Translation, Transformation & Education

Bringing Oregon's
Distant Landscapes
into Portland's Urban Center
to Support Outdoor Education

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University of Oregon 2025

Acknowledgments

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1. Background



1.0 What Can Botanical Gardens Teach Us?

THE IMPORTANCE OF EDUCATIONAL LANDSCAPES FOR YOUTH

Exposure to ecosystem interactions is critical in developing sensitivity and connection to the natural world, but due to urbanization, travel to areas considered natural can be limited due to transportation and costs. However, this does not mean that connection to nature is not possible in urban spaces.

Portland, Oregon is an exemplary city in integrating landscape features with the urban environment. With over 10,000 acres of parks, Portland has embraced natural areas and gardens as a part of its identity. Despite its many parks and public gardens, opportunities still exist to fill landscape niches that educate audiences about Oregon's diverse, distant landscapes.

The McCormick and Baxter Superfund Site in Northeast Portland, Oregon has sat vacant for many years and is located in one of the most racially and financially diverse parts of the city. Along with its proximity to several elementary schools, like Rosa Parks Elementary, these factors influence the potential of the site to serve as an educational landscape.

Under the new ownership of the Portland Botanical Gardens (PBG), the site can support a variety of education and equity goals, which is a need of urban residents.

Designing with Oregon's state-mandated, 5th grade Outdoor School Program in mind will enable design of a venue for youth to learn about climate, biological adaptations and the historic relationships between Oregon's plants and its people.

A central feature of the PBG will be a bioregional garden sequence representing Oregon. This master's project elaborates on PBG's role as an educational landscape, that brings Oregon's biodiversity to the urban center to support state-mandated outdoor education for 5th grade students.

The bioregional gardens showcases seven of Oregon's biomes. Site scale design is performed for one example collection, with a design framework that can be applied to the other 6 bioregions.

Professional consultation, state and site climate analysis, and botanical garden precedents work to inform best practices for engaging a 5th grade audience and translating Oregon's distant landscapes into a botanical garden at an urban Superfund site.



1.1 The Urban Disconnect Problem

RECONNECTING URBAN RESIDENTS TO THE ENVIRONMENT

The cultivation of plants coincided with human's first societies.[1] Because plant cultivation was born out of necessity for survival, interactions between people, plants, and the earth were unavoidable. Today we exist in an increasingly digital world, where many 5th grade students have not had the opportunity to garden in the urban environment or visit natural landscapes in day-to-day life, particularly affecting those who can not travel beyond the city, as many city-dwellers do not own personal transportation.

Because increasing populations in urban environments have limited access to the natural world, "urbanization and technification" has led to a decrease in personal connection to nature, efforts to protect it, and overall health and wellbeing in youth.[2] To counteract this phenomenon, Oregon enacted a statewide Outdoor School program with Ballot Measure 99 in 2016.[3] This measure makes outdoor education a right for all students in Oregon.

In light of climate change and urbanization, outdoor education is becoming increasingly important. This type of education relates to" knowledge concerning the biophysical environment and its associated problems, [awareness] of how to help solve these problems, and [motivation] to work toward their solution."[4]

A botanic garden that represents its own broader geographic context can be an opportunity to contribute to place-based environmental education. This setting can instill an appreciation of the place one inhabits or is visiting.

Because traveling across Oregon is timely and financially costly, geographic limits shape the role of bioregional learning opportunities in state-mandated curricula. However, a deeper connection to student's larger, yet immediate surroundings can positively influence attitures towards the environment.

A bioregional garden representing the state of Oregon challenges the premise that locally diverse landscapes are beyond the reach of many young Portlanders and ensures exposure to Oregon's natural systems.

1 Hill, A. W. (1915). The History and Functions of Botanic Gardens. Annals of the Missouri Botanical Garden, 2(1/2), 185–240. https://doi.org/10.2307/2990033

2 Gienger, A., Nursey-Bray, M., Rodger, D., Szorenyi, A., Weinstein, P., Hanson-Easey, S., ... Yoneyama, S. (2024). Responsible environmental education in the Anthropocene: understanding and responding to young people's experiences of nature disconnection, eco-anxiety and ontological insecurity. Environmental Education Research, 30(9), 1619–1649. https://doi.org/10.1080/13504622.2024.2367022

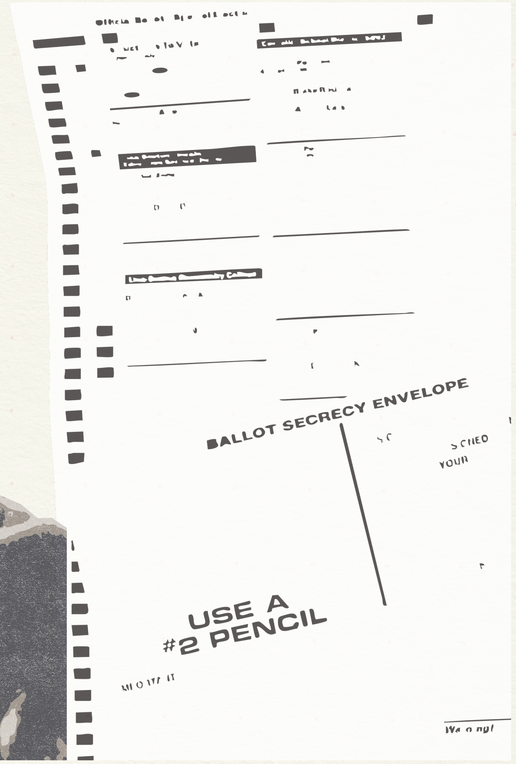
3 Oregon State University Extension Service. (2024, December 18). Outdoor School. OSU Extension Service. https://extension.oregonstate.edu/outdoor-school. Accessed 27 Feb. 2025

4 Stapp, W. B. (1969). The concept of Environmental Education. Environmental Education, 1(1), 30–31. https://doi.org/10.1080/00139254.1969.10801479

OREGON BALLOT MEASURE 99 (2016)

Result of “Yes” Vote: creates designated fund, financed through Oregon Lottery Economic Development Fund and administered by Oregon State University (OSU), to provide outdoor school programs to 5th grade students statewide.





1.2 Oregon's Outdoor School

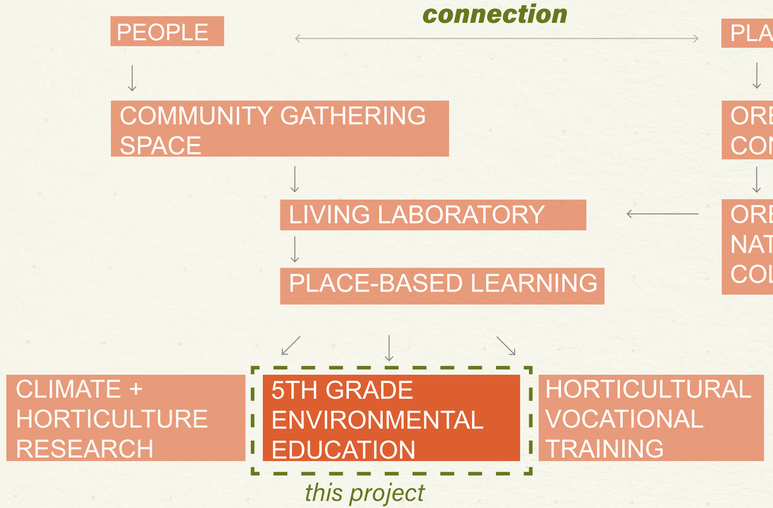
CREATING EQUITABLE ACCESS

Ballot Measure 99, enacted in 2016 works to counteract the phenomenon of urban disconnect. The statewide Outdoor School program in Oregon is mandated for all students in 5th grade. This type of education, referred to as environmental education, relates to “knowledge concerning the biophysical environment and its associated problems, [awareness] of how to help solve these problems, and the [motivation] to work toward their solution.”

Due to its relatively new implementation, feedback from students, teachers, parents, and outdoor educators should inform ways to improve learning objectives and access. This project considers feedback from participants of Oregon’s Outdoor School Program.

1.3.0 Portland Botanical Gardens

CONNECTING PEOPLE TO PLANTS



The primary goal of the PBG is to connect people with plants. This is achieved through a combination of site features that aim to support Oregon's largest collection of native plants, Oregon's largest conservatory and flexible space for gathering and research.

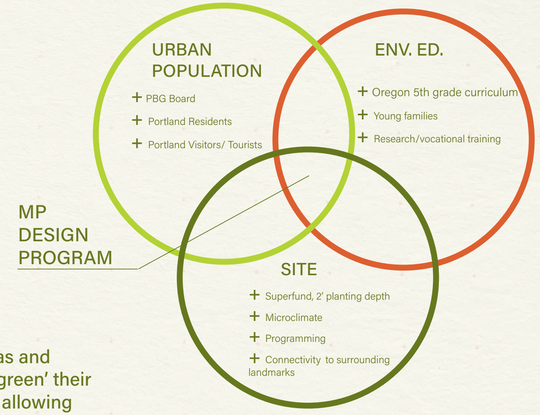
1.3.1 Environmental Education in the Botanical Garden

Botanic gardens aim to conserve plant populations, but this cannot occur without education. The inhabitants of Oregon have always had strong relationships with the plants of our region. From the Kalapuyan, to logging pioneers, to migrant farmers, to horticulture professionals, we see a long-standing relationship between flora and fauna, a mutualistic exchange steeped into tradition. A botanic garden presents the perfect setting to tell this narrative through the landscape and to continue the tradition of establishing connections with nature.

The Botanic Gardens Conservation International Education Guidelines recommend that the Portland Botanical Gardens "identify themes for their programmes and activities that are relevant to their local and regional environment and conservation issues," and to "raise awareness of their role in providing a sanctuary/refuge in urban areas and support local communities to 'green' their neighborhoods."[1] If successful, allowing visitors to engage with the ecology of Oregon can provide an equitable way to inform visitors about the environment both at the individual and community level.[2]

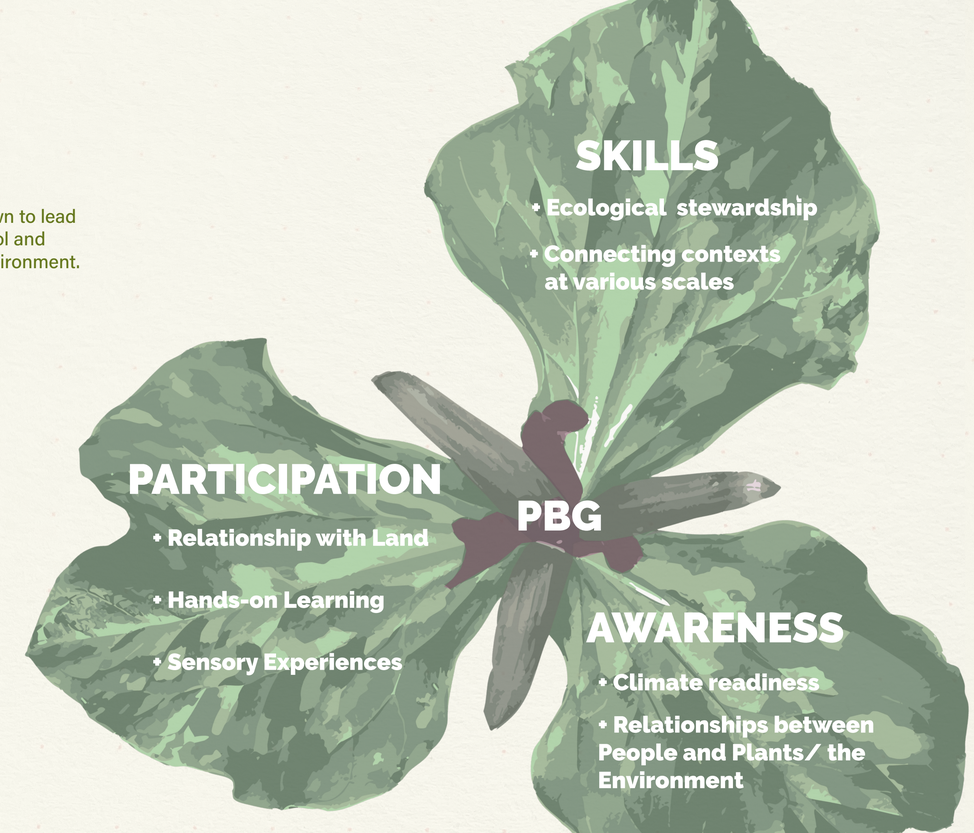
Portland residents have a need for community space that connects them with nature.[3] Through the consideration of plantings, layout and interpretive elements, the Portland Botanical Gardens can help people connect to place.

