Expanding Native Edible Fruit Bearing Trees and Shrubs in City of West Saint Paul Parks

ESPM 4041W: Problem Solving for Environmental Change

Report Number 2/9

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West Saint Paul rests on the native and traditional lands of the Wahpekute and Očhéthi Šakówiŋ people.

Executive Summary

The City of West St Paul's Parks and Recreation Advisory Committee and Environmental Committee are interested in exploring the use of fruit-bearing trees and shrubs in public parks. The scope of this exploration includes assessing community interests and perceptions. Our research supports the incorporation of edible trees and shrubs as being beneficial in providing a sense of community, as well as encouraging more environmentally friendly actions. Additional outcomes include physical and mental health benefits from working with gardens, and aesthetic benefits stemming from the presence of increased greenery. These are what the City of West St. Paul's Environmental Committee aims to foster through the creation and maintenance of food forests. This report was a collaboration between the City of West Saint Paul and University of Minnesota undergraduate seniors in the Environmental, Science, Policy, and Management major. The research was composed of a literature review and interviews with key persons to form recommendations.

Our recommendations are as follows:

1. Fruit-bearing trees and shrubs: We recommend planting fruit trees and shrubs of various species that fruit across the seasons, to have a continuous harvest. Pruning should be done in a way that enables safe and accessible harvesting. Species should be chosen based on maintenance needs, fruit quality, and potential desirability to community members.
2. Community Engagement/Education: Volunteer efforts are critical to the success of food forests. Begin with a detailed survey to gauge community interest. Educational outreach activities and events can be organized to enhance volunteer participation. Training events held by the city in conjunction with University of Minnesota tree and garden programs will serve to educate the community on how to care for their food forest. Signage will be used throughout the park to inform visitors of the purpose of this project as well as the specifics of each plant present.
3. Management Practices: Ensuring that management strategies fit the needs of the specific site maximizes the benefits of a food forest, and community management fills this role well for West St. Paul. Some scheduled maintenance will need to be conducted by municipal workers as community members grow more comfortable with managing the space. Community-based management practices encourage engagement and create a stronger relationship among residents.

Introduction

In recent years the local food movement has grown in popularity and more people are becoming interested in urban agriculture (Cong. Administrative Publication 068, 2015). Urban Agriculture is the practice of growing or raising food in an urban or suburban setting (Purdue extension, 2021). The scale of operations can range from a small community garden to a full-sized urban farm. Common tenets of urban agriculture are community, public health and food security, sustainability, and economic development (World Bank, 2013; Hall, 1996; Walker, 2015).

The most noteworthy benefit of urban agriculture is an increase in social and community values (Santo et al. 2016; Hall 1996; Walker 2015). Sites of food production serve as a community gathering place and allow for social interaction between residents of diverse backgrounds who previously may not have had the opportunity or incentive to build relationships. The addition of green spaces has been associated with crime reduction; as a result, residents in neighborhoods with an urban agriculture component have reported a perceived sense of safety and an increase in community pride (Santo et al., 2016). Sites of urban agriculture provide young people with educational opportunities. Through formal programs and informal interactions, youth can learn about agricultural literacy, environmental stewardship, healthy eating, and responsibility (Santo et al., 2016). Involvement with urban agriculture can increase general health and wellbeing. The act of maintaining or harvesting crops promotes physical activity and has been seen to reduce stress, improve self-esteem through a sense of accomplishment, and connect people with nature (Santo et al., 2016). Food access and security are also improved by urban agriculture (Walker, 2015; Hall, 1995; Horst et al., 2017). Sites provide residents with greater access to fresh produce at low or no cost and an increase in fruit and vegetable consumption has been noted, but these benefits come second to those associated with general health and well-being (Santo et al., 2016).

Urban agriculture is commonly referred to as an important component of the transition to sustainable agriculture (Wang et al., 2014). There are many reported benefits to environmental sustainability, but they are largely limited by scale (Schaffstall, 2019; Riolo, 2018; Fischer 2021; World Bank, 2013). Benefits include an increase in biodiversity and pollinator habitat through diverse plantings, a reduction in air pollution through plants' ability to filter air particles, an increase in soil health and rainwater infiltration, and carbon sequestration by vegetation (Santo et al., 2016). The potential benefits are many, but the experienced benefits will depend largely on the size and type of agricultural site and are not guaranteed (Schaffstall, 2019). Economic development is often used as a reason to engage in urban agriculture; however, this is the least documented outcome (Coffey, 2021; Horst et al., 2017). Similarly to

sustainability, economic outcomes for urban agriculture may fall short when compared to the perceived benefits (Dvorak et al., 2016; Schaffstall, 2019). Agricultural sites are not operating on a scale large enough to provide a significant number of jobs and there are many unknowns about the long-term viability or profitability of commercial operations (Santo et al., 2016). Thus, the use of edible trees and shrubs in public parks would be a fitting solution to some of the challenges associated with urban Agriculture, keeping the overall project size manageable, while remaining beneficial to the population of the area.

The idea of small-scale urban agriculture has been applied with success in the past but is described commonly as a food forest (Riolo, 2018; Fischer 2021). Food forests are areas containing edible, often native, species, attempting to reproduce the way that they would be found in nature (Project Food Forest, 2021 Fischer, 2021). Food forests would be used to form a resilient ecosystem that can be used to provide food, like an urban garden (Project Food Forest, 2021; Riolo, 2018). A food forest consists of a variety of species, with various sizes, shapes, and purposes (Project Food Forest,2021). Food forests are often planted with the expectation that they will be permanent, and this expectation of permanence leads to year-on-year growth (Fischer, 2021; Project Food Forest, 2021).

Food forests, like urban agriculture, are often implemented to increase education and community connection, rather than increase affordable food access (Coffey, 2021; Horst et al., 2017). An increase in community pride and connection among residents would be beneficial to West Saint Paul while it experiences a new influx of residents into newly established rental units. The outcomes should consequently be emphasized when planning a food forest or urban agriculture project. Both of these exalted factors would be found in a small food forest, such as a project prioritizing edible fruit trees and shrubs.

West St. Paul, with its several public parks, is a fitting setting for a food forest project. Small Scale systems in public areas generally have more success, as they are less resource intensive (Schaffstall, 2019). This report will serve as a future reference for planting edible trees and shrubs in the city of West St. Paul.

Visions, Goals, and Objectives

Class Vision

Through collaboration with the City of West St. Paul and our independent research, the values of conservation, equity, and community engagement were integrated to develop solutions which are effective and innovative. With these integrated values as a guide, West St. Paul can promote safe and sustainable public growth to serve the community and its future generations.

Group Vision

To provide sustainable community support, recreation, and education to residents of the City of West Saint Paul. This project is an opportunity to provide equitable access to urban green space as well as nutritious food through community-based efforts.

