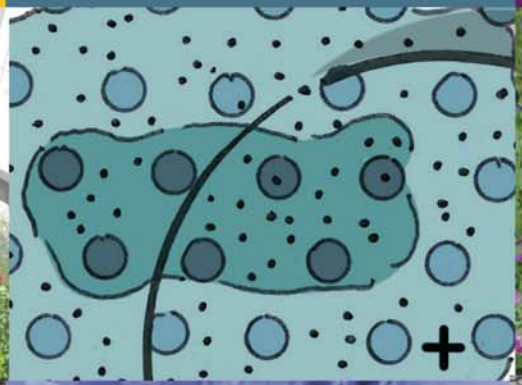
The Meadowscaping Handbook












WEST MULTNOMAH
Soil & Water Conservation District

Acknowledgments

The Meadowscaping Handbook: Designing, Planting and Managing an Urban Meadow is a collective effort of the Pacific Northwest Urban Meadowscaping (PNUM) working group. The experiences of regional ecologists and landscape professionals, along with regional prairie research, also informed this handbook.

Production of The Meadowscaping Handbook was managed by Mary Logalbo, Urban Conservationist, West Multnomah Soil & Water Conservation District, who also wrote and edited the book along with Mark Griswold Wilson, Ecologist. Additional edits were made by Carolyn Lindberg, Communications Coordinator, West Multnomah Soil & Water Conservation District.

Many thanks to the following for document review:

- Gaylen Beatty, Columbia Land Trust, Backyard Habitat Certification Program
- Mary Bushman, City of Portland Bureau of Environmental Services
- Erik Carr, East Multnomah Soil & Water Conservation District
- Jennifer D'Avanzo and Briana Danner, GreenWorks
- Eric Mader, The Xerces Society
- Dominic Maze, City of Portland Bureau of Environmental Services
- Tiffany Searsdodd, West Multnomah Soil & Water Conservation District

Appendix items contributed by:

- Lynda Boyer & Eric Hammond, Heritage Seedlings & Liners
- GreenWorks
- Elaine Stewart, Metro
- Mark Griswold Wilson, Ecologist
- The Xerces Society

Additional thanks to Mark Griswold Wilson and GreenWorks for in-kind contributions beyond the scope of their contracts.

This Handbook was funded by West Multnomah Soil & Water Conservation District (WMSWCD). The contents of this document do not necessarily reflect the views and policies of WMSWCD, nor does the mention of trade names or commercial products constitute endorsement or recommendation for use.

This publication is available in downloadable format at www.wmswcd.org.

Front Page Photo and Graphic Credit:

Top Row (from left to right): Graphic 1 and 2: GreenWorks; Photo 1: Mary Bushman, City of Portland Bureau of Environmental Services; Photo 2: Lynda Boyer, Heritage Seedlings & Liners; Photo 3: Gaylen Beatty, Columbia Land Trust

Middle Row (from left to right): Photo 1: Eric Mader, The Xerces Society, Photo 2: Mary Bushman, City of Portland Bureau of Environmental Services; Graphic 1 and 2: GreenWorks; Photo 3: Mary Bushman, City of Portland Bureau of Environmental Services.

Bottom Row (from left to right): Graphic 1: GreenWorks; Photo 1: Mary Bushman, City of Portland Bureau of Environmental Services; Photo 2: Bob Hansen; Photo 3: Mary Logalbo, West Multnomah Soil & Water Conservation District; Graphic 2: GreenWorks

Inside Cover Graphic Credit: GreenWorks

Photo credit: Bob Hansen

Table of Contents

"We have to raise the bar on our landscapes. In the past, we have asked one thing of our gardens: that they be pretty. Now they have to support life, sequester carbon, feed pollinators and manage water."

Douglas Talamy, Professor
University of Delaware, 2015

1. Introduction

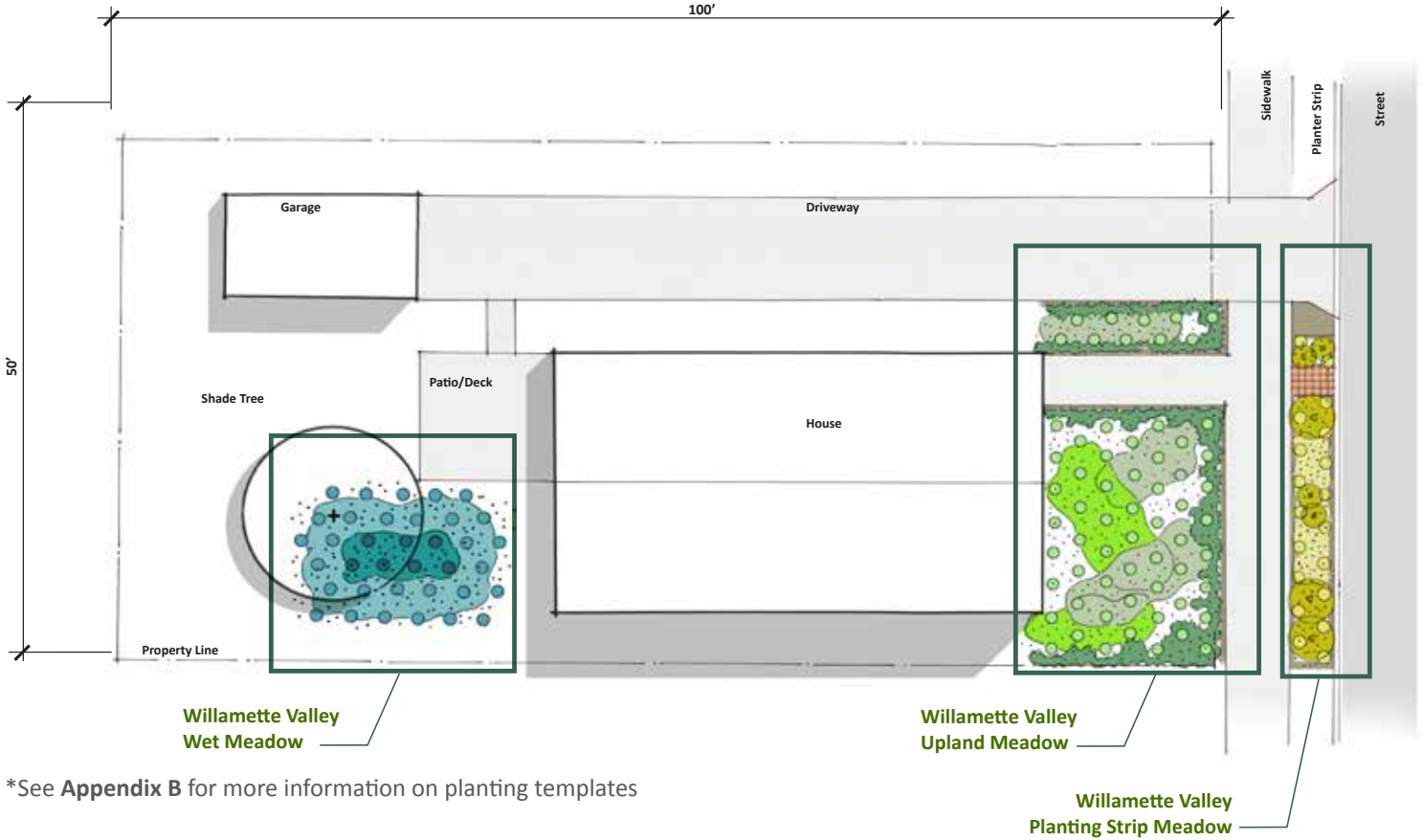
Photo credit: Bob Hansen

Purpose

The purpose of this handbook is to help gardeners, landscape professionals and ecologists in the Willamette Valley design and plant communities of native prairie plants in urban garden settings. It is important to note that this is not a technical manual for restoring large scale prairies in the region. Rather, this how-to publication offers guidelines for planning, designing, planting, and maintaining meadows on small urban plots (less than 0.25 acres in size) using plants native to the Willamette Valley.

This guide is a compilation of lessons learned locally by partners of the collaborative Pacific Northwest Urban Meadowscaping (PNUM) working group, the experiences of regional ecologists, landscape professionals and regional prairie research data. While the information presented is specific to the Willamette Valley it is adaptable to other areas of the Pacific Northwest west of the Cascades.

WILLAMETTE VALLEY MEADOW ZONE PLANTINGS



*See **Appendix B** for more information on planting templates

Why Meadowscape?

Help reduce our ecological footprint

If a significant number of people converted their lawns to native grasses and wildflowers, it could have a quantifiable and significant impact on the world by providing habitat and stormwater benefits (See: *http//footprintnetwork.org*). Meadows can also provide enhanced ecosystem services, such as conserving water and sequestering carbon, compared to some common landscape alternatives (Pickett et al.2008). Because our native prairie plants are adapted to the region and seasonal drought conditions, the need for supplemental irrigation decreases after they are established. Deep-rooted meadow plants have shown the ability to enhance soil structure and infiltration rates (Selbig et al, 2010). Additional polluting inputs that other landscape features may require, such as fertilizer and frequent gas-powered mowing, are not necessary.

