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THE PLACE OF COMMUNITY FOOD FORESTS: A REVIEW AND CASE STUDY OF  
COMMUNITY FOOD FORESTS AND THEIR UNTAPPED POTENTIAL

By

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B.A. International Relations, Virginia Tech, Blacksburg, VA, 2012

Thesis

presented in partial fulfillment of the requirements

for the degree of

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Option in International Conservation and Development

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# ABSTRACT

Eiden, Sarah Marie, M.S., May 2021

Resource Conservation

*The Place of Community Food Forests: a review and case study of community food forests and their untapped potential*

Chairperson: Dr. Keith Bosak

As population grows, the borders of urban and peri-urban areas continue to expand. The UN projects that by 2050 more than 68% of the world population is expected to live in urban areas (UN, 2018). Presently, urban centers are heterotrophic, or highly consumptive of products produced elsewhere, making them one of the most pressing challenges to global sustainability (Wu, 2008). With an ever-increasing imperative for more sustainable food production, multi-use edible green landscapes and other autotrophic, or self-feeding urban agriculture initiatives, are gaining attention and creative practice to incorporate a diversity of ecosystem services (ES). Community food forests (CFF) are novel pieces of this emergent place-based food system (PbFS). To validate the call to incorporate CFF within a PbFS, I establish a framework for analyzing the tangible and intangible ES of these systems as an alternative to the industrial model by working towards goals of sustainability, equity, food citizenship, and place-building. I continue this framework by introducing the ES typology to understand the multifaceted benefits available from a landscape. In chapter two I present a scoping review of CFF in literature and practice. I apply the PbFS and ES typologies to expose the limitations of our scholarly inclusion of CFF as pieces of a larger system. This review exposes the gap that exists between our academic approach with the purpose and intentions of CFF currently in practice. To answer the call proposed in chapter two for a scholarly investigation of the perceived and actual value of CFF to a community of users, I apply a place-based ecosystem assessment to 6<sup>th</sup> Ward Garden Park, a CFF in Helena, MT. This case study highlights the importance of CFF to meet cultural services needs within a community while working towards the larger goals of PbFS. The case study identifies CFF as systems of stacked ES benefits while identifying specific ES that serve as doorways for deeper use and community benefit. Looking forward, this case study provides a working model for assessing user perceptions and values of CFF as a way to assess their role in addressing the wider vision PbFS.

*Key Words: Community Food Forest, Place-based Food Systems, Place-based assessment of ecosystem service*

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The space to develop and explore the world of place-based food systems was made possible by Dr. Keith Bosak, whose encouragement and freedom has transformed the trajectory of my life. You provided a calm and gentle guidance throughout this process, challenging me towards deeper degrees of connection and meaning. Committee member Dr. Sarah Halverson provided invaluable direction and guidance early in the early development of this research process. Your commitment to robust research made this project a reality, thank you. Committee member Caroline Stephens introduced me to the world of farming, the fundamental experience that fuels this research. Thank you for introducing me to a world that has so long felt inaccessible. For providing a space for theories and frameworks to become practice I am grateful beyond words to the partnership between Garden City Harvest and the University of Montana at the PEAS farm. This research would not have been possible without the four-semester research assistantship sponsored by the US Forest Service International Programs, thank you for your continued support.

And finally, to my sisters, you have been my steady rock and best friends, you gave me courage to begin again. To my family, friends, and the public lands of Montana, you have renewed me with life and joy. Thank you.

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## LIST OF ABBREVIATIONS

AFN: Alternative Food Networks

CCF: Community Food Forests

CS: Cultural Services

EGI: Edible Green Infrastructure

ES: Ecosystem Services

FAO: Food and Agriculture Organization of the United Nations

FF: Food forests

FGS: Forest Garden Systems

PbFS: Place-based Food System

PS: Provisioning Services

RS: Regulating Services

S&R: Supporting and Regulating Services

SS: Supporting Services

UA: Urban Agriculture

UFF: Urban Food Forestry

UN: United Nations

UN MEA: United Nations Millennium Ecosystem Assessment



# CHAPTER 1. COMMUNITY FOOD FORESTS AND GUIDING FRAMEWORK

## 1. Introduction and Background:

As population grows, the borders of urban and peri-urban areas continue to expand. The UN projects that by 2050 more than 68% of the world population is expected to live in urban areas (UN, 2018). Presently, urban centers are heterotrophic, or highly consumptive of products produced elsewhere, making them one of the most pressing challenges to global sustainability (Wu, 2008). Food is one such product. With an ever-increasing imperative for more sustainable food production, multi-use edible green landscapes, urban agriculture, urban food forests, and other autotrophic, or self-feeding urban agriculture initiatives, are gaining attention and creative practice.

In 2016, the Food and Agriculture Organization of the United Nations (FAO) published guidelines promoting urban forestry as one way to create multifunctional landscapes to incorporate a diverse range of ecosystem services (ES). The FAO encouraged the removal of barriers to the development and incorporation of food forests and encouraged “coordination among municipal authorities and civil society actors on food production in urban areas” (FAO, 2016). Urban forests have the potential to address specific UN developmental goals, including food and nutritional security, zero hunger, and the development of sustainable cities and communities by addressing provisionary and human well-being needs in a manner that is both ecologically and socially sustainable (FAO, 2016). Multifunctional self-feeding community agriculture initiatives stand in contrast to the unsustainable mutually reinforcing characteristics of homogenization, productivism, and commodification that currently dominate the industrial agriculture landscape (Altieri and Nicholls, 2013; Guptill et al., 2017). The negative effects from industrial agriculture jeopardize human health and well-being and threaten Earth’s planetary boundaries, the bio-physical limits necessary to maintain favorable human life. The need to rethink agricultural practice and systems is inspiring novel solutions both for food production and

participation within these green spaces. Community food forests (CFF) are one type of food forestry practice capable of addressing the range of ES.

## 1.1 Community Food Forests

I suggest CFF are novel systems, meaning they have emerged as relatively new or unusual manifestations of community gardening and public spaces for community interaction. However, the origins of CFF are not new; rather they are rooted deeply within various scientific practices, agricultural manifestations, and historical traditions. Agroecology is the scientific backbone of agroforestry practice, the integration of woody vegetation, crops, and/or livestock on the same landscape. Simply, agroecology is “the application of ecological concepts and principles to the design and management of sustainable agroecosystems” (Gliessman, 1998, p.13). Agroecology prioritizes the ecological structures and functions of a natural system within a managed landscape to maximize ES for sustainable practice, ecological diversity, and livelihood (Altieri, 2002). Francis et al. (2003) takes agroecology a step further as “the integrative study of the ecology of the entire food system, encompassing ecological, economic and social dimensions” (pp. 100). The agroecological science that supports agroforestry practice, as well as a rich history of traditional knowledge, equip agroforestry with the potential to address multiple ecological and community related sustainability challenges (Nair, 1993; Kumar, 2006; Nair 2007; Clark and Nicholas, 2013).

CFF are the result of integrating *food forests* with a *community*. Food forests are edible, perennial, polyculture systems, intentionally constructed and managed to mimic the natural heterogenous structures and functions of a climatically appropriate forest (Whitefield, 2002; Crawford, 2010; Jacke & Toesmeier, 2005). Food forests are designed using primarily edible plants in a heterogeneous layering system, including large shade trees, smaller trees, shrubs, herbs, roots and climbers planted in such a way as to maximize comparative advantage and fill a diverse range of ecological niches (figure 1.1) (Crawford, 2010). Functional diversity and complementing interactions promote a suite of ecologically benefiting services. Food forest systems utilize plants for nitrogen fixation, nutrient retention,

groundcover, and pollination. They provide structural heterogeneity for increased habitat that encourage the abundance of natural pest predators (Crawford, 2010; Jacke and Toesmeier, 2005; Whitefield, 2002). Additional supporting and regulating services are attributed to the diversity of plant functional niches present: soil health and stability, water regulation and retention, and carbon sequestration (Schafer et al., 2019; Montagnini and Nair, 2004). Cultural services such as recreation, reconnection of humans with the ecology of a landscape, educational opportunities and even job provision can be present. Resembling a natural forest, food forests are meant to be largely self-sustaining and self-renewing. CFF are not only about the ecological design of a food producing system but include the essential element of *community*.

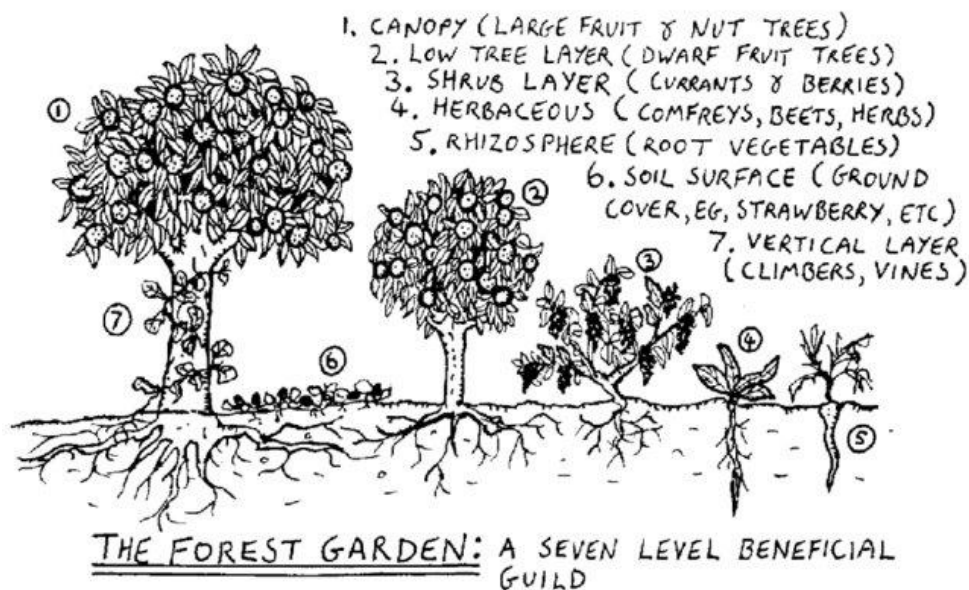


Figure 1.1 Structure of a Forest Garden System or FF. Source: Rhodes, 2012

CFF are designed as public food commons. CFF provide space for a community to gather and collaboratively grow food. The working definition of CFF combines both aspects of food forestry with community as: a multistory, perennial, food-based system, designed to mimic the natural structures and functions of the ecology of a place in the form of a public commons, providing a place where people can collaboratively grow food (Jacke & Toesmeier, 2005; Crawford, 2010; Bukowski, 2018). As a community gathers and collaborates within the form of a public commons, the commons become places

of human-human and human-ecological interaction and connection. CFF are therefore defined, shaped, and adapted by the community they represent (across or within various scales), as well as the ecology of the place. As complex social-ecological systems, they can be adapted and implemented to address a variety of ecological, environmental, and social needs. In the temperate world, novel systems are popping up as complex household gardens, forest-incorporated school gardens, community food forests and community urban food parks, or garden parks in order to serve a wide array of goals (Park et al., 2018; Bukowski, 2014; McLain et al, 2012).

## 1.2 Research Objectives & Questions

At the time of this writing, CFF are still novel systems in the United States. As novel systems, with a relatively recent practice in the United States, the academic research surrounding the utility of CFF is scarce. Assessing the state of our current knowledge surrounding CFF can help determine gaps for future research. Case studies of specific CFF can help assess the role they might play in a wider place-based food system. My research serves to address two main objectives:

1. To evaluate community food forests in the academic literature as well as in practice in order to determine gaps in our current knowledge (chapter 2).
2. To conduct a place-based ecosystem assessment of a community food forest to evaluate the relative importance of ecosystem services provided by the community food forest for both leadership and its community of users (chapter 3).

To address the first objective, I conducted a scoping literature review (chapter 2). The results of this literature review serve as both the justification and motivation for the second research objective. The second objective consists of original research in the form of a case study (chapter 3) and was guided by two main research questions:

1. What is the perceived value of ecosystem services provided by 6<sup>th</sup> Ward Garden Park for its community of users?

2. What is the actual value of ecosystem services provided by 6<sup>th</sup> Ward Garden Park for its community of users (how are users actively using the system)?

Understanding and answering these two questions can both reveal how users are valuing and using the system as well as provide a base for project decision makers and program planners to align the system with users' needs and interests. Identifying ES of high perceived importance and high use can potentially serve as doorways for deeper engagement for the community at 6<sup>th</sup> Ward Garden Park.

## 2. Guiding Framework

CFF are complex social and ecological systems with benefits and services that cover the scope of human-to-human, human-to-ecology, and complex ecological interactions. The guiding framework surrounding this investigation into CFF in literature and practice serve to address both the ecological and social components and intentions of the system. The first framework is built on the unifying goals of place-based food system (PbFS), with primary attention given to the social system in which food operates. The PbFS frameworks serves as a way to evaluate if CFF share the same goals and objectives as other alternative food systems and therefore if they ought to be situated within the alternative food discourse. The second framework identifies the common elements across food forests (FF) and human interactions with these systems. The purpose of this framework is simply to identify any trends in the built structure of the CFF as an ecological system. To date, this framework is the only method used to highlight the unifying factors that exist between such diverse manifestations of CFF systems. The third framework, the ecosystem service (ES) framework, serves to combine both the complex ecological functions with the social system in which the CFF operates. The ES framework of this study allows us to understand the range of tangible, intangible, and ecological benefits and services of CFF. The following sections elaborate on these frameworks in order to ground and justify the lenses used in both Chapter 2 and Chapter 3 to analyze and evaluate the utility of CFF.

## 2.1 PbFS

My personal motivation for assessing the current knowledge of CFF and understanding their perceived and actual value for a community of users is to evaluate the role they might play within a place-based food system (PbFS). PbFS is a generic term I use to include the numerous alternative food networks (AFNs) and alternative food theories that have arisen to respond to the injustices, inequities, externalized costs, and concentration of power found within the dominate industrialized agri-food system. PbFS as a term is adapted from DeLind (2011) who suggests “alternative agriculture” as a response to “industrial agriculture” ought to be considered in terms of its deeper goals of equity, food citizenship, place-building, and sustainability through multiple forms of expression “to explore the integration and reintegration of local food into redundant place-based practices” (pp.273). DeLind suggests a need to reevaluate our practices based upon these unifying central goals of place-based practices. Academics have found various ways to title permutations of alternative agriculture and alternative food movements; most notable being civic agriculture, regenerative food networks, local food systems, and foodshed praxis. I suggest that the four goals proposed by DeLind are embedded within the goals of these movements and theories. PbFS then serves to embody the deeper concerns of these movements without being “stuck” on one manifestation in particular. Regardless of the terminology, PbFS stand in contrast to industrialized agriculture by elevating four goals (equity, food citizenship, place-building, and sustainability) through a redundant system of place-based practice (DeLind, 2011).

Industrial agriculture can be characterized in numerous ways: extensive vertical and horizontal concentration of economic power, lack of ecological diversity, cyclical dependence on technology, the externalization of cost for higher production of cheap food, and the commodification of output, among others. The neoclassical production model of farming is fundamentally designed to increase productivity by replacing labor capital with technological capital built upon the foundations of “mass production, standardization and homogenization of agriculture commodities” (Lyson, 2004, p.22). Guptill et al. (2017) describes productivism as “an ideology promoting ever-increasing output and efficiency with the

assumption that it ultimately benefits everyone” (p.114). Essential to the narrative of productivism is commodification, “the process of shaping products to be interchangeable mass-produced goods that take their value for the prices they fetch on the market” (Guptill et al., 2017, p.14). Commodification associated with the productivism of industrial agriculture has decontextualized communities, farms, and their economies. The technological advancements that have made industrial agriculture possible have also shifted a sector once characterized as “craft production” to one dependent upon “mass production” (Lyson, 2004). In the industrialized and globalized farm, food is no longer associated with a story, region, farmer or even season. Rather, consumers eat a place-less food while farmers produce for a face-less market. As Guptill et al. writes, “with relatively loose ties to any particular place, global food companies can seem a lot like global food: everywhere but nowhere in particular” (2017, p.129). Productivism is both an output of the industrial agriculture system as well as the narrative guiding it. PbFS such as Alternative Food Networks (AFNs) and alternative food theories, have risen to address the fundamental decontextualization of place that has occurred as a result of the dominate system.

### 2.1.1 PbFS: Alternative food system theories and practice

Over the last few decades, there have been many permutations of alternative food system theories and practices. Civic agriculture stands as a framework that embodies the equity (social and economic), food citizenship (participatory empowerment), place-building and sustainability of a truly just and resilient place-based food system (DeLind, 2011). Lyson coined the term civic agriculture to draw attention to the social, political and economic relationships of PbFS which are civic in nature and thus “instruments of *place-based* negotiation, *collective* responsibility and *participatory* democracy” (DeLind, 2011, p.275, emphasis my own). To Lyson, civic agriculture is the “embedding of local agricultural and food production in the community...[that] contribute to the health and vitality of communities in a variety of social, economic, political, and cultural ways” by reintegrating agricultural systems back into the social and ecological context of place (2005, p.93). It is an emphasis on the “civic” that moves the discourse of alternative agriculture away from purely economic and productionist thought and re-engrains agriculture

back into a social-ecological-political context of a place (DeLind, 2002). Civic agriculture stands as a response to the industrialized food system. Unlike the industrial system where products and farmers are commodified and complex social-ecological places are turned into homogenized non-places, civic agriculture encourages the reconnection of community, ecology, and landscape (Lyson, 2005). Civic agriculture elevates the ecological and social system above the reductionist science needed for a commodified productivist approach. DeLind identifies the civic role of place from a humanistic perspective, as “the raw material of citizenship, of civic virtue, of ‘we-ness’” where “the language of tradition and commitment to community, to memory, to home, to common ground—is acquired” (DeLind, 2002, p.220 referencing Bellah et al., 1985 and Kemmis, 1990). Re-embedding the social-ecological system of a place can be a strategy for nourishing a sense of place and food citizenship (DeLind, 2002). Civic agriculture is “a commitment to developing and strengthening an economically, environmentally, and socially sustainable system of agriculture and food production that relies on local resources and serves local markets and customers” dependent upon the social relations of a place (Lyson, 2005: 94). DeLind highlights that civic agriculture “can (and should) promote citizenship and environmentalism within both rural and urban settings not only through market-based models of economic behavior, but through common ties to place and physical engagement with that place” (2002, p.217). The centrality of geographic place to work towards goals of equity, food citizenship, place building and sustainability are evident in other similar movements as well.

Alternative food theories, including regenerative food systems, local food movements, foodshed praxis, food citizenship and food democracy, among others, embody similar foundational concepts dependent upon the centrality of place theory. Regenerative food system is a framework coined by Dahlberg in 1993 to address the system in which food operates. As part of a system, food cannot be separated from the ecology, history and political power of a place (DeLind, 2011). This type of systems thinking requires addressing the interconnectedness among actors in a place in which “the goals and values relevant at each level for the health and regenerative capacity of the system need to be included” (DeLind, 2011:274 citing Dahlberg 1993:77). The local food movement integrates economies of place



into a regenerative food system, defined as “a collaborative effort to build more locally based, self-reliant food economies—one in which *sustainable food production*, processing, distribution, and consumption [are] *integrated to enhance the economic, environmental and local health of a particular place*” (Feenstra, 2002, p.10, emphasis my own). Feenstra’s definition embodies a place-sensitivity that is both collaborative and participatory in nature incorporating the necessity of equity and food citizenship into the place equation (DeLind, 2011). Foodshed praxis is a similar expression of PbFS, in which Kloppenburg et al. (1996) draws attention to the unity of “place and people, of nature and society” by using the ecological understanding of watershed as a metaphor for conceptualizing the movement of food, from production to distribution to consumption (1996, p. 34). Foodshed is not only a way of analyzing food networks, but a source of organizing, it as “a vehicle through which we reassemble our fragmented identities, *reestablish community*, and *become native not only to place but to each other*” (Kloppenburg et al., 1996, p.34, emphasis my own). Foodshed praxis highlight a moral economy that stands in contrast to productivism and commodification, the building of commensal communities, spatial proximity promoting self-reliance for greater social and ecological sustainability, and ecological embeddedness in a socio-geographical place (Kloppenburg et al., 1996). Similar to AFN, the strength of civic agriculture, regenerative food systems, local food movement and foodshed praxis hinge on the centrality of geographic place as a “conceptual quiet center,” to address the unifying goals of equity, food citizenship, place-building, and sustainability. As such, PbFS serves as a framework to encompass these alternative food practices, systems, and their specific elements. It is my belief, as this research will show, that CFF share in such goals and ought to be included in PbFS praxis.

### *Equity*

For many, food equity and food security are directly linked. The United Nations Food and Agriculture Organization (UN FAO) defines food security as existing “when all people at all times, have physical and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life” (FAO, 2006 citing FAO World Food Summit, 1996). Issues of food security are disproportionately felt by poor and minority groups and directly intersect with

issues of equity (Mui et al., 2021; Odoms-Young & Bruce, 2018). Food equity is then the ability and opportunity for *all peoples* to grow and consume healthy, affordable, and culturally significant foods where no one group within a community “suffers from a disproportional burden of food production impacts” (UCI Law, 2016).

### *Food Citizenship*

Food citizenship is defined as “the practice of engaging in food-related behaviors that support, rather than threaten, the development of a democratic, socially and economically just, and environmentally sustainable food system” (Wilkins, 2004, pp. 269). Food citizenship moves consumers beyond food shopping to “broader engagement with the food system in its many dimensions” and can be practiced along a spectrum: from consumer mindfulness, to participation in local networks, to advocacy efforts (Polson Institute for Global Development, 2003, pp.7; Warner et al., 2014).

### *Place-building:*

Place-building as a goal of PbFS is grounded in geographic theory and sense of place. Tuan (1980) suggests sense of place is the essence of rootedness or an “unmediated kind of people-place tie,” an unconscious sense of belonging and being in one’s locality (Arefi, 1999 pp.183, citing Tuan, 1980). Place-building is understood in relation to what it stands against: an industrialized food system decontextualized from place roots (Feagan, 2007). Wendell Berry (2002) notes that “the separation of people and places and products from their histories” is both a result and requirement of the industrialization of agriculture (p.7). Through the homogenization of agricultural landscapes (and the societies, economies, histories, and ecologies in which they are embedded), sense of place is under threat. Place-building, as a goal of PbFS, is the realignment of human and social interactions by recontextualizing food within place (Feagan, 2007). As Feagan describes, place-making is when “places and communities are evinced as spaces of resistance through which agency and local institutional efforts can manage change in ways which more closely meets their needs” through community participation in their foodways (Feagan, 2007, p.32).

## *Sustainability*

“*Sustainability*” as a goal of PbFS is not easily defined. The term sustainability has been adapted, altered, and coopted to define and justify an endless variety of practice. To attempt a foundation of commonality, sustainability as a goal of PbFS in this paper is adapted from Wu (2008) definition of urban sustainability, or “the dynamic capacity of an urban area for adequately meeting the needs of its present and future populations through ecologically, economically, and socially sound planning, design, and management activities” (pp. 44). While focused on urban environments, Wu’s definition incorporates some of the unifying components of sustainability, namely the *evolving* and *fluid capacity* to meet needs in the *present* without compromising *future needs* across *economic, ecological, and social scales* (emphasis my own). Agyeman, Bullard, and Evans take this definition further to include an equitable sustainability that “ensure a better quality of life for all, now, and into the future, in a just and equitable manner, while living within the limits of supporting ecosystems” (2003, 2). This definition suggests that simply sustaining the current system may be perpetuating aspects of unsustainability. Sustainability might be augmented to mean disruption or transformation rather than maintenance of the status-quo (Allen & Sachs, 1993; Agyeman et al., 2003). PbFS takes this position, in which the status-quo (dominant agriculture practices) perpetuate an economically, ecologically, and socially unsustainable and unequitable system. Defining and expanding upon sustainability as a goal of PbFS is outside the scope of this paper but is worth further attention.

