Interdisciplinary Approaches to Grassland Restoration

Exploring best practices and interdisciplinary collaboration in the context of grassland restoration.

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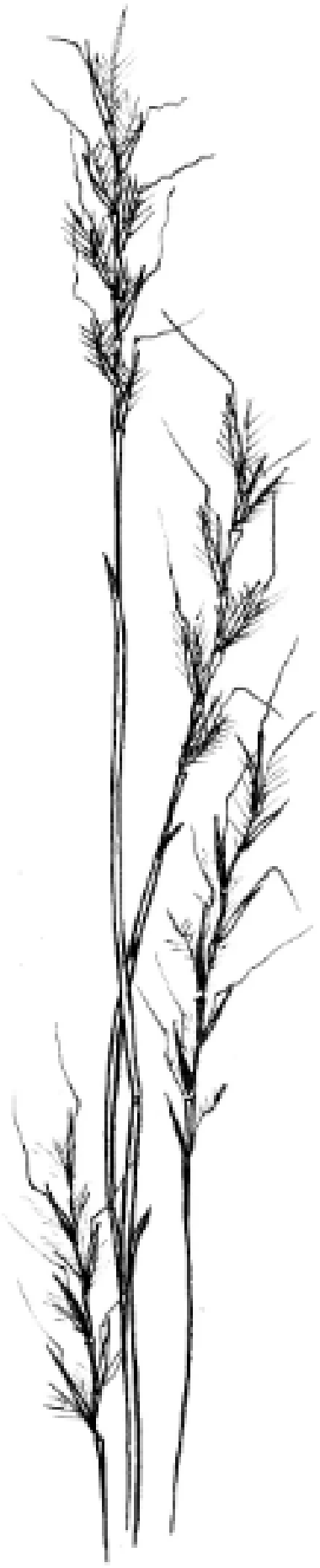
1: Abstract



Little Bluestem
(Schizachyrium scoparium) E2

Abstract

Rates of desertification in grassland environments across the globe have accelerated considerably in the past century. This acceleration is a result of the disruption of plant-animal interfaces, the destruction of prairie ecosystems for human development and agriculture, increases in global temperatures, and increased severity and frequency of droughts. This loss of grassland ecosystems threatens global biodiversity, releases massive amounts of carbon into the atmosphere, disrupts global hydrologic cycles, and places communities that depend on grassland ecosystems for their livelihoods at significant risk (Junior et al. 2022, 1).

Professionals across many different disciplines have responded to this crisis by developing techniques for the management of our global grasslands that can prevent and reverse the impacts of desertification. There have been tremendous efforts made by grassland restoration ecologists and landscape architects to better understand and implement grassland restoration in diverse contexts, however, there is surprisingly little work that has explored the potential for collaboration between these two disciplines. This paper analyzes the differing beliefs and practices surrounding grassland restoration within the fields of landscape architecture and restoration ecology and explores how interdisciplinary collaboration between these fields could produce mutually beneficial outcomes.

To better understand the relationship between these two disciplines this paper analyzes a wide variety of relevant materials including existing literature produced by restoration professionals in a range of disciplines, interviews with professionals in ecology and design fields, and design precedents. Analysis of these materials helps to identify common themes that guide practice of grassland restoration in both fields and provides insight into how these themes developed over time. This analysis produces a comprehensive understanding of the existing beliefs and practices within each field and explores the barriers to effective grassland restoration. Beyond identifying these barriers, this thesis offers opportunities to overcome them and in doing so, helps to facilitate collaboration between disciplines. The analysis produced through my research and presented in this thesis help to develop a mutual understanding between grassland restoration ecologists and landscape architects. This understanding will help to facilitate interdisciplinary collaborations that produce grassland restoration designs and management practices that improve the health of grassland ecosystems and the communities that depend upon them.

2: Introduction

Sideoats Grama
(Bouteloua curtipendula) E3

Introduction

"Grasslands account for two thirds of the earth's land surface"
-Allan Savory

Context

Grasslands have been hubs of human agriculture and development for thousands of years. Human occupation of these ecosystems has played a key role in the development and changes in grassland ecosystem composition throughout their shared history. Unfortunately, for the last two centuries these ecosystems have experienced rapid degradation, with vast areas now struggling to maintain their ecological integrity. Several anthropogenic causes have resulted in this acceleration of grassland desertification including the appropriation of land for human development and agriculture, the disruption of essential animal plant interfaces, and global temperature increases (Butterfield, Bingham, Savory 2019, 1-56). The degradation of these essential ecosystems has resulted in significant losses in biodiversity, the pollution and disruption of regional water cycles, and massive decreases in soil carbon. The recognition of the pivotal role that grasslands play in global biodiversity, carbon sequestration, and water management has spurred an urgent call for their restoration.

This call has been answered by professionals across many different disciplines, each of which have attempted to apply their unique skill sets and techniques to the restoration of these grassland landscapes. Fortunately, over the past 50 years, restoration ecologists and land managers in this field have made significant progress towards developing effective tools and techniques for the restoration of degraded grasslands. While the development of these techniques is a promising start, restoration ecologists are now faced with the challenge of adapting these best practices to the wide range of land types and uses that exist within grassland ecological zones (Shepard 2020, 40-60).

Concurrent with restoration ecologists developing a suite of grassland best practices and techniques, landscape architects have been experimenting with how to integrate grassland ecosystems into their designs. These efforts are reflected in a general shift in design sentiment towards more natural, native, and ecologically sound designs over the past several decades. However, even as ecological health has emerged as an important consideration of many designers, adoption of grassland restoration techniques has remained limited. By interviewing current practitioners, my research found that the failure to establish and integrate native grasslands into designed spaces for human use is primarily due to interdisciplinary collaborative barriers, including, financial limitations, misconceptions about the other field, and safety hazards caused by integrating human use and restoration practice.

Both groups of practitioners have approached the same problem but with different primary users in mind. Landscape architects are taught to design with human use as the primary consideration, while most restoration ecologists focus primarily on ecological systems. The importance of interdisciplinary collaboration between these two fields becomes evident when we take a step back and look at the interdependence between humans and ecosystems. Humans cannot survive without preserving the ecological integrity and functionality of the ecosystems they occupy. Similarly, in a world dominated by human development, ecosystems cannot survive without adapting to and allowing for human use. We are left with no choice but to develop and design spaces that serve the interests of both the local ecology and human users. In the context of grassland restoration, restoration ecologists have become experts in addressing the ecological needs of a site while landscape architects have specialized in designing within social and cultural contexts. The effective development of a landscape design and management plan that serves human and ecological needs will require input and collaboration on the part of experts in both disciplines.

Research Problem and Questions

Both disciplines share a desire to restore grassland ecosystems. However, both have encountered significant barriers to collaboration resulting from differences in expertise and knowledge that have prevented them from effectively progressing towards their restoration goals. This thesis attempts to identify means of overcoming these barriers through interdisciplinary collaboration between practitioners in both fields. This inquiry was guided by the following questions: What are the existing best practices for grassland restoration within the landscape architecture and or restoration ecology fields? What barriers have prevented the full realization of the restoration goals of each discipline? How might collaboration between both disciplines improve restoration outcomes?

Road Map

I progress through a series of sections in this paper, each of which explores different aspects of this paper's research questions. Beginning with a literature review, I summarize the relevant literature and precedents from both the restoration and landscape design perspectives. My discussion of restoration ecology literature resembles a more traditional literature review that identifies relevant themes within the existing body of knowledge. I then identify gaps in the field that can be filled by my research. The nature of the design field means that the majority of the grassland restoration work within landscape architecture does not appear in traditional peer reviewed journals. To respond to this difference, I review a series of relevant design precedents that have been developed within grassland ecosystems or have listed grassland restoration as a primary goal of their design. My discussion of these precedents identifies the primary historic design trends that have influenced how grasslands are used within design.

Following the precedent review, I outline the research methodology for this thesis, focusing on key informant interviews. I then categorize and analyze the data gathered through these interviews. This analysis builds on existing knowledge while providing insight into the experiences of professionals in the relevant fields.

Finally, I synthesize the research conducted to form a cohesive set of conclusions. These conclusions provide resolutions and insights that address the research questions and describe the contributions that this paper has on the broader fields of landscape architecture and grassland restoration ecology.

Conclusion and Impact

This thesis begins to bridge the gap between two disciplines that have been working towards similar goals from different perspectives. The conclusions derived from this paper's research effectively identify the existing best practices and barriers of grassland restoration, in both the ecological restoration and landscape architecture fields. From this base of knowledge, professionals can make more informed designed decisions that create landscapes with significant value to the people and ecologies that depend upon them.

3: Literature + Precedent Review

Indian Grass
(Sorghastrum nutans) E4

Literature Review

In this literature review I summarize the knowledge within the field of grassland restoration that are essential to understand the central inquiries of this thesis. To clarify the contributions of the varied sources of research brought together in this text, this review is divided into four sections: the cultural context of restoration, land and water management best practices, soil preparation and amendment, and conservation and human use dynamics. In addition to providing context for the original research within this thesis, through reviewing existing research, this section begins to outline the existing best practices for grassland restoration within the restoration ecology field. There is not a significant body of academic literature surrounding grassland restoration techniques within the specific context of landscape architecture. Landscape architecture best practice is outlined in the interview results and analysis.

The Cultural and Historical Context of Grassland Restoration

To begin the discussion of the cultural and historical context of grassland restoration, it is important to recognize that prairie ecosystems across the globe co evolved with and were shaped by Indigenous peoples and migratory ruminant herds. This relationship between the Indigenous groups and the native grassland ecosystems was unique to each cultural and regional context. In this thesis, I focus primarily on the North American Great Plains and the associated Indigenous groups and bison herds that shaped their ecology. Bison herds became the dominant force on the North American Great Plains after the most recent mega fauna extinction. The loss of many of these species left several ecosystem niches vacant. The Bison survived this extinction event and were able to greatly expand their range in the absence of interspecific competition. This expansion resulted in the establishment of the North American bison as an essential keystone species within the plains ecosystems from southern Canada to northern Mexico (Confer and Waiser 2016, 25-30).

For thousands of years, massive herds of bison were the primary source of food for many Indigenous groups. These people would follow the herds of bison throughout the year and use the various parts of the bison for food, textiles, and tools. Indigenous people would also expand the habitat of the bison by burning forests to expand prairies. This practice resulted in the creation of significant areas of new prairie, particularly in what is now known as the American Midwest. While these groups were efficient bison hunters, they lacked the technology to facilitate massive over hunting which allowed for both the human and bison populations to remain relatively stable across the centuries (Confer, Waiser 2016, 32-34).

This relationship between Indigenous people and the bison would shift dramatically during the period of colonization and settlement of the western states. Europeans brought horses and a market for bison goods when they arrived. The introduction of horses allowed for significant increases in the quantity of bison that could be killed in a single hunt. This newfound capacity for large scale hunting, coupled with significant trade demand for bison products resulted in severe over hunting. This over hunting,coupled with the "White Hunt" in the late 1800s, a period of server over hunting of bison conducted by settlers moving west, all but eliminated the Bison herds from the Great Plains. The removal of the bison as a keystone species from the Great Plains ecosystem started a cascade of ecological and cultural disruptions throughout Indigenous cultures and grassland ecosystems. However, many of the impacts that this eradication had on the landscape would not be understood for several decades (Flores 2016, 41-78).

In the 1900s the Great Plains would be further fragmented as land was taken and brought to establish agriculture and human development. This fragmentation has resulted in significant degradation of the prairie ecosystem, causing massive losses in biodiversity, soil fertility, and water quality. The agricultural impact on prairie ecosystems would be made obvious during the 1930s dust bowl which destroyed untold amounts of arable land and

removed topsoil from historic grasslands (Anderson 2008, 1-2). This event would motivate some of the earliest recognized grassland restoration projects, including Curtis Prairie and the Fermi Accelerator Laboratory projects. These early attempts at grassland restoration were primarily framed as restoration projects and not restoration research projects, as a result there was not significant scientific documentation of their processes early on. However, as momentum built around restoration movements there was a push for a more scientific approach to these projects which led to a more experimental model of restoration moving forward. The Curtis Prairie and Greene Prairie, both managed by the University of Wisconsin, would be the primary testing grounds for various restoration experiments throughout the 1940s, 50s, and 60s. During that time, they made significant progress towards their restoration goals and developed a strong understanding of restoration methods including controlled burning, weed management, and seeding. These two projects would inspire countless other scientists and practitioners to attempt their own restoration efforts in the decades that followed. As the field has evolved since those early efforts in Wisconsin, there have been many researchers and practitioners that have explored the role of biodiversity, hydrology, livestock integration, pest control, and many other factors in the restoration of prairie ecosystems. These studies have all contributed to our current understanding of grassland restoration ecology (Anderson 2008 , 3-8).

To respond to this degradation, researchers have begun to look back to the human ecological relationships that historically shaped these ecosystems. One focus of this branch of research has been the exploration of traditional resource and environmental management (TREM), which attempts to identify the land management techniques that were historically employed by Indigenous groups to manage the health of ecosystems. This research in a grassland context has primarily focused on the use of prescribed burning and the tending of culturally significant plants as a means of improving ecological and cultural health (Holl 2018, 1-3).

There has also been a significant push to understand the nature of the relationships and interdependencies between the large ruminant herds and arid grassland ecosystems. This research has been spearheaded by the Savory Institute. One of the primary insights from the work of the Savory Institute has been to contend that arid grassland ecosystems lack the moisture and humidity required to sustain the microbial life necessary for rapid decomposition by bacteria and fungi. Instead, these ecosystems depend on the micro biomes of ruminant herds to decompose excess plant biomass as they graze. The removal of the large ruminant herds from the plains disrupted the nutrient cycling within these ecosystems, which has subsequently resulted in their gradual degradation (Butterfield, Bingham, and Savory 2019, 1-56).

While many branches of research look back and try to understand the history of grassland degradation and management, there are also groups that are beginning to explore what grassland restoration looks like within a modern cultural context. Some have explored how the restoration of grassland ecosystems can improve food security, increase water quality and availability, and decrease rates of human displacement in communities that live within modern day grasslands (Lyonset al. 2023, 1). Grassland restoration can have other social benefits as well, particularly for Indigenous groups whose cultural traditions are closely related to the health and management of native ecosystems (Holl 2018, 1-3). Other scholarship emphasizes the broader emotional and societal importance of humans operating as participants and stewards within healthy native ecosystems (Fukuoka 2009, 1-62).

Current grassland restoration efforts are the product of historical relationships between people and prairie landscapes and are significantly influenced by the cultural context in which they are undertaken. Understanding the historical and cultural context of grassland restoration allows us to make more effective restoration decisions in future projects.

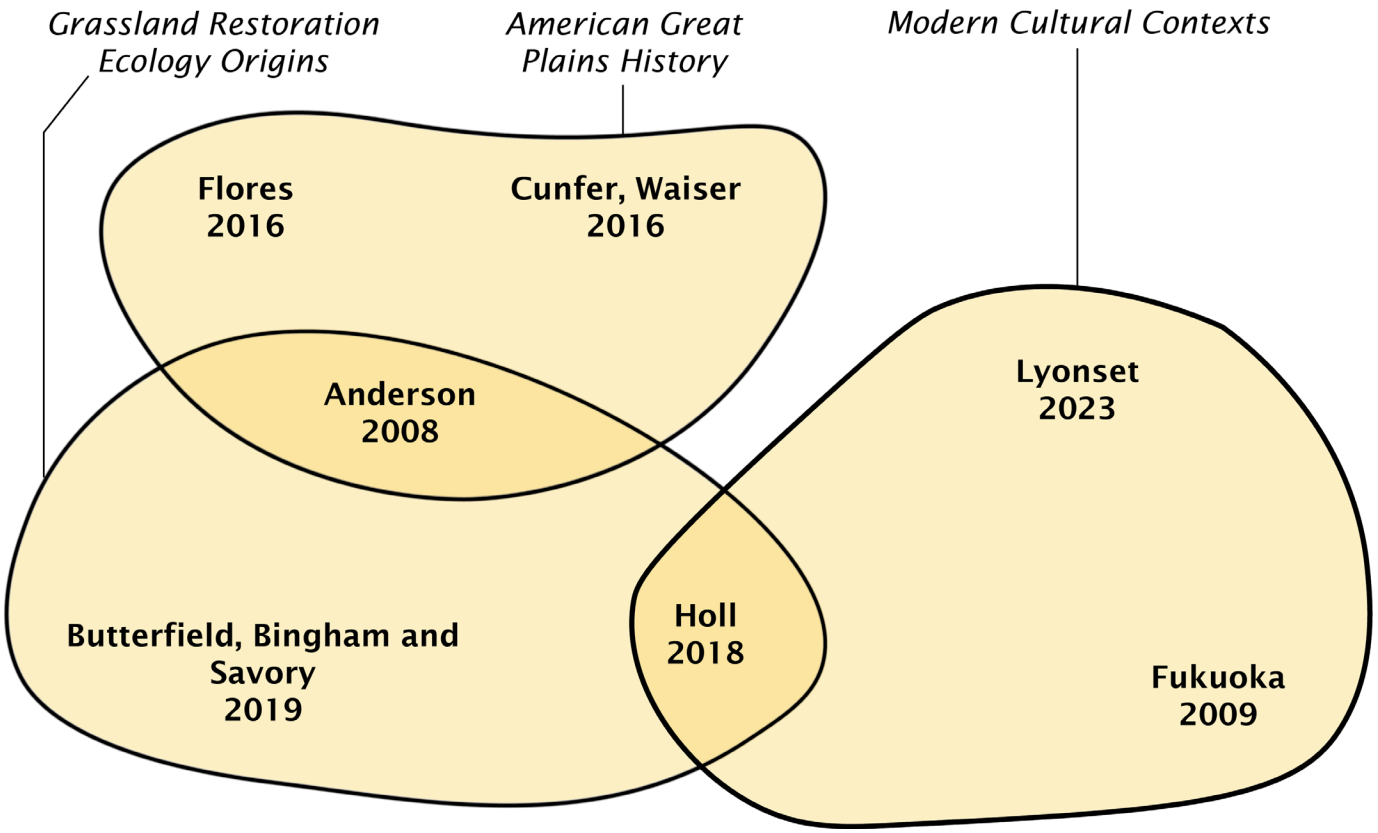


Fig 1. Bubble diagram showing relationships between sources referenced in the Cultural and Historical Context of Grassland Restoration literature review.

