A Stewardship Plan for a Pollinator Meadow Garden at Bloedel Reserve

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Abstract

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Complex ecological design projects that address issues of biodiversity loss are bridging disciplines of landscape architecture, restoration ecology, and environmental planning. Through these combined efforts, landscape architects are restoring degraded lands and improving the quality of habitat and human health across a variety of environments. As a result, we can set the stage for healthy ecosystems to unfold. Landscape architects can develop stewardship plans not only to facilitate collaboration between disciplines, but also to articulate clear goals and performance outcomes for the projects they design. This thesis provides an account of the resources, methods, and insights gained from generating a customized stewardship plan for the Bloedel Reserve on Bainbridge Island, Washington. The goal of this professional project thesis was to create a stewardship plan for a newly implemented pollinator meadow garden located at the Bloedel Reserve. The stewardship plan summarizes the vision of the design, provides the context for understanding the meadow as an ecosystem, and identifies important elements of the visitor experience. In addition, it includes recommendations on how to adaptively manage and measure the performance of the project.

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CHAPTER 1: Introduction

My Professional Interests

Throuought the final year and a half of my time in graduate school, I have gained interest in planting design as an essential skill for practicing landscape architecture. Before this thesis, I wanted to explore what my interests were, and access what experiences and skills I should improve before entering the profession. This thesis provided me a unique challenge to learn how to design, manage, and maintain meadow gardens.

Planting design is an essential skill for landscape practitioners. It is a building block to understand plant species in terms of their morphology, lifecycle, and ability to thrive within a given environment. A knowledge of plants can enable a designer to manufacture unique experiences using plants and engineer living systems. One of my goals with this professional project thesis was to engage in professional practice and enable opportunities for observations in the field. The history of our professional field has grown and changed as a result of our practical knowledge of plants. As part of a discipline that can fundamentally alter the environments in which we live, I believe that landscape architects should be fully confident in their abilities to design with plants using an awareness of cultural implications surrounding the historical use of plants, and the implementation of plants in the context of healthy ecosystems. The marriage between our profession and plant knowledge should encourage our ability to design and manage natural systems within various urban, rural, agricultural, and wild environments.

Planting design and an appreciation of plant ecology begins with the ability to articulate the relationship that a landscape designer has to the garden. One of my goals as a designer is to design places that foster an inspirational connection between humans and their natural world. I believe that our designs should value plants as the building blocks of living systems and ever-evolving landscapes, not simply green materials that conform to limitations in built environments. Planting plans in the profession today appear to be more about filling space than creating experience. By considering plants at the start of the design process, designers help them assume their rightful places as the driving experiences of composition. Putting plants first is crucial (Ogden & Ogden, 2008). I believe that our ideas for a better world rely on our ability to not only design but manage and steward our designs as part of a sustainable vision for the future.

Gardens are potent because they represent idealized natural spaces while retaining individual qualities and spirits as specimens within the landscape. Recognizing that we belong to this living kingdom remains one of the few moments of transcendence left in modern life, reminding us of our place in nature (Ogden et al., 2008). Landscape architects continue to play a critical role in finding design solutions to the challenges our urban environments and culture face today. As awareness of environmental stewardship continues to seat itself deep in the collective cultural psyche, the ecological planting style becomes increasingly compelling (Hartlage & Fischer, 2015). We can more confidently create positive change by knowing how plants thrive, how they contribute to human health and well-being, and how plants shape the places and enhance the ecosystems among us. A garden can foster reconnection with the natural world, resonance with one's

region, and expression of the uniqueness of a site (Ogden et al., 2008). This notion is part of a shared social experience among practitioners and visitors alike at gardens like the Bloedel Reserve.

Scope of Professional Project Thesis

The professional project thesis option fits best within my interests because it is grounded in professional practice and requires exploration into a project currently being implemented. I started working at Fischer Bouma Partnership on Bainbridge Island during the Summer of 2018 where I was introduced to a project underway at the Bloedel Reserve: a new meadow garden adjacent to the Bird Marsh. When it came time to decide on a direction for my thesis, I approached Fischer Bouma and the Bloedel Reserve and offered an opportunity to parlay my thesis project into a deliverable that informs improved management processes and provides an in-depth look at ecological planting design. We decided the scope of the professional project was to develop a management document for the newly implemented pollinator meadow garden.

I started researching the following questions: what is required to design, implement, and manage a pollinator meadow garden? How does this information begin to take form as a customized plan that ensures standards of sustainability and stewardship? How does this academic exercise relate to broader topics surrounding professional practice? How can management plans affect the performance and long-term success of a design?

I developed a stewardship plan for Bloedel Reserve. The stewardship plan summarizes the vision of the design, provides the context for

understanding the meadow as an ecosystem, and identifies important elements of the visitor experience. In addition, it includes recommendations on how to adaptively manage and measure the performance of the project.

Thesis Overview:

Professional Project Question:

What information is essential to communicate the design vision and management values that will contribute to the stewardship of the pollinator meadow garden at the Bloedel Reserve?

Objectives:

1. Determine what approaches are fundamental to address maintenance operation needs and organizational goals related to visitor experience.
2. Develop a customized management document that supports ongoing sustainability and stewardship.

Stewardship plans are a way for project teams, often led by landscape architects, to articulate and document goals related to the long-term stewardship of a project. For landscape design projects with ecological and social performance in mind, it can be helpful to have a structured outline of fundamental maintenance and management values to ensure the project delivers on the intended goals. Monitoring project data can serve as a feedback loop to assess how the project is or is not meeting standards of

care. I argue stewardship plans should be common practice for long term sustainability and stewardship of ecological design projects. The following chapters explain the research that influenced the stewardship plan for the Bloedel Reserve.

Chapter 2, titled *Why This Matters*, considers ecological design projects such as the meadow garden within the context of climate change and biodiversity decline. Projects that support wildlife and biodiversity provide critical responses to the rapid decline of pollinators by improving habitat and ecosystem functioning. These threats require a systems-based philosophy to generate appropriate design solutions. By aligning ecological restoration management strategies with landscape architecture frameworks, we are better equipped to communicate accurate design solutions. In addition, ecological planting is both an approach and a skill that designers can use when balancing aesthetics and function. The pollinator meadow garden is one example of how to implement an ecological planting design.

Chapter 3, titled *Supporting Topics of Inquiry*, outlines the areas of research incorporated into the stewardship plan. I summarize general approaches to the design and management of meadows and include descriptions of implementation strategies specific to the pollinator meadow garden. How an ecosystem performs long after an initial design is in many ways unpredictable. An adaptive management plan can help identify and prepare for these uncertainties. I present how an adaptive management approach supports post-design and implementation efforts to achieve standards of design and performance. The landscape performance framework developed by the Landscape Architecture Foundation provided insight to develop monitoring protocol to assess social, environmental, and

economic targets. Lastly, I provide three case studies that influenced the formatting and content of the stewardship plan.

Chapter 4, titled *Pollinator Meadow Stewardship Plan*, presents the stewardship plan I developed for the Bloedel Reserve. There are several chapters within the plan: *Pollinator Meadow Garden, Garden Ecology, Visitor Experience, Maintenance, and Landscape Performance Targets*.

CHAPTER 2: Why This Matters

Climate Change and Threats to Biodiversity

Climate change accompanied by anthropogenic activities such as widespread pollution and considerable land use changes are having detrimental effects on healthy ecosystems across the U.S. and the world. (USGCRP, 2017) Biodiversity loss is occurring at a more rapid rate than has ever been observed in recorded history. (Ceballos, G., et.al., 2015) Our response to biodiversity loss is one critical area that we can address as designers, planners, and managers. Complex ecological design projects that make efforts to address issues of biodiversity loss are bridging disciplines of landscape architecture, restoration ecology, and environmental planning. Our combined efforts are restoring degraded lands, improving the quality of habitat and human health in urban environments, and altering the landscape in ways that are beneficial to ecosystems. Our actions, small and large, can reverse these trends across multiple spatial and temporal scales. Climate change and biodiversity loss are critical issues that landscape architects should address as 21st-century practitioners.

Healthy ecosystems have two primary components: the species that live within them, and the interactions among species and between species and their environment (USGCRP, 2017). Pollinators are among the declining species in abundance and diversity. Pollinator populations depend directly on plants for nutrition, and, in turn, plants depend on pollinators for reproduction (Marinelli, 2005). About three-quarters of the more than 240,000 species of the world's flowering plants rely on pollinators—insects,

birds, bats, and other animals—to carry pollen from the male to the female parts of flowers for reproduction (NRC, 2007). Plant survival depends on pollinator presence, and pollinator health is linked to the food webs and proliferation of healthy ecosystems across the globe.

In the United States alone, we are continuing to see a decline in invertebrate and vertebrate pollinator species. (NRC, 2007) Socio-cultural, economic, and political systems are mutually dependent on the health and activity of pollinators. The influence that pollinators have on agricultural production cannot be underestimated. (Allen-Wardell, G, et. Al., 1998) One out of every three bites of food most Americans eat exists because of the activity of pollinators, including many fruits, vegetables, and seeds. In the United States alone, pollination by honeybees contributed to over $19 billion of crop production in 2010, while pollination by other insect pollinators contributed to nearly $10 billion of crop production (NRC, 2007). Pollination is not only a natural process of evolution but also a billion-dollar industry.

There are numerous issues surrounding pollinator health and biodiversity conservation. Pollinators face major threats including habitat loss, degradation and fragmentation, competition, and proliferation of non-native species, diseases, pollution, pesticides, and climate change (Johnson, E., 2014). Many of these threats are a result of anthropogenic activities. Landscape architecture can contribute to increasing biodiversity by designing for the improvement, implementation, and management of healthy ecosystems. The meadow garden at Bloedel is an example of an ecological design project that can provide benefits to pollinator populations. However, a single isolated pollinator meadow project may achieve little in increasing abundance and diversity (Simao, M., Matthijs, J., Perfecto, I., 2018) Site level responses are

beneficial if they contribute to a broader landscape-wide effort. To achieve sustainability goals, there needs to be a shift in policy, economic valuation, design, and planning to conserve and restore the structures and resources needed for pollinators to thrive (Schwartz, M., Salisbury, N., 2016). As designers, our reach of influence in addressing the issue of pollinator decline can extend across multiple landscape types, from agricultural, rural lands and urban environments.

Climate Projections in the Puget Sound

The results of climate change projections in the Puget Sound may influence the species of plants we use in our designs. Native plants and their adaptability to changing climate conditions is a relevant topic of discussion. This is an important consideration when designing meadows with a goal of establishing resilient plant communities. Changes in average temperature, precipitation, and seasonal variance are factors that will affect vegetation in the Puget Sound (Mauger, G.S., et. al., 2015). The ability to select appropriate plants to endure long-term climate variability will have impacts on resources, cost, and labor associated with meadow gardens. It is easier to replace plants on small scale projects as we discover they no longer are able to adapt to climate patterns. Larger scale restoration projects, however, rely on the success of multiple species of plant communities to survive across hectares of land. A different set of challenges are presented if the plants within that ecosystem are struggling. Climate change patterns may cause important biological interactions between plants and wildlife to become unsynchronized (Mauger, G.S., et. al., 2015). As a result, range shifts will vary

among species, and will also be affected by non-climatic factors such as development and management practices (Mauger, G.S., et. al., 2015). The average annual temperature is likely to increase 4° to 6°F by the 2050s, with extreme heat events becoming more common and extreme cold events less frequent (Mauger, G.S., et. al., 2015). Summers in the Pacific Northwest will likely be drier, with climate models projecting an average of 22% less rain during summer months by the 2050s (Mauger, G.S., et. al., 2015). In addition, the majority of climate models project an increase in winter, spring, and autumn precipitation.

In reality, we must wait to see how plants respond to climate changes. If unprepared for these changes, responses will likely require immediate and drastic measures which may stress water demand, soil availability and nutrient needs. In this field, we must be flexible and open to reevaluating our strategies of adaptability and monitoring. This summary of climate projections in Puget Sound only comments on how it may affect plants, but there are other topics relevant to landscape architecture in response to climate change such as environmental justice, flood protection, sea-level rise, and agricultural challenges, to name a few.

Design Response Potential in Landscape Architecture

Issues related to climate change will continue to provide opportunities for designers and professionals from various fields to collaborate and communicate about the design and management of ecosystems across multiple spatial and temporal scales. Landscape architecture can be effective at contributing to these efforts by incorporating our knowledge of ecological

sciences into our design frameworks. Accepting our role as humans within an ecosystem, and not separate from it, is an essential step to become informed practitioners. We understand ecosystems as open systems that behave in ways that are self-organizing and unpredictable. (Reed, C., Lister, N., 2014) Change, dynamism, and uncertainty are traits found within ecosystems. Ecosystem design must then mirror our interpretation of natural processes.

Ecosystems are defined by their structure, function, and composition. (Holling, C.S., 1978) We can begin at this definition when trying to identify the biotic and abiotic building blocks of what makes an ecosystem system healthy (Hobbs et al. 2006). Landscape architects do not always frame our projects in this sense, but when working with disciplines in the sciences, it can be constructive to speak in these terms. If our designs can reach a state in which goals of self-sufficiency and resiliency are achieved, then our job of designing healthy ecosystems has more or less been met. In ways, we are engineering novel ecosystems towards goals that are not necessarily dictated by historical conditions, but by specific ecosystem services (Miller & Bestelmeyer, 2015). The services provided through design are clean air, clean water, and biodiversity, to name a few. Our design responses in landscape architecture require a shift in perspective towards systems thinking, incorporating adaptive management, ecological principles, and scientific knowledge into our design framework(Ruhl, J.B., 2016) We should not operate separate from healthy ecosystems, but recognize that we are fundamentally a part of them.

The meadow garden at Bloedel Reserve takes ecological inspiration from natural and human managed ecosystems: Prairie and steppe ecosystems, Puget Sound lowland prairies, and wild meadows. I describe

these landscape types and their characteristics in more detail in the stewardship plan. The primary relationship that the meadow garden has to these landscape eco-types is in the vegetative composition of grasses of forbs. Ecosystem stability for the meadow garden at Bloedel Reserve, can be interpreted as achieving the establishment of intended grass and forb species, with dense coverage of the soil surface and sub-soil layers, which allows for minimal non-targeted species to dominate (Diboll, N., 2018). The grasses and forbs should self-sow, spread, and interact in a dynamic relationship that should not require intense human management once established. The goal is not an ecological restoration project however.

The existing ecological integrity on site at the meadow garden at Bloedel Reserve, is one of diverse landscape eco-types. Coniferous forest edges, mixed deciduous forests, wetland marsh, and shrubby hedgerow surround the existing meadow. The meadow garden will add floral and faunal diversity among these interacting eco-types. The intended meadow ecology will increase pollinator and invertebrate activity, which will cause change across the food web. The overlapping interaction of these eco-types is what allows for an inspiring experience on site by providing a place for visitors to commune with nature. The meadow garden at Bloedel Reserve is a design that emphasizes the social and ecological benefits of natural processes within the context of a garden.

Ecological Planting Design

If we follow the perspective that we are participating in the unfolding of healthy ecosystem establishment as designers, one of the strategies we can

use as part of ecological design practices is the concept of ecological planting. James Hitchmough, a professor of horticultural ecology at the department of landscape architecture, at the University of Sheffield in England, describes ecological planting as “the creation of designed plant communities that are essentially assemblages of species that through necessity, have to interact with each other.” When we think about naturalistic planting, there are distinctions to be made between naturalistic and ecological planting. While some plantings can appear naturalistic, that does not mean they have a high degree of ecological function, as James argues. Characteristics such as stability, native plant communities, layers, texture, density, and diversity, contribute to ecological functioning. (Hitchmough, J. 2017) With ecological planting, one is harnessing the beneficial ecological processes within plant communities to be used to improve function. (Oudolf, p., Kingsbury, N., 2014)) As a society, we assign cultural value to the arrangement and order of plant communities. Ecological planting is driven by function as well as aesthetic considerations.

Characteristics such as layering among plantings, intermingling between species, biomass, and ecological fit help set the stage for ecological functioning to occur (Hitchmough, J., 2017). Two needs for setting the stage for ecological performance through ecological planting design are:

1) Broadly equivalent competitiveness within each plant layer.
2) Ecological fit to prevent competitive elimination.

