Responding to the COVID-19 Pandemic through Community Gardens:
A Lifeline to Food Security and Community

A Research Report

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Photo credit: Community Gardens of Tucson

INTRODUCTION

A global initiative termed The Milan Urban Food Policy Pact (MUFPP) created a network of 211 cities (as of April 2021) committed to developing and implementing sustainable food systems that support the exchange of ideas and experience on how to address common problems. Urban agriculture is an important part of this initiative. Urban agriculture exists in most cities globally. Although still scarce, some literature exists showing that urban agriculture has helped communities reduce food insecurity during the COVID-19 pandemic (see e.g. Padilla Carrillo, 2020; Lal, 2020). Community gardens provide land for gardeners to practice urban agriculture. Such gardens provide numerous benefits from access to familiar vegetables and herbs not found in grocery stores, to the strengthening of social networks, to physical exercise. Gardening is also conducive to emotional well-being, family bonding and community creation. Tucson, Arizona, has numerous community gardens in the metropolitan area. These include

community gardens run by non-profit organizations and foundations such as Trees Please Arizona, the Dunbar Coalition and Primavera Foundation, Las Milpitas de Cottonwood which is an urban community farm run by the Community Foodbank of Southern Arizona, and school gardens.

With Tucson's high poverty and food insecurity rates, which have only intensified under the current COVID-19 pandemic, urban gardening offers low-income residents a way to gain access to affordable, healthy produce. However, there are numerous challenges to gardening in a semi-arid, drought-prone region; this includes the rising cost of water. This cost can be a real impediment for an organization that manages a garden, particularly during a crisis period when not as many gardeners can afford to pay plot fees. Thus, more plots are provided at subsidized rates to accommodate the increasing needs of gardeners.

This research report is based on a study conducted with the Community Gardens of Tucson (CGT), a nonprofit which manages 20 gardens across the city of Tucson for producing vegetables, herbs, and flowers. Gardeners' perspectives on practicing urban agriculture in the context of COVID-19 are presented in this research report (for more on the effect of water subsidies on CGT see the policy brief by Buechler, Mansaray, Feierabend and Plenk, 2021). Recommendations are based on interviews conducted for this study from June 2020 – February 2021 of CGT gardeners, staff, volunteers, and Board as well as on a literature review. The study builds on 2016-2018 research conducted by Buechler, Tong and Erbe on Tucson's community gardens (see: https://geography.arizona.edu/greeningfooddeserts).

Background and Research Methods

CGT serves many low-income gardeners, including refugee gardeners. As is the case with urban farmers globally, most of CGT gardeners are women. Even before the COVID-19 pandemic, Tucson and its sister city South Tucson had higher poverty rates compared to other similarly sized U.S. cities and other cities in Arizona (MAP, 2019). Poverty and food insecurity are highly interconnected. In 2019, Tucson's poverty rate was 17.8 percent (MAP 2020), placing it second highest among 12 western cities, after El Paso, Texas (MAP 2019). Relatedly, in 2017, out of 12 western metro areas, Tucson had the fourth highest food insecurity at 13.6 percent (Pullen 2020). With the current economic crisis due to the COVID-19 pandemic, gardeners' need for free or reduced plot fees has significantly increased. This has placed an additional burden on CGT to cover a greater percentage of plot fees; this funding was previously dedicated to covering labor and water costs.

CGT has 20 operating gardens located on a range of public, private, church, temple, and residential properties. Each plot is 3 feet wide by 20 feet long; some gardens have raised beds to accommodate the disabled and seating areas. In addition to the land, gardeners gain access to tools and irrigation. Plot fees are paid every 6 months and are $18 per month with discounts for those who qualify for reduced payments. In recognition of the economic effects of the pandemic, more plots were provided by CGT at subsidized rates; a gardener noted that as a result of receiving the subsidy: "I felt I could afford to garden; the higher rate was more than I could afford". With over 300 gardeners and 244 occupied garden plots, CGT staff and gardeners are a heterogenous group with a diversity of food production experience which affects both gardening and management of gardens.

Fifteen qualitative interviews were conducted remotely via phone, Zoom or email due to the pandemic with under- or unemployed gardeners with the goal of investigating the effect of gardening on produce accessibility for gardeners and their household members, any limitations they experienced gardening under COVID-19 conditions, and the strengths and weaknesses of social and institutional networks related to gardening during COVID-19. Over half of the gardeners interviewed (54 percent) were women to reflect their predominance among urban gardeners in Tucson and within CGT. Seven of the interviews were done with non-native English speakers or non-English speakers to gain insight into any differences that existed in the effect of the pandemic on these individuals and the impact gardening had on their food access. Languages spoken by the interviewees included English, Spanish, Swahili, Farsi and Kinyarwanda; interviewers were native speakers of these languages and translated

interviewee responses into English. Four interviews were conducted with CGT staff, volunteers, or board members on the financial effects of water meters subsidized by Tucson Water on CGT and the results of these interviews are reported here and in a separate project output, a policy brief (see Buechler et al, 2021).