Land and Water Management Best Practices

Following World War Two, agriculture and land management practices within the United States became largely governed with an input-focused approach to land management. Imbalances within ecosystems including pests, weeds, and nutrient deficiencies were met with newly developed herbicides, pesticides, and fertilizers. These approaches resulted in numerous harmful ecological impacts that are beyond the scope of this thesis. As the harmful impacts of these methods have become more apparent, many land managers have condemned an input-centered land management philosophy (Fukuoka 2009, 15-19). The shift away from input focused land management has led to the development of new ways of managing land that improve ecosystem health and productivity. This shift has been led by practitioners like P.A Yeomans and Alan Savory.

Through years of pragmatic and hands-on research, Alan Savory and the Savory Institute that he founded have provided several key insights into grassland management. Firstly, as mentioned in the previous section, they have found that migratory ruminant herds are essential for the health of grassland ecosystems. These herds serve several essential functions including to help to cycle nutrients through their microbiomes, increasing water infiltration by breaking up soil crusts, and creating periods of intense grazing followed by long periods of rest for the land. These three functions are essential for the health of plants, soil microbiomes, and other animals that share these grassland ecosystems. Secondly, Savory Institute research has found the functions that have historically been fulfilled by herds of bison in the context of the North American grasslands can be mimicked through the careful management of livestock. This process of mimicking historic bison herd behavior using livestock like sheep and cattle is referred to as 'multi-paddock' rotational grazing, and it is one of the most effective tools that has been developed to restore the health of grassland ecosystems. Finally, research has found that when the aforementioned insights and grazing management techniques are applied within a holistic framework that considers the ecological, cultural, and financial context, it is possible to develop a land management strategy that can sustainably support both the human and ecological users of an area. Alan Savory has spent his life educating other land managers about these insights and methodologies and has significantly impacted the practices of

grassland restoration professionals across the globe (Butterfield, Bingham and Savory 2019, 1-87).

Savory's methods have been adopted by many practitioners in the American west and mid west. One of the most influential groups to take an interest in Savory's practices in the agricultural research department at Texas A&M. This group led by Teague has explored the impact of the methods developed by Savory across several multi-year studies. These studies provide a more scientific approach to measuring the impacts that these practices have on biodiversity, foliage cover, soil composition, and macrobiotic activity. Their studies have found significant benefits to utilizing Savory's methodology (Teague 2011, 1-2).

P.A Yeomans and practitioners that have since adopted and further developed on Yeomans's research have also significantly influenced the modern approach to the restoration of arid ecosystems. Yeomans was an Australian rancher who developed a style of land management called 'Keyline design'. This system was created to improve permaculture productivity through improved water management. Yeomans' driving belief is that water is the basis of ecological health and that if you can restore the health of an area's hydrology, other ecosystem functions like soil health, biodiversity, and agricultural productivity will follow suit. The Keyline approach to managing a site's hydrology is to "slow, spread, and soak" the water that falls on the land. This approach aims to decrease the speed of runoff traveling across the land, spread the water across the landscape as evenly as possible, and increase the rate of water infiltration by increasing the site's permeability and increasing the amount of time that the water spends on the site. To achieve these goals, Yeomans and his followers have developed a series of tools that can be used to adjust the behavior of water on the land, which together comprise the core concept of a landscape's "Keyline". This keyline is an imaginary line derived from the existing topography and contours that dictates where the water that falls on the site will flow. Identifying and using the Keyline can help develop a system of swales, ponds, damns, and subsoil rips that slow, spread, and soak water across the landscape (Yeomans 1993, 1-46). These methods have demonstrated a significant capacity to improve soil health, biodiversity, and productivity on a site. These methods were primarily developed in arid woodland areas in Australia, which poses a limitation to their applicability in the semi-arid grasslands of the western states. Subsequently, there is a need to update and adapt these methodologies to the diverse landscapes across the globe.

In response to these limitations, longtime Keyline practitioner and advocate Mark Shepard has adapted Yeomans ideas to the landscapes of the American midwest. Shepard found that since the Keyline system was developed in Australian watersheds which tend to be much simpler landforms than what we find in the American west and midwest, many of the methodologies do not directly translate to the more complex landforms. To address these discrepancies, Shepard's research introduced what he calls a "Masterline", which serves a similar function to a Keyline but offers much more flexibility in where it can be located on a site. This flexibility allows the approach to be adapted to more complex landforms. After the establishment of the Masterline, Shepard advocates for the use of similar interventions to those introduced by Yeomans, including swales, subsoil rips, dams, and ponds. With these adaptations to Yeoman's methodologies, Shepard has observed similar improvements in ecological and agricultural outcomes to those reported by Yeomans in very different geographies and ecological contexts. (Shepard 2020, 32-45)

There is also a contingent of researchers that argue that viewing grassland restoration through a lens of succession can be beneficial. Researchers that subscribe to this perspective consider, "grassland restoration as a long term assembly towards old-growth endpoints." (Buisson et al, 2022, 1). This approach to land management research tracks restoration through the different phases of succession and posits that the land management strategies should adjust and adapt to the unique ecosystem needs that arise at different stages (Buisson et al, 2022, 1-3). This sentiment is echoed in the fields of agroforestry and silvopasture which advocate for the benefits of transitioning grassland ecosystems into woodlands, which many would see as a next step towards "old growth endpoints" (Junior et al, 2022, 2-3).

Research into the field of grassland restoration has made significant technological and methodological develop-

ments in the last several decades, which have significantly improved knowledge of how healthy grasslands function. These developments have demonstrated their efficacy in restoring ecological health of grasslands across the globe; however, there are still some significant gaps that remain to be filled or further developed. The first being, how could inputs be integrated into these methodologies in a way that enhances restoration efforts? Secondly, how has human use been considered within the context of these restoration efforts?

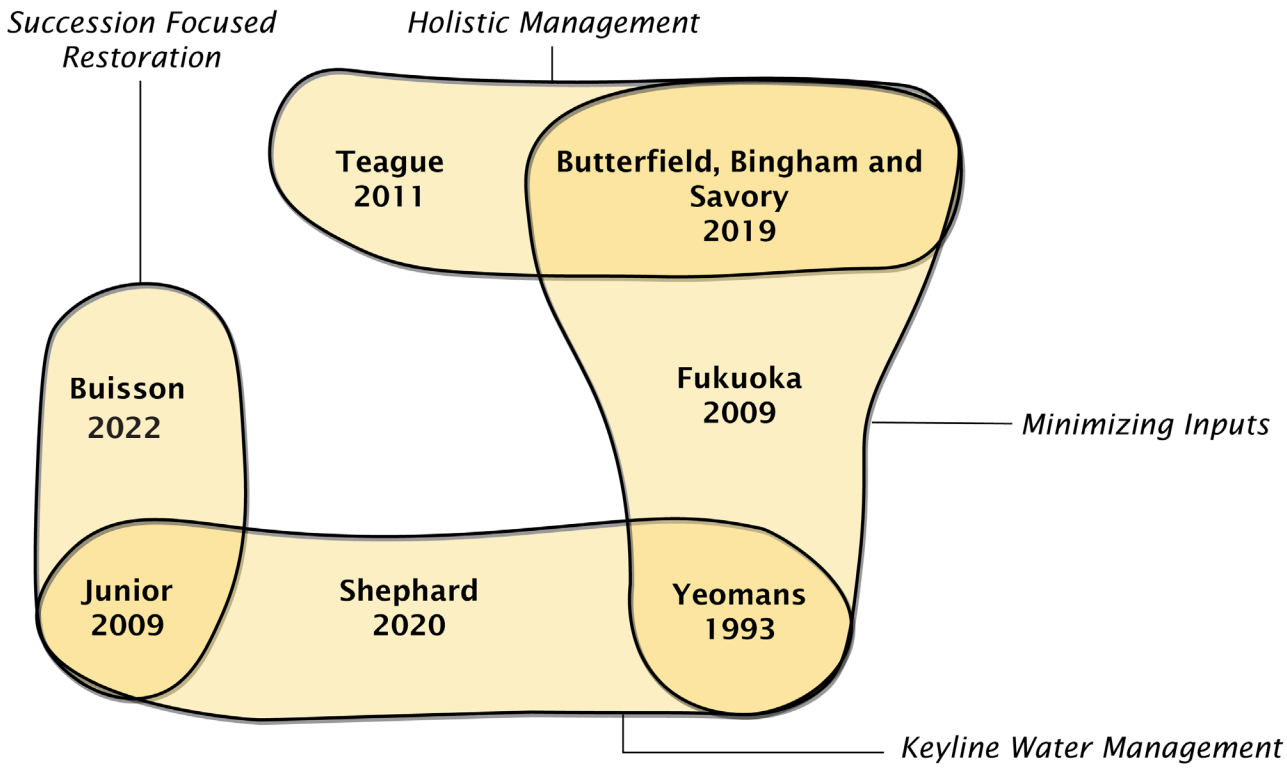


Fig 2. Bubble diagram showing the relationship between sources referenced in the Land and Water Management Best Practices literature review.

Soil Preparation and Amendment

Many of the practitioners from the previous sections avoid inputs on their land, this means that instead of applying amendments chemical or otherwise to the land, these people favor management approaches that restore the natural ecosystem functions and fix imbalances, which will result in cascading improvements in ecological health. While this is a valid approach that has produced impressive results, there has also been significant development in the research into soil amendment practices and the potential for impact on larger ecosystem functions. These new developments have potential to accelerate restoration outcomes without having the drawbacks that are often associated with agricultural inputs (Mrunalini et al. 2022, 1-2).

A meta-analysis paper titled, "Nature-based Solutions in Soil Restoration for Improving Agricultural Productivity" provides a helpful overview of the existing best practices for soil amendment. This paper outlines methods of producing and applying soil amendments such as compost, manure, biochar, fly ash, biogas slurry, and natural minerals. These amendments all demonstrate benefits to ecological health and ecological productivity within different contexts without resulting in many of the negative impacts that petrochemical inputs often produce (Mrunalini et al. 2022, 1-2). Much like how the management practitioners neglect the input side of restoration, soil amendment research often neglects the management framework in which the amendments are applied. There is potential for greater overlap between these two schools of thought.

A recent and promising development of research into soil amendments has been experimentation with the role of mycology in restoration. Scientist Paul Stamets is a leading researcher in this field who explores a variety of restoration techniques that focus on utilizing various species of fungi as a means of achieving restoration goals. The key insight of his research is that mycelium plays a crucial role in nutrient cycles, water retention, and inter-plant communication. Careful design of the mycological conditions within an environment can positively impact a wide variety of factors that contribute to ecological health. (Stamets 2011, 55-114). The majority of the research into this dimension of soil amendment has been conducted in the forests of the American Pacific Northwest where the climatic conditions are significantly different from those in arid grasslands. This may somewhat limit the applicability of this research; however, emerging research into arid mycology can further expand on the methodologies developed by Stamets to yield similar ecological benefits from mycology application in arid grassland environments. While there have been studies that show improved pest resistance and increased native plant establishment in areas with fungal inoculations in arid landscapes, the field is still far from developing a cohesive set of best practices (Allenand 1989, 1-5).

Nature based soil amendments have proven to have beneficial effects on the overall ecosystem health. However, there is still a significant amount of research and development to be done to integrate these amendments into grassland restoration frameworks.

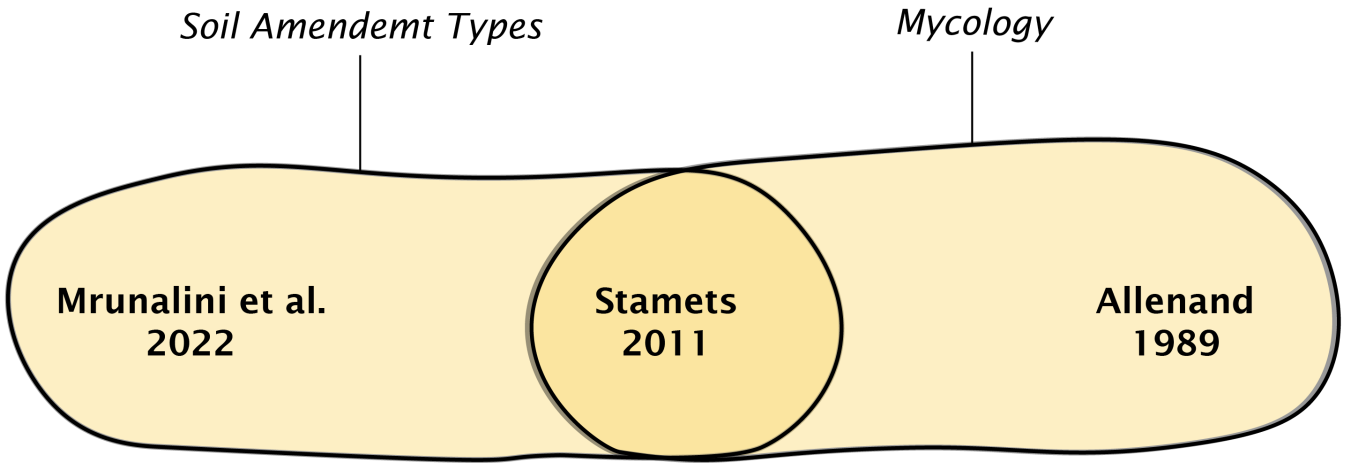


Fig 3. Bubble diagram showing the relationship between sources referenced in the Soil Preparation and Amendment literature review.

Conservation and Human Use Dynamics

Proposing restoration and conservation efforts within designs that center human use requires a consideration of how these interactions impact both the environmental systems and the users. There has been significant academic work exploring different aspects of conservation and human interactions including papers focusing on how to minimize conflict between recreation and natural systems and impacts on pro-environmental behavior in conservation recreation design models.

To understand and avoid conflict between recreation and conservation you first have to define which types of recreation are permitted on a site and understand how that mode of recreation impacts the natural systems in the area. To make these distinctions it is helpful to break down the types of activities into consumptive and non consumptive types. Consumptive recreation like hunting and fishing will have a more significant impact on the natural systems of an area and should therefore be more closely regulated to insure that their impact does not produce any significant imbalances in the ecosystem. Non-consumptive recreation like hiking, biking, climbing will gradually degrade an ecosystem through erosion, pollution and trampling. These impacts can be managed with much looser regulation and enforcement than consumptive recreation. Beyond the definition of recreation-

al types and potential impacts, a further focus on which natural systems could be impacted and how is important to plans for recreation and monitoring. It is helpful to focus on these four major landscape components: soil, vegetation, wildlife, and water. Developing an in-depth understanding of how each of these components is impacted by the different forms of recreation allows us to tailor the signage, permitting systems, trail and road networks, and types of recreation that may be appropriate for the conservation goals at a specific site. This approach can become the foundation for a landscape approach and design where conservation and use are able to coexist and even benefit from one another (Cole 1993, 105-107).

Other researchers have investigated how combining conservation and recreation can impact pro-environmental behavior in users. They have demonstrated that recreation creates opportunities for "place making" and "place attachment", two concepts that landscape architects dedicate significant time and effort to facilitate within their designs. Studies have found that place making and attachment correlate with pro-environmental behaviors while users are on site and in other aspects of a user's life (Lee 2009, 1). Careful design can intertwine conservation and use in a way that not only avoids conflict but also contributes to a stronger sense of place and connection to natural systems for landscape users (Larson 2018, 1).

While there are significant hazards that can arise when combining conservation and human use in a design, there are many examples of maintenance best practices that can help to avoid any potential conflict. Sites that carefully avoid conflicts have the potential to be tremendous ecological and community assets that protect natural systems and encourage environmentally responsible behavior in their users.

The relationship between placemaking and conservation is built upon by Bridget M Atkin who discusses how design principles can be used to develop legible restoration aesthetics in design. As Atkin writes, "Designers, restorationists, and landscape architects can use a fundamental design vocabulary to articulate their ideas and develop the ideal of an ecological aesthetic." (Atkin 2013, 40). Atkins provides a robust argument for the integration of ecological restoration in design and utilizes design theory and principles to outline how restoration elements can be made legible in the landscape. While the paper does provide helpful guidance on how to adjust landscape design to accommodate restoration within the design aesthetic, it does not provide descriptions of ecological restoration best practices beyond the realm of aesthetics. As Atkin writes, "the thesis focuses on the above ground characteristics of flora related to the restoration, or re-creation, of a sagebrush grassland plant community. This narrow view of ecology is taken within this thesis because the above-ground manifestation of a landscape is the tangible connection between the visual aesthetic of a landscape and its potential ecological contributions." (Atkin 2013, 15). While this paper begins to draw the connection between grassland restoration and landscape design, there remains a significant gap in the literature describing how grassland restoration is practiced within landscape architecture beyond landscape aesthetic.

