood of area. You feel a little bit more, welcomed maybe, or that it's a little bit more secure...When you go to a place where all the verges are maintained and there's different textures and colours, it's a lot more welcoming. You do feel more secure. Even if potentially the crime might be the same, it does feel better.' (LGA)

Respondents also highlighted the mental and physical health benefits of gardening. For example:

'Digital detox, and being in touch with the earth and doing something, it's very grounding... Like, put down your phone and just go and plant plants. It's not until you see it. If your New Holland honeyeaters jumping in and out, you're going to, "Wow, look at that."... I think it's got to be good for your mental health, just visually... in such a visually-polluted world.' (Horticulture and Irrigation)

Sense of place

Almost all stakeholder categories (Environmental Consultants, Horticulture and Irrigation Industry, State Government and Champions of Change) had at least one or more respondent referring to the capacity for native gardening on verges to build a 'sense of place'. It was consensual that the potential to use verge gardening to leverage the tremendous uniqueness of the Perth's natural history and flora to define the character of local communities, locally and to the wider world, had not been fully explored. Stakeholders described the value of making a clearer demonstration of our own unique 'sense of place' through our local native flora as benefitting both the local population (e.g. sense of identity and wonder, associated health benefits) and international visitors:

'If we can demonstrate our sense of place, of who we are, down each street ... and are actually really coming into the ownership of our heritage as custodians, ... then wow, that would be exciting.But again, it's the deeper aspect of who we are on this country...this beautiful country. And we have the ability to create our own ideals and our own styles of what West Australian gardening is. It's not even invented yet!...If we can come into something, you know, I am creating something unique because our plants are so unique, we're going to actually start having our sense of place represented in our gardens. Of actually, really, who we are.' (Environmental Consultant)

'I mean, could you imagine the tourists that would come? And they already come internationally...to go out into the country ...and they go to King's Park. And that's fantastic. But could you imagine just the wow-ness that they would drive or walk by just through...going down the street. And just saying, "Wow! I've never seen that plant before! Wow, I've never seen that flower!" (Environmental consultant)

Fostering and harnessing a unique 'sense of place' to draw international tourism was a key reason behind the State Government's *Wildflower Capital Initiative*:

'They decided there should be a sense of place for Perth... so [government agency] said we will choose some key locations which are entry statements to the city and retrofit landscaping to make it really iconic West Australian species within the constraints of a high-moving environment and safety.' (State Government)

Despite Western Australian flora being recognised internationally, many respondents felt there remained broad swathes of our own population who are missing the beauty and wonder local native plants can inspire. This was often raised as a barrier to verge gardening with native plants.

'Our bush is what it is. And it's the most beautiful, you know, at certain times of the year, and people travel from all over the world to come and look at it, but you know, we just need to change.'
(Horticulture and Irrigation Industry)

Fostering a sense of community

Verges designed with intent can foster a sense of community through deliberate planting schemes, art, and space for play and rest. Several Environmental Consultants and Champions of Change respondents described the role of verges in supporting nature play and contemplation opportunities. For example, an Environmental Consultant respondent aimed to promote community engagement and vibrancy by incorporating a mix of edible species, including bush tucker, other native species and giant, functional art pieces on the verge in their developments. They also described the benefit of retaining significant trees in their design:

'On that topic of where we're retaining significant trees on site, then quite often it becomes a bit of a small play space or it becomes a sitting area, a place of contemplation. And so we make those spaces really nice and encourage them to go, there's nothing better than sitting under a giant big, massive old tree, they're great places of contemplation...' (Environmental Consultant)

Stakeholder preferring turf verges also recognised the verge was 'where people connect, out on the verge' and described how engaging, accessible green spaces will encourage people to walk across it and access each other, particularly in a time where there is often limited community interaction.

For those stakeholders who had engaged with verge gardening themselves, all described how it provided more opportunity for incidental interactions with people passing by, or their neighbours:

'Oh, it's tremendous. I mean, seriously, when I'm out on my verge and I've heard it from so many people - they speak to the people walking by and there's interactions that occur.' (Champion of Change)

'Just from the simple act of being outside on your verge, I know from doing it myself, you're out in the public space and you meet people walking to the shops, you meet residents, you wave at people as they drive by, and it's just that physical act of being out the front of your house, undertaking an activity - gardening. And then certainly, if you create something from what might have been a pretty barren... full of weeds... [area]... people appreciate what you're doing to that streetscape, and you get to talk to people. And they stop and they chat, because I find that inherently, people want to communicate but there are limited opportunities within the streetscape, within a local community, so it's this fantastic act of community building as well, that I think is something that's probably really under-recognised in that space.' (LGA)

Several respondents emphasised the role of connected verges in providing welcoming corridors encouraging people's mobility, outside of vehicles (i.e. walking, cycling, jogging), and access to recreation or public open spaces. For roadside verges along 'principal shared paths' or more significant walk/cycle thoroughfares, one respondent described examples of successfully incorporating public education and heritage information in the verge space, for example Noongar heritage or biodiversity information. The verge space then also became about '*community awareness as well as people cycling and walking, as well as the aesthetic*'.

Several respondents commented on how demographic characteristics influence likely capacity to engage with verge gardening. Interestingly one respondent thought newer suburbs with young families might be more likely, while several others thought this demographic group was likely too time poor.

Economic recognition of the ecosystem services provided by verges

Improving property values, though rated lower on the combined responses list, was still of some degree of importance for 89% of all respondents overall (Figure 11). It was a very to extremely important service for all Developer and Environmental Consultant stakeholders, and to 80% of Peak Body stakeholders. In addition, it was rated moderately to very important among LGA respondents.

LGAs are developing regulations that place a monetary cost on single trees. With these regulations they intend to prevent tree loss and seek financial compensation when a mature tree has to be removed (by utility or main roads works, developers, residents seeking subdivision). Yet, one State Government respondent noted that these regulations are yet to be applied, or are not very well suited to costing the value provided by an area of vegetation. This has all prompted new discussions around compensation between LGAs and Utilities, and LGAs and State Government departments.

Several respondents expressed frustration at how the public does not fully appreciated or economically value the multiple ecosystem services provided by trees. For example:

'I don't think people see the benefit of trees. They just see it as a hindrance. And it costs us nothing. It costs us 50 bucks to buy the tree and it grow and then, "All right, well, we'll just cut it down. It cost us nothing." No one puts any value in it...So, although the person who's bought the house doesn't like the tree, it's everyone's tree. It's not just his tree. It's the [LGA]'s tree, it's the community's tree, it's the street's tree.' (LGA)

A nursery respondent also expressed frustration at how the community values native plants:

'I think that's why I don't like that attitude of 'set and forget' for native plants. I think we've got to value them and be prepared to invest in them and be taught what a huge benefit they're giving us. I've spoken a lot to people about annuals- you know we're growing a lot more annuals as well- like how people will go out each year and buy petunias to put in their garden but not kangaroo paws- people just don't think that way about natives. They'll spend thousands on all this other stuff [non-natives] but then resent doing it for natives. For some reason we've taught them they shouldn't pay anything for natives, we've devalued the bush, we've devalued natives.... It's just appalling how Australians value their natives...We've gotta change perceptions' (Horticulture and Irrigation Industry)

While LGAs incentives, such as low-cost or free native tubestock plants, are commonly regarded as a positive action to encourage native verge gardening, one Environmental Consultant respondent felt strongly this resulted in a negative feedback loop for local native plant nursery businesses. The respondent felt that such incentives could risk perpetuating the community's expectation of low cost native plants, which does not reflect the actual cost of bringing those plants to the market:

'The economic model that they're using actually inhibits the provider, the grower. And it's a negative impact, it's not a positive impact... if the local government keeps doing what they're doing, those in the WA plant nursery industry who are focusing on gardens and landscapes, are gonna die.' (Environmental Consultant)

This respondent was concerned this practice could ultimately force smaller nurseries out of business, reducing the diversity of suppliers, plants available and gene pool. In the respondent's opinion, it would be preferable if LGAs focused on other incentives (e.g. demonstration gardens and education).

'Those tubestocks are coming from over east! Being shipped back to Western Australia because our propagators are not being paid to be able to get the stock. The local demand for WA garden natives is so small that it makes no sense for a nursery to grow WA plants.' (Environmental Consultant)

Culturally valued plant species

For some respondents, ‘culturally valued species’ represented edible European species, for others Indigenous edible species, and for some both categories of edibles. For others, it constituted charismatic or iconic endemic species with the potential to enhance connection to place.

When asked about Noongar-Whadjuk culturally valued species, stakeholders mostly referred to edible species or species selection to highlight the Noongar six seasons. One Champion of Change respondent linked the idea of connectivity to Indigenous cultural values - the cultural connectivity potentially provided by ecological corridors and connectivity with totemic affiliations. However, seasonality was the primary reference. The Noongar six seasons was a guiding principal behind the Wildflower Capital Initiative and several stakeholders were already incorporating the ‘six season’ guide or wanted to see greater use of it in urban greening. The reasons behind this included aesthetics (having something beautiful flowering in the garden all year), fostering an environmental ethic of care and respect (to support native species e.g. pollinators, to support Noongar-Whadjuk biocultural knowledge), as well as building our shared, local connection to place.

‘... the flowering gives you a sense of where you are in the season. That’s basically some of the Aboriginal heritage, using the time, because we all know our four seasons isn’t relevant to WA in reality. Soon we’ll start having the flowering time of the wattles and the bottlebrush’s heralding the end of winter rather than the beginning of spring.’

‘We used to teach people to have a colour scheme, a diverse palette of colours. Or something flowering every week of the year in the garden.’ (Champion of Change)

The value of understanding the six seasons was also expressed in a relational sense. For example, caring for the land, through gardening, assists us also caring for ourselves:

‘If we can come in line with what the six seasons are with ourselves, there will be a natural affinity for us... knowing that we’re doing things on a seasonal basis, it will have that natural regularity or natural flow and it’ll also help us...to do something to create that nurturing within us - which is what the land gives us.’ (Environmental Consultant)

3.3.2.4 Provisioning services: Edibles in the verge

There was a range in interest in growing edibles on the verge among stakeholders, from very high (part of an ideal verge makeup) to no interest at all. A respondent predicted a similar spectrum of interest among the broader public:

‘Whilst it’s [growing edibles] really important for [us], there’s a lot of people out there where it’s not that important, and they wouldn’t be interested in verge food production gardens.’ (Environmental Consultant)

Overall though, the potential of verges to provide *food for people* was valued comparatively least among almost all stakeholder categories, with the exception of Champions of Change (80% rating this extremely important). These respondents regarded the sharing economy and enhanced community interaction that can flow from edible verges as very important social values.

Respondents also raised potential risks or negative aspects of growing edibles on the verge. These included the greater water use (compared with native vegetation) (Champion of Change), the potential for contamination from vehicle fumes (LGA, Peak Body, Champion of Change), herbicide overspray or drift, the pest pressure that may arise after planting if there’s not much other vegetation around (Horticulture Industry), and the higher level of ongoing maintenance required. In addition, while maintained fruit trees are not an issue, if people moved out and the trees were not maintained by new owners, they could become sources of fruit fly spread (LGA).

Local bush foods (endemic edibles)

In terms of incorporating native edible species in verge gardening, horticulture (native nurseries) and environmental consulting stakeholders raised several challenges. Native edible species can be difficult to propagate, very slow growing or only a once-off use (respondents from Horticulture and Irrigation Industry), with many just not commercially available in the quantity required from a commercial design perspective (Environmental Consultant). These respondents also felt there to be a general lack of understanding among the public in terms of the suitability for growing bush tucker in gardens or what was required for their safe preparation for consumption, although it was acknowledged such information is becoming increasingly available. Finally, stakeholders highlighted potential cultural sensitivities or issues around intellectual property when developing new products to market. While these stakeholders were very keen to embrace and support the use of endemic, culturally-valued species they acknowledged these practical difficulties, for example:

'Yeah, totally, except for the fact that they're [Noongar-Wadjuk culturally-valued species] hard to get hold of, those species. And also, they don't necessarily suit verge gardens, they're not necessarily all groundcovers or low-lying plants. So, the barriers would be that they're either difficult to get hold of, not grown or not suitable in terms of height or form'.

'People have said they want edible stuff in there, and we try to get as much as we can but it's not like... a lot of native plants that are edible aren't like, traditional fruit bearing plants. You generally have to destroy the plant to get the fruit off it or to eat the root or to eat the stem or something. So, I mean, in that regard, it's not as easy as it would seem.' (Environmental Consultant)

However, the consensus was that interest in endemic edibles has grown rapidly in recent years. Stakeholders also referred to several local Noongar bush-tucker businesses, highly in demand, and which are helping to promote and share bush foods and seasonal knowledge.

Key Findings:

- All stakeholders felt vegetated verges have the potential to provide several ecosystem services.
- Stakeholders rated the most important ecosystem services verges can provide as: temperature regulation, stormwater management (regulating services), aesthetics, recreation and mobility (social-cultural services), rainwater infiltration and plant diversity (supporting services).
- LGAs are increasingly finding mechanisms to place financial value on verge vegetation, for their ecosystem services (e.g. the amenity from street trees), given these represent assets for the whole community. This is generating new negotiations for vegetation loss between LGAs and numerous stakeholders including developers, building contractors, State Government departments, and utilities.

3.3.3 Verge size, scale and social-ecological connectivity

Following the discussion on the ecosystem services provided by verges, respondents were asked to consider at what scale verges might be most effective in the provision of those services. Two key scales were discussed, the single verge and multiple verges. The majority of respondents emphasised the larger the area of verge land able to be connected, the better, particularly when there is connectivity with nearby public open space and reserves. 'Green corridors linking habitat' promoting ecological connectivity was one of the few verge functions that all respondents from all stakeholder categories felt was important to some degree (no one rated 'not important').

3.3.3.1 Connectivity at the single verge scale

Connectivity at the single verge scale means connectivity between the resident's front garden and the verge, for both aesthetics and species movement. Reducing the amount of solid fencing between the

two areas was suggested to facilitate movement of animals like bobtails. A Champion of Change respondent expressed '*I think it's important that there's a link between the verge and the front garden. These creatures [bobtails] need to be able to move around.*'

Several respondents said that the location of the footpath, if in the wrong place, could negatively influence aesthetics, resident's connection with the verge, and plant survival. For example:

'In one area they'll have it against the road, in another area, against the property boundary but you'll see different landscaping techniques. By putting the footpath here [against the property boundary], it creates a big problem... That to me is the biggest negative to verges. Separates the land- tells people- that's not my land- a lot of people don't think that's their land. And you see nice and beautiful here [in their garden], and it's dead there [verge the other side of the footpath]... I think, if I had a preference, I'd like to see it [the footpath] on the edge of the road. Because then you can have a continual green space into your yard.' (Horticulture and Irrigation Industry).

A respondent from a Peak Body also noted the importance of footpath position in residents' engagement with their verge:

'I do still think amongst many in the community there's this, "It's not my verge, it's the councils". I think it's encouraging, in 'Liveable Neighborhoods', the footpath position did change, so you can put the footpath along the road. It's interesting when you see that happen, people then will treat the verge as an extension of to their property and will maintain it. Whereas, I think recently they wanted to turn it around and put the footpath back... [against to the property boundary] and the verge in between. I think that's when you don't see that maintenance occurring. I think that would be an interesting study to just to have a look at that. I think you would see a significant difference.' (Peak Body)

From a pedestrian safety point of view, placing footpaths closer to the property boundary was preferred by other stakeholders involved in urban planning.

Having only a narrow strip of land between the footpath and the road was described as a 'death zone' for plant survivorship:

'They're ineffective... Because anything that's under, I'll call it under 60 cm in width, garden bed width, is ineffective. So this is where this [footpath] location is important, ok, it's much better having that on the edge at any time. And if you've got anything small, just get rid of it, just make the footpath wider. If the garden's there, it's ineffective. Just make the footpath wider.' (Environmental Consultant)

In terms of a preferred minimum verge width (residential areas), a Champion of Change respondent felt a width of about 4-5 m was minimum to '*actually get a plant or a group of plants out there.*' State government stakeholders noted that there was general consensus among many stakeholders that verges should be 4-5 m minimum in width, which also provided for the minimum conditions for plant survivorship in high speed road networks. The original Liveable Neighbourhood guidelines (2009) generally specified a minimum of 4.1 m but, as an Environmental Consultant respondent noted, implementing this in practice was not always easy:

'We struggle to get that [bare minimum of 4 m] in new suburbs, we have to push for it and quite often if it's a larger suburb or infill development, we may not get every verge that wide, but then we try and have a focus on particular streets or small pockets of where we can retain trees, where there's a break out from a squeezed verge.' (Environmental Consultant)

The reviewed Liveable Neighbourhood 2009 guidelines (2015 Draft) specified increasing verge widths to a minimum of 5 m '*to adequately accommodate street trees, utilities, and street furniture assisting walkability, reduce adverse urban heat island effects and assists local stormwater collection and*

retention.' (WAPC, 2015 p.8). Following extensive stakeholder consultation DPLH scaled this back to 4.5 m in 2016, however Liveable Neighbourhoods is in the process of being reviewed under Neighbourhood Design.

The increasing number of battle-axe subdivisions with urban infill was also raised as a trend not only squeezing verge space, but causing breaks in connectivity. A Peak Body respondent raised that:

'Maybe you'll see an area where there's been a lot of battle axe subdivision. You might see their multiple crossovers and then there is the verge. There's a very narrow strip between driveways that then you just can't use for anything.' (Peak Body)

In addition, plant height restrictions did frustrate some respondents (Environmental consultants, Horticulture and Irrigation Industry), who understood clear sightlines as necessary for safety, but felt a set-height approach limited the use of larger shrubs, which are important for birds:

'This is where it's a shame that councils are doing the blanket 0.5 m or 0.6 m height restrictions and they could look at particular verges where sightlines are not as important and allow some larger plants, because little plants have a shorter lifespan, they're much more easily damaged by people and dogs, and they don't provide the habitat for birds that larger shrubs do. When we did that plan for [name of LGA] - I got their Parks and Gardens people to agree to policy whereby if this verge was 6 m or greater - we could do this [indicated drawing] and in here you could have some bigger shrubs you know, still safe from sightlines.' (Horticulture and Irrigation Industry)

Another design consideration, rear entry residences, was raised as potentially contributing to the disconnection of residents from their verge, making it much easier to ignore:

'I think one of the main challenges I see is where you have places like [suburb] that have those laneway lots... Everyone goes in and out through their back garage... So they'll have the back garage and then a front street verge and they never maintain it, well not never, but 50-60% of them don't maintain the front...And so you'll just see these weed-ridden landscapes and it's awful, to be honest.' (LGA)

3.3.3.2 Connectivity through joining multiple verges: green corridors

Respondents described both social and ecological benefits when extending connectivity beyond a single verge. The relatively high scoring importance of 'Green corridors' function suggests widespread recognition amongst all stakeholders for the capacity of connected verges to provide ecological benefits (linking habitats). Multiple respondents (from LGAs, Environmental Consultants, Developers, Peak Bodies and State Government) also felt green corridors were equally important for meeting social needs, providing the necessary shaded corridors between public open spaces to encouraging a walking neighbourhood. For example, for an environmental consultant:

'Green corridors, for connecting habitats', again, really, really important, and in the master planning phase when we're doing projects, that is at the forefront, to make sure we've got green links for biodiversity, but also those green links play a crucial role in pedestrian movement, and bicycle movement as well.' (Environmental Consultant)

'Establishing green networks as a linkage, at a strategic level- that is the most important value, the idea being to link tree-lined streets with local parks, medium parks, regional open space...And not just trees, but also other species that help with water sensitive urban design' (State Government)

Footpaths were also raised at this broader arterial corridor scale, for example, the specifications of 3.5m wide, dual use paths were raised as an issue squeezing the capacity to provide shade. For example, an Environmental Consultant described a policy to avoid having trees close to the footpath to avoid potential damage:

'So they see the trees as a problem, rather than a benefit. They acknowledge that there needs to be shade but they just can't come to grips with the fact that they're going to have trees beside it and potentially in 30 years' time it's going to damage their footpath. Our argument on that is, well after 30 years, by the time those trees are up, it's probably the cue for your footpath to be upgraded.' (Environmental Consultant)

Socially, there were benefits of linking multiple neighbouring verge gardens together. Within a street or local neighbourhood, productive verge gardens were seen to promote the sharing economy (for example giving away excess home grown produce). Two respondents were both enthusiastic for street-scale verge gardens, or even trials extending it further:

'I think we're happy to do it on a street scale, would be fantastic to actually make a corridor. I don't think I've seen that done anywhere yet.' (Peak Body)

'And that's the corridor. You know, that's the verge. Not only is it important to have these large spaces of the garden, you know, in the front or back yard where you can really bring in the habitat and the ecology and all those [good things], but it's also knowing that it can be done on a verge'. (Environmental Consultant)

In terms of a minimum scale for providing social benefits of native verge gardens:

'From a person to person point of view, I'd have to say, if I had three gardens from every ten houses, that would be an effective [scale] from a community point of view. That would create intrigue, interest and continuity.' (Environmental Consultant)

Several respondents recognised the social benefits for fostering neighbourly/community relations through verge conversions on a street scale, for example:

'It could generate really good links between people who may not have encountered each other otherwise. You also might get that lovely thing between an older person and a younger person who might help them out a bit more, some other nice connection.' (Horticulture and Irrigation Industry)

Interestingly, an environmental consultant respondent felt verge greening on a street-scale would be more challenging and only likely to succeed if there was prior education and advocacy:

'I don't see it, to be honest, I think there's just too much variability in people's desires to maintain a verge or use it for parking ... Unless there was a good promotion of the benefits of having your whole street planted up.' (Environmental Consultant)

Ecologically, the idea of wildlife corridors was popular among multiple stakeholders. For example:

'I love that idea [wildlife corridors]. Just having interconnected verges, corridors, I love that idea, if we were able to do a whole street... especially if animals can hop from one verge to another and especially if it connected to different bushlands, you know, through the urban area, that would just be amazing, wouldn't it?' (Environmental consultant)

Several LGA respondents described the ecological connectivity function as 'stepping stones' or 'hopping spots' between reserves or even gardens along a street. For example:

'It doesn't have to be a mammal species., it could be a small lizard species, it could be butterflies, even just birds transferring through the landscape and being able to have these stepping stones through the landscape to allow species movement.' (LGA)

In terms of supporting diversity of bird species, dense understorey (vertical scale), was described as critical to provide foraging habitat for smaller birds and protection from larger birds (Environmental

Consultants, several LGAs). For small birds and insects using the wildflower corridor potential of verges one respondent described needing:

'something every 20m and that is going to get a really nice, small, shy bird, from one place to the next...For some of the bees and the insects, they don't even go that far. So I need something effective from, whether or not it's a front yard, back yard, verge, for it to be effective as a corridor.'