DISCUSSION

Economic Impact of COVID and Food Security

Job insecurity and consumption

In the United States, an economic downturn can result in concern over debt, retirement, healthcare, bills, as well as food. Indeed, such concerns followed fluctuating food prices as shifts in the food supply chain occurred around the country. In 2020, grocery store prices were 3.5% higher than in 2019 and 75% above the yearly average for the past 20 years (USDA, 2021). These increasing prices also occurred as there was increasing uncertainty related to the job market given COVID-19 measures, resulting in effects on decision-making concerning household spending. According to a Pew research study, 42% of Americans report spending less money in the intervening year since the beginning of the pandemic, with lower income residents in particular reflecting concern for their overall finances. Similarly, in March 2021, 32% of lower income adults expressed concern over an ability to buy enough food daily or almost daily -- worry which met expectations of higher-than-average food prices for the year -- especially for meat and fresh fruits and vegetables (Horowitz et. al, 2021; USDA-ERS, 2021b).

The increased job instability and job loss for U.S. residents because of the COVID-19 pandemic resulted in a significant increase in the use of government aid. As of March 6, 2021, there has been a 227% change increase compared to last year's weekly initial claims made by US residents for unemployment insurance; Arizona meanwhile, had an 18.2% increase in the number of weekly claims for unemployment benefits compared to March 6, 2020 (AZ Economy, 2021). This employment instability intersected with food insecurity and directed some community members around the country to turn to their community gardens as a reliable and cheap source of healthy, fresh food (Mercado, 2021). CGT staff members too noticed increased numbers of people signing up or coming to the garden, with many gardeners noting the savings of growing their own food as a supplement to their diet. Protection of this source of income was and is essential as despite safety net components like unemployment insurance, for a number of populations, such as non-English speakers, those without citizenship, or households who don't have a computer or the literacy needed to make such claims, access to such crucial support is neither equitable nor a simple process.

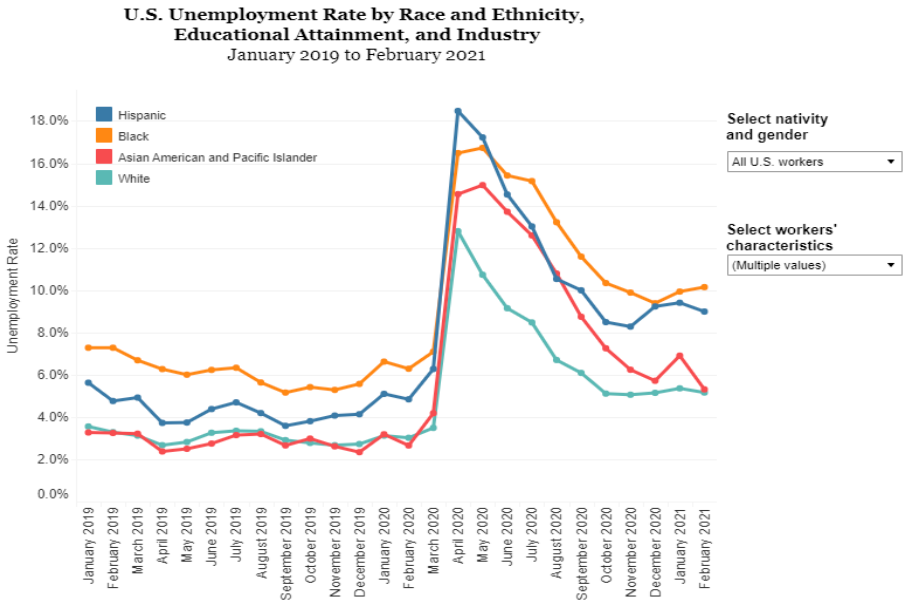

Figure 1: U.S. Unemployment Trends during Pandemic. Source: Migration Policy Institute. (2021). https://www.migrationpolicy.org/programs/migration-data-hub/us-unemployment-trends-during-pandemic

In April 2020, a large surge in unemployment occurred, particularly for immigrant women (and especially Latina women), young workers without a high school degree, and those employed in retail, leisure, and hospitality. Some in these industries lost their jobs multiple times. One gardener shared, "[my husband] lost his job in April, was brought back, then was laid off again in July and then brought back in August. In 2021, these demographics have fluctuated with higher unemployment rates for Black Americans and migrants (see above in Figure 1) (Capps et al, 2020; MPI, 2021).

Immigration and residency status can disqualify many immigrants from access to many of the benefits created due to the pandemic. For some gardeners, particularly the refugee or asylum seeking, the gardens were not just an opportunity to save money but also to make money as many were gardening for market pre-pandemic. Arizona as a state and Tucson as a city have had the highest refugee resettlement rates in the U.S., with refugees coming from nations in Southeast Asia, Eastern Europe, the Caribbean, the Middle East, and Africa (Arizona DES, 2021). As with the rest of the US, refugees in Tucson have been hard-hit by the COVID-19 pandemic; and despite pre-migration education and training, many are employed in the worst-affected sectors of the U.S. economy during COVID-19: the service sector, especially hotel and food services, and transportation. According to We are the World, by May 2020, 70-90% of refugees in the US had lost their jobs or had hours reduced – a number that doesn't include asylum seekers (Kunz, 2020). While gardens around the country were in fear of closing given COVID-19 conditions and many qualifying as "recreational", they pose a significant financial and food security buffer during economic crises.