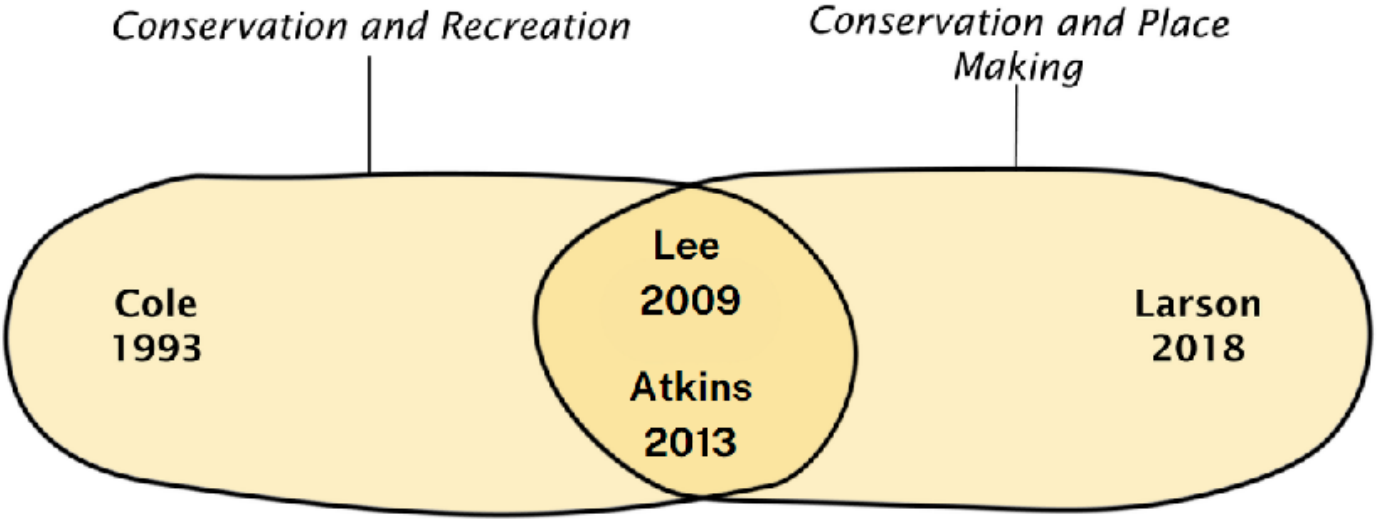


Fig 4. Bubble diagram showing the relationship between sources referenced in the Conservation and Human Dynamics literature review.

This literature review outlines the existing literature that acts as the knowledge base from which I have conducted my research. Research and analysis that will be presented in this thesis build upon this existing base of knowledge and provide compelling insights that help to fill some of the gaps in knowledge that are evident in this review.

Precedent Review

In this precedent review, I develop an understanding of the historical progression of grassland use in landscape design. To achieve this, I describe design movements that influence grassland use and provide examples of projects that exemplify each movement.

As mentioned in the literature review, grasslands and humans have been codependent for thousands of years in areas like the Great North American Plains. While we do not commonly refer to the Indigenous groups that occupied these grasslands for centuries as landscape architects, they were engaged in the manipulation and creation of landscapes for human use. Seeing as that is one definition of the landscape architect profession, it could be argued that early Native American groups using grassland fires is one of the first acts of landscape architecture on the Great Plains landscape. These fires served several purposes including, burning excess fuel to prevent severe forest fires, clearing areas for the construction of temporary settlements, burning forests to create more grassland grazing opportunities for bison, and burning existing prairies to control the migratory patterns of bison (National Park Service, 2020). Since most of these Indigenous groups were nomadic, there is no one site where these practices are most evident, instead we can observe the impact of these actions in the expansion of the grasslands into forested areas in the Midwest and we can learn about these practices through collaboration with the Indigenous groups that have historically practiced these techniques.

The American Picturesque

The American Picturesque movement, spearheaded by Fredrick Law Olmsted significantly influenced how grasslands were used within landscape design. American Picturesque was defined by a series of guiding design principles which included: “relating the layout of the designed landscape to original landscape features, avoiding formal design except in very limited areas about the buildings, utilizing open lawns and meadows in large central areas, creating flowing outdoor spaces, and providing circulation by means of organically curving and wide sweeping roads and paths.” (Gelbloom, 1975, 13). This movement centered grass and meadow planting through the integration of massive rolling lawns. These lawns were highly manicured and do not closely resemble native grasslands in aesthetic or function. During this period aesthetic qualities of grasslands like the open horizons and rolling topography were prioritized, however the ecological reality of the designs remained divorced from native grassland ecologies. We can look to sites like Barton Heights Cemetery to see this style in action.

Prairie Style

We also see grasslands and landscape architecture explicitly linked in the Prairie Style of landscape architecture that emerged in the late 1800s. This style was pioneered by landscape architects like Simonds and Jensen. These took the concepts that defined the American Picturesque and built upon them to create the Prairie Style. This new style emphasized grouping native plants and the use of level horizons. The majority of the designs that these two worked on were in the American Midwest, as a result, many of the native plants that were central to their

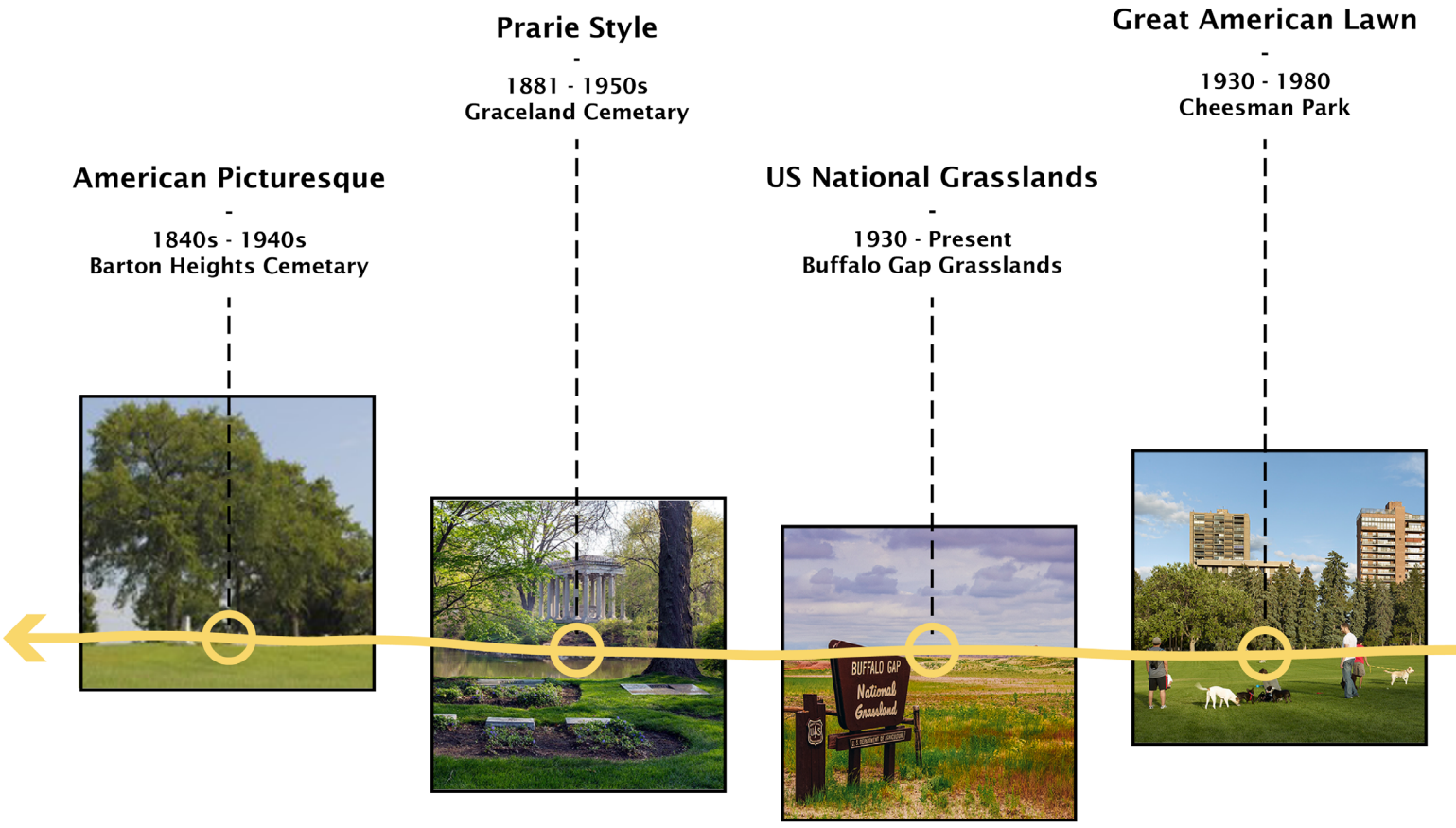
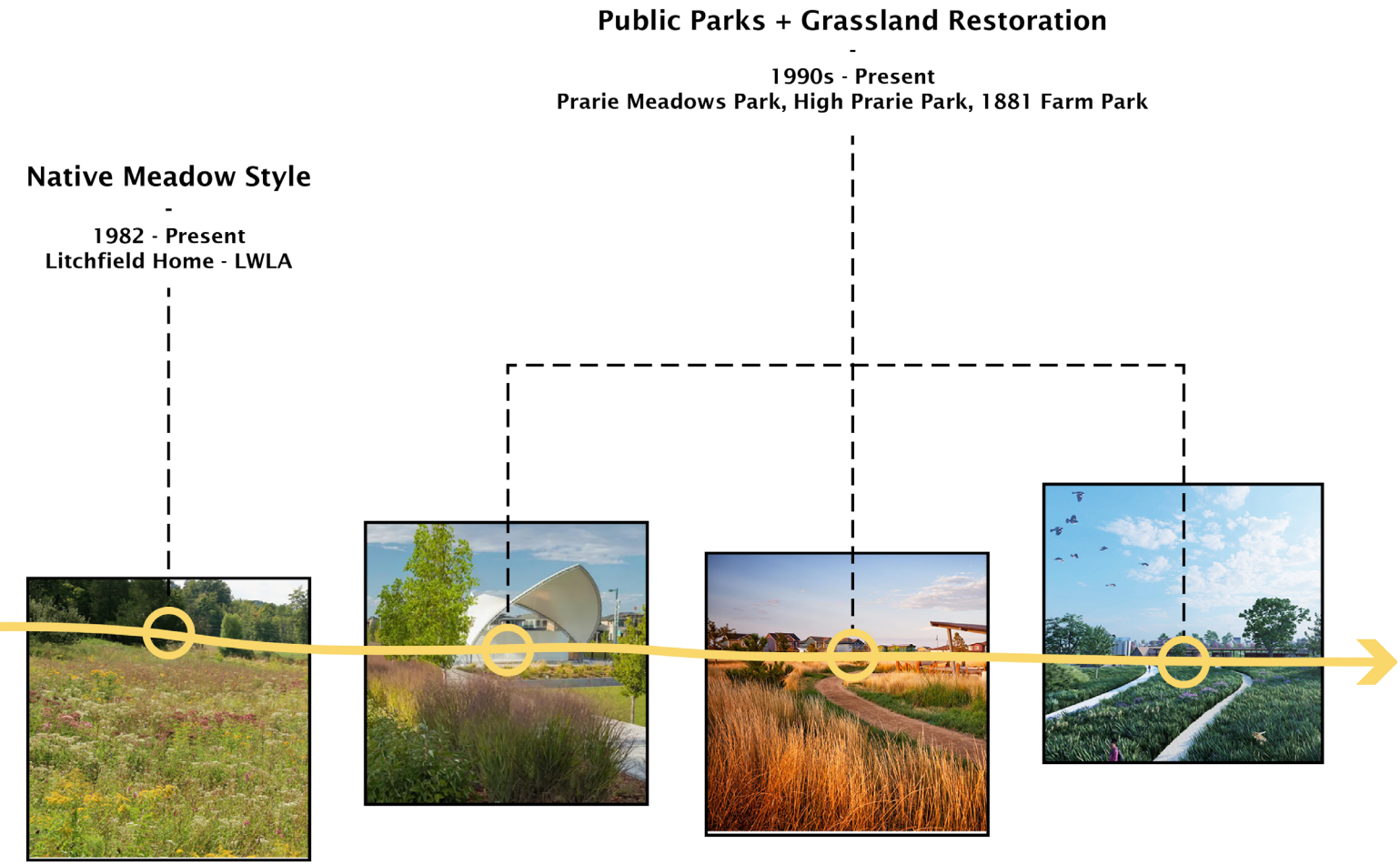


Fig 5. Timeline conveying the different design movents discussed in the precedent review. Endnotes 5-12

designs were native prairie species. This plant palette combined with the flat horizons that resembled large open grasslands earned their designs their Prairie Style name (Faiks, 2001, Ch7). While these designs began to emphasize native prairie ecology, they are still dominated by large manicured lawns and the native grassland plantings are relatively contained and controlled within planters. These two factors result in 'Prairie Style' designs that for the most part do not resemble native prairie ecosystems. The most famous examples of this design movement are Graceland Cemetery and Columbus Park, both of which are located in Chicago, Illinois.

National Grasslands

The early 1900s saw massive expansion in agricultural development of the American grasslands across the midwest and west. This agricultural development meant that "Land that should never have been plowed yielded its topsoil to incessant dry winds." (USDA, 2023, 1). The dust bowls that traumatized the American midwest brought about a heightened cultural appreciation for grassland ecosystems, resulting in the establishment of the national grasslands in 1960. These areas were designed to preserve the grassland ecologies that are essential to the identity and ecological function of the American Prairie regions. While their primary goal is preservation, they are also public lands that attract visitors and therefore must accommodate and be designed for human use. This approach to grassland restoration in landscapes with human use starkly contrasts with the previous two movements in that the landscape is allowed to assume its natural aesthetic and the health of the ecological systems is prioritized over human use. There are national grasslands across the US, Buffalo Gap Grassland being a prime example of this movement.



The Great American Lawn

The Great American Lawn came to dominate the American perception of grassland ecologies beginning in the 1930s and experienced rapid expansion post WWII with the acceleration of suburbanization. This movement re-invigorated the ideal of a carefully controlled monoculture lawn that once dominated the American Picturesque aesthetic. However, this time instead of grand rolling lawns, grass was utilized on small residential lawns and on medians and buffers along the rapidly expanding road infrastructure system. This aesthetic became so dominant that most Americans today, if asked to picture a grass landscape, would likely imagine an over watered and routinely mowed Kentucky bluegrass field (Smithsonian, 2016, 1). Examples of this movement are ubiquitous in the US, with parks like Cheesmen and Congress Park in Denver being perfect examples of this typology.

Native Meadow Ecologies

Our expansion in knowledge surrounding grassland ecologies in the mid 1900s lead to the production of designs that are characterized by native meadow ecologies. This movement challenged the ubiquitous American Lawn typology and offered an alternative that is much more ecologically sound and beneficial. These efforts attempt to replicate native grassland and meadow ecologies through careful species selection and landscape maintenance. This style was pioneered by LAs like Larry Weaner beginning in the 1980s. Key examples of this movement include the Litchfield Home and Twin Maples, both designed by LWLA (LWLA, 2024).

Public Park Restoration

While the movements of the Great American Lawn and Native Meadow are both very much a part of the modern approach to grasslands in landscape architecture, the newest innovations in the field are coming from designers who are trying to integrate grasslands into public park projects. This movement integrates elements of grassland restoration into public park uses, like play, education, and trail design. Examples of these types of projects include Prairie Meadows Park, High Prairie Park, and the 1881 Park all of which have been developed in the 25 years. The modern context of grassland restoration is defined by ecologically sensitive native grassland designs slowly replacing lawns in public use landscape architecture designs. This precedent review introduces the primary design movements that have shaped how grasslands are viewed and used within landscape architecture practice.

4: Methods

Blue Grama
(Bouteloua gracilis) E13

Methods

Having conducted a thorough literature and precedent review, it is clear that there are significant gaps in knowledge that necessitate further research. These gaps are articulated in the following research questions: What barriers have prevented the full realization of the restoration goals of landscape architects and grassland restoration practitioners? How can collaboration between both disciplines improve restoration outcomes? To provide possible answers to these questions–and address associated knowledge gaps–I conducted interviews with professionals in both restoration ecology and landscape architecture.

For these interviews I consulted three landscape architects, three restoration professionals and three professions with experience in both fields. See Figure 10. All of the interviewees have direct experience managing grasslands in some capacity. I selected designers based on their past projects that either took place in a grassland environment or attempted to include grassland elements within designed landscapes. When I was reaching out to restoration professionals, I focused on finding practitioners who managed grasslands in areas with human use because their work is more relevant to my specific inquiries than those of practitioners who primarily operate in an agricultural context. While I had a general outline of the type of professionals I wanted to speak with before beginning my research, my research goals and future interviews shifted throughout the research process in response to my interactions with each professional. To guide this process I utilized an approach known as relational interviewing, which is a method that allows the researcher to modify elements of their interview structure including lines of questioning, interview location and context, and overall research goals based on new insights gained within the research process (Fuji, 2018, 1-2). This approach meant I was able to tailor my interview approach to each professional based on our relationship and their unique expertise, which further allowed me to adjust my research approaches based on the suggestions made by interviewees.

