PLANT BIOSECURITY
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Demographic mapping across gardening communities to inform urban and periurban plant biosecurity engagement strategies

Are community gardens a representative model for evaluating plant health education and engagement at a local level?

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Executive Summary

The academic literature, as compiled in PBSF027 (Lye & McGregor 2020), and as focussed upon most recently in the National Biosecurity Strategy (DAFF 2022), identifies biosecurity preparedness benefits in building community accountability and a culture of biosecurity. Community level change may be more readily leveraged where existing networks based on trust and reciprocity, social norms and strong social governance are already established. In this context, these attributes also support biosecurity compliance and involvement through targeted, local-level community-based engagement strategies and community facilitated information transfer, and therefore remove reliance on more traditional approaches that are based on an assumed homogenous cultural demographic.

On that basis, this report focuses in more depth on exploring the implications for engagement via existing community and social networks, the diversity in those networks in relation to the broader community and if a diversity of needs can be met through this approach. We conclude by exploring what strategies and program design features are most supported in this context and applicable or adaptable to other biosecurity extension.

This study sought to determine how existing, open-source data can act as a proxy to provide a strong indicator of cultural and/or language barriers in urban environments – in this case among the broader urban gardening community of Melbourne (using community gardens as test cases). This work used insights from the investigation to suggest novel methods of engagement that community gardens may use to improve pest knowledge, learning and sharing capacity within and between gardens and gardeners in culturally diverse communities in Australia. The concept and value of community gardens as sentinel nodes in a broader surveillance and information network is revisited in line with the findings from the previous study (Lye & McGregor, 2020) As such, we used grass-roots social enterprises (community gardens) as a model system to investigate education and engagement methods for different locality types, and hypothesised these community nodes and networks are a viable model system for testing training and engagement methods for broader community and industry outcomes.

A number of key research questions probed the hypothesis that community gardens offer an appropriate, innovative, and accessible framework for community engagement and extension for plant health and biosecurity and that via a variety of approaches and methodologies, a deeper understanding of these communities may be ascertained, such that a strategised, targeted and more efficient and effective approach to engagement/education design and delivery may be undertaken to achieve these aims. As such, a range of data collection and investigative methodologies were applied, including collation and analysis of demographic data, interviews, and the physical assessment and classification of type and activity of gardens.

The findings in this project offer insight into both the value and limitations of the community garden networks in Melbourne as a representative model for evaluating plant health education and engagement at a local level. Most notably the importance of a tailored, strategic, integrated approach to community engagement and education, and the opportunity to leverage existing and build new social capital within communities, to support positive biosecurity outcomes.

The work also identified a number of areas for future investigation, including further exploration into the motivations for joining community gardens in a highly diverse community, to conduct longitudinal data collection and analysis of community garden membership and knowledge needs, to track changes to their potential role as an important community and knowledge hub and for exploration of overseas models for garden governance, resourcing, engagement and as educational hubs and networks to inform the future Australian context.

1. Background

1.1 Overview

A desktop study conducted in 2019-2020, (Lye and McGregor, 2020) proposed that community gardens are a good indicator of local levels of social capital and are potentially potent networks for engagement and extension activities. The project also determined that, in a changing urban farming or urban greening context, community gardens represent existing local knowledge sharing and learning hubs for supporting better plant health outcomes.

The growing disconnect between regional and urban dwellers has evolved such that it is commonly accepted as part of contemporary society in Australia. However, this continues to generate concern for government and associated organisations with respect to engagement with food production, and plant biosecurity (Beale et al., 2008; Srinivasan and Simpson, 2014), with a recent enquiry into food security launched by the Federal Government in 2022. Food production in any setting requires a knowledge of areas such as plant health, biosecurity and market conditions. Importantly, shifting mindsets and ideals relating to the importance of plant health stewardship and, more broadly, access to green spaces and locally grown products is increasingly being supported by community-led action and local policy setting. This green direction shift is likely to have substantial implications relating to plant health attitude and knowledge and presents important opportunities for supporting greater plant biosecurity engagement at a local level in urban environments. Notably, the relationship between biosecurity and food security is emerging, where previously only tenuous or cursory links between these two important areas were made, and individuals and organisations identified themselves to work almost exclusively in one or the other. However, despite increasing activity and focus on these areas, societal understanding of the relationship between plant health knowledge, attitudes towards biosecurity and food production in any setting are not well characterised.

To explore these key concepts and relationships in our previous project, *Urban plant biosecurity: Using a foundational approach to understand emerging risks, support resilient cities and safeguard rural industry (2020*), we suggested a divergence from traditional approaches applied for building biosecurity engagement, which relies on a top-down knowledge transfer and outlined a more sophisticated approach towards improving plant biosecurity outcomes in urban environments. This approach takes into consideration emerging trends around changing land use and socio-demographic value drivers - in line with the growing popularity of urban greening and urban agriculture. We demonstrated how geospatial mapping of urban land use, key organisations, grey communication networks and planning frameworks, such as local policies and local support structures, can aid in identifying locations and communities where there are the greatest opportunities for supporting plant health outcomes in urban environments, and thus safeguarding adjacent high-value production areas. This report also filled an important information gap in relation to characterising urban resident attitudes towards biosecurity and willingness to report suspect exotic pests. Overall, the report highlighted that significant opportunities exist to use the described geospatial analysis and social research approach to investigate and pilot building community level social capital among urban communities, to improve plant health and biosecurity outcomes – a need that has also been highlighted by other studies in recent years (Klepeis and Gill, 2016; Sinclair et al., 2020). This work integrated a number of discipline areas, including social research, geospatial analysis, and community engagement, in a novel methodology to support development of targeted, local-level community-based engagement strategies in urban environments. The study yielded several key findings, identified areas and approaches for further investigation and therefore supports the methodology applied in this most recent body of work.

1.2 Grey networks, social capital, learning networks and resilient communities

1.2.1 Building knowledge and awareness of plant biosecurity through strengthening of community social capital

A lack of knowledge and confidence among potential reporters has been found to be a limiting factor in improving plant health outcomes in urban and rural environments (Lye & McGregor, 2020). This barrier is unlikely to be appropriately addressed through traditional biosecurity outreach approaches that place an emphasis on providing direct information about priority pests. Rather, it is proposed that a more holistic process of building community social capital (for example strengthening informal networks and developing a culture of trust and reciprocation, civic norms and social participation) through empowering individuals and groups to become more familiar with their seasonal garden ecology will support longer-term positive outcomes.

In the previous project (Lye & McGregor, 2020) we also demonstrated that integration of geospatial mapping analysis into engagement planning affords an opportunity to take biosecurity engagement strategy to a more sophisticated level as it offers a method of conducting comparative visual analysis of urban demographics and environments to direct strategic engagement activity. The report emphasised that as such, urban residents represent a potentially powerful pool of interested individuals if plant health training and engagement is offered in line with major motivators and values, and with a view to building community level social capital, that is the development of generalised trust, social participation and determining civic norms for the community. The work also identified that where diverse communities exist, developing a deep understanding of context, community values, beliefs and behaviors is essential for effective engagement. Understanding how and why community social capital exists (in what forms) and what the differences are within and between diverse groups and communities strengthens application of extension approaches and adaptation to new contexts. These concepts are introduced and discussed in the context of the various components of this project and towards the development of recommendations for application of this understanding in biosecurity program design and extension methodology.

1.2.2 The importance of informal learning networks in supporting biosecurity contributions from urban communities

Community gardens as a model system for local learning and engagement

The integration of existing, informal (grey) networks in the development of an engagement strategy, formed a key aspect of the proposed approach for building biosecurity awareness and capability among non-farming urban and peri-urban residents. These networks include key influencers such as local knowledge brokers, special interest group information platforms, and peers. The recently released National Biosecurity Strategy (DAFF 2022, National Biosecurity Strategy) prioritises the development of a "*culture of biosecurity*" and the need for community accountability for biosecurity in Australia. The report identifies this cultural or paradigm shift as a "*meaningful opportunity for change*", moving away from government and legislative accountability towards community accountability, supported by social governance frameworks, trust and social participation in civic norms. This (and future work) offers the opportunity to explore to what degree these frameworks already exist in community networks - such as Community Garden and Urban Agriculture networks - and what resources and support are needed to strengthen these frameworks.

The American Community Garden Association description of a community garden captures the multifaceted nature of these community organisations. It is a place…"*That can be urban, suburban, or rural. It can grow flowers, vegetables or community. It can be one community plot, or can be many individual plots. It can be at a school, hospital, or in a neighbourhood. It can also be a series of plots dedicated to "urban agriculture" where the produce is grown for a market.*" (American Community Garden Association, 2020).

Figure 1 depicts the history of the use and popularity of the terms 'community garden' and urban agriculture' over time and hence infers the change in reality, in terms of acceptance and understanding of these activities and development of associated communities.

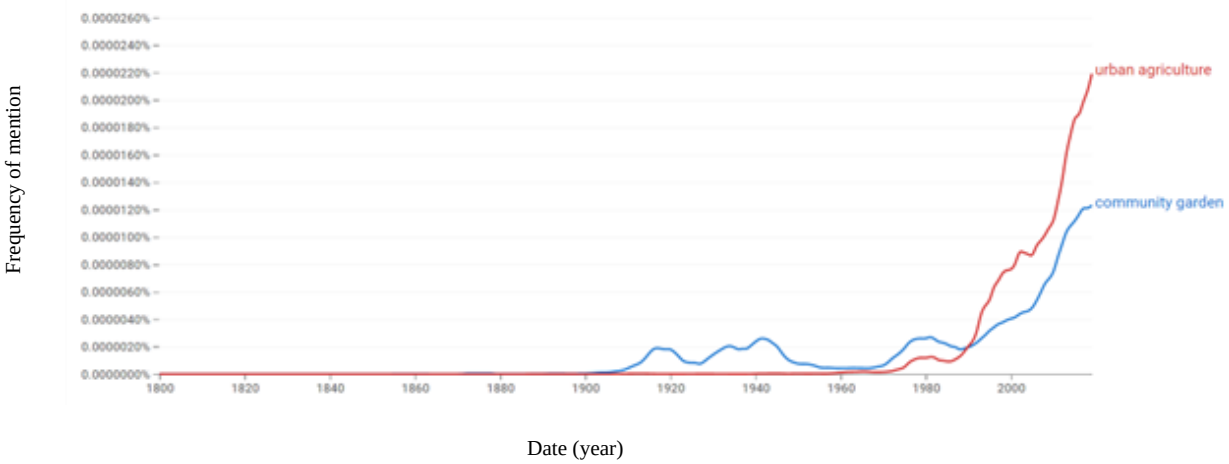


Figure 1. Usage of the terms 'community garden' and 'urban agriculture' across English literature over time (source: NGram)

Community gardens are characterised by the (most commonly) voluntary status of those involved with the garden and their focus on community engagement. However, beyond these key attributes the 'make-up' of a community garden is multi-faceted, including volunteer activity, garden and project management, social contact, physical activity, production of food, selling or distribution of produce and training and education. Quantified benefits arising from participation include growing individual and community social capital, and access to shared knowledge and resources (Lovell et al., 2014).

The establishment of formal community gardens in Australia has been a relatively recent initiative, particularly in comparison to other countries such as the United Kingdom and the United States. This was largely driven through the 1990s due to rising environmental protection concerns – manifesting as an increased demand for waste management through composting and urban permaculture (Grayson, 2000; Thompson et al., 2007), and more recently from a growing community awareness of impacts and threats of food insecurity and increasing food prices.

Community gardens as incubators of social capital, belonging, and learning

Community gardens are often created in response to a local need. Key examples reflecting the Australian context include: to improve availability of fruit and vegetables during an economic slump; to allow the growing of traditional foods and reconnection with cultural values; local pressure to reduce waste and improve environmental connectivity; patient rehabilitation or to support social connection and physical wellbeing for community elders.

Knowledge sharing, resource availability, and development of relationships are all attributes of community gardening, and are important elements of developing social capital within a community and for individuals. The link between strong social capital and the ability of a community to withstand an upheaval or major change (resilience) is increasingly described in the scientific literature, with reference to events such as drought, bushfires and COVID19. (Dynes, 2006; Makridis & Wu .,2021). In certain community or societal contexts social capital (cooperation, access to trusted networks, knowledge sharing, reciprocation) may hold increased importance, for example in low-income, diverse or disadvantaged neighbourhoods (Thompson et al., 2007).

Accounts of immigrant communities forming gardens to reconnect with their cultures and grow traditional foods are common (Forbes, 2001). In a study of three public housing community gardens in Waterloo, just 2km from the Sydney central business district, researchers found that the gardens provided important cross-cultural interactions, serving to educate garden volunteers about other cultures through food and recipe sharing (Bartolomei et al., 2003). In this study it was found that the gardeners had access to a variety of learning activities, such as field trips to other gardens, visits to the Royal Botanic Gardens propagation facility, and on-site training sessions on a number of topics covering a variety of technical expertise, some of

which were directly supported through the involvement of the Royal Botanic Gardens and the state government. Bartolomei et al. (2003) also noted that these gardens were serving more broadly, as effective community environmental education platforms and programs, and that the gardens increasingly provided vehicles for information transfer to the broader community as engagement within the community grew.

In this project we delve further into the relevance of grass-roots social and learning hubs as sources and providers of high-quality learning, communication and knowledge for plant health management in Greater Melbourne, as reflective of the Australian community context. We also investigate what differences in learning requirements and networks may exist between different localities, within and between communities in Melbourne, emphasising the potential power of grass-roots learning networks to support local biosecurity and plant health capability, which can complement more traditional top-down approaches to urban education and awareness for plant health.

1.3 Exploring and classifying community diversity and demographics in Greater Melbourne

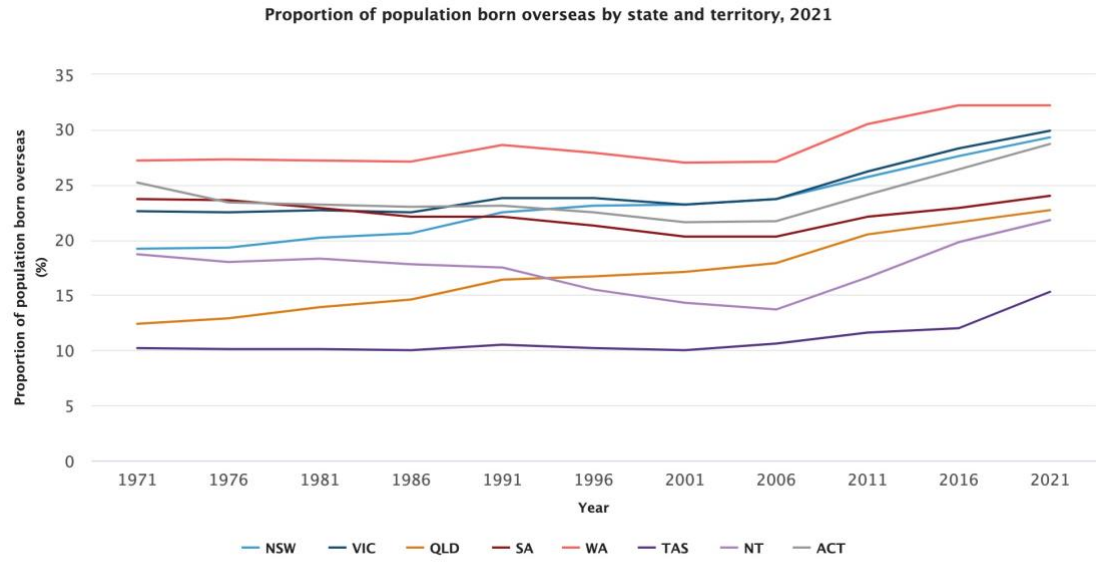
Greater Melbourne is widely recognized as a richly diverse, urban community. Hence, in using Melbourne as our community of interest for this work, a key aim of this study was to determine the demographic indicators that offer an understanding of the breadth and significance of the community diversity in Melbourne, and to support segmentation of the city into a range of 'diverse' and 'homogeneous' localities based on local government areas (LGAs). Generic definitions of community diversity refer to factors such as background, personality, life experience and beliefs, which in turn inform how we view and interpret the world. Diversity in any community may be also be recognised or quantified based on the variance in ethnicity, age, gender, religion and a wide range of other unique attributes, such as career, education, communication style and influences on personal perspective. These attributes can be further classified into those informing social identity and those informing professional identity, and for individuals within these communities, may influence how others in their community relate to, communicate with, view or treat them.

A further area of interest and focus for this work is engaging with culturally or ethnically diverse communities, including where members of the community identify as having low proficiency in English. The Australian Bureau of Statistics (ABS) captures and quantifies the cultural diversity of Australia through collection of Census data and identifies that since the end of World War II there has been a steady increase in overseas born and second-generation migrants living in Australia. The term ethnicity is often synonymous with diversity in communities, and for ABS Census data, indicators are captured through the approach recommended by Borrie (1984). The census captures these changes in diversity of demographics over time via collecting ('self-classifying') data through the census process such as ancestry, country of birth, English proficiency, language spoken, Indigenous status and religious affiliation (ABS Census 2021). This diverse and changing demographic of Australia presents an interesting context for extension, engagement and program design – including how to determine if the demographic engaged is broadly representative of the Australian community, or more discretely represents the target community.

Our understanding of the breadth of changes in demographic also informed the choice of demographic indicators applied in this project (section 3.2.1), where comparisons between diversity in the Australian demographic and the classification and quantification for diversity from the indicators in this study can also be made (section 3.3 & 3.4).

1.3.1 Demographic trends

For all states and territories, the proportion of the population born overseas has increased since 2006, with 29.9% of people in Victoria identifying in this classification in 2021 (ABS/Census 2021). Figure 2 below shows the change in proportion of population born overseas by state or territory, demonstrating an average increase of 5.6% and a median increase of 5.3%. Victoria returned an increase of 7.3% for this period (3rd highest state or territory), with Queensland the highest rate of change at 10.3%. Victoria (and NSW) also had the highest proportions of their population born overseas in urban areas, possibly due to already established communities, access to support services, employment or education.