Saving and Making Money through Gardening

These changes in job security, coupled with a disruption in supply chains and shifts in demand as COVID measures were put into place, changed both purchasing power and food access for many Tucson residents – a shift which CGT met with additional conversations about how to meet the needs of their gardeners. For many gardeners, growing food at CGT has allowed gardeners to both save money from groceries they do not have to buy as well as make money from produce they choose to sell. Saving money is also made possible through various supports from CGT including tools, mulch, and reduced costs for plot payments for those who cannot afford to pay the full fee. These investments provided by the gardens are essential since saving money given the uncertainty of the job market has been a necessity for many households and also because both gardening as well as buying certain food (e.g. organic or specialty) can be an expensive endeavor. One gardener said, "[A reduced fee] helps [me] afford more manure, seeds, and resources and to justify being able to partake in gardening rather than cutting further into the budget."

For many gardeners, at least two of their top four reasons for gardening were connected to socio-economic reasons that ranged from access to affordable food (organic or specialty), reducing their grocery bill, and access to land to grow food. Interviewed gardeners noted the pandemic made them more selective about what they were buying to save money. One gardener echoed what others mentioned, that is, a reduction in consumption of select foods and other products during COVID-19: "Since I'm not going anywhere, I'm really not spending the same amount. I'm eating more at home. I'm consuming more stuff that I need". Another whose partner lost his job in the entertainment industry said:

> We needed to hunker down and reduce our spending. A huge part of my budget has always been groceries...I definitely was not buying any meats really unless it was on sale. I pretty much stick to organic dairy but I don't do a ton of dairy. So, um, you know I was still buying those few things like my choice things. I actually was buying a lot less fresh produce because I just didn't want to go to the store. So when I did go to the store I would buy fresh produce, but I was only going to the store like once a month...so I turned to my food pantry and my garden, and we made that work so nice.

Figure 2: Refugee woman gardening in a CGT garden.

Governmental and Non-government

A few gardeners directly mentioned that their reduction in purchasing during COVID-19 was due to increased prices. A gardener told us: "There was an increase in the prices of the food...That kind of bothered me because I like my meats and my salad".

Just as there were intensified requests for governmental aid, non-governmental food programs also saw an increase in requests in the U.S. for free or federally subsidized food through food banks, soup kitchens, and food stamps (Parker et. al 2020). When asked how his family has reacted to their change in income as a result of the pandemic one gardener said, "we have become more dependent on food stamps, at times begging from those who know us."

Similarly, many gardeners referenced not just reliance, but greater interaction with pantries, the Community Foodbank of Southern Arizona, Market on the Move, Gap Ministries, and churches among other organizations as sources they use to supplement their food supply**.** The Community Food Bank of Southern Arizona, which serves Tucson and surrounding areas, reported that from March 2020 through March 2021 there was a 25% increase in households served compared with March 2019 through March 2020 (Caspi, 2021). This reveals the stress of COVID-19 on household food security due in part to job disruptions, with increased hunger (insufficient food and nutrients) particularly amongst female headed households, Black and Hispanic households, the elderly and families with children (Machelor, 2021). While several gardeners mentioned going to a food pantry and growing their own food as a way to deal with COVID-19 induced unemployment or underemployment, CGT also stood as a source of produce for pantries around Tucson. A CGT staff member mentioned that during the pandemic:

> A couple of times one of our members at the end of the season [will ask] if people have any leftover chard or any food they are basically done with. [If they do] she harvests it and takes it to the food bank or other community organization.

Community gardens thus are not only viable sources of food security for gardeners but provide direct and indirect services to members of the broader Tucson community.

Socio-political benefits of gardening

Community creation and sharing of knowledge and produce

The community gardens have a heterogeneous population of gardeners each of whom derives different benefits from producing food in a community garden. Some garden as a hobby, some to access cheaper and/or organic produce for their own household or family and friends, and others to sell a portion to market. But the benefits also include community creation and knowledge sharing.

Figure 3: Family gardening during COVID
Photo credit: Karina Martinez

A common characteristic of CGT's gardeners is that the majority of gardeners interviewed began gardening at CGT through the recommendation of someone in their social network. The garden space was viewed by many as conducive to creating or maintaining a sense of community. This was reflected in the prevalence of produce sharing, often with fellow gardeners, food pantries, and with family members and friends who are not gardening. This sharing extends the benefits of gardening beyond the garden perimeter. As one gardener explained:

> What always tends to happen in my garden is that I planted a bunch of stuff, and then a few things do really well and then I have way more than I could ever use of those couple of things. So...it's like anybody who comes over, you're getting a bag to go anytime I'm coming to a dinner or like for a visit... So, you know, close friends and family were always on the receiving end.

This gifting of crops and food is used globally as a way to assist in food security but also to cement social ties and is especially common among women (Buechler 2009).

Community is also created in the gardens among people from diverse backgrounds but who all share an interest in growing food. As one gardener expressed it:

> We meet people from around the world...they are wonderful-the cultures they come from. They are into home gardening and you learn about their personal experience even down to generations... Gardening is a global thing, many people consider it a cultural thing. Many people consider it a part of their existence.