Conserve and increase biodiversity

Biodiversity, the variety of life, is crucial to ecosystem sustainability and resilience. As of 2005, 32-40 million acres of land has been converted to lawn in this country (Milesi et al, 2005), which equates to an area of non-native monocultures more than eight times the size of New Jersey. Installing diverse meadows increases the variety of life in urban areas. Meadows throughout the urban environment create crucial stepping stones of habitat, providing food and shelter, which enhance wildlife connectivity between our backyards and urban greenspaces. Meadowscaping provides guidance that is particularly targeted at ensuring that our diminishing native pollinators, primarily native bees, have their food and habitat needs met. Pollinators are vital to creating and maintaining habitats and ecosystem functions that many animals depend on, including humans.

Increase awareness of our natural and cultural heritage

Prior to European settlement, the Willamette Valley was covered with a mosaic of oak woodlands, open savanna, prairie, and wetlands intermixed with stands of conifer forest. Less than seven percent of this original Willamette Valley habitat remains due to a variety of factors including development, fire suppression and flood control (The Intertwine Alliance, 2012). Planting and caring for urban meadows can reconnect us to our Oregon prairie heritage (Campbell, 2004).

Photo Credit: Gaylen Beatty, Columbia Land Trust

Photo Credit: Kammy Kern-Korot,
West Multnomah Soil & Water Conservation District

Urban Meadows and Pollinators

Although original vast Willamette prairies are now diminished, the urbanizing Valley is still home to 50 native species of butterflies, several of which are at risk. While the planting of an urban meadow cannot substantially increase the numbers of endangered butterflies, it can provide habitat for other pollinators, particularly bees.

Nationwide there are approximately four thousand species of bees, with 600-800 species native to Oregon alone. In the Willamette Valley there are likely more than 150 species of native bees. While significant media attention has been devoted in recent years to the decline of introduced European honey bees, there is also evidence of native bee species/wild pollinator decline.

Causes of decline are difficult to pinpoint, but loss of habitat due to increased urbanization, expansion of intensive agriculture, invasive species, introduced diseases and parasites, and the widespread use of pesticides all negatively impact pollinator populations. Protecting, enhancing, or providing new habitat is the best way to conserve native pollinators. (Excerpts from Xerces Society, *Pollinator Conservation in the Portland Metro Region*). Please see the **Appendix** for "Pollinators that May Be Found in Urban Portland Gardens."

Helpful Definitions

Prairie

A **Prairie** is an extensive area of flat or rolling land dominated by grass and other non-woody plants. Prior to pioneer settlement of the Oregon territory in the early nineteenth century, much of the Willamette Valley was composed of both wetland and terrestrial prairies (Boyd, 1999). Now, most of the Valley is treed, farmed, or developed; the vast majority of historic Willamette prairie has been removed. In this guide **prairie** will describe the historic Willamette Prairie.

Photo Credit: Laura Taylor, West Multnomah Soil & Water Conservation District

Meadow

A **Meadow** is a tract of land dominated by grass and other non-woody plants, either in its natural state or used for a purpose. Until recently, the term meadow was used to describe a grassy feature of the managed rural landscape such as a pasture or its urban relative, the lawn. In this guide we'll use the words "urban meadow" to describe managed groups of native prairie plants.

Photo Credit: Laura Taylor, West Multnomah Soil & Water Conservation District

Meadowscaping

Meadowscaping is the actual practice of designing, planting, and managing an urban meadow to provide ecological functions and benefits such as pollinator habitat and stormwater improvement. Meadowscaping is an alternative to managing a monoculture of turf grass lawn. Meadowscaping with a diversity of native prairie plants is a practice adapted to the local climate and soil conditions as well as to the needs of native wildlife. This landscaping practice uses native plant species that are deep-rooted and drought resistant, offers habitat and forage for birds, pollinators, and beneficial insects, improves water infiltration and stores carbon (Zimmerman 2010 and Xerces Society 2013).

Photo Credit: Gaylen Beatty, Columbia Land Trust


“The original idea that ecology involved trips to faraway places that people would consider to be pristine reflected a very deep seated belief that people and nature are separate.”
Dr. Steward Pickett
Baltimore Ecosystem Study

2. Planning Your Urban Meadow

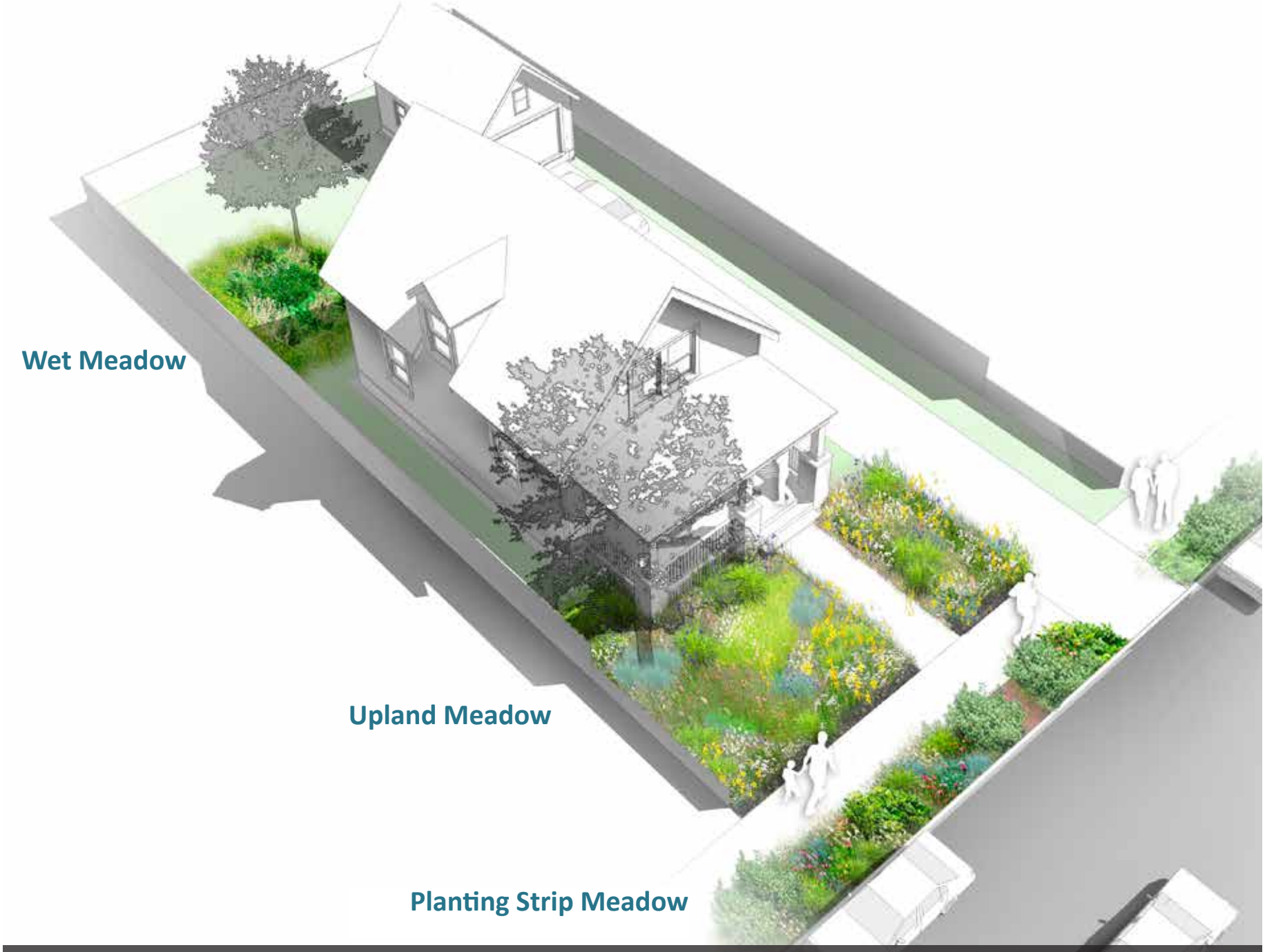
Photo Credit: Mary Bushman, City of Portland, Bureau of Environmental Services

Planning

If you consider the creation of an urban meadow planted with native prairie plants as a partial re-naturalization, rather than a restoration of the historic landscape, the project has a more achievable goal. In some cases, creation of a new hybrid meadow habitat garden would be most appropriate. These meadow landscape features may be located and designed with various goals in mind, such as increasing available wildlife habitat, improving aesthetics, and/or enhancing stormwater management. At the residential scale there are many opportunities to install a collection of native meadow plants or hybrid landscapes of native and non-native plant communities.

Meadows need an open sunny area to thrive. Identify an open area that receives full sun at least six hours per day. If feasible, find an area not normally inundated with weeds and avoid sites infested with highly invasive weeds (Wilson, 2015 and Boyer, 2010). Long term weed control is easier if a non-vegetated buffer (of pavement, gravel, mulch, etc.) surrounds the potential meadow area. Consider establishing a meadow in areas with little slope to prevent erosion. Right-of-way areas such as parking strips and roadsides are good choices but may have plant height limits due to line-of-sight safety issues. Depending on site goals, consider lower traffic (fringe) areas that have been landscaped solely with turf such as along fence lines or isolated garden beds. Initially, plan to create a small urban meadow project in order to achieve long term success. After analyzing your site's parameters and your goals, assess the best area to locate your meadow. In the **Appendix** we provide design templates for some suitable meadow locations including parking strips and areas of unused lawn.