Direction of connectivity also, was raised as important for small birds by a respondent:

'And little birds jump from bush so if you can increase their range, allow them to east-west rather than north-south all the time it makes a difference. It's the problem with a lot of the coastal corridors of bush, they're not wide enough. They need to be able to go east-west as well. And that's something that we've never been able to get happening. Having that corridor allows them to go inland. And the only way you can do that is by having home gardens with decent size, doesn't have to be native, but something they can bounce to, one to the other. Because they're too exposed in trees.'

However, it was also noted, an effective scale to support biodiversity is obviously highly species dependent and both shape and scale important considerations for reducing weed spread and impact. For example, one respondent described a width ideally of 50 m that would minimise edge effects, however it is exceedingly rare to have a road reserve wide enough to allow for a 50 m corridor in the metro area.

'The design of each linkage is dependent on the species. So, if it's avian, if it's birds, possibly but we have planted stuff on the side of the roads and then birds come to eat it and then they get killed. They get hit. So, we try not to have corridors for animals right next to the road, we try to have it off the road...So, you could have a bridge, in effect a bridge over the road, which you vegetate, which moves animals from one patch of veg to another, because the road stops the linkage. Or you could have an underpass for animals.' (State Government)

Verge connectivity to remnant urban bushland can also facilitate not only weed spread but the movement of introduced predators such as cats and foxes. One respondent also referred to research they were involved with where significant verge vegetation was separated by a road from adjacent bushland. Here they provided an effective under-road piping system with multiple spurs, to give Quendas (*Isoodon obesulus*, also known as the Southern Brown Bandicoot) a chance of escaping these introduced predators when trying to move about the landscape, as well escaping urban fire events.

Key Findings:

- Verge connectivity to provide potential ecosystem services occurs at a variety of scales
- Verges can connect with private gardens and assist the movement of small reptiles, birds, insects.
- Driveway design and footpath location are important for connectivity outcomes.
- Vegetation height restrictions can reduce the potential for verges, in appropriate locations to provide vertical connectivity (ground through to mid storey and canopy) for birds.
- Green corridors were described as essential in providing social and ecological ecosystem services. For example to support 'liveable, walkable' neighbourhoods and conduits for animal movement.
- The current level of uptake of native verge gardens is insufficient to function as ecological corridors in most locations.
- An awareness that green corridors can potentially facilitate the spread of invasive weeds or hybrids and introduced predators is also important.

3.4 The process of transforming verges with native plants

The following section relays stakeholders' responses to questions regarding the process of transforming 'traditional' street verges through verge gardening, primarily through the use of native species. Included in the process is the stakeholder's understandings of the inspiration for conversion, the resources required, including what guides the choice of particular plant species and the enabling and constraining factors for transformation. Results relating to LGA incentives and LGA verge maintenance are also presented here, as is community feedback stakeholders may have received.

3.4.1 Inspiration and motivation

Stakeholders were asked what factors they believed were most important for encouraging residents to undertake native plant gardening on their verges. For stakeholders overall, reducing water use, being aesthetically pleasing and attracting wildlife to garden, as well as LGAs providing incentives, were the most important factors motivating residents to undertake verge gardening (Figures 12 and 13).

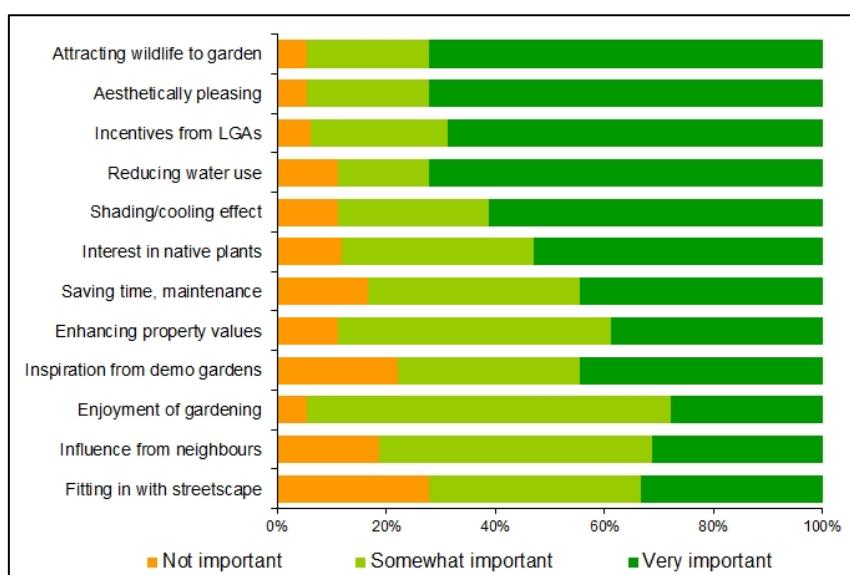


Figure 12: Stakeholder rating of factors motivating verge gardening by Perth residents.

Responses are drawn from interviewed stakeholders ($n=17$), and represent stakeholders' perceptions based on their experience in the sector.

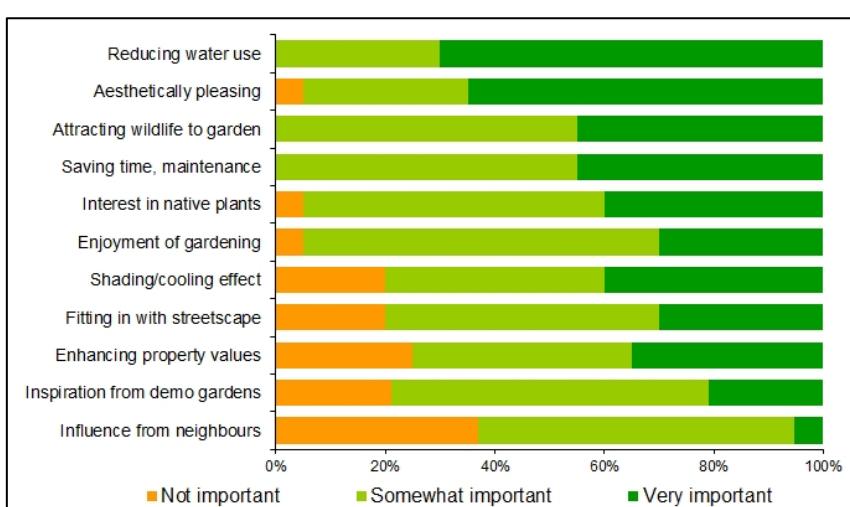


Figure 13: LGA respondents' rating of factors motivating verge gardening by Perth residents.

Responses are drawn from an online survey of LGA representatives ($n=20$).

From across several stakeholder categories, saving on water and maintenance was frequently cited:

'Water, water, water'... 'Well, I guess it's maintenance as well. People getting lazy. They think it's less maintenance having a garden, it's not.' (Peak Body)

'They've had enough of that turf, the turf is too hard to manage. We see that collectively. So from that aspect, that's the opportunity to turn it into a verge garden... So it's maintenance entwined with cost and as, as brutal as we all are, a fundamental is everything comes back to a cost. If it can be less cost for an area that would be the choice.' (Horticulture and Irrigation)

'That's probably a main driving factor, people are fed up with watering their lawn and maintaining it. Well, I guess that's the other point is the maintenance aspect. [One] guy said that he bloody loves his verge garden because he loves to watch the neighbour mow his lawn every Saturday and he just sits there.' (Environmental Consultant)

LGA respondents (early adopters) also provided a range of ecosystem services as motivators for their engagement in verge programs, including health benefits:

'Getting out and talking to your neighbours, getting involved in your street, it's got links with mental health, it's just huge.' (LGA)

Messaging is clearly a critical part of inspiring people and sharing knowledge and shapes the strategies used by various industry-related or behaviour change native gardening programs. One respondent described tailoring their messaging to target different demographics and noted their organisation was now shifting away from emphasising water-saving as a cost-saving measure, given the inexpensive cost of water:

'So, it really is about focusing on... you know, we're targeting our message about focusing on doing the right thing, being in the community, keeping it green, doing your bit for the environment, creating oxygen, places for flora and fauna to be where they're supposed to be.'

A Champion of Change identified sharing positive stories in the media as effective in encouraging people to consider verge gardening also:

'What I have noticed is now that a lot of the papers are... there's a number of papers have contacted us to get story... we've had some of the local newspapers and major newspapers contact us to get in... and because we have a network of people that we can put them onto, they're willing now to share the positive story of the values of verge gardens. So, having positive stories in the press also I think, helps influence and change people's perception of, "Well, if they can do it, I can do it." And, "I didn't think about that. Maybe we can do that."

Champions of Change and Environmental Consultants all had direct experience in the process of verge transformation and understanding what prompts people to engage in this practice, noting communities becoming more vocal in wanting native plants, and sometimes edible plants, in streetscaping. Leading by example was cited as a direct source of inspiration for people. For example:

'If we can do an example project, we might be talking to various levels of government, through government offices, local government, state government offices and agencies. All those people that we're talking to, they're all residents themselves somewhere, so it's not just about talking to their own organization, that messaging does filter down. So [name of project] for example, the amount of ministers, federal and state ministers, as well as all the researchers from the various universities. All the universities I think have done tours down there. And then all the various state government agencies from Western Power through to Horizon Power. All of them, basically. And local government offices tours. All that messaging, does at some point filter and trickle down to either verge policy or state government policy or something else. So it's leading by example.' (Environmental Consultant)

Interestingly, while ‘influence of neighbours’ was rated less important than many other factors (Figure 12), many respondents all had direct experience of observing a positive influence among neighbours engaging with verge gardening. In effect, where people are influenced by their neighbour or someone in a nearby street having installed a verge garden, and go on to install their own. For example:

‘When someone does put a verge garden in, someone else in the street does it as well...They go, oh wow, look at that, let’s do that as well...[the] best advertising is the one we do on site, standing there working.’ (Environmental Consultant)

‘The other cool thing has been streets and neighbours. So, one neighbours will do it and it’s that kind of behaviour change thing. So they’ll see it and then they’ll talk to their neighbour about how easy it is or the [LGA’s] got this great program, so then another neighbour will do it. I’ve got streets where I’ve got three or four verges in a street or there’s a suburb... where we’ve got little clusters of verges and you can really see it driving around.’ (LGA)

This experience of ‘contagion’ of verge garden conversions has similarly been documented in studies from other cities around the world (Hunter and Brown 2012), and demonstrates the influence of the local street or neighbourhood as sources of inspiration and encouragement.

Several respondents cited a sense that residents might want to ‘do something’ with their verge:

‘I think it’s probably a source of frustration more than anything, like they’re sick of looking at a dead, weedy lawn, or mowing it, or you know? Yeah, that’s what I’d say it would be. I don’t think people generally go out and go, “I’m going to plant a nice native garden.” They’ll probably say, “I’m sick of looking at that. What can I do there?”’ (Horticulture & Irrigation Industry)

‘...unfortunately, a lot of the streetscapes are neglected. They’re tired, they’re weed-infested, they’re overgrown, they’re neglected. There’s some standouts, but I would go 80/20 rule that 80% of them were neglected. So hence why we adopted the one on the corner, which always had trolleys onto it, when I would always drive past it.’ (Champion of Change)

A related notion was the desire to bring joy and beauty through native plants:

‘It’s just been a vision I’ve always had ... that there would be (Christmas Morrison) Verticordia nitens in these beautiful block colours. Over Christmas time, down [name of road]. I mean that colour would just be such, you know, bring so much joy.’ (Environmental Consultant)

One respondent felt financial incentives sent the wrong signals and were less likely to encourage the resident to invest enough effort to maintain their verge garden over the long term:

‘If the motivator is receiving money to make you do it, I don’t think that’s a very good motivator...The motivator for people who get into this might be for free food, might be for environmental reasons, whether it’s the urban heat island effect or whether it’s water penetration or it might be for the little bugs and wildlife.’ (Champion of Change)

Key Findings:

- Stakeholders felt residents were motivated to undertake verge conversions (to native/mixed gardens) largely by the potential to save water, reduce maintenance time and effort
- Champions of Change and Environmental Consultants emphasised the need for demonstration verge gardens to inspire uptake, often with very wide community reach.
- Some respondents directly involved in verge conversions were inspired through enjoyment of gardening, wanting to improve neglected streetscapes, and bring joy and colour.
- Some respondents had observed the contagion effect of small clusterings of converted verges, demonstrating the influence of neighbours inspiring others in their street.

3.4.2 Resources required

Space, environmental conditions, plant survivorship, chain of supply (from seed/propagation to market), considerable labour, knowledge and some expense were all listed as resources required for verge transformation. Stakeholders also raised issues particular to their industry, such as the materials required by the native nursery industry and factors impacting their financial survivorship. LGA respondents reported the Water Corporation's partnership program providing essential financial resources to support their verge programs, though they felt there was still demand beyond their resourcing capacity (staff time or budget).

Respondents presented a spectrum of likely expenditure for residents, when describing verge conversion with native plant gardening. Many were concerned most people underestimated the task:

'When it comes to actually doing it, it needs commitment, you need to physically be able to do it, or have the money to pay someone. It can be extremely costly, like \$5 000 (2.5k for bob-cutting the soil removal, 2.5k for providing and installing plants)... Actually, that's what it costs, and no one is making much out of that either...The cost is underestimated and the labour is underestimated, if you have to do it yourself. And the other thing is that people don't understand that poisoning lawn, is it has to be done in the growing season. And I have so many people ringing me up now [June] saying they want their verge done but I have to say it's too late, too cold.' (Horticulture and Irrigation)

In contrast, Champions of Change emphasised the more hands on, relatively low cost option:

'So don't spend more than you need to on the verge, or more than you're willing to lose. So I can start a native garden on my verge with only buying some \$1.50, or \$1.00, or free native plants from the council, or any other subsidized or cheap sale. So a lot of that came about to enable people to do it, to realize they don't have to spend much money. They don't have to be a horticulturist. They don't have to go and buy all the fancy soil conditioners. They just need to follow a few steps'. (Champion of Change)

Respondents from the Horticulture stakeholder category raised resourcing issues particular to their industry, including obtaining seed supplies and good quality soils, issues with propagation and even maintaining a viable business model financially. For example:

'Seed supply. From a production point of view...Actually getting the seed supply locally, to grow for environmental jobs and stuff is an issue, an ongoing issue that no one seems to be addressing. [Described how the accessible area for seed picking is decreasing as clearing of banksia woodland sees increasing areas protected as Threatened Ecological Communities]. There's fewer and fewer actual bush pickers picking seed, because it's a bit of a dying industry.' (Horticulture and Irrigation Industry)

'Sometimes none of it [seed supply] comes up. It's unpredictable- one year every seed, for example, pink myrtle will come up, another year- zero. That's really difficult for us in terms of our costs and in terms of telling people what we can supply' (Horticulture & Irrigation Industry)

'Getting good soil is more difficult. It has to be sterile and once used it has to be disposed of as part of the accreditation. Very expensive, soil.' (Horticulture & Irrigation Industry)

And financially challenging:

'We've never had differential pricing, but we started doing that for the first time. Other nurseries do that...[We've had to] because of increasing competition. Just unfortunately, the price that people will pay for plants keeps getting driven down. So, our basic price now is the same as it was 16 years ago. Getting to the point where we can't afford to grow plants, as we're on the verge of bankruptcy all the time.' (Horticulture & Irrigation Industry)

The size and conditions of the verge space was important, a constraining resource in itself, which dictated management and survivorship. Creating a supportive environment was particularly important for the longer timeframes of tree longevity:

'So I guess creating the environment is, you need enough physical space above ground and below ground to accommodate the mature tree. The above-ground is relatively straight forward. If you put a big tree right under the power lines, well ok, you've created a job for yourself for the next 50 years. Creating a space underneath the ground... trees need air and water below ground and nutrients, so you need to create that environment somehow. And it might be that it's already pre-existing if you've got a really large wide verge. But it might be again, when you come down to the really narrow verges, it might be that you start needing to have a look at the engineered concepts to create the space.' (Environmental Consultant)

Resident interest in verge gardening incentive programs is growing. In terms of the future demand envisaged over the next five years from residents for verge gardening support, 15 of 20 LGA respondents to the online survey felt demand would increase (Figure 14).

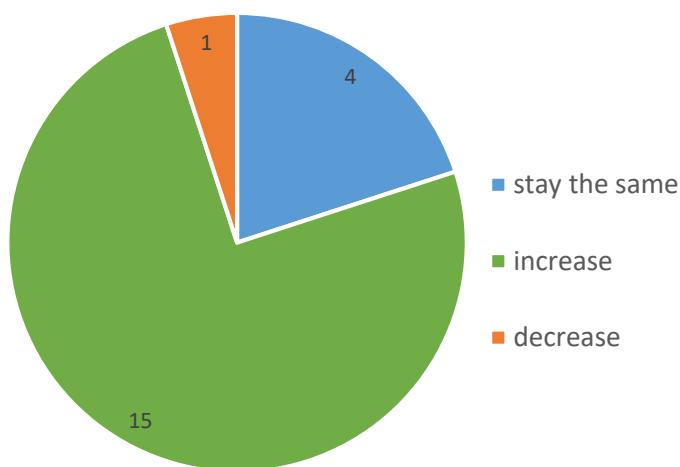


Figure 14: Envisaged demand by residents for native verge garden support and incentives.