Part of the importance of community creation among this diverse group of people is that it fosters placemaking, that is, a sense of belonging, for all. This can be particularly important for minoritized groups as a way to establish a sense of place and understanding of the broader Tucson community through their communication with people of shared backgrounds. They also made new friends by sharing crops. One immigrant gardener shared this:

> When I got here, I said I'd like to grow African things here in Tucson because I wanted to share the idea with other people too. If people say "what's that?" I can say "That's African food" or "That's African greens. You want to try? Have some." And some may like it.

A woman said that she and her fellow gardeners have a strategy they follow: "we don't grow the same thing so we can share". Through gardening together and sharing produce, gardeners said that they made friends they saw in and also outside of the garden boundaries. One elderly gardener said: "I've made lots of friends. We not only meet in the garden. These are people with magnificent mindsets. There is [gardener name] who takes care of the chickens, speaks Arabic. There is [gardener name] from Africa planting his native seeds. It's really nice and really unites you with a common interest".

Gardening, though, serves as a way not just to connect with new people interested in horticulture but also to connect with people from their past. For gardeners who migrated from outside Tucson or the US, many drew connections to family members, significant others, or friends with whom they used to farm or garden. These findings are consistent with other studies on community gardens that reported that they are important means of placemaking among immigrant populations. Hondagneu-Sotelo, for

example, has argued that urban community gardens in Los Angeles allow "marginalized Latino immigrants and especially groups such as the indigenous, the undocumented, and immigrant women, groups who find access to both public and private spaces particularly limited... [to] connect[] the homeland of the past to the homeland of the future" (2015: 26).

Community gardens can also serve as conduits of knowledge exchange. This includes knowledge about how to garden. Gardeners stated that they obtained knowledge about horticulture, water management, as well as food programs around Tucson through their engagement with neighboring gardeners, volunteer coordinators, and staff during the pandemic. As one gardener explained:

> I learn about plants in the context of Tucson because gardening here is not like [the country he migrated from], I learn what other gardeners think of plants, [and] share skills... I [also] get to still associate with people from Africa, Cambodia and other places….

Additionally, a few gardeners obtained information through CGT's website that has videos on topics such as how to mulch receiving positive feedback. In acknowledgement of the challenges regarding irrigation, CGT has also uploaded videos on how to fix irrigation drip lines.

Green space, land access, and food sovereignty

Another socio-economic benefit of community gardens is green space. Green space provided by community gardens has been found to reduce crime (Shepley et. al 2019). One gardener reflected that the presence of the garden and gardening are a way to keep people from engaging in criminal activities, including drug use. At Blue Moon Community Garden, however, food theft was mentioned as a defining issue. A CGT staff member highlighted that gardeners there made a decision to create a community plot so those who were stealing food would be welcomed rather than excluded, extending the green space benefits to more community members:

> There has been more adoption of community beds, which are beds available for everyone in the garden. In the case of Blue Moon, I think the origin of having more of a community bed for everyone was that it's not gated and people were seeing a number of their food get jacked from people outside the garden. And I like this solution because instead of people saying we need to build a gate to keep people out it was more like there is a need here how can we grow food for people who are hungry and stealing our food. I'm excited about that initiative and hopeful that it will thrive and grow too.

Figure 4: Welcome Sign at Blue Moon Garden. Photo Credit Karina Martinez

In addition to green space, gardening also provides access to productive, irrigated land for agriculture, which in an urban setting is usually scarce**.** Container gardening or gardening in raised beds is a viable and common choice for urban gardeners generally as well as in Tucson. A number of gardeners interviewed grew crops using containers or pots prior to joining CGT as a way to grow food closer to home. Even so, for those who rent housing including those who live in an apartment with no access to land that they own, urban agriculture can be a challenge. The little land that might be available around rental units to garden may also often require a great deal of labor to amend the soil. Container gardening in Tucson can be frustrating; as one woman said, once her plants started growing larger, they would die-she was convinced that this was because the roots would become too close to the edge of the pot where it was hot from the sun. Access to a community garden which also provides needed resources such as plots with enriched soil, tools, irrigation, and other inputs can make all the difference for this segment of the population.

A significant theme for choosing the garden is food sovereignty. Food sovereignty, states the U.S. Food Sovereignty Alliance, "goes well beyond ensuring that people have enough food to meet their physical needs. It asserts that people must reclaim their power in the food system by rebuilding the relationships between people and the land, and between food providers and those who eat" (2021). For those who garden as a hobby rather than a necessary supplement to their food supply (at least prior to COVID) many expressed the importance of not only knowing where their food originates, but the ability to choose which food they grow and consume. Many see gardening as a way to play their part in sustainability with concern for carbon footprints, avoiding use of chemicals in store bought produce, as well as nutrition value noted as important components to food sovereignty. A number of gardeners noted their ability to play a role in restoration of land as an interest as well. Across all demographics of gardeners interviewed, self-reliance was an underlying goal. During COVID, growing their own food helped gardeners address the scarcity of certain vegetables, fruits, and herbs. It also stood as an investment in their own health and knowledge. This self-reliance was a way to localize a portion of Tucson's food production and to connect it to the local environmental context with increasing temperatures and decreasing rainfall.