Goals and Objectives

The goal of this project is to provide resources and information for the City of West Saint Paul to make informed decisions on how to incorporate fruit-bearing trees and shrubs into their community parks. The main objectives are:

1. Identify native and non-native fruit-bearing trees and shrubs appropriate for West St. Paul.
2. Identify opportunities for community engagement and education in food forests.
3. Identify suitable management practices of a community-run food forest.

Methods

Site Description

The City of West Saint Paul is a suburb located in Dakota County, bordering South Saint Paul and the East-central part of the state of Minnesota (Figure 1). It borders the west side of the Mississippi River. The city has a population of approximately 20,615 (US Census Bureau, 2020). A report published by West St. Paul in 2016 revealed that there is an average of 3.0 parks within every half-mile of the city, the highest average among peer cities (West St. Paul, 2016).

The city is approximately 5 square miles and is home to 13 parks. It is also home to the Garlough-Marthaler Trail Project, which has been in the works since 2017 and was officially opened fall of 2021.

Before settler colonization, the Wahpekute and Očhéthi Šakówiŋ people inhabited the area (City of West St. Paul, 2021). In the 1800s the Sioux lived in the villages of Kaposia and Mendota; parts of which border what is now called the City of West Saint Paul (City of West St. Paul, 2021). Indigenous peoples currently make up about 1% of West Saint Paul's total population (U.S. Census Bureau, 2020).

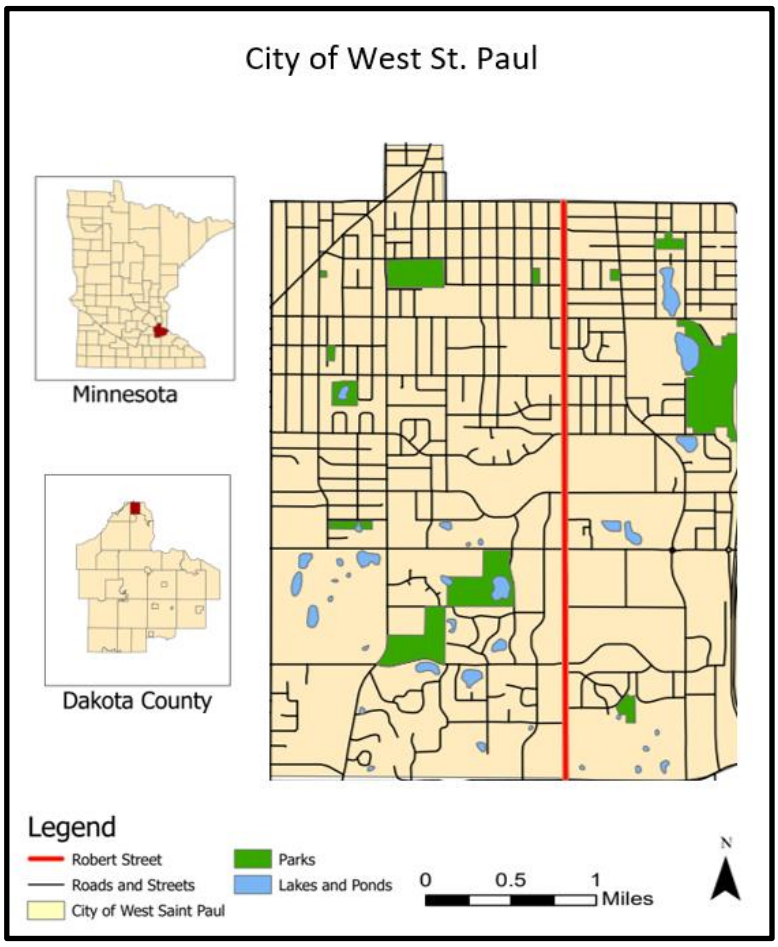

Figure 1. Map of West St. Paul

Literature Reviews

To understand the results and successes of other food forests, literature regarding fruit-bearing trees and shrubs on public land was collected and synthesized. The University of Minnesota's "Agriculture and Environmental Science" database was used to locate literature using the following keywords "Urban Agriculture" AND "Public" AND "Fruit Trees". The specific inclusion criteria looked for references that investigated public orchards and community educational opportunities. Two case studies were identified, and their findings were applied.

A document review of local communities with food forests was conducted to inform best management practices. Criteria for inclusion require food forests to be located in public parks. The "News Bank-Minnesota" database was used to identify projects in the state using the keyword "Food Forest". Once the locations of the food forests were identified, official city documents were obtained for use.

Research regarding the types of native fruit-bearing trees and shrubs that would be appropriate for the City of West Saint Paul to plant were identified from the *Trees and Shrubs of Minnesota* guidebook (Smith, 2008). Factors taken into consideration were soil type, USDA hardiness zone, hydrology, sun exposure, and climate change. Flowcharts were developed for the City of West Saint Paul to select suitable and easily recognizable trees and shrubs for their community. Non-native tree species were identified from the University of Minnesota Extension, Planting a Community Food Forest (UMN Extension, 2021). Maintenance requirements for the selected fruit species were compiled using information from the University of Minnesota extension (UMN Extension, 2021).

A literature review was conducted to gather information on methods of community engagement in the natural resources field. The University of Minnesota Agriculture and Environmental Science database was used to locate literature using the following keywords "community engagement" AND "community education" AND "classes". The specific criteria were used to determine best practices for educating and involving the public.

Key Informant Interviews

Key informant interviews were conducted with professional educators and experienced environmentalists who work with edible landscapes or in related fields (Table 1). Interviewees were selected based on a variety of criteria including experience with fruit trees, public park planting, and community engagement projects. Those interviewed work in or around the Twin Cities and can provide location appropriate information. Potential interviewees were contacted through email and in-person meetings were scheduled. Those interviewed were asked a set of questions (Appendix A) related to their experience with fruit tree planting and maintenance in public parks. Key informant interviews address the objectives of identifying fruit-bearing trees and shrubs appropriate for West St Paul and informing best practices for a community-run food forest.

Table 1. Key informants who participated in interviews

Name	Title
Stephanie Hankerson	Member of the Hamline-Midway Environment Committee
Patricia Ohmans	Founder and Director of Frogtown Green
Gary Wyatt	UMN Forestry Extension Educator
Annie Klodd	Assistant UMN Extension Professor for Fruit and Vegetable Production

Findings

Tables of viable fruit-bearing trees and shrubs were created to help facilitate the city's selection of species and varieties. Native fruit trees and shrubs are generally more acclimated to Minnesota's climate and more resistant to cold weather; when choosing non-native varieties be sure to consider their hardiness rating (Ohmans, personal communication, 2021; Wyatt, personal communication, 2021). Non-native cultivars are often more disease and pest-resistant while having more manageable maintenance requirements (Klodd, personal communication, 2021; Hankerson, personal communication, 2021). Commonly recognized non-native species that are suited to Minnesota's climate and are non-invasive have been included. Table 2 provides information for potential shrub species including preferred soil conditions, mature size, pollination, diseases, harvest, and any special considerations. Table 3 provides information for potential tree species including preferred soil conditions, mature size, pollination, diseases, harvest, and any special considerations. Species that have done well in Minnesota include serviceberries, raspberries, elderberry, pear trees, and cherry trees (Klodd, personal communication, 2021). Learnings from a public orchard in Montreal, Quebec revealed that city planners must ensure there is a sufficient number of fruit trees and shrubs that are well-liked and appropriately located within a community for a successful public orchard (Colinas et al., 2019). Survey results may also be helpful when finalizing a selection of species from this list.

