

# Social, Health and Environmental Impacts of Community Gardens

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A WELLINGTON CITY COUNCIL +  
VICTORIA UNIVERSITY +  
INNERMOST COMMUNITY GARDEN  
COLLABORATION

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## **Description of Research**

The research is set out in this report according to the three main milestones.

### **Milestone 1: Literature Review on the Social, Health and Environmental impacts of community gardens and how they are measured**

The literature review identifies a range of local and international reports and studies that focus on community gardens social, health or environmental impacts and how they have been measured.

### **Milestone 2: Data collection and analysis**

Data collection was done in two parts. The first was 10 informal interviews with gardeners from Innermost Gardens in Mt Victoria, Wellington, New Zealand. These interviews have been transformed into a word cloud to seek the most common terms. The second part was 10 hours of surveying composters at Innermost gardens. The compost data has been transformed into graphs.

### **Milestone 3: Website content for Innermost's 'Green KPI's' project**

The website content entails a new set of KPI's (Keypoint indicators) and ways to measure them for Innermost and other current or future community gardens/urban farms in Wellington, New Zealand.

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## **Who was Involved?**

The project was a collaborative effort between Wellington City Council – led by Brittany Rymer, Innermost Gardens – led by Tim Packer and Chris Montgomery, and Victoria University – led by Fabricio Chicca. Frequent meetings were held during the 10 weeks of the research which generated a lot of ideas and discussion.

### **Goals of each organisation:**

#### **Wellington City Council (Brittany Rymer)**

- Gain a better understanding of how other community gardens around the world have measured the social and environmental impacts they have on their surrounding neighbourhoods.
- Collect qualitative and quantitative data to measure the impact Innermost Gardens is having on its surrounding neighbourhoods.
- Build stronger connections between WCC Community Services, Victoria University, and Innermost Gardens.

#### **Innermost Gardens (Tim Packer)**

- For the exploration of other community gardens also identify common elements and measurement approaches to support discussion around a best practice framework.
- For the literature review also identify research to support our own findings for the quantitative and qualitative measures we've identified.

#### **Victoria University (Fabricio Chicca)**

- Assess how capable we are to measure social KPI's
- See if a very well managed community garden with good social KPI's can produce something environmentally meaningful.

#### **Victoria University (Bliss Graetz)**

- Research and understand the different impacts generated by community gardens over the world in their different contexts
- Explore and define ways we can measure the impacts of Wellington urban agriculture
- Gain an overall better understanding of the role of community gardens for people and the city to further explore in masters

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## A Summary

The literature review was set out to gain a better understanding of the role of community gardens and the impact they have on the different communities they serve. This part of the research has been important to identify different impacts community gardens have had around the world and how they have been measured to see if similarities exist in Wellington community gardens. This is so we can apply new methods to measure impacts from community gardens in the Wellington context. Reports, studies and other content from twenty-five sources that focused on studying either the social, health or environmental impacts of community gardens were reviewed. The literature review identifies key distinctions to make when assessing these three impacts. It was concluded these distinctions are crucial to consider when designing methods to measure the impacts of community gardens or other forms of urban agriculture. It also highlighted the importance to generate more quantitative evidence on the benefits of community gardening if we are to promote more evidence-based planning for urban agriculture growth. Overall these findings from the review assisted the formation of a critical framework of KPI's to measure Wellington's Urban agriculture impact (See part 3.3).

Data collection at Innermost gardens aimed to gain more information on the impacts the gardens have had in the community and compare it to sources found in the literature review. Interviews with gardeners were conducted to gain more qualitative information on the social impacts of the gardens. Compost surveys, on the other hand, were conducted to seek more quantitative data on the environmental impacts of the gardens. The ten interviews with gardeners from Innermost Gardens displayed similar findings in terms of the social, health benefits and challenges to the findings in the literature review. The most common and similar benefits found were peoples sense of belonging, social wellness, social opportunity, physical health improvements, improved gardening skills, and sense of environmental stewardship. A lot of the challenges mentioned were either to do with folk stealing produce or facility limitations such as access to toilets and water. The compost surveys found that most composters live within 500 meters of the gardens and travel there on foot. It was also found most drop off 10 litres of food scraps, once per week, for soil health and environmental reasons along with not having access to composting facilities at home. This data is displayed in graphs in part 2.2.

As mentioned earlier the literature review assisted the development of a new set of KPI's. Four reports or studies from the literature review that had used or suggested obvious key point indicators were analysed against each other, Innermost KPI's and Five Borough Farm's KPI's. The Five Borough Farm's report executed the most elaborate set of keypoint indicators and ways to measure them (Cohen, 2012), although they were tailored towards New York City urban agriculture, specifically urban farms that gain revenue from produce. The Five Boroughs sets of KPI's still provided a good example for organisation and measuring methods. All six sets of KPI's were identified (part 3.2), and the most important and relevant measures were put together to tailor towards measuring Wellington's current and future urban agriculture (part 3.3). This chart will be accessible on Innermost's 'Green KPI's Project' website.

### Reference:

Cohen, N & Reynolds, K & Sanghvi, R. 2012. Five Borough Farm: Seeding the Future of Urban Agriculture in New York City. Design Trust for Public Space & Added Value.

# Part 1: Literature Review

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## 1. Introduction

The purpose of this literature review is to gain a better understanding of the role of community gardens and the impact they may have on the different communities they serve. The types of community gardens discussed in this literature review will be ones that grow edible crops by volunteers in urban settings. This literature review assesses various reports and studies across a range of cultures that provide findings on the social, health and environmental impacts of community gardens. The findings are analysed in relation to their garden's context (socio-economic state, environment, culture or design). Many of the impacts found have been recorded with qualitative measures. If the intention is to develop and grow the movement, both quantitative and qualitative evidence is useful to support evidence-based planning.

Social and health benefits of community gardens are firstly identified in this literature review. Benefits are analysed across eight studies and compared against each other as well as the context of the community gardens. The analysis highlights the importance of considering context when it comes to measuring the benefits from community gardens.

Environmental impacts are then identified. The distinction between indirect and direct environmental impacts is made to better understand different ways community garden environmental efforts can be measured. Community gardens are proven to be more successful at having indirect than direct environmental impacts. There needs to be more quantitative measures on direct environmental impacts like greenhouse gas mitigation.

Negative impacts are also identified. After reviewing these reports two types of negative causes are identified, the first being negative community interaction and second, being funding or site challenges. These impacts are identified as being negative due to the mental and physical health risks for participants involved in community gardening such as increased stress levels or exposure to pollutants

The review then focuses on the context Wellington, New Zealand with support from local literature. One source of literature provides insight into the possibility of community gardens becoming a public

health intervention for New Zealand (Earle, 2011). Another piece of literature examines the current state of urban agriculture in Wellington and suggests a strategic approach to support and develop the movement (Stephens, Chicca, & Adams, 2014).

## 2. Social & Health Benefits

The hierarchy of positive social, health and well-being impacts may vary based on socio-economic state, culture or environment of the neighbourhood.

Upon reviewing eight international studies gathering qualitative data on the health and social impacts from community gardening, it is evident that communities from various cultures, socio-economic status and environments state very similar benefits gained from community gardening. What varies is that members from different community gardens consider some benefits to be more important than others. This hierarchy reflected the state of a neighbourhood's culture or socio-economic status.

This is particularly evident in two studies, one done on multiple gardens in a rough, multi-ethnic neighbourhood with high poverty rates in South-east Toronto, Canada (Wakefield, Yeudall, Taron, Reynolds, & Skinner, 2007) and one on a community garden in a middle class, Anglo-Saxon neighbourhood in Port-Melbourne, Australia with predominantly elder female gardeners (Kinglsey, Townsend, & Henderson-Wilson, 2009). Both studies were carried out with semi-structured interviews with garden members, to seek the wellbeing, health and social impacts of the gardens. Similar health benefits were identified in both studies. Both stated the gardens provided a space for intergenerational exercise, a relaxing sanctuary from pressures outside the gardens and access to more nutritional. The two studies also highlighted the importance of the community gardens for their social health as they provided a comfortable and supportive environment for advice and discussion.