Gardening for Improved Health

Community gardens provide several health benefits including: improved access to healthy and nutritious foods; benefits to mental health and social-emotional development; provision of spaces for recreation, physical activity, and skill building; mitigation of the effects of pollution, and even reduction in violence (CDC, 2010). For CGT gardeners, consideration of and realized benefits to health and wellbeing consistently fell into one of the top reasons for gardening. Interviewees tied the health benefits to attributes like opportunities to teach the next generation about growing and consuming healthy food, access to a socially distanced and healthy environment (especially given the pandemic), improved mental and spiritual health, physical exercise, as well as improved nutritional intake.

Centering Individual and Community Wellbeing

Many of the gardeners used the gardens as a site for the education of children or other adults about growing healthy food and community interaction, which given increased dependency on technology for socially distanced communication were important lessons to navigate for parents. Research has shown that youth's participation in gardening programs increases their consumption of fruits and vegetables (Lautensclager & Smith, 2007). One gardener relayed: "I used to garden with my mom and I would like to pass that on to my daughter".

Whereas the initial stages of the pandemic left a division between states around the country as to whether community gardens should be considered essential, others closed or were at threat of closing in the early stages of the pandemic. Over the past year, however, the outdoors have been promoted and taken advantage of as a safe space during the COVID-19 pandemic, with gardens serving as a place for families and friends to access fresh air, exercise, and enjoy the mental health benefits of green space. In a recent study with Las Milpitas Urban Farm, it was found that gardening as a form of exercise total a value of $573,000 in benefits and access to a closer source of food and healthier diet $848,000 (Las Milpitas 2020). These savings reflect the reduced risk to disease, exposure to harmful pollutants, as well as access to a space to relieve stress. Often, green spaces are not as easily accessible to low-income residents in distance or cost of entry for institutionalized places. Where present, these spaces may not show the same level of investment in upkeep or amenities as those located around higher income neighborhoods. A new initiative by Tucson's mayor Regina Romero in partnership with Tucson Clean and Beautiful and its subsidiary program, Trees for Tucson which aims to plant one million trees would partially address this problem (Davis, 2021).

Mental and Physical Health during COVID-19

A couple of gardeners compared their home during the pandemic to a prison with their respective gardens becoming a much needed escape. "[Gardening] is a stress relief...I feel it's necessary for everybody to have an outlet. After a couple of days, even your own home starts to feel like a prison." Numerous studies have shown that green space in

cities reduces rates of depression and stress and promotes overall well-being (Tsai et al 2018). In 2020, those who got out into fresh air and got exercise during the pandemic (particularly where others were present in a socially distanced outdoor setting) were also less likely to experience depression and anxiety and less apt to engage in risky health behaviors such as alcohol abuse (Sanderson et al, 2020).

Reflecting on her mental health, one gardener said:

> [Gardening] got me outside. It got me like physically moving around and doing things and feeling like I have things I got to do. Right? Because I I talked to so many people that were so stagnated or felt trapped, like in jail at home. It gave me something that allowed me to feel like I was accomplishing something every day, feeling like you know, I was still making progress... I could still have a fulfilling life, even though all the social interaction was on hold and you know any kind of career moves or anything may be on hold, but I had this other thing that I could still do with my time that I felt was important.

Another gardener explained the benefits to physical health:

> The effect of gardening has been to lower my blood pressure, [there are] many positive side effects that make you feel better emotionally, spiritually. Nothing like it for self-esteem and good will, to watch them grow, be a nurturer. All those positive hormones to make you healthier.

Growing one's own food can bring one closer access to food that is healthy, fresh, and organic. Similarly, growing food can address the health risk of having to visit stores during COVID-19. This can be particularly important for families with kids or individuals with health conditions.

Filling in Dietary Gaps

While Tucson is often referenced for its food deserts and high food insecurity, Tong, Buechler and Erbe propose that in these regions, small independent food stores provide a way for communities not only to access food in general but also food that reflects their own food values (2016). In the same way, community gardening provides a way to access dietary needs and wants not easily found in commercial or local grocery stores. In conjunction, several gardeners regarded the gardens as a space to "grow your own meals" as a way to fill in dietary gaps unmet by surrounding local produce. The ability to grow and consume one's chosen food is just as important to food security as having a store which supplies food more generally in a given area.

Similarly, some gardeners noticed changes in the type of food provided by their supplementary sources. In reference to Market on the Move, a gardener noted how thankful she was for her garden as a means to fill in the gaps in fresh and diversified food created by the pandemic. She said thoughtfully: "Before [the onset of COVID-19 induced changes] there was more diversity in the food, more flexibility because you could pick what you wanted. Now there is a set box and the set box has less flexibility." A Community Food Bank staff member commented that these changes could be due to a number of factors in the supply chain from seasonality, to increased USDA funds for subsidies to American farmers for specific crops only, to changes in facility space or the organization of labor in food production lines.

At the same time, for some gardeners there was still a lurking concern of exposure to COVID-19 at the gardens. In some cases, this resulted in their reduced visitation to their respective CGT garden. Some also decided to delay planting due to social distance concerns compounded by an unusually hot and dry summer in 2020.