1 Adamau et al. (2006). Environmental Education in Botanic Gardens: Guidelines for Developing Individual Strategies, Botanic Gardens Conservation International.
2 Maharramli, Bemmy, Bredow, Victoria Lowerson, & Goodwin, Lindsay. (2021). Using civic ecology education to foster social-ecological resilience: A case study from Southern California. The Journal of Environmental Education, 52(6), 445-462. 10.1080/00958964.2021.1999886
3 DEQ and PBG Community Engagement Meeting, May 2025



Implementation considers site constraints, like Superfund designation, programming, and surrounding context. Achieving environmental education for the urban population will have to consider outdoor education principles and site opportunities and constraints.

Outdoor education has been shown to lead to increased engagement in school and positive relationships with the environment.



Giant Purple Wakerobin
Trillium kurabayashii

Klamath-Siskiyou bioregion species

1.4 Improving Environmental Literacy

A SOLUTION TO DISCONNECT

There is value in environmental education for the general population, particularly for younger generations that will be present for continuing shifts in the climate, such as elementary school students.

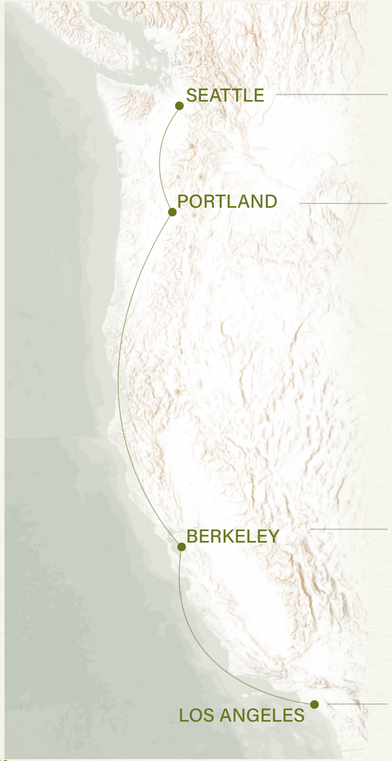
Benefits for younger students include increased engagement in learning, improved attendance and environmental sensitivity, which is achieved through participation in the educational landscape.

Limited resources make achieving these broad educational goals more difficult, often due to limited funding or locality. Bringing Oregon's diversity to underutilized parcels of land, like the McCormick and Baxter Superfund site in Northeast Portland, can expose urban populations to Oregon's ecological treasures.

Visiting the PBG can have outcomes like increased interaction with the landscape that can improve environmental stewardship and climate readiness skills and help 5th grade students connect local contexts from the microclimate to the state scale. It is positioned in a location within the city to provide services to the next generation of land stewards.

PBG is located in a neighborhood of mixed financial and racial demographics, including a high percentage of young families of color with a high school level education or lower. Therefore, designing for 5th grade students serves as a proxy for educating a much larger group. Educational and interpretive design elements designed for 5th grade students can serve as a baseline of educational programming for visitors of all ages.

After leaving PBG, 5th grade students should have a better understanding of their local and broader geographic contexts, the influences that shape our surroundings, and the diverse web of organisms we share our environment with. In turn, this will equip 5th graders with skills to navigate future climate scenarios and awareness of their own role in land stewardship.



CONSERVATION AND RESEARCH ENTITIES

PACIFIC CONNECTIONS GARDEN
UW ARBORETUM
→ University of Washington

PORTLAND BOTANICAL GARDENS
→ University of Portland
→ University of Oregon
→ Portland State University
→ Lewis & Clark

UC BOTANICAL GARDEN AT BERKELEY
→ University of California, Berkeley

THE HUNTINGTON BOTANICAL GARDENS
→ University of California, Los Angeles

Newest Ecological & Horticultural Knowledge & Research

→ PUBLIC COMMUNICATION & EDUCATION

→ STATE-MANDATED OREGON OUTDOOR SCHOOL CURICULA



1.5 Strengthening a Conservation Network

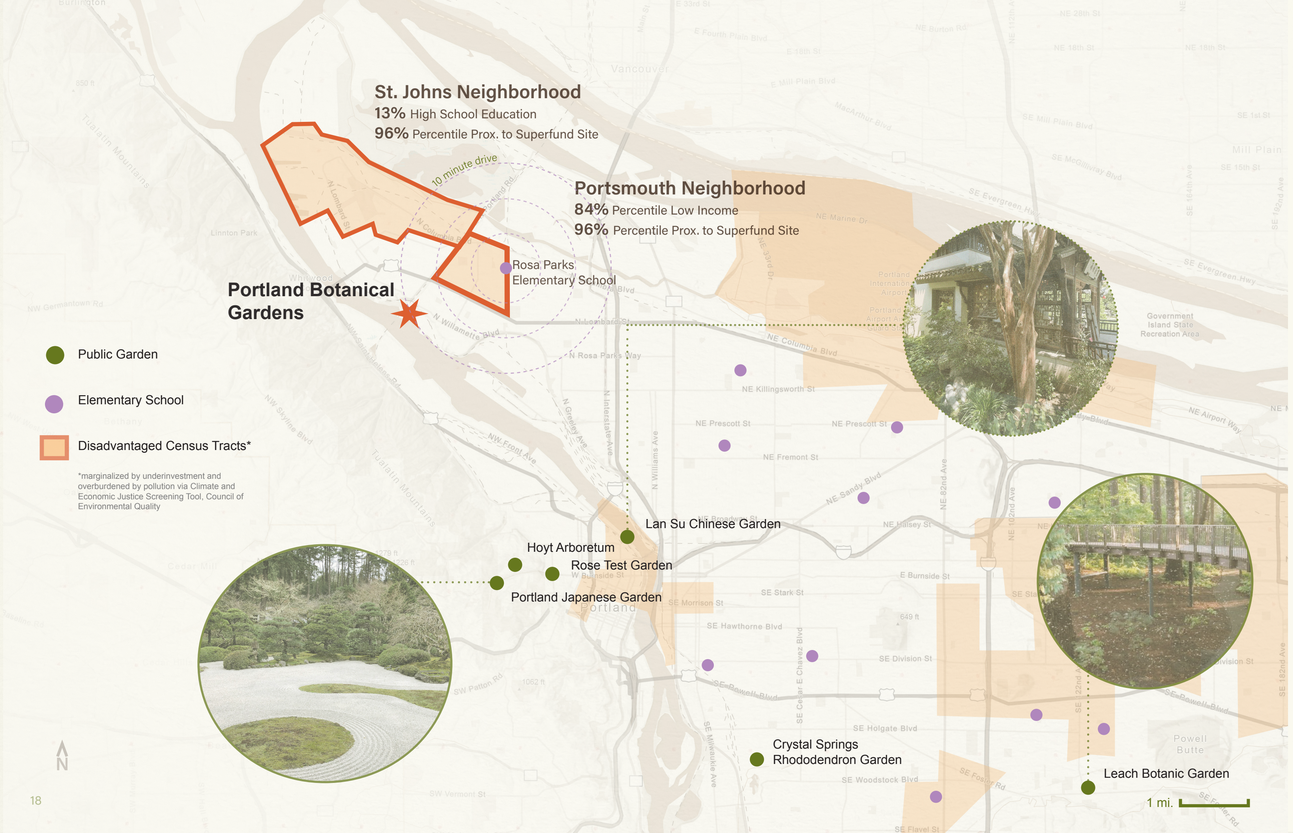
OPPORTUNITIES FOR ALL AGE LEARNING

The role of botanic gardens has shifted significantly throughout the last few centuries, yet many values remain the same. While originally conceived to grow edible or medicinal plants, these spaces soon became inseparable from the landscape design and scientific research.[1] Since their conception, the transfer of knowledge has been an integral component of this type of landscape.[2]

Many major cities host botanic gardens around the world. Notable examples on the West Coast include the UC Berkeley Botanic Garden in California and Washington Park Arboretum in Washington. A botanic garden in Portland, Oregon is a natural link between these examples of educational landscapes, creating a network of cultural and horticultural exchange. The potential for the Portland Botanical Gardens to tap into this network, along with the public garden network in Portland, strengthens the educational goals of the nonprofit by opening gateways of communication between conservation entities.

This also provides opportunity for the Oregon Bioregional Garden to be a source of education for a broader audience, informing the cutting edge of horticulture and climate research in collaboration with research and educational institutions, such as the University of Portland and University of Oregon. Because the work of these institutions inform public health values, they are sure to inform the information that is conveyed to the general public.

1 Krishnan, S., & Novy, A. (2017). The role of botanic gardens in the twenty-first century. CABI Reviews, 1–10. https://doi.org/10.1079/PAVSNNR201611023
2 Huxley, A. (1992). The New RHS Dictionary of Gardening. MacMillan Press, London.



1.6 Portland's Public Gardens

CONTRIBUTING A NEW EQUITABLE GARDEN EXPERIENCE

Portland is a pioneer in garden culture in the United States. From the Portland Japanese Garden to the Leach Botanical Garden, there is a legacy of large-scale, public gardens. It is important to consider what will set the Portland Botanical Gardens apart from the existing public gardens that the city already has to offer.

The Leach Botanic Garden features a pollinator garden, woodland garden, tree walk and several gathering spaces. The Portland Japanese Garden offers collections of exotic plant species from Asia. Other prominent public garden spaces include Crystal Springs Rhododendron Garden and the International Rose Test Garden. While all valuable additions to Portland's landscapes, none of the aforementioned landscapes highlight the diverse bioregions of Oregon in a comprehensive way.

An opportunity exists for PBG to create a new experience for its citizens that will contribute to the city's vibrant garden culture.

The Portsmouth and St. Johns neighborhoods, adjacent to the PBG site, are designated as disadvantaged census tracts. This is a result of historic underinvestment and proximity to the Superfund site. Within this community is Rosa Parks Elementary School, which is approximately ten minutes from the PBG site by car. Ten other elementary schools reside in the east side of Portland, and there are 45 city-wide. These communities have a high need for access to nature due to systematic, demographic inequities.

