Garry Oak Ecosystem Pollinator Meadow at the Reconciliation Pole

SEEDS REPORT

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Cover photo: Suhaila Ng

We acknowledge that the research meadow described in this study lies on the traditional, ancestral, unceded territory of the Musqueam people, whose stewardship and connection to this land span time eternal. Situated near the Reconciliation Pole, the space serves as a poignant reminder of the complex histories of colonization and its ongoing impacts on Indigenous communities. This space is not just a site of study but a place to reflect on the enduring relationships between the Musqueam people, their cultural traditions, and the land's rich biodiversity.

By conducting research here, we aim to honor and learn from these histories, holding in our work a commitment to reconciliation, respect, and the recognition of Indigenous knowledge systems. We approach this space with humility and gratitude, mindful of our role as guests on this land and of the responsibility to contribute to its care in ways that respect its past and support its future.

Practitioner's SUMMARY

Background

- Urban green spaces and university campuses often prioritize a traditional well-groomed and pristine landscape aesthetic over ecological function, leading to biodiversity loss and missed opportunities for cultural integration (Miller & Hobbs, 2002; Hitchmough & Dunnett, 2004).
- The Garry Oak ecosystem, a rare and declining habitat in British Columbia, offers a unique opportunity to enhance urban landscapes with native plants that support ecological integrity and cultural heritage (Lea, 2006; Barton & Lindhjem, 2020).

Goals and Objectives

- **Revitalize Urban Landscapes**: Socialize Garry Oak meadows as functional, aesthetically pleasing, and sustainable landscapes on UBC campus.
- **Promote Biodiversity**: Foster native flora and fauna, contributing to habitat restoration.
- **Advance Reconciliation**: Celebrate and incorporate Indigenous plant knowledge and cultural significance.
- **Create a Scalable Model**: Develop practices that can be replicated in urban areas worldwide.

Methods

- **Site Selection**: Focus on areas surrounding UBC's Reconciliation Pole for their cultural and ecological significance.
- **Species Selection**: Emphasize native plants like Yarrow, Nodding Onion, and Woolly Sunflower, selected for their adaptability, aesthetic appeal, and ecological benefits.
- **Collaborative Input**: Connect with local Indigenous communities, botanists, ecologists, and urban planners to inform project design and implementation.
- **Implementation Strategies**: Utilize sustainable planting and maintenance practices to ensure long-term success.

Key Findings

- **Ecological Benefits**: Native species improve soil health, enhance pollinator networks, and increase biodiversity.
- **Cultural Relevance**: Highlighting native plants strengthens connections to Indigenous heritage and traditional ecological knowledge.
- **Aesthetic Appeal**: Garry Oak meadows offer a visually stunning alternative to conventional landscaping.
- **Climate Resilience**: Native plants are better adapted to local conditions, reducing water and maintenance needs.

Conclusions

- Native Garry Oak meadows present a transformative opportunity to integrate sustainability, biodiversity, and cultural heritage in urban landscapes.
- This initiative can redefine urban green spaces, creating dynamic environments that serve ecological, cultural, and community needs.
- With proper implementation, this project offers a scalable model for cities worldwide to embrace sustainability and reconciliation.

Next Steps

- Pilot planting events with ongoing monitoring and community involvement.
- More meadows are being created in other spaces on campus.

Executive SUMMARY

This report explores the integration of native plant species into urban landscapes to promote ecological, cultural, and aesthetic benefits. With increasing urbanization threatening biodiversity (Miller & Hobbs, 2002; Cameron et al., 2012), this study emphasizes the need to create sustainable green spaces that support native ecosystems while addressing climate resilience and fostering community engagement.

The research objectives include assessing the suitability of native Garry Oak meadow species for urban landscaping and developing a pilot project at the University of British Columbia (UBC). The selected species—such as *Achillea millefolium* (Yarrow), *Allium cernuum* (Nodding Onion), and *Eriophyllum lanatum* (Woolly Sunflower)—were chosen for their ecological significance and low maintenance requirements (Boyer, 2013; Tallamy & Shropshire, 2009), as well as compatibility with urban settings (Rupp & Stohlgren, 2016).

Methodology involved extensive literature review and analysis of Indigenous knowledge systems, particularly the ecological stewardship practices of the Coast Salish peoples– including the Musqueam First Nation, whose ancestral lands encompass the UBC campus. The study also incorporates modern horticultural techniques to aid in the feasibility of establishing and maintaining these meadows in a highly urbanized environment.

Key findings indicate that Garry Oak meadow species provide numerous ecosystem services, including supporting pollinator populations, enhancing soil health, and contributing to urban biodiversity. Their cultural significance further underscores their role in reconciliation efforts, aligning with UBC's commitment to decolonization and sustainability.

This report concludes with actionable recommendations, including maintenance advisements, a phased implementation plan, and educational outreach initiatives to engage the campus community. These steps aim to inspire broader adoption of native plant landscaping across urban settings.

This project envisions a future where urban green spaces serve as living exemplars of biodiversity conservation and cultural preservation. By fostering ecological resilience and integrating Indigenous flora into urban spaces, this initiative not only aims to enhance urban landscapes but also to set a precedent for sustainable and inclusive urban design practices globally.

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Introduction and Background

Urban landscapes are increasingly recognized for their vital role in environmental sustainability, biodiversity conservation, and community well-being (Tallamy & Shropshire, 2009). The integration of native plant species into urban settings can enhance ecosystem resilience, support local wildlife, and uphold cultural heritage (Boyer, 2013). Among these, the Garry oak (*Quercus garryana*) ecosystem, native to the Pacific Northwest, holds significant ecological and cultural importance (Lea, 2006). However, urbanization and habitat fragmentation have led to the decline of these ecosystems, necessitating targeted conservation efforts (Barton & Lindhjem, 2020).