The unifying goals of PbFS form one of the typologies used to analyze CFF (typology 3, table 1.1). The PbFS typology serves as a bridge between understanding the role of CFF in isolation and their role within a larger food system landscape. The next two chapters will demonstrate that CFF are not the answer to these goals but serve to address them as a piece of a larger PbFS. Referring once again to DeLind’s (2011) call, CFF ought to be considered as one of the “multiple methodologies and forms of expression to explore the integration and reintegration of local food into diverse and redundant place-based practice” (pp. 273).

## 2.2 Food Forest Unifying Factors

As a practice, FF are considered to have five unifying goals. Jacke & Toesmeier (2005) suggest these goals include: economic sustainability, provisionary food and non-food products, recontextualization of humans with their ecologies, self-maintenance and renewal, and ecosystem health. Economic sustainability suggests that FF support a lower cost over the long run as people and communities grow their own food. The principle of economic sustainability does not discount the high initial startup cost often associated with FF and perennial landscaping. Rather, economic sustainability is justified by the long-term use and reuse of perennial start-ups and the diversification of products able to be gleaned from the system. FF are comprised of not just food but also non-food products. Non-food products within a FF often consist of medicinal herbs and cut flowers, but can be further diversified to include products such as timber and fiber. As perennial and evolving systems, FF are often justified by the goal of stability for self-maintenance and self-renewal. Stability is a result of consistency and resilience of ecosystem functions within the system (Jacke & Toesmeier, 2005). As perennial systems, the system self-renews as the flora return year after year. Jacke & Toesmeier (2005) who proposed these five unifying goals, go to great lengths to clarify the meaning of self-maintenance and self-renewal, suggesting “maintenance is the grunt labor of running an ecosystem: getting nutrients where they’re needed, supplying water, harvesting crops, planting plants, and so on... ‘largely self-maintaining’ [means] that many or most of these tasks are in the hands of the system itself” and is altogether separate from self-management, or “envisioning the future [of the system] and marshaling the forces required to get there” (pp. 48). Ecosystem health is a response to stability of ecosystem functions and its ability for self-renewal. Lastly, FF often elicit and cultivate new paradigms for human interaction and participation with their ecologies as people interact with and within a new type of landscape.

These unifying factors of FF are referred to through this thesis as Typology 1: Food Forest Characteristics (typology 1, table 1.1). Although this typology is useful in assessing the design of CFF, it does not provide a framework for the various aspects of community use within the system.

## 2.3 UN MEA typology

The role of CFF as a piece of PbFS can be better understood by assessing the ES they provide. Set forth by the Millennium Ecosystem Assessment (MEA), human well-being and livelihood depend upon the provisioning of ES (United Nations, 2005). Natural resource managers, policymakers and stakeholders have broadly used the MEA framework to better understand the ES of a landscape and their contributions to human well-being (United Nations, 2005; Zagarola et al., 2014). The MEA defines ES as benefits people obtain from an ecosystem based on categorizations of supporting, regulating, provisioning and cultural services (United Nations, 2005).

- *Provisioning services (PS)*: goods provided or produced by an ecosystem for direct use or consumption (e.g., food, fuel, fiber).
- *Cultural services (CS)*: Non-material benefits from an ecosystem (e.g., recreational, spiritual, aesthetic, educational).
- *Regulating services (RS)*: Benefits from regulation of ecosystem processes (e.g., water purification, climate regulation, pest control, pollination)
- *Supporting services (SS)*: Underlying system processes and functions required to produce ecosystem services (e.g., soil formation, nutrient cycling, primary production).

The typology set forth in the MAE is broadly accepted, yet there is no universally agreed upon definition of ES or typology for their classification. Boyd and Banzhaf (2007) proposed a new definition of *final ecosystem services* as “components of nature, directly enjoyed, consumed, or used to yield human well-being,” distinguishing ecosystem services from its benefits, structures, and functions. (Boyd and Banzhaf, 2007, 619). Boyd and Banzhaf’s definition of ES is particularly useful to provide a metric for quantifiable and measurable final services by acknowledging the importance of ecosystem benefits as value-added inputs to measurable final services and thus not separate metrics in themselves (Boyd and Bandzaf, 2007; Fisher et al., 2009). While this definition has utility as a consistent metric to be applied across contexts,

Fisher et al. (2009) suggest how we classify ES informs the ecosystem characteristics under question and the context in which the ecosystem services are being investigated.

This project uses the MEA broad definition of ES and subsequent typology justified by the ecosystem characteristics and specific research questions of this study (Zagarola, Anderson, and Veteto, 2014). The ecosystem characteristics of a CFF encompass both social and ecological provisions and therefore require acknowledgement of unquantifiable benefits (i.e., cultural services) as well as ecosystem structures and functions (i.e., regulating and supporting services). Furthermore, the aim of this research is to address user perceptions of value as opposed to monetary or economic value.

The MEA typology is referred to throughout this thesis as: typology 2: U.N. Millennium Ecosystem Assessment (MEA) and provides the basis for the deductive approach in assessing CFF in practice (chapter 2) and the case study of perceived value (chapter 3).

The three typologies are referenced in varying degrees throughout the following two chapters of this thesis (table 1.1). Typology 2 serves as the main lens used to analyze the role and utility of CFF for the community of users and ecology of a place. Typology 3 helps situate the results of chapter 2 and 3 within the wider PbFS discourse. Typology 1 serves as a “fence” to understand the basic functional intention of food forests as built systems. These three typologies provide the framework for the scoping review and case study of CFF.

Table 1.1: Three typologies used to analyze CFF. Typology 1: Jacke and Toesmeier (2005); Typology 2: United Nations Millennium Ecosystem Assessment (2005); Typology 3: adapted from DeLind, (2011)

Typology	Coding Nodes
<b>Typology 1: Food Forest Characteristics</b>	<ol style="list-style-type: none"> <li>1. Economic sustainability</li> <li>2. Provisionary food and non-food products</li> <li>3. Recontextualization of humans with their ecologies</li> <li>4. Self-maintenance and renewal</li> <li>5. Ecosystem health</li> </ol>
<b>Typology 2: U.N. Millennium Ecosystem Assessment (MEA)</b>	<ol style="list-style-type: none"> <li>1. Cultural Services:               <ol style="list-style-type: none"> <li>a. Cultural Heritage</li> <li>b. Environmental education</li> <li>c. Inspiration</li> <li>d. Recreation</li> <li>e. Sense of place</li> <li>f. Social connection</li> <li>g. Spiritual or religious</li> </ol> </li> <li>2. Provisionary Services:               <ol style="list-style-type: none"> <li>a. Food products</li> <li>b. Fresh water</li> <li>c. Genetic information</li> <li>d. Medicinals</li> <li>e. Non-food products</li> </ol> </li> <li>3. Regulating Services:               <ol style="list-style-type: none"> <li>a. Habitat</li> <li>b. Improved air quality</li> <li>c. Mitigating climate change</li> <li>d. Pest regulation</li> <li>e. Water purification</li> <li>f. Water regulation (flooding, runoff, erosion)</li> </ol> </li> <li>4. Supporting Services:               <ol style="list-style-type: none"> <li>a. Nutrient cycling</li> <li>b. Photosynthesis</li> <li>c. Soil formation</li> <li>d. Water cycling</li> </ol> </li> </ol>
<b>Typology 3: Place-based Food Systems (PbFS)</b>	<ol style="list-style-type: none"> <li>1. Equity (social and economic)</li> <li>2. Food citizenship</li> <li>3. Place-building</li> <li>4. Sustainability</li> </ol>

CFF are still novel systems in the United States and the academic research surrounding the utility of CFF is scarce. As social-ecological systems they can be adapted to meet the goals, needs, and ecological conditions of their specific community and place. Built upon the frameworks of PbFS, unifying factors of FF, and MEA ES typology, the following chapters seek to understand and assess the unique role that CFF might play in alternative food systems. In chapter two I will first look at the state of

the academic knowledge surrounding CFF as well as the goals and mission statements of CFF in the United States. This scoping review will identify gaps in knowledge, areas for future research, and serve as justification for a place-based assessment of a specific CFF. In chapter 3 I will answer the call of chapter 2 by conducting a place-based assessment of ES through a case study of the 6<sup>th</sup> Ward Garden Park in Helena, MT. This case study will address user perceptions and usage of ES provided by the CFF. The results of chapters 2 and 3 argue for the utility of CFF to be more widely studied and implemented within the multifaceted networks of PbFS.



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# **CHAPTER 2. SCOPING REVIEW OF COMMUNITY FOOD FORESTS: IN STUDY AND IN PRACTICE**

## **1. Introduction**

The first phase of my research was to conduct a scoping review of community food forests (CFF) in the academic literature and in practice. In order to understand the role of CFF as part of a PbFS and the ES benefits they provide, it is first essential to assess our current knowledge and identify any gaps that might exist. This chapter stands on its own as a resource and call to action for researchers and practitioners as well as a justification for the final chapter of this thesis project.

The scope of this review falls within the prevailing definition of food forestry but is further specified by the inclusion of community as: a multistory, perennial, food-based system, designed to mimic the natural structures and functions of the ecology of a place in the form of a public commons, providing a place where people can collaboratively grow food (Jacke & Toensmeier, 2005; Crawford, 2010; Bukowski, 2018). This definition will limit the reviews incorporated into my study to freely accessible perennial, polyculture, and tree integrating spaces designed for public use regardless of the terminology set forth in the article. I will also include research-based food forests designed for the collection of ecological or biological data. These criteria will exclude systems that may exist at universities or schools for campus use unless clearly stated access is open to the public. Orchards that do not include multistory layering components, individual household plots, or systems for commercial use will be excluded based upon my defined CFF criteria. In order to address how community food forests are or are not being evaluated in the academic and grey literature and the purpose of systems established, I conducted a scoping review guided by two questions: 1) How and where are community (or public access) food forests being represented in the academic and grey literature? 2) What are the functions and goals of the systems being established?

## 2. Methods

I conducted a scoping review of the literature in order to identify peer reviewed English-language scholarly journal articles that addressed specifically, or included generally, CFF as well as grey literature (magazine articles, trade journals, reports, and theses). The academic literature was limited to Northern America and Europe. The inclusion and exclusion criteria were established before the review began. A record of excluded documents is included in a separate database, in addition to a justification for their exclusion. A review of the mission and vision statements of established CFF in the United States was then conducted. A review of the peer-reviewed literature and a review of the goals and objectives of established projects provide the background to my thesis project, understanding users' perceptions of the ES provided by CFF.

### 2.1 Document Search

Research question one is dependent upon the academic literature. My search of the peer reviewed literature consisted of keywords that have been used to describe FF and CFF across various disciplines throughout the existing literature. Keywords identified by Clark and Nicholas (2013), Russo et al. (2017), and Park et al. (2019) provided a starting point that was then narrowed down based on my predetermined definition of a community food forest. The final search query used was:

"edible forest\*" OR "edible urban forest\*" OR "forest farm\*" OR "food forest\*" OR "forest garden\*" OR "forestry food production" OR "permaculture garden\*" OR "tree garden" OR "community orchard\*" OR "edible green infrastructure" OR "edible landscap\*"

The initial keyword search was conducted October 2020 in the AGRICOLA and Agriculture & Environmental Science Database. An additional search was conducted October 2020 in the Web of Science Core Collection. I widened my search to include grey literature for comparison of years published and author classification of CFF.

Research question two required a review of the CFF projects that have been or are being established. Some of this information was informed by the grey literature found in my scoping review. Identification of known and established CFF came from the self-reported initiatives at: <https://communityfoodforests.com> as well as through Google and Facebook searches. Document selection consisted of any mission or vision statements with a web presence (e.g., Facebook page, website, or journalistic interview). The search was limited to the United States.

## 2.2 Document selection

Peer-reviewed literature were screened in three rounds (table 2.1). The first round of screening took place on the database interface through the use of the title and keywords. Any article that could potentially fall into the inclusion criteria was imported into Mendeley for a second round of screening. The second round of screening consisted primarily of reading the abstract. Any article that could potentially fall into the inclusion criteria was kept for a third round of screening, and any that were deemed to fall outside of my inclusion criteria were documented with a reason given. The third round consisted of a final evaluation and a full read of the article when necessary. Any documents that fell outside of my criteria were recorded and justified.

Table 2.1: Inclusion and exclusion criteria of literature search

Inclusion	Exclusion
Phase 1: Keyword search of title, keywords, and abstract <ul style="list-style-type: none"> <li>• English</li> <li>• Published up to October 2020</li> <li>• Web of Science Core Collection; AGRICOLA and Agriculture and Environmental Science database</li> <li>• North America (U.S. and Canada) and Europe including Russia</li> <li>• Including grey literature</li> </ul>	<ul style="list-style-type: none"> <li>• Non-English</li> <li>• Not available in searched databases</li> <li>• Systems geographically located outside of study scope</li> </ul>
Phase 2: title, keywords, and abstract review (and brief review of text when necessary) <ul style="list-style-type: none"> <li>• Abstracts that used the relevant terms: (community food forests, urban food forestry, forest garden systems, community orchards)</li> <li>• Abstracts that did not use the key terms stated above but addressed food production on public landscapes</li> </ul>	<ul style="list-style-type: none"> <li>• Home-scale or commercial food forests</li> <li>• Community gardens that were not public access with perennial, tree-based, polyculture components</li> <li>• Orchards that were not public access with perennial polyculture components</li> <li>• University and school food forests that were not publicly accessible</li> <li>• Urban foraging without a community food forest component</li> </ul>
Phase 3: Full text review to select documents that were clearly addressing or had sufficient description/attention to community food forests as I defined them.	<ul style="list-style-type: none"> <li>• Articles that mentioned community food forests in passing without enough attention to codify them.</li> <li>• See exclusion criteria for Phase 2.</li> </ul>

### 3.3 Classification and categorization criteria

The classifications of literature review sources to answer research question one was established inductively based upon the keywords provided by the author, or when necessary, based upon my own reading of the source. To synthesize the peer reviewed literature and answer research question two, analysis was deductive based upon typologies set forth in the literature. Typology 1 was provided by Jacke and Toesmeier’s (2005) unifying goals of food forests, Typology 2 was taken directly from the UN Millennium Ecosystem Assessment (MEA), and Typology 3 was my adaptation of various place-based food system frameworks within the literature as suggested by DeLind (2011) (table 2.2). Justification and framework for all typologies is provided in chapter 1 of this thesis. There is evident overlap of coding nodes between the three typologies, so each typology was coded and analyzed separately. References were made to articles that did not fit into the deductive framework. Two additional interest points were coded that did not fall within the existing typologies: references to permaculture and inclusion within a broader food collective. All categorization and coding were done in NVivo.

Table 2: Typology classifications; Typology 1: Jacke and Toesmeier (2005); Typology 2: United Nations, Millennium Ecosystem Assessment (2005); Typology 3: DeLind, (2011)

Typology	Coding Nodes
<b>Typology 1: Food Forest Characteristics</b>	Aim 1: Economic sustainability Aim 2: Provisionary food and non-food products Aim 3: Recontextualization of humans with their ecologies Aim 4: Self-maintenance and renewal Aim 5: Ecosystem health
<b>Typology 2: U.N. Millennium Ecosystem Assessment (MEA)</b>	Cultural Services: Cultural Heritage Environmental education Inspiration Recreation Sense of place Social connection Spiritual or religious Provisionary Services: Food products Fresh water Genetic information Medicinals Non-food products Regulating Services: Habitat Improved air quality Mitigating climate change Pest regulation Water purification Water regulation (flooding, runoff, erosion) Supporting Services: Nutrient cycling Photosynthesis Soil formation Water cycling
<b>Typology 3: Place-based Food Systems (PbFS)</b>	Equity (social and economic) Food citizenship Place-building Sustainability



### 3. Results and Discussion

#### 3.1 Peer- reviewed articles selected

A total of 28 peer-reviewed articles were selected after three rounds of screening. An additional 27 sources were noted as reference points. These were non-peer reviewed or trade-journal articles, magazine articles, books, one thesis and one UN report. Of the peer-review articles selected, 83% were published in the past five years (since 2015) (figure 2.1). This is compared to the number of the non-peer reviewed literature, of which only 48% were published in the last five years. Of the peer-reviewed articles, 10 sources were published in “Urban Forestry and Urban Greening” which put out a special 2018 issue addressing Urban Food Forestry in the first recognition of the need for additional academic and peer-reviewed research (Riolo, 2019).

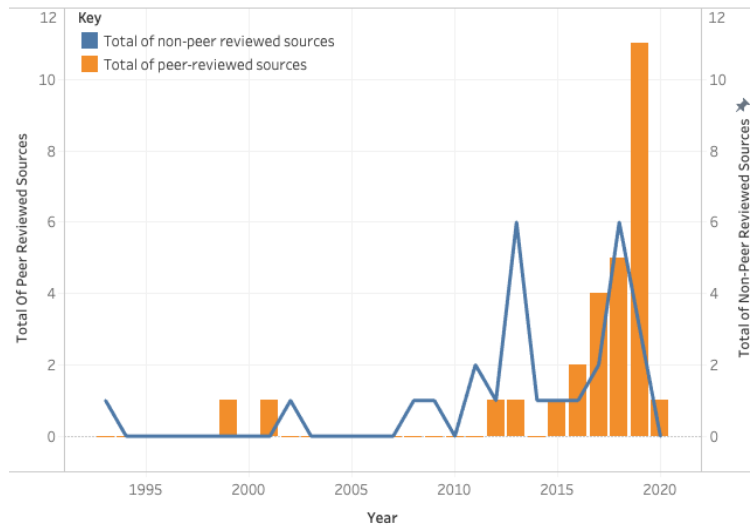


Figure 2.1: Peer reviewed literature published over time as compared to grey literature.

Of the peer-reviewed articles selected, nine classifications emerged: Urban Agriculture (UA), Agroforestry, Community Orchard, Ecological Literacy, Ecology, Edible Green Infrastructure (EGI), Forest Garden Systems (FGS), Permaculture, Political Ecology, Urban Food Forestry (UFF), and Community Food Forestry (CFF) (figure 2.2). Each article was ascribed at least one classification based on how the authors categorized their work. Some of the articles fell into more than one classification. UA had the majority (28.33%) of coding references followed by FGS (16.67%) and Agroforestry (15%)

(figure 2.2). Within the UA classification, half of the coding references (52.94%) were related to UFF while just under half of the coding references (41.18%) were related to UA broadly (figure 2.2). Only one peer-reviewed journal article was classified as directly identifying a CFF as the subject of research. The peer reviewed journal articles and their classification are provided in table 2.3.

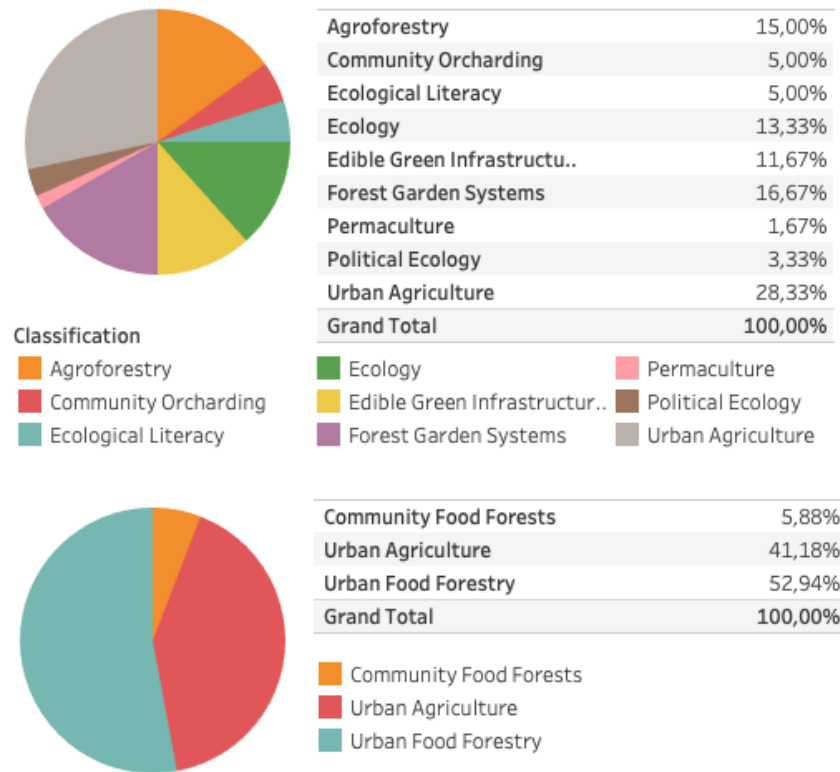


Figure 2.2: Percentage of coding references of peer-reviewed journal articles for each classification and sub-UA classification.

Of the grey literature, the distribution of classification differed from the peer-reviewed classification distribution. UA had a clear majority of coding references (61.1%) followed by EGI (16.1%) and community orcharding (9.7%) (figure 2.3). When investigated further, CFF made up 67% of the coding references within UA, with general UA and UFF classifying 23.45% and 9.55% of the coding references respectively (figure 2.3).

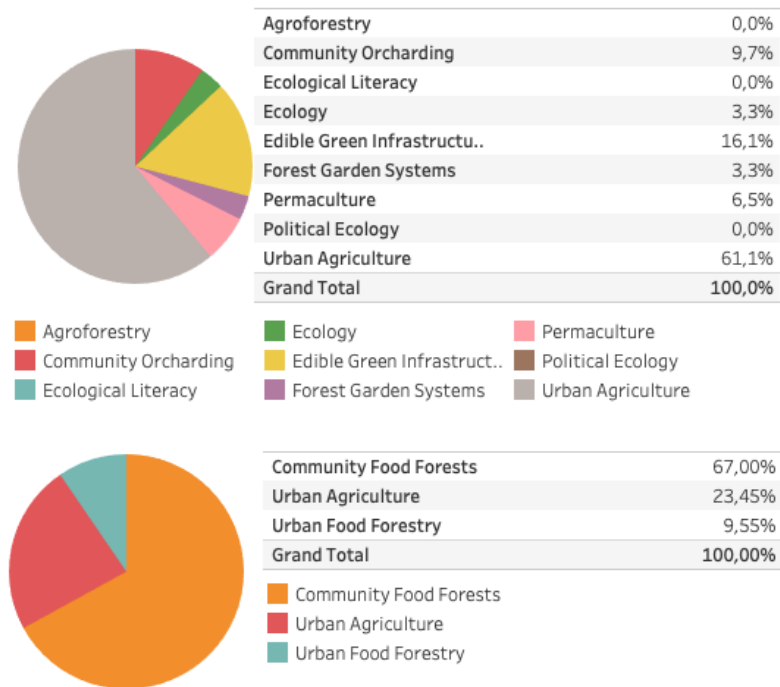


Figure 2.3: Percentage of coding references of non-peer reviewed references for each classification as well as UA sub-classifications.

