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Community Perceptions and Aesthetic Valuation of Remediation Gardens

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Community Perceptions and Aesthetic Valuation of Remediation Gardens

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by

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Abstract

Creating successfully remediated landscapes may rely on both natural resources and human perception in landscape design. Urban areas present a dynamic environment wherein communities and nature compete for resources and space. This dissertation study was designed to better understand aesthetic perceptions of native plants capable of land remediation in midwestern communities. Findings from this study show the importance of aesthetic perceptions of stakeholders towards rehabilitated landscapes and the importance of organizing indicators for future design decisions in an interdisciplinary fashion. Recommendations include continued evaluation of aesthetic perceptions for plant species in urban landscapes and modeling a more consistent framework for these interdisciplinary studies. With knowledge of stakeholder perceptions through continued research, improved aesthetic and ecologic designs can seamlessly merge into reclaimed and rehabilitated landscapes.

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Introduction and Context for the Project

Background of the Project

Public green spaces used in learning gardens can be developed to educate the public on regional plants and on specific uses of these plant species. While food and pollinator gardens are commonly found in communities, less so are gardens that specifically illustrate phytoremediation techniques. Phytoremediation – the use of plants to change a site- can benefit most any degraded landscape. To rehabilitate or reconstruct these landscapes is ideal because it would mean a return to an original state; however, remediation, reclamation, or rehabilitation techniques are more commonly used and simply improve the state of land. In a time when these techniques are in focus, phytoremediation gardens with native species can be of use in restoring damaged sites that were previously mined, farmed, or otherwise degraded. These gardens can also influence local communities to learn about landscape and land health.

Creating demonstration phytoremediation gardens involves more than just professional input for the garden's longevity. Using the public's input to discover what is most aesthetic for local residents can influence the acceptance of future landscape projects and inspire residents to create similar spaces at home. While there are many factors at play, the ecology of choosing the right species for the geographic region and landscape, the psychology behind the aesthetics of the project in the community, and the theory of how to implement such gardens for enhanced learning all affect one another in an interdisciplinary web that can be used to form more educational and inspirational spaces for the public to interact in while reclaiming and restoring landscape.

In this project, a site was chosen in Pittsburg, Kansas, a forming mining town, to install two demonstration gardens which used native species. A questionnaire was conducted over four weekends before and after the gardens were installed. The objectives of the project were to evaluate how aesthetics might impact species choice and to investigate if having a demonstration garden

modeled inspired individual action and pro-environmental behavior. Those who walked by the gardens on a local trail were asked about their knowledge of plant species, if they found the space aesthetic, and what they would want planted in the space in the future as well as if they gardened and how maintained they liked a site to be.

The findings from these questionnaires illustrated a general lack of knowledge to what "native species" means and, to some degree, plant blindness (not noticing one's environment regarding flora). With additional gardens installed these shortcomings may be addressed. By using more aesthetic or valued species, plant blindness may be minimized and with the use of educational signage, knowledge may be increased. Local outreach is needed for success in these land rehabilitation projects as each region has site-specific needs and can benefit from understanding plant remediation abilities. A multi-disciplinary approach is needed that accounts for the basics of funding, outreach, and site development as well as the psychology behind the choices people make in choosing what appeals to them in landscape design and what species are best suited to the task.

Choosing species which are most noticeable and aesthetic for passers-by can add to these gardens by increasing the community involvement with the project. Signage can enhance the experience by allowing individuals to be a co-learners in garden spaces and increase knowledge of landscape health. Public input for plant choices aids in the longevity of the project and may inspire personal implementation of similar gardens in the public's home space.

Chapter One: Common Themes in Aesthetic Perceptions of Reclaimed Urban Landscapes

Abstract

Creating successfully rehabilitated urban landscapes involves both the sound design of natural resources and incorporation of human perceptions of landscape. Moving forward with an invested interest from society is a challenge for the efficacy of reclaimed landscape design. In particular, urban areas present a dynamic environment wherein society and nature compete for resources and space. The objectives of the study were to (1) identify general themes of perceptions in landscape design research; (2) review landscape restoration studies in published work; and (3) explore aesthetic perceptions for rehabilitated landscapes in ecology, psychology, and theory. This review examined how perceptions of plants for urban community members, the stakeholders for the plant species that share their environment, are reflected in their aesthetic considerations. The Theory of Planned Behavior (TPB) as applied to pro-environmental behavior (PEB) was used as a theoretical framework in reviewing publications with repeated keywords related to landscape planning. Findings from this literature review include repeated themes of (1) aesthetic perceptions of stakeholders in rehabilitated landscapes and (2) the importance of organizing indicators of aesthetic perception for future design decisions. The psychology, theory, and ecology of landscape planning were areas found to be ideal starting points for interdisciplinary action and collaboration in sustainable design. Recommendations include addressing the gap in research on aesthetic perceptions of reclaimed urban landscapes and addressing the lack of a consistent and widely accepted framework for these interdisciplinary studies. With knowledge of stakeholder perceptions, improved aesthetic and ecologic designs can more seamlessly merge into reclaimed urban landscapes.

Keywords*:* urban landscape design; aesthetic perception; landscape ecology; interdisciplinary horticulture

Introduction

Aesthetic perceptions of a landscape are individualized -- the allure of a place which fascinates some may be discerned by another as immaterial (Bell, 2012; Gobster et al., 2007; Nohl, 2001). In spite of their significance, the terms perceptions and preferences are not clearly defined and are used interchangeably in the literature, though preference is more often attributed to "liking one area of landscape better than another" (Swanwick, 2009, p. 63). Perception primarily refers visual appreciation and how residents assign value to landscape (Farahani & Maller, 2018; Swanwick, 2009). Aesthetic value has also been described as emotive of pleasure from an observed object, in the perspective of the viewer (Tribot et al., 2018). These perceptions are of importance because they reflect these intimate links in the socio-ecological experience and may influence future behavior (Tribot et al., 2018).

Opdam (2018) suggested landscape as a medium for transdisciplinary research to investigate communication and mutual benefits between land and society. Reviewing research aimed at measuring aesthetic valuation of landscape is viewed as a critical step in providing metrics needed for holistic landscape studies for future design (Tribot et al., 2018). Combining landscape ethics with aesthetics and ecological attributes adds insight in rehabilitated landscape composition (Antrop, 2018; Termorshuizen & Opdam, 2009; Wu et al., 2017). Urban environments, which contain abandoned lots, residential yardscapes, and gardens, comprise major land covers and provide an excellent area for socio-ecological studies (Burr et al., 2018; Ignatieva et al., 2011). Goddard et al. (2013) emphasized the need for managing these areas of urban expansion in a sustainable manner to encourage for biodiversity and implied that the social and natural world must combine in a mutualism to be resilient in the future; particularly in these urban areas because they encompass areas of rapid infrastructure development and landscape change (Allen, 2003).

Termorshuizen and Opdam (2009) suggested that there are two additional prerequisites that the field of landscape ecology should address to produce effective and sustainable landscape design in urban neighborhoods. First, there must be a valuation component, and second, it must be user-friendly for collaborative decision-making at a local scale by non-scientists. The aim of this literature review was to summarize perceptions regarding the aesthetics of rehabilitated landscape and to examine how these findings may be evaluated for the creation of a general framework based around urban landscape design. The review focused on (1) identifying general themes of perceptions in landscape design research; (2) reviewing the scale of landscape restoration studies in published work; and (3) exploring aesthetic perceptions and valuation for these rehabilitated landscapes in ecology, psychology, and theory.

Theoretical Framework

Theory in Landscape Ecology

Models and pre-existing theories have indicated that -- in order to understand the relationship between land and man -- understanding human perceptions is fundamental (Lee et al., 2008). In evaluating perceptions to aid in future design, it is possible to integrate the social and biophysical aspects of urban ecosystems (Ignatieva et al., 2011; Rademacher, 2019). While pivotal frameworks in landscape ecology have not established an accepted model for transdisciplinary studies and socio-ecological preference, authors have made attempts to provide such a framework over the past few decades. Termorshuizen and Opdam (2009), who are among authors that have tried to create a framework that promotes interdisciplinary research, described the difficulty in finding an accepted and applicable theory in multi-level landscape design. Nohl (2001) developed a conceptual framework for better understanding aesthetic landscapes when they are perceived as objects by the community; Zube et al, (1982) attempted to analyze the paradigms used by using

perceived landscape values. Further, Zube et al. (1982) identified a conceptual framework for four paradigms after a thorough literature review but subsequently noted an absence of an acceptable theoretical framework.

Landscape preference reasoning is usually attributed to aesthetic factors but depends on person and place and can be influenced by knowledge, community pressures, or by one's sense of self (Ives & Kendal, 2013; Khew et al., 2014; Bell, 2012). As an individual's behavior accumulates and affects ecological outcomes in the landscape, the Theory of Planned Behavior (TPB) can be used as a tool in environmental psychology to predict intention, though barriers may hinder the ultimate outcome (Ajzen & Madden, 1986; Ajzen, 1991; Ives & Kendal, 2014, Schwartz, 1977).

According to the TPB, the chief incentive to carry out any behavior is the intention to perform it, which depends on attitudes, subjective norms and perceived behavioral control (Ajzen, 1991). As environmental aesthetics play an important role in individual preference, intent, and future behavior, TPB can be used to frame Pro-Environmental Behavior (PEB) in landscape ecology (Figure 1, Ajzen & Madden, 1986; Harland et al., 1999; Hines et al., 1987).

PEB, like TPB, is the end result of an individual's attitude, the perceived social norm, and the behavioral control one has (Ajzen & Madden, 1986; Schwartz, 1977). As defined by Kollmuss and Agyeman (2002) it is behavior that consciously seeks to minimize negative impacts on one's interactions in the natural world based on different personal inputs. PEB is linked to values tied to environmental ethics and personal perception. It is important to understand the variables that are inputs to an individual's behavior—for example, the beliefs that are based off of personal perceptions (Ives & Kendal, 2014). In order to create successful and sustained restorative projects, the land must be given some value by the individuals in the community that resides in the landscape and that value must be understood by the landscape developers (Ives & Kendal 2013). Figure 1

illustrates how attitudes, social norms, and behavioral beliefs can affect intention and action regarding PEB. Integrating PEB into the TPB, a theoretical framework can be used, regarding perception and ultimate behavior, to help interpret the themes present in the literature review findings section.

The three parts of the TPB (attitude, subjective norm, and behavioral control) can be manipulated to create action. Aesthetic valuation as part of an individual's attitude can be used as well as the subjective norm of social pressures in the neighborhood combined with one's own belief that personal action regarding gardens is important. By educating communities with environmental knowledge, even in passive or informal ways, the perceived behavioral control can be improved to add confidence to an individual's abilities. These three components can influence intention to act- and by adding an aesthetic experience- can also influence ethics behind actions. These theoretical components can act together to create a system that influences PEB by putting external and internal pressures and abilities on an individual.

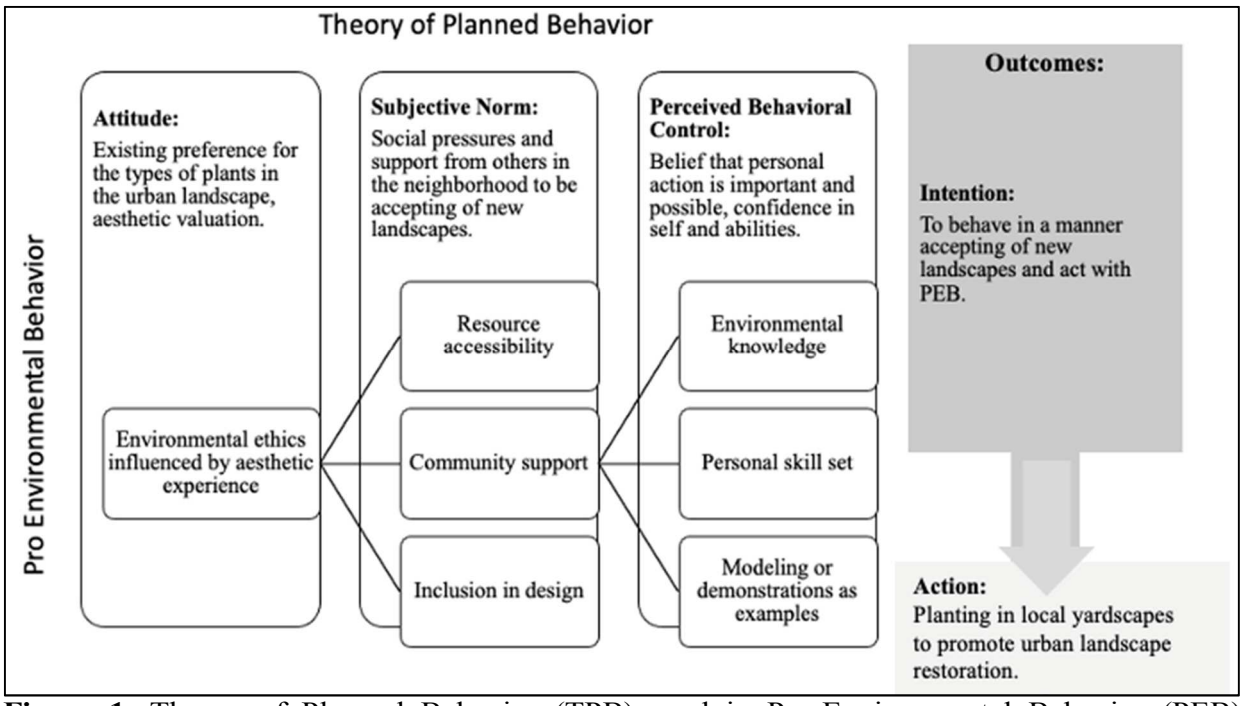

Figure 1. Theory of Planned Behavior (TPB) used in Pro-Environmental Behavior (PEB): UsingMixed Theory as an Example of the Aesthetic Experience toward Citizen Action (Ajzen & Madden, 1986; Harland et al., 1999; Hines et al., 1987).