The University of British Columbia (UBC) Vancouver campus, with its commitment to sustainability and innovation, presents an ideal setting for pioneering research in urban landscapes using native species. This research project aims to establish herbaceous Garry oak meadow plots on the UBC campus, providing a living laboratory to evaluate their performance and contribute to the broader knowledge base of sustainable urban landscapes. The research seeks to address the challenges and opportunities associated with integrating native plants into urban settings, emphasizing their ecological benefits, adaptability, and contributions to biodiversity (Kirkwood & Dunnett, 2007).

Research Relevance

The anticipated value of this research is multifaceted. Environmentally, it aims to enhance urban biodiversity by providing habitats for pollinators and other wildlife, thereby contributing to broader societal goals of sustainability and conservation (Tallamy & Shropshire, 2009). On a campus level, this project aligns with UBC's sustainability initiatives, offering practical insights and methodologies for incorporating native species into urban landscapes. Additionally, it serves as a model for other urban areas looking to implement similar projects, fostering community engagement and education about the importance of native plant conservation.

This research aligns closely with several of UBC's strategic frameworks, particularly the Campus Vision 2050 and the Climate Action Plan 2030 (CAP 2030). These initiatives emphasize the importance of creating resilient and restorative landscapes, integrating biodiversity, and promoting sustainability in campus planning and operations.

This project supports the biodiversity and resilience goals of CAP 2030, which highlight enhancing natural systems, applying climate-adaptive plantings, and reducing the ecological footprint of urban spaces. By introducing native Garry Oak meadow species, the research contributes to habitat restoration and species conservation, directly addressing biodiversity enhancement as described in section 5.3.1 of CAP 2030. This project also aims to contribute to furthering UBC's commitment to integrating Indigenous land stewardship and ecology, as outlined in both CAP 2030 and the Campus Vision 2050 plan, by dedicating resources to the development of native species incorporation into urban environments. At the institutional level, this project exemplifies the "living laboratory" approach envisioned by Campus Vision 2050. By using the campus as a testing ground for sustainable land use practices, the research aligns with UBC's goals for fostering innovative, interdisciplinary research and education. By adding to community engagement through hands-on restoration work and educational outreach, the project also contributes to CAP 2030's objective of embedding sustainability across the university and into the wider community.

Beyond UBC, this research offers a scalable model for urban biodiversity initiatives. It supports the vision of enhancing ecological connectivity between urban and natural systems, a key strategy for mitigating climate impacts and improving resilience on a broader scale. This alignment with UBC's strategic priorities ensures that the project not only supports ecological health but also strengthens cultural, educational, and community connections, contributing to a resilient and inclusive campus ecosystem

Project Context- the Importance of Garry Oak Ecosystems

This project was identified as a priority due to the increasing recognition of the ecological and cultural value of Garry oak ecosystems and the urgent need for effective urban biodiversity conservation strategies (Lea, 2006). Garry oak ecosystems are native to the Pacific Northwest and are characterized by open woodlands dominated by Garry oak trees (*Quercus garryana*), along with a rich assemblage of native grasses, wildflowers, shrubs, and forbs. These ecosystems feature plants such as camas (*Camassia spp.*), woolly sunflower (*Eriophyllum lanatum*), farewell-to-spring (*Clarkia amoena*), and common yarrow (*Achillea millefolium*). The biodiversity supported by Garry oak ecosystems provides critical habitat for species like Western bluebirds, pollinators such as bumblebees, and rare plants. However, these ecosystems are increasingly threatened by urbanization, invasive species, and habitat fragmentation, making their conservation an urgent priority (Barton & Lindhjem, 2020).

Project Purpose, Goals, and Objectives

The primary purpose of this project is to enhance the understanding and practical application of native planting in urban environments, with a focus on identifying which approaches are best suited to the specific ecological context of the UBC Vancouver campus. The specific goals are:

1. To assess the performance of herbaceous Garry oak meadow species in urban landscapes.
2. To document the effectiveness of different planting methods, locations, companion species, and propagation techniques.
3. To develop practical resources, including plant identification guides and landscape technique manuals, to support future urban landscaping projects with native species.
4. To engage stakeholders and foster collaboration between academic researchers, campus facilities management, and community members.

By achieving these goals, the project aims to provide actionable insights and resources that can be utilized for sustainable urban landscaping projects, promoting ecological resilience and biodiversity on the UBC campus and beyond.

Introduction to Native Plant Integration in Urban Landscapes

Urban landscapes are increasingly recognized for their potential to enhance environmental sustainability, support biodiversity, and improve community well-being (Tallamy & Shropshire, 2009). Native plant species, particularly those adapted to local conditions, offer numerous benefits, such as resilience to climate change, support for pollinators, and cultural significance (Boyer, 2013). However, integrating native plants into urban environments presents a complex set of challenges. These include the difficulty of selecting species that can thrive in altered urban conditions—such as compacted soils, pollution, and limited water availability—as well as balancing aesthetic preferences with ecological function. Urban spaces often prioritize human-centric design and may lack the ecological knowledge necessary for planning diverse, sustainable plantings (Hitchmough & Dunnett, 2004). Additionally, there are logistical hurdles, such as overcoming resistance from communities accustomed to non-native or ornamental landscaping and managing long-term maintenance needs. Successfully integrating native plants thus requires a comprehensive, interdisciplinary approach that considers both ecological principles and the practical constraints of urban development.