Number of LGAs (n=20) reporting envisaged demand over the next five years from residents, in support of verge gardening with native species (increase, decrease or stay the same)

During interviews, LGA respondents highlighted financial support from the Water Corporation's water efficiency verge subsidy program. For example:

'So, they [the Water Corporation] will provide up to \$10 000. Probably the total cost of the program is, so they'll provide half, it's 25, sometimes 30K, so the [LGA] does stump up probably the majority of the funding.' (LGA)

'The waterwise greening fund that we did access last year, which was a 50/50 financial agreement, where we put in 50% of the project financial cost and they refunded us back 50%. And that is for native seedling schemes, it can be used for waterwise garden workshops and the kind of things that will encourage the community to be more waterwise in their gardens ... Which is really good for us, because what that meant was the money that we got back from that, we can then reinvest this year when we run the program again. We can then offer more plants, because they sold out within a few days.' (LGA)

LGAs also raised the challenge of providing some other related materials, for example mulch, in terms of sourcing the correct quantities;

'it can be a bit of a headache, to be honest Because you know, trying to estimate the right amount for residents and things like, and then trying to get it delivered and people wanting it at different times, and we didn't get enough, and all that sort of stuff.' (LGA)

Several LGAs did emphasise the good return for their limited investment, however, making it a staple in their budget. For example:

So we do budget the same amount each year for the subsidy scheme and it just so happens that this year, we're going to be able to offer more plants, just because we got that extra external funding in, which is great. And it's not something that we're planning to can any time soon because it's quite popular and it achieves quite a bit for limited investment, really. But it is, it is a recurring thing, we don't ever question removing that from the budget. (LGA)

Key findings:

- The resources residents required to convert their verges to native gardens varied depending on stakeholder category- Champions of Change generally felt they required less resources, compared with an Environmental Consultant or member of the horticulture industry.
- Factors affecting resources and process of installing native vegetation on verges for stakeholders included available space, environmental features (quality and reliable chain of supply (plants, soil, reasonable environmental conditions
- Stakeholders also raised issues particular to their industry, such as the native nursery industry- where materials required included reliability and quality in supplied seeds, soil, reliability in the propagation process, factors also influencing the organisation's financial viability.
- LGA respondents reported the Water Corporation's partnership program providing essential financial resources to support their verge programs, though they felt there was still demand beyond their resourcing capacity (staff time or budget).

3.4.3 Species selection

Respondents were asked to rate the relative importance of various factors guiding species selection for both tree and understorey species. Results reported here are limited to understorey species, and are presented separately for those interviewed stakeholders whose work or activities include experience with species selection, and for the 20 LGAs surveyed online.

In terms of native vegetation broadly, two pertinent points shaping suitable species consideration are raised by this respondent, that it is highly site specific and that in urban areas, sites can often be a highly modified environment (for example in terms of soil characteristics):

'It's entirely site specific because you know, each microclimate is variable. And when you get into urban spaces, and this is one of the challenges with growing natives, particularly in highly modified areas is that potentially the endemic vegetation there may have been, you know, sort of acid soil or slightly lower pH soil-adapted plants and that may have been the case until development occurred. At that point a large proportion of the top soil has been removed and so now we're talking about growing things in subsoil, a very different soil structure and that same specific location might not be suitable for that vegetation anymore, even though geographically it's meant to be there. Conditions have changed that far, that it's completely unrealistic to [plant] that [there].'

3.4.3.1 Considerations guiding stakeholders' species preferences for verge understorey species

For interviewed stakeholders, the most important factors influencing species selection for the understorey were species hardiness, fitting with the built environment and wildlife friendly (all considered very important by more than 70% of respondents) (Figure 15). While the first two factors were also in the LGA survey respondents' top three most important factors, safety was of equal greatest importance as species hardiness (Figure 16). Community preferences for understorey species were more important to LGA respondents, than the broader collective of stakeholder respondents.

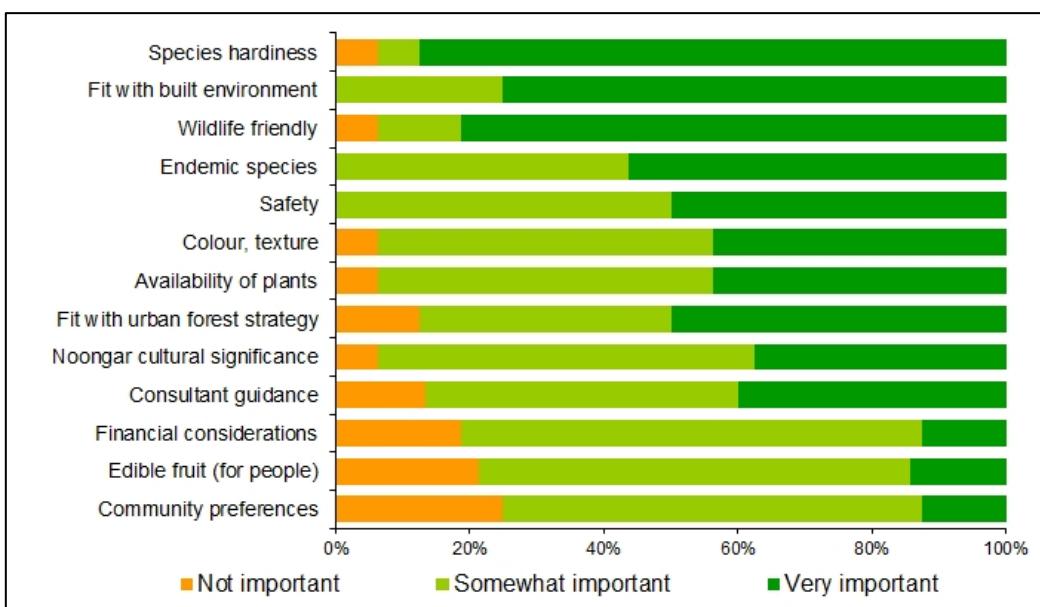


Figure 15: Stakeholders' perceptions of factors influencing understorey species selection

Results drawn from interviews with stakeholders across multiple categories; n=17.

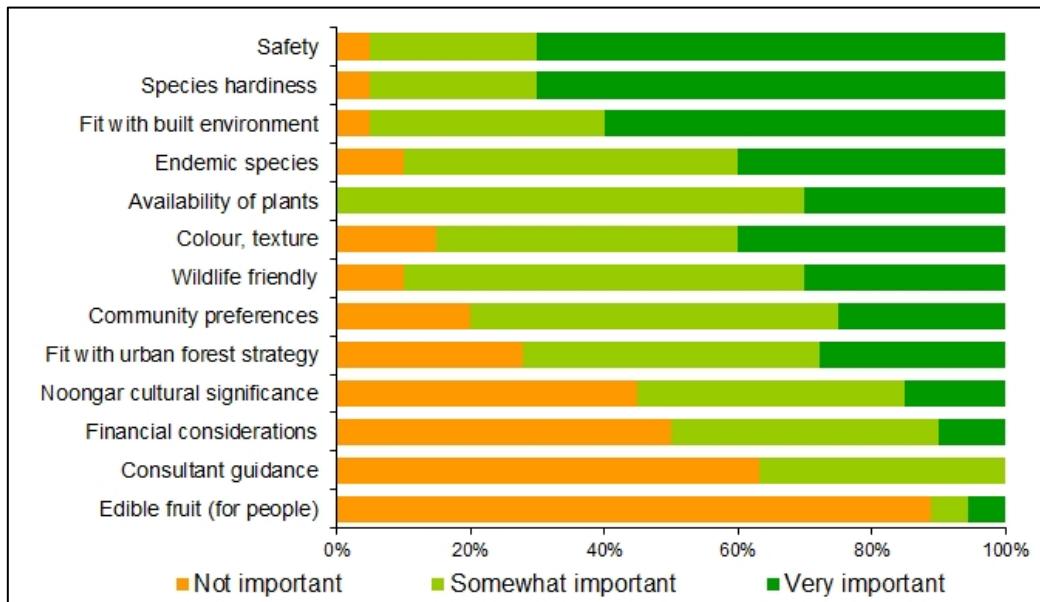


Figure 16: LGA perceptions of factors influencing understorey species selection

Results drawn from an online questionnaire; n=20.

For understorey species, almost all interview responses emphasised the LGA sightlines (rules of height) for safety and visibility. One key provision was to be tough-'*proven, really tough and low maintenance.*' They explained:

'Proven means that we know that they will survive so in our road reserves, it's not like planting back into the bush in the area. It's a very changed environment. It's a lot of reflected heat. The soil is disturbed. It's a highly modified landscape. It's a really tough environment for them. So, we want them to be native but not all natives will survive in that environment, particularly locals, because it's a changed environment.'

In terms of guidance for species selection, the Botanic Gardens and Parks Authority (BGPA) (which manages Kings Park) expertise was important for several respondents, along with experience. For example:

'Kings Park, definitely our biggest one, and the nurseries. Landscape architects really don't help us. They come up with some really weird stuff. They come up with a list using every species and you can't even get half of them commercially... A lot of it is experience, talking with nurseries, what they can supply.' (State Government)

In addition, many respondents emphasised the value of the smaller plants for adding flowering colour and a variety of forms or textures. It was here many respondents emphasised the capacity to reflect the six seasons. For example:

'...have to make sure that it looks great. So... and then we, we also are trying to capture some indigenous, the six seasons, the different species and so on, so there's lots of subtle messages and important things to think about.' (State Government)

A respondent (Horticulture and Irrigation Industry) described how proven plant selection will be reused, the preferred options in design, though this respondent felt landscape architects' primary aim was maximising aesthetic impact, with biodiversity outcomes less important. For example,

'The architects will have a good experience with a plant. Like it will perform well in one of their jobs, and they'll tend to reuse it. It'll be their go-to sort of palette. It just really shows you that correct plant selection will come out again. But they're after texture, colour, form, so it's going to look good all year round as well as it's got flowers. There's still not... I don't think they take into account the biodiversity or impacts it will have on animals or anything like that. (Horticulture and Irrigation Industry)

Important to note also, that several respondents from the Horticulture and Irrigation Industry stakeholder category, understorey species/cover also included lawn/turf.

'We need grass for active open space, we need it for people to sit on, but do we need too much of it? No we don't, we need a balance. So we've got somewhere in the shade to sit and all of those things.' (Horticulture and Irrigation Industry)

For nursery industries and related consultancies, three respondents raised matching the 'theme', or what the resident wants to achieve, plus the time and effort they can spare in maintaining it (Champions of Change, Environmental Consultants) guiding understorey species selection. Others in the nursery industry commented on how the requirements associated with verge gardening (e.g. sightlines) have shaped the species and form being grown by nurseries (and issued with 'Plant Breeders Rights', PBRs) in response to the growing demand. For example:

'...because of the verge programs we are selecting the suitable verge ones out of the range that we already grow. Over the last few years we've put a lot more energy into this and growing those ones as there's now a market for verge plants that there never used to be.' (Horticulture and Irrigation Industry)

In terms of the use of natives in understorey species, advances in garden-suitable species availability and form was noted by several respondents as influential. For example the improvement in ability of dwarf versions had been important in encouraging the uptake of garden and verge suited native species.

'Because if you think of some of the old melaleucas, the shrub was 5 m tall, it takes over the whole verge environment. There's some new hybrids that have got really vibrant colours and things like that, a lot of the places have been selecting for the hybrids that are really showy.' (Champion of Change)

One respondent felt it would be positive to encourage more emphasis on endemic species, for example building it into the completion criteria for LGA or developer jobs but noted this may require a shift in wider preferences, feeling natives are still undervalued:

'I think it's changing people's perception of what an acceptable landscape would look like, and that's going to be hard, because well, "Oh, that's just bush." (Horticulture and Irrigation Industry)

For developer respondents, they described their influence on understorey species selection as through their choice in landscape architects/consultants, who '*almost always will recommend a water wise kind of approach, palette, planted colour*' (*Developer*). This is unlike for tree species selection, where LGAs have greater influence. In addition, they noted their waterwise developments, including species selection, are certified now through Water Corporation.

LGA respondents largely cited the logic of their respective verge policy as guiding their preferred species, i.e. low growing, meeting height restrictions, aesthetically pretty and local, '*as much as possible*'. Plant performance was important, not just for economic value, but particularly when attempting to support behaviour change in supplying residents as this Champion of Change noted:

'normally the ones that they manage to get to grow are the bombproof ones. In terms of the guidance, I think it's very important, because one failure is enough to put people off for years. And they just lose heart.'

Similarly, this LGA reiterated their priorities regarding species selection, '*And most importantly, things that grow well in sand and are local, because you don't want residents getting plants that don't perform well.*' (*LGA*) Another LGA noted how different guiding factors might be prioritised by different departments within the LGA, for example: '*then depending on which department, slightly different slant for parks and gardens- e.g. aesthetics - form, colour. If it's the environment department- ecosystem services.*'

An environmental consultant noted some limitations if attempting to adhere to strictly to the 'endemic' status, if this is local to the biogeographical area and generally true to type, finding it can be somewhat limiting, and particularly when also having to meet height/size limits. For example:

'But I do like to use WA plants, not necessarily endemic plants because I think the variety of endemic plants for a particular area is quite limited, to get that real creative kind of feature garden, just choosing endemic plants can be a little risky.'

'There might be 15-20 plants local to that area [available] but there might not be enough within that range to actually comply to the policy of 0.5 m plants and to have a variety of different groundcovers that sort of contrast or feature well together. And then not only that but also ones that will be suitable for a verge, you know, in terms of their growth habitat but also their ability not to get too woody, you know and things like that?'

Finally, environmental risks like disease (*Phytophthora cinnamomi*), were factors some respondents raised in considering species selection:

'And native species, you know, we got things like Phytophthora here and if we don't use quality suppliers and make sure that, we're aware of all of these things, then it could be a bit of disaster. Maybe that's another thing, die-back resistant plants we select for those verges. (Horticulture and Irrigation Industry)

And:

'That type of [urban forest] policy, where you're nominating lengthy streets of a particular species, that actually can run into its own problems where you end up with a potential monoculture, across particular suburbs. And then you end up with either pest or disease attack ... Things that we don't know about now that might occur when those trees are mature, in say 50 years' time.' (Environmental Consultant)

Though disease risk was of less concern for this respondent;

'Not really, I think the pest and disease management sort of fits more into the urban forest strategy and when people are trying to decide, determining ratio of genus and family that they want to have in the [LGA] to kind of mitigate against those kind of impacts....And I guess, you know, creating a supportive environment mitigates against pests and disease anyway. It's the old [adage], healthy trees don't get sick anyway.' (Environmental Consultant)

The other environmental risk raised was that of the risk of importing or increasing weed spread or plants that might hybridise with natives in nearby parks.

'I think we need to also reflect some of the biodiversity values of the area in that approach [species selection], and that we're not planting native plants [from elsewhere], which technically become weeds [or hybridise].' (Champion of Change)

Key Findings:

- Species hardiness, fitting with the built environment, wildlife friendly were the most important understorey species selecting factors for all stakeholder respondents collectively. For the LGA survey respondents, safety and community preferences were more important factors.
- Species hardiness was critical - favouring species that have proven survivorship, are tough and low maintenance. Disease risk and weed spread were other factors several respondents raised as important to consider when selecting species.
- Understorey species were where respondents emphasised the capacity to maximise the visual interest through showy flowers and tracking the Noongar Whadjuk six seasons.
- Horticulture industry noted increasing availability of native species and forms suitable for gardening, but is an industry in transition and local specialist native garden plant suppliers are still facing many challenges, including competition with eastern states suppliers.
- Lawn was noted as an important groundcover for several respondents across several stakeholder categories, to provide a parking option or in concert with verge garden plants.

3.4.4 Enabling factors supporting residents to undertake verge native gardening

Building on residents' inspiration and motivation to transform their verges with various forms of native garden, stakeholders frequently raised the critical need for greater information and education activities to support residents in their verge gardening endeavours. Success often boiled down to sufficient knowledge and many respondents felt this was a significant gap. Their suggestions to address this are provided. (3.4.4.1). LGA provided incentives were the other significant enabler raised as influential and supporting residents verge gardening efforts and here results from both stakeholder interviews and the online survey are presented (3.4.4.2).

3.4.4.1 Information and education to support LGA behaviour change and gardening practices

There was a consensus across almost all stakeholder categories that education (with the exception of the utility category, for which it was not applicable) and awareness was critical for supporting engagement in verge transformation (gardening with natives) and that it was far too limited.

Respondents frequently cited lack of knowledge (or misconstrued understanding), as a factor limiting uptake and as the reason for failing in verge gardening efforts, for both residents and LGA level installations:

'I think, you've got to overcome this overwhelming failure in Australia about the lack of knowledge and interest in native plants, because I think you've just have this huge [non native] nursery industry promoting other things. So I think, one of the biggest barriers is lack of education... The main thing

is ignorance- for example a lack of understanding of how to remove couch grass.' (Horticulture and Irrigation Industry)

'And that is a problem with having native plants, people just don't know how to look after them. People know a lot about roses, there're books on pruning roses, but there's not a book written on how to manage a whole lot of native plants, which is really a sad and unfortunate thing. Apart from maybe kangaroo paws, a lot of people know a little bit more about those because there's a huge variety and people tend to like them. You've got to still manage those. Getting this sort of baseline knowledge about how to prune and when to prune, how to look after them. It's just not available at this stage.' (Environmental Consultant)

Just understanding what trees and plants need to thrive. I think that's a really big factor that there's a lack of that, you know, you don't necessarily have very high-level horticulture in local government. Often you have a lot of goodwill and a lot of intent and sometimes there's skill and ability there but not always and not always to the level that you need. Same with landscape architects, there's a whole bunch of design ability and skill there but sometimes there's not a great understanding of what you need. (Environmental Consultant)

Respondents described how gardeners needed practical, locally specific advice to have gardening success, gain confidence and continue to enjoy their verge gardening. For example:

So there's the sharing of the knowledge. So that's sharing the story, so they know that they have got the backbone, the foundation, of what we're talking about. Then it's [using] the evidence... 'Show me, show me, show me, show me...' And I can show you so many failures. And I can show you failures because of the amount of watering people do, the amount of mulching that people do, the amount of soil contaminant, I'll call it contaminant, do.'