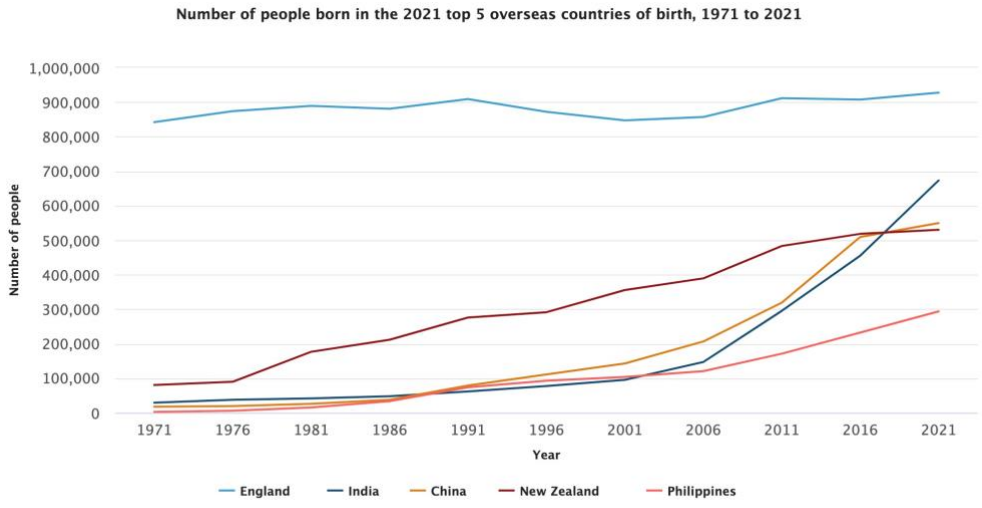


Source: Australian Bureau of Statistics, Cultural diversity of Australia 20/09/2022

Figure 2. Changes over time in the proportion of the Australian population born overseas, by state and territory (2021 data)

In Victoria the areas (LGAs) with the highest numbers of people born overseas were Dandenong (57.6%), Melbourne City (54.7%) and Monash (50.8%). For Australia, the highest proportion of people born overseas was recorded in Auburn in Western Sydney, at 61.7% (ABS/Census 2021 data)

To further understand diversity within the classification of "born overseas", region and country of birth are captured. Noting that for some areas with a high proportion of people born overseas, the representation of diversity by region or country of birth is relatively low. There has also been a change in migration patterns with respect to country of birth since the first half of the 20th century, driven by factors such as immigration policy, people seeking asylum and certain sectors of a demographic seeking education or employment opportunities. The significance of this data is further explored in the methodology for capturing and analysing demographic data and for the selection of the six comparative LGAs, and is summarised in Figure 3 below. This graphical representation emphasises where populations have a relatively stable rate of migration or have changed rapidly after a given point in time, demonstrating the significance of temporal factors driving these trends for some overseas communities.



Source: Australian Bureau of Statistics, Cultural diversity of Australia 20/09/2022

Figure 3. Change over time of number of people born overseas comparing migration rates for people from England, India, China, New Zealand and Philippines

Interestingly, the number of Italian migrants has decreased over time, where 50 years ago, it represented the largest migrant community after England. By 2021, it had the greatest decrease of all countries captured since 2016. Many Italian migrants moved to Australia between 1947 and 1976 to work in agriculture (and infrastructure) projects, but by the early 1970s and with improving economic conditions in Italy, more Italians migrated from Australia than arrived (Castles, 1994). This is further emphasised by the finding that in 2021 data, the median age of the Italian-born population was 72 years old, with 69.4% having arrived in Australia more than 50 years previously (Castles, 1994). This has significant implications for this study with strongly cohesive communities of Italians living in areas of Greater Melbourne and as known experienced urban agriculturalists, with a high level of knowledge shared within their own cultural and community networks.

Implications of language spoken (and written) are high for program design in engagement and extension, making this a key consideration in this study. The 2021 data reported that 22.8% of the Census population spoke a language other than English at home, representing a small increase from 2016 (21.6%). Quantification of proficiency in English is captured in Census data through a self-assessed measure across a scale of 'very proficient' to 'no proficiency'. Speaking another language other than English at home was reported as most common in first generation Australians (71.8% in 2021 data). For Australian born people speaking a language other than English at home, 83% had one or both parents born overseas and almost half (48%) were under 15 years of age.

A total of 872,000 people reported to speak English not well or not well at all in 2021 data, representing 15.1% of all people reporting to speak a language other than English at home. Of this population, 59.2% arrived in Australia over 10 years ago, again, representing an important age demographic in this community. From 2021 data, the highest spoken language was Mandarin, with 62.7% of people who speak Mandarin as their first language, first generation Australians born in China. People who spoke Mandarin were also reported as the largest group with the lowest English proficiency, accounting for 25.9% of all speakers of Mandarin and greater than 20% of all people reporting a low proficiency in English. The largest increase was in people speaking Punjabi: an increase of 80.4% between 2016-2021, reflecting a rise in Indian migrants across the same period (ABS, 2021).

Are garden communities reflective of the broader demographic diversity?

It is reasonable to assume that diversity within a community garden will reflect some aspects of the broader local community, particularly in terms of values or reasons why people engage with community gardens (or other community groups). Membership to community gardens is commonly restricted to residents who live within 1-2km (up to 5km in areas with lower population densities) from the garden (the membership 'catchment' area). This is to encourage a place-based community and to support people gardening who may not have access to transport or the physical means to travel further afield for a similar activity. Hence it is also reasonable to assume that for comparable populations (regions or LGAs) with a larger number of gardens, there is a greater likelihood that diversity within the community will be captured in the garden memberships. Many gardens also have this policy in place to deepen community connectedness and offer members the opportunity to meet people with whom they have a place-based commonality, and in turn are more likely to engage in local events and support those held by the garden. This is supported by Bartolomei et al. (2003) who found that when given a choice of three gardens, people chose to frequent the garden in closest proximity to their residence. Results from Hernandez Lasso (2019) concur, demonstrating that 75% of the gardeners surveyed in Oslo, Norway, lived within walking distance to the garden (n = 102). In this study, many of the gardeners emphasized the importance of having a garden plot close to their home, as many of them live in apartment buildings with no access to a garden (66%).

Table 1 Demographic findings from a survey of community garden members in Waterloo, Sydney (Bartolomei et al. 2003)

Garden membership	Members tended to attend the garden in closest proximity to their residents, despite having access to other gardens within close proximity.
Age	36 to over 75 years, with the majority falling within the age range of 56 to 75 years (approximately 60% of total gardeners)
Gender	Women were the majority of the members (70% of total membership)
Ethnicity	Fifteen nationalities were represented
Length of residency	There were varying lengths of residency on the Estate, ranging from three years to over 10. The majority had lived on the Estate for over four years, with at least 30% of all gardeners having resided on the Estate for more than 10 years.
Tenure	Of the 55 members, nine had been involved since the establishment of the first local garden in late 1997

Motivators for garden establishment and membership

As discussed, apart from proximity there must be intrinsic motivators for garden membership, be it an interest in social interaction, access to fresh produce, learning, physical exercise, environmental views etc. Identified motivators for garden involvement have been shared through several research studies. Key motivators identified by Bartolomei et al. (2003) were: community and social life (sharing produce, ownership and connection to the estate, connecting with others); cross-cultural interactions (growing food for cultural connection, sharing garden practices, sharing recipes, links with country of origin); health and wellbeing (a source of fresh food and traditional medicine, an opportunity for physical exercise, a place for peace and relaxation, routines that bring comfort and purpose, something to live for, gardening and spirituality, general wellbeing and happiness); the pleasure of gardening (satisfaction of seeing plants grow, enjoying learning new skills, the joy of seeing beauty in the garden). Kingsley et al. (2019) undertook an assessment of six community gardens in Melbourne, Australia. In this study motivators were found to be: family history, childhood and passion for gardening, productive gardening, sustainability and growing fresh produce in nature, building social and community connections, community and civic action, stress relief, building identity, and pride and purpose.

Changing urban demographics and impacts on food production awareness

In 2007, Thompson et al. described the growing trend in cities towards medium density housing and the associated implications of such a trend – a reduction in available open space and thus a dramatic shift away from current residential lifestyles that place an importance on having room to garden and for children and pets to play. As private growing spaces in residential areas of Australia decrease in size and availability, the development of new sharing and learning platforms through co-operative growing has the potential to reconnect urban residents with the realities of food production and promote biophilia – necessary attributes that underpin good plant health management and biosecurity practices.

Within this project, the analysis of the demographic data for Melbourne and the community gardens networks offers the opportunity to explore these hypotheses as they apply in an Australian context, and as it is equally reasonable to assume that there will always be a subset of a local population that will *not* engage with community gardens, or indeed possibly any community networks at all, to offer possible strategies to connect with all facets of any given community. From this understanding, recommendations for key design features for the development of engagement strategies within and for diverse communities can be developed.

2.0 Aims and intention of the study

This study sought to determine how existing, open-source data can act as a proxy to provide a strong indicator of cultural and/or language barriers in urban environments – in this case among the broader urban gardening community of Melbourne (using community gardens as test cases). This work will also test a co-innovation approach to develop tailored upskilling models with community gardens on the topic of crop protection (citrus), and is conducted with the specific intention to further inform best methods to improve pest knowledge, learning and sharing capacity within and between gardens and gardeners in culturally diverse communities in Australia. The concept and value of community gardens as sentinel nodes in a broader surveillance and information network is revisited in line with the findings from the previous study (Lye & McGregor, 2020).

As such, we used grass-roots social enterprises (community gardens) as a model system to investigate education and engagement methods for different locality types, and hypothesised that these community nodes and networks are a viable model system for testing training and engagement methods for broader community and industry outcomes.

The primary or higher-level research questions investigate to what degree these gardens are reflective of the local demographic – indicative of inclusive and appropriate learning platforms and networks.

- How are demographic differences across a major city reflected in engagement styles on the topic of plant health and biosecurity at community gardens?
- What proxy data can strongly indicate where cultural/language barriers could be in an urban environment?

Several secondary research questions were also investigated in this project to marry the primary research aims and the context of urban growing communities and community gardeners in Melbourne.

- What are potential demographic indicators for segmentation of a city into a range of ‘diverse’ and ‘homogeneous’ localities?
- Based on demographic findings, are community gardens a potential model system for testing and evaluating plant health education and engagement at the local level? Do community gardens reflect the diversity of the wider local community?
- Do planting choices and plant care practices of garden members differ between diverse and homogeneous localities?
- What are the knowledge needs of urban residents in relation to plant health/plant growing?
- Do community garden engagement activities align with knowledge and learning needs?

In describing the project methodology and outcomes, this report outlines further steps we have taken to explore the concept that, in future, biosecurity engagement should go beyond basic biosecurity awareness activities and should investigate activities that will build social capital within communities through identifying community attributes and needs. Again, this has its premise in exploring the power and potential of grass-roots social enterprises and has been guided by the idea that an important factor in building social capital is fostering collaborations within and between groups, and facilitating strengthened communication throughout horizontal (grey) networks. It further emphasises our previous message, that biosecurity engagement in urban environments must be undertaken with consideration of the wider urban planning context.

Continued strengthening of grassroots and policy supported urban greening directions at a local level will offer new opportunities for improving community plant health knowledge and stewardship, and strengthening of trusted plant health learning networks. Biosecurity organisations and affiliated groups may capitalise on a changing local context through targeted, data driven and pre-emptive engagement.

3.0 Collection and analysis of demographic data for Greater Melbourne

3.1 Background

Our previous project identified the potential within the urban agriculture networks in Greater Melbourne to participate in activities that have the potential to slow down or stop the movement of plant pests and diseases through early detection, appropriate management and extension of urgency through these community networks. As previously discussed, the most impactful places to conduct these activities may be along commodity distribution routes or 'most-likely' transmission routes for exotic pest species or in areas where transmission could occur between industrial areas (e.g., pallets/contaminated containers) and suburban gardens. Other target areas could include those in close proximity to ports or transfer locations, or high density commercial growing areas.

The ability to identify and understand the gardener communities in these areas, who could support sentinel detection, testing and awareness activities, offers an opportunity to apply a novel approach to pest and disease surveillance and support plant biosecurity activities. Further to the work completed previously, this new data set seeks to classify diversity (in the context of this work) and will investigate how well diverse communities are represented through the community garden networks.

3.2 Methodology

Demographic data was compiled using the most recent available Census data (Australian Bureau of Statistics 2016-2021) – accessed initially between November 2021 and March 2022. Whilst this data is dynamic and there are likely to be changes over time for demographic distributions captured, the data reported here offers a tangible example of the use of open-source demographic data to better understand, target and segment communities within Australia. The data set used to ultimately categorise diversity and select the final subset of LGAs (six) for the focus group, consisted of 15 key data types. These data types were selected from definitions of diversity in the literature, those used for demographic analysis of diversity in ABS descriptions, and those selected as highly relevant to this project context. These 15 data types were further transformed and classified into a total of 18 data types used in the final analysis. Data for these 18 integers was downloaded directly from the ABS website or extrapolated from the 15 key data types and captured in MSExcel.

3.2.1 Data types and selection of LGAs for intensive assessment

The data types applied and the hierarchy of filters is shown in Table 2. As proficiency in English is a key indicator of interest in this project, this featured as a primary. This indicator is implicitly higher in communities with a high proportion identifying as born overseas, offering these two indicators as (related) tier one filters. The proportion of the LGA community born overseas was further defined by the number of regions or countries represented in this demographic, ranging from 1 to 9, where LGAs with 7 to 9 regions represented were considered more diverse in ethnicity or country of origin. However, for LGAs where the proportion of residents born in any one region was high, a reduced overall score for diversity in that LGA was applied. That is, for communities with a greater range of regions or countries represented in the LGA (7 to 9) but with one region highly represented, these communities were considered relatively less diverse than those where all regions were represented more proportionally.

Other integers considered most relevant for the project context and against which the demographic was filtered are also listed in Table 2. Consideration was given to factors such as population density, population growth and growth of the population born overseas, the dominant housing type, the average (regular) distance travelled for work and leisure activities (degree to which the community is place-based), and ease of access to resources and virtual communities via internet access to the home.

Where possible, data were also normalised for age and gender. However, the age and gender distribution may not reflect clustered differences in these indices. For example, where smaller populations with particular attributes are resident in a

large and diverse community (LGA). To accommodate for these limitations, where this is known to be likely based on the metadata from ABS and the literature, adjustments in interpretation of data from all sources can be made in the recommendations extended from analysis of these data.

The data for 32 LGAs and 15 key indicators was compiled in MSExcel and median values for each indicator calculated. The relative value for each indicator was compared against the median and based on the implication for diversity, a "high" "low" or range (1-5 or 1-10) of classification was allocated to it. Data for number of gardens, garden activity and notes regarding, for example, garden type was added to the sheet to provide an overview of selection criteria for the subset of six LGAs.

Table 2. Demographic subsets and associated indicators of diversity

Data types by LGA	Indicator	Filter level
Diverse or homogenous community (culture, ethnicity and language)	• Language other than English spoken at home (%) • Proficiency in English • Born overseas (%) and country of birth • # of different regions of birth (max 9 in census classification) within LGA community • % of community from most common country of birth (by LGA)	**Primary**
Population	• Total population (number) • Population density (persons/km^2) • Population growth • Population density change over time • Rate of change of % of community born overseas (% 2016-2021)	**Secondary**
Residential occupancy and transience (proxy)	• % demographic that rent the house they live in (tenancy rate) • % total dwellings offered as rental accommodation • Total # dwellings • Dwelling type (detached, semi-detached, apartment)	**Tertiary**
Local activity and/or access to resources/engagement	• % dwellings have internet • Distance travelled from home (work and leisure)	**Tertiary**

To facilitate objectivity in the selection of the six LGAs for assessment, and with weighting towards ethnicity and language (as focus areas in this study) a "diversity score" was calculated. The indicators used to calculate this score were: proportion of population born overseas, proficiency in English language, number of different regions of birth for each LGA demographic and the proportional representation of each region (per LGA). Distributed scores of 1-5 or 1-10 were applied (to match mapping distributions (Figures 4-7)) to the indicators and a diversity score derived based on the cumulative total, with a maximum possible score of 30 (Table 3).

Table 3 Quantification of key indicators for calculation of diversity score

Indicator	Born overseas (%)	Proficiency in English (not proficient in English(%))	# of different regions of birth (1-9) within LGA community	most dominant region represented (%)
Score	1-10	1-10	1-5	1-5

Consideration was then given to the number and type of active gardens in each LGA, differences (furthest from median), population density, population growth, population growth for persons born overseas and housing type. Ultimately, the six LGAs were selected as three diverse and three homogenous LGAs, with the number of (active) gardens greater than the mean for all LGAs (active gardens n>5).

3.3 Results

Descriptive analysis and the examination of spatial distribution of indicators was conducted for key demographic data. Of the 32 LGAs represented in the data, 21 had a proportion of the population born overseas greater than the mean (29.9%). The LGA with the highest proportion born overseas was Greater Dandenong (57.6%) and the lowest (Mitchell Shire (11.5%). The number of regions represented in each LGA varied from 9 (highest possible) to 3 (median 6), with the region most dominantly represented in the greatest number of LGAs being North West Europe. This was also the region dominant in all LGAs with a lower score for diversity. The proportion of the demographics speaking a language other than English at home ranged from 64.5% (Greater Dandenong) to 5.4% (Mornington Peninsula), with 50% (16) LGAs represented above the median. The median proportion of residents "not proficient in English" was 9.5% with a range of 2.1% in the Mornington Peninsular to 24.5% in Greater Dandenong, with 23 LGAs above the median.