Each of the species in a given arrangement is chosen in the context of how they are performing as part of an ecological community. Broadly

equivalent competitiveness attempts to avoid the issue of one or a few species dominating the succession of planting.(Dunnet, N., Hitchmough, J., 2007) The vigor and spread of a certain plant should not out-compete another targeted plant for light, soil surface area, and root zone (Oudolf, P., et. al., 2014). Ecological fit is essential because the species chosen need to establish in a balanced progression of growth among each other; if a species is put in a wet area that prefers drier soils, it will simply get out-competed by the plants that are environment appropriate (Dunnet, N., Hitchmough, J., 2007) Meadows gardens are an example of ecological planting. When done right, grasses and forbs grown together create a thick mat across the soil surface, not allowing invasive weeds to establish. The root systems grow extensively underground, resulting in vegetation that can handle temperature and precipitation variability. The plant communities within a meadow work synchronously. The product is greater than the sum of its parts.

Ecological planting design and its effectiveness as a performative landscape solution, will depend on the response and adaptation of planned plant communities to change over time. As a designer, it can be a challenge to imagine clear outcomes for how plant communities will behave years down the road. Adaptive management must be an ongoing solution incorporated into design strategy for the purposes of addressing ecological uncertainty. For meadows, the best approach with management involves a reliance on restoration ecology principles and practices, and aesthetic considerations that stem from the fields of horticultural and landscape design.

Stewardship Plans

Stewardship plans are a way for project teams, often led by landscape architects, to articulate and document goals related to the long-term stewardship of a project. A stewardship plan is an effort to try and best communicate to whoever will be managing the project, the critical elements of the physical design, and the experiential qualities of the original vision. Depending on the project, the ideas and concepts driving the design may sound simple or straightforward, but successful execution of those ideas and concepts is much more difficult. The gardens and landscapes we design will be managed for decades, and even centuries.

Stewardship plans are a final demonstration of graphics and writing that communicate value, intention, and meaning that a *place* has in the world. For landscape architects, these *places* are often gardens, public spaces, and outdoor environements. Stewardship plans can be the result efforts by a committed community of people to see that the spirit of place is preserved. Lawrence Halprin's efforts at Sea Ranch is an example of a designer's commitment to the legacy of their original design vision. Halprin played a significant role in articulating the core principles that guide community stewardship at Sea Ranch (Gordon, K., 2004) He led workshops that brought together homeowners, facilitated conversations about land ethic, sustainability, and community values. "The Sea Ranch is a vision, inspiring in its beauty; a concept, daring in its invention; a covenant with nature and the land" (Gordon, K., 2004). His intentions and actions have fostered an ongoing dialogue between community members. His vision for the stewardship of Sea Ranch is part of his design legacy.

Stewardship plans can be a record of the processes and actions that establish an ongoing commitment to care. Beatrix Farrand's *Plant Book* was a living document that she continually augmented and changed during her involvement at Dumbarton Oaks. Her book, originally written in 1941, is still referred to today as part of garden management. "Realizing that inevitably changes in the gardens would need to be made, that certain functions would be altered or eliminated, and that maintenance standards would be lowered in the future, he requested that Beatrix Farrand write a plant book that would become a guide for their future upkeep and development."(Dumbarton Oaks, 2019). Farrand organized the book into garden areas and scrupulously documented intentions, plant lists, and maintenance practices that would achieve the vision she continually adjusted (Dumbarton Oaks, 2019). The potential value that stewardship plans can provide for landscape architects is in creating a document that articulates the values and vision of the project from design to maintenance to performance. The value to clients and agencies who take on these projects is a succinct record of design documentation, maintenance protocol, and performance standards that serve as a guide to decision making.

During my collaboration with the Bloedel Reserve, the process of developing a stewardship plan began by addressing a need to document the design and planning stages, and make conclusions and recommendations as to how the garden will be managed, while taking into consideration a balance between visitor experience and meadow ecology. The process involved conservations with staff, and investigation into two years' worth of design and planning notes, graphics, and documentation, to pull out the most important pieces of information. Stewardship plans will ultimately serve

the needs that are unique to each project and support the goals articulated by project stakeholders.

CHAPTER 3: Supporting Topics of Inquiry

Design and Management of Meadows

My research into design, implementation, and management of meadows took place in two primary ways. First I determined who some of the 'experts' in the field were, and probed what methods and strategies they employ on their designs. Secondly, I had first person experience in observing the implementation of the meadow garden at Bloedel Reserve. Between these two modes of study, I have learned a lot about the practical considerations of meadow design, implementation, and management. In summary, I found that there are several common themes and methods that are critical for design, implementation and management: Site analysis, planting mix determination, installation, establishment period, and post planting management are the themes I concluded are fundamental.

Site Preparation and Analysis

Site analysis is critical to achieving a successful meadow. Similar to what one would expect from a typical landscape architecture site analysis, an inventory of existing site conditions will inform design decisions related to species selection and weed control methods. It is important to analyze the light, soils, grade, topography, and existing vegetation as an indicator of what will grow well on site Meadows can thrive on a variety of soil types such as sand, loam, clay, etc., but each requires a different suite of adapted plants (Patchett, J., et. al., 2015) The site analysis for the meadow garden at Bloedel

Reserve is summarized in the stewardship plan. Micro-climates, soil analysis, and hydrology were all analyzed.

Planting Mix Selection:

Most examples of meadow gardens will consists of planting communities that comprise of grasses and forbs. The grasses form the fabric of a meadow, creating a sod that binds everything together to cover the entire soil surface. (Diboll, N., 2018) Grasses are generally separated into annuals and perennials. Some grasses are strongly perennial, enduring ten years or more; others are weakly perennial, living perhaps two or three years before they die (Greenlee, J., 2010). Meadows are likely to persist with a strong foundation of long-lived perennial grasses. Mimicking the growth of natural grassland and the niches found there in will make for the most stable, resilient, and functional planting (Patchett, J., et. al., L., 2015)

For the meadow garden at Bloedel Reserve, the Puget Sound is considered a temperate maritime climate, with cool, wet conditions predominating from fall through spring, with short but hot summers. Cool season grasses naturally thrive better in this climate, so cool season grasses are likely to serve as the primary fabric of the meadow (Diboll, N,. 2018) The wildflower (forbs) mixes for the meadow are primarily Pacific Northwest natives, specific to the Willamette Valley eco-region, and a mix of midwestern prairie species. Further elaboration of these plant mixes is addressed in the stewardship plan.

Installation

Installation starts with the removal or killing of existing vegetation, in order to provide available soil surface for seeds and planting plugs to establish (Patchett, J., et. al., 2015). Some methods for eliminating existing growth include herbicide spray treatment, solarization, tilling the soil, and smothering. It is common practice to conduct two years of existing weed elimination in preparation for a soil that limits the amount of viable weed seeds.

There are two primary methods for planting a meadow; planting by seed, and planting with plugs. The meadow garden at Bloedel Reserve includes both seeded areas and areas planted by plug. When applying seeds to the site, it is important to allow for good seed contact with the soil. Hand casting or spreading with machines works effectively if the site is prepared correctly. A no-till drill seeder machine was used at the meadow garden at Bloedel Reserve. Planting with plugs will often result in faster establishment, but is higher cost and still requires weed management resources.

Post Planting Management

During post plantig management, it is necessary to carry out a routine weed control program to ensure the successful establishment of a meadow. The most appropriate methods are determined by the size of the project, maintenance budget, method of installation, and the appearance of weed species (Weaner, L., et. al., 2016) Monitoring the germination rates and coverage of the intended grass and forbs species will provide indication of

how certain plants are establishing. In some cases, re-seeding in the fall and spring can increase species diversity and richness, but is not always necessary if coverage goals are being met. During the first few years of meadow establishment, the primary resources will be spent controlling invasive weeds, and monitoring the outcomes of targeted plant species. (Dibbol, N,. 2018) Given time a meadow can evolve into a self-sustaining and resilient system.

Establishment:

The establishment period can take anywhere from three to seven years to achieve. The goal for meadow establishment is a dense interweaving of stems and foliage that should be mirrored underground by the root systems of the meadow grasses and wildflowers (Weaner, L., et. al, 2016) This dense fabric of growth is weed resistant once established. Larry Weaner recommends a consideration of two time scales when establishing meadows:

1) Seasonal: Some plants grow most actively during the warm weather season, from late spring until early autumn, whle other plants make their growth during cool seasons, especially spring. It is important to have corresponding seasons of growth.

2) Mult-year: To keep weeds under control, a meadow should include fast-growing plants that cover the ground during the first year of growth, biennials and short-lived perennisals to take over as the first year plants fade, and longer-lived perennials to provide long-term cover. All of

these need to be present to prevent a vulnerable gap in the meadow's ability to resist weeds.

Establishment goals will vary from project to project depending on the aesthetic and ecological values embedded in to the design. For example, some meadow designers prefer grasses to be the dominant vegetation, with accents of wildflowers. For meadow restoration projects, establishment goals will largely depend on the historical conditions one is trying to re-create. The grasses to forbs ratio, species diversity, and coverage goals will differ depending on the scope of the project. The meadow garden at Bloedel Reserve intends to create an outer meadow planted by seed, and a corridor meadow along the pathways that is planted with plugs and supplemented with seeds. The stewardship plan describes characteristics and management goals for these areas.

Adaptive Management Approach

Adaptive management is described as an approach to maintaining or restoring the composition, structure, and function of natural and modified ecosystems for the goal of long-term sustainability. (Williams, B., Szaro, R., Shaprio, C., 2009) The term first introduced by C.S. Holling in a journal of ecological restoration proposed an alternative management philosophy that was counter to the conventional methods of U.S. forest management and natural resource management. Since then, theoretical frameworks have evolved, and many iterations of adaptive management followed. The

definition related to my stewardship plan is an adaptive management approach that incorporates research into the ecological design framework through the integration of design, monitoring, and management to systematically test assumptions about design elements in order to learn and then to adapt management actions. (Rottle & Yocom, 2010) Landscape architects are typically not involved in the ongoing management of ecological design projects, but there is an opportunity for project enhancement if landscape architects know of anticipated management practices.

To first develop an appropriate adaptive strategy, it requires an assessment of the project goals and intended outcomes. After project goals and outcomes are identified, assessing uncertainty is the next step to develop a framework that allows for flexible and learning based management practices (Higgs, E., 2003). The effectiveness of adaptive management on a given project is unknown at the beginning of the project and requires re-evaluation and reflection from the management team throughout the lifetime of the project. Landscape architects need to be involved in the process of communication of management goals shortly after project implementation. In a best-case scenario, a landscape architect can be involved during major milestones of the project's life, and engage in re-evaluation and reflection.

Landscape architects are among the professionals most influential on the health and existence of ecological systems in intensively modified landscapes. (Trendle, C., 2016). Socio-cultural contexts influence our design decision making. The question of whether adaptive management strategies should include the social, economic, and political goals and outcomes of a

project is an important conversation to have among the project team. In the context of ecological restoration, in which most adaptive management literature is written, it would be assumed that adaptive strategies are exclusively focused on the monitoring of natural processes of targeted flora and fauna within an ecosystem. Rist argues that adaptive management should be evaluated on its own merits independent of some of the failures that result from the policy, social, and institutional environments within which all management approaches are embedded, but to which adaptive management has unfortunately become particularly closely associated (.Rist, L., A. et. al., 2013). Developing frameworks and theories surrounding adaptive management strategy, however, could eventually evolve into a learning-based approach that includes and identifies management targets that contain social, political and economic goals. For this professional project thesis, I am referring to adaptive management as it relates to the goals and outcomes associated with the establishment of targeted meadow vegetation only. I have developed social and economic targets separate from the context of adaptive management. In sum, it is necessary to consider independently the appropriateness of adaptive management as a means of reducing ecological uncertainty, from its feasibility in a specific management context, and ultimately its success as a process via which additional goals such as democracy, may be achieved (Rist, L., A., et. al., 2013)

Meadows can take three to eight years to establish and demand a significant amount of resources. For the meadow garden at Bloedel Reserve, the goal of emphasizing the need to establish and maintain a composition of high species diversity and coverage, will catalyze an increase in pollinator populations in the area. This may have further implications on allowing for

other forms of life to flourish. For the management of the meadow at the Bloedel Reserve, learning should occur through the comparison of observed versus anticipated outcomes. An adaptive strategy aligns management action with observational data and understanding, as uncertainty reduces through time. (Ruhl, J.B., 2016)

Landscape Performance

Landscapes of the 21st century are expected to perform more than just aesthetic and artistic services. The potential values of landscape include and are not limited to efforts in green infrastructure design, wildlife habitat, improving human health and wellness, and reducing energy consumption, to name a few. Projects become complex in their abilities to address challenges related to climate change, politics, economics, and environmental justice. Developing performance metrics for landscape projects is becoming increasingly important for comparative performance metrics.

Landscape Performance Series, developed by Landscape Architecture Foundation, is a way to assess how well design goals are being met by setting project performance targets and quantifying the measurable benefits of those targets (LAF, 2019) Case study investigations are independent research projects that measure the performance of project. Performance targets fall within Environment, Social, and Economic categories (LAF, 2019). The importance of establishing benchmarks and methods to quantify performance is crucial to the sustainability of those projects.

Potential values of measuring landscape performance (Hiromoto, J., 2015):

1. Feedback on design performance aspects of the project
2. Promote Evidence-Based Design
3, Increases client exposure and potential to generate new business
4. Demonstrate your firm's mission
5. Identify cost saving measures
6. Mitigate Risk and maximize investment
7. Comply with regulatory requirements

This framework helps us to quantify the benefits of designed systems, challenging us to design with an anticipation of measuring performance. Quantifying results enables designers to showcase the value of sustainable landscape solutions. When communicating to a client, data can help interpret the long-term value of design strategies. The more data gathered the better we can cross-compare performance results to organize and mechanize specific design decisions.

Management Precedents

Long Island Conservation Plan

When typing a search online using keywords "stewardship plan" and "landscape architecture ", the results provided few examples of precedents that were clearly relevant to my stewardship plan. It required me to expand beyond those keywords and search for master plans and conservation documents. The *Long Island Conservation Plan* outlines an environmental

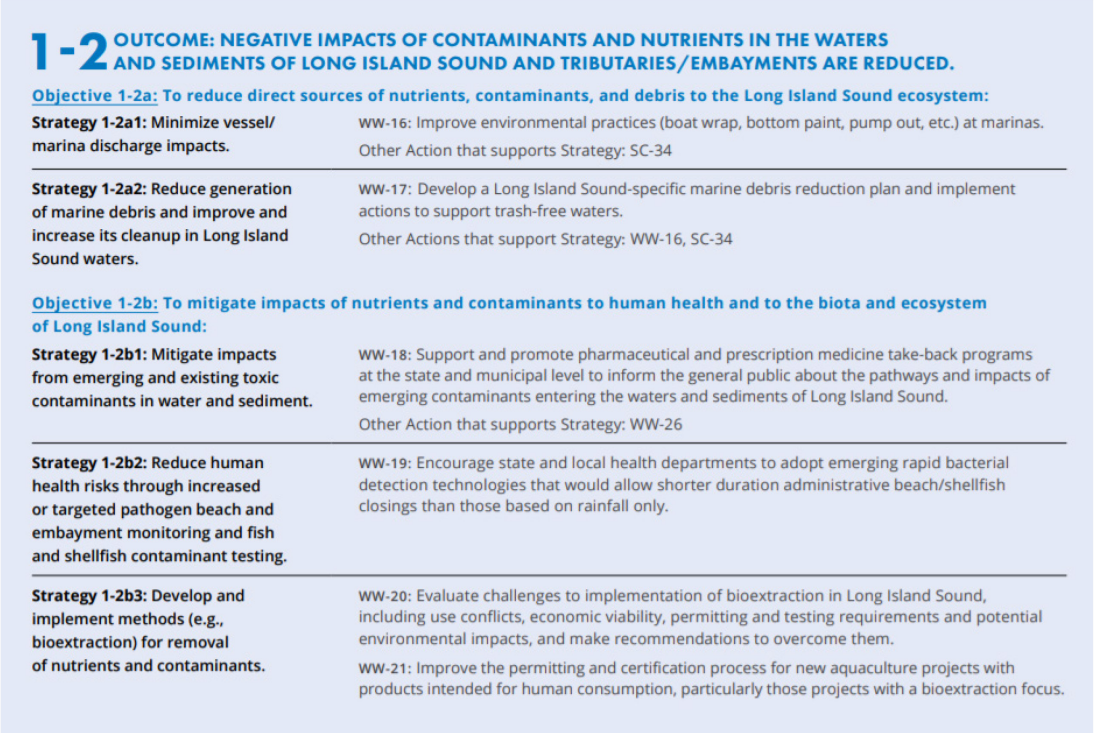
and social vision for the future of the Long Island Sound eco-region. The stated vision for the document is: “A vision of abundant and diverse wildlife, of flourishing commercial fisheries, of harbors accessible to the boating community, and a regional consciousness and a way of life that protects and sustains the ecosystem” (LICP, 2015).