Confidence. That is the more they can be confident with growing a native garden, the more they will connect to the outside. They will go outside instead of staying inside, because then they just, they feel like they have a value, they've got a value to contribute... The enabling thing is relaxation, they want to connect to, they want to make it look good and connect to them feeling comfortable and, just relaxation. (Environmental Consultant)

Evidence-based information is critical to gardening success, without which it is harder to challenge negative perceptions of gardening with natives, many of which were established in earlier eras when less suitable species were available and certainly there was less information available on how to care for them. Thriving examples will encourage others to see the positives of gardening with local native plants and attitudes were slowly shifting with more garden- suitable species and forms available, as well as the rise in environmentally conscious public. For example:

'And I think maybe the native thing used to have a negative connotation, because in the 80s, so if you were talking to baby boomers, "Oh, native plants, because they're all straggly, and they're big and horrible," and all that sort of stuff, whereas I think now, it's probably turned around and gone, "No, native is okay, because it takes in this whole range biodiversity and conservation issues. Helping the native bees, and helping doing this." (Horticulture and Irrigation Industry)

Workshops and demonstration days were described by LGAs, Champions of Change and Environmental Consultants as critical sources of education for the public, to inform, inspire and update or correct, various misinformation in circulation, and to provide evidence-based information, direct steps and frank discussion on the requirements for verge conversion, including ongoing maintenance. This is important generally, but particularly so for controversial treatments like the application of herbicide. For example:

'In my ... course, we talk about responsible use of herbicide. One of those things is using it at the right time of year. You let it [couch grass] die for 2-3 weeks, encourage it to grow again and come

back and spot spray anything that comes back and shouldn't plant anything for a month after that process. Then for first year or so you have to be absolutely vigilant for anything that comes back. If not, it'll come back the next year and you have to poison again. If you're going to use poison, you must be responsible and must eradicate.' (Horticulture and Irrigation Industry)

'So, we tried to show people that where you need to plant is, so they touch each other in four years. So, if you have them any closer than that, they start competing against each other and the plants die or start looking poorly. So, if you give them enough room to start off with, they grow nicely in together, you get what you call canopy closure. And canopy closure shades the ground, so you don't get weed germination. But until they're four [years old], you got to keep the weeds out (Champion of Change)

'And we introduced the how-to, the steps. Because they didn't know how to do it. They thought you just pulled it out of a pot, plonked it in the ground and away you go. Put a sprinkler in it...How to do drip irrigation. There was virtually no councils that ever had drip irrigation until we started doing them all over the place. It's amazing to think, we often think not much has happened but actually it has.' (Champion of Change)

'Maybe some good, sound advice on irrigation. Whether it's community workshops or whatever it may be, for people that are interested, because not everybody is. Most certainly. We ran irrigation controller courses ... just on how to set your controller, how to adjust it, what it means. And I think all of it, education is just radically important and somewhere for people to go and get it, you know? If they need to talk to somebody about a plant, plants, which ones would suit, it's just very, very important. And if you're not going to put irrigation in, the fact is you're going to have to hand water them to get them through the first couple of summers, probably. At least the first summer.' (Horticulture and Irrigation Industry)

In terms of where to go for best-practice information, stakeholders raised several key providers: local government authorities, native nurseries, the Botanic Gardens and Parks Authority (Kings Park). Most respondents believed LGAs, along with native nurseries, were best placed (or could have a greater role) in providing this information directly to the public. For examples of LGAs filling this role:

'I think local governments, definitely, you know, anything that can be done, anything that can be done to subsidise, to assist them, is really, really important. Whether it's water use, fertiliser use, plant selections, plant maintenance. If you've got that available, you know, once some people get a bit educated and then other people hear about it, they're interested too, you know. But we gotta keep educating people, because when people are educated, then they get on board.' (Horticulture and Irrigation Industry)

Education through various media sources, television and radio programs (particularly local, Western Australian specific) and the web were also described as influential in educating the public: For example:

I think TV, Gardening Australia programs, that sort of stuff is certainly an enabler. They talk about it a lot on there. (Environmental Consultant)

But locally specific information is critical:

'And that's the difference [success or failure] between going out there and getting [local information] in the suburb rather than you know, watching your Gardening Australia which is trying to cover the whole of the country. I mean, fantastic show but the guy in Queensland's got nothing to do with us.' (Champion of Change)

An environmental consultant heavily engaged in this space also have a publicly available library on their website:

'And then we made sure that the material that we produced their [Water Corporation's] design work on, irrigation, or advice notes, all that sort of stuff is publicly available. And we still have a huge library on our website, it's free to download. So I don't think our available library is utilized enough. Maybe we don't push it enough, anyway.'

3.4.4.2 Incentives

An online survey of 20 LGAs (administered in 2019) provided a snapshot of incentives Perth Metropolitan local governments intended to provide in 2019. These results are summarised in Table 9. Of the 20 respondents, 19 offered some form of incentives or support material. Almost all offered the provision of a street tree at the request of the resident, 14 provided recommended species lists and 13 provided information on creating verge gardens, while almost half of respondents (nine) offered verge gardening workshops.

The number of individual households that LGAs chose to support in the installation of new residential native gardens in 2019 varied widely. Of the 16 councils who were providing support and/or incentives to residents, eight supported 100 households or less, while two supported over 100 and another reported over 1000 households. Three LGAs reported that they did not support any households in native verge transformations and a further two were not able to quantify the number supported.

Stakeholder interviews provided the opportunity to inquire further about incentives, among LGAs with varying degrees of involvement in supporting residents' verge gardening. Some LGAs identified providing mulch, offering prizes, and offering workshops as valuable incentives they had either settled on or were soon to implement.

'Annually, we have offered free mulch to residents who register, because we have our own mulch that we generate ourselves. So each resident, I think, registered was allowed to take away one or two trailer loads of mulch and that was to encourage that verge transformation. And I think, I've found, previously we've given away some soil amendments as well, like bags of soil wetting agent and soil amendments. So, I think we have played around with that before but I think our mainstay is the seedling subsidy scheme, a bit of education and the mulch. The mulch is a big thing.' (LGA)

'...what I'm actually going to do is waterwise street, to encourage that behaviour change, the 'best street'. And it's good that we've waited three years or so, because now there are some streets that will have quite a few. So, I'll have to think of what it is, like is it more than two and you know, then how well are they maintained? And then we'll be able to go, oh this street in [name] is the waterwise street of the year type of thing. And then I'll have one for best verge as well. (LGA)

And an example of workshops provided:

'So, we provide the training. Once people come along to the training, usually on that day, I give them their little pack- a nursery voucher, trowel, the waterwise verge guide from the Water Corporation, a greening [name of LGA] guide with local species, little everlasting seeds, information - how to plant, and then more sort of step by step guides (an overview of workshop information). We have a chat at the workshop about mulch and their verge sizes and what they want to do. I record how much mulch they would like and they pick up their 20 free plants and then mulch is delivered to their house a couple of weeks after the workshops... But they do have to undertake any weed control themselves, irrigation themselves and then obviously any maintenance and installation of the verge themselves...'

'And we do actually run maintenance workshops as well. That's important I think, that maintenance aspect. But yeah, I think that is important, to keep on top of that weed control side of things.' (LGA)

Table 9: Snapshot of incentives offered by Perth LGAs for residential native verge gardens, 2019
The table below depicts the variety of incentives, rebates and advice offered by 19 Perth metropolitan LGAs. Data drawn from an online questionnaire. One of the 20 responding LGAs selected 'no incentives' and this response is excluded from the table.

LGA	Incentives planned to be offered to residents in 2019																	
1		✓	✓			✓	✓	✓	✓	✓			✓		✓	✓	✓	
2	✓		✓	✓	✓	✓		✓				✓	✓		✓		✓	
3		✓	✓	✓				✓		✓	✓		✓	✓	✓		✓	
4	✓		✓	✓	✓	✓			✓			✓				✓	✓	
5	✓			✓	✓	✓						✓		✓	✓		✓	
6			✓	✓	✓	✓			✓					✓		✓	✓	
7	✓			✓	✓	✓						✓		✓			✓	
8	✓			✓	✓	✓					✓				✓		✓	
9			✓	✓	✓	✓					✓			✓		✓	✓	
10	✓		✓		✓						✓	✓					✓	
11				✓		✓			✓				✓		✓		✓	
12	✓			✓		✓				✓						✓	✓	
13					✓	✓			✓			✓					✓	
14				✓		✓				✓	✓						✓	
15					✓	✓			✓	✓							✓	
16			✓		✓												✓	
17			✓															
18													✓					
19						✓												

Key – incentives offered by LGAs to residents to transform a verge by growing native plants

	Rebate for residents installing a native verge garden		Provision of mulch
	Covering the full cost of installing a native verge garden		Provision of low-growing native plants (free to resident)
	One-on-one consultation with residents to choose species and design native verge gardens		Incentives for multiple residents in one street to transform their verges together
	Booklet and/or website with advice on creating and maintaining native verge gardens		Provision of subsidised low-growing native plants (purchased by resident)
	Workshops on creating and maintaining native verge gardens		Other incentives or support tools (please list)
	List of recommended native plants suitable for verge gardens		Awards or prizes for verge gardens
	Herbicide application to remove grass and weeds		Opportunity for one-on-one contact for ongoing advice after initial installation of native verge garden
	Earthworks to excavate and dispose of unwanted soil (boxing out and levelling)		Provision of a street tree sapling for planting by resident
	Provision of topsoil		Provision and planting of a new street tree at request of resident

Icons sourced from <https://icons8.com/>.

Other stakeholders had a range of incentives they noted within their work practices. Two Peak Bodies offered incentives for developers and suppliers to select waterwise products and plantings.

The trend in interest in LGA provided verge gardening incentives is clearly growing (though rates are varying among LGAs), with broadening demographics, word-of-mouth momentum and LGA nursery suppliers noticing the annual increase in interest from LGAs:

'It's been quite good, we've seen a lot of momentum, sort of word of mouth. Sometimes people go, 'oh, I didn't know about this program'. We do advertise it on Facebook and our website and things like that but a lot of people don't see that. We do occasionally have media releases that go into the local newspaper but the main thing is word of mouth "my neighbour has done this..". We've got a little 'waterwise verge in progress' sign that people can put onto their verge,' if you'd like yours, contact the [LGA]'. So, we've had a lot of enquiries from that. So, it's certainly that word of mouth' (LGA)

'We're getting a broader demographic than we usually do for our environmental programs. So we do get, not as many young families, but we do get the sort of, 40 to 50 year old workers doing it, especially this year [2020] with all the online stuff. So, initially yes, we had the retirees. So we have been broadening that demographic out... So it's also good to see people who aren't doing it for environmental reasons. And then we will ask them if they want to sign up to our environmental newsletter.' (LGA)

One important point regarding incentives that multiple respondents (LGAs, Champions of Change) reiterated was the need for residents to have 'skin in the game'. This is where if everything required for the verge transformation is provided for free then the resident is less invested to maintain it, whereas providing assistance at some halfway point can be more beneficial in encouraging residents to put some of their own capacity into the process makes it a more sustainable one. For example:

'One of the anecdotes I think, from the [name of LGA] was that, when they started their verge program, they basically did [it all] lock, stock, and barrel. They'll come and clean your verge up, put all the plants in, but I think they had mixed success with that, because it costs a lot of money. You only get a few verges done, and they look brilliant. But if the people don't have skin in the game, they didn't actually have to invest in it, they didn't have to put their back into it, then I guess it doesn't have that same resonance or personal investment that they want to keep it continuing...I think it's when you see a lot of developments going up, and people getting their free verge garden, because it makes the street look pretty, it makes the development more saleable, they throw in free gardening for a year or two, but once that stops, it just turns to a dust bowl again...So, I think they still haven't found that balance of, "We'll do half if you do half." I think they need to find that balance. It's not easy. I don't envy their position, but I think it's, how can we get partnerships happening where you've got someone interested to do something so we go in halves? (Champion of Change)

And this LGA, aware of the varying levels of resourcing LGAs have to spend on this topic:

I think [name of LGA] was doing it already, and we grabbed their idea but modified it to suit our staffing and workforce levels. Because, we can't afford to do the level of service that [this LGA] was doing with getting the soil movement sorted out. We don't have the resources or the staff to do that. So we said, "Ok residents, you do all the work and as long as you do it, to what we're chasing, within those guidelines, like within the height requirements and waterwise requirements, we'll give you \$500 after you've installed it and then after a three-month maintenance period", so that they really take ownership of it. And they're more likely to keep it maintained after that. We took the view that if we did all the work, all that hard yards for them, that they would just sit back and enjoy it and not really buy into it. (LGA)

Similarly:

'If people are actually investing money in something, they're much more likely to look after it. If we were giving them away for free, to be honest, I don't think we'd get as good results. So, when there is that monetary exchange, even if it is really low, people are much more likely to actually want to get their money's worth out of things. Which is another reason why sometimes giving things away for free doesn't necessarily work in a behavioural change kind of manner as well. '(LGA)

Requiring residents to invest some level of their own efforts in the process appears to encourage sustainability (or longer term success) in verge gardening. Of course this is not appropriate where a resident actually does not have the means (physical or financial capacity) themselves to engage in verge gardening. This is an instance where LGAs supporting complete verge transformations is appropriate and for example, a respondent noted one LGA they were aware of offering a means tested application process to do complete verge gardens for those residents that fell in that group.

Key findings:

- Many respondents across almost all stakeholder categories frequently cited lack of knowledge and education as critical factor limiting transforming verges with native species gardens (either limiting uptake or causing failed efforts), at both the residential and LGA level of verge management.
- Stakeholders directly involved in verge conversion stated gardeners needed practical, locally specific, evidence-based advice to support their gardening success, gain confidence and continue the practice.
- Workshops and demonstration days were critical sources of education for the public, according to LGAs, Champions of Change and Environmental Consultant respondents, to inform, inspire and correct any misinformation in circulation, and to provide simple, direct steps and frank discussion on the requirements for verge conversion, including ongoing maintenance.
- In terms of where to go for best-practice information, stakeholders raised several key providers: local government authorities, native nurseries, the Botanic Gardens and Parks Authority (Kings Park). Most respondents believed LGAs, along with native nurseries, were best placed (or could have a greater role) in providing this information directly to the public.
- Local media sources were also important avenues raised by Champions of Change and Environmental Consultants in terms of locally-relevant advice regarding gardening with native species.
- Providing information and some incentives together were preferred support strategies by respondents of successful programs and experiences (LGAs and Champions of Change). This empowered residents with both knowledge and some degree of material support (but not all), while still requiring some investment of care by the resident.

3.4.5 Barriers in undertaking native vegetation planting along verges

Interview respondents and LGA survey respondents alike identified very similar major barriers in native vegetation planting along verges. Using verges for parking (particularly in inner city or higher density areas) as well as lack of personal interest, and a preference for grass were the top ranked barriers, collectively, with over 50% of respondents rating these three as very important (Figures 17 and 18). The main differences between the stakeholder interview group and the LGA online survey respondents was that the broader stakeholder interview group rated LGA regulations and the lack of LGA incentives as more important/significant than the LGA respondents did.

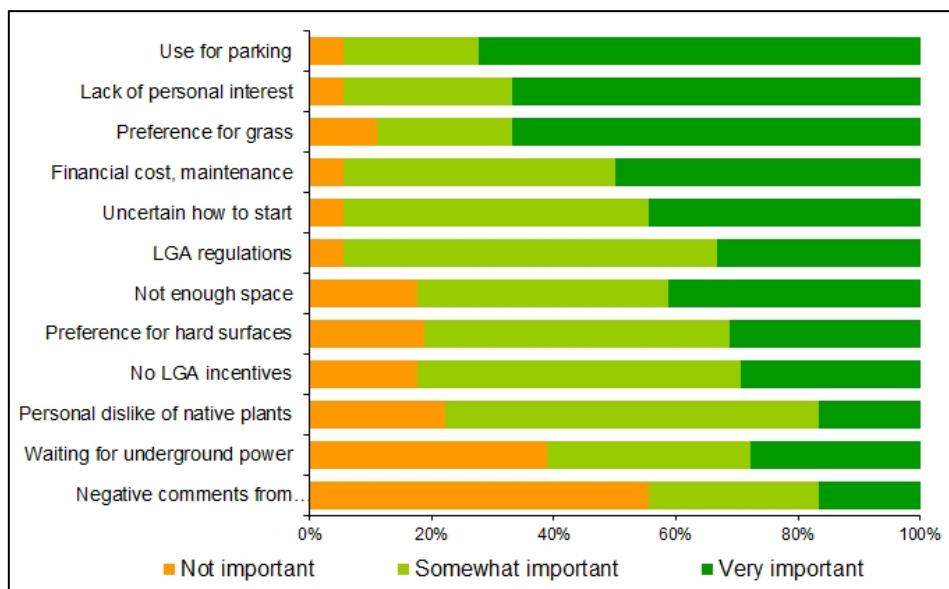


Figure 17: Stakeholder perceptions of barriers for residents to use native plants on verges
Results drawn from interviews with stakeholders across multiple categories; n=17.

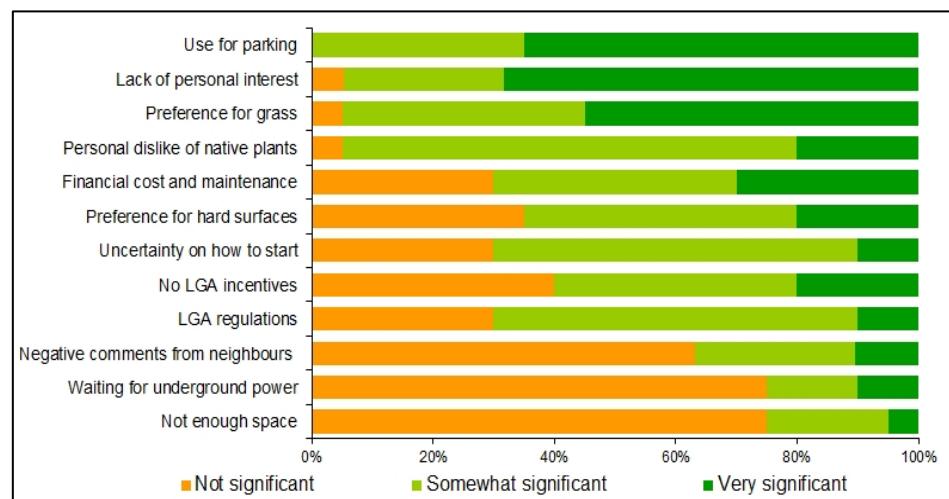


Figure 18: LGA perceptions of barriers for residents to use native plants on verges
Results drawn from an online questionnaire; n=20.

There were slightly different barriers for different aspects of native verge vegetation and management. For verge gardening, resident labour, cost, commitment, LGA policies, gardening knowledge, including for the effective removal of couch grass were identified as the main barriers. For example:

'Partly the cost, the labour and commitment. First of all couch grass is a very difficult weed to remove. It requires understanding, it requires herbicide, which a lot of people don't like using or don't know how to use responsibly. I think verge conversion is a complex task and there's little understanding of what's involved and people have been sold that it's easy. The cost is underestimated and the labour is under estimated, if you have to do it yourself. (Horticulture and Irrigation Industry)

And

'So, I find that most verge gardens are undertaken by people who love gardening or have that education about all the different attributes that are positive but for someone that may not know

what to do, it can be somewhat daunting. And then that limits the spread. As well as, cost and economic implications but then all these different things that come into it, what should I do, do I need to ask permission, how do I design it, how much water is it going to use? Do I need to put reticulation, all these other elements and then you get sight line and parking and why you see the most, it's a simple little space, it's this confluence of all these different areas.' (Champion of Change)

Several respondents noted LGA organisational structures unintentionally generated internal barriers. For example, a Peak Body respondent noted LGA engineering and urban forestry staff seeking different objectives in a development process:

'In a new subdivision, where the developer is quite keen to try and retain the trees where they can because they recognize it brings value, it's attractive to buyers. But, unfortunately the engineers will require levels to be certain heights. And of course then what you'll see may not be possible to retain a tree. We've had time and time again, situations where councils want tree surveys. They're well-intended because they're obviously trying to retain the trees, but then the engineering part of the council will want levels to be certain height to manage runoff and all the rest of it. Which then means you can't retain trees or there's not enough flow going to trees.'

For LGA street verge management programs more broadly, respondents to the online survey rated the significance of various factors acting as a barrier for implementing native vegetation planting programs along streetscapes. Lack of interest from residents, increased program administration costs and increased compliance monitoring were the most significant barriers (Figure 19). Increased risk of exposure (e.g. to litigation or insurance issues) was a significant barrier for just over 60% of respondents, while uncertainty on implementation was somewhat significant for ~40% of respondents. Lack of interest within the LGA rated as somewhat or very significant for only ~30% of respondents.

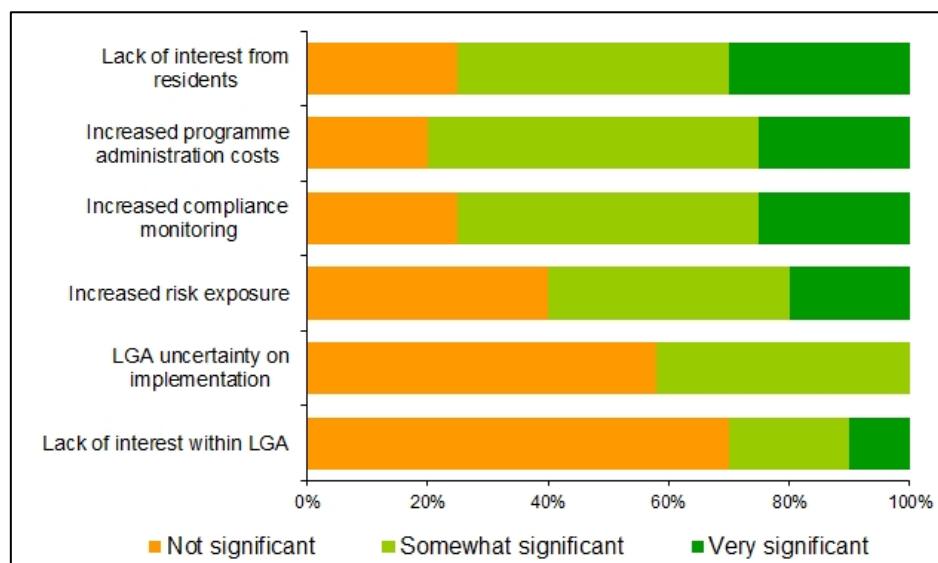


Figure 19: Significance of barriers within LGAs to planting native species on street verges
Results drawn from an online questionnaire; n=20.