Median population density was 1,528.5 people/km^2 - with a range of 16.6 people/km^2 in Mitchell to 5,624.4 people/km^2 in Port Phillip. These data are also reflected in housing type, with a greater proportion of the population living in apartment or semi-detached accommodation in LGAs with higher than median population density.

A number of LGAs had interesting data that was also considered in the selection of the six LGAs for analysis. Maroondah returned a diversity score of 16 (16/30 – median 19) but was included in the selection - as although it represented broadly as a moderate diversity LGA, it has a high population growth for people born overseas (10%) a relatively high population density and met all the other selection criteria. This is in comparison to Port Phillip, similarly returning a diversity score of 18 but with a comparatively low population density.

In general, the results indicate a highly diverse community, that could be segmented against a number of key indicators to derive focus on ethnicity, housing or other attributes. The range of results and median value for each indicator is shown in Table 4.

Table 4. Maximum, minimum and median values for key indicators used for classification and assessment of relative diversities for LGAs in Melbourne

Indicator	Born overseas			Language	Population density and growth		Housing				Access to resources	Place based lifestyle	Gardens in LGA
	Total born overseas (B/O)/%	# Regions represented	Dominant country % of total B/O	Not proficient in English/%	Population density (persons/km2)	% pop growth B/O	detached housing %	semi detached %	Apartment %	% residents rent	% dwelling have internet	Av distance travelled from home/km	# gardens in LGA
Maximum	57.60	9	61.24	24.50	5624.40	23.51	93.67	26.27	83.42	72.60	89.20	33.00	17
Minimum	11.50	3	16.24	2.10	16.6	-0.34	8.81	3.32	0.45	16.00	67.80	6.60	1
Median	29.90	8	28.99	9.5	1528.50	2.14	79.10	15.67	4.68	51.40	82.80	14.70	6

For the six LGAs selected for assessment, results are shown in Table 5, with LGAs that have data indicative of higher diversity shown in green, data indicative of greater homogeneity shown in red and where data is not directly related to diversity (but is indicative of other factors under consideration) is shown in grey. Noting where LGAs hold a more moderate or varied classification, this approach offers the opportunity to make other important comparisons in the broader data, particularly those that are not captured in diversity score alone.

Table 5. Classification of key indicators for the six LGAs selected for comparison of demographics and garden networks in more diverse and homogenous demographics in Melbourne.

Indicator	Born overseas			Language	Diversity Score Total	Population density and growth		Housing				Access to resources	Place based lifestyle	Gardens in LGA
LGA	Total born overseas (B/O) (%)	# Regions represented	Dominant country % of total B/O	Not proficient in English (%)	(1-30)	Population density (persons/km2)	pop growth B/O (%)	detached housing (%)	semi detached (%)	Apartment (%)	Residents renting (%)	Dwelling has internet (%)	Av distance travelled from home (km)	# Gardens in LGA with >5 score for activity
Merri-bek (Moreland)	33.90	8	26.84	15.30	21	3704.70	0.30	56.28	26.27	16.63	58.40	84.80	10.70	8
Maribyrnong	40.00	9	33.75	19.50	24	3041.80	1.01	51.09	24.34	23.57	63.70	79.70	11.00	3
Port Phillip	31.40	9	16.24	6.40	18	5624.40	1.29	8.81	23.86	65.84	67.40	72.00	8.40	6
Maroondah	23.10	7	28.14	12.20	16	1944.30	10.00	88.90	8.44	2.35	54.10	82.90	16.40	5
Yarra Ranges	16.30	4	53.37	4.30	7	64.80	0.00	92.34	10.00	3.53	32.70	83.60	20.10	3
Mornington Peninsular	17.80	3	61.24	2.10	7	233.20	-1.66	84.22	3.58	4.68	43.00	80.70	22.00	9
Median	29.90	8	32.05	8.90	19	1449.80	5.29	83.57	12.72	3.53	49.50	84.00	15.50	2

Examining the spatial distribution of key indicators in GIS, also offers a visualisation of the relative diversity across and between LGAs in Greater Melbourne and supports examination of relationships between demographic data distribution, garden location, activity and networks.

Figures 4 and 5 offer visual comparisons for differences and commonality between proportion of the (LGA) demographic born overseas and proficiency in English, and Figures 6 and 7 capturing the six LGAs selected, diversity score and garden location and activity.

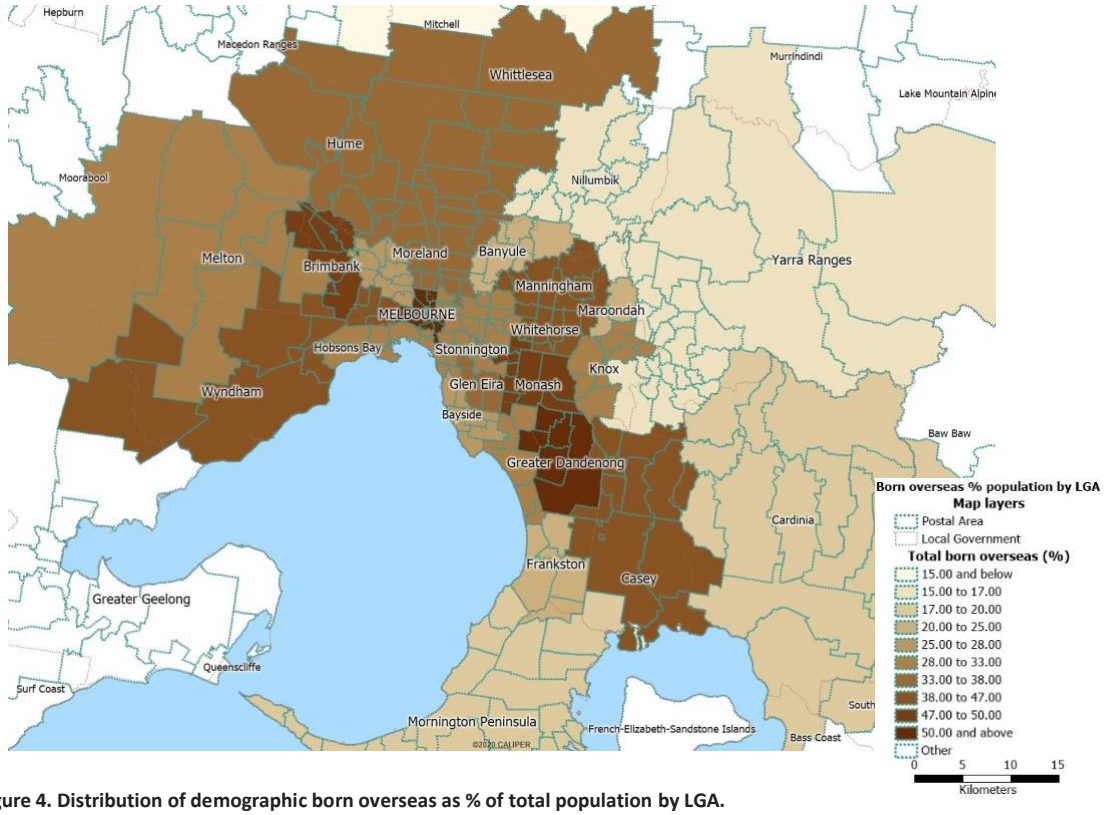


Figure 4. Distribution of demographic born overseas as % of total population by LGA.

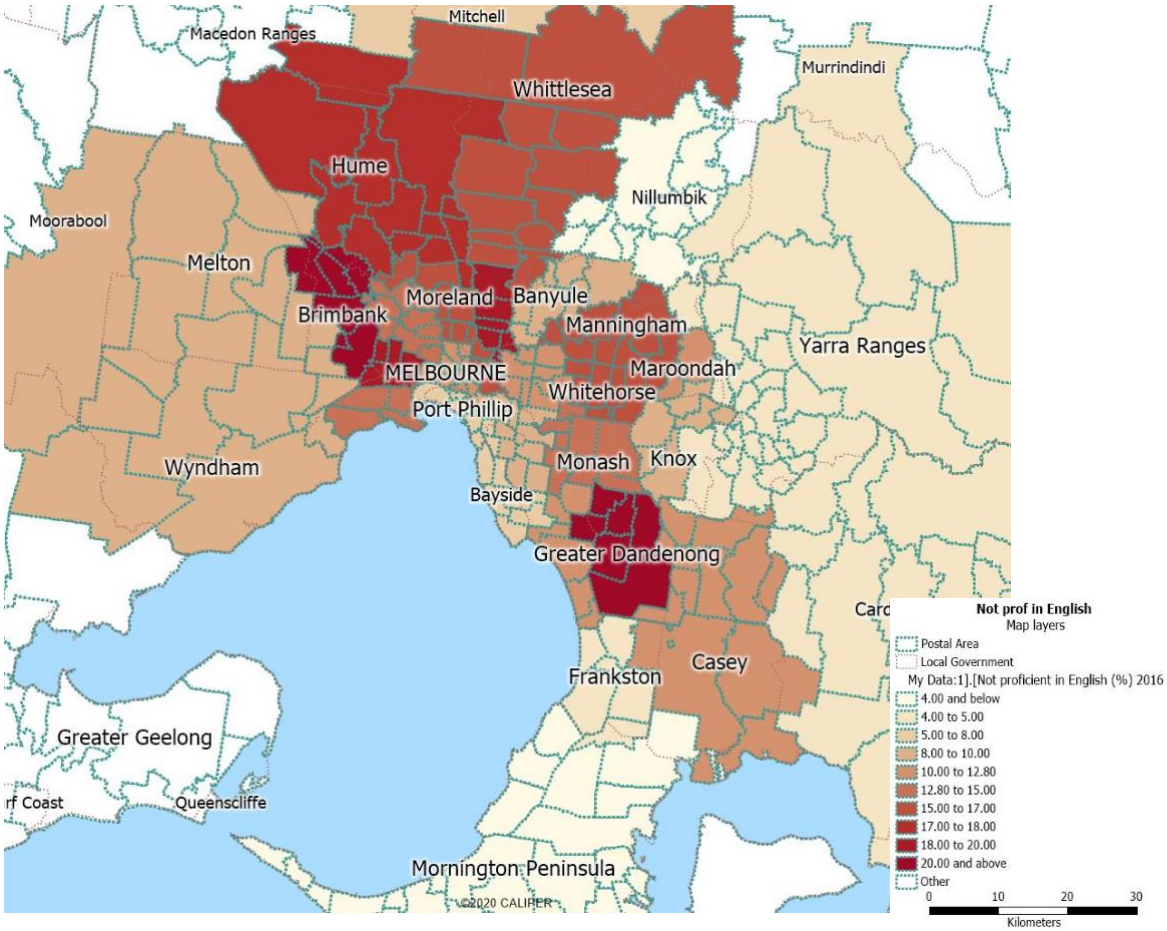


Figure 5. Proportion of demographic identifying as not proficient in English (%)

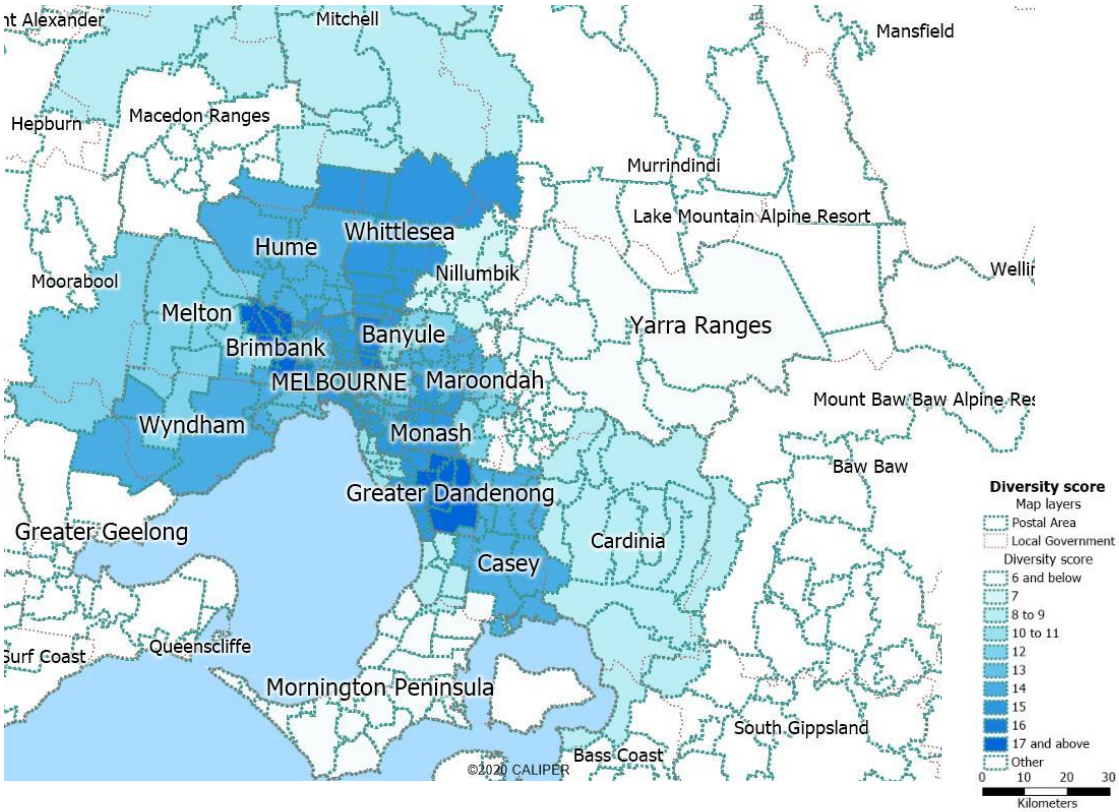


Figure 6. Diversity score across all LGAs

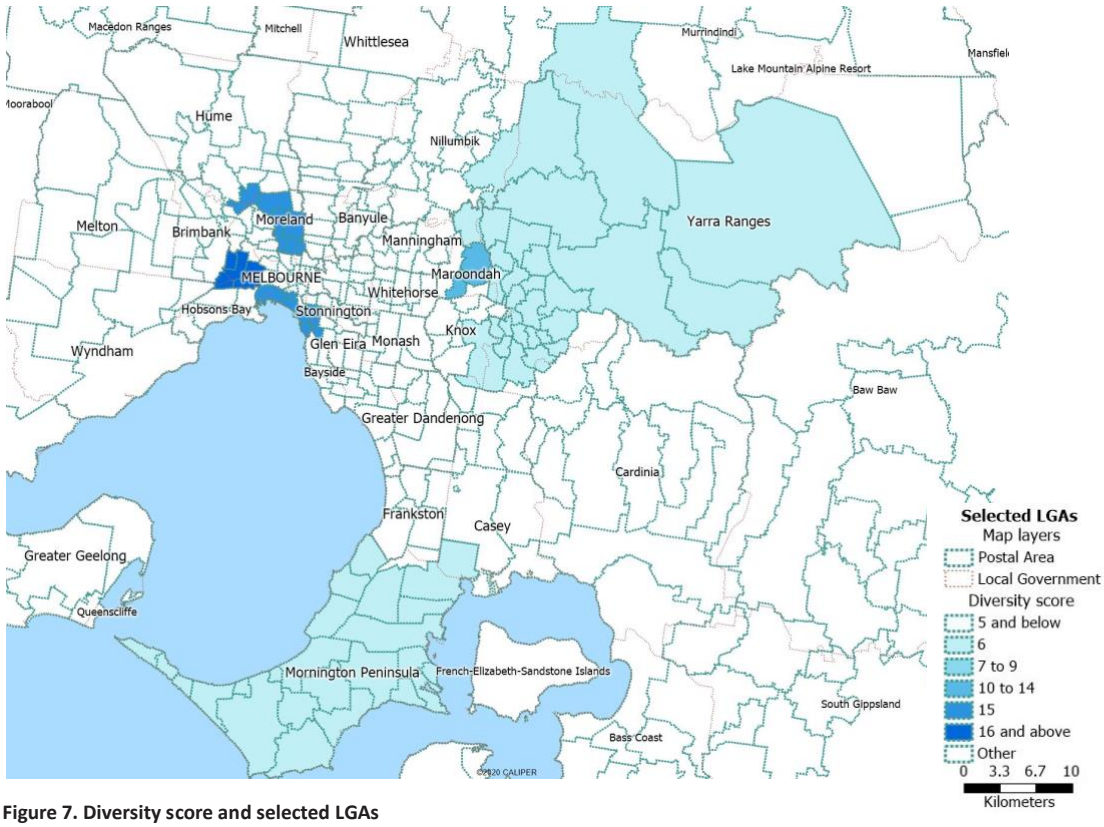


Figure 7. Diversity score and selected LGAs

(Note: a slight difference in scale/colour density between the two graphs was used to accentuate the relative differences for LGAs shown in each)

3.4 Discussion

The ABS data offered a wide variety of data types and easy access to this open-source data online for discrete analysis and mapping. The indicators available, and those that were chosen to represent diversity in this data set, are broadly consistent with those in the literature and offer a reasonable level of granularity for analysis at the level of LGA consistent with other aspects of our methodology and approach.

The LGAs ultimately selected for further assessment may not be the most or least diverse based on the diversity score alone, as these selections attempted to capture indicators for diversity, inclusive of and focussed on ethnicity and language, but considerate of other demographic factors. Importantly, the final selection considered garden numbers and activity of gardens, to ensure that data collected in the physical garden assessments and interviews was reflective of the broader garden community and not biased by low member engagement or activity.

However, it is likely that nuanced diversity is not visible in the data where clustering of demographics occurs - based on factors such as ethnicity, age, housing, etc. This could be likely for larger LGAs that are reasonably diverse and are located towards the outer boundaries of Greater Melbourne, such as Whittlesea, Casey, Wyndham and Hume where there may be greater differences between inner aspects of the LGA and those represented in the outer suburbs. However, this is also possible and known to occur in discrete areas of inner Melbourne, such as the Inner North and Central districts. The significance of this for integrity of outcomes will depend on the potential impact against other criteria for assessment, in this case community garden memberships. In general terms, it is expected that there is a high level of integrity in the application of this data in the context of this project, particularly given the range of indicators used and as this data is ground-truthed and further analysed through local knowledge, garden assessments and interviews.