Fruit-Bearing Trees and Shrubs Considerations

Site conditions

When choosing which plants to include in a food forest the following must be considered: preferred soil conditions, light requirements and shade tolerance, the number of varieties needed for pollination, and the prevalence of common diseases and pests (UMN Extension: Fruit, 2021, UMN Extension: Planting a community food forest, 2021). Controlling site conditions can determine the quality of the yield of the fruit as well as quantity (Ashraf, et al., 2012). The preferred growing conditions of individual species must be met at the chosen planting site (Smith, 2008). Aesthetics must also be considered, because of the preference people have for more colorful fruit plants (Kaya, et al., 2018). The forest will also benefit more utility if it is placed in a location with frequent visitors, such as a local park that is located closer to residents (Kardan, et al., 2015).

Harvest Timing

Harvest time is important to consider; choosing species that are ready for harvest at various times throughout the season will make maintenance and harvest more manageable for community members (Hankerson, personal communication, 2021). Growing a variety of perennial plants with a wide range of harvest times will also always ensure the presence of fruit for consumption (Elzer-Peters, 2013).

Disease resistant varieties

Planting disease-resistant varieties when possible is crucial to long-term retention, easier maintenance, and cost reduction (North, personal communication, 2021; Klodd, personal communication, 2021; Simms, et al., 1994). Many plants commonly used in food forests have non-native varieties that have been selected for disease resistance (UMN Extension: Fruit, 2021). Choosing disease-resistant varieties will reduce the need for spray and other chemical maintenance practices that may be harmful to the health of consumers (Carvalho, 2017).

Highly-Spreading Species

Aggressively spreading species should be placed near the back of the food forest to make the area more accessible and to decrease the amount of maintenance required. Maintenance to reduce spread includes pruning, mesh enclosures around the base of the tree, mulch spreads, and proper spacing (Hankerson, personal communication, 2021; North, personal communication, 2021; DiSabato, 2006).

Maintenance Intensity

Plant varieties should be chosen with preference given to species that are easier to maintain (Draus et al., 2014; Wyatt, personal communication, 2021). Plant varieties that require less time and money to maintain should be favored (Summit, et al., 1998). This can be in terms of money and time spent on recruitment, routine workshops, and tools (Colinas, 2019). Plants requiring less physical maintenance in terms of manual labor such as pruning should also be considered. The pruning of branches maintains plant health and ensures public safety (Summit, et al., 1998).

Recognizable and High yielding

Preference should be given to species that the community finds desirable (Wyatt, personal communication, 2021). Native varieties may be tarter and are less appealing to the public than their cultivated counterparts (Klodd, personal communication, 2021). Yield should be considered as it can be important to plant varieties that will produce more fruit for the public to harvest; with cultivated varieties being superior in this aspect (Dvorak et al., 2016; Schaffstall, 2019).

General Maintenance Requirements

Trees and Shrubs require maintenance, such as watering, pruning, and fruit cleanup (UMN Extension: Fruit, 2021). All fruit tree species are found to produce the best yield in full sun. Species with higher shade tolerance are noted in Table 3 (UMN Extension: Fruit, 2021). The most optimal timing for pruning is annually in late spring or early winter (UMN Extension: Fruit, 2021). Optimal Tree spacing distance was found to be minimally equal to tree height. Machinery needs are often integrated into spacing decisions (UMN Extension: Fruit, 2021; North, personal communication, 2021). A pruned tree height of 6-8 feet allows for ease of harvest and maintenance. Usage of espalier-style pruning has been found to further reduce harvesting complexity (North, personal communication, 2021). Optimal shrub spacing was found to be at least 3-5 feet apart (UMN Extension: Fruit, 2021). Findings indicate that shrubs need moist soils which often necessitates regular watering (UMN Extension: Fruit, 2021).

Leaving fruit unpicked can cause issues due to the tendency for it to fall and rot. Rotting fruit can be slippery and create safety hazards, as well as attract insects and other animals. This is a cause of resident apprehension (Visentin, 2019). Competition from weeds can reduce productivity, thus effective weed control positively impacts the growth of trees and shrubs in terms of health and fruit yields (Hartley, 1998).

The following tables are species and varieties that are common in food forests in Minnesota (UMN Extension: Planting a community food forest, 2021; North, personal communication, 2021; Wyatt, personal communication, 2021).

Table 2. Maintenance requirements and other considerations for potential shrub species and varieties (UMN Extensions: Fruit, 2021).

Tree Species	Native Varieties	Non-native Varieties	Pollination	Disease/ Pests	Soil	Harvest	Special Considerations
Plum	American Wild Plum	-Toka -Alderman	Two of the listed varieties are needed	Brown Rot (risk of significant damage is low)	Well-drained Sandy to loamy	August	Blooms in spring, cold frost could ruin that season's crop Spread via root suckers needs to be controlled
Cherry	Black Cherry	-Evans/Bali -Mesabi	Two of the listed varieties are needed	Brown Rot (risk of significant damage is low)	Well-drained Sand to loamy	Late June-Mid July	Spread via root suckers needs to be controlled
Apple	N/A	-Chestnut -Honeycrisp -Haralson	Two of the listed varieties are needed	Apple scab and fireblight, resistant varieties were chosen	Well drained Most soil textures	September-October	High maintenance compared to other trees (intensive pruning and thinning requirements
Pear	N/A	-Summercrisp -Patten	Two of the listed varieties are needed	Fireblight (Little concern)	Well-drained Sandy to loamy	August-September	
Serviceberry	Saskatoon		Self-compatible	Little concern	Well-drained Most soil textures	June	Can be pruned shorter and spaced closer together

Table 3. Maintenance requirements and other considerations for potential trees species and varieties (UMN Extensions: Fruit, 2021).