Previous studies have shown that native plants are well-suited to local conditions and can thrive with minimal maintenance once established (Gordon & Davis, 2016). Emphasizing the importance of designing native plant gardens that celebrate regional flora, such landscapes can enhance urban biodiversity and contribute to ecological resilience (Hitchmough & Dunnett, 2004). However, the practical aspects of integrating native species into urban environments, such as appropriate planting methods, species selection, and maintenance practices, require further research and documentation (Kirkwood & Dunnett, 2007).

Existing Research and Knowledge Gaps

Despite widespread recognition of the benefits of native plant landscaping in urban areas, the knowledge gaps identified in the literature span both global and regional scales. On a global level, empirical studies quantifying native species' growth patterns, habitat preferences, and ecological interactions in cities remain scarce (Miller & Hobbs, 2002; Cameron et al., 2012). Regionally, particularly in the Pacific Northwest and within the Garry Oak ecosystems of British Columbia, these gaps are even more pronounced. Few studies have examined how Garry Oak meadow species perform under local climate, soil, and microhabitat conditions (Barton & Lindhjem, 2020), and practical tools such as plant identification guides and technique manuals tailored to this region are virtually nonexistent (Rupp & Stohlgren, 2016).

The UBC Vancouver campus, situated within the traditional territory of the Musqueam people and characterized by remnant Garry Oak habitats, is uniquely positioned to address both global and region-specific research needs. By establishing and monitoring herbaceous Garry Oak meadow plots here, this project will contribute empirical data on native species performance in a Pacific Northwest urban context and develop the first locally relevant resources to support native plant urban landscaping. In doing so, it will bridge the gap between broad theoretical benefits and the practical, site-specific knowledge required for successful implementation.

Research Methodology

The research methodology for this study is based on a mixed-methods approach, integrating both qualitative and quantitative techniques to examine the integration of herbaceous Garry oak meadow species in urban landscapes; in particular, the UBC Vancouver campus landscape. The philosophical foundation of the research is pragmatism, which emphasizes the practical implications of research findings and the use of various methods to address complex research questions (Miller & Hobbs, 2002). The theoretical framework is rooted in landscape ecology and conservation biology, focusing on the interactions between native plant species and their urban environments.

Importantly, this work is situated within the Pacific temperate coastal ecosystem of UBC Vancouver - 994 acres on the western edge of the Point Grey peninsula, surrounded by Pacific Spirit Regional Park's second-growth mixed coniferous-deciduous forests and estuarine habitats- which provides a site-specific context for assessing how Garry Oak meadow species perform under local climate, soil, and disturbance regimes ((University of British Columbia Campus & Community Planning, 2023).

The overall strategy involves a systematic approach to collecting, analyzing, and interpreting data. This includes a comprehensive literature review (secondary data) and empirical data collection through direct observation and experimentation (primary data). This approach ensures a thorough understanding of the subject matter and allows for the validation of findings through triangulation.

Secondary data collection involved an extensive review of existing literature on Garry oak ecosystems and the use of native plants in urban landscaping. The selection criteria for the literature included peer-reviewed journal articles, books, and reports published in the last two decades. Keywords used in the search included "Garry oak ecosystems," "urban landscaping with native plants," "biodiversity conservation in urban areas," and "native plant integration in urban landscapes." Databases such as JSTOR, Google Scholar, and the UBC Library were utilized to gather relevant sources. Additionally, insights were incorporated from personal communication with Dr. Peter Arcese, which helped refine site-specific planting and monitoring protocols.

The types of secondary data collected included historical data on Garry oak ecosystems, findings from previous studies on native plant performance in urban settings, and theoretical discussions on the ecological and cultural significance of native plant conservation.. This review provided a foundational understanding of the current knowledge landscape and identified research gaps addressed by this study.

Primary data collection encompassed two complementary components. First, herbaceous Garry Oak meadow plots were established across representative microhabitats on campus. Planting, propagation, and regular monitoring protocols—weekly growth measurements, photographic records, and qualitative assessments—were used to track survival, biomass accumulation, and community interactions from May 2024 through April 2025.

Second, a germination trial of *Plectritis congesta* (sea blush) was conducted in collaboration with Dr. Arcese in the UBC Faculty of Forestry to investigate seed age, source population, and seed morphology (winged vs. unwinged) as drivers of germination success. Seeds collected from five populations adjacent to Vancouver Island (Isabella, Clive, Piers, Pellow, and Shell) between 2005 and 2024 were refrigerated until experimentation; 2024 seeds received a four-day windowsill ripening followed by two days of refrigeration. Except for the small 2024 cohort, yearly cohorts were pooled and sown in trays of standard potting substrate at a depth of ½ inch, with six seeds per cell (three winged, three unwinged) on a greenhouse mist bench misted every 17 minutes for 21 days. Emergent seedlings were then transplanted into the research meadow to establish.

Site Selection and Preparation

The study site, a meadow surrounding the UBC Reconciliation Pole outside the Forest Sciences Centre, was chosen for its ecological suitability for Garry oak meadow species, its accessibility for educational purposes, and its cultural significance (Figure 1). Site preparation included soil depth testing, removal of unwanted non-native species, and plot clearing to create optimal planting conditions. After consultation with community experts affiliated with the UBC Faculty of Forestry, the Beaty Biodiversity Museum Indigenous Garden, UBC Campus and Community Planning, and the Pacific Spirit Park Society, a border of invasive species around each plot was intentionally left in place to mitigate soil erosion and serve as a barrier to prevent foot traffic.

