

Foraging in Tucson's Parks: Interest, Barriers, and Opportunities

Paola Ortez

Senior Capstone, Sustainable Built Environments Program

The University of Arizona

4 May 2021

### Abstract

This paper considers the negative impact of reducing green spaces in cities on people-nature relationships and how urban foraging can help bridge that gap using Tucson, Arizona, as a case. All park policies, laws, and regulations at both city and state scales and laws that affect trees lining streets are reviewed. A content analysis was performed with questions relating to the following barriers to foragers: behavioral restrictions, management practices, and safety concerns. In addition, University of Arizona students were surveyed to gauge interest in an edible city initiative in Tucson, Arizona, and an interview with an urban land planner gave further insight into the design aspect of incorporating edible landscaping in a city. It was concluded that the language in laws that affect public parks, state parks, and streets is restrictive to foraging practices, with the common theme being that people should not be interacting with vegetation in parks. Moreover, student surveys showed interest in foraging, especially for educational purposes and alleviating food insecurity. It is concluded that for Tucson to start a city-wide edible city initiative, the legal barriers must be addressed first.

## Table of Contents

|   |    |
|---|----|
| <b>1. Introduction</b> .....  | 4  |
| <b>2. Literature Review</b> .....   | 5  |
| 2.1. <i>People-Nature Connections</i> .....                               | 5  |
| 2.2. <i>Major Barriers and Forager Concerns</i> .....                     | 5  |
| 2.3. <i>Edible Cities in Europe</i> .....                                 | 6  |
| <b>3. Research Questions</b> .....  | 6  |
| <b>4. Methodology</b> .....   | 7  |
| 4.1. <i>Study Area</i> .....  | 7  |
| 4.2. <i>Research Design and Methods</i> .....                             | 8  |
| <b>5. Results</b> .....   | 10 |
| 5.1. <i>Context</i> .....   | 10 |
| 5.2. <i>Are there any restrictions on urban foraging practices?</i> ..... | 10 |
| 5.3. <i>Are there any landscaping barriers?</i> .....                     | 11 |
| 5.4. <i>Is there any legal protection against contamination?</i> .....    | 12 |
| 5.5. <i>Are there any barriers to participation?</i> .....                | 12 |
| <b>6. Discussion</b> .....  | 13 |
| <b>7. Limitations</b> .....   | 13 |
| <b>8. Conclusion and Recommendations</b> .....                            | 14 |
| <b>References</b> .....   | 15 |
| <b>Appendix A. Content Analysis Questions</b> .....                       | 17 |
| <b>Appendix B. Student Survey Questions</b> .....                         | 18 |
| <b>Appendix C. Expert Interview Questions</b> .....                       | 19 |
| <b>Appendix D. Coding sheet</b> .....                                     | 20 |

Foraging in Tucson's Parks:  
Interest, Barriers, and Opportunities

## 1. Introduction

People have always depended on nature to survive. This dependence on nature historically took the form of producing food and gathering raw materials and using natural resources for production. The Industrial Revolution, and later the intense focus on urbanization, changed people-nature interactions from “direct consumption and exploitation to more mutualistic relationships in which people actively seek out interactions with nature for recreation and enjoyment” (Keniger et al., 2013, p. 914). This use of nature for recreational purposes indicates a longing for experiences that contrast the indoor life of most modern humans. Moreover, the increase of urbanization in cities results in reduced accessibility to the natural environment as cities continue to grow and add “substantial geographic distance from natural, or even sometimes any vegetated, landscapes” (Fuller & Irvine, 2010, p. 135). This decrease in exposure to nature or green spaces leads to a reduction in the social, psychological, and physical wellbeing resulting from quality interactions with nature. Interactions between people and nature are important because they lead to a better quality of life, have positive effects on stress, and “contribute to personal identity” (Irvine et al., 2010, p. 218). Loss of connection to natural or vegetated landscapes can be attributed to a “large bias that continues to exist in favour of growth and consumption,” which has led to biodiversity loss and reduced the ability of cities to be resilient in the face of climate change (Wood et al., 2000, p. 2). Sustainable design often focuses on increasing vegetation in the urban landscape; however, this is not always done thoughtfully. Greening cities, for aesthetic reasons, may deplete water sources and soil nutrients if the plants used are not native species or naturally thrive in the climate that they are placed in. Intentionally vegetating urban green spaces with occupants in mind can provide social, physical, psychological, and educational benefits.

A practice that dissolves the distinction that people are separate from nature is urban foraging. The practice of urban foraging has gained more attention in the last couple of years because there is little knowledge of the subject, the applications, or the benefits. There is a growing amount of literature on urban foraging, including who forages, the motivations of foragers, what plant species are collected, the social benefits of foraging, and how urban foraging can be better incorporated into sustainable design practices. The rise of green infrastructure programs such as those that promote planting trees, vegetating sidewalks, restoring habitats, building community gardens, etc., offers different scenarios in which urban foraging can be included to achieve urban sustainability.

In this paper, I begin with a literature review about urban foraging, including challenges to the established way of thinking about urban green spaces, the legal barriers of incorporating edible plants in public spaces, the safety concerns of foragers, and the effectiveness of edible city initiatives in Europe. I then review public park and streetscape policies in Tucson, Arizona, to identify any legal barriers that would prevent the incorporation of foraging-friendly planning and design initiatives. I also introduce the survey that was sent out to university students to gauge knowledge and interest in urban foraging and the expert interview. Finally, I identify specific legal barriers present in Tucson laws that prevent the use of edible plants in urban green spaces and present the survey and interview results.