I contacted potential interviewees via email or phone, without offering any compensation. The interviews took place on Zoom, over the phone, or in local cafes, depending on the interviewee's availability and preference. Participants signed a consent form permitting me to record and transcribe the interview for use in this thesis. Audio recordings were transcribed using an online service and edited for accuracy. These were kept confidential throughout the process, and were deleted within 6 months of the successful defense. All written sections referencing interviews were shared with interviewees for approval before the thesis was finalized, ensuring accuracy in my representation of their beliefs.

I used a semi-structured interview approach guided by a consistent set of topics related to my research questions that further allowed space within the interviews for unique lines of questioning based on the subject's particular expertise or any topics that arose naturally within conversation (Knott et al, 2022, 1). This approach allowed me to gain an understanding of each interviewee's insights and expertise on the central topics of my research, while also investigating less concrete topics like how they think and what they believe. The guiding topics used throughout all of the interviews is listed below:

- Educational backgrounds.
- Primary user considerations.
- Perspectives surrounding each field's capabilities.
- Human use and restoration integration.
- Experience with interdisciplinary collaborations.

After compiling all interview transcripts, I conducted an interpretive analysis of the interviews. In interpretive analysis, "the goal is not to achieve a singularly accurate, objective snapshot of the world, but to develop an explanation of how people socially—that is, intersubjectively—construct and understand the worlds in which they are embedded and the logics they use to navigate those worlds" (Fuji, 2018, 1). The central focus of my research

is to understand the prevailing beliefs and practices within the fields of grassland restoration and landscape architecture and to explore how those beliefs impact interdisciplinary collaboration. This inquiry is strongly rooted in the social dynamics and individual beliefs of practitioners, making it ideal for an interpretive analysis. I used the three-stage coding process, where I first transcribed the interviews using Otter AI software and reviewed them by hand while listening to the recordings to ensure the accuracy of each transcript. I then began to categorize relevant information in the interviews, first based on their connection to my three guiding research questions. I conducted a second round of analysis that focused on identifying themes that do not directly relate to my central inquiries but nonetheless are useful for providing insights into grassland restoration practice.

Once central themes across the interviews are identified, I discuss how those themes relate to the gaps in knowledge and research questions that inspired the research. Through these methods, I am able to build on existing literature to provide novel insights into best practice for grassland restoration in landscape architecture and the relationship between the fields of restoration ecology and landscape architecture. The presentation of this research educates readers on the collaborative relationships between practitioners and the current design best practices, allowing for more effective grassland restoration design.

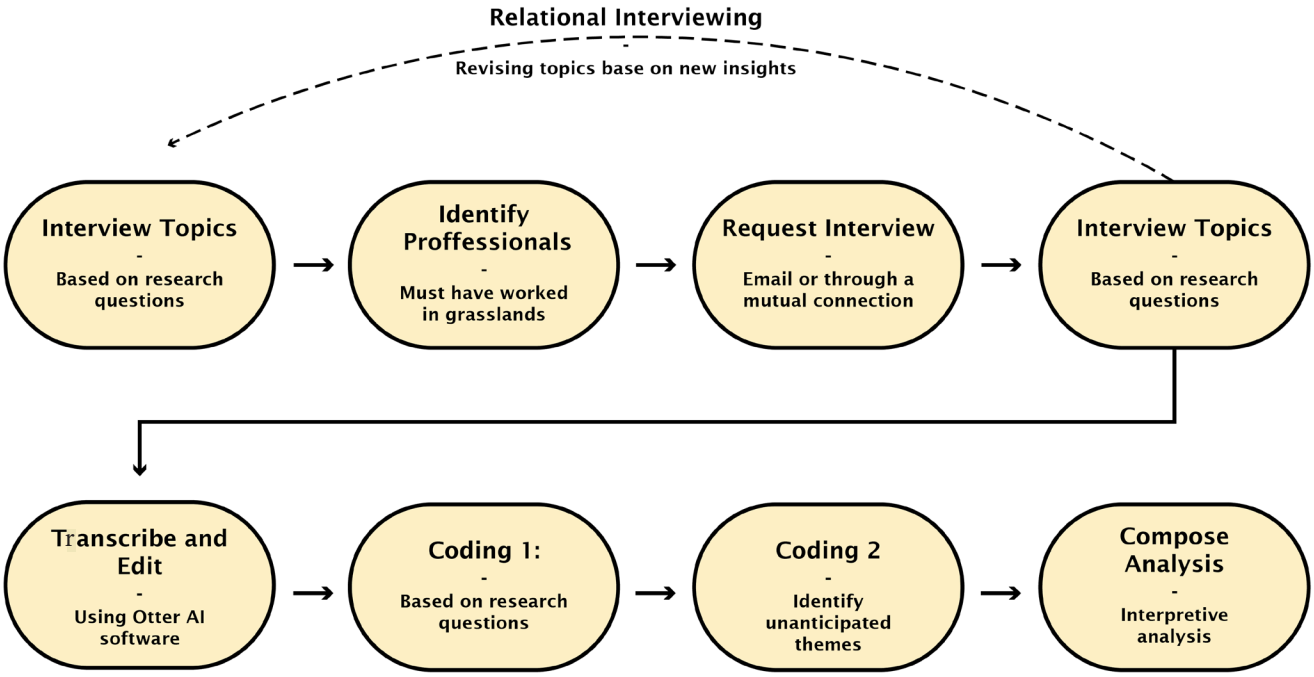


Fig 6. Flow chart representing my research process.

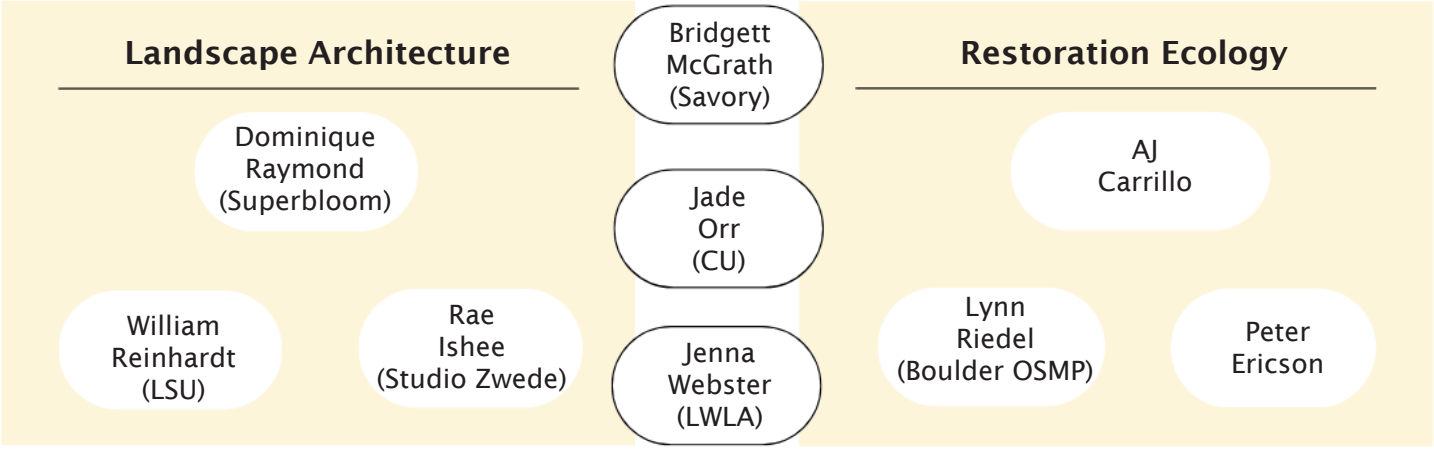


Fig 10. Diagram showing the professional categorization of my interviewees.

5: Results

Switchgrass
(Panicum virgatum) E14

Results

In this section of the thesis, I present the analysis and findings from interviews I conducted with professionals in the fields of landscape architecture and restoration ecology. My thesis is centered around the interactions, overlaps, and conflicts between these two disciplines, a deep understanding of which can not be gathered through literature and precedent reviews alone. These interviews provide further insight into the best practices in each field, the barriers to interdisciplinary collaboration, and the opportunities for collaboration between these disciplines.

Best Practices

The literature and precedent reviews provided an introduction to some of the dominant best practices for grassland restoration in the fields of landscape architecture and restoration ecology. The insights from this interview analysis will allow us to identify practices that have not been written about extensively in the literature and to gain a better understanding of how these methodologies and techniques are implemented in practice. It is important to note that while this section of the analysis will discuss best practice in restoration ecology and landscape architecture the majority of the interview analysis will focus on LA practice since that is where the largest gap in the literature was found. The relationship between best practices in both fields is represented in Figure 7. My analytical intent is to present the best practices as they were described by professionals in both disciplines and then use the barriers and opportunities sections that follow within this analysis to discuss how the similarities and differences between these approaches can lead to both conflicts and opportunities.

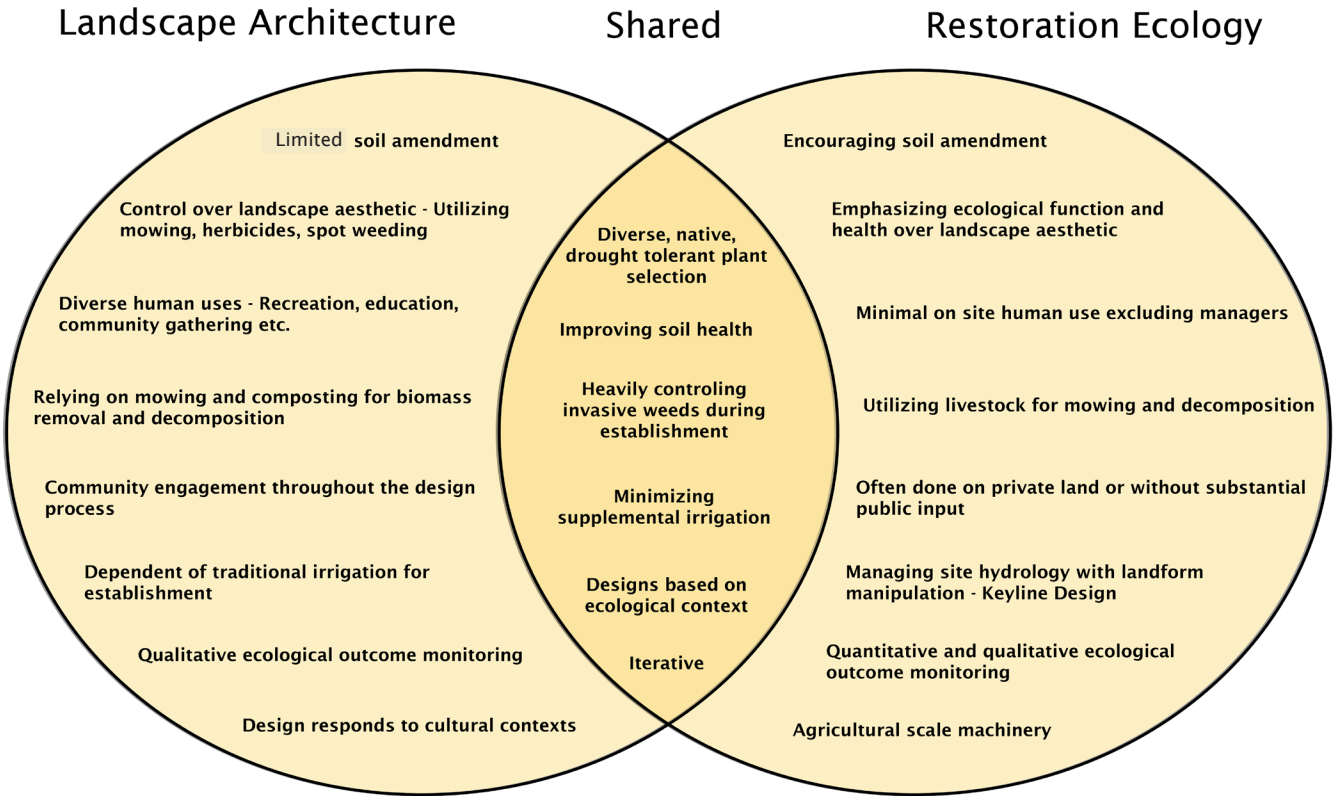


Fig 7. Venn diagram exploring the similarities and differences in grassland restoration best practice in landscape architecture and restoration ecology. The majority of the restoration practices listed under restoration ecology were gleaned from the recourses presented in the literature review. The LA information is taken from the section following this figure.

Throughout my interviews with landscape architects, several themes surrounding best practices in grassland restoration arose. The central themes that I identified are: design intent, maintenance philosophies, mowing and weed control, ecological monitoring, soil amendment, hydrology, planting, aesthetics, and user ecology interactions. This section of my analysis will make explicit the dominant grassland restoration techniques and decision making frameworks that have historically been hidden in professional practice within the field of landscape architecture.

Following the landscape architecture best practices is a presentation of restoration ecology best practices. The vast majority of the best practices that were mentioned during my interviews with restoration professionals have been written about extensively and have therefore been captured within the literature review of this thesis. Unlike landscape architecture, where most of the technical knowledge is hidden in professional practice, most of the best practices of restoration ecology have been published in books and journal articles. As a result, this section of the analysis will be significantly shorter than the previous best practice analysis to avoid presenting information that is redundant with the content discussed in the literature review. There are, however, some novel insights that arose through my interviews, including several new applications for grassland restoration techniques, insights into land ownership dynamics, and contradicting information surrounding soil amendment and cattle grazing.

Landscape Architecture Design Intent

Interviewee	Quote
Jenna Webster	"They [landscape architects] can really contribute. Because they make land use decisions, and they shape how the land looks and functions."
Jade Orr	"Multi purpose, right, like they can be trails and parks, but they can also serve as flood mitigation and they can also serve as habitat and a lot of different things."
William Reinhardt	"Nature, we can change within our lifetime, we can see it rebound so fast, even if it gets knocked down to nothing."
Jenna Webster	"Ecological integrity, but also aesthetic integrity."
Rae Ishee	"Messy ecologies, orderly frames."
Rae Ishee	"Connection between people and place, like that's, that's success."
William Reinhardt	"I think [design intent is] an important thing to observe and share."
Jade Orr	"Working with communities that have been facing environmental injustices for decades."

Before delving into the details of the types of restoration and design implementations, it is important to understand the underlying motivations and goals that are inspiring designers to include grasslands in their designs. The primary motivations I observed through interviews with professionals were: improving ecological health and function, diversifying their aesthetic palette, and improving the users' sense of place through ecological and cultural education.

In recent years, heightened awareness of ecological health, particularly in the context of climate change, has underscored the significance of integrating healthy ecosystems into landscape designs. Landscape architects have recognized their pivotal role in shaping land use decisions, as emphasized by Jenna from LWLA. This realization has prompted landscape architects, such as PhD candidate Jade Orr, to advocate for multifunctional designs that serve purposes beyond aesthetics, encompassing elements like flood mitigation and habitat preservation. By integrating ecological restoration principles into their designs, landscape architects directly influence ecological health outcomes. Professor William Reinhardt emphasizes the positive impact that integrating ecological restoration into design practices can have, noting the remarkable resilience of nature and its ability to rebound rapidly even from severe degradation. This recognition motivates designers to incorporate restoration projects into their work, driven by the potential for tangible, positive impacts on local ecological health.

As Jenna from LWLA suggests, grassland restoration has also been brought into landscape designs not only to support "ecological integrity" but the "aesthetic integrity" of sites as well. Grasslands and meadows are utilized as turf alternatives and provide more colors and textural intrigue in the landscape. This integration can provide landscape architects with the opportunity to create new aesthetic frameworks, which Joan Iverson Nassauer famously described as "messy ecosystems, orderly frames." (Nassauer, 1995, 1). Interviewee Rae Ishee from Studio Zewde referenced this research to explain how the maintenance and framing of native landscapes can be used to create more legible and aesthetically pleasing designs. The inclusion of grassland restoration in design helps to facilitate a departure from the sod-dominant landscapes of the past towards more dynamic landscape aesthetics.

Landscape architects are driven by their potential to create connections between users and the spaces that they occupy. Rae Ishee described this when she says that when you see a connection, "between people and place… that's success." Education serves as a means through which landscape architects (LAs) can nurture the connection between individuals and their surroundings. This is exemplified by Professor William Reinhardt's emphasis on utilizing grassland landscapes as educational tools for his students, highlighting the importance of observing and sharing such experiences. Similarly, Bridgett McGrath, a restoration professional operating a kids' education camp, underscored the value of monitoring ecological health as a platform for students to engage in hands-on learning experiences, such as conducting forage assessments. Ecological restoration also has the potential to revive historical and cultural ties to a site. Jade Orr noted that for communities grappling with environmental injustices over decades, the act of reconnecting with culturally significant landscapes through restoration efforts holds substantial value.

Maintenance Philosophies

Interviewee	Quote
AJ Carrillo	"It's actually not a maintenance mentality. It's a management mentality. You're not trying to keep anything the same. You're trying to make it healthier. And that's a very different paradigm."
Rae Ishee	"The meadow is not a one size fits all, you have to, like, fine tune it for the site, for the place for the works for the actual conditions in the ground. And, you know, for people's expectations."
Jenna Webster	"We're designing for maintenance."
Bridgett McGrath	"Holistic Management, and and those sort of practices is how I plan our programming."

Landscape architects adopt several different maintenance philosophies that guide the maintenance techniques they choose to utilize. These philosophies tend to frame landscape architects as active stewards who are maintaining the landscape to improve ecological health and enhance the user experience.