### 2.1 Socioeconomic + ethnic context

In her 2011 thesis 'Community Gardening as a public health intervention' Margaret Earle found that New Zealand health inequalities are evident when comparing the health of Pakeha to Māori, Pacific, South-Asian and other marginalised groups. Marginalised groups generally experience poorer access to health resources, in particular access to healthy, nutritious food (Earle, 2011). The results from the community gardens surveyed in South-East Toronto reflected this issue. The study showed that many of the participants thought that better access to nutritious and cultural food was of utmost importance to them as it increased their physical and mental health along with it being a cost-effective option, "In some cases, substituting garden-grown produce for store-bought foods was seen to make a significant difference in household food costs" (Wakefield, Yeudall, Taron, Reynolds, & Skinner, 2007). This imbalance of food availability was confirmed and discovered to be a common trend among poor, multi-ethnic communities charted on a US app 'Streetwize', used to log neighbourhood trends and information. The app exposed that there were 50-60 liquor stores to 1-2 grocery stores in West Oakland, a predominantly poor, African American neighbourhood. The food available in these liquor stores are highly processed, carbohydrate, sugary foods, foods which not only accelerate health inequalities but are also known to cause children to be mistakenly diagnosed with ADHD in these areas (Dr Akom, 2019). More exposure and activity in green spaces reduces ADHD symptoms in children (Kuo & Taylor, 2004). Another quantitative study 'Fruit and vegetable intake among community gardeners' by Katherine Alaimo et al in 2008 discovered that household members who are involved in community gardens are 3.5 times more likely to eat fruits and vegetables 5 times a day compared to the household members that aren't involved. This highlights the significance and impact community gardens have in marginalised neighbourhoods by providing a space to educate pupils and access to healthy, cost-effective nutritious food.

The Toronto community gardeners also saw the gardens as being a great tool for breaking barriers of marginalisation and social exclusion whilst also providing a good meeting ground for people to discuss

neighbourhood issues unrelated to the gardens. A different study done by Donna Armstrong in 2000 surveyed 63 community gardens in New York. This study found that those in low-income neighbourhoods were four times as likely as those not in low-income neighbourhoods to treat the community garden as a community organizing hub to sort issues such as solving local crime problems. Armstrong also found that the community gardens in low-income neighbourhoods stimulated additional neighbourhood beautification, tree planting, and crime watch efforts. Most of the Toronto garden participants stated they enjoyed the gardening as a physical, 'stress-relieving', leisure activity (Wakefield, Yeudall, Taron, Reynolds, & Skinner, 2007). While this highlights the importance of community garden initiatives in poorer communities, these benefits can be relevant in most community garden spaces no matter the context.

In the Port-Melbourne study, 70% of gardeners interviewed were Anglo-Saxon females and over the age of 50. The term 'holistic health' which includes physical, mental and social wellbeing was used by the gardeners to describe benefits gained from their involvement. Many stated that for them the garden is a social space that allows them to have a defined role in their community and give them a sense of achievement. Many of the gardeners in the study stated that there is a wide range of activities involved with community gardening which suits all ages, bodies, levels of fitness, and genders making it inclusive for anyone (Kingsley, Townsend, & Henderson-Wilson, 2009). The empowerment gained from community gardening was confirmed in a qualitative study by Diana Parry et al in 2005 on examining gender roles and relations in St. Louis, USA community gardens. The resistance of traditional gender roles was a common finding throughout the gardens studied in Parry's report. The study found many tasks were divided amongst gardeners based on physical ability, skill and knowledge rather than the traditional expectation that men should do the heavy work and women to do lighter or more decorative work. These benefits again could be applicable to most community gardens but were pointed out to be most important in the context of a neighbourhood with high socio-economic conditions and fewer challenges related to health resources. Kingsley's study still showed that access to nutritious food was a highlighted benefit, but it wasn't considered to be the most important.

## 2.2 Environment setting

Armstrong also charted the most highly regarded benefits between urban and rural community gardens.

### Urban Areas

- Enjoyment of nature/open spaces
- Benefits to mental health
- Food source for low-income households

### Rural Areas

- The practice of traditional culture
- Exercise

### Both

- Fresh food/tastes better
- Enjoy nature/open space
- Healthy activity
- Mental health benefits

These comparisons reflect that similar benefits are gained from community gardening in very different settings, but the main motives of starting a community garden or joining one will vary due to which benefits the gardeners deem most important to the community.

## 2.3 Conclusion

The studies show similar physical, mental, nutritional and social health benefits are found across community gardens in very different contexts. Although depending on the context of the garden, the order of the importance of these benefits does vary. The literature indicates that the impact that community gardens have in less privileged neighbourhoods is especially important for providing nutritious food and providing a healthy environment for people to come together to sort issues (Earle, 2011; Wakefeild et al, 2007; Dr Akom, 2019; Kuo et al, 2004; Alaimno et al, 2008; Armstrong, 2000). In middle-class neighbourhoods, with nutritious food readily available, the gardens function more as a social bonding tool improving health and providing an empowering, leisure activity (Kinsley et al, 2019; Parry et al, 2005).

This highlights the importance to carefully consider and study context when designing methods to measure impacts of a community garden, for example deeply assessing the nutritional food access and crime rates in low-income communities and seeking evidence to support how much community gardens can change that through the food and environment which they provide.

## 3. Environmental impacts

Understanding the difference between indirect and direct environmental impacts

In comparison to most urban green spaces, community gardens invite people to grow, learn and partake in small-scale environmental efforts such as composting, carbon sequestration, localised food production, water management and alternative food consumption. This can be seen as an indirect environmental impact, for it influences peoples environmental awareness and acts as a facilitator towards their learning and connection with natural processes (Okvat & Zautra, 2011). Community gardens are often perceived and promoted as ‘sustainable’ enterprises, but due to their scale, their direct environmental impact is still very low. As Chicca, states in ‘A Seed and a Wish’ a report on urban agriculture in Wellington, New Zealand in 2014 “Local food production and urban agriculture are not necessarily sustainable, they have to be a part of a major behavioural change” (Stephens, Chicca, & Adams, 2014). Heather Okvat’s report, ‘Community Gardening: A parsimonious path to individual, community, and environmental resilience’ (2011), distinguishes the indirect from direct environmental impacts in community gardens. Okvat’s report uses evidence from one study that measured carbon sequestration in soil but also suggests other potential direct environmental impacts from community gardens. Table 1 shows examples of the direct and indirect climate change benefits provided in Okvat’s report.

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**Table 1.**  
Potential Climate Change Benefits of Community Gardens

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### Direct Pathways (Greenhouse gas mitigation)

- Carbon sequestration: Plants absorb CO<sub>2</sub>, separate and release O<sub>2</sub> and store carbon
- Reduce carbon emissions associated with food transportation from afar
- Reduce carbon emissions associated with food packaging, refrigeration, and grocery store cooling/heating/lighting
- Using kitchen scraps as garden compost decreases “trash” sent to landfills, decreasing carbon emissions from transportation and methane emissions from landfills
- Reduce carbon emissions associated with sewer system cleaning of runoff water
- Vegetation lowers ambient temperatures, this reduces cooling demand and thereby reduces CO<sub>2</sub> emissions from power plants
- While gardening, carbon emissions are reduced for transportation, cool/heating, lighting, appliances



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### Indirect Pathways (Urban lifestyle change and Education)

- Teach people about climate change processes
  - Demonstrate how food choices and systems impact climate
  - Develop awareness of the connection of human actions and the natural environment, and humans as part of the Earth community
  - Community gardens can have an environmental education component focused on sustainability, including global climate change.
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### 3.1 Direct Environmental Impacts

Carbon sequestration, stormwater management, ecologies

Okvat's report delves into the potential direct impacts that community gardens have on the environment, with particular focus on methods of carbon sequestration. An example study showed that a 0.4 acre (just over half of a football field) organic communal garden increased its soil organic matter from 1% to 7.7% in 10 years (Meadows, 2000). This garden sequestered 19 tons of carbon from the atmosphere at that time (Meadows, 2000). Okvat and Zautra made a very rough calculation and found that 190,000 tons (172,365,101 Kg) of carbon would be offset in 10 years by the estimated 10,000 community gardens in the United States. This calculation highlights the demand for an accessible way for all community gardens around the world to be able to measure this type of data to create a meaningful figure. Community gardens also absorb rainwater thereby reducing the heavy runoff caused by impervious urban surfaces. Wellington City Council has a CMP plan (Catchment Management Plan) to help mitigate stormwater runoff and improve water quality (Wellington City Council, 2020) which could coincide with a community garden development plan and reduce civil service expenses. Other important direct environmental impacts to measure that is not mentioned in the table would be measuring the impacts community gardens have on local ecosystems whether it may be the soil, re-vegetation to provide habitat for wildlife, pest control or attraction to bees.

### 3.2 Indirect Environmental Impacts

Environmental awareness, stewardship and education

Community garden members interviewed in the study 'Growing Urban Health' in South-East Toronto, Canada, stated they're concerned with soil and air quality for growing their produce. What the study found was that these types of concerns indicated that urban citizens who tend to be involved with community gardens gain a deeper awareness and understanding of climate and environment conditions (Wakefeild, Yeudall, Taron, Reynolds, & Skinner, 2007).