They organize this vision into a set of overarching socio-ecological themes (LICP, 2015):

Theme 1: Clean Waters and Healthy Watersheds
Theme 2: Thriving Habitats and Abundant Wildlife
Theme 3: Sustainable and Resilient Communities
Theme 4: Sound Science and Inclusive Management

Within each theme, is listed ecosystem targets, outcomes, objectives, strategies, and implementation actions. They define the following terms and their roles as (LICP, 2015):

Outcomes: Broad results needed to achieve goals
Objectives: Desired management accomplishments to support outcomes
Strategies: Broad, strategic actions needed to achieve an objective.
Implementation Actions: Tactical actions to measurably carry out the strategies over the next five years.



1-2 OUTCOME: NEGATIVE IMPACTS OF CONTAMINANTS AND NUTRIENTS IN THE WATERS AND SEDIMENTS OF LONG ISLAND SOUND AND TRIBUTARIES/EMBAYMENTS ARE REDUCED.

Objective 1-2a: To reduce direct sources of nutrients, contaminants, and debris to the Long Island Sound ecosystem:

Strategy 1-2a1: Minimize vessel/ marina discharge impacts.	WW-16: Improve environmental practices (boat wrap, bottom paint, pump out, etc.) at marinas. Other Action that supports Strategy: SC-34
Strategy 1-2a2: Reduce generation of marine debris and improve and increase its cleanup in Long Island Sound waters.	WW-17: Develop a Long Island Sound-specific marine debris reduction plan and implement actions to support trash-free waters. Other Actions that support Strategy: WW-16, SC-34

Objective 1-2b: To mitigate impacts of nutrients and contaminants to human health and to the biota and ecosystem of Long Island Sound:

Strategy 1-2b1: Mitigate impacts from emerging and existing toxic contaminants in water and sediment.	WW-18: Support and promote pharmaceutical and prescription medicine take-back programs at the state and municipal level to inform the general public about the pathways and impacts of emerging contaminants entering the waters and sediments of Long Island Sound. Other Action that supports Strategy: WW-26
Strategy 1-2b2: Reduce human health risks through increased or targeted pathogen beach and embayment monitoring and fish and shellfish contaminant testing.	WW-19: Encourage state and local health departments to adopt emerging rapid bacterial detection technologies that would allow shorter duration administrative beach/shellfish closings than those based on rainfall only.
Strategy 1-2b3: Develop and implement methods (e.g., bioextraction) for removal of nutrients and contaminants.	WW-20: Evaluate challenges to implementation of bioextraction in Long Island Sound, including use conflicts, economic viability, permitting and testing requirements and potential environmental impacts, and make recommendations to overcome them. WW-21: Improve the permitting and certification process for new aquaculture projects with products intended for human consumption, particularly those projects with a bioextraction focus.

Figure 1.1: A screen shot of a page showing the graphic organization of strategies. (LICP, 2015)

They define monitoring as: "Tracking implementation of management actions are critical components of adaptive, ecosystem-based management. Monitoring activities support evaluations of whether management actions are being implemented as planned and have resulted in progress toward stated environmental goals." (LICP, 2015) An added benefits of monitoring is that it establishes baselines from which to evaluate the environmental response to ecosystem disruption.

The stated primary goals of monitoring are to (LICP, 2015):

1. Measure the effectiveness of the management actions and programs implemented under the CCMP
2. Provide essential information that can be used to redirect and refocus the CCMP during implementation

3. Inform and facilitate research and modeling efforts by providing a suite of baseline data on the spatial and temporal variability of environmental condition.

To summarize the values of a successful monitoring program (LICP, 2015):

1. Clear goals and objectives that are articulated as questions that are meaningful to the public and that provide the basis for scientific investigation
2. Include only what is needed so that the likelihood of being sustained during difficult budget times will be enhanced.
3. Take full advantage of existing monitoring programs, including opportunities for citizen science.
4. Generate long term commitment to answer key questions and key hypotheses.
5. Take advantage of new technologies and methodologies as they become available while doing everything possible to make new observations compatible with historical data.
6. Develop and sustain a rich array of informational products that are tailored to special needs and interests of different constituencies.

Their monitoring program is not only contributing to the dataset for the Long Island Sound but is contributing to a larger body of scientific research. They have a loyal involvement of volunteers and community organizations that help generate reports. The datasets and reports are translated and communicated into biennial reports (LICP, 2015). They also collaborate with researchers from academic and research agencies.

The conservation plan is an example of how a core document can be an ongoing reference and resource for the community and researchers involved in the long term stewardship of the Long Island Sound. The scope of the conservation plan covers an entire eco-region; my stewardship plan focuses on a five-acre garden. The LICP goals and strategies are broader in their application. The value of this conservation plan is in its organization of broader goals being paired down into a series of deliberate implementation actions.

Cornwall Park Master Plan:

The Cornwall Park Master Plan is an example of how landscape architects can facilitate the documentation of long-term visions of a project . The goal of the master plan was to make a useful tool for the care and development of Cornwall Park for the coming decades. The project states the intention of balance between three important elements: the Cultural Landscape of the Maori, early settlers and the founder's vision, the Agricultural Landscape of New Zealand and the ecological assets of the site (ASLA, 2015). "The landscape architect was hired to envision the development of Cornwall Park in Auckland, New Zealand over the next century, continuing the legacy of long-term planning and visionary thinking established by the park's founder, Sir John Logan Campbell, who sought to ensure a park that provides a world-class public space for recreation and enjoyment for its citizens." (ASLA, 2015).

Chapters describe key aspects of the park character and experience. The plan articulates guiding principles, as well as goals and strategies to

assist design and maintenance. The strategies speak to programming, operation, and maintenance practices within the park. Design interventions are organized by precinct. The plan creates a pedestrian-oriented landscape, expands the park's capacity to reveal and sustain healthy urban ecologies, and will educate the public and delight visitors of all ages (ASLA, 2015). The master plan organizes six chapters: Cultural landscape, Park Ecology, User Experience, Agriculture, Infrastructure, Precincts.

The use of images, diagrams, and maps helps to communicate ideas about monitoring, maintenance, preservation, and design strategies. Successful execution of graphic communication allows for easy readability and understanding of complex socio-ecological and historical contexts.

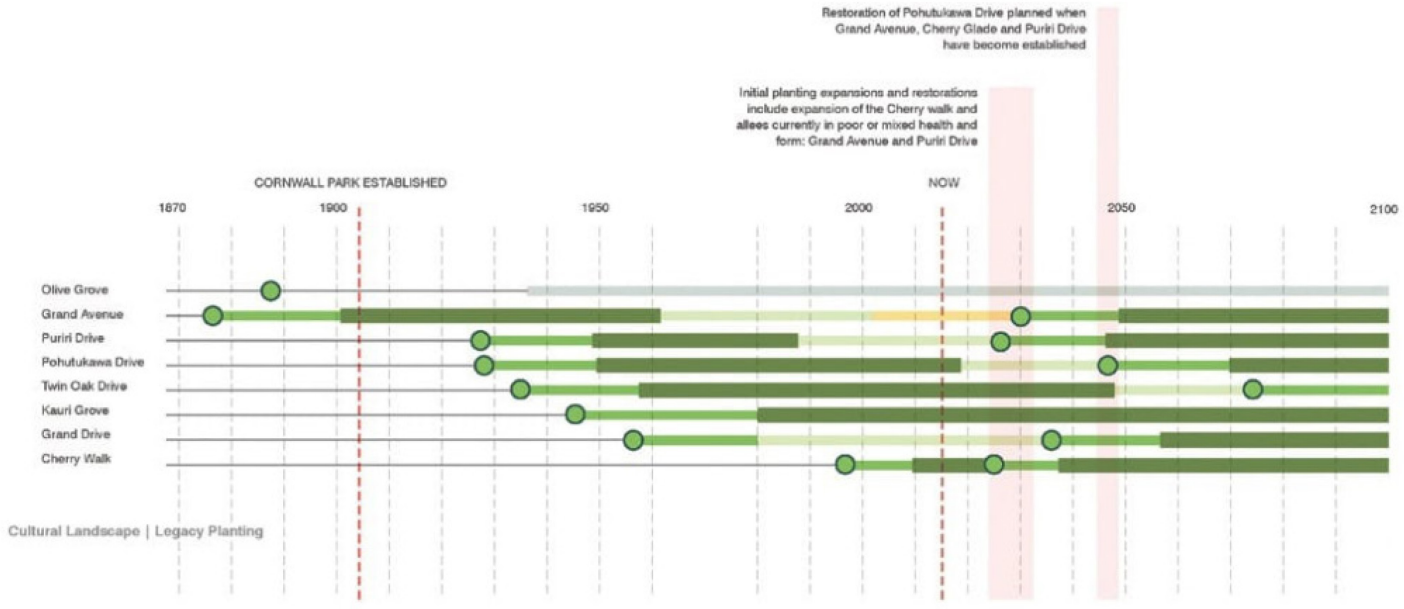


Figure 1.2: The timeline displays the planting dates of all the legacy plantings to visualize the lifecycle of each area and assist in developing a park-wide approach to phasing restoration that allos for regeneration without detracting from the visitor experience. The restoration phases begin by replanting areas in the worst condition as a result of poor soil and disease (ASLA, 2015).

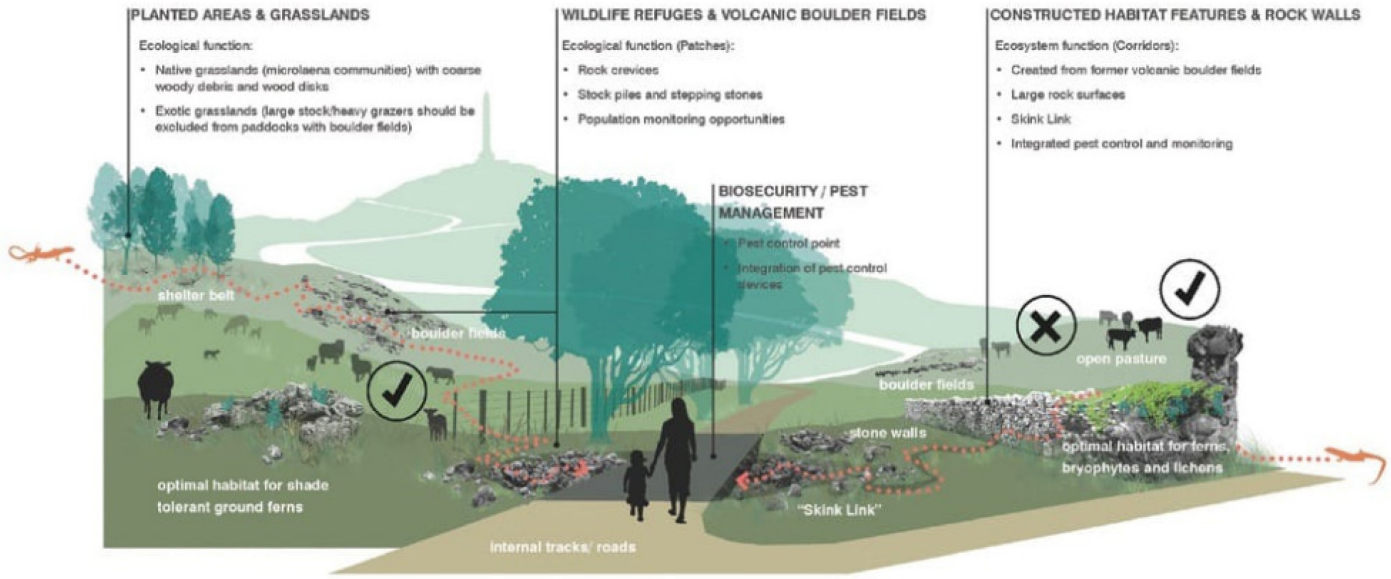


Figure 1.3: Master plan initiatives connect habitat within the park for the endangered copper skink and make this threatened ecology visible to visitors. (ASLA, 2015).

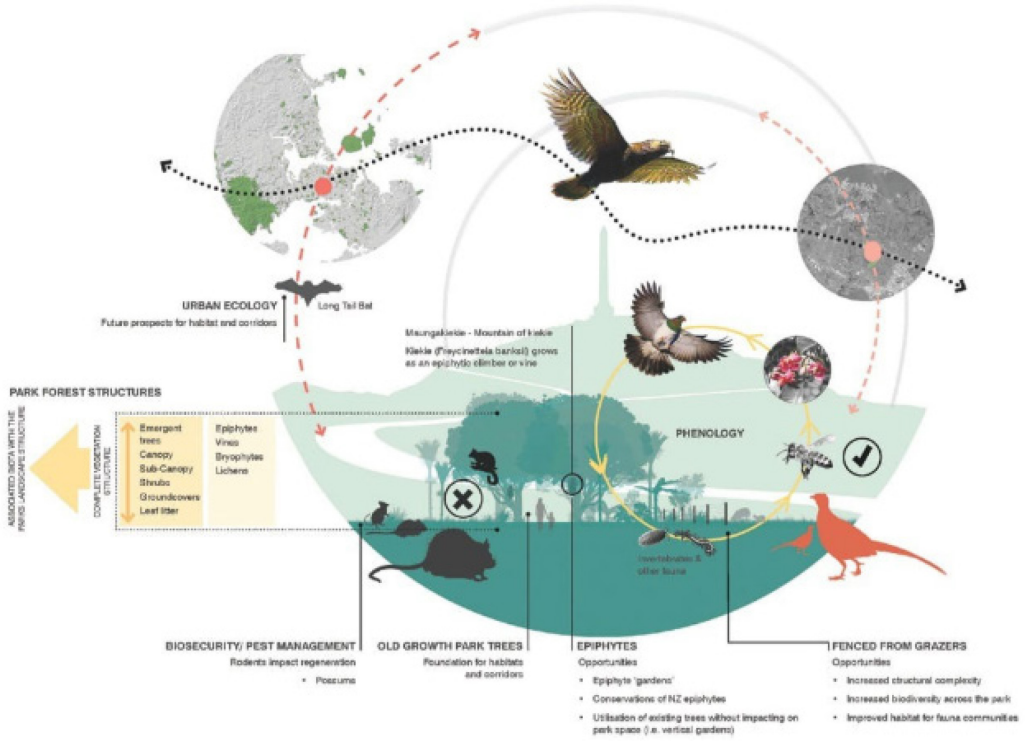


Figure 1.4: The master plan recommends the monitoring and assessment of its natural resources as the park plays an important role as a regional refuge for wildlife (ASLA, 2015).

The Native Pollinator Habitat Restoration Guide: Best Management Practices for the Puget Sound lowlands

The Native Pollinator Habitat Restoration Guide, produced by Earth Corps, is described as a practitioner guide for best management practices for native pollinator habitat restoration in the Puget Sound region (PGBMP, 2018). It provides information relevant to planners, land managers, restoration practitioners, farmers, gardeners, orchardists, teachers, students, and homeowners.

The primary sections of the document are:
Part 1 - General information about pollinators and their habitat.
Part 2-4 - Site level restoration considerations.
Part 5 - Policy recommendations.
Part 6 - Plant lists.

The primary goal of this document is the promotion of increasing pollinator habitat. There is less focus on aesthetic considerations, rhythm, space, and composition; attributes often associated with garden design. Instead, the emphasis is on ecological functionality; providing a clear and thorough presentation of key design characteristics that encourage pollinator health and habitat. These design characteristics are helpful to understand when thinking about how management strategies should be organized to allow for the inclusion of pollinator habitat value.