Access to Organic Food

Gaining access to organic food is also important. Stores with organic produce are more often found in higher income neighborhoods. CGT promotes growing organic food, a mission many gardeners project. Reflecting on the benefits of gardening at CGT during the pandemic, a gardener said, "[a benefit is] growing your own food and eating at a lesser price

or cost of production; growing things by your own and it's organic or healthy...economically despite COVID...we were still getting food from community gardens." Still, growing food organically is not done by all, a challenge discussed below.

Challenges to reaping garden benefits

Infrastructural Challenges

While gardening can provide several benefits, it also presents challenges. Gardeners mentioned infrastructural, environmental, security, and COVID-19-specific challenges to gardening in a community garden. In terms of infrastructure-related challenges, one issue is the small size of the plots and restrictions on the number of plots any individual or household can farm. As one refugee noted: "I was growing different crops in my home country like potatoes, beans, corn. Here I cannot grow those because the gardens are small". Another infrastructure-related issue is the lack of garden supply stores that are located in close proximity to the community gardens. As a gardener explained, he cannot buy the fertilizers or seeds that he wants. Instead, he must rely on what is given to him because he does not own or have access to others with a car. In a 2016-2018 study conducted by Buechler, Tong and Erbe, it was found that many community gardens in Tucson are located far from where some gardeners reside and that public transportation to them was inadequate or inconvenient. This was more of an issue, however, for those gardening with the Community Foodbank of Southern Arizona and other non-CGT gardens (Buechler et al, 2018).

Water and Climate Change Impacts

In the context of the Sonoran Desert which has lower rainfall than many areas of the US, producing food can be even more difficult. Water is a scarce and precious resource in Southern Arizona. Tucson, with a population of 982,000 (macrotrends.net), depends on the distant Colorado River for its surface water supply. This river water is pumped 336 miles, and 3,000 feet uphill, to Tucson via the Central Arizona Project (CAP) with considerable energy and financial implications. Groundwater is used less frequently as prior overpumping compared to natural recharge rates and climate change have led to ever-diminishing water table levels in the region and to restrictions on groundwater use (Lahmers and Eden, 2018). Water costs are rising which is a problem for non-profits like CGT managing community gardens. Profligate water use by some gardeners is a challenge for CGT's budget. One CGT staff member explained: "We do have gardens where people hand water and at those gardens the bills are astronomical."

Climate Central, an independent organization conducting research on climate change impacts, reported that between 1970 and 2018, Tucson and Arizona were the third fastest warming U.S. city and state. Tucson was an average 2.50^0C (4.5 degrees F) warmer in 2019 than 1970 (2019). The National Weather Service declared summer 2020 the hottest summer since 1897, when climate records commenced in Tucson (Stormont, 2020; Tucson Mayor and Council, 2020). Without emission cuts, Pima county, where Tucson is located, could see 100 days annually with 100^0F temperatures by 2060 and 130 days by 2100 (Gonzalez, et al., 2018). One recent study of 20 southwestern cities found that Tucson had the third biggest temperature disparity between richer and poorer neighborhoods on average summer days due in large part to disparities in green space location (Dialesandro et al, 2021). At present greenhouse gas emission rates, Arizona's average monsoon rainfall could drop 30-40% by 2100 (Gonzalez, et al, 2018). Many gardeners are familiar with producing food in regions outside the southwest U.S. with higher rainfall and lower temperatures. The lower rainfall and higher temperatures in Tucson translate into higher time investments for gardeners. Water is a limitation in the sense that with very little rainfall, gardeners depend largely on drip irrigation. CGT has videos on how to fix drip irrigation lines on their website. Some gardeners overuse resources like water instead of fixing irrigation lines, changing irrigation timing, cropping and mulching. One gardener described their summer 2020 gardening experience thus: "The lack of rain and heat were significant-even for [crops] shaded properly; the ambient temperature was so extreme; no humidity; the lack of rain was incredible; plants suffered. Even with more watering it was hard for them to survive or be as prolific as they could be". CGT's response has been to work with gardeners to ascertain the timing of their irrigation with a hose to cooler times of the day and to educate them about the benefits of

mulching, applying fertile compost soil and using shade cloth.

Soil Quality and Pest Attacks

Gardeners are encouraged, following CGT regulations to garden organically. Some gardeners, however, do not have knowledge on regenerative agriculture, noted a CGT staff member. They thus use chemicals to deal with poor soil quality that is harming their production instead of adding compost. Others do not add natural predators (ladybugs, lizards, etc.) and flowering plants (such as lavender or marigolds) to deal with pests and thus experience harvest losses. After increased familiarity with additional challenges such as ground squirrels, sun profile, a couple of gardeners also realized that with some crops, transplanting the fruits and vegetables from a nursery provided better results.

Crop Theft

Another barrier to successful gardening mentioned above has been crop theft. This has been particularly problematic at gardens located in lower-income neighborhoods. A response at one CGT garden was to create a community plot with the help of schoolchildren. The plot has signage that indicates that the crops can be harvested by any person in the neighborhood.