### 3.1.1 Reviews

Of the 28 scholarly peer-reviewed articles included, 4 were reviews of the academic literature and 3 were reviews of management plans and tree-incorporating food initiatives. CFF were broadly incorporated in UA, EGI, agroforestry, and community orchard reviews. Park et al. (2019) offered the most specified review of tree-based urban food systems in order to address the need for a common understanding of how UFF is used in the literature. More broadly, Lin et al. (2015) included CFF in their review of UA, concluding that the structural heterogeneity (vertical and horizontal), diversity of native plants, and restoration of soils of previously impermeable surfaces are characteristics of UA that have been shown to directly increase biodiversity, pollination, pest regulation and climatic resilience. These characteristics and subsequent benefits suggest CFF can be an appropriate component of UA to address sustainability and development goals (Lin et al., 2015; Kowalsi & Tenley, 2019). Russio et al. (2017) included CFF in a systematic review of EGI and the associated provisionary ecosystem services, trade-offs, and disservices, concluding that EGI can contribute to the social, economic, and ecological sustainability and resilience of urban areas. Wartman et al. (2018) reviewed FGS from an agroforestry perspective, identifying the lack of peer-reviewed research compared with the momentum the systems are

gaining in practice. The authors suggest temperate FGS provide a unique opportunity to combine food production with “cultural principle that prioritize people, the land, and water over profits” to serve as avenues for actively transforming industrial agriculture by confronting “societal patterns of imperialism, capitalism, white privilege, and patriarchy” (Wartman et al., 2018, pp.12).

Three reviews synthesized and analyzed management plans including urban forestry management plans (Kowalsi & Tenley, 2019), community orcharding projects (Betz et al., 2017), and urban food trees (Clark & Nicholas, 2013). Clark & Nicholas (2013) is identified as a landmark publication, introducing the concept of UFF to combine UA with urban forestry based upon agroforestry ecology principles. As multifunctional landscapes, UFF can provide a suite of ecosystem services along with an untapped potential “to contribute to urban sustainability via increased food security and landscape multifunctionality” (Clark & Nicholas, 2013, pp. 1649). According to the authors, UFF systems have experienced a rapid establishment since 2008—much like the trend seen in CFF establishment (figure 2.4).

Table 2.3: Results of peer-reviewed classifications. Riolo, 2019 represents the one peer reviewed article directly addressing user values of CFF.

REFERENCES	
Reviews	Clark et al., 2013; Lin et al., 2015 ; Betz et al., 2017; Russo et al., 2017; Wartman et al., 2018; Kowalski & Conway, 2019; Park et al., 2019
Cultural Services & Objective 5	<u>Ecological literacy</u> : Askerlund & Almers, 2016; Almers et al., 2018; Hammerson et al., 2019 Howe & Wheeler, 1999; McLain et al., 2012; Stoltz & Schaffer, 2018; Farrier et al., 2019; Linares, 2018; Miedema, 2019; <b>Riolo, 2019</b>
Regulating and Supporting Services & Objective 2 & 3	Park et al., 2017 ; Wartman et al.; 2017; Park & Higgs, 2018; Lehmann et al., 2019; Schafer et al., 2019
Provisionary Services & Objective 2	Beck et al., 2001; Björklund, et al., 2019; Nytofte & Henriksen, 2019
Equity and Citizenship	Leeuw, 2016

### 3.1.2 Provisioning services and Goal 1

Central to CFF is *food*, without food CFF would be an entirely different system. UFF, as defined by Clark & Nicholas (2013), identify four benefits directly associated with food production: 1) an increase in food available through the transformation of non-provisioning landscapes to provisioning landscapes; 2) marked increase in equitable access to free food within neighborhoods; 3) food provisions are nutrient dense and can serve to address malnutrition; 4) limited capacity to serve as buffers to food stability. As expected, Park et al. (2019) found food provision as the primary functionality of tree-based systems associated with UA and community gardening. Although food production is an essential component in all CFFs, the amount of peer-reviewed literature addressing food provision potential is limited. Only one peer-reviewed experimental study sought to estimate the energy and micronutrient content of food production yield in a temperate food forest system, concluding that in order for a system to provide a significant impact on urban food security, systems would have to be scaled up significantly from the 0.08ha experimental plot (Nytofte & Henriksen, 2019). Nytofte & Henriksen (2019) suggest converting municipality owned land into community owned and operated food forests would increase yield while maintaining lower cost/labor requirements along economies of scale. Björklund et al., (2019) reviewed various food-species composition in Sweden to address climate specific species design. Food production was referenced in relation to community development (Farrier et al., 2019; Riolo, 2019), place connection (Howe & Wheeler, 1999; Farrier et al., 2019; Riolo, 2019), decentralized food initiatives (Wartman et al., 2018; Miedema, 2019; Riolo, 2019), and incorporation in urban planning initiatives (McLain et al., 2012; Riolo, 2019). Within the peer-reviewed literature, no studies specifically addressed non-food provisionary services although they are recognized as being provisionary benefits offered by CFFs (Russio et al., 2017).

### 3.1.3 Cultural Services and Goal 5

Like food, *community* is an essential component of CFF, suggesting cultural services relating to community and social interactions would be primary functions of CFF. Park et al. (2019) identified social

connections, recreation, environmental education, and reconnection with nature to be secondary functionalities of UFF within the literature. Contrary to the Park et al. (2019) review of tree-based food systems, community was more referenced and evaluated in CFF peer-reviewed literature with 10 (35.7%) articles addressing community, place, and additional cultural services (table 2.3).

Social connection and place identification were the most observed cultural services cited in the peer reviewed literature. Miedema (2019) observes CFF can be a part of a decentralized place-based food initiative where community-sufficiency replaces individual self-sufficiency by increasing resilience by through redundancy. As PbFS explore and institute multiple expressions of UA, more opportunities exist for communities to take part in various avenues of social connection and place identification. Farrier et al. (2019) evaluates Todmorden, a uniquely decentralized place-based food system holistically embracing an edible and communal landscape model. Participating residents in Todmorden identified an increase in place identification through connection and participation with the food production of their locality (Anonymous, 2013; Farrier et al., 2019). Community-centric food growing “can be an important and holistic place-making tool—promoting health, wellbeing, ecological sustainability, distinctiveness and belonging” (Farrier et al., 2019, pp.20). In response to placelessness and non-places of the industrial food system, community food growing initiatives can “act as a focus for the community to come together...and help create a sense of local distinctiveness—a sense that each particular place, however ordinary, is unique and has value” (Howe & Wheeler, 1999, pp.15).

Riolo (2019) presented the only observational study of the use and perceived value of a specific food forest. The author offered many achievements of the project, beginning with reframing the historical municipal “do not touch” role of urban forests and gardens. With hands-on community involvement, the Picasso Food Forest was able “to make fresh produce and other edibles accessible to the community “reconnecting them to healthy eating habits, food growing, and the special experience of foraging and harvesting food directly from the plant in a nature-like setting” (Riolo, 2019, pp.10). The ecological complexity and diversity of the Picasso Food Forest is reconnecting people to nature (Goal 5), and

challenging “nature deficit disorders” more holistically than parks or traditional gardens (Riolo, 2019). Unlike traditional gardens, often both the structure and a built goal of CFF is to facilitate a hands-on sensory learning environment, in which children and adults aren’t merely in outdoor spaces but are *engaging with* the outdoor space. Human well-being is not explicitly indicated within the MEA typology and marks a flaw in the deductive classification. The mental and physical health benefits from human-nature interactions and nutritious food have been recognized in the literature. Stoltz & Schaffer (2018) suggest the salutogenic effects of EFG in particular, such as responding to stress and fatigue, encouragement of pro-environmental behaviors, and social cohesion, are untapped benefits worth further study. In addition to sense of place, social connection, and human well-being, the intentional hands-on nature of CFF make them unique tools for environmental education.

A collective out of Sweden organized a multi-study initiative to examine the role of FGS on environmental literacy and environmental pedagogy in children (Askerland & Almer, 2016; Almers et al., 2018; Hammerson et al., 2019). Drawing on ecological literacy literature, Hammerson et al. (2019) observed an increase in the “holistic view [of nature] where humans are part of, rather than separate from, the natural world” among the children of a three-year study (pp. 237). Common themes throughout these three studies reflect upon the role FGS plays in the development of ecological literacy in children; specifically feeling a sense of belonging (Almers et al., 2018; Hammerson et al., 2019), experience of oneself as part of a system (Askerlund & Almers, 2016; Almers et al., 2018), knowledge of human-environment co-creation (Askerland & Almer, 2016; Almers et al., 2018), and creatively imagining place-transformation (Almers et al., 2018).

### 3.1.4 Regulating and supporting services and Goals 2 and 3

Regulating and supporting services provided by CFF are grounded in the science of agroecology and commonly cited as justification for the sustainability of CFF and similar projects. The need for sustainable food production systems that either restore or increase ecosystem health have contributed to

the growth of UA, UFF, and EGI. The peer-reviewed literature frequently references the provision of regulating and provisioning services provided by CFF but with limited empirical studies.

Ecological benefits (supporting and regulating services) were cited throughout the literature as part of the untapped-potential of tree-based food production systems. Carbon storage and climate mitigation along with ecosystem health is often cited as an argument for their establishment. There has been substantial attention given to the ecological benefit of trees; however, only 3 (10%) of peer-reviewed articles responded to Clark & Nicholas' (2013) call to provide empirical evaluation of the ecological potential of specific forms of UFF. In an experimental food forest in Devon, UK. Lehmann et al., (2019) found an estimated  $39.53 \pm 4.05 \text{ Mg C ha}^{-1}$  to be stored in living biomass, suggesting the potential of food forests to “store a considerable amount of carbon that is at least within a similar range to other literature sourced urban and peri-urban land uses” (pp.6). Schafer et al. (2019) confirmed the role of a diverse understory in contributing to carbon storage, suggesting “temperate food forests encompass a noteworthy addition to the carbon stock in temperate food forests compared to other food production systems such as agriculture and pastures” (pp.7). Wartman et al. (2017) found increased tree growth to be a benefit of apple trees grown in FGS compared to grass understory systems.

CFF are often cited as providing and contributing to the ecological integrity of a landscape (Jacke & Toensmeier, 2005; Kumar and Nair, 2006; Crawford, 2010; Higgs, 2017; Park et al., 2017). Park & Higgs (2018) and Park et al. (2017) established a framework for evaluating food forest projects against restoration goals. Park et al. (2017) concluded that food forests have a “potential as an urban restoration tool in terms of enhancing the multifunctionality of heterogeneous landscapes undergoing significant changes” (pp. 284). The 2017 evaluation of the restorative potential of food forests resulted in the evaluative framework for monitoring CFF against restoration goals to inform adaptive management (Parks & Higgs, 2018).



### 3.1.5 PbFS goals: Equity, Food Citizenship, Place-building, and Sustainability

Along with place-building and sustainability (as referenced in 3.4 & 3.5), equity and food citizenship are foundational objectives of alternative food frameworks (DeLind, 2011). In a case study of the Lower Ninth Ward in New Orleans, Leeuw (2016) applied the concepts of Political Ecology and space creation to “untangle the interconnected economic, political, social, and ecological process that go together to form highly uneven and deeply unjust urban landscapes” (pp.1 citing Swyngedouw and Heynen, 2003). Leeuw (2016) suggests that community gardens and CFF can serve as a way for communities to exercise food citizenship by claiming a right to “determine the form, function, utility, and accessibility of neighborhood amenities” on neighborhood scales “offering profound potential for broader social change” (pp.1). In addition to food citizenship and equity, Leeuw (2016) highlights themes of place-building and points to CFF and community gardens as avenues “to sustain and strengthen the historically self-sufficient and deeply-rooted community of the Lower Ninth Ward of New Orleans” by using food traditions to “build community, revitalize the neighborhood, and preserve cultural heritage” (pp.14 citing [www.backyardgardenersnetwork.org](http://www.backyardgardenersnetwork.org)).

### 3.1.6 Challenges Identified

CFF have only been minimally studied in the peer-reviewed literature. As novel systems in their infancy, there are many challenges associated with them. One significant challenge is the time requirement in establishing a mature system. In comparison to annual produce gardens, the development of a complex, multistory, perennial system is a slow and long-term process (Riolo, 2019). Although they are intended to be self-maintaining and self-renewing systems, CFF require high initial labor, cost, and energy input. Beck et al. (2001) empirically evaluate sustainability through energy analysis, or the solar energy cost of all the inputs and outputs of the system. They suggested the economic inputs along with the size and age of plots would all affect the sustainability of the system. They found the initial energy requirements were much higher for the EFG compared to lawn or ornamental garden, and suggested energy and sustainability ratios might not break even until much later, if at all (Beck et al., 2001). Russo

et al. (2017) suggest maintenance, pruning, and water needs of fruit trees may generate higher overhead cost but identify a need for more specific study of disservices and trade-offs. Possibly more challenging than the time requirement is the people requirement.

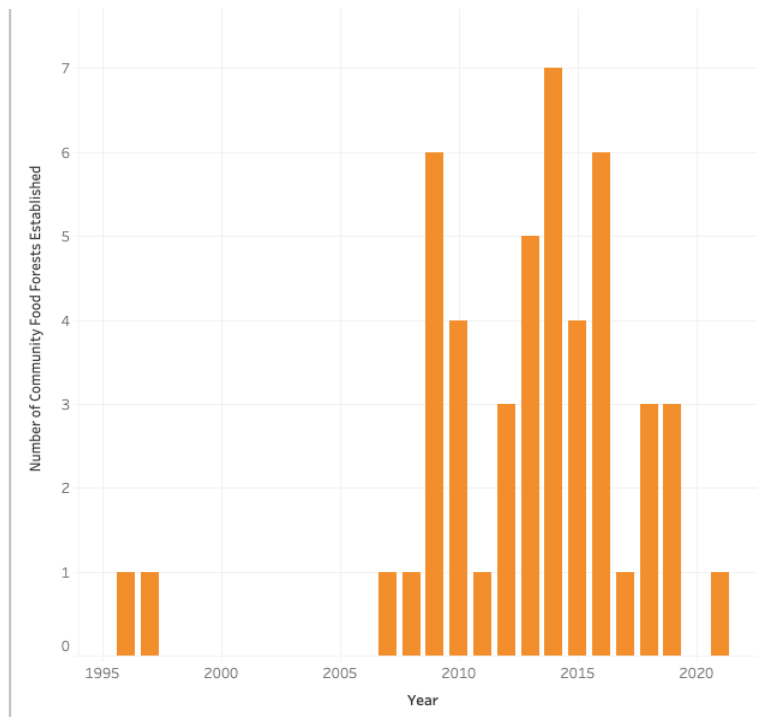
Community is essential for building, maintaining, and using CFF. Ecosystems can adapt, grow, and thrive without human input, but a CFF relies on a community. Human failure (burn out, loss of interest, relocation) has been identified as the main factor in system failure (Taylor, 2014 interviewing Dave Jacke). CFF are in their infancy in the U.S. and organizing communities around such a system is an adaptive process. How CFF represent the community of place is another aspect in need of further investigation. Leeuw (2016) suggests CFF can be a form of food citizenship within neighborhoods to serve and engage the population of the surrounding community. During initial development, Beacon Hill (Seattle, WA) noted that although the site was chosen for its ethnic diversity, the volunteers that showed up were almost entirely white residents of different neighborhoods (Taylor, 2014). Disparity of representation was identified as an opportunity for development at the 6<sup>th</sup> Ward Garden Park (Helena, MT, Chapter 3), suggesting the question of place-diversity within CFF participation (or representation of who is actually involved verses who is living in proximity) requires further investigation.

## 3.2 Community Food Forest in Practice

### 3.2.1 Characteristics

A total of 84 CFF were identified out of a self-reporting database, Facebook, Google, and grey literature searches. Out of those identified, 53 had a web presence with a mission or vision statements, half were still clearly operational, and a third were connected to broader food collaborations. The majority of the projects recorded were established in the past 12 years (since 2008) (figure 2.4). It must be noted that the analysis is skewed towards the CFF that had an established web presence. Some mission statements were more elaborate than others. To prevent skewing towards more detailed statements, the following analysis is referencing the number of coded sources rather than coded references. Additional limitations in this analysis come from the deductive approach. I approached analyzing and discussing

established projects from a three-fold typology in an effort to capture all potential purposes of the CFF projects. I attempted to note where this process fell short. This review is most likely passing over less



formal, grassroots initiatives, which are worth further investigation for inclusion. Likewise, future research might assess the longevity and stability of grassroots movements vs. municipally organized projects which remains outside the scope of this review.

Figure 2.4: Number of CFF projects per year based on self-reported “start date” (either when the project broke ground, began initial meetings or opened to the public).

### 3.2.2 MEA (Typology 2)

Overwhelmingly, more cultural services were referenced in the vision and mission statements compared to provisionary, supporting, and regulating services (figure 2.5). Of the 53 mission and vision statements, 51 referenced cultural services of some type. The majority of those references fell into environmental education (77%), social connection (68%), and sense of place (25%) (figure 2.5). Environmental education goals were expressed as demonstration sites, educational center spaces, connection to local school curriculums, and attention to food literacy. The Bengal Alley Street Park (San

Francisco, CA) is one of many sites that intentionally prioritized goals of education by designing a “living laboratory” to “host site activities that build ecoliteracy” (Bengal Alley Street Park, n.d.). The Roger Williams Park Edible Forest Garden (Providence, RI) was intentionally designed to not only be a living classroom for environmental education but also an educational model for alternative urban landscape management (Scialla, 2012). The Green Belt Food Forests (Greenbelt, MD) built in opportunities for community connection through education by “[facilitating] multigenerational social and regenerative educational opportunities through collaboration with schools, after school programs, the city government, and other volunteer-based grounds” (Green Belt Food Forest, 2014). Still other CFF connected educational goals to community sufficiency such as the 6<sup>th</sup> Ward Garden Park (Helena, MT), which aims to “increase food security by empowering people to grow their own food” (6<sup>th</sup> Ward Garden Park, n.d.). Of the provisionary services, 95% of the statements referenced the intention to provide food. When referencing food, most statements addressed the novelty of providing freely accessible public food by providing a “fair share for all” (Beacon Food Forest, n.d.). In the instance of the Auburn Permaculture Park (Auburn, NY), plan designs were meant to “[replace] resource intensive lawn with edible forest gardens and food forests in public parks and along public pathways [to] make fresh fruits, nuts, and vegetables abundant and available for everyone” (Auburn Permaculture Park, 2015). Other projects were born out of municipal initiatives to address issues of food security. The Atlanta Food Forest (Atlanta, GA) is a byproduct of the city initiative to get 85% of the city residents within half a mile of fresh food by 2021 (Henderson, 2019). Although CFF are intended to provided food and non-food benefits, additional provisionary benefits were hardly referenced in the CFF mission statements, with medicinals being the second most referenced at only 9% of the sources.

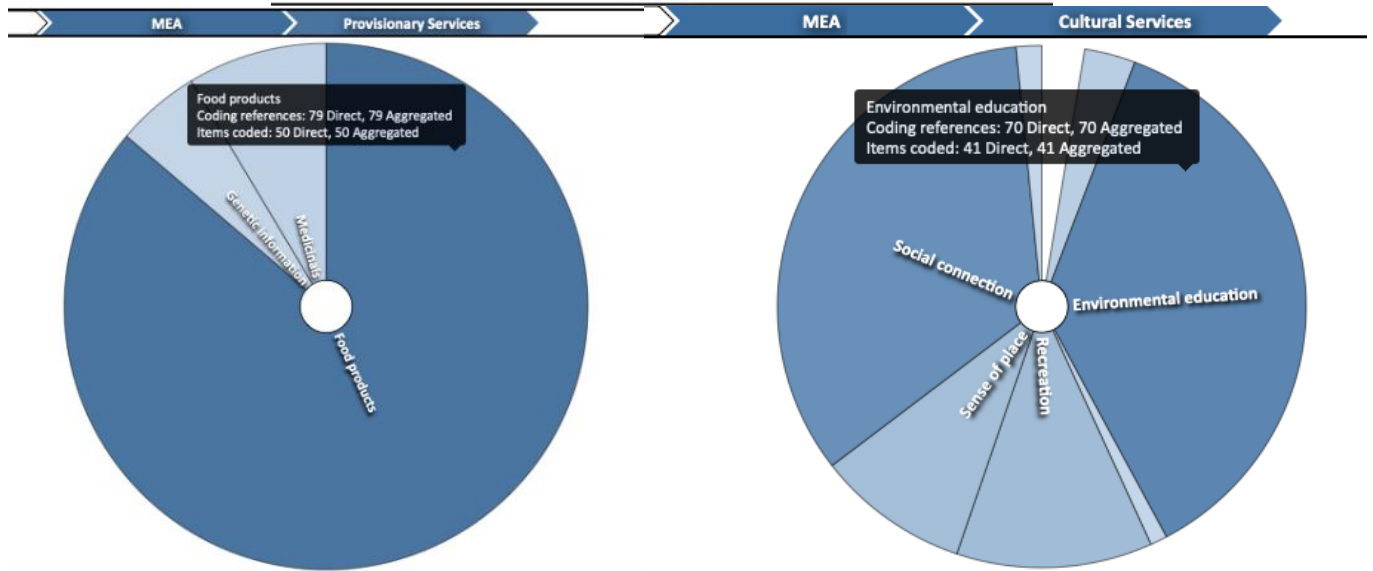
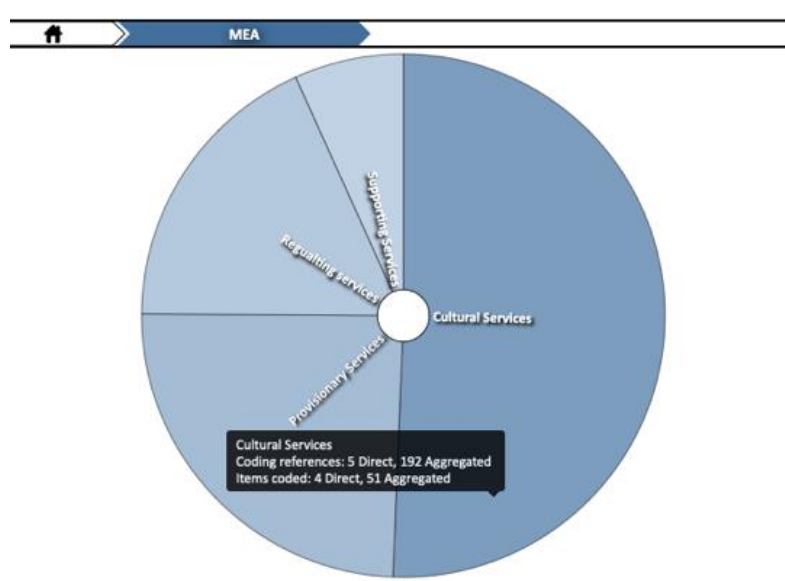


Figure 2.5: MEA percentage of coding references and cultural/provisionary services references.

Regulating and supporting services were referenced in 56% of the mission statements, giving attention to the ability of these systems to serve ecological goals such as habitat formation, provision of beneficial pollinators and pest predators, water retention, and soil health. Three systems in particular were established with the specific intention to regenerate and rehabilitate the landscape (Ferry Forest Garden, Grayson Food Forest, Growing Together). Issues related to water retention and regulation were the regulatory service most referenced and addressed in climate specific ways based on geographic place. Along the Virginia coast where rain can be over abundant, the Northside Civic League Food Forest (Norfolk, VA) was designed as a rain retention garden as part of the effort to “engage Norfolk residents in a city-wide, systemic approach to water management” (Northside Food Forest, 2018). Based on the

design and structure, CFF is intended to absorb “over 3,000 gallons of stormwater, helping reduce localized flooding” (Northside Food Forest, 2018). The Glendale Public Library Food Forests (Glendale, AZ) faces a much different climate. In an arid region, the system was designed to capture and store as much rainwater as possible (Hines, 2018). The Bee Inspired Gardens in Moab, Utah are designed to attend specifically to increasing climatic variability by both catching as much rainwater as possible and increasing soil water retention through groundcover shading (Brain et al., 2017).