3.4.5.1 Maintenance issues

Every respondent interviewed raised issues related to the maintenance of verges. Respondents described residents' understanding of the maintenance required for native vegetation gardens as frequently limited or misinformed. Instances of LGA maintenance practices, lack of knowledge or adequate resourcing, including high rates of staff turnover, to carry out necessary maintenance were found to limit sustainable innovation practices in developments (developers, environmental

consultants, horticulture and irrigation categories of respondents). This is significant given LGA have ultimate authority over street verge/verge management. The cost of maintenance is a significant barrier. For example:

'...traffic volumes do not allow you to do a lot of maintenance in the day if there is no emergency lane, so then it's very costly and you have to do traffic management. Sometimes the traffic management is double [the cost of] what you're actually doing. And the other thing is ...it's much harder to get recurrent funding for ongoing maintenance than it is to do a once-off job.' (State Government)

Respondents believed residents found 'saving time and maintenance' considerations to be a significant factor motivating residents to engage in native vegetation verge gardening (Figure 12 and 13). However many respondents also described the narrative of native gardens being 'no maintenance' or 'set and forget' as completely inaccurate. See for example, these comments from across related industries:

'And the other thing I really hate is people have been sold this thing that natives are easy. That they're 'set and forget'. All this hype they're given. They're not set and forget. The main thing is they have to be weeded. You can't put a tube stock in and then let the wild oats grow...[Some people] have no consciousness about a weed growing over the top of a tiny plant. They just think the plant's not tough enough and they've been told you don't have to water, don't have to prune, you can just forget about it and, anyway I do a lot of telling people you have to prune their plants. Tip pruning necessary if want them to look good. And you need to weed it. The seed bank in the soil- you've just got to be vigilant in the first two years, and then you'll never have to weed again, but if you don't do it for [the first] two years, you'll just have a weed patch.' (Horticulture and Irrigation)

'Low maintenance'. The words 'low maintenance' are easy to say but, you know, you're still going to have weeds in the season and so, there's still work to do. So you have to be a little bit garden orientated and a couple of times a year, don't mind pulling all the weeds out. Some people I guess can afford to pay people to do it, so if that's the case, that's fine but it's certainly, weed management is something that's a major issue with it. (Horticulture and Irrigation)

'There's no such thing as no maintenance gardens. That is a complete misnomer. Native plants, depending on what you want from them, they need a bit of pruning and a bit of TLC like anything else. As far as with the native trees, they need less inputs than the exotic trees...and a lot of it is preventative, if you put good arboriculture into the early stages of growing and establishing a tree, you sort of set yourself up for a much easier time in years to come.' (Environmental Consultant)

'If you think you're going to save on maintenance...that might not be right, but people will think that, no doubt...If you want a nice looking native garden...it's not a massive workload, but it's not nothing'. (Horticulture and Irrigation)

Failure to carry out some maintenance at critical times of the year (weeding in winter and spring for the first couple of years, watering over the first summer or two, tip pruning for good shape) directly impacts the success and longevity of the native plants installed.

Developers also raised issues with LGA maintenance, as did LGAs with developer protections of streetscape vegetation. For example, street trees are usually installed early in the development process, but were found to be at significant risk of being destroyed when builders and various contractors were constantly parking on verges.

'Often we hear councils will require landscaping to go in upfront. Developers would like to put that towards the end because you'll get trucks or whatever will go in, damage trees, damage the verges, and then obviously they've got to go back in and redo it. It would just be a little bit cleaner if all that happened at the end and probably get a better outcome.' (Peak Body)

There were examples of innovative landscaping approaches being scaled back, where the LGA has determined the maintenance process are too arduous or expensive. For example:

Once the lots are sold pretty much we're out of it and it's really handed over to the local authority to manage and that might be where some verge packages little bit ... need some maintenance ... It's a bit of an issue for us because often we will try to put in a water sensitive design, the best results are usually when you do have vegetative swales but then the local authority will go, "No, we're not going to manage that." Because if they can't drive a mower over it, they're not really interested. It's a bit of an ongoing issue and I think there are, yeah, there are other efforts being made to try and address that one.' (Developer)

At the end of the day it's local government, which will control the outcome. Even if developers have one intent, they'll [the LGA] be the one that ends up maintaining that. (Environmental Consultant)

In terms of streetscape, and you know, getting native veg into the streetscape, there's not a lot of support from local government for that sort of thing. Trees, certainly there is. But yeah, understorey stuff, it's, they don't want to maintain it and they don't have the resources to maintain it. So they're not interested. The developer's not gonna try and push the issue uphill for something that's gonna cost them money and potentially look pretty average as soon as they stop maintaining it. They've got their two years of maintenance and then they stop and the council rips it out or lets it go.' (Environmental Consultant)

An environmental consultancy for a strata development built the costs of maintaining their innovative verge design and vegetation into the strata management; '*And so there'll be a responsibility in perpetuity for the strata to maintain verges.'*

Respondents from Environmental Consultants, the Horticulture and Irrigation industry and Champions of Change all raised examples of LGA resourcing, lack of knowledge or difficulty in shifting adapting 'business as usual' methods with new evidence or policy, as barriers to successful implementation of healthy, functioning native vegetation along streetscapes/verges. For example:

'A lot of them, councils, because they contract out the maintenance on it, they live a very blinkered approach to maintenance as well, so the contractor will just go along and cut off anything, using his hedge trimmer, basically...[names example]...We did all the plants. It looked great. But then they [LGA] hand over to a contractor, but they are out there spraying glyphosate and they keep hitting the plants. The plants suffer. Longterm, they die. They get ripped out, and then I find the council blames that plant rather than the maintenance, or the contractor's bad techniques. So I think there's definitely an education thing there.' (Horticulture and Irrigation Industry)

Having multiple groups responsible for different aspects of verge management can also present barriers for adopting new or innovative practices within LGAs. For example:

'Even within LGAs- often different parts of the city have responsibility for maintaining verges. Some LGAs have specific branches or departments, others don't at all, and maintenance can sit apart from verge incentive programs, which may be in a 'sustainability' department. Often there's no single department in charge of it. There's no one entity that's in charge of it or wants to take charge of it, I suppose'.

3.4.5.2 Community feedback for LGAs

LGA respondents were asked to rank the frequency of complaints they received from their residents. The most frequent complaints fielded related to the maintenance or presence (ie requests to remove) of street trees (Figure 20). Complaints relating to the species of street tree (requests for a different species) and the maintenance of grassy verges followed in frequency. 'Safety hazards' complaints specifically related to perceived safety hazards of street verge gardens, of which respondents received more frequently than complaints about the perceived safety of grassy verges, though on a similar frequency to complaints regarding appearance, or meeting impermeable surfacing requirements.

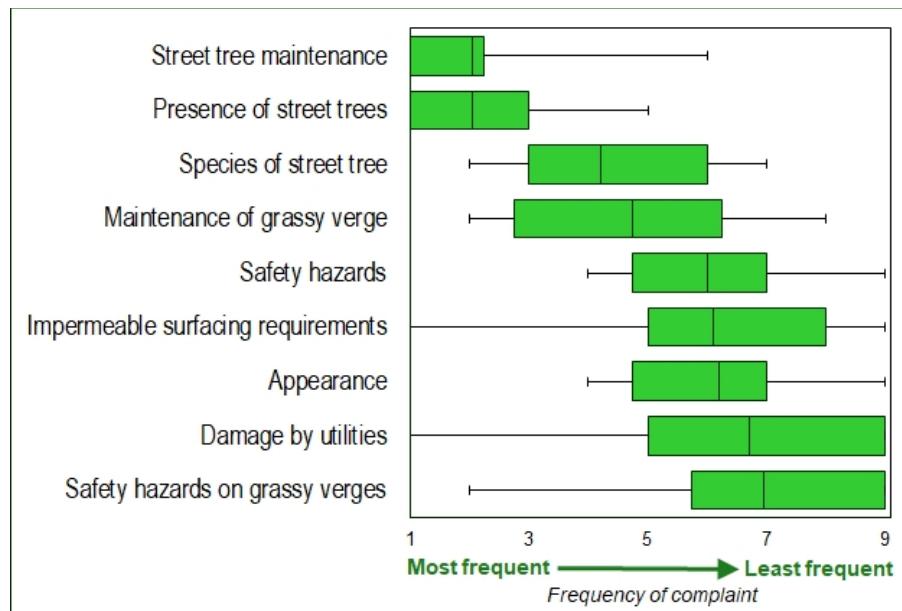


Figure 20: Relative frequency of complaints fielded by LGAs relating to street verges

Respondents ranked a list of complaints, where 1 is the issue most frequently complained about through to 9, the least frequently raised. Box plots show the range (error bars), upper and lower quartile (green box) and mean rank (midline) for each complaint.

Key findings:

- The use of verges for car parking, a lack of personal interest in verge conversion, and a preference for grass were identified as the most important barriers for engaging with native verge gardening (over 50% of respondents rating these as very important). Negative comments from neighbours and waiting for underground power were rated the barriers of least importance.
- LGA respondents (LGA online survey) rated the presence of a verge policy and verge gardening incentives as less important than the broader stakeholder respondent group did.
- Maintenance of verge vegetation emerged as a significant theme relating to barriers: i) Residents were frequently encouraged by ‘no/low maintenance’ idea of native vegetation, however, most respondents argued this was a misnomer (only low maintenance once well established). ii) Multiple respondents (across several stakeholder categories) felt LGA maintenance practices and resourcing constraints limited uptake of ecologically beneficial streetscape vegetation designs. iii) LGAs (among other respondents) noted factors of resource constraints, entrenched practices, unskilled staff/limited knowledge, high staff turnover and organisational structure influenced their streetscape vegetation maintenance practices.
- The most frequent verge related complaints LGAs received from residents related to street trees (requests to maintain, remove, change species) (LGA online survey).

3.4.6 Perceived risks associated with native verge greening

Maintaining the physical safety of the community was the primary risk raised across all respondents. This ranged from the emphasis on maintaining sight lines, safe verge surfaces, safe setbacks (so vegetation didn’t spill out onto the road or in front of signage) and sufficient maintenance for safety e.g. to reduce fire risk in some regions. Despite this some respondents felt there was a tendency for LGAs to be heavily risk adverse, with what some described as ‘fear-driven’ policy, a fear of litigation:

'The perception of insurance risk...they're just very risk averse...Trip hazard, limb falling, slipping on gravel...everything!' (Environmental Consultant)

Where the risk of tree/branch fall was raised it was countered by the acknowledgement of the arboriculture profession able to provide this safety advice. Community safety more broadly was generally acknowledged by all, however, as an important aspect of design. For example one Environmental Consultant described how 'Crime Prevention Through Environmental Design' was a principle guiding their design work to ensure community safety in public open spaces, including verges. To counter this however they also noted the benefits of increasing activation (e.g. people walking past) of a place in preventing crime.

Utility issues were raised in a variety of ways. For verge gardeners the risk of verge garden loss to utility activities remains, while a low risk, a simple fact to remember and may deter some from the gardening effort:

'Your beautiful native garden may just be dug up and there's nothing you can do about it. You need to be aware of that, because that's just the fact of it. So, you know, try and not to spend not too much money on developing it would be a good suggestion.' (Horticulture and Irrigation Industry)

An Environmental Consultant installing verges described the presence of high-pressure mains as the biggest risk, requiring not only checking with 'Dial Before You Dig' service but also seeking ATCO's permission. For Utility Providers and State and Local governments maintaining roadside vegetation, safe access to do so was their biggest risk. For example: '*You've got to maintain it. Someone has to pull off the road...you have to build that into your design,*' (State Government).

Potential fire risk of additional corridors of native vegetation was identified across several stakeholder categories. A Utility respondent (electricity provider) identified their constant consideration of pole-top fire risk, but they had pragmatic management of keeping the bases clear of vegetation to prevent sparks taking off. A Peak Body respondent felt fire was a high risk, *'if a development is adjacent to an area that is considered bushfire prone, and then any vegetation that is attached to that, would potentially then introduce a finger of bushfire-prone vegetation into the subdivision'*. Another Peak Body respondent referenced DFESWA's recommendation of short green turf as fire mitigating in fire-prone areas. A respondent from Horticulture and Irrigation mentioned low water use verges as favourable but only to the extent of not creating fire hazards where by:

'if we linked them all together, and they've all got dry mulch on them and vegetation, we get a screaming easterly wind and one catches on fire, that would be a big concern.'

Fire hazard was not raised as a concern by Environmental Consultants or most Champions of Change.

Other risks raised included inappropriate plantings, such as spiky, cutting or poisonous plants harming pedestrians, potential contaminant risks for food grown on verges, plant theft from verges, and climate risk and pest or disease attack (see resilient species selection (3.4.3)). Finally, converting verges without sufficient education was felt to be the biggest risk for one Environmental Consultant, effectively setting people up to fail and resulting in a poor looking and performing verge garden.

Key findings:

- Stakeholders identified several potential risks associated with installing native plants along verges. These included the need to consider: community safety, the potential facilitation of fire risk, the loss off plants to utility works or plant theft, safe access strategies for the organisations maintaining roadside vegetation, appropriate species selection (for safety, for climate, pest and disease resilience).

3.5 Changing trends in verge greening

Stakeholders were asked if they had observed any increase in the value of verges, any trends for particular verge treatments (surfaces) or species preferences, changes in attitudes to verge gardening or particular changes within their own industry as it related to verges. For those that felt verges had increased in value, most suggested this was driven by the increasing pressure placed on urban greenspaces, the knowledge of the urban heat effects, the need for water efficiency and for encouraging biodiversity. These respondents also commonly reported the growth in value wasn't universal, for example particular demographics or individuals will always have more time or interest in maintaining their verge. For example:

'Yeah, I think in some areas [value of the verge has increased], and I think more so with people who own their properties. When you've got high density and it's rental accommodation, there's probably not the same thought about the value of it. But if you've got kids and you're bringing your kids up and all that sort of thing, very much so.' (Horticulture & Irrigation Industry)

'It actually is starting to grow in importance now as we are starting to understand, and are coming to experience, particularly the urban heat island effects. You know, that's an absolute game-changer.' (Champion of Change)

I think for some people they never change, but I think maybe it's becoming more discussed... something that's more topical, and I think yes, the circumstances that are probably driving us to smaller spaces are now... and smaller living, has maybe lifted the profile of them. And the value of them are starting to come back into vogue, if that's a word, because people are living in more high dense spaces, the remnant bushland is getting pushed further away, their parklands potentially not as engaging as they could be.' (Champion of Change)

'There certainly has been a greater awareness of water conservation. And also, people wanting to encourage more local bird species and animals, reptiles, insects etc to live in their garden so certainly, people are more conscientious about that. Over the period that I've been in the industry, since 2004, back then there was no policy about verge gardens. You know what I mean? There was no encouragement, no influence. Or if there was, it was very small. And so, I guess, over the time... it's definitely been growing.' (Environmental Consultant)

'Some communities are supportive. I think others a little bit less so. We're still hearing people... They like street trees, but they don't necessarily want a street tree on their verge, they want the neighbours to have it, they don't like... Perhaps it blocks their views or they don't like the leaves if it drops. All those kind of things. I think it is changing. I think some of the messages around about how much value it adds to your property haven't really been well communicated....I think it's changed, but it's only changing in trees, looking at canopy coverage. I don't think there's been much more beyond that.' (Peak Body)

In terms of any increasing trend observed in verge gardening generally, there was a range of mostly affirmative responses:

'Now, I'm getting clients who I would not have envisaged before, you know, high end professionals [who] generally want ... low maintenance... And suddenly they're putting this waterwise garden in out the front ... But I guess they've kind of seen the light and understood the benefits...And not only the benefits from an environmental perspective but from an aesthetic one as well. I mean, one way I kind of push the idea is that it's like an extension of your liveable space. It's land that's in front of your house that you didn't have to pay for that you can kind of make use of.' (Environmental Consultant)

Another consultant felt residents were more emboldened to garden on their verges.

'I think they're [residents] not as... I'll call it fearful of being told off by the government. That has reduced. I think people are, "I can do more with my verge now than I think I've ever been able to do.'" (Environmental Consultant)

An LGA respondent suggested post-COVID also, that some residents are likely to be more mindful of gardening 'across the board' because of the time at home. A surge in nursery sales was also reported, anecdotally, by another respondent.

Another trend made clear in relation to any changes in client requests was the increasing uptake of artificial turf as a verge treatment:

'...The one that's changed ... is that more and more people want to do artificial turf. Which is not something that we currently provide for. But we do get more and more requests for that.' (Developer)

'It's forefront. So it's a conversation daily. It's getting more and more, probably in the last four or five years? And every year more and more. Even to the point, if you start driving around subdivisions and looking at the difference in what they're doing, you'll be quite surprised in the switch over.' (Horticulture and Irrigation Industry)

All respondents noting the growing demand expressed concern about it, and the need for regulation:

'We've now outlawed paving the [whole] verge, you can only have 30% hard surface and that includes Astroturf. Astroturf is an issue that needs to be addressed majorly because it's also made out of plastic that breaks down and feeds our fish with plastic. I'm not even sure why Astroturf is legal... I've always been aware of the dangers of plastic in our oceans but I never thought of Astroturf as plastic and that is causing a problem. Before, a lot of people don't know, but the Astroturf, you've got to compact the ground so very hard so it runs off, it doesn't infiltrate the ground. That's always been my issue with Astroturf and paving but now it's the plastic which is a chronic issue.' (LGA)

'I really evaluate that [garden species and surfacing] when I get my water bills... So, people... are obviously looking at alternatives. They still want something green at the front, which is been demonstrated, I think, by the [artificial] turf industry. But now people are onto plastics sustainability, micro-plastics. We're like, "Do you know that's going to take [hundreds of years] to break down into micro-plastics?"' (Horticulture and Irrigation Industry)

Of course, there are direct implications for both the turf and irrigation industry on this shift:

'The turf industry is quite suffering because of these changes and the turf industry is reacting and the turf industry is trying to get more awareness.' (Horticulture and Irrigation Industry)

One respondent felt the shift arose 5-7 years ago, after initially being endorsed in the State's water efficiency push. Decreased verge size and the increase in demand for synthetic turf were seen as competing with turf, with native gardens having proportionally less impact. Respondents also raised negatives of having to replace the whole verge if a patch needed fixing, problems with drainage as water can't infiltrate, parking irreparably damages it and the surfacing contributes to heating of the suburbs.

Similar concerns were noted across diverse stakeholder categories, for example:

'It's horrendous. Oh, I mean, I understand why people do it, it gives them a green look and they don't have to maintain it, for a start. But you know, it's not a nice product, it's gonna wear out, it's gonna get weeds. You know, we get such dust accumulation here. So therefore, you're gonna have to spray it or pull the weeds out, depends what you put under it, because to keep it level, it may not drain very well. Then you have any sloped, then you're gonna have run-off issues... I'd rather just

see it as not considered. I did an investigation many years ago... and we did a look into the cost comparison and natural turf and synthetics. And there was report put out by the Victorian bowling green keepers association, which showed that at times, it is nearly 20 degrees hotter on a synthetic surface so that just... you know, we're sort of mitigating all the good we're doing by making the place green, by reducing the heat, [then just contributing to] getting the heat island effect.' (Horticulture and Irrigation Industry)

'It's scary and it's scary in road verges as well. And that's because it's helping them to increase the urban heat island effect. In small areas, it's a goer but for large areas, a verge and if you just go one street over here, there's four or five verges in a row all plastic and that really pulls in the heat...I'm [an advocate for] a blanket ban...[And regarding utilities digging up the verge] If you've got artificial lawn you're stuffed because you cannot match it. So, you've basically got to do the whole thing again.' (Champion of Change)

The only stakeholder category with no respondents raising the artificial turf issue was Utilities.