Given the focus in this work on ethnicity and language as key elements for understanding appropriate communication strategies in extension, the data supported some quantification and mapping of diversity across all LGAs. Derivation of a diversity score facilitated some objectivity in selection of the six LGAs for further assessments. However, the integration of data for housing, population, and travel, as well as garden activity, location, access and type, all ultimately contributed to final selections and engagement. The level of analysis and activity required to ensure without doubt that an appropriate process in quantification and application of these data to this context is well beyond the scope of this project, given its budget, timeframes and multifaceted approach. However, a more objective and applied statistical methodology may be more appropriate for a larger and more intensive exploration of these concepts.

Population density and housing type offer proxy indicators for likelihood of engagement with community gardens – as it is hypothesised that community gardens may be more common, and the community of an LGA may be more drawn to participate in a community garden if they have less access to growing area at home. The inclusion of travel distance offered interesting insight and was consistent with the hypothesis that people living in higher density environments, assumed to have more services close to home, travel shorter distances for work and leisure. These factors could be further assessed by examining the relationship between population density and numbers of gardens, size, relative location within the LGA and garden memberships (possible and actual). Further investigation of these attributes of communities against location, type, activity, governance and reach (including online presence and activity) of community gardens would be interesting for future works and could provide considerable insight into what factors contribute to community garden attributes such as resilience, abundance and sustainability.

Ultimately census data offers a valuable resource to quantify, classify and analyse demographics, and for this project, offered a data source accessible for any context (region, city, demographic) with a high level of integrity from which selection of communities for further engagement in the project was supported and possible.

4.0 Community Garden data update and comparison 2020-2022

4.1 Background

Garden data collected in the previous project (2019-2020) (Lye & McGregor, 2020) was updated in October 2022, with a new score aligned for each garden, indicative of a relative level of activity for the garden (including on social media) across the period between July 2020 and October 2022. This data offers insight into how garden activity changed over this period and may offer as a proxy for the relative resilience of gardens or relationships between demographics of LGAs, and sustained or diminished garden activity across a time when many community activities were affected by COVID. This activity score was also considered for selection of the six LGAs for garden and community assessment, as it was important for this work to ensure the garden membership was active and representative of their "normal" post COVID.

4.2 Methodology

The previous project collated data from a total of 231 urban (176) and peri-urban (55) gardens across local government areas in Greater Melbourne. The dataset was compiled from open source, individual community garden data, local council data and national and institutional databases, such as those compiled by key organizations supporting community garden networks and urban agriculture (e.g. Australian Community Gardens Association and local council databases). To capture the differences across gardens, LGAs and communities (demographics), the 2020-2022 database was revisited and an "activity score" allocated based on social media and other activity for the period July 2020 - October 2022. A scoring range of 1-10 was applied using the following framework:

- Score 0 – no activity visible since early 2020
- Score 1 – sporadic posts and minimal other activity
- Score 5 – one post per month and some evidence of physical garden activity
- Score 10 – one post per week and evidence of regular garden activity

Notes regarding where activity had taken place (e.g., social media, in person/in garden workshops) and the type of activity was also captured in text fields in the spreadsheet.

Updated information was captured for garden membership, social media numbers and activity, website activity and contact information and significant changes in status such as governance or location. Implicit within this is the gardens' ability to continue to support and engage their membership through COVID and how quickly and easily they returned to their "normal" activity once restrictions were relaxed and/or local communities were comfortable to return to community activities. These data were also updated for 2022 and reported in a new section for comparison with "activity score" and the findings of the physical garden assessments.

4.3 Results

A total of 88 of the 205 gardens assessed for activity between July 2020-October 2022 returned an activity score of >5. Five LGAs had zero gardens with activity scores >5 and three LGAs had gardens with zero activity on social media. The total combined virtual (social media) membership of all gardens across all (32) LGAs was 143,093. This is a reduction of approximately 16% compared to data from the previous project (2020). Relationships between garden size, type and activity, demographics of LGAs and other LGA and garden attributes were not formally explored in this project, as the activity score primarily served to assist selection of LGAs and therefore gardens within these for further assessment.

In compiling the gardens database (2020 and 2022), the opportunity to capture the diversity of intention for community gardens represented as garden type, was explored. Information for garden membership numbers, garden size and reach was also captured in 2020 and 2022 data, supporting comparisons across time, between and within LGAs and garden classifications. However, formal analysis of these data was beyond the scope of this project.

The spatial distribution of gardens across selected LGAs and their relative activity (score) is captured in Figure 8 below.

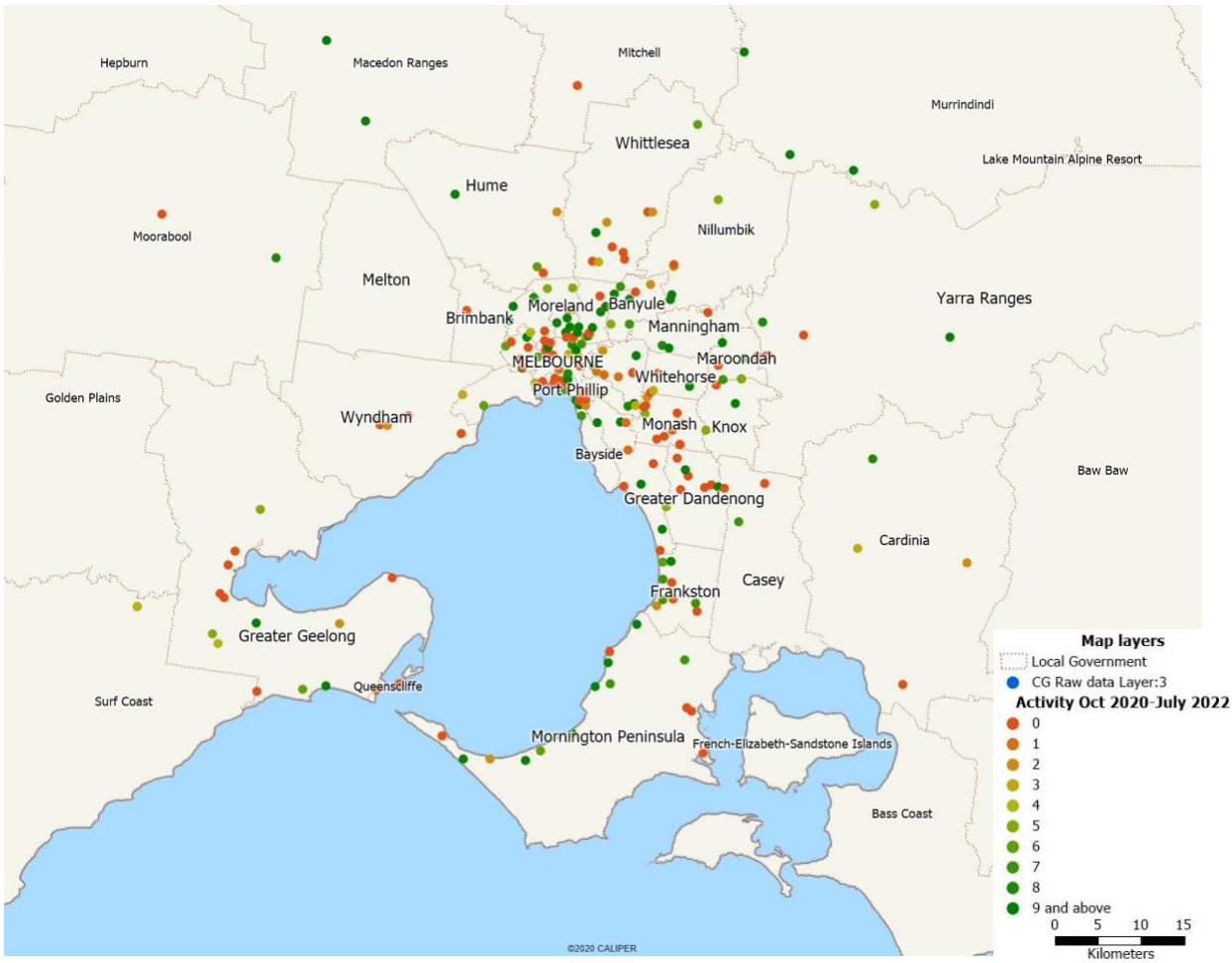


Figure 8. Spatial distribution of community gardens in Melbourne (colour coded for level of activity)

4.4 Discussion

Assessment of garden activity via member engagement through social media demonstrated that even when face-to-face garden activities were not possible or supported, some gardens remained very active on social media and therefore had the capacity to remain more strongly connected to their membership via these virtual means. Hence, applying an objective classification to garden activity across the 2020-2022 period supported the selection of gardens for physical assessment and interviews, with knowledge that there was an inherent level of member engagement and activity in these selected gardens. However, the limitations of this assessment are also acknowledged, in that not all member engagement avenues were captured i.e., where gardens communicate via email, newsletters or other community channels not visible or apparent to this project.

The project team were also aware that for some gardens a return to “normal” activity may have been delayed or more gradual, due to a “hangover” from restrictions associated with COVID, members taking variable lengths of time to feel comfortable in an in-person setting and seasonal drivers including weather and optimal planting times. As such, for other applications, capturing and analysing this data over time would be a more appropriate measure. This is particularly the case for investigating this (or similar) data as proxy for attributes such as garden resilience or community cohesiveness and when analysed in conjunction with other data types and sources, such as local government policy or community network activity, that may contribute to variability in these outcomes.

5.0 Local plant management knowledge and knowledge needs survey

5.1 Background

In investigating the current and potential role of community gardens as learning nodes in the local community, it was important that this project included the capture of data that indicated gaps and confidence in relation to knowledge of key topics relating to growing healthy food plants. Collecting such data and cross-checking it against educational offerings from community gardens supports a path to better understanding the strength of alignment between these grass-roots learning and engagement nodes and local knowledge needs.

5.2 Methodology

To understand how confident Melbourne gardeners feel about plant management and to gain a sense of common knowledge gaps among Melbourne gardeners, a short online survey was run between August and November 2022. Survey questions are displayed in Table 7 and Appendix 1. All community gardens with either email or social media contacts that were publicly available were approached to promote the survey through their social media networks. On this basis the survey was sent to a total of 189 gardens through late August and early September. In a second round of engagement, postcards with a QR code linked to the survey were also placed at Bunnings outlets in six suburbs and handed out at two plant fairs (Community Gardens Australia National Gathering 2022 and Yarra Valley Plant Fair). The survey design supported completion in 3-5 minutes and to be highly accessible via a smartphone.

Table 7. Knowledge survey structure

Item	Question	Answer
Location	In what Local Government Area are you located?	Checkbox of LGA
Growing preferences	What best describes your gardening activities?	Multiple choice (one answer allowed from three options)
Growing preferences	Do you grow any of the [plant families] below?	Checkbox of multiple plant families (no limit on answer)
Level of local engagement	What is your affiliation with your local community garden?	Checkbox of multiple scenarios (no limit on answer)
Level of knowledge/confidence	Indicate how you feel about your current level of knowledge in the following topic areas	Three point scale (answer required for each topic)
Interest areas	What topic areas would you like to improve your knowledge in?	Checkbox (top three topics)
Knowledge sources	When it comes to plant health / growing, from where do you most often source trusted information or advice?	Checkbox of multiple possible sources

5.3 Results

The number of responses received at the close of the survey on 20th November did not support analysis at local government level. Instead, all survey results arising from respondents located across Melbourne were analysed as one dataset. The survey received 59 responses across 17 LGAs in Greater Melbourne with community gardens. The locations of respondents (by LGA) are shown in Figure 9. Responses were collected from residents across 20 LGAs. The proportion of respondents from each LGA was between 1-5%, with two exceptions: the LGA with the highest number of respondents was Glen Eira (27% of responses), which is located in the inner south-east of Melbourne, followed by Merri-bek (previously Moreland) (8.47%), which is located in the inner north of Melbourne. No respondents were located in the LGAs of Banyule, Brimbank, Cardinia Shire, Casey, City of Yarra, Hume City, Macedon Ranges Shire, Manningham, Mitchell Shire, Monash, Moonee Valley, Murrundindi Shire, Stonnington and Wyndham. Other responses were also supplied by individuals in Greater Geelong and Bayside Council.

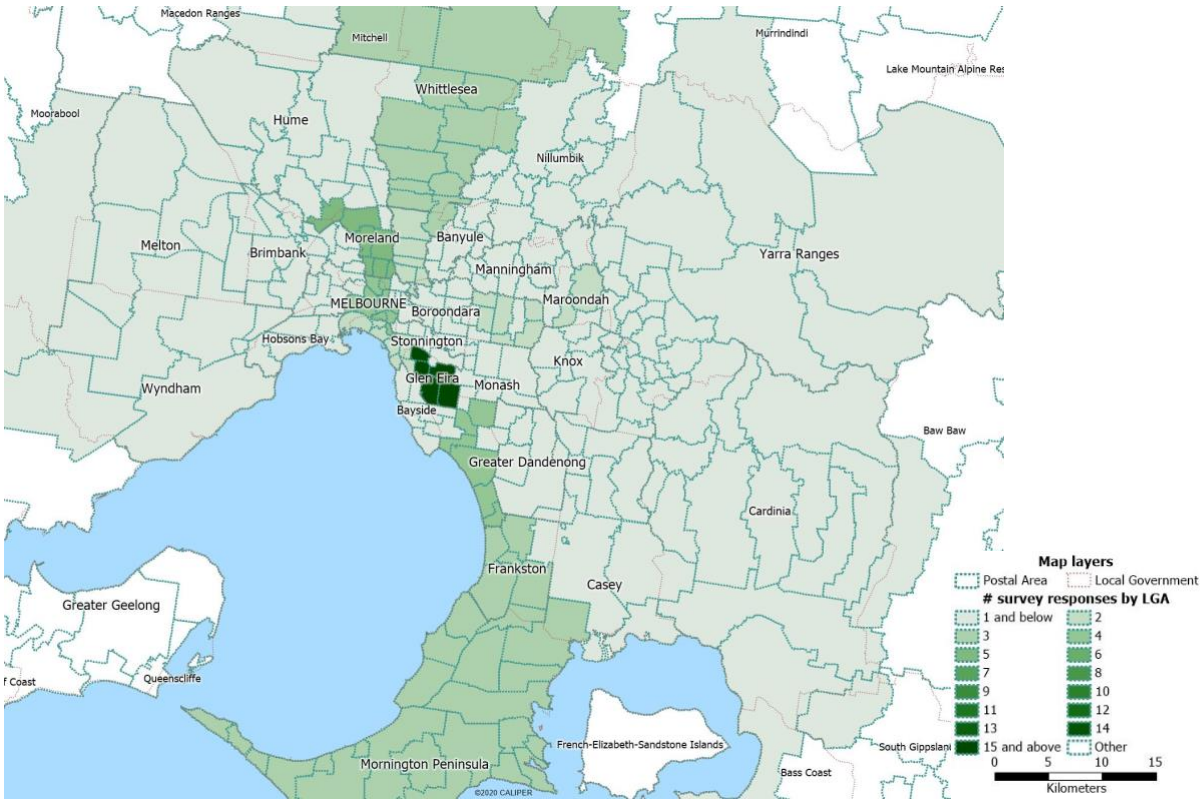


Figure 9. Location for survey circulation and number of respondents across the Melbourne metropolitan area

The majority of respondents (83%) had some affiliation with their local community garden. This affiliation ranged from active members who maintain plots (34%) and contributed to the management of the garden (56%), and less active members who occasionally visited the garden or did not visit the garden at all (10%). Six percent of respondents were not members of a local community garden; however, they followed a community garden on social media. Almost one third of respondents (27%) had attended a training session at a community garden.

The majority of respondents (64%) reported that they grow an even mix of crop and non-crop plants, while 31% reported that they prefer growing crop plants. Only 5% of respondents indicated that they prefer to only grow non-crop (e.g. ornamental) species. In relation to what crop plant species respondents grow, among tree fruit types listed, citrus was the most popular (86%), followed by stone fruit (56%), and fig (39%). Of the vegetables and herbs listed, Lamiaceae plants were the most popular (90%), followed by Brassicaceae, Amaranth, and Asteraceae (83%) (Figure 10).