Shrub Species	Native Varieties	Non-native Varieties	Pollination	Disease/Pests	Soil	Harvest	Special considerations
Blueberry	Lowbush	-Northland -Northblue	Benefits from a second variety	Little Concern	Well-drained Sandy textures Acidic	Late July-Early September	Amendments will likely be needed to lower soil pH
Raspberry	Wild raspberry	-Autumn Britten -Heritage	Self-compatible	Cane blight (has no long-term impacts on the plant)	Well-drained loams	July-August	Nonnative varieties may be easier to maintain. Spread via root suckers needs to be controlled.
Elderberry		-Johns -Adams -Bob Gordon	Benefits from a second variety	Powdery mildew (low risk)	Well-drained Loamy soils	August-September	Spaced 4-6 feet apart Does not require regular watering.
Gooseberry	Missouri	Captivator	Self-compatible	Powdery mildew	Well-drained Loamy to clay loams	July-August	Shade tolerant but with a lower yield. Native variety flood tolerant.
Currant	Wild black currant	-Honeyqueen -Ben Sarek	Self-compatible	Powdery mildew	Well-drained Loamy to clay loams	July-August	Shade tolerant but with a lower yield

To help fulfill the goal of identifying native and non-native species appropriate for the area, a series of flowcharts (Figure 2; 3) was created by synthesizing information from "*Trees and Shrubs of Minnesota: The Complete Guide to Species Identification*" (Smith, 2008). These flowcharts aim to assess a variety of site factors, environmental conditions, and possible infrastructure that have impacts on species selection and location.

