

BRINGING FOOD TO THE TABLE: EXPLORING THE POTENTIAL OF URBAN  
AGRICULTURE IN HONOLULU

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For my parents, George and Marianne, and my sister, Salomé, for all their support through this research, the completion of my undergraduate degree and all my different endeavors.

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## ABSTRACT

The growing interest in local food production coupled with the social, environmental and economic benefits associated with agricultural uses in urban areas has spawned numerous small-scale agriculture projects. These range from individuals' backyards to community gardens and urban farms. Local governments have devised policies and plans to support such endeavors, or in some cases, regulations to sanction them (e.g. local zoning codes that do not permit urban agriculture). This qualitative study explores the potential for urban agriculture to support local food production and the factors that influence the implementation of projects in Honolulu. The topic of urban agriculture was chosen as Honolulu is not food secure, however looking at local food production could help to increase food security. Drawing on stakeholder interviews, a review of existing literature and precedent cities, and policy and planning documents on the topic, it looks at how different stakeholders (public, private, and non-profit) are engaging in urban agriculture in Honolulu. The findings will deepen our understanding of urban agriculture within the broader context of local food production, highlighting some of the opportunities and challenges for its implementation.

Through this study it was found that urban agriculture could be a possibility in Honolulu, however the current policies and regulations need to be updated to allow projects to be implemented. Looking at the Kaka'ako Special Design District can shed light on how the zoning regulations could be changed to allow for urban agriculture. Finding available land to use is another hurdle that needs to be overcome in order for urban agriculture to be implemented in Honolulu.

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## CHAPTER 1. INTRODUCTION AND BACKGROUND

### 1.1 IMPORTANCE OF RESEARCH AND GOALS

The primary objective of this research is to provide a better understanding of the challenges in implementing urban agriculture within an already existing food system, such as that in Honolulu. In this paper, I define urban agriculture as food that is able to be grown in an urban landscape, with a focus on produce grown by corporations and community gardens. I examined the relevant policy and planning landscape to learn how it could facilitate or limit the implementation of urban agriculture. I also conducted interviews with experts in different fields to supplement my secondary research. The purpose of investigating the potential of urban agriculture in Honolulu is to understand if food availability and accessibility could be increased while also decreasing food deserts and food insecurity. I examined this by asking - how viable is urban agriculture in Honolulu?

The central issue with food security on O‘ahu is the excessive reliance on the importation of food. 85-90% of all food available comes from imports, and most of the sources of food are the same (U.S. Environmental Protection Agency et al., 2017; Merrigan & Miles, 2020) This leaves Honolulu vulnerable in terms of food security. Looking closely at food insecurity in Hawai‘i and how urban agriculture could play a part in relieving some of the pressure on food systems is important because Honolulu’s food system is vulnerable to disturbances, as highlighted by the COVID-19 pandemic (Miles, 2020). Being on an island also creates additional challenges such as limited space and distance from major food production areas (La Croix & Mak, 2021).

A food system is a complex web of activities involving the production, processing, transportation, sale (wholesale and retail) as well as consumption and disposal (Donald, 2008). Food systems are an important aspect of a city because food is an integral and necessary part of life. Studying how a food system works is ultimately about understanding how food moves through a system (Donald, 2008). It can be used to identify the areas that need to be updated to ensure that food is accessible and affordable for all. While food security<sup>1</sup> is a critical issue and the COVID-19 pandemic has exposed the weaknesses of food supply chains, my study is limited to exploring how urban agriculture can support existing food supply chains by contributing to localized food systems.

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<sup>1</sup> Food security can be defined as all people, at all times have physical, social, and economic access to sufficient, safe, and nutritious food that meets their food preferences and dietary needs for an active and healthy life (IFPRI : International Food Policy Research Institute, n.d.).

## 1.2 GLOBAL POPULATION GROWTH AND URBANIZATION

The global population has increased significantly over the past couple of decades; the majority of this growth has been in cities (United Nations, 2019). In 1900 the urban population was 14% of the total global population; however, by 2007 that percentage had increased to just above 50% (Orsini et al., 2013). These numbers are expected to continue to rise. In the paper cited, the projected percentage was 55% by 2020 (Orsini et al., 2013). The urban population has grown at a faster rate than was expected. In 2020, the percentage of the global population living in an urban area was 56.2% (Buchholz, 2020). More recent studies project that the urban population will reach 68% of the total global population by 2050 (United Nations Department of Economic and Social Affairs, 2018). The projected increase in and growth of the urban population could put stress on urban systems if unable to adapt to the rate of population growth.

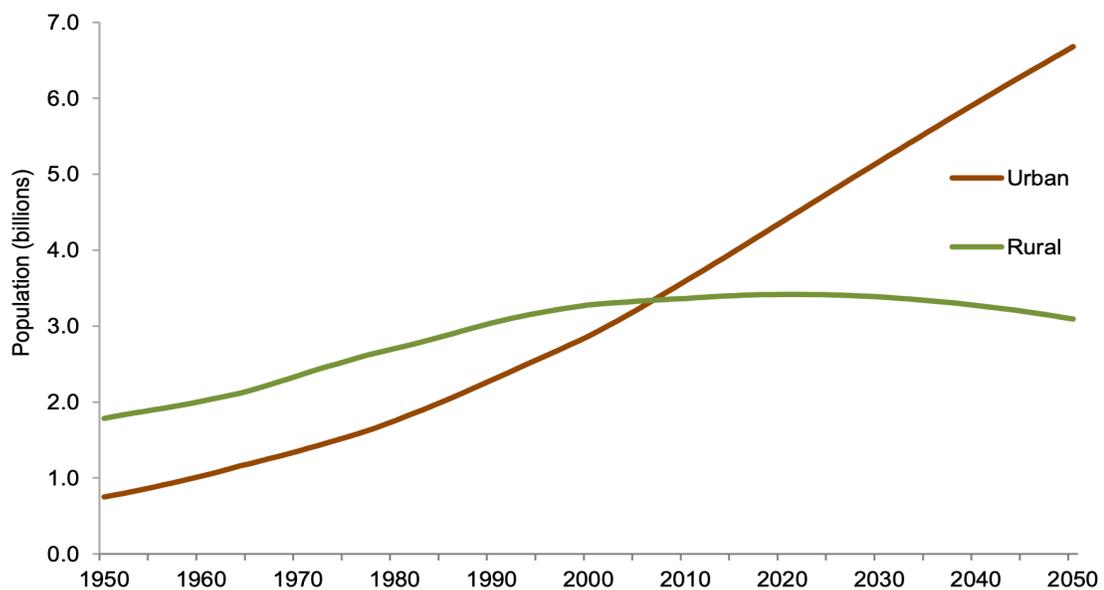


Figure 1 Population from 1950 till 2050 (projection) in both rural and urban communities globally (United Nations, 2019)

Figure 1 (United Nations, 2019) shows the average population growth worldwide between 1950 up until 2018. From 2018 until 2050, predictions were used. The figure

shows that after about 2007, the urban population exceeded the population in rural areas. In 2018, 4.2 billion people, roughly 55% of the population, inhabited cities and this is predicted to continue to increase (United Nations, 2019).

In 2015, the United Nations disseminated the Sustainable Development Goals (SDGs) (United Nations Development Programme, n.d.). There are 17 SDGs, each targeting a different area of society and the environment to help the betterment of people. There are three overall goals: i) to protect the planet; ii) to end poverty; and iii) to ensure peace by 2030 (United Nations Development Programme, n.d.). The SDGs were introduced to draw attention to these issues and encourage governments to take action toward the aims listed above. SDG Goal 11 is titled “Sustainable Cities and Communities” and recognizes the need to focus on cities and human settlements and make them “inclusive, safe, resilient and sustainable” (United Nations Development Programme, n.d.). Most urban areas rely on importing goods from rural and international markets, including critical resources such as food, water, and fuel which makes cities unsustainable and unstable on their own, since any significant disturbance to the systems and pathways could limit or remove access to these resources (Gebre & Gebremedhin, 2019). Food systems can be particularly vulnerable during such disruptions to the global supply chains, as many countries rely on imports to meet the demand for food. Several of the SDGs, therefore, address the need to strengthen the global supply chain, sustainably increase agricultural production, reduce food waste, and ensure access to nutritious food for all.

### 1.3 LAND USE PLANNING AND FOOD SYSTEMS

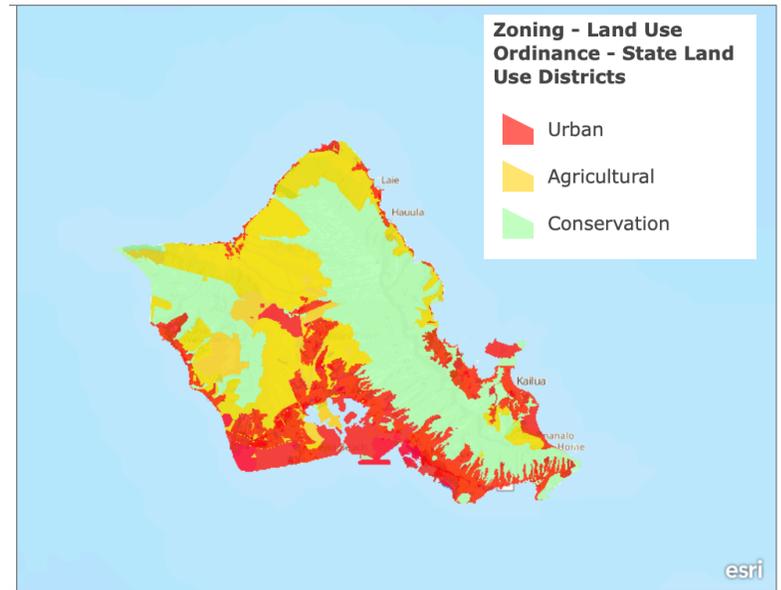
Land use planning looks at the potential of an area based on a land and water assessment to determine the best land-use options for that area (Young & FAO, 1993). Land use planning is a broad term which also encompasses zoning considerations. The assessment of the land also incorporates the socio-economic elements of the area and the surrounding community to better understand the land and the way that it is used. The purpose of land use planning is to determine the best use for a particular area, taking into account the demands of the community while also ensuring that the resources in the area are protected for future generations. To ensure that land utilization best reflects the needs of the land and community, there needs to be flexibility within planning practices in order to anticipate potential and sudden changes (Young & FAO, 1993). In Hawai‘i the land use planning laws are intricate, due to the unique requirements and deadlines of the various governmental and political entities who all have some jurisdiction over the topic (Sullivan Meheula Lee, LLLP, 2021).

#### 1.3.1 STATE LAND USE

The State Land Use Commission (LUC) classifies designated zones and defines which types of land falls under specified categories (State Land Use Commission, n.d.). The main purpose of having a LUC is to ensure that as the land becomes more developed, it stays within the guidelines of a state’s current plan. The plan incorporates developing an area to ensure the sustainability of neighborhoods by protecting the safety, health, and welfare of the community. More specifically, by ensuring that the right land use is in place, it allows for the least impacts on the natural, historic, and aesthetic aspects of the

island. The LUC stipulates the guidelines for the different types of structures that can be built based on the land use designation (State Land Use Commission, n.d.).