Materials and Methods

A literature search was gathered from peer-reviewed publications through ProQuest and Google Scholar for articles published within ten years of conducting this literature review and used the following terminology: aesthetic, perception, phytoremediation, landscape, and ecology (+aesthetic, +perception, + phytoremediation, +landscape, +ecology). This search yielded 382 articles. Twenty-one other peer-reviewed and scholarly articles were found using these keywords in the journals relevant to landscape ecology, sustainability, and ecosystem services and were also evaluated. Because this literature review is focused on aesthetic perceptions, publications that focused primarily on economics or culture were set aside (-economic, -culture, -cultural) and only those that focused on aesthetic perceptions were used. By adding a value to exclude the terms related to root words of econ- and culture in the title, the total number of applicable articles was

65. Using a search for more recent publications at the time this was written resulted in 46 full-text, peer-reviewed articles from 2009-2019.

Reviewed literature was separated by literature theme. Themes were developed for their relevance to the present literature review based on the keywords --chosen by prevalence and how perceptions were used regarding aesthetic valuation in the literature. Themes were categories of theory, ecology, or psychology. An initial scan to review the relevance of the findings was conducted by evaluating the article title, abstract, and images. This approach yielded 23 publications; their abstracts were checked to meet criteria of 1) mention of perception or preference, 2) a setting (online or geographic) was included, and 3) the language used was English.

In total, 21 articles from 2014-2019 were identified and used as a part of this literature review regarding aesthetic perceptions and valuation; two were removed because the focus was on human health and restoration more than on the ability of a plant species to be restorative to the environment. Both studies and literature reviews were included in the search. Other literature was used contextually and in the body of this paper. The literature reviewed was organized by author, scale, keywords, findings, theme, and journal and much of this information can be found in the following section or in the appendix.

Results

Themes and subthemes became apparent as the literature was reviewed. The categorization was based on the priority of the authors and their underlying supporting frameworks or secondary goals. For example, if an article pertained to the psychology of aesthetic choice, it often addressed how this would affect the ecology of a landscape as well. Themes of aesthetic valuation that became apparent included: (1) ecology, and/or (2) aesthetic environmental psychology, and (3) a focus on theory and frameworks such as PEB and TPB (Figures 2-7). Key vocabulary terms --

such as “orientation” and “attitude” -- were used to describe perceptions and preferences in much of the literature and is not uncommon terminology (Buchel & Frantzeskaki, 2015, p. 170, as cited in Farahani and Maller, 2018; Swanwick, 2009). The majority of the articles identified scale but not all. Scale in this review refers to geographical place as: urban (U), neighborhood (N), rural (R), or online (O). When evaluated by prevailing phrases and geographic scale, the psychology behind perceived aesthetic value and the concerns for ecology and biodiversity in an urban landscape were the most commonly found themes, respectively.

Subthemes Found in Ecology

Inclusion

Particularly in urban areas, where the surrounding landscape is dynamic, there is a need for ecological landscape modeling to “link ecosystems with many human responses and activities, including land-use decisions, landscape planning, landscape management, and preferences” (Harris et al., 2017; Lee et al., 2008, p. 60). Models and research tools that do not clearly link the socio-environmental systems, that are too complex or that are too expensive are common and impractical (Olander et al., 2018). As Weir and Doty (2016) suggested, this may be due to a lack of familiarity with the method, or assumptions of disapproval by stakeholders.

More research is needed to understand why communities are not as involved as they could be in local land-use decisions. When these stakeholders are included in development of landscape, their involvement may also shape preferences in their own yardscape and garden (Harris et al., 2017). Many scientists have not seen the socio-ecological system as a primary concern, hindering sustainability of the design, “the lack of attention paid to social processes represents a clear gap that future cross-disciplinary research should address” (Evers et al., 2018, p. 8).

Phytoremediation

Using plants to rehabilitate an environment to a functioning state which can support other diverse organisms is an economic and chemical-free remediation strategy which has grown in the last twenty years, however, studies on local people's perception for this technique are scarce (Vodouhe, 2015). Recently published literature on nature-based solutions has focused primarily on the cultural ecosystem services (CES) such as recreation, education, or spiritual settings provided in urban environments and less on remediation landscapes or species that rehabilitate landscapes (Hegetschweiler et al., 2017; Niemelä et al., 2010; Russo et al., 2017). Urban planning theory and ecological principles is not enough, community-wide involvement is suggested for creating a master plan which indicates how vacant or damaged land in the urban environment may be remediated and rehabilitated (Smith, 2015).

Biodiversity

Complex vegetation or highly diverse landscapes are typically more preferred than those with fewer physical features (Harris, et al., 2017). Perceptions of biodiversity or the heterogeneity of a landscape have been investigated with regard to preference, but they do not fully express all aesthetic aspects of an environment just by being measured as simple or heterogenous (Harris et al., 2017; Pickett et al., 2017; Tribot et al., 2018).

Novel ecosystems (those formed as a consequence of human disturbance) also contribute to biodiversity but are less reviewed in land management, possibly because they concern anthropogenic landscapes (Evers et al., 2018). Management recommendations to increase biodiversity in damaged landscapes rarely account for how the surrounding community will feel regarding support of the new landscape. Occasionally this is because of the complexity of diverse landscapes, as an abstract concept, it can be difficult to teach. Using urban landscapes as a tangible

way of teaching about biodiversity in practice and environmental ethics can be a way to ameliorate this perceived barrier (Minteer et al., 2019).

Scale

The appropriate scale to measure social predictors of landscape change need to be more thoroughly investigated (Eigenbrod, 2016). Planning in the social sciences and urban design may benefit from understanding the locational choices humans make concerning land and how they then feel about their surroundings (Pickett et al., 2016). Urban systems and human actions are affected by the scale at which they function, like a home network. A localized systems approach can provide more support -- more investment, intention, and behavioral action -- if communities see these spaces as in need of protection (Evers et al., 2018; Pickett et al., 2016; Smith, 2015).

Landscape	Garden
	Demonstration
	Phytoremediation
Biodiversity	Science
	Integration
	Heterogenous
Design	Aesthetics
	Context
	Suburb
Socio-ecological	Community
	Human relations
	Dynamics

Figure 2. Included Literature: Keywords in Ecological Papers on Landscape

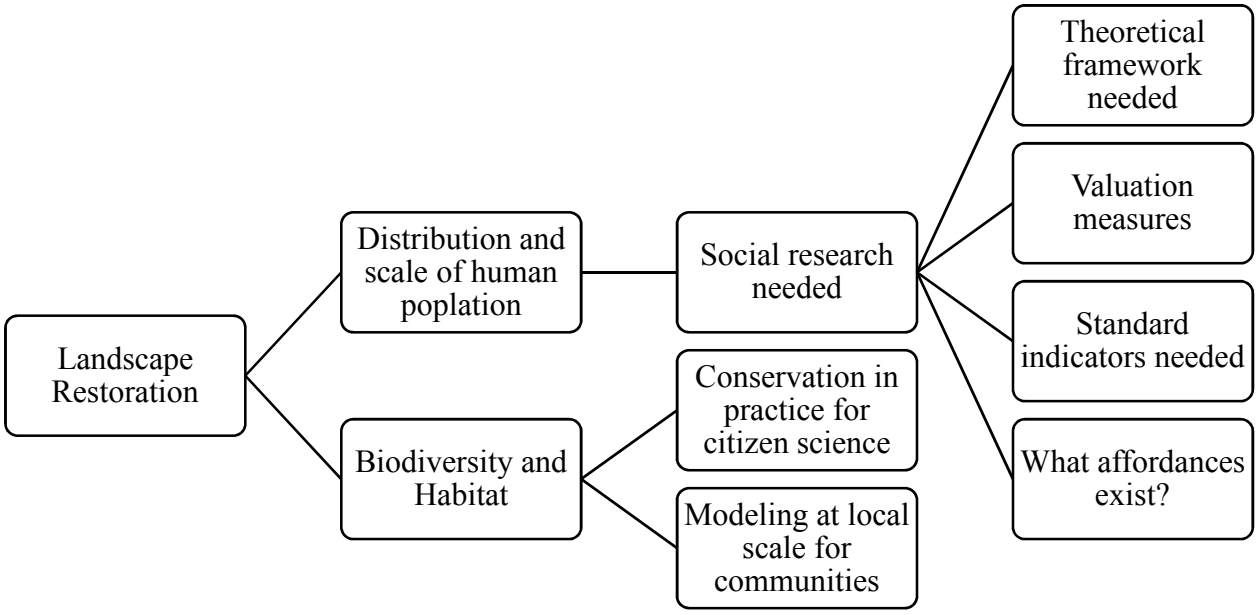

Figure 3. Included Literature: Ecology Themes.

Subthemes Found in Psychology of Aesthetic Perception

Visual Aesthetic Quality

The visual quality of a landscape is composed of a synthesis of the elements that reside in it and influenced by the viewer's characteristics (Kalivoda et al., 2014; Shanahan et al., 2019). Filova et al. (2015) give examples of elements in the urban landscape as water, greenery, hardscaping, and the level of maintenance. Previous studies have compared native to non-native species or natural to anthropogenic landscapes as well as the balance of the elements in the landscape and often these studies question preferences of only one landscape type with different elements (Filova et al., 2015). Preference for a landscape was attributed to familiarity with the present elements and not necessarily based on native or non-native evaluations (Hoyle et al., 2017).

Qualitative studies that examine factors of aesthetic perception and valuation and how they relate to the subjective visual preferences of plants in various landscapes are few (Agarwala et al., 2014; Kalivoda et al., 2014) and little is known about the broader perceptions of the urban public (Kim, 2016). Further review of plant species in these landscapes could benefit the existing body of research and visions for the future of landscape planning (Filova et al., 2015; Ives & Kendal, 2013; Özgüner & Kendle, 2006). The impact of decisions made about the design of restorative landscapes and how they are used for society's benefit often concerns visual preferences, which could be expanded on to include auditory or olfactory experiences as well (Olander et al., 2018). If a landscape is available and accessible to the public, the next concern is if it is considered attractive (Biernacka & Kronenberg, 2019) and while the aesthetic value of a landscape is subjective, studies have shown that the higher the rating for VAQ, the higher the consensus from those surveyed. This illustrates that measures of aesthetic quality can hold insight into valuation.

Affordance

Knowledge of landscape elements and frequency, intensity, and duration of time spent in a landscape can develop or enhance an individual's perception of their natural environment and affect mental and physical health (Menatti & Casado da Rocha, 2016; Shanahan et al., 2019). As a form of educational psychology, *affordance* offers an idea of what may be available at a basic level to an organism in the landscape (Gibson, 1979 as cited in Harris et al., 2017, p. 6). These relational possibilities may drive preferences of parks or gardens in the urban landscape. Examples include a varied arrangement of trees, structures, and diverse plant species. This approach may indicate that perception is balanced between instinct and experience (Menatti & Casado da Rocha, 2016).

Perception	Stakeholders
	Preference
	Processual
Landscape	Characteristics
	Features
	Voids
Quality	Accessibility
	Affordance
	Availability
Visual	Aesthetic
	Valuation
	Intensity

Figure 4. Included Literature: Psychology Keywords

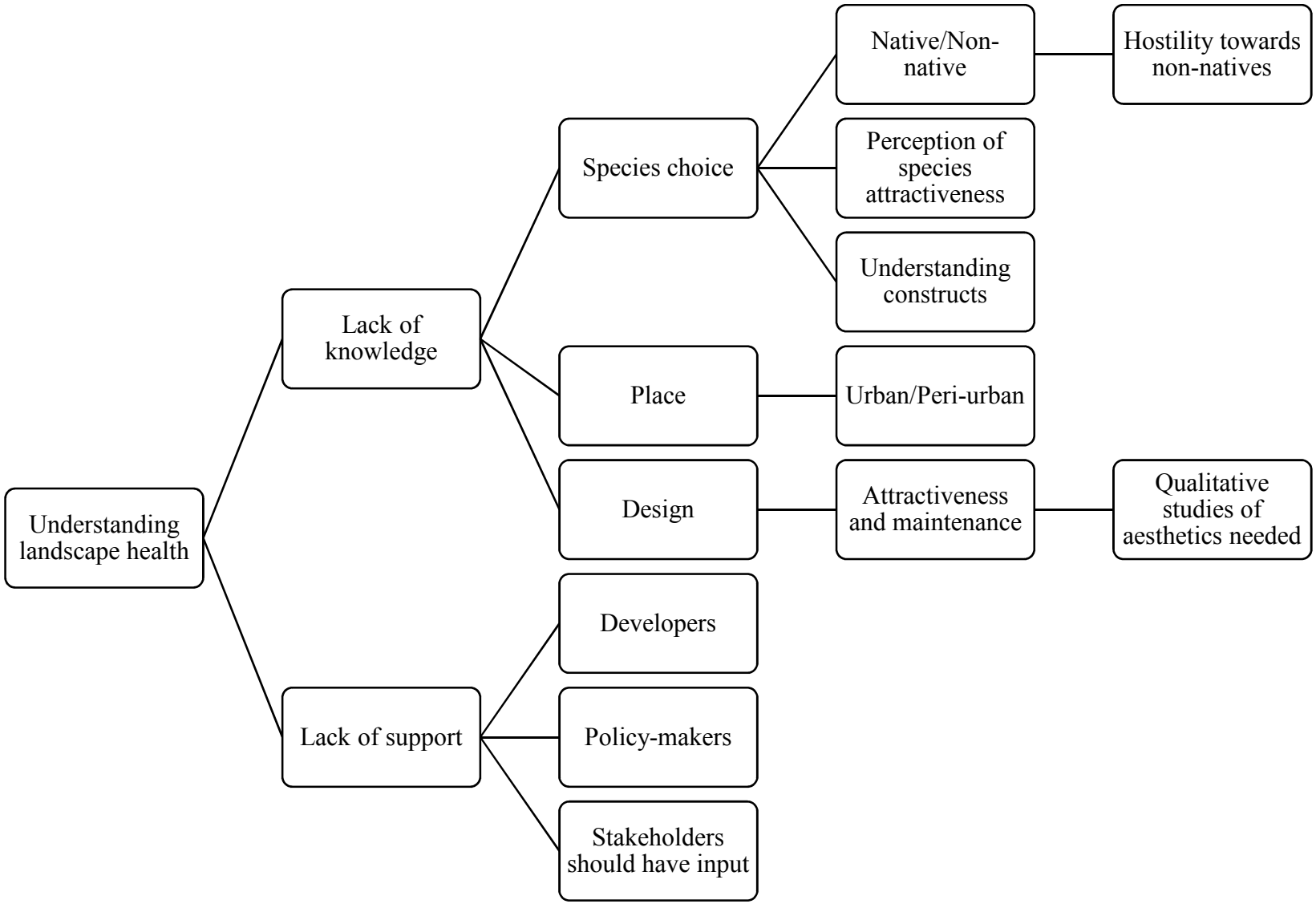

Figure 5. Included Literature: Psychology Themes.