Key Design Characteristics (NPHRG, 2018):

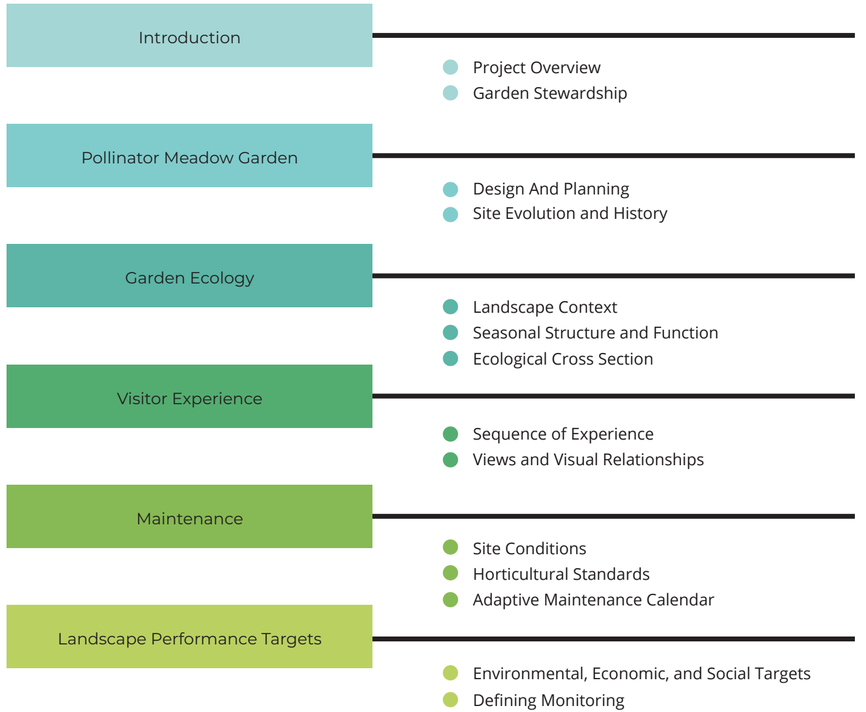
1. Pollinator Resource Requirements:
2. Native Plants: larval life stages of native pollinators often depend on native plants. Native neighboring plants from Oregon.
3. Species Diversity
4. Structural Diversity
5. Overlapping bloom times
6. Plant species in clumps

Control Method	Advantages	Limitations	Type of Site Where Method is Most Applicable
Hand pulling	Inexpensive and requires only basic tools and expertise. If done properly, removes entire root system of weeds. Targets only invasive species.	Time consuming and usually requires repeated pulling over time to remove all weeds.	Small sites or patches of weeds interspersed with desirable native vegetation.
Sheet mulching or smothering	Inexpensive. Doesn't require experienced landscapers or heavy equipment. Suppresses and kills all vegetation.	Labor intensive. Kills native plants. Does not eliminate the weed seed bank.	Degraded sites dominated by invasive species. Small areas or large areas with scattered patches of weeds.
Solarization	Effective at killing existing vegetation and weed seed bank.	Covering material may be expensive and must stay installed properly, requiring maintenance following wind or other damage. Some seeds are extremely long-lived and would need repeated years of solarization to exhaust the seed bank.	Small areas or patches within larger areas. Relatively flat places without obstacles. Heavy infestations with little to no native component.
Cultivation	If large tilling equipment is available, can be done quickly and efficiently. Can be performed at any time of year.	Labor intensive and may require special equipment or experienced landscapers. Does not affect the weed seed bank. Leaves behind or spreads segments of weeds that can resprout. Should not be performed in protected Mima Mound areas.	Small or large areas but not in Mima Mound habitat.
Prescribed Burning	Effective method that mimics historic fire processes. Can remove moss and thatch layer.	Requires expert oversight to avoid damage to structures or neighboring properties from fire. May require follow up herbicide treatment (see resources appendix).	Large parcels.
Herbicides	Specific herbicides can be used that target non-native grasses (and avoid natives). Cost effective for larger areas. Spraying can be done over large areas or spot treated at precise locations.	Requires careful use of toxic chemicals.	Most sites if herbicide is applied correctly per label instructions.
Mowing	Low cost if a mower is readily available. Does not require special expertise. Reduces future weed seed bank if timed prior to seed set.	May weaken but does not remove the weed root system. Affects desirable native herbs as well as weeds.	Relatively flat sites dominated by weeds, where the other control methods are not feasible.

Table 1.1: This table gives an overview of the limitation and benefits of different invasive weed control strategies (PGBMP, 2018).

Monitoring and control of invasive weeds are paramount. As invasive weeds decline, introducing supplementary seed applications of targeted species to the site should happen in addition. The supplementary plantings focus on reinforcing both species diversity and structural diversity on the site. This can only happen if invasive weeds are under control.

Chapter 4: Pollinator Meadow Garden Stewardship Plan



INTRODUCTION

Located in the southwestern corner of the Bloedel Reserve is the Frank Buxton Bird Marsh and Meadow. A new project as of 2016, the Frank Buxton Bird Marsh and Meadow is intended to expand upon Prentice Bloedel's commitment to conservation, sustainability, and visitor experience. The gardens at the Bloedel Reserve are a collection of unique and varied landscapes that inspire human connection with nature. The new meadow garden will be a stunning addition to the ensemble of gardens at the Reserve. A garden inspired by regional prairie and wildflower landscapes, the meadow garden will showcase a diverse combination of Pacific Northwest native and North American native wildflowers and grasses. Environmental stewardship and conservation of biodiversity are at the core of the garden's management approach while creating a distinct visitor experience is the garden's mission.

The following Stewardship Plan is intended to summarize the vision and values of the meadow garden design, inform readers on the importance of understanding the garden in the context of a functioning ecosystem, and provide recommendations on how to adaptively manage and measure the performance of the project.

Figure 4.1: Wildflowers in the meadow garden. Image Credit: Author

GARDEN STEWARDSHIP

The document organizes into four major themes that set a context for ongoing stewardship of the garden.

1) Garden Ecology
2) Visitor Experience
3) Maintenance
4) Landscape Performance Targets

Garden ecology provides an overview of the natural and social landscapes that influence the way we think about the composition and structure of the meadow.

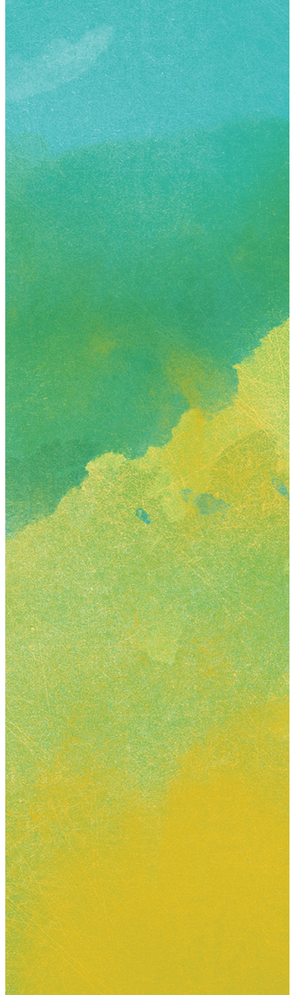
Visitor experience photo-documents a walk-through the meadow, identifying essential circulation patterns, highlighting views and visual relationships along the path.

Maintenance articulates horticultural standards as part of an ongoing adaptive management approach that includes implementation, establishment, and post-establishment phases.

Landscape performance targets recommends social, economic, and environmental goals that can be monitored and measured to inform management decisions and track the progress of the garden's success.

Figure 4.2: Diagram of stewardship plan framework. Image Credit: Author

POLLINATOR MEADOW GARDEN



DESIGN AND PLANNING

During the Spring of 2016, conversations began among grounds maintenance, the board of directors, and Fischer Bouma Partnership to generate ideas for improvements to the existing bird marsh and meadow. The agreements reached were to enhance the quality and diversity of guest experience, increase accessibility, create new habitat and birding opportunities, and improve environmental performance. The intent is a subtle, naturalistic, and memorable garden where the ephemeral and seasonal qualities of the landscape are revealed, and resources stewarded. The pond, wetlands, meadows, woodlands, and forest edges will become part of an integrated and diverse Bird Marsh and Meadow experience. The Bird Marsh and Meadow improvements are fully funded through community donations. The project name is in memory and honor of Frank Buxton.

The meadow garden will feature a new pathway that winds through a diversity of wildflowers and grasses, taking visitors to areas of the Reserve previously inaccessible. The highest point in the meadow will provide new views of the pond and surrounding meadow. New plantings will augment the existing meadow ecology through the addition of wildflower and grass species. A new hedgerow planting plan will support habitat and refuge. Birds, butterflies, and insects buzzing and darting through colorful plants will

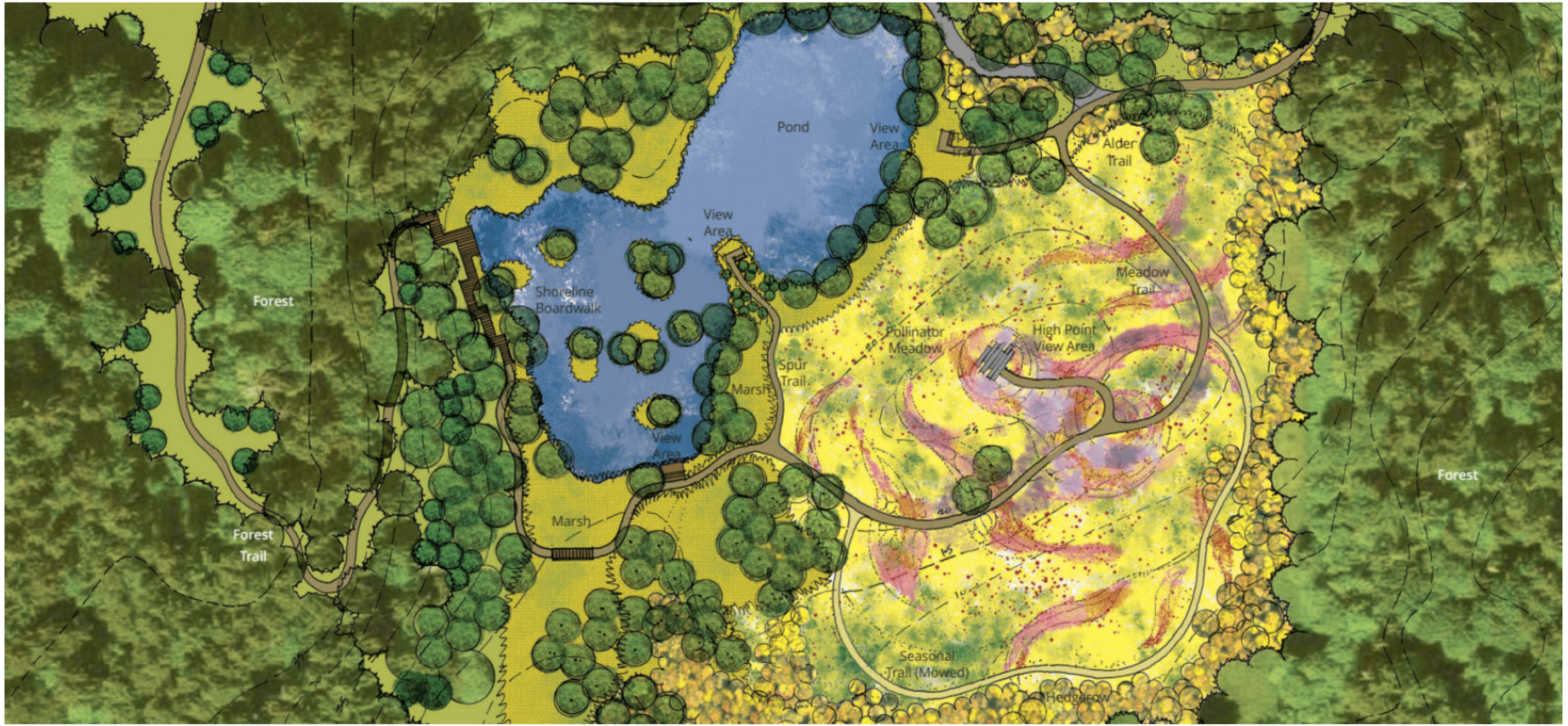


Figure 4.3: Site plan rendering of the meadow garden at Bloedel Reserve. Image Credit: Fischer Bouma Partnership

Figure 4.4: Graphic illustration of the meadow garden at Bloedel Reserve. Image Credit: Fischer Bouma Partnership and Jim Collins

awaken all senses and promote a sense of unity with the surrounding landscape.

Among all the improvements within the Bird Marsh and Meadow, the meadow garden portion of the project will take on special consideration and planning. Unlike other planting enhancement areas, establishing a new meadow demands time, patience, and flexibility. An adaptive management approach is unique to this garden area, and so this stewardship plan focuses on the aspects of maintenance, planning, and garden experience that are associated with the meadow garden area, that is part of the larger Bird Marsh and Meadow project. The meadow garden is an exciting opportunity and endeavor to establish yet another exemplary garden experience at the Reserve.

KEY IMPROVEMENTS

1) Longer paths, and new boardwalks will be expanded to embrace the marsh, pond, meadow, and forest.
2) Visitors will be immersed in diverse ecologies and provided quiet contemplative places.
3) Expanded riparian meadow plantings will enhance shoreline and upland bird habitat.
4) A beautiful meadow landscape will reveal the benefits of native and pollinator plants.
5) Creation of a new hedgerow at the edge of the forest will attract and house a wide variety of bird species.

SITE EVOLUTION

The Bird Marsh and Field, identified as LCA 1D in the Heritage Landscape Report (2016), encompasses the location of the new meadow garden. Refer to the Heritage Landscape Report (2016) for a comprehensive history and character description of LCA 1D.

In 1955, the Bloedel's purchased the parcel that contains what is now the bird marsh and meadow. Soon after buying the Coleman parcel, the Bloedel's used a portion for agriculture to support their pasture and crop endeavors. Since the purchase of the parcel, the field's topography has existed as a small hill, with minor changes in vegetation, soil composition, and hydrology all affecting the visual and land use characteristics over time. Bloedel grew a newly developed alfalfa cultivar, a species not common in Northwest at the time, to support the livestock he pastured on other cleared areas of the property (BRHLR, 2016). He also excavated a portion of the marsh to build a pond for irrigation of the adjacent agricultural fields (Figure 4.5). From 1976 to 1985 the pond was transformed as a result of work with Richard Haag.

The work of Bloedel and Haag to create a Bird Refuge from the agricultural Circle Pond form the space in 1981. EPD design work in the late 1980s and early 1990's broadened the experience of the Bird Marsh, including the meadow on Coleman Hill (BRHLR, 2016). EPD also reseeded the hill in meadow grasses,

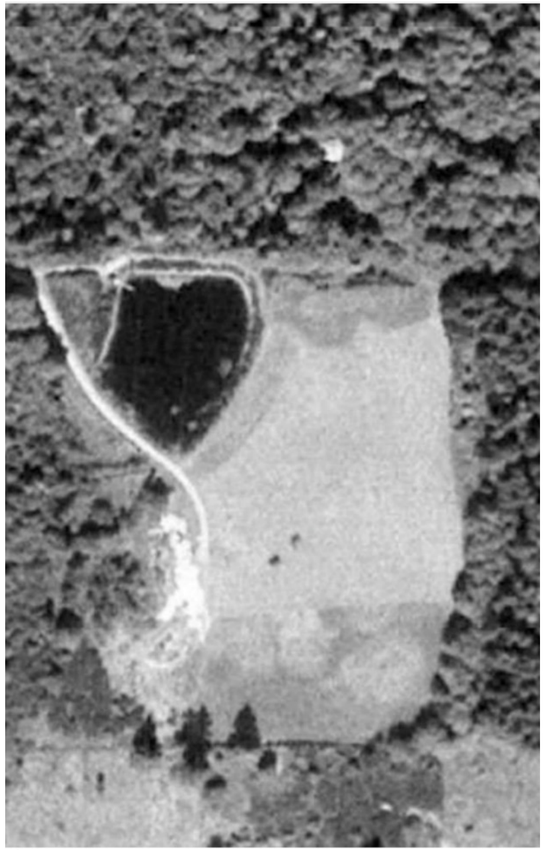


Figure 4.5: Aerial image of Coleman Hill Image Credit: BRHLR (2016)

Previously home to native tribes, the Coleman Homestead was settled in the 1900's and cleared for timber. In 1955 the Bloedels purchased the property.