There are four main types of state land use zones which can be used to classify and categorize different areas; rural, urban, agriculture and conservation (State Land Use Commission, n.d.; Robinson, 2019). Figure 2 shows the state land use districts. Rural is not a category on O‘ahu because there are no areas that meets this classification for the rural distinction. The category was



Esri, CGIAR, USGS | Esri, HERE, Garmin, SafeGraph, METI/NASA, USGS, EPA, USDA

Figure 2 Map of State Land Use distinctions on O'ahu (City & County of Honolulu & Honolulu GIS Office (HOLIS), 2020).

created for the other island

communities that were not represented in the urban, agricultural or conservation categories. The classification and definition of land uses, and policies vary across cities and governing bodies. Further distinctions of land uses, such as residential and industrial zones, are left to the discretion of the county. As shown in Table 1, the Land Use Ordinance (LUO) from the City and County of Honolulu outlines several classifications for land uses inside the urban district which is under the City and County's jurisdiction. The different classifications are explained in detail in the LUO (Land Use Ordinance, 2021). The LUO also influences where food production and distribution can occur within a city or community based on each different use. On O‘ahu, there is no zoning designation for rural land.

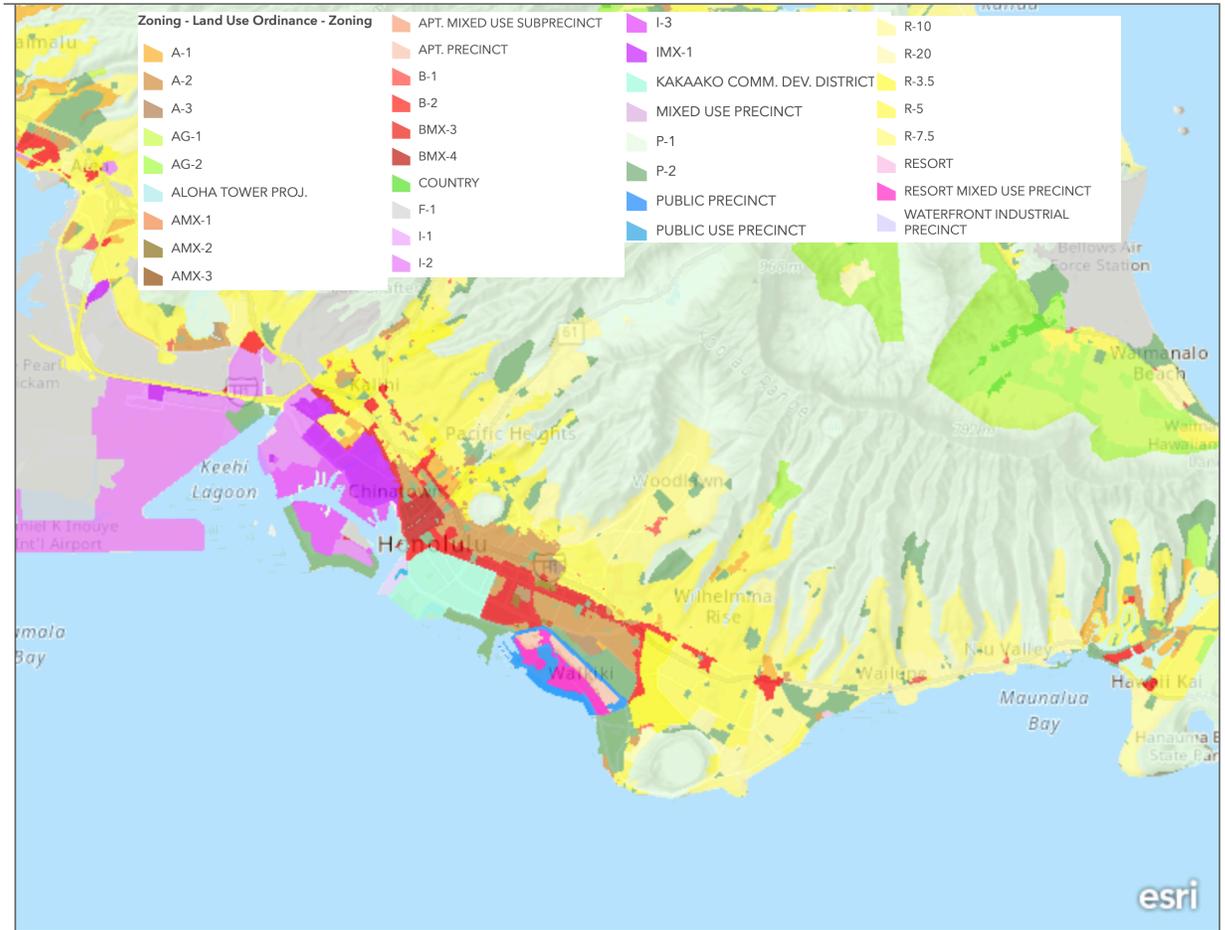
1.3.2. CITY AND COUNTY OF HONOLULU ZONING POLICY

Title	Map Designation
Preservation	
Restricted	P-1
Military and federal	F-1
General	P-2
Agricultural	
Restricted	AG-1
General	AG-2
Country	C
Residential	
	R-20
	R-10
	R-7.5
	R-5
	R-3.5
Apartment	
Low-density	A-1
Medium-density	A-2
High-density	A-3
Apartment Mixed Use	
Low-density	AMX-1
Medium-density	AMX-2
High-density	AMX-3
Resort	Resort
Business	
Neighborhood	B-1
Community	B-2
Business Mixed Use	
Community	BMX-3
Central	BMX-4
Industrial	
Limited	I-1
Intensive	I-2
Waterfront	I-3
Industrial-Commercial Mixed Use	IMX-1

Table 1 The different zone classification on O'ahu (Land Use Ordinance, 2021).

Zoning focuses on the specific rules and regulations associated with a land use. The zoning code indicates what uses can be practiced on the land (Land Use Ordinance, 2021). The zoning policies of the City and County of Honolulu are applied to the whole of O'ahu, not only to the Honolulu area. Special permit requests are evaluated against the zoning codes as well as the state designated land uses. The zoning code relates to food systems planning as it identifies and defines the pieces of land that can be used for various elements of the food system. The zoning code is more significant in this regard as it identifies what is permitted on each parcel of land. Figure 3 shows the location of the different zones within the Honolulu area identified in

Table 1.



Esri, NASA, NGA, USGS | Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, USDA

Figure 3 Map of zoning districts in Honolulu area (City & County of Honolulu & Honolulu GIS Office (HOLIS), 2020)

The Kaka‘ako area has a different zoning policy as it is a special design district. Its purpose is to “provide a means by which certain areas of the community in need of restoration, preservation, redevelopment or rejuvenation may be designated as special districts to guide development to protect and/or enhance the physical or visual aspects of an area for the benefit of the community as a whole” (LUO, 2021, Sec.21-9.20). The Kaka‘ako Special Design District is under the jurisdiction of the Hawai‘i Community Development Authority (HCDA), which is a state-run organization. Its designation allows the zoning to accommodate a multitude of uses.

### 1.3.3 FOOD SYSTEMS

Food systems planning focuses on the improvement of a community's food system which includes processes such as the production, distribution, and consumption of food in an area through urban planning practices (Donald, 2008). Each of the elements incorporated in food systems planning are essential in ensuring that food goes to the desired areas to provide the most benefits. Food systems planning can take place at a few different levels - global, regional, national, and local (American Planning Association, n.d.). It is often seen as a new aspect of focus for planners, as they have historically not specifically taken food systems into account unless it is a part of more standard occurrences such as zoning (Vitiello & Brinkley, 2013). In more recent years, there has been an increased awareness of the impact planning can have on public health, in particular in relation to food (Born & Purcell, 2006). Food systems planning has not been as prevalent in the planning realm because transportation, housing and land conservation have been centerstage (O'Brien et al., 2012). The lack of emphasis on the importance of incorporating food systems planning into a city's planning process was realized in the 1960s and 1970s through the global food crisis. The importance of food systems planning was noted in two seminal books written during this time; Rachel Carson's *A Silent Spring* and Moore Lappe's *Diet for a Small Planet*. These books also sharpened the focus on the extent of the impact that food production has on the environment. The issue with global food systems is not so much a lack of food production, but rather a global misalignment between areas of production and consumption needs, coupled with an inefficient and ineffective distribution system (O'Brien et al., 2012).

According to the USDA, a food hub is an organization or business which manages food products, mainly from local and regional farmers through the accumulation, distribution, and advertising of the products in order to fulfill demands (Purdue University, 2015). Incorporating more food hubs can be useful for increasing the availability of food in areas such as food deserts. Alternatively, the food bank concept is more broadly known and is defined as a “non-profit organization that collects and distributes food to hunger-relief charities” (Feeding America, n.d.). While it can be seen as similar to a food hub, generally food banks are on a smaller scale. Food hubs also differ from food banks because food hubs are a link between rural agriculture production and consumers in an urban or sub-urban area (Purdue University, 2015). Food banks, on the other hand, are donation-based and give these donations to those in need (Feeding America, n.d.)

On the other side of the spectrum are food deserts. Food deserts are described as low-income area where a significant proportion of residents have limited access to a large grocery store (Wright, 2021). Food deserts relate to access to food; the primary determinant of a food desert is having limited access to food. The limitation can relate to food affordability, availability of healthy food, or the distance required to access food.

Recycling mechanisms are not currently a significant aspect of the food system, however it can help to reduce the amount of food waste made from consumption. A lot of food is thrown away pre-maturely due to the inconsistency of how ‘Best By’ or ‘Use By’ dates are calculated. Decreasing the amount of food waste generated through recycling can start to create a more sustainable food system.

Land use planning influences food systems through zoning (Ikerd, 2011), which regulates where food is grown, stored, processed, and other processes necessary for the production and distribution of food. The zoning for these processes can differ depending on the equipment needed and application of equipment at the site. According to Ikerd (2011), one of the best ways to encourage urban agriculture projects is to change the zoning to allow land to be permanently used for urban agriculture, instead of only temporarily. Changing the zoning encourages urban agriculture projects because it reassures project managers that the land will not be repurposed or rezoned for another land use. However, there are additional challenges associated with making this change. For instance, changing the zoning permanently to agriculture will make it unavailable for development, which can be a concern for cities as the urban population continues to increase. Changing the zoning also decreases the value of the land because of this loss of development potential and the land is considered ‘down-zoned’ (Ikerd, 2011). One way in which a zoning change could accommodate urban agriculture is through mixed-use zoning. Mixed-use zoning enables a combination of uses including housing, civic, commercial, and retail on a plot of land (City of Lebanon, OR, 2018).