Photo Credit: Gaylen Beatty, Columbia Land Trust



Graphic Credit: GreenWorks

Existing Conditions Analysis

A full review of existing conditions and landowner goals can help identify opportunities and constraints for locating and preparing your site and installing your meadow. Always look into any local building codes or other private or municipal zoning regulations that will influence what you can do on your property. Have your utilities marked by calling #811 or *http://call811.com/before-you-dig* prior to any work to protect yourself and others from unintentionally hitting underground utility lines. To identify your meadow's location and size, create a map of your property showing the constraints and goals you've considered for each area.

Various online mapping tools can help you map your meadow. For example, the Cornell Lab's YardMap Network (*http://app.yardmap.org/*) tool allows you to map habitat features and share your project with others. Data Basin (h*ttp://databasin.org*) is another online platform that aims to support sustainable environmental stewardship.

Determine Area

After carefully mapping your site to determine the best location for your urban meadow, calculate the size of your meadow to determine the total area that you will be planting and seeding using the following calculation:

Length (feet) x Width (feet) = Total Urban Meadow Area (square feet)

Photo Credit: Gaylen Beatty, Columbia Land Trust

Soil Testing

Once you select an area for your meadow, it's crucial to determine your soils' ability to drain water so that you may choose plants that will thrive in those conditions (See the **Appendix** for Soil Testing Protocols). You may decide to get your soil tested by a lab which can provide additional information such as pH, trace nutrient levels and percentages of available nitrogen, phosphorus and potassium. If possible, compare with similar data from a nearby prairie remnant. Soil test results and data will allow you to refine the plant species and related communities that can survive on your site.

Photo Credit: Gina Emanuel

“Novel landscape designs that improve ecological quality may not be appreciated or maintained if recognizable landscape language that communicates human intention is not part of the landscape.”

Joan Nassauer
Messy Ecosystems, Orderly Frames

3. Designing and Selecting Plants for Your Urban Meadow

Photo Credit: Mary Bushman, City of Portland, Bureau of Environmental Services

Photo Credit: Lynda Boyer, Heritage Seedlings & Liners

Meadow Design Overview

The lack of order in meadowscaped yards can create a certain level of psychological discomfort, especially when compared with the surrounding cultural norms of traditional turf-dominated landscapes. This makes perfect sense when one considers that proportion, order, repetition, balance, focal point, and unity have been the staples of garden design for hundreds of years.

In a small meadow garden both design and ecological function should be considered - focus on the form and function of smaller plants in the design. When determining placement of individual plants or groupings, think about focal points, managing edges (perhaps with a viewing path), and aesthetic parameters such as contrasting textures, seasonal interest and color. Patches of like-plants are generally more aesthetically pleasing than random single plants and research suggests this is also more desirable to foraging pollinators (Pendergrass et al, 2008).

See three design templates for urban meadows in the **Appendix**.

Plant Selection

To provide ample food for a diversity of pollinators throughout the season, choose a variety of wildflowers that will cover at least three bloom times (early, mid- and late-season) (See the *Bloom Time Chart* in the **Appendix**). Select at least one bunchgrass suited for your site conditions in addition to a diversity of wildflowers with different flower color, size and shape as well as growth habits (Pendergrass et al, 2008). Our native bunchgrasses often provide important food for beneficial insects and larvae of native butterflies, in addition to overwintering sites for beneficial insects, such as predaceous ground beetles (Pendergrass et al, 2008).

Your selection of native plants should also be guided by what species are currently available from nurseries and seed growers and/or additional species that may be available from contract growers. Sourcing native plants and seed has become easier as demand has increased, but the native industry is still emerging with a seasonally limited list of available stock. Whenever feasible, purchase from Willamette Valley growers who specialize in "local eco-type" plants, which means that the seed or plants were harvested or produced from a local source (Xerces Society 2013). These locally-sourced native plants are best adapted to your region's conditions. There are many opportunities to get small quantities of native plants and seed sourced through nurseries and seed growers at plant sales operated by local non-profits, Soil & Water Conservation Districts and some retailers. See the **Appendix** for additional information about local native plant nurseries and seed producers.

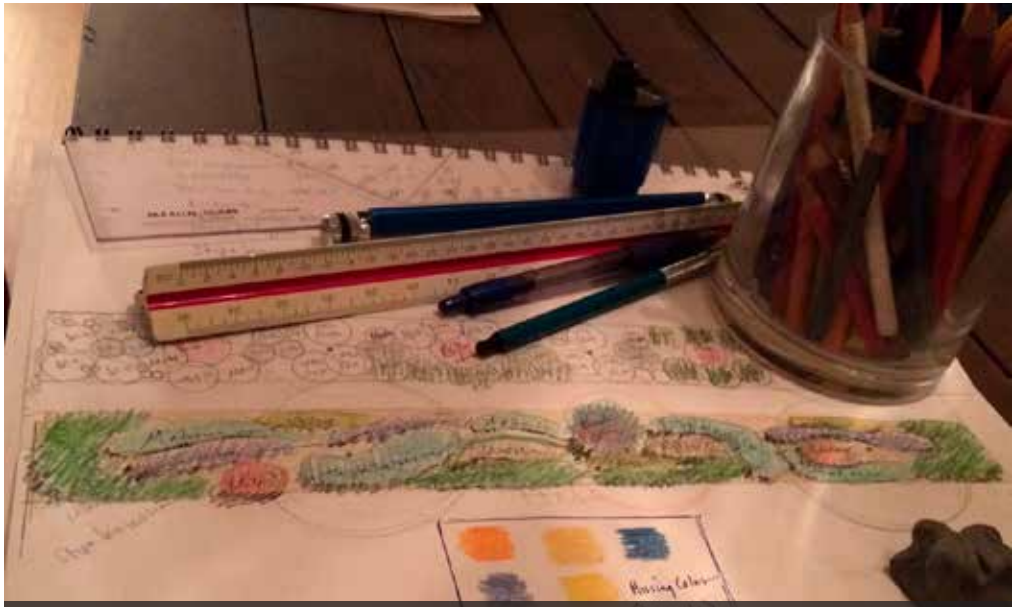


Photo Credit: Jennifer D'Avanzo, GreenWorks

All Photo Credit: Mary Bushman, City of Portland, Bureau of Environmental Services

Plant Associations and Groupings

After analyzing your site and developing a list of species available for purchase, narrow your plant palate to suit the size of your site and accommodate your design goals. Try to place the right plant in the right place by using plant association and/or historical plant information as much as possible (See comprehensive plant lists in the **Appendix**). Communities of native plant species will have the most success and provide the most pollinator benefits when used in the correct location (Pendergrass et al, 2008). Space plants slightly closer than the size of the mature plant to ensure that other plants, such as seeded annual grasses and wildflowers can be used to fill the gaps and keep weeds at bay. Start simple with the basic components of incorporating one bunchgrass and a variety of wildflowers that will span three seasonal bloom times, knowing that you can add more later to ensure long term success and lessen maintenance. When looking at the ratio of bunchgrasses to forbs, consider how quickly the perennial forbs will grow over time and through the seasons.

We recommend you first install plugs of perennial wildflowers and slow growing bunchgrasses, then plant mature bulbs, corms and/or rhizomes. Second, seed the gaps with quickly germinating annual wildflowers. Interseeding should be considered when developing your plant design. This can discourage weeds, provide for early erosion control and help native plants gain a foothold prior to the encroachment of weeds. Interseeding with annual grasses is only recommended if you are very competent in identifying grasses and understand their growth habits because some can be quite weedy. Well-placed and marked perennial bunchgrasses will provide important overwintering habitat and be easier to identify and maintain.

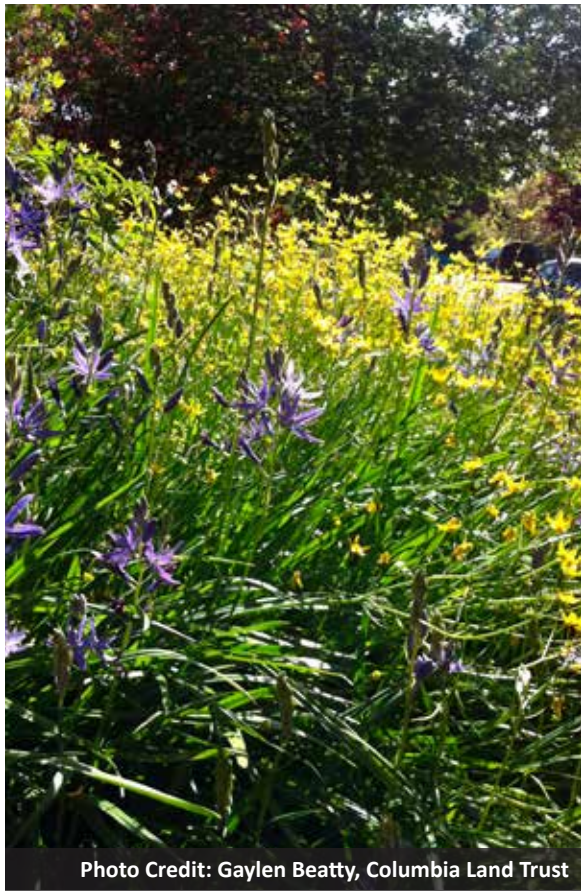


Photo Credit: Gaylen Beatty, Columbia Land Trust

The ratio of bunchgrass to perennials to annuals in your design will vary depending on your goals. Consider the following in determining ratios:

- In general, use 50% or less bunchgrasses per planted area so that you provide ample space for the wildflowers needed to cover three seasons of bloom times for pollinators. You may want to plant bunchgrasses more densely to decrease maintenance, help combat weeds, decrease erosion after site preparation and provide pleasing aesthetic features year round.
- If the main goal is to provide ample pollinator forage and you can maintain some larger open spaces in your design during the dormant season, the ideal mix would be no more than 25% bunchgrasses (Xerces Society 2013). Provide temporary fill as needed by seeding native annual grasses and wildflowers (Wilson, 2015).
- A meadow planting palette dominated by perennial grasses and wildflower species (up to 75%) will increase the chance of establishment and resilience compared to starting with a lot of annuals. You can always decrease the number of perennials to make room for more annuals.