In terms of any changes in community preferences or demand for native species, all respondents did not commonly recognize a perceived change. For example, within the horticulture and irrigation industry respondents had mixed opinions on this. One respondent hadn't noticed changing trends in demand for particular species/categories of species '*no, not really*', while an LGA respondent discussed their observations of increased ease of access to native species through the nursery industry:

'There's a link to the nursery industry as well, in that up until, I'd say about 5 years ago in WA, it was very difficult to get a lot of the range of native plants that were low-growing, really hardy, quite showy as well from a visual perspective, low maintenance, you pretty much had to shop around at a few different native nurseries or go to the plant subsidy scheme...there's a couple of plant suppliers that will supply these species now... and they're far more accessible... you can now go to [various places] and get a good range whereas previously I found you would be somewhat limited.' (Local Government Authority)

A Champion of Change felt there had been a definite increase in demand, though preferred maintaining people's options for choice:

'Well I think there definitely is a push for natives. While, what I was saying before is that, while I'm a great advocate for them, I don't think we should blind out, take away the other things that are out there because people don't like to be pushed into a particular garden, any particular garden style. They have a choice and choice is available, so I reckon that makes sense.' (Champion of Change)

Developers held mixed views, such that there hadn't been a noticeable increase in demand for native species in recent years:

'I think the native vegetation push has been around for some time, so I don't think it's really increased over the last five or six years, I think it's just, it's just trying to get that balance right between native and overseas species and the right trees. I think there's a role for both in the streetscape.' (Developer)

'I still see, I think, the predominant model is still to turf it. Particularly display homes, they always seem to go for the turf verge, even if they do something more interesting with the front landscape, for some reason that verge just has to be grass and maybe that's reflecting what people's purposes are so they can park on it or whatever.' (Developer)

Another horticulture respondent felt attitudes towards native species had generally improved among the younger generation:

'Absolutely, I think the younger generation has it nailed. I think our generation was hopeless and still too heavily influenced by English ideas.'

Other stakeholders had noticed trends in terms of their respective practices, relating to verge management. For example, an increase in LGAs engaging with their urban forest:

'They're [LGAs] getting up to speed with that. I can't see that doing anything other than growing...that's going to be become a continuum, more of a priority' (Environmental Consultant).

Utilities reported clearing trees and biosecurity risks (weeds and dieback), including on verge land, as their two biggest concerns having increased over the years:

'It's definitely coming up in a lot of our land access issues that we have with third parties and public land holders. Clearing of trees and then biosecurity risks, weed and dieback, are probably their two biggest concerns that have been increasing over the years....Through our assessments, it's acknowledged in individual projects, that in some essences the road verge has increased values. And as a result, the assessment reflects that, and the conditions of how we manage our works vary to reflect it.'

Two respondents drew on the Wildflower Capital Initiative as a demonstrated example of a shift in how people are valuing roadside vegetation. For example:

'I think [government agency] have come a long way...I can't believe the amount of money they're spending on trying to improve roadside environments for people to look at, basically as they're driving past them. Because it's such a major shift, I think in terms of, 'don't just grass everything and mow it'. There's a lot of time and effort and money and a lot of people doing a lot of work to try...to get better diversity, topsoil transfer, of maintaining the long term sustainability of all of these landscapes. There's obviously an aesthetic drive and there's also an ecological drive.... I think the Wildflower Capital Initiative's a great one because we are in a biodiversity hotspot and it's about time they're showing it off. So it's a great, great way for people to experience it'. (Environmental Consultant)

The Wildflower Capital Initiative project marked a significant internal shift in management attitudes towards roadside vegetation within the relevant state government agency, as a predominantly engineering focused department, as well noting signs reflecting growing value among the broader community and LGAs:

'Well, I think the very fact that [government agency] found a significant amount of money to fund wildflower initiatives says that there is a change in value. [It's] an engineering organisation, it's not an environmental organisation. Its function is engineering. So, you've got an engineering organisation, the leaders of this organisation are engineers and they're saying, this green stuff is important... And I think councils, just the fact that councils are reaching out or wanting to get more information, I've seen that shift from the first year to now.' (State Government)

Some respondents noted trends providing a challenge for their practice. For example one respondent commented on the increasing expense of seed collection due to loss of bush in the Perth metropolitan area:

'There are plants that are getting too horticulturally expensive as we've destroyed all the bush and seed collection is getting too difficult, it is becoming very expensive in the Perth metropolitan area.' (Horticulture and Irrigation Industry)

This could have implications for the supply of particular species, not just for residential gardens but for restoration work also.

Additionally, those involved with turf supply noted a decline in order size:

'So if the average size order used to be 100 m², now the average order is 40-50 m². Because the backyards are smaller, the front verges are smaller. Some councils don't even have verges, the properties are right up on the boundaries.' (Horticulture and Irrigation Industry)

In terms of growing recognition of other environmental values of verges, an environmental consultant felt there had been increased awareness in managing stormwater at the source in verges.

'On some projects we've got rain gardens in, on another project, we managed to get tree wells at street level so that they fill up with water when it rains and then overflow into the drainage systems so they're getting water that way... Some civil engineers are looking at infiltrating stormwater at that point rather than pumping it off somewhere else to try to infiltrate it at a collective sump or somewhere like that. So there's a recognition that we can do more in the streetscapes in terms of stormwater infiltration and things like that.'

Inquiry as to any engagement with Noongar Whadjuk stakeholders found most LGAs now referred to an Indigenous reconciliation or reference group for consultation regarding natural resource management issues, dual naming programs, or Aboriginal ranger programs. In terms of any change in uptake of local Indigenous knowledge relating to plants, an LGA respondent noted they were starting to recognize Indigenous plant names, while another felt it was still '*a very limited area in terms of recognising Indigenous plant names and Indigenous uses*'. From an edible gardens perspective, respondents reported gardeners increasingly interested in bush foods, however there were issues of scale (not much space, though the argument was made for a network of them). Some Champions of Change were encouraging greater recognition of the history of Indigenous agriculture also, through their work.

Key Findings:

- Stakeholders' perceptions differed regarding changes in attitude towards native verge gardening. Some respondents felt there had been no real change, whilst others reported some degree of increased uptake or value attached to native verge gardens.
- There were mixed responses in terms of an increased trend in demand or preference for native species for verge gardening (from little change to a definite increased demand). The importance of choice was reiterated by several stakeholders.
- Almost all respondents in all stakeholder categories raised the increasing appearance of artificial turf as problematic, highlighting environmental concerns (blocking infiltration, adding plastics to the environment, increasing heat) and competition.
- Several examples of changing values attributed to verges were noted. Noted trends included greater incorporation of storm water management practices (environmental consultants), the Wildflower Capital Initiative (State government and environmental consultants), increasingly technical surveillance equipment for urban canopy cover (environmental consultants), and an increase in managing verge related concerns (Utility, LGAs).
- Engagement with Noongar Whadjuk perspectives in urban planning and natural resource management broadly, at the LGA and State level is increasing through the establishment of Noongar Whadjuk reconciliation or reference groups, however LGA perspectives also noted there was plenty of scope for supporting the increasing community interest in Noongar Whadjuk biocultural plant knowledge (edibles and other uses).

3.6 An ‘ideal’ verge

Respondents were asked to describe their ‘ideal’ verge. Many respondents conceded that any single such verge is hard to describe as it is likely to be highly context dependent, for example reflective of the preferred purpose of the verge, or character, biogeography and climatic conditions of the area within the Perth Metropolitan region.

Only the utility stakeholders made no reference to verge vegetation. Utilities sought straightforward, fully documented verge assets to enable easy identifying and fixing of any faults. Utility corridors were seen as best located underground *‘to remove environmental factors and third party impacts’* with adequate access pits above ground. This aligned with several other stakeholder preferences for underground utility provision, to remove the need for tree canopy containment and interference. For example:

‘I would love for an opt-out street tree program, love for underground power and where every power pole was there to be a tree.’ (Local Government Authority)

All other respondents wanted, at a minimum, something *‘healthy and living’* for example:

‘Green. Just green. Green with a tree in the middle. You can park your car there or you can sit in the shade’ (Peak Body)

‘I would like to see half of it native plants and half of it turf, so people can park there if they need... There’s certainly a combination needed.’ (Horticulture and Irrigation Industry).

The need for choice and balance was emphasised by various respondents, for example:

‘It’s about trying to promote more effective landscapes, where it appropriate. Because there are some areas where it’s appropriate to have a lawn, especially if you live in the hills and the like, because it actually acts as a firebreak. So, it’s about fit for purpose, it’s about balance. And those options weigh in, you know, not only the environment you’re in but people’s lifestyles and their needs and wants as well. ... We’re not about bagging lawn or bagging plants or saying you must only plant natives. It’s about having a choice, still giving people the choice, it’s about promoting green and real, over fake and hot, essentially.’ (State Government)

The need for green overall, however, was raised in common recognition of either the human health benefits or aesthetic desirability for living amongst green spaces (as opposed to browned-off turf or weeds frequently characterising Perth’s urban verges in summer).

The majority of stakeholders provided further detail on their preferred composition and purposes of verge vegetation. Two stakeholders recognised likely need for different areas of foci - e.g. some areas may be activity hubs and require more off-street parking, so would be better suited to tree and turf, while other areas could have a concentrated biodiversity focus. Among the Champions of Change, two included having food resources to share (e.g. low maintenance citrus tree), all mentioned trees and covered with plants, including ground cover and shrubs. One also expressed the capacity or space for kids to play or interact among the space (e.g. a swing on a tree) and space to sit and read a book or talk. One environmental consultant respondent also included edibles in their ideal verge and essential canopy cover for shade:

‘An ideal verge would be wide, at least 30% edible, 30% shade cover/canopy cover on the same verge.’

Stakeholders engaged with urban planning and development raised various perspectives, including that an ideal verge meant walkability shaded with mature trees, or something *‘more biodiverse’* and

connected to public open space to provide '*a bit more of a corridor*', with all three tiers of vegetation: '*a mixture of canopy, ground cover and a bit of shrubbery in between*'. One respondent noted specifically the following all-encompassing goal:

'Let's get [the] public realm as a place for people, not just vehicles'

The desire for factors such as walkability, shade and an opportunity for people to engage in physical activity and socialise were also mentioned by several respondents.

Where respondents referred to specific vegetation, all emphasised they preferred multiple structural layers of vegetation (within lines of sight for safety). Several referred to the focus to date on urban street trees and the need to expand on this:

'A lot of urban forest strategies talk about trees and nothing else. I think it's about time they had shrubs.... An ideal one [verge] is something flowering all year round. In clumps of three. It's the only way you can get it. Then use creepers to infill, they're very fast to grow so they fill in the gaps while others starting to grow up. When you get canopy closure, the weeds become a non-event.' (Champion of Change)

'From an aesthetic, habitat and heat effect [point of view], it'd be nice to have a diverse understorey. And overstorey as well, as opposed to just one or the other, so that it fulfils a range of social and ecological functions.' (Environmental Consultant)

In terms of structural diversity, there was also an emphasis on vegetation that included bird attracting shrubs (mid-storey) and flowering native plants to reflect our local seasonality, as well as the use of ground covers. For example, one respondent from the Environmental Consultant category provided this visualisation:

'It would have a beautiful tree. It would be like, even like a Banksia grandis. It would have a tree that is a stand-out to say, I am home. It would have an understorey [plants of] 1.5 m and they are the habitat of where the bird goes, it's like, I am the protector of the bird, ok? [The next level of plants] which are 1 m, they're just that seasonal colour. It's not everywhere, but if we look at the six [Noongar] seasons, there are these six beautiful, magnificent displays of colour that you will see at one time throughout the six seasons. And then [you have the next level of plants] 50 cm and ...30 cm, where you've got like your dome shapes or your flat shapes or your mound shapes or your vase shapes or your erect shapes. And it's just got all these plants dancing under the tree of magnificence - the [bird protectors] and the seasonal colour that sits underneath that.'

A State Government agency also referred to the desire for flowering native verges as part of the Wildflower Capital Initiative, seeking to create '*clean and tidy*', '*safe*' and '*stunning [verges]*. Constantly evolving so we're picking up the six [Noongar] seasons rather than four [temperate northern hemisphere] seasons.'

Several stakeholder described the need for an ideal verge to be resilient. For some this meant climate resilience (adaptable to increasing average or extreme temperatures), and for others this meant in addition, resilience to the exposure associated with verges alongside roads (for example heat reflecting off the road, greater wind exposure) and the likelihood of being dug up.

Being '*self-sustaining*' and resilient was particularly important for larger arterial roads. For this State Government respondent, roadside vegetation was seen as ideally:

'surviving through climate change, because we're in a drying climate and for the verges of our roads this is even more exacerbated- reflected heat, wind.'... That's where our standards have changed, so that we're not doing narrow areas as well, because they are not sustainable.'

Some respondents from the horticulture industry had a preference for verges composed of native species, and some also referred to the need for careful species selection to minimise weed and fire risk issues:

'It'd be nice to have a nice strategy per street. So, if you're driving down one street, it looks similar. Interesting native gardens - aesthetically that'd be nice. Then along more arterial roads or corridors, more the native bush look to it. But I know there's a big weed management issue, and things like that. But maybe with the right selection of plants, that can be overcome as well a bit, too.' (Horticulture & Irrigation Industry)

'I'd like to see native gardens that don't require any fertiliser, that's my opinion....if you went down every block here and had half of it was native plants on one verge, I would think that's pretty neat. If it was maintained and looked after, but if it's just going to turn into a fire hazard, well ... you know, and that in itself is maybe down to the selection of the species.' (Horticulture and Irrigation Industry)

In terms of considering water usage, several LGA respondents 'waterwise verge gardens' or 'water sensitive design' in their ideal verges. Two environmental consultancies had emphasised water sensitive design elements in their previous work and emphasised better use of verges for stormwater management. For example:

'lots of native understorey and winter wet depressions - so topography is important'

'one that makes use of storm water, like rain garden infiltration..and to have people understand its function and treat it as such would be quite good.'

Key Findings:

- Respondents noted it was difficult to describe a single 'ideal verge' as they are highly context dependent - character, purpose (e.g. activity hub areas) and biogeography of the particular area within the Perth metropolitan region.
- Respondents emphasised the need for balance among different verge treatments, and the need for personal choice, from 'something green' (excluding artificial turf), a mix of turf and tree shade for the option of parking, to more complex descriptions of preferred vegetation cover.
- Stakeholders with detailed vegetation preferences desired structural complexity (canopy, mid-storey and understorey, with an emphasis on midstorey (shrub layer) for bird habitat and understorey to suppress weeds and create floral beauty through the six Noongar Whadjuk seasons).
- Stakeholders across several categories expressed the need for ideal verges to be highly resilient (to climate change, to hostile road environments, and to plants being dug up and transplanted).
- 'Walkability' featured for some stakeholders, requiring the shade of mature trees, greater use of green corridors and enhanced biodiversity.

3.7 Future preferences

Stakeholders were asked to describe any policy or management improvements that would assist their work or their hopes for the future regarding the verge space.

3.7.1 LGA policies and management

Regarding LGA policies, several respondents expressed preference for a unifying verge and street tree policies across all LGAs:

'Across the board, I think it would be really good if councils adopted the same policy. If there was an overarching policy. It'll never happen but if there was a wish list it would be great if there was an adopted uniform policy.' (Environmental Consultant)

'The key thing for our members is they want consistency. They want certainty and consistency. Often they'll say, "We don't really mind what the rules are. Just tell us upfront so we know and we can plan for that". What they don't like is if one council has a different requirement to another.' (Peak Body)

'The thing is that every council has its own regulations so that creates mass confusion when you move from one suburb to another, what's ok here and what's not ok. So, I suppose standardising that would be a good step. (Champion of Change)

Another respondent (Developer) however acknowledged the difficulty of a one-size-fits-all policy:

I mean some consistency across councils helps but, as I said before, each council is gonna have its own character as well. It's not something that's a really pressing issue for us.' (Developer)

Multiple respondents across stakeholder categories felt removal of restrictive verge policies would assist residents engage in verge gardening. In addition, a Champion of Change also expressed the value of manageable verge policy supporting verge 'adopters':

'Having a policy that's enabling and manageable and common sense and allows people to take some of this into their own hands but set some guidelines...It needs to be planned for in the first place that there is sufficient space for this to be a place of public amenity which can facilitate certain things. Maybe moving forward, then we design, "Okay, well these areas can't be for this, but we'll set aside some verges in the neighbourhood that can be adopted, whether it's adopted by the resident who is adjacent to it or some others."

That we maybe put up a program that says, "Okay, well if you adopt a verge, we'll set aside certain ones where we can put raised garden beds, a fruit tree and all the rest of it and we'll put up X amount of dollars to help you do that." Just having some enabling programs around that. (Champion of Change)

One LGA also established new rules for trees regarding property subdivision approvals, where, if a tree absolutely had to be removed, compensation to the LGA of the tree's amenity value is required. This same LGA also reported extended their heritage tree registry to private land also (residents can voluntarily register a significant tree on their property).

One non-LGA respondent felt the incentive of providing free or discounted plants should be stopped:

'Stop selling/providing discounted/free plants. Be absolutely responsible for demonstration areas, garden areas, demonstrating what gardens can look like. Be the inspiration, stop being the provider. And be accountable for being that inspiration. Stop taking the easy road and start bringing in the colour but it's like, get the [real] advice. Come to the people who have got the experience and knowledge of the plant...LGA's are missing the opportunity to absolutely be the leaders in this space.'

One LGA respondent expressed hope for a policy using majority native plants in the LGAs public spaces, particularly to support their work in reducing fertiliser nutrient run-off:

'I tried to get that up and going, so that the majority of plants used in our parks and our verges and roundabouts are native. Could not get that through. So...just trying to get a native plant policy through would be ideal.'

Several respondents all noted the need for LGAs to have greater resources available for improving maintenance of streetscapes. For example when asked of the single most important change to improve the values of urban verges and streetscapes, this Environmental Consultant replied:

'I think if the local government's going to get behind it, they need more maintenance budget. They just don't have the budget, the resources. And promotion to the community as well. Like, [strong messaging regarding] education about the benefits.'

In addition, multiple respondents expressed the need now that canopy cover is well known, for an increased focus on the mid and understorey vegetation, now the canopy cover has received significant attention.

'So we've got the trees, which is great, we've got the median strips, say down [name of street] with the trees in there but really, we should be trying to get some bushes sort of happening down there as well...So that's not happened... That's the big next thing. The understorey ... that's really important for me, from a wildlife point of view.' (Champion of Change)

3.7.2 Other issues

A variety of suggestions were provided by respondents in the Peak Body stakeholder category regarding policy changes. One peak body suggested planning policy changes, in terms of designating a percentage footprint of natural green space would be valuable, and another suggested certification of industry professionals to improve outcomes. A respondent noted that the trend of outsourcing and contracting utility and developer/builder work crews over the years has increased damage to verges and thus the requirement for these contractors to have written permission from LGAs to operate is essential, to enable LGAs to intervene and manage requirements to properly protect or reinstate the verge. Respondents across Peak Bodies and Utilities noted potential future trends in co-locating infrastructure assets where safe, and leaving sufficient space for street trees. Without a strong government policy, there was less momentum for driving this trend.

An environmental consultant noted concerns with widening footpaths, where it compromised the ability of the verge to support trees. No shade renders it too hot and effectively defeats its purpose-people being far less likely to use it in full sun.

A Champion of Change felt community awareness was critical for the future:

'Community awareness I think. We're seeing a lot of suburbs which really struggle to get residents to say "Yes I want a street tree, I want a verge tree" ... they actually say "No I don't want a street tree because it drops leaves". The perception of too much maintenance... And a lot of people want their street tree removed, and whilst it doesn't happen, there's aggression comes from that as well.'

All respondents who noted an increase in the installation of artificial turf expressed concern for the multiple negative environmental impacts (plastic breakdown and contaminating the water/soil environments, contributing to urban heat island effect, lack water infiltration) and preferred it wasn't allowed as an option for verge surfaces (universal LGA ban as an acceptable verge treatment).