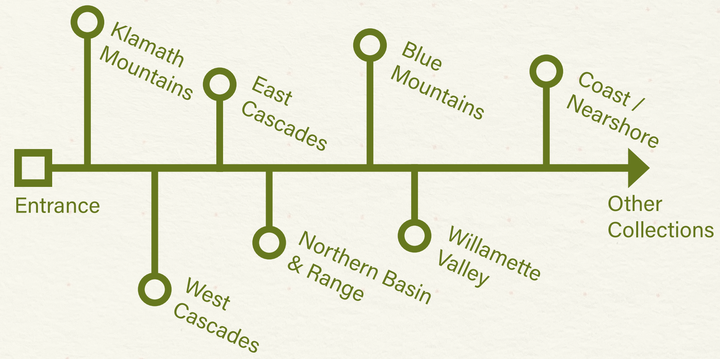
Investment in the reimagining of the former McCormick and Baxter Site is an opportunity for the city to give back to the communities that should be prioritized for equitable natural space while also providing a new type of garden experience and social setting for the city.



1.7 Local Bioregional Collections

CELEBRATING OUR STATE

BIOREGIONAL GARDEN SEQUENCE



A bioregional garden allows you to traverse through Oregon's distant landscapes without leaving the city. A bioregion can be defined as areas of similarity in ecosystem and in the type, quality and quantity of environmental resources. It is a useful spatial framework for communicating ecosystems and their driving factors, such as climate and resource availability.[1]

The bioregionalism model also serves as a way to conceptually categorize Oregon's ecologies in a way that promotes strategic narrative. It allows visitors to relate to a place at a variety of scales and encourages intervention at the personal level.[2]

1 Omernik, J., (1995). Ecoregions: A spatial framework for environmental management. Biological Assessment and Criteria: Tools for Water Resource Planning and Decision Making.
2 Wearne, S., Hubbard, E., Jónás, K., & Wilke, M. (2023). A learning journey into contemporary bioregionalism. People and Nature, 5(6), 2124–2140. https://doi.org/10.1002/pan3.10548

Comparison of site conditions with Oregon climate regimes informed the layout of the Oregon Sequence Garden, which pairs Oregon bioregions to its most suitable location on site. An Oregon bioregional garden sequence will take visitors through an immersive experience from coastal forests to wildflower meadows of the Gorge, along with all the spaces in between.

The Oregon Bioregional Garden can teach 5th graders about:

+ Ethnobotany
+ Plant Adaptations
+ Habitat loss
+ Geology

1.8.0 Process



Analysis

This project began with a literature review that identified a gap in knowledge in outdoor education and botanical gardens. Climate analysis was then conducted to understand the climatic regimes of Oregon and the site. This included comparison of elevation, annual high and low temperature, precipitation, and vegetation cover across the state.



Engagement

Conversations with Outdoor Educators, Botanical Garden Staff, and Landscape Architects served as a starting point and checkpoint for design strategies.



Design Iteration

Design interventions began by depicting the bioregional layout on site. From there, decisions about plant communities and programming were made. Site-scale design occured for one example garden room in the bioregional sequence.



Consultation

Weekly meetings with Michael Geffel, Project Director at PBG guided project refinement.

Feedback from UO faculty committee and the PBG Board of Directors at 25% helped to narrow the scope of this project to target the 5th grade audience.

Self-evaluation occurred based on design guidelines informed by research and engagement.



Precedent + Case Study

Lower Table Rock, in Jackson Co., Oregon serves as a case study due to its vast similarity to the PBG site in both biotic and abiotic factors.

Other Botanical Gardens and Horticultural entities, such as Klamath Siskiyou Native Seeds, inform transferability of landscape elements, such as vegetation.



Communication

Ideas are conveyed graphically through digital media and presented verbally to reviewers and feedback is implemented.

Future community engagement is essential for real world implementation.

A mixed methods approach compiles project considerations from stakeholders, along with climate and site limitations.

Iman Labanieh

Education Program Manager
Zenger Farm

Deepa Preeti Natarajan

Former Education Program Coordinator
UC Berkeley Botanical Gardens

Board Member
Portland Botanical Gardens



Michael Geffel

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LNDLAB

Project Director
Portland Botanical Gardens

Greg Dahlke

PLA
Land Morphology

1.8.1 Professional Consultation

GETTING THE DIRT ON OUTDOOR EDUCATION & DESIGNING FOR BOTANICAL GARDENS

Consultation with a diverse set of professionals, such as landscape architects, horticulturalists, and educators, reinforce best practices and inform the implementation of site programming. These diverse opinions informed design decisions, such as the appropriate educational material for a 5th grade audience, which went on to influence all stages of design.

Recurring meetings with Michael Geffel, Project Director at PBG, allowed for deeper understanding of the site's history, its remedy and surrounding community. Michael suggested valuable resources and approaches to problem-solving.

Educational guideline consultation took place over the phone with Iman Labanieh, Youth Education Program Manager at Zenger Farms and Deepa Natarajan, former Public Education Program Coordinator at the UC Berkeley Botanical Garden. Both provided helpful insight into the pitfalls and successes of engaging a 5th grade audience in outdoor education.

Iman reminded me that educational topics should be aimed at 5th grade interests, not the interests of the designer or botanical garden. From Deepa's experience leading youth in botanical garden tours, she suggested hands-on activity and engagement of the senses, such as touch, smell or taste.

A conversation with Greg Dalhke from Land Morphology provided insight on how his firm has tackled designing for the Leach and Yew Dell Botanic Gardens, including how feedback, flexibility and reaching a target audience informed the process. Land Morphology's approach to designing a botanical garden included multi-faceted engagement, that could entertain a variety of different audiences.

1.8.2 Design Guidelines

OUTCOMES OF PROFESSIONAL CONSULTATION

ENVIRONMENTAL EDUCATION DESIGN ELEMENTS

TEACHING METHOD	EDUCATIONAL VALUE	SENSORY EXPERIENCE
Storytelling	Relatability, generational knowledge	
Activity-based activation	High level of engagement, can work in group settings	
Scale	Immersive quality, defines collection layout, elements and programming	
Language	Accessibility, targets major languages in Portland	

Teaching methods were distilled from conversations with professionals.

Educational value was determined through literature review.

Sensory experiences were assigned to teaching methods based on proposed PBG landscape interventions, primarily through sensory planting.

1.8.3 Design Guidelines

Place-based, environmental education has the ability to provide visitors with new knowledge that persists long after they leave the site. Researchers have found that education is most memorable in the botanic garden setting when it is paired with hands-on activities and formal education.[1] Further, personal relevance to learning topics aids in breaking down environmental myth into tangible issues.[2]

This project will explore implementation of hands-on learning for a K-12 student audience through sensory experiences and 3 interpretive design nodes, a rock outcrop, a carnivorous bog and an interactive pathway.

Research on Oregon's outdoor education curriculum, other models of environmental education, and engagement with professionals inform engagement strategies and site fixtures for activation and discovery.

Through research and engagement, it was determined that the easiest and most effective way to engage and teach a 5th grade audience is through evoking the senses.

Senses are one of the most memorable experiences in the Botanical Garden setting, making them a valuable tool for engagement of visitors.

1 Sellmann, Daniela, & Bogner, Franz Xaver. (2013). Climate change education: quantitatively assessing the impact of a botanical garden as an informal learning environment. Environmental Education Research, 19, 415-429.

2 Gigliotti, L. M. (1990). Environmental education: What went wrong? What can be done?. The Journal of Environmental Education, 22(1), 9-12.

DESIGNING FOR THE SENSES



TOUCH

What does this plant feel like?



HEAR

Does this plant make any sounds? What about its pollinators?



SMELL

Does this plant smell good or bad?



SEE

What does this plant look like?



TASTE

What does this plant taste like?

2. Analysis

2.0.0 McCormick & Baxter Site

BRINGING NEW LIFE TO A LOVED PART OF THE CITY

The McCormick & Baxter Superfund Site is one of two Superfund sites within Portland Harbor. The 41 acre site is the former home of a creosote factory and has always been a cherished site for Native communities.

Between 1944-1991, the site was used as a wood treating facility, which resulted in contamination of Creosote, pentochlorophenol, copper, chromium, zinc and arsenic into soil and the Willamette River. After McCormick and Baxter ceased operations after filing for bankruptcy, the Department of Environmental Quality (DEQ) took over site management.

Beginning in 1996 and completed in 2005, the DEQ and the Environmental Protection Agency (EPA) completed site remedy. The remedy included excavation and off-site removal of non-aqueous phase liquid contaminated soil and the installation of a soil cap over the entire site. Further, a subsurface barrier wall was installed to control NAPL migration, and Creosote was extracted from the groundwater between 1989 and 2011.

Long-term monitoring, observation and maintenance of the site is still performed by the DEQ based on EPA Requirement. Inspections are quarterly and there is a review report every five years.[1]

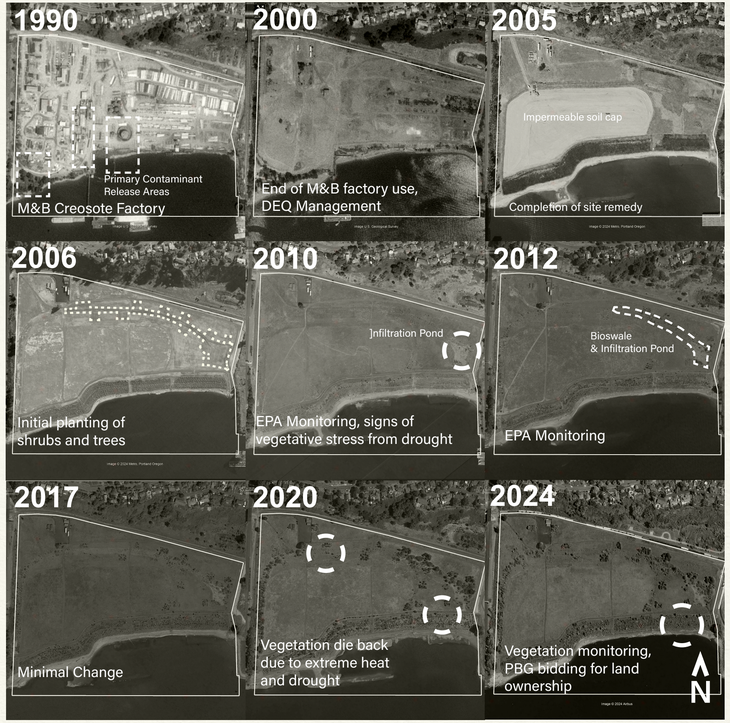
Today, the site hosts stands of healthy Pacific Madrone (Arbutus menziesii), Ponderosa Pine (Pinus ponderosa), Oregon White Oak (Quercus garryana) and other native species that were planted by the EPA in the mid-2000's. It is notable that only drought-tolerant species have survived initial planting.

The DEQ has successfully monitored the site for two decades, and new ownership provides research opportunities that may inform other restoration or Superfund projects. Continued longterm monitoring and engagement with the land will ensure the remedies continue to protect the environment and public health.

1 McCormick & Baxter Creosoting Co. (Portland Plant) Site Profile. EPA, Environmental Protection Agency. (2017, October 20). cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=1000339. Accessed 27 Feb. 2025.

2.0.1 McCormick & Baxter Superfund Site Over Time

TRACKING LANDSCAPE CHANGES



2.0.2 Site Management

SETTING THE STAGE FOR STEWARDSHIP

Several species are thriving on-site following remediation and planting by the DEQ and EPA. The mature stands of Oregon White Oak *(Quercus garryana)*, Ponderosa Pine *(Pinus ponderosa)* and Pacific Madrone *(Arbutus menziesii)* create an instant backbone of an Oregon Bioregional Garden.