## 2. Literature Review

### 2.1. *People-Nature Connections*

The distinction that urban green spaces such as parks and urban forests should only provide services and not any material goods ignores the long-held practice of urban foraging. Indeed, the incorporation of edible green infrastructure is mostly frowned upon by planners and park managers. Shackleton et al. define urban foraging as “the practice of harvesting or gathering raw biological resources (fungi, plants, parts of plants, invertebrate and vertebrate animals, and fish) within urban and peri-urban settings primarily for direct consumption, decoration, crafts, barter, or small-scale sale” (2017, p. 2). The same study examines case studies of urban foraging practices from multiple cities around the world and concludes that “forager identities span social, cultural, and economic groups” (Shackleton et al., 2017, p. 12). Moreover, foraging practices differ greatly between groups and locations, but people still depend on frequent foraging. The main reasons identified for foraging are food, fun, and health (Landor-Yamagata et al., 2018, p. 10). Recent studies confirm that urban foraging has the potential to connect “a broad range of groups within urban societies to nature, including younger generations,” which is important because younger generations are exposed to fewer nature experiences (Fischer et al., 2020, p. 4). In addition, it is important to identify ways that people can create a sense of belonging to their city. Both local and new foragers can do this through “active relating, moving, and engaging (not simply being) with plants, mushrooms, and spaces in the city” (Poe et al., 2014, p. 910). There are as many ways of foraging as there are foragers, so understanding the multiple layers around urban foraging can aid in policy change, city planning, and land management.

### 2.2. *Major Barriers and Forager Concerns*

The main barriers to foraging in the United States are the legal situations that prohibit gathering. The problem is that the practice of urban foraging challenges established roles of humans in cities. Urban green space planners and managers must acknowledge the value of foraging and embrace this practice as a legitimate use of urban green spaces. As McLain et al. nicely sum up, “foraging practices appear to be important for maintaining cultural identities and have the potential to contribute to food security and human and community well-being” (2014, p. 236). Moreover, planning efforts that work with forager needs and practices will create green spaces that are inclusive and more environmentally responsive.

General challenges to including edible plants in urban environments are adequate protection against contamination and vandalism, risk of injury to passersby, lack of proper maintenance when relying on community stewardship, and formal restrictions. The first major challenge refers to damages to branches, which may be intentional or accidental, and damages from dogs which “leads to [a] low rate of edible plants survival” (Hajzeri, 2019, p. 46). A second challenge is reducing “health and safety risks associated with fallen fruits” (McLain et al., 2014, p. 234). Fruit trees that yield large fruits such as apples or pears pose safety threats to those sitting or walking nearby. Depending on the tree’s location, (i.e., if it is lining the street), the fallen fruits can damage automobiles. On the other hand, if the trees produce soft fruits, it can result in bicyclists getting in an accident after slipping or attempting to avoid the patch of fallen fruit. Lack of proper maintenance can also pose health concerns and can result in “certain types of edible trees [to] grow uncontrollable, which in turn may affect the amount of fruit production and increase difficulties for harvesting” (Hajzeri, 2019, p. 46). In addition, soft fruits left

unattended may attract insects or bees and make the outdoor space uncomfortable to be in. Lastly, formal restrictions may include the location of edible landscaping and the types of species that can be planted. This category of challenges focuses on the legal barriers. For the reasons mentioned above, some vegetation is more appropriate in public open spaces than others. Moreover, cities may prohibit the planting of some trees but approve others. There are also challenges with where to plant edible landscaping due to soils being “contaminated from previous or current use as industrial production sites, waste dumps, or transportation corridors” (McLain et al., 2014, pp. 234-235). This further limits the type of plants that can be used, favoring trees over vegetables that may produce fruits that are not safe to eat.

According to Synk et al. (2017, p. 101), 37% of respondents that were surveyed in the Baltimore area cited safety as a barrier. Foragers prefer to forage in rural areas where they feel confident that the land has not been contaminated. Foraging from sidewalks or public lots often contains risks of site pollution that would affect the quality of the plants collected. A study looking at the cadmium and lead content in fruits that were collected from inner-city neighborhoods in Berlin, Germany concluded, that the fruits were “below the E.U. standards for fruits, [and] partially below values found in fruit samples from supermarkets” (von Hoffen & Säumel, 2014, p. 238). Studies like these can be recreated in cities across the United States to ascertain that sustainability initiatives that include food production are successful in producing fruit that is safe for human consumption. In urban forests, land managers might use “toxic herbicides and other chemicals in vegetation management,” which would also reduce the desire and ability to forage vegetation there (McLain et al., 2012, p. 193). Furthermore, recognizing foraging as a routine activity in urban forests can pressure land managers to stop harmful practices, strengthen ecosystems, and enhance urban biodiversity.

### *2.3. Edible Cities in Europe*

Several initiatives can be analyzed for policy effectiveness. Edible cities, such as that of Andernach in Germany, strengthen the “city’s attractiveness, place identity, social bonding and experiential food connection through recreation and nature observation in the edible areas” (Artmann et al., 2020, p. 10). Policy implementation alone does not produce these benefits. Informing the public of the resource and creating community participation through hosted activities after the edible park has been established will aid in the policy’s success. Strong community engagement can also be accomplished when a bottom-up approach is taken. For example, the edible district policy implemented in the Friedrichshain-Kreuzberg district in Germany has been effective because it sets clear goals and relies on community involvement in the planning and planting stages, resulting in more than ten projects being completed so far (Hajzeri, 2019, p. 46). Community initiatives demonstrate commitment and deepen local identity. Edible city models are being tested worldwide, yet it has been proven that “co-planning, co-design, and co-implementation of ECS [Edible City Solutions] are crucial to avoid green gentrification” (Säumel et al., 2019, p. 14). Furthermore, these are just two of many initiatives around the world can be learned from, improved upon, or adopted.

## **3. Research Questions**

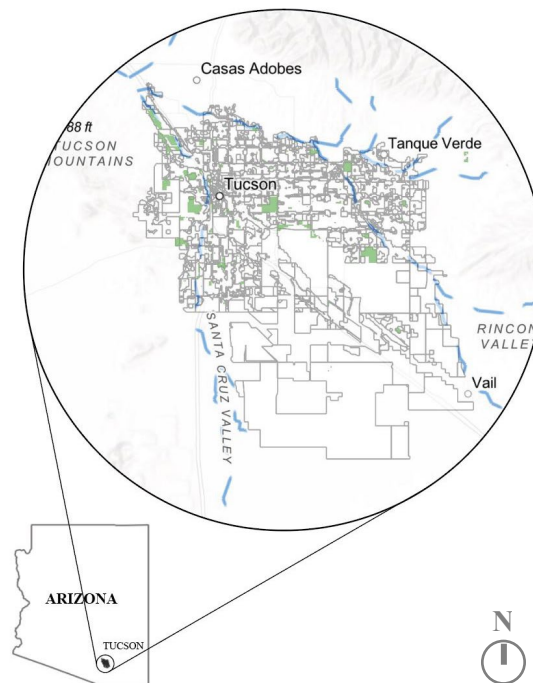
As the world population increases, there is less and less space for people to interact with nature. People-nature relationships are important, and the reduction of green spaces in cities has negative consequences for its residents.