A report from Berlin, Germany 'Civic greening and environmental learning in public-access community gardens in Berlin' in 2012 examines if and how community gardens can combat 'extinction-of-experience', a term used to describe a detachment with nature among urban citizens, and ways community gardens can become more integrated within the city environment to do so. The findings show that gardeners involved have become much more aware of their local environment and climate conditions to do with soil quality, temperature, shade, wind as well gaining more of a sense of environmental stewardship. The study determined that having active and open boundaries around community gardens is important for welcoming people to explore the space. Integrating heterogeneous urban activities in the gardens was also considered to be of utmost importance for attracting other citizens who may not be as willing to engage with nature. An important quote from the study encompasses this strategy "the sustainable city does not weave nature only into its physical landscape, but into the everyday practices and experiences of its citizens as well" (Bendt, Barthel, & Colding, 2012).

The idea of community gardens as mixed learning environments leads into the next study: 'Community Gardens as contexts for Science, Stewardship, and Civic Action Learning' by Marianne Kransy and Keith Tidball, 2009. Kransy and Tidball examine an after-school program called Garden Mosaics that utilizes community gardens as 'Heterogeneous Learning Environments'. The objective of the program was to

provide an interactive learning experience for kids, adults and immigrants. The community gardens associated with the program are used as fields for interactive learning because they provide diversity in plants and cultures, and teach management and governance practices, offering multiple possibilities for learning focused on science, stewardship, and advocacy. The study conducted various interviews, surveys, questionnaires and interpretations of children's drawings that measured the success of this interactive learning theory. Some of the educators reported their students saw a connection between the health of the soil and what can be grown after examining organisms in soil and compost. Their participation also made them more aware of the cultural and environmental/sustainable significance of the community gardens. The report on Garden Mosaics provides evidence of the interdisciplinary learning potential of community gardens. It promotes further experimentation for education institutions to collaborate with community gardens, for the mutual benefit of youth becoming environmental stewards through interactive learning and community gardens gaining more support.

### 3.3 Conclusion

The urban agriculture movement driven by climate change motives is growing day by day, but it seems that there is still a missing gap of quantitative evidence that can provide a clear picture of the movement's feasible improvement to our industrial food system. Evidence of indirect environmental impacts outweighs evidence on the direct environmental impacts of community gardens. Overall the available community garden literature shows that community gardens are predominantly spaces for sharing, exchange, information sharing, co-learning and demonstrating. There is a need for further research to quantify the direct environmental impacts (and potential impacts) of community gardens. The lack of quantitative evidence to support the environmental impacts from community gardens discourages support from potential policy decisions and urban-planning in most cities which feeds in a variety of negative impacts.

## 4. Negative Impacts

Though a long list of benefits from community gardens exist, issues are still present and they can reoccur in similar themes across a range of community gardens. Many issues have been documented through qualitative surveys and observations. Many challenges stem from the lack of awareness of community garden systems or the 'unspoken rules' in how they function. Whether it is the lack of awareness from non-participating neighbours, passer-by's or the gardeners themselves, these specific issues can manifest as complaints, stealing or exclusion (Earle, 2011; Murnane, 2000; Parry et al 2005). Other issues are concerns from community garden members with the environment the gardens are situated in and the support they are given, such as soil pollution from previous establishments, air pollution from the surrounding city, tensions revolving around the leasing of the land or accumulating funding for resources and facilities (Wakefield et al, 2007; Folstad et al, 2015; Armstrong 2000; Kingsley et al 2009).

### 4.1 Community Interaction

Complaints, stealing and exclusion

Earle reported an incident in Auckland where a local community board decided to remove a community garden in Basque Reserve because neighbours were unhappy with its 'Messy Look' (Earle, 2011). A New Zealand Herald reporter said it was a thriving garden that held community events for seven years, employed people with low incomes and included community service workers to educate alternative ways of accumulating food (Murnane, 2000). Though this led to Auckland City Council creating guidelines for community gardens to cooperate on public land, it didn't solve the issue that some community members that weren't involved in the gardens either didn't completely understand the positive impacts of the gardens or didn't feel included in its practices. This highlights the importance of

increasing awareness and creating digestible information for the public to be able to see the whole picture and for community gardens to become more inclusive spaces to other activities or events if possible. An unspoken rule in many community gardens is that those who don't put effort into the garden are not expected to take produce. In the case of many community gardens, people confuse the meaning of 'community' in 'community garden' which results in non-participants taking produce for well-intentioned reasons of being part of the wider community/neighbourhood (Finn, 2011). Whilst community gardens provide a space for inclusion, they may also unintentionally be exclusive which was highlighted in Troy Glover's 2004 report 'Social capital in the lived experiences of community gardeners'. Exclusions may take the form of physical barriers such as fences or locks making the space less welcoming to be a part of, or racial, gender and cultural barriers such as the space attracting a majority culture in a mixed neighbourhood making it less comfortable for the minorities to participate. This emphasizes that it is important for community gardens to be clear with their intentions. Making the space as welcoming as possible will benefit the gardens to gain more support from local communities, councils, or governments.

#### 4.2 Site/Funding challenges

Pollution, leasing, and support

Due to the nature of most community gardens having been established on empty lots in dense urban environments, there are always the effects of soil and air pollution to be concerned about. This has the potential to negatively impact the gardener's well-being. In the South-East Toronto study, gardeners reported site pollution as one of their main concerns. A 2015 report 'Soil Contaminants in Community Gardens', states that it is not uncommon to come across metals, solvents, pesticides, and petroleum hydrocarbons in the soils on post-industrial sites, all of which 'increase risk for acute and chronic health problems' (Folstad, Long, Soldat, & Siemering, 2015). It requires a lot of determination and skill to rehabilitate contaminated soil. This is sometimes hard to acquire for community gardens with scarce or busy volunteers and little support. Armstrong also highlights a risk community gardens improve the neglected land they lease and beautify or improve the neighbourhood beyond their boundaries. This could potentially cause an increase in property values which may encourage profitable sales of these gardens and the destruction of the community garden or make the area unaffordable for the people it was meant to help. Armstrong found 11% of the gardens she surveyed were in danger of losing land. The insecurities on land tenure was also a common issue found in the community gardens surveyed in South-East Toronto, which was compounded with the lack of resources and political will to assist them. Members of the Port-Melbourne community garden highlighted the lack of toilet facilities there and at other community gardens which not only limits the time spent at the garden but also becomes a public health issue. Another limiting factor that some gardeners highlighted was the distance they had to travel to the gardens, and sometimes they had to resort to fossil fuel burning methods of transport (Kinglsey, Townsend, & Henderson-Wilson, 2009).

#### 4.3 Conclusion

Most of the issues found were recorded with qualitative measures of gardener's emotional responses to situations in their community garden. Issues revolving around complaints, stealing and exclusion seem to be caused by a lack of awareness of community garden norms or disagreements with systems of organisation. By practising ways to make more inclusive spaces integrated within community gardens perhaps, we would see less of these issues.

The limiting, risky, and unhealthy consequences from issues revolving around pollution could be measured to provide more quantitative evidence of the direct environmental impact that community gardens may have by changing their site. Whether it be significant or not, this can be done by scientifically measuring soil and air pollutants over a period of time in an area with a community garden or comparing them with industrial environments nearby. Pollution in the site along with the issues to

do with leasing and lack of support may only be improved with more acknowledgement, funding and growth of community gardening in our cities.

## **5. Wellington, New Zealand context**

The greater region of Wellington houses a variety of sub-cultures of different ethnicities and socio-economic states in various environmental settings. This means that even in the small corner of the world that Wellington takes up, there is still no one way that community gardens may impact everyone in the region.

### **5.1 Community gardening as a health intervention in Wellington, New Zealand**

Earle emphasizes in her report that the most significant impact community gardening may have in the New Zealand context could be by addressing health inequalities (Earle, 2011). She reinforces that health inequalities are unevenly spread across the population, most negatively affecting ethnicities such as Māori, Pacific Islanders, South-East Asians and other minority groups. She highlights 'Article three of the Treaty of Waitangi guarantees Māori will share equally in the benefits of modern society' (Durie, 2001). By being implemented as a public health intervention, Earle believes community gardening could address this issue.