A distinctive aspect of maintenance philosophy within landscape architecture is the emphasis on management rather than preservation, as articulated by AJ Carrillo: "it's actually not a maintenance mentality. It's a management mentality. You're not trying to keep anything the same. You're trying to make it healthier." This perspective reflects a paradigm shift towards proactive stewardship, where the goal is not to maintain static conditions but to actively improve and sustain the ecological integrity of landscapes.

Jenna Webster underscores the importance of designing landscapes with maintenance in mind, emphasizing the need for designs that are not only visually appealing but also sustainable and manageable in the long term. This approach necessitates site-specific management plans tailored to address the unique conditions and user requirements of each location, as highlighted by Rae Ishee's acknowledgment that "the meadow is not a one size fits all." Bridgett McGrath builds upon this idea with her advocacy for "Holistic Management", which entails considering a wide variety of contextual factors, human and ecological, during restoration planning and implementation. By considering the interconnectedness of ecological, social, and cultural factors, practitioners strive for comprehensive landscape management strategies that prioritize resilience and adaptability to ensure the long-term viability of designed spaces.

Mowing and Weed Control

Interviewee	Quote
Rae Ishee	"If you do all of these steps, you do the right, you know, level of maintenance and care in the intermediate, which is a high level, then, then this is what I'm going to expect, you'll mow once a year, you'll, you know, for all of these areas, instead of every week, you'll do spot checks every other month. And what that requires is a team to come out and just kind of look for invasives."
AJ Carrillo	"Use roller crimper roller crimper roller crimper is really great."
Rae Ishee	"It just animals a exponential effect, because they're not just stopping that stuff down. But they're also eating it running it through their huge biodigesters and then adding a bunch of fertilizer to it and then watering the landscape and adding nitrogen all at the same time. There are millions of years of symbiosis."
Rae Ishee	"In my own exploration of restoration ecology, it's like, shocking to hear that, herbicide is an important part of that, or what have you, how can that be true? And it's not the only way, but it's, it's the mediation in time, right, and like time and effort, we could have people out there taking care of things continually. Or kind of have these like shortcut methods."
William Reinhardt	"The best is to do like the twice a year bush hog and kind of reset the meadow. So we'll manage it for the mix as much as we can for as long as we can, and then mow it down and reset."
Bridgett McGrath	"Not only am I looking at rotational grazing, but I'm also looking at rotational use on the site with our program."
Jenna Webster	"A mon buffer strip, that's going to minimize, it's not going to completely prevent, but it's going to reduce the amount of weeds that are going to spread either through gravity, disperse by the wind or clonal growth. It's just a way to sort of maintain that edge."
Jenna Webster	"Herbicide can be much cheaper than other methods. And you can oftentimes get much greater species diversity with herbicide than you ultimately can get with other either prep or management techniques, because they're just a little less refined."
Jenna Webster	"Goats are a tool as well. But they have their pros and cons, just like herbicide has its pros and cons. And burning has its pros and cons. And mowing has its pros and cons. And those are all kind of pretty common management tools. But they all have their pros and cons. And it's important to understand what those pros and cons are and how does that interface with your goals, site conditions, and your budget."

The discourse surrounding weed control encompasses a spectrum of methodologies. This portion of the restoration discussion garnered considerable attention across most interviews I conducted. When exploring weed control strategies for grassland restoration, Bridgett McGrath's approach of rotational grazing stands out as a method that integrates livestock management with restoration goals. In her interview, she emphasized the importance of managing the intensity of use, whether by livestock or humans, to control biomass and weed growth effectively. AJ Carillo also highlighted the ecological benefits of using livestock mowing, emphasizing the symbiotic relationship between animals and grassland ecology. However, conflicts can arise when integrating livestock with human use, as noted by William Reinhardt, who advocates for a non-livestock approach involving periodic bush hog mowing to reset the meadow. Jenna from LWLA proposes an alternative method of frequent mowing to create buffer strips that reduce weed spread from adjacent properties.

The debate surrounding herbicide usage in weed management also reflects differing perspectives within the field of ecological restoration. Rae Ishee expressed surprise at learning that many grassland meadow projects needed herbicides to maintain them, highlighting a broader discourse on the topic. While acknowledging the efficiency of herbicides in time-efficient management, practitioners like Jenna from LWLA stress the need for a nuanced understanding of their ecological implications. Despite concerns about their potential environmental and health impacts, targeted herbicide use can contribute to improved restoration outcomes by facilitating greater species diversity outcomes.

Practitioners in landscape architecture utilize a wide range of methods to manage the biomass and weeds that their sites produce and, " they all have their pros and cons, but it is important to understand what those pros and cons are and how that interfaces with your goals, site conditions, and your budget" Jenna Webster stated.These practices must be site specific as previously mentioned; however, when done correctly, the maintenance of an established grassland is often less than what would be needed for turf alternatives. Rae Ishee articulates the long term reduction of maintenance labor that can be achieved through careful implementation of grassland restoration mowing and weed management techniques when she states "you'll mow once a year, for all of these areas, instead of every week."

Soil Amendment

Interviewee	Quote
Rae Ishee	"So there's just there is a huge amount of growth in understanding the value of soils, different types of soils, different nutrient levels of soils."
William Reinhardt	"I'm still trying to remove biomass by, you know, making piles away from the meadows and various and trying to get more seed contact in the soil, but mostly, the soil, you know, we're leaving up to its own processes."
Jenna Webster	"We're dealing with constructed soils. And so we like to be involved in the discussions with the soil consultants, so that we're ensuring what we like are low fertility soils."
Jenna Webster	"We want low fertility, because many of our native grassland species thrive in low fertility, and it also means that the weeds are going to be less vigorous, in low fertility soils. So we're often having to advocate for, don't fertilize. So don't amend the soil in that way, whether it's constructed soils or not."

Practitioners prioritize strategies that minimize soil disturbance, preserve soil structure and microbial communities, and promote the establishment of native plant communities through the use of low fertility soils.

Through discussion during her interview, Rae Ishee highlighted the growing appreciation for soil diversity and its impact on grassland restoration practices. This shift in perspective emphasizes the importance of understanding various soil types and nutrient levels in fostering successful restoration outcomes. Similarly, William Reinhardt's focus on minimizing soil disturbance underscores a commitment to preserving soil health through a minimalist approach to soil amendment that he described in his interview. By prioritizing practices that maintain soil integrity and nutrient levels without significantly disrupting the soil composition, such as composting methods, Reinhardt aims to facilitate natural soil processes that are essential for sustainable grassland restoration. This minimalist approach is echoed in Jenna from LWLA's approach which she described as, "don't fertilize, don't amend the soil." Jenna further emphasized the importance of advocating for low fertility soils, as many native grassland species thrive in such conditions, while weeds are less vigorous in low fertility soils.

Hydrology

Interviewee	Quote
William Reinhardt	"We don't irrigate. But we do have swales all throughout the edges of the meadows. Some of them are for trees to grow and some of them are just herbaceous."
Jenna Webster	"We're seeing hydrological variation, whether that's constructed or not, we're responding to that."
Jenna Webster	"Put that seed down and the plants are gonna figure it out, they'll sort themselves out and you'll begin to see those hydrological patterns get expressed in the vegetation."
Jenna Webster	"Historically we have never, we tend to be very discouraging of irrigation historically. But as we deal with climate change, I'm wondering if some of our firm's practices may actually change."
Dominique Raymond	"There's not going to be any irrigation there in the future, and it will just be irrigated by natural processes."

Practitioners emphasized the integral role of hydrological processes in shaping grassland ecosystems and prioritize interventions that seek to mimic and enhance natural hydrological patterns.

Professor William Reinhardt from LSU, described the use of swales to naturally manage water flow along the edges of meadows within the Louisiana State University Arboretum, highlighting the significance of such features in supporting diverse communities of vegetation. Dominique Raymond from Superbloom acknowledged the necessity of irrigation during the early stages of establishment, particularly in arid environments. However, the firm designs their systems with the intention of transitioning away from irrigation, creating systems that will eventually be "irrigated by natural processes" exclusively.

Jenna from LWLA expanded further on these approaches to irrigation, emphasizing the importance of responding to both constructed and existing hydrological patterns. This adaptive mindset recognizes the dynamic nature of hydrological contexts and the need for flexible design strategies. Jenna also reflects on the potential shifts in irrigation practices in response to climate change when she discussed the potential need to evolve traditional approaches to accommodate changing environmental conditions in grassland restoration projects.

Ecological Monitoring

Interviewee	Quote
William Reinhardt	"We're looking at scanning our meadows and scanning, you know, the biomass scanning the carbon scanning the wet spots, doing soil, carbon tests, and trying to quantify and find quantitative ways to monitor as well."
William Reinhardt	"I look at Inaturalist, our species diversity compared to other areas."
Jenna Webster	"There are instances where they might do bioblitzes, or some sort of biodiversity capture, prior to the project being installed, and then after it's installed, so that there's some sort of before and after kind of comparison."
Jenna Webster	"A kind of visual assessment and kind of functional assessment of, are there problem weeds present and invasive species present that are going to jeopardize the habitat integrity of what we want."

Through the integration of various monitoring techniques, landscape architects are able to actively engage with the ecological dynamics of grassland ecosystems and adapt their approaches accordingly.

William Reinhardt emphasized the benefits of quantitative monitoring methods, highlighting the use of scanning technologies and soil carbon tests to gather data on biomass, carbon levels, and soil characteristics. Additionally, Reinhardt discussed the use of iNaturalist or other app and computer-aided engagement strategies to educate the broader community in documenting species diversity and tracking biodiversity changes over time. This participatory monitoring approach not only enhances data collection efforts but also promotes community engagement and awareness of local ecosystems.

Jenna from LWLA introduced the use of biodiversity blitzes to capture data before and after project installation, enabling practitioners to assess ecological impacts and habitat changes. However, Jenna acknowledged that comprehensive quantitative assessments may be limited by project budgets. In such cases, she suggests visual assessments focusing on identifying problem weeds and invasive species that could compromise habitat integrity. While less precise, these assessments provide crucial information to inform future management practices within constrained budgets.

Planting

Interviewee	Quote
Jenna Webster	"When you're establishing a landscape from seed, it can go through sort of a messier phase and can look a little less legible to people. It will get there eventually, but it takes longer than if you're working with live plants."
Jenna Webster	"You can't just plant into existing vegetation, you have to send it back to essentially bare soil, even if you're not tilling and herbicide is a very useful tool for that."
Dominique Raymond	"There's sod in here, but even though we're doing grass, we're doing a drought tolerant fescue."
Dominique Raymond	"Inoculate the seeds in a way that we would call it instead of hydro mulching, we call it hydroseeding."
Dominique Raymond	"Utilizing drought tolerant native plants."
Dominique Raymond	"The plant list has over like 1500 grasses like in one area, but their plugs, which means that they're smaller plants, so they'll establish easier because they're, they're younger, they're less mature."
Lynn Riedel	"Another aspect, aspects of restoration can be, as you know, I know, but can be just more managing an existing plant community and nudging it in the right direction or doing actions that keep it healthy or reduce nonnative cool season grasses."

My discussions with practitioners revealed various planting techniques and plant types that are used to establish diverse and sustainable grassland ecosystems.

Jenna highlighted the importance of removing vegetation prior to seeding the new species when she stated, "you have to send it back to essentially bare soil" further noting that, " herbicide is a very useful tool," for achieving this outcome. Once the slate is clean,there are several different methods for planting including seeding, plugging, hydroseeding and planting potted plants. The level of control the designer has over the aesthetic decreases as the age of the plant you are planting decreases. Seeding and plugging allow for greater diversity at lower costs but do not allow for the same level of aesthetic control as ornamental plantings.

There are also many sites where designers are not starting from a blank slate and have a healthy existing plant community. Lynn Riedel emphasized the importance of managing existing plant communities as part of the restoration process, noting that restoration efforts may involve taking established plant communities and making slight adjustments to direct the future ecological development, instead of using herbicides to reach a blank slate. While there were significant discrepancies in planting techniques, all of the people I interviewed emphasized the importance of utilizing native plant communities. Native planting pallets improve rates of establishment, decrease irrigation use, decrease maintenance requirements, and help to re-establish a site's ecological identity.

Aesthetics

Interviewee	Quote
William Reinhardt	"We are kind of straddling between, you know, restoration and then just a pure aesthetic."
Jenna Webster	"You need to educate the stakeholders that they understand, 'Oh, it's gonna look like this for this amount of time. And then it's going to develop and change over time.' And so that there's really, especially on these public projects there's buy-in, and an understanding of the process."
Jenna Webster	"That can be perfectly acceptable in some contexts. But in other contexts, that's just not going to read well to people. And it doesn't make sense. So I think being really sensitive to context is important."
Jenna Webster	"That mon buffer, it's very simple, but it's just communicating to people this space is cared for. It's there's human intention here. So simple kind of tools like that can really go a long way to getting greater acceptability of something that might feel a bit wilder and rougher, especially in the short term."
Jenna Webster	"In the kind of design world, we talk a lot about legibility. So it's, is it checking that box? Does it feel cohesive?"
Jenna Webster	"Landscape preference matrix identifies common human landscape preferences. So those are things like does it have both legibility and complexity?"

The approach to landscape aesthetics in grassland restoration projects is characterized by a thoughtful balance between ecological restoration goals and user aesthetic preferences.

William Reinhardt acknowledged the delicate balance between restoration objectives and aesthetic considerations, noting that practitioners often have to navigate between "restoration and then just a pure aesthetic." To navigate this tension, Jenna from LWLA emphasized the importance of educating stakeholders about the evolving nature of grassland landscapes to help to manage stakeholder aesthetic expectations to improve buy-in and understanding.

In addressing concerns about the perception of wilder and rougher landscapes, Jenna suggested the use of simple tools such as mown buffer strips to communicate human intention and care for the landscape. Jenna also discussed the concept of landscape legibility, emphasizing the importance of designing landscapes that are both legible and complex and suggested the use of, "landscape preference matrix," which identifies common human landscape preferences. Concepts like mown bufferstrips are a tool that can be used to achieve the, "messy ecosystems in orderly frames," that was coined by Nassauer and reiterated during my interview with Rae Ishee (Nassauer, 1995, 1). This balance ensures that landscapes are visually engaging while also providing users with clear cues and navigational elements. These subtle interventions can enhance the acceptability of restoration efforts, particularly in public projects where user perception plays a crucial role.

User-Ecology Interactions

Interviewee	Quote
William Reinhardt	"We're looking at different ways to do primary paths and secondary paths through these areas, so people can still experience them, but not disturb the landscape."
Bridgett McGrath	"How do you create transition, and wayfinding? Through those spaces within landscape architecture can be a really interesting thing, like how do you tell the story of grazing and its impact?"
Jade Orr	"Land could be restored to maybe some of the original purposes or to grow some of the original crops so that people can then begin to have that connection, again, with their culture that was kind of taken from them."
Jade Orr	"You have to figure out how to put it into more like practical terms. And that's why we're creating graphics for the Environmental Defense Fund. So it's not just a lot of like words coming out people, it's like they can actually see what the land might look like and what it might transition."
Jade Orr	"Community members are a lot of times distrustful of an outsider showing them this change. So they don't necessarily trust you that it's going to be to their benefit, especially people who have faced so many, like historic harms at the hands of outsiders. So that's why we've done a lot of community engagement."
Lynn Riedel	"Interpretive signing to help them understand so that the deeper natural values."
Rae Ishee	"So if we can, like repair those bonds, through a process of communication of, you know, what, what do you want to see here, that's genuine and culturally specific. It just strengthens the success of however, that land is restored, because it's seen."

Landscape architects make significant efforts to facilitate and manage safe and enjoyable interactions between the users and ecological systems on their sites. William Reinhardt emphasized the need for designing paths within grassland landscapes that enable people to experience the environment without causing ecological disturbances. His approach when designing and managing the LSU Arboretum prioritizes creating primary and secondary paths that offer accessibility while minimizing disruption to the natural surroundings.

Bridgett McGrath introduced questions aimed at transition and wayfinding. McGrath noted that careful consideration of those factors can result in the effective integration of storytelling elements into design interventions. This storytelling approach enhances user comprehension of the cultural and ecological significance of grassland landscapes and their management techniques.

Jade Orr stressed the importance of community engagement and emphasized the need to convey ecological concepts in practical terms through signage. Lynn Riedel further supported this idea by advocating for interpretive signing to deepen users' appreciation for the natural values embedded within grassland restoration projects. Rae Ishee summarized the importance of considering the human use interactions stating,"if we can repair those bonds, through a process of communication that's genuine and culturally specific, t just strengthens the success of however that land is restored, because it's seen."

Best Practices in Grassland Restoration Ecology

Interviewee	Quote
Jade Orr	"So for them, they're more advocating for introducing habitat corridors, or habitat restoration because a lot of habitat has been degraded and cut off by agriculture. They are advocating for the return of range land, because range land is actually a pretty sustainable use if it's done correctly, because a lot of perennial grasses and meadows, and it also can serve as flood mitigation."
Jade Orr	"There's something called flood Mar and agmar and that's basically agriculture that can tolerate flooding."
Jade Orr	"They're also really focused on trying to bring back like the native bee population, because basically, then pretty much decimated in California."
Jade Orr	"Good articles where they're trying to, like quantify how much space do you need around a town, like if you're gonna have a green buffer to provide all these benefits."
Jade Orr	"Have land under the solar so you can still grow like shade-tolerant things or you can have like a perennial grassland underneath it. So like the soil still being regenerated."
Jade Orr	"So land subsidence is like when you if you imagine like, our land is like this, and if there's a well that's coming like this, the more it pulled down, it like starts to pull the land down with it, too. So becomes like it like infrastructure crumbles, lots of terrible things happen."
Jade Orr	"Smaller scale farmers lease their land, so they don't necessarily own their land. And then sometimes they're kind of beholden to what the land holder will allow them to do."
Peter Ericson	"The absentee landowners or they don't have like a hyper specific management goal, the goal is, it looks pretty good, supports the right number of cattle. So in the more in the private realm, I would say those, those become more subjective. But if you're dealing with public entities or nonprofits who have a mission like that, then you do get sort of on the hook, as it were of some very specific management outcomes."
Jade Orr	"Basically categorizes soils into like how, how well, they can drain water, so back down into the aquifer."
Lynn Reidel	"We often don't use soil amendments in our restoration projects because they it is very difficult to get material that is weed free."
Lynn Reidel	"They and so the amendments crank up the nitrogen and help the non-native species grow."