Key Findings:

- Unifying LGA verge policies would be useful for some stakeholders
- Some stakeholders felt requirements such as submitting a verge garden plan for approval were overly restrictive. In addition, these respondents felt further support for 'adopt a verge' programs would be valuable.

- Some LGAs are innovating in terms of policies relating to registering significant trees on both private and public land, and obtaining amenity value compensation for street tree loss through unavoidable development or utility actions.
- Respondents expressed the need for increased attention on mid-understorey and groundcover species in terms of contribution to urban forests, in addition to trees.

4 Conclusions, recommendations and further research

4.1 Key findings and recommendations

This report examined stakeholder values regarding the various functions and ecosystem services that street verges can potentially provide, through a case study of stakeholders from across the Perth Metropolitan Region in Western Australia. The primary motivation behind the research was to examine stakeholders' perceptions of the currently small, but growing, trend towards installing native gardens and native plants along roads, particularly adjacent to residential properties. Although gardening along the street verge remains uncommon, there was a remarkably diverse group of individuals and organisations engaged within this issue throughout the Perth metropolitan region.

This research sought to better understand how diverse stakeholder groups value and interact in their engagement with urban street verges, through in-depth interviews with 30 respondents representing stakeholder categories of utilities, local government authorities, state government departments, champions of change, peak bodies, environmental and planning consultants, developers and representatives from the horticulture and irrigation industry. This research also conducted a timely review of the Perth Metropolitan local government authority online verge policies and gained the perspectives of 20 of these LGAs on their verge management practices through an online survey. Detailed key findings are summarised at the conclusion of each results section, but the critical points are synthesised here.

4.1.1 Policy and governance of verges

With rapidly growing interest from residents and LGAs alike, it is now common across the 31 Perth metropolitan LGAs to provide a verge treatment (surface cover) or verge garden policy. Additionally, 20 LGAs have Urban Forest Strategies, most of which have been developed recently. The diversity of these policies, and their implementation was a challenge for some stakeholders operating across the Perth region. Nursery respondents noted the plant height restrictions in LGA verge policies had influenced their choice (and form) of species and their growing and supplying practices.

Changes in the Perth planning landscape to encourage higher density development has driven the loss of backyard greenery and canopy cover in the private realm and increased the expectation of verges to provide green space, while both new developments and suburban in-fill have concurrently reduced the available verge area to support trees in particular, along with the necessary utilities.

Individuals were found to be very influential as 'Champions of Change' in generating policy change at State and Local government levels, particularly in encouraging organisational behaviour change. The viewpoints of local government elected members were also identified as central in determining verge policies and the political will to support their enforcement.

In terms of the verge being a site of contestation, the spectrum to which LGAs carried out enforcement of their policies ranged from rigorously doing so, to lack of enforcement, where will or resourcing capacity to do so was limited. Other contentious issues frequently discussed by respondents included the need and scale of compensation for street tree loss and damage between local and state government departments or these and utilities or developers. Finally, the spectrum of preference of verge vegetation and composition, from a simple 'green and living' including irrigated lawn, through to entirely local provenance native species and multiple structural layers, could at times prove contentious given strongly held personal views and implicated livelihoods. A respondent emphasised the need for continual listening and learning from one another amongst all green space advocates to address these points of divergence.

4.1.2 Verge stakeholder networks

Given the diverse stakeholder interests in verge specifications and management preliminary social network mapping analysis found this was reflected in diverse networks. Networks commonly comprised all levels of government, including multiple state and local government authorities, multiple allied industries and their peak/representative bodies, a variety of consultants spanning design, development, landscaping and environmental planning, not-for-profit community and advocacy groups and individuals, research institutions, multiple media platforms and media gardening personalities.

There were examples of strong and effective partnerships identified across stakeholder groups generating new or best practices in urban greening/development or verge policies. Information sharing pathways were identified as important for all stakeholders, though they engaged in diverse means of information sharing, depending on their role and the nature of their organisation.

4.1.3 Stakeholders' valuing of verges

This report has highlighted the significant functional and ecosystem service values that stakeholders recognise urban verges support. In terms of general verge functions, space for street trees, pedestrian access and visual amenity were the three most important functions respondents identified. Car parking, although rated toward the bottom of the scale of important functions provided by verges, was still important to some degree for 82% of respondents, reflecting the highly car-dependent nature of Perth's urban sprawl. LGAs are increasingly applying amenity values to street trees, and retention conditions in development approval processes, in recognition of the ecosystem services they provide to the whole community.

All stakeholders felt verges with predominantly native vegetation had the potential to provide ecosystem services, with some respondents noting the capacity of lawn to provide certain services. Respondents noted the most important ecosystem services as urban temperature regulation, urban storm water management (regulating services), aesthetics and recreation and mobility (social-cultural services) and rainwater infiltration and plant diversity (supporting services). The least important ecosystem service of those rated, was felt to be the provision of food for people. Other notable services recognised were water quality management (regulating), soil formation and biodiversity, animal diversity (supporting), a sense of place, wonder and well-being, fostering a sense of community, financial value, and space for culturally valued garden species (all social-cultural services).

Different stakeholders did place more importance on different ecosystem services. For example Champions of Change and Peak Bodies valued almost all ecosystem services at a moderately to extremely important degree. Utility providers, followed by Developer respondents place the least importance on most ecosystem services, with the exception of temperature regulation and stormwater management. Developer respondents also considered aesthetics, improving property value and mobility (walkable neighbourhoods) as extremely important ecosystem services.

Verge connectivity within and between adjacent verges was noted as significant influencer of its potential to provide ecosystem services, and this occurs at a variety of scales and is species specific. Connectivity between a single verge and residential garden can assist with supporting small fauna species and driveway design and footpath location were reported as likely influencers of residents' engagement with verges. At the street or broader scale, green corridors potentially generated by native verge gardens and canopy cover were described as essential for supporting walkable, liveable neighbourhoods as well as providing conduits for animal movement and other ecological processes. Overall, there was widespread desire among respondents for more aesthetically interesting, locally-representative native verge gardens to enhance a local sense of place and well-being among suburban streetscapes and major transit areas.

4.1.4 Stakeholders' views on verge transformation with native plants

Stakeholder's understandings of the process of transforming an urban verge through native plant gardening in terms of inspiration and major motivators or enabling factors, as well as constraints were elicited. Major motivating factors were identified as reducing water use, attracting wildlife, generating aesthetically pleasing streetscapes, incentives from LGAs, saving time on reduced maintenance.

In terms of major sources of inspiration Champions of Change and Environmental Consultants who were themselves engaged or experienced in this process identified demonstration gardens and activities as critical sources of inspiration, often with wide community reach, less so than LGA respondents (online survey). Some respondents from these stakeholder categories were personally inspired through an enjoyment of gardening, a lack of their own verge space (hence adopting a public space), being fed up with unappealing streetscapes (neglected verges), and wanting to bring joy, colour and evidence of care, to their neighbourhood streetscapes. These stakeholders, as well as LGA respondents (early and emerging LGA adopters) had observed the clustering, contagion effect of neighbourly influence inspiring multiple verge conversions in one street.

The resources believed to be required to convert verges with native gardens varied among stakeholders with a consultant or nursery respondent usually specifying greater cost and effort than a champion of change. Factors affecting resource availability and installation included available space, environmental characteristics and material supplies (reliable and quality supply chain for soil, plants) There were industry specific issues also, particularly for the native plant nursery in securing quality soil, seed, reliability in propagation processes. LGAs reported the Water Corporation's waterwise verges partnership program provided essential financial resourcing to support the verge gardening programs they could offer their residents, though often demand still outstripped their capacity. A majority of LGAs surveyed also envisaged demand from residents to grow.

Factors influencing species selection (trees) were fitting with the built environment and species hardiness (survivorship) as very important for more than 80% of respondents, as well as being wildlife friendly. Fitting with the urban forest strategy was most important for the LGA survey respondents. Arborist respondent highlighted the need for understanding the local growing environment which could be highly modified, and that to maximise tree survivorship it was important to think in a long-term tree-centric manner. For understorey species the most important factors guiding selection were the same as for trees, apart from LGA survey respondents who emphasised safety and community preferences as more important and being wildlife friendly less so. Understorey species were also where respondent described the capacity of verge gardens to reflect the Noongar Whadjuk six seasons. Species had to be tough and low maintenance and a 'safe' form for roadside gardens (sightlines, sprawl etc). Respondents described how landscape consultants often prioritise colour and form (design elements) over biodiversity values. Respondents also noted the Western Australian nursery industry was in transition, with the availability of many more local and beautiful species, but also precariously positioned facing competition with eastern states suppliers.

The major enabling factors were: incentives offered by LGAs; educational opportunities; and practical, evidence-based advice information provision - lack of knowledge were critical factors limiting uptake cited by many respondents across almost all stakeholder categories. Workshops were described as very effective. Respondents across multiple stakeholder groups believed LGAs were best placed to deliver this information and education and as key influencers of residents' engagement with the verge, could often play a greater role in positive messaging regarding the benefits verge vegetation (including street trees). Of the 20 LGAs surveyed, 11 for example, offered verge garden rebates in 2019, with most supporting 100 or fewer households, ranging to another supporting more than 1000 households.

Stakeholder views on the constraining factors for residents engaging with verge gardening included the use of verges for car parks, lack of personal interest, and a preference for grass. Interestingly LGA respondents rated the importance of LGA policies and incentives as less important than the collective of stakeholders overall. Barriers for residents were also suggested to be incorrect idea of the maintenance effort involved in a native verge garden. For LGAs barriers for implementing native streetscape management included limited resources, entrenched practices, high staff turnover and verge related responsibilities being diffused across an LGA organisational structure. Potential risks were also identified, including maintenance for community safety, safe access for those providing vegetation maintenance along busy roadsides, fire, weed and plant disease spread. Education around species choice and safe maintenance practices is critical to assist in managing these risks.

Stakeholders observed trends in relation to urban greening of the verge space. An influential finding among the surveyed LGAs, was that a majority, felt residents' interest in native verge gardening would increase in the future. While LGAs reported a growing interest in verge gardening the perception of growing interest was more mixed among stakeholders. Additionally, almost all stakeholders noted the increase in artificial turf as a verge treatment which they universally took issue with for environmental concerns (shedding plastic to the environment, preventing rainwater infiltration, limiting soil health, adding to the heat effects of the built environment) or in combination with livelihood interests. Other trends included greater incorporation of stormwater management practices, of a growing emphasis on using WA native species along streetscapes.

Stakeholders recognised no single ideal verge, but that they are highly context dependent, and reflect the character and biogeography of particular area. Vegetation preference ranged from 'something green and living', a mix of lawn and a tree to retain the option of parking, to more complex vegetation descriptions, including the preference to reflect local six seasons flora, provide bird habitat and sufficiently suppress weeds. Ideal verges importantly had to be highly resilient to climate change, hostile road environments and being dug up.

4.2 Further Research

Limited research has been undertaken to date on stakeholder perspectives relating to the urban verge, or verge. This research process has highlighted some key areas of further research that emerged during the research process as well as the contribution from some respondents also proposed ideas of future research interest of value to their work/industry.

4.2.1 Design, species selection and maintenance

- Further exploration through quantitative and qualitative approaches using case studies to understand how verge design can influence social and ecological connectivity values and processes.
- Further exploration through demonstration sites for adapting a form of 'rewilding' in street verge management and maintenance e.g. instead of dead weeds or mowed turf or herbicide treated woodchip surfacing, verge management practices are altered to support self-perpetuating communities of local species that require low inputs.
- Impacts of species selection on local water balance and supporting faunal diversity (both invertebrate and vertebrate).
- Risk assessment for species selection in designing 'green corridors' to present risks relating to hybridisation with local native species or becoming an invasive weed or facilitating weed movement to urban bushlands.

4.2.2 Information sharing

- Identifying means of enhancing collaboration between key stakeholders to support *early and ongoing* interaction. This is relevant for collaborations between urban environment and planning consultants, arborists, utilities and developers, throughout design and approvals processes with state and local governments, to facilitate more sustainable environmental outcomes.
- Further research into the means of effective information and resource sharing among stakeholders

4.2.3 Quantitatively assessing change in ecosystem service provision

- Development and application of metrics to assess change in various social and ecological ecosystem service provisions in before/after case study of a converted street.
- Research into the health and well-being benefits people may derive from ‘re-wildling’ (incorporating native vegetation and ecological processes) public open space, including verges. (Environmental consultant)
- Research into the potential of verge public space to support the native plant species known to be part of TECs or, threatened species, or may support threatened fauna species.
- Quantitative measures of ecological outcomes (positive or negative) for fauna and flora biodiversity through case study pre/post installation of significant native verge corridors connecting bush reserves

4.2.4 Financial evaluation of the provision of ecosystem services

- Further quantification of full ecosystem service economic value over a multi-layered native vegetation lifecycle, to encourage greater economic recognition of WA native plants among the community and industry stakeholders.
- Economic assessment into the true costs of bringing new native plant species to market, of native plant propagation and of any potential impacts arising from the LGA native plant subsidy scheme for local native plant nurseries
- Economic modelling of the contribution of a native verge garden to house sale price would be of interest to several stakeholder groups and industries.

4.2.5 Understanding community preferences

- Research investigating preferred landscaping surface choice by residents purchasing in new developments
- Investigating public willingness to incorporate native species in their garden or verge. This may include measuring the impact of public demonstration events (workshops, demonstrations, garden show displays) through pre/post evaluation surveys.
- Further potential for cross-cultural work to enhance recognition of Indigenous cultural values, of culturally valued species, potential endemic bush food species suitable for understorey/groundcover in verges.
- Understand the drivers behind the growing uptake of artificial turf and the decisions made by LGAs to prohibit or limit its use on the verge.

4.3 Conclusions

This research has highlighted the surprisingly diverse and numerous stakeholders with interests in Perth Metropolitan’s urban street verges, an area of public land frequently overlooked. Stakeholders’ interests in urban street verges spanned access for utility maintenance, supporting the provision of urban canopy cover, interests in vegetation design, installation, maintenance and management, and as an element of urban design and planning for new and retrofitted developments. Stakeholders

recognised the potential of the verge for providing numerous supporting, regulating, cultural and provisioning ecosystem services, but primarily the regulating services of contributing to mitigating the urban heat island effect and stormwater management (and accompanying supporting service of rainwater infiltration) and the cultural services of contributing to aesthetically interesting and uplifting streetscape and our local sense of place. A majority of stakeholders' identified a trend of growing interest among planners, managers, consultants and residents for native greening of street verges, given these beneficial outcomes and the challenging context of adapting to climate change impacts and of retaining sufficient urban green space with an increasing urban population.

References

- Barnes, M. L., P. Wang, J. E. Cinner, N. A. J. Graham, A. M. Guerrero, L. Jasny, J. Lau, S. R. Sutcliffe & J. Zamborain-Mason (2020) Social determinants of adaptive and transformative responses to climate change. *Nature Climate Change*, 10, 823-828.
- Bates, B. C., P. Hope, B. Ryan, I. Smith & S. Charles (2008) Key findings from the Indian Ocean Climate Initiative and their impact on policy development in Australia. *Climatic Change*, 89, 339-354.
- Bodin, Ö. & C. Prell. 2011. Social Networks and Natural Resource Management: Uncovering the Social Fabric of Environmental Governance. Cambridge: Cambridge University Press.
- Bolleter, J. (2017) Living suburbs for Living Streams: how urban design strategies can enhance the amenity provided by Living Stream orientated Public Open Space. *Journal of Urban Design*, 23, 518-543.
- Brown, H., D. Katscherian, M. Carter & J. Spickett. 2013. Cool communities: Urban trees, climate and health. Report of a workshop at the Department of Planning, Perth. Perth, Australia: Curtin University.
- Brunner, J. & P. Cozens (2013) 'Where have all the trees gone?' Urban consolidation and the demise of urban vegetation: A case study from Western Australia. *Planning Practice and Research*, 28, 231-255.
- Bryan, B. A., C. M. Raymond, N. D. Crossman & D. H. Macdonald (2010) Targeting the management of ecosystem services based on social values: Where, what, and how? *Landscape and Urban Planning*, 97, 111-122.
- Clark, J. A. & R. M. May (2002) Taxonomic bias in conservation research. *Science*, 297, 191-192.
- Collard, L. & C. Bracknell (2012) Beeliar Boodjar: An introduction to Aboriginal history in the City of Cockburn, Western Australia. *Australian Aboriginal Studies*, 1, 86-91.
- Commander, P. (2003) Outline of the geology of the Perth Region. *Australian Geomechanics*, 38, 7-16.
- Davison, A. & J. Kirkpatrick (2014) Re-inventing the Urban Forest: The Rise of Arboriculture in Australia. *Urban Policy and Research*, 32, 145-162.
- Demographia. 2020. Demographia World Urban Areas (Built up urban areas or world agglomerations). 16th Annual Edition.
- Dickinson, D. C. & R. J. Hobbs (2017) Cultural ecosystem services: Characteristics, challenges and lessons for urban green space research. *Ecosystem Services*, 25, 179-194.
- Duncan, J. M. A., B. Boruff, A. Saunders, Q. Sun, J. Hurley & M. Amati (2019) Turning down the heat: An enhanced understanding of the relationship between urban vegetation and surface temperature at the city scale. *Sci Total Environ*, 656, 118-128.
- Elmqvist, T., M. Fragkias, J. Goodness, B. Güneralp, P. J. Marcotullio, R. I. McDonald, S. Parnell, M. Schewenius, M. Sendstad, K. C. Seto & C. Wilkinson. 2013. *Urbanization, Biodiversity and Ecosystem Services: Challenges and Opportunities*.
- Environmental Protection Authority. 2015. Interim Strategic Advice: Perth and Peel @3.5 million - Environmental impacts, risks and remedies. Perth.
- Ernstson, H. (2013) The social production of ecosystem services: A framework for studying environmental justice and ecological complexity in urbanized landscapes. *Landscape and Urban Planning*, 109, 7-17.
- Ernstson, H., S. Sörlin & T. Elmqvist (2008) Social movements and ecosystem services - the role of social network structure in protecting and managing urban green areas in Stockholm. *Ecology and Society*, 13, 39.
- Fazey, I., A. C. Evelyn, M. S. Reed, L. C. Stringer, J. Kruissen, P. C. L. White, A. Newsham, L. Jin, M. Cortazzi, J. Phillipson, K. Blackstock, N. Entwistle, W. Sheate, F. Armstrong, C. Blackmore, J. Fazey, J. Ingram, J. O. N. Gregson, P. Lowe, S. Morton & C. Trevitt (2012) Knowledge exchange: a review and research agenda for environmental management. *Environmental Conservation*, 40, 19-36.
- Fuller, R. A., Irvine. Katherine N, P. Devine-Wright, P. H. Warren & K. J. Gaston (2007) Psychological benefits of greenspace increase with biodiversity. *Biology Letters*, 3, 390–394.