The 2018 census discovered that the Maori and Pacific Islander population is larger in the peripheral regions around Wellington city (IDNZ, 2018). The 2013 census showed the household income in these area's is significantly lower than Wellington City (IDNZ, Wellington City Household Income, 2013). This indicates that health inequalities may exist in the Wellington region. Though a large diversity still exists throughout the region, including part of the communities that don't experience health inequalities. Earle states that the diversity of people found to be involved in community gardens means that community gardens could be used as a flexible health intervention fit for a diverse range of communities (Earle, 2011). Earle highlights the strength and opportunity of the co-benefits that come from community gardening such as cultural reconnections, increased interest in food cultivation and preparation, demonstrations of environmental actions and developing community resilience. This supports the findings from section 2.1 where it was discovered community gardens can achieve holistic health amongst a wide variety of communities.

The study comparison between the South-East Toronto gardens and Port-Melbourne gardens enforced the idea that similar benefits from community gardens exist for a diverse range of communities and the hierarchy of those benefits differs depending on what the community feels most deprived of. Earles report emphasizes that marginalised communities that have less access to health resources could most benefit from the nutritional and physical health outcomes from participating in community gardens. We know from analysing the Port-Melbourne study, more privileged communities may benefit more from social health benefits of community gardens instead. Whereas an immigrant community may find access to growing culturally appropriate foods as being the most beneficial outcome. A university community garden may feel they benefit more from the environmental impact the community garden may be generating. It is therefore important to view Wellington as a group of many diverse communities with different wants and needs when analysing and measuring the health impacts of existing and future community gardens or designing community gardens as part of a flexible health intervention system.

### **5.2 Supporting and developing urban agriculture in Wellington**

The 2014 report on urban agriculture in Wellington, New Zealand 'A Seed and a Wish' by Charlotte Stephens et al, reported on the current local food initiatives happening around Wellington and how we can view and improve them. The report is broken down into eight sections:

1. *Policy + Advocacy*
2. *Education*
3. *Branding*
4. *Growing + Operations*
5. *Processing storage + distribution*
6. *Buying + Selling*
7. *Eating and +celebration*
8. *Waste management + recycling*

(Stephens, Chicca, & Adams, 2014)

To strengthen the urban agriculture movement in Wellington, the report suggests it must be done by having the support and connection with local enterprises, businesses and local community (Stephens, Chicca, & Adams, 2014). Together these groups can work together in the eight different sectors to develop the urban agriculture movement in Wellington. In the report, Chicca highlights food as the largest environmental impact in most developed countries (Stephens, Chicca, & Adams, 2014). With this in mind, we must acknowledge the potential power urban agriculture can have in changing the way we eat and connect with food in our cities.

The Wellington city population is already unique in the way they connect with food. Four large fruit and vegetable markets attract a great portion of the innercity population each weekend. Eighteen community gardens are plotted around the city with access to some government funding (Wellington City Council, Stone Soup Fund, 2020). As highlighted in the Stephens report, markets provide grounds for more local food enterprises to sell to and connect with the general public beyond the farm or gardens boundaries. Mentioned earlier from Bendts Berlin report, active, inviting boundaries are essential for attracting the wider public sphere into the community gardens or urban farms. Not just boundaries but also making sure a variety of urban activities can take place in the gardens to attract people who may not be initially seeking a connection with nature (Bendt, Barthel, & Colding, 2012). Something to consider with the growth of community gardens in Wellington is not just how they can engage more people at the markets but also how their boundaries, position and activities can engage more people to grow food in Wellington.

## 6. Conclusion

Social and health benefits were firstly identified in this literature review. Similar benefits were found across most of the studies, though the context of each community garden largely determined the hierarchy of which benefits were deemed most important. Variables which mostly affected the hierarchy of benefits were the socio-economic, cultural, and environmental settings of the community garden. This finding emphasizes the importance to deeply consider the context of the community garden when measuring the benefits, it provides.

Environmental impacts were secondly identified. The differentiation between direct and indirect environmental impacts is highlighted as an important distinction to make when analysing community gardens. It was found that community gardens do well at providing a space for generating indirect environmental impacts, such as influencing urban lifestyle change and education (Okvat & Zautra, 2011), this has been largely documented with qualitative measures. On the other hand, direct environmental impacts from community gardens such as greenhouse gas mitigation (Okvat & Zautra,

2011), haven't been measured to the same degree as indirect impacts. There is an opportunity for more direct environmental impacts to be measured and fill the missing gap of quantitative evidence to support the sustainable advocacy of community gardens.

The causes of the negative social and health impacts identified were found to revolve around community interactions and funding or site challenges. Many of these challenges affected the mental health of participants such as increased stress levels. Exposure to pollutants in urban sites was also seen as a physical health risk. There is the possibility that many of these negative impacts may dissipate with more support, awareness, funding and growth of community gardens.

The local literature identified in the Wellington section covered ways urban agriculture can be supported and developed. Earles report identified New Zealand's existing health inequalities and suggested how community gardens could address them if implemented as a flexible public health intervention. Stephens report highlighted the importance of having support from local enterprise, business and community. The report logistically identifies eight different sectors of urban agriculture so the development can be clearly measured against these sectors.

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- Kinglsey, J., Townsend, M., & Henderson-Wilson, C. (2009). Cultivating health and wellbeing: members' perceptions of the health benefits of a Port Melbourne community garden. *Leisure Studies*, 207-219.
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## Part 2: Data collection + Analysis

## Contents

1. Word cloud from interviews
2. Compost survey data
3. A sign for Innermost gardens online survey on composting

## 1. Word cloud from Interviews

**Aim:** To gather more qualitative data on the social and health impacts of Innermost community garden.

**Method:** 10 semi-structure interviews with 4 organisers, 4 allotment holders and 2 volunteer's.

**Results:**





## 2. Compost Survey Data

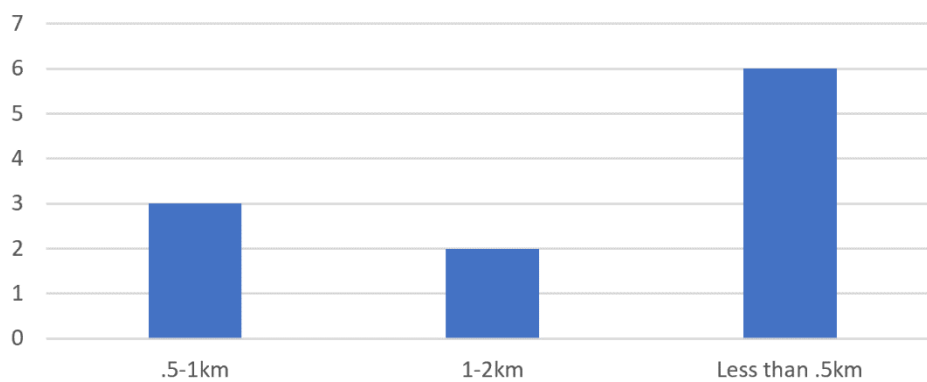
**Aim:** Gather more data that can be quantifiably represented

**Method:** 10 hours of surveying split into 2-hour shifts at the gardens, stopping composters to answer the following questions.

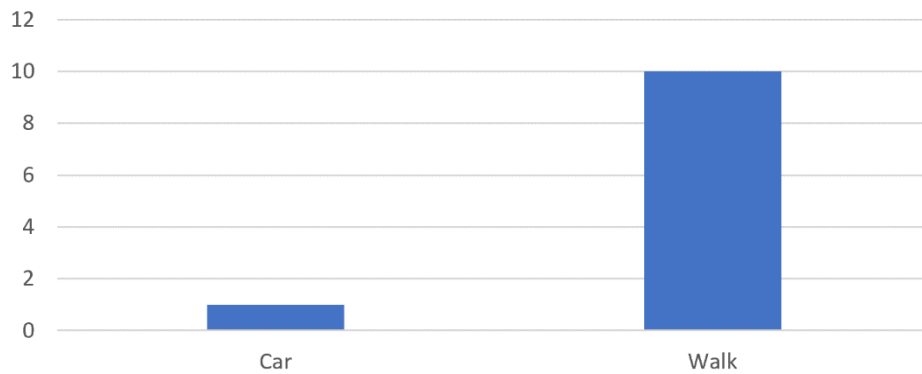
**Results:** Most common answers from each question