While all four of the MEA typologies were represented in the CFF mission statements, cultural services were both more diverse and more heavily referenced. The MAE typology proved to be a clear system for analyzing the intended benefits and goals of individual CFF projects. The following sections will demonstrate that there were intended goals that fell outside of the MEA classification.

### 3.2.3 Unifying Food Forest Characteristics (Typology 1)

The Food Forest Characteristics are meant to be unifying goals of all food forests and have significant overlap with the MEA typology in referencing the provision of food and non-food service and ecosystem health. The goals of self-maintenance and renewal were explicitly identified in 26% of the statements. In Auburn Park (Auburn, NY) the ecological complexity to mimic the structure and function of a natural forest was meant to create an ecological system that was “self-watering, self-weeding, self-fertilizing and highly productive with little to no maintenance” (Auburn Permaculture Park, 2015). Although the goal of complete system “self” care is highly idealized, most projects referenced the goal to *minimize* maintenance needs and external inputs. The Hazelwood Food Forest (Pittsburg, PA) recognized the goal of low maintenance to be time sensitive, “hoping someday that the food forest will be a self-sustaining entity” (Hazelwood Food Forest, n.d.). Self-maintenance and self-renewal can serve to support the goal of economic sustainability. The Mesa Harmony Garden (Santa Barbara, CA), for example, “aims to grow and share as much nutritious food as [they] can through a low-maintenance system using as few resources as possible...water, people, and money” (Mesa Harmony Garden, n.d.). In Nashville, the CFF model was a community-appropriate solution in which people power, through a diverse collaboration of

people and skills, replaced high budget power to create “low-tech solutions to problems in [the] landscape (Nashville Urban Food Forest, 2013). The Wetherby Park Edible Forests (Iowa City, IA) intends to take economic sustainability into the community as well, aiming to decrease grocery bills by providing “baskets of delicious fresh food available for grazing and storing” (Whetherby Edible Food Forest, n.d.). Goals of economic stability were harder to interpret as they could include maintenance costs, long term ecological stability, and food access aspects. While some information was gained by examining “economic sustainability” it did not prove to be a helpful categorization and would benefit from more specification. Similarly, recontextualization of humans and their ecologies proved to be too broad of a category and harder to analyze. Working to restore sense of place, environmental education, and land heritage could be understood however as the process of recontextualizing humans with their ecologies.

### 3.2.4 PbFS (Typology 3)

The four PbFS goals of place-building, sustainability, equity, and food citizenship were fairly equally reflected in the mission statement of existing CFF initiatives (figure 2.6). Place-building and sustainability were well reflected in the other typologies. Equity and food citizenship were two significant goals of CFF projects that were not accounted for in the MEA and Food Forest Characteristics. Community preferences and community grassroots participation were key elements in the systems being established. Particularly in urban settings, CFF were meant to be community initiatives predicated upon community involvement, to serve the decided needs of the community of a place. Food access concerns were reflected in the need to provide free and accessible, nutrient-rich produce with the intent to increase community level food sufficiency and resilience. As reflected in the Prairie Ally Food Forest (Luverne, MN), the goal is “to make food available to anyone at any time, as long as the food is ready for harvest, without needing to provide proof of income. If someone is hungry, curious, or just wants to enjoy fresh, local, healthy food, he or she is welcome to harvest” (Project Food Forest, n.d.). The Beacon Hill (Seattle, WA) mission statement addresses issues of equity and citizenship most explicitly with the intent to “cultivate a community dedicated to building equitable food systems for all people” as they “work to

dismantle an unjust food system rooted in white supremacy and conquest by nurturing its replacement” (Beacon Food Forest, n.d.). The Beacon Hill Food Forest aims at being a form of resistance to the dominating and prevailing food system through “open harvest and collaboration within and among communities.... inclusive to all in need of food” (Beacon Food Forest, n.d.). CFF can serve as novel solutions of resistance to the institutional barriers preventing food access within community populations. The Philadelphia Orchard Project (POP, Philadelphia, PA) reflects, “despite the prominent number of community gardens, the city is still home to several food deserts, neighborhoods in which fresh produce is expensive and difficult to access” due to the fee requirements, discretionary time, and basic farming knowledge needed to take advantage of them (PFF, 2020). POP seeks to remove those barriers by “working to bring food sovereignty and self-sufficiency to residents of Philadelphia via...non-traditional community gardens on underappreciated, vacant land” (PFF, 2020). The location of these projects reflected goals of equity, place-building, sustainability and food citizenship.

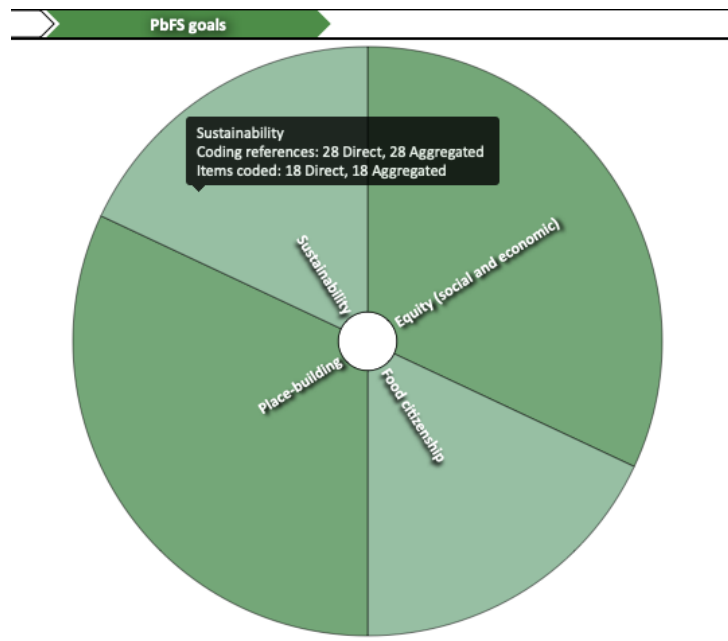


Figure 2.6: PbFS characteristics as represented in CFF mission statements.

The CFFs ranged from grassroot city initiatives reflective of guerrilla gardening movement to formal elements of city urban forestry plans. Repurposing of vacant land for productive community provision was a common motivation for place-choice. The Mesa Harmony Garden (Santa Barbara, CA)



was built to serve the “practical purpose of putting previously vacant land into productive use for our community, with all the food we produce available for donation to local organizations serving people in need...with a mission to share knowledge and experience about the sustainable production of food in an urban setting.” (Mesa Harmony Garden, n.d.). These vacant lots are transformed, “bringing neighbors together to make use of vacant lots for food production, education, and community building” as a community resource to provide food and place for the community (Fargo Forest Garden, n.d.). In an act of reclaiming the commons, vacant land is being transformed and turned into places of community empowerment as well as sources of food provision. CFF “[rely] on the principle that commons can be sustainably managed where people know each other, trust each other, and work together in caring for a place” (Swale Barge, n.d.). Understanding how place location supports or hinders the goals of the projects would benefit from further study.

The goals of PbFS are interconnected and often mutually supporting. Analyzing the mission statements and goals of CFF through this framework provided greater insight into the transformative potential of these projects in their relative context. The goals of PbFS are in essence place specific. A third of the CFF documented were explicitly linked to larger community-based food initiatives. Understanding the utility of CFF as a cog in a larger place-based food *system* would benefit from in-depth case studies of specific projects.

## 4. Conclusion

The peer-reviewed studies included provide a starting point for examining the “untapped potential” of CFF to serve a range of ES. In 2013, Clark & Nicholas called for an increase in qualitative and quantitative case studies to identify the value of UFF, the extent of their potential, and their management strategies. This call has started to be answered (figure 2.1). I would further suggest that certain manifestations of UA, UFF, EGI, and agroforestry practices have been disproportionately studied over others, with CFF significantly underrepresented in the scholarly literature (figure 2.2). There remains

an existing need to “compare the functionality of different urban food systems and practices that involve trees” to better inform design, implementation, and management to meet specific ecological and/or social goals (Park et al., 2019, pp.8). The nuanced differences and areas of overlap between UFF, FGS, agroforestry, UA and edible landscaping are resulting in the bypassing of CFF in the academic literature. Lumping community food forests in with other forms of agroforestry, UA or edible landscaping can result in a misunderstanding of their benefits and services and an underappreciation for the non-food related benefits they can provide.

CFF as a *piece* of a place-based food *system* is in its infancy. Current projects are developing and adapting as examples of success and failures for future projects. As the analysis of mission statements reflects, food provision does not seem to be the primary benefit of these systems. The hard-to-quantify benefits of community-building, place-attachment, education, community-place transformation, resistance to inequities, and platforms for civic involvement appear to be where the true value of these projects lie. CFF are not meant to replace other sustainable and equitable means of food production within the system. Predicated and dependent upon community engagement and participation, they have the “untapped potential” to provide their own unique benefits.

We are left with the question, why does it matter *how* CFF are being represented in the peer-reviewed literature? Communities of practice can gain momentum in their own right. As more projects develop, transforming a community’s relationship to place and food through hands-on engagement, CFF can gain their own legitimacy. Understanding the successes, failures, and adaptive capacity to address systemic concerns such as equity and food citizenship, or scientific capabilities such as habitat building and soil provision, will require attention of the scientific community. Concerted attention in the peer reviewed literature can only serve to legitimize their untapped potential, removing barriers to their establishment. We are still left with a lingering question, what really is the extent of the untapped potential of Community Food Forests? Answers will only come through specific observations of communities in practice.

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# **CHAPTER 3. MORE THAN FOOD: A CASE STUDY OF USER VALUES AT 6TH WARD GARDEN PARK, HELENA MT**

## **1. Introduction**

The final phase of my research was to conduct a case study of user's perceptions and values of a community food forest (CFF). After assessing the role of CFF in literature and in the vision and mission statements of operating parks (chapter 2), it was critical to understand how users are actively interacting with a like-system. The results of chapter 2 clearly identify a gap in the academic understanding of the role of CFF for a community of users. As novel systems, it is critical to assess how they are actively being valued. By understanding the use and perception of CFF, food forests can be better incorporated into place-based food systems.

### **1.1 Guiding Typologies**

This study employs three different typologies to analyze the qualitative data. The purpose of multiple typologies is to account for the limits of one particular framework when employing a deductive analysis. Typology 1 is adapted from Jacke and Toesmeier (2005) unifying goals of food forests, Typology 2 was taken directly from the UN Millennium Ecosystem Assessment (MEA) (2005), and Typology 3 is my own adaptation of various place-based food system (PbFS) frameworks within the literature as suggested by DeLind (2011) (table 3.1). Justification and review of these typologies is presented in Chapter 1 section 2 of this thesis. There is evident overlap of coding nodes between the three typologies, so each typology was coded and analyzed separately.

Table 3.1: Three typologies used to analyze CFF. Typology 1: Jacke and Toesmeier (2005); Typology 2: United Nations, Millennium Ecosystem Assessment (2005); Typology 3: adapted from DeLind, (2011)

Typology	Coding Nodes
<b>Typology 1: Food Forest Characteristics</b>	Aim 1: Economic sustainability Aim 2: Provisionary food and non-food products Aim 3: Recontextualization of humans with their ecologies Aim 4: Self-maintenance and renewal Aim 5: Ecosystem health
<b>Typology 2: U.N. Millennium Ecosystem Assessment (MEA)</b>	Cultural Services: Cultural Heritage Environmental education Inspiration Recreation Sense of place Social connection Spiritual or religious Provisionary Services: Food products Fresh water Genetic information Medicinals Non-food products Regulating Services: Habitat Improved air quality Mitigating climate change Pest regulation Water purification Water regulation (flooding, runoff, erosion) Supporting Services: Nutrient cycling Photosynthesis Soil formation Water cycling
<b>Typology 3: Place-based Food Systems (PbFS)</b>	Equity (social and economic) Food citizenship Place-building Sustainability

## 1.2 Background

6<sup>th</sup> Ward Garden Park is a community food forest located in Helena, MT. The origins of the park are rooted in a permaculture design workshop hosted in Helena in 2013 with Dave Jacke. The permaculture design course was a three-day workshop with around twenty participants. The workshop consisted of permaculture practice and group design education. As part of the workshop, participants split



into three groups to collaboratively come up with conceptual designs for the garden park. A public meeting allowed for the community to give input to the design teams for further collaboration and refinement. The final group designs were then incorporated into one design with the help of Jacke and a local landscape architect. The 2013 workshop culminated in a “Design and Implementation Report” which consisted of the proposed park design and narrative regarding its purpose. The 6<sup>th</sup> Ward Garden Park planning committee continued meeting throughout 2014 to specify species lists and specific species placement. Ground was broken for soil development during the fall of 2015 and planting begun the spring of 2016.

The location of the 6<sup>th</sup> Ward Garden Park previously housed a community playground, baseball field, and small summer wading pool for the neighborhood. Over time the playground and community pool gave way to a construction staging ground for the Helena Area Transit Service building. The 6<sup>th</sup> Ward Garden Park itself, and the location, are now owned by the city of Helena as part of Helena City Parks and Recreation Department. The city both owns the land and pays the water cost needed to support the ecological system. Seasonal city workers are responsible for the routine maintenance and park upkeep. At the beginning of the project the initial startup committee did significant amount of fundraising and a critical donor provided the bulk of the financial start up required for purchasing of plant material and supplies to build the park. Since the beginning, 6<sup>th</sup> Ward Garden Park has been a collaborative project. City stakeholders include Helena Food Share, Helena Parks and Recreation Department, Helena Community Gardens, Margaret Stuart Youth Homes, Lewis and Clark Public Health, MSU Extension, and community members.

The 6<sup>th</sup> Ward Garden Park acknowledges the commonalities of community food forest projects within its mission statement. The project is a “space for the community that promotes ecological, social, and economic revitalization” (aim 2, 3 and 4),” while working to “increase food security by empowering people to grow their own food” (aim 1 and 5) (6<sup>th</sup> Ward Garden Park, n.d.). The layout of the park embodies these aims. The garden is planted with patches to mimic natural woodland ecosystem

succession and relationships (aim 2), fruit and nut trees to provide the overstory to berry shrubs and medicinals (aim 1), and picnic areas and community garden plots serve as additional gathering points for the community (aim 5). As a natural ecosystem evolves back and forth along a spectrum of succession, so too does 6th Ward Garden park as it “continues to evolve into an inclusive, engaging space where the community can meet, learn, play, relax, grow and enjoy food” (6th Ward Garden Park, n.d.).

## 2. Methods

### 2.1 Place-based assessment of ecosystem services

The research was carried out as a qualitative case study to address the perceived value of ecosystem services (ES) provided by the 6<sup>th</sup> Ward Garden Park to its community of users. This project follows a framework for conducting a place-based assessment of ecosystem services as outlined by Potschin & Haines-Young (2013). Potschin & Haines-Young (2013) ground place-based assessments in place-based thinking in which context is paramount. The authors suggest, “place-based approach provides an understanding of context through a deliberative process, designed to reveal how different people or groups see a place, and what visions and values they bring to assessing the significance of past and future change” Potschin & Haines-Young, 2013, pp. 1060.

ES assessments provide support and information necessary for decision makers (Potschin and Haines-Young, 2013). To date, most ES assessments have focused on biophysical or value-based metrics, often overlooking the perceptions and values of ES to the people of a place (Cowling et al., 2008). Increasing attention has been given to place-based assessments of ES in order to understand how communities of users perceive of the ES provided by a landscape and assign relative value (Cowling et al., 2008). Potschin & Haines-Young (2013) assert that “place [provides] the context in which the problems can be recognized and articulated, and within which different values can be understood, conflicts resolved, and choices made” (Potschin & Haines-Young, 2013, pp.1054). A focus on ‘place’ can

then serve to clarify and identify the important ES issues for a community and their well-being (Potschin & Haines-Young, 2013).

Place-based assessments are particularly useful to inform land management decisions by more adequately identifying perceptions of intangible or cultural ES, needs, and values (Asah et al., 2012; Potschin and Haines-Young, 2013). Potschin and Haines-Young (2013) exert that a cultural approach provides context to reveal a people's perceptions of a place relevant to all the categories of ES set forth in MEA typology. As assessments are place specific, findings must, and can only be, understood "in the environmental, economic, and socio-cultural settings of a specific landscape or region" (Potschin & Haines-Young, 2013, pp.1055 citing Wu, 2006).

A place-based assessment of ecosystem services is grounded within the ES model, which values the benefits people obtain from an ecosystem to manage the underlying processes and functions necessary to support those benefits (Asah et al., 2012). Frameworks, such as the typology set forth in the MEA, are beneficial in acknowledging the externalized services and benefits of a landscape. There is no universally established framework for conducting place-based assessments of ES. The Institution of Environmental Sciences (IES) (2013) put together the Ecosystem Service Assessment: how to do one in practice. This assessment provides the framework for conducting a general ES assessment. It is worth noting this framework gives specific emphasis on economic valuation as opposed to a place-based assessment; however, the guiding framework is transferable (table 3.2). Potschin & Haines-Young (2013) adapted this framework for developing a place-based assessment (table 3.3). The literature provides a range of methodological examples of place-based assessments dependent on the scale of the ecosystem and scope of the community in question. Common across assessments is the use of interviews (open ended and semi-structured) of key informants to inform a survey analysis. Qualitative interviews are an essential component of place-based assessments by providing space for respondents to provide personal accounts and reflect upon perceptions of benefits received from the environment. Common threads of inquiry are delineated based upon the ES framework used by the principal investigator (often following the typology set forth by the MEA) to be further refined based upon the ecosystem and place of interest. Common

across assessments is the use of interviews (open-ended and semi-structured) of key informants to inform a survey analysis. The use of a mixed-methods qualitative approach is particularly useful for gathering information pertaining to the community of users’ opinions, perceptions, and lived experiences (Hay, 2005).

Table 3.2: Framework for ecosystem service assessment adapted from the *Ecosystem service assessment: How to do one in practice* (Everard M. & Waters R., 2013).

1. Identify area of study	Geographic boundary Ecosystem services present Key stakeholders
2. Identify purpose of the assessment	Assessing user perceptions? * Economic valuation of the system? Risk assessment?
3. Assess	Methodology informed by 1 and 2
4. Presentation of results	For place-based assessments results may include: <ul style="list-style-type: none"> <li>• Key areas of provision</li> <li>• Who benefits currently: key “winners” and “losers” across service categories</li> <li>• Desired service enhancements (areas of value and importance)</li> <li>• Necessary measures to address enhancements</li> <li>• Assessment of benefit-to-cost ratio</li> </ul>

Table 3.3: Framework for developing a place-based assessment of ecosystem services as authored by Potschin & Haines-Young (2013).

Question	Rationale
1 What are the ecosystem services associated with this place that matter to peoples’ well-being?	Helps in setting the conceptual and spatial boundaries to the assessment; defines the place of concern
2 How are these services generated? Do they arise locally or are they generated outside the place or area being considered?	Identification of dependencies and cross-scale issues in relation to the supply of services; helps explore the links between the place of interest and other places
3 How important is each of these services, to which individuals or groups, and for what reasons? Do people outside the area also depend on these services?	Helps to identify who has a stake in the deliberations about the place and their needs, and develops understanding of the spatial relationships between one place and other places
4 How can the importance of these services be prioritised or valued?	Opens up discussions about how values should be assessed and compared (e.g., using individual vs community values; monetary vs non-monetary)
5 Do we expect to have enough of each of these services either here or elsewhere in the future?	Highlight the issues surrounding the notion of living with environmental limits and questions about sustainability of natural capital
6 What, if anything, could replace or substitute for each of the benefits obtained from these services, either here or elsewhere?	Links to question 4, and further explores the nature of criticality, compensation and substitutability of benefits; provides a riches insight into the relationships between different places
7 What kinds of management or policy actions are needed to protect or enhance these services and in particular how might actions directed towards one service impact or enhance another?	Helps in understanding the acceptability of management or policy interventions to different stakeholder groups and the identification of potential trade-offs and conflicts and how they might be resolved

To my knowledge this approach has not yet been applied to a community food forest system. One reason may be the scale in which assessments often take place. Within the literature, ES research takes place in larger land-use areas (i.e., national forests, state parks, surrounding landscapes of a community, etc.). The scale of a community food forest is significantly smaller than ecosystems generally assessed; yet they are distinct and unique ecosystems in which the range of ES is intentionally managed. Although the scale of the project is small, assessment of user values and perceptions of ES is essential for management and adaptive capacity of the project. The differentiation in scale did not appear to pose an issue in using a place-based ecosystem service assessment as a guideline for research inquiry. The methodology modeled after a place-based ecosystem service assessment provided the data necessary to address user perceptions in order to analyze the relative importance of benefits, services, and functions of the specific community food forest to its particular community of users. User perceptions of ecosystem services within a community food forest will serve to identify: 1) the extent to which relative values align with the civic agriculture movement; 2) the relative importance of provided ecosystem services to community food forest participants, which will inform leadership planning for maintained user involvement; and 3) where perceptions of ecosystem services align between project leadership and its community of users for increased project synergy and/or acknowledgement of potential gaps in ecosystem service knowledge.

## 2.2 Study Site

This case study takes place at the 6th Ward Garden Park in Helena, MT. The park is Montana's first public edible landscape situated on a 1.1-acre plot within city limits (figure 3.1). The park was designed in 2013 using a patchy, multi-strata layering system to mimic the heterogeneous structure and function of a natural forest. The park is located in the 6th Ward of Helena, Montana, a lower income neighborhood that has been relatively neglected in city revitalization initiatives. Community stakeholders involved in the establishment and ongoing maintenance of the park include Helena Parks and Recreation, Helena Food Share, Helena Community Gardens, Lewis and Clark Public Health and individual

community members. In this study, leadership is used to refer to individuals on the current Advisory Council as well as those involved in the planning and implementation of the food forest. Community refers to the general community of users (Helenites involved in the Food Forest to any degree: from occasional visitors of the park to the coalition of community stakeholders).



Figure 3.1: Sixth Ward Garden Park concept design map. Source: 6thwardgardenpark.com, n.d.

### 2.3 Visitation and pilot testing

I visited 6<sup>th</sup> Ward Garden Park a handful of times over the summer and fall of 2020. My proposed methodology was amended as the COVID-19 pandemic increased in Montana and greater restrictions were put in place. The intent was to partake in volunteer workdays and group educational events to increase community connection and time spent with users of the park. Throughout the course of this research, COVID-19 prevented social gatherings at the park.

After developing the survey, it was pilot tested within a local place-based experiential farm system, the Program in Ecological Agriculture and Sustainability (PEAS Farm, Missoula, MT). About 12 students at the PEAS Farm took the survey and provided feedback. The PEAS farm displays some of the key characteristics of the 6<sup>th</sup> Ward Garden Park as an experiential learning site operated, at least in part,

by a community of volunteers (university students), and engaging with the range of ES. One CSA member with the PEAS Farm piloted the interview view and provided feedback before I began interviews with the 6<sup>th</sup> Ward Garden Park Advisory Council.

## 2.5 Survey and semi-structured interviews

A key informant provided access to the 6<sup>th</sup> Ward Garden Park and a 400+ person listserv of park users. Without access to park users, I conducted four pre-survey interviews with my key informant and contacts on the 6<sup>th</sup> Ward Garden Park Advisory Council. These interviews lasted between forty minutes to one hour. These initial interviews presented no new “services” of the Garden Park that appeared missing from the MEA typology. The survey was amended to include some additional information deemed helpful for the Advisory Council, but no major changes were made to the MEA typology and no reason for abandoning the typology was presented. Two lines of sub questions were created, one for those involved in the project’s planning and establishment and one for general users of the park (Appendix A). I went forward by releasing the survey to the 6<sup>th</sup> Ward Garden Park listserv and placing flyers with a QR code to the survey at the park for any visitors not included in the listserv in October 2020.