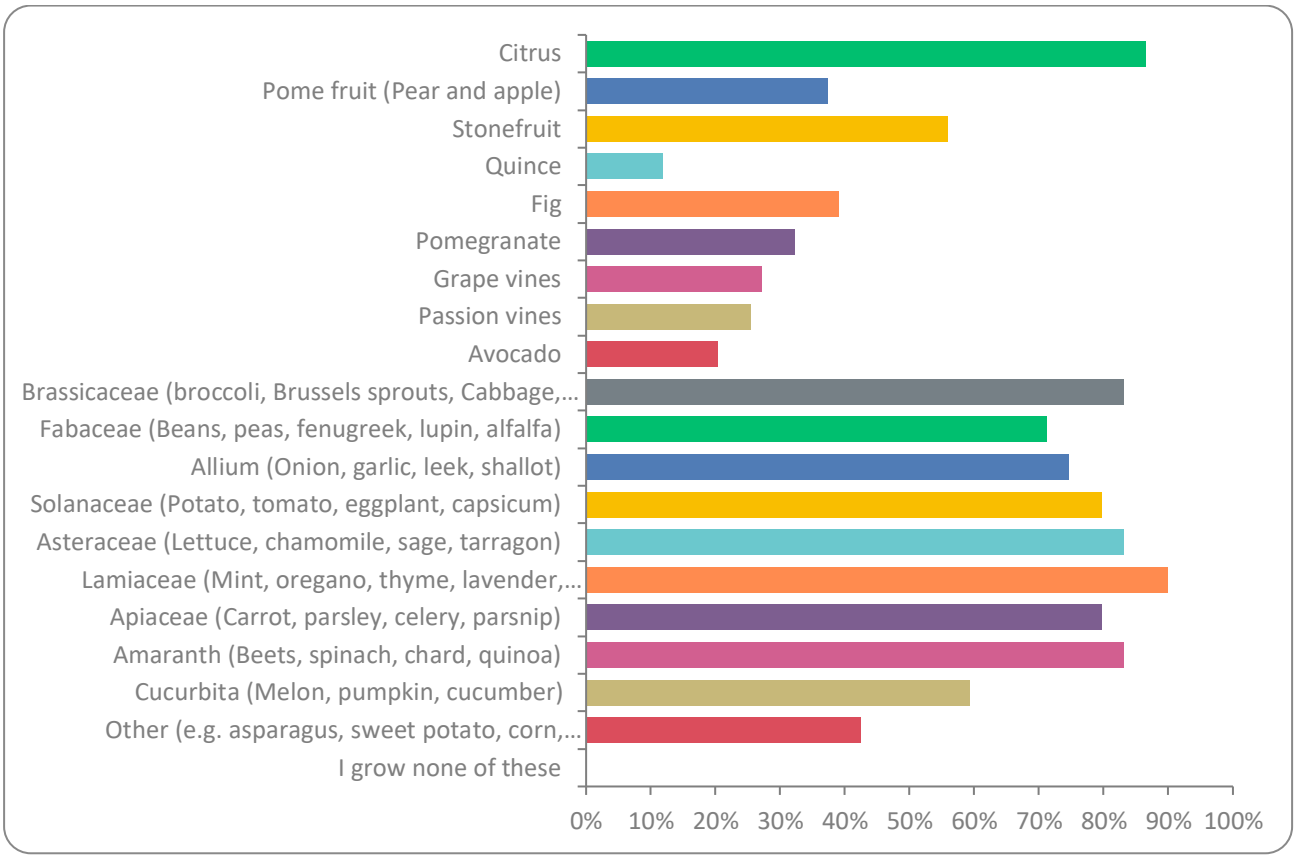


Figure 10. Plant types grown by survey respondents

When asked how they felt about their current level of knowledge across topic areas relating to plant health and management, areas where knowledge level was commonly reported to be low, or where respondents felt they had no knowledge were: beneficial insect identification and husbandry (75%), plant disease identification and management (75%), biosecurity/garden hygiene practices (70%), plant pest identification and management (68%), and pest monitoring (66%). Conversely, areas where the majority of respondents felt that they had adequate knowledge were: food safety (88%), meal preparation/uses for garden produce (86%), harvesting (78%), composting (76%), making seasonal or location specific planting choices (75%), and garden bed preparation (71%) (Figure 11).

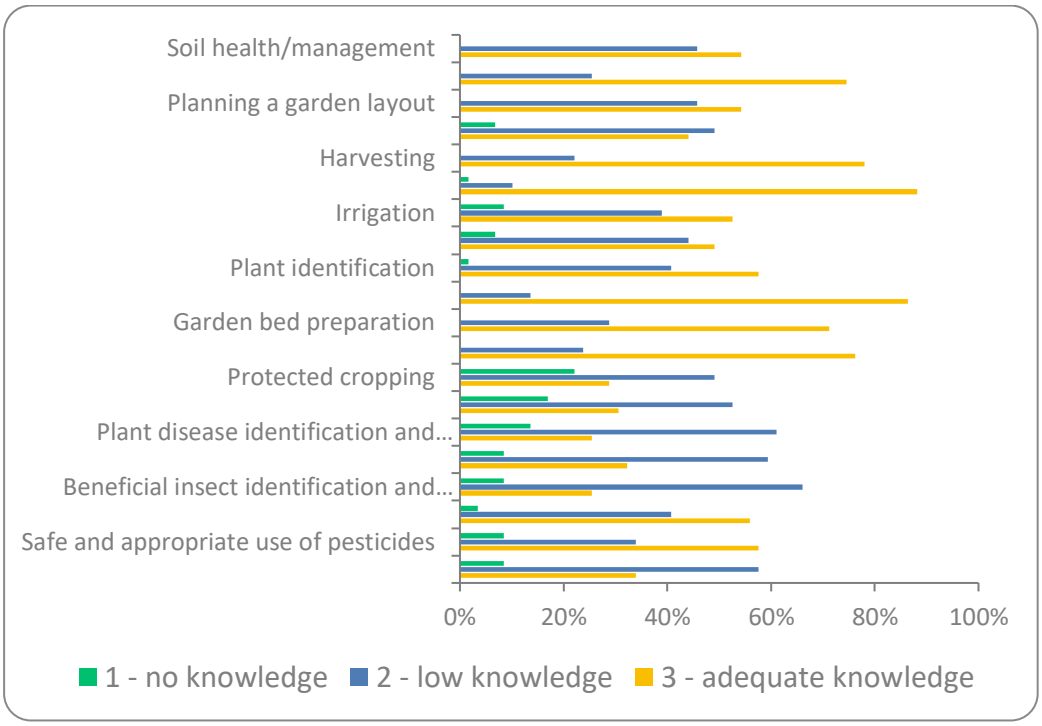


Figure 11. Levels of knowledge by plant health and management topic area

Respondents were asked to choose three priority topic areas where they would like to improve their knowledge. The most popular choice was 'plant disease identification and management' (63%), followed by 'plant pest identification and management' (61%), and 'beneficial insect identification and husbandry' (58%). Topic areas of least interest were 'meal preparation/uses for garden produce' (5%), 'food safety' (7%), 'harvesting' (8%), and 'safe and appropriate use of pesticides' (14%) (Figure 12).

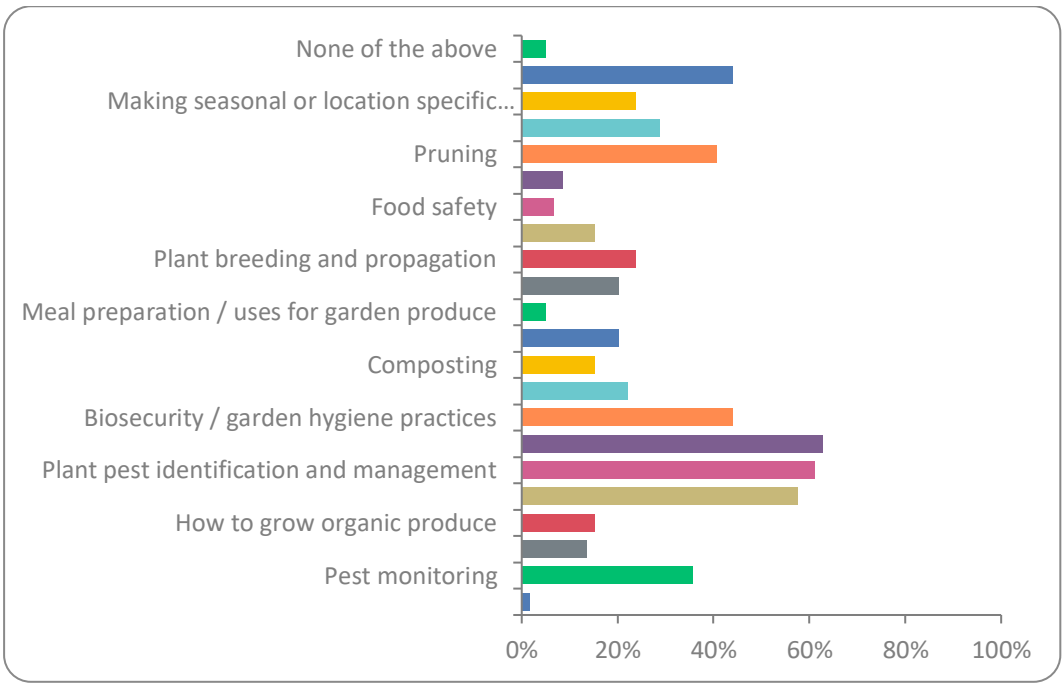


Figure 12. Interest in topic areas for knowledge improvement

Respondents were also asked to indicate what information source is most trusted when it comes to learning about plant health and plant growing. The most popular trusted information source was 'the local community garden' (20%). The local government, state government, botanic gardens, and universities were the least trusted sources of information (5%, collectively). Technical manuals and gardening clubs were evenly represented at 19%. Other trusted sources of information were contributed by 29% of respondents. They included:

- "Read online articles while I am travelling on the train or leisure time"
- "Gardening Australia, but for more in depth also check Agriculture Vic website and books at home."
- "Internet/ Google"
- "Books"
- "Podcasts and Permaculture books"
- "The internet in general, local community members, plus my mother who is a horticulturist"
- "TV Gardening shows and magazines"
- "Variety of sources-permaculture mainly"
- "From permaculture literature, and from colleagues or fellow gardeners with knowledge/experience in specific plants or techniques."
- "Local council resource, nursery, agriculture group also sometimes university, garden clubs for the wider resources and also my experience with records can be one of the most reliable resources."
- "Friends who also garden"
- "Ask other growers, Sustainable Gardens Australia, online resources, sometimes community garden members but not been able to help me or answer my question why I have this problem"

5.4 Discussion

Respondents were spread fairly evenly across the North, East and South Eastern suburbs. However, there was an underrepresentation of respondents from the Western suburbs. Given the limitations of this survey (low number of total respondents), it is difficult to ascertain if this could have been a product of the methods used to distribute the survey or what other factors have contributed to this outcome. However, it was noted in the previous study that the Western suburbs of Melbourne are lacking in community garden networks with high interconnectivity and reach (Lye & McGregor, 2020).

Linkages to local community gardens were evident among respondents and this was most likely a product of the method used to attract survey responses (community garden social media). Despite this, only 34% actively gardened at community plots. This indicated the most likely alternative is that most respondents actively gardened at home, and derive other value (not discerned in this short survey) from being connected to a local community garden.

Specific knowledge gaps were very evident from the survey. Biological and ecosystem related topics, such as identification of pests, beneficials and diseases as well as pest monitoring, were areas where knowledge is low. From the perspective of maintaining effective integrated pest management in home gardens, this is concerning. Good knowledge of species lifecycles (both pests and beneficials) is required to effectively manage and steward these species. Such low knowledge levels will impinge the ability of residents to detect anything unusual in home or community gardens, thus reducing potential to detect exotic species early. This is a plant health issue in a city such as Melbourne - a major Port of Entry, where the risk of exotic pest entry and spread is higher than inland locations. A deeper understanding of if and how people are accessing information on these key areas, and what resources and support are available to these communities, (for example in comparison to commercial growers, where access to technical advice from agronomists, entomologists, and industry development officers is comparatively easier), would assist in understanding the needs of garden communities and offer insight for the development of strategies to address these gaps.

The proportion of respondents growing crop plants was high in comparison to gardening for aesthetic purposes, which indicates that information about plant health and crop management may be well received and used by home and community gardeners in Melbourne. High interest in growing Lamiaceae, Brassicaceae, Amaranth, and Asteraceae strongly

reflected the planting choices observed during community garden mapping. Interestingly, the proportion of respondents who grew citrus was extremely high, while citrus observed at community gardens during the mapping exercise was relatively few and those citrus trees observed at community gardens were generally of poor health.

Such a high density of one crop species, such as citrus, in an urban area raises potential plant health implications - if knowledge of plant management best practices for that species are low. One example of a plant health issue that has emerged in Melbourne in recent years is Citrus gall wasp (*Bruchophagus fellis*) a native insect native to coastal regions around the border of Queensland and New South Wales. Adequate control of this pest requires knowledge of the pest lifecycle, and coordination between close neighbours to manage it effectively. As a future activity, it would be interesting to investigate if the general health of tree crops such as citrus were of higher health when found in private gardens – an urban forest of low health citrus trees would be of higher risk of harbouring exotic pests and diseases.

Topic areas of interest for further improvement strongly reflected knowledge gaps, and those topics for which there was less interest in improvement strongly reflected where knowledge was already high. To facilitate learning, particularly in topic areas that are more challenging for gardeners, there is the potential to integrate biological and ecosystem knowledge into information with which residents may be more familiar (e.g. information/education on use of produce and recipes may be paired with pest management to grow higher quality produce for recipes). In this way residents may be eased into learning about topics that may seem intimidating due to the breadth of information currently available, and the technical nature of that information.

High impact delivery mechanisms for topics of interest or importance are also indicated by the answers to the final question of the survey, which investigates use of trusted information sources. Among respondents, resources such as horticulture books, as well as accessing advice from other gardeners were the most popular sources of trusted information on plant health and plant management. This is in line with findings and recommendations made in the previous study (Lye & McGregor, 2020), which demonstrated the relatively untapped power of grey (grass-roots) communication networks for raising collective knowledge of plant health. The relatively high proportion of respondents who had attended training delivered by their local community garden (27%) also indicates the success of, and appetite for, in-person grass-roots education pathways.

6.0 Mapping the breadth of community garden types across low and high diversity localities (physical surveys of gardens)

6.1 Background

At the outset, project personnel hypothesised that community garden operational and physical structures would be likely to vary both within and across Local Government Areas (LGAs) and that in turn, governance, operational and physical structures of these gardens are likely to influence the type of role that each of them may play as educational platforms for plant health. Common operational structures include:

- Garden open to the public with public, shared plots.
- Garden open to the public with private/allocated plots.
- Closed to the public, membership-based with shared plots.
- Closed to the public garden, membership-based, with allocated plots.

These different operational structures, and the offerings of each garden type, i.e., the role played by each garden type in the local community, was investigated through selected interviews (Section 7). However, physical garden offerings – through the types of plant species commonly grown, to garden facilities and garden guidance resources – will influence the level of interest that the garden receives from the broader community and the retention of active participants. To understand commonalities and differences in garden offerings from a physical stand-point the project team undertook a garden mapping exercise.

The purpose of this exercise was two-fold:

1. To capture the extent of diversity in planting choices across LGAs and garden types.
2. To understand the breadth of resources and facilities available at community gardens and assess these against diversity of demographics in LGAs and garden type. Examples of resources and facilities included in the assessment included but are not limited to: on-site guidance materials and garden infrastructure, plot number, growing and composting resources.

In addition to completing the physical garden assessments the opportunity and expertise existed within the project team to trial the use of aerial imagery technology and location data, utilising software that presents frequently updated, high resolution imagery of specified sites and locations. The integration of this tool was to determine if it is possible to replace or augment an on-the-ground, resource heavy exercise such as garden mapping with a comparable virtual activity and identify potential for future use, including its limitations and applications.

6.2 Methodology

6.2.1 Physical garden assessment, resource and infrastructure mapping

The spatial analysis of demographics resulted in a determination of relatively low and high areas of diversity across Melbourne. From this dataset, six LGAs were chosen as representative for low and high diversity localities. For each of the six localities, three community gardens were chosen as sites that would undergo physical mapping. Informing this selection was the knowledge that a variety of types of gardens had been classified in the community garden dataset (Figure 13). Therefore, gardens were selected based on:

- Activity score (>5) (section 4.3) - A high likelihood that they had remained an active organisation following COVID lockdown measures;
- Diversity of operational structures (a mixture of membership-based and open to the public were targeted); and
- The intention to capture a broad geographic spread of gardens across each LGA.

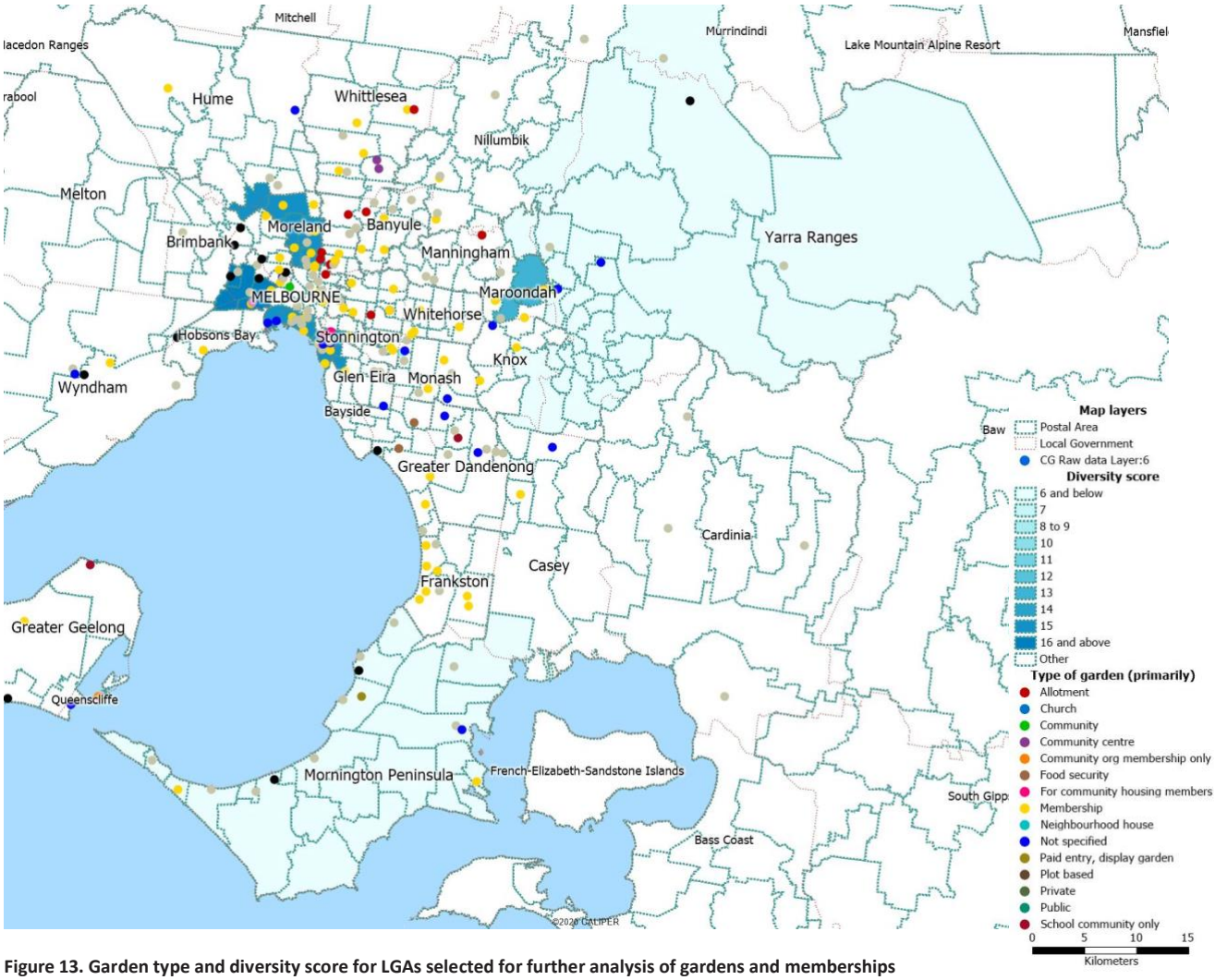


Figure 13. Garden type and diversity score for LGAs selected for further analysis of gardens and memberships

Gardens were physically mapped during September - November 2022 as this is a time of year when it was expected that gardener activity and new plantings would be high. The physical garden assessment included a review of available infrastructure and guidance material, as well as an assessment of plants grown. To guide mapping, a checklist was followed (Table 8 and Appendix 2): Data gathered from each site was compiled and analysed in Excel.