Subthemes Found in Frameworks

Pro-environmental Behavior

Specific opportunities to experience first-hand nature in yardscapes, can influence positive urban landscape choice (Khew et al., 2014). Tailored workshops, surveys, or field days can benefit those that wish to gain knowledge in restorative landscapes, education and experience helps residents in urban areas understand the benefits associated with rehabilitated yardscapes (Lucey & Barton, 2011). As the provision of landscape in urban areas often occurs without input from residents the link between place and PEB cannot develop (Farahani & Maller, 2018).

A cognitive hierarchy that begins with values and beliefs, or perceptions, is carried through attitudes and behavioral intentions into behaviors (Ives & Kendal, 2014). The behaviors are considered to be more unstable but the perceptions stable. Environmental psychology links PEB to these environmental values and the theory of planned behavior (Ives & Kendal, 2014). By measuring values, more can be understood of their actions and behavior in the environment or be used to trigger positive environmental consciousness (Wang & Yu, 2018).

PEB	Behavior
	Attitudes
	Ecosystem services
Perception	Framework
	Constructs
Social	Ethics
	Valuation
	Exposure
Planning	Policy
	Public
	Livibility

Figure 6. Included Literature: Theory Keywords.

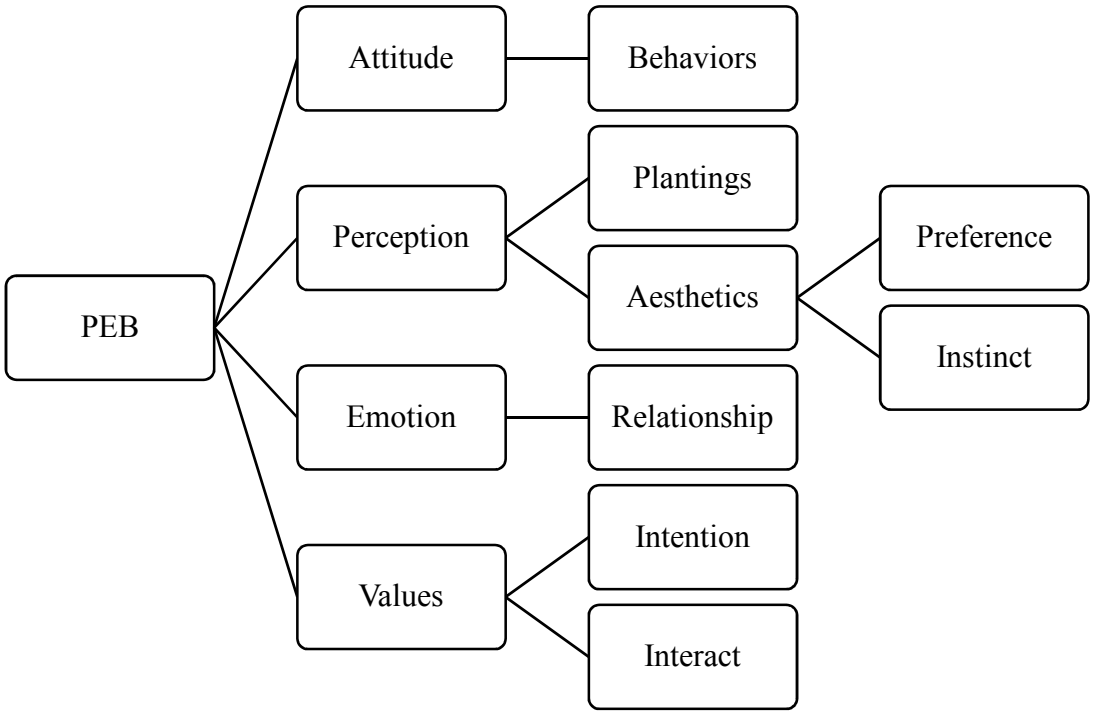

Figure 7. Included Literature: Theory Themes.

Discussion

Themes and Subthemes

Themes were used as a way to prioritize author research goals in the literature reviewed. They were also used to address aesthetic preference of local stakeholders in urban environments in other publications of other literature on interdisciplinary research and landscape design goals. Related literature that supports these thematic findings also focused on perceptions of aesthetics, the role of local communities, and the need for interdisciplinary research in urban landscape design and evaluation. These themes played upon one another and were interminably linked.

Perceptions of Aesthetics

If an ecological aesthetic exists, there is an importance to human perception and what is considered aesthetic in the landscape (Gobster et al., 2007). Examining the perceptions behind landscape valuation based on human experiences requires an analysis of the landscape attributes

themselves, whether the landscapes are considered places of utility, culturally appealing, or aesthetic (Svobodova, 2013). Human perception of landscape design and changing patterns "goes beyond just their visual appreciation – beautiful though they may be – into a richer understanding of how we experience our environment" (Bell, 2012, preface).

An expansion of inquiry for perceptions of species used in restorative landscapes could help clarify socio-ecological relationships; thus, contributing to urban habitat management and planning (Hegetschweiler et al., 2017). As Petursdottir, Aradottir, and Benediktsson (2013) note, ecological health revolves around complex biological processes, but its successes depend on public acceptance and support. Facilitating public acceptance and eagerness toward a more diverse and natural landscape must be based on results found from studying residents' perception and preference for landscape, research that has been primarily visual but recently includes other senses and experiences.

Justification for (Peri-)Urban Settings

In urban communities there exists an opportunity to measure community perceptions in an area of flow, growth, or of changing landscapes. Urban areas are perceived as synergistic areas by the public and regarded as valuable in terms of understanding the human-landscape relationship (Ives & Kendal, 2013). Urban landscape design contains elements of landscape protection but in order to more fully protect the land, the land must hold value by the community that resides within the landscape (Ives & Kendal, 2013). The formation of aesthetic valuation for backyards in urban neighborhoods could be a key component to creating a sense of investment and admiration by community residents (Beumer & Martens, 2015).

While some urban neighborhoods offer parks or botanical gardens, the yardscapes of the average citizen are often overlooked (Burr et al., 2018). Urban landscapes transform quickly due

to expansion; because of this rapid rate of growth and urbanization these areas are ideal for an analysis of biodiversity and landscape preference studies (Qviström, 2018). The impetus, recently, has been for a more inclusive environment; as a greater awareness of beneficial landscape practices and attitudes in the urban environment have been more incorporative of diverse landscapes (Özgüner & Kendle, 2006). For example, yards and gardens are ubiquitous in the Midwest of the United States and take up large amounts of land; in urban areas, residential gardens result from a mix of plant choices, creating the ideal area for further research (Kendal et al. 2012) and as urban yard habitats provide a variety of landscapes, they may act as key linkages between social actors, stakeholders, and ecological systems (Kibler et al., 2018).

The Local Community as Stakeholders

Without public support and involvement, urban greenspaces could fail to meet residents' preferences and be abandoned (Farahani et. al., 2018; Jim & Chen, 2006, p. 338). A well-educated and involved public can help guide the remediation and restoration process for the lasting benefit of all (Hutchins, 2018). Participation and investment from the local community leads to a more sustainable design based on "both an analysis of sociocultural priorities and an understanding of possible trajectories of ecosystem development associated with the available restoration methods to avoid results that are neither socially acceptable nor ecologically feasible" (Petursdottir et al. 2013, p. 75; Svobodova, 2013). Merging societal perceptions of landscape into new or existing urban design can benefit both society and the environment by creating a sense of ownership and unity in the stakeholders which contributes to the longevity of restoration methods (Nohl, 2001). As not all species of plants are perceived the same (Gobster et al., 2007; Nohl, 2001) and as residents are the stakeholders in urban neighborhoods, more information is needed to evaluate which species are preferred so that future local design is sustainable and supported.

A Multi-disciplinary Approach

Li et al. (2017), stressed the need for an integrated relationship between artificial and natural systems. This sentiment is not unique to one area, it is held across disciplines: biologists, geologists, social scientists, and many communities recognize a need to cohabitate with their surroundings. Such multidisciplinary research can be used to set the stage and describe people in their environment as one of three players: as a receiver from the landscape, as an actor on the landscape, or as an active participant, exchanging with the landscape (Zube, 1987). Over the past several decades, research in landscape restoration has unified disciplines that contain a common theme of socio-ecological multifunctional design.

Conclusion

Whether in an urban or rural setting, humans are woven into the ecology of their surrounding landscape as an integral member, as an inhabitant and as a shaper (Bell 2012). In order to be sustainable, planned services should include human perceptions at a local level as a design necessity for future development (Haines-Young & Potschin, 2010; Wu, 2013). Focusing on and understanding aesthetic preferences for ecosystem services at a local scale in urban areas helps to select avenues that have both a complementary effect for a community and positive implications for the landscape (Hegetschweiler, 2017).

While study methodologies of large-scale and regional landscape ecology are still hard to fully control for rigor, urban areas could offer a smaller space to be evaluated for human preferences and perceptions at a dynamic local scale. These studies can consider human perceptions and preferences for biodiversity but also general aesthetics of restorative sites using phytoremediation techniques. Additionally, using models that are community-friendly can help incorporate people into land-use decisions based around the ecology of a landscape. Understanding

preferences on a local scale can aid in implementation choices for landscape design that will subsequently have a complementary effect for a community and positive implications for the ecology of the area. Understanding the variables that impact intention and behavior can give insight to best practices in remediation design. Using a framework such as TBP, variables that account for how people value landscape, in terms of aesthetics, can provide future clues to intention and action. At both the human and the landscape scale, theoretical frameworks should be clarified to accommodate rehabilitated landscapes, and can help fulfill social principles (Nassauer, 1995; Svobodova, 2013).

Through an understanding of resident perceptions of the value of restorative landscapes, it is possible to create neighborhoods with increased ecological interconnectedness, resulting in positive change for ecosystems and for society (Haines-Young & Potschin, 2010; Sutter et al., 2018). Landscape designers working in urban environments with restorative landscape may find that by including community perceptions, the longevity of restorative landscaping plans can be upheld. Installation of restorative landscapes becomes more feasible and streamlined with regard to sustainability if "the interdependence of the spatial structure of social and ecological components is explicitly recognized" (Opdam et al., 2018, p. 4) and the neighborhood community supports design and development.

Limitations

This review is limited to the journal articles found by the chosen databases and guidelines. Terms that were intentionally excluded from the results – economic and culture – turned up in the literature, if not specifically in the vocabulary then in context. This literature review focused more on the perceptions, however, than on the economics or on the culture behind choices made regarding restorative landscape. As aesthetic perceptions are partly based on a cultural

background, this yielded a limitation in the research. Additionally, this literature review was conducted in 2019 and further literature review may be needed to make the date timelier.

Recommendations

The dualism in landscape planning of aesthetic-versus-ecological valuation provides an example of the need for input from different disciplines when planning a best practice landscape design (Qviström, 2018). Incorporating human perceptions of what is aesthetically valued can help rehabilitate damaged urban areas, but interdisciplinary cooperation is essential to move forward in a holistic manner (Nohl, 2001).

There exists a need to understand why some landscapes are valued and others are not. While personal preference cannot be fully predicted, with more research that examines the human experience in the natural environment, the literature can be built upon to include other forms of evaluation. Not only through visual, but auditory, olfactory, or experience-based exchanges with the landscape. Yardscapes or urban areas may offer sites for remediation or restorative landscaping that is supported by the local community if more is known about socio-ecological preference. Research in landscape aesthetics is growing but is missing links that connect community and ecology. Deciding on an appropriate scale at which these links are processed is also a need. In the future, to fully benefit from restorative landscapes, human perceptions can be incorporated into urban design (Ignatieva et al., 2011; Russo et al., 2017) and by including these perceptions in practice, applied research can produce real-world outcomes with regard to the relationship between nature and society and the valuation of landscapes used in remediation in urban environments (Niemela et al., 2010; Rudd, Vala, & Schaefer, 2002; Tzoulas et al., 2007).

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Appendix

Figure 2 and 3 Sources

Source	*	Keywords	Theme
Eigenbrod, 2016	-	Landscape scale, biodiversity, socio-ecological relations	Distribution and scale of human population, wealth, land management, play key role in ecosystem services (ES)
Evers et al., 2018	U, R	ES, biodiversity, social impact, novel landscapes	Lack of research on social aspects of novel ecosystems (NE), ES, and biodiversity. Social research needed
Harris et al., 2018	U, N	Landscape context, preferences, biodiversity, gardens	Preferences shape neighborhood decisions, parks preferred, role of affordances important
Minteer et al., 2018	U	Demonstration garden, applied science, biodiversity	Conservation in practice, inquiry-based education, youth perceptions of biodiversity in different habitats
Pickett et al., 2017	U	Heterogenous landscape, human dynamics	Lack of theoretical framework in urban ecology for heterogeneity to combine social and ecological system
Schram-Bijkerk et al., 2018	U	Relationship with land, urban management and design, ES	Standardized indicators for evaluation of effects in urban design, improve social cohesion, valuation, citizens as stakeholders
Tribot et al., 2018	-	Aesthetic value, biodiversity, scale, case study	Aesthetic perception of landscape, value, and biodiversity poorly understood, gaps in methods in assessment of aesthetics and in connections and links, enhanced knowledge for conservation
Smith, 2015	N	Phytoremediation, community, design for integration	Urban phytoremediation transforms infrastructure, environmentally responsive planning, citizens as stakeholders, multiple theory

Note. *Abbreviations *scale*: N=Neighborhood; U=Urban; R=Rural; -=NA.