Hawai‘i is faced with a lack of affordable housing and has one of the highest rates of homelessness in the nation. The lack of housing – and in particular affordable housing – is due to the lack of developable land available as well as a limited housing supply growth. This increases the pressure to develop agricultural land for housing. Since affordable housing scarcity is such a pressing issue, the idea of using available developable land for urban agriculture is not always welcomed by landowners and

developers (American Planning Association, Hawai'i Chapter, 2005; Cox & Vieth, 1997).

#### 1.4 FOOD SECURITY IN HAWAI'I

In Hawai'i, 85 to 90% of all available food is imported (U.S. Environmental Protection Agency et al., 2017; Merrigan & Miles, 2020) and at any point in time there is only enough food throughout Hawai'i to sustain the population for 5-7 days (Merrigan & Miles, 2020). The short timeframe is largely due to a lack of storage capacity and the short shelf-life of many food items and does not allow for much of a buffer to help sustain the population if food imports are interrupted. The reliance on imports makes Hawai'i dependent on other states and countries for its food supply, due to the location. The heavy dependency on imports makes Hawai'i's food system vulnerable to disasters, both natural and human-made. Climate change and the global COVID-19 pandemic are two of the risks that Hawai'i's food system is currently facing (Merrigan & Miles, 2020). At the beginning of the COVID-19 pandemic, there was increased stress on global food supply chains, especially on the transportation routes (OECD, 2020). The interruptions were caused by emergency policies put into place to help decrease the spread of the virus. There were also abrupt shifts in the demand for food. The fear of a global pandemic meant that people would stock up on non-perishable foods which increased the demand for these foods (OECD, 2020). The main mode of transportation that was impacted was air freight. Hawai'i mainly receives its food through container ships and although it did not see too much of a disturbance to its food system, the pandemic highlighted the potential for disruption to shipments due to unforeseen circumstances (Merrigan &

Miles, 2020). The closest ship port to Hawai‘i is over 2,000 miles away in Oakland, California, which is a journey that cannot be done in a day (Merrigan & Miles, 2020).

<b>2015 Crop Summary by Acreage</b>							
<b>Crop Types</b>	<b>Hawai‘i</b>	<b>Kaua‘i</b>	<b>Maui</b>	<b>Moloka‘i</b>	<b>Lāna‘i</b>	<b>O‘ahu</b>	<b>State Total</b>
Aquaculture	165	183	-	28	-	274	651
Banana	536	26	62	-	-	345	969
Coffee	5,525	3,788	545	123	-	168	10,149
Commercial Forestry	21,061	1,743	33	-	-	26	22,864
Dairy	1,855	-	-	-	-	-	1,855
Diversified Crop	3,266	1,199	1,582	937	54	9,865	16,904
Flowers / Foliage / Landscape	1,612	165	134	26	10	484	2,432
Macadamia Nuts	21,359	-	186	-	-	-	21,545
Papaya	2,566	-	-	93	-	166	2,824
Pineapple	-	-	1,094	-	-	3,414	4,508
Seed Production	-	13,299	754	2,342	-	7,333	23,728
Sugar	-	-	38,810	-	-	-	38,810
Taro	61	443	54	2	-	51	612
Tropical Fruit	3,144	463	104	43	-	227	3,980
<b>Crop Total:</b>	<b>61,149</b>	<b>21,310</b>	<b>43,360</b>	<b>3,593</b>	<b>65</b>	<b>22,354</b>	<b>151,831</b>
Pasture	554,324	41,934	108,447	38,261	-	18,464	761,429
<b>Total Agriculture</b>	<b>615,473</b>	<b>63,244</b>	<b>151,808</b>	<b>41,854</b>	<b>65</b>	<b>40,818</b>	<b>913,261</b>

Table 2 The different crops grown in Hawai‘i in 2015 categorized by the different islands and shown in acreage used to grow (Melrose et al., 2016).

Hawai‘i produces some of its food; however, it is not enough to sustain the growing population as well as the entire tourism industry, which is a key driver of its economy. Table 2 shows the distribution of crops grown on each of the Hawaiian Islands, with the top three crops grown on O‘ahu being sugar, seeds, and macadamia nuts (Melrose et al., 2016). The types of crops and the quantities produced indicate that there is not enough to sustain the population of O‘ahu. Looking at Tables 2 and 3, the lack of produce able to sustain the population is highlighted as the crops produced in the highest quantities include seeds and pineapple.

In 2020, another report was published providing updated data about the crops grown on agricultural land throughout the state. Table 3 shows the changes in the amount of agriculture on O‘ahu from 2015 to 2020, including the change in acreage and percentage (Perray & Collier, 2020). It is an update of the 2015 Statewide Agricultural

O'ahu	Acreage		Change (2015 to 2020)	
	2015	2020	Acres	%
Aquaculture	274	300	25	9.3
Banana	345	360	15	4.3
Coffee	168	169	1	0.7
Commercial Forestry	26	27	0.2	0.6
Diversified Crop	9,865	10,595	730	7.4
Flowers / Foliage / Landscape	484	510	26	5.3
Macadamia Nuts	-	2	2	NA
Papaya	166	164	-2	-1.2
Pineapple	3,414	3,437	23	0.7
Seed Production	7,333	7,376	43	0.6
Taro	51	77	26	49.9
Tropical Fruits	227	260	33	14.8
Crop Total	22,354	23,275	921	4.1
Pasture	18,464	18,035	-429	-2.3
<b>Total</b>	<b>40,818</b>	<b>41,310</b>	<b>493</b>	<b>1.2</b>

Table 3 The difference in the amount of crops grown on O'ahu in acres between 2015 and 2020 (Perroy & Collier, 2020)

Land Use Baseline to depict the differences between 2015 and 2020 in terms of the amount of agriculture on the different islands. The data presented shows that overall, there has been a 1.2% increase in the amount of food produced on O'ahu between 2015 and 2020.

Seed production is one of the highest acreages on O'ahu. The majority of the seeds produced are exported to the mainland and are not for use on O'ahu (Martin et al., 1999). Seed production is so prevalent on O'ahu because of the optimal growing conditions. For instance, during the 1997-1998 season, the seed industry on Hawai'i had an estimated value of \$25.2 million (Martin et al., 1999).

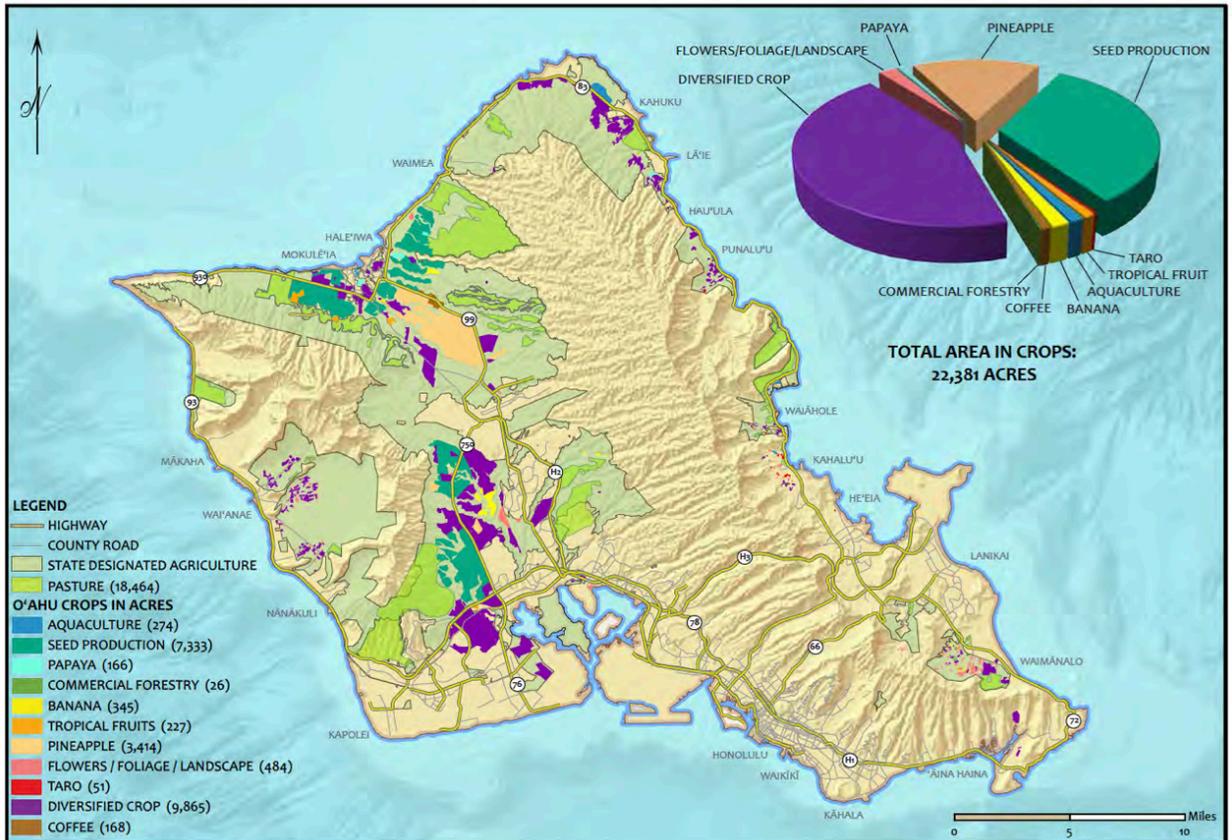


Figure 4 Map of O'ahu showing where the different crops are grown and the percentage of each type of crop in 2015 (Melrose et al., 2016).

Figure 4 shows the distribution of the crops specified in Table 2 across O'ahu. There is an uneven distribution of food production across the island, with the majority of production existing in the middle channel of the island. This makes sense due to the topography of the land. The middle channel is the flattest area of land. However, it raises the question as to whether there is uneven distribution of food for consumption as well.

The communities of low-income residents are the most vulnerable in the state (Merrigan & Miles, 2020). The cost of living is high, and the impact is further exacerbated by the low minimum wage, both of which increase the poverty rate which was 14% in 2020. These combined factors bring about high levels of food insecurity,

especially in indigenous Hawaiian communities. The high poverty rate and cost of living often result in increased utilization of mal-nutritious foods (Antonio et al., 2021).

To improve the food security issue that Hawai‘i is currently facing, there needs to be a better and more developed food system available to the residents (Merrigan & Miles, 2020). According to Merrigan & Miles (2020), there needs to be increased assurances to guarantee that there is enough food in Hawai‘i for the residents in an emergency situation. These assurances could include increasing the number of food storage facilities in Hawai‘i, ensuring that at any time there is enough food and water for all the residents of Hawai‘i for 14 days, and accommodating an emergency or secondary food supply chain. Increasing food production in Hawai‘i can help with improving food security, as more food would be much more easily accessible (Merrigan & Miles, 2020). One of the impending issues in Hawai‘i the ability to increase food production is the limited land available.