Table 8 Garden assessment domains (the full checklist is found in Appendix 2)

Category	Item
Growing area	Total garden size Number of plots Average size of plot Structure of plots
Inputs	Irrigation Water source Growing media
Plantings	Average number plants per plot Average number plant types per plot Plant types grown
Guidance / education	Guidelines and information Signage Language/s used

6.2.2 Results – physical garden assessments

A full capture of results from the assessment across 18 gardens and six LGAs is provided in Appendix 3. Figures 14 & 15 provide pictural examples of garden infrastructure, garden layout, plot design, composting infrastructure, composting initiatives, and other planting media.

In summary, the most common plant families grown across all community gardens were Brassicaceae and Asteraceae, which were found at each garden surveyed. Of Brassicaceae plants, broccoli and kale were frequently grown. Of Asteraceae, lettuce was the most common plant grown. Apiaceous plants were found at 17 of the 18 gardens, with parsley being abundant at these sites. Amaranth plants were also popular, in this case chards were commonly grown. Fabaceae were found at 15 out of 18 gardens, and these were commonly represented by peas. Lamiaceae was slightly less common across gardens (found at 11 of 18 gardens) and this family was commonly represented by mint and rosemary. Of the tree fruits, citrus was the most common, occurring at 15 of the 18 gardens visited, although overall tree fruits were scarce across the gardens. Cucurbits were the most uncommon vegetable family across gardens. It was generally observed that open to the public gardens had less plant diversity than closed to the public (membership-based) gardens. In the case of open to the public gardens, Brassicaceae and Asteraceae tended to be found in high numbers, possibly as a result of self-seeding or ease of growing and accessibility for gardeners of different knowledge levels.

Growing practices were similar across gardens, with an emphasis on low chemical use and growing in raised beds or containers. Hand hosing and use of mains water was the most common method of irrigation. Sixteen of the 18 gardens made their own compost on site, with several gardens acting as a hub for local community composting.

Figure 14. Examples of community garden layouts and plot design.

In terms of educational, engagement and guidance material on offer at each garden, the extent of materials varied. The most common guidance material / signage related to composting, followed by signposting of plant types. All materials and signage were in English, with one garden also supplying pictorial signage.

Table 9. Educational and guidance materials offered on-site at 18 community gardens in high and low diversity localities, and languages used (D = diverse, H = homogeneous)

	Materials	Languages
Port Phillip (*D*)		
Garden 1	1 x signage for regular gardener meetings; direction on use of seed swap scheme	English
Garden 2	Compost guidelines	English (pictorials too)
Maribyrnong (*D*)		
Garden 3	Compost guidelines, garden hygiene guidelines	English
Garden 4	Garden hygiene guidelines	English
Garden 5	Garden hygiene guidelines; Signposting for facilities	English
Merri-bek (*D*)		
Garden 6	Compost guidelines; Biosecurity/ garden hygiene guidelines; signposting for facilities	English
Garden 7	Compost guidelines: Garden hygiene guidelines: Signposting for facilities	English
Garden 8	Factsheet / Information posters: Signposting for facilities (signage for plants)	English
Maroondah (*H*)		
Garden 9	Crop signs	English
Garden 10	Compost guidelines	English
Garden 11	NIL	N/A
Yarra Ranges (*H*)		
Garden 12	Crop signs	English
Garden 13	NIL	N/A
Garden 14	Crop signs	English
Garden 15	Community notice board with various fact sheets and event announcements.	English
Mornington Peninsula (*H*)		
Garden 16	Compost guidelines; Biosecurity/ garden hygiene guidelines; signposting for facilities.	English
Garden 17	Schedule and site map; working bee signage	English
Garden 18	Information on workshops to be organised by council; Compost guidelines; crop signs	English

Figure 15. Examples of composting infrastructure, composting initiatives, and other planting media.

6.2.3 Discussion

This practical exercise allowed the project team to understand planting choices, growing knowledge gaps and also, what practices are followed in terms of plant care and garden hygiene, and if the garden is providing appropriate on-the-ground signage, guidance and resources to cater for local cultural diversity.

In conducting the mapping exercise, the priority placed on creation of growing media on site, through composting was apparent. Most educational signage associated with the gardens were related to composting methods. In several cases, composting programs were available to access by the wider local community (including non-members), which represents one mechanism by which these gardens are extending educational reach outside of the immediate membership or regular volunteers. This also represents an opportunity to connect with people in the local community who have no interest in gardening on the site, but perhaps do have an environmental motivation to compost their food waste.

As one example of an expansive composting initiative, the Community Alliance in Waste Reduction and Sustainability (CAWRS) was a feature at several gardens visited. CAWRS sourcing funding from Sustainability Victoria via a 'Recycling for Communities' grant. CAWRS hubs are now found at community gardens, neighbourhood houses and businesses across Melbourne's eastern and southern suburbs. The initiative aims to:

- Help community gardens lead the change to reduce waste
- Improve accessibility of messaging
- Build greater awareness for what it means to 'Care for Country'

Other garden signage was limited, and usually was not educational in nature, but rather tended to provide information on upcoming events via a community noticeboard. While one garden included pictorials on the signage, all other signage was delivered in English. This was an unexpected result, particularly for those gardens identified in localities with diverse communities, as it was assumed that at least to some degree, the diversity in the community (language and ethnicity) would be more reflected or apparent in the gardens and their community engagement.

Planting choices were very similar between gardens located in high diversity areas and those in low diversity areas. However, when considering garden types (open to public vs membership only/closed to public), in general there was less plant diversity found in gardens that were open to the public. The maintenance of these gardens tended to be reliant on local volunteers but not necessarily volunteers who were formal members of an organisation, for example an Incorporated Association (a common garden structure). In the gardens with lower plant species diversity, Lamiaceae (mint), Amaranth (chards), and Asteraceae (lettuce) were abundant. This may be a result of self-seeding, (lower) cost of planting and low maintenance requirements.

6.3 Use of virtual mapping tools for spatial analysis of garden location, and suitability as monitoring and surveillance nodes

6.3.1 Background

The original intention of the application of aeriel imagery technology in this project was to determine if efficiencies in garden assessment and streetscapes were possible through the application of existing software and technologies. As whilst the physical garden and streetscape assessments provide valuable information into garden infrastructure, practices, resources, culture and community, there are limitations with respect to the time these assessments take and the need for personnel to be available to travel to garden locations - rendering that methodology impractical for remote assessment of similar contexts (e.g. at national scale or of regional communities from an urban based organisation). Broader application of these and similar technologies (artificial intelligence and machine learning approaches) in a biosecurity context is also emerging, having already been applied or researched for contexts such as remote sensing for urban forest biosecurity (Carnegie et al., 2022) and for biosecurity surveillance in the livestock sector (in progress).

6.3.2 Methodology

Gardens that had been selected for physical assessment were viewed in Nearmap™ (aeriel imagery technology offering high resolution, imagery of sites and locations). These assessments literally provide a birds-eye-view of the surrounding landscape, and support assessment of total garden area, growing areas and infrastructure and some appreciation (based on relative height and density) of the types of plants grown and changes to garden activity over time. Exploration of the context in which gardens are situated (suburban housing, industrial areas, commercial growing areas, transport hubs or networks etc) is also possible offering the opportunity for quantification of the relative value of gardens as surveillance nodes.

6.3.3 Results

Data was compiled for garden size, growing area, plant types, activity over time and garden infrastructure for gardens physically assessed in all 6 LGAs. However, when compared to physical assessments the integrity of this data did not support its broad use in this context, as limitations were identified for calculation of garden areas obscured by trees or heavy vegetative cover or where gardens were proximal to large buildings. On this basis the data are not formally reported here.

6.3.4 Discussion

Assessment of pest establishment risk in urban areas is heavily reliant on accurate identification of plant species. In a landscape with many land managers, a diversity of gardening interests, and many varied landscape features, this is a challenging activity. However, in recent years efforts to improve plant biosecurity surveillance in urban environments through new imaging and mapping technologies has gained ground.

The City of Melbourne now displays the entire (public land) urban forest for that locality on Urban Forest Visual (http://melbourneurbanforestvisual.com.au/), which is an initiative under the City of Melbourne Urban Forest Strategy. This initiative is not only useful for supporting biosecurity surveillance design, it is also an engaging plant health education platform for local residents.

Aerial mapping of urban forests and concurrent imaging of plant health using hyperspectral imagery is another research and development area that holds great promise. This is an approach that may be useful in not only identifying tree species at the level of the individual, but also tracking potential onset of disease or pest feeding symptoms over an extended period (months to years) (Carnegie et al., 2022). Application of this technology in high density urban areas has the potential to greatly enhance biosecurity surveillance operations during pest incursions or for the purposes of early detection by identifying areas of highest risk and supporting targeted, complimentary, on-ground surveillance activities.

7.0 Consultation to understand the extent of garden engagement activities - Community Garden Member Interviews

7.1. Background

We complemented findings of the physical garden assessment and garden member survey through direct consultation with key community garden committee members. The aim of this approach was to better understand what factors contributed to the attraction of members and volunteers to a particular garden, to ascertain if the community garden membership or volunteer demographic reflected that of the wider community, and to identify the level of education and training opportunities offered across gardens.

Structured interviews were conducted with members of gardens that were physically surveyed, within the six LGAs of interest. The interview guide is included in Appendix 4. The interview was conducted by the project team member

conducting garden assessments in that LGA. Interviews were conducted face to face during garden visits or over the phone. The structured format of the interview ensured a consistent approach between project team members and reduced any possible differences in interviewee experience. A total of eight interviews were conducted with at least one interview conducted per LGA. Interviewees were selected to be knowledgeable garden members with an understanding of garden membership, infrastructure, events, funding and governance. To ensure the breadth of responses were representative of the majority of community gardens across LGAs, interviews were not conducted with members from gardens with a special interest or intention. Key themes explored in the interviews were; membership numbers, type and member demographic, garden approaches to engagement and education, and member resources.

7.2 Results

The complete compiled results for interviews from community garden committee members across eight LGAs are found in Appendix 5. Below are key insights from this process, which also supported and informed development of the citrus protection upskilling plan (Section 8.2), along with the recommendations in this report. The data in these interviews and the process of undertaking the consultation also provided further insight into the inherent limitations for proposed engagement strategies via these grassroots networks.

Key insights arising from this process were:

- In all cases, those interviewees located in 'diverse' localities (as identified through our demographic analysis) described their local community as diverse.
- In all interviews undertaken in 'diverse' localities, interviewees did not think that the wider community demographic was well represented in the garden.
- Community garden membership or volunteers was overwhelmingly described as Caucasian / European across all gardens.
- No garden offered resources or educational materials in a language other than English.
- Membership had increased over the past five years at all gardens, apart from one (membership had stayed the same).
- The highest ranked reason for joining as a member or volunteer varied across gardens, however, 'the social' aspect was ranked most highly most often among interviewees. 'No planting space at home' also often ranked highly.
- Level of attendance at community garden events (e.g. workshops) was most often 10-50 people. No garden reported attracting more than 50 people to events. Attendees at these events were usually a core group of the membership, although occasionally there was a mixture of members and non-members reported as attendees (no differences found between homogenous and diverse gardens).
- In diverse localities, the age range of members or volunteers was most commonly 30-65 years of age. In the two gardens in homogeneous localities, the age range of members and volunteers was most commonly over 65 years of age.
- The most common education topics across all gardens were composting, soil health/management, planning seasonal plantings, and garden bed preparation. The least common education topics were biosecurity and plant diseases.
- Gardens mostly attracted members through word of mouth and walk-ins, rarely through proactive membership drives (e.g. over social media).
- Advice on plant health was commonly sourced from fellow gardeners, according to interviewees, although plant nursery staff, local council and Agriculture Victoria were mentioned by some. Accessing technical manuals and books was also common.

7.3 Discussion

Perspectives on diversity differ. One community garden interviewee, in a locality that had been identified as 'homogenous' by our methodology, described the local community as diverse. The local community in this case was made up of many European cultures. The same interviewee also commented that while they did not provide resources in languages other than English, they provided a platform for visually impaired users of the garden (sensory garden), and also gave regular access to groups with disabilities. In the case of this garden, infrastructure had also been built to allow comfortable wheelchair access at garden beds. However, when viewing diversity from the indicators used in this analysis, it was apparent that community gardens often are not representative of, nor do they cater to, aspects of the demographic of the local area. Since community gardens are historically a common European initiative, with origins in 18th century England (Flavell, 2003) this is not necessarily surprising.

As the level of garden event attendance was not reported to exceed 50 people (often core members), direct education through gardens to local residents is not necessarily a high impact path to improving local plant health knowledge. However, as reported in Lye & McGregor (2020) some of these gardens had extensive and active social media networks, which greatly improves reach and the ability of these gardens to influence the thinking of their followers. The common knowledge source among gardens (fellow gardeners/garden members) also cannot be ignored. The commonality between gardens in using this source of information, and noting the results of the knowledge survey (Section 5) emphasizes the importance of this avenue as a potential magnifier of trusted and robust plant health/plant biosecurity advice.

One common motivator of joining a community garden was 'no planting space at home'. In regard to this motivator, one interviewee noted the changing housing landscape of the local area, and the decreasing garden space available as more medium rise housing had begun being built. He predicted that garden membership would increase as a result. As many Melbourne suburbs are undergoing similar changes to housing infrastructure, particularly as land value continues to increase, it is possible that increases to community garden membership will continue. This process has highlighted the growing interest in becoming members or volunteers of such initiative.

8.0 Discussion

8.1 Overview

This project has explored demographic mapping across Melbourne LGAs and has brought together data on garden types, infrastructure and resources, knowledge needs of Melbourne community gardeners, current educational offerings from Melbourne community gardens, and popular crop species planted at these gardens. Comparison of community garden types has shown that membership-based community gardens with sophisticated organisational structures, policies and procedures tend to have a greater diversity of plantings, a larger active gardening community, as well as regular and diverse garden activities that incorporate working bees, workshops, hosting of visitor groups, and a social media presence. In comparison, open-to-the-public community gardens tend to grow a lower diversity of plants. These open-to-the-public gardens are often informal and volunteer-based and lack the high level of organisation and coordination found at a membership-based garden. However, volunteer recruitment and time was a limiting factor for many gardens of all types and was found to be a significant consideration for success in engaging with gardens via email or social media (and compared to in person).

It is also interesting to note that where gardens are part of a larger organisation and/or community network, administrative support, and therefore engagement pathways, are more apparent and robust. These differences between gardens may be driven by a variety of factors, including access to resources and infrastructure, garden history and legacy, local council policy and support, association with local networks and resource hubs and a variety of demographic or community level factors.

8.2 Key insights

Ultimately this work determined that, having an understanding of how spatial and demographic factors and values-based motivators influence the likelihood of community engagement, surveillance activity and likelihood of reporting, can lead to the following benefits:

- Improvement in judging actual biosecurity risk posed by demographic groups living in different settings;
- More cost effective and impactful stakeholder engagement campaigns where audience and stakeholder needs are understood;
- Application of segmentation to audience and stakeholder groups for the development of more appropriate, targeted engagement strategies, designed to honour audience motivations;
- Identification of localities where plant health and agronomic knowledge is likely to be very low or very high; and
- Improved ability of biosecurity authorities to predict what sub-populations would be early adopters of biosecurity and plant health training, and therefore training resources may be developed and delivered to suit and appeal to those sub-populations.

The study resulted in several other important insights in relation to community gardens and the role of these organisations in plant health education. They were:

- Community garden memberships do not appear to broadly mirror the diversity in communities particularly with regard to age, ethnicity or language. Based on eight community gardener interviews, the volunteer base and membership of gardens tend to be of Caucasian background. However, it was not determined if this is in fact a limitation in engagement program design and delivery as these subgroups (age, ethnicity or language) in communities may not be gardeners or well represented in the gardening community.
- Gaining a more thorough understanding of reasons why people are engaging with a community garden will further inform and drive effective engagement strategies. Reasons may vary considerably for different demographics, organisations, and localities (particularly in light of transitions in urban planning, which will continue to effect available residential planting space).
- The importance of knowledge brokers and trusted community champions or influencers should be considered in any local educational program design. Dissemination of extension messaging via these sources is likely to be more effective than through administrative channels.
- For diverse communities, consideration of alternate engagement channels will be of greater importance in comparison to driving engagement in more homogenous neighbourhoods. e.g. alternate community networks may offer greater representation, social cohesion and trust in information offered, than a local community garden when it comes to discussions about plant health and biosecurity.