There is not enough research on implementing an edible city in a hot and arid climate region. This study attempts to initiate the backdrop needed to promote native edible plants in Tucson's urban environment. The cultural diversity in Tucson makes it a desirable city that could benefit from a program like this. This study focuses on identifying legal barriers that would prevent edible food initiatives in Tucson, Arizona, and on getting a better understanding of public interest in the practice. In particular, I will address the following research question: **What types of barriers prevent the implementation, normalization, and use of edible landscapes in Tucson parks**, what specific laws prohibit foraging?

## 4. Methodology

### 4.1. Study Area

This study focuses on Tucson, Arizona (see *Fig. 1*), the second-largest city in Arizona, with a population of 548,073 inhabitants and an area of 226.71 square miles ("U.S. Census Bureau," n.d.). The average population density is 2,500.1 persons per square miles ("City of Tucson," n.d.). Tucson is ethnically diverse, with foreign-born persons making up about 15.2% of the total population ("U.S. Census Bureau," n.d.).



**Figure 1.** The study area, city boundary, parks, and rivers.

Tucson differs from many U.S. states in that it was named a City of Gastronomy by the United Nations Educational, Scientific, and Cultural Organization (UNESCO) in 2015. Many restaurants use local ingredients to cook traditional foods, celebrating the culinary heritage of this area. Once a year, food vendors of all backgrounds and ethnicities come together at the Tucson Meet Yourself food festival. As a city known for its food culture and focus on cooking with local and native ingredients, Tucson's next step would be making cooking this way more accessible to its residents.

The topic of urban foraging is relevant in Tucson, a city within the larger Pima County area. Pima County's Sustainable Action Plan for County Operations (SAPCO) is a framework with the main goal of reducing greenhouse gases. Five areas have been chosen, each with specific goals and requirements that will satisfy this commitment to sustainability. Chapter 3: Landscapes has a subsection titled "Food Systems" where they state that one of their goals is to "Maintain or expand number of County sites with public access for harvesting native plant foods" (Pima County Sustainability & Conservation, 2018, p. 29). The seven-year plan has no baseline data yet but does have an implementation strategy in place. The county also attempts to implement more food programs and expand food heritage activities, among other goals. (Pima County Sustainability & Conservation, 2018, p. 29). This demonstrates changing attitudes toward people-nature connections in Arizona.

#### *4.2. Research Design and Methods*

This study examined all public park policies, laws, and regulations at both city and state scales, as well as laws affecting streetscapes. Questions relating to various barriers to urban foraging were asked to determine which level of governance (district, city, state) restricts urban foraging practices (see Appendix A). The questions were developed from the barriers outlined in the literature review, which were then grouped into three main categories of barriers (see *Fig. 2*). Each question asks if the selected text mentions a certain practice, where **1 = Yes** and **0 = No**. This approach of using a score sheet gives insight into what kind of barriers are present, if any, that would prevent the introduction of an edible city initiative. It is important to note that the questions touch on aspects of the barriers that must be dealt with during a typical policy timeline (see *Fig. 3*).

The official City of Tucson website gives general park rules and a link to the Tucson City Code. The Tucson, AZ Code of Ordinances covers information on the operation and regulation of public parks. Under this Code, Chapter 21: Parks and Recreation was reviewed for public parks, and the Tucson Unified Development Code Article 7.6 was reviewed for streetscapes. State laws and regulations are another layer that influences activities taking place in public parks. Furthermore, Arizona Revised Statute Title 11, Chapter 7, Article 2 was reviewed for public park information. In an effort to incorporate multiple areas where research has shown that people forage, state parks were also reviewed. The Arizona State Parks & Trails website lists all the statutes, rules, and rulemaking activities that affect state parks. Under the "Rules" section, a link was provided to the Arizona Administrative Code Title 12, Chapter 8 and the Arizona Revised Statute Title 41, Chapter 3, which were also reviewed. Finally, because urban foraging has also been recorded to take place on college campuses, the University of Arizona was chosen for further review. A google search revealed that the Campus Arboretum hosts edible landscapes tours. Moreover, the University of Arizona Campus Arboretum Tree Care Plan outlines a code of conduct regarding campus tree maintenance and guidelines for foraging on campus. The University of Arizona edible landscape tour was included as a small-scale case study that could be recreated in another part of the city on a larger scale.

To supplement the legal barriers to urban foraging, a survey was distributed to University





Figure 2. Barriers to the successful implementation of an urban foraging initiative.