The survey was conducted entirely online through Qualtrics and distributed through a MailChimp listserv. The survey was entirely anonymous with an additional question to opt-in to a follow-up semi-structured interview. 73 surveys were recorded. Semi-structured interviews allowed respondents to elaborate and reflect upon their perceptions of landscape benefits and personal usage of 6<sup>th</sup> Ward Garden Park. I conducted these interviews from October 2020 through January 2021. A total of 15 interviews lasting between twenty minutes to one hour were recorded and transcribed for analysis. Upon transcription the recorded interviews were deleted, and informant kept anonymous.

## 2.6 Data analysis

I used a deductive approach based upon the three typologies presented in chapter 1 with specific focus on the MEA ES typology. I left flexibility to identify additional categories of service not embedded

within the MEA ES typology, should they present themselves. I analyzed survey data through Qualtrics and coded and analyzed semi-structured interviews in NVivo.

### 3. Results

Place-based assessments of ES depend upon survey and interview data to collectively identify and distinguish perceived benefits of a system to its community of users. These results are intended to inform park leadership and decision makers by describing who is currently using the park, and what users perceive as beneficial verses how the park is actively being used. Identifying gaps between intended and actual use is necessary to help the built environment adapt to its community of users and project aims. By identifying these gaps, decision makers can better address and project goals, project design, and community planning. In this chapter, I present the results of a user assessment through both survey data and semi-structured interviews to identify the ES present and prominent at 6th Ward Garden Park. This place-based assessment of ecosystem services is based upon the UN Millennium Ecosystem Assessment (MEA) typology: provisioning services (PS), cultural services (CS), and supporting & regulating services (S&R). S&R services are linked in this analysis as there was no differentiation between them among any respondents. The results are based upon a deductive analysis with space to identify any emergent expressions of ES that are not present in the MEA typology.

#### 3.1 Survey Data Demographics

73 surveys were obtained and used in analysis. All survey respondents had a preexisting relationship with 6<sup>th</sup> Ward Garden Park. The distribution of respondents varied across age, household income, years connected, and level of involvement. Household income with respondents varied, with over half of respondents (63%) reporting a household income of \$50,000 or higher (table 3.4). 85.5% of respondents self-identified as white and 71% self-identified as female. Compared to Helena demographics, respondents indicated higher income on average compared to the mean household income of Helena (47% reported >\$75,000) (table 3.4, indicated in red). Additionally, there was a notably higher



female over male involvement when compared to the demographic spread of Helena. While outside of the scope of this study, the gender division of CFF participants warrants its own future research. The remaining categories followed trends similar to census data for Helena city.

Table 3.4: Demographics of 6<sup>th</sup> Ward Garden Park respondents and Helena’s Population \*based on 2019 census data (census.gov)

Respondents from 6 <sup>th</sup> Ward Garden Park			Helena Population*	
	73 respondents		33,124	
Gender	Male Female Non-binary	27% 71% 1%		48% 52% n/a
Age Categories	18-24 25-34 35-44 45-54 55-64 65+	0% 23% 19% 11% 15% 31%	20-29 30-39 40-49 50-59 60-69 70+	13% 15% 11% 12% 15% 12%
Race/ethnicity	White Black or African America American Indian or Alaskan Native Native Hawaiian or Pacific Islander Asian Two or more races Hispanic or Latino, percent White alone, not Hispanic or Latino, percent Prefer not to answer	85.51%  1.45% 1.45%  4.35%  7.25%		93.7% 0.5% 1.2% 0.1% 0.9% 2.8% 4.3% 90.6% n/a
2019 Household Income	< \$25,000 \$25,000 - \$34,999 \$35,000 - \$49,999 \$50,000 - \$74,999 \$75,000 - \$99,999 \$100,000 - \$149,999 > \$150,000	10% 7% 18% 16% 25% 13% 9%	<\$50,000 \$50,000-\$100,000 \$100,000-\$200,000 >\$200,000  Mean household income (in 2019 dollars) 2015-2019 Per capita income in past 12 months (in 2019 dollars) 2015-2019	40.5% 33.3% 22% 4.2%  \$61,324 \$35, 976

The survey was distributed throughout a user listserv of 6<sup>th</sup> Ward Garden Park via multiple MailChimp campaigns. 73 users took the survey over the course of two months. Out of those 73 survey participants, 23 opted into a voluntary interview follow-up with 15 participating in a post-survey interview. The survey primarily functioned as a place-based assessment of ES. Survey participants were asked to first identify all ES they believed the park provided for the community of users and Helena’s ecology. Participants then ranked the top 5 most important ES provided by the park based on their opinion and perception, not necessarily personal usage. Finally, participants were asked to identify which services they used and identify which were personally most important.

### 3.2 Survey Results

Survey data was analyzed as a cohort of 73 respondents and additionally analyzed by subsets pertaining to involvement capacity, years involved, and frequency of food harvesting (table 3.5). Of the 73 survey respondents, 42 identified as visiting the park but not being actively involved in park programs and/or volunteering, classified as “park visitors.” The remaining 42% of respondents indicated some level of participation within the park and are identified as “program participants.” Respondent involvement was weighted toward participants connected to 6<sup>th</sup> Ward Garden Park for more than 5 years at 44% of respondents. The remaining 56% of respondents were distributed throughout the remaining brackets with 12% <1 year involved, 7% 1-2 years involved, 21% 2-3 years involved, and 12% 3-4 years involved. Food harvesting was subclassified along a scale of “often/very often harvest,” “rarely/very rarely harvest,” “rarely/very rarely/never harvest,” and “never harvest.”

Table 3.5: subclassifications of survey response analysis.

Classifications	
COHORT	All 73 respondents
Park visitors	42 respondents who identified as "visit the park a few times a year" or "visit the park throughout the year but not involved in programs or in a volunteering capacity"
Program Participants	27 respondents who identified as "somewhat involved in programs and/or volunteering"; "regularly involved in programs and/or volunteering"; "highly involved in the organization and/or facilitation of programs"
Program Facilitators	6 respondents who identified as "highly involved in the organization and/or facilitation of programs"
>5 years connected	32 respondents who identified as "connected to 6th Ward Garden Park in any capacity" for >5 years.
<5 years connected	38 respondents who identified as "connected to 6th Ward Garden Park in any capacity" for <5 years.
Often/very often harvest	10 respondents who identified as "often or very often" harvest from 6th Ward Garden Park
Rarely/very rarely harvest	27 respondents who identified as "rarely or very rarely" harvest from 6th Ward Garden Park
Rarely/very rarely/never harvest	57 respondents who identified as harvesting "rarely or very rarely" or "do not harvest"
Never harvest	30 respondents who identified as never having harvested from 6th Ward Garden Park

#### 3.2.1 Identified ES provided by the park

Of the 64 respondents who identified ES provided by 6<sup>th</sup> Ward Garden Park, inspiration was the most widely identified at 88% of respondents indicating it as an ES provided by the park (figure 2). Food products were the second most identified ES across the 64 respondents at 83%, followed by pollination,

environmental education, and recreation at 81%, 75%, and 70% respectively (figure 3.2). Pollination was the only supporting or regulating service to be highly identified (or identified by  $\geq 70\%$  of the respondents).

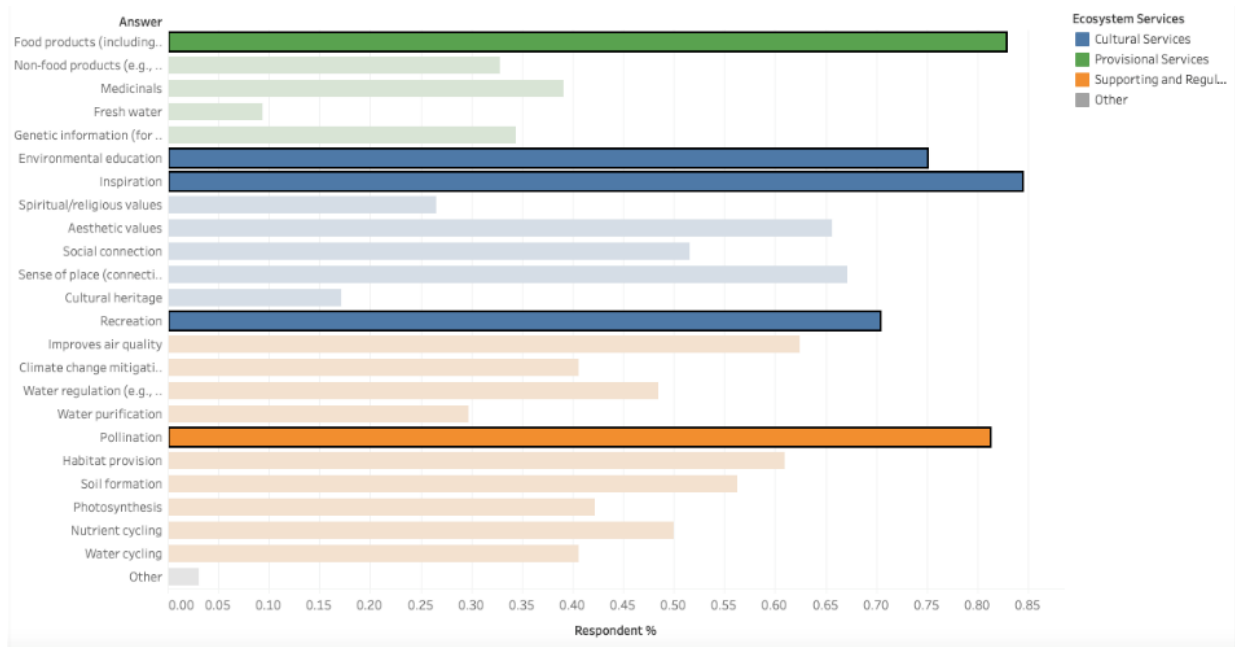


Figure 3.2: ES of 6<sup>th</sup> Ward Garden Park identified by the cohort of respondents. Response % indicated and organized by type of ES. Most highly identified (identified by  $\geq 70\%$  of respondents) ES highlighted.

Inspiration remained the most highly identified ES across subsets apart from respondents with <5 years connected, respondents that never harvest, and respondents that often/very often harvest (table 6). Within these subsets, inspiration was the second most frequently identified ES provided by the park. The subsets of respondents that often/very often harvest and respondents that never harvest most frequently identified food provision as an ES provided by 6<sup>th</sup> Ward Garden Park at 100% and 81% respectively. Among the highly identified ES across subsets, sense of place/connection to the land and aesthetics were also included (table 3.6). More cultural services (inspiration, environmental education, recreation, sense of place/connection to the land, and aesthetics) were more highly identified than provisional services or supporting and regulating services.

Table 3.6: Highly identified (identified by  $\geq 70\%$  of the respondents) ES across subsets

ES provided by the park					
COHORT		>5 YEARS CONNECTED		RARELY/VERY RARELY/NEVER HARVEST	
1 Inspiration	88%	1 Inspiration	87%	1 Inspiration	83%
2 Food provision (including herbs)	83%	2 Food provision	84%	2 Food provision (including herbs)	79%
3 Pollination	81%	3 Sense of place/connection to the land	74%	2 Pollination	79%
4 Environmental education	75%	4 Pollination	71%	3 Environmental education	74%
5 Recreation	70%	4 Recreation	71%		
PARK VISITORS		<5 YEARS CONNECTED		NEVER HARVEST	
1 Inspiration	86%	1 Pollination	91%	1 Food provision (including herbs)	81%
2 Food provision	83%	2 Inspiration	88%	2 Inspiration	77%
3 Pollination	81%	3 Food provision	82%	3 Pollination	73%
4 Environmental education	72%	3 Environmental education	82%		
4 Sense of place/connection to the land	72%	4 Recreation	70%		
		4 Aesthetic values	70%		
PARK PARTICIPANTS		OFTEN/VERY OFTEN HARVEST		RARELY/VERY RARELY HARVESTS	
1 Inspiration	89%	1 Food provision (including herbs)	100%	1 Inspiration	89%
2 Food provision (including herbs)	81%	2 Pollination	90%	1 Recreation	89%
3 Pollination	81%	2 Inspiration	90%	2 Pollination	85%
4 Environmental education	78%	2 Sense of place/connection to the land	90%	3 Food provision (including herbs)	78%
4 Recreation	78%	3 Aesthetic values	80%	3 Aesthetic values	78%
		3 Recreation	80%	3 Environmental education	78%
		3 Environmental education	80%		

### 3.2.2 ES ranking

The cohort of respondents ranked food provision (including herbs) as the ES with the primary importance at 30% of respondents (figure 3.3). Among all subsets, food provision was ranked as the ES of primary importance. The percentage of park visitors and respondents who often/very often harvest, weighted food provision as the primary ES provided by 6<sup>th</sup> Ward Garden Park above the cohort at 40% and 50% respectively. Respondents connected >5 years to the park, park participants, and respondents or who never harvests ranked food provision as the primary ES, but weighted below the cohort's response at 21.74%, 20%, and 22.73% respectively (figure 3.3). Apart from food provision, sense of place (connection to the land) and environmental education appeared in the top 3 responses of the primary ES in subsets with long-term connections to the park (>5 years connected and park participants) (figure 3). Across most subsets more CS were perceived as being of primary importance compared to PS or S&R services. The only subset to weight a PS (food provision) higher than the collective CS or S&R services were respondents who often/very often harvest from the park at 50% of responses compared to 20% of responses (figure 3.3).

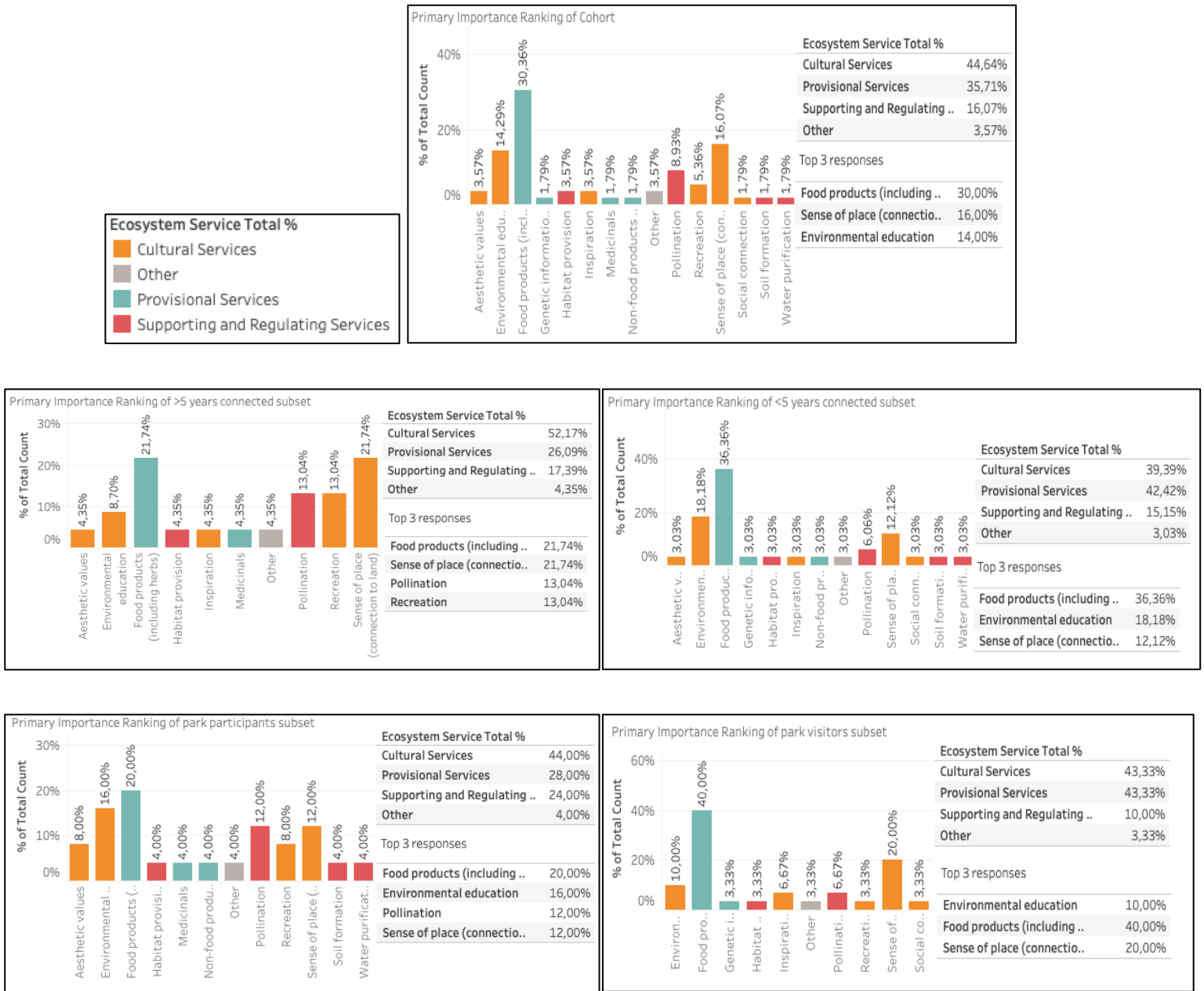


Figure 3.3: Perceived primary ES provided by 6<sup>th</sup> Ward Garden Park for cohort of respondents and across visitation and time connected subsets. Ranked up to top three or >10% identified. Total % of CS, PS, and S&R services indicated.

Environmental education and/or food provision were identified across subsets as the second most important ES provided by the park, reflective of the perceptions of the cohort who identified environmental education as the second most important ES at 20% of respondents and food provision at 11% of respondents (table 3.7). Along with environmental education, habitat provision was identified as

the 2nd most important ES by park participants, those that often/very often harvest, and those that rarely/very rarely harvest. Environmental education and inspiration were identified as the 3rd most important ES across most subsets with the exception of those that never harvest who identified sense of place/connection to the land as the third most important ES at 17%. Pollination was identified as the 5th most important ES across all subsets apart from park participants who ranked pollination higher, as the primary or secondary ES provided by the park. Recreation, social connection, aesthetic values, improved air quality, and soil formation were identified as ES with a rank value in the top five ES provided by 6th Ward Garden Park.

Recreation as an ES was ranked 5th in order of perceived importance by the cohort of respondents. Recreation was more highly ranked by park visitors (3rd) compared to park participants (5th). Aesthetic values only appeared as secondary responses to the 5th most important ES provided by 6th Ward Garden Park. Pollination, habitat provision, improved air quality, and soil formation were the only supporting and regulating services to be identified with rank value. Park participants and respondents with >5 years connected to the park identified more supporting and regulating services compared to park visitors and respondents with <5 years connected to the park. When analyzed by rank importance based on ES categorizations, CS were more highly identified across all ranks and subsets. Although food provision was identified as the most important perceived ES provided by the park, CS (environmental education, inspiration, aesthetic values, social connection, sense of place, and recreation) made up 45% of the total responses compared to 34% of provisionary services (food products, non-food products, and medicinals).

Table 3.7: Perceived rank of ES provided by the park. Percentages listed by cohort and subsets. Ranked up to top three or >10% identified. Top identified ES of each category highlighted.

1ST COHORT	2ND COHORT	3RD COHORT	4TH COHORT	5TH COHORT
30% 1 Food provision (including herbs) 2 Sense of place/connection to the land 3 Environmental education	20% 1 Environmental education 2 Food provision (including herbs) 2 Sense of place/connection to the land 2 Habitat provision	14% 1 Environmental education 2 Inspiration 2 Sense of place/connection to the land	16% 1 Food provision (including herbs) 2 Habitat provision 2 Sense of place/connection to the land 2 Social connection	19% 1 Pollination 2 Aesthetic values 3 Social connection 3 Recreation
40% 1 Food provision (including herbs) 2 Sense of place/connection to the land 3 Environmental education	23% 1 Environmental education 2 Food provision (including herbs) 2 Social connection 2 Inspiration	17% 1 Environmental education 2 Recreation 3 Sense of place/connection to the land	18% 1 Sense of place/connection to the land 2 Food provision 2 Social connection 2 Inspiration	30% 1 Pollination 2 Aesthetic values
20% 1 Habitat provision 1 Environmental education 2 Food provision (including herbs) 3 Pollination 3 Sense of place/connection to the land 2 Sense of place/connection to the land 3 Recreation	17% 1 Habitat provision 1 Environmental education 2 Food provision (including herbs) 2 Pollination 1 Food provision (including herbs) 2 Habitat provision 2 Environmental education 2 Sense of place/connection to the land 2 Social connection 2 Inspiration	16% 1 Inspiration 2 Improves air quality 2 Environmental education 1 Environmental education 2 Sense of place/connection to the land 2 Soil formation	23% 1 Food provision (including herbs) 2 Habitat provision 2 Environmental education 2 Environmental education 2 Environmental education	17% 1 Recreation 2 Social connection 2 Sense of place/connection to the land 2 Sense of place/connection to the land
23% 1 Food provision (including herbs) 3 Pollination 3 Recreation	20% 1 Food provision (including herbs) 2 Habitat provision 2 Environmental education 2 Social connection 2 Sense of place/connection to the land 2 Sense of place/connection to the land 2 Environmental education 2 Social connection 2 Inspiration	24% 1 Environmental education 2 Sense of place/connection to the land 2 Soil formation	21% 1 Sense of place/connection to the land 2 Food provision 3 Pollination 3 Habitat provision 3 Environmental education	22% 1 Pollination 2 Aesthetic values 3 Recreation
36% 1 Food provision (including herbs) 2 Environmental education 3 Sense of place/connection to the land	26% 1 Environmental education 2 Pollination 2 Inspiration 3 Habitat provision	13% 1 Habitat provision 1 Inspiration 1 recreation	16% 1 Food provision (including herbs) 2 Social connection 3 Habitat provision 3 Recreation	17% 1 Pollination 1 Social connection 2 Environmental education
50% 1 Food provision (including herbs) 2 Sense of place/connection to the land/connection to the land	20% 1 Food provision (including herbs) 1 Habitat provision 1 Sense of place/connection to the land	33% 1 Inspiration 2 Recreation 2 Soil formation	22% 1 Food provision (including herbs) 1 Environmental education	22% 1 Pollination
27% 1 Food provision (including herbs) 2 Environmental education 3 Sense of place/connection to the land	20% 1 Environmental education 2 Pollination 2 Inspiration 3 Habitat provision	15% 1 Environmental education 2 Sense of place/connection to the land 3 Habitat provision	18% 1 Food provision (including herbs) 2 Habitat provision 2 Social connection 2 Sense of place/connection to the land	19% 1 Pollination 2 Aesthetic values 3 Recreation
23% 1 Food provision (including herbs) 2 Environmental education 3 Sense of place/connection to the land	35% 1 Environmental education 2 Social connection	17% 1 Sense of place/connection to the land 2 Food provision (including herbs) 2 Habitat provision	18% 1 Food provision (including herbs) 1 Sense of place/connection to the land	21% 1 Pollination 2 Food provision (including herbs) 2 Aesthetic values 2 Sense of place/connection to the land
30% 1 Food provision (including herbs) 2 Environmental education 3 Sense of place/connection to the land	14% 1 Food provision (including herbs) 1 Pollination 1 Habitat provision	22% 1 Environmental education	17% 1 Habitat provision 2 Food provision (including herbs) 2 Pollination 2 Social connection	17% 1 Pollination 1 Recreation 2 Aesthetic values

### 3.2.3 Personal value

Across subsets, there was more variability when asked to identify ES based on personal usage rather than perceived value. 52% of respondents identified using food products (including herbs) and 32% not using any provisional services (table 3.8). Sense of place/connection to the land and environmental education were the most used cultural services across subsets. Only park visitors indicated no usage of cultural services along with sense of place/connection to land at 19% of responses (table 8). Pollination was seen as the most beneficial supporting and regulating service provided by 6<sup>th</sup> Ward Garden Park to Helena’s ecology. Semi-structured interviews were conducted to further identify personal usage and personal value of 6<sup>th</sup> Ward Garden Park.