Other native species like Snowberry (*Symphoricarpos albus*), Bigleaf Maple *(Acer macrophyllum)* and Cascara *(Rhamnus purshinana)* are still present and thriving on the site.

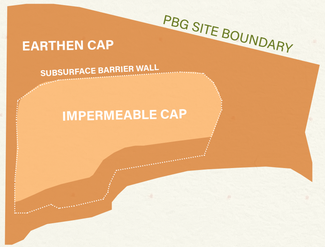
A site visit confirmed that species less tolerant of drought and extreme heat have not been as persistent, such as Red-osier dogwood *(Cornus sericea)* and Twinberry *(Lonicera involucrata).*



2.0.3 Site Remedy Opportunities

MAKING THE MOST OF THE CAP

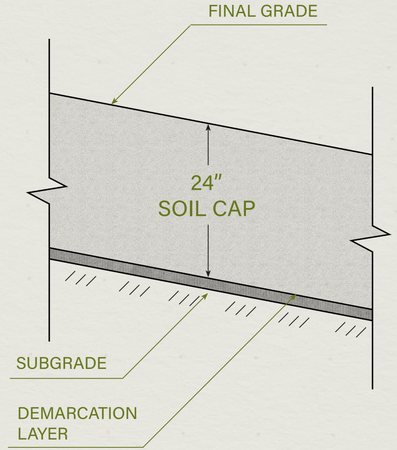
The site's land area is covered in an earthen and impermeable cap which present different planting opportunities. Areas of the site with an impermeable cap will take a seed heavy approach to planting. This will result in several meadow spaces central to the site. The earthen cap is more suitable for shrub and tree installation due to the fact that the cap demarcation layer allows root permeability.



Additionally, vertical planting opportunities allow for full control of planting media, which is necessary for plants adapted to soils that differ from the site's existing conditions.

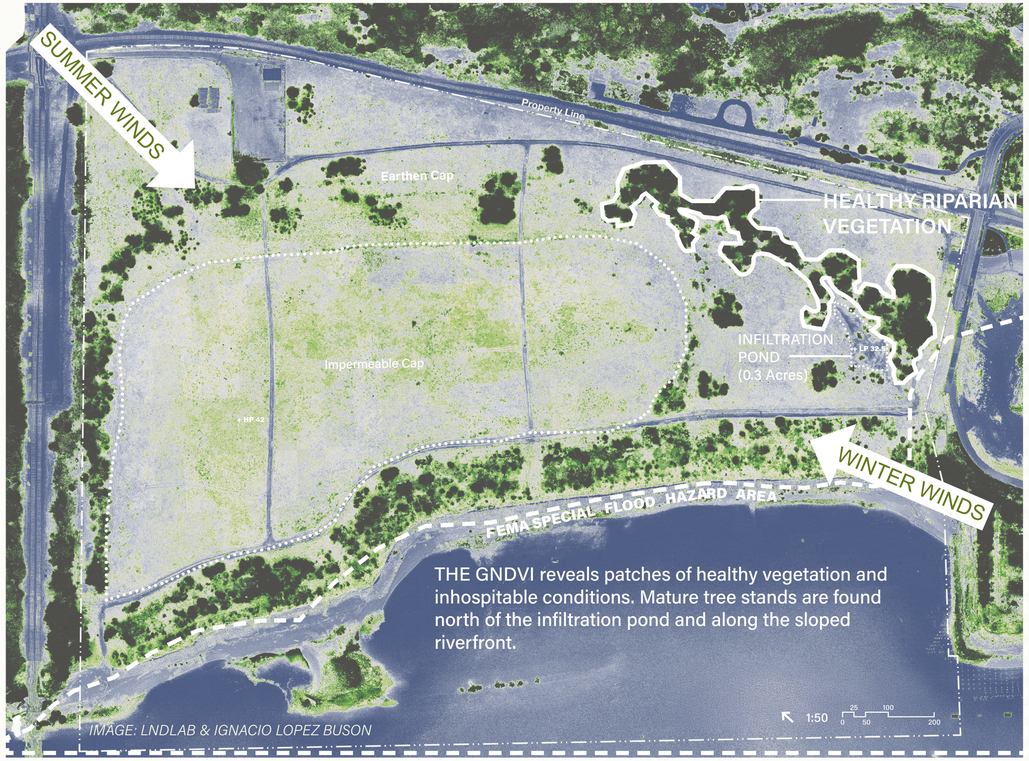
Because of soil cap limitations, the Oregon bioregion garden sequence will be restricted to the earthen cap.

EARTHEN CAP SECTION
(TYP. OUTSIDE WALL)



2.1.0 Site Analysis

VEGETATION AND SITE FEATURES



2.1.1 Site Analysis

CLIMATE - HEAT & DROUGHT



EXISTING SITE CONDITIONS











DESIGN CONSIDERATIONS

Oregon Bioregional Garden Sequence

+ Located on earthen cap
+ Sited near enterance
+ In proximity to public greenway trail
+ Utilizes existing vegetation

2.2 Site Conclusions

After completing the analysis phase of the project, it was determined that the earthen cap is the most suitable location for the Oregon Bioregional Garden Sequence. It should be easy to access, ideally near the garden entrance the public greenway trail. It should also utilize the existing native vegetation onsite. Based on existing site vegetation and historical documentation, it was determined that the site is readily suitable to accommodate hot, dry bioregions, but cool, wet climates take greater design intervention.

3. Translation



3.0.1 Site Layout

SERVING PROGRAMMING NEEDS

To set limitations on site layout, I used a conceptual layout shared by PBG to inform the location of the large conservatory, main entrance and parking lot. Further limitations were then put in place based on existing vegetation and infrastructural needs, like the bike greenway. Site infrastructure also considered feedback from parents, students and educators about Oregon Outdoor School facilities. The most important takeaway was that the site should feel inclusive and accommodating of all identities, backgrounds and abilities, and that there should be an abundance in proximity to engagement areas.

Parking draws on existing design proposals and facilitates primary site access. Building clusters are oriented for maximum solar potential and sited to support programming needs determined by PBG and Portland residents. Existing vegetation is drought-adapted and should be protected during construction. The tree setback should be clearly defined by a fence that prevents any machinery or vehicles from damaging the tree root system. Primary circulation is organically formed around programmatic spatial organization. Roads and the Willamette Greenway Trail provides connectivity and public access for bicyclists and pedestrians.

OREGON VEGETATION TYPES
ILLUSTRATING LANDSCAPE TYPOLOGIES

SCRUB



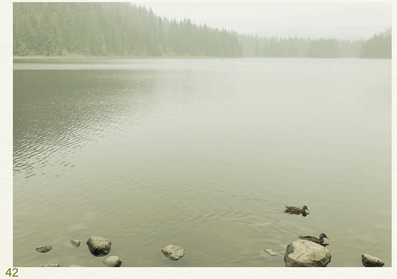
PONDEROSA FOREST



SAGE ON LAVA



DOUGLAS-FIR/WESTERN HEMLOCK FOREST



SHORELANDS



RIPARIAN MIXED CONIFER FOREST



3.1.0 Accommodating Different Environments

Oregon's regional diversity serves as a foundation for a garden sequence that teaches visitors about the state's climate, history and ecology. Oregon's vegetation communties become collections within each bioregional garden.

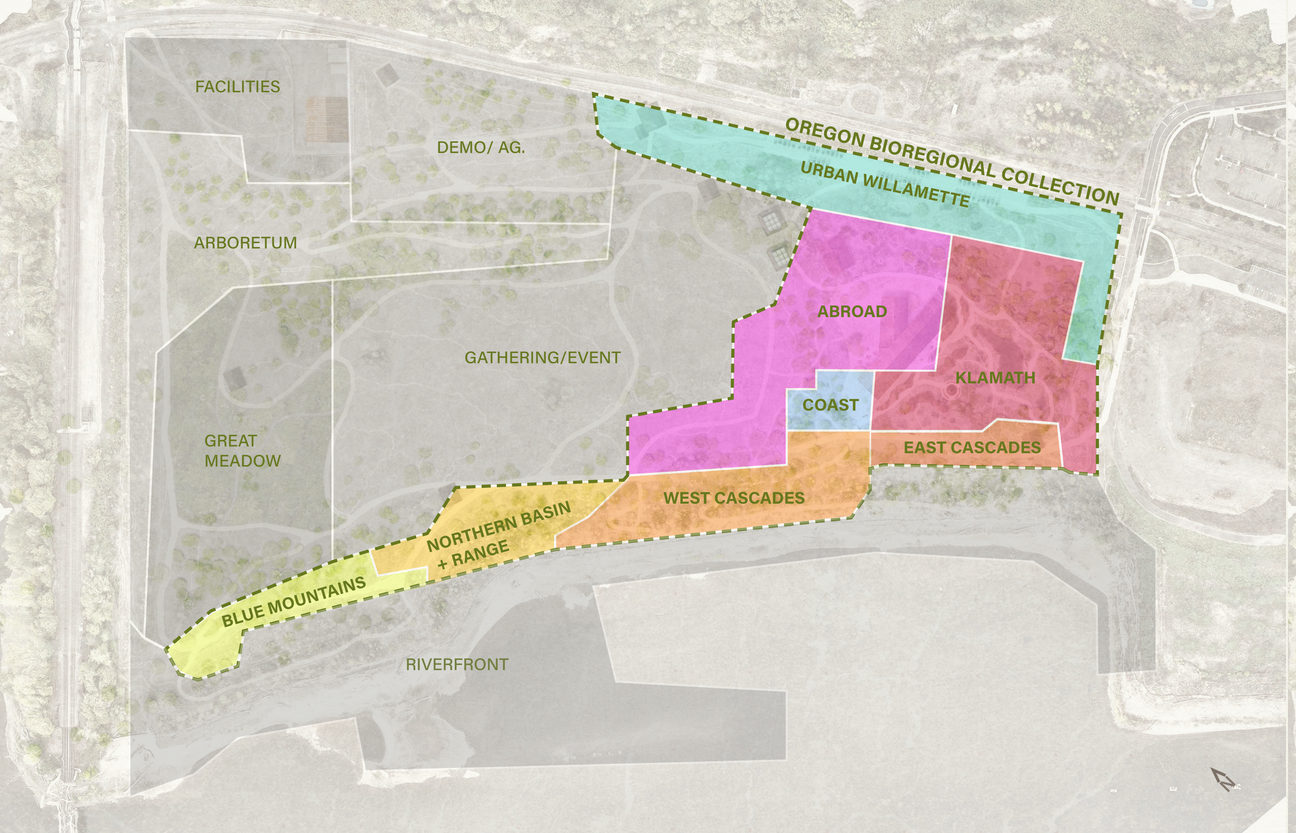
Oregon is a very ecologically-diverse state. There are coastal, alpine and desert conditions in close proximity. These bioregions are shaped by geographic conditions that take careful consideration to translate into a Portland site.