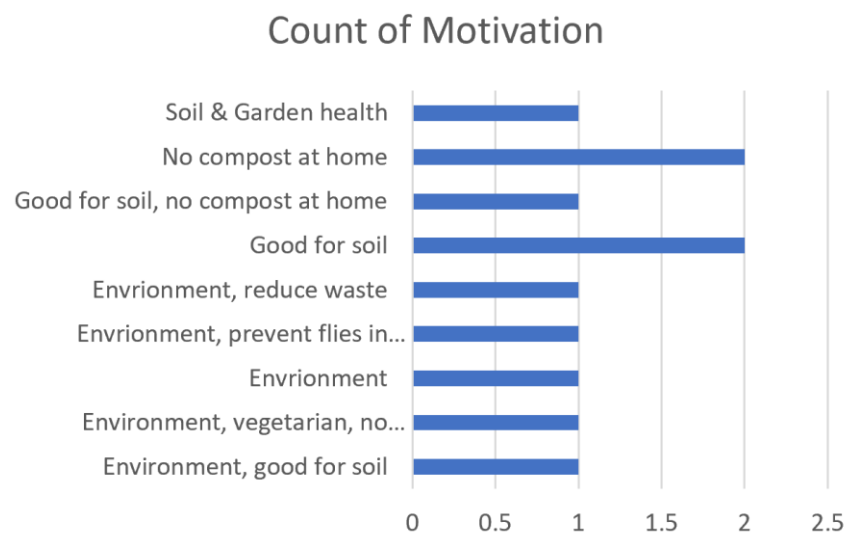
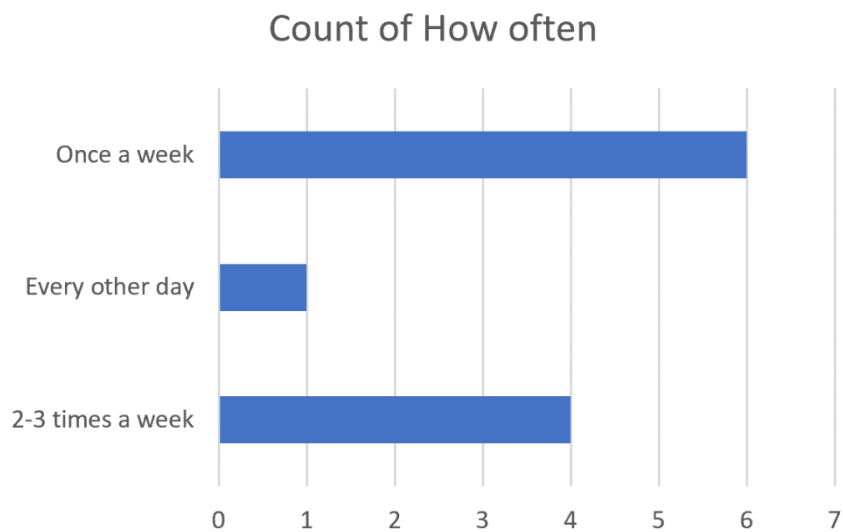
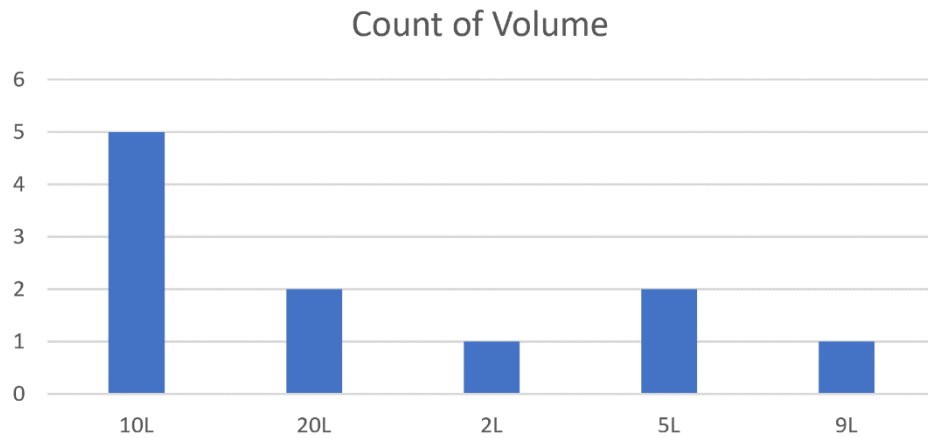
- 54% of composters live less than 0.5km from the gardens
- 90% of composters walk to drop off their compost
- 45% of composters drop of 10L
- 54% drop of compost once a week
- 45% compost for the environmental reasons

Count of How far did you travel?

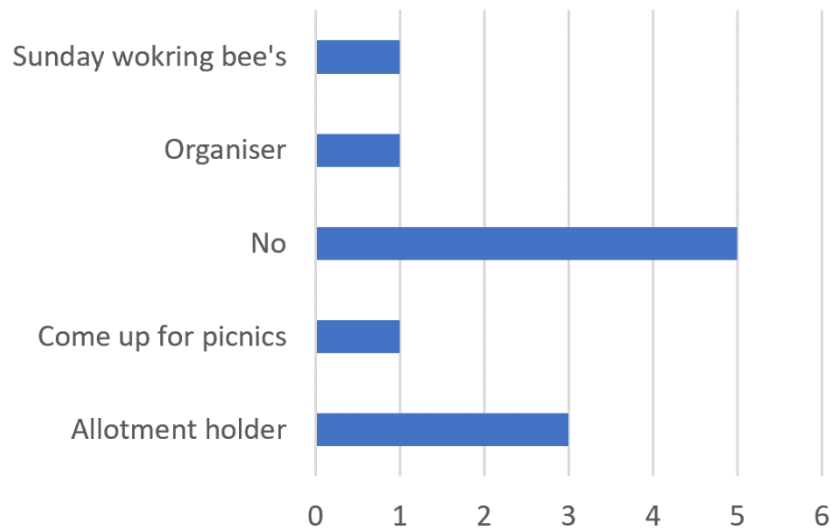


Count of Method of travel





## Count of Other garden activities?



### 3. A sign for Innermost gardens online survey on composting

Because we knew there were many more composters to be surveyed, Innermost decided to put up an online survey. This sign was designed for the gardens to catch composters attention near the bins.

## Dear composters,

In collaboration with Wellington City Council and Victoria University

The Innermost team is collecting more information about our compost and other activities at the gardens.

Please fill out our quick online survey

You can do this by using the **web-link below** on your Internet browser, or scanning the QR code on you device.



**Thank you!**

[bit.ly/innermost\\_compost](https://bit.ly/innermost_compost)

## Part 3: Website content

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### Contents

1. Summary of Impacts
2. KPI's from Innermost, other studies and reports
3. Recommended set of KPI's

### 1. Summary of impacts

#### Health Impacts

Participating in community gardening can bring you an array positive health benefit's. The benefits can be viewed in three different categories, physical, mental and nutritional. Jobs around community gardens are versatile and can accommodate anyone's level of fitness. People often find the gardens as an important break from the city, a chance to deepen their connection with nature and relax. The access to nutritional food is of course also a plus and knowing where it comes from and how it is grown. This is particularly important for communities with less access to good food.

Sources:

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#### Social Impacts

Community gardens serve as social spaces and give you a chance to connect with new people. They can accommodate people of any age, ability and ethnicity which means that people from different backgrounds get to share ideas, stories, advice and knowledge with each other. This generates social resilience, necessary in this day in age where we live in a world often detached from our neighbours.

- Bendt, P., Barthel, S., & Colding, J. (2012). Civic greening and Environmental learning in public-access community gardens in Berlin. *Landscape and Urban Planning* 109, 18-30.

- Earle, M. (2011). *Cultivating Health: Community Gardening as a Public Health Intervention*. Wellington: University of Otago.
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### **Civil Service Impacts**

Community gardens can also take the pressure off civil services like waste and stormwater management. When community gardens have efficient composting systems for the community, this can significantly reduce the volume of rubbish collected by waste management. On top of that, the food scraps get turned into healthy soil for the garden. And depending on the size of the garden, all the permeable surfaces can absorb a lot of rainwater and divert it from going in the municipal stormwater system.

- Beilin, R., & Hunter, A. (2011). Co-constructing the sustainable city: How indicators help us "grow" more than just food in community gardens. *Local Environment: The international Journal of Justice and Sustainability*, 523-538.

### **Economic impacts**

Community gardens can serve as a cost-effective way to acquire more nutritional food. But the economic impacts mostly align with activities of urban farms. Urban or Market farms will often locally distribute food through CSA or markets and through those sales they can employ gardeners and farmers.

- Wakefield, S., Yeudall, F., Taron, C., Reynolds, J., & Skinner, A. (2007). *Growing Urban Health: Community Gardening in South-East Toronto*. Oxford University Press.