Another reason that residents of Honolulu, in particular, are facing food insecurity is due to the cost of food. In 2019, households in Honolulu spent \$10,000 annually on average, making it the second-highest in relation to other cities in the US (Iwamoto, 2019). The amount spent on food is roughly 11% of the average income in Honolulu. The price of food threatens food security (Iwamoto, 2019).

## CHAPTER 2. METHODS

Using qualitative data, this study focuses on urban agriculture, paying particular attention to how it can support existing food supply chains by contributing to localized food systems in Honolulu. Urban agriculture is defined by the United States Department of Agriculture (USDA) as the cultivation, processing, and distribution of agricultural products in urban and suburban areas (USDA, n.d.). The question that motivated my research question is: How viable is urban agriculture in Honolulu? In my study, I examined what is required to implement urban agriculture projects in Honolulu and how it could impact the city's current food system. When investigating the likelihood of implementing new infrastructure in a city it is important to examine policies that are already in place and how these might influence the new infrastructure being introduced. A multi-method approach was taken in order to gain a better understanding of the issue. My study, therefore, focused on efforts to implement urban agriculture to enhance the current food system considering the broader policy context. I employed a multi-method approach to gain a better understanding of the issue.

I primarily drew upon existing literature and in-depth interviews to explore my research question. For a deeper understanding of the topic, I conducted background research through a review of published papers on urban agriculture. This allowed for a comprehensive of scholarly work in this realm and highlighted the gaps. The existing body of work sheds light on the benefits of urban agriculture, case studies of cities across the world that have supported initiatives to promote it, and the implementation challenges faced in urban agriculture projects. I also examined the tools of land use planning and policy that would facilitate the implementation of urban agriculture in Honolulu.

I received IRB (Institutional Review Board) approval to interview individuals who have first-hand experience with urban agriculture, in Honolulu and in cities where urban agriculture has been successfully implemented. Upon receiving an exemption from the IRB, I identified 10 key experts for the study with whom I then conducted interviews with, each lasting about an hour. These were conducted using Zoom to meet the COVID-19 safety protocols in place at the time. Each interview lasted about an hour and was audio recorded with the consent of each participant, subsequently and transcribed for detailed analysis.

The interviewees who were asked to participate in the research project were selected for their knowledge of the topic and their experience in a decision-making role. Including key individuals from a range of relevant fields, such as urban planning and urban farming, allowed for a nuanced understanding of how the implementation of urban agriculture might align with the current food system. These knowledgeable experts also represented a cross-section of sectors – public, private, and non-profit – which offered further insight into the implementation process.

I conducted a thematic analysis – a process of identifying patterns and themes within qualitative data (Braun & Clark, 2006) – of the interview transcripts. I began familiarizing myself with the interview data that I transcribed. I categorized the interviews into three groups of interviewees representing the private, nonprofit, and public sectors to allow for a cross-comparison of responses. I then developed codes – word or short phrase that represents the key attribute of the narrative data – in the transcripts which I sorted into a code structure – definition of each code and sub-codes within them. The starting structure for the codes was derived from the literature review. I

determined the frequency of the codes to help distill the key themes and identify patterns in the transcripts, aligning these with my research focus. This was an iterative process which required several rounds of refinement.

For a better understanding of the implementation process, I also explored three cases where urban agriculture has been successfully implemented – Portland, Vancouver, and Singapore. In order to draw conclusions and comparisons across these cities, Table 7 presents a summary of comparison. The metrics for the matrix supplement the data from my interviews. See Appendix A for a sample of coding.

## CHAPTER 3. URBAN AGRICULTURE

### 3.1 LITERATURE REVIEW

Urban agriculture has been defined in a multitude of ways by different researchers and organizations. One definition specifies that it is agriculture which is produced in plots in areas defined as urban or peri-urban or at home (Orsini et al., 2013), whereas the US EPA (Environmental Protection Agency) classifies it as agriculture in a city or suburban area that takes place in urban environments such as backyards, roof-tops, community gardens and roadside fringe agriculture (US EPA, n.d.). The range of definitions provides new perspectives on urban agriculture and contrasting viewpoints that offers more insight into what it involves and what it can provide to a community. Defining urban agriculture is also a challenge due to the numerous methods that can be used to execute a successful urban agriculture project, as briefly mentioned above in the US EPA definition of urban agriculture (Lin et al., 2017). In this paper, urban agriculture is defined as food that is able to be grown in an urban landscape, with a focus on produce grown by corporations and community gardens.

Urban agriculture has existed throughout history, predominantly in the form of communal gardens. These have often been seen as positive to implement by local authorities as they enhance community engagement (Vitiello & Brinkley, 2013). In recent years, they have garnered attention as a possible solution for food insecurity and to reducing the carbon footprint of food in cities (Temmer, 2017). However, no form of urban agriculture is unable to fully replace a traditional food system as the amount of food required for consumption in an urban area exceeds the capacity of food able to be grown in these areas (DiDomenica & Gordon, 2016). The types of products that can be

grown and harvested in a city is also limited. For instance, cultivating livestock cannot usually be accomplished in a city setting due to a lack of resources, most notably land and the available space required (DiDomenica & Gordon, 2016). While urban agriculture might not be able to meet the majority of nutritional needs of a city-region, it could offer a way to increase the benefits of the food system. There are a variety of methods available to enhance the effectiveness of urban agriculture such as hydroponics, vertical

	<b>Where</b>	<b>Scale</b>	<b>Primary functions</b>	<b>Access/ Management</b>
<i>Community gardens</i>	Empty lots in a community/ neighborhood	Tend to be on a mid-sized scale, with enough space to provide some nutrition as well as education	Providing produce to the community and has the potential to be used as an education too	Usually managed by the community, or a group that initiated the project
<i>Private gardens</i>	Sub-urban areas, closer to the city limits	Smaller scale, depends on space available and number of people it is serving	Personal use and consumption	Usually private property, some give access to public
<i>Easement gardens</i>	Empty lots in a neighborhood, converted green spaces, in an urban or peri-urban area	Has a range of scale depending on land available	Positively impact water quality and soil erosion	Community or private, run and regulated by local authorities
<i>Rooftop gardens</i>	Roofs of buildings, including enclosed parking lots, in an urban	Size of area used is smaller, however can produce a lot due to abundance of vertical space	Grow vegetation, usually for consumption	Usually run by a corporation or residents, with approval of the building manager
<i>Urban orchards</i>	Recently, more have been at schools and hospitals, can be run in empty lots or along roads	Large due to the space needed for multiple trees	Providing edible produce that is grown on trees to a community	Run privately or within a community
<i>Peri-urban agriculture</i>	Along the edges of an urban area	Has a range of scale depending on the placement of it	Can be for personal and aesthetic uses as well as to provide nutrition for the community	Run and used primarily by the community in the surrounding area
<i>Vertical farming</i>	In buildings or outside in an urban area	Has a range of scale, depending on how high up	Growing produce for consumption and for sales	Usually run by corporations as it is a technology intensive form
<i>Guerilla gardening</i>	Road verges in an urban area	Small due to how small the type of space used is, edible landscapes	Growing produce and using green area for more productive vegetation than grass	Public, in need of approval by local authorities

Table 4 Characteristics of urban agriculture projects (Lin et al., 2017; Nakai, 2018; Orsini et al., 2020)

farming, and community gardens, among others. For a successful urban agriculture implementation plan, it is best to introduce and encourage multiple types of practices to take full advantage of scale and variety of available spaces in an urban environment (Steele, 2017).

The most common types of urban agriculture include: community gardens, private gardens, easement gardens, rooftop gardens, urban orchards, peri-urban agriculture, vertical farming, and guerrilla gardening (Lin et al., 2017; Tuijl et al., 2018). Table 4 highlights the most important aspects of the different types of urban agriculture listed. Importantly, an urban agriculture project can fall into more than one of these types.

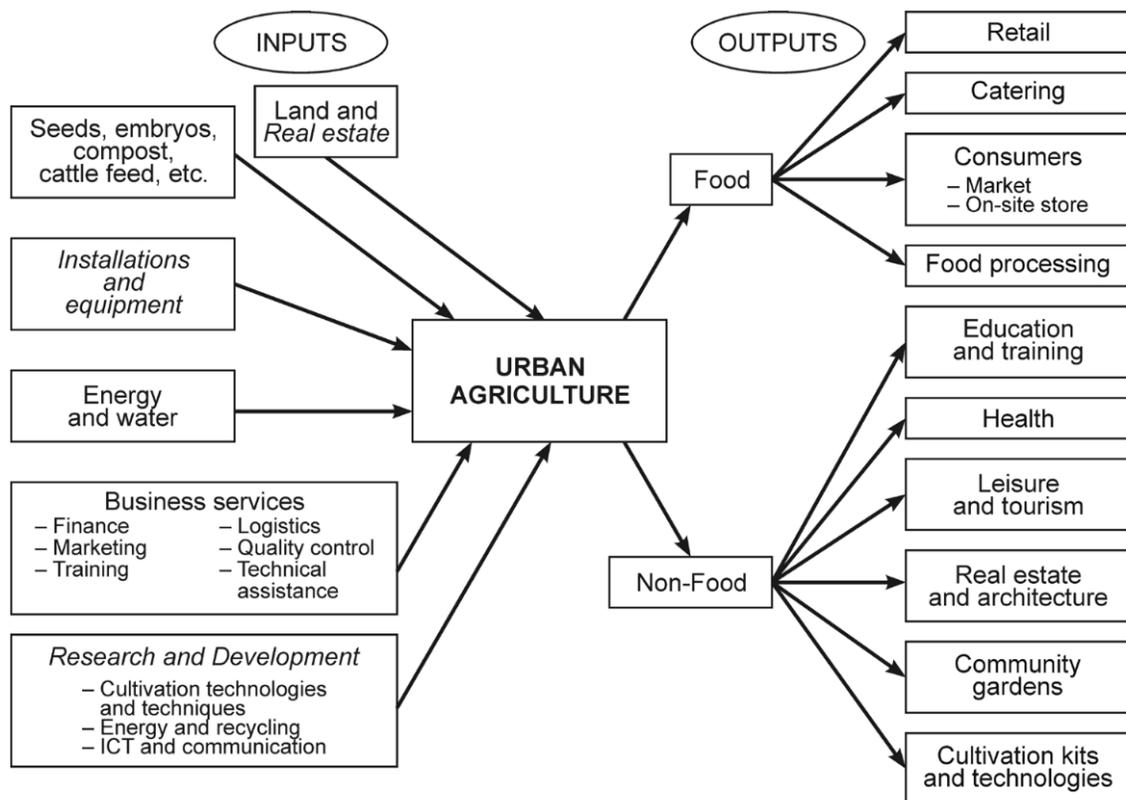


Figure 5 Diagram showing the different inputs and outputs of urban agriculture (Van Tuijl et al., 2018)

Figure 5 exhibits the different inputs and outputs for urban agriculture. The inputs are mainly associated with natural resources and features beneficial and necessary for

starting an urban agriculture project, whereas the outputs underscore the wide range of impacts such projects can have. Showing the different pathways in this format allows for easier comprehension of the different aspects necessary for the implementation of an urban agriculture project. Clearly, there are several factors that can influence implementation.