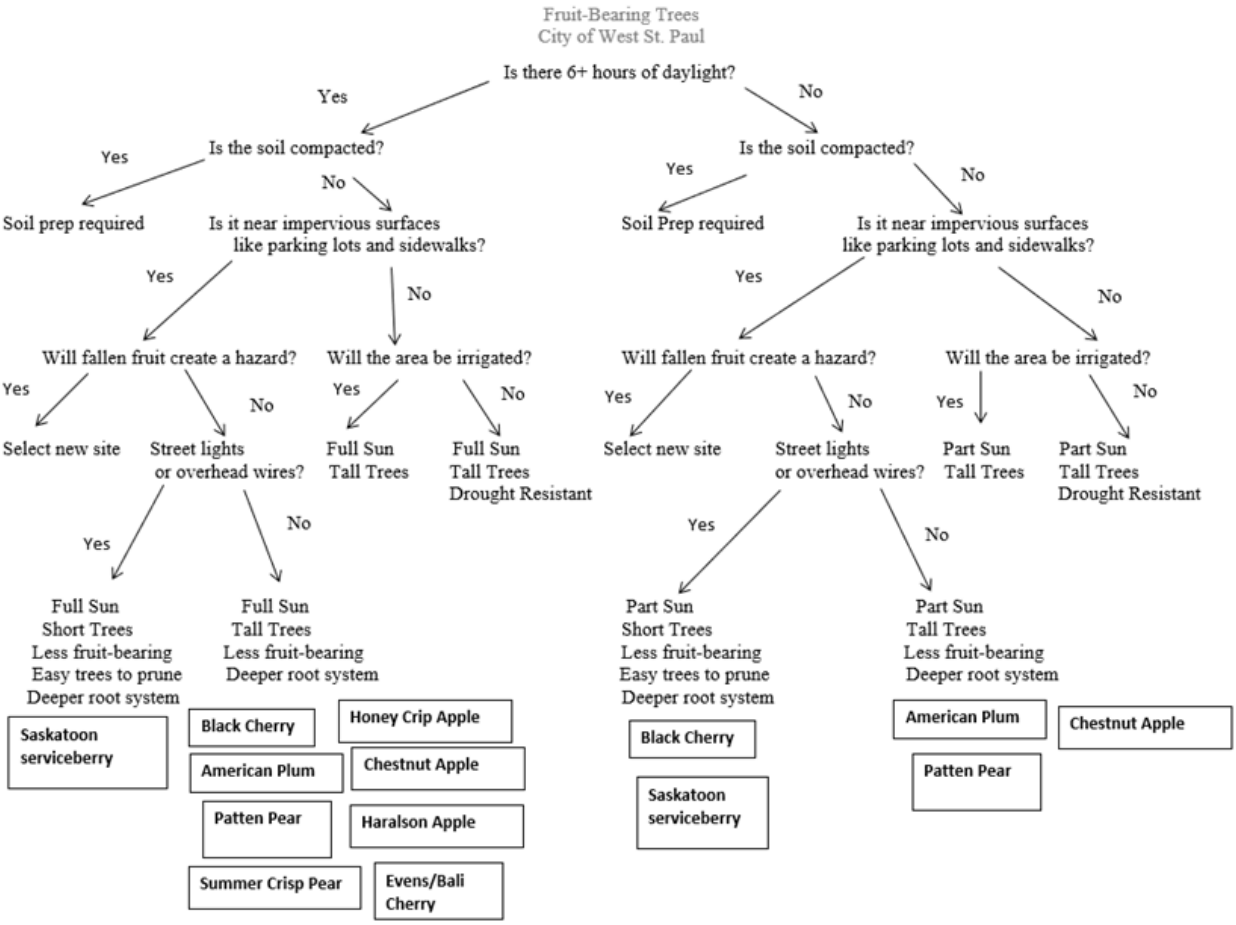

Figure 2. Decision tree: habitat requirements for fruit-bearing trees

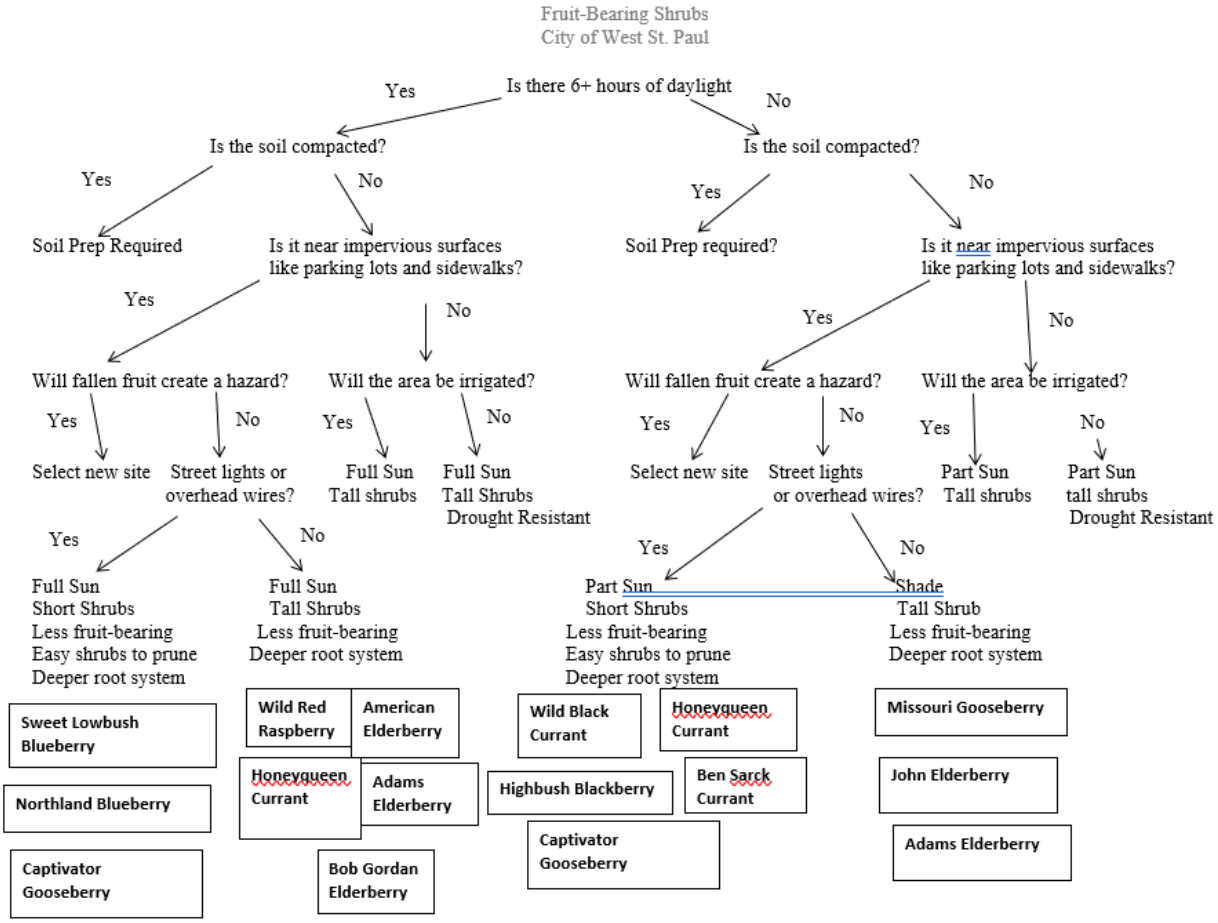

Figure 3. Decision tree: habitat requirements for fruit-bearing shrubs

Community Engagement and Education

Food forests globally and locally help develop a sense of community and create positive socio-environmental impacts (Dubbeling et al., 2009, Colinas et al., 2019, Becker and McClintock, 133). Taking time to educate residents about food forests is critical to gaining their support and commitment to keeping the gardens inclusive (Dubbeling et al., 2009). Specifically, there is a need to sufficiently inform residents and other key stakeholders early on about a food forest project and its many benefits using several different media platforms like websites, Facebook, mailers, and local newspapers (Colinas et al., 2019). After the implementation of a food forest in Rosario, Argentina, the inhabitants of the area felt proud of their involvement and truly took ownership of their gardens (Dubbeling et al., 2009). The Upper Sioux Community near Granite Falls, Minnesota considers their food forest a restoration of natural habitats which is a cornerstone of their values (Gorman, 2020). Restoration reconnects people to the land and water around them. Volunteering with neighbors to grow food gives us a connection to each other and a connection back to the earth which is our source of life (Gorman, 2020).

Volunteer Groups

Having a core group of community volunteers is important for a successful food forest. Values of shared resources must be promoted, and the community must accept responsibility for the maintenance of the garden areas (Dubbeling et al., 2009). A study used the United States national census and survey of municipal forestry operations to determine the involvement of volunteers in tree activities and the variables that impact volunteer numbers. The use of volunteers in urban forestry is important as they have the potential to complete projects that may otherwise not happen due to a lack of resources. Participation by community members has also been found to increase tree survival rates (Hauer et al., 2018). Creating community events or classes with activities geared toward information about the orchard, the fruit trees, and the environment could all increase the socio-environmental impact that a food forest would have on a city (Colinas et al., 2019).

Outreach Programs

Outreach activities were found to increase the odds of volunteer participation by 115% due to the opportunity to educate potential participants on the reasons to join (Hauer et al., 2018). Programs that targeted outreach at local groups saw improved community engagement. Groups that are commonly involved in tree care include school groups, youth organizations such as scouting groups, nonprofits, and neighborhood associations (Hauer et al., 2018). Having conversations with social groups, clubs, schools,

religious organizations, and local non-profits often leads to sustained involvement of the entire group (Ohmans, personal communication, 2021; Klodd, personal communication, 2021). Besides growing food to share, the community orchard in Portland, Oregon educated volunteers about fruit tree care, provided excess fruit for distribution to outside low-income neighborhoods, and transformed how the community worked together on the orchard and other projects too. Connection to others and nature was a large part of the success of the community orchard (Becker and McClintock, 139).

Management Practices

Policy

Local governments can provide critical support for food forests (Klodd, personal communications, 2021). Cities can establish policies and strategies that drive the social, economic, and physical environments in their communities (Public Health Law Center and Feeling Good MN, 2017). The city council of Burnsville, MN approved a sustainability plan in 2020 that establishes strategies and implementation actions to increase local food production through community gardening and food forests so that no neighborhood is a food desert (Grow Burnsville, 2021). Urban Roots, a St. Paul non-profit, helped the city design and implement a pilot food forest near the civic center. Future food forests are planned to meet the city's sustainability and health objectives (Grow Burnsville, 2021). Luverne, Minnesota was declared a food desert by the U.S. Department of Agriculture in 2020 (Yang, 2020). Prairie Ally Food Forest was established in 2018 to address this lack of accessibility to fresh, local food (Project Food Forest: Prairie Ally, 2021). While it takes years for a food forest to reach maturity and high yields, this period means that there is ample time for education. In addition to providing food, Prairie Ally aims to inspire the community to think about the environment, soil, and water health (Mankato Free Press, 2020; Project Food Forest: Prairie Ally, 2021). However, Prairie Ally food forest would not have been possible without the collaboration between the city of Luverne and Project Food Forest. Private-public collaboration similar to Luverne's Food Forest should be considered when planning a Food Forest. Cities may also select the location for a food forest based on other criteria including land space and proximity to neighborhoods.

Collaboration

Collaboration is extremely important when establishing food forests. In Rosario, Argentina, city planners and University staff collaborated with low-income communities to develop a land-use plan to include space for a food forest including fruit trees, natural habitat, food production, educational activities, and recreation. A "Bottom-up" planning process was conceived to include city planners, architects,

government officials, grassroots activists, homeless populations, and low-income groups (Dubbeling et al., 2009). This participatory design process allowed all stakeholders to work toward common goals and meet the needs of the community. In Portland, Oregon, a key learning was that the boards of managing food forest nonprofits must have representation from the neighborhoods they are serving or risk the food forest and community becoming a gentrified site of displacement (Becker and McClintock, 151). Inclusion is important and must be considered throughout the entire life of the project. Seeking community input and installing community members as leaders of the food forest initiatives will result in a closer-knit community and more support for the project (Becker and McClintock, 151).