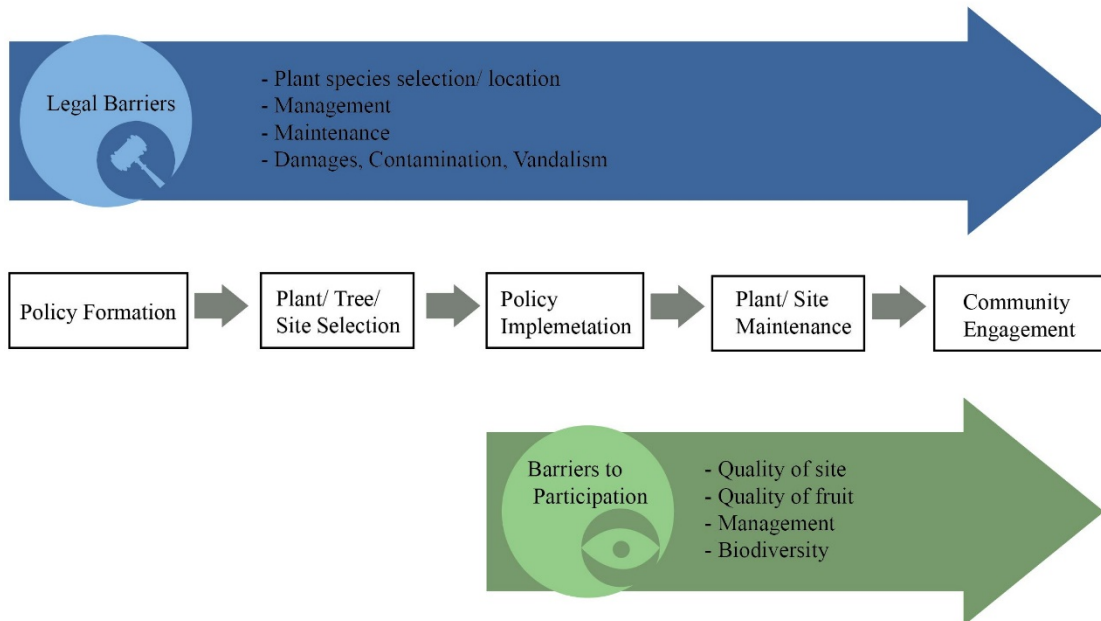


Figure 3. Policy Phases and corresponding barriers.

of Arizona students to identify any barriers to participation and gauge overall interest in the subject (see Appendix B). This survey also gives insight into how familiar the Tucson community is with the resources the Sonoran Desert provides. The survey was created on Qualtrics and distributed over email. Snowball sampling was used to gain responses beginning with students in the College of Architecture, Planning and Landscape Architecture. This survey was by no means extensive and further research would be needed to gain a true representation of the Tucson community's attitudes toward an edible city initiative. Finally, a more in-depth interview with an urban land planner was conducted over a phone call to assess the difficulties involved in incorporating edible plants in public spaces (see Appendix C).

## 5. Results

### 5.1. Context

Urban foraging relies on public parks and natural areas, streets lined with vegetation, and other public areas to gather resources. There are often many agencies that control activities on public property and that prohibit certain practices such as collecting plants, plant parts, and fungi. This layered landscape of rules and restrictions can only be understood on a case-by-case basis. The sources selected cover laws that directly affect public parks at the local and state level, streetscapes at the local level, as well as state parks and the University of Arizona campus. The main focus is on parks because it is easier to modify existing green spaces in cities rather than find an open space in the urban fabric to rehabilitate. Appendix D contains the coding sheet for the 78 documents that were reviewed in this study. All three categories of barriers are present in laws affecting Tucson's parks and streetscapes.

### 5.2. Are there any restrictions on urban foraging practices?

Most policy makers have a negative view of foragers, believing that the best policy is to keep people away from vegetation in public spaces. This defeats providing these spaces for public use and reinforces the idea that parks should only provide services instead of material resources. Moreover, it lessens direct engagement and connection to nature.

The results suggest that Tucson's laws reflect this philosophy and do not support urban foraging practices. Out of the 78 laws that were reviewed, only one law mentioned urban food production, two laws mentioned foraging activity, and two laws talked about penalties due to foraging activity (see *Table 1*). Section 21-3 (1) of Tucson's Code of Ordinances states that no persons may "remove or damage soil, rock, stones, trees, shrubs or plants" in a park (Relating to park grounds and park property, n.d.). In addition, the City of Tucson's Parks and Recreation website lists "damaging or removing natural resources..." as prohibited activities in parks (City of Tucson, n.d.). Although the language suggests that entire plants or trees should not be removed, it can also be interpreted to include plant parts. Violators of any of the laws relating to the regulation and operation of parks listed in the Code are subject to a fine of up to \$1000, imprisonment of up to six months, up to three years' probation, or any combination thereof (Penalties, n.d.). This reinforces the understanding that people interacting with natural elements in parks is not allowed.

Another layer of laws that affect urban foraging are at the state level. The Arizona Revised Statutes relating to intergovernmental operations of public parks is a set of statutes that define the powers of the multiple governing bodies in charge of all county parks. One of the park ranger law enforcement duties listed in A.R.S. § 11- 935 includes "protecting the parks and recreational areas and other public areas... against damage" (Powers and duties, n.d.). Under the

**Table 1.** A count of the number of laws that mentioned each barrier sorted by levels of government.

| Barriers to Urban Foraging      | # of Laws |      |          |
|---------------------------------|-----------|------|----------|
|                                 | State     | City | District |
| <b>Behavior</b>                 |           |      |          |
| Urban food Production           | 1         | 0    | 0        |
| Foraging Activity               | 0         | 1    | 1        |
| Penalties                       | 1         | 1    | 0        |
| <b>Management</b>               |           |      |          |
| Public/state park/ urban forest | 54        | 14   | 1        |
| Streetscape                     | 0         | 9    | 0        |
| Native Species                  | 0         | 2    | 1        |
| Plant Maintenance               | 0         | 0    | 1        |
| <b>Safety</b>                   |           |      |          |
| Pets                            | 1         | 1    | 0        |
| Pest Control                    | 0         | 0    | 0        |
| Plant Infection                 | 0         | 0    | 1        |
| Preventing Soil Contamination   | 0         | 1    | 1        |
| Ecological Quality              | 0         | 2    | 1        |

state parks laws, A.R.S. § 41-511.13 states that “any person who knowingly damages, defaces or destroys any public park or monument property...” is violating the law (Violations; classification, n.d.). It is not further clarified as to what ‘damage’ encompasses, but it can be assumed that the preservation of public property is supported in both these cases. The Arizona administrative code R12-8-103 states that no persons may “deface, injure, destroy, remove, or use” plant objects in a state park (Vandalism, 2020). This is the only instance found that a law mentions the use of a plant object. The specification and restriction of the use of plants in an Arizona state park further limits where foragers can gather resources.