COVID-19

Other challenges were COVID-specific. For example, some people in the initial phase of COVID-19 felt uncertain about going to the gardens. Some gardeners stated that they were not able to socialize as much with other gardeners as before the pandemic. This included discussions, for some gardeners, concerning what types of job opportunities were available in Tucson. For others, it meant not obtaining needed farming inputs from fellow gardeners. Those wishing to sell a portion of their crops experienced farmers' markets and other sale venues that were shut down, restricted and/or with fewer customers during various stages of the pandemic.

Institutional challenges of community garden management

Community gardens provide multiple benefits, yet access to a community garden is not an automatic benefit to communities. On the one hand, different groups within a community may benefit differently. Access can be determined by a number of different attributes that extend past geographic location and knowledge of a garden. Language, accessibility for people of various abilities, and the culture of an organization are but a few of many factors which can have an impact on participants (as well as staff or board composition) in a community garden program.

Creating Community

Similarly, the community in a community garden can come to be divided by these barriers. Many gardeners for example expressed interest in meeting other people who were interested in gardening or getting to know their community; there were mixed experiences, however, in finding that connection for which they were searching. Language, particularly for gardens with non-English gardeners, proved an initial barrier for consistent interactions between gardeners and non-English gardeners and staff. For the gardeners who speak the same language, they have created their own network of communication, and staff and volunteer coordinators with the language capacity engage these gardeners; yet the breadth of this support system is limited. Some gardens have also taken the liberty of creating shared plots to establish a shared sense of responsibility, while others have made use of the garden space as a place to socialize and not just grow food.

A member of one garden reminisced about the community she has been able to maintain at the garden since COVID:

> [At the garden we can] spend some time there, talk to others... it's not in the mall or indoors. It's under the sun, its outside. We have benches there and have book club meetings. Somebody else had a birthday with their toddler. You have to ask if it's okay but you get permission and can have it in the garden.

There are significant opportunities for gardens to act as spaces that increase engagement with geographically proximate communities – including community members who were not always drawn to the community gardens pre-pandemic. A volunteer garden site coordinator remarked on new visitors to the garden:

> We have a group home that has a coordinator [who] comes with adults [with mental disabilities]…that's the first time they've come to garden, but I imagine the opportunities for them are few and far between in this type of [COVID-19 centered] environment...it was cool to see someone [else] who just needed to get out [given the COVID-19 pandemic].

COVID-19 thus has not only presented an opportunity to address the needs of current gardeners but future ones as well. It also provides a platform to discuss the meaning of community and audience, along with engagement. As more visitors representing different sects of the population are drawn to CGT, representation and access will also prove a constant conversation.

Equity and Inclusion

For a nonprofit running a community garden, socio-political events shape the institutional structure of a community garden. Attention to disparities within health and food systems under the pandemic combined with increased attention to injustices and systemic violence against historically marginalized groups have underscored the importance of reflecting on CGT's role in social justice as well. A CGT staff member reflected on managerial roles:

> We try to have a diversity of people younger and older, single people, families, people that live here that don't have kids…but almost by definition it means people aren't in the garden at the same time so it makes it harder to develop those kinds of friendships...We haven't been successful developing gardens in the south and west and talking about what to do. We had gardens that failed because we didn't have enough communities and we would like to have more diversity in our gardeners and also on our board. It is an ongoing issue we recognize, and we have yet to resolve.

Organizational and programmatic considerations are an essential part of creating community for a community organization, particularly because these considerations can affect decisions which shape factors from funding and provision of resources to the culture of an organization. With this in mind, for CGT, greater considerations of diversity, equity, and inclusion have been made from the gardener to board levels.

A CGT staff member opined that:

> COVID has illuminated social inequities and the rifts that already exist in our communities in this country and world broadly...It's a long process but there is a little more looking inward maybe happening in the organization and trying to figure out some action steps and how CGT can better serve our community and be better representational of our community...We have a long way to go because community gardens are in a broad sense - they can be an amazing resource to tend land and grow food and have a connection to the earth in a way that is not always present for people in urban landscapes. And then it's like [we need to think about] how can community gardens be a really gentrifying force in certain neighborhoods and they can be weaponized in this way and not serve people adequately.

One means of equity CGT has paid particular attention to is distribution of resources across gardens since every garden does not have the same wealth distribution. CGT provides reduced funding to pay for plots for gardeners who need it.

A CGT staff member shared:

> We are trying to figure out policies around that which is complicated because it isn't this thing that is binaried with people having resources and others not. It can look very different at one garden so it's [about] trying not to make generalizations that can negatively impact people.

They also consider the supply of resources like shade cloth, compost, and other tools for gardens which may not organize as quickly as others to meet those needs as a community. Since the onset of COVID-19 measures, there has been a 3% increase in requests for free or reduced plots and several plots have been left unused indicating that some may stay away due to the cost implications (Buechler & Mansaray 2021). The funds from plot subsidies provide a buffer for gardening expenses, such as soil amendments or replanting when crops fail.