Incorporating Seed

The recommended seeding rate for forbs in your meadow ranges from 20-30 seeds per square foot, but the exact rate and how much of each species you will need by Pure Live Seed (PLS) weight will depend on meadow design, seed species and size. For more detail about individual species see Native Seed Information in the **Appendix** (Wilson 2015 and Xerces Society 2013). Pure Live Seed (PLS) is a phrase that describes seed quality. Technically, PLS is the percentage of seed (i.e. good viable seed) that has the potential to germinate within a measured one pound weight of seed lot. Local wildflower and grass seed growers are often able to help you determine the seeding rate or you may use the downloadable Xerces Society Seed Rate Calculator found in the **Appendix**. If you are planning to sow patches of individual annual grasses and wildflowers (a practice beneficial for pollinators), have your seed species packaged separately so that you can deliberately sow them in the desired location and rate.

Guidance on how to seed is provided in the **Installing Your Meadow** section.

Photo Credit: Gaylen Beatty, Columbia Land Trust

Photo Credit: Eric Mader, The Xerces Society

Tips on Creating a Landscaped Look

If one of your goals is to create an urban meadow that appeals to traditional garden aesthetics, please consider the following design cues (Contribution from Erik Carr with Concepts from Nassauer, 1995):

- From a landscape design perspective, we cannot forget that the house is the focal point of the residential landscape – especially in the front yard. The garden, therefore, should accentuate the house and take cues from the house in terms of design and details. For example, structural and hardscape accessories (an entry gate, fence, water feature, pathway, patio, etc) create order and unity in the landscape, especially when the materials complement those found on the house.
- From an artist's perspective, lawn is not undesirable. It can create a negative space for the viewer's eye to rest, especially in comparison to the busy plantings of the meadow. A small swath of lawn that doubles as a pathway can create a simple foreground, which further accentuates the color, texture, and shape of the meadow plantings in the background.
- Intention can be implied by keeping the edges well defined (via pavers, pathways, lawn), using lower growing plants, and fewer species of plants.
- Grouping and massing same or similar plant species provides structure to the garden and gives them more visual impact (with the added benefit of pollinator efficiency). Usually groups consist of three, five, or seven plants. Also, place your tallest plant groupings at the back of the bed and shorter plants in the front.
- Use a limited, repeating color palette to create rhythm in the garden and tie the garden together. Repetition of plant groups/textures/colors will pull the viewer's eye through the garden.
- Shrubs (even a limited number) provide a structural backbone to the garden. They could easily be placed in the back of a meadow bed, serving as a low-maintenance plant that doesn't require regular access.

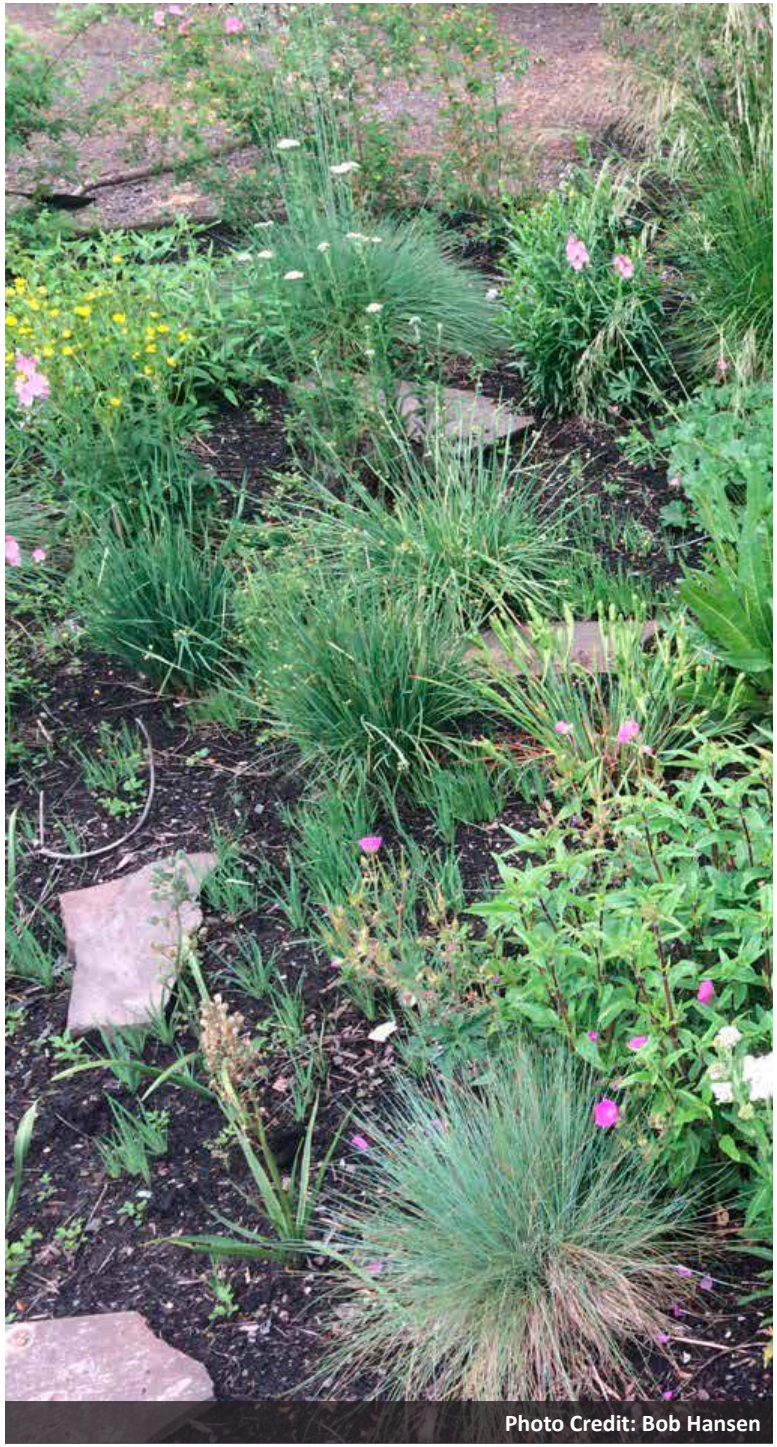


Photo Credit: Bob Hansen

Photo Credit: Eric Mader, The Xerces Society

“People are turning to their gardens not to consume but to actively create, not to escape from reality but to observe it closely. In doing this they experience the connectedness of creation and the profoundest sources of being. That the world we live in and the activity of making it are one seamless whole is something that we may occasionally glimpse. In the garden, we know.”

Carol Williams
Bringing a Garden to Life, 1998

4. Site Preparation

Photo Credit: Mike Faha, GreenWorks

Photo Credit: Gaylen Beatty, Columbia Land Trust

Site Preparation Overview

Good site preparation is crucial for the successful establishment of your meadow. Make sure you fully eradicate aggressive non-native weed species (i.e. invasive plants) prior to attempting to establish a meadow. An Integrated Pest Management (IPM) approach to site preparation is an effective and environmentally-sensitive approach to plant management that relies on a combination of methods. IPM uses comprehensive information on the life cycles of weeds and their interactions with the environment. This information, combined with available weed control methods, is used to select a site preparation strategy that is the most economical and the least possible hazard to people, property, and the environment (US EPA, 2014). IPM considers all appropriate weed management options including, but not limited to, mechanical/manual techniques, solarization, sheet mulching and/or the judicious use of herbicides. Depending on the abundance and type of weeds on your site, multiple years of site preparation may be needed prior to planting and seeding your meadow. Invasive annual and perennial grasses and weeds with aggressive rhizomes and deep taproots will be the most challenging to control. Many invasive weeds produce long lasting robust seed banks and are capable of reproducing by spreading roots or other plant parts. They may respond positively to mowing, digging or other techniques. Always take steps to prevent and control erosion that can result from ground disturbing activities.

Your site preparation plan may include: sod and soil seedbank removal, solarization, sheet mulching, digging, mowing, the use of herbicides, or a combination of these methods. After your site is free of all vegetation and the soil is dry, debris should be removed and soil should be graded smoothly before planting and seeding (Wilson, 2015 and The Xerces Society, 2013). Cultivation and tillage are generally not recommended because these practices bring weed seed to the surface and expose them to light and subsequent germination. It is extremely difficult to exhaust a weed contaminated soil seedbank that has built up in the soil for generations without excavating several inches of topsoil (Boyer, 2010 and Wilson, 2015). Non-weedy lawn grasses can be killed in one season of site preparation; however, many deep-rooted or rhizomatous weeds will take more than one season to control. Also, hard-seeded species such as vetch and annuals like sow thistle, crane's bill, mustard, and speedwell may take advantage of the newly opened space during the second season (L. Boyer, 2010).