A circular pond was excavated for irrigation and the meadow was planted with an experimental variety of alfalfa. A new road connected the pond to the barn.

The pond was expanded with islands and more diverse plantings to encourage bird habitat. Additional property was purchased between the marsh and Port Madison Road and a buffer of conifers was planted.

Figure 4.6: Site evolution diagrams showing land use change over time. Image Credit: BRHLR (2016)

Figure 4.7: Aerial image of the Bird Marsh not long after completion Image Credit: BRHLR (2016)

further distancing the Bird Marsh landscape from its agricultural past (BRHLR, 2016). The dense coniferous and mixed woodlands that edge the water and field spaces have evolved, enlarged, and softened the edge since the late 1990s (BRHLR, 2016).

Master plans produced by Richard Haag Associates in 1979 and 1980 show potential circulation routes traveling along the backside of Coleman Hill, with the southern area of Coleman field labeled as a flower field. With the current project underway, the existing pathways will be changed to remove a portion of the trail along the water's edge to improve habitat, while a new path will circle around the pollinator meadow and lead visitors to a high point on the hill with views of the pond and surrounding meadow.

OVERLAPPING ECO-TYPES

This area of the Reserve is unique in the diversity of landscape eco-types that are present. The meadow garden and hedgerow will be complementary additions to the existing ecological richness of the area. These overlapping eco-types are what makes this area of the Reserve distinctive. There is a multitude of biotic and abiotic processes that occur on site, resulting in a dynamic and ever evolving living system. The novel interactions and observation with wildlife that visitors experience on site are highly valued.

An increase in plant species diversity and the establishment of new plant communities within the meadow garden will bolster biodiversity by supporting food and habitat needs within the local food web. Native wildflowers attract rare and common pollinator groups. Invertebrates and insects can thrive in new environments created within the meadow. Birds can find new habitat within the grasses and hedgerow plantings, more food availability from new flowering shrubs, and an increase in the insect population. The ecological processes that exist today are exceptional. A successful pollinator meadow garden will be a strong addition to this dynamic landscape.

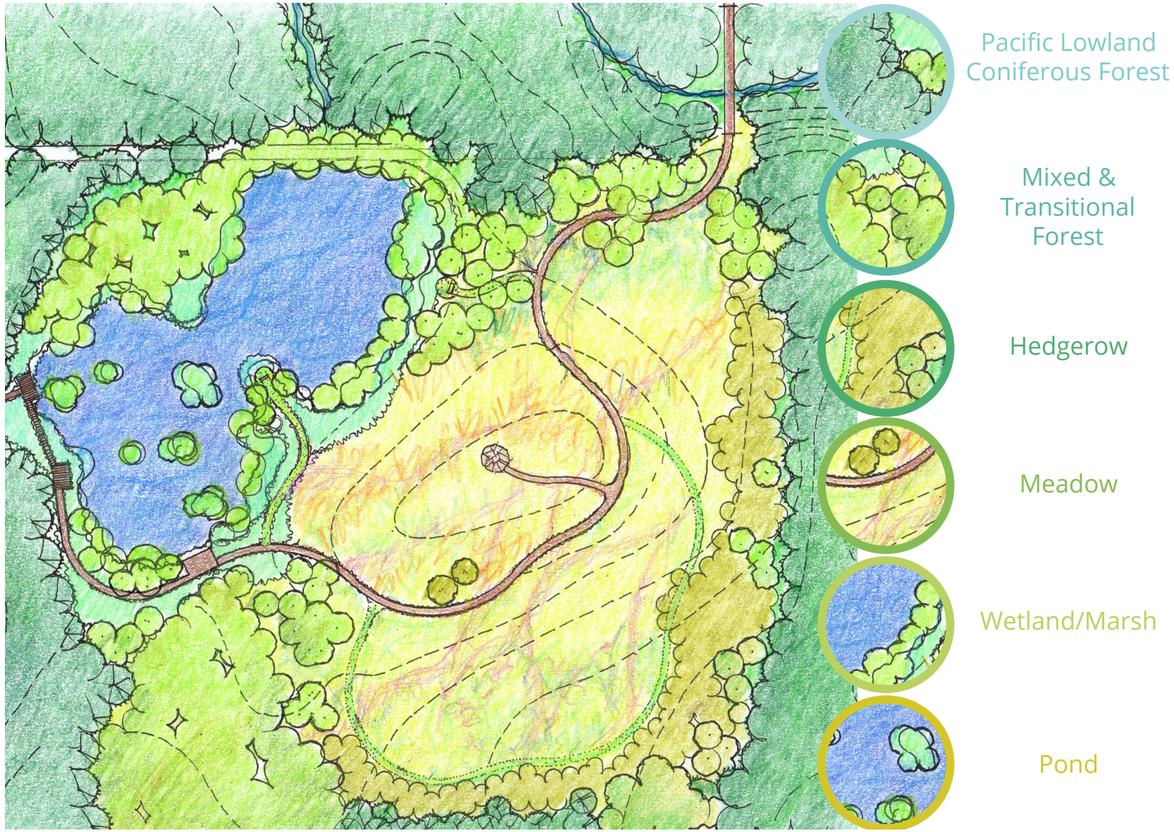
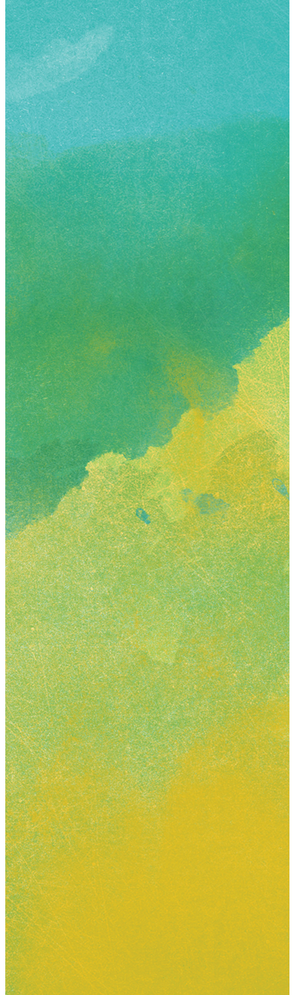


Figure 4.8: Diagram and site plan highliting various eco-types on site Image Credit: Author's edit of Fischer Bouma Partnership's content

GARDEN ECOLOGY



LANDSCAPE CONTEXT

An essential focus of maintenance efforts will be towards establishing and sustaining plant communities within the meadow. It can be helpful to place this garden into the contexts of relevant social and natural landscapes. The meadow garden shares characteristics, function, composition, and plant communities with the following landscape types:

1) Prairie and Steppe Ecosystems

2) Puget Sound Lowland Prairies

3) Wild Meadows and Meadow Gardens

4) Pollinator Gardens

5) Ecological Planting

Each of these landscapes has cultural value and attributes that make them unique, as well as ecological traits that influence their functioning. Thinking about the ways these landscapes vary in scale and time can help us better understand how to define this meadow garden. Our understanding of these social-ecological systems impacts the management and maintenance of the pollinator meadow garden.

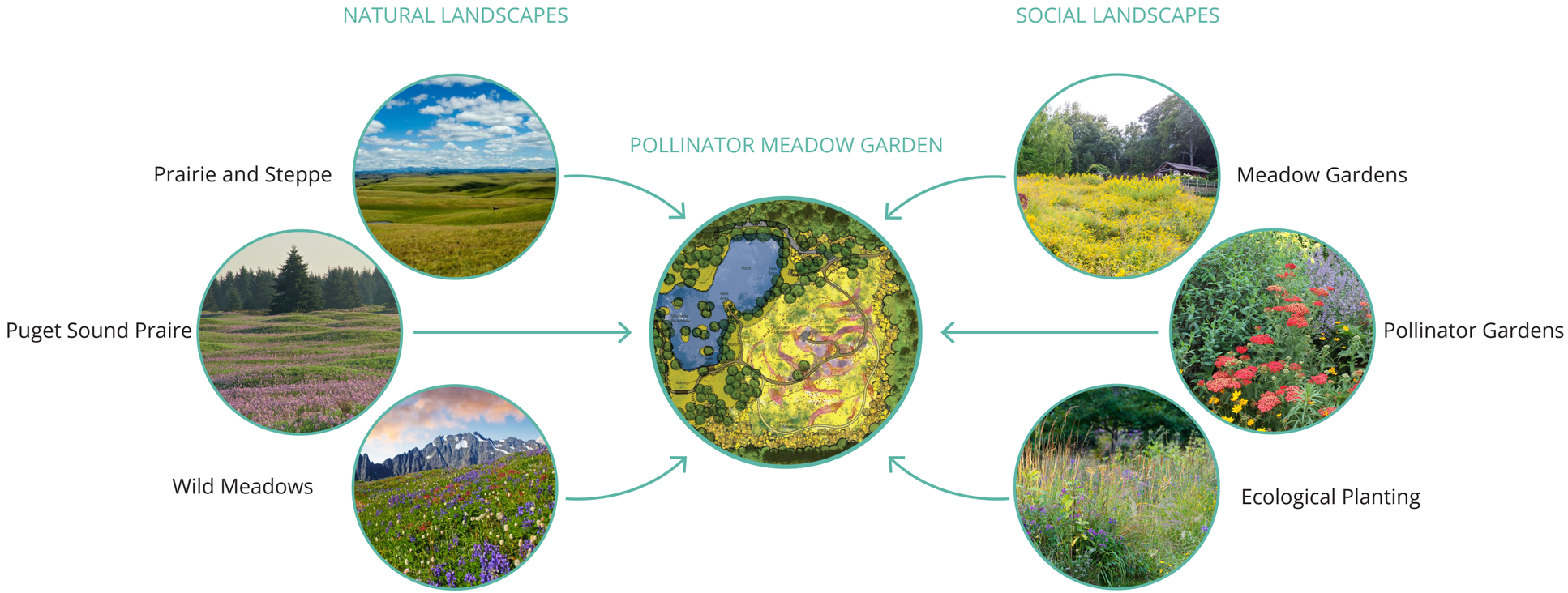


Figure 4.9: Landscape context diagram Image Credit: Author

PRAIRIE AND STEPPE ECOSYSTEMS

A prairie can be understood as an extensive area of flat or rolling land dominated by grass and other non-woody plants (Logalbo, 2016). Prairie landscapes vary in soil types and depth, moisture, and slope. This creates many different situations and niches for specific plant communities to fit into. (Weaner, et. al., 2016) Most of the plant mass of a prairie community is underground in the form of extensive root systems. On average, 70%-90% of a prairie grass's total mass existed below ground. (Patchett, 2015) The climate on a prairie can range from extreme heat and drought in August to bitter cold winters locked in ice and frigid winds. The vast prairies of North America are often associated with the historical grasslands that once covered territory East of the Rockies, across the Midwest, and to the Mississippi River and as far South as Texas (NGS, 2012). The seed mixes sown into the meadow include plants native to the Pacific Northwest, (some specific to the Willamette Valley eco-region), as well as species commonly found in Midwestern prairies.

Figure 4.10: Zumwalt Praire, Oregon. Image Credit: Trip Advisor

Figure 4.11: Willamette Valley prairie with camas flowers.
Image Credit: Ash Creek Forestry

Figure 4.12: Mt. Finlayason, San Juan Island, Washington.
Image Credit: National Park Service

Figure 4.13: Camas blooms at Mima Mounds, Washington.
Image Credit: Washington Department of Natural Resources

PUGET SOUND LOWLAND PRAIRIES

One of the rarest ecosystems in the country, these open savannas were created by retreating glaciers 15,000 years ago, which left behind gravelly soils that dried out quickly during summer droughts. (CNLM, 2019) Native Americans sustained these grassy plains for thousands of years using fire to keep the encroaching forests at bay so that tribes could harvest the prairie's bounty of wildflowers and bulbs for food and medicine. (CNLM, 2019) Today conservationists maintain these prairies through active management and restoration. It is estimated that 3% of the original prairie landscapes in Washington State remain today. (CNLM, 2019)

Conservation easements and private landownership comprise most of the land that remains. The preservation of these prairies would not be possible without the efforts of volunteers providing labor to control invasive species and reestablish native species.

WILD MEADOWS

Wild meadows can range in identity from an opening in the woods to a slope of wildflowers in an alpine landscape. Wild meadows occur across the world and often are smaller scale versions of natural grasslands and prairies. However, they comprise of different species than those found in prairies.

Meadows are full of a diversity of plants that support a variety of life: from the fundamental microbial level to birds, bees, and butterflies, and all kinds of creatures (Greenlee, Holt, 2010). Meadows store springs floodwaters and releases cool flows in late summer. Grasses and soil filter out sediment and pollutants. Flowers and plants provide high-quality forage and provide habitat for all kinds of wildlife.

Figure 4.14: Wild meadow in cascade mountain range.
Image Credit: Washington Wild

Figure 4.15: Camas meadow near Wenatchee, Washington.
Image Credit: Washington wildlife and recreation coalition

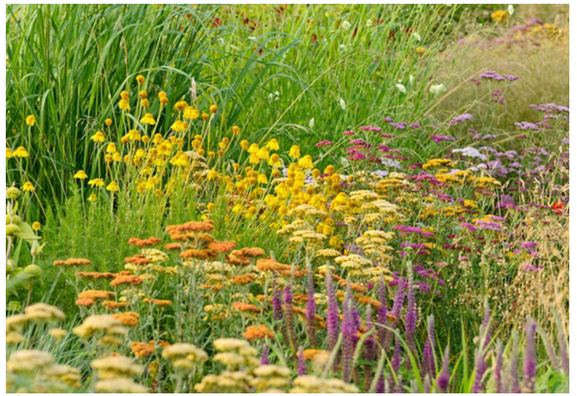


Figure 4.16: Perennial plantings Image Credit: Gardenia.net

Figure 4.17: Piet Oudolf meadow garden Image Credit: Piet Oudolf

MEADOW GARDENS

There are broad definitions of what constitutes a meadow garden. For most people, the interpretation is a large tract of land covered in grasses and wildflowers. Understanding the soil, the exposure, the micro-climates, moisture, and slope will influence what plant communities will be able to thrive in a location. (Oudolf, Kingsbury, 2014) Compared to other garden styles, one driving principle in meadow garden design is the goal of establishing plant communities that interact, adapt, and grow among each other, as opposed to in blocks neatly separated from each other (Dunnet, Hitchmough, 2007).

Meadows can either start from sowing seed mixes of grasses and perennials into the ground or by planting small plug plantings. Both methods can produce different results but are both effective at establishing a meadow garden.

POLLINATOR GARDENS

Pollinator gardens emphasize design that pairs pollinators with beneficial flowers to promote habitat and seasonal abundance of pollen and nectar. Pollinator gardens and pollinator plantings can occur at multiple scales and in rural and urban environments. (Johnson, 2014) Within an urban environment, patches of pollinator plantings can create migratory corridors to support habitat and foraging. (Schwartz, Salisbury, 2016). In agricultural lands, planting hedgerows can allow resident pollinator populations to establish and benefit crop production. (WSU, 2015)

The management and implementation requirements of pollinator gardens are similar to meadow gardens, but there more emphasis placed on creating habitat and food needs for pollinators. They often prioritize these benefits over aesthetic considerations and native plant conservation values.

Figure 4.18: Pollinator planting. Image Credit: Jersey Friendly Yards

Figure 4.19: Pollinator landing on a flower. Image Credit: Author

Figure 4.20: Wildflowers at the meadow garden at Bloedel Reserve. Image Credit: Author

Figure 4.21: Planting design by Larry Weaner
Image Credit: Claire Takacs via Noel Kingsbury blog

ECOLOGICAL PLANTING

Meadows can be an example of ecological planting. A successful meadow consists of grasses and forbs growing together to create a thick mat across the soil surface, not allowing invasive weeds to establish. (Diboll, 2018) The root systems grow extensively underground, resulting in vegetation that can handle temperature and precipitation variability. (Weaner, et. al., 2016) The plant communities within a meadow work synchronously. The product is greater than the sum of its parts.

Each species is chosen in the context of how they will perform as part of an ecological community. Managing ecological communities create difficulty to identify clear goals for what it is to become. Because of this complexity, adaptive management can be an ongoing solution to address the shifting states of the ecological design. It requires a capacity to look into the future, which is not always easy to do.