### **Environmental Impacts**

Community gardens can have a range of environmental impacts both directly and indirectly. Direct environmental impacts include greenhouse gas mitigation, carbon sequestration,

increased biodiversity and regeneration. The indirect environmental benefits are more to do with influencing urban lifestyle change and education

- Beilin, R., & Hunter, A. (2011). Co-constructing the sustainable city: How indicators help us "grow" more than just food in community gardens. *Local Environment: The international Journal of Justice and Sustainability*, 523-538.
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## 2. KPI's from innermost and five other reports/studies

As mentioned earlier the literature review assisted the development of a new set of KPI's. Four reports or studies from the literature review that had used or suggested obvious key point indicators were analysed against each other, Innermost KPI's and Five Borough Farm's KPI's. The Five Borough Farm's report executed the most elaborate set of keypoint indicators and ways to measure them (Cohen, 2012), although they were tailored towards New York City urban agriculture, specifically urban farms that gain revenue from produce. The Five Boroughs sets of KPI's still provided a good example for organisation and measuring methods. All six sets of KPI's were identified (part 3.2), and the most important and relevant measures were put together to tailor towards measuring Wellington's current and future urban agriculture (part 3.3). This chart will be accessible on Innermost's 'Green KPI's Project' website.

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DOCUMENT	Packer, Tim. (2019). <i>Iris-metrics_innermost_gardens</i> . Excel Document.	
IMPACT	KPI / Measures	Type
Ecosystem Services	<b>Native trees planted</b> Number of plants (cumulative)	Quantitative
Ecosystem Services	<b>Carbon sequestration</b> ITree or other agreed model with central government	Quantitative
Ecosystem Services	<b>Pesticides / herbicides used</b> Litres	Quantitative
Ecosystem Services	<b>Water - stormwater diversion</b> ITree or other agreed model with central government	Quantitative
Ecosystem Services	<b>Ecological restoration</b> Story - DDT	Qualitative
Ecosystem Services	<b>Biodiversity benefits</b> Story - insect biodiversity	Qualitative
Ecosystem Services	<b>Biodiversity benefits</b> Story - Bees	Qualitative
Ecosystem Services	<b>Ecosystem approach</b> Story - Permaculture	Qualitative
Ecosystem Services	<b>Stewardship</b> Story - Community hands in the soil	Qualitative
Local Food Production	<b>Total trees planted</b> Number of plants (cumulative)	Quantitative
Local Food Production	<b>Common annual bed yield</b> Kilograms (from yield estimate for area m2 in garden)	Quantitative
Local Food Production	<b>Allotments</b> Story - Allotment holders	Qualitative
Community Wellbeing	<b>Hall users - number of people</b> Headcount	Quantitative
Community Wellbeing	<b>Garden users - number of organisations</b> Amount of groups (corporate) given access to gardens	Quantitative
Community Wellbeing	<b>Gardening skills development</b> People attended	Quantitative
Community Wellbeing	<b>Use of facilities</b> Story - homeschool group	Qualitative
Community Wellbeing	<b>Building community connections</b> Story - Mt Vic Hub and Community Dinners	Qualitative
Community Resilience	<b>Community resilience</b> First aid	Quantitative
Community Resilience	<b>Community resilience</b> Emergency accommodation	Quantitative
Community Resilience	<b>Community resilience</b> Emergency water	Quantitative
Community Resilience	<b>Community resilience</b> Emergency food	Quantitative
Civil Services	<b>Hall users - number of organisations</b> Organisation count per month	Quantitative
Civil Services	<b>Compost - landfill diversion</b> Kilograms	Quantitative
Civil Services	<b>Compost - materials recycled</b> Kilograms	Quantitative
Civil Services	<b>Value of nearby housing</b> GV or other valuation methods	Quantitative
Health Benefits	<b>Physical health</b> Story - Walkways	Qualitative
Health Benefits	<b>Mental health</b> Story - Tuesdays club	Qualitative
Health Benefits	<b>Physical health</b> Story - Pollution blocking effect of Trees	Qualitative

REPORT	Cohen, N & Reynolds, K & Sanghvi, R. 2012. <i>Five Borough Farm: Seeding the Future of Urban Agriculture in New York City</i> . Design Trust for Public Space & Added Value.	
Health	<b>Improve access to healthy food for underserved communities</b> # Pounds / Kilos produced by the garden	Quant
Health	# (\$) %of the farmers market sales from food access programs	Quant
Health	# of CSA's linked to the farm/garden	Quant
Health	# of participants in CSAs linked to the farm/garden	Quant



Health	#, % low income shares in CSAs linked to the farm/garden	Quant
Health	<b>Improve food-health literacy/skills/aspirations for underserved communities</b>	
Health	# of people participating in garden programs/activities reporting that they sometimes, very often, or always read food nutrition labels at the supermarket	Qual
Health	# of people participating in garden programs/activities that agree with the statement "I can change the things I eat"	Qual
Health	<b>Increasing healthy eating</b>	
Health	# of participants in the garden's health-related programs	Quant
Health	# of healthy eating program strategies being implemented	Quant
Health	#,% of healthy eating program participants meeting the Healthy People 2020 recommended servings of five fruits and vegetables per day	Qual
Health	#, % of healthy program participants consuming a fruit and/or vegetable snack once per day	Qual
Health	# of different vegetables eaten in the last 2 weeks by health eating pprogram participants	Qual
Health	#,% of healthy eating program participants that can identify where their food comes from (I.e origin of food as plant based)	Qual
Health	<b>Increasing physical activity</b>	
Health	# of people engaged in farming/gardening on the farm/garden	Quant
Health	# of total person-hours spent farming/gardening on the farm/garden per year	Quant
Health	# (average) time spent farming/gardening among people who participate in programs/activities	Qual
Social	<b>Social capital/connection</b>	
Social	# of people participating in farm/garden programs/activities	Quant
Social	# total person-hours spent working on the farm/garden per year	Quant
Social	# of farmers markets the farm/garden sells in	Quant
Social	# (\$) from urban agriculture based farmers market sales	Quant
Social	% increase in urban agriculture-based farmers market sales from prior year	Quant
Social	Community members perceived benefits and concerns about urban agriculture	Qual
Social	Community perceptions of safety (personal safety, crime) in their community	Qual
Social	<b>Youth Development</b>	
Social	# of youth participating in the farm/garden	Quant
Social	#, % of farm/garden programs that employ youth	Quant
Social	# of total youth-person-hours spent working on the farm/garden per year	Quant
Social	# of youth the farm/garden trained in job skills	Quant
Social	#,% of youth who participate in a youth program that graduate from high school	Qual
Social	#, % of youth who participate in a program that report high self esteem	Qual
Social	#, % of youth who participated in a program reporting they have at least one good relationship with an adult other than their parent (mentor)	Qual
Social	#,% of youth indicating positive attitude change and/or aspirations related to participating in youth-adult partnerships	Qual
Social	#,% of youth who participated in a program reporting that they are/identify with being "part of the community"	Qual
Social	#,% of individuals reporting positive attitude and/or aspiration related to volunteering for civic activities, community service, and/or philanthropy	Qual
Social	#,% of youth engaged in the political/governance process	Qual
Social	<b>Food access</b>	
Social	#(\$),% of sales from food access programs	Quant
Social	# of CSAs linked to the farm/garden	Quant
Social	# of participants in the CSA linked to the farm/garden	Quant
Social	#,% low income shares in CSA linked to the farm/garden	Quant
Social	# (pounds) of food produced by the farm/garden	Quant
Social	# of people participating in programs/activities that are growing food because they face food security issues	Qual
Social	<b>Age integrate space</b>	
Social	# of participant over 65	Quant
Economic	<b>Local and regional economic stimulation</b>	
Economic	\$ total value of food produced	Quant
Economic	\$ total value per quare food of produce	Quant
Economic	#, (\$) total revenue generated from sales of food**	Quant
Economic	% of total revenue from sale of regional produce	Quant
Economic	% of CSA sales that is from regional produce	Quant
Economic	# (hours) of volunteer-time contributed to the farm/garden	Quant
Economic	# (\$) from urban agriculture-based farmers market sales	Quant
Economic	% increase in urban agriculture-based farms market sales from prior year	Quant