Figure 4 and 5 Sources

Source	*	Keywords	Theme
Biernacka et al., 2019	U	Availability, accessibility, and attractiveness, stakeholders	Attractiveness is associated with the design and maintenance of landscape and barriers include policy and planning failures and lack of stakeholder input
Filova et al., 2015	O	Visual preference, perception of specific features	Online survey showed respondent characteristics significant, place of origin significant, knowledge affects perception
Kalivoda et al., 2014	R	Respondent characteristics, visual aesthetic quality	Significant results on preference for scenes based on gender, age, education, occupation
Kim, 2016	U	Public valuation, urban voids, quality of life (QOL)	Planner and designer suggestions based on gap in research, enhanced QOL, reuse and reclaim urban land when urban sprawl occurs
Shanahan et al., 2015	-	Intensity, duration, frequency of exposure to landscape	Nature dose can help in health, stress, social well-being, manipulation of landscape for people
Hoyle et al., 2017	U	Perception, non-natives in design	Hostility toward non-natives without reason, abstract, social construct
Kim and An, 2017	U	Perception, landscape aesthetics, case study	Support, even with lack of knowledge, of restorative landscape, seek quantitative values and correlational studies for aesthetics
Menatti and Casado da Rocha, 2016	-	Affordance, eco-psychology, processual landscape	New theoretical framework for human health and landscape: how to distinguish landscape from environment, define aesthetic pleasure

Note. *Abbreviations *scale*: N=Neighborhood; U=Urban; R=Rural; -=NA.

Figures 6 and 7 Sources

Source	*	Keywords	Theme
Cohen, 2017	U	Lit review, framework, categories in (ES)	Lack of principle and framing in field of landscape sustainability leads to cherry-picking and non-cohesion
Farahani et al., 2018	U	Perception and preference, livability, policy, planning	Develop a new framework to understand perception and preference for greenspace
Ives and Kendal, 2014	-	Valuation, perception, human behavior	Stakeholder values vital and overlooked, what management goals are reflected, socio-ecological relationship poor
Wang and Yu, 2018	-	Environmental ethics and aesthetics, public attitudes, pro-environmental behavior (PEB)	Modeling environmental attitude, value, intention, triggered aesthetic feeling, and emotional approach needed for PEB. Rational cognition and aesthetic perception interact with each other
Whitburn et al., 2018	U	Social constructs, exposure, PEB	PEB is exposure related, psychological constructs need defined- more neighborhood plantings increase environmental behavior

Note. *Abbreviations in scale: U=Urban; -=NA.

Chapter Two: Viewer Response to Demonstration Gardens; Usefulness of Informal Education in Plant Preference for Future Landscaping

Abstract

With limited natural resources and a growing population, a sustainable relationship between humans and the natural environment is crucial to the health of urban landscapes. Cultivating value for those sustainable relationships can occur through informal education; however, understanding the initial perceptions toward urban landscapes, including aesthetics, can assist educators in tailoring learning opportunities to meet the needs of learners. The purpose of this study was to describe trail users' perceptions of existing plant species along the Watco Trail and the users' preference for future landscape change. Examining a way to educate local communities about native forbs that may be used in land reclamation, as pollinator habitats, or as aesthetic spaces in urban communities is important as a sustainable component of future land stewardship. To evaluate aesthetic value, an evaluation (n = 35) was conducted in July 2019 before the addition of two native wildflower plots along the trail and a second evaluation (n = 20) was conducted after the garden plot was in full bloom in July of 2020 with another group of respondents. These demonstration gardens were used as an informal education intervention along a commonly used walk/bike path in Pittsburg, KS with high visibility from a well-trafficked area. Results indicated a greater number of people found the demonstration plots around the trail to be attractive with an increase from 42% to 65% finding the trail very or highly attractive in the area of the demonstration garden block. Recommendations for community involvement in landscape design include addressing aesthetic perceptions toward beneficial native species as a measure of community preference for future plant choice and sustainable development.

***Keywords*:** demonstration garden; plant preference; perception; informal education; trail users

Introduction

One of the more complex problems facing the agricultural, food, and natural resources industries today is in the interpretation of social-ecological relationships (Pauley et al., 2019). With a majority of the US population residing in nonrural areas, building dynamic living spaces where society and nature share resources in time and space (Farahani et al., 2018) is a critical piece to solving this grand challenge. Citizen science can improve natural resource management when the citizens are educated in sustainability (Minteer et al., 2018).

Communities initiating change toward stewardship practices must consider the values and perceptions of their community members; if neighborhoods are not invested in environmental projects, the changes are not lasting (Cáceres et al., 2015; Morales et al., 2019). In greenspaces such as gardens, parks, and trails, the biodiversity of species used in urban plantings can evoke emotion in the users of the place (Hoyle, 2015; Ko et al., 2017). It has been shown that the more biodiverse and native the selected plantings are, the better they tend to be for the landscape (Hoyle et al., 2017) but how the plant biodiversity is viewed by the public is still being researched.

Aesthetic perceptions- or the use of one's senses to discern what is beautiful- can be used to analyze societal valuation and preference of plant species in land stewardship (Eastburn et al., 2018). With positive public perceptions there is a greater sense of ownership and interest from local communities; methods concerning perceptions are scattered though and require organization to be of greater use (Collins et al., 2011; Fisher et al., 2009). While a survey of aesthetic perceptions of plants can be used to identify and to emphasize how individual species are valued by different social actors there remains a lack of qualitative input from the communities at the local level (Cáceres et al., 2015). Whether an "aesthetic" can be measured in landscape planning, design, and management is still debated (Gobster et al., 2007); however, reviewing aesthetic

perceptions on a local scale may lead to sustainable future design for the landscape. Examining sustainable initiatives requires an analysis of the landscape attributes preferred by the public (Cáceres et al., 2015; Gobster et al., 2007; Svobodova, 2013).

Demonstration gardens that promote biodiverse species influence the public's aesthetic perception and increase awareness of native species (Buckingham, 2016; Minteer et al., 2018; Morales et al., 2019). Integrating native eye-catching species that are also beneficial to pollinators and used in soil amendment might inspire more local plantings of these native forbs (Minteer et al., 2018).

Plant species can aid in erosion control, soil amendment, enhancement of pollination, water retention, or remediation of contaminants (Eastburn et al., 2018; Hayden et al., 2015; Menz et al., 2011). However, considering community members' aesthetic perceptions of these plant species could aid in the longevity of land stewardship projects (Hutchins, 2018). Previous studies have found aesthetics to be the primary consideration of homeowners when making landscape choices, valuing environmental aspects to a lesser degree (Fernandez-Canero et al., 2011; Larsen & Harlan, 2006; Spinti & St. Hilaire, 2004). Hayden et al. (2015) found that while over half of their respondents considered the ecological health of their yard when making landscape decisions, over one-third felt they lacked the knowledge required to include ecological health as a factor in their landscape decision-making. Yet, homeowner perceptions of their personal landscapes may not translate to residents' perceptions of community landscapes. Many studies have implied that societal perceptions and preferences involving plant species can be used to identify and to emphasize how beneficial plants are valued by different stakeholders -- but there remains a lack of local community input (Cáceres et al., 2015). This lack of research in restorative plant design that include humans as part of the overall system points to a misunderstanding of how humans fit

into the natural environment (Collins et al., 2011). Understanding community members' aesthetic perceptions of existing plants can help determine what variables affect their valuation of specific plant species (Brown & Amacher, 1999; Hayden et al., 2016), thereby informing future landscape choices within a community's shared spaces (Nohl, 2001; Olander et al., 2018) and providing informal educators with information to better shape community learning experiences to initiate lasting change (Andenoro et al., 2016).

Therefore, in creating successful and sustained restorative projects, the land must be given some value by the community that resides within the landscape and that value must be understood by the landscape developers (Ives & Kendal, 2013). Public response to demonstration gardens has been used as an indicator of aesthetic valuation based on spatial layout and content of biodiversity (Lindemann-Matthies et al., 2010). In order to understand how native species are viewed in southeast Kansas, evaluations were conducted on users along Watco Trail in Pittsburg, KS before and after installation of two demonstration gardens with a biodiverse mix of local native species of wildflowers. More areas like this are needed in southeast Kansas to promote pollinator health and improve previously mined land: both aesthetically and in soil composition. To be a sustainable planting, public awareness of the existence of the plants (Amprazis et al., 2020) and aesthetic valuation or acceptance is important (Lindemann-Matthies et al., 2010; Nohl, 2001, Ramos et al., 2007) and future landscape design should take aesthetic valuation of native species into account.

Conceptual Framework

The National Research Agenda of the American Association for Agricultural Education (Roberts et al., 2016) specifically identified the global challenge of natural resource management as one needing multiple perspectives, interdisciplinary understanding, and transdisciplinary solutions (Andenoro et al., 2016). Therefore, the conceptual framework for this study draws from

(among other subject areas) literature from landscape studies, education, horticulture, and psychology to use an interdisciplinary approach

Informal Learning and PEB

A well-developed body of theory and evidence that explores concepts of land ecology and social value across different disciplines which include philosophy, economics, sociology, and psychology is helpful in analysis (Ives & Kendal, 2014). Insight from these disciplines provides a robust and sophisticated platform for considering the role of social values in land stewardship and research (Ives & Kendal, 2013). Smith (2015) outlines several theories, of these, the ecological integration theory, which proposes that natural systems, not designed landscapes, be integrated as support elements to create healthy communities and stewardship. In order for these natural systems to be long-lived it is important to take account of human preference and perception (Palmer, 2013). Evaluation of these intentions and behavioral predictors has been used in studies on understanding pro-environmental behavior (PEB) and the outcome of how a community or an individual will react to an environment (Hines et al., 1987; Wang & Yu, 2018). Environmental aestheticians maintain that experience in nature can instill environmental ethics and by understanding how those experiences are received and interpreted, it is possible to predict or affect future behavior (Ajzen, 1991; Wang & Yu, 2018).

An informal approach to education can contribute to the experiences had in greenspaces by means of informational signage, displayed images, or self-guided tours and is often used in educational areas such as museums and botanical gardens (Holt, 2019; Sanders, 2007). A concept thought to have originated from educational philosopher John Dewey, informal approach to learning plays a large role in how people continue to learn throughout life (Burrows et al., 2018;

Monk, 2013). Informal environmental education can influence PEB by creating a setting that encourages people to identify plants in their surroundings and is guided by simple signage.

Purpose and Research Questions

This study observed and recorded trail user perceptions of two scenes along the same block in Pittsburg, KS, before and after a garden plot was constructed. Previous research has shown that plants used in landscape design can be seen as having value based on cultural, economic, aesthetic, or recreational reasons (Cáceres et al., 2015; Fisher et al., 2009). The purpose of this study was to evaluate perceptions regarding current greenspace in the trail environment and to discover future greenspace preference by use of aesthetic valuation based around participant attitudes.

The goals of the study were to:

1. describe trail users' aesthetic perceptions before and after the installation of two demonstration gardens in the greenspace along the Watco Trail in Pittsburg, KS;
2. describe trail users' aesthetic responses to plant species present in the landscaping;
3. observe trail users' knowledge of their environment before the installation of the demonstration plot signage along the Watco Trail and after.

Methods

In May 2019, an 11-item electronic questionnaire was developed by the researcher and approved by the Internal Review Board at the University of Arkansas. The questionnaire items asked for respondents' perceptions of the aesthetic value of a site and included plants along the Watco Trail. Questions were divided by context, personal interest, and environmental preference categories (Hoyle, 2015). Questionnaire items were evaluated via three cognitive interviews with University of Arkansas volunteers as participants. The questionnaire was tailored as suggested by

these interviews and followed with a pilot study in July 2019. The pilot test was administered two weeks apart with participants from the University of Arkansas to measure internal consistency of the constructs and context of the instrument, resulting in a Cronbach's alpha score of 0.82, which was deemed to be acceptable for this study (Cronbach, 1951). Instrument validity was also established through construct and face validity by using an expert panel consisting professionals in social sciences, questionnaire development, and informal education.

Initial Observation, 2019

In 2019, the population for this study included all adults traveling along the Watco Trail during the course of two weekends in July between 9:00am and 5:00pm (N = 59). Using an electronic tablet to collect responses, those walking along the trail were approached and asked to complete the electronic questionnaire. A convenience sampling method was used at the Watco Trail in Pittsburg, KS. No repeat submissions of the questionnaire were allowed, and subjects were required to first declare that they were over the age of 18. A response rate of 59% (n = 35) was recorded over the two weekends in which survey was executed.

Following Garden Installation, 2020

In July of 2020 using convenience sampling along the trail with passers-by, the same instrument was used with a population of N = 25. Approaching all adults traveling along the Watco Trail during two weekends between 9:00am and 5:00pm resulted in a response rate of 80% (n = 20) after a total of four days of data collection. Using a tablet to collect responses, and using proper precautions due to COVID-19, those walking along the trail were approached and asked to complete the electronic questionnaire. No repeat submissions of the questionnaire occurred, and subjects were required to first declare that they were over the age of 18.

For both 2019 and 2020, fully completed questionnaires were analyzed using Microsoft Excel software and are reported via frequencies. We caution readers against generalizing beyond the respondents in this study, as nonresponse error was not able to be controlled due to the face-to-face nature of the data collection.