Site Condition & Preparation Scenarios

1. Removing a weed-free lawn in one growing season:

Option A: Mow, remove thatch, then strip sod (mechanically or manually) in dry weather. Do not cultivate! Cover area with a very thin layer of sterile media such as very fine bark mulch or non-amended weed-free top soil. Plant meadow plugs before seeding in the fall.

Option B: Mow and then sheet mulch or solarize for one or two growing seasons. Dig emerging weeds for one–two growing seasons. In the fall, after achieving weed control results, cover area with a thin layer of sterile media such as very fine bark mulch or non-amended weed-free top soil and plant meadow plugs before seeding.

2. Removing a lawn with some common yard weeds in one–two growing seasons:

Option A: Mow, remove thatch, then strip sod in dry weather. Do not cultivate! Solarize plot for one–two growing seasons. Depending on weed control results, remove plastic and plant meadow at the end of the first or second growing season.

Option B: Mow and then sheet mulch or solarize for one or two growing seasons. Dig or spot treat emerging weeds with herbicide for one–two growing seasons. In the fall, after achieving weed control results, cover area with a thin layer of sterile media such as very fine bark mulch or non-amended weed-free top soil and plant meadow plugs before seeding.

3. Removing aggressive invasive weeds on a highly disturbed site in two or more growing seasons (areas dominated by invasive weeds are not ideal meadow sites – pick a different area if feasible):

Option A: Excavate debris, cut weeds and grass, remove thatch and/or re-grade site in late winter-early spring when soil conditions are dry. Consider soil removal and replacement if needed. Solarize plot for two growing seasons. Hand dig re-sprouting weeds as they appear.

Option B: Excavate debris, treat herbaceous and woody weeds with herbicide, cut and/or remove thatch and regrade site as needed in late winter-early spring when soil conditions are dry. Retreat weed regrowth with herbicide up to three times yearly in accordance with the product label (First fall, early spring, early summer, and second fall) before planting and seeding.

Photo Credit: Jennifer D'Avanzo, GreenWorks

Photo Credit: Nancy Lee Adamson, The Xerces Society

Site Preparation Options:

Mechanical and Manual Site Preparation

If the only vegetation you are removing is low-growing turfgrass, you can use a variety of mechanical or manual tools before planting the site. Sod cutters sever the grass at the roots so you can remove entire sections of sod and expose the bare ground underneath. Walk-behind gas-powered sod cutters are available to rent from many hardware and tool companies (The Xerces Society, 2013). You can also remove small areas of sod manually with a square edge sod cutter or kick sod cutter. The cut sod will be heavy and will likely require off-site disposal.

Solarization Site Preparation

This method uses the heat of the sun to cook plants, weed seeds, nematodes, insects and soil pathogens in the uppermost layers of soil. Solarizing alone may not treat some persistent invasive weeds, so this method may need to be coupled with hand digging and/or herbicide spot sprays to be effective. After removing all vegetation from the site, place seam-free, heavy-duty, UV-stabilized, clear plastic sheeting (such as greenhouse plastic) on the bare soil and leave it in place for most of the growing season (March through September). The following steps are recommended to solarize an area (adapted from Wilson, 2015 and The Xerces Society, 2013):

- Dig all tap-rooted or rhizomatous perennials in the late winter/early spring.
- Mow grass, strip sod, and remove all sharp rocks, roots and other material and dispose offsite.
- Dig a small shallow trench around area to be solarized and save some extra soil for weighing down the plastic sheeting.
- Irrigate thoroughly and lay down clear plastic on entire site, including the trench. Backfill saved soil on plastic in trench ensuring no air gaps.
- Weigh down the center, if necessary, to prevent wind displacement.
- Repair any rips with greenhouse repair tape.
- Remove/replace the plastic in the early fall before the weather cools.
- Immediately plant plugs and sow seed in the early fall when soil is moist enough to work.

Sheet Mulching Site Preparation

Sheet mulching or "lasagna" composting is a cold composting method used to convert lawn to other garden uses. Sheet mulch alone may not treat invasive weeds, so this method may be coupled with other methods such as hand digging and/or herbicide spot spraying to be more effective. As with all compost, sheet mulching calls for carbon, nitrogen, oxygen and water inputs in the correct ratio to break down organic materials into a good growing medium (OSU Extension Service – Lane County Compost Specialist, 2009). Sheet composting is best started several months to a year before you want to plant. Given that both meadow seeds and potted plants should be installed in the fall, early spring would be the latest time to start this method. It involves placing fairly equal alternate layers (each 1" deep) of carbon and nitrogen materials onto the soil (OSU Extension Service – Lane County Compost Specialist, 2009). Technical advisors to this handbook report success in using 6-12 inches of fresh weed-free compost following the placement of wet cardboard or newspaper, in lieu of the following layering method.

These steps are recommended to sheet mulch an area (adapted from OSU Extension Service – Lane County Compost Specialist, 2009 with modifications specific to PNUM site findings):

- Remove vegetation by mowing and clearing any debris in the spring.
- Ensure ample drainage by loosening the soil with a spading fork.
- Cover the ground with 1-2 overlapping layers of cardboard or 4-6 overlapping layers of newspaper.
- Wet the newspaper or cardboard thoroughly and cover with a one-inch layer of a nitrogen source material such as weed-free manure or compost, kitchen scraps, green produce or a combination thereof.
- Top the nitrogen layer with an inch of carbon material such as leaves, straw, bark, shredded paper, dryer lint or a combination thereof.
- Continue adding alternate layers of carbon and nitrogen until the final height is reached (~6 inches). In general, the greater the volume of material the longer it will take to decompose.
- As the materials decompose more layers may be added, but always end with a carbon layer to help discourage fly eggs on exposed nitrogen material.
- A final layer of overlapping burlap coffee sacks can be used to keep the pile neat and in place – these should be removed prior to planting your meadow.
- If a pile becomes too wet, it can be covered with black plastic loosely weighted down at the sides to warm it, encourage faster decomposition and prevent nutrients from leaching during heavy rain.
- The area is ready for planting when the layers have decomposed to the point that the original materials are no longer recognizable and it looks and smells like fresh earth.
- Prior to planting/seeding, top dress with a thin layer of non-amended weed-free soil or fine bark mulch.

Photo Credit: West Multnomah Soil & Water Conservation District

Photo Credit: Gaylen Beatty, Columbia Land Trust

Herbicide Site Preparation

If considering using herbicide, you may decide to hire a licensed herbicide applicator. Licensed applicators have experience in techniques and demonstrated knowledge of herbicide laws, safety, modes of action, and weed identification and lifecycles. If you decide to use over-the-counter products to prepare your site, always follow the instructions on the herbicide label and understand the risks for your own safety and that of the environment. As with all IPM methods, it's crucial to have a clear understanding of your target weeds' life cycles and the tool you are using so as to be effective and minimize environmental harm. Timing of the herbicide application is crucial. The National Pesticide Information Center (NPIC) provides objective, science-based information about pesticides and pesticide-related topics so you can make informed decisions about pesticides and their use: 1.800.858.7378 or *http://npic.orst.edu/.*

Using a non-persistent low-toxicity herbicide with the active ingredient glyphosate is a low labor-intensive treatment to be applied when target weeds are actively growing (Xerces Society 2013). Different formulations of glyphosate with other added ingredients may have differing toxicities – seek out the least toxic option if using this tool. Glyphosate is a broad-spectrum herbicide that is effective in treating a wide array of target weeds including some invasive plants that are extremely difficult to control with organic methods alone. Glyphosate is a systemic herbicide meaning that it's capable of killing the entire plant. This herbicide is absorbed by leaves and other green plant tissue and rapidly sent throughout the entire plant, including its roots. It's crucial to get good contact with the desired weed foliage for effective treatment and to avoid contact with any desirable plant's foliage since this is a non-selective herbicide. Check the label of whatever you are using, but generally you may plant or seed fairly quickly after the glyphosate application has eliminated all of the affected plants, which may take weeks to months.

During the site preparation phase of the project, other planning work can be accomplished:

- Compose a work sequencing schedule
- Procure plants/seed (e.g. submit deposits for seed/plant purchase, initiate seed collection and/or contract growing, etc.)
- Control erosion and/or seed temporary cover
- Construct optional structures, walls, paths, etc.

Photo Credit: Metro


“So extraordinary is Nature with her choicest treasures, spending plant beauty as she spends sunshine, pouring it forth into land and sea, garden and desert.”
John Muir

5. Installing Your Urban Meadow

Photo Credit: Mary Bushman, City of Portland, Bureau of Environmental Services

Prepare Soil

After completing weed control and/or removing undesirable vegetation, do not till or cultivate and avoid any added ground disturbance that could bring new weed seeds to the surface. When the soil is dry, smooth out soil clumps and lightly pack the surface with a rake and/or turf roller. Then spread and rake a light layer of fine bark mulch (less than two inches) on the soil surface to control surface erosion and serve as a good seedbed.

Placing and Installing Plants

We recommend planting a diverse combination of bunchgrasses and perennial plugs, bulbs, corms and/or rhizomes and then inter-seeding with native annual wildflowers and optional grasses in the gaps. In the Willamette Valley, fall planting and seeding produces the best result. Many native plant seeds require exposure to cold temperatures and damp conditions (cold stratification) before germination can occur (Wilson, 2015 and The Xerces Society, 2013). Winter precipitation helps seeds settle into the soil and stimulates germination while helping newly installed plantings establish in a moisture-rich environment.