Species Selection and Planting

A native seed mix was planted in October 2023 by UBC Campus & Community Planning prior to the beginning of this SEEDS project in order to fill in the space and prevent unwanted invasive species from overtaking the space. This seed mix included seeds from Alaska Brome (*Bromus sitchensis*), Camas (*Camassia quamash* or *Camassia leichtlinii*), Farewell to Spring (*Clarkia amoena*), California Oatgrass (*Danthonia californica*), Blue Wildrye (*Elymus glaucus*), Fireweed (*Chamerion angustifolium*), Tufted Hairgrass (*Deschampsia cespitosa*), Indian Blanket (*Gaillardia pulchella*), Roemer's Fescue (*Festuca roemeri*), Native Red Fescue (*Festuca rubra*), Gumweed (*Grindelia spp.*), and Large Leaf Lupine (*Lupinus polyphyllus*).

Plant propagules were then sourced from Satinflower nurseries on Vancouver Island on April 30th, 2024 and planted in the meadow over the next two weeks. A diverse range of herbaceous Garry oak meadow species was selected, including *Achillea millefolium* (Yarrow), *Allium cernuum* (Nodding onion), *Grindelia stricta* (Entire-leaved gumweed), *Cerastium arvense* (Field chickweed), *Eriophyllum lanatum* (Woolly sunflower), *Elymus mollis* (Dune wildrye), and *Primula pauciflora var. pauciflora* (Few-flowered shooting star). Selection criteria were based on their ecological roles, cultural significance, price per propagule, and adaptability to urban conditions.

All species were planted through plug planting. Variations in plant densities, moisture levels, soil depths, and companion species combinations were also evaluated. Detailed documentation of the planting process, including species selection criteria and techniques, was maintained for future reference (see appendix).

Monitoring and Data Collection

Regular monitoring of the research plots was conducted to record plant growth and health. The monitoring involved conducting weekly checks on the plants, measuring their growth, taking photographs, and assessing their overall condition. Data collection tools included qualitative and quantitative surveys, photographic records, and manual measurements of plant growth and health.

The data collection timeline spanned from May 2024 to April 2025, with daily observations and monthly comprehensive assessments. The highly accessible location of the plots facilitated easy monitoring and data collection. The choice of combining in-person observations with electronic data logging was driven by the need for accuracy and timeliness in data collection while minimizing disruptions to the plants.

Stakeholders, including academic researchers, campus facilities management, and community members, were engaged to raise awareness and gather feedback on the project. This collaborative approach ensured that the research was aligned with community needs and leveraged local expertise.

Results

In terms of the propagules sourced from Satinflower Nurseries, a total of 391 plants were planted across seven species, with an overall survival rate of approximately 95%. Most species exhibited robust survival, with entire-leaved gumweed (*Grindelia integrifolia*), dune wildrye (*Leymus mollis*), and field chickweed (*Cerastium arvense*) achieving nearly 100% survival. Conversely, shooting star (*Dodecatheon meadia*) had the lowest survival rate at just 13%, with only 2 of the 15 planted individuals persisting. Growth in diameter varied among species, with entire-leaved gumweed displaying the most substantial increase, growing from an average of 5 inches at planting to 30 inches. Other notable growth included field chickweed (+15 inches) and woolly sunflower, which increased from 4 inches to 14 inches on average (+10 inches).

The seeded species from the October mix also thrived in many places. *Clarkia amoena* (farewell-to-spring) dominated the seeded areas, with dense populations observed across all plots. *Lupinus polyphyllus* (large-leaved lupine) was particularly successful in Plot 3, while *Linum lewisii* (blue flax) established extremely well in Plots 1 and 2. Additional species such as *Gaillardia pulchella* (Indian blanket), *Deschampsia cespitosa* (tufted hairgrass), and *Chamaenerion angustifolium* (fireweed) were also present, albeit in smaller quantities.

In terms of the *Plectritis* germination trial, data collection has been completed, and the results of the germination study are currently being analyzed. The outplanted propagules that grew from the study have been establishing very well in the meadow and have flowered and spread.

The combination of planted and seeded species demonstrates the success of the restoration strategy. Planted species generally performed well in terms of survival and growth, with entire-leaved gumweed and field chickweed emerging as standout performers. Seeded areas were particularly effective at enhancing biodiversity and preventing weeds from overrunning the space, with farewell-to-spring thriving as the dominant species. These results underscore the resilience of native species and highlight the importance of both planting and seeding in ecological restoration projects.

Discussion and Suggestions for the Future

The establishment of herbaceous Garry oak meadow plots during this project exemplifies the successful integration of native species into urban landscapes, promoting biodiversity and environmental sustainability. The project aligns with the increasing recognition of urban environments as critical spaces for ecological restoration and community engagement (Tallamy & Shropshire, 2009). As urbanization continues to threaten natural ecosystems, initiatives like this highlight the potential of urban landscapes to serve as vital refuges for native flora and fauna (Barton & Lindhjem, 2020).

The data collected during this study revealed several valuable insights into plant performance and survival rates. The findings corroborate existing research emphasizing that native plants, being well-adapted to local conditions, often thrive with minimal maintenance (Boyer, 2013; Gordon & Davis, 2016). However, the shooting star (*Dodecatheon meadia*) struggled, with only a 13% survival rate. This poor performance raises questions about the suitability of this species as a low-maintenance species in an urban environment, possibly linked to insufficient moisture levels during the hot, dry Vancouver summer. It suggests that further exploration into the optimal conditions for its growth is necessary.