Maintenance

Maintenance support is another area the local government can provide to food forests. When fully established food forests are robust and low maintenance, the relative cost is low (Project Food Forests). However, for at least the first 5 years, city budgets should account for costs associated with potential fruit littering clean-up, and tree and shrub maintenance (Colinas et al., 2019). Signage, fencing, irrigation, and lighting are costs that local municipalities should anticipate (Dubbeling et al., 2009). Contacting local banks and grocery stores may help cover some of the financial costs associated with food forests (Wyatt, personal communication, 2021). Cities may need to annually support volunteer initiatives and formal volunteer training opportunities. Volunteer commitment following plantings is difficult to maintain, and any training that provides opportunities for direct care can retain volunteers (Ohmans, personal communication, 2021). Formal events like tree-pruning lead to higher volunteer numbers. Programs that have no formal training activities conducted by municipal employees had a 45% reduction in volunteers (Hauer et al. 2018). Maintenance tasks, such as watering, were found to be more successful when done through organized schedules, signed agreements, and monitoring. Participants are likely to stop volunteering when experiencing barriers such as a lack of adequate tools or logistical issues; thus, the use of planning and organization around volunteer activities is key in preventing such barriers (Hauer et al., 2018). Finally, local government support for celebratory community events and educational tree care clinics are needed yearly to continually get new residents to participate and have ownership in the orchard. Seasonal bloom schedules, that could be posted on the city's website, assist community members in keeping up with important maintenance and harvest timelines (Klodd, personal communication, 2021).

Recommendations

The creation of a pilot project in one central park that contains all plant varieties the city plans on using would be an effective way to begin the implementation of edible fruit trees and shrubs into West Saint Paul (North, personal communication, 2021; Schaffstall, 2019). City officials expressed interest in Garlough Park as a central location. Based on soil reports for this site, found in appendix E, this park is located on mostly well-drained sandy loams and would be able to support the growth of many trees and shrubs commonly used in food forests (U.S. Dept. of Agriculture, 2021). This plot could serve as the main hub for events, education, and training which are vital for the success of food forests (North, personal communications, 2021; Roman et al., 2015; Schaffstall, 2019). Signage should also be implemented at this location (Dubbeling et al., 2009; North, personal communications, 2021). Each plant will have educational signage discussing identification, maintenance, harvest, and fruit uses.

Recommendation: Fruit Bearing Tree and Shrub Varieties

Choosing semi-dwarf or dwarf varieties for fruit trees and/or pruning to a maximum height of 6-8 feet is preferred (North, personal communications, 2021; Moran & Koehler, 2021). A 6-8 foot maximum height will ensure that harvests are accessible. This maximum height also reduces the likelihood of people climbing on trees or ladders to get fruits, reducing liability. Choosing low-maintenance native fruit trees and shrubs will keep costs low and increase the effectiveness of volunteer efforts; while maximizing the benefit gleaned from planting edible trees and shrubs (Childers, 2019). The species we recommend are generally well-known by members of the public, which would increase willingness to eat from the trees and shrubs (Wyatt, personal communications, 2021). Plantings should occur according to plant requirements, site, and desirability; while balancing factors such as disease and pest resistance (UMN Extension: Fruit; UMN Extension: Planting a food forest; Wyatt, personal communications, 2021). Disease and pest-resistant plants are preferred because of the decreased maintenance costs and decreased hazards to consumers (Carvalho, 2017). A location with frequent visitors that will benefit from the plants in higher numbers is also preferred (Kardan, 2015). The yield of the plants is another consideration, and a higher yield is generally preferred (Dvorak et al., 2016; Schaffstall, 2019). Planting a variety of plants that will produce fruit yields at different times is preferred to ensure the presence of fruit throughout the season (Elzer-Peters, 2013). All these factors must be balanced in a way that suits a space.

Figure 4. An example site map showing the placement of species in Garlough Park.

Recommendation: Community Engagement and Education

Community participation in tree care is important, as volunteers have the potential to initiate and complete projects that may otherwise not happen. Volunteer participation has been found to increase tree survival rates (Hauer et al., 2018). Thus, outreach activities will be vital in fostering community engagement. The City of West St. Paul should use a survey and other educational material to inform residents of the project purpose and opportunities for involvement. Further methods that should be used to increase community involvement include hosting municipal-led events, implementing educational signage, and involving local groups and organizations.

Survey

Conducting a well-designed community engagement survey will gauge public interest in the food forest and be essential in understanding the level of citizen volunteer commitment in maintaining the fruit trees and shrubs. The City of West St. Paul should provide online access to the survey for residents through the city homepage. Additional outreach to promote completion of the survey would be done in the local newspaper: West St. Paul Reader or through the city's social media (Colinas et al., 2019; Hankerson, personal communication, 2021). The focus of survey questions should be fruit preferences, individual capabilities, and total time commitment preferences concerning plant maintenance. Potential survey questions can be found in Appendix C.

Municipal-led community events

Community events build connections between neighbors while also attracting new members of the community to get involved (Colinas et al., 2019; Becker and McClintock, 139, Hauer et al. 2018). The City could hold yearly blossom festivals in May to promote the food forest and community involvement opportunities throughout the summer and a yearly harvest festival to celebrate the fall season (Project Food Forest, 2021). Seasonal events such as these would provide community socializing events showing the tangible benefits of edible trees and shrubs, through eating the food that they contributed to growing, leading to a feeling of accomplishment and taking ownership of the food forest (Dubbeling et al., 2009).

Signage

Signage is an important tool to educate community members about the food forest, and it can also establish a community's identity (Dubbeling et al., 2009; North, personal communications, 2021). There are many types of signs needed. First, create a sign with a food forest logo to communicate that the

orchard is free and open to all. Include the mission statement for the orchard. This promotes the involvement of the community. Second, create signs with maps to the orchard and other nearby orchards. Third, there should be signs for each species of tree/shrub with information about bloom time, harvest time, identifying features, and nutritional benefits. QR codes should be placed on the signs for residents to scan for healthy recipes to make with the fruit as well as more in-depth plant information (North, personal communications, 2021). Fourth, orchard rules must be communicated including guidelines on how, when, and how much to harvest. Finally, safety signage is critical to ensuring residents are harvesting the correct edible fruit and handling it properly. Signage examples can be found in Appendix D.

Involvement of Community Groups

The involvement of local groups has been found to increase volunteer participation (Hauer et al., 2018). Some of the common groups that participate in tree care across the US include school groups, youth organizations such as scouting groups, nonprofits, and neighborhood associations (Hauer et al., 2018). Local leaders in tree care recommend involving social groups and clubs, religious organizations, and local nonprofits and projects like Project Sweetie Pie and the Celestial Gardens (Dubbeling, et al., 2009; Klodd, personal communication, 2021; Ohmans, personal communication, 2021; Wyatt, personal communication, 2021).