Urban agriculture can provide a multitude of benefits to a city (Lin et al., 2017; Orsini et al., 2020). Given the opportunities it presents and challenges that need to be overcome for its implementation, it can result in diverse outcomes across cities depending on the involvement of the community, the willingness of the local government to support urban agriculture and other important factors. Land use and zoning are often seen as a challenge in implementing urban agriculture projects (Orsini et al., 2013). Table 5 summarizes how implementing urban agriculture can impact or be impacted by the regulations and policies in place. However, challenges can become opportunities through making changes to the land-use and zoning policies (Orsini et al., 2013). In terms of the cost of urban agriculture, the main issue to be addressed is the cost required to start an urban agriculture project (Cox & Vieth, 1997). There are also often significant price differences between imported food versus agricultural sourced from urban farms. Most local foods and produce cost more than imported food. Including both in a food system creates intense competition in the market and imported foods can outcompete the local foods, which renders them commercially unsustainable. Grants are one of the opportunities available to encourage urban agriculture projects to have a place in a food system (Cox & Vieth, 1997). Increasing the grants available for urban agriculture projects and farms decreases the initial cost to start the project and can reduce the overall cost of

the produce making them competitive (Orsini et al., 2020). Education can also be a benefit of urban agriculture projects. The projects provide knowledge about how food is grown and where food comes from. The benefits of the urban agriculture project can go beyond simply agricultural knowledge. The produce grown can also be sold which gives the opportunity for individuals to learn math and accounting skills or apply knowledge learned in the classroom in a real-life situation besides generating income.

<b>Opportunities</b>		<b>Constraints</b>	
<i>Food security</i>	Food system sustainability	<i>Land limits</i>	Limited green space in a city environment
	Helping to ensure food security in times of crisis		
<i>Ecosystem service provisions</i>	Biodiversity	<i>Policies and legal framework</i>	Land use and zoning usually exclude agriculture in city zoning
	Energy efficiency		
	Stormwater runoff and flood control		
	Water quality provision		
<i>Efficient use of resources</i>	Groundwater replenishment	<i>Required water usage</i>	Inefficient use of water from lack of knowledge Limited water available in cities
	Can be grown in controlled environments		
<i>Climate change resiliency</i>	Able to use irrigation techniques	<i>Potential disservices to communities</i>	Potential for low-income neighborhoods to become gentrified
	Air pollution removal		
<i>Beyond food systems</i>	Carbon storage and sequestration	<i>Potential health risks</i>	Removal of air pollution can mean risk of heavy metals in produce
	Key role in managing social and aesthetic functions		
<i>Education and awareness</i>	Education of agriculture practices and food systems		
	Awareness of where food comes from		
	Knowledge about nutritional foods and healthy foods		
	Large gap of knowledge on provisional services and urban agriculture systems		

*Table 5 Explaining the different opportunities and potential constraints to implementing an urban agriculture project (Orsini et al., 2013; Orsini et al., 2020; Toner & Ebner, 2019; Van Tuijl et al., 2018; US EPA, n.d.)*

## 3.2 PRECEDENT STUDIES

Looking at cities in other regions of the world that have been able to implement urban agriculture helps to understand the process and outcomes. It highlights the range of strategies utilized, the obstacles faced and the feasibility of urban agriculture projects under diverse governmental and institutional entities. To best compare the various case studies of cities that have incorporated urban agriculture into the food system, a comparison is presented in Table 7.

Several cities have started to incorporate urban agriculture into their food systems. Each of these cities has implemented urban agriculture based on how that city is structured and the types of infrastructure already in place. Of these cities, I selected Singapore, Vancouver, and Portland for review and analysis. In the following section, I describe the rationale for selecting each of these cities, the important aspects of their efforts to implement urban agriculture, and the key takeaways.

### 3.2.1 SINGAPORE

Singapore was chosen as a precedent due to its similarities to O‘ahu which can provide insight into some of the opportunities and challenges it may face in implementing urban agriculture. One of the main similarities is the geographical isolation from other areas and the lack of space for agriculture on an island. In Singapore’s past, most of the food was imported to the island (Kovachevich, 2019; Rodrigues, 2021). My interviews with key participants in Singapore shed light on the dynamics of urban agriculture and the implementation strategies using local knowledge.

The primary drive to introduce urban agriculture to Singapore came after the 2007 global food crisis which highlighted its food insecurity (Ludher & Paramasilvam, 2018). While some members of the local community had already seen a need to introduce more agriculture in Singapore, the 2007 food crisis was the main point when it became a priority for the government (Ludher & Paramasilvam, 2018). This was the most severe crisis relating to food since 1974 (Golay, 2010). The reason for the crisis was the increase in the price of food, especially staples such as wheat and rice (Golay, 2010).

Today, there are different schemes and targets that are aiding the implementation of urban agriculture projects in Singapore. One is the LUSH scheme incentivizes the landscaping of urban spaces and high-rises by motivating developers to initiate greenery projects on the upper floors and roofs of high-rise buildings (Astee & Kishnani, 2010). The greenery projects can also include urban agriculture rather than simply ornamental greenery. Other schemes that are encouraging urban agriculture in Singapore include the Sustainable Development Blueprint Target and the Urban Redevelopment Authority (Astee & Kishnani, 2010).

The Sustainable Development Blueprint Target is set by the Singaporean government to increase the sustainability of Singapore. It focuses on the ways the city works, consumes, produces, and how people live (Meissonnier, 2021). The Urban Redevelopment Authority is an organization tasked with making Singapore more sustainable (Urban Redevelopment Authority, 2022). It uses long-term planning practices to achieve this.

One of the benefits to introducing urban agriculture into the food system in Singapore is the ability to use vegetable crop waste for bio-methanation (Song et al.,

2022). Bio-methanation already exists in Singapore; the primary reason for its limited use is due to a lack of biowaste available. Increased urban agriculture would increase biowaste and allow for bio-methanation to become a more prominent electrical energy source. It is estimated that eight hundred tons of organic waste per day would produce six megawatts of energy per hour, which could power an electrical station as well as ten thousand households (Song et al., 2022).

Currently, the most prominent types of urban agriculture are soil-based conventional farming and vertical farming with natural light both in semi-enclosed greenhouses as well as indoor farming within a controlled environment including artificial lighting (Ludher & Paramasilvam, 2018). There is also some interest in introducing rooftop farming into the food system (Astee & Kishnani, 2010). The Housing and Development Board (HDB) has the potential to help introduce more rooftop agriculture as it makes up over 80% of all the housing in Singapore. With appropriate regulations in place, the HDB could initiate large-scale rooftop agriculture in Singapore (Astee & Kishnani, 2010). Multi-story car parks are also being explored as a potential opportunity for urban agriculture projects. Singapore originally planned for many more cars than are currently owned, which has led to a situation where there are more parking spaces than cars, which would make this excess space a potential opportunity for implementing urban agriculture (Ker et al., 2019).

### 3.2.2 VANCOUVER

Vancouver was chosen as a precedent as it is one of the leading cities for urban agriculture, so its implementation process can be instructive.

The process of increasing urban agriculture in Vancouver started in 2003 when there was a motion to create a more sustainable and fair food system. Following this motion, in 2004 the Vancouver Food Policy Council was established, and a Food Action Plan was created (Kjærås, 2013). The council and plan aided in kickstarting the implementation of urban agriculture (Vancouver Urban Farming Society, 2015). There were three important changes to the bylaw, which provided guidelines for a whole range of urban agriculture initiatives: urban beekeeping, urban agriculture in the private realm and backyard hens (Kjærås, 2013). In 2009, the Greenest City Action Team was created and in 2011 they published the Greenest City Action Plan along with an implementation update report in 2012. Also, in 2009 the ‘Vancouver 2020: A Green Bright Future’ report was formulated (Kjærås, 2013).

There are several entities and councils which help to encourage the implementation of urban agriculture (MetroVancouver, 2014). The Agricultural Land Commission (ALC) Act has three main purposes: preserve agricultural land, encourage collaborative farming with connected communities, and encourage different governmental entities to enable and accommodate the use and compatible uses of agricultural land in policies (Government Communications and Public Engagement & Agricultural Land Commission, n.d.). The Agricultural Land Reserve (ALR) is a zone within the province of British Columbia that prioritizes agriculture as a land use (Agricultural Land Commission & Government Communications and Public Engagement, n.d.). The area is a total of 4.6 million hectares and the land is agriculturally suitable. The main goal of this zone is to encourage and protect agricultural uses while restricting non-agricultural uses (Agricultural Land Commission & Government

Communications and Public Engagement, n.d.). The City of Vancouver modified the zoning policy to include the RA zone, which is a designation for ‘residential-agriculture’. The inclusion of a mixed-use zone allowed for more projects to be implemented (MetroVancouver, 2014).

The City of Vancouver classified different types of urban agriculture based on the size of the urban agriculture project and the technique used. The Urban Farm Guidelines Bylaw was implemented in 2016 and defined these classifications across two tiers (McClintock et al., 2021). Class A encapsulates more residential and community farms. The size of each parcel is limited to 325 square meters and there are limits as to the amount of revenue can generate. Class A would include projects located in the new RA zone. Class B can be implemented on a larger scale and includes more high-technological and industrial types of urban agriculture. The size limit per parcel for Class B is 700 square meters. The distinction of the types of classes is important for permitting and licensing of urban farms. Table 6 shows a comparison between the two classes.

	Urban Farm Class A	Urban Farm Class B
Description	Small scale urban farms in residential neighbourhoods. Usually located in front or backyards, and growing in soil.	Small or large scale urban farms that may include structure-based farming including indoor or greenhouse production.
Zoning District (where this farm type is permitted)	Residential Zones	Industrial, Commercial and Historical Area (Chinatown, Gastown, and Yaletown) Zones
Size Limit - Per parcel	Maximum planting area 325 m <sup>2</sup> *	Maximum planting area 7000 m <sup>2</sup> **
Size Limit - Combined area across all farm parcels	Maximum planting area 7000 m <sup>2</sup>	Maximum planting area 7000 m <sup>2</sup>
Farm Revenue Limits - If farmland is leased	None	None
Farm Revenue Limit - If farmland is owned	\$9,999 per organization or business	None
Business License	Business license required. \$10/year/farm parcel. One-time business license application fee (\$60) is waived for urban farms.	Business license required. \$155/year/farm parcel. One-time business license application fee (\$60) is waived for urban farms.
Development Permit	Not required*	Required (contact staff to discuss fee & process)
Building Permit and Structures	An accessory structure up to 10 m <sup>2</sup> may be permitted without a building permit	Building permit required for structure-based farming (eg: indoor or , greenhouse production)
Farm gate sales	Only allowed if located on Institutional land	Allowed

\* If the farm is on institutional land and demonstrates strong social impact, it may be approved for up to 7,000m<sup>2</sup>. In this case, a development permit will be required.