Discussion and Suggestions for the Future

From the study, several key lessons emerged regarding best practices for establishing native species in urban settings. One notable suggestion is to plant a few weeks earlier in the summer to give the plants more time to establish before the dry season. The study also indicated the success of a deep watering strategy, where plants were watered deeply every 1-2 weeks during the hottest months of July and August to supplement the lack of rain. In the future, it might also be beneficial to conduct a pollinator survey.

The findings of this research support UBC's strategic frameworks, such as the Campus Vision 2050 and the Climate Action Plan 2030 (CAP 2030), by contributing to sustainable practices and adding to the lexicon of knowledge that relates to the integration of native biodiversity into urban environments, enriching the approach to land stewardship and ecological restoration (Lea, 2006). This not only fosters a deeper cultural connection to the landscape but also reinforces the value of collaborative practices in environmental conservation.

In conclusion, the establishment and performance of the Garry oak meadow plots at UBC highlight the significant benefits of integrating native species into urban environments. These efforts contribute to biodiversity conservation and ecosystem resilience while enhancing community well-being and cultural heritage. Continued research and collaboration will be essential to overcome existing challenges and ensure the long-term sustainability of native plant landscaping initiatives in urban settings. By addressing the lessons learned from this study, the UBC project can hopefully serve as a model for similar initiatives in urban areas seeking to balance ecological health with community needs.

Future Actions

Therefore, a list of recommended **future actions** is:

- **Adjust Planting Schedule** → Initiate planting several weeks earlier in the season to allow seedlings to establish before Vancouver's dry summer period.
- **Implement Deep-Watering Regime** → After planting plugs, continue and refine deep watering every 1–2 weeks during July and August to help with adjusting to the site and survival in low-rainfall months.
- **Expand Species Palette** → Plant more individuals of Garry oak ecosystem herbaceous species, prioritizing species proven to thrive at the site (e.g., *Achillea millefolium*, *Allium cernuum*, *Eriophyllum lanatum, etc.*) and defer uncertain performers (e.g., *Primula pauciflora*) until their water/environmental needs are better understood.
- **Conduct Pollinator Surveys** → Integrate routine pollinator monitoring into maintenance protocols to assess ecological function and inform planting mixes.
- **Strengthen Stakeholder Collaboration** → Maintain and deepen ongoing engagement with Musqueam knowledge-holders, facilities management, student groups, and local NGOs to ensure cultural relevance and shared stewardship.

Future Research

A list of recommended **future research** is:

- **Optimal Moisture Regimes for *Primula pauciflora*** → Design targeted trials varying soil moisture levels and mulch treatments to determine thresholds for establishment.
- **Long-Term Survival and Community Dynamics** → Establish multi-year monitoring to track changes in species cover, biomass, and inter-species interactions over time.
- **Broader Pollinator Network Analysis** → Extend pollinator surveys across seasons and compare with areas on campus dominated by non-native cover to evaluate habitat value for bees, butterflies, and other invertebrates.
- **Socio-Cultural Impact Assessment** → Use surveys and interviews to gauge campus community perceptions, learning outcomes, and cultural connections fostered by the meadows.
- **Scalability Testing** → Pilot meadow installations in additional campus microhabitats (e.g., shaded versus full-sun sites) to refine site-specific guidelines for broader application.
- **Integration of Traditional Ecological Knowledge:** Collaborate further with Coast Salish and Musqueam experts to document and test Indigenous stewardship practices in meadow management.

Current and Future Project Developments

On October 19th, 2024, we held a successful planting bee at the research meadow with undergraduate forestry student volunteers, who played a vital role in enhancing our restoration efforts. During this event, the volunteers assisted in weeding and clearing areas to create optimal conditions for planting camas bulbs (*Camassia spp.*) and scattering seeds of Plectritis congesta (*sea blush*). Their involvement not only contributed to the immediate needs of the project but also fostered a sense of community engagement and awareness about the importance of native plant restoration.

Looking ahead, we aim to continue collaborating with volunteers and students to expand our planting efforts and increase biodiversity within the project area. Future developments will include additional planting events focused on incorporating more native species to engage the UBC community, as well as monitoring the establishment of recently planted bulbs and seeds. We will also assess the effectiveness of the initial planting strategies and adapt our methods based on observations and feedback from these activities. Additionally, another pollinator meadow is currently being established at another place on campus, with plans in the works for a third eventually.

As we progress, future projects are recommended to evaluate the performance of the newly planted species, adding to existing data. This will continue to inform future planting strategies and help refine our approach to native species integration in urban landscapes. By continuously adapting our methods based on field observations and research findings, we aim to enhance the ecological resilience of the Garry oak meadow and contribute to the broader goals of biodiversity conservation and community engagement.