The interviews that I conducted shed light on new applications for grassland restoration, the role of land ownership dynamics, and new perspectives surrounding soil preparation that build on the existing research cited within. In my discussions with Jade Orr, various potential applications for grassland restoration methods

emerged. Jade advocated for introducing habitat corridors and restoration to address habitat degradation caused by agriculture. Additionally, she highlighted the role of grassland restoration projects in flood mitigation, known as "floodmar and agmar," which involves intentionally flooding agricultural areas to mitigate flood damage in adjacent areas and to enhance aquifer infiltration, thereby improving water security and reducing subsidence impacts.

Jade Orr and Peter Ericson offered insights into how land ownership dynamics influence restoration efforts. Jade noted that smaller scale farmers who lease their land may be limited in executing restoration plans due to constraints imposed by landowners. Peter highlighted the subjective nature of restoration goals on lands owned by absentee landowners, contrasting them with public entities or nonprofits with specific management outcomes. Both interviewees mentioned that land management leases are often too short for the land managers to properly execute and benefit from restoration efforts. This dynamic results in a hesitancy on behalf of the managers to implement restoration efforts on the land.

These interviews also uncovered perspectives on soil amendment not extensively covered in the literature. Jade Orr discussed soil categorizations based on permeability for flood mitigation, emphasizing the importance of this variable in grassland restoration for aquifer replenishment. Lynn Riedel provided insights into the practical challenges of using soil amendments, citing difficulties in sourcing weed-free materials and the potential for increased nitrogen levels favoring non-native species growth. These insights challenge traditional views on soil fertility and underscore the importance of considering soil permeability and invasive species management in grassland restoration projects.

Best Practices Conclusion

The synthesis of findings from interviews with practitioners in the fields of restoration ecology and landscape architecture provides valuable insights into best practices for grassland restoration. These insights can be categorized into design intent, maintenance philosophies, mowing and weed control, ecological monitoring, soil amendment, hydrology, planting, aesthetics and user ecology interactions.

Landscape architects are motivated by a multifaceted desire to implement grassland restoration projects, aiming to enhance ecological health, improve aesthetic appeal, and foster a deeper connection to place through cultural and ecological education. This motivation drives their proactive maintenance philosophy, which prioritizes stewardship, ecological health, user experience, and adaptability. Within the realm of maintenance, a dynamic approach to mowing and weed control is emphasized, tailored to respond to the unique conditions of each site. This approach aims to achieve long-term reductions in maintenance efforts. Similarly, many practitioners advocate for a minimalist approach to soil amendment favoring maintaining relatively low fertility levels to promote native species establishment while suppressing weed growth.

Throughout the interviews, the concept of site specific intervention was heavily emphasized. For example, hydrological processes play a fundamental role in shaping grassland ecosystems, leading practitioners to prioritize measures that mimic and enhance existing hydrological patterns. By responding to site specific conditions, designers can create landscapes that operate without supplemental irrigation improving sustainability and resilience. Monitoring methods are essential for landscape architects to effectively interact with the unique ecological processes of their site's grassland ecosystems and adapt their strategies as needed.

While many considerations are site specific, there are some aspects that there is consensus on for applicability across sites. For example, centering native low-water plants in grassland areas, utilizing design principles to create aesthetic interventions that increase the acceptability of restoration efforts, and providing meaningful opportunities for users to engage with and learn from the natural environment were all agreed upon as essential

elements to effective grassland restoration in landscape architecture.

My interview analysis of best practices in grassland restoration ecology also yielded some novel insights, including fresh applications for grassland restoration techniques, revelations about land ownership dynamics, and new perspectives regarding soil amendment.

This best practices analysis reveals connections between design intent, maintenance philosophy, soil amendment practices, hydrological considerations, monitoring methods, planting strategies, aesthetic interventions, and user engagement within the field of landscape architecture. These connections uncovered through interviews with landscape architecture professionals help to make knowledge that has been hidden in professional practice explicit. This section also builds upon the extensive restoration ecology literature. These contributions address my first research question: what are the existing best practices for grassland restoration within the landscape architecture and or restoration ecology fields? and begin to fill knowledge gaps that I previously identified in the literature review.

Barriers to Interdisciplinary Collaboration

The previous analysis of best practices in landscape architecture and restoration ecology reveals significant overlap in the motivations and techniques that are prevalent in both landscape architecture and restoration ecology fields. However, despite these similarities, there is limited interaction and exchange of ideas between professionals in both fields. This is articulated by Bridgett McGrath who was educated as a designer and now works with the grassland restoration group the Savory Institute, when she was asked if she was aware of many professionals with experience in grassland restoration and landscape architecture and she responded,"You know, honestly, no, I don't see a lot of people like me in this space." The inquiry that this section will explore is articulated by McGrath when she asks, "how do you balance usage requirements with ecological processes? Sometimes they're in conflict. So I think it's about also identifying where, through your context, where do you put value? And where are you willing to sacrifice?" These conflicts and barriers that arise when balancing interactions between restoration ecology and landscape architecture can be divided into several different types of barriers, including: misconceptions about the other fields' professional capabilities, scale conflicts, different aesthetic expectations, financial limitations, different educational backgrounds, and hazards that arise when implementing restoration techniques.

Profession Capability Misconceptions

Interviewee	Quote
Jenna Webster	"Design might have advanced pretty far. And they might have already figured all out all of the hardscape and all of the circulation. And so that's going to give us sort of less leeway to be part of a conversation."
Dominique Raymond	"However, sometimes, the timing of city submittals and the timing of when landscape architects are brought to the project aren't always in alignment."
Jade Orr	"I think a lot of people still don't understand, really what landscape architects do, and are."
Jade Orr	"I think that they kind of see landscape architecture as like the end step, not a really important step in the whole process."

In the discourse between landscape architecture and restoration ecology, misconceptions regarding professional capabilities often emerge, hindering effective collaboration and understanding. Landscape architects seemed to have a relatively strong grasp on the general type of work that fell under the umbrella of ecological restoration, however, as Jade Orr points out, "I think a lot of people still don't understand what landscape architects do, and are." This sentiment reflects a broader misunderstanding of the diverse skill set and capabilities of landscape architects, emphasizing the need for greater awareness and education about the profession.

Jenna Webster highlights how the misunderstanding of landscape architecture practice affects project timelines, limiting landscape architects' involvement. Design phases often progress significantly before landscape architects are brought into the conversation, leaving little room for their input. Similarly, Dominique Raymond noted a misalignment between the timing of city submittals and the involvement of landscape architects, indicating a broader issue in recognizing their essential role early in project development. This discrepancy underscores the underutilization of landscape architects' expertise due to a lack of understanding of their contribution to project planning and design phases.

Scale Misconceptions

Interviewee	Quote
Peter Ericson	"Just the scale is unlikely to be there to make that a true ranching operation."
AJ Carrillo	"Landscape designers are seen as being able to landscape small landscapes for as farmers and ranchers are developing, and managing their huge landscape of potential."
AJ Carrillo	"Small scales intensive, large scale is extensive. And they require different different things. They can learn from each other, but you also want to like capitalize on their strengths. And their strengths lie in different scales."
Bridgett McGrath	"I see it more in possibly like parks and rec departments that have more land space, I think it's harder to integrate livestock in the middle of a half acre public park."
Jade Orr	"I think sometimes landscape architecture is overlooked for their capacity to work on those projects. I think a lot of times like we were people still think we work on site scale things like we work on a park, or we work on a house, or we work on maybe like a trail, that doing that whole regional planning."

In the fields of landscape architecture and restoration ecology, there exists a wide variety of project scales, often accompanied by misconceptions and differing perceptions regarding the scope of work and capabilities within each discipline. Interviews with practitioners shed light on the beliefs and misunderstandings surrounding project scales.

The interviewee from Peter Ericson who worked on ranching scale restoration highlighted the challenge of scale when converting ranching operations into landscape-scale projects, indicating that ranching methodologies might not translate to a landscape architecture scale. AJ Carrillo delved into the discrepancy in scale perception between landscape designers and restoration professionals further, noting that landscape designers are often associated with small-scale interventions, contrasting with the expansive landscapes managed by restoration projects. This disparity suggests a disconnect in applying industrial-scale restoration principles to smaller contexts. McGrath suggested that rotational grazing methods may find more application in parks and recreation departments with larger land spaces rather than urban park designs, introducing a nuanced perspective on the scalability of restoration techniques in landscape architecture practice.

Contrary to the notion that landscape architects are limited to small-scale projects, Orr argued that landscape architects are overlooked for their capacity to work on large-scale projects, challenging the misconception that their expertise is confined to site-scale interventions rather than regional planning.

Maintenance Misconceptions

Interviewee	Quote
Rae Ishee	"The thing about restoration, native Meadows is that most people are like, 'Oh, you set it and forget it.' But that's such a like, you know, colonizer approach really born out of, you know, this idea that the United States was like settled and it just was and that you know, these lands, these native lands were pristine and untouched."
Rae Ishee	"The training, you know, you can there's, like, millions of people that can understand lawnmower."
Rae Ishee	"There's just kind of that education gap, too, for maintenance, available maintenance crews."
Rae Ishee	"That's the biggest gap is that it's a total shift in how you maintain. And that unknown is like a source of fear and discomfort."
William Reinhardt	"We do get some help from mowing and maintenance from city workers, but they are afraid of the snakes and possible habitat that it creates."
Jenna Webster	"People are very accustomed to what's required to maintain turf."
Dominique Raymond	"You need a balance of simplifying the soil approach and the soil strategy, but still utilizing a soil scientist."
Dominique Raymond	"It's been a difficult thing to try and find someone who's knowledgeable enough and willing to do this type of work."

Grassland restoration in landscape design requires maintenance efforts that diverge from the traditional methods of landscape maintenance. Adapting restoration ecology maintenance techniques to a landscape architecture context requires specialized training on behalf of the maintenance crews.

One significant barrier to effective grassland restoration lies in the misconception that prairies require minimal maintenance. Rae Ishee addresses this issue, noting that this belief often stems from a colonial mindset that views landscapes as inherently pristine and untouched. Furthermore, there exists an educational gap regarding maintenance practices, with traditional landscape maintenance being widely understood, while knowledge of prairie restoration maintenance methods remains niche. This gap in understanding leads to reluctance among landscape architects to adopt new maintenance practices, as described by Ishee, who highlights the fear and discomfort associated with shifting maintenance paradigms. William Reinhardt echoes this sentiment, emphasizing the resistance among maintenance crews accustomed to traditional turf management practices. Dominique Raymond echoed this sentiment in her discussion of the challenge of finding individuals knowledgeable and willing enough to undertake the transition to alternative maintenance practices.

Different Primary Users and Aesthetics

Interviewee	Quote
William Reinhardt	"It's very different users in mind. Probably 90% user experience, you know, we're Public Garden."
Rae Ishee	"Controlled is it basically, um, designers want so much control to let some things go."
Jade Orr	"If we had a grassland that was probably focused on, you know, restoration, it probably wouldn't look very, you know, kept up. And that's when we would get pushed back on."
Bridgett McGrath	"Public education and access that a prairie land is not going to look like an ornamental grassland, it's going to have a very different look to it."
Unknown	"The restoration professionals, extent to which I can speak to it, I think their focus tends to be more on what the plant community is being restored to and wildlife, and then kind of very practical site considerations."

Differences in design decision-making between landscape architecture and restoration ecology stem from the distinct primary users each discipline considers. Landscape architects prioritize human user experience, as emphasized by William Reinhardt, who claimed that nearly 90 percent, of all decisions in his landscape architecture practice are based on enhancing human experience. Rae Ishee claimed that this emphasis often leads to meticulous control over natural elements to curate specific aesthetics and user interactions, and noted that restoration outcomes require designers to relinquish some of that control over the landscape.

Reinhardt also discusses potential conflicts that may arise if restoration efforts compromise the curated aesthetics of public gardens, indicating a need for public education to align perceptions with the reality of ecological restoration. Bridgett McGrath underscores this need for education by emphasizing how prairie landscapes differ significantly from ornamental grasslands, highlighting the importance of managing public aesthetic expectations.

McGrath outlines the primary user considerations in restoration ecology, focusing on plant and wildlife communities and practical site aspects, often neglecting human experience. This omission is criticized by Ishee, who argues against the ideal of untouched natural landscapes devoid of human influence, emphasizing the necessity of acknowledging human presence and interactions with the environment in restoration efforts.

Financial Limitations

Interviewee	Quote
AJ Carrillo	"How do we measure biodiversity? How do we measure ecosystem services? So that's, I think that's coming, people are getting better at how to do that, how to quantify that into dollar."
Rae Ishee	"You know, we just went through the pandemic, like parks, everyone's lips are so great, like, everybody loves parks, and then they're like, oh, let's do that on less money."
William Reinhardt	"Only those high-end gardens that can afford to have a maintenance plan."
Bridgett McGrath	"A private ranch may not have the capital to do that type of investment in work."
Bridgett McGrath	"I think in terms of labor cost, it's more, but if you look at it holistically, perhaps your inputs are less, you don't have to spend as much on fertilization, receding things like that."

Interdisciplinary collaboration between these two disciplines often requires an expert in one of the fields to be hired by the other to consult on a project. This increases the amount of labor required to produce a restoration design and increases the overall project cost. Budget constraints in both industries can make interdisciplinary collaboration financially strenuous.

Reinhardt emphasizes that only high-end gardens with substantial resources can afford to hire restoration consultants. McGrath highlights the financial limitations faced by larger restoration efforts which hinder their engagement with landscape architects. These constraints have tightened for landscape architects due to decreased government funding for parks and recreation. Rae Ishee reflects on the exacerbated challenges during the pandemic, citing budget cuts and reduced funding as factors limiting resources for grassland restoration projects.

Despite these financial constraints, practitioners like McGrath recognize the potential long-term benefits of holistic restoration approaches. McGrath suggests that although labor costs may initially be higher, holistic restoration approaches can reduce long-term inputs such as fertilization and reseeding. Similarly, Jade Orr acknowledges the patience required for financial returns from restoration efforts, noting that strategies may take years to yield results. Despite the upfront costs of interdisciplinary collaboration, there is evidence that sound restoration design can lead to long-term economic benefits.

Educational Backgrounds

Interviewee	Quote
Rae Ishee	"Pretty plant next to this layout was pretty. I also think in the field, there was generally like a huge dirth of planting design knowledge."
William Reinhardt	"Landscape architects who don't really have animal husbandry backgrounds."
Bridgett McGrath	"Young people coming out of these programs, they would need to have some sort of dual background. In order to do that."
Jenna Webster	"Landscape architects, you know, they're coming there, most of them are trained in horticultural practices, and less than kind of the restoration realm that they don't understand some of the particularities."
Jenna Webster	"And people coming out of the horticultural realm, they're always taught, 'Oh, the more fertile, the better,' which is sort of an agricultural kind of legacy."
Jade Orr	"We haven't always been trained to read some of it. And some of these articles are being done by scientists, and they're written in a really technical way. And we might not understand it readily."

The education backgrounds of landscape architects and restoration ecologists significantly influence their approaches to grassland restoration and can pose challenges to effective collaboration.
Bridgett McGrath highlights the necessity for a dual background in design and ecology to effectively achieve both ecological restoration and human use goals. However, such dual expertise is often lacking in educational programs, presenting a challenge for emerging professionals. Jenna underscores the challenges stemming from differing educational backgrounds, noting that landscape architects may lack a thorough understanding of restoration ecology. This knowledge gap can lead to misalignment between horticultural design education and the ecological needs of grassland restoration.

Additionally, Jade Orr points out that landscape architects may struggle to comprehend technical scientific literature essential for informed decision-making in restoration projects. This difficulty arises from differences in educational backgrounds and communication styles between landscape architecture and restoration ecology disciplines, hindering effective information exchange.

Hazards from Integrating Restoration Methods and Human Use

Interviewee	Quote
AJ Carrillo	"It's not really like recreational space, they are farms."
AJ Carrillo	"Bringing animals into human spaces is just a recipe for contamination if it's not extremely well managed."
AJ Carrillo	"Have your good composting practices, you have to realize that that's going to be rotting stuff if that public park, so maybe that's not where that goes."
Rae Ishee	"If it doesn't survive the human experience, then it's really the worst. Because you put it all up, you've invested all this effort, and you've become a failed experiment."
Domonique Raymond	"Bold ideas. And we're all, you know, we want to be thought leaders and do good work and excellent concepts in landscape architecture. And then when we try to execute it, it's Ooh, it's, that's where we run into the challenges."
Lynn Reidel	"Have trails that either at the periphery of our big grassland blocks to try to maintain the least fragmentation possible."
Lynn Reidel	"Dog interaction is one problem, and then people deciding that they want to just wander off trail and, and people creating new trails, the weeds follow and other people follow and, and use those trails, and then the habitat is more fragmented."