Demonstration Gardens

Importantly, the initial observations occurred before the installation of two demonstration gardens measuring 20 x 10 feet (Figure 1) that were planted with biodiverse native forbs which are detailed in Figure 2. These gardens were planted in the late fall of 2019 to be used the following summer as a native plant demonstration garden. In July of 2020, the gardens were in full bloom with 11 species represented at the time of surveying (Figure 2). The gardens were installed as an educational intervention along with various signage accompanying the plants. While the gardens were within 20 feet of the walking path, the signage was closer so trail users would not have had to leave the path to get information. These signs indicated to trail users that the gardens were composed of North American wildflowers and good for pollinators, such as butterflies (Figure 3).

Figure 1. Garden Plots in July.

Series 1: Erosion Control
Chasmanthium latifolium (inland sea oats)
Sporobolus cryptandrus (sand dropseed)
Rudbeckia subtomentosa (sweet black-eyed Susan)
Series 2: Soil Amendment
Maximilian sunflower
Dalea candida (white prairie clover)
Series 3: Pollination
Solidago missouriensis (Missouri goldenrod)
Echinacea purpurea (purple coneflower)
Symphyotrichum laeve (smooth blue aster)
Series 4: Seasonal Bloom
Gaillardia pulchella (Indian blanket)
Asclepias syriaca (Milkweed)
Centaurea cyanus L. (Cornflower)

Figure 2. Planted Forbs.

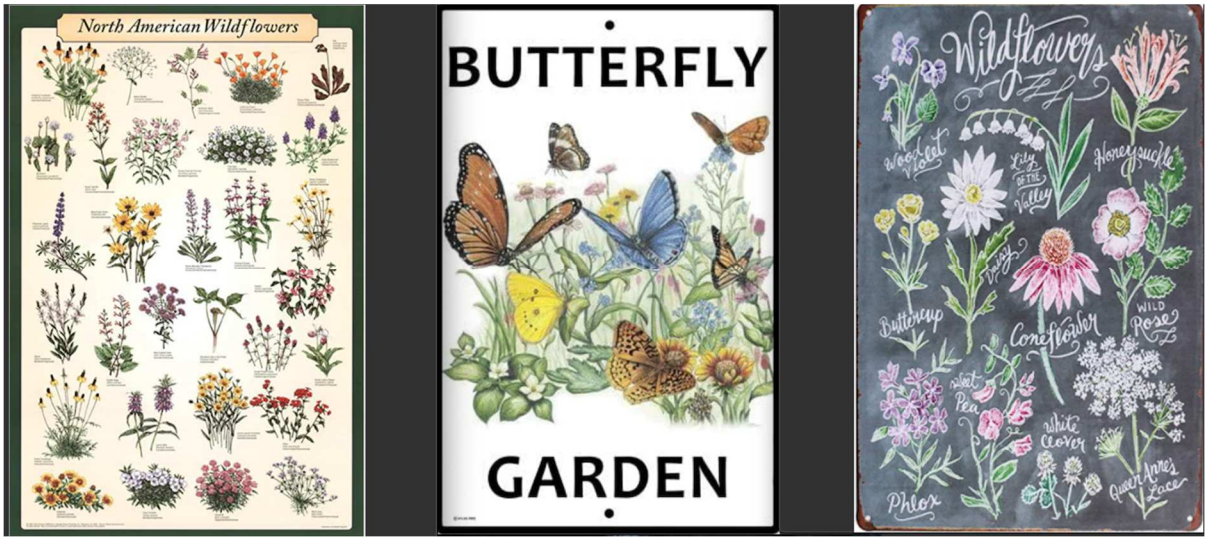

Figure 3. Demonstration Plot Signage Used at the Site.

Findings

Locality and Trail Use

In 2019 a majority of the respondents were fairly regular trail users; 80% (n = 28) [in 2020 65% (n = 13)] indicated they visited the Watco Trail either weekly or monthly, while 9% (n = 3) [in 2020 35% (n = 7)] reported this being their first time to the Watco Trail (Figure 4). This may have been because there was a festival in town near the trail that day. In 2019 slightly over half of the respondents (54%*;* n = 19) reported using the trail that day for exercise, while just under one-

third (28%; *n* = 10) chose recreation as a motivating factor for coming to the trail. In 2020, however two-thirds of the respondents (70%*; n* = 14) reported using the trail that day for exercise or pleasure, while one-third (30%; *n* = 6) chose travel from point A to point B as a motivating factor for coming to the trail. In both 2019 and 2020, most of the respondents were local and over half [2019, 54%; (*n* = 19); 2020, 65% (*n* = 13)] had only traveled between one and five miles. All first-time users had travelled over five miles to use the trail, while those that used the trail seasonally were all located within three miles Figure 4).

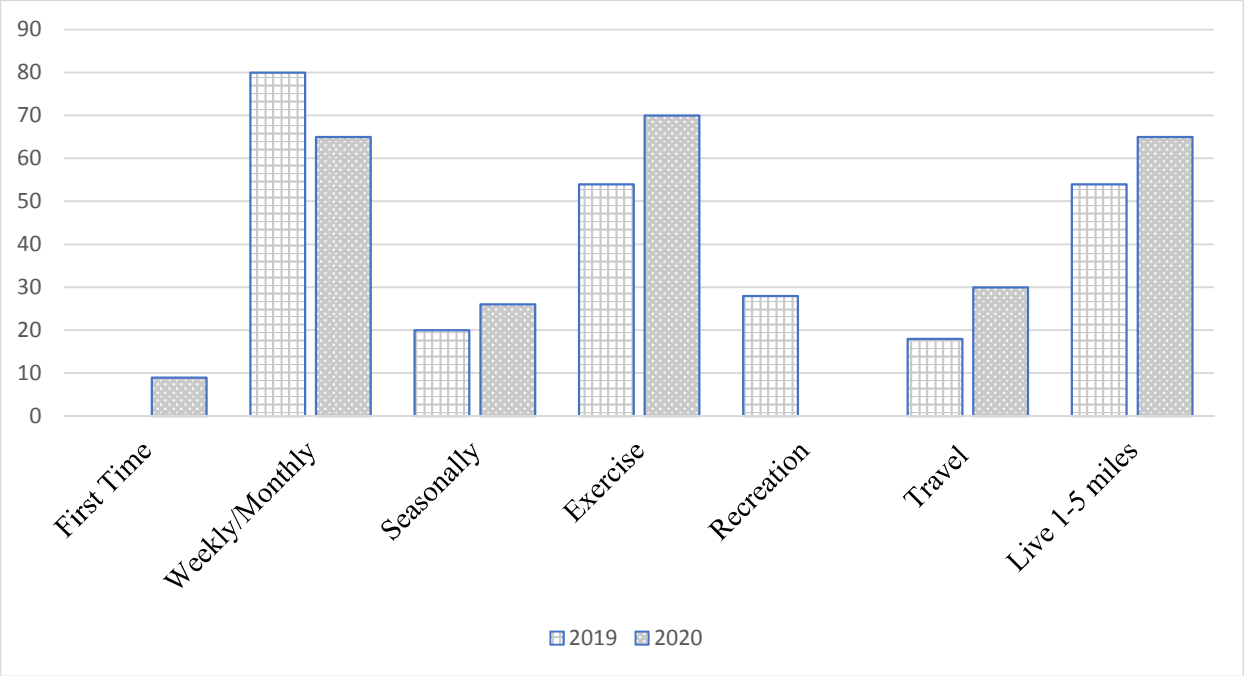

Figure 4. Trail Use and Locality.

Trail Environment

Feedback from trail users on feelings on relaxation, attractiveness, and tidiness of the trail were addressed through questions that asked respondents to rate their answer from one (least) to five (most). In 2019 most respondents (54%, *n* = 19) indicated feeling relaxed (indicated as a 4 or 5 on the scale) as a result of walking on the trail and believed the trail to be well managed (57%; *n* = 20; Figure 5). In 2020, however, only some of respondents (35%, *n* = 7) indicated feeling

relaxed as a result of walking on the trail while a greater number of people were not feeling relaxed (40%, *n* = 8) yet many believed the trail to be well managed (60%; *n* = 12). It's possible that fewer respondents were relaxed as the area was experiencing its first surge in COVID-19 cases with a local outbreak. Respondents were more varied in their perceptions of the trail's attractiveness, with over a quarter of the respondents (28%; *n* = 10) rating the trail as unattractive (indicated as a 1 or 2 on the scale) in 2019. In 2020 a quarter of the respondents (25%; *n* = 5) rated the trail as unattractive in the block with the demonstration gardens, whereas two-thirds of the respondents had more aesthetic feelings (65%, *n* = 13; Figure 5).

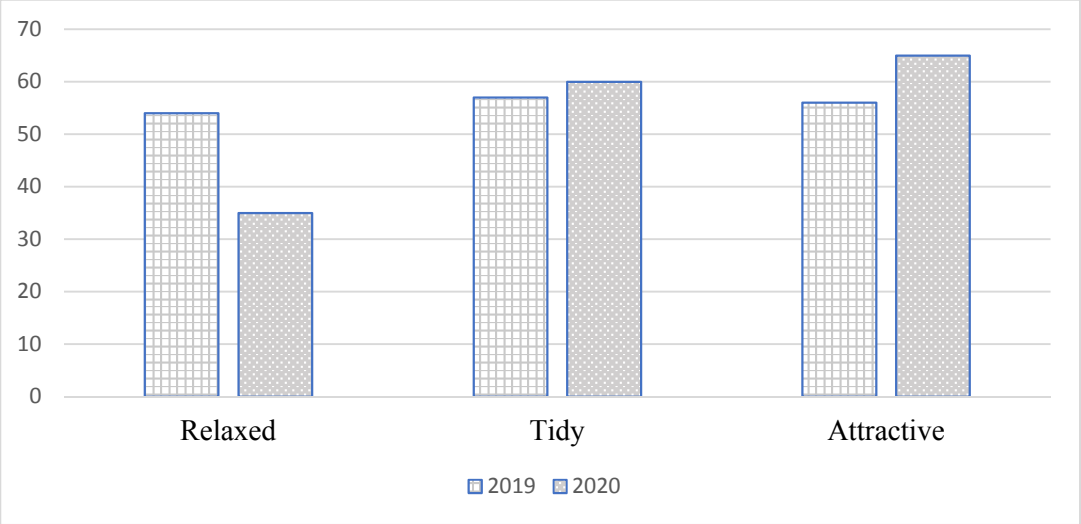

Figure 5. Response to Trail Environment- 2019 and 2020.

Plant Preference

In 2019 many of those surveyed did not express interest in gardening (71%; *n* = 25), [2020, 55 %; *n* = 11]. When asked if they would prefer a vegetable, flower, or no garden at all, 34% (*n* = 12) of the respondents indicated they would like to be involved with both flower and vegetable gardening, while 23% (*n* = 8) chose vegetable gardening, and 23% (*n* = 8) chose flower gardening. Only 20% (*n* = 7) chose to not garden at all. In 2020 when asked if they would prefer a vegetable, flower, or no garden at all, 60% (*n* = 12) of the respondents indicated they would like to be involved

with both flower and vegetable gardening, while 5% (n = 1) chose only vegetable gardening, and 20% (n = 4) chose only flower gardening. Fifteen percent (n = 3) chose to not garden at all.

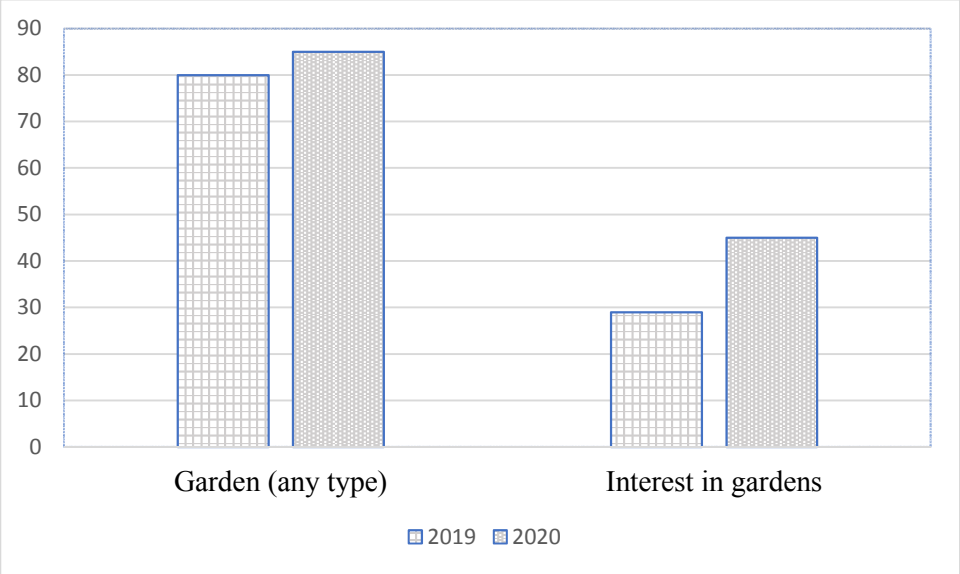

Figure 6. Preferences for gardening type (flower, vegetable, other) and personal interest in gardens in 2019 and 2020.

When asked about the plant species on the trail almost half [2019, 43% (n = 15); 2020, 50% (n = 10)] of the users noted that they had counted between one and eight species on their walk. In 2020 only 15% (n = 3) said they had not noticed any of the species on the trail. A majority of the respondents believed that "all" [2019, 29% (n = 10); 2020, 20% (n = 4)] or "most" [2019, 34% (n = 12); 2020, 45% (n = 9)] of the species were native (Figure 7). Some [2019, 37% (n = 13); 2020, 20% (n = 4)] of the trail users were not sure if the species of plant along the trail were native or non-native indicating a lack of knowledge on the concept (Figure 7).