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Appendices

A Figures

B Planted Species

C Invasive Species ID

D Photos of the Meadow

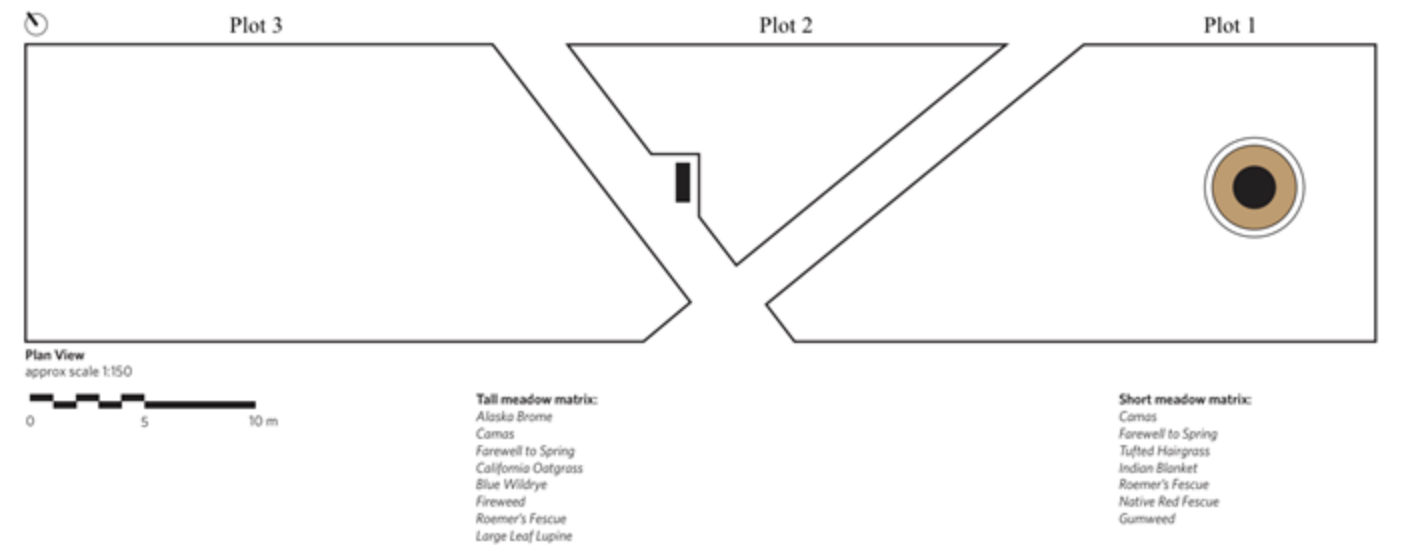


Figure 1. Map of the research meadow plots located on Musqueam territory at UBC, adjacent to the Reconciliation Pole. The map showcases all three plots and lists the species included in the native seed mix which was sown in October, 2023. Plot 1 and Plot 2 received the short meadow seed mix, while Plot 3 received the tall meadow seed mix.

Appendix A

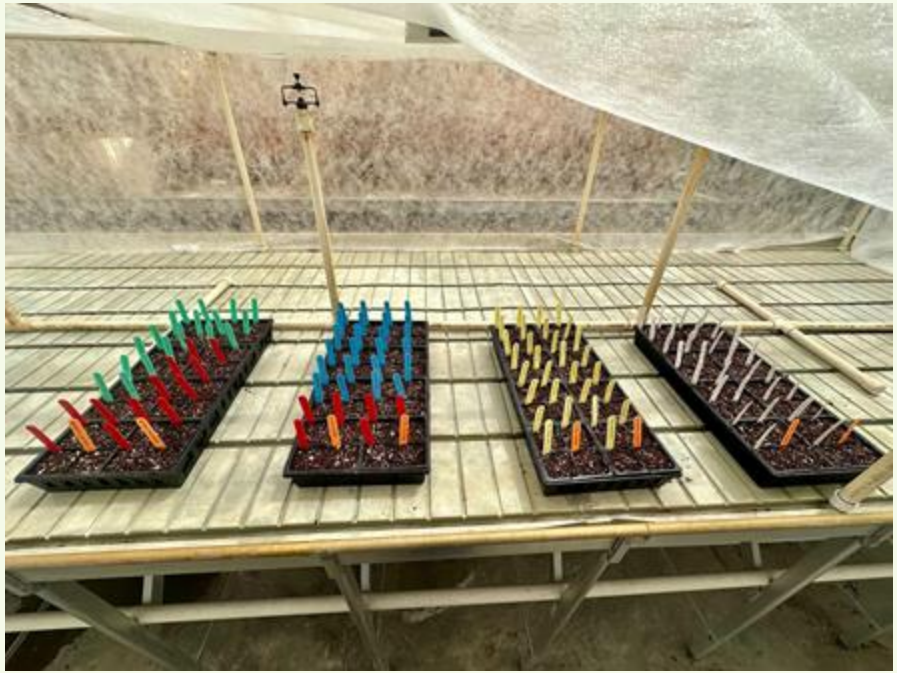


Figure 2. Experimental setup for the *Plectritis* study. Seeds from five populations near Vancouver Island (Isabella, Clive, Piers, Pellow, Shell) were collected between 2005 and 2024 under Dr. Peter Arcese's supervision. Seeds were stored refrigerated until use, with 2024 seeds ripened for 4 days on a windowsill followed by 2 days of refrigeration. Viable seeds from previous years were pooled, while only ripened seeds from 2024 were used. Each cohort was sown into 6 cells (3 per seed type: winged and unwinged) with 6 seeds per cell. Seeds were sown in trays filled with potting substrate at a depth of ½ inch and placed on a greenhouse mist bench with misting every 17 minutes for 21 days.