Incorporating restoration ecology methods–many of which were not designed with the intent of incorporating human use–into landscape architecture projects introduces various hazards that practitioners must navigate. Carrillo emphasizes the potential hazards of bringing animals into human spaces, citing risks of contamination if not properly managed. He also discusses implications such as composting practices in public parks, indicating the need for careful consideration to ensure user safety when integrating agricultural scale restoration techniques.

Furthermore, integrating landscape architecture elements into restoration landscapes requires addressing habitat fragmentation, as noted by Lynn Riedel. Riedel stresses the importance of minimizing fragmentation by strategically designing trails at the periphery of grassland blocks. However, human impacts such as unauthorized trail creation can exacerbate fragmentation, leading to weed proliferation and further fragmentation. Maintaining cohesive and continuous habitat swaths is essential when merging restoration and landscape design efforts.

Another major hazard lies in the potential failure of landscape architecture projects that integrate restoration ecology methods if they do not effectively design their restoration landscapes. Rae Ishee underscores this point by emphasizing that “if it doesn’t survive the human experience, then it’s really the worst because you put it all up, you’ve invested all this effort, and you’ve become a failed experiment”. Designers are hesitant to integrate restoration efforts into their designs because doing so without the appropriate technique can compromise the quality of their designs.

Barriers to Collaboration Conclusion

Interviews with practitioners in landscape architecture and restoration ecology shed light on the various barriers that hinder interdisciplinary collaboration, including: misconceptions about the other fields professional capabilities, scale conflicts, different aesthetic expectations, financial limitations, different educational backgrounds, and hazards that arise when implementing restoration techniques.

One notable misconception revolves around the role and capabilities of landscape architects, particularly regarding project timelines and their involvement in the design process. Another common misconception highlighted in the interviews is the belief that landscape architects only operate at small scales and restoration ecologists operate at industrial scales, when in fact both disciplines are capable of contributing to projects at a wide variety of scales. The belief that grassland restoration interventions require more maintenance is yet another interdisciplinary misconception. This belief stems primarily from landscape architects being ignorant of restoration maintenance practices and a reluctance to shift maintenance philosophies to better accommodate the needs of grasslands.

Different primary user considerations also create conflict between these two practices. Landscape architects tend to prioritize human user experience, while restoration ecologists focus on designing for plant and animal communities. This difference is primarily a result of different educational backgrounds as well as different goals within the two fields. Differing skill sets and knowledge bases create collaborative conflicts. Bridging this gap necessitates interdisciplinary training and a shared understanding of communication styles between the two fields. Financial limitations emerged as significant barriers to collaborative efforts in grassland restoration projects. The primary barrier being the consulting fees required for collaboration. Overcoming these barriers will require innovative approaches to funding and resource allocation, as well as a shared commitment to recognizing the enduring economic value of comprehensive restoration efforts.

Finally, incorporating restoration ecology methods into landscape architecture projects introduces hazards that practitioners must navigate. These hazards arise because many restoration techniques were designed for landscapes that do not incorporate human use. Adjusting these methods to accommodate user safety and comfort requires innovative efforts on the part of landscape architects and restoration ecologists.

Opportunities for Collaboration

Despite all of the barriers mentioned in the previous sections many professionals in both fields see significant potential for increased interdisciplinary collaboration. This section of the analysis will explore examples of the types of projects that could benefit from participation from landscape architects and restoration professionals, dimensions of the design profession that would benefit restoration practice, aspects if ecological restoration approaches that could benefit design projects, the merits of multi-use restoration landscapes, and the methods that can be used to overcome interdisciplinary barriers.

Projects with Potential for Overlap

Interviewee	Quote
AJ Carillo	"If the county was able to get grants for the physical materials, the fencing, the metal, the shoots, the stuff like that, then those farmers being allowed having a lease to come in and be like, 'You need to take care of this. And if you do, you can use all of this. You don't have to pay anything if we don't pay you.' Yeah, but you can install it. And you can also use this to grow your business. Do mutually beneficial win-win situation? Yes, please."
Bridgett McGrath	"Especially with trails, like trail design, looking at that integration into a holistic plan would make more sense because there's more access and opportunity for the public to engage in it."
Domonique Raymond	"Open space master plan, where we're doing press on restoration out there is a ton of superior."
William Reinhardt	"Our potential is probably more urban, you know, in this vacant lots, removing, you know, invasive sods."
Jenna Webster	"Many sort of highway projects where they're doing stormwater and they have to address stormwater issues, and they're seeding grassland species."
Bridgett McGrath	"I managed 21 acres of a property that is a hybrid of a school, nature, conservation space, and agricultural production. I can say it's absolutely doable, I think you have to have, um, you have to have people who are really educated in it, to understand it."
Bridgett McGrath	"Campuses with large land undeveloped land spaces, like how do they manage their land? And is there a way to use Holistic Management in an institutional framework?"
Jade Orr	"Looking for opportunities to give land back, and where land could be restored to maybe some of the original purposes or to grow some of the original crops so that people can then begin to have that connection, again, with their culture that was kind of taken from them."
Peter Ericson	"They've had the hospitality and the hunting, there's a birding rocking on bird observatories."

Restoration ecologists and landscape architects engage in a diverse array of projects that could greatly benefit from their combined expertise. Bridgett McGrath emphasizes the importance of integrating trail design into holistic plans, recognizing the increased accessibility and public engagement opportunities such integration offers. Similarly, Dominique Raymond highlights the value of incorporating grassland restoration into open space master plans, illustrating the vast potential for restoration in public spaces. McGrath further extends this discussion to include large public projects associated with universities, prompting considerations on how holistic management principles could be applied within institutional frameworks.

In more urban contexts, William Reinhardt envisions collaboration opportunities focused on reclaiming vacant

lots and addressing invasive species. Jenna from LWLA elaborates on this by mentioning the involvement of restoration ecologists and landscape architects in highway projects, particularly in addressing storm water issues and seeding grasslands as part of infrastructure interventions.

Jade Orr explored the potential for projects that simultaneously restore ecological health while honoring the cultural significance of the land. This involves restoring landscapes to their original purposes or growing traditional crops or grazing to reconnect communities with their cultural heritage. Both Bridgett McGrath and Peter Ericson advocated for the integration of landscape design and restoration ecology on private properties. McGrath shared her experience managing a multifaceted property that combines educational, conservation, and agricultural elements. Peter provided examples of private properties where restoration efforts coexist with alternative human uses such as hospitality, hunting, and bird observatories.

Design Benefits for Restoration Ecology Projects

Interviewee	Quote
Domonique Raymond	"Distill knowledge into a constructible, approvable like city approval, and constructible plan."
Lynn Reidel	"Certainly having trails opens up in these grassland areas opens up the opportunity for the public to learn more and to enjoy them. And that is high value."
Jade Orr	"We can do that mapping to, and we can understand the policies, but then how it actually gets implemented on the ground, I think that they should be probably consulting more with landscape architects."
AJ Carrillo	"Landscape architects because they have a people-centered approach, often have insights into how to design these sorts of landscapes in ways that are most effective for farmers and users."
Rae Ishee	"There's no inch of this world amongst that hasn't been kind of, you know, if not manhandled, touched by humans. And so the social and cultural side of restoration is so key."
Rae Ishee	"Have generational connections to land and are severed to re bridging that, you know, through a project that might have an ecological land on it, like, it's just an amazing thing when the community can return to a place to land and restore that appreciation for that place for that land that they carried all along."
Jenna Webster	"I think architects have a lot of experience, communicating, whether that's through documentation or presentations and they have an understanding of how to work with stakeholders. Whereas somebody coming more from the science side of things may have just by virtue of their training, you know, fewer of those skills."
Jade Orr	"Landscape architects can kind of, I think, be a huge benefit, because we know how to do that site analysis. And we know how to read landscapes. We know how to do large scale planning, and we know how to do phased planning. And so I think we're also a little bit better sometimes at coming up with innovative uses for things like we were just talking about, like multi-use recreation."

Restoration ecology projects can benefit greatly from the diverse skill set that designers–particularly landscape architects–bring to the table. Landscape architects possess expertise in site analysis, landscape reading, large-scale phased planning, and innovative design approaches, all of which are invaluable in the context of grassland restoration. According to insights from my interviews, landscape architects also play a crucial role in translating technical knowledge into actionable plans that meet regulatory requirements. They have the ability to distill complex knowledge into constructible and approvable plans, ensuring that restoration projects are not only environmentally sound but also feasible within regulatory frameworks. Furthermore, landscape architects possess the expertise to understand and navigate policies related to land use and restoration implementation. Their knowl-

edge of mapping techniques and understanding of on-the-ground implementation processes are instrumental in ensuring the successful execution of restoration plans. By leveraging their implementation knowledge, landscape architects help to bridge the gap between design concepts and practical realities, ultimately contributing to the overall success of grassland restoration projects.

Landscape architects also offer a consideration for social and cultural aspects of restoration that are often lacking in restoration ecology projects. As Rae Ishee put it, "there's no, inch of this world that hasn't been, if not man-handled, touched by humans and so the social and cultural side of restoration is so key". Landscape architects are experts on how to incorporate historical and cultural themes into built environments, making them essential for any project that is seeking to restore cultural heritage through ecological restoration. Rae Ishee spoke to the impact that these types of projects can have when she said, "it's just an amazing thing when the community can, return to a place to land and restore that appreciation for that place for that land that they carried all along" Additionally, designers excel in communication and stakeholder engagement, as noted by Jenna Webster. This is particularly valuable because oftentimes, that is an underdeveloped skill set for those with more scientific backgrounds. Their ability to effectively communicate project objectives and engage stakeholders improves community buy in and support which is incredibly valuable in any restoration development.

Restoration Ecology Benefits for Landscape Design Projects

Interviewee	Quote
William Reinhardt	"You know, nature, we can change within our lifetime, we can see it rebound so fast, even if it gets knocked down to nothing."
Bridgett McGrath	"Not only am I looking at rotational grazing, but I'm also looking at rotational use on the site with our program."
Jenna Webster	"I've always felt like if we look to the restoration world, we can make a lot of improvements to conventional horticulture, we can integrate the ecological restoration components."
Jade Orr	"So they might sit adjacent to following and when that happens, you know, there's a higher prevalence of dust. And there's also a higher prevalence of pesticides. And so then, if those areas sit adjacent to land that's being fallow, they no longer become super safe for people to use and recreate."
Dominique Raymond	"Consultants that were more specialized and more attuned to those kinds of specifics."

Restoration ecologists play a vital role in enhancing landscape architecture projects by bringing a diverse range of technical knowledge to the design process. William Reinhardt remarked that nature exhibits remarkable resilience, rebounding swiftly even from significant disturbances. Ecologist's understanding of how to best facilitate the development of these resilient ecologies can be incredibly helpful within landscape architecture projects. Jenna Webster mentioned the potential for integrating ecological restoration principles into traditional landscape planting and horticultural practices, leading to improvements in environmental sustainability in planting design. Jade Orr introduced the significance of restoration projects in areas of high human use, making reference to restoration projects' ability to mitigate potential hazards such as dust and pesticides that can be produced by fallowed or agricultural landscapes located adjacent to human use areas. Dominique Raymond discussed the value of specialized restoration consultants in addressing site-specific technical challenges within landscape architecture projects.

Benefits of Mixed Use Approaches

Interviewee	Quote
AJ Carrillo	"The design parameters are people centered and equitable and include proactive hazard mitigation."
AJ Carrillo	"We want to design these places, so they won't flood so that they're tolerant to drought, so that they keep us cool through evaporative cooling through lots of shade and trees, that they have interesting places to have community events, starting to really look at it in terms of that mixed use lens."
AJ Carrillo	"Now you can see how there's like you're integrating, you're creating a landscape that's managing its water, integrating nature based solutions on a pattern that has human use in mind at the beginning. It can achieve our goals, as long as we approach it from a holistic design perspective, proactively and iteratively."
Jade Orr	"Recreational opportunities can be a multi use purpose, right, like they can be trails and parks, that they can also serve as flood mitigation. And they can also serve as habitat and a lot of different things. So I think that's really where landscape architects are coming into this or need to come into this."
Dominique Raymond	"So it was just like striking a balance, because this is still a public park. But we really wanted to bring permaculture and regenerative landscapes to educate the community members and the children on where their food comes from."
Pete Zapata	"Idea of layering, Tourism Plus hunting, plus, you know, farm to table dinners, plus concerts plus, in being able and willing to be creative enough to bring all that stuff together. And seeing that, 'Oh, this isn't just a pain in the butt that's gonna limit my cattle operation. But it's actually you know, it can be additive."
Pete Zapata	"Yes, having a diversified op ↓ n is mandatory financially."

Having discussed the types of projects and what each discipline brings to the table, this section will now discuss some of the benefits that arise when multiuse restoration and human use begin to overlap. When design parameters prioritize people-centered and equitable approaches alongside proactive hazard mitigation, there's significant potential for improved outcomes in both restoration and human use according to AJ Carrillo. Carrillo described how multiuse landscapes can facilitate flood resilience, drought tolerance, unbranded cooling, engaging community events, and overall environmental quality. He mentioned that to achieve these aims, grassland restoration and landscape design must be approached holistically and iteratively. Jade Orr further developed these ideas when she highlighted the versatility of multi-use landscapes, which can serve recreational, flood mitigation, habitat, and educational purposes simultaneously. Dominique Raymond's work on the 1881 Farm park exemplifies this type of multi use landscape by striking a balance between public park amenities, educational elements, and restorative permaculture practices.

The financial benefits of this approach are significant as well. Peter Ericson discussed the financial viability of diversified operations within multi-use landscapes. He claimed that integrating various uses onto a restoration site can provide additional sources of income to support restoration techniques and ongoing maintenance.

Overcoming Collaborative Barriers

Interviewee	Quote
AJ Carrillo	"Education, technical assistance, and find the grants like consultation funding."
Rae Ishee	"You have to bring people along, no matter what, and kind of meet them, you know, meet them where they're at. And then help them move that dial up with the education."
Rae Ishee	"Pushing that, you know, pushing the connection to research to, you know, what's available from the ecological sciences."
Bridgett McGrath	"I think it's always about compromise."
Bridgett McGrath	"And it's definitely imperfect."
Jenna Webster	"I think helping them sort of understand that, that it is this process that you need to scaffold that process, you need to educate the stakeholders, especially on these public projects so there's buy in, and an understanding of the process."
Jade Orr	"That's part of what we're trying to also show with our research is like landscape architects are really necessary for this work."
-	"So just making sure that the landscape architect is involved, like advocating for us to be involved in those conversations with the contractors."
AJ Carrillo	"Contract animal managers to design the open spaces for holistically planned rotational grazing."

In the realm of grassland restoration and landscape architecture, collaboration between practitioners is crucial for successful outcomes. As AJ Carrillo said in his interview, facilitating this collaboration is dependent upon providing, "education, technical assistance, and grants for consultation funding."

Rae Ishee emphasized the importance of a patient and inclusive approach to collaboration, when she stressed the need to meet stakeholders where they are in terms of experience and expertise. She noted that being willing to guide stakeholders through the process of education and implementation and being willing to undergo the same process yourself is essential to effective collaboration. Jenna Webster echoed this necessity to educate stakeholders, especially in public projects, to ensure buy-in and understanding of the unique grassland restoration methodologies. Ishee emphasized the role of professionals, particularly landscape architects, in seeking out ecological education and advocating for the integration of research from ecological sciences into the collaborative process. Bridgett McGrath acknowledged the challenges of collaboration, when she discussed the need for compromise between best practices in both fields and recognized the inherent imperfections that arise in that process.

Opportunities for Collaboration Conclusion

Landscape architects and restoration ecologists share similar goals of integrating healthy grassland ecosystems into their designs. Both disciplines have skill sets that could be tremendously beneficial to the practices of the other discipline. This portion of the results section outlined potential collaborative opportunities, the types of benefits that each field has to offer the other, the benefits of multi-use projects, and the key factors in overcoming collaborative barriers.

Designers, particularly landscape architects, offer a diverse range of benefits to restoration ecology projects including, distilling knowledge into actionable plans, enhancing public enjoyment and learning, bridging the gap between policy and implementation, restoring social and cultural connections, facilitating effective communication and stakeholder engagement, and promoting innovative and multi-use planning approaches. Restoration can also make significant contributions to landscape design practice. Ecologists can significantly enrich landscape architecture projects by leveraging their expertise to facilitate positive ecological transformations that designers do not have the technical know-how to execute themselves. When these benefits are realized through collaborative efforts, incredibly impactful multi use landscapes can be achieved. These multi-use landscapes offer a wide array of benefits, including enhanced environmental resilience, diverse community engagement opportunities, educational opportunities, and economic sustainability.

Overcoming the collaborative barriers described in the previous section of this analysis requires a multifaceted approach that includes educating the practitioners in both fields on the best practices and capacities of the other field, providing technical assistance throughout the design process, finding financial support for interdisciplinary efforts, and a healthy collaborative mindset. By addressing these various methods, practitioners can foster effective collaboration and achieve successful outcomes in grassland restoration and landscape architecture projects.

Colaborative Benefits

Landscape Architecture

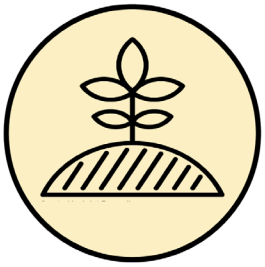
Distilling technical knowledge into actionable plans

Increasing user's enjoyment of the landscape

Designing for and with communities

Designing multi-use spaces

Restoration Ecology



Improving soil health

Improving a site's hydrologic function

Increasing biodiversity

Decreasing hazardous pollution

Fig 8. Summarizes the key benefits that each dicipline can offer the other through interdisciplinary collaboration.