The University of Arizona was also reviewed due to the edible plant tours that the Campus Arboretum hosts. According to the Campus Tree Care Plan, written for the purpose of guiding the campus administration in taking care of all the trees on campus, “there are no prohibited practices stated in the University of Arizona’s Student Code of Conduct, as a practical matter, students are not allowed to carve tree bark, climb trees, affix signs with nails, or suspend things from tree branches” (U.A. Campus Arboretum Administration, 2009). Urban foraging is accepted on the university campus, although it should be noted that the U.A. Facilities Management Staff takes care of plant maintenance. Furthermore, the university does not rely on student stewardship to remove fallen fruit, trim the leaves, and so forth. Lastly, it is unclear who forages on campus (students or public), the frequency of foraging, or the motivations for foraging.

### 5.3. Are there any landscaping barriers?

This section of challenges encompasses any limitations on planting locations, plant species, and products used on plants, which may be of concern to foragers. The results show that there are no laws directly affecting public or state parks that use the term “edible plants,” “urban food production,” “edible weeds,” “wild food,” or “ecosystem services.” Furthermore, Tucson’s Unified Development Code for development standards was analyzed to get a full picture of the laws affecting landscaping within city borders. Out of the nine laws, only two touched on the use of native plants. Article 7.6.1 establishes standards according to “xeriscape principles and to provide for the protection of native vegetation,” among other landscaping goals (Purpose, n.d.). Article 7.6.4 further clarifies that “all plant material used for landscaping must be selected from the Arizona Department of Water Resource’s Low Water Use/Drought Tolerant Plant List” (Landscape Standards, n.d.). Although edible city initiatives give preference to native plants over

nonnative plants for biodiversity reasons, it is more challenging in a hot and arid desert climate region to choose edible native plants that fit the requirements for incorporation into public spaces and that are easily recognized as edible. Moreover, the law seems to use the terms 'native' and 'drought-tolerant' interchangeably, although not all drought-tolerant plants are native to the Sonoran Desert. It is still unclear what treatment, if any, streetscape plants receive that might cause safety and health concerns.

#### *5.4. Is there any legal protection against contamination?*

To support urban foraging practices, there needs to be protection against contamination, pests, and vandalism. In total, six laws contained information to the questions asked in this section of barriers. Damages by dogs are the most common form of vandalism, which can be lessened by constructing a barrier around the tree's base. There are currently no laws that do this; however, there are laws affecting pets in park boundaries. Tucson's Code of Ordinances Section 21-3 (7) states that no person shall "bring or escort a dog or any other domestic animal or pet into any area within park boundaries which is clearly marked by signs bearing the words: 'Domestic Animals and Pets Prohibited in This Area'" (Relating to miscellaneous Activities, n.d.). In addition, dogs must be on a leash in areas where they are permitted. This is also true for state parks (Pets, n.d.). In response to protecting ecological quality, Tucson's Code of Ordinances is most concerned with protecting park waters against pollution (Relating to sanitation, n.d.). Unlike the city laws reviewed, the guidelines set by the University of Arizona were by far the most comprehensive, including plans of action in the case of plant infection and pest control.

#### *5.5. Are there any barriers to participation?*

Of the 16 total survey respondents, 37.5% stated that they were familiar with the term 'urban foraging.' Three respondents noted that they had foraged before on a college campus. Citrus was the most common foraged item, with prickly pear, rosemary, and saguaro fruits were also mentioned. Of those that responded that they have not foraged, the most common barriers were that they do not know how (67%), have safety concerns (17%), perceived social stigma (8%), and do not need to forage (8%). All respondents said that they would support educational programs with a strong focus on foraging and would be interested in seeing city parks vegetated with edible plants.

Students place a lot of value on open spaces in their lives (69%). When asked how allowing for urban foraging would change the park's role in their lives, the most common response was that it would positively affect social and mental wellbeing. It was often noted as a reason to spend more time outdoors, enjoy parks in a different way, and to be part of a community effort:

*Urban foraging would encourage me to be more connected with nature as well as expand my role as part of the Tucson community.*

The next most common response was that it would help reduce food insecurity. Although urban foraging has not been proven to eliminate food insecurity, providing edible plants in food deserts and food-insecure areas can certainly be a resource to those in need. Next, respondents put a lot of importance on incorporating an educational aspect to engage the public, as one student explained:

*It would be a good opportunity to educate people on nutrition, ecology, and related topics.*

Another student explained:

*I think it would allow children to grow an appreciation for the time and care that's needed to grow their food as they see it grow with them as they age.*

Lastly, respondents believe that having edible landscaping in parks would positively affect their diet, helping them make healthier food choices.

The interviewee stated that people-nature connections were very important in their work and that vegetating public spaces with edible plants would beautify cities. The climate was named the biggest barrier, making it difficult to grow plants, leading to transient spaces. To solve this, it was suggested to incorporate greenhouses, although there would also be safety and maintenance problems associated with the idea. Providing edible plants would change the role of parks to include a new form of recreation and a study opportunity for park visitors.

## **6. Discussion**

While recent studies have highlighted successes in implementing urban food initiatives in many cities across America, there has yet to be a city-wide initiative in a hot and arid climate region. This study attempts to identify barriers present in the implementation, normalization, and use of edible landscapes in Tucson parks. The results indicate that the main barriers are legal. Tucson's public parks laws are extremely restrictive to foragers on multiple levels. The study also found that the University of Arizona edible landscapes tour was thoughtfully implemented. The tree care plan provided on the Campus Arboretum website touches on many safety concerns provided by active foragers while also serving as a learning opportunity for students and the public alike. Nevertheless, there is a lack of student knowledge on the subject even with the tours taking place on their campus. However, there is student interest in the practice, which could lead to a revitalization of the tours and more student engagement in the future. The interviewee mentioned that a challenge with vegetating parks with edible landscaping was the depletion of plants; however, it has been shown that many foragers attempt to take care of the plants they forage from and self-imposed "rules" when foraging (Landor-Yamagata et al., 2018, p. 11).

As new research about urban foraging emerges, policy makers can begin to make the necessary changes to collect plant material in urban areas. Existing fruit harvesting groups in Tucson have a big focus on reducing food waste; therefore, the local governing body can make necessary appeals to local ordinances, considering local interests and county goals. All in all, this study sets the foundation for future work and informs policy regarding the use of urban landscapes.