Table 3.8: Top three or >10% response frequency of ES personal value from the cohort of respondents and across all subsets. % round to the nearest whole integer.

MOST USED PS					
COHORT		>5 YEARS CONNECTED		NEVER HARVEST	
1 Food products (including herbs)	52%	1 Food products (including herbs)	57%	1 None, I don't use any	82%
2 None, I don't use any	32%	2 None, I don't use any	36%	2 Food products (including herbs)	12%
3 Medicinals	12%	3 Medicinals	18%		
PARK VISITORS		<5 YEARS CONNECTED		OFTEN/VERY OFTEN HARVEST	
1 None, I don't use any	48%	1 Food products (including herbs)	57%	1 Food products (including herbs)	100%
2 Food products (including herbs)	41%	2 None, I don't use any	29%		
3 Medicinals	7%	3 Medicinals	7%		
PARK PARTICIPANTS		RARELY/VERY RARELY/NEVER HARVEST		RARELY/VERY RARELY HARVESTS	
1 Food products (including herbs)	65%	1 Food products (including herbs)	40%	1 Food products (including herbs)	61%
2 Medicinals	17%	1 None, I don't use any	40%	2 Medicinals	26%
3 None, I don't use any	13%	2 Medicinals	15%		
MOST USED CS					
COHORT		>5 YEARS CONNECTED		NEVER HARVEST	
1 Sense of place/connection to the land	29%	1 Sense of place/connection to the land	42%	1 Environmental education	33%
2 Environmental education	24%	2 Environmental education	27%	2 None, I don't use any	19%
3 Inspiration	15%	3 Inspiration	15%	3 Social connection	14%
PARK VISITORS		<5 YEARS CONNECTED		OFTEN/VERY OFTEN HARVEST	
1 Sense of place/connection to the land	19%	1 Environmental education	21%	1 Sense of place/connection to the land	56%
1 None, I don't use any	19%	2 Sense of place/connection to the land	17%	2 Inspiration	22%
2 Environmental education	16%	3 Inspiration	14%		
2 Recreation	16%	3 Recreation	14%		
2 Inspiration	16%				
PARK PARTICIPANTS		RARELY/VERY RARELY/NEVER HARVEST		RARELY/VERY RARELY HARVESTS	
1 Sense of place/connection to the land	42%	1 Environmental education	27%	1 Sense of place/connection to the land	38%
2 Environmental education	33%	2 Sense of place/connection to the land	22%	2 Environmental education	21%
3 Inspiration	13%	3 Inspiration	13%	3 Inspiration	17%
MOST BENEFICIAL S&R					
COHORT		>5 YEARS CONNECTED		NEVER HARVEST	
1 Pollination	25%	1 Pollination	30%	1 Soil formation	32%
2 Soil formation	18%	2 Soil formation	19%	2 None, not enough information to answer	14%
3 Habitat provision	16%	3 Climate change mitigation	15%	2 Nutrient cycling	14%
		3 Habitat provision	15%	2 Pollination	14%
PARK VISITORS		<5 YEARS CONNECTED		OFTEN/VERY OFTEN HARVEST	
1 Pollination	19%	1 Pollination	20%	1 Pollination	44%
2 Soil formation	16%	2 Soil formation	17%	2 Habitat provision	22%
2 Habitat provision	16%	2 Habitat provision	17%		
3 Not enough information to answer	13%				
PARK PARTICIPANTS		RARELY/VERY RARELY/NEVER HARVEST		RARELY/VERY RARELY HARVESTS	
1 Pollination	32%	1 Pollination	21%	1 Pollination	28%
2 Soil formation	20%	2 Soil formation	19%	2 Habitat provision	24%
3 Habitat provision	16%	3 Habitat provision	13%	3 Climate change mitigation	12%



### 3.2.4 Food provision - harvesting

When asked “have you ever harvested from 6th Ward Garden Park?” 55% of respondents said yes while 45% said no. Of those who have harvested, the majority (66%) indicated they rarely harvest, with harvesting having little to no economic offset (table 3.9). Within the >5 years connected subset, more respondents indicated having harvested from the park (63%) but with less frequency compared to respondents <5 years connected. Park visitors represented the lowest percentage of respondents who have harvested at 44% with a lower overall frequency compared to park participants who represented the highest percentage of respondents who have harvested at 74% (table 3.9).

Table 3.9: Harvest response and harvest frequency rates for cohort of respondents and across subsets. % rounded to the nearest whole integer. Red indicating a harvesting percentage above the cohort.

Subsets	% of respondents	Have harvested				Have not harvested
		Very often	Often	Rarely	Very rarely	% of respondents
Cohort	55%	5%	24%	66%	5%	45%
> 5 years involved	63%	0%	20%	70%	10%	38%
< 5 years involved	49%	11%	28%	61%	0%	51%
Park visitors	44%	6%	22%	61%	11%	56%
Park participants	74%	5%	25%	70%	0%	26%

When asked to rank their comfort level going to the park, harvesting from the park, and volunteering at the park, the majority of respondents felt very comfortable going to the park (90%) but showed more dispersed feelings regarding harvesting and volunteering comfort levels (table 10). 39% of respondents indicated feelings of neutrality to very uncomfortable harvesting from the park (table 10). Higher levels of harvesting of discomfort were indicated by park visitors, respondents connected to the park for <5 years, and those who never harvest (table 3.9).

Table 3.10: Comfort of harvesting percentages across the cohort of respondents and all subsets. Subsets with harvesting discomfort  $\geq$  to the cohort of respondents at 10.75% are indicated in red.

Subset of Respondents	Comfort	Neutral	Discomfort
Cohort	60.72%	28.57%	10.72%
<5 years connected	56.66%	30.00%	13.33%
>5 years connected	65.39%	26.92%	7.69%
Park participants	76.00%	24.00%	0.00%
Park visitors	48.38%	32.26%	19.36%
Never harvests	20.00%	55.00%	25.00%
Often/very often harvests	100.00%	0.00%	0.00%
Rarely/very rarely harvests	80.77%	15.38%	3.85%
Rarely/very rarely/never harvests	54.35%	32.61%	13.04%

Discomfort harvesting was acknowledged by interviewees as a current issue facing 6<sup>th</sup> Ward Garden Park, suggesting discomfort harvesting is the result of a social conception of what a park is and how it is to be related to:

*... one issue we do have ... is getting people to come and harvest food. You know, when you go to a park, you're not always sure... can I take this apple? Can I take this pear? ... can I pick this?*

Recontextualizing human interactions with food was indicated an intended purpose of the 6<sup>th</sup> Ward Garden Park in design and implementation.

*I mean why ... do we just have shade trees and lawn? If we are going to plant trees, lets plant an orchard. And if we are going to have a lawn, let's make it edible!*

### 3.3 Semi-Structured Interviews

Of the 73 survey participants, 23 opted into a voluntary interview follow-up with 15 completing the post-survey interview. The semi-structured interviews were purposed to expand upon the personal and perceived value of 6<sup>th</sup> Ward Garden Park to its community of users. Of the 15 interviewees, four are current residents of the 6<sup>th</sup> Ward. 11 interviewees have been involved in some capacity since the implementation of the project, with 5 actively involved in the permaculture course that designed the garden park. Six interviewees are active advisory council members (AC). Five were identified as planners and with the remaining 10 as participants. AC members and planners often did not overlap; rather, the AC

reflects community partnerships and stakeholders involved with the project. All respondents are active users of 6<sup>th</sup> Ward Garden Park.

### 3.3.1 Attributing importance to ES

Importance of ES was analyzed by responses to direct questions (i.e., “How do you primarily use the park” and “What do you think is the primary way the park serves Helena and the broader community?”) and frequency with which respondents addressed ES throughout the interview.

Among all interviewees, the focus of users’ personal value centered upon the CS provided by 6<sup>th</sup> Ward Garden Park. When asked “how do you use the park,” all respondents referenced at least one CS compared to 8 out of 15 respondents who additionally indicated some level of supplemental PS. Of the CS referenced, environmental education was the most highly used ES (table 3.11).

Perceptions of 6<sup>th</sup> Ward Garden Park’s primary benefit to Helena’s community and ecology reflected interviewees personal usage (note: some interviewees identified more than one ES) (table 3.11). Everyone identified at least one CS of primary value, with 9 identifying recreation and 8 identifying environmental education. Mental health was indicated by two interviewees citing self-sufficiency and rest/rejuvenation for mental health benefit. 7 interviewees identified food provision with 6 of those responses being linked to issues of food equity and revitalization/provision for the 6<sup>th</sup> Ward neighborhood. Only three respondents identified supporting or regulating services as a primary benefit to Helena (Table 11).

Table 3.11: Interviewees coded responses to questions: “how do you primarily use the park?” and “What do you think is the primary way the park benefits Helena and the broader community?” Interviewees often gave more than one response.

HOW DO YOU USE THE PARK?		PRIMARY WAY THE PARK BENEFITS HELENA?	
<b>Cultural Services</b>	<b>15</b>	<b>Cultural Services</b>	<b>15</b>
Environmental education	8	Recreation	9
Recreation	5	Environmental education	8
Aesthetics	4	Social connection (place-building)	7
Social connection (place-building)	4	Inspiration (demonstration)	4
Volunteering (giving back/sense of purpose)	3	Sense of place (reconnecting humans with their ecologies)	4
Sense of place (reconnecting humans to their ecologies)	3	Mental health (rest/restoration/rejuvenation; self-sufficiency)	2
Inspiration	2	Aesthetics	1
Mental health (rest/restoration/rejuvenation)	1	<b>Provisional Services</b>	<b>7</b>
Personal satisfaction	1	Food provision	7
Cultural heritage	1	<b>Supporting and Regulating Services</b>	<b>3</b>
<b>Provisional Services</b>	<b>8</b>	Pollination	2
Food (snacking/supplemental)	6	Habitat provision	2
Community garden plot	2	Soil development	1
Cut flowers	1	Stacked ecological functions	1
		<b>PbFS</b>	<b>6</b>
		Equity (food access)	6
		Food Citizenship	1

### 3.3.2 Provisioning Services

#### *Food Provision (including herbs)*

All 15 interviewees acknowledged and identified the PS of food (including herbs) as a benefit and use of 6<sup>th</sup> Ward Garden Park. Only one interviewee identified food as a significant use of the park with economic value in reference not to foraging from the park, but to a community garden plot at 6<sup>th</sup> Ward Garden Park. When referencing food provision, 10 out of 15 interviewees referenced food provision in the form of sampling, snacking, and herb supplementation rather than significant harvesting.

*...if there's something ripe, we will taste it and maybe take a little bit home... we've taken, like, cut flowers at times, or herbs, or fruit when it's been in season.*

*I often, um, snag snacks while I'm walking through there too...berries and fruit.*

*It's kind of a hands-on salad bar, I guess, which [the kids] are definitely going to go enjoy, which is kind of unusual for most parks.*

11 out of 15 of those references to food provision overlapped with references to CS of environmental education, inspiration, and recreation or PbFS values of food equity and food citizenship. For some, harvesting at 6<sup>th</sup> Ward Garden Park means connection to a landscape for educational benefit, social connection, and recontextualization to a place:

*[My son] loves picking the berries... it's just a great way for him to go in and learn about these plants... It's just an incredible park, we love it.*

*It's super nice to have that kind of a place to show [my kid] ... because we don't have a garden at home, and I like for them to feel connected to, um what they're eating.*

For others, the free-pick, all-are-welcome policy of 6<sup>th</sup> Ward Garden Park works towards PbFS values of food equity and food citizenship by not only providing actual food, but more importantly providing access and inspiration to food engagement and food citizenship for community residents.

*I think [the park] has been vital to help the people in this particular community and a lot of our low-income housing is not far from...it is within the 6th Ward Boundaries...so I think...there is an opportunity for folks to go down...kids that had never seen strawberries growing, kids that had never seen grapes growing, kids that had never seen fruit on trees that they can pick and...um... and then we have also partnered with Helena Community Gardens that has a portion of the park that allows actually people in the residential area to have their own garden there as well.*

*It's not like [the park] is producing food that puts a dent in anything that is needed ... but it is more of the concept that food can be produced in very unique ways and maybe untraditional ways... it doesn't have to be a 10-acre farm to produce some amount of food. And helping people see what can be produced in their own back yards. And especially during this time...when food is in such peril...and potentially going to be in more peril...that people have an opportunity to start seeing what that can be, and what the potential of your own back yard can be for food growth.*

### 3.3.3 Cultural Services

Although survey respondents indicated food as the most important perceived ES provided by the park (table 6), interviewees discussed the benefits of CS in response to direct questioning and in overall higher frequency compared to PS.

All 15 respondents identified the value of environmental education, 14 identified recreation, and 13 identified environmental education, sense of place, and social connection as important ES for personal and community benefit throughout the interviews.

#### *Environmental education*

Environmental education was the CS most recognized and referenced ES by interviewees, supported by the survey data. All survey subsets, with the exception of users who often/very often harvest, indicated environmental education as the primary or secondary CS of personal use and value. The

prominence of environmental education is rooted in its relevance and use to participants across ages and levels of experience:

*I see it as being, like, a nice thing for my daughter to get some exposure to.... when I was a kid, I had, um, a little garden and things like that where I grew food and picked it, and so I feel like it's just whether she enjoys it or not later on or not, it just seems to me like.... a rite of passage, like everybody should do that you know in a way.*

*I don't have a big background in gardening, but I enjoy, um, kind of dipping my toe in and having that experience, um, and talking to the other... gardeners who happened to be there who can give me some pointers*

*You can garden for decades and still learn so much more, and so I just think it is a really good community ... just sharing that wonderful knowledge...*

In the built environment of a community food forest, environmental education is accessible through both informal experiential/sensory learning and formal community education programming:

*[My son] loves picking the berries... for a kid his age, like three, it's just kind of the perfect space where it's the right size to explore ... with all his senses and getting to taste these different wild plants is just a great learning opportunity for him.*

*We used to do educational events where people would come in from the community and talk about soil, or they would talk about composting.... but every time that a leader is in there and there are kids running around, we try to teach them about the park informally...I think it is a huge educational piece.*

Interviewees identified the relationship between education and a place of community connection as valuable CS the built environment encourages:

*[I love that] there's a community of like-minded individuals that want to establish beautiful spaces, useful spaces.... I just love that there's that ... type of community that I can tap into. I love that I can tap into a community of expert gardeners...the education. So I just loved it, that it's accessible.*

Other interviewees highlighted the relationship between informal education that results from recreation and the inspiration of new ways to think about and relate to the landscape:

*There's a playground there, so there's the opportunity for... children to come, and I mean, not necessarily to have, like, a strict educational tour, but just to sort of by osmosis like, 'Oh, this is possible. This is a nice place to be.... I think community and inspiration...are some of its biggest values.' .... I mean, most of us these days don't even understand how food grows... let alone that there are different possibilities there. It's much easier to just take someone there and have them taste currants and be*

*like, 'Oh, yeah, this is really cool. I wish I could have this in my yard' instead of trying to explain it to them.*

Connection to the landscape inspires environmental education that comes from hands-on and observational learning:

*[A place] where people actively worked and maintained and learn from... watching systems action.*

### *Recreation*

Recreation was the second most identified CS benefit of 6<sup>th</sup> Ward Garden Park. Parks have innate recreational value reflected in some of the personal usage of 6<sup>th</sup> Ward Garde Park as:

*I just appreciate that there's a playground in this neighborhood.... the neighborhood tends to have a lot of kids who wander around after school, and so it's nice that they kind of have a place to go.*

*My sense is the overall public is there just to have a park, and have a playground, to have a place to eat.*

The majority of interviewees (9 out of 14) identified recreation as a CS useful in promoting other more highly valued CS. The tendency to value other CS over recreation is supported by the survey data where recreation did not appear as a highly valued ES compared to CS such as environmental education, social connection, and sense of place/connection to the land.

*It's been super nice as a parent to, um to have it for my kids. Um, I just I really love the idea that it's, uh, kind of a public space. Like a public community space that we can visit. We spend a lot of time on public lands ... but to have a public garden is super cool.*

*I really, really want my son to be outside in nature as much as possible. And for a kid his age, like three, it's just kind of the perfect space where it's the right size to explore and, um, exploring with all his senses and getting to taste these different wild plants, um is just a great learning opportunity for him. So that's amazing.*

*It has a little playground there. Some days when I was weeding...there would be a family and we would talk, so it just kind of...and then they would ask questions. They were only there for the little playground ... it was just a way to connect people and pull people in and share its value. Um, so I think that does connect the community. So, you know, a lot of people were like 'Oh, I had no idea what all this was behind the playground!'*

### *Sense of place/connection to the land*

Along with environmental education, survey data indicated sense of place/connection to the land as the most personally used CS across subsets. Three interviewees directly identified highly valuing connection to the landscape or connection to public land

*Personally, I appreciate that it's a connection to some land because we don't have a garden right now.*

*It is a good educational tool for young people to be grounded.... I think it's a good place for people to feel connected back to nature, maybe learn some things about edible plants that they didn't already know.*

13 interviewees identified sense of place as a geographic sense of place connection (see chapter 1 section 2). Respondents highlighted the historical usage (social and ecological) and cultural heritage values the park provides. The playground, box elders, and lilac hedge remain as reflections of how that landscape was historically used. Intentional incorporation of sweetgrass facilitates overlapping benefits of native plant communities and the cultural heritage of the landscape. Respondents highlighted how cultural heritage, sense of place, and environmental education are intertwined in the value of the landscape as a historic cultural and ecological place.

*A couple of years ago, there was a group from Helena Indian Alliance that came and ... they were, Cree, and they taught us how to harvest the sweetgrass in the Cree way. And so after I did that with them, I asked permission to cut some of the sweet grass ... because we gift sweetgrass braids often when we ask, you know, help of indigenous individuals for knowledge.*

Exposure to traditional usage of native plants is opportunity for the community of users to challenge established histories:

*...for other children to experience spaces and for people to say, "Wait, there is sweetgrass there?" or, uh, you know "Oh, you're connected to the native community. Now, I know that I need to be more careful about appropriation ... so is there a way to harvest it? Can someone teach me?" And so that's been kind of cool to see, like, a greater awareness of the white privilege and colonization ... people are like, "Oh, well, maybe we can and should consider this other point of view because this isn't my cultural practice." And so then people are looking out for programs like that, and they're going to the park seeking out, um, you know, the sweetgrass ...*



Respondents highlighted the interconnectivity of CS at 6<sup>th</sup> Ward Garden Park. Environmental education, recreation, inspiration, sense of place, social connection, and aesthetic value are mutually reinforcing and frequently referenced together:

*[The park] is growing a community. I have seen people come by on their lunch break...or bring their kids to just come out and do something. And you see kids playing hide-and-seek in the park...or scavenging around and being able to be like 'hey oh look at this plant, this is edible, you can do this, this grows this way' so a very educational tool. We have involved the community a lot in using their art resources to build things...and so that gives those kids a sense of community as well. It's...yeah, it's very educational and... it is a wonderful piece in our community.*

*...they planted things that end up blooming and blossoming through different parts of the summer. And so you always see something new as you walk through there" ... "I think it's a good aesthetic addition. This area of town. I mean, the railroad goes right through it. It's got a lot of industrial and light industrial areas. And so it's a nice, like break in that landscape.*

#### *Personal value and MEA comparisons*

Parks can be places of rest, green spaces in the middle of industry, and an oasis for community members. Not all respondents indicated benefits that fell within the MEA typology. Respondents identified personal satisfaction, mental health attributes (rest, restoration, rejuvenation), and volunteering (giving back/sense of purpose) as both personal and communal benefits provided by 6<sup>th</sup> Ward Garden Park. Interviewees acknowledged the value of green space as a place of rest: “an oasis in this area” and “a green space where people can rest.”

One respondent describes the interrelationship between sense of purpose/ownership and social connection fostered by the built environment:

*It gives kids a chance to go and garden and see what it's like to like grow things and to nurture things and to take care of things and it gives them a sense of accomplishment and kind of ownership because they are like "hey I put sweat into this place and it is part mine now" and so like, building that community.*

The personal satisfaction from volunteering and giving back was linked by respondents to the social connection ES:

*Because of COVID, I'm thinking you know 'What can I volunteer? What can I give to my community? This is going on.... I feel helpless.' ...I thought... I really love 6<sup>th</sup>*

*Ward Garden Park, and that's my community piece, it's a way to give to my community ...*

MEA indicators of well-being were integrated into respondents' perceived benefits of 6<sup>th</sup> Ward Garden Park. The MEA typology suggests human well-being is a function of the ES provided by a landscape (United Nations, 2005). Interviewees suggested well-being indicators have value as ES in themselves. The health benefits of recreation, green spaces, and rest were linked to mental health as an ES absent from the MEA typology:

*I think it is really good for mental health, and people's well-being to be well-balanced and grounded back in nature.*

*It is kind of an oasis in town. It is very grounding.... a place [people] can go and relax...*

*...and sometimes when [the teenagers] are frustrated, they really love to weed, and it is really good.*

When asked if 6<sup>th</sup> Ward Garden Park is an important space for the community of Helena, respondents pointed out the compounding benefits of the outdoor community space in a time of COVID-19 related isolation and uncertainty, suggesting built social ecological systems:

*[The park] will be really beneficial to people in the future for their mental health, because ... we have a long way to go, and I think...I think doing things that help people feel self-sufficient, and that [the park] is right there, um is really appealing to the community in these times.*

### 3.3.4 Supporting and Regulating Services

Supporting and regulating (S&R) services are separate categorization in the MEA typology but are referenced by interviewees interchangeably. As services that support biophysical functions, they did not appear in any of the interviewee's responses when asked "how do you use the park?" S&R services were mentioned as value for how the park benefits Helena.

Soil formation/health, habitat, pollination, and water regulation were the only S&R services to be acknowledged by respondents mirroring survey data, in which soil formation, pollination, and habitat were ranked as important ES provided by the park.

S&R services were referenced by respondents as stacked functions, or functions with compounding benefits. While cultural and provisioning services may be the primary benefit the community of users is receiving from the landscape, the S&R services are foundational for the usage and presence of material and non-material benefits.

*I mean, I think, um, that it's number one value is for, um, for inspiration and for sort of creating connections between people in the community because it's a park. I love that there are all of these sort of stacked functions... as far as... the scale of it, ecologically, I mean, it's really good that it's there...but really like in the in the grand scheme of Helena, is this one little half acre site that important on its own for, like, wildlife habitat or, um, water filtration or anything like that? Um, maybe not. I mean, within the scale of itself... it probably is. Um and so I think that that's where I'm most hopeful about it...as a model for like, 'oh, we could be doing this across half of Helena...or all of Helena...with our landscaping.' Um, and then that would...really change both how we interact with this landscape...*

*...one of my favorite things is walking through there, and just as you walk through there... the amount of butterflies and bees and everything else that just kind of explode out of the plants as you walk by.... You don't see that going...to other parks ... but there it's just like an explosion of pollinators. It's pretty cool.*

The respondents who identified S&R services were respondents involved with the project's design and management compared to respondents who are general users of the park.