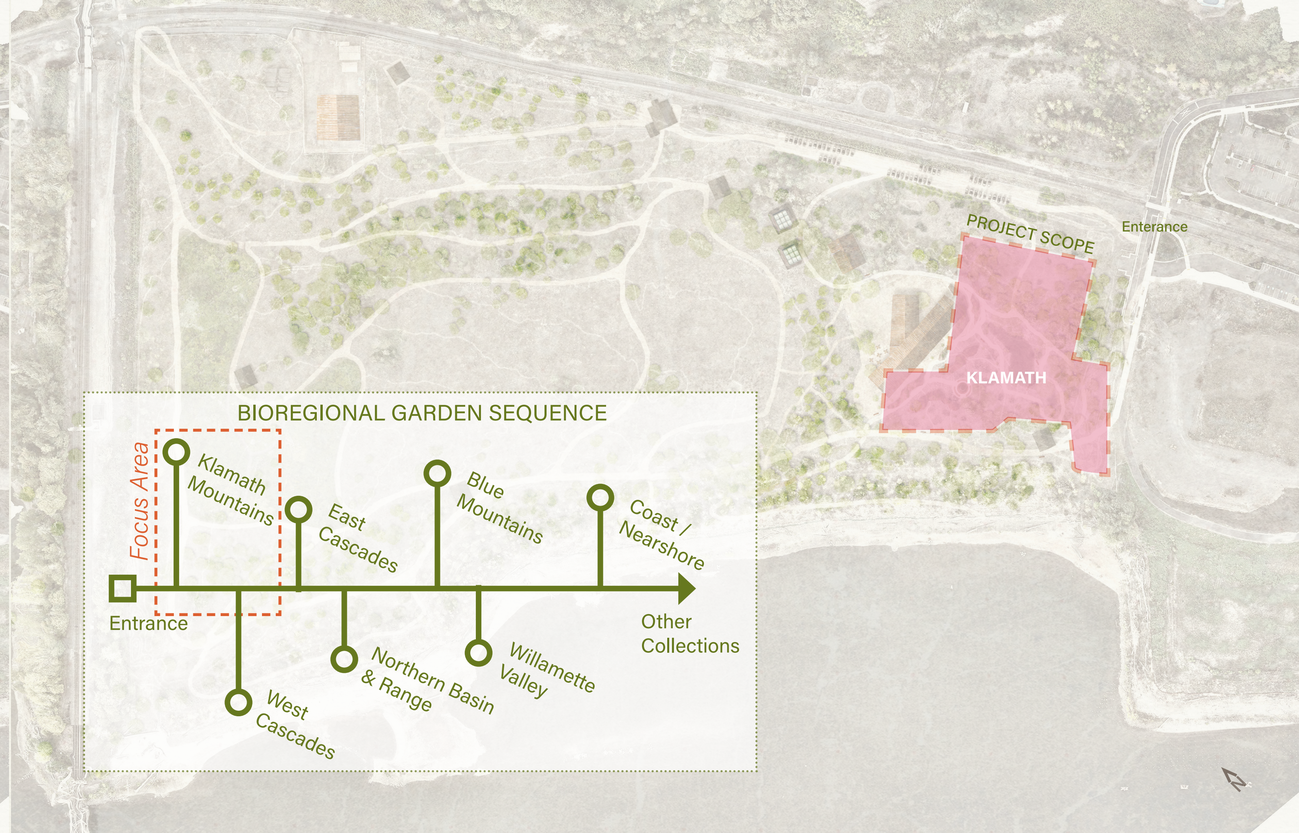
Conditions of the PBG site are generally warmer and dryer than the greater Portland metro area.

Parts of Oregon are well-adapted to transfer into Portland's urban conditions, which are generally more hot and drought-prone than the rest of the Willamette Valley. Some areas will take greater design intervention.

DESIGN TRANSLATION
Considerations for Garden Spatial Organization

OREGON	PBG SITE
	
Hot & Dry Climates *e.g. Klamath-Siskiyou, Willamette Valley*	Exposed, drought-prone site locations
Cool & Wet Climates *e.g. Coast, Blue Mountains*	Sites protected from heat through planting, buildings, constructed shade, and/or supplemental water
Vegetation type and plant community composition *e.g. Oak Savanna, Shrubland*	Garden plant communities


FACILITIES
DEMO/ AG.
OREGON BIOREGIONAL COLLECTION
URBAN WILLAMETTE
ARBORETUM
ABROAD
GATHERING/EVENT
KLAMATH
COAST
GREAT MEADOW
EAST CASCADES
WEST CASCADES
NORTHERN BASIN + RANGE
BLUE MOUNTAINS
RIVERFRONT


PROJECT SCOPE
Enterance
KLAMATH
BIOREGIONAL GARDEN SEQUENCE
Focus Area
Klamath Mountains
East Cascades
Blue Mountains
Coast / Nearshore
Entrance
Other Collections
West Cascades
Northern Basin & Range
Willamette Valley

OREGON FLORA PROJECT

Oregon Flora is a powerful search engine full of citizen observations of a given plant species. This tool confirmed plant alliances and localities.



ATLAS OF OREGON

The second edition of *Atlas of Oregon* provided critical state climate data, including precipitation regimes, temperature patterns and spatialized geological and botanical information.

LOWER TABLE ROCK

Site observation informed plant community organization, related species and hydrological conditions.



3.1.3 Learning from Oregon

LESSONS FROM PEOPLE & PLACE

Lower Table Rock is a landmark in southwest Oregon. This site informs plant communities to transfer into the Klamath-Siskiyou Garden at PBG due to its similarity in site conditions. After identifying key vegetation types, research on specific species and their cultivation was necesary.

Futher, Klamath Siskiyou Native Seeds is a seed supply company that designed Troon Botanical Garden and documented the process, which they then shared on their website. Finally, the Oregon Flora Project provides georefrenced citizen observations of a given plant species, allowing me to confirm species distribution and vegetation communities.

All of these resouces were valuable in developing Klamath Siskiyou Garden Collections.

CASE STUDY/PRECEDENT INFLUENCE

LOWER TABLE ROCK → PLANT COMMUNITIES

KLAMATH SISKIYOU NATIVE SEEDS → PLANT SPECIES

PLANT COMMUNITIES → PLANT SPECIES → PLANT CULTIVATION

BOTANICAL GARDEN + PARK PRECEDENTS → SITE IMPLEMENTATION

PLANT CULTIVATION → SITE IMPLEMENTATION

KLAMATH SISKIYOU LANDSCAPE FEATURES

VARIED VEGETATIVE COVER
MIXED FORESTS, PRAIRIE, ROCK OUTCROPS

DIVERSE SLOPE RANGE (5-95%)
TOPOGRAPHIC VARIATION

EXPOSED GEOLOGY
SERPENTINE, RIDGELINE

VARIABLE SUN EXPOSURE
MICROCLIMATES
FULL SUN TO SHADE

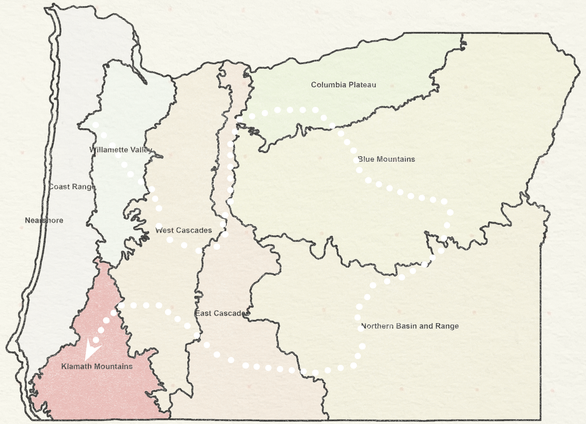


3.1.4 Distilling The Klamath-Siskiyou

OREGON'S MOST DIVERSE ECOREGION

Comparison of site conditions with Oregon climate regimes informed the layout of the Oregon Sequence Garden, which pairs Oregon ecoregions to its most suitable location on site.

The Klamath-Siskiyou garden is located in the hottest and driest part of the PBG site. Several of the bioregion's features are suitable in urban conditions. The garden aims to be an interpretation of the region, not a replica, meaning some liberty is taken in plant distribution overlap and species density, but elements like rock outcrops and forest composition are borrowed.





Lower Table Rock has many site simillarities to the PBG site, such as large areas of flat topography with shallow soils.

3.2.0 Landscape Parallels

IDENTIFYING LOWER TABLE ROCK'S TRANSLATABLE LANDSCAPE FEATURES

Utilizing Southern Oregon's geographical landmark, Lower Table Rock, located in Jackson County, Oregon as a case study is useful for designing details at site scale. The Table Rock plateau has many parallels to the site, such as temperature regimes and soil composition, which make it ideal to support translation of the Klamath-Siskiyou biome to the PBG site.

DESIGN PRECEDENT

Lower Table Rock,
Jackson County, OR

Key Landscape Elements to Replicate in the Botanical Garden Setting

+ Plant Communities
  Species with similar resource requirements; species dominance and composition
+ Soil Profile
  Botanical garden soils are constructed to replicate soil conditions from their bioregion, e.g. sharp drainage
+ Slope/Light/Water Conditions
  Collections display species that grow in a variety of environments
+ Disturbance Regimes
  Wildfire, anthropogenic activity



3.2.1 Evergreen Forest

Evergreen forest are dominated by stands of Pacific Madrone *(Arbutus menziesiii).* Trees grow in small groves with 10-15′ of space in between them. The understory is a shady grassland. These communities often occur on slopes and cannot tolerate waterlogged soil.

3.2.2 Shrubland

Shrubland is comprised of drought-tolerant perennials and evergreen shrubs like Buckbrush *(Ceanothus cuneatus).* Shrubs grow in small stands of 5-10 plants with 10-20′ between groupings. Plants in this ecosystem are adapted to summer dry conditions.

3.2.3 Oak Savanna

Oak Savanna habitat is defined by a predominant canopy of Oregon White Oak *(Quercus garryana).* Oaks are distributed in an open habit, creating sunny grassland conditions underneath them.

3.2.4 Vernal Pool & Mounded Prairie

Seasonally wet meadows have mild variations in topography, that dry out by the summer. Species are therefore adapted to seasonal inundations of water and summer dryness.



GARDEN COLLECTION CRITERIA/CONSIDERATIONS

WATER

SUMMER DRY *IRRIGATED*

LIGHT

SUN *PART SHADE* *SHADE*

SUBSTRATE

NUTRIENT DEFICIENT *FREE DRAINING* *MOISTURE RETENTIVE*

3.3.0 Garden Collections

Microclimates support a range of habitats. Wind and solar azimuth analysis inform proper utilization of site microclimates and interventions that create suitable conditions for a given botanical collection. Aerial photographs, topography, subgrade cap condition, Normalized Difference Vegetation Index (NDVI) multispectral imagery, and site hydrology modeling created a finer scale of data. Finally, inventory of existing vegetation allowed for inferences of site conditions.

Existing vegetation creates a layer of visual screening that can visually divide PBG into smaller garden collections.

Views from the main conservatory orient the visitor to views of different bioregional collections and the Willamette River.

DESIGN PRECEDENT

Troon Botanical Garden, *Applegate Valley, OR*

KSNS & Troon Vineyard

Troon Botanical Garden, designed by horticulturalists from Klamath-Siskiyou Native Seeds (KSNS), was a great starting point to determine what plants from the Klamath- Siskiyou were in cultivation and readily grow outside of their native range.

Cross comparing species from the Table Rock case study to the plants cultivated by KSNS was an essential resource for this project, as they provided key cultural considerations for each species they grow and supply seed with local genetics. They also provided a list of species they used in the garden,.