STRUCTURE AND FUNCTION

Quite simply, meadow vegetation is an interrelationship between grasses and forbs. The most basic approach in establishing a meadow is to make an effort toward developing communities of grasses and forbs. It is intended that this meadow and its plant species be utilized not only as a horticultural planting specimen but managed and appreciated within the context of a valuable living system. Seasonal beauty holds value for both humans and wildlife. The plants of grassland ecosystems stagger their respective times of maxiumum activity, focusing their growth in spring, summer, or fall. (Diboll, 2018). It is essential to consider what grasses and forbs are doing seasonally, and what the characteristics of each season are in terms of aesthetic and ecological function.

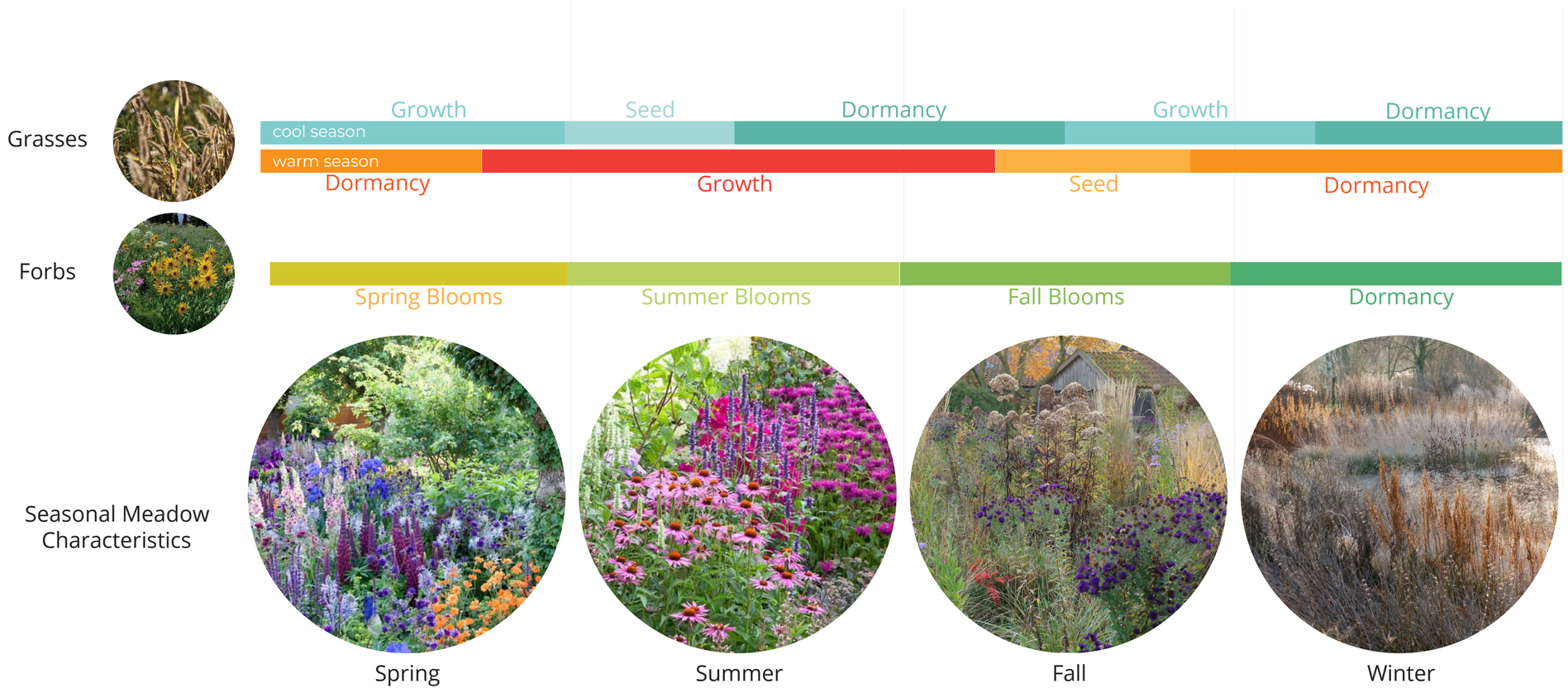
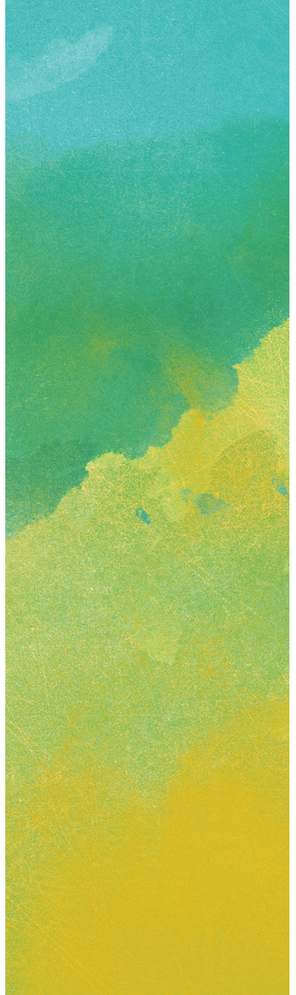


Figure 4.22: Diagram showing seasonal meadow characteristics and growth timeline of grasses and forbs. Image Credit: Author

Figure 4.23: An ecological cross section of the Bird Marsh and Meadow. Image Credit: Author

VISITOR EXPERIENCE



THE MEADOW EXPERIENCE

Prentice Bloedel and Richard Haag planned for a varied, rhythmic sequence that visitors would experience as they made their way from the meadow down to the bird marsh. (BRHLR, 2016) There was a discussion about increasing circulation through the site and incorporating the pastoral Coleman hill into the garden. The field and hill echo the experience of the entry meadow in LCA 1, in a choreographic relationship to each other.

Each visitor will have their unique interpretation of walking through the site, but there remains a level to which we can direct attention through our design decisions. Just as it is essential to think at the scale of ecosystem functioning, perceiving a shared experience at the human scale is also critical. Thinking about design in terms of space, scale, circulation, and physical elements help to articulate the experience of movement through space.

The following exercise conducts a photo-documentation walk-through of the site and describes views and visual relationships, identifying essential features observed in the background, middle ground, and foreground of someone's frame of reference while being in that particular location. These descriptions are intended to support the character defining features outlined in the Hertiage report.

Figure 4.24: Contour lines overlayed on to a sattelite image. Image Credit: Author

TRANSITION TO THE MEADOW

The transition sequence to the meadow begins as you walk past the first bench along the pond's edge. In the distant view, one can see the bright light from beyond the trees, drawing visitors to the opening in the woods.

Space: Tall deciduous trees and a lower tier of undergrowth on either side of the path define the space. A canopy above head provides a sense of enclosure and low light.

Scale: One can feel small in this space, given the mature trees that surround and fill the space in every direction. Shrubs also frame the pathway at eye level, creating a visual screen and barrier between humans and the water.

Circulation: This area is a transitional space beginning from the first bench to the next open view into the pond.

Physical Elements: Largely dominated by vegetation in all directions. Soft edges and overhanging branches make this space characteristically lush.

Figure 4.25: Site plan marking the locations of the photographs. Image Credit: Author

Figure 4.26: Transition image 1. Image Credit: Author

Figure 4.27: Transition image 2. Image Credit: Author

ARRIVAL TO THE MEADOW

The meadow trail leads through an opening in between two alder strands that expand the sense of discovery and mindfulness of the visitor by directing movement through a varied landscape.

Space: This is the moment at which one walks through the dense forest and into a refreshing moment of big sky and wide open space.

Scale: The immediate transition from enclosure to vastness is a vital threshold to maintain.

Circulation: The path leads visitors up to a small slope. For some, this can mean a moment of rest once arriving upon expanding views, while for others, this can stimulate curiosity to keep moving. Also, this spot marks an intersection at which visitors can either walk towards the water's edge to a viewing platform or continue further uphill to the meadow.

Physical Elements: A juxtaposition exists between the meadow vegetation at ground level with the dense multi-story vegetated layers of the forest and marsh edges.

Figure 4.28: Site plan marking the locations of the photographs. Image Credit: Author

Figure 4.29: Meadow arrival image 1. Image Credit: Author

Figure 4.30: Meadow arrival image 2. Image Credit: Author

MEADOW EXPANSE

Initially walking along the path, a small slope blocks views of the pathway and southern field. As visitors walk closer to the top of this slope, views are expanded to include the southern slope, meadow high-point, and perimeter forest.

Space: Hedgerow plantings line the right edge of the path, with a vast expanse of the grassy ground plane that is a character-defining feature of the meadow hill.

Scale: Distant views, up close flowering plants, and wildlife activity characterize the various scales present here.

Circulation: The curvilinear path guides the visitor along with intriguing combinations of wildflowers, sparking curiosity to continue discovering what is further along the pathway.

Physical Elements: The open sky above head, distant trees on the horizon, and a soft but defined sloping ground plane create an array of visual interest.

Figure 4.31: Site plan marking the locations of the photographs. Image Credit: Author

Figure 4.32: Meadow expanse image 1. Image Credit: Author

Figure 4.33: Meadow expanse image 2. Image Credit: Author

IMMERSED IN THE MEADOW

At the midpoint along the meadow path, one can find themselves immersed in the meadow vegetation. The sound of bees buzzing and flying through the air enhances the sense of harmony and mindfulness achieved by a multi-sensory experience of nature.

Space: Surrounded by meadow grasses and wildflowers, this space should feel alive with activity.

Scale: The hill to the west will block views of the pond, creating a moment of separation from that area of the garden, making the meadow experience even more distinct.

Circulation: The pace at which one walks along the path should be slow and the multi-sensory experience should encapsulate visitors.

Physical Elements: Color, texture, and height variation of meadow vegetation should create engaging visual interest from the foreground to the background.

Figure 4.34: Site plan marking the locations of the photographs. Image Credit: Author

Figure 4.35: Meadow image with view of historic trees and the top of the hill. Image Credit: Author

Figure 4.36: Meadow image facing towards bird marsh and the top of the hill. Image Credit: Author

ON TOP OF THE HILL

At the top of the hill, there is a complete presentation of surround sound and visual stimulation. Birds in all directions call out, echoes from the pond and surrounding forest are sublime.

Space: This space is one of the most open areas of the entire reserve. Views include the pond, the surrounding perimeter of trees, and all areas of the meadow.

Scale: A contrast from the walk in the woods, this location provides a sense of openness.

Circulation: The top of the hill is an essential destination for visitors. Pictures with friends and family are likely to occur, and many other special moments.

Physical Elements: Stone pavers and large stone benches provide a place to sit and rest. Their presence gives structure and form amongst a meadow filled with wildness.

Figure 4.37: Site plan marking the locations of the photographs. Image Credit: Author

Figure 4.38: Meadow image facing south from on top of the hill. Image Credit: Author

Figure 4.39: Meadow image facing the bird marsh. Image Credit: Author

AT THE END OF THE PATH

The end of the path allows visitor another view into the pond, drawing interest in the next phase of the garden.

Space: The ground slopes from left to right as the path takes one final curve towards the adjoining pathway.

Scale: A transition from vastness to enclosure occurs along this stretch, with tall alders and the pond occupying the field of vision.

Circulation: The path winds down the hill around a large curve and comes closer to the hedgerow plantings.

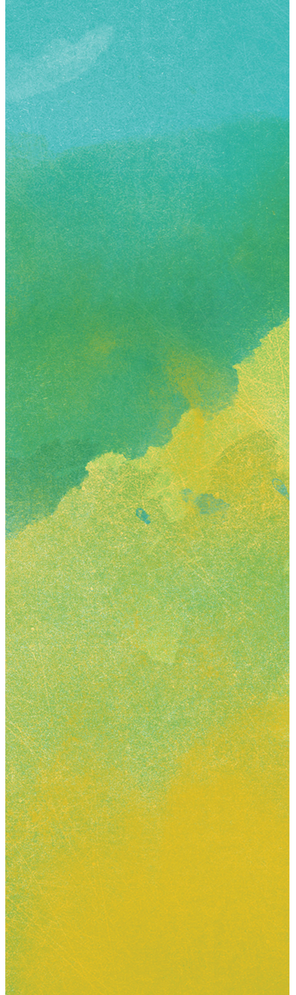
Physical Elements: Along this stretch of path, visitors come close to the hedgerow plantings along the forest edge. Wildlife activity in the hedgerow is subtly but noticeably distinct from the action within the surrounding meadow, adding a bit of interest.

Figure 4.40: Site plan marking the locations of the photographs. Image Credit: Author

Figure 4.41: Meadow image with views into the pond. Image Credit: Author

Figure 4.42: Meadow image with views of the north slope and bird marsh. Image Credit: Author

MAINTENANCE



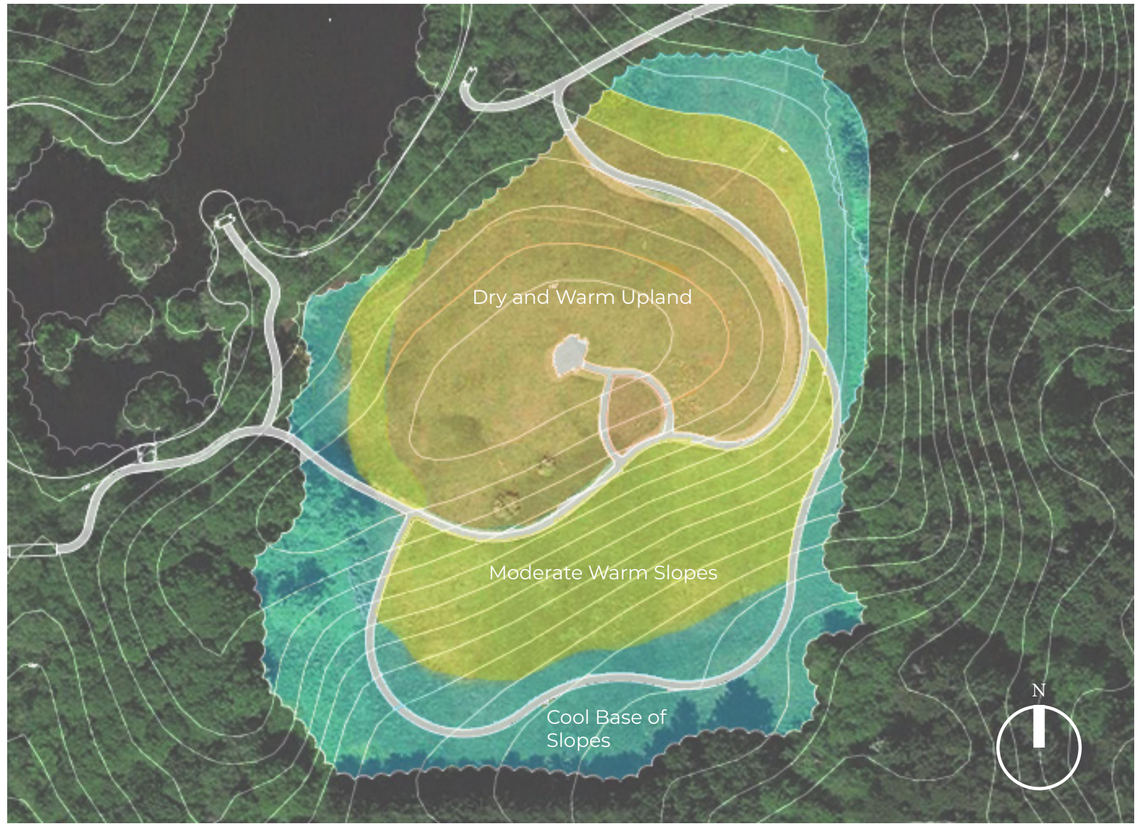


Figure 4.43: Plan view graphic showing areas of micro-climate zones. Image Credit: Author

SITE MICRO-CLIMATES

Area 1: Dry and Warm Upland

This area has moderate to gradual slopes and includes the viewing platform at the summit of the hill. Generally, this area is in full exposure seasonally, with minimal to no trees casting shadows on the land. Warm season grasses will likely thrive here, in addition to mid-western prairie species.