- Garrard, G. E., N. S. G. Williams, L. Mata, J. Thomas & S. A. Bekessy (2017) Biodiversity Sensitive Urban Design. *Conservation Letters*, 11, 1-10.
- Gioia, P. & S. D. Hopper (2017) A new phytogeographic map for the Southwest Australian Floristic Region after an exceptional decade of collection and discovery. *Botanical Journal of the Linnean Society*, 184, 1-15.
- Gómez-Baggethun, E. & D. N. Barton (2013) Classifying and valuing ecosystem services for urban planning. *Ecological Economics*, 86, 235-245.
- Graham-Taylor, S. (2009) Reflections on the Swan River *Early Days: Journal of the Royal Western Australian Historical Society*, 13, 371-386.
- Guenat, S., A. J. Dougill & M. Dallimer (2020) Social network analysis reveals a lack of support for greenspace conservation. *Landscape and Urban Planning*, 204, 103928.
- Guerrero, A. M., M. Barnes, Ö. Bodin, I. Chadès, K. J. Davis, M. S. Iftekhar, C. Morgans & K. A. Wilson (2020) Key considerations and challenges in the application of social-network research for environmental decision making. *Conservation Biology*, 34, 733-742.
- Hall, T. (2010) Goodbye to the Backyard?—The Minimisation of Private Open Space in the Australian Outer-Suburban Estate. *Urban Policy and Research*, 28, 411-433.
- Hope, P., W. Drosdowsky & N. Nicholls (2006) Shifts in the synoptic systems influencing southwest Western Australia. *Climate Dynamics*, 26, 751-764.
- Hopper, S. D. & P. Gioia (2004) The Southwest Australian Floristic Region: conservation of a global hotspot of biodiversity. *Annual Review of Ecology, Evolution and Systematics*, 35, 623-650.
- Hubacek, K. & J. Kronenberg (2013) Synthesizing different perspectives on the value of urban ecosystem services. *Landscape and Urban Planning*, 109, 1-6.
- Hunter, M. C. R. & D. G. Brown (2012) Spatial contagion: Gardening along the street in residential neighbourhoods. *Landscape and Urban Planning*, 105, 407-416.
- Ignatieva, M., G. H. Stewart & C. Meurk (2011) Planning and design of ecological networks in urban areas. *Landscape and Ecological Engineering*, 7, 17-25.
- Jansson, A. (2013) Reaching for a sustainable, resilient urban future using the lens of ecosystem services. *Ecological Economics*, 86, 285-291.
- Josh Byrne and Associates. 2016. Waterwise Verge Best Practice Guidelines. Verge Policy Review and Recommendations. Report for the Water Corporation. Fremantle, WA.
- Kahn, P. H. & S. R. Kellert. 2002. Children and nature: Psychological, sociocultural, and evolutionary investigations. MIT Press.
- Kottek, M., J. Grieser, C. Beck, R. Bruno & R. Franz (2006) World map of the Köppen-Geiger climate classification updated. *Meteorologische Zeitschrift*, 15, 259-263.
- Lin, B. B., S. M. Philpott & S. Jha (2015) The future of urban agriculture and biodiversity-ecosystem services: Challenges and next steps. *Basic and Applied Ecology*, 16, 189-201.
- Livesley, S. J., G. M. McPherson & C. Calfapietra (2016) The Urban Forest and Ecosystem Services: Impacts on Urban Water, Heat, and Pollution Cycles at the Tree, Street, and City Scale. *J Environ Qual*, 45, 119-24.
- Luederitz, C., E. Brink, F. Gralla, V. Hermelingmeier, M. Meyer, L. Niven, L. Panzer, S. Partelow, A.-L. Rau, R. Sasaki, D. J. Abson, D. J. Lang, C. Wamsler & H. von Wehrden (2015) A review of urban ecosystem services: six key challenges for future research. *Ecosystem Services*, 14, 98-112.
- Millennium Assessment 2005. Millennium Ecosystem Assessment. Ecosystems and Human Well-being: Synthesis. Washington, DC.
- Majer, J. D., H. F. Recher, B. E. Heterick & A. C. Postle (2001) The canopy, bark, soil and litter invertebrate fauna of the Darling Plateau and adjacent woodland near Perth, Western Australia, with reference to the diversity of forest and woodland invertebrates. *Pacific Conservation Biology*, 7, 229-239.
- Marshall, A. J., M. J. Grose & N. S. G. Williams (2019) From little things: More than a third of public green space is road verge. *Urban Forestry & Urban Greening*, 44, 126423.

- Martinus, K. & T. J. Sigler (2018) Global city clusters: theorizing spatial and non-spatial proximity in inter-urban firm networks. *Regional Studies*, 52, 1041-1052.
- Martinus, K., T. J. Sigler, G. Searle & M. Tonts (2015) Strategic globalizing centers and sub-network geometries: A social network analysis of multi-scalar energy networks. *Geoforum*, 64, 78-89.
- McDonald, E., B. Coldrick & W. Christensen (2008) The Green Frog and Desalination: A Nyungar Metaphor for the (Mis-)Management of Water Resources, Swan Coastal Plain, Western Australia. *Oceania*, 78, 62-75.
- Milcu, A. I., J. Hanspach, D. Abson & J. Fischer (2013) Cultural Ecosystem Services: A Literature Review and Prospects for Future Research. *Ecology and Society*, 18.
- Mittermeier, R. A., P. Robles Gil, M. Hoffman, J. Pilgrim, R. Brooks, C. G. Mittermeier, J. Lamoreux & G. A. B. da Fonseca. 2005. *Hotspots revisited: Earth's biologically richest and most endangered ecoregions*. Mexico City, Mexico: CEMEX.
- Mumaw, L. & S. Bekessy (2017) Wildlife gardening for collaborative public-private biodiversity conservation. *Australasian Journal of Environmental Management*, 24, 242-260.
- Myers, N., R. A. Mittermeier, C. G. Mittermeier, G. A. B. Fonseca & J. Kent (2000) Biodiversity hotspots for conservation priorities. *Nature*, 403, 803-808.
- O'Sullivan, O. S., A. R. Holt, P. H. Warren & K. L. Evans (2017) Optimising UK urban road verge contributions to biodiversity and ecosystem services with cost-effective management. *Journal of Environmental Management*, 191, 162-171.
- Pandit, R., M. Polyakov, S. Tapsuwan & T. Moran (2013) The effect of street trees on property value in Perth, Western Australia. *Landscape and Urban Planning*, 110, 134-142.
- Pataki, D. E., M. M. Carreiro, J. Cherrier, N. E. Grulke, V. Jennings, S. Pincetl, R. V. Pouyat, T. H. Whitlow & W. C. Zipperer (2011) Coupling biogeochemical cycles in urban environments: ecosystem services, green solutions, and misconceptions. *Frontiers in Ecology and the Environment*, 9, 27-36.
- Pauli, N., C. Mouat, K. Prendergast, L. Chalmer, C. E. Ramalho & E. Ligtermoet. 2021. The social and ecological values of native gardens along streets: A socio-ecological study in the suburbs of Perth. Melbourne, Australia: Clean Air and Urban Landscapes Hub (CAUL).
- Prell, C., K. Hubacek & M. Reed (2009) Stakeholder Analysis and Social Network Analysis in Natural Resource Management. *Society & Natural Resources*, 22, 501-518.
- Ramalho, C. E., E. Laliberté, P. Poot & R. J. Hobbs (2014) Complex effects of fragmentation on remnant woodland plant communities of a rapidly urbanizing biodiversity hotspot. *Ecology*, 95, 2466-2478.
- Ramalho, C. E., K. M. Ottewell, B. K. Chambers, C. J. Yates, B. A. Wilson, R. Bencini & G. Barrett (2018) Demographic and genetic viability of a medium-sized ground-dwelling mammal in a fire prone, rapidly urbanizing landscape. *PLoS one*, 13, e0191190.
- Reed, M. S., A. Graves, N. Dandy, H. Posthumus, K. Hubacek, J. Morris, C. Prell, C. H. Quinn & L. C. Stringer (2009) Who's in and why? A typology of stakeholder analysis methods for natural resource management. *J Environ Manage*, 90, 1933-49.
- Reed, M. S., L. C. Stringer, I. Fazey, A. C. Evelyn & J. H. J. Kruijsen (2014) Five principles for the practice of knowledge exchange in environmental management. *J Environ Manage*, 146, 337-345.
- Robinson, L. A., H. L. Blincow, F. E. Culhane & T. O'Higgins (2019) Identifying barriers, conflict and opportunity in managing aquatic ecosystems. *Sci Total Environ*, 651, 1992-2002.
- Rupprecht, C. D. D. & J. A. Byrne (2014a) Informal urban green-space: Comparison of quantity and characteristics in Brisbane, Australia and Sapporo, Japan. *PLOS One*, 9, e99784.
- Rupprecht, C. D. D. & J. A. Byrne (2014b) Informal urban greenspace: A typology and trilingual systematic review of its role for urban residents and trends in the literature. *Urban Forestry & Urban Greening*, 13, 597-611.
- Säumel, I., F. Weber & I. Kowarik (2016) Toward livable and healthy urban streets: Roadside vegetation provides ecosystem services where people live and move. *Environmental Science & Policy*, 62, 24-33.

- Scott Shafer, C., D. Scott, J. Baker & K. Winemiller (2013) Recreation and Amenity Values of Urban Stream Corridors: Implications for Green Infrastructure. *Journal of Urban Design*, 18, 478-493.
- Searle, G., T. Sigler & K. Martinus (2018) Firm evolution and cluster specialization: a social network analysis of resource industry change in two Australian cities. *Regional Studies, Regional Science*, 5, 369-387.
- Seddon, G. 1972. *Sense of place: A response to an environment: The Swan Coastal Plain*. Perth: University of Western Australia Press.
- Stenhouse, R. N. (2005) Assessing disturbance and vegetation condition in urban bushlands. *Australian Journal of Environmental Management*, 12, 16-26.
- Sweeney, O. F., J. Turnbull, J. M., L. M., T. M. Newsome & A. Sharp (2019) An Australian perspective on rewilding. *Conservation Biology*, 33, 812-820.
- Threatened Species Scientific Committee. 2016. Approved Conservation Advice for the Banksia Woodlands of the Swan Coastal Plain ecological community (In effect under the EPBC Act from 16-Sep-2016). Canberra: Department of the Environment and Energy.
- Ulrich, R. S. (1981) Natural Versus Urban Scenes: Some Psychophysiological Effects. *Environment and Behavior*, 13, 523-556.
- Utility Providers Services Committee. 2018. Utility Providers Code of Practice. Perth, Australia: Utility Providers Services Committee.
- Valentine, L. 2009. Patterns of ground-dwelling vertebrate biodiversity in the Gnangara Sustainability Strategy study area.
- WAPC (2015) *Liveable Neighbourhoods Background Information: Review of Liveable Neighbourhoods*. Western Australian Planning Commission, Perth.
- Ward Thompson, C., J. Roe, P. Aspinall, R. Mitchell, A. Clow & D. Miller (2012) More green space is linked to less stress in deprived communities: Evidence from salivary cortisol patterns. *Landscape and Urban Planning*, 105, 221-229.
- Wasserman, S. & K. A. Faust. 1994. *Social Network Analysis: Methods and Applications*. Cambridge University Press.
- Weber, F., I. Kowarik & I. Säumel (2014) A walk on the wild side: Perceptions of roadside vegetation beyond trees. *Urban Forestry & Urban Greening*, 13, 205-212.
- Weston, P. 2020. "This is no damn hobby": the 'gangsta gardener' transforming Los Angles. *The Guardian* 29/04/2020.
- Wolch, J. R., J. Byrne & J. P. Newell (2014) Urban green space, public health, and environmental justice: The challenge of making cities 'just green enough'. *Landscape and Urban Planning*, 125, 234-244.
- WWF. 2016. Living Planet Report 2016. *Risk and resilience in a new era*. Gland, Switzerland.
- Young, E. 2017. 'Get out there and do it': Perth council ditches street verge rulebook. *WAtoday* 27/02/2017.
- Young, E. 2018. Just do it: Meet Perth's guerrilla gardeners. *WAtoday* 13/01/2018.

Appendix 1: List of contributing stakeholders

List of contributing individuals or organisations and their primary stakeholder classification. (Note: not all interviewees wished to be named).

Individual or Organisation	Primary Stakeholder Classification
LGA Councillor	Champion of Change
Guerrilla Gardener	Champion of Change
Green Space Alliance	Champion of Change
Beyond Gardens	Champion of Change
Verge Gardens Australia	Champion of Change
Satterley Property Group	Developer
Development WA (formerly LandCorp)	Developer (State Government)
Arbor Centre	Environmental consultancy
Western Wildflower Gardens	Environmental consultancy
Sustainable Outdoors	Environmental consultancy
Josh Byrne & Associates	Environmental consultancy
Ecoscape	Environmental consultancy
Plantrite	Horticulture & irrigation industry
Irrigation supplier	Horticulture & irrigation industry
Turf consultant	Horticulture & irrigation industry
Native plant nursery	Horticulture & irrigation industry
City of Canning	Local Government Authority (LGA)
City of Kwinana	LGA
City of Mandurah	LGA
Town of Victoria Park	LGA
City of Joondalup	LGA
Irrigation Australia (IA)	Peak body
WALGA	Peak Body
Turf Growers Association (TGA)	Peak body
Urban Development Institute of Australia (UDIA)	Peak Body
Water Corporation (Water Efficiency Partnerships)	State Government
Main Roads Western Australia	State Government
Department of Planning, Lands and Heritage (DPLH)	State Government
Water Corporation (Utility)	Utility (State Government)
Western Power	Utility (State Government)

Appendix 2: Stakeholder interview question guide

The following question guide covers a range of questions for key stakeholders, acknowledging that different groups of stakeholders will have particular interests or experiences, and that not all Local Government Authorities have policies on verge gardening. The final set of questions for each stakeholder interviewee was tailored to the needs and interests of that stakeholder group, so that not all questions were asked of each interviewee, and the wording of some questions was framed to suit the interviewee and their organisation.

Interview questions were asked during the process of mapping stakeholder networks. The interviewer facilitated the process, where the respondent was asked to draw out their network of stakeholder interactions in relation to verge and streetscape management. Stakeholder interactions were illustrated, described, discussed and built upon throughout the interview process.

Theme: Stakeholder Interactions and awareness

- In your management/advocacy/involvement in verges and streetscapes, who are the organisations you interact with? [draw the links]
- How do you characterise these stakeholders you interact with?
- How similar to your own organisation's would you describe their attitude to verge greening? Can you describe the nature of each of these interactions (content of flow, and strength, frequency, ease, free/incentivised interaction)?
- With who do you share or receive information regarding verge management/verge gardening? In which direction does this information flow?
- Do you have any engagement with Indigenous stakeholders in urban greening work?

Theme: Local policy

- Can you describe your organisation's current policy and/or programmes on urban greening?
- How does your organisation select plants for street-scaping of arterial roads and verge programmes?
- Can you describe your current policy on verge gardens, and how this policy has been developed?
- What is/are the main reasons that your organisation has decided to develop (or not develop) a programme to encourage verge gardens?
- Do you offer any incentives or supports for verge transformations? (E.g. demonstration verges, guidelines, physical assistance, rebates or plant subsidies?). Can you tell me the current annual budget for this? Has this changed over time?
- Is your organisation certified as waterwise by the Water Corporation? If yes, are there any incentives or rebate programmes with matched funding from Water Corporation?
- Are there any other local policy initiatives that are relevant to street verge transformation projects
- Can you tell me which part of your organisation is responsible for verges?

Theme: Values of verges

- What do you consider to be the actual and potential value of verges for the environment?
- Are there differences in how your organisation understands these values for residential verges vs streetscapes?
- How does your organisation understand the value of the verge to key stakeholders including residents, neighbours, and developers?
- What do you consider to be the role or potential role of verges for community engagement/cohesion?
- How has the value (or perceptions) of street verges changed over the last few decades?
- Do you consider the values of verges to differ for residential in-fill vs new developments?

Theme: Process of verge transformation through native gardening

- How do you understand the actual or potential process of transforming a verge area to a native garden
- What in your experience inspires this process to begin?
- What kinds of resources are required, and available for verge related activities and who coordinates these?
- [Where appropriate] what is the annual budget for verge transformations?
- What are the constraints and enabling factors encouraging the uptake of native verge gardening?

Theme: Impacts & outcomes

- What were the advantages and disadvantages of streetscape/verge garden transformation?
- Where there any recognisable changes in ecosystem service provisioning? [Is there any monitoring/ evidence post verge transformation]?
- Any observed financial, social or environmental outcomes for your organisation or community?
- What are the compliance, maintenance and risk management issues associated with street verge transformations? [any monitoring of these?]
- Does your organisation have in mind a desired proportion of 'transformed' verges throughout the LGA? [Or alternatively, preferred distribution of transformed verges].

Theme: Community feedback

- How many participants have taken up incentive or rebate programs for street verges / native plants this year [or latest year for which complete data available]? How has this changed over time?
- What do you think are the main motivations for verge transformations by residents?
- What do you think are the main barriers in the uptake of verge transformations for residents?
- What are the challenges, conflicts or complaints that most often arise when it comes to verge gardening?

Theme: Future preferences

- Given adequate resources- what would an ideal streetscape verge look like to you? (species composition, density, ground cover, other?)
- What would an ideal residential verge look like to you?
- Are there any changes you'd like to make to your street scaping/ street verge policies or programs for the future?

Appendix 3: Short questionnaire role of urban street verges

Note, not all respondents replied to all questions as some were outside the scope of their interests.

Short questionnaire on the roles of urban street verges

Administered by: University of Western Australia [contact name]

Research project: From footpaths to ecosystems: understanding the role of the verge in delivering urban ecosystem services.

Respondent/Organisation:

1. Urban street verges serve multiple functional purposes. What degree of importance does **your organisation** place on the following **functions** of urban street verges? (Place an X in the appropriate box)

	Extremely important	Very important	Moderately important	Slightly important	Not at all important	NA
Provision and maintenance of utilities						
Space for off-road car parking						
Space for street trees						
Green corridors for connecting habitats						
Recreational space						
Space for footpaths and pedestrian access						
Space for future road widening						
Space for social interaction						
Visual amenity to create pleasant streetscapes						
Access to public transport and bus stops						
Space for bicycle paths						

2. Urban street verges incorporating native vegetation can potentially provide a range of ecosystem services. In considering your interests in street verges, how important to **your organisation** are each of the following potential ecosystem services provided by urban street verges?

	Extremely important	Very important	Moderately important	Slightly important	Not at all important	NA
Regulating ecosystem services						
Stormwater management						
Water quality improvement						
Air quality improvement						
Temperature regulation (shading to reduce urban heat)						
Carbon sequestration						
Soil nutrient cycling						
Supporting ecosystem services						
Rainwater infiltration						
Supporting soil formation and soil biodiversity						
Supporting plant diversity						
Supporting animal diversity						
Providing food for urban wildlife						
Cultural ecosystem services						
Recreation and mobility						
Aesthetic pleasure						
Mitigating road noise						
Encouraging social interaction						
Providing food for people						
Augmenting residential property value						

3. How important would you rate the following factors, in shaping the recommended species for vegetating urban verges/verges?

For TREE species

	Very important	Somewhat important	Not at all important	N/A
Fitting with urban forest strategy				
Community preferences				
Consultant guidance				
Financial considerations				
Commercial availability of plants				
Wildlife friendly				
To fit with built environment (verge width, power lines)				
Culturally significant species for Noongar community				
Species hardiness				
Colour and texture				
Locally occurring species				
Safety considerations				
Edible fruit				

For UNDERSTOREY species

	Very important	Somewhat important	Not at all important	N/A
Fitting with urban forest strategy				
Community preferences				
Consultant guidance				
Financial considerations				
Commercial availability of plants				
Wildlife friendly				
To fit with built environment (verge width, power lines)				
Culturally significant species for Noongar community				
Species hardiness				
Colour and texture				
Locally occurring species				
Safety considerations				
Edible fruit				

4. Perceptions of enablers and barriers for residents in undertaking native verge gardening

4A - How important do you think the following reasons are for *encouraging* local Perth residents to plant more native vegetation along the verge adjacent to their dwelling?

	Very important	Somewhat important	Not at all important	N/A
Enhancing property values				
Reducing water use				
Saving time on maintenance				
Shading and cooling effect on property				
Creating aesthetically pleasing landscape				
Enjoyment of gardening				
Attracting wildlife to their garden				
Fitting in with the streetscape				
Interest in native plants				
Influence of neighbours				
Inspiration from exemplar or demonstration gardens				
Incentives from LGAs				

4B - How significant do you think the following **barriers** are for local Perth residents to plant more native vegetation on the verge adjacent to their dwelling?

	Very significant	Somewhat significant	Not at all significant	N/A
Regulation by local government authority				
Lack of personal interest				
Awaiting installation of underground power				
Personal dislike for native plant species				
Personal preference for grassed verge				
Verge used for off-street parking				
Financial cost of installing and maintaining verge gardens				
Absence of local government incentives				
Uncertainty of how to start				
Negative comments from neighbours about verge gardens				
Personal preference for gravel/laterite verge				
Insufficient area available to install native plants				