3.3.1 Riparian Forest

FULL SUN to FULL SHADE
IRRIGATION REQUIRED

PERENNIALS

Red Baneberry
Actaea rubra
2 ’x 2”

Sweet Coltsfoot
Petasites frigidus
2’, spreading

SHRUBS

Western Serviceberry
Amelanchier alnifolia
15’ x 6’

Red-flowering Currant
Ribes sanguineum
10’ x 10’

TREES

Ghost Pine
Pinus sabiniana
75’ x 6’
No water once established

ASSOCIATED SPECIES

Perennials

Dense Lacefern	*Aspidotis densa*
Pacific Bleeding Heart	*Dicentra formosa*
Oregon Iris	*Iris tenax*
White Insideout Flower	*Vancouveria hexandra*
Redwood Sorrel	*Oxalis oregana*
Miner’s Lettuce	*Claytonia perfoliata*

Shrubs

Oceanspray	*Holodiscus discolor*
Osoberry	*Oemleria cerasiformis*
Tall Oregon Grape	*Berberis aquifolium*
Western Azalea	*Rhododendron occidentale*

Trees

Pacific Madrone	*Arbutus menziesii*
Sugar Pine	*Pinus lambertiana*
Ponderosa Pine	*Pinus ponderosa*
Incense Cedar	*Calocedrus decurrens*

The riparian forest garden collection is comprised of a dense canopy with layers of vegetation. Small trees and shrubs connect grasses and perennials to the upper canopy. Inner forest conditions may require summer irrigation to accommodate species that naturally occur near water. Edge conditions accommodate species that are adapted to summer drought.



3.3.2 Wetland

FULL SUN
IRRIGATION REQUIRED

PERENNIALS

Bigelow's Sneezeweed
Helenium bigelovii
3'x2'
Bloom: June - September

Sparse-flowered Bog Orchid
Platanthera sparsiflora
2'x1'

Cobra Lily
Darlingtonia californica
2'x2'

SHRUBS

Bog Laurel
Kalmia polifolia
3'x5'
Bloom: June - September

ASSOCIATED SPECIES

Perennials

California Butterwort	*Panguicula macroceras*
Yellow Monkeyflower	*Erythranthe guttata*
Umbrella Plant	*Darmera peltatum*
Showy Milkweed	*Asclepias speciosa*
Large Camas	*Camassia leichtinii*

Shrubs

Pacific Wax Myrtle	*Morella californica*
Evergreen huckleberry	*Vaccinium ovatum*
Bog Rosemary	*Andromeda polifolia*

Trees

Pacific Madrone	*Arbutus menziesii*
Ponderosa Pine	*Pinus ponderosa*

The wetland classification of plantings has a unique feel to it due to its unique growing conditions. Mirroring natural ecosystems, this garden community grows in a free-draining, nutrientless media of 50% pumice, 20% pine needles and 30% wood chips. A subterranean waterproof liner slows the rate of water infiltration under plant roots, creating moisture retentive conditions.

Varied topography and plant heights create a variety of sun exposures, allowing for a more diverse plant palette.

3.3.3 Mixed Evergreen Forest

FULL SUN to FULL SHADE
NO WATER



PERENNIALS

Lomatium utriculatum
Arbutus menziesii
2’ x 2”

Henderson’s Shooting Star
Dodecatheon hendersonii
2’x2’

SHRUBS

Fremont Silktassel
Garrya fremontii
15’ x 10’

Hairy Manzanita
Arctostaphylos columbiana
15’ x 10’

TREES

Ponderosa Pine
Pinus ponderosa
130’x6’

Pacific Madrone
Arbutus menziesii
130’x15’

ASSOCIATED SPECIES

Perennials

Western Columbine	*Aquilegia formosa*
Vanillaleaf	*Achlys triphylla*
Pacific Hound’s Tongue	*Adelinia grandis*
Hooker’s Fairybells	*Prosartes hookeri*
Giant Purple Wakerobin	*Trillium kurabayashii*

Shrubs

Blueblossom	*Ceanothus thyrsiflorus*
Snowbrush	*Ceanothus velutinus*
Baldhip Rose	*Rosa gymnocarpa*

Trees

Oregon White Oak	*Quercus garryana*
Sugar Pine	*Pinus lambertiana*
Baker Cypress	*Cupressus bakeri*
Incense Cedar	*Calocedrus decurrens*

The mixed evergreen forest collection has 40-70% canopy cover. The canopy is dominated by Pacific Madrone, but contains some conifers. The understory features a sparse scattering of evergreen shrubs. The herbaceous layer is comprised of a mix of spring ephemerals.

3.3.4 Oak Savanna

FULL SUN to PART SHADE
NO WATER

PERENNIALS | SHRUBS | TREES



Oregon White Oak
Quercus garryana
30 ’x 30’

Buckbrush
Ceanothus cunneatus
10’x10’

Whiteleaf Manzanita
Arctostaphylos glauca
12’ x 10’

Common Madia
Madia elegans
1-6’ x 3’

Common Yarrow
Achillea millefolium
2’ x 3’

ASSOCIATED SPECIES

Perennials

Silver Lupine	*Lupinus albifrons*
Cobweb Thistle	*Cirsium occidentale*
Western Coneflower	*Rudbeckia occidentalis*
Serpentine Sunflower	*Helianthus bolanderi*
Prairie Smoke	*Geum triflorum*
California Globe Mallow	*Iliamna latibracteata*
Paintbrush Species	*Castilleja spp.*
Prairie Junegrass	*Koeleria macrantha*
Roemer’s Fescue	*Festuca roemeri*
California Oatgrass	*Danthonia californica*

Shrubs

Nootka Rose	*Rosa nutkana*
Antelope Bitterbrush	*Purshia tridentata*

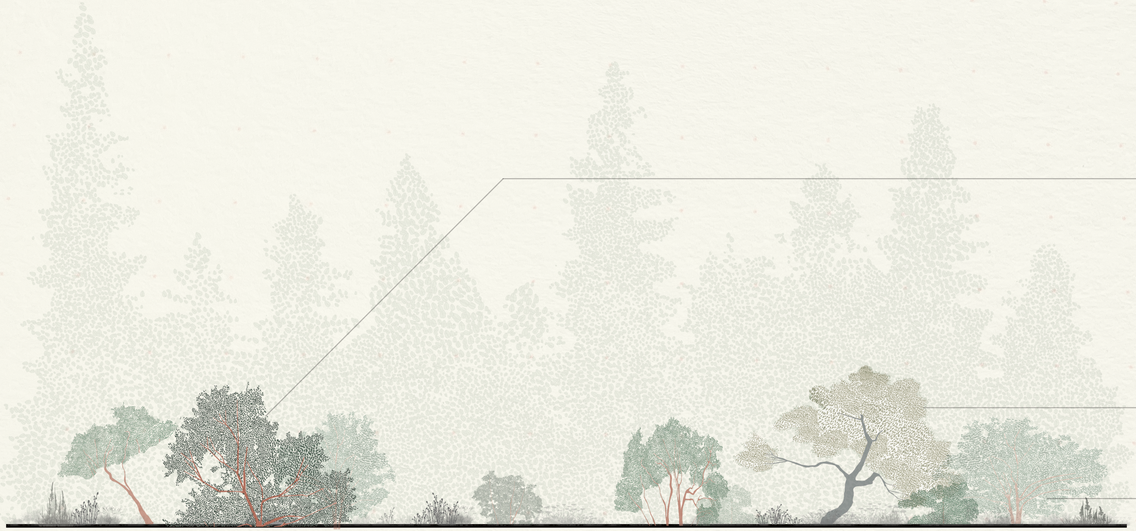
Trees

Pacific Madrone	*Arbutus menziesii*

Oak savanna features sparse, open canopy of no more than 30% and open prairie. Oregon White Oak dominates the tree composition, with scatterings of Pacific Madrone. Prairie species grow in full sun to part shade in seasonally wet meadows.

3.3.5 Shrubland

FULL SUN
NO WATER



SHRUBS

Buckbrush
Ceanothus cunneatus
10’x10’

Whiteleaf Manzanita
Arctostaphylos glauca
12’x10’

Tan Oak
Nolithocarpus densiflorus
6’x6’

ASSOCIATED SPECIES

Perennials

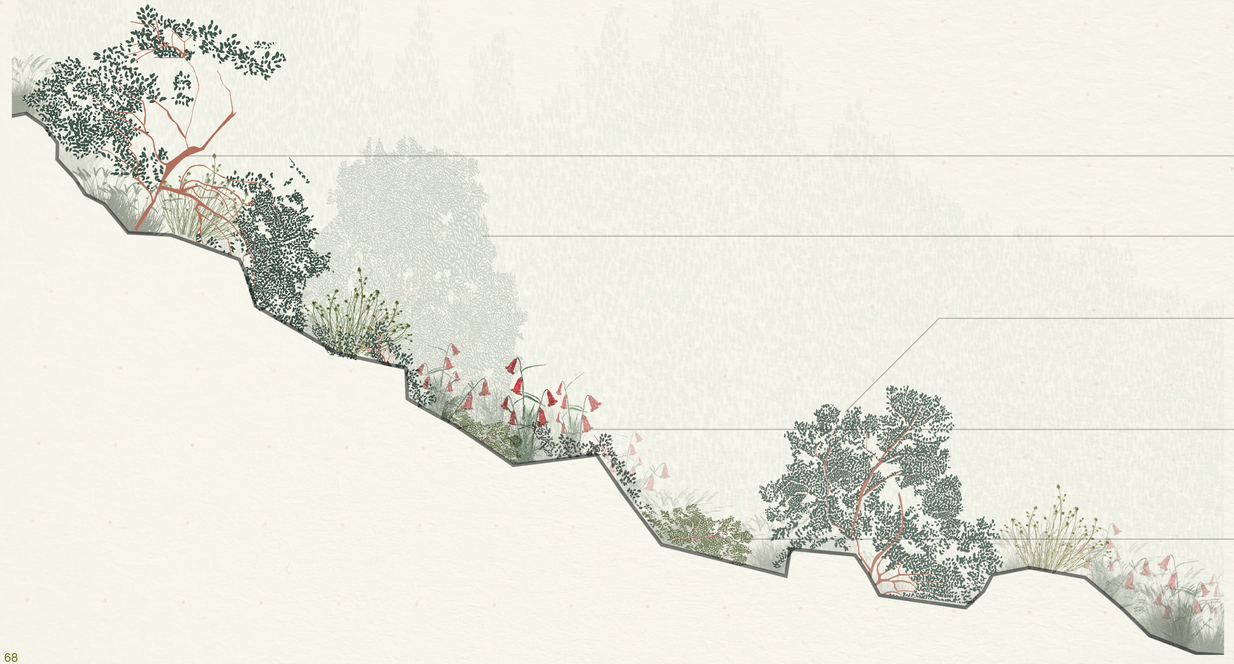
Meadow Larkspur	*Delphinium nuttallianum*
Ookow	*Dichelostemma congestum*
Oregon Iris	*Iris tenax*
Giant Blue Eyed Mary	*Collinsia grandiflora*
Vinegar Weed	*Trichostema lanceolatum*

Shrubs

Curlleaf Mountain Mahogany	*Cercocarpus ledifolius*
Red-flowering Currant	*Ribes sanguineum*
Wax Currant	*Ribes cereum*
Kinnikinnick	*Arctostaphylos uva-ursi*
Yerba Santa	*Eriodictyon californicum*

The shrubland collection is dominated by Buckbrush (Ceanothus cunneatus) and Whiteleaf Manzanita (Arctostaphylos glauca), making up 50% and 30%. of the species composition respectively.