Appendix B: Garry Oak Meadow Species

Yarrow (*Achillea millefolium*)

Rhizomatous perennial forb

Flowering: May - September

Habitat: meadows, rocky slopes, beaches

Light: full sun to partial shade

Moisture: dry to mesic

Height: 30 - 80 cm

Appendix B

Nodding Onion (*Allium cernuum*)

Perennial forb from bulb

Flowering: May - July

Habitat: rocky outcrops, woodlands, shorelines

Light: full sun to partial shade

Moisture: dry to mesic

Height: 15 - 40 cm

Appendix B

Entire-Leaved Gumweed (*Grindelia stricta*)

Perennial forb

Flowering: June - November

Habitat: beaches and coastal bluffs

Light: full sun

Moisture: dry to mesic

Height: 30 - 80 cm

Appendix B

Field Chickweed (*Cerastium arvense*)

Mat-forming perennial forb

Flowering: April - June

Habitat: meadows and rocky slopes

Light: full sun to partial shade

Moisture: dry

Height: 5 - 30 cm

Appendix B

Woolly Sunflower (*Eriophyllum lanatum*)

Perennial forb

Flowering: April - July

Habitat: meadows and rocky slopes

Light: full sun

Moisture: dry to mesic

Height: 10 - 60 cm

Dune Wildrye (*Leymus mollis*)

Rhizomatous perennial grass

Flowering: June - July

Habitat: beaches

Light: full sun

Moisture: dry to mesic

Height: 50 - 150 cm

Appendix B

Few-Flowered Shootingstar (*Primula pauciflora var. pauciflora*)

Perennial forb

Flowering: April - May

Habitat: meadows and rocky slopes

Light: full sun

Moisture: mesic to seasonally wet

Height: 10 - 30 cm

Appendix B

Blanketflower (*Gaillardia pulchella*)

Perennial forb

Flowering: April - May

Habitat: meadows and rocky slopes

Light: full sun

Moisture: mesic to seasonally wet

Height: 10 - 30 cm

Appendix B

Farewell-to-Spring (*Clarkia amoena*)

Annual forb

Flowering: May - July

Habitat: rocky slopes

Light: full sun

Moisture: dry

Height: 10 - 40 cm

Appendix B

Native Red Fescue (*Festuca rubra*)

Rhizomatous perennial grass

Flowering: mid-spring

Habitat: meadows, shorelines, and fields

Light: full sun

Moisture: dry

Height: 20 - 100 cm

Appendix B

Roemer's Fescue (*Festuca roemeri*)

Perennial bunchgrass

Flowering: May - June

Habitat: meadows and rock outcrops

Light: full sun

Moisture: dry

Height: 20 - 80 cm

Appendix B

Tufted Hairgrass (*Deschampsia cespitosa*)

Perennial bunchgrass

Flowering: June - July

Habitat: saltmarshes, meadows, and shorelines

Light: full sun

Moisture: moist to wet or seasonally flooded

Height: 30 - 150 cm

Alaska Brome (*Bromus sitchensis*)

Perennial bunchgrass

Flowering: late spring

Habitat: open forests, shorelines, and meadows

Light: full sun

Moisture: dry

Height: 50 - 150 cm

Blue Wildrye (*Elymus glaucus*)

Perennial grass

Flowering: May - June

Habitat: meadows and woodlands

Light: full sun to partial shade

Moisture: dry to mesic

Height: 30 - 120 cm

California Oatgrass (*Danthonia californica*)

Perennial bunchgrass

Flowering: May - July

Habitat: meadows and rocky slopes

Light: full sun

Moisture: dry to moist

Height: 15 - 80 cm

Appendix B

Fireweed (*Chamaenerion angustifolium*)

Rhizomatous perennial forb

Flowering: June - September

Habitat: meadows, thickets, and woodlands

Light: full sun to partial shade

Moisture: mesic

Height: 1 - 2 m

Appendix B

Large-Leaved Lupine (*Lupinus polyphyllus*)

Rhizomatous perennial forb

Flowering: June - September

Habitat: meadows, thickets, and woodlands

Light: full sun to partial shade

Moisture: mesic

Height: 1 - 2 m

Appendix B

Sea Blush (*Plectritis*)

Annual forb

Flowering: April - June

Habitat: meadows, rocky slopes, and woodlands

Light: full sun to partial shade

Moisture: dry to mesic

Height: 10 - 60 cm

Appendix B

Great Camas (*Camassia leichtlinii ssp. suksdorfii*)

Perennial forb from bulb

Flowering: April - June

Habitat: meadows and woodlands

Light: full sun to partial shade

Moisture: dry to mesic

Height: 20 - 100 cm

BULB

Appendix B

References

Photos and plant phenology/morphology:

https://satinflower.ca

https://www.centralcoastbiodiversity.org

https://ibis.geog.ubc.ca/biodiversity/eflora

Appendix C: COMMON INVASIVES in BC

DANDELION (*Taraxacum officinale*)

ID Tips:

- Leaves are deeply lobed
- Leaves form a basal rosette close to the ground
- Long, hollow stems emerge from the center of the rosette
- Yellow flowers with numerous petals, resembling a miniature sun
- Mature flowers transform into white, spherical seed heads called "puffballs," dispersing seeds when blown by the wind
- Milky sap may be present in the stems when broken

Appendix C

LAMBSQUARTERS (*Chenopodium album*)

ID Tips:

- Has white flecks on its leaves
- Leaves have wavy or jagged edges (vary in shape)
- Flowers are small, green, and lack petals
- Stem stands upright and branches out in many directions

Appendix C

CRABGRASS (*Digitaria spp.*)

ID Tips:

- Low-growing grass with a prostrate growth habit
- Leaves are smooth, narrow, and folded in the bud
- Blades may have a distinct midrib, often with a light-green color
- Arrangement of leaves alternates along the stem
- Seedheads may emerge from nodes along the stems

Appendix C

PURSLANE (*Portulaca oleracea*)

ID Tips:

- Succulent plant with smooth, thick, reddish stems
- Leaves are paddle-shaped, succulent, and arranged alternately along the stems.
- Flowers are small, yellow, and have five petals, blooming at tips of stems or in leaf axils
- Seed pods develop after flowering, containing tiny black seeds