## **7. Limitations**

Having a focus on foraging in parks is a limitation of the study. Park suitability made the most sense for this content analysis because vegetated open spaces have fewer safety concerns associated with them and because there is an opportunity to engage the community. The development of new green space in a city is complex, even in less dense urban areas (Haaland & van den Bosch, 2015, p. 764). Previous literature on the subject has recorded many places in cities where people forage outside of parks; therefore, this approach may have limited the number of policies that were applicable and chosen for review (McLain et al., 2014, p. 233).

Consequently, it fails to capture all the layers of policy surrounding foraging practices in Tucson. Another content analysis would be needed on other sites where people might harvest.

Another limitation is the lack of response to interview requests because of the COVID-19 pandemic situation. Ideally, an interview with someone in the Tucson Parks and Recreation department and a representative from the Iskashitaa refugee network would have supplemented this study.

## **8. Conclusion and Recommendations**

The size of the target audience must be considered when providing edible landscaping in cities. School playgrounds can be more easily vegetated with edible trees and shrubs to provide an educational aspect. Parks and urban forests will naturally need to be more biodiverse to create a niche for foragers. The end goal should be to make urban foraging inclusive and available to everybody. Depending on the location of already existing parks, problems can arise when there are inequities in the location, size, and quality between parks in wealthier neighborhoods as opposed to those in lower-income neighborhoods.

Tucson is an ideal city for a bottom-up approach. There are already food harvesting groups, foraging tours, community gardens, a diverse population, and a desire to connect to nature. The fact that Tucson is a college town means that more community engagement will be needed. Native foods in the Sonoran Desert may be harder to identify for those that are not locals, and even for locals as well. For this reason, a strong educational program centered around the many benefits and uses of native plants could help residents create a deeper sense of belonging with the city.

## References

- American Legal Publishing Corporation. (n.d.). Part II Tucson Code. Retrieved from [https://codelibrary.amlegal.com/codes/tucson/latest/tucson\\_az/0-0-0-1388](https://codelibrary.amlegal.com/codes/tucson/latest/tucson_az/0-0-0-1388).
- Arizona State Legislature. (n.d.). Arizona Revised Statutes. Retrieved from [www.azleg.gov/arstitle/](http://www.azleg.gov/arstitle/).
- Artmann, M., Sartison, K., & Vávra, J. (2020). The role of edible cities supporting sustainability transformation—A conceptual multi-dimensional framework tested on a case study in Germany. *Journal of Cleaner Production*, 255, 120220.
- Become a Tucson Foodie: City of Gastronomy. (n.d.). Retrieved from [www.visittucson.org/become-a-tucson-foodie](http://www.visittucson.org/become-a-tucson-foodie)
- City of Tucson (n.d.). Park Rules. Retrieved from [www.tucsonaz.gov/parks/ParkRules](http://www.tucsonaz.gov/parks/ParkRules).
- City of Tucson (n.d.). Population Density and Land Area Data. Retrieved from [www.tucsonaz.gov/hcd/population-density-and-land-area-data](http://www.tucsonaz.gov/hcd/population-density-and-land-area-data).
- Fischer, Leonie K, & Kowarik, Ingo. (2020). Connecting people to biodiversity in cities of tomorrow: Is urban foraging a powerful tool? *Ecological Indicators*, 112, 106087.
- Fuller, Richard A, & Irvine, Katherine N. (2010). Interactions between people and nature in urban environments. In *Urban Ecology* (pp. 134-171).
- Haaland, C., & van Den Bosch, C. K. (2015). Challenges and strategies for urban green-space planning in cities undergoing densification: A review. *Urban forestry & urban greening*, 14(4), 760-771.
- Hajzeri, A., & Kwadwo, V. O. (2019). Investigating integration of edible plants in urban open spaces: Evaluation of policy challenges and successes of implementation. *Land Use Policy*, 84, 43-48.
- Irvine, K. N., Fuller, R. A., Devine-Wright, P., Tratalos, J., Payne, S. R., Warren, P. H., ... & Gaston, K. J. (2010). Ecological and Psychological Value of Urban Green Space. *Dimensions of the Sustainable City*, 215.
- Keniger, L. E., Gaston, K. J., Irvine, K. N., & Fuller, R. A. (2013). What are the benefits of interacting with nature?. *International journal of environmental research and public health*, 10(3), 913-935.
- Landor-Yamagata, Jonah, Kowarik, Ingo, & Fischer, Leonie. (2018). Urban Foraging in Berlin: People, Plants and Practices within the Metropolitan Green Infrastructure. *Sustainability* (Basel, Switzerland), 10(6), 1873.
- McLain, Rebecca, Hurley, Patrick T, Emery, Marla R, & Poe, Melissa R. (2014). Gathering "wild" food in the city: Rethinking the role of foraging in urban ecosystem planning and management. *Local Environment: Subversive and Interstitial Food Spaces*, 19(2), 220-240.