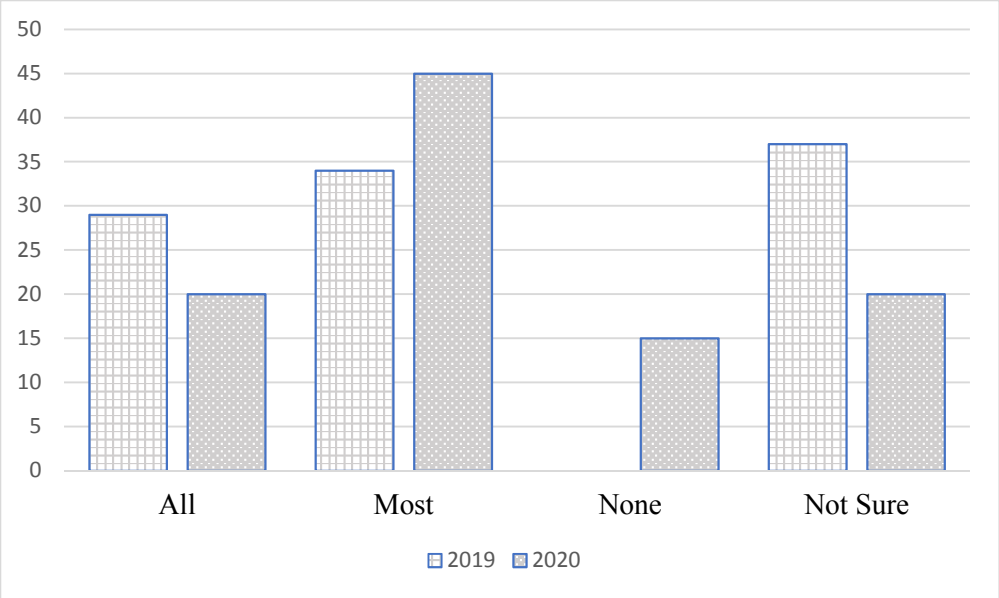

Figure 7. 2019 and 2020 Responses in Native Plant Identification.

When asked what type of plants they would like to see along the trail, in 2019 nearly half (46%*; n* = 16) indicated a preference for native plantings, while the second highest frequency was found with no opinion or preference (29%; *n* = 10; Figure 8). In 2020 35% (*n* = 7) indicated a strong preference for native plantings, while the second highest frequency was found with no opinion or none (15%; *n* = 4; Figure 8). The non-native species category was chosen by roughly 11% (*n* = 4) and 14% (*n* = 5) felt that no additional plants were needed in 2019 and similarly in 2020 the non-native species category was chosen by 10% (*n* = 2) and 15% (*n* = 3) felt that no additional plants were needed.

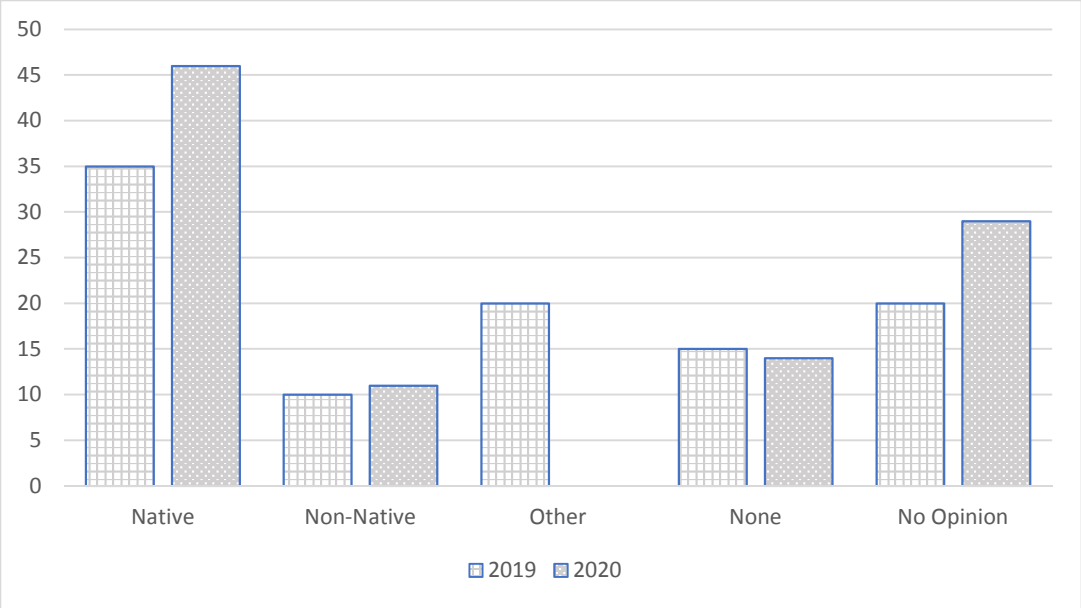

Figure 8. Response for Future Plant Preference.

Comparing Observations Before and After Garden and Signage Installation

Results between the two observations show many similarities. Responses on the purpose of use were unchanging (82%, 70%) as most were there for recreation or exercise. With regard to how well the trail was managed, the numbers were consistent at 57% and 60% in 2019 and 2020 summers, respectively. Most of the trail users classified "most" or "all" plants as native in both the observations (63%, 65%) and half of them counted between one and eight species along the trail (56%, 50%). Count differences were noted in the following categories, however: frequency of use, feelings of relaxation, gardening involvement, and how attractive they found the walk.

Trail frequency of use changed (80% to 65%) reflecting how "regular" of a user the respondent was. This could indicate more new users to the trail or a drop in the regular users. Interestingly, while a greater number of people found the landscape around the trail to be more attractive, with an increase from 42% to 65%, far more people questioned were feeling less relaxed (54%, 35%) in 2020 than in 2019. A greater number of users (from 34% to 60%) in 2020 were interested in gardening -both flower and vegetable.

Discussion

The purpose of this study was to describe such local aesthetic perceptions and preferences of plants for the trail users who frequented or passed by Watco Trail both before and after the implementation of a demonstration garden with informational signage. Increasing resident knowledge of restorative plant species that can enhance fall pollinators, improve soil quality, and prevent further erosion, this project exhibits a preliminary step that can be beneficial to land stewardship in any region that has had previous landscape disruption.

After reviewing respondent preferences for future plantings, it can be noted that there is a lack of knowledge for which species are native and which are non-native to the region. Initial results indicated that while the majority of respondents were regular trailgoers and felt the trail provided a sense of relaxation, their perceptions regarding the landscape's attractiveness and its current or future inclusion of native plants were varied. These findings differ somewhat from those of previous studies of homeowners, which reported aesthetics to be a high priority when making landscaping decisions (Fernandez-Canero et al., 2011; Hayden et al., 2016; Larsen & Harlan, 2006; Spinti & St. Hilaire, 2004). Further, respondents did not strongly indicate a preference for native plants, suggesting they could lack knowledge of these plants' beneficial qualities to an ecologically healthy greenspace, as was found by Hayden et al. (2015).

Additionally, the observation before the installation of the garden plots in the summer of 2019 found that there was a possibility of "plant blindness" – or the lack of noticing one's floral environment – that could explain some of the responses to plant preference and the aesthetics of the trail (Amprazis et al., 2020). Plant blindness, posited to be caused by the tendency for plants to blend together and by their lack of movement, can have detrimental implications for plant conservation efforts (Balding & Williams, 2016). Informal education remains a low-maintenance

option for community education outreach and may be used in greenspaces to promote the idea of native species or beneficial species and to encourage community knowledge and engagement with plants or to combat plant blindness.

Limitations

In 2020, after the installation of the demonstration plots, a much larger percentage of the trail users indicated that they found the area aesthetically pleasing- perhaps due to the diverse flowering forbs in the two plots. Interestingly, fewer people felt a sense of relaxation- despite reporting the area to be attractive- though this might be explained by the environment of the time, as Pittsburg was having its first real wave of a COVID-19 outbreak in a local factory and many people were taking precautions in approaching and speaking with the researcher. Further studies would be needed to discover why this might be, however.

Other limitations that should be noted are that the sampling occurred over two warm (>95 degrees Fahrenheit) weekends in July of 2020 and that this sampling technique would have missed any users that only traveled on weekdays. Additionally, as noted, there was a COVID-19 outbreak where the city was affected in such a way that positive numbers quickly rose from dozens to hundreds in a city of 20,000. More research is needed with a greater number of participants as well. A different approach may be to leave a large sign with a website or QR code for passers-by to answer any aesthetic-related questions in their own time. A different sampling technique might help increase the numbers of participants or allow for a group to repeat responses in a pre-post-test approach.

Finally, while the plant species list was seeded in the plots, not all of the species grew well and had to be supplemented with other donated local native species that also were able to be used

in the same categories. Growing the plants on-site from seed was a financial choice and if possible, future plots should be planted with seedlings and plants for faster establishment.

Recommendations for Practitioners and Future Research

This study quantitatively assessed community members' perceptions of a community greenspace. However, several of the results left us with further questions, providing opportunity for continued research. First, while we assessed respondents' perceptions of whether plants were native, we did not assess their knowledge of native plants, including the definition of a native plant. We suspect knowledge of native plants was not consistently high among respondents, as a considerable number of them was unsure as to whether the plants along the trail were native. Therefore, we recommend researchers investigate knowledge of native plants to assist with future educational efforts. We also recommend qualitative inquiry into the visibility plants have among trailgoers, as plant blindness could be a factor educators and landscape designers may need to consider when garnering support for landscape changes.

The results of this study created several recommendations for practitioners as well. First, the lack of respondent consensus on the inclusion of native plants in the future and the number of respondents who were unsure whether the landscape included native plants leads us to recommend informal education on native plants for the area, as well as their ecological benefits. Informal education should also raise awareness of plants in general in an effort to thwart plant blindness along the trail. Extension agents would be well suited to provide both passive and active educational opportunities in this context. Additionally, offering demonstration gardens or informational signage may help residents understand more about the flora around them and make more informed decisions. By offering residents a choice in species selection of restorative or remediation landscaping, these same community members might implement similar landscapes in

their backyards, particularly when provided knowledge through demonstration plots that encourage resident use and land stewardship.

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Chapter Three: Aesthetics of Remediation Demonstration Gardens—

Installation of Signage and Native Plants to be used as an Informal Education Strategy in Southeast Kansas

Abstract

Use of demonstration garden plots in public greenspaces or along well-traveled paths can be beneficial for increasing awareness of beneficial native plant species. Signage can be used as an educational delivery method- such as is used in arboretums and museums- to bring awareness of pollinators and native species. Additionally, using species that are considered aesthetic or which create positive feelings may help inspire local trail users to incorporate the same species in their own yards. This study's garden installation evaluated user feelings of beauty, relaxation, and management both before and after demonstration garden plots were planted along a multi-use trail in southeast Kansas. While many demonstration gardens use a "hands-on" or active approach to learning, evaluating more passive and informal techniques can be helpful as well. The greatest perceived challenges for this case study were allotment of time and of money for initial costs of the demonstration garden as well as how to address possible plant blindness. Findings show there was support for future plantings of native species and a greater sense of aesthetics after the wildflower plots were added to the community greenspace.

Keywords: demonstration garden; informal education; plant blindness

Introduction

Demonstration gardens supply a practical tool and an ideal setting for informal education and can be used to enhance or measure public perception on feelings of landscape aesthetics and to gauge what landscaping should be done in the future (Biernacka & Kronenberg, 2019; Chan et al., 2016; Niţă et al., 2012). In areas where there is a need for land remediation, they can be used as demonstration areas for reclamation and remediation (Ruelle et al., 2013; Shaw, 2015) or as indicators of a community's knowledge or acceptance of certain plant species (Van Marwijk et al., 2012). Including community perception of plant species in landscape evaluations for any future or

ongoing plantings can add to sustainable development of landscape changes (Amprazis & Papadopoulou, 2020; Irving et al., 1999; Niţă et al., 2012). Informational signage can help community members understand more about the species present or draw attention to plants that might otherwise have been ignored (Armatas et al., 2016; Bolt, 2017; Hansen, 2012).

Demonstration gardens tend to be low-cost after their installation and, by using appropriate species, low maintenance (Kim & An, 2017). They can also influence people through behavioral change or action to plant their own gardens (Bolt, 2017; Hansen, 2012; Hill & Daniel, 2007; Williams et al., 2017). It is possible that the more aesthetic an area in the landscape, the more a user of that space may notice what is present in plant species (Galindo & Hidalgo, 2005; Hill & Daniel, 2007; Van Marwijk et al., 2012). Thus, by creating more aesthetic spaces with useful plants and informational signage, landscape remediation may be brought into focus for multiple audiences (Ramey Gassert et al., 1994; Sanders, 2007).

Planting a garden in a high-visibility area can help; even small spaces have been shown to influence passersby when using attention-getting signage or aesthetic plant species (Biernacka & Kronenberg, 2019; Hill & Daniel, 2007). An advantage to choosing an informal approach to education through signage means more spaces could be created as native plantings with signage are a fairly low-involvement approach to community education (Sanders, 2007). Informal education using signage is commonly used in botanical gardens, museums, or in downtown art areas (Monk, 2013). Styling remediation demonstration gardens as such can influence learning by being a source of self-directed experiences (Buckingham, 2016; Llorens-Monteserin & Rosing, 2016).

As a study area for installing demonstration gardens, Pittsburg, Kansas shows potential with several paved walkways along greenspaces and currently has few informal education areas

outdoors. This area in southeast Kansas shows a need for improved understanding of remediation as a formerly strip-mined site that has not been fully remediated (https://geokansas.ku.edu/coal-mining). In regions like this, focusing on plant species that can enhance local pollination, promote the growth of native species, or amend soil conditions, demonstration gardens centered around remediation can narrow in on regional needs and promote landscape change by influencing knowledge and attitude in the community (Drake & Lawson, 2015; Lou & Fu, 2017; Rees & Melix, 2019).