Area 2: Moderate Warm Slopes

This area has a moderate slope facing Southeast. One would think the Southeastern slope results in full exposure, but the large coniferous trees on the perimeter cast a shadow across the land in the early morning. The shade is most prominent in the Winter months, and this site can become saturated during these months and hold moisture through spring.

Area 3: Cool Bases of Slopes

These are the coldest and wettest areas on the site. They bump up against the hedgerow and transitioning forests. There is moderate sun exposure in these areas throughout the day.

Figure 4.44: View from on top of the hill Image Credit: Author

Figure 4.45: View of southern field. Image Credit: Author

Figure 4.46: Northern path
Image Credit: Author

Figure 4.47: Plan view graphic showing two different soil types, and locations of soil samples. Image Credit: Author

SITE SOILS:

Soils on site can be described as two predominant types:

1) Well-drained, dry loamy sands on the uplands and slopes
2) Poorly drained loamy sand with high organic matter content at the base of slopes

Soil was moderatley acid with sufficient quantities of Potassium, Calcium, and Magnesium (Diboll, 2018). It was recommended that no soil amendments be required except for supplementary calcium to support species that require a pH of 7.0 or higher to perform well. (Diboll, 2018).

Sample Site 1:
PH Balance: 5.9-6.4 Organic Matter %: 4.1

Sample Site 2:
PH Balance: 5.7-6.4 Organic Matter %: 5.0

Sample Site 3:
PH Balance: 6.2-6.5 Organic Matter %: 4.4

Sample Site 4:
PH Balance: 6.3-6.8 Organic Matter %: 2.8

Sample Site 5:
PH Balance: 6.0-6.7 Organic Matter %: 2.2

Sample Site 6:
PH Balance: 6.2-6.6 Organic Matter %: 2.8

Sample Site 7:
PH Balance: 5.8-6.7 Organic Matter %: 2.3

Sample Site 8:
PH Balance: 5.9-6.8 Organic Matter %: 3.3

Sample Site 9:
PH Balance: 6.0-6.7 Organic Matter %: 3.0

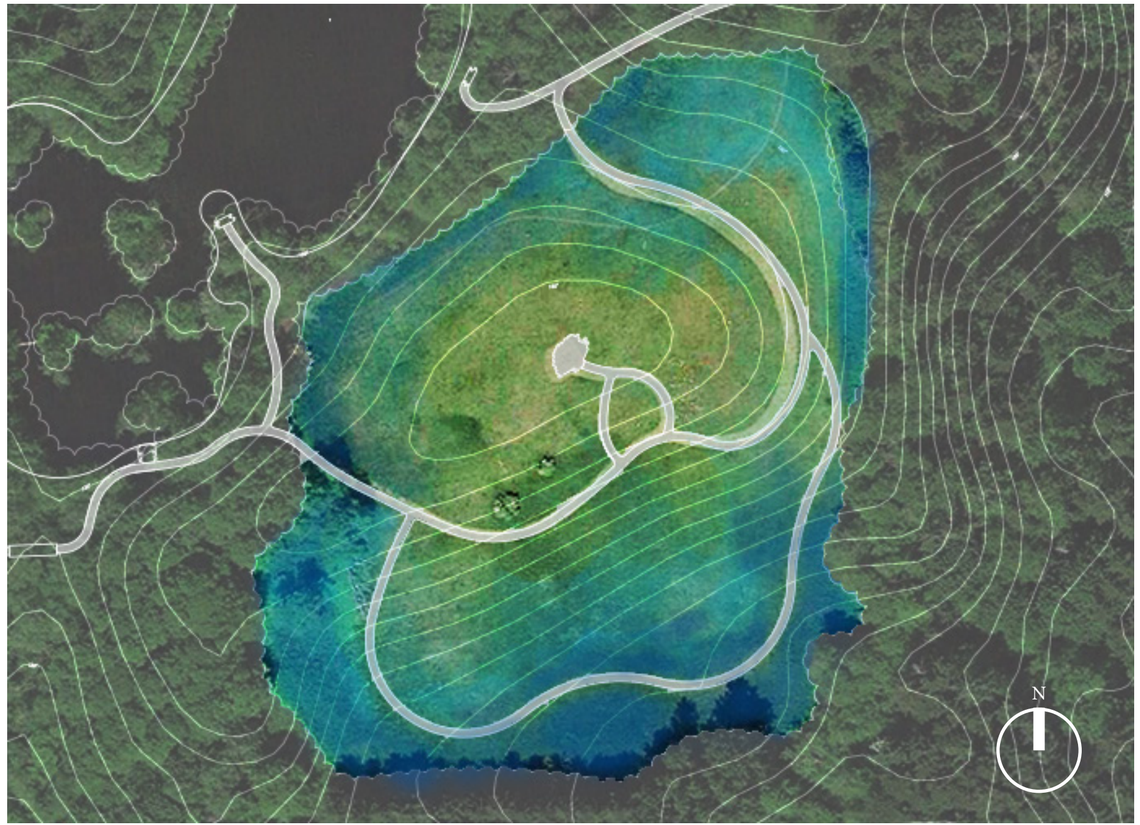


Figure 4.48: Plan view graphic showing areas of commonly of wet vs. dry conditions. Image Credit: Author

SITE HYDROLOGY

The site hydrology is what you would mostly expect by analyzing the slopes, with a few exceptions. In most cases, the bottom of the slopes are the most saturated areas, with some instances of standing water during the Winter due to poorly draining soil beneath. The Southern slope is the location with most saturation.

This analysis was created by overlapping six different satellite images from the previous six years. Each aerial image was taken in the Spring and Summer. Each area of the meadow that had consistent visual evidence of “green-ness” indicated a region that held moisture well, indicated by the dark blue hue. A lighter blue hue indicates areas of moderate moisture, transitioning to the driest areas of the meadow, shown without a blue hue.

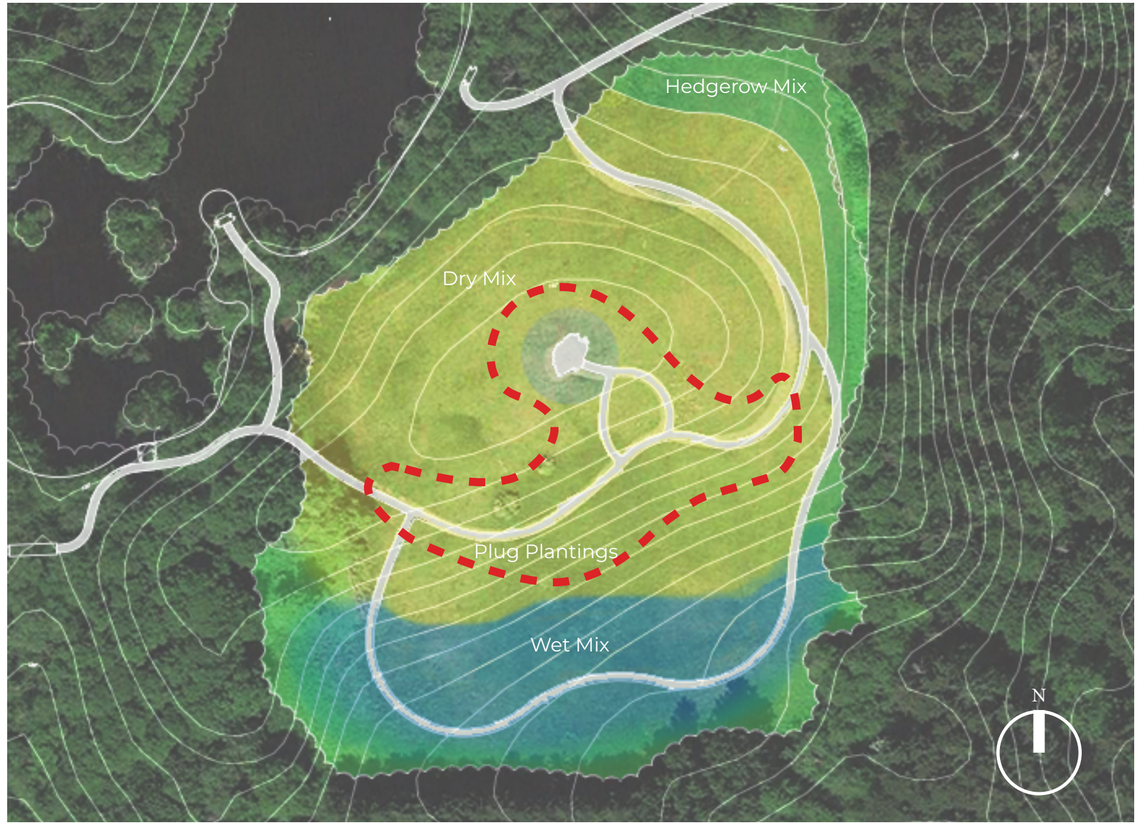


Figure 4.49: Plan view graphic showing locations of where the dry, wet, and hedgerow seed mixes were applied. Image Credit: Author

SEEDED MEADOW:

Composition: A majority perennial and grass species native to the Pacific Northwest, with a mix of Midwestern prairie perennials. The perennial species outnumber the grass species, in species diversity and quantity of seed. Outcomes related to which species will spread, establish, and bloom from year to year is mostly unexpected. Reseeding with target species seed mixes will likely be necessary to support native species proliferation.

Characteristics: Emphases of biodiversity, ecological fit, and dynamism.

Figure 4.50: South Puget Sound prairies
Image Credit: South Sound praires

CORRIDOR GARDEN:

Composition: Contains most of the same species as the original seed mix Contains a majority of the same species as the seeded meadow area with a higher amount of Midwestern species.

Characteristics: Emphases of controlled wildness, stylized, choreographed. The shape, size, and form of the plants, their vegetative features, and flowers are taken into consideration as part of the interest along the path.

Figure 4.51: Piet Oudolf meadow Image Credit: Piet Oudolf

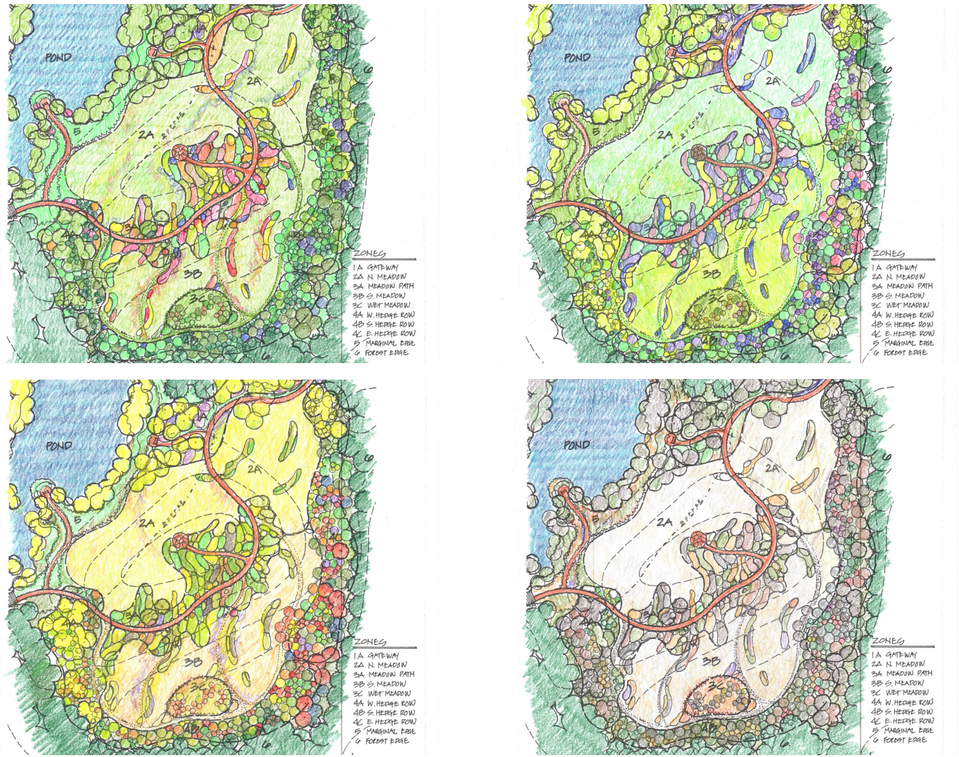


Figure 4.52: Plan view illustrations showing the intention of seasonal patterns and interest across planting zones.
Image Credit: Fischer Bouma Partnership

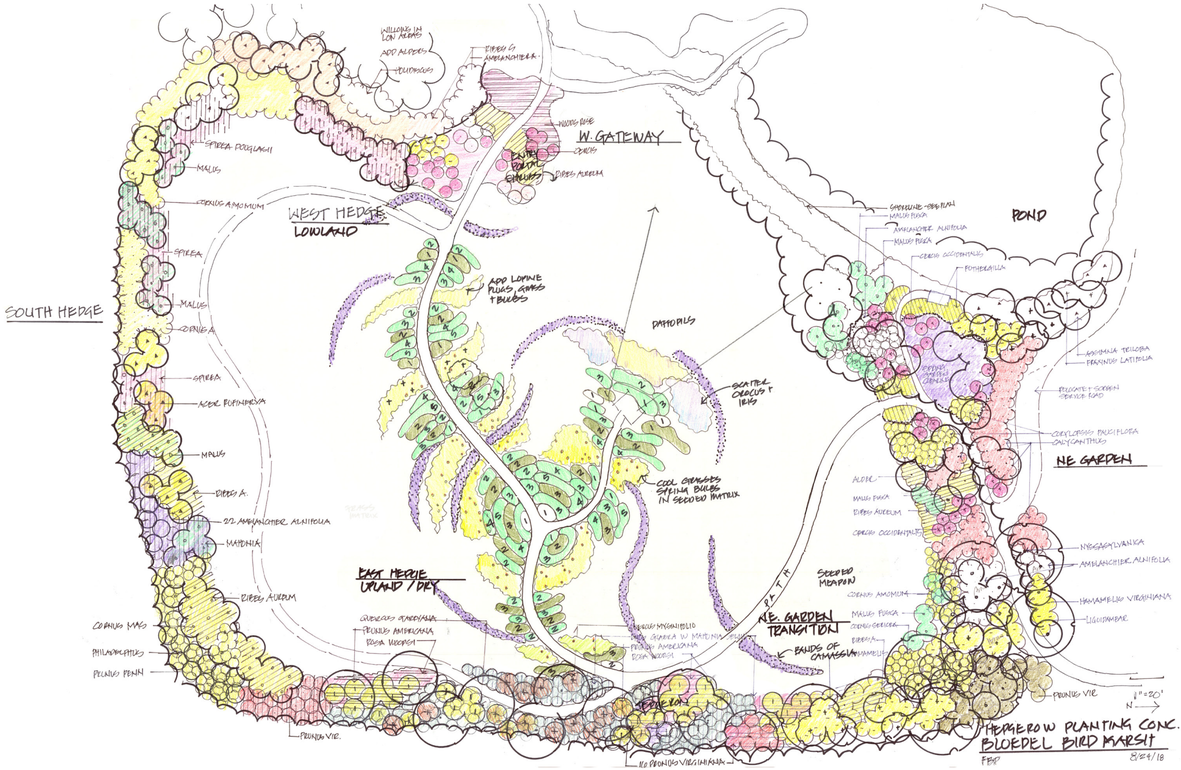


Figure 4.53: Illustrated planting plan showing headgerow planting plan, and the corridor garden plug planting plan.
Image Credit: Fischer Bouma Partnership

HORTICULTURAL STANDARDS

1) Height Variation
2) Species Diversity
3) Seasonal Color/Overlapping Blooms
4) Contrasting Textures and Plant Form
5) Species Clumping
6) Control of Invasive Weeds and Encroachment of undesired vegetation
7) Protected habitat for wildlife

These standards are meant to guide maintenance decisions by setting clear expectations for how the garden should be performing horticulturally. These standards should allow for flexibility and variation across different parts of the garden, as it is expected that areas of the garden will evolve and change at different rates and in different ways from each other.

The corridor refers to plantings along and nearest to the main pathway. These areas will require a higher intensity of management and care compared to the outer seeded meadow areas. The corridor and seeded meadow areas share the same horticultural standards but differ in the approach towards achieving these standards.

1) Maintain Height Variation

Height variation creates visual interest across the foreground, middle ground, and background within one's field of view. Grasses and perennial varieties have been chosen and designed to sustain shape, size, and color in every season and across visual ranges. Refer to the original planting plans before determining that a plant should be replaced with another species or different kind of plant altogether.