CGT has been working to connect with more organizations as a means to draw in the community. Gardeners already tap into programs like the Pima Master Gardener Program of the University of Arizona's Pima County Cooperative Extension. CGT's collaboration with the Pima Master Gardener Program has helped increase the number of Master Gardener trainings available. Iskashitaa Refugee Network has also provided support during COVID-19 through the provision of produce to gardeners. Iskashitaa has also connected CGT to Tarjimily, a language translation app, to help communicate with gardeners who are non-English speakers. Also, one of the gardeners who has put in several volunteer hours to help with garden upkeep, supports gardeners in their gardening knowledge, as well as provides Swahili translation to many refugee gardeners has also been recently hired. Moving forward, these partnerships will be important to filling in gaps in programming.

Connecting Gardeners to Resources

Little use of the website across gardener demographics proves a challenge to CGT's dissemination of knowledge resources. Their website contains resources such as fixing irrigation leaks, a planting guide, as well as common FAQ's both new and experienced desert gardeners commonly ask. Despite this, most interviewed gardeners noted they do not use the website, with many expressing in-person or phone communication as their preferred form of communication and learning. This is also a reflection of many gardeners coming to know of CGT through word of mouth rather than the website.

CONCLUSIONS AND RECOMMENDATIONS

This study was carried out via remote interviews of urban community gardeners at the start of the COVID-19 pandemic in spring 2020 and just prior to widespread vaccination in spring 2021. It shed light on the particular ways in which urban food production in community gardens has shaped pandemic experiences of a diverse group of gardeners in Tucson, Arizona. Interviewees included gardeners across gender, parental status, age, ethnicity and citizenship who practice urban agriculture with the Community Gardens of Tucson (CGT). Gardeners experienced changes in employment or income or who had a household member who experienced such changes due to the pandemic.

Gardening provides numerous economic benefits that are interlinked with food security. Gardening allows gardeners to save money through growing food, particularly specialty or organic food, which would otherwise prove an extra strain on household spending. Community gardening also provides gardeners with an additional source of income. These benefits are tied to greater self-reliance for gardeners. . The government's provision of subsidies to community gardens can help managing teams and gardeners tap into these benefits. Community gardens can foster these economic benefits by connecting gardeners with produce marketing or business opportunities.

Socio-political benefits included creation of a sense of belonging, creation of a social network, knowledge sharing, food sovereignty and self-reliance. In terms of community creation, immigrants and those originally from other states in the U.S. found that they could share their knowledge of crops they grew in their homelands with others while learning farming or gardening skills from gardeners who had lived in Tucson longer. Other socio-economic benefits

included access to green spaces, access to agriculturally productive, irrigated land that was especially important for those who rent and all those who do not have land of their own. During the COVID-19 pandemic, gardeners could get exercise, access healthy food and gain a sense of purpose during the multi-dimensional crises that the pandemic created in a setting that allowed safer socializing with others.

There were additional health and nutrition benefits which included stress relief from being secluded at home and the ability to diversify diets and to provide vegetables and herbs that were specific to food traditions. Community gardens also provide a space for socio-emotional learning for adults and youth. Harnessing these benefits can be done by way subsidies or investments in community gardens as institutions which are in essence health services – services that can be particularly taken advantage of by historically marginalized communities who may not reap the benefits of health services as other communities.

Gardeners relayed numerous challenges to farming in a city located in a semi-arid region being profoundly impacted by climate change. Solutions to some of these environmental problems will need to be addressed at the program and policy level in the city and globally. These include assistance with making the organic production as water-efficient as possible with support for non-profits running these gardens for drip irrigation system maintenance and training programs on lower water crop selection, mulching and soil enrichment via the use of compost soil. Challenges noted related to COVID-19 include marketing restrictions and impediments to communication between gardeners on important matters such as employment availability, access to gardening inputs, etc. Since knowledge sharing seems to occur best when done gardener to gardener, instituting a time and space for gardeners to share their problems and the solutions they have devised to address those problems might be fruitful.

Institutional challenges to gardening and community garden management reflect many of the same inequities found in various institutions around the country. Creating a sense of community can involve trade-offs as well as institutional restraints such as language capacity, time, and community interest which shape participation in the garden. Relationship building can be initiated at multiple levels from gardener to Board which create space for gardeners of diverse backgrounds to interact with one another. As a nonprofit, CGT has increased considerations of equity not just in financial resources but also in terms of who is welcomed to the garden and who has decision-making power. Connecting equity to policies and programming will be an important aspect of ensuring the potential benefits of community gardens are achieved by gardeners.

Based on our study, community gardens are an important fallback measure during crises. This study highlights economic benefits of community gardening as a safety net not just for low-income households but for all households in times of economic instability and uncertainty. Inclusion of community gardens as part of urban contingency plans could ensure food security in times of economic crisis, particularly for communities who may not be able to easily access government support. Challenges to reaping these benefits, however, indicate there should also be deeper equity considerations in order to be able to reach broader populations. Greater equity could be achieved via needs assessments and evaluations as part of strategic planning initiatives conducted by non-profit organizations such as CGT in collaboration with relevant city agencies such as Tucson Water.

Further research should investigate the benefits and challenges of community gardening in other locations in the U.S. and internationally during crisis periods. Issues of food access, community creation, emotional and physical health and knowledge sharing during crises need to be explored in greater depth, in particular during pandemics and other crisis periods, such as economic and social crises. In order to increase social inclusion and participation, city governments would need to prioritize the co-development, with non-profits, of equity-focused policies that would include community garden spaces.

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