After a good early fall rain pick a dry day to plant and seed. Assemble all the plant materials. Lay out the containers and plugs according to spacing plan, adjust as needed to cover the area, and check species location. Then plant containers and plugs by digging a small slot in the bed with a small planting (or round point) shovel rather than disturbing the ground by excavating a planting pit and potentially exposing more weed seed to light. Leave the shovel in the slot while carefully removing plants from their containers (plug tray ends can be cut off) and gently roughing up any compacted roots. Hold your plant in the planting slot ensuring the depth of the root collar is level with the soil surface before sliding out the shovel, making sure all roots are pointed down (upward pointing roots can kill your plant), and filling all gaps with soil. Firmly tamp down the soil around the plant (tamping down the soil with your foot around the plant works well for this) to ensure that there is good soil contact and minimal air between the plugs and the soil. Then plant the bulbs, corms and/or rhizomes and mark locations with small stakes. If installing any bare root materials, wait until the plants are fully dormant in late winter–early spring.

Photo Credit: Jamie Stamberger

Photo Credit: Jennifer D'Avanzo, GreenWorks

Mulching and Seeding

Before seeding annual grasses and wildflowers over the top of the planted plugs and bulbs, spread an additional thin layer of fine bark mulch on the bare soil between the plantings. On small urban meadow sites, broadcast seeding can be performed by hand using a variety of tools such as tea strainers, kitchen sieves, coarse salt shakers, or colanders to evenly distribute both large and very small seed (Wilson, 2015 and The Xerces Society, 2013). Sow large seeded species first and rake lightly to cover with mulch. Then sow the finely seeded wildflowers and grasses on the surface of the mulch and do not cover. Like-sized seed may be mixed together before sowing if they have similar soil, moisture and light requirements.

Photo Credit: Mace Vaughn, The Xerces Society

Watering

Finally, water the newly installed plantings and seeds. If there is no rainfall within a few days, water the annual grasses and wildflowers lightly as needed until you see some seeds sprouting. Erect temporary or permanent fencing to keep people and animals from disturbing your newly-planted meadow.

Photo Credit: Bob Hansen

“The care of the Earth is our most ancient and most worthy, and after all our most pleasing responsibility. To cherish what remains of it and to foster its renewal is our only hope.”

Wendell Berry

6. Maintaining Your Urban Meadow

Photo Credit: Mary Bushman, City of Portland, Bureau of Environmental Services

Photo Credit: Mary Logalbo,
West Multnomah Soil & Water Conservation District

Maintenance

The transformative nature of meadows throughout the seasons and years can bring great joy to the observant and engaged gardener, but be clear that meadows will not persist without proper maintenance. While waiting for spring wildflowers to bloom, prepare resources, tools and supplies for site maintenance and monitoring during the crucial period of establishment (first two years after planting). Initiate weed control in late winter following planting/seeding.

- Identify planted/seeded seedlings and colonizing weed seedlings.
- Hand weed and/or spot treat infestations with herbicide.
- Sow additional native annuals as needed.

As with any other landscape feature, regular monitoring, weeding and replanting is required as needed. Fertilizers and other added soil amendments should not be needed for a meadow. Hand water your meadow when needed during the first two summers to establish your plantings. Monitor your site's moisture conditions and spot water individual plants rather than using an overhead sprinkler. After plants are established, watering is only necessary when your area is experiencing a prolonged drought. Deep infrequent watering early in the morning is recommended.

On-going maintenance should include:

- Survey your site and remove tree seedlings and any colonizing weedy plants (e.g. holly, tree of heaven, etc.).
- Manage meadow plant reproduction to favor grass or wildflower dominance.
- Use regular planned disturbance (that mimic historic fire impacts) to control meadow plant succession: rake, mow or conduct prescriptive burns in cooperation with your local fire department.
- Continue monitoring to determine if goals are achieved and the project is a success.

Insights on Meadow Maintenance and Management

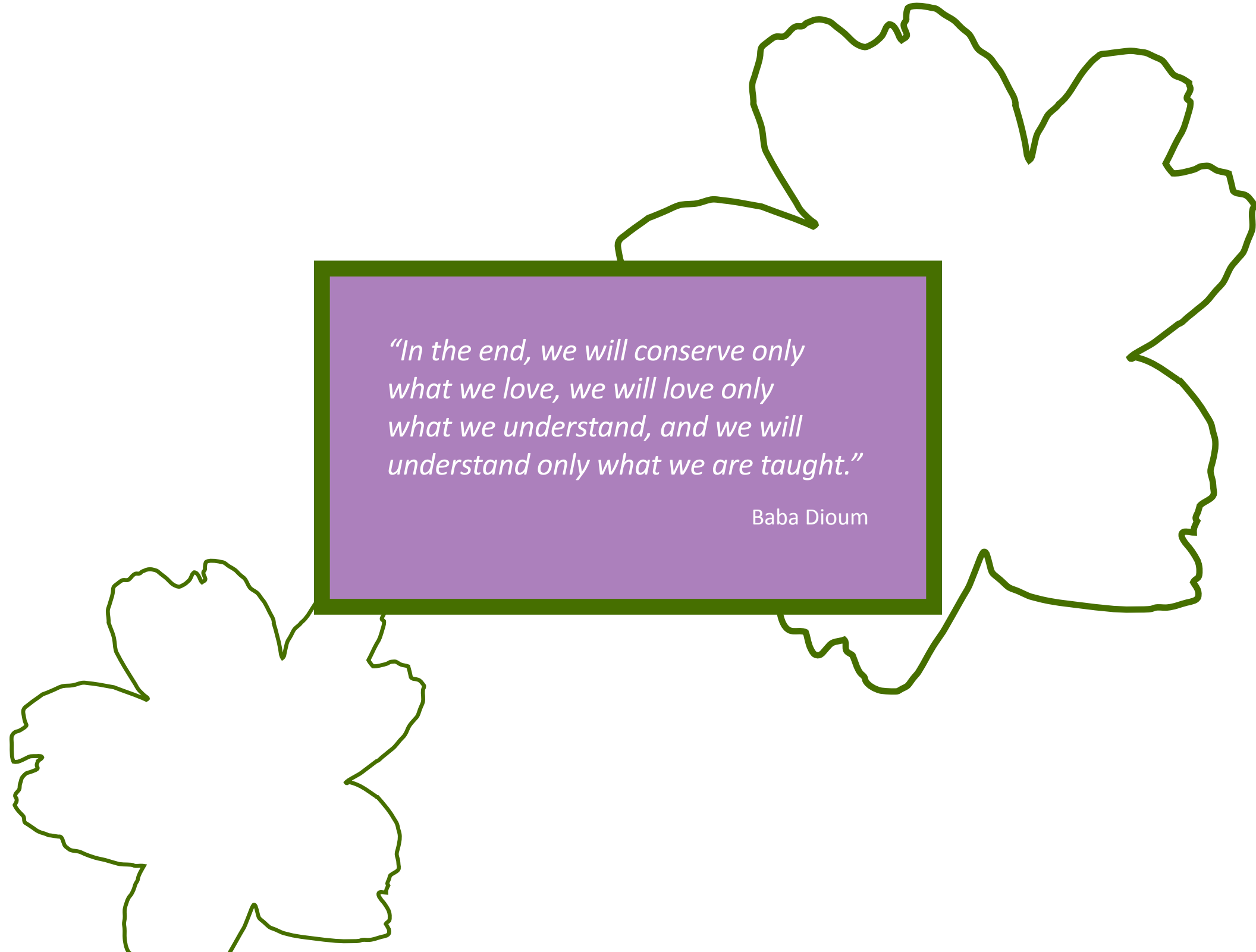
"One lesson many of us have learned about designing small urban meadows prairie gardens is that some plant species work best in only large areas where their ability to spread quickly is not of concern. Strongly rhizomatous species including many grasses, perennial sunflowers, asters, goldenrods, etc., can quickly take over a small garden. I have removed many of those species from my own gardens, replacing them with bunchgrasses and wildflowers that don't spread as quickly. I've kept a few "spreaders" in the garden, but am pretty aggressive about yanking many of them up each year to keep them thinned out. Several friends and I trade plants (and advice) back and forth as we try to figure out the best mixtures for our respective gardens.

Managing aggressive plant species is not the only challenge facing urban meadow gardeners. For example, wildflowers in gardens tend to grow taller and leggier than in more highly competitive prairies, sometimes causing them to flop all over as they outgrow their ability to hold themselves up. You can tie them up, of course, but I also do quite a bit of "grazing" with clippers throughout the season to keep plants knocked back and force them to bloom at shorter heights.

I also wrestle with whether or not to allow plants to make seed. I let some go to seed because I want to harvest from them, but I chop flowers off others before seeds ripen so I don't have to contend with numerous seedlings the next year. There's no right or wrong way to do any of this, it's just important to recognize that prairie gardens will not always behave the way you want them to without your strong guidance. Mulch or no mulch? Water during dry periods or not? Mow/rake at the end of the season or not? Lots of options, lots of consequences – and lots of opportunities to learn from each of them."