CORRIDOR:
This will be of most importance in the corridor garden. Attention should be paid to the variation between the long-lived perennials and clumpings of grasses as they develop over the years. Ensure that there is consistency in height variation along the entirety of the path.

SEEDED MEADOW:
This standard is less critical within the seeded meadow. Perennials, biennials, and annuals will spread and create a naturalistic canvas that results in nature's composition and interpretation of height variation. In some cases, uniformity can result in a smooth ground plane that is continuous with the character-defining features in the HLR.

2) Maintain High Species Diversity

Pollinators benefit from a high diversity of species. Different flower shapes and structures attract different pollinators. Typically with an increase in floral species richness, an increase in insect diversity and abundance will follow. This outcome has a beneficial influence up the food chain. Some native pollinators are very selective when it comes to choosing which flower to pollinate. The selectivity is dependent on several factors such as flower color, flower shape, ease, and access to pollen.

CORRIDOR:
Species diversity in the corridor garden will work well in tandem with standards of seasonal color. Because the corridor garden has a higher amount of Mid-Western species, these varieties may tend to outgrow and compete Pacific Northwest Native perennials and grasses. It will be essential to care to preserve northwest native species while also allowing the showstoppers to thrive.

SEEDED MEADOW:
Given that the seeded meadow will evolve more dynamically and have less maintenance intensity than the corridor garden, it will be important to track the success of species establishment and naturalization.

3) Maintain Seasonal Color and Overlapping Blooms

Pollinators benefit from nectar and pollen availability across seasons, as some pollinators will emerge and forage at different times of Spring and Summer. For some native pollinators, they will rely on a consistent supply of their host flowers year after year.

CORRIDOR:
Similar to the height variation standard, this standard intends for a pattern of color along the pathway. Refer to the seasonal zones within the planting plan to understand which zones highlight a given season.

SEEDED MEADOW:
Overlapping blooms will allow for an impressive display of color across the seeded meadow area. Wildflowers carpeting the landscape is a characteristic of Puget Sound prairies and wild meadows. Some wildflowers will have more profuse blooms than others depending on the moisture and climate of the season.

4) Maintaining Contrasting Textures and Plant Forms

Contrasting textures provide visual interest and ecological benefit. Growth habit, leaf structure, flower shape and size, and seasonal appearance support principles in garden design.

CORRIDOR:
Plants within the mixes have been chosen for their uniqueness in form. It is beneficial to consider flower and plant forms such as spires, buttons and globes, plumes, daisies, umbels, and screens and curtains. In regards to grasses, movement, seasonal interest, distinct winter shape, and light catchers are a focus.

SEEDED MEADOW:
Following the same logic as within the corridor garden, this information should be considered when selecting plants to re-seed and encourage the establishment of new flowers from year to year.

5) Maintain Clumpings of Species and Groupings of intended Plant Combinations

Clumps of flowers help pollinators locate them. Many organisms of the same species often improve plant establishment and make maintenance between clumps easier.

CORRIDOR:
Blocks of planting have been specifically designed to choreograph a sequence of seasonal color along the pathway. Pairings of perennials within a planting zone are intended to balance, contrast, and complement each other.

SEEDED MEADOW:
A plant's genetic adaptation will likely determine groupings of perennials, biennials, and annuals to climate and soil conditions. As long as mono-cultures do not dominate areas of the seeded meadow, supplementary seeding will allow for natural clumping of plants to form.

6) Control of Invasive Weeds and Encroachment of undesired vegetation

Once the meadow has successfully established, it will be a self-sustaining landscape comprised of interdependent and interacting plant communities. Ideally, invasive grasses will be kept under control and out-competed by established perennials by year five, using a sethoxydim and clethoxydim treatment. Any occasional herbaceous weeds will need to be hand weeded, mowed, and spot-sprayed.

CORRIDOR:
Weeding should occur more frequently and intensively in the corridor garden. This should allow perennials to spread, establish, and impress visitors. Once intended grasses and perennials are well-established, this should minimize the resources and labor dedicated to weeding.

SEEDED MEADOW:
The size of the seeded meadow will provide a challenge for managing invasive weeds. Mowing and herbicide treatment are likely to be the best use of resources to keep undesired vegetation from dominating. Re-seeding annually will allow for targeted species to compete with invasive weeds.

7) Protect Wildlife Habitat

Wildlife activity occurring in the Bird Marsh and Meadow is a fundamental part of the visitor experience. Maintenance actions should take care not to disturb or hinder the activities of nesting birds, overwintering insects, and other wildlife habitat. Attentive observation of wildlife activity by the staff can help inform appropriate maintenance decisions.

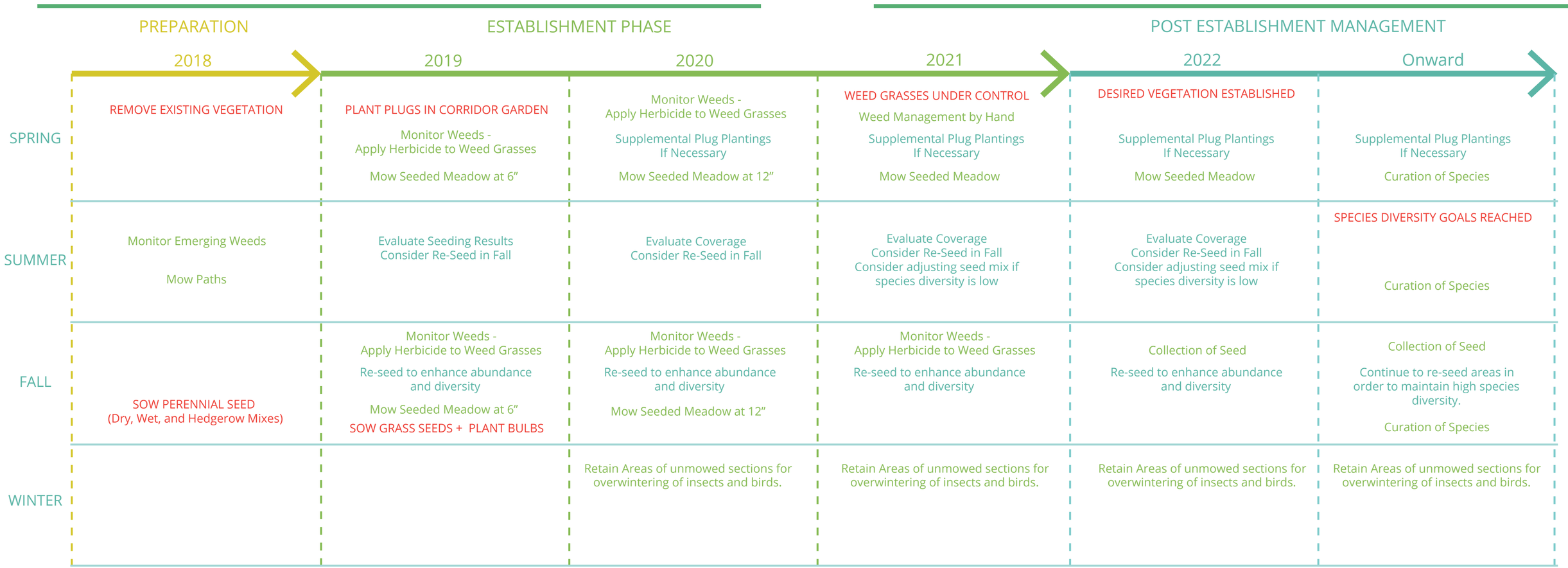
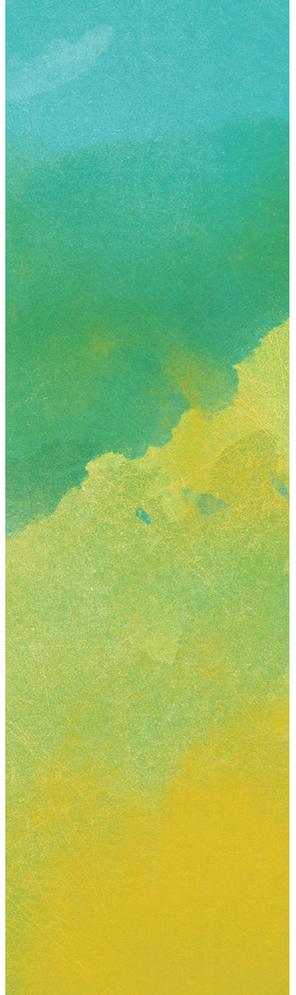


Table 4.1: Table outlining maintenance milestones and weed control activities. Image Credit: Author

LANDSCAPE PERFORMANCE TARGETS



LANDSCAPE PERFORMANCE TARGETS

Landscape Performance Series, developed by Landscape Architecture Foundation, is a way to asses how well design goals are being met by setting project performance targets and quantifying the measurable benefits of those targets. Case study investigations are conducted on a per-project basis, and performance targets are unique to each project. All targets are organized under environmental, social, and economic goals.

With the increasing frequency of projects that rely on complex ecosystems for design performance, the importance of establishing benchmarks and methods to quantify performance is crucial to the sustainability of those projects.

VALUES OF MEASURING PERFORMANCE:
1. Feedback on design performance aspects of the project
2. Promote Evidence-Based Design
3, Increases client exposure and potential to generate new business
4. Demonstrate your firm's mission
5. Identify cost saving measures
6. Mitigate Risk and maximize investment
7. Comply with regulatory requirements

ENVIRONMENTAL BENEFITS

Benefit 1: Increase Biodiversity

Target: Monitor the populations of bird species within the Bird Marsh and Meadow.

Potential Methods:

1. Continue Self Developed Surveys
2. Conduct Citizen Science Survey courtesy of bird conservation organization
3. Agency or Institution that conducts research on ornithology

Target: Monitor the populations of pollinators and within the Bird Marsh and Meadow.

Potential Methods:

1. Establish bee hotels to observe behavior
2. Use Xerces Society Citizen Science Surveys to cross compare with results across the country.
3. Collaborate with institution or agency doing research in etymology.
4. Develop in field-survey to be used by employees, visitors, or volunteers

Benefit 2: Native Plant Conservation

Target: Count the species richness of native wildflowers in the meadow.

Potential Methods:

1. Collect seed seasonally and grow in test plots in nursery.
2. Develop in house field survey using quad-rat or transect method for species diversity count.
3. Collaborate with institution or agency doing research in botany, ecological restoration, or

SOCIAL BENEFITS

Benefit 1: Increased Visitation

Target: Determine the overall number of visitors annually; determine how many visitors came to see the meadow garden specifically.

Potential Methods:

1. Visitation entry and exit surveys
2. Manual tracking at front desk by asking visitors
3. Online surveys

Benefit 2: Educational Programming

Target: Develop education based programs led by garden staff and track the outcome on visitor experience.

Potential Methods:

2. Track Visitation returns as result of education programming.

Benefit 3: Health And Wellness

Target: Track the potential health effects of spending time in nature

Potential Methods:

1. Post Visit Surveys, Online Surveys
2. Continue Strolls for Wellness Surveys
3. Collaborate with institution or agency researching sociology and/or environmental psychology.

ECONOMIC BENEFITS

Benefit 1: Minimize Horticultural Expenses

Target: After establishment phase of meadow is reached, track horticultural expenses to determine relative cost associates with meadow management versus other garden areas.

Potential Methods:

1. Accounting

Developing performance metrics for landscape projects is becoming increasingly important for cross-comparison of the various performance values that projects can achieve socially, economically, and environmentally. Measuring and monitoring performance can occur across various levels of effort and scientific rigor.

GENERAL OBSERVATION

General observations don't need to be logged or documented rigorously, but in some cases, it could be useful to record an observation as part of management practices. It is likely general observations happen at random and far more frequently than other levels of monitoring.

SELF-DEVELOPED SURVEYS

Formalized methods for recording observations. Spreadsheets to record observations of pollinator species, interactions with flowers, and general counts of biological activity. Useful information to the extent that it is worth logging. Would likely influence staff decision making.

CITIZEN SCIENCE

Xerces society provides robust spreadsheets, forms, and resources to allow for organized monitoring activities of pollinator and invertebrate species. These follow a specific protocol that results in data that can be compared across other organizations or groups engaging in citizen science.

INSTITUTIONAL RESEARCH

Contracts and negotiations with research institutions to conduct studies on site that contribute to the broader scientific community. Depending on the data could prompt lead management to re-assess ecosystem targets, objectives, and management strategies.

Figure 4.54: Pollinator landing on a flower
Image Credit: Xerces Society

Figure 4.55: Birder focused on other birds
Image Credit: Mavani Photography

Figure 4.56: Group field survey
Image Credit: Virginia Working Landscapes

Figure 4.57: Independent field survey
Image Credit: The Nature Conservancy

Chapter 5: Conclusion

Over the course of this professional project thesis, there were three primary areas that further developed my thinking as a landscape designer.

Firstly, I was inspired to learn how versatile and effective the meadow planting style can be. Meadows can provide ecological function, beauty, and education. Meadow gardens can vary widely in style, with relevance to environmental restoration, horticulture, response to climate change, and numerous applications within urban environments. As a tool within landscape architecture, meadow gardens can potentially reduce maintenance costs, provide ecological function, and promote the value of biodiversity and ecological planting. As an extension of meadow gardens, ecological planting is a concept I envision becoming more relevant in the vernacular of landscape architecture. I have learned that designing effective systems requires an understanding of the components that make the system function. Ecological planting as part of a design framework can provide valuable strategies.

Secondly, the scope of my thesis included a deliverable: to complete a stewardship plan to be given to Bloedel Reserve. Upon reflection of the process to develop a stewardship plan as part of an experimental academic exercise, I find that there is significant value in repeating this process in future practice. One critical aspect I learned for ongoing stewardship plan development, is that it must tailor to and satisfy the unique needs of the stakeholders involved with the project. Consequently, it is unrealistic to assign a universal structure or standard organization for what a stewardship plan

should be. This stewardship plan was structured to include a summary of the design vision, the intended values of visitor experience, and developed adaptive strategies for maintenance and monitoring. Without my involvement with Bloedel Reserve, they would not have had a formal document that organized and archived both the significant aspects of the design process or documentation of the project's ongoing vision. The archival value alone of a stewardship plan is worth considering budgeting for and folding into professional practice. Ultimately, time will tell how valuable the stewardship plan for Bloedel Reserve will be as a maintenance resource, and if the recommendations and strategies for performance will be adopted.

Lastly, throughout this process I developed a stronger sense of design philosophy. I now question the importance of landscape architects serving as stewards of their designs. Perhaps if there was economic incentive for the long-term management of our projects, we would be more involved in the outcomes of our designs. From a philosophical perspective, I view stewardship as an opportunity to commit to the change and evolution of the places and people we influence through our creative thinking. For landscape architects, these places are often landscapes within the built environments, influencing a range of economic classes and cultures. Observing the commitment of some of the members of the staff at the Bloedel Reserve placed this perspective in the forefront of my thinking. When I consider the commitment and vision led by Prentice Bloedel and landscape architect Richard Haag, as well as their influence on shaping this garden, it inspired me to strive for projects in the future that demand ongoing attention and commitment, for those may bring lasting fulfillment.

Reflection

My primary goal at the beginning of this thesis was to utilize my skills and curiosity to develop something useful for the Bloedel Reserve. I was fortunate to be able to combine my schoolwork with collaboration between Fischer Bouma Partnership and the Bloedel Reserve. I am a firm believer in learning by doing. Taking multiple site visits to the Reserve recharged my curiosity and excitement for this project. Engaging with staff at Bloedel, and with Sandy and Jeff from Fischer Bouma, was an opportunity to ask questions and truly get a grasp for what it takes to facilitate a project such as the meadow garden at Bloedel Reserve. One of the greatest aspects of engaging in a professional project is that it will continue to evolve outside of the scope of this thesis. During this thesis process I had many challenges with leading the communication between my work, school, and Bloedel, but conclusively, continuing to develop this skill will prove valuable in the workplace. Hopefully the conversations, outcomes, and deliverable as a result of this thesis will provide value and knowledge to the Bloedel Reserve, to Fischer Bouma Partnership, and to the field of landscape architecture. For me, it strengthened my motivations, skills, and philosophy towards designing enduring landscapes such as the one at The Bloedel Reserve.

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