Appendix C

PIGWEED (*Amaranthus spp.*)

ID Tips:

- Leaves vary in shape but are typically lanceolate or diamond-shaped with prominent veins
- Leaves alternate along the stem and may have wavy or toothed margins
- Flowers are small and inconspicuous, clustered in dense, terminal spikes
- Seed production is prolific, with each plant capable of producing thousands of small black seeds in capsules

Appendix C

SHEPHERD'S PURSE (*Capsella bursa-pastoris*)

ID Tips:

- Basal rosette of deeply lobed leaves
- Leaves have a distinctive triangular or elongated shape with serrated margins.
- Stems are slender, branching, and often covered with fine hairs
- Tiny white flowers with four petals (cross-like), arranged in loose clusters at the top of stems.
- Seed pods are triangular, flat, and resemble small purses

Appendix C

QUACKGRASS (*Elytrigia repens*)

ID Tips:

- Stems are erect, typically reaching heights of 1-3 feet
- Leaves are long and narrow, with rough edges and a prominent midrib
- Leaves have a distinctive rolled vernation
- Seedheads are open panicles with spikelets arranged along the branches
- Rhizomes are extensive, white to pale yellow in color, and produce new shoots at nodes

Appendix C

BINDWEED (*Convolvulus arvensis*)

ID Tips:

- Twining stems that wrap around other plants or structures
- Leaves are arrowhead-shaped or triangular, with pointed tips
- Leaves alternate along the stems and are typically smooth-edged
- Flowers are funnel-shaped, white to pink in color, and about 1-2 inches in diameter
- Roots are extensive, fibrous, and may penetrate deep into the soil

Appendix C

NUTSEDGE (*Cyperus spp.*)

ID Tips:

- Triangular stems with grass-like leaves arranged in sets of three at base of plant
- Leaves have a prominent midrib and are typically glossy green
- Stems are solid, upright, and can reach heights of up to 3 feet
- Flowers are small, brown or greenish, and arranged in clusters at the top of stems
- Each flower cluster is surrounded by several leaf-like bracts
- Tubers or nutlets develop underground

Appendix C

BUCKHORN PLANTAIN (*Plantago lanceolata*)

ID Tips:

- Rosette of lance-shaped leaves close to the ground
- Leaves are long, narrow, and typically have prominent parallel veins
- Leaf margins are smooth
- Flower stalks (up to 18 inches) emerge from the center of the rosette
- Flowers are small, greenish-white to brownish, and arranged in dense spikes at the top of the stalks

Appendix C

REFERENCES

- https://mgabc.org/article/whats-weed
- https://www.almanac.com/content/common-garden-weeds

Appendix C

Meadow Photos- May

Appendix D

Meadow Photos- May

Appendix D

Meadow Photos- May

Appendix D

Meadow Photos- May

Appendix D

Meadow Photos- June

Appendix D

Meadow Photos- June

Appendix D

Meadow Photos- June

Appendix D

Meadow Photos- June

Appendix D

Meadow Photos- July

Appendix D

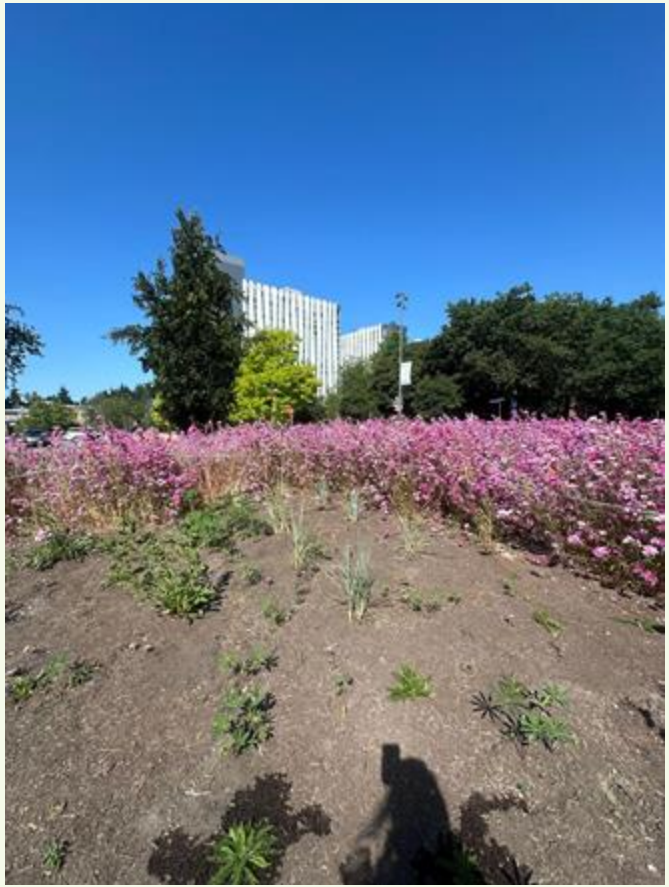
Meadow Photos- July

Appendix D

Meadow Photos- July

Appendix D

Meadow Photos- July



Appendix D

Meadow Photos- August

Appendix D

Meadow Photos- August

Meadow Photos- August

Appendix D

Meadow Photos- August

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Meadow Photos- August

Appendix D

Meadow Photos- August

Appendix D

Meadow Photos- August

Appendix D

Meadow Photos- September

Appendix D

Meadow Photos- September

Appendix D

Meadow Photos- October-November

Appendix D

Meadow Photos- November

Appendix D

Meadow Photos- November

Appendix D

Meadow Photos- November

Appendix D