	<b>Job Readiness</b>	
Economic	# of people the farm/garden has trained in job skills	Quant
Economic	# of youth the farm/garden trained in job skills	Quant
Economic	#, % of farm/garden programs that employ youth	Quant
	<b>Affordable healthy food</b>	
Economic	#(\$), % of sales from food access programs	Quant
	<b>Awareness of food systems ecology</b>	
Ecological	# of school students participating in food system ecology programs	Quant
	<b>Stewardship</b>	
Ecological	# of total participants in food system ecology programs	Quant
Ecological	# (pounds) of food produced by the farm/garden	Quant
Ecological	#(pounds) of food production per square foot	Quant
Ecological	Community garden perceptions of the importance of urban agriculture as part of green/open space	Qual
	<b>Conservation</b>	
Ecological	# (square footage) of rooftop area collected for rainwater harvesting	Quant
Ecological	#(\$ ) annual consumption of water use	Quant
Ecological	#(\$ ) annual consumption of energy	Quant
Ecological	#, % (square footage) of land/lot that could potentially grow food	Quant
Ecological	#, % (square footage) of land/lot actually used to grow food	Quant
	<b>Stormwater management</b>	
Ecological	# (square footage) of permeable surface in the farm/garden	Quant
	<b>Soil Improvement</b>	
Ecological	# lead level in the farms/gardens soil, per year	Quant
Ecological	# (pounds) of compost produced/processed	Quant
	<b>Reduced food waste</b>	
Ecological	# (Pounds) of food waste collected	Quant
	<b>Habitat improvement/biodiversity/ecological connectivity</b>	
Ecological	# of activities related to increase biodiversity	Quant
Ecological	# of beehives that are part of the farm/garden	Quant
Ecological	# of chickens that are part of the farm/garden	Quant
Ecological	% of vegetation planted with native/heirloom varieties through the farm/garden	Quant
Ecological	# of crops grown	Quant
Ecological	% of produce grown (as measured by % of total weight) without use of synthetic pesticides	Quant
Ecological	% of produce grown (as measured by % of total weight) without use of synthetic fertilizers	Quant

## REPORT

### Co-constructing the sustainable city, how indicators help us grow more than food in community gardens

	<b>Community engagement</b>	
Social	Range, # of external community groups registered as plot holders/annum	Quant
Social	Range, # of general public members who use the CG site for events, activities, and programmes/annum	Quant
Social	Range, # of general external community groups who use the CG site for various activities/annum	Quant
	<b>External community engagement</b>	
Social	Range, # of formal visits booked within the CG organisation by community groups	Quant
	<b>Biodiversity</b>	
Ecological	Bird monitoring/surveys	Quant
Ecological	Insect monitoring/surveys	Quant
Ecological	Habitat monitoring/surveys	Quant
Ecological	Genetic diversity of crop species	Quant
	<b>Community engagement with local food production</b>	
Local food production	# farmers markets, Community gardens, city farms, veggie gardens, planter boxes and other UA in municipality	Quant
Local food production	# of people on a waiting list at a CG within municipality	Quant
Local food production	Average time a resident has to wait to acquire a plot	Quant
Local food production	Average number of residents who attend a farmers market per month/fortnight/week	Quant
Local food production	# of council requests/inquiries relating to localised food production activities eg. Where is my nearest CG?, How do I initiate a new CG?	Quant

## STUDY

Krasny, M., & Tidball, K. (2009). **Community Gardens as Contexts for Science, Stewardship, and Civic Action Learning**. Cities and the Environment Vol. 2 Iss.1 Art.8.

	<b>Youth Development</b>	
Social	Pre/post-program, Young Children draw a garden - code elements	Qual
Social	Pre/post-program "What does a garden need to grow"	Qual
Social	Pre/post-program "What does a garden give back to you?"	Qual
	Educators asked "What is the greatest impact of garden program on youth?" Science concepts, Awareness of gardens and gardens contributions to community, general learning and exposure, motivation to learn, awareness of source of food, connection to nature, self empowerment, sense of achievement, contributions to community, learning from elders, working together, multicultural understanding, stayed out of trouble, science inquiry	
Social		Qual
<b>REPORT</b>	Okvat, H., & Zautra, A. (2011). <b>Community Gardening: A Parsimonious Path to Individual, Community, and Environmental Resilience.</b> Tempe: Society for Community Research and Action 2011.	
	<b>Indirect Environmental impacts</b>	
Environmental	# of people learnt new things about climate change processes	Quant
Environmental	# of people know that food choice and systems impact climate	Quant
Environmental	# of people developed awareness of connection between human actions and natural environment	Quant
Environmental	# education programs in community gardens on sustainability and global climate change	Quant
	<b>Direct Environmental impacts</b>	
Environmental	Kg of carbon sequestered/m <sup>2</sup>	Quant
Environmental	Kg of carbon emissions saved of each crop usually transported to local grocery	Quant
Environmental	Kg of carbon emissions used to package and refrigerate crops we grow when in local grocery	Quant
Environmental	Kg of foodscrap collected p/week	Quant
Environmental	m <sup>3</sup> of Storm-water runoff cleaned at community garden	Quant
Environmental	Kg carbon emissions from municipal to manage stormwater per m <sup>3</sup>	Quant
Environmental	°C of community garden compared to urban spaces nearby (heat island affect)	Quant
<b>STUDY</b>	Alaimo, K., Packnett, E., Miles, R., & Kruger, D. (2008). <b>Fruit and Vegetables Intake among Urban Community Gardeners.</b> Nutrition Education and Behaviour, 94-101.	
	<b>Fruit and Vegetable consumption</b>	
Health	no. household members per/participant	Quant
Health	no. household member participating in community garden	Quant
Health	% consuming fruits and vegetables 5 times daily	Quant