\*\*A larger size may be approved if the farm demonstrates strong social impact.

Table 6 Description of the different classes of urban farms in Vancouver.

### 3.2.3 PORTLAND

Portland was researched for this project as it is one of the leading cities in the US to implement urban agriculture. While there are many similarities between Vancouver and Portland regarding urban agriculture, the important distinction between the two is that Portland is in the US therefore, the regulations and policies are most similar to those in Honolulu.

There are a number of projects and initiatives in Portland (Mendes et al., 2008). The Portland Fruit Tree Project is a nonprofit organization whose main goal is to increase access to nutritious foods amongst all members of the community (McClintock et al., 2021). It also hopes to encourage the community to care for the fruit trees and share the harvest as a way to strengthen it. The 1000 Gardens Initiative was also useful in

increasing the amount of land available (McClintock et al., 2021). Between 2009 and 2012 there were 17 new gardens with over 1,000 new plots created due to the initiative. These plots can increase land availability for urban agriculture, which is often one of the main constraints when initiating an urban agriculture project. In addition, the Portland/Multnomah Food Policy Council existed from 2009 to 2012 as a citizen-based board that advised the City of Portland as well as Multnomah County (McClintock et al., 2021). The board was able to contribute to greening the economy of these areas. The goal of the board was to address different policy issues relating to the food system and is made up of a diverse group of community members.

Portland's Urban Food Zoning Update was approved in 2012. The approval of the zoning update allowed for the increase of urban agriculture projects (Elliott, 2018). The 2012 update was able to lift restrictions on the zoning policies regarding the potential locations to implement community gardens. Increasing the number of plots of land available allowed for more projects to be implemented and increase the amount of food available in Portland's food system. The update also included guidelines for profit-based urban agriculture in terms of signage, permitting and hours of operation. After the update was implemented and adopted, there was an increase in the number of small-scale farmers markets as well as an increase in the number of subscription services for fresh produce (Mendes et al., 2008).

One of the issues discussed in the literature is the potential for urban agriculture to increase gentrification in low-income communities. It is worth noting that the communities that were surveyed in order to gain a better understanding of how urban agriculture can be implemented in Portland were primarily white communities. This

shapes the narrative and leaves out communities of color as well as any differences in their practices or needs (Elliott, 2018; McClintock et al., 2021). Gentrification either pushes out residents of low-income areas or pulls in wealthier individuals into an area (Marcuse, 1985). This can be triggered by changes in the housing market and prices, through developers coming in and buying land in these areas and developing them for a wealthier demographic, or changes to public policy (Marcuse, 1985).

### 3.2.4 SUMMARY OF PRECEDENT STUDIES

	<b>Types of UA</b>	<b>Size</b>	<b>Implementation</b>	<b>Main driver</b>
<b>Singapore</b>	High-tech farms	Varies based on lot size Smaller than traditional farming	Government incentives	Government encouragement
	Roof-top farms	Smaller than traditional farming	Policy changes	
	Agriculture parks			
<b>Vancouver</b>	Community gardens	Smaller plots, based on availability	Change of zoning policies	Changes to the zoning
	Residential gardens	Has the zoning for large scale technology-based commercial farms	Implementation of Guideline Bylaws Interest in becoming Green City	
<b>Portland</b>	Community gardens	Smaller individual plots of land	Updated zoning policy	Grassroots, nonprofit and NGO involvement
	Residential gardens	Available space	Increased interest from local community	
	Urban orchard			
	Guerrilla farming			

*Table 7 Summary of the different case study cities on urban agriculture*

Table 7 shows a summary of what was discussed above to facilitate a comparison. While there are some variations in the types of urban agriculture that have been implemented in each of the three precedents, one of the implementation methods that can be identified throughout all three is the importance of changing policies or zoning regulations.

The precedents outlined in this section can be used as a learning tool when considering the implementation of urban agriculture in Honolulu. They highlight the different paths that could lead to urban agriculture being successfully implemented or integrated into the food system in Honolulu. One of the main lessons to be learned is the importance of different entities playing a role in the implementation of urban agriculture projects. The precedents show that understanding the needs and priorities of communities will help to determine the best implementation method for urban agriculture projects.

### 3.3 CURRENT INITIATIVES IN HAWAI‘I AND HONOLULU

While legislatively there has not been much done to encourage the implementation of urban agriculture in Honolulu, there has been an emphasis on increasing the amount of locally grown food. These initiatives have focused on both increasing food production in urban areas, such as Honolulu, as well as encouraging increased local food production throughout the Hawaiian Islands.

The Aloha+ Challenge is a state-wide initiative to commit to making Hawai‘i more sustainable by striving to achieve specific sustainability goals (State of Hawai‘i & Hawai‘i Green Growth, 2018). Overall, there are six goals: Clean Energy, Local Food, Natural Resource Management, Waste Reduction, Smart Sustainable Communities, and

Green Workforce and Education. These goals are also related to the 17 SDGs created by the UN. For the Local Food Initiative, the SDGs which are relevant include are 1, 2, 3, 10, 12, 13 and 17. Looking more closely at the Local Food goal of the Aloha+ Challenge, it is further segmented into five different targets to help achieve the goal: local food production, labor and land resources, processing, distribution, and consumption (State of Hawai‘i & Hawai‘i Green Growth, 2018).

Kaka‘ako has special zoning that allows one of the urban farms, MetroGrow, to produce and sell their products within urban Honolulu (Department of Business, Economic Development and Tourism, 2005). The goal for the Kaka‘ako area is to become a mixed-use neighborhood that allows for a wider variety of features to be implemented. In the makai section of the Kaka‘ako Special Design District, there are specific uses that can be implemented. Under commercial uses, greenhouses and plant nurseries are some of the uses permitted. This broad inclusion allows for more urban agriculture projects and companies to be established (Department of Business, Economic Development and Tourism, 2005). The authority over the Kaka‘ako Special Design District is given to the Hawai‘i Community Development Authority by the State of Hawai‘i (Kaka‘ako Special Design District (KSDD), 2021). Looking at the approach to zoning used by the Kaka‘ako Special Design District could be beneficial as a guide for the rest of the Honolulu area. The one issue to look into further is the potential impacts that could result from expanding the flexible zoning approach used in the district to the rest of Honolulu.

The Ulupono Initiative is a group that is committed to the sustainability of Hawai‘i through research, policy, investments, and community engagement (Clay &

President, n.d). There are three projects that are currently under way to increase the amount of food grown locally. The first project is titled ‘White Paper: Switching the Paradigm’ which investigates the impact of increased renewable energy on agricultural lands (Uluono Initiative, n.d.). There are clear pressures for agricultural land to be developed because more space is required for renewable energy, and the most space ‘available’ is agricultural land (Uluono Initiative, n.d.). The second project is ‘808 Conservation Planner’ (Cooke et al., n.d.), which is an online planning tool for farms on O‘ahu to help efficiently institute conservation plans for farmland (Cooke et al., n.d.). The final project is titled ‘Local Food Market Demands Study of O‘ahu Shoppers’ and constitutes research of the consumer aspect of the supply-demand chain in order to best promote local food production (Campaniano et al., n.d.).

‘Local Food, Local Places’ is an action plan for the Honolulu and Kaka‘ako areas that is driven by the local community to increase the amount of food produced locally (U.S. Environmental Protection Agency et al., 2017). The goal of the program is to create a livable sustainable neighborhood using increased local food production to create improvements in local food systems. The program is sponsored by several government organizations<sup>2</sup> and helps to implement projects, such as farmers markets and community gardens, in the selected partner community. Team members from ‘Local Food, Local Places’ work with community members to create goals and start projects that are best

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<sup>2</sup> The U.S. Department of Agriculture, Environmental Protection Agency, the Centers for Disease Control and Prevention, the U.S. Department of Transportation, the U.S. Department of Housing and Urban Development, the Appalachian Regional Commission, and the Delta Regional Authority, with support from the White House Rural Council.

suiting to the needs of the community (U.S. Environmental Protection Agency et al., 2017).

### 3.4 URBAN AGRICULTURE IN HONOLULU

In Honolulu, one of the main types of urban agriculture is peri-urban farming using community gardening techniques or vertical farming (Heavilin, 2014; Merrigan & Miles, 2020). This is evident in farms such as MetroGrow, Kupu Place, and Roots Café Farm at the Ho‘oulu ‘Āina Nature Preserve, which are commercial farms that operate in the Honolulu area. MetroGrow is a vertical technology-based farm, whereas Kupu Place is a vertical farm that uses aquaponics, and the Roots Café Farm is a more traditional farm on the edge of Honolulu (Lucas et al., n.d.; MetroGrow Hawaii, 2022; Yee & Mau, n.d.).

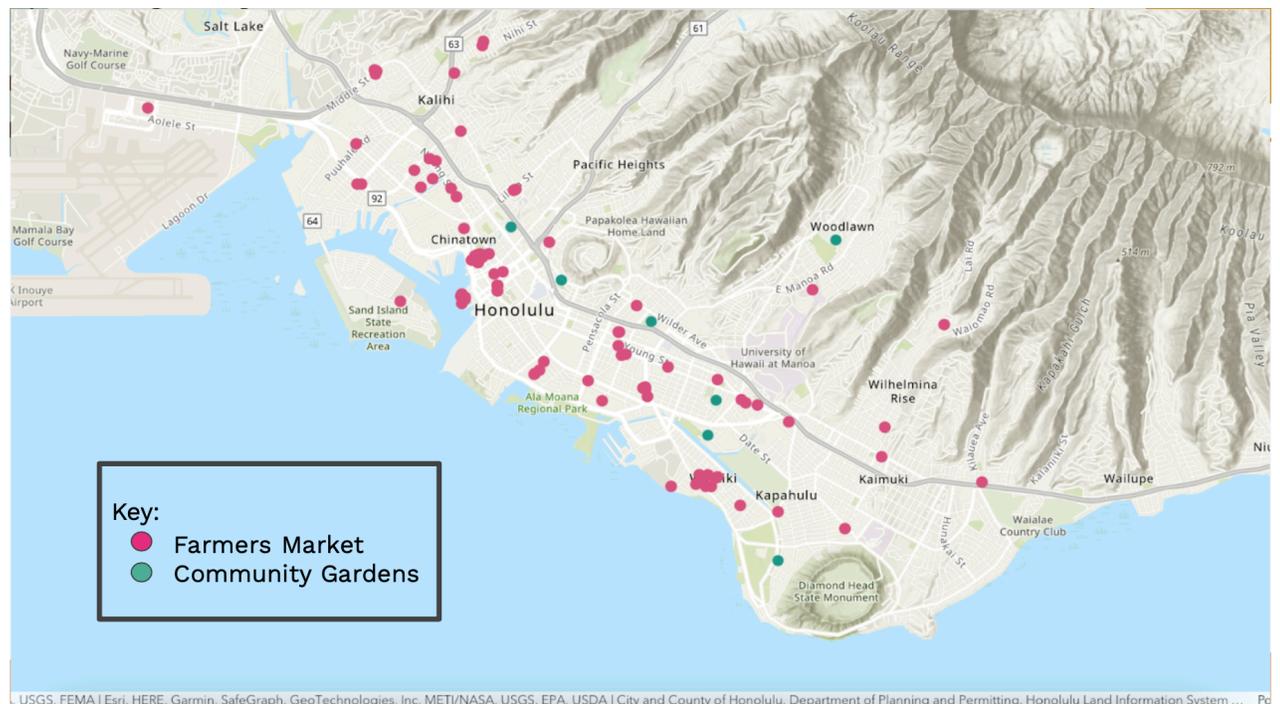


Figure 6 Community gardens and farmers markets in Honolulu. Adapted from (City and County of Honolulu, 2021; Climate Oahu, 2021).