8.3 Citrus protection upskilling plan

The CitrusWatch program (citrusaustralia.com.au/biosecurity) has a key aim of improving knowledge of citrus health management and early detection of exotic citrus pests in urban zones. The program was involved in this investigation, with the intention of using insights from this study to refine program engagement activities, and suggest additional methods of engagement to knowledge nodes like community gardens. From the gardener knowledge survey data and insights from interviews with community garden committee members in diverse and homogeneous localities, there are several activities that may be conducted by community gardens and with local communities to fill knowledge gaps on plant health. These activities leverage strengths and opportunities exhibited across community gardens, such as:

- Reliance on fellow gardeners, local nursery staff, and technical manuals for advice;

- Lower age groups associated with community gardens in diverse areas;
- A gap in plant health education events and written materials delivered in other languages;
- Attractiveness as an area to grow food plants as purchase of a house and garden set up becomes less affordable, and attractiveness as a social outlet as connectivity within local communities erodes.

With these factors in mind, six novel engagement strategies are suggested below and as a holistic plan to improve plant health education through community gardens and other, associated networks. These strategies have the potential to not only upskill existing community garden members, who potentially act as an important source of knowledge, but also to extend the reach and impact of community garden generated information to the wider local community. For any given community, it is likely that an engagement program would combine a number of these approaches, integrated and delivered to augment one another and based on knowledge of the target audience demographic. For the purpose of this plan, citrus is used as an example.

1. Outreach through garden-based community-wide initiatives

There is an opportunity to reach out to the wider community through community composting initiatives, such as the Community Alliance in Waste Reduction and Sustainability, through which information on plant health and exotic pests may be shared. These initiatives are in a unique position to strongly link community gardens to the wider community, and to extend information on plant health and exotic plant pests and diseases. This is an important opportunity as produce of low quality (e.g. produce with disease symptoms) is most likely going to end up composted rather than consumed. Information at composting sites may include images of fruit impacted by exotic diseases, and may provide advice on how to report such symptoms. (The 2018 detection of the impactful exotic disease, citrus canker, in Darwin was a result of symptomatic fruit being identified at a retail outlet.)

2. Integration of knowledge through familiar topics

There is potential to integrate biological and ecosystem knowledge into information topics with which garden members and local residents may be more familiar. In this way residents may be eased into learning about topics that may seem intimidating due to the breadth of information currently available, and the technical nature of that information. Importantly, information about biosecurity and plant diseases – two topics of low knowledge according to the survey, and of uncommon focus at community gardens – may be integrated into the delivery of more common topics (e.g. information/education on use of produce and recipes may be paired with a disease management focus in order to grow higher quality produce for recipes).

3. Delivery of information through trusted sources

The importance of trusted community members as a source of plant health advice (fellow gardeners and local plant nursery staff) or influencers (including those specifically supporting gardeners or particular sectors of the community) should be considered in any attempt to improve local plant health knowledge. Dissemination of extension messaging via these sources is likely to be more effective than through administrative channels. In the case of citrus, it was observed that trees located at community gardens were often of low health, potentially due to the sizable job of regular pruning and care, in comparison to growing vegetables in plots. The nursery stock used for citrus grown at community gardens may also play a role (e.g. if the trees are grafted on site), as well as the emergence of new pests to Melbourne and surrounds, such as Citrus gall wasp. This pest can be difficult to effectively manage without good knowledge of the wasp life cycle. Therefore, there is potential to identify local advisers or advisory networks, and provide them with direct training in the topic areas of citrus fruit production, tree pruning, sourcing of high-quality nursery material, site selection of planting, pest monitoring and pest management.

4. Conversion of existing gardener resources to other languages

Based on the demographic analysis conducted in this study there is potential to convert and extend popular technical resources about citrus growing into languages that would be common in each locality. These could be disseminated via trusted community members or through groups and organisations that are active in these communities and have a specific cultural context. These may be gardener support organisations, but equally could be other community organisations with

good reach and trust for particular communities. Further, in localities identified to have high diversity in the community, more investigation would reveal key local community hubs through which translated plant health information may be delivered via a number of means and across a wider range of community segments.

5. For diverse communities consider alternate channels:

The suggestion above may also extend to delivering social media information in languages other than English, in line with the local community make-up. Indeed, in localities with higher diversity in the community, all types and sizes of community garden may not necessarily be the most ideal hub for plant health education of local residents. However, the social media channels of larger/higher reach community gardens in these areas may offer a useful pathway to engagement and knowledge sharing in the broader gardening communities.

Based on the garden interviews and comparing diverse and homogenous communities (as defined in this project), there is potentially an important consideration relating to the age ranges of garden members. From the information generated through the garden member interviews, in homogenous communities members tended to be over 65 years of age. Therefore, increasing reliance on communication channels such as social media are not necessarily expected to yield similar results. More investigation should be conducted to explore differences in ages across locality types and gardens, and how this could impact on engagement and upskilling.

6. Improvements to garden induction material and resources over time:

Based on increasing garden membership over the past five years, as reported by interviewees, there is potential to provide support to community gardens in strengthening information on plant health management and biosecurity during the member induction process. For instance, information on reporting suspect pests, along with a gallery of images for key pests of citrus (or other crops) may be integrated into the garden handbook, which is a common resource provided to members across gardens in both diverse and homogeneous localities. As available planting space at residences of the outer and inner suburbs continues to decline, an influx of members and volunteers at community gardens is a growing opportunity for upskilling of these groups.

9.0 Conclusion

Project outputs have included creation of a sizable dataset comprising: demographic information across all Melbourne Local Government Areas, community gardener interviews exploring garden membership and local engagement, physical assessment of garden offerings through garden site visits, and data in relation to knowledge levels and needs of gardeners across Melbourne. The project has used the insights gathered throughout the investigative process to describe several engagement pathways for improving educational offerings on the topic of plant health and biosecurity, with a focus on citrus, offered both through community gardens and more broadly through local community networks. The overarching outcome from this investigation has been an improved understanding of both the potential and limitations of community gardens in Melbourne (as a pilot city) as educational hubs for local communities. While an assumption may be made about the high potential of community gardens as educational hubs – that they are generally sophisticated organisations with vibrant memberships or volunteer bases, and regular local engagement offerings - the reality is much more complex.

The voluntary basis for practical garden management and governance often results in a core group of people being the most 'active' members - this core group are also most often at garden educational and training events. Reliance on core members to keep gardens running appropriately does mean that the frequency and nature of educational activities offered at gardens is necessarily balanced against the availability of time and energy of members and volunteers. While memberships across gardens are strongly increasing, as evidenced by the interview process in this study, community garden core members may be under greater time pressure to run larger garden groups – with this comes the potential for educational offerings to either drop off or flourish, depending on the mix of volunteers and the social cohesion of the garden membership. The role of community gardens in local communities may also grow more complex as membership increases and housing developments transition from large blocks and medium rise estates. It is currently not apparent if this transition in type of residence will mean community gardens become more representative of local community

demographics over time or have other impacts on garden membership and resilience - this is a question for further study. During this investigation it became apparent that community garden membership, for the most part, was not wholly representative of the local community demographic, which limits the potential for these organisations to act as high impact/high reach, grass-roots knowledge hubs within communities. However, community gardens are also increasingly taking advantage of social media platforms to distribute information, extending their reach beyond the physicality of the local community and may be one reason why so many community gardens managed to remain functioning and active throughout the COVID-19 pandemic, including through several multi-month lockdowns in Melbourne in 2020 and 2021.

Ultimately, this work supports the need for a deeper understanding of the local context within which community gardens are operating, in order to develop a targeted but multifaceted strategy based on these understandings.

10.0 Recommendations

Recommendations arising from this investigation are:

- Undertake further investigation into motivators for joining community gardens in a high-density, highly diverse city, such as Melbourne.
- Continue to track community garden membership changes over time, particularly in light of a growing trend towards smaller dwellings with less planting space. With increases in membership, community gardens may become an increasingly important hub for gaining plant health advice and training. This tracking exercise may extend to garden membership demographics, membership size, and membership type (i.e., to quantify the extent of interaction between community members and the garden).
- Undertake scoping and mapping of alternate engagement nodes and networks in diverse localities.
- Investigate the potential to create more accessible educational material in other languages, that may be supplied to community gardens for value-add offerings to members and the broader community who take part in garden events.
- Develop training and information resources targeted to knowledge gaps identified in this study. Undertake a broader and more thorough investigation to determine exactly what suite of resources are needed at a local level.
- Examine and compare key attributes of gardens and LGAs where garden activity remained high during the COVID-19 pandemic, to better understand what makes these gardens resilient during a crisis.
- Examine overseas models for community gardens (including networks, education/training, resources, support, funding models and governance) as they tend to be more established than in Australia. This may build understanding of what factors contribute to garden resilience, including if this is an inherent attribute of a garden due to time, place and community or to “external” factors such as governance frameworks, funding etc. This examination could also extend to what engagement strategies they have tried/use for plant health and biosecurity.

Appendices

Appendix 1 – Garden knowledge survey

Calling all Melbourne gardeners! Complete our 2-minute gardener knowledge and activity survey

With the increasing global spread of exotic plant pests and diseases, gardens near major ports of entry, such as the Port of Melbourne, are an important line of defense against exotic species that may be transported to Australia. We are undertaking a small Melbourne study to better understand how gardeners can help in improving the health of plants in urban environments. A healthy plant is much better equipped to withstand attack from exotic pests and diseases, so it is important that urban residents have good knowledge to support their gardening efforts.

This is research being conducted by Citrus Australia and Redefining Agriculture Pty Ltd. Your participation in this survey is voluntary. The procedure involves filling an online survey that will take approximately 2 minutes.

To protect your confidentiality, the survey results will not contain information that will personally identify you. The results of this study will be used only as summarized data, for research purposes and for the improvement of community garden engagement. Your personal details will not be linked to survey responses.

If you have any questions or concerns about this survey, please contact Dr Helen McGregor at helen@redefiningagriculture.com.au

1. In what Local Government Area are you located?

Banyule
Boroondara
Brimbank
Casey
City of Yarra
Darebin
Frankston
Glen Eira
Greater Dandenong
Hobsons Bay
Hume City
Kingston
Knox
Manningham
Maribyrnong
Maroondah
Melbourne
Monash
Moonee Valley
Moonee Valley
Moreland
Nillumbik
Port Phillip
Stonnington
Whitehorse
Whittlesea
Wyndham

2. What best describes your gardening activities?

I prefer cultivating crop plants
I prefer to grow non-crop species (e.g. ornamental plants)

3. Do you grow any of the below?

Citrus
Pome fruit (Pear and apple)
Stonefruit
Quince
Fig
Pomegranate
Grape vines
Passion vines
Avocado
Brassicaceae (broccoli, Brussels sprouts, Cabbage, Cauliflower, Kale, Cress, Mustard, Oriental brassicas, radish, swede, turnip)
Fabaceae (Beans, peas, fenugreek, lupin, alfalfa)
Allium (Onion, garlic, leek, shallot)
Solanaceae (Potato, tomato, eggplant, capsicum)
Asteraceae (Lettuce, chamomile, sage, tarragon)
Lamiaceae (Mint, oregano, thyme, lavender, rosemary, basil)
Apiaceae (Carrot, parsley, celery, parsnip)
Amaranth (Beets, spinach, chard, quinoa)
Cucurbita (Melon, pumpkin, cucumber)
Other (e.g. asparagus, sweet potato, corn, mushroom, okra, sweet corn)
I grow none of these

4. What is your affiliation with your local community garden? Check all that apply

I have a gardening plot at a local community garden

I am a member of a local community garden, but I don't garden on the site
I follow a local community garden / gardens on social media page
I have attended training and information sessions at a local community garden
None of the above apply to me

5. Indicate how you feel about your current level of knowledge in the following topic areas (3 – I have adequate knowledge for my purposes, 2 – I have a low level of knowledge, 1 – I have no knowledge)

Soil health/management
Making seasonal or location specific planting choices
Planning a garden layout
Pruning
Harvesting
Food safety
Irrigation
Plant breeding and propagation
Plant identification
Meal preparation / uses for garden produce
Garden bed preparation
Composting
Protected cropping
Biosecurity / garden hygiene practices
Plant disease identification and management
Plant pest identification and management
Beneficial insect identification and husbandry
How to grow organic produce
Safe and appropriate use of pesticides
Pest monitoring
Other_____

6. What topic areas would you like to improve your knowledge in? Check your top three

Soil health/management
Making seasonal or location specific planting choices
Planning a garden layout
Pruning
Harvesting
Food safety
Irrigation
Plant breeding and propagation
Plant identification
Meal preparation / uses for garden produce
Garden bed preparation
Composting
Protected cropping
Biosecurity / garden hygiene practices
Plant disease identification and management
Plant pest identification and management
Beneficial insect identification and husbandry
How to grow organic produce
Safe and appropriate use of pesticides
Pest monitoring
Other_____

END SURVEY – THANK YOU!

Appendix 2 – Physical assessment of gardens - data collection sheet

Community Garden Assessment Checklist

Category	Item		Comments
Growing area	Total garden size (satellite imagery)		
	Number of plots		
	Average size of plot		
	Structure of plots • Raised beds/containers • Vertical • Ground level rows or blocks		
Inputs	Irrigation • Overhead sprinklers • Ground level sprinklers • Hand hosed • Drip or trickle system • Wicking bed system Water source • Rain / tank • Mains • Recycled water / grey water Growing media • Compost made on site • Manure (direct from farm) • Direct from bulk supplier (e.g. landscaping supply business) • Sterilized (e.g. Bagged and sealed potting mix)		
Plantings	Average number plants per plot		
	Average number plant types per plot		
	• Citrus • Pome fruit • Stonefruit • Quince • Fig • Pomegranate • Grape vines • Passion vines • Avocado • Brassicaceae • Fabaceae	• Allium • Solanaceae • Asteraceae • Lamiaceae • Apiaceae • Amaranth • Cucurbita Other: • Bee hive/s • Chickens	
Guidance / education	• Compost guidelines • Biosecurity / garden hygiene guidelines • Biosecurity signage at entrance • Fact sheets / information posters • Signposting for facilities		*Note languages used*

Appendix 3 - Physical assessment of gardens - results

Planting practices across 18 community gardens in high and low diversity localities (D = diverse, H = homogeneous)

	# plots	Structure of plots	Irrigation	Water source	Growing media	Plant types
Port Phillip (*D*)						
Garden 1	9	Raised beds/containers	Hand hosed	Mains	N/A	Citrus; Stonefruit; Brassicaceae; Allium; Solanaceae; Asteraceae; Lamiaceae; Apiaceae; Amaranth
Garden 2	7	Raised beds/containers	Hand hosed; Wicking bed system	Rain/tank	Compost made on site	Citrus; Brassicaceae; Fabaceae; Solanaceae; Asteraceae; Lamiaceae; Apiaceae; Amaranth
Maribyrnong (*D*)						
Garden 3	10	Raised beds/containers	Hand hosed: Wicking bed system	Mains	Compost made on site	Citrus; Pome Fruit; Brassicaceae; Fabaceae; Allium; Solanaceae; Asteraceae; Lamiaceae; Apiaceae; Amaranth; Cucurbita
Garden 4	10	Raised beds/containers	Hand hosed	Rain/tank	Compost made on site; Direct from bulk supplier	Citrus; Pome fruit; Stonefruit; Grape vines; Passion vines; Brassicaceae; Fabaceae; Allium; Solanaceae; Asteraceae; Lamiaceae; Apiaceae; Amaranth; Cucurbita
Garden 5	13	Raised beds/containers	Hand hosed	Rain/tank; Mains	Compost made on site; Manure (direct from farm); Direct from bulk supplier	Citrus, Stonefruit,Grape vines, Passion vines, Brassicaceae, Fabaceae, Allium, Solanaceae, Asteraceae, Lamiaceae, Apiaceae, Amaranth, Cucurbita
Merri-bek (*D*)						
Garden 6	30	Raised beds/containers; Ground level rows or blocks	Overhead sprinklers; hand hosed	Rain/tank	Compost made on site	Citrus; Pome fruit; Stonefruit; Fig; Brassicaceae; Fabaceae; Allium; Solanaceae; Asteraceae; Lamiaceae; Apiaceae; Amaranth; Cucurbita

Garden 7	60	Raised beds/containers; Ground level rows or blocks	Overhead sprinklers; hand hosed; drip or trickle system	Mains	Compost made on site; Direct from bulk supplier (council)	Citrus; Pome fruit; Stonefruit; Fig; Grape vines; Brassicaceae; Fabaceae; Allium; Solanaceae; Asteraceae; Lamiaceae; Apiaceae; Amaranth; Cucurbita
Garden 8	3	Raised beds/containers; Ground level rows or blocks	Hand hosed; Drip or trickle system; Wicking bed system	Mains	Compost made on site; Direct from bulk supplier	Citrus; Pome fruit; Stonefruit; Quince; Fig; Pomegranate; Grape vines; Brassicaceae; Fabaceae; Allium; Solanaceae; Asteraceae; Lamiaceae; Apiaceae; Amaranth; Cucurbita
Maroondah (*H*)						
Garden 9	9	Raised beds/containers	Wicking bed system	Mains	Compost made on site	Citrus; Pome fruit/ Stonefruit; Olive; Brassicaceae; Facaceae; Allium; Solanaceae; Asteraceae; Lamiaceae; Apiaceae; Amaranth; Strawberry, Rubus, Blueberry
Garden 10	27	Raised beds/containers; Ground level rows or blocks	Drip or trickle system; Wicking bed system	Mains	Compost made on site; Direct from bulk supplier	Citrus; Pome fruit; Stonefruit; Fig; Pomegranate; Avocado; Brassicaceae; Fabaceae; Allium; Solanaceae, Asteraceae; Lamiaceae; Apiaceae; Amaranth; Cucurbita; Strawberry; Asparagus
Garden 11	40	Raised beds/containers; Vertical; Ground level rows or blocks	Hand hosed	Rain/tank	Compost made on site; Direct from bulk supplier	Citrus; Pome fruit; Stonefruit; Passion vines; Avocado; Brassicaceae; Fabaceae; Allium; Solanaceae; Asteraceae; Lamiaceae; Apiaceae; Amaranth; Cucurbita
Yarra Ranges (*H*)						
Garden 12	9	Raised beds/containers	Hand hosed	Mains	Direct from bulk supplier; Sterilised (e.g. bagged and sealed potting mix)	Avocado; Brassicaceae; Fabaceae; Allium; Asteraceae; Lamiaceae; Apiaceae; Amaranth
Garden 13	11	Raised beds/containers; Ground level rows or blocks	Ground level sprinklers	Rain / tank	Compost made onsite; Sterilised (e.g. bagged and sealed potting mix)	Citrus; Pome fruit; Asteraceae; Lamiaceae; Amaranth; Strawberry