Out of the 73 users engaged in this research, the majority are common users (non-planners of the project) who interact with the park as community visitors (table 5). Overall, these results suggest the primary users of the 6<sup>th</sup> Ward Garden Park are actively engaging with the park as a place to meet compounding CS needs: as a place for recreation, community engagement, environmental education, inspiration, and aesthetic beauty. Indicators of mental health were the only subjects to be identified as valuable services outside the MEA typology. Although food provision is a significant piece of the park's perceived value, users engage with PS in a supplemental capacity and as co-benefit and facilitating benefit for other ES. The ecological structural and functional heterogeneity of the parks design facilitates more S&R services than were identified as important or valuable by respondents. Responses indicated the S&R benefits were primarily among the handful of respondents who approached the park from a personal background in horticulture, botany, or ecology or those involved in the permaculture design course. The

results of this study suggest that although community food forests are novel systems that may be designed to simultaneously address a range of ecological goals through an edible system their community value and primary use lies in the opportunity grow more than just food.

#### 4. Discussion: Community food forests—opportunities to be more than food.

The results of my study validate the importance of intangible benefits provided by 6<sup>th</sup> Ward Garden Park for its community of users. One of the original goals of this study was to compare users' experience to the built intention of the project organizers, designers, and planners. As the study evolved, it became clear that the project had a guiding vision, but priorities were as diversified as there were stakeholders involved. Rather than comparing the original intention of the park with users' experiences, I want to highlight both what I believe to be the unique benefits of the novel system as well as some challenges and opportunities for the park moving forward to engage with the community and landscape more deeply.

This research directly fills a gap in the academic literature by assessing the use and relative importance of the services provided by community food forests (chapter 2). As a case study, the results from 6<sup>th</sup> Ward Garden Park cannot be attributed to any and all community food forests. Rather, this study provides a framework for assessing use, values, and perceptions and should be used across community food forests of different structures, goals, and locations in order to acquire a broader picture of their relative value and use for the community of users. The remainder of this discussion will highlight the major contributions of this research to our understandings of CFF and the benefits valued by a community of users.

##### *Involvement and ES Usage*

Before discussing the current opportunities facing 6<sup>th</sup> Ward Garden Park, it is valuable to identify where areas of difference in value were concentrated. Distinct segments of users emerged with varying

relationships to 6<sup>th</sup> Ward Garden Park (table 3.5). Involvement was the most helpful matrix in understanding how users relate to and use 6<sup>th</sup> Ward Garden Park. Even within the limited scope of this study, the majority of respondents were identified as park visitors who perceive the park as a place for food supplementation and compounding CS. Park participants were the smaller subsection and tended to more highly value sense of place/connection to the land when compared to visitors who were more uncertain regarding the non-material benefits received from the landscape. Additionally, they tended to be more comfortable and more willing to both harvest and volunteer compared to the visiting users (table 3.8, table 3.9), suggesting that a sense of place development takes both time around and embeddedness in a built environment (Tuan, 1980; Arefi, 1999; Casey, 2001; chapter 1 section 2). Users who engaged in a more participatory capacity with the park tended to more highly value S&R services; yet S&R services remained referenced with a lower frequency compared to CS and PS.

Awareness and value of S&R service benefits related more to the personal background of users rather than the level of involvement with the exception of those involved in the planning and design of the park. Leadership involved in the permaculture course and/or the design and implementation of the project were both more aware of and more highly valued the S&R built into the park's design. Interviewees who identified themselves as general park users rarely identified S&R services. Of the two community respondents to identify S&R service value, one identified a personal background in botany and the other in horticulture practice. Leadership serving as stakeholder representatives rarely mentioned S&R service benefits but focused rather on the services related to their positionality (food shares, youth involvement, community gardens, etc.). This suggests that while CS and PS are accessible and beneficial to the scope of users, the perceived value of S&R services are more abstract and dependent upon a user's personal background. Observational S&R services such as habitat and pollination are more widely understood, more visible and therefore more often perceived as important benefits (figure 3.3, table 3.7) and can serve as entry points for valuation and awareness of more complex S&R functions.

These results align with other place-based assessments of ES. Many studies found there to be an isolation of scientific terminologies related to supporting and regulating services within the scientific community itself, not spilling over into the public (Zagarola et al., 2014; Asah et al., 2012). Place-based assessments suggest the need for capitalizing on the many interconnections within the MEA typology in which supporting and regulating services underpin CS and PS benefits (Fisher et al., 2009). In a similar study, Asah et al. (2012) suggests the failure of users to identify S&R services may be attributed to difficulty articulating or simply the fact that S&R services are not directly enjoyed by users as they are often hidden ecological functions rather than enjoyable services.

This information provides some possible opportunities for the park moving forward. S&R services are often less understood and less directly beneficial to the general community of users. Interviewees suggested that the complexities of ecological structures and functions incorporated into the design may not only be inaccessible to its majority of users but could become barriers for general community involvement. Although food forests have a multiplicity of ecological benefits, increasing the “laymen friendly” nature of the ecological structure of the park has the potential to foster greater community engagement and buy-in. Respondents suggested, as the park balances between ecological complexity and familiarity of species, more recognizable cultivars will increase production, drawing in more community members and increasing participation. By simplifying the park without compromising the structural and functional diversity, users of the park may experience an increase in comfort volunteering and harvesting, transitioning them from park visitors to park participants.

Across place-based assessments, users value a particular system differently. Fisher et al., 2009 identifies “benefit dependence” as the reality that the benefits you are interested in will determine how you value a systems importance (Zagarola et al., 2014; Berghoefter et al., 2010; Boyd & Banzhaf, 2006). Variability in views and perceptions was cited across numerous ES assessments as reason for conducting a place-based assessment of ecosystem services, noting that users of a landscape are not a homogenous demographic, but rather represent a great diversity of values within a system (Blanco et al., 2020). This

study observed a qualitative typology of users within 6<sup>th</sup> Ward Garden Park as it relates to perceived and actual value of a CFF. As the only study of its kind, opportunities exist to further assess possible “user segments” (table 3.5) that emerged from 6<sup>th</sup> Ward Garden Park. More place-based assessments of ecosystem services across CFF have the potential of pulling out a statistically inferred typology of user types to inform their relationships to CFF.

#### 4.1 More than food: stacked ES benefits

Community food forests are built environments intended to integrate ecological complexity within the social system of a community to offer a range of benefits. This place-based assessment provides decision makers with critical information regarding how the 6<sup>th</sup> Ward Garden Park is actively being used and perceived as valuable by its community of users. Results from this study align with other place-based assessments, in which survey and interview respondents were more likely to identify cultural and provisioning services rather than supporting or regulating services as valuable benefits provided by a landscape (Asah et al., 2012; Silva et al., 2017). Unlike other assessments, interviewees did not so much “muddle” MEA categories of services but rather identified linkages between cultural and provisioning services as compounding and mutually reinforcing stacked benefits (Asah et al., 2012). The assumption of these linkages is the justification for a place-based approach in which “the treatment of ecosystem services as a set of functional relationships is commensurate with the very idea of an ecosystem” (Potschin & Haines-Young, 2013, pp. 1064). These relationships, or linkages, exist when one service or benefit facilitates and even encourages the use of another. Specific PS and CS emerged as especially facilitative for users. Linkages between services foster these stacked benefits, or benefits that can be co-enjoyed. This section will highlight some of the important observations related to the linkages and stacked benefits of 6<sup>th</sup> Ward Garden Park, for what I believe have the potential to be opportunities for increased participation and use of the landscape.

*Stacked Benefits: doorways for engagement*

The benefit of CFF lies in the multifaceted services they provide. 6<sup>th</sup> Ward Garden Park is substantially more than a food system. It is an opportunity to serve a diverse community of users through compounded and mutually-reinforcing benefits. CS benefit the scope of users and can therefore be doorways and linkages into deeper involvement, use, and value.

Food provision, specifically for supplementation and snacking, were linking points between experiencing PS and CS. Respondents highlighted this linkage in their “as we pick...it is an opportunity for...” language. Most frequently, users linked harvesting with environmental education, recreation, and connection to the landscape in which the second CS was more valued but encouraged by the first PS. In such cases, picking as a PS was a linkage, or doorway, from experiencing one type of ES to another. Likewise, environmental education as a CS was often discussed as a linkage to uncovering the more hidden S&R service benefits of the landscape. Valuation of S&R is a valuable goal for CFF (and 6<sup>th</sup> Ward Garden Park) in their own right. S&R services are the backbone for the CS and PS users so highly value. Proper valuation of S&R services not only works toward PbFS goals of ecological sustainability, but helps users understand the intricacies that make the system possible. Identification of these linking services can help park leadership highlight and encourage the use of one benefit in hopes of facilitating more complex interactions with the landscape by the community of users.

The results of this study suggest the primary use of 6<sup>th</sup> Ward Garden Park is in the stacked CS benefits that are encouraged by the linkages of PS supplementation and sustained by the S&R ecological services inherent in the park’s design. Respondents tended to overlap CS when describing both personal use and perceived importance. This overlap is prominent in the language surrounding environmental education as a significant ES in rank-importance, use, and perceived value (figure 3.3, table 3.7, table 3.8). This prominence can be attributed to the fluidity of environmental education as a stacked benefit experienced alongside other ES to the range of park users. At 6<sup>th</sup> Ward Garden Park, environmental education is informally experienced in the recreation of young children to master gardeners learning new



planting techniques within the social connection of a community sharing knowledge. Intentional education programming is used to connect the community to the cultural heritage of the landscape through traditional knowledge, increasing users' sense of place as they are connected back to the landscape. Picking berries or harvesting herbs are platforms for sensory learning and introduction to both new cultivars and native plants. Observation of the landscape introduces users to new plant species in the aesthetics of the garden design while inspiring new ways of envisioning one's relationship to both food and the land.

Environmental education, recreation, and food provision were frequently referenced together when users discussed benefits of the park. An opportunity exists for 6<sup>th</sup> Ward Garden Park to use these widely accessible stacked benefits as doorways for helping users engage with more of the lesser-used ES provided by the park. Environmental education is often the first step in linking users to the value of hidden S&R services inherent in the design of the park. When done with others, environmental education, recreation, and foraging naturally foster community connection and sense of place. I suggest prioritizing and highlighting the formal and informal environmental education, recreation, and foraging opportunities in the park. In doing so, 6<sup>th</sup> Ward Garden Park will be meeting users in the benefits they hold the most valuable while simultaneously serving to widen their use and appreciation of other ES.

These highlighted stacked benefits are opportunities to serve as doorways for deeper community engagement with the built landscape. As families come to recreate and play, that purpose for recreation and play naturally facilitate social community connection, environmental education, and sense of place. As leadership work towards growing involvement and community awareness with the park, knowing these significant "doorway" CS are valuable be entry points for deeper engagement.

#### *MEA typology and new or emergent benefits*

The MEA typology provided a useful structure and common language to discuss the benefits perceived and received by the landscape. It is critical that the MEA typology remain a framework for common language, rather than a rigid structure for assessing the benefits of a landscape. As described in

this study among others, place-based assessments can be useful tools for identifying novel or emergent categorizations of benefits and services. Emergent categories such as volunteering and stewardship were identified as intangible benefits received by a landscape in this study among others (Asah et al., 2012). Some assessments link ES value and perceptions to determinants of health (Abram et al., 2014; Folke et al., 2005) while others suggest determinates of health may be perceived as benefits in their own right (Asah et al., 2012). Users at 6<sup>th</sup> Ward Garden Park identified with the ladder suggesting potential limitations of the MEA typology.

#### 4.2 More than Food: opportunities for reconceptualizing public spaces

Central to the concept of community *food* forests is *food*. As such, a unifying goal of community food forests, and a built intention of 6<sup>th</sup> Ward Garden Park, (chapter 2, section 3) is the free access of fresh food to the community. As a PS, food is a tangible benefit, something that can be picked, held, and tasted. In theory, food benefits should be easily recognized, identifiable, and accessible by all users or visitors of the park. It is not surprising that food was ranked by the cohort of survey respondents as the service of perceived primary importance and identified by every interviewee as a benefit of 6<sup>th</sup> Ward Garden Park (table 3.6, figure 3.3, table 3.7). Yet, users' personal relationship with food provision was more complex than their perceived value would suggest. Just under half of survey respondents reported never harvesting from the park (table 3.9). Discomfort harvesting was acknowledged by both survey respondents and interviewees as a current issue facing 6<sup>th</sup> Ward Garden Park. One possible explanation suggests discomfort harvesting is the result of a social conception of what a park is and how we relate to public spaces:

*One issue we do have ... is getting people to come and harvest food. You know, when you go to a park, you're not always sure ... 'can I take this apple? Can I take this pear? ... can I pick this?'*

Designed as a demonstration garden, reconceptualizing human interactions with food and landscape is an intended purpose of the 6<sup>th</sup> Ward Garden Park and directly linked to inspiration as a CS. Much like environmental education, users discussed inspiration in a web of co-benefits. Across survey

data, inspiration was the most identified ES of 6<sup>th</sup> Ward Garden Park. Inspiration is an ES unique to each visitor of the park. Inspiration can be experienced while watching the Evening Primrose open as the sun begins to set or by observing what bird species can be seen in the park's natural green space. Inspiration is a benefit experienced in the aesthetic landscape as an oasis for rest and rejuvenation. Harvesting new culinary or medicinal herbs can inspire new tea blends through foraging.

Inspiration can be traced back to the purposeful design of 6<sup>th</sup> Ward Garden Park as a “demonstration” and “inspiration park” for the community, cultivating new relationships and visions of what a public park can be. The park was intended to challenge the way the community interacts with public green spaces, inspire reimagination of traditional shade-trees and lawns, and demonstrate climate-appropriate complex ecological relationships for sustainable means of food production. As one user noted:

*It... changes...what you expect from a pretty park and what's possible. And so, I think in that way it...broadens the horizons of...what people are willing to accept in a public space.*

The reconceptualization of human interactions with public landscapes takes time. As novel concepts in the United States, and as the only system of its kind in Helena, the expressed discomfort is a logical barrier. The more park leadership can remove barriers to harvest (I suggest widely encouraging harvest, highlighting what is in season for harvest, and simplifying/clarifying edibles available to harvest), the more likely users will engage with the PS available at the park. While PS are not the primary benefit users receive from the landscape, supplemental foraging, tending to plant growth, and observational interaction with edible plants serve as linkages to facilitate intangible CS benefits.

In reconceptualizing what a park is and how to interact with it, leadership of 6<sup>th</sup> Ward Garden Park will benefit from being as explicit as possible. Explicitly encouraging foraging, snacking, or harvesting is a critical step in combatting discomfort or hesitation among users. Opportunities exist for 6<sup>th</sup> Ward Garden Park to engage in direct outreach to its community of users and neighborhood residents. Inviting users and neighbors back into the space, highlighting the free-pick-nature, educating what is in

season, and introducing the new park concept in layman terms are some steps that can help reignite community engagement and use with the landscape.

#### 4.3 More than Food: PbFS goals

Thus far, the results and discussion of this study have been largely limited to the MEA typology. The importance of this place-based assessment not only helps inform park leadership of the opportunities and challenges in engaging park users but serves to place this system within a broader place-based food system (PbFS) (see chapter 1). This section will highlight the ways that I believe community food forests, such as 6<sup>th</sup> Ward Garden Park, have a role in meeting place-based food system (PbFS) goals. It is outside the scope of this chapter to fully assess the role of 6<sup>th</sup> Ward Garden Park in meeting PbFS goals; however, it is worth noting some key overlaps between the place-based assessment of ES and PbFS goals.

##### *Food Citizenship*

The goal of food citizenship is outlined by the results in Appendix B. Further study is recommended to understand how a user's involvement with 6<sup>th</sup> Ward Garden Park effects involvement with other avenues of food citizenship.

##### *Sustainability*

Sustainability goals most overlap with MEA ES typology in relation to ecological sustainability. Neither interviewees nor survey respondents directly addressed the role of community food forests in working towards goals of ecological sustainability. In part, issues of ecological sustainability correspond with the S&R services provided by a landscape which, as discussed previously, are often less accessible to the common user. Indirectly, ecological sustainability benefits were alluded to in the design of the park as a system of complex ecological functional redundancy by the few respondents directly involved in the conceptual design, planning, and implementation of 6<sup>th</sup> Ward Garden Park.

*It was really critical that...we plant species that are adapted to our climate ... zone 3 maybe 4 hardy....that they are drought tolerant or at least can tolerate some dry periods.... they needed to climate appropriate.*

*The systems themselves and the different plants ... they are working together with other plants, you know, and those sort of um, not necessarily micro level, but small interactions ... and systems within the park [were] pretty consciously designed or at least planned for in the beginning.*

Sustainability of volunteer involvement is directly related to the human component required for a community food forest. *Community* food forests are dependent upon the *community* in which they reside and are intended to support. During interviews, concerns of sustainable human capacity were referenced by respondents as they discussed maintenance issues, feelings of burn out, and a lack of community awareness.

As a volunteer-driven project, the fluctuation of human schedules and the reality of burn-out directly effects the park. One respondent described the cyclical nature of the volunteer capacity:

*“we get a little stronger in the spring, but by this time of year we can’t really get anyone to help us with fall clean-up. So there is always this kind of pressure...because there never seems to be more than 6 of us at the table.”*

Over time, project enthusiasm can fade as people are more eager to plant fruit trees than do the tedious task of weeding as the ecosystem establishes into a useful and productive landscape. Increased simplicity without compromising ecological functional diversity was frequently referenced as a way to increase community buy-in and volunteer capacity as well as prevent feelings of exclusion among the general public.

Human capacity is essential for the longevity and health of a community food forest, as one respondent stated:

*What I think is most important going forward is the community aspect, because without the communication with the community and communication about what the park is, that park is not gonna last.*

The challenge of human volunteer capacity facing 6<sup>th</sup> Ward Garden Park is significant; however, it is also an opportunity to both increase simplicity and draw upon users’ passions and expertise. More accurately understanding who is using the park, how they are using the park, and any barriers to involvement, decision makers may be better able to facilitate involvement in ways less “limiting” for the

common visitor—bringing them from engagement as a visitor to a participant. Navigating between accessibility and ecological complexity is an important balancing act facing 6<sup>th</sup> Ward Garden Park’s need to diversify its volunteer capacity. Capitalizing on the stacked benefits and doorways are opportunities to increase volunteer sustainability. More feedback regarding respondents’ suggestions to increase human capacity is outlined in Appendix B.

### *Place-building*

Interview and survey data suggests 6<sup>th</sup> Ward Garden Park is a built environment actively promoting place-building among its community of users. Place-building, as outlined in chapter 1 section 2, is directly linked to the MEA CS of sense of place and social connection. Both CS were ranked highly in perceived value and personal value by the community of users (figure 3.3, table 3.7). Additionally, interviewees were asked if (and how) their connection to 6<sup>th</sup> Ward Garden Park affected their sense of connection to communities within Helena.

*For Helena to be behind a project that really not many other communities in the country have taken on...and that we have done such a good job...having non-profit world interface with the city and ... being able to do this permaculture on their property basically and they have been very set as well as super progressive for our little town. And I like where it is going ...I'm really proud as a citizen that Helena has that.*

*It has connected me to people I didn't know. It pulled me in with the gardening aspect first... but there are a lot of local businesses right around it that I would have maybe just driven past, especially not living in town... it just allows you to maybe...instead of just passing by but seeing what is around you.*

Apart from sense of place and social connection, place-building was discussed by interview respondents in reference to revitalization of the 6<sup>th</sup> Ward. Construction of 6<sup>th</sup> Ward Garden Park has transformed a central block in the 6<sup>th</sup> Ward from an abandoned lot a landscape serving similar historic purpose, primarily as a park, playground, and recreation center. Respondents viewed 6<sup>th</sup> Ward Garden Park as a positive and useful addition to the landscape by creating a space for community involvement and activity:

*...but more recently [the city is] trying to bring more business [to the 6<sup>th</sup> Ward], they are trying to kind of revitalize it, so it helps with that revitalization and getting that community, that neighborhood involved.*

*I think the first thing that it did is it revitalized a park that was sitting empty and barren...that people weren't using at all... it became a park that is slowly getting the attention not just of our community but as a larger gathering as well. I think it has become an integral part of really helping even real estate around that particular area ... grow.*

Revitalization was discussed by respondents both as a means of place-building and as a method for food equity.

### *Equity*

Equity was the most discussed PbFS goal by interviewees. As freely accessible and freely harvestable systems, community food forests have a unique opportunity to address issues of food equity (chapter 2, section 3) In addition to the free-access principle, survey and interview results suggest equity goals are tied directly to the prominence of provisional and cultural services provided by a community food forest. At the 6<sup>th</sup> Ward Garden Park, CS and PS were meant to be available and accessible to the community at no cost and without any required participation. As respondents noted:

*[It is] something developed for the whole community, and that's free for people to use.*

As mentioned, revitalization is not just an opportunity for place-building, but as a method for food equity. The 6<sup>th</sup> Ward was chosen as the neighborhood to house this project, in part out of the hope to increase access to fresh produce.

*There's a community of like-minded individuals that want to establish beautiful spaces, useful spaces, spaces ... right [in the 6<sup>th</sup> Ward] because it is such a food desert. And there's a lot of homeless people that kind of hang around ... the 6<sup>th</sup> Ward. And by the way, I just moved to the 6<sup>th</sup> Ward... and you know that was always kind of one of the intents is to allow people free use to forage as needed.*

Community partnerships with Helena Food Shares, Helena Community Gardens, Lewis and Clark Public Health, and other community entities work to increase the capacity of 6<sup>th</sup> Ward Garden Park to be an equitable community project:

*That is our goal...how do we get those, our lower income, our people with disabilities, our new moms, our young families, people who maybe aren't always the avid gardeners... just to get some of our more... 'vulnerable populations group' to get to the park would be really great.*

*There was a big push to grow quite a bit of... produce for neighborhood consumption. Um, that's kind of how we got involved with the Helena Food Share...*

*One of [Helena Community Gardens] missions [is] to develop...community gardens within walkable distance of everybody that lives in the city. And so that space, really in the 6<sup>th</sup> Ward area.... [was] well, perfect, uh, [there are] kind of two missions... access to good and healthy food in the local community, and then also ... looking at developing a new community garden.*

Perception around the goal of food equity was diverse. Some users perceived the park as serving the goal to increase access to fresh produce within the neighborhood through PS from both the food forest and the community garden partnership as well as CS of recreation and education:

*I think it has been vital to help the people in this particular community and a lot of our low-income housing ... is within the 6<sup>th</sup> Ward boundaries ...there is an opportunity for folks to go down...kids that had never seen strawberries growing, kids that had never seen grapes growing, kids that had never seen fruit on trees that they can pick and...um... and then [the park] also partnered with Helena Community Gardens that has a portion of the park that allows actually people in the residential area to have their own garden there as well.*

Other respondents suggested a disparity gap remains. The concerns of neighborhood use were primarily vocalized by users who reside in the 6<sup>th</sup> Ward.

*I would say I did kind of think to myself, 'It's cool that there's people you know all over town getting it, but I just, I just don't really feel like my neighbors actually are' ... and it was really sort of, um maybe some retired community from around other parts of town, unless they live closer than I think.*

*I wish the focus was a little bit more on this neighborhood and not so much like folks from outside of the neighborhood coming in to use it for themselves.... not that they shouldn't be there, but I also think we should be encouraging people close to it to use it.*

*I think it's pretty consistent that people from within this neighborhood are not part of those events. Not that they're not invited, but again, like it's the barrier [of all] the things that go along with the neighborhood...*

*"I guess just any kind of program that ... that brings kids from the neighborhood. So I guess I kind of feel like I see it two different ways where I see that there's a lot of kids around here who could really kind of use some extra activities or, um, learning experiences and there's a garden that could really use some gardeners. So I wish...I wish we could figure out how to really connect the two."*



This research fell short in identifying exactly who was using the park. Out of the survey respondents most users are within Helena City limits, however actual neighborhoods were not identified. Out of the 15 interviewees, only 4 were residents of 6<sup>th</sup> Ward. To better assess if 6<sup>th</sup> Ward Garden Park is actually serving the residents of the 6<sup>th</sup> Ward, a simple follow up survey to learn the neighborhood of users is suggested.