Shrubs are underplanted with a matrix of perennial grasses and annual forbs. This garden receives no supplemental water.



3.3.6 Serpentine

FULL SUN
NO WATER

PERENNIALS

Harford's Wild Buckwheat
Ceanothus cunneatus
1'x1'

Scarlet Fritillary
Fritillaria recurva
2'x1'

Coyote Mint
Monardella villosa
2'x2'

SHRUBS

Greenleaf Manzanita
Arctostaphylos
6'x9'

Serpentine Coffeeberry
Frangula californica ssp. tomentella
10'x10'

Gasquet Manzanita
Arctostaphylos hispidula
6'x6'

ASSOCIATED SPECIES

Perennials

Barestem Biscuitroot	*Lomatium nudicaule*
Gentner's Fritillary	*Fritillaria gentneri*
Siskiyou Fritillary	*Fritillaria glauca*
Sanborn's Onion	*Allium Sanbornii*
Narrowleaf Onion	*Allium amplectens*
Corn Lily	*Veratrum californicum*
Tolmie Star-Tulip	*Calochortus tolmiei*
Threadleaf Penstemon	*Penstemon filiformis*
Nose Skullcap	*Scuttelaria antirrhinoides*

Shrubs

Tanoak	*Nolithocarpus densiflorus*
Pinemat Manzanita	*Arctostaphylos nevadensis*
Creeping Oregon Grape	*Berberis repens*

The serpentine garden community is particularly diverse in its topography. Constructed over an artificial rock formation, the soil is free-draining and is deficient in calcium and phosphorus. Perennial species predominate in this garden community, inviting close observation.

4. Application



4.0 Site Implementation

SITE-SCALE DESIGN NODES

1. Serpentine Siskiyou Canyon

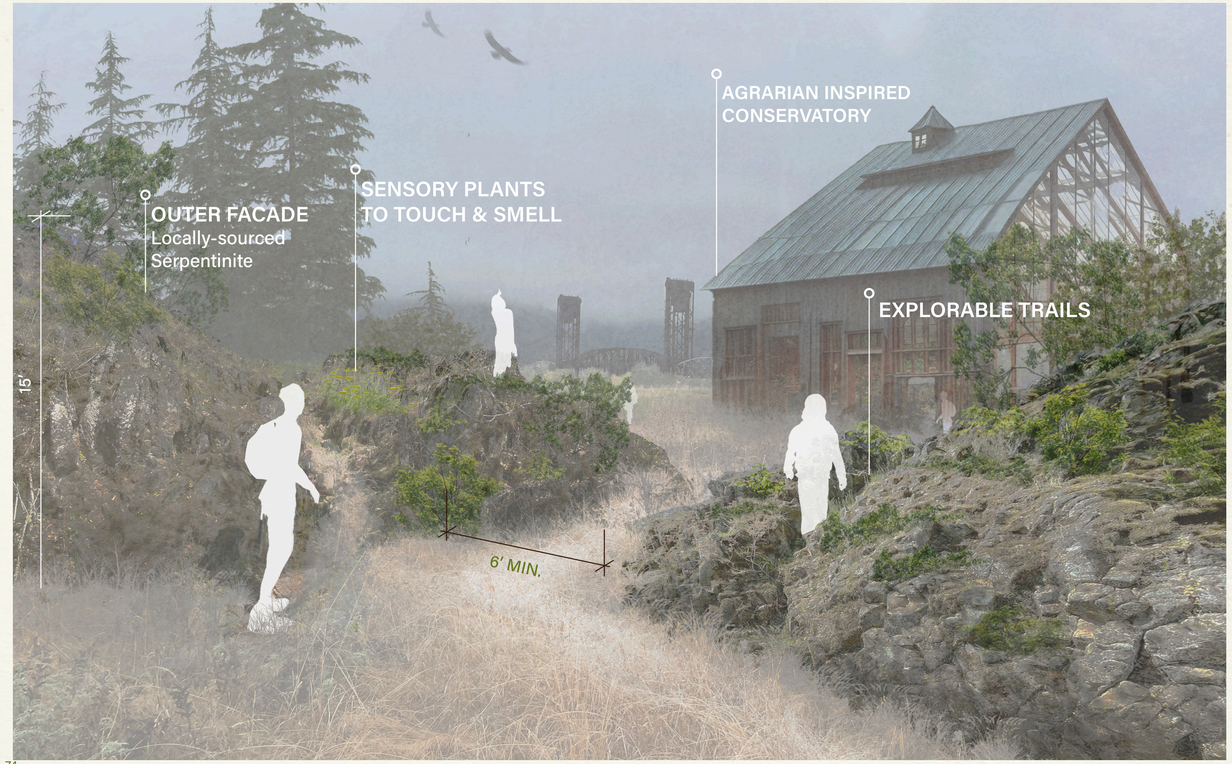
This node brings 5th grade students into an immersive rock outcrop with eye-level viewing and species exploration. Students are invited to walk over outcrops with clear pathways.

2. Carnivorous Bog

The Carnivorous Bog invites wonder by allowing 5th graders to hop through the wetland area via raised, reclaimed stumps. Students can get up-close and personal with unique species.

3. Microtopo Pathways

Modified pathways are planted along the perimeter and universally accessible in the middle. This allows for side-by-side play and exploration for students of all abilities.



4.1.0 Serpentine Siskiyou Canyon

The Serpentine Siskiyou Canyon brings a new topographic experience to the otherwise flat PBG site. This landscape feature allows visitors to explore serpentine plant communities in rocky outcrops.

Soil cap construction informs footing depths for rock installations and in-situ stabilization (ISS) under building footprints for earthquake preparedness. Rock facades are constructed over a concrete frame set over stabilized soil. The concrete framework is filled with large reclaimed concrete from the site and then overfilled with a loose aggregate material, low in nutrients matter.

Attention to scale is important to make the space feel immersive for a 5th grader, and the structures are intended to be walked through and over, allowing engagement with a variety of plant species.

Rare or sensitive species shall be protected from areas that invite foot traffic. Fencing or guardrails can be used to highlight rare species in proximity to circulation. Constructed rock outcrops have the ability to interface with the large conservatory, connecting the inside to the outside through a seemingly continuous rock formation. During spring, summer and fall months, removable and sliding walls of the conservatory open to create a continuous experience of the canyon.

ENGAGED SENSES



TOUCH



SMELL

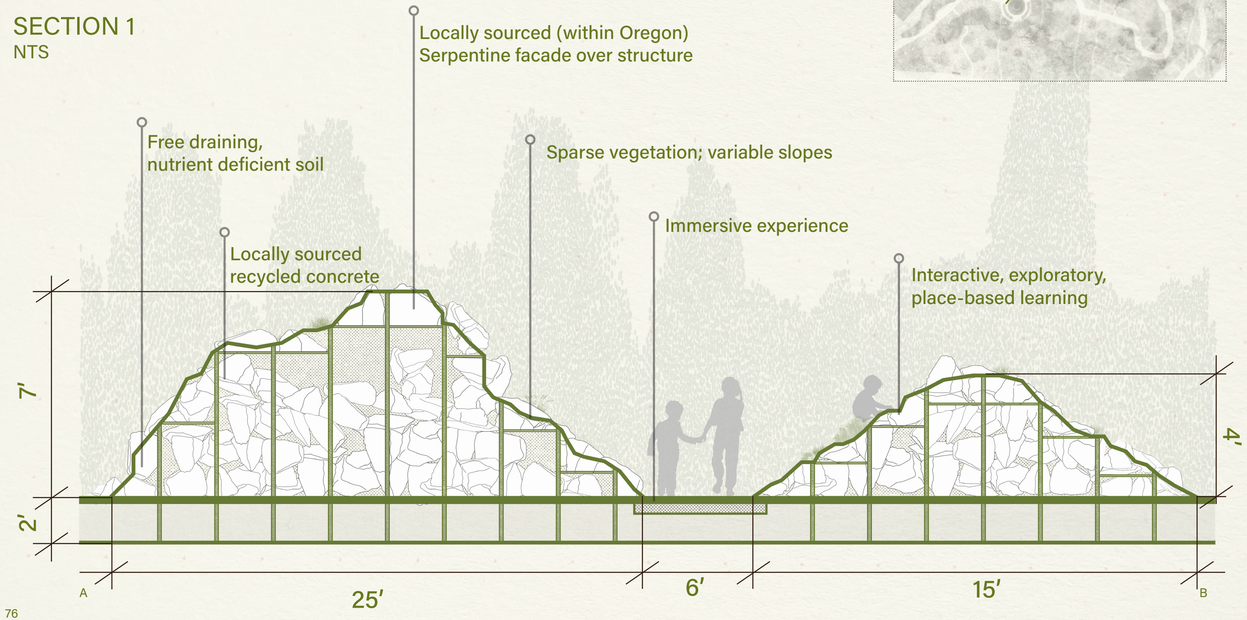


SEE

4.1.1 Constructing the Canyon



SECTION 1
NTS



4.1.2 Serpentine Soldiers



California Coffeeberry
Rhamnus californica ssp. tomentella

This medium-sized, evergreen shrub has fuzzy leaves that invite touch.

Scarlet Fritillary
Fritillaria recurva

This species has eye-catching color and its bell shaped flower can spark imaginative imagery for youth.

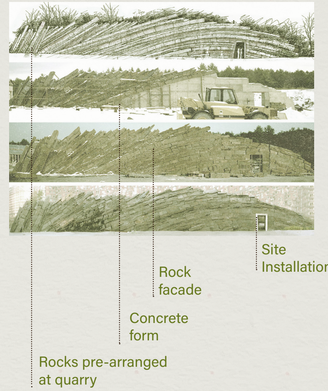
Coyote Mint
Monardella villosa

Ethnobotanical uses as tea and medicinal remedy; foliage is fragrant when rubbed.

DESIGN PRECEDENT

Teardrop Park, *NYC*
MVVA

Teardrop Park is an example of an interactive rock sculpture built on structure that informs the construction of the PBG Serpentine Canyon.





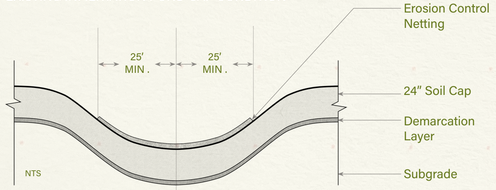
4.2.0 Carnivorous Bog

The Carnivorous Bog brings one of Oregon’s most unique vegetative communities into the city, allowing visitors to get up close and personal with uniquely adapted species.

Analysis of the existing retention pond construction revealed that it is filled with sand, allowing for water to drain freely. Due to the sharp drainage of the retention pond and lack of irrigation, there are almost no species currently growing in this area of the site.

The existing depressed topography of the retention pond connects to an existing bioswale, which can create ideal conditions to support a seasonally-wet plant community from the Klamath region. A waterproof liner will modify the retention pond to create bog conditions to support a collection of Cobra Lily (Darlingtonia californica), an Oregon Native carnivorous plant.