The Green thumbs

Grass root community groups are self-organizing units that help to engage neighbors to be involved in some aspect of their community (Dubbeling et al., 2009). The “Green Thumbs” group in West St. Paul is such a group, with a commitment to ‘all things green’. The city should seek out members of this group and other similar-minded neighbors for guidance on the food forest initiative. This involvement of local stakeholders will lead to increased community awareness and involvement (Becker & McClintock 151; Dubbeling et al., 2009)

Community foraging group

Municipal-led events lead to an increase in volunteer efforts (Hauer et al., 2018; Klodd, personal communication, 2021). City members from the board of parks and recreation hosting local foraging groups at their main parks would help to educate the community on foraging, harvesting, and cooking with fruits (Project Food Forest, 2021). They could take the community on foraging hunts, educate them on harvesting fruits and do various cooking demonstrations with the fruits found in the parks. Twin-Cities-based organizations like Ironwood Foraging and Four Seasons Foraging could be hired to host in-

depth classes and workshops. The city could fund the event by providing a sign-up sheet with a pay-what-you-can donation.

Recommendation: Management Practices

From interviews and literature reviews, it is clear that chosen management strategies and practices of a food forest are critical to its overall success. Properly matching the appropriate management techniques to the area and the species present allows for more effective and efficient management of the area and maximizes the benefits of a food forest (Drescher 2005; Roman et al., 2015). In addition, the encouragement of a private-public partnership could help secure funding for management (Project Food Forest: Prairie Ally, 2021; Wyatt, personal communication, 2021). Collaboration between stakeholders to ensure management is completed is crucial (Colinas et al., 2019; Dubbeling, 2009). The cost of management materials such as signage, tools, lighting, fencing, irrigation, and safety measures should be estimated and integrated into the planning process (Dubbeling et al., 2009).

Planning and organizing seasonal tree care

Implementing schedules for regular maintenance requirements is recommended (Klodd, personal communication, 2021). Logistical issues and lack of adequate tools are key reasons for volunteers to stop participating in tree care events (Hauer et al., 2018). To overcome these barriers, scheduling larger maintenance events such as prunings and yearly mulching so that participants can have access to professionals and tools is recommended (Colinas, 2019; Hauer, 2018). It may also be beneficial for park buildings to have tools required for smaller maintenance tasks available for rent should participants want to come on their own time (Hauer et al. 2018).

We recommend the use of sign-up sheets for smaller tasks, such as watering, as this leads to an increase in participation and tree survival (Hauer et al., 2018, Klodd, personal communication, 2021). Thus, monitoring should take place in addition to sign-up sheets; volunteers could check in with employees inside park buildings to ensure task completion. If no sign-in occurs, park employees could carry out the task.

Training

Fruit trees and shrubs need care and maintenance to thrive in their environments. The idea behind a food forest is to have citizens take responsibility for the care of the trees and shrubs. Consider working with the University of Minnesota Tree Care Advocates (North, personal communication, 2021; Wyatt, personal communication, 2021). Participants in the program would be certified and will act as community leaders to train other participants (Minnesota Tree Care Advocate, 2021). Also, working with the University of Minnesota Extension Master Gardener Volunteer Program will help provide educational outreach and project-based efforts. Master gardeners will build volunteer confidence and assist in the creation of a program specifically for fruit-bearing trees and shrubs (UMN Extension: About the Master Gardener volunteer program, 2021). Through these programs, volunteers could be trained on the following topics: watering, pruning, disease awareness, and pest management. Conducting training on a regular schedule is preferred so new people have an opportunity to join (P. Ohmans, personal communication, 2021). Training should reflect the needs of the plants, as well as the necessities of harvesting. To ease training dispersal, a series of videos about the basic care and maintenance of fruit trees and shrubs could be created. These could be watched whenever interested community members have time (Jones 1998).

General Management Practices

All plants will require regular watering in their first year after planting and during dry periods once established (UMN Extension: Fruit, 2021). All plants will produce the best yield in full sun; plants that have a higher shade tolerance are noted in the table (UMN Extension: Fruit, 2021). Pruning for all species should occur annually in the late spring or early winter (UMN Extension: Fruit, 2021). All trees should be spaced at a distance at least equal to their height; the recommended pruning height is 6-8 feet (UMN Extension: Fruit, 2021, North, personal communication, 2021). Additionally, training should instruct on espalier-style pruning when possible, as it further reduces harvesting complexity (North, personal communication, 2021). All shrubs should be spaced at least 3-5 feet apart and watered regularly to maintain moist soils unless otherwise noted in the table (UMN Extension: Fruit, 2021). Plant spacing should also consider machinery needs.

Unpicked fruit is also a cause for concern. Unpicked fruit is prone to falling and rotting. This creates safety hazards such as slippery sidewalks. They may also attract animals and insects. Fruits that fall and rot quickly should be planted away from walkways and sidewalks (Visentin, 2019). The presence of weeds must also be considered. Adequate weed control, through mulching or manual weeding, will positively impact the growth of the trees and shrubs in terms of health and fruit yields (Hartley, 1998).

Conclusion

This report was conducted to determine feasible integration strategies pertaining to edible fruit trees and shrubs in the landscape of West Saint Paul. Recommendations consist of suggestions for tree and shrub species selection, management practices, and engagement and education of community members within the food forest.

By focusing on a combination of tree and shrub species, our recommendations will lead to a fruitful food forest space in West St. Paul. The list of plants includes easily identifiable fruits as well as some fruits that may be unfamiliar to the average person. The usage of familiar fruits will allow people to familiarize themselves with the food forest experience and ease the community's hesitation for utilizing edible fruit from native trees and shrubs. Gauging community opinions is also necessary. A list of survey questions has been formulated to measure interest in the project as well as current community knowledge about food forest to assess the amount of training that will be required. Training and maintenance are essential to the success of this initiative. Enlisting the aid of interested community members will ensure the longevity of these shrubs and trees in the community. Each of the plants has unique requirements, so a comprehensive training program is crucial. Education of community members via training and signage will increase awareness about the plants.

Our findings have demonstrated the numerous benefits resulting from incorporating fruit-bearing trees and shrubs in West Saint Paul Parks. Strategic community engagement through the involvement of local organizations is crucial to the success of the program. The adoption of these recommendations will enhance the use of the fruit bearing trees and shrubs in West St. Paul. Consequently, the City of West Saint Paul has the opportunity to equitably meet the needs of its diverse and growing community.

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Appendix A: Key Informant Interview Questions

- What tasks should volunteers be trained in to provide proper care and maintenance of a food forest?
- Are there any resources you have used to educate community members?
- Are there any specific species or varieties that you have found to do well in community food forest and garden programs?
- Are there species that you would recommend staying away from?
- What methods have you used to increase community support and engagement with your projects?
- Who are key stakeholders that should be involved in this project?
- What maintenance practices would you recommend for the recommended perennial trees and shrubs?