One of the explicit goals of 6<sup>th</sup> Ward Garden Park is “to increase food security by empowering people to grow their own food” (6<sup>th</sup> Ward Garden Park, n.d.). Further opportunities exist for the park to address this goal. Identifying where the majority of users are located will help first assess if neighborhood outreach is needed (if that remains a goal of 6<sup>th</sup> Ward Garden Park). This research serves to inform the “most accessible” avenues for engagement for most users, the stacked CS benefits, and doorways for engagement.

#### 4.4: Limitations and Future Research

This study faced specific limitations because of the COVID-19 pandemic. Most notably, the park was closed to all formal and informal group gatherings. Restrictions on gatherings not only limited the study scope of participants but resulted in “we used to” language. As identified by this research, community connection and place-building along with educational program opportunities are important intangible benefits provided by the 6<sup>th</sup> Ward Garden Park. Every interviewee identified how they had historically used the park, indicated a level of change during COVID, and “suggested elements missing” (i.e., formal events, gatherings, and school field trips) because of pandemic restrictions. The results of this study must be understood through the specific limitations placed upon communities during the COVID-19 pandemic.

This study provides a valuable starting point in addressing a gap in the current academic literature surrounding use and value of CFF. As a case-study, this research is limited in scope and the results drawn from the data would benefit from more place-based assessments of ecosystem services across various

CFF. To my knowledge, this research is the first of its kind and provides a jumping off point for future research. Future research to create a statistically significant typology of users would serve to help future projects and organizers understand how *who* is using their system informs benefits of importance. Maybe more importantly, identifying linking services and stacked benefits across CFF can help leadership capitalize on users limited capacity or involvement by maximizing highly valued services while also facilitating and encouraging interaction with new ecosystem services.

Incorporation of CFF into place-based food systems is dependent upon a greater understanding of the values and benefits they offer as well as their limitations. This study specifically focused on the value of ecosystem services, while making observations relating to their place in addressing some of the goals of a place-based food system. Chapter 2 noted a research article authored by Wartman et al., 2018 suggesting FGS as unique opportunities to combine food production with the prioritization of people and land over profit to actively transform unjust and inequitable societal patterns. Equitably addressing food security and food access is a goal of 6<sup>th</sup> Ward Garden Park and a common goal across CFF (chapter 2). Understanding the food needs of users, where they come from, and their proximity to the park itself will allow park leadership to assess if the landscape is serving the needs of the neighborhood in which it resides, or outside users. A follow up study directly addressing these PbFS goals is recommended for the 6<sup>th</sup> Ward Garden Park and across CFF. I believe this is a critical step in understanding the role that CFF have to play in the larger story of PbFS and ought to be prioritized.

## 5. Conclusion

The intent of this place-based assessment of ecosystem services is twofold: to fill a gap in our current knowledge regarding how users actively value the system, and to provide information to the Advisory Council to inform decision making as the park continues to naturally evolve and adapt to the needs of its community. Along with other place-based assessments, this study found that when provided with a framework of potential ES, users were able to describe their perceived importance and personal

value derived from a landscape (Silva et al., 2017; Abram et al., 2014; Asah et al., 2012; Agbenyega et al., 2009) supporting the role of place-based assessment in incorporating user values and specifically intangible uses into the dialogue with specialists and decision makers. This study moves forward our understanding of human perceptions of social-ecological system of CFF necessary for integrating aspects of social values into landscape-level land use, planning, and management.

This study suggests the primary users of 6<sup>th</sup> Ward Garden Park are community visitors seeking an outdoor classroom, inspiration, a natural oasis, a place of recreation and rest, connection to land, and enjoyment of supplementary snacking. Simplifying the complexity of the ecological interactions and diversity while maintaining the S&R integrity of a food forest, is a balancing act. Natural transition to a more layman-friendly plant community might serve to decrease the discomfort and hesitancy community members feel in harvesting and volunteering. Encouraging linking ES and stacked benefits as entry points for deeper engagement with the ecological complexity of the food forest may provide avenues to transform user's passive relationship to the space to one that's more interactive.

User responses from 6<sup>th</sup> Ward Garden Park validate the importance of a CFF in providing complex, interdependent, and interlinking ecosystem services. As novel systems, the benefit and value of CFF should not be overlooked or ignored. Responses suggest CFF may have a significant role in working toward PbFS goals on the ground and within a community. Results are promising and warrant further research across the many unique expressions of CFF in the United States. Community food forests are about more than community just as much as they are more than food. Embedding complex ecological food structures into a community unlock stacked benefits capable of addressing complex goals and meeting a host of needs.

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## Appendix A: Semi-Structured interview guide

**Investigator: To begin I am going to ask you a few questions regarding your background and association with Helena:**

1. Do you identify as being from Helena?
2. How long have you lived and worked in Helena?
  - a. What do you do for a living?
3. Do you own or rent land in Helena?
  - a. [If yes]: how do you use the land?
    - i. Do you produce on or gather anything from the land? If so, what and from where?
4. How would you describe your community connection within Helena?
5. Were you a part of the planning of 6<sup>th</sup> Ward Garden Park?
  - a. [If Yes] continue with question 6:
  - b. [If No] jump to question 16:

First, I want to talk about your connection to the project:

6. Logistically, how did you get connected to the planning of the project?
  - a. Were you connected to any existing organization in Helena?
7. What interested you about this parks establishment?
  - a. Why did you want to be involved in the planning and implementation of this project?

Next, I want to talk about the planning process:

8. What were you concerned with during the planning process? (*By concerned with, or concerns, I am specifically asking about matters of importance*)
  - a. Were there any specific ecosystem and/or biophysical concerns?
    - i. How were these concerns addressed during initial implementation?
      1. Do you think they were adequately addressed in the implementation of the project?
  - b. Were there any specific community concerns?
    - i. How were these concerns addressed during initial implementation?
      1. Do you think they were adequately addressed in the implementation of the project?
  - c. Were there any specific provisional concerns?
    - i. How were these concerns addressed during initial implementation?
      1. Do you think they were adequately addressed in the implementation of the project?
9. What were some of the hurdles in implementing the project?

Next, I want to talk about the benefits of this type of park:

10. During planning and implementation, what did you see as the important benefits and services provided by this park?  
[For example: ecological services, cultural, biophysical, provisional benefits?]
  - a. Were those incorporated into the design and implementation of the park? How so?
  - b. Do you think the project adequately provides the benefits and services you find important?

- i. [If yes] How so?
  - ii. [If no] Why not? Where is the project lacking?
- 11. In your view, are those still the important benefits and services provided by the park?
- 12. Have any additional benefits and services become important since the park's establishment? Have they evolved over time?
  - a. [If yes] What are they?
    - i. Has the park adjusted to address these newly important benefits and service?
    - ii. [If yes] how?
- 13. Has the Park ecology evolved since establishment?
  - a. [If yes] How?
- 14. Has Park involvement evolved since establishment?
  - a. [If yes] How?
- 15. What does it look like to maintain the Park financially?

Next, I want to talk about the park's importance to you and your community:

- 16. What do you personally like most about the Park?
  - a. Anything you dislike?
- 17. Do you view the park as an important space in the broader community (ecologically, socially, etc)?
  - a. [If yes] Why?
  - b. [If no] Why not?
- 18. What benefits do you and/or your family receive from the Park? (For example, both material and non-material benefits.)
  - a. Of those benefits, which are most important to you?
  - b. Can you (or your community) receive these benefits or services elsewhere?
  - c. Have any of these benefits changed over time (become more or less important?)
- 19. In what ways, if any, has your involvement in the park affected your sense of community or connection within Helena?

Next, I want to ask about your vision for the Park

- 20. How do you see your involvement with the park in the next 5 years? 10 years?
- 21. How do you hope to see this park grow in the next 5 years? Next 10 years?
- 22. Are there any benefits or services you hope this Park can provide to you or your community in the future?

And finally,

- 23. Is there anything else you would like to say about this Park? About its importance? Its role in the community? Its benefits?

## Appendix B: Survey of 6th Ward Garden Park

### ONLINE SURVEY CONSENT FORM

You are invited to participate in a research project about the ecosystem services provided by 6th Ward Garden Park. This online survey should take about 5 minutes to complete. Participation is voluntary, and responses will be kept confidential to the degree permitted by the technology being used.

You have the option to not respond to any questions that you choose. Participation or nonparticipation will not impact your relationship with the University of Montana. Submission of the survey will be interpreted as your informed consent to participate and that you affirm that you are at least 18 years of age.

If you have any questions about the research, please contact the Principal Investigator, Sarah Eiden, via email at [sarah.eiden@umconnect.umt.edu](mailto:sarah.eiden@umconnect.umt.edu) or the faculty advisor Keith Bosak at [keith.bosak@mso.umt.edu](mailto:keith.bosak@mso.umt.edu). If you have any questions regarding your rights as a research subject, contact the UM Institutional Review Board (IRB) at (406) 243-6672.

Please print or save a copy of this page for your records.

*Q1 By agreeing to participate you are indicating that you are at least 18 years of age, have read the above information and agree to participate in this research project.*

Yes, I have read the informed consent

Q2 How old are you?

18 - 24

25 - 34

35 - 44

45 - 54

55 - 64

65 or older



Q3 What is your current zip code?

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Q4 What was your total household income last year?

- Less than \$25,000
- \$25,000 - \$34,999
- \$35,000 - \$49,999
- \$50,000 - \$74,999
- \$75,000 - \$99,999
- \$100,000 - \$149,999
- More than \$150,000

Q5 What is your race/ethnicity?

- Hispanic or Latino or Spanish Origin of any race
- American Indian
- Alaska Native
- White
- Black or African American
- Asian
- Native Hawaiian or Pacific Islander
- Two or more races
- Prefer not to answer

Q6 What is your gender?

- Male
- Female
- Non-binary
- Self Identify \_\_\_\_\_

Prefer not to answer

Q7 How long have you been connected to 6th Ward Garden Park in any capacity?

Less than 1 year

1-2 years

2-3 years

3-4 years

Over 5 years

Q8 What is your current level of involvement with 6th Ward Garden Park?

Visit the park a few times a year

Visit the park throughout the year but not involved in programs or in a volunteering capacity.

Somewhat involved in programs and/or volunteering.

Regularly involved in programs and/or volunteering.

Highly involved in the organization and/or facilitation of programs.

Q9 Throughout your connection with 6th Ward Garden Park, how has your level of involvement changed?

Drastically increased

Increased

Stayed the same

Decreased

Drastically decreased

Q10 What project programs and/or events have you taken part in at 6th Ward Garden Park?  
Check all that apply.

Educational programs

Harvesting

- Volunteer weeding
- Adopting a plot
- Renting a community garden plot
- Social events
- Other \_\_\_\_\_

Q11 Have you ever harvested food from 6th Ward Garden Park?

- Yes
- No

Q12 If you have harvested food, how often? (Leave blank if the question does not pertain to you).

- Very often
- Often
- Rarely
- Vary rarely

Q13 How would you describe the economic offset (grocery bill) during seasons of harvest? (Leave blank if the question does not pertain to you).

- No difference
- Little difference, slight savings
- Moderate savings
- Very different, high savings

Q14 In your opinion, which of the following ecosystem services does 6th Ward Garden Park provide you and the broader Helena community? Check all that apply

- Food products (including herbs)

- Non-food products (e.g., timber, raw materials, flowers)
- Medicinals
- Fresh water
- Genetic information (for plant species diversity)
- Improves air quality
- Climate change mitigation
- Water regulation (e.g., mitigating runoff, flooding, erosion)
- Water purification
- Pollination
- Habitat provision
- Environmental education
- Inspiration
- Spiritual/religious values
- Aesthetic values
- Social connection
- Sense of place (connection to land)
- Cultural heritage
- Recreation
- Soil formation
- Photosynthesis
- Nutrient cycling
- Water cycling

Other \_\_\_\_\_

Q15 In your opinion, what are the 5 most important services provided by the 6th Ward Garden Park to you and the broader Helena Community. Rank your top five in the following questions:

Q16 In your opinion, what is the service with the highest importance?

▼ Food products (including herbs) ... Other

Q17 In your opinion, what is the service with the second highest importance?

▼ Food products (including herbs) ... Other

Q18 In your opinion, what is the service with the third most importance?

▼ Food products (including herbs) ... Other

Q29 In your opinion, what is the service of fourth most importance?

▼ Food products (including herbs) ... Other

Q20 In your opinion, what is the service of fifth importance?

▼ Food products (including herbs) ... Other

Q21 Of the following *provisional services* (goods provided by an ecosystem for direct use and/or consumption) provided by 6th Ward Garden Park, which do you use? Check all that apply.

Food products (including herbs)

Non-food products (timber, raw materials, flowers)

Medicinals

Fresh water

None, I don't use any provisional services from 6th Ward Garden Park

Other \_\_\_\_\_

Q22 Of the following provisional services provided by 6th Ward Garden Park, which is most important to you?

Food products (including herbs)

Non-food products (timber, raw materials, flowers)

- Medicinals
- Fresh water
- None, I don't use any provisional services from 6th Ward Garden Park
- Other \_\_\_\_\_

Q23 Of the following *cultural services* (non-material benefits provided by an ecosystem) provided by 6th Ward Garden Park, which do you use? Check all that apply.

- Environmental education
- Inspiration
- Spiritual/religious values
- Aesthetic values
- Social connection
- Sense of place (connection to the land)
- Cultural heritage
- Recreation
- None, I don't use any cultural service from 6th Ward Garden Park
- Other \_\_\_\_\_

Q24 Of the following cultural services provided by 6th Ward Garden Park, which is most important to you?

- Environmental education
- Inspiration
- Spiritual/religious values
- Aesthetic values
- Social connection

- Sense of place (connection to the land)
- Cultural heritage
- Recreation
- None, I don't use any cultural service from 6th Ward Garden Park
- Other \_\_\_\_\_

Q25 Which of the following *supporting and regulating services* (ecological system benefits) do you believe are present in 6th Ward Garden Park?

- Soil formation
- Photosynthesis
- Nutrient cycling
- Water cycling
- Genetic information (for plant species diversity)
- Improves air quality
- Climate change mitigation
- Water regulation (e.g., mitigating runoff, flooding, erosion)
- Water purification
- Pollination
- Habitat provision
- None, or not enough information to answer

Q26 Of those supporting and regulating services, which do you see as most beneficial to Helena's ecology?

- Soil formation
- Photosynthesis

- Nutrient cycling
- Water cycling
- Genetic information (for plant species diversity)
- Improves air quality
- Climate change mitigation
- Water regulation (e.g., mitigating runoff, flooding, erosion)
- Water purification
- Pollination
- Habitat provision
- None, or not enough information to answer

Q27 In the coming year, do you expect to stay involved with 6th Ward Garden Park in any capacity?

- Yes
- No

Q28 How comfortable are you:

	Very Comfortable	Somewhat Comfortable	Neutral	Somewhat Uncomfortable	Very Uncomfortable
Going to the park	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Harvesting from the park	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Volunteering in the park (weeding, upkeep, etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q29 What was your initial motivation in going to the park (or becoming involved with the park)?

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Q30 Which of these additional activities do you partake in? Check all that apply

- Growing a personal garden (home/community garden plot)
- Composting
- Planting a native ecosystem on your property
- Consuming locally produced food (from CSA, farmers markets, community farms, etc.)

Q31 Of these activities, which *increased or began* after your involvement with 6th Ward Garden Park?

- Growing a personal garden (home/community garden plot)
- Composting
- Planting a native ecosystem on your property
- Consuming locally produced food (from CSA, farmers markets, community farms, etc.)

Q32 Do you have any concerns or additional comments regarding the usage of or participation with 6th Ward Garden Park? Please add any concerns or comments below:

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Q33 Thank you for taking the time to complete this survey. If you would be willing to partake in a short zoom or phone interview (approximately 15 minutes) regarding your perceptions and use of 6th Ward Garden Park please indicate with your name and information of your preferred method of contact. This information will be recorded separate from your anonymous responses.

- Yes (Name and information of preferred method of contact)

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- No

## Appendix C: Additional Data Collected for 6th Ward Garden Park

Additional data collected from 6<sup>th</sup> Ward Garden Park survey that may serve as valuable to the Advisory Council:

### **WHO IS USING THE PARK:**

Income:

Answer	%	Count
\$25,000 - \$34,999	7.46%	5
\$35,000 - \$49,999	17.91%	12
\$50,000 - \$74,999	16.42%	11
\$75,000 - \$99,999	25.37%	17
\$100,000 - \$149,999	13.43%	9
Less than \$25,000	10.45%	7
More than \$150,000	8.96%	6
Total	100%	67

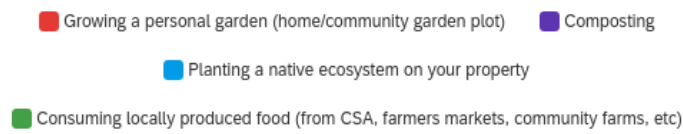
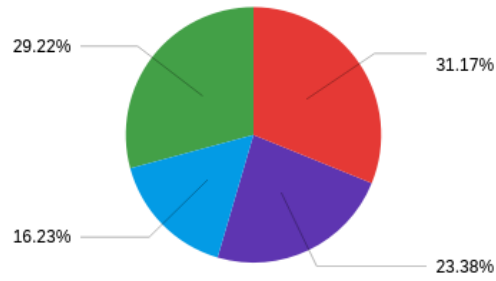
**How long have you been connected to 6<sup>th</sup> Ward Garden Park in any capacity?**

Answer	%	Count
3-4 years	12.86%	9
2-3 years	21.43%	15
1-2 years	7.14%	5
Over 5 years	45.71%	32
Less than 1 year	12.86%	9
Total	100%	70

**What is your current level of involvement with 6<sup>th</sup> Ward Garden Park?**

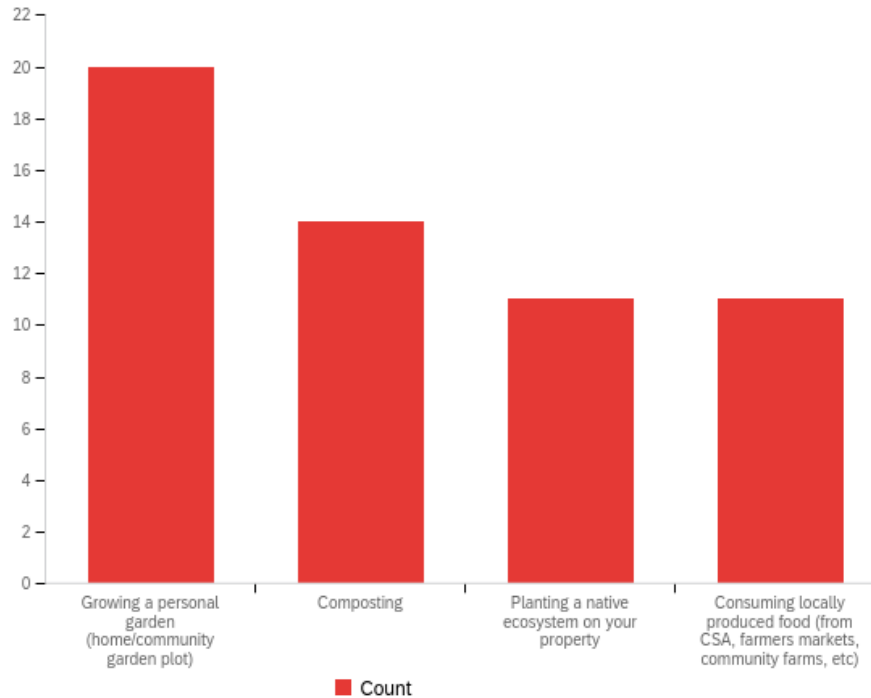
Answer	%	Count
Visit the park a few times a year	33.33%	23
Visit the park throughout the year but not involved in programs or in a volunteering capacity.	27.54%	19
Somewhat involved in programs and/or volunteering.	24.64%	17
Regularly involved in programs and/or volunteering.	5.80%	4
Highly involved in the organization and/or facilitation of programs.	8.70%	6
Total	100%	69

**Additional activities**



	%	Count
Growing a personal garden (home/community garden plot)	31.17%	48
Composting	23.38%	36
Planting a native ecosystem on your property	16.23%	25
Consuming locally produced food (from CSA, farmers markets, community farms, etc)	29.22%	45
Total	100%	154

**Did any increase since your involvement with 6<sup>th</sup> Ward Garden Park?**



Growing a personal garden (home/community garden plot)	35.71%	20
Composting	25.00%	14
Planting a native ecosystem on your property	19.64%	11
Consuming locally produced food (from CSA, farmers markets, community farms, etc)	19.64%	11
Total	100%	56

**Any concerns or additional comments regarding the usage of or participation with 6<sup>th</sup> Ward Garden Park? Please add any concerns or comments:**

- I hope it continues
- Would love to see the better weed management and help making the park’s design and functions more legible to the general public.
- Weeding
- I support Helena's public gardens because they provide food and offer the opportunities for people to connect to the land and gain knowledge about growing food.
- Great place to have in our community
- A need for more inclusivity from the lower social economic class in the community
- Community educational efforts in ecological education
- I think that participation in workdays/weeding will improve if there is a little more of a socialization element included when possible, though this would have been a tough year for gatherings. Hope we can do more potlucks next year.

- It would be helpful to create a larger group of committed and engaged volunteers to help with Park maintenance. The City is amazing but we also need volunteers to help maintain the patches and walkways. I would like to be able to host social events (music, bike garden tours, etc.) once the pandemic is over. Great to see young kids engaged in 'discovery' of new foods and seeing food in new ways (wow! those are chives?). So fun to see kids running around the patches because there are hidden spaces, corners, etc.
- The Pandemic has directly affected the usage and participation in the Park due to virus transmission and personal health safety. The reduction or elimination of park activities and chores do NOT reflect reduced interest or participation. Rather a health safety issue that is prudent. Interest is still HIGH. Participation is LOW but only due to Covid19. Looking forward to next year!
- More Rented lots available
- Not now, I could be more involved
- I only decreased involvement because waiting list for garden plots. I had a plot and felt somebody else should get a chance
- Would like to see more educational info and identifying info about plants and products in park
- 6th turned into a jungle. Many poorly planned plants and areas.
- I don't think it's reaching the low-income families around the 6th ward. It seems like permaculture and the park in general is sort of an 'elite' activity, or at least that's who it attracts most. If someone is just barely getting by, pay-check to pay-check, or struggling with other things like mental health or drug use, planting a garden or participating with 6th Ward is likely not a priority. I hope that the 6th Ward can find ways to involve low-income families and individuals through incentives or other targeted programs
- Seems lacking
- I believe it has changed the dynamics of the neighborhood, it was an abandoned field of weeds and garbage. Now it is a place the neighborhood can use and be proud of. It has also spurred business growth in the area.
- Enough volunteer capacity
- I'm grateful for it and all the folks like Christopher who have made it a wonderful place. I was sick this last year so didn't get there as often as I hoped
- I feel the park needs more local involvement, community support and city parks and rec support. The garden was many times too dry this summer. Weeds are taking over especially alfalfa, comfrey, and vetch. The fruit trees need a lot of personal attention by someone who knows about disease prevention. About 70% of the initial plantings are doing OK by themselves, especially in the SE section of the park. But even medicinals like sweetgrass are taking over other plantings which were part of the first design.