### 3. Recommended set of KPI's . . .



The Green KPI framework for Wellington Urban Agriculture						
Impact	No.	KPI / Measure	Type	Ref.	Difficulty (x=Easy)	Original Innermost KPI's
Health	1	Physical activity		3,6		
	1.1	# of people engaged in farming/gardening on the farm/garden (e.g # of volunteers + allotment holders)	Quantitative	3	X	11,28
	1.2	# of total person-hours spent farming/gardening on the farm/garden per year (e.g 'How many hours a week do you spend on your allotment?')	Quantitative	3	XX	11,28
	1.3	# (average) time spent farming/gardening among people who participate in programs/activities (# people + hrs spent in workshops)	Quantitative	3	XX	11,28
	1.4	Perceived physical health impact ('What impact has your involvement had on your physical health?')	Qualitative	7	X	28,
	2	Healthy Eating		3,		
	2.1	#, % of participants consuming a fruit and/or vegetable snack once per day	Quantitative	3	X	28,
	2.2	# of different vegetables eaten in the last 2 weeks by participants	Quantitative	3	X	28,
	2.3	##% participants that can identify where their food comes from (i.e. origin of food as plant based)	Quantitative	3	X	28,
	2.4	% of participant consuming fruit and veg 5 times daily compared to non-participants from the same household	Quantitative	1	XX	28,
	3	Mental health		6,		
	3.1	# garden programs for mental health issues & # participants	Quantitative	7	X	27,
	3.2	# gardens programs for people with disabilities & # participants	Quantitative	7	X	27,
	3.3	Perceived participants with mental health improvements	Qualitative	7	XX	27,
Social	4	Youth Development		3,4		
	4.1	# of youth participating in the farm/garden	Quantitative	3	X	
	4.2	# of total youth-person-hours spent working on the farm/garden per year	Quantitative	3	XXX	
	4.3	# of youth the farm/garden trained in job skills	Quantitative	3	X	
	4.4	#, % of youth who participate in a program that report high self esteem	Quantitative	3	X	
	4.5	##% of youth indicating positive attitude change and/or aspirations related to participating in youth-adult partnerships	Quantitative	3	XX	
	4.6	##% of youth who participated in a program reporting that they are/identify with being "part of the community"	Quantitative	3	X	
	4.7	Pre & post-program code answers (i.e Young Children draw a garden,"What does a garden need to grow?", "What does a garden give back to you?")	Qualitative	4	X	
	4.8	Educators asked "What is the greatest impact of garden program on youth?", code answers (i.e Science concepts, motivation to learn, self empowerment)	Qualitative	4	X	
	5	Intergenerational space		7		
	5.1	#, % Age of all participants (Group into ranges i.e 18-30, 65+)	Quantitative	3	X	
	5.2	# of intergenerational programs (e.g Tuesday working bee's= retiree's and active)	Quantitative	7	X	
	6	Community connection and engagement		2,3,6		
	6.1	# of people participating in farm/garden programs/activities (e.g # of people at working bee's, workshops, composting, allotments etc)	Quantitative	3	X	4,6,11,24
	6.2	# total person-hours spent working on the farm/garden per year (e.g # hrs of working bee x # people)	Quantitative	3	XX	11, 24
	6.3	# of community groups who use the CG site for events, activities, and programmes/annum (e.g Mt Vic hub dinners at Innermost)	Quantitative	2	X	5, 24
	6.4	# total events, activities, workshops per year	Quantitative	7	XX	11, 24
	6.5	Type & # of facilities & resources available to community (e.g composting, picnic area, seats, emergency water, play zone etc)	Quantitative	7	XX	14-17, 22, 24
	6.6	# of allotments	Quantitative	6	X	24,
	6.7	# of allotment holders (some allotments may be empty, some may have two gardeners)	Quantitative	6	X	24,
	6.8	Average time on waitlist for an allotment per year	Quantitative	7	X	24,
	6.9	m2 of community garden plots	Quantitative	7	X	24,
	6.10	interactions?"	Qualitative	3	X	24,
	6.11	Community perceptions of safety (personal safety, crime) in their community i.e. "How does the garden affect the safety in the community?"	Qualitative	3	X	24,
	7	External community engagement		2,6		
	7.1	# of general external community groups who use the CG site for various activities/annum (e.g Active group, Wilder kids)	Quantitative	2	X	5,
	7.2	# of activities/events/workshops held by external groups at gardens/farm per annum	Quantitative	7	X	5,6
	7.3	# of farmers markets the farm/garden sells in	Quantitative	3	X	
	7.4	\$(S) from urban agriculture based farmers market sales	Quantitative	3	XX	
	7.5	% increase in urban agriculture-based farmers market sales from prior year	Quantitative	3	XXX	
Civil Service	8	Compost (food scraps diverted from landfills)		6,		
	8.1	# Kg of food scraps collected each week	Quantitative	7	XX	9,
	8.2	m3 of food scraps collected each week	Quantitative	7	XXX	9,
	8.3	Method of transport people use to go an drop of compost (i.e. foot/bike/bus/car/scooter/other)	Quantitative	7	X	9,
	8.4	# Km of distance people travel to drop off compost	Quantitative	7	X	9,
	8.5	Time it takes for people to drop off compost (i.e. find out whether they make a special trip or combine drop off with other routine travel)	Quantitative	7	X	9,
	8.6	How often do people drop off their compost (i.e. once a week, 2-3 times a week, every other day, once a month)	Quantitative	7	X	9,
	8.7	What motivates people to compost at the garden/farm (i.e. environment, no compost at home, feed the soil for garden)	Qualitative	7	X	9,
	8.8	# Kg of carbon material recycled for compost (i.e. coffee husks, cardboard)	Quantitative	6	X	10 10,
	9	Stormwater management		3,6		
	9.1	m2 of permeable surface in garden/farm	Quantitative	3	XX	13,
	9.2	m2 of rooftop area collected for rainwater harvesting	Quantitative	3	XX	13,
	9.3	m3 rainwater collected/annum	Quantitative	7	XXX	13,
Economic	10	Local and regional economic activity		3,		
	10.1	#, \$(S) total revenue generated from sales of food	Quantitative	3	X	
	10.2	% of CSA sales that is from regional produce	Quantitative	3	XX	
	10.3	# (hours) of volunteer-time contributed to the farm/garden	Quantitative	3	XX	
	10.4	% increase in urban agriculture-based farms market sales from prior year	Quantitative	3	XX	
	11	Job readiness		3,6		
	11.1	# of people the farm/garden has trained in job skills	Quantitative	3	X	
Environment	11.2	# of youth the farm/garden trained in job skills	Quantitative	3	X	
	11.3	# hrs per week of employment	Quantitative	3	X	
	12	Stewardship		3,		
	12.1	# of total participants in programs that promote stewardship?	Quantitative	3	X	25
	12.2	# Kg of food produced by the farm/garden	Quantitative	3	XXX	25,
	12.3	# Kg of food production per m2	Quantitative	3	XXXX	25,
	12.4	Garden participant perceptions of the importance of urban agriculture as part of green/open space	Qualitative	3	X	25,
	12.5	Garden participant perceptions of their urban lifestyle change since participating in garden/farm	Qualitative	7	X	25,
	12.6	Garden participant perceptions of the importance of urban agriculture in their city	Qualitative	7	X	25,
	12.7	Garden users' perceptions on their gardening skills development	Qualitative	6	X	
	13	Resources Conservation		6,		
	13.1	m2, % of rooftop area collected for rainwater harvesting	Quantitative	3	XX	13,
	13.2	\$(S) annual consumption of water use	Quantitative	3	XX	
	13.3	\$(S) annual consumption of energy	Quantitative	3	XX	
	13.4	m2, % of land/lot that could potentially grow food	Quantitative	3	XX	
	13.5	m2, % of land/lot actually used to grow food	Quantitative	3	XX	
	14	Ecological Restoration		2,6		
	14.1	# Native trees planted	Quantitative	6	X	1, 18
	14.2	Soil improvement (e.g DDT restoration or % of Organic matter)	Quantitative	6	X	18,
	14.3	# lead/other pollutant level in the farms/gardens soil, per year	Quantitative	3	XXX	18,
	14.4	# Kg's of compost produced/processed p/w	Quantitative	3	XXX	18,
	14.5	(Average Temperature °C) of community garden compared to urban spaces nearby per mid-season (heat island affect)	Quantitative	5	XXX	
	15	Biodiversity		6,		
	15.1	# of plant soede varieties (i.e. heirloom, native)	Quantitative	3	X	20,
	15.2	# of beehives that are part of the farm/garden	Quantitative	3	X	20,
	15.3	# of chickens that are part of the farm/garden	Quantitative	3	XX	20,
	15.4	% of produce grown (as measured by % of total weight) without use of synthetic pesticides	Quantitative	3	XXX	8, 20
	15.5	% of produce grown (as measured by % of total weight) without use of synthetic fertilizers	Quantitative	3	XXX	8, 20
	15.6	Bird monitoring/surveys	Quantitative	2	XX	20,

	15.7	Insect monitoring/surveys	Quantitative	2	xxx	20,		
	15.8	Habitat monitoring/surveys	Quantitative	2	xx	20,		
	16	Carbon sequestration		6,				
	16.1	# Kg of food scraps collected p/week p/month	Quantitative	5	x	7,		R
	16.2	# Kg of carbon sequestered per Kg of food scraps turned into compost	Quantitative	7	xxxxx	7,		R
	16.3	# Kg of finished compost produced p/week p/month	Quantitative	3	xx	7,		R
	16.4	# Kg of carbon sequestered through compost p/week p/month	Quantitative	5	xxxxx	7,		R
Local Food Prod.	17	Community engagement with local food production		2,				
	17.1	# of CSAs linked to the farm/garden	Quantitative	3	x			
	17.2	## low income shares in CSA linked to the farm/garden	Quantitative	3	x			
	17.3	# Kg of food produced by the farm/garden	Quantitative	3	xxxx			
	17.4	# of people participating in programs/activities that are growing food because they face food security issues	Quantitative	3	x			
	17.5	# of people on a waiting list at a CG within municipality	Quantitative	2	x			
	17.6	Average time on waitlist for an allotment	Quantitative	7	x			R
For the city to measure	17.7	# farmers markets, Community gardens, city farms, and other UA in municipality	Quantitative	2	xx			
For the city to measure	17.8	Average number of residents who attend a farmers market per month/fortnight/week	Quantitative	2	xxx			
For the city to measure	17.90	# of council requests/inquiries relating to localised food production activities e.g. Where is my nearest CG?, How do I initiate a new CG?	Quantitative	2	x			
	18	Total tree planted		6,				2,
	18.1	# of fruit tree planted	Quantitative	6	x	2,		R
	18.2	# of edible native tree planted	Quantitative	7	x	2,		1A
	19	Yield		6,				
	19.1	# Kg yield of fruit /annum	Quantitative	7	xxxx	3,		R
	19.2	# Kg yield of vegetables /annum	Quantitative	7	xxxx	3,		R
	19.3	# Kg yield of allotment yield	Quantitative	7	xxxxx	3,		
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	5	Okvat, H., & Zautra, A. (2011). <b>Community Gardening: A Parsimonious Path to Individual, Community, and Environmental Resilience</b> . Tempe: Society for Community Research and Action 2011.						
	6	Packer, Tim. (2019). <b>Iris-metrics_innermost_gardens</b> . Excel Document.						
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		Recommended framework for innermost gardens						

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## Conclusion

Overall the literature review successfully contributed to the research by identifying, analysing and comparing international studies on community garden impacts to our very own. The subjects of the studies and reports identified came from a vast range of socio-economic, ethnic and environmental contexts. It was concluded these attributes of context are crucial to identify when studying the impacts of a community garden in order to gain a holistic understanding of the role the garden plays within its community. This helped view the context of Innermost and other community gardens around Wellington from a more critical perspective. With the assistance of the data collection in part two, similarities and unique attributes between Innermost and other gardens were easily identified. Collecting interviews and surveys at Innermost gardens was a practical way of understanding the complexities that can exist behind data collection. Both the literature review and the data collection assisted the creation of the KPI chart. The aim of the chart is to be a clear, strategic and easy tool for gardens around Wellington to collect more data on their impacts. Wellington itself is made up of a variety of subcultures that will each be affected by community gardens in unique ways. Categorising the new KPI chart by impact is an important feature so garden coordinators can easily identify what type of impact they want to measure about their space in relation to their context.