Figure 6 pinpoints the different locations of existing farmers markets and community gardens throughout the Honolulu area. The figure shows that there are significantly more farmers markets than community gardens in the urban Honolulu area. The data that was used to formulate the figures also includes the rest of O‘ahu, however, Honolulu has the most concentrated number of farmers markets and community gardens. The data used was from the City and County of Honolulu’s GIS program.

These diverse policies, projects, and programs increase the potential for and awareness of urban agriculture in Honolulu and provide the broader context within which my research is situated.

## CHAPTER 4. RESULTS

In this chapter, I present the results from my interviews based on a thematic analysis of the qualitative data. I categorize the results into three sub-sections, each focusing on the sector that the participants represented – private, public, and non-profit – for a more nuanced presentation of the data. A summarized version of the main themes and associated sub-themes across all of the transcripts can be found in Appendix A.

### 4.1 PRIVATE SECTOR STAKEHOLDERS

The two themes that emerged in this group were enabling urban agriculture projects and the impacts of urban agriculture. The former includes references to the availability of grants as well as promoting local agriculture production and the latter to how the quality of food produced locally is positively impacted and community empowerment.

#### *Enabling urban agriculture projects*

Stakeholders from the private sector highlighted the need to enable urban agriculture projects by providing or reshaping infrastructure and grants necessary for the development and implementation of such projects. They stated the importance of providing adequate infrastructure and redesigning existing infrastructure by introducing more diversity into infrastructure to allow for more uses, including urban agriculture. Grant opportunities such as a state-funded micro-farm grant to encourage the establishment and growth of such farms was also deemed important. Several participants stated that access to grants and external funding increases the opportunities for urban agriculture projects to take off.

“I was looking, researching, when we were thinking of moving outside of Kaka’ako, you know the industrial classification would probably be ok, maybe just a subset of that zoning would be alright, or even the mix use I think would be another category that we might fit in. But I think just hearing the word farm made them think ‘oh it has to be agriculture’, so just broadening of an existing category would help.” (Interview 3, July 2021)

### *Impacts of urban agriculture*

The interviewees described the benefits of urban agriculture beyond the food system such as its potential impact on the communities and neighborhoods where it is introduced. Some of the benefits mentioned included community empowerment and education. They saw community gardens as an opportunity to encourage social connections. Gentrification is a possibility when urban agriculture projects are introduced into low-income neighborhoods by external project managers. Participants mentioned it as a concern and a potential drawback to consider before implementing a new urban agriculture project. Education can be introduced into an urban agriculture project by teaching different methods of farming, either using recent technology or more traditional farming techniques. It can also be used as a resource to teach younger members of a community about nutritious foods and the importance of introducing them into a diet.

“I think also, it's digging into the numbers and the data a little bit, because we can say, okay, 14% of our food is locally sourced, and we want to get to 25% by the year 2030, for example. But say we do that, but we also increase imports over that same period of time, and we're not really changing too much, you know, the, the carbon footprint, the amount of, pesticides and fertilizers that are going into the land in California, or North Carolina, wherever those foods are being grown, still the same. You know, the same thing is if we were producing less food for visitors, for example, and redirecting more of the local food to local people, that would, you know, be a benefit for us.” (Interview 9, February 2022)

## 4.2 PUBLIC SECTOR STAKEHOLDERS

From the interviews of the public sector specialists, there were three main themes that were most prominent in the analysis of the transcripts. They can be summarized as the challenges and advantages to implementing urban agriculture, enabling urban agriculture projects, and the entities relating to urban agriculture.

### *Benefits and challenges of urban agriculture*

Some of the challenges of urban agriculture that were put forward in the interviews were land availability and access to resources necessary for growing produce, such as electricity, water, sunlight, and nutrients. Land availability was identified as one of the main bottlenecks in implementing urban agriculture projects. Access to resources, especially water, was another critically restricted element. Some of the interviewees saw urban agriculture as a means to bolster the resiliency of a city and the connections within a community by strengthening the local food system.

“I think that urban agriculture has a really specific role. I would say from my perspective and what I have seen in my work, I don’t think that it’s necessarily a solution for island-wide food security. I think that there are really specific areas in which it can be great for developing food security and increasing food access especially for people that live in food deserts so if you were to create a community garden for instance in an area where they don’t have access to grocery stores and great produce.” (Interview 2, June 2021)

### *Enabling urban agriculture*

The interviews emphasized that appropriate infrastructure and funding could support urban agriculture projects. Some participants stated that urban agriculture could be encouraged by rethinking how buildings could be adapted for urban agriculture projects. Funding is also crucial to starting projects, as there are many start-up costs. Successful projects create interest and can catalyze future urban agriculture projects.

“I think policy wise, again, it's going to be things like zoning, if the zoning allows it. I would think that it does right now, I think that the biggest hurdle is really cost of operations to actually make it a goal, right? I mean, if it's a small type of urban ag, it might be able to do it. But then you limit yourself to just the type of product.”  
(Interview 6, November 2021)

#### *Entities relating to urban agriculture*

The participants mentioned introducing new facilities such as agricultural centers and food hubs as well as collaboration with the City & County of Honolulu Parks and Recreation Department. The idea was to have a collaboration between the City & County Department as well as the College of Tropical Agriculture from the University of Hawai‘i to assist in the implementation of urban agriculture in the urban center of Honolulu. This would be used to provide education to communities about urban agriculture practices and coming up with different resources to aid with implementation.

“Hydroponics will be a great one as far as on top of your roofs. Also, some of the apartments and condominiums that you could do those small little topsoil plots on your lanai. So, there is a possibility. What we have to look forward to is maybe getting the College of Tropical Agriculture up at the University of Hawaii plus also maybe the urban forestry division of the City and County Parks and Recreation Department to be a part of the discussion in regards to getting more agriculture in the urban core.” (Interview 6 , November 2021)

#### 4.3 NON-PROFIT SECTOR STAKEHOLDERS

The analysis of the non-profit stakeholder interviews highlighted the impacts of urban agriculture, the challenges associated with urban agriculture, the influence and importance of regulations in enabling urban agriculture and the key role played by communities and collaboration.

#### *Impacts of urban agriculture*

The participants highlighted some of the positive impacts of urban agriculture on the local community. Among these was environmental protection particularly for revitalizing brownfield sites. This allows for increased soil health, biodiversity, and water retention in the soil. Facilitating these aspects helps to improve the sustainability and resiliency of an area. Increasing urban agriculture projects, especially through residential gardens, can also help with personal food security.

“... we could produce all of the fresh fruit or the fresh vegetable needs within urban Honolulu for residents and tourists but that requires a complete reimagining of how peoples life’s and time are structured and so the broader structure of working for wages and having high rent doesn’t necessarily allow for the time to invest in growing for one’s self but the positive externalities from both a land evaluation as well as outdoor recreation and people pursuing healthy outdoor activities would be a net positive.” (Interview 1, May 2021)

#### *Enabling urban agriculture*

The participants identified regulations and policies as playing a key role in the introduction of urban agriculture to the food system of a city. Revising the regulations would allow more projects to be implemented, especially those which aim to become profitable. One of the participants stated that designating urban agriculture as a permanent land use could provide the necessary incentive for project managers to continue investing time, money, and energy into implementing and running such projects. Another interviewee stressed the importance of ensuring community involvement and collaboration. Without the collaboration of the community that is expected to receive an urban agriculture project, it would not be sustainable. Collaboration between the local government and the community is also important. Communities can put pressure on local governments and inform policy-makers to initiate changes based on their priorities and needs.

“Well, the success of urban agriculture really relies on how invested the communities [are] in it, because we can't think of urban agriculture as a thing that's on its own that will happen. It's not right. Like you need investment, you need interest. And you need interest and investment from both the community, as well as local government and other actors who will support that initiative.”  
(Interview 7, January 2022)

## CHAPTER 5. DISCUSSION

In this chapter, I summarize the findings from my interviews and case studies and situate them within the existing literature.

One of the main themes that were highlighted in most of the interviews was access to land. This is not unexpected as the literature on urban agriculture highlights the importance of access to land as central to implementing an urban agriculture project (Montgomery, 2008; Orsini et al., 2013). Cities have limited land availability due to the influx of people coming into cities.

Working towards reducing food insecurity through increasing urban agriculture projects was mentioned as a possibility in the interviews. This theme is reflected in the literature. Food insecurity can be reduced through urban agriculture as it allows for an additional source of locally available nutrition (Orsini et al., 2020). Much of the food that is available from urban agriculture projects is typically consumed in the community in which it is grown (Lin et al., 2017), which increases personal food security as well.

Education and awareness of urban agricultural practices were mentioned as another potential benefit, which is consistent with the literature. Scholars have highlighted the benefits of urban agriculture beyond food, such as for education through the increase of urban agriculture projects, including orchards in schools (Tuijl et al., 2018). These types of projects can be used as an opportunity to learn about agricultural practices as well as about natural environmental systems, such as nutrient uptake and pollination (Orsini et al., 2013). It can provide a hands-on learning experience to students and the community.

The need for resources and their efficient use was specifically noted by interview participants in relation to water insecurity and in terms of urban agriculture which heavily relies on technology. This is further explained in the literature as water can be allocated more efficiently by technology-based irrigation systems (Orsini et al., 2020). Exact amounts of this precious resource can be used to ensure water it is not being wasted. However, in soil-based urban agriculture, using only the amount of water necessary is more complicated, and usually more water than is needed is used.

One of the main themes recognized by several of those interviewed is the involvement of the government in implementing urban agriculture projects. This is also highlighted in the study of Singapore. Singapore has a unitary parliamentary republic government structure which allows for new policies and regulations to be implemented quickly (Abdullah & Kim, 2020). My interviews with the key individuals who have local knowledge of Singapore revealed that the governance structure facilitated the implementation of urban agriculture projects. While the speed of implementation in Singapore cannot be replicated in other cities due to the structure of the local government, it reiterates the importance of having government involvement, which was a recurrent theme during multiple interviews. When the local government prioritizes increasing food security, it lays the groundwork for regulations and policies that can encourage urban agriculture.