Using a physical garden site can include experiences as minoras reading a quick message while passing, or as a more complex self-guided tour of plant identification. Targeting which remediation message might be most applicable for local demonstration gardens is site-specific and need-dependent. By meeting with local community stakeholders, it is possible to gain understanding of what might be right (species, signage, locations, and educational approach) in a community for a focused demonstration garden (Biernacka et al., 2019; Hansen et al., 2012; Ghose & Pettygrove, 2014).

These demonstration gardens can be a tool for those who work in education, natural resources, parks departments, agriculture, or for Extension agents to improve outreach at a physical site (Desmond et al., 2004; Fančovičová & Prokop, 2011; Galindo & Hidalgo, 2005). Additionally, by using QR codes on signage, delivery methods can include additional online learning as well. While these gardens can serve as an educational tool, knowing how to make the most of a space and by what approach still requires evaluation and input from local actors (Amprazis, 2020). The demonstration garden in this case study was implemented as a tool to measure how local trail users felt about the aesthetics of a remediation garden and to extract how much was known on native species by local residents. Garden development can be most streamlined by doing preliminary

research into regional needs and more sustainable by having community input and approval on messaging and plant species.

Purpose and Objectives

The purpose of the study was to evaluate feasibility and transferability in the installation of a local demonstration garden. The objectives of the study were to:

1. Describe the social and the physical of goals in the creation of the demonstration garden;
2. Evaluate the success rate of meeting these set goals; and to
3. Identify challenges and limitations to installing regional demonstration gardens.

Methods

This case study is based off a demonstration garden study in two parts. Initially, an area of simple lawn, consisting of crabgrass, along a well-traveled multi-use trail in downtown Pittsburg, KS was used as a site for two new demonstration gardens. Convenience sampling was used to survey those passing by on the trail with regard to their aesthetic experience of the trail area and on their knowledge of the few plants already present along the trail. After collecting data over two weekends in the summer of 2019, two demonstration plots were built and planted in the fall of 2019 with native wildflower species and grasses, all of which can be used in a remediation capacity. A second survey was conducted after these plants were in bloom the following summer in 2020 to compare results from the two different groups of trail users. This article focuses on the steps in collaborating with local social actors in the community and in installing the gardens used for this study.

Planned Outcomes

To document the process, each step of the garden creation was recorded in a daily planner based if the planned outcomes were successful. The planned outcomes of the study are detailed in Table 1 and the actual process in Figure 1. The creation of the garden and the choice of people involved was fluid and adaptability was key. Recording weekly progress of what worked and what needed to be updated helped focus goals and give new talking points on future ideas. Memoing the process was general at first as the plans were being developed and later honed in on what resources were actually available and on the idea of remediation demonstration gardens and an adaptation on the theory of pro-environmental behavior (PEB). Additionally, rigor was addressed by keeping a record of detailed memos on any analytical decisions made in the process.

Initially the case study was designed for a grant (which was not funded) and the process was meant to be very linear and to include greater outreach, signage, and community workshops. Without grant funding, the process had to be tailored to balance between inputs and people who could volunteer their time and resources towards the demonstration gardens. While there were still a variety of plant species present, informational signage was more limited because of funding constraints. Figure 1 shows a less structured and slightly smaller project with fewer goals as a result of the change in funding. The ideal outcome of the study would have shown an impact on trail users finding: 1. the area more beautiful with the additional of garden; and 2. inspiration in using some of the species in their own yards.

The process involved creating the garden plots with members of the community who could donate land and time, garden resources, or educational material. The Pittsburg Parks Department was most helpful in this as well as local greenhouses.

Table 1
Pre-planned Methodology for Demonstration Garden - Outcomes and Evaluations.

Planned Outcomes	**Process**	**Activities**	**Evaluation**
Creation of new demonstration plots along Watco Trail with remediation plant species.	Creation of demonstration plot, planting, and upkeep with *passive/informal education signag*e.	Analysis of data from questionnaires and publication of case study, other manuscripts.	Interviews, reliability and validity measures, pilot study, and input from dissertation committee.
Increased knowledge about the species in the demonstration plot.	*Creation of signage for information in plots, planned workshops for the community.*	Knowledge on how to use restorative species increases comfort in planting those species themselves.	*Follow-up studies.*
Gained understanding of landscape solutions: erosion control, nitrogen fixation, and pollination.	Regional dissertation presentations, shared manuscripts, and *workshops.*	Increased knowledge for those outside the region, case study for those who want to replicate it.	Follow-up questionnaire on plant species preference and recognition of native versus non-native plants.
Participation in questionnaires before and after installation of demonstration plot.	Convenience sampling of and time spent with walkers of Watco Trail in Pittsburg, KS.	Resident reflection on own yardscapes, participation in *workshops or follow-up with online learning.*	User count of number reached, and resident reflection on aesthetic feelings of garden plots.
Transferability of ideas around species use to local yardscapes and gardens.	Demonstration plots exist and *illustrate how to grow plants* and what plants to grow in the region.	*Neighborhood sampling of garden plots.*	*Follow-up with retrospective pre-tests in demonstration plots.*

Note: Items in italics indicate setbacks/limitations.

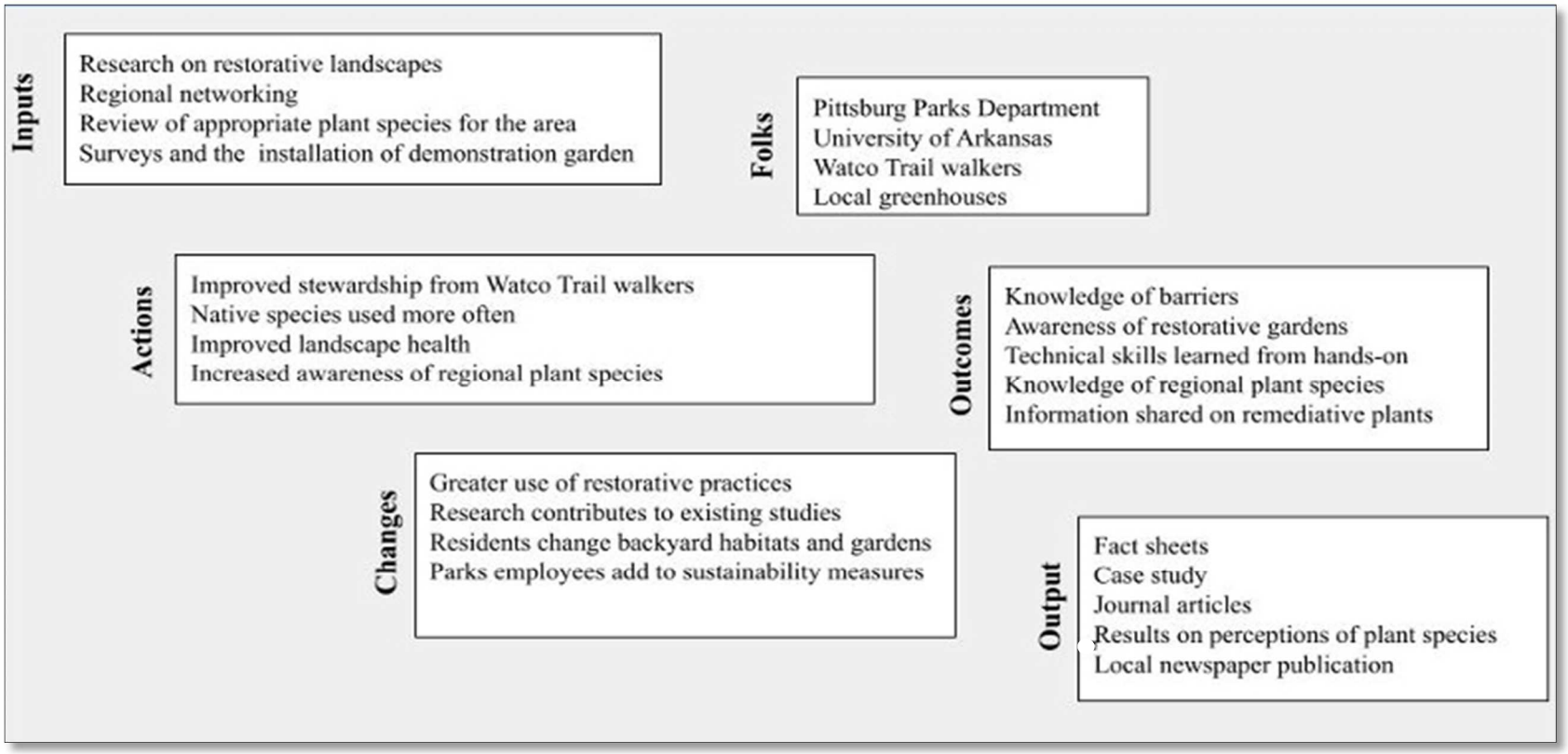

Figure 1. Actual Demonstration Garden Process.

Methodology Limitations

Specific limitations are noted in italics in Table 1. A difference exists between Table 1 and Figure 1 because of funding limitations. Without grant funding, several outreach activities had to be cancelled and the project pared down to streamline the process for time and cost. While this absence of funding assuredly caused a smaller amount of outreach to the community, it was countered with the researcher actively networking in the community to reach out for free and low-cost resources and volunteers. Signage was limited, as the most expensive component, and was thus made simpler and more targeted. Ideally, a weatherproof signage board would have stood near the gardens with additional space to hold information and interactive tips. Instead, weatherproof signs made of metal were purchased with less information present. Time spent at the gardens was more limited except for minimal upkeep and any future studies will have to be undertaken by others or the local volunteer group. The workshops that would have involved the community and taken place at the gardens would have presented a greater chance of interaction and possibly maintenance of the garden space. Many of the limitations led to finding other options for the study and were not totally detrimental to the process though funding would have, of course, aided the project more.

Results of Process

Physical Goals of Garden Creation

The physical goals for the project included choosing a site, proper signage and wording, and the plant species choice for the demonstration garden. All of the physical goals needed to align to attract the public as part of a social outreach.

Site Selection

A location along Watco Trail in Pittsburg, KS was used on 9th Street and Walnut Street as a site that would be easy to prepare for the demonstration garden and that would provide an obvious contrast from lawn to wildflower garden (Figure 2). This site was visible to both drivers and to trail users, which improved the possibility of an encounter with the gardens. Additionally, many more sites like this are found along the trail and are either owned or maintained by the Pittsburg Parks Department which may allow for future plantings at other sites. Other places that were considered included areas along bike paths, in abandoned city lots, and near existing strip-mined lands. Several agencies were approached and ultimately the parks department was the most receptive to hosting the gardens and occasionally caring for them.

Figure 2. Site Selection for Gardens.

Signage Selection

Information displayed on three signs near the two demonstration gardens was visible from the trail but not from the roadway. This educational delivery method was chosen as a low-involvement, informal education approach. The three signs that were posted in the gardens are shown below (Figure 3) and were chosen to reflect that the garden contained native plants and was there to promote pollinators.

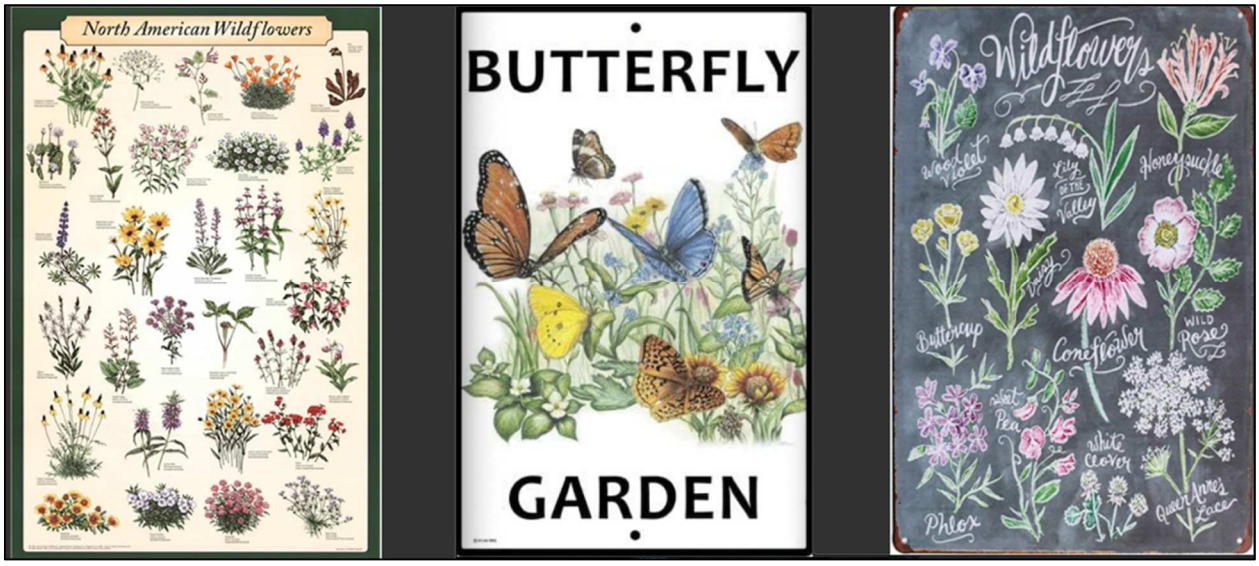

Figure 3. Demonstration Garden Signage.

While these signs had initially appeared to be enough to indicate the garden's purpose, additional material supplied through a QR code and informational website would have amplified the intent of the gardens for those who had further interest.

The delivery method was meant to be simple, informal, and brief as the gardens were smaller (10'x8') and people using the trail often were there to quickly pass by during exercise. After the gardens were planted the COVID-19 surge occurred and it is possible fewer people used the trail initially when many were uncertain of how the virus was spreading. Had there been more online or seasonal information at this point, more would have benefited who had an interest in the

demonstration gardens. Moreover, the physical signage was somewhat limited due to cost restraints of the researcher.