Appendix B: Fruit Bearing Trees and Shrubs Info

Fruit-Bearing Trees

Plum -- *Prunus sect. prunus*

- Require two varieties for pollination.
- The native American Wild Plum could be paired with Toka or Elderman to maintain a selection of native species.
- Grows best in well-drained sandy to loamy, slightly acidic to neutral soil.
- Native plum harvest would be best for cooking while non-native plums can be eaten raw.

Cherry -- *Prunus avium* L.

- Requires two varieties for pollination
- The native Black Cherry could be paired with Evans Bali to maintain a selection of native species.
- Grows best in well-drained sand to loamy, slightly acidic soil.

Pear -- *Pyrus* L.

- Requires two varieties
- Recommended varieties are Summercrisp and Patten. There is no native variety.
- Grows best in well-drained soil, loamy sand soil that is slightly acidic to neutral

Serviceberry -- *Amelanchier* Medik.

- Self-fertile
- The recommended variety is the native saskatoon. This variety has the highest quality fruit and has few disease and pest problems.
- Grows best in well-drained, sandy, or sandy loam soil that is slightly acidic.
- Serviceberry can be pruned to act as a shrub if space is an issue.

Apple -- *Malus*

- Requires two varieties
- Recommended varieties are Chestnut, Honeycrisp, and Haralson
- Grows well in most soil textures but requires good drainage.
- High maintenance requirements compared to other trees.

Fruit-bearing Shrubs

Blueberry -- *Vaccinium sect. Cyanococcus,* Rydb.

- The yield benefits from having two varieties
- The native lowbush blueberry can be paired with Northland or Northblue blueberries to maintain a selection of native species.
- Grows best in dry sandy, strongly to weakly acidic soil
- Amendments will likely be needed to lower the soil pH, but Blueberry is otherwise straightforward to maintain

Elderberry -- *Sambucus* L.

- Self-fertile
- Recommended varieties are Johns, Adams, and Bob Gordon
- Grows best in well-drained soil that is loam or sandy loam in slightly acidic soil. However, they can tolerate various soil textures and acidity.
- Elderberry is a culturally significant medicinal plant, still commonly used today.

Gooseberry -- *Ribes uva-crispa* L.

- Self-fertile
- The non-native Captivator variety is recommended as it has higher quality fruit, is resistant to powdery mildew, and has fewer spines making it easier to work with and harvest from.
- Grows best in well-drained, silt, or clay loam that is slightly acidic.
- Can grow in partial shade, at the cost of a lower yield, and can tolerate flooding.

Currant -- *Ribes* L.

- Self-fertile
- The native variety is wild black currant. It may be beneficial to plant non-native varieties, like Honeyqueen, due to disease resistance.
- Grows best in well-drained sandy, stilty, and loamy soil that is moderately acidic to basic.
- Can be grown in partial shade, at the cost of a lower yield, and can tolerate waterlogged soils.

Raspberry -- *Rubus*

- Self-fertile
- Recommended varieties are the native wild raspberry or the non-native Autumn Britten or Heritage.
- Grows best in a well-drained, loamy soil.
- Non-native raspberries may be easier to maintain due to the availability of fall-bearing(primocane) varieties. Raspberry has high maintenance requirements relative to other shrubs.

Appendix C: Survey Questions

Question 1: How do you feel about a project that would put edible fruit-bearing plants in our public parks?

Potential Answers:

1	2	3	4	5
Not interested		Indifferent		Extremely interested

Question 2: Would you harvest fruit from plants grown in our park system?

Potential Answers:

- No.
- Infrequently.
- Yes, when I happen to be in the parks.
- Yes, I would go to parks with the intention of harvesting fruit to bring home and eat/cook.

Question 3: Would you be interested in caring for a fruit tree/shrub, and to what extent? Select one or more.

Potential Answers:

- I have no interest in personally caring for a fruit tree planted on public land.
- I would do small tasks occasionally (ex. watering, mulching, weeding)
- I would do small tasks regularly
- I would do larger tasks occasionally (ex. planting, pruning)
- I would do large tasks regularly

Question 4: Do you have any knowledge of maintaining and/or growing fruit trees/shrubs?

Potential Answers:

- Absolutely none, and no interest in learning.
- None, but always willing to learn something new.
- A little, with some vague knowledge of general caretaking.
- Yes, I am knowledgeable and experienced in growing and maintaining fruit trees.

Question 5: If offered, would you attend a free community education class regarding community food forests and how to care for them?

- No
- Yes, but I would likely not volunteer following the class.
- Yes, and I'm interested in volunteering my new skills following the class.

Question 6: Of the following fruits, please select up to three that you would be most interested in seeing in city parks. Rank up to 10 to indicate your preference (1 being highest)

- Apple ___
- Plum ___
- Cherry ___
- Serviceberry ___
- Pear ___
- Elderberry ___
- Gooseberry ___
- Currant ___
- Raspberry ___
- Blueberry ___

Appendix D: Example Signage

American Red Plum (*Prunus americana*)

Bloom Time

- Bloom mid-April through the end of May
- 3 weeks duration

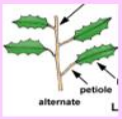
Harvest Time

- Ripe mid-August
- Fruit will turn from green to a deep purplish red with a thin waxy coat

Identification

Leaves

Simple and alternate



Elliptic to oblong elliptic

Flowers

White flowers

Clusters with 1 to 4 flowers

Height

10-25ft

Nutritional Benefits/Recipes

- Full of fiber
- Rich in antioxidants
- Vitamin A and potassium

- Jams and Preserves
- Pies and Plum crisp

Rules For Garlough Park Orchard

1. Pick only in designated areas or where there is signage
2. Do not climb or shake the trees. Limbs break easily, and the fruit will fall and bruise
3. Use one hand to hold the branch, use your forefinger and thumb to gently turn fruit upward till it releases. (Pulling will cause other fruit to fall and destroy flower buds for next year's crop)
4. Please pick only what you need and be respectful of other harvesters
5. Beware of pollinator friendly insects like bees and wasps as you are picking fruit to prevent stings

Edible Fruit Safety

- Pick only ripe, non-diseased, non-damaged fruit

- Wash fruit with cold water before eating

- Beware of pits while eating fruits like cherries and plums

- Follow preservation recipes carefully

Appendix E: Soil Web Survey of Garlough Park

Dakota County, Minnesota (MN037)

Dakota County, Minnesota (MN037)

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
189	Auburndale silt loam	1.4	5.7%
342B	Kingsley sandy loam, 3 to 8 percent slopes	2.6	10.9%
342C	Kingsley sandy loam, 8 to 15 percent slopes	6.8	28.9%
342E	Kingsley sandy loam, 15 to 25 percent slopes	3.7	15.6%
539	Klossner muck, 0 to 1 percent slopes	3.5	14.8%
861C	Urban land-Kingsley complex, 3 to 15 percent slopes	0.2	1.0%
1027	Udorthents, wet	5.5	23.1%
Totals for Area of Interest		**23.7**	**100.0%**