One of the main obstacles mentioned by the participants was the impact of zoning laws and regulations on initiating urban agriculture projects. Vancouver is a good example of increasing urban agriculture opportunities by creating and redefining the zones around and within the city. The interventions entailed a clear articulation of urban

agriculture and its links to specific zones with regulations by defining and dividing urban agriculture into two distinct classes and linking them to specific zones (McClintock et al., 2021). Allowing urban agriculture in two different zones also increased the opportunities for urban agriculture as well as diversifying the types that can be implemented. Additionally, the creation of a mixed-use zone (RA or residential-agriculture) accommodated urban agriculture on residential plots in the city of Vancouver (MetroVancouver, 2014). The RA zone allows for urban agriculture to take place in residential plots of land and is linked to one of the two classes mentioned above (MetroVancouver, 2014). Together, these land-use changes helped increase the presence of urban agriculture in Vancouver.

During the interviews, another important theme that emerged was the importance of community involvement. In Portland, this was very present as seen by the many grassroots and non-profit organizations that initiated urban agriculture projects. The different community-run organizations were created to fill a need that urban agriculture in particular could satisfy. In the interviews, the importance of community support for urban agriculture projects was highlighted as necessary for sustaining them. Without community involvement, the projects can be short lived. This not only shows the importance of community involvement, but also points to the impact communities can have on their local governments and policies if enough people advocate for the changes they want to see.

## CHAPTER 6. CONCLUSION

Food security is a pressing issue for many cities globally. Honolulu is one of these cities and is especially vulnerable due to its geographic location. As O‘ahu receives 85-90% of its food from imports, it can be concluded that it is not food secure. As the global population increases, the population in cities grows. This creates an uneven distribution and applies more pressure to the food system of a city to meet the nutritional needs of this growing population. Urban agriculture supports food supply chains for cities, including Honolulu, by providing another source of food. However, bringing urban agriculture into a cityscape presents its own set of challenges. Cities were not planned to include agricultural practices, therefore, the policies and regulations currently in place in most cities, among other factors, limit the number of successful urban agriculture projects.

This qualitative research highlighted the different challenges associated with implementing urban agriculture, especially in Honolulu. The analysis of the interviews and case studies revealed three key takeaways. First, government involvement is important in encouraging urban agriculture. Land use and zoning were one of the main obstacles mentioned by the participants, who saw the involvement of the local government as necessary for the implementation of urban agriculture projects. Second, the limited access to land presents a challenge. In Honolulu, this is amplified by competing land uses, such as for affordable housing, for instance. Finding unique solutions to identify and allocate land for urban agriculture sited is essential. Third, urban agriculture cannot be the sole solution in the fight against food insecurity. Relying only on one source for meeting the needs of a city is unrealistic. Instead, food security can be increased by diversifying the existing food system in order for it to withstand the impacts

of extreme or unexpected events and the associated disruptions to the food supply chains. Although limited land and the high cost of living make it challenging to implement urban agriculture in Honolulu, changing the zoning and land use policy could provide the necessary incentive for such projects to take shape.

### *Limitations*

The qualitative research project relied on a purposive sample by identifying key experts. It was not without its limitations. These included my inability to conduct in-person interviews due to the restrictions imposed by the COVID-19 pandemic, the time constraint that limited the number of interviews, and the difficulty in recruiting participants. It should also be noted that given the interpretive nature of the project, coding for the thematic analysis could have benefited from having more than one coder. Overall, the results offer useful insights and provide the basis for future research on the topic.

### *Further Research*

There are several ways in which the research can be furthered to gain knowledge about implementing urban agriculture in Honolulu, some of which were mentioned in the interviews. These include exploring the possibility of redesigning the space lining the planned rail project on O‘ahu. These areas are expected to have increased noise levels, therefore, potentially abandoned buildings along the rail could be a good location for urban agriculture.

In regard to the different community gardens and farmers markets populating Honolulu, a future study could look into how these locations relate to the population density. Such a study would then help to better understand potentially underserved communities. This study could entail GIS mapping, specifically a suitability analysis, to learn about food deserts for example. Another way is by surveying different communities to best understand the point of view of the community on their access to community gardens and farmers markets.

One of the most common concerns when it comes to implementing new projects is the cost. A cost-benefit analysis assessment on implementing urban agriculture in Honolulu could aid in policy and regulation decision making through providing an in-depth analysis on the potential costs and economic opportunities available through urban agriculture. Allowing decision makers to have access to these data sets could help advocate for urban agriculture projects. The study could also examine how urban agriculture projects influence gentrification, especially in communities of color by illuminating the social equity dimension of such projects. One aspect to consider with the analysis is the type of benefits associated with urban agriculture – economic, social, and environmental. Looking at a range of benefits could highlight whether an urban agriculture project adds to or detracts from a community.

## POSTSCRIPT: REFLECTION

If this study were to be repeated, one of the main changes that I would make, to increase the understanding between the interview participants and myself, would be to provide the definition of urban agriculture used in this study at the beginning of the interview. This would likely allow the participants' responses to be more closely related and relevant to the study. The analysis of these data generated in this way would also reveal more information when compared to the literature. I think it would also be interesting to ask the participants at the start of the interview to provide their own definition of urban agriculture. This would be an addition to the interview questions because their view of what urban agriculture is shapes their perspective on how it can be implemented and any corresponding challenges that could surround that.

Another aspect that I believe could have been an interesting inclusion in this study would be to get the local community of Honolulu involved through surveys. Community involvement and inclusion was highlighted as an important aspect during one of the interviews in particular. Getting an understanding of the needs and wants of the local communities would provide a better understanding of the potential role that urban agriculture in Honolulu. If the local communities are not interested in the inclusion of urban agriculture in Honolulu, then the implemented projects are less likely to succeed.

## APPENDICES

### APPENDIX A: RESULTS

#### *How Viable is Urban Agriculture in Honolulu?*

Themes across the stakeholder groups
<ul style="list-style-type: none"><li>• Encouraging UA<ul style="list-style-type: none"><li>○ Grants/ Funding</li><li>○ Incentives and subsidies</li><li>○ Promoting urban and local agriculture</li><li>○ Updating restrictive regulations</li></ul></li><li>• Types of UA</li><li>• Regulations for UA implementation<ul style="list-style-type: none"><li>○ Land availability</li><li>○ Zoning</li></ul></li><li>• Changes to Infrastructure for UA</li><li>• Incentives for UA implementation<ul style="list-style-type: none"><li>○ Sourcing funding from external entities</li></ul></li><li>• Communication and cooperation between necessary entities</li><li>• Entities for UA implementation</li><li>• Community involvement</li><li>• Challenges of Implementing UA<ul style="list-style-type: none"><li>○ Land</li><li>○ Cost</li><li>○ Zoning</li><li>○ Other</li></ul></li><li>• Aspects that can be integrated into UA<ul style="list-style-type: none"><li>○ Traditional food systems</li><li>○ Tech</li><li>○ Variety of types of UA</li><li>○ Types of produce</li><li>○ Innovative space</li></ul></li><li>• Advantages of UA<ul style="list-style-type: none"><li>○ Environmental sustainability</li><li>○ Increasing resiliency</li><li>○ Higher quality and nutrition</li><li>○ Strengthening local economy</li><li>○ Encouraging circular systems</li><li>○ Bettering the understanding of food</li></ul></li></ul>

## APPENDIX B: IRB APPROVAL



UNIVERSITY  
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MĀNOA

Office of Research Compliance  
Human Studies Program

**DATE:** April 16, 2021  
**TO:** Das, Priyam, University of Hawaii at Manoa, Urban and Regional Planning  
Singer, Dana, University of Hawaii at Manoa, Urban and Regional Planning, King, Seraphina,  
Urban and Regional Planning, University of Hawaii at Manoa  
**FROM:** Rivera, Victoria, Dir, Ofc of Rsch Compliance, Social&Behav Exempt  
**PROTOCOL TITLE:** Bringing Food to the Table: Exploring the Potential of Urban Agriculture in Honolulu  
**FUNDING SOURCE:** Undergraduate Research Opportunities Program  
**PROTOCOL NUMBER:** 2021-00094  
**APPROVAL DATE:** April 16, 2021

### NOTICE OF APPROVAL FOR HUMAN RESEARCH

This letter is your record of the Human Studies Program approval of this study as exempt.

On April 16, 2021, the University of Hawaii (UH) Human Studies Program approved this study as exempt from federal regulations pertaining to the protection of human research participants. The authority for the exemption applicable to your study is documented in the Code of Federal Regulations at 45 CFR 46.104(d) 2.

Exempt studies are subject to the ethical principles articulated in The Belmont Report, found at the OHRP Website [www.hhs.gov/ohrp/humansubjects/guidance/belmont.html](http://www.hhs.gov/ohrp/humansubjects/guidance/belmont.html).

Exempt studies do not require regular continuing review by the Human Studies Program. However, if you propose to modify your study, you must receive approval from the Human Studies Program prior to implementing any changes. You can submit your proposed changes via the UH eProtocol application. The Human Studies Program may review the exempt status at that time and request an application for approval as non-exempt research.

In order to protect the confidentiality of research participants, we encourage you to destroy private information which can be linked to the identities of individuals as soon as it is reasonable to do so. Signed consent forms, as applicable to your study, should be maintained for at least the duration of your project.

This approval does not expire. However, please notify the Human Studies Program when your study is complete. Upon notification, we will close our files pertaining to your study.

If you have any questions relating to the protection of human research participants, please contact the Human Studies Program by phone at 956-5007 or email [uhirb@hawaii.edu](mailto:uhirb@hawaii.edu). We wish you success in carrying out your research project.

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## APPENDIX C: INTERVIEW QUESTIONS

### General:

1. What role do you think urban agriculture plays or could play in larger efforts to improve food systems planning?
2. In your professional opinion, what steps do you think need to be taken to implement an urban agriculture project?
3. What are some opportunities for scaling up urban agriculture projects in Honolulu?
4. What are some challenges to implementing such projects in Honolulu? And what can be done to overcome these challenges?
5. Are there incentives and/or policies that you are aware of to encourage urban agriculture in Hawai'i?
6. How do you think existing policy should change to better accommodate urban agriculture?
7. Is there a specific type of urban agriculture that you believe is best suited for Honolulu?
8. Do you believe that implementing urban agriculture in Honolulu will have a positive or negative impact on our food systems? Why?
9. If properly and successfully implemented, could urban agriculture be one of the main sources of produce for Honolulu?
10. What do you think are the tradeoffs in importing our food from the mainland?
11. What could be done to support urban agriculture projects?
12. Could you describe 2-3 ways in which the City and County of Honolulu could encourage such projects?
13. Do you see a role for non-state actors (e.g. NGOs, private sectors) in taking on such projects?
14. What process in food system planning is the least effective, aside from the production of produce?
15. Do you think that urban agriculture is viable for Honolulu, given the competing land uses and high energy costs?
16. What food item is the most needed to be grown in Honolulu?

### Personal:

1. In what capacity are you involved in urban agriculture in Honolulu? How has your experience been so far?

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