- McLain, Rebecca, Poe, Melissa, Hurley, Patrick T, Lecompte-Mastenbrook, Joyce, & Emery, Marla R. (2012). Producing edible landscapes in Seattle's urban forest. *Urban Forestry & Urban Greening*, 11(2), 187-194.
- Office of the Secretary of State Administrative Rules Division (2020). Arizona Administrative CODE Title 12. Natural Resources. Retrieved from [https://apps.azsos.gov/public\\_services/Title\\_12/12-08.pdf](https://apps.azsos.gov/public_services/Title_12/12-08.pdf).
- Pima County Sustainability & Conservation (2018). Sustainable Action Plan for County Operations 2018-2025. Retrieved from [https://webcms.pima.gov/UserFiles/Servers/Server\\_6/File/Government/Office%20of%20Sustainability%20and%20Conservation/Newsroom/1816%20October/2018-Sustainable-Action-Plan-for-County-Operations.pdf](https://webcms.pima.gov/UserFiles/Servers/Server_6/File/Government/Office%20of%20Sustainability%20and%20Conservation/Newsroom/1816%20October/2018-Sustainable-Action-Plan-for-County-Operations.pdf)
- Poe, Melissa R, LeCompte, Joyce, McLain, Rebecca, & Hurley, Patrick. (2014). Urban foraging and the relational ecologies of belonging. *Social & Cultural Geography*, 15(8), 901-919.
- Säumel, I., Reddy, S. E., & Wachtel, T. (2019). Edible City solutions—One step further to foster social resilience through enhanced socio-cultural ecosystem services in cities. *Sustainability*, 11(4), 972.
- Shackleton, Charlie, Hurley, Patrick, Dahlberg, Annika, Emery, Marla, & Nagendra, Harini. (2017). Urban Foraging: A Ubiquitous Human Practice Overlooked by Urban Planners, Policy, and Research. *Sustainability (Basel, Switzerland)*, 9(10), 1884.
- Synk, Colleen M, Kim, Brent F, Davis, Charles A, Harding, James, Rogers, Virginia, Hurley, Patrick T, . . . Nachman, Keeve E. (2017). Gathering Baltimore's bounty: Characterizing behaviors, motivations, and barriers of foragers in an urban ecosystem. *Urban Forestry & Urban Greening*, 28, 97-102.
- U.A. Campus Arboretum Administration (2009). University of Arizona Campus Arboretum Campus Tree Care Plan. Retrieved from <https://arboretum.arizona.edu/sites/arboretum.arizona.edu/files/uploads/UATreeCarePlan.pdf>.
- U.S. Census Bureau (n.d.). QuickFacts: Tucson city, Arizona. Retrieved from <https://www.census.gov/quickfacts/tucsoncityarizona>.
- von Hoffen, L. P., & Säumel, I. (2014). Orchards for edible cities: Cadmium and lead content in nuts, berries, pome and stone fruits harvested within the inner city neighbourhoods in Berlin, Germany. *Ecotoxicology and Environmental Safety*, 101, 233-239.
- Wood, et al. *The Root Causes of Biodiversity Loss*. Earthscan, 2000.



**Appendix A. Content Analysis Questions****(1) Behavioral Restrictions: Urban Foraging, Human Activity**

- Does it talk about urban food production?
  - If yes, does it allow food production?
- Does it talk about foraging activity (gathering/planting)?
  - If yes, does it allow gathering/ planting?
- Does it talk about any penalties due to foraging activity?

**(2) Management: Locations, Species, Products**

- Does it relate to a public park/ urban forest/ state park?
- Does it relate to a streetscape?
- Does it talk about native species?
  - If yes, does it allow native species to be planted?
- Does it talk about plant maintenance?
  - If yes, does it restrict the use of toxic herbicides/ pesticides?

**(3) Safety Concerns: Damages, Contamination, Vandalism**

- Does it talk about pets/ dogs?
  - If yes, are there measures in place that prevent the damage of plants/trees by pets?
- Does it talk about pest control?
- Does it talk about plant infection?
  - If yes, are there any specified measures that must be met?
- Does it talk about preventing soil contamination?
- Does it talk about ecological quality?

**Appendix B. Student Survey Questions****(1) Demographic Questions**

- What gender do you identify as?
- What is your age?
- What is your classification in school?
- What is your major?

**(2) Urban Foraging Knowledge and Practices**

- Are you familiar with the term 'urban foraging'? (Yes/No)
- Are you aware the Sonoran Desert offers numerous edible plants and fruit? (Yes/No)
- Have you ever foraged? (Yes/No)
  - If yes, where?
    - College campuses
    - City parks
    - State parks
    - Street trees/ vegetation
    - Recreational trails
    - Other
  - If yes, what plants/produce?
  - If not, what has stopped you?
    - Didn't know how
    - Lack of tools
    - Safety concerns
    - Perceived social stigma
    - Nothing available near you
    - Other
- Would you support educational programs with a strong focus on foraging and utilizing plants that are native to the Sonoran Desert? (Yes/No)
- Would you be interested in seeing city parks vegetated with edible plants? (Yes/No)
- How much value do you place on open spaces in your life?
  - 5- A great deal
  - 4- A lot
  - 3- A moderate amount
  - 2- A little
  - 1- None at all
- How would allowing for urban foraging change the role parks and open spaces play in your life?

**Appendix C. Expert Interview Questions**

- (1) What is your official job title? What does a typical day look like for you?
- (2) What is the importance of people-nature connections in your work?
- (3) What are your thoughts on vegetating public spaces with edible plants? What are the pros and cons?
- (4) How does providing edible plants change the role of parks for residents?
- (5) What barriers prevent the normalization of edible green infrastructure in cities like Tucson that are in hot and arid climates?
- (6) What are some of the legal barriers that you are aware of that prevent the incorporation of edible plants in public spaces?
- (7) Additional thoughts you believe are beneficial to this research?