Chris Helzer: The Prairie Ecologist, *http://prairieecologist.com*

Photo Credit: Jamie Stamberger


“In the end, we will conserve only what we love, we will love only what we understand, and we will understand only what we are taught.”
Baba Dioum

7. Appendix

Photo Credit: Lynda Boyer, Heritage Seedling & Liners

A – Soil Testing Protocol

Infiltration Test

The ability of soil to drain water is one of the most important considerations for understanding the site and properly selecting plants. Ideally, conduct this test when the soil isn't frozen and when groundwater levels are high, such as in the early spring.

1. Dig a 6" deep hole in the middle of the area where the meadow will be installed.
2. Fill the hole with water to just below the rim. Let the water drain completely.
3. Refill the hole with water again and record the time it takes to drain.
4. Repeat step 3 three more times. The third test will give you the best measurement of how quickly your soil absorbs water when it's fully saturated.
5. Divide the distance of water (i.e. 6") by the amount of time it took for the water to drain out of the hole. For example, if the water dropped 6 inches in 12 hours, then 6 divided by 12 equals ½ inch per hour of infiltration.

INTERPRETING THE INFILTRATION TEST	
Drainage Rate	**Relative Infiltration**
Less than ½ inch – 1 inch per hour	Low infiltration rate. Consider additional soil amendments to prepare soil and select moisture-loving plants, if the soil is moist year round.
Between 1-2 inches per hour	Moderate infiltration. Select plants that thrive in this middle drainage range.
Faster than 2 inches per hour	High infiltration. Select plants that are more drought-tolerant.

All Photo Credit: Gina Emanuel

Soil Texture Test

1. Take a handful of the soil you dug for your infiltration test. Pulverize it in your hand and remove any bits of organic matter or obvious rocks.
2. Wet the soil with a small amount of water and rub it between your thumb and index finger. Don't use too much water - the soil should feel sticky, gritty or smooth. The grittier it is, the more sand is present in your soil. The smoother it is, the more clay it contains. Smooth soils are sometimes an indicator of a fine silt or loam. Discard the soil.
3. Next, take another sample in your hand. Add water until it has the consistency of dough and try to form into a ball. If you can't, your soil is very sandy. Most soil types easily form a rough ball.
4. Knead the soil together between your thumb and fingers and attempt to form a ribbon. As you build the ribbon it will either hold together or break off. If the soil breaks quickly in the process, then it likely has a high sand content. If the ribbon forms quickly and stays strong, it has more clay.

The determined general soil texture coupled with your infiltration rate will help you select the best plants for your site. Share what you've learned with nurseries when ordering plants and consult the native plant materials we have in the **Appendix** to make your plan.

All Photo Credit: Gina Emanuel

B – Urban Meadow Design Templates and Sketches

How to use the Meadowscaping Design Templates

This Handbook was not conceived as a natural landscape design manual, but consideration of natural design aesthetics and principles can help create an ecologically functional garden feature that looks intentional and fits your site. In order to provide prospective meadow creators with practical how-to design/build information, the Handbook includes designs for three typical Willamette Valley urban meadow types (Upland Meadow, Planting Strip Meadow and Wet Meadow) as well as recommended plant material lists and specifications. By consulting the design references listed below for inspiration and using the meadow design templates as guidelines, urban gardeners can establish an attractive landscape amenity that provides habitat for pollinators.

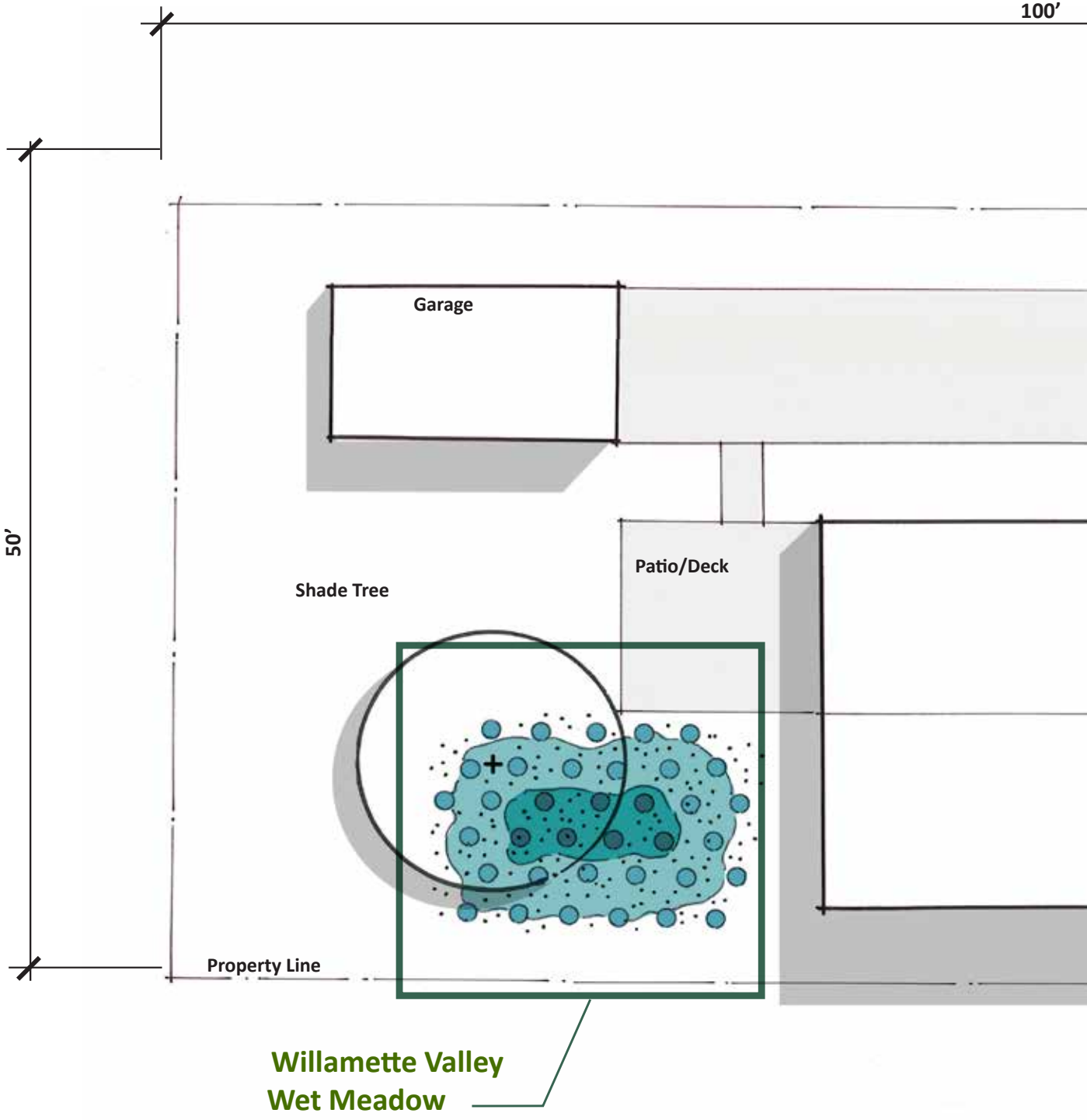
The three meadow designs in the Handbook illustrate good environmental design and best management practices: The upland meadow and the planting strip meadow complement the site's focal point (a home or small business), and a well-defined and easily managed edge for front yard meadows helps formalize the natural landscape by conveying a sense of intentional design. Edges can include sidewalks, streets, paths, walls, fences, planting strip pavers, graveled meadow edges, and low-growing edge plantings.

- Low-growing shrubs in the planting strip meadow and wet prairie can frame views of the house from the street and backyard and provide year-round landscape structure and habitat. Planting non-colonizing shrubs at the edges of the upland meadow provides contrasting color and shape to the wildflowers and grasses and enhances habitat for invertebrates and birds.
- Pollinators are active through most of the Willamette Valley growing season from early spring to early fall. Selecting individual wildflower species to achieve a long continuous bloom cycle benefits many pollinators.
- Pollinators prefer large wildflower patches of the same or similar species. Grouping and massing wildflowers also increases their visual impact by providing recognizable structure and color across the meadow landscape. Planting bulbs and small perennial wildflowers in groupings of 3, 5, 7 or more plants creates repetitive patches of color and texture.
- Placing tall wildflowers in the interior patches of the upland meadow and the wet meadow and short plants in the foreground allows all plants to be seen and can give a sense of perspective to viewers.
- The Handbook's meadow designs recommend commercially available meadow plant materials, and appropriate propagule sizes and plant spacing to achieve a 100% native vegetation ground cover in 1 years' time. While close plant spacing still may require supplemental weed control and irrigation during a period of establishment, long term maintenance requirements can be reduced thereafter.