EXISTING INFILTRATION POND CAP CONDITION



ENGAGED SENSES


TASTE


HEAR

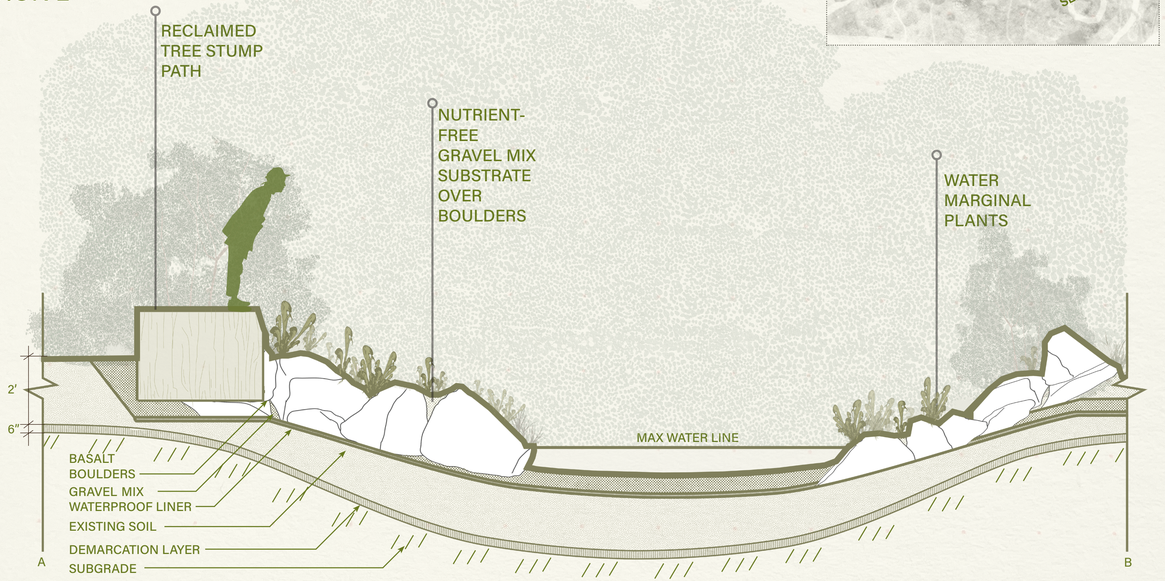

SMELL


SEE

4.2.1 Reviving the Retention Pond



SECTION 2



4.2.2 Carnivorous Carnival

Cobra Lily
Darlingtonia Californica

Trapped insects can be heard buzzing in the liquid-filled tubes of the Cobra Lily if you listen carefully. Get too close however, and you might catch a whiff of those dying bugs! Gross but unforgettable!

Sparse-flowered Bog Orchid
Platanthera sparsiflora

Flower size and structure may also vary year to year on this plant. This curious mechanism may introduce students to deeper biological concepts for those who are interested in pursuing science.

Miner's Lettuce
Claytonia perfoliata

This plant grows in ecotone understories. Miner's Lettuce gets its name because it was eaten by gold rush workers. This plant can be grown in abundance for tasting on guided tours. This is an easy plant for 5th graders to try growing at home in moist, shady areas.

California Lady Slipper
Cypripedium californicum

This unusual flower can spark imaginative inquiry. Lady Slipper flowers have coevolved with their pollinators to ensure best viability. Their pouch-like morphology acts as a trap for insects, that then transports pollen to the plant's stigma on their way out, thus facilitating pollination.



4.3.0 Interactive Microtopography

Microtopographic pathways direct your attention down to the ground to view small-scale biodiversity, considering the role of scale in designing for the target audience. Engagement with diverse plantings that utilize the microtopography of pathways can be a fun activity for kids, and a 6' wide leveled pathway through the center makes it universally accessible for all.

Subtle topography creates ideal conditions for species that coexist with disturbance and limited resources. Boulders create a gradient of moisture and lighting variation that can support a number of small, annual species.

ENGAGED SENSES



TOUCH



HEAR



SMELL

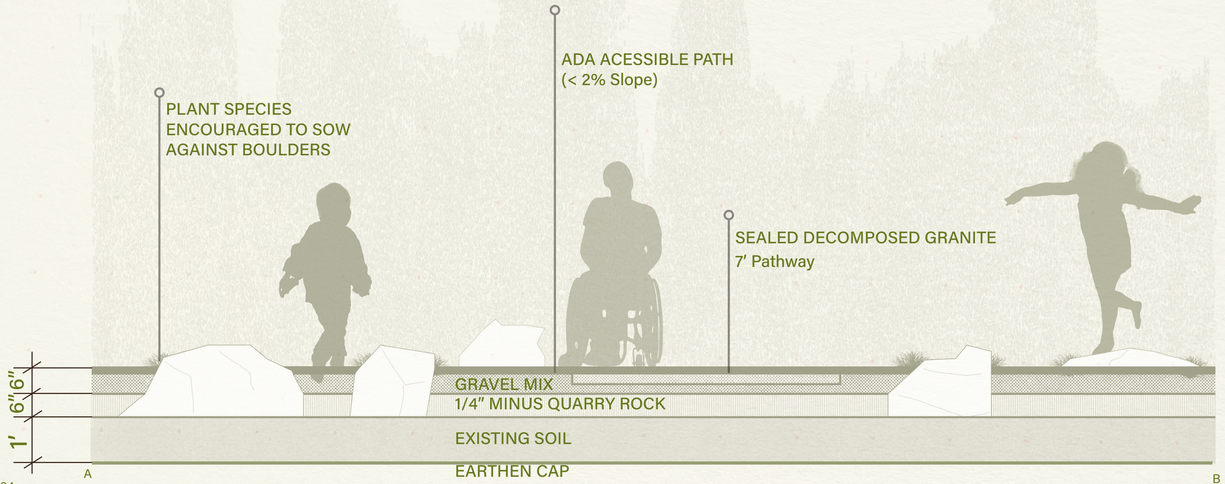


SEE

4.3.1 Engagement for All



SECTION 3



4.3.2 Small Moments.. Big Impacts

Pearly Everlasting
Anaphalis margaritacea

Dry, papery husks make an interesting sound when touched. On guided tours, visitors should be encouraged to pick a flower and bring it close to their ear for a listen.

Rosy Plectritus
Plectritus congesta

Rosy Plectritus has a delightful fragrance. Plantings en masse will amplify its effect. Seeds can be allowed to self sow around pathway edges and rock formations.

20 mm

California Goldfields
Lasthenia californica

This tough annual creates a blanket of yellow over the prairie landscape in spring.

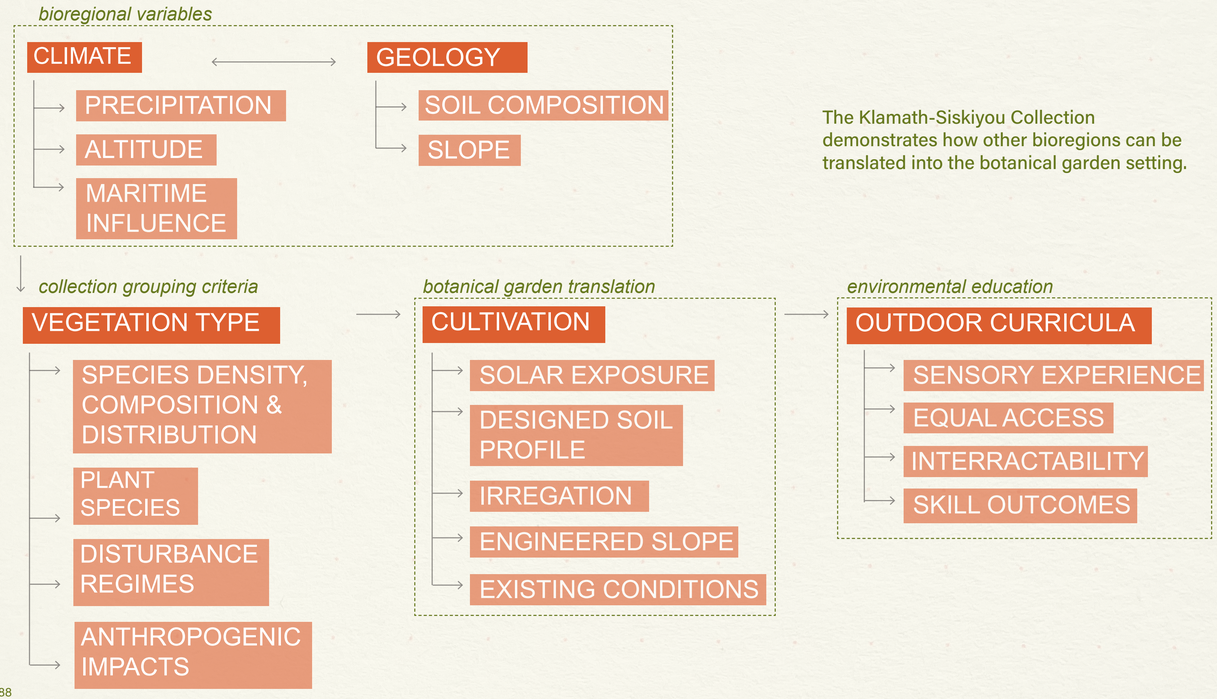
2 cm

Cow's Udder
Trifolium depauperatum

Visual similarities to its namesake make this plant memorable. Dense sowing by seed ensures light foot traffic is not detrimental to population density.

5. Conclusion

BIOREGIONAL COLLECTION TRANSLATION CONSIDERATIONS



The Klamath-Siskiyou Collection demonstrates how other bioregions can be translated into the botanical garden setting.

5.0 Translation Framework

This project resulted in a design framework for translating bioregional collections into a botanical garden setting and an implementation strategy for education. By examining climatic variables, distilling vegetation types and species and then implementing horticultural strategies, this project culminated in three educational nodes that successfully demonstrate engagement of all five senses though Oregon native plants.

Using a landscape analog as a casestudy, like Lower Table Rock, is an excelent way to distill landscape features that can then be translated into the urban setting. The considerations listed on the opposite page can be used to translate the remaining Oregon Bioregional gardens.

IMPLEMENTATION NEEDS

FEEDBACK

- Public Schools & 5th Grade Students
- Native Communities
- Botanical Garden Staff
- Portland Community Members

DATA

- Public Schools & 5th Grade Students
- Species Cultivation & Availability
- Species Cultivation

COLLABORATION

- Public Schools & 5th Grade Students
- Environmental Education Organizations
- Public Agencies



5.1 Measuring Design Outcomes

It is important to acknowledge that evaluation of design interventions is only possible through engagement with the target audience. Feedback from Native communities, Portlanders, botanical garden staff and public school teachers and parents are sure to impact implementation of this project, creating opportunities for PBG to serve its local community.

This project demonstrates that engagement with Oregon's flora can provide memorable educational outcomes. Outdoor focused learning settings, such as botanical gardens, serve the broader need to connect urban populations, particularly youth, to the natural environment. Informing fifth-grade student visitors of our region's cultural history can better prepare future urban residents to embrace their role within the environment.

A botanical garden at the McCormick and Baxter Superfund Site that hosts a complete collection of Oregon's bioregions will strengthen community, awareness and resilience for Portland youth and residents of Northeast Portland.

With a local bioregional garden sequence, PBG can become an ideal destination for school field trips and youth engagement.

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Page 16: Leach Botanical Garden Tree Walk, *Tamra Tiemeyer*, n.d.

Page 55: Troon Botanical Garden, *Klamath Siskiyou Native Seeds*, May 2024

Page 75: Teardrop Park Construction Detail and Photo, *Michael Van Valkenburgh Associates Inc.*, n.d.