| (41-511.16)                             |                  |   |  |                                       |  |  |  |                                  |                                    |   |                                       |   |                               |  |                                  |                                     |  |   |  |  |
|---|------------------|---|--|---------------------------------------|--|--|--|----------------------------------|------------------------------------|---|---------------------------------------|---|-------------------------------|--|----------------------------------|-------------------------------------|--|---|--|--|
| Policy                                  | Type of Document | Does it talk about urban food production? | If yes, does it allow food production? | Does it talk about foraging activity? | If yes, does it allow gathering/ planting? | Does it talk about any penalties due to foraging activity? | Does it relate to a public park/ urban forest/ state park? | Does it relate to a streetscape? | Does it talk about native species? | If yes, does it allow native species to be planted? | Does it talk about plant maintenance? | If yes, does it restrict the use of toxic herbicides /pesticides? | Does it talk about pets/dogs? | If yes, are there measures in place that prevent damage of plants/trees by pets? | Does it talk about pest control? | Does it talk about plant infection? | If yes, are there any specified measures that must be met? | Does it talk about preventing soil contamination? | Does it talk about ecological quality? |  |
| Title 41. Ch 3. Article 1.1 (41-511.17) | Revised Statutes | 0   | 0                                      | 0                                     | 0  | 0  | 1  | 0                                | 0                                  | 0   | 0                                     | 0   | 0                             | 0  | 0                                | 0                                   | 0  | 0   | 0                                      |  |
| Title 41. Ch 3. Article 1.1 (41-511.18) | Revised Statutes | 0   | 0                                      | 0                                     | 0  | 0  | 1  | 0                                | 0                                  | 0   | 0                                     | 0   | 0                             | 0  | 0                                | 0                                   | 0  | 0   | 0                                      |  |
| Title 41. Ch 3. Article 1.1 (41-511.19) | Revised Statutes | 0   | 0                                      | 0                                     | 0  | 0  | 1  | 0                                | 0                                  | 0   | 0                                     | 0   | 0                             | 0  | 0                                | 0                                   | 0  | 0   | 0                                      |  |
| Title 41. Ch 3. Article 1.1 (41-511.20) | Revised Statutes | 0   | 0                                      | 0                                     | 0  | 0  | 1  | 0                                | 0                                  | 0   | 0                                     | 0   | 0                             | 0  | 0                                | 0                                   | 0  | 0   | 0                                      |  |
| Title 41. Ch 3. Article 1.1 (41-511.21) | Revised Statutes | 0   | 0                                      | 0                                     | 0  | 0  | 1  | 0                                | 0                                  | 0   | 0                                     | 0   | 0                             | 0  | 0                                | 0                                   | 0  | 0   | 0                                      |  |
| Title 41. Ch 3. Article 1.1 (41-511.23) | Revised Statutes | 0   | 0                                      | 0                                     | 0  | 0  | 1  | 0                                | 0                                  | 0   | 0                                     | 0   | 0                             | 0  | 0                                | 0                                   | 0  | 0   | 0                                      |  |
| Title 41. Ch 3. Article 1.2 (41-511.25) | Revised Statutes | 0   | 0                                      | 0                                     | 0  | 0  | 1  | 0                                | 0                                  | 0   | 0                                     | 0   | 0                             | 0  | 0                                | 0                                   | 0  | 0   | 0                                      |  |
| Title 41. Ch 3. Article 1.2 (41-511.26) | Revised Statutes | 0   | 0                                      | 0                                     | 0  | 0  | 1  | 0                                | 0                                  | 0   | 0                                     | 0   | 0                             | 0  | 0                                | 0                                   | 0  | 0   | 0                                      |  |
| Title 41. Ch 3. Article 1.4 (41-519)    | Revised Statutes | 0   | 0                                      | 0                                     | 0  | 0  | 1  | 0                                | 0                                  | 0   | 0                                     | 0   | 0                             | 0  | 0                                | 0                                   | 0  | 0   | 0                                      |  |
| Title 41. Ch 3. Article 1.4 (41-519.02) | Revised Statutes | 0   | 0                                      | 0                                     | 0  | 0  | 1  | 0                                | 0                                  | 0   | 0                                     | 0   | 0                             | 0  | 0                                | 0                                   | 0  | 0   | 0                                      |  |
| <b>Arizona Administrative Code</b>      |                  |   |  |                                       |  |  |  |                                  |                                    |   |                                       |   |                               |  |                                  |                                     |  |   |  |  |
| R12-8-113.                              | Law              | 0   | 0                                      | 0                                     | 0  | 0  | 1  | 0                                | 0                                  | 0   | 0                                     | 0   | 0                             | 0  | 0                                | 0                                   | 0  | 0   | 0                                      |  |
| R12-8-114.                              | Law              | 0   | 0                                      | 0                                     | 0  | 0  | 1  | 0                                | 0                                  | 0   | 0                                     | 0   | 0                             | 0  | 0                                | 0                                   | 0  | 0   | 0                                      |  |
| R12-8-115.                              | Law              | 0   | 0                                      | 0                                     | 0  | 0  | 1  | 0                                | 0                                  | 0   | 0                                     | 0   | 1                             | 1  | 0                                | 0                                   | 0  | 0   | 0                                      |  |
| R12-8-116.                              | Law              | 0   | 0                                      | 0                                     | 0  | 0  | 1  | 0                                | 0                                  | 0   | 0                                     | 0   | 0                             | 0  | 0                                | 0                                   | 0  | 0   | 0                                      |  |
| R12-8-119.                              | Law              | 0   | 0                                      | 0                                     | 0  | 0  | 1  | 0                                | 0                                  | 0   | 0                                     | 0   | 0                             | 0  | 0                                | 0                                   | 0  | 0   | 0                                      |  |
| R12-8-120.                              | Law              | 0   | 0                                      | 0                                     | 0  | 0  | 1  | 0                                | 0                                  | 0   | 0                                     | 0   | 0                             | 0  | 0                                | 0                                   | 0  | 0   | 0                                      |  |
| R12-8-122.                              | Law              | 0   | 0                                      | 0                                     | 0  | 0  | 1  | 0                                | 0                                  | 0   | 0                                     | 0   | 0                             | 0  | 0                                | 0                                   | 0  | 0   | 0                                      |  |
| R12-8-124.                              | Law              | 0   | 0                                      | 0                                     | 0  | 0  | 1  | 0                                | 0                                  | 0   | 0                                     | 0   | 0                             | 0  | 0                                | 0                                   | 0  | 0   | 0                                      |  |
| R12-8-125.                              | Law              | 0   | 0                                      | 0                                     | 0  | 0  | 1  | 0                                | 0                                  | 0   | 0                                     | 0   | 0                             | 0  | 0                                | 0                                   | 0  | 0   | 0                                      |  |
| R12-8-126.                              | Law              | 0   | 0                                      | 0                                     | 0  | 0  | 1  | 0                                | 0                                  | 0   | 0                                     | 0   | 0                             | 0  | 0                                | 0                                   | 0  | 0   | 0                                      |  |
| <b>University of Arizona Arboretum</b>  |                  |   |  |                                       |  |  |  |                                  |                                    |   |                                       |   |                               |  |                                  |                                     |  |   |  |  |
| Campus Tree Care Plan                   | Guideline        | 0   | 0                                      | 1                                     | 1  | 0  | 1  | 0                                | 1                                  | 1   | 1                                     | 0   | 0                             | 0  | 0                                | 1                                   | 1  | 1   | 1                                      |  |