Garden 14	23	Raised beds/containers; Ground level rows or blocks	Hand hosed	Rain / tank	Compost made on site; Manure (direct from farm)	Pome fruit; Brassicaceae; Fabeaceae; Allium; Solanaceae; Asteraceae; Lamiaceae; Apiaceae; Amaranth; Rubus
Garden 15	13	Raised beds/containers	Hand hosed	Rain/tank	Compost made on site	Pome fruit; Avocado; Brassicaceae; Fabaceae; Allium; Solanaceae; Asteraceae; Lamiaceae; Strawberry; Rubus; Blueberry
Mornington Peninsula (*H*)						
Garden 16	86	Raised beds/containers	Handhosed: Wicking bed system	Rain/tank; Mains; Recycled water / grey water	Compost made on site; Manure (direct from farm); direct from bulk supplier (e.g. landscaping supply business); Sterilized (e.g. bagged and sealed potting mix)	Citrus; Pome fruit; Stonefruit; Fig; Grape Vines; Brassicaceae; Fabaceae; Allium; Solanaceae; Asteraceae; Apiaceae; Amaranth; Curcubita; Bee hive/s; Chickens
Garden 17	25	Ground levels rows/blocks	Hand hosed	Mains	Compost made on site	Citrus; Stonefruit; Fig; Brassicaceae; Fabaceae; Allium; Asteraceae; Lamiaceae; Apiaceae; Amaranth
Garden 18	54	Raised beds/containers	Hand hosed	Rain/tank	Compost made on site; Manure (direct from farm); direct from bulk supplier (e.g. landscaping supply business)	Citrus; Pomefruit; Stonefruit; Fig; Passion vines; Avocado; Brassicaceae: Fabaceae; Allium: Solanaceae; Asteraceae; Lamiaceae: Apiaceae; Amaranth; Cucurbita

Appendix 4 – Interview guide

Topic area	Questions
Membership number	What is the current membership? • Less than 20 • 20-100 • 100-500 • >500 How has the total membership changed in the past 5 years? • Gone up (approximately ____%) • Stayed the same • Gone down (approximately ____%) How has the total membership changed in the past 2 years? • Gone up (approximately ____%) • Stayed the same • Gone down (approximately ____%) Do you currently have a waiting list for membership? • Yes • No What's the average time someone may stay on the waiting list? • Less than 1 month • 1-12 months • Over 12 months
Membership demographic	What are the approximate age ranges of your membership (and approximate proportion across the membership)? • Under 30 (___%) • 30 – 65 (___%) • Over 65 (___%) Would you regard the local community you live in to be culturally diverse (a variety of cultural or ethnic groups)? From a diversity perspective, do you think the local community is represented in the community garden membership? If no, what cultures/ethnicities are most represented?
Membership type	What requirements need to be met for membership? • Age restriction/range _____ • Residential proximity _____ • Invitation by current member _____ • Approval by committee _____ • Reference check_____ • Other _____

	From your knowledge, what are the most popular reasons for joining? Rank 1 (most popular) to 4 (least popular) • No planting space at home – rank_____ • The social aspect – rank_____ • Getting out of the house – rank_____ • Learning – rank_____ • Other _____
Member recruitment	From your knowledge, how does your garden most commonly attract its members? • Walk ins • Word of mouth / direct promotion from members to non-members • Active membership drives (e.g. Social Media, open days) If active membership drives is the most common method, please determine what type – social media or face to face.
Engagement & education	Approximately how many members are 'active' (regular visits, committee roles etc.) vs passive (pays fee but never seen)? Active members _____% Passive members _____% What % of members pay for growing space? ____% Are all plots in use? • Yes • No, approximately ____% are not in use What community activities do you run? What is the general level of attendance? • <10 people • 10-50 people • 50-100 people Type of attendees? • Usually mostly members • Usually mostly non-members Does the same core group of people attend, or does the group vary? What education topics are a common focus at the garden? • Soil health/management • Planning seasonal plantings • Pruning • Harvesting • Irrigation • Plant breeding and propogation • Plant identification • Meal preparation • Garden bed preparation • Composting • Protected cropping • Biosecurity • Plant diseases • Beneficial insects

	• Growing organically • Pesticide usage • Pest trapping • Other_____ When it comes to plant health / growing, does the garden have a 'go to' for information or expert advice? • No, advice is sought from members • Agriculture Victoria • Local council • University researcher/s • Botanic garden staff • Local plant nursery • Other garden groups • Social media • Use of technical manuals or scientific literature • Other _____
Resources for members	Do you have a community garden 'handbook'? • Yes • No If yes, what aspects does the handbook cover? Do you have any garden policies or procedures? • Yes • No If yes, what are they? Does the garden provide resources in any language other than English? • Yes • No If yes, what are they?

Appendix 5 - Interview results

D = Diverse, H = Homogeneous

	Membership	Resources and activities
Garden 1 (D)	**Activity and structure:** • Membership is free • Current membership is 100-500 • Total membership has increased by approximately 20% in the past 5 years. Membership increase was not impacted by Covid-19 pandemic. • Do not currently have a waiting list for membership • Approximately 5% of members are 'active' (regular visits, committee roles etc.) and 95% are 'passive' (pays fees but never seen). • All plots are in use. **Recruitment and promotion:** • Members require approval at the • committee level. • Volunteers (not members) require a reference check. • Reasons for joining the garden, in order of popularity are: the social aspect, no planting space at home, getting out of the house, and learning. • Mostly attracts members through word of mouth. **Local and garden demographic:** • Membership breakdown by age: <30 years old (20%), 30-60 years old (50%), >65 years old (20%) • Interviewee regarded the local surrounding community as "highly diverse" • Interviewee believed that local community diversity is represented in the garden membership, particularly Vietnamese, Italian, and Burmese.	• Community activities and services run by the garden include: playgroup, healthy living program, mosaic class, cooking classes, community lunches, emergency relief. • The general level of attendance at garden activities is 10-50 people, with attendees usually being from among the membership. The same core group of people attend activities. • Education topics that are a common focus are: soil health/management, planning seasonal plantings, harvesting, irrigation, meal preparation, garden bed preparation, composting, protected cropping, growing organically, and pest trapping. • Gaining plant health / growing advice involves accessing member knowledge and sourcing advice from a horticulturalist. • The garden does not have a handbook, but it does have various policies and procedures: usage of gloves and hats, washing of hands, garden tidiness, health and safety. • The garden does not provide resources in a language other than English.

Garden 2 (D)	**Activity and structure:** • Membership is $10 per year and $7 for concession. • Current membership is less than 20. • Total membership has increased by 100% in the past 5 years • Do not currently have a waiting list for membership • Approximately 80% of members are 'active' (regular visits, committee roles etc.) and 20% are 'passive' (pays fees but never seen). **Recruitment and promotion:** • Reasons for joining the garden, in order of popularity are: no planting space at home, learning, the social aspect, and getting out of the house. • Mostly attracts members through word of mouth and walk-ins. **Local and garden demographic:** • Membership breakdown by age: 30-65 years old (100%), • Interviewee regarded the local surrounding community as "highly diverse" • Interviewee believed that local community diversity is not represented in the garden, with membership being all Caucasian.	• Community activities and services run by the garden include: panel discussions, community equipment, general working bees. • The general level of attendance at garden activities is under 10 people, with attendees usually being from among the membership. The same core group of people attend activities. • Education topics that are a common focus are: soil health/management, planning seasonal plantings, pruning, plant breeding and propagation, plant identification, harvesting, irrigation, garden bed preparation, composting, beneficial insects, growing organically, protected cropping, growing organically, and pest trapping. • Gaining plant health / growing advice involves accessing member knowledge. • The garden does not have a handbook, but it does have various policies and procedures: be friendly, organic gardening principles. • The garden does not provide resources in a language other than English.

Garden 3 (D)	**Activity and structure:** • No membership fee. • Current membership is less than 20. • Total membership has stayed the same in the past 5 years • Do not currently have a waiting list for membership • 100% of members are 'active' (regular visits, committee roles etc.). • All plots are in use. **Recruitment and promotion:** • Reasons for joining the garden, in order of popularity are: the social aspect, no planting space at home, getting out of the house, and learning. • Mostly attracts members through walk-ins. **Local and garden demographic:** • Membership breakdown by age: <30 years old (20%), 30-65 years old (80%), • Interviewee regarded the local surrounding community as "highly diverse" • Interviewee believed that local community diversity is represented in the garden membership, particularly Italian, and Swiss. The membership is mostly European. • Residential proximity is a factor that is considered for gaining membership.	• Community activities and services run by the garden include: planting workshops, composting workshops, native food growing workshops, set-up and harvest workshops, beehive workshops. • The general level of attendance at garden activities is 10-50 people, with attendees usually being from among the membership and also non-members. • The group attending workshops varies. • Education topics that are a common focus are: soil health/management, planning seasonal plantings, pruning, harvesting, plant identification, meal preparation, harvesting, garden bed preparation, composting, beneficial insects, growing organically, protected cropping, plant diseases, beneficial insects, and growing organically. • Gaining plant health / growing advice involves taking advice from local council. • The garden does have a handbook, which covers basic guidelines to be a member, how often you need to use the space, and general responsibilities. The garden does not maintain additional policies or procedures. • The garden does not provide resources in a language other than English.

Garden 4 (D)	**Activity and structure:** • Current membership (volunteers) is 20-100. • Total membership has increased by approximately 50% in the past 5 years, although it had gone down by approximately 20% in the past 2 years. • Do not currently have a waiting list for membership. • 40% of members are 'active' (regular visits, committee roles etc.). 60% are 'passive' (pays fees but never seen). • Approximately 10% of plots are not in use. **Recruitment and promotion:** • Reasons for joining the garden, in order of popularity are: no planting space at home, the social aspect, learning, and getting out of the house. • Mostly attracts members through walk-ins and word of mouth. **Local and garden demographic:** • Membership breakdown by age: <30 years old (10%), 30-65 years old (50%), >65 years old (%40). • Interviewee regarded the local surrounding community as culturally diverse. • Interviewee believed that local community diversity is not represented among the garden membership, which is mostly of Caucasian background. • There are no requirements for membership, only an application.	• Community activities and services run by the garden include: planting workshops / beginner tutorials, pruning how to, mind space plots for mental health, volunteering for school or Duke of Edinburgh students. • The general level of attendance at garden activities is 10-50 people. Attendees are mostly the same core group of members. • Education topics that are a common focus are: soil health/management, planning seasonal plantings, pruning, harvesting, plant identification, meal preparation, harvesting, garden bed preparation, composting, growing organically. • Gaining plant health / growing advice involves accessing member knowledge. • The garden does have a handbook, which is currently being updated. Garden policies and procedures cover OH&S, and gardening guidelines. There are also policies and procedures for funding and petty cash. • The garden does not provide resources in a language other than English.

Garden 5 (D)	**Activity and structure:** • Current membership is less than 20 • Total membership has increased by approximately 10% in the past 5 years, but has stayed the same in the past 2 years. • 95% of members are 'active' (regular visits, committee roles etc.). 5% are 'passive' (pays fees but never seen). • Approximately 10% of plots are not in use. **Recruitment and promotion:** • Reasons for joining the garden, in order of popularity are: the social aspect, enthusiasm, getting out of the house, and learning. • Mostly attracts members through walk-ins. **Local and garden demographic:** • Membership breakdown by age: <30 years old (20%), 30-65 years old (80%). • Interviewee regarded the local surrounding community as "highly diverse". • Interviewee believed that local community diversity is not represented among the garden membership.	• Community activities and services run by the garden include: workshops. • The general level of attendance at garden activities is under 10 people. Attendees are mixed (volunteers and non-volunteers). • Education topics that are a common focus are: soil health/management, pruning, harvesting, irrigation, plant identification, harvesting, garden bed preparation, composting, biosecurity, plant diseases, beneficial insects, growing organically, pesticide usage, pest trapping.. • Gaining plant health / growing advice involves accessing member knowledge, sourcing from Agriculture Victoria, local council, local plant nurseries, the use of manuals or scientific literature, and the Very Edible Gardens initiative. • The garden does not have a handbook, policies or procedures. • The garden does not provide resources in a language other than English.

Garden 6 (D)	**Activity and structure:** • Current membership is 100-500 • Total membership has increased by approximately 20% in the past 5 years, and has increased by 5% in the past 2 years. • Do not currently have a waiting list for membership • 50% of members are 'active' (regular visits, committee roles etc.). 50% are 'passive' (pays fees but never seen). • All plots are in use. **Recruitment and promotion:** • Reasons for joining the garden, in order of popularity are: the social aspect, getting out of the house, no planting space at home, and learning. • Mostly attracts members through walk-ins and word of mouth. • Members need to apply to private plots, and be in close residential proximity. **Local and garden demographic:** • Membership breakdown by age: <30 years old (5%), 30-65 years old (45%), >65 years old (50%). • Interviewee regarded the local surrounding community to have "some diversity – not high". • Interviewee believed that local community diversity is not represented among the garden membership, which is mostly Caucasian.	• Community activities and services run by the garden include: workshops, lunches, working bees, local community events, drop-in mornings. • The general level of attendance at garden activities is 10-50 people. Attendees are usually mostly members. • Education topics that are a common focus are: pruning, harvesting, plant breeding and propagation, garden bed preparation, composting, protected cropping, biosecurity (fruit fly education), plant diseases, beneficial insects, growing organically, pest trapping, and 'planting from seed to harvest'. • Gaining plant health / growing advice involves accessing member knowledge, the use of manuals or scientific literature, the library and websites (SGA). • The garden does have a handbook that covers safety, a map of the garden, how to contact the committee, toilets, harvesting, composting, spaces in the garden, a garden map. • The garden has policies and procedures covering occupational health and safety, process of board decision making, inclusion policies, social media etc. • The garden does not provide resources in a language other than English.

Garden 7 (H)	**Activity and structure:** • Total membership has stayed the same over the past 5 years. • Do not currently have a waiting list for membership • 30% of members are 'active' (regular visits, committee roles etc.). 70% are 'passive' (pays fees but never seen). • All plots are in use. • Membership is free. **Recruitment and promotion:** • Reasons for joining the garden, in order of popularity are: the social aspect, learning, getting out of the house, and no planting space at home. **Local and garden demographic:** • Membership breakdown by age: 30-65 years old (30%), >65 years old (70%). • Interviewee regarded the local surrounding community to not be diverse. • Interviewee believed that local community diversity is represented among the garden membership.	• Community activities and services run by the garden include: Fund-raising, plant sale and swap, wine drive, invitations to various local community groups, workshops • The general level of attendance at garden activities is 10-50 people, with the same core group usually attending. • Education topics that are a common focus are: soil health/management, harvesting, irrigation, plant breeding and propagation, garden bed preparation, composting, protected cropping, growing organically, and pest trapping. • Gaining plant health / growing advice involves accessing member knowledge, the use of manuals or scientific literature, the local plant nursery, and other garden groups. • The garden does not have a handbook. • The garden has policies and procedures covering respect for members, keeping the garden tidy, no smoking. • The garden does not provide resources in a language other than English.

Garden 8 (H)	**Activity and structure:** • Current membership is 20-100 (another 6 groups use the garden – for therapy and childcare). • Total membership has stayed the same over the past 5 years (as no plots are available). • Currently has a waiting list for membership plots, but social membership has not waiting list. 1-12 months is the average wait time. • 60% of members are 'active' (regular visits, committee roles etc.). 40% are 'passive' (pays fees but never seen). • 90% of members pay for growing space and all plots are in use. **Recruitment and promotion:** • Reasons for joining the garden, in order of popularity are: growing own vegetables (safer and more economical), no planting space at home / the social aspect, learning, and getting out of the house. • Mostly attracts members through active membership drives via open days. • No requirement for membership, only application. **Local and garden demographic:** • Membership breakdown by age: 30-65 years old (20%), >65 years old (80%). • Interviewee regarded the local surrounding community to be diverse (European), with at least 20 nationalities, e.g. Lithuanian, French, Italian, Greek etc. • Interviewee believed that local community diversity is represented among the garden membership.	• Community activities and services run by the garden include: open days, monthly workshops, and garden tours. The garden also maintains a library on site. • The general level of attendance at garden activities is 10-50 people, with usually mostly members attending. • Education topics that are a common focus are: soil health/management, planning seasonal plantings, irrigation, meal preparation, plant breeding and propagation, garden bed preparation, composting, and pesticide usage. • Gaining plant health / growing advice involves accessing Bunnings staff. • The garden does have a handbook that covers rules and guidelines. • The garden has policies and procedures covering respect for members, keeping the garden tidy, no smoking. • The garden does not provide resources in a language other than English.

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