Funding

The project was tailored to accommodate for a lack of grant funding by focusing on outreach and asking for volunteers in the community, donations from businesses, and help from the Pittsburg Parks Department. Peat moss was donated by In the Garden- a local greenhouse- and the Pittsburg Parks Department offered to prepare the soil and till the area before the seeds were broadcast. Mulch was obtained from the Pittsburg wastewater treatment plant composting facility at no cost. Additionally, seeds were used instead of seedlings or plugs as they were less costly and were bought locally from a Co-op in Girard, KS. Volunteers also helped in the creation of the demonstration plot but the volunteers were not used in 2020 to maintain the garden due to COVID-19 precautions

							Final
Supplies and Materials	*Item*	*Description*	*Quantity*	*Price*	*Total*		
Demo Plot Installation							
Raised Bed (2 at 8'x 10')							
Materials							
	Deck lumber		12	10.98	$131.76	6.4	**138.16**
	4x4 post		3	7.47	$22.41	1.76	**24.17**
	Corner hardware			23	$23.00	$1.73	**24.725**
Filler							**0**
	Mulch	Leaf litter decomp	18	5.9	Free through wastewater		
	Organic Fertilizer	AgroThrive 64	2	13	$26.00	$1.95	**27.95**
	Peat Moss	Vigoro 2 cu. ft. Organic	18	6	Donated by greenhouse		
Plant Species							
	Seed mix from co-	10 lb	1	143.5		NA	**143.5**
Learning Plaques and Signage							
	Tin signs		6	13.3	$79.80	3.4	**83.2**
Passive Education Preferences Survey							
	Printing Costs	Information	150	0.25	$37.50		**37.5**
Equipment Rental							
Bed prep/leveling	Tiller				Parks Dept		
Final Cost							**479.205**

Figure 4. Budget Modifications.

Plant Choice

There are a multitude of plants that can be used in demonstration gardens but as this study considered the aesthetics of the choices, and the utility of their purpose, the following plants were chosen after speaking with the local native plant society (Figure 5).

Series 1: Erosion Control
Chasmanthium latifolium (inland sea oats)
Sporobolus cryptandrus (sand dropseed)
Rudbeckia subtomentosa (sweet black-eyed Susan)
Series 2: Soil Amendment
Maximilian sunflower
Dalea candida (white prairie clover)
Series 3: Pollination
Solidago missouriensis (Missouri goldenrod)
Echinacea purpurea (purple coneflower)
Symphyotrichum laeve (smooth blue aster)
Series 4: Seasonal Bloom
Gaillardia pulchella (Indian blanket)
Asclepias syriaca (Milkweed)
Centaurea cyanus L. (Cornflower)

Figure 5. Plant Species Seeded in Gardens.

It was important that the plants be: 1) perennials for ease of maintenance; 2) native- the seeds were locally harvested and bought through the Girard Farmer's Co-Op-; 3) pollinator-friendly; 4) in flower throughout multiple seasons to keep trail user interest; and 5) able to serve a remediation purpose- specifically, species that were useful for erosion control and soil amendment were included. As this was a baseline study on community interest in demonstration gardens in a formerly strip-mined area much of the signage did not go into detail on the use of each plant. Future studies could use the same plots and build on existing signage with more community input.

Social Goals of Garden Creation

Ultimately, the purpose of the physical garden was to get social input from people who were stakeholders in the success of the project. On a basic level, passers-by would find the garden

aesthetically pleasing and an improvement from the lawn that existed before. The ideal situation would be that the public would be inspired to investigate the garden and learn or to try a remediation garden at home.

Local Outreach

Initially, a grant was written for the construction of the demonstration gardens but was declined which spurred more local outreach for collaborators or donors. With more time, a garden could have been planted by using local greenhouses to grow seedlings but on a tight timeline and with limited funding there were fewer opportunities for networking. Outreach to branches of the Natural Resources Conservation Service Kansas, the Kansas Department of Health and Environment, the City of Pittsburg, Pittsburg State University, volunteer-based groups, and private corporations yielded both space to plant the demonstration gardens as well as garden soils and fertilizer. The Pittsburg Parks Department has also continued to collaborate on seasonal garden care. Currently problematic is the social distancing guidelines that prevent face-to-face collaboration during this time but may soon be lifted.

Ability to Meet Goals

Many of the goals had to be adapted as the project was developing. For instance, when certain species of plant didn't grow, an alternative species had to be substituted. Small changes were commonplace and while many changes stemmed from a lack of funds, others were implemented due to environmental factors. Physical examples include: the actual site was new and required a lot more preparation due to weeds, not all the species made it after a frost, and the garden signs weren't as big as planned. Social examples were slightly more complicated: fewer people frequented the trail than originally thought and COVID-19 occurred and may have lowered the

response rate. In retrospect, creating a garden closer to the trail and with a different question format might have worked more effectively given these circumstances.

Limitations and Challenges

Future use of the garden might inspire a resident to create their own garden, schools to use the space, or other remediation research to build on this novel study in demonstration gardens for land amendment.

As is often the case in limitations, funding was difficult to come by and on the timeline required for a seasonal project. Hence, much of the work was done by the researchers and some community volunteers. There were time limitations as the garden was a distance away but which led to a quickly self-sustaining space. Also, there were issues with the study in that COVID-19 became known midway through and limited the second questionnaire-- it is possible that fewer people felt comfortable speaking with the researcher during a local community outbreak of cases. In the future, continuing to survey residents on their feelings towards and knowledge of the garden is key for long term success.

Discussion

Findings of this study point to demonstration gardens used in remediation as a possible tool for future landscaping. Aesthetic species can be used to combat plant blindness in people who pass by the gardens (Amprazis & Papadopoulou, 2020). Informational signage may use simple explanations of the species but include a QR code or website to encourage follow-up activity online (Hansen, 2012). Demonstration gardens have commonly been used to show farming techniques, to encourage learning, or to involve a community in land-use planning. In using interpretive signage and follow-up website links, gardens can be used to teach about phytoremediation in land reclamation and remediation as well (Amprazis & Papadopoulou, 2020). Respondents from the

questionnaire in this study found that the area was more beautiful with the additional of the gardens, even though they were relatively unmanaged indicating a willingness to see more gardens like this in the community and some level of interest.

Questions asked of respondents before and after the garden was planted also pertained to how many species they thought were native or of species that they might be able to name. Before the gardens were installed it seemed that many people did not know what was native or if they had even noticed the plants in the area. After the gardens were present, more people noticed plants along the trail and more people wanted natives to be planted.

Self-directed learning with small demonstration plots can expand beyond food and pollinator gardens to encourage people to learn about native species and the benefits they provide (Chan et al., 2016; Galindo & Hidalgo, 2005; Shaw, 2015). By using community input on which of the native species they find most appealing, avoiding a wild or unmanaged area, communities can plan their gardens tailored for the region's needs (Bolt, 2017; Glen et al., 2014). Finding high-impact areas along trails, parks, or even roadways can reach greater number of people in the community and increase audience.

Ease of care is essential but with proper planning, plant species can establish and require very little attention after the first year of growth (Armatas et al., 2016). In the installation phase, it can be difficult to find funding, volunteers, and community support but once planted and through their first season, many native plants require little to no labor and can aid in regional remediation (Jiménez et al., 2021).

Installation Guidance

Rather than focus on community gardens for food, which have been fairly well-received by communities across the globe, or on botanical gardens which can be used in educational

settings, this study evaluated how native species used in demonstration gardens would be seen in regional areas that need remediation. Using native species that can self-support after a year has the benefit of not needing a great deal of time but may be viewed as less "managed" or "aesthetic" by members of the community. Finding useful species that can tackle land issues in phytoremediation can be seen as an expansion on community gardens or greenspaces, promoting remediation or environmental change. To be effective in this, community input is essential so that a garden viewed as unattractive. In this study, there were few changes between the two groups who evaluated the area where the demonstration gardens were installed in Pittsburg, KS, but importantly, more people did find the place aesthetic with the addition of the native plants and many found it to be informative as well as relaxing. Taking these results and working with community partners can ensure a sustainable project for the future.

Demonstration Garden Audience

Many of the trail users were local, so the findings apply to local users and in relation to the aesthetics of the area. By focusing on aesthetics in garden development, a demonstration garden can serve both to attract attention and to educate. Adding interactive experiences can also be a draw, but to keep things simple informational signage can be used that can change seasonally or that explains the benefits of the species. Native plants in low-maintenance gardens allow for more gardens to be implemented on a budget and thus can increase visibility for a greater audience.

Relevant Species and Land Use Practices

As an added benefit, demonstration gardens that promote (phyto)remediation, pollination, or native species can be used in almost any area. There are many unused spaces that can become these gardens with little budgetary risk for the community. By focusing on what a specific community finds aesthetic in plant and landscape design there can also be greater involvement

with these spaces. Expanding local gardens to include functional gardens can bring greater awareness to regional remediation techniques and land improvement. Horticulture practices that would be of use in this specific region include plants for erosion control, soil amendment, plants for late-season pollinators, and plants that can change the acidic pH.

Educational Approach

Finding the type of education strategy that reaches the greatest audience can be a situation of trial and error (Llorens-Monteserin & Rosing, 2016; Niţă & Comănescu, 2012). Thus, surveying the people who pass by demonstration gardens on what they may have noticed or what they have learned can help pinpoint the best attention-getting signage. More interactive education may be used but simple informal signage is an easy place to start and can emphasize the value of plants in the gardens and their best uses for the region. Ongoing evaluation to gauge attitude, future action, and knowledge of those who interact or pass by the garden can lead to more succinct learning as the educational strategy is adapted for the audience.

Conclusions

In general, demonstration gardens have been proven as an effective method used to teach people about community, food production, pollinators, and nature. They can also be used to target regional reclamation and remediation strategies or "right plant, right place", a mantra used by Extension Master Gardeners (Cohen & Ondra, 2012). By using these gardens as a visual model for what is most ameliorative in a regional environment, community members can be encouraged to increase their knowledge on the garden or even to plant their own.

Focusing on aesthetic species can be a draw for the local community. These species should be native or appropriate for use with one or more assets which may be used in land remediation for the region. Horticultural practices can be illustrated on colorful signage that includes plant

labels for easy identification of the species and plants ideally should bloom seasonally with overlap.

Creating a garden that inspires community members and organizations to volunteer their time or resources is the goal as support from the local stakeholders is essential. Taking time in the first year of garden installation to invest in collaborator networking is also key and will benefit the garden, even if it is self-sustaining in the following years.

The use of signage in the garden may be seen as an informal educational approach but can be made more interactive later. Plant labels and seasonal changes should be addressed and while some information can be shared easily on metal signs, having a QR code or website available creates additional information and opportunity.

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Conclusions

Summary

Previous studies have found aesthetics to be the primary consideration of homeowners when making landscape choices, valuing environmental aspects to a lesser degree. This may be because making landscape choices to improve land health might be too detailed for the average citizen but these gardeners do know what they can visually appreciate.

It is often found that gardens which promote biodiverse species influence the public's aesthetic perception and may increase awareness of native species. A localized systems approach can provide more support -- more investment, intention, and behavioral action -- if communities see these spaces as community investments.

Preference for a landscape was attributed to familiarity with the present elements and not necessarily based on native or non-native evaluations so the focus need not be only on natives but on plants that are appropriate for the purpose and region and non-invasive. Further review of plant species in these landscapes could benefit the existing body of research and visions for the future of landscape planning.

Overall, ecological health revolves around complex biological processes, but its successes depends on public acceptance and support. Facilitating public acceptance and eagerness toward a more diverse and natural landscape should be based on results found from studying residents' perception and preference for landscape, research like this that has been primarily visual but might include other senses and experiences. Further review of plant species in these landscapes could benefit the existing body of research and the future of landscape planning which could continue its focus on a socio ecological balance.

Appendix

Appendix I

IRB Exemption

UNIVERSITY OF ARKANSAS

To:	Rachel C Bechtold BELL 4188
From:	Douglas James Adams, Chair IRB Committee
Date:	07/10/2019
Action:	**Exemption Granted**
Action Date:	07/10/2019
Protocol #:	1906200210
Study Title:	Pre- and post-test questionnaire regarding aesthetic preferences of landscape along the Watco Trail in Pittsburg, Kansas

The above-referenced protocol has been determined to be exempt.

If you wish to make any modifications in the approved protocol that may affect the level of risk to your participants, you must seek approval prior to implementing those changes. All modifications must provide sufficient detail to assess the impact of the change.

If you have any questions or need any assistance from the IRB, please contact the IRB Coordinator at 109 MLKG Building, 5-2208, or irb@uark.edu.

cc: Kate Shoulders, Investigator

Appendix II

Questionnaire Used

Pre-test Questionnaire----Pittsburg, KS------July, 2019

Consent

Good (morning/afternoon)!
I am working with the University of Arkansas on a research project and was wondering if you could answer a few questions about this space on Watco Trail. Your participation is voluntary and your answers will remain anonymous.

[1] Yes
[2] No

Context

Q1: How often do you come to this part of the Watco trail?

[1] Weekly
[2] Monthly
[3] Seasonally
[4] Yearly
[5] First time

Q2: What is your usual reason for coming to this part of the trail?

[1] Exercise/recreation
[2] Pleasure/nature
[3] As a way to get to an endpoint
[4] Other_____

Q3: How far have you traveled to get here?

[1] 1-3
[2] 3-5
[3] 5 or more miles

Personal

Q4: On a scale of 1 to 5 -- with 1 being no interest at all and 5 being great interest – how much interest do you have in gardens?

[1] 1 (no interest)
[2] 2
[3] 3
[4] 4
[5] 5 (great interest)

Q5: (Previously 4.5): Which type of garden would hold the most interest for you?

[1] Vegetable
[2] Flower
[3] Both
[4] Neither

Environment

Q6: On a scale of 1 to 5 – with 1 as not relaxed and 5 as relaxed, how does walking the trail here make you feel?

[1] 1 (not relaxed)
[2] 2
[3] 3
[4] 4
[5] 5 (relaxed)

Q7: On your walk today, how many types (species) of plants have you noticed along the Watco Trail?

[1] 1-3
[2] 4-8