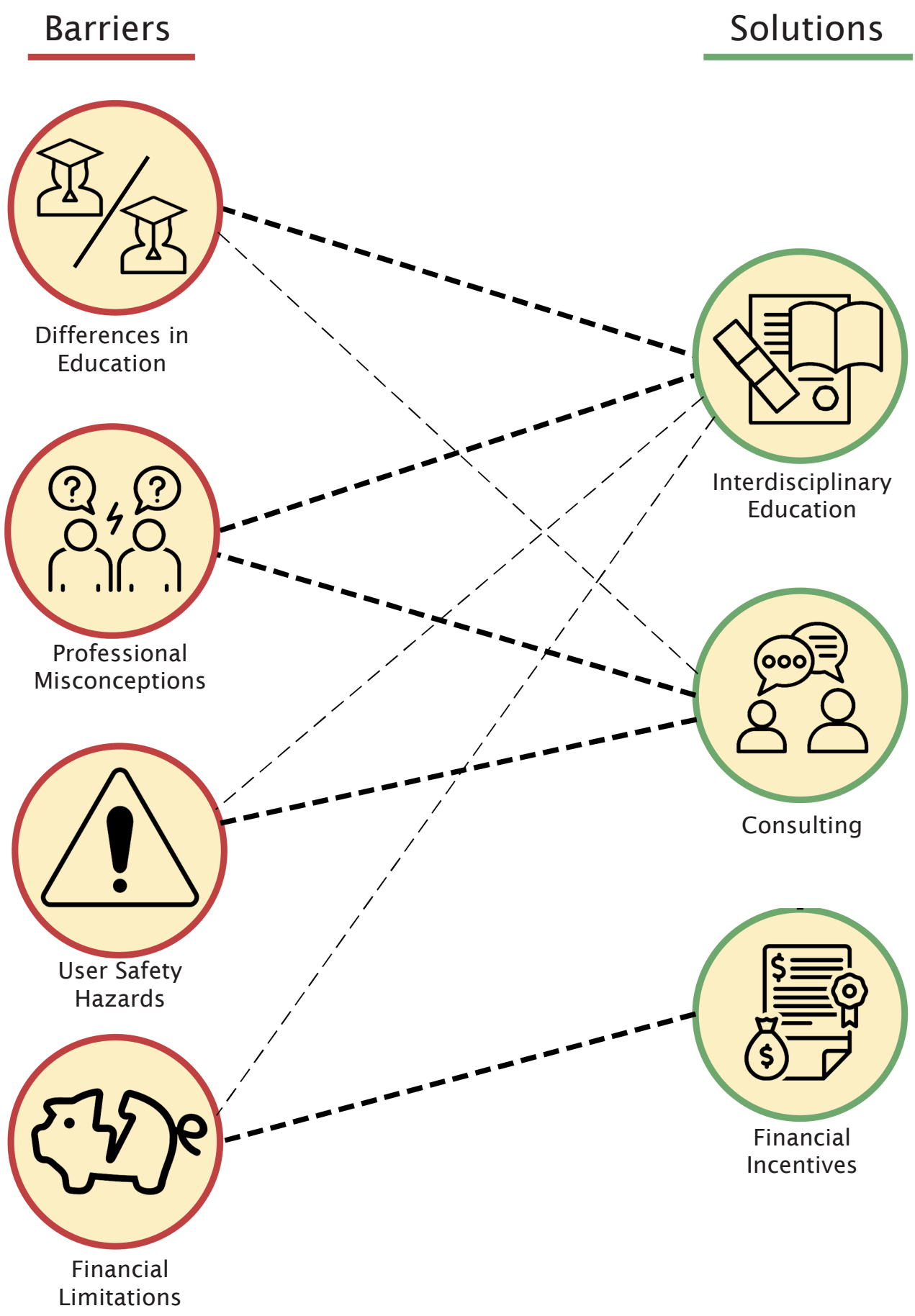


Fig 9. Identifies the key barriers that prevent interdisciplinary collaboration and draws connections to potential solutions that were discussed in my interviews.

6: Conclusion

Western Wheat Grass
(Pascopyrum smithii) E15

Conclusion and Impact

This project began with an interest in and appreciation for our global grassland environments. My research was inspired by a realization that the degradation of these essential ecosystems has resulted in significant losses in biodiversity, the pollution and disruption of regional water cycles, and massive decreases in soil carbon. Recognizing the critical importance of our collective understanding of these ecosystems, I set out with the goal of contributing to our collective understanding of grassland restoration ecology. My education as a landscape architect guided me to the intersection of grassland restoration ecology and landscape architecture practice. Initial explorations of the interactions between these two disciplines revealed a surprising lack of collaboration. This sparked my interest in exploring the interdisciplinary dynamics between the fields of grassland restoration ecology and landscape architecture. From this point, I set out to explore the following three research questions: What are the existing best practices for grassland restoration within the landscape architecture and or restoration ecology fields? What barriers have prevented the full realization of the restoration goals of each discipline? How might collaboration between both disciplines improve restoration outcomes?

To address the first research question, I conducted literature and precedent reviews and built upon the existing knowledge base through interview analysis with professionals in both fields. An in-depth understanding of the best practices in restoration ecology was developed primarily through the literature review which discusses many of the most effective grassland restoration techniques that have been produced by the ecological restoration field. This paper further contributes to the collective understanding of ecological restoration best practices through the presentation of methods and techniques that arose during interviews with professional restoration ecologists. Best practices in landscape architecture were significantly lacking in the existing literature. Through precedent and interview analysis, this paper reveals significant amounts of knowledge about grassland restoration that has been hidden in professional landscape architecture practice. My presentation of these techniques as they have been described to me by landscape architecture professionals, represents a novel contribution to the academic understanding of grassland restoration best practices in the field of landscape architecture. This contribution will help future designers and researchers to more effectively access the wealth of restoration knowledge that has been developed through landscape architecture practice, to help inform their future grassland design and research efforts.

This paper also provides significant insights into the primary barriers that have prevented effective interdisciplinary collaboration between the fields of restoration ecology and landscape architecture. These insights were primarily produced through interview analysis which revealed not only the physical barriers to collaboration, such a scale and physical hazards, but also the interpersonal barriers like misconceptions about the other field. This section provides a summary of the primary conflicts between the two disciplines so that future practitioners who are attempting to collaborate with the other field will have a better understanding of the potential roadblocks they may encounter, in hopes that they will be better prepared to overcome those barriers as a result.

Finally, this paper provides an in-depth discussion of how restoration outcomes can be improved through interdisciplinary collaboration. This discussion is primarily supported through interview analysis, and helps to outline how each field can contribute to the other and what benefits are produced as a result of that collaboration. This section is meant to educate professionals in the field about the value and capabilities of the other to overcome the interdisciplinary misconceptions that have previously prevented effective collaboration. This discussion also provides suggestions for how to overcome the barriers that were revealed previously, and includes many examples of potential opportunities for collaboration. The results from the exploration of this research question provide practitioners in both fields with the knowledge and tools necessary to facilitate further interdisciplinary collaboration.

Facilitating interdisciplinary collaboration is a crucial step towards realizing the full potential of grassland res-

toration landscapes. Ecological restoration professionals can create landscapes that have tremendous ecological benefit by restoring soil health and stability, improving biodiversity, restoring hydrologic function, and sequestering carbon in soils. Landscape architects excel at creating landscapes that produce opportunities for recreation, community gathering, art, education, exploration and joy. Through interdisciplinary collaboration these benefits can be woven together to create landscapes with extraordinary cultural and ecological value. These collaborations are not only beneficial but also necessary. Humans cannot survive without preserving the ecological integrity and functionality of the ecosystems they occupy. Similarly, ecosystems cannot survive without adapting to and allowing for human use in an anthropogenic world. We are left with no choice but to develop and design spaces that serve the interests of both the local ecology and human users, which will require interdisciplinary practice on behalf of restoration ecologists and landscape architects.

Looking Forward

Through my exploration of this thesis's guiding research questions, several other potential lines of inquiry arose. While these are out of the scope of this thesis, they do offer opportunities for future research that could contribute to the fields of landscape architecture and grassland restoration ecology.

How can grassland restoration techniques that were developed in agricultural settings be adapted to fit within public use landscapes?

How might grassland restoration approaches vary across different global grasslands?

What types of financial infrastructure is best suited to encourage the expansion of grassland restoration efforts?

Could elements of other restoration fields such as wetland or forest restoration, be adapted to benefit grassland restoration efforts?

How might the principles of holistic land management and the keyline scale of permanence inform circulation and programing in landscape architecture projects?

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Appendix A

Interview Questions:

Bridgett McGrath

Do you see any potential for use of the Savory methods of rotational grazing and financial planning and all of that, within a more human use context, in landscape architecture, public parks, , areas with trails, areas with pauses, areas that are more centered around human use?

- In your experience, having those things integrated together? Are there any, hazards that you've run into? Or issues of, having educational activities next to, agricultural production?

- Have there been any like cool opportunities? Like I'm guessing those educational elements where you're like teaching the students about the processes on the land? Have you found that having that integration creates, like, different opportunities for us that you might not have in a space that doesn't have these restoration practices on it?

- Do you see it going the other direction? Have you, in your consultant with Savory do have anybody who consulted on like a regional park or something like that?

- I was kind of interested in the you mentioned that you're working with like the indigenous group and ecological monitoring. The only context that I've heard about that COGIC of monitoring in is, is through like the potential for carbon, carbon, like credit systems, and cap and trade and all that thing, those things. So is that kind of what the monitoring is working towards? Or is, is there? Are there other goals associated with the monitoring?

- In your experience, has maintaining these types of more biodiverse and natural prairie ecosystems? Is that more maintenance work? Is that less than how might the maintenance practices have to kind of shift?

- And have you found any kind of maintenance solutions? Like you mentioned, some areas might not be suitable to bring livestock in? Is there any way that you can create that kind of herd mimicking or mimic the different Watershed Systems without using the cattle?

- I was wondering, you seem to occupy kind of a unique space of having this perspective from the design side and the restoration side. Is that something that you see is, like common within the space or does it seem like there's kind of these two siloed disciplines that maybe you occupy kind of a unique intersection of like, do you see a lot of landscape architectures? Like consultants working on range land projects or working on restoration projects?

- In your own experience, I see on a ranch have you run into any of those issues where you have a space where you haven't done these restoration techniques? Because there's too much conflict between the human use and the restoration?

Appendix A

Interview Questions:

Rae Ishee

- How have you experienced collaboration between soil science and landscape architecture?

- Are there any major barriers that you've come up with when trying to implement some of these more scientific concepts into your landscape architecture practice?

- Have you found that working with clients that the aesthetics of these more naturalized meadows are an issue with clients?

- How is the actual maintenance of one of these meadow spaces different from the expectation?

- How have you seen that collaboration between soil sciences and learning about these different manners happening?

- What misconceptions have you seen around the maintenance side of that?

- In your experience, how is the maintenance of one of these spaces kind of different from that expectation?

- How do you see this almost like a cultural restoration and also like this ecological restoration interacting and being mutually beneficial?

- How are those goals and what defines success and that restoration as LA?

Appendix A

Interview Questions:

AJ Carrillo

Yeah. Kind of wondering like what the human use on your land looked like, were you like strictly producing food or weather? were you living on the land? Were people like hiking on your land? Was their recreation like, what? What did the overall use pattern on your land kind of look like?

I was wondering if you know, anybody within the agricultural zone that you were in, that has like a more of a human centered approach or like, recreational centered approach to this situations?

Do people to communicate with landscape architects when they're like designing their permaculture farms? Is there an overlap there at all?

Are there any, like practices in the restoration field or kind of approaches that you think you mentioned, like orchards are probably too hazardous to have in the human use type thing, or at least in the mechanized version that you describe, like the large machinery?

So do Are you hopeful that in the future that those types of activities are going to be more viable? Like financially?

Are there other barriers that you see between the two disciplines in terms of like communication?

Appendix A

Interview Questions:

William Reinhardt

- What's your experience with like grassland restoration?

- What's your approaches do you go for more like naturalistic focusing on the ecological processes? Or are you focused more on the aesthetics education type side of grassland?

- What are the barriers between the landscape architecture practice and ecological restoration?

- What's the landscape architecture view on Prairie maintenance? And is that shifting over time?

- What have you found is the most effective between all of those in the landscape context?

- Have you looked into what like having goats on your property would look like? And what were the reasons why you decided not to go with that?

- Do you see any other, you know, points of friction between landscape architecture practice and ecological restoration?

- In having gone to a lot of these conferences, does it feel like that's the the general consensus is that in most contexts, using livestock isn't really manageable because of these different considerations? Or is it more like, is it specific to your site? Or is that kind of a trend that you're seeing across the industry?

- What type of monitoring work do you do in your own meadows in terms of tracking the progress of your price?

- What are the best applications of a grassland restoration within design?

- What have you found has been some of the most effective species in you know, achieving your restoration outcomes? Or what's what are the stars of your Arboretum?

- How do you approach the like pollinator side of things? I guess that's more of an agricultural type context. But are you just tracking? Are you kind of trying to purposely trying to attract different pollinators?

- How do you approach around hydrology and irrigation?

Appendix A

Interview Questions:

Jenna Webster

- What's your usual practice? Are you consulting with landscape architects, or firms? Are you running your own projects? And what is your work look like?

- What are some of the major misconceptions or gaps in knowledge that you find when you're beginning to work with Landscape Architects?

- How is that shift happening in the public perception and the perception of landscape architects? Or is that? Where is it kind of in that shifting of aesthetic expectation?

- Are there any other examples that you can think of are elements of the landscape architecture profession that you think would be beneficial if they made their way over to the restoration side?

- How is that idea of of a landscape evolving and becoming, you know, following through these different successional phases, is that something that's embraced? Or I guess, I can imagine that if they want this area to be a low grass meadow, and then it's, you know, starting to go through these successional phases and becoming more of a woodland, is that acceptable in the landscape architecture part practice? Or is that kind of a conflict?

- I'm wondering if there's any other examples where you're having to compromise? What would be your ideal restoration, you know, efforts for the human use side of things? And kind of what what those compromises look like?

- How do you measure success?

Appendix A

Interview Questions:

Jade Orr

- What was the work you did related to following land and your involvement?

- Was the 500,000 acre estimate of land that would need to be fallowed based only on following practices, or does it include regenerative practices?

- What are the primary land uses being advocated for, such as regenerative agriculture? Are they also advocating for just restoration sites, or what are the main techniques and methodologies being implemented?

- What kind of supports are they providing to different farmers, such as education funding, grants, etc.? What does the support look like?

- How are they tracking groundwater levels and changes over time? It seems there is more data available on surface water impacts compared to groundwater - how are they measuring progress towards groundwater goals?

- How are they tracking the ground water?

Appendix A

Interview Questions:

Dominique Raymond

- What were the main methodologies that you were kind of trying to utilize when you were designing for like soil and water conservation?

- Did you go to like hydrologist expert as well for the kind of water conservation side of things?

- Were there conflicts that arose or compromises that had to be made in order to integrate that, like, an enjoyable human experience into these contexts that aren't traditionally designed for those?

- Have there been any issues that you've come up with through that process?

- Do you have experience working on projects that aren't as restoration focused and are more like using more traditional like lawns and things like that, that might?

- Is the is the approval process uniquely difficult with these restoration approaches? Or is that just kind of, you know, anything with the city is gonna take those steps?

- Do you have a plant or like a planting area that you're like most excited to see established on this plan?

Appendix A

Interview Questions:

Peter Ericson

- What is your role again? Are you specifically working with Zapata ranch? Are you with the larger ranch lands group?

- Tell me more about what that means, like a human uses in landscape, particularly, how would you imagine that might be applied to a land manager like ranches?

-Does the management also shift in response to having that kind of tourism element on the site?

-What did you see when you work there as like, the primary barriers to the expansion of this type of operation in this type of restoration practice?

-Does ranch lands work with any like public private type, like National grasslands or public open spaces or anything like that?

- It seems like ranch lands has a very strong restoration and conservation ethic and philosophy that guides it? Do you see that as like a relatively unique thing within like the ranch operating feet like, field?

-Like how do y'all monitor and like start to quantify the effects that you're having on the land in terms of conservation and restoration is there like a framework for that they all use?

Do you incorporate landscape architects or people who focus more on the human side of the activity on the land?

As an organization, do you think that focusing on that restoration and conservation has overall been like a financial asset or a detriment?

Have you seen, as you said, like conservation and restoration becoming a more mainstream and more well accepted view within the industry?

Appendix A

Interview Questions:

Lynn Riedel

Her background LA?

What is her current role in OSMP?

What are the primary grassland restoration and maintenance techniques used by Boulder OSMP? Scale of management

How do those techniques respond to the human use side?

What are the main issues with implementing grassland restoration in Boulder?

Any hazards that arise between human use and restoration efforts?

In your experience in restoration and LA do the two fields collaborate often?

if yes, any good examples of restoration and use

If not, do you think these fields could benefit from more overlap and collaboration? What barriers are there to facilitating this collaboration?

Do you use livestock in maintenance?

Aware of/collaborated with Savory or Keyline specialists?

Yes, what are the main takeaways or maintenance strategies that transfer the best

No, Are you open to a discussion?

Is soil amendment used?

General planting outlook, how it relates to restoration

What are the primary planting considerations in a grassland restoration project?