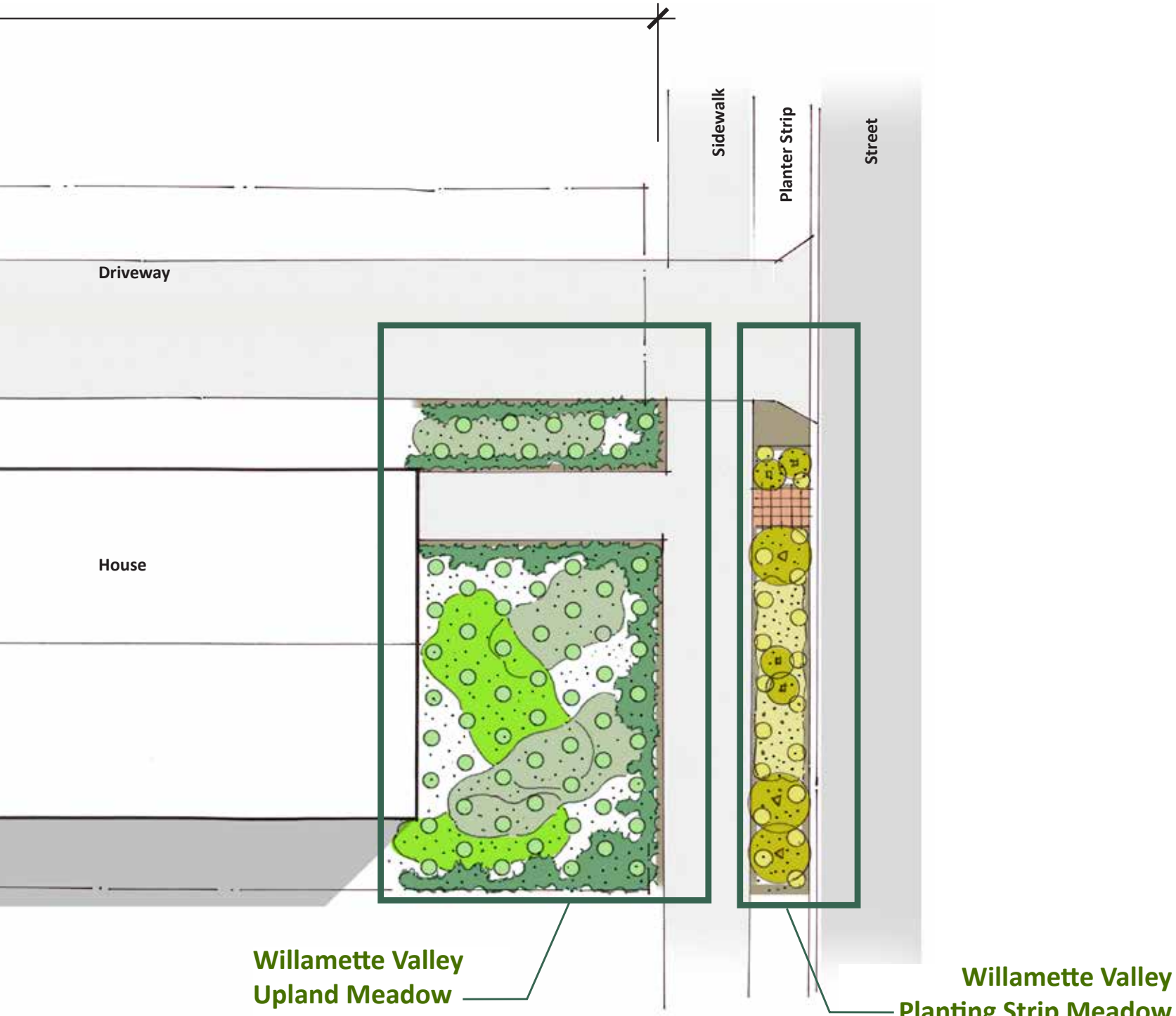
PERSPECTIVE SKETCH OF URBAN MEADOW DESIGN TEMPLATE LOCATIONS

GREENWORKS

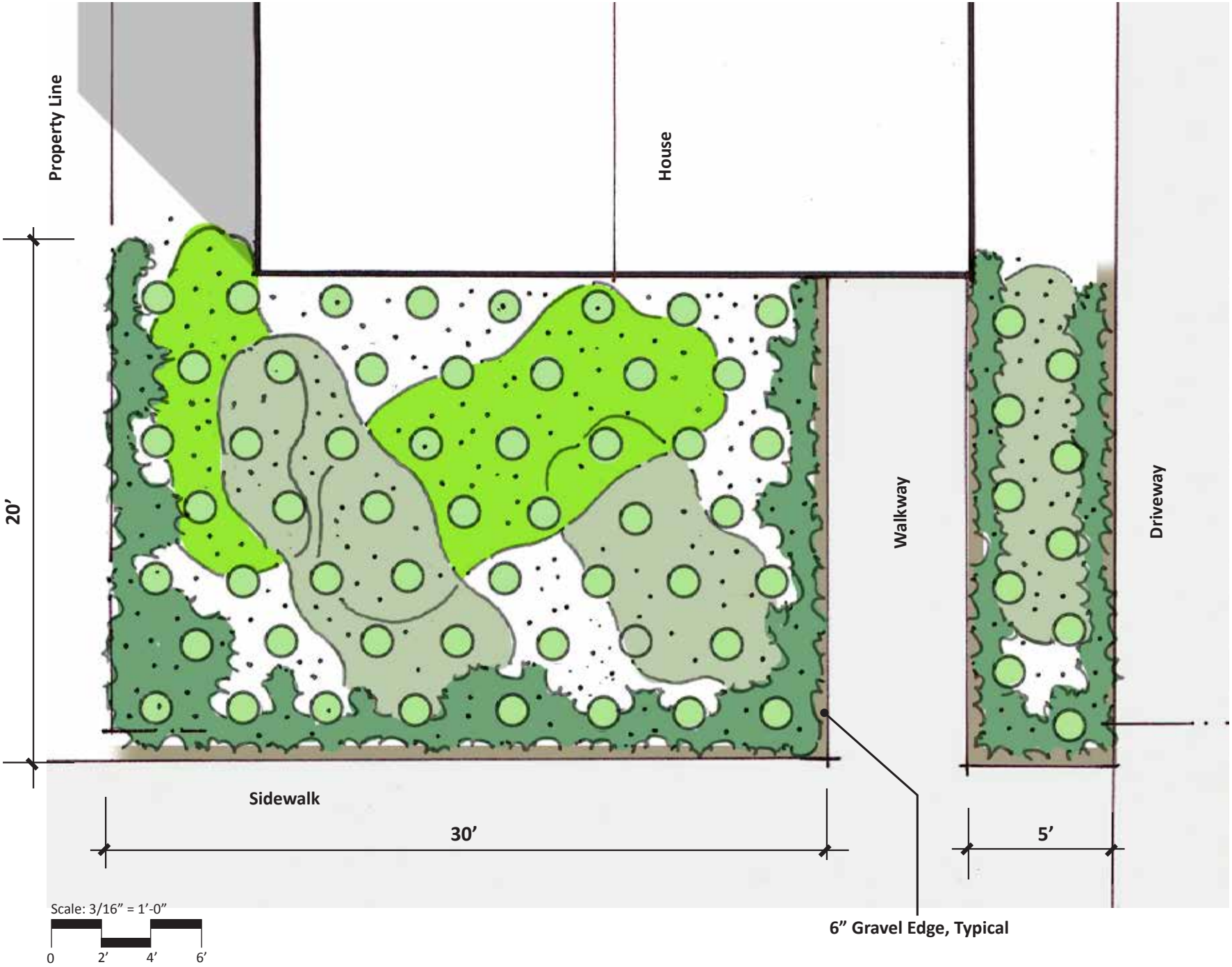
WILLAMETTE VALLEY MEADOW ZONE PLANTINGS



GREENWORKS


Sidewalk
Planter Strip
Street
Driveway
House
Willamette Valley
Upland Meadow
Willamette Valley
Planting Strip Meadow

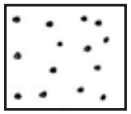
WILLAMETTE VALLEY UPLAND MEADOW



LEGEND

Willamette Valley Upland Meadow

This upland meadow plant community is for seasonally moist soils in full sun. It is composed of a foundation of native Willamette Valley shortgrass prairie species and additional western Oregon native wildflowers to extend the bloom season.

	Species	Plant Type	Spacing/Seed Rate
	**Perennial Grass/Rush/Sedge Matrix***		3’ O.C.
	(25%) *Carex tumulicola*	Plug	
	(25%) *Danthonia californica*	Plug	
	(25%) *Festuca roemeri*	Plug	
	(25%) *Juncus tenuis*	Plug	
	*Distribute matrix species evenly throughout the entire planting area.		
	**Wildflower Edge Patch**		
	Achillea millefolium	Plug	10’ O.C.
	Fragaria virginiana v. platypetala	Plug	10’ O.C./groups of 3-7
	Eriophyllum lanatum	Plug	10’ O.C./groups of 3-7
	**Wildflower Patch 1**		
	Lupinus rivularis	Plug	10’ O.C.
	Camassia leitchlinii	Bulb	10 bulbs/100 s.f. in groups
	Ranunculus occidentalis	Plug	10’ O.C./groups of 3-7
	Grindelia integrifolia	Plug	6’ O.C.
	**Wildflower Patch 2**		
	Aquilegia formosa	Plug	6’ O.C
	Potentilla gracilis	Plug	10’ O.C.
	Sidalcea virgata	Plug	10’ O.C.
	Symphyotrichum hallii	Plug	6’ O.C.
	**Annual Wildflower Mix**		
	Clarkia amoena	Seed	< .01 oz./100 s.f.
	Collomia grandiflora	Seed	< .01 oz./100 s.f.
	Gilia capitata	Seed	< .01 oz./100 s.f.

Note:
Wildflower Patch outlines are shown overlapping to indicate that patches can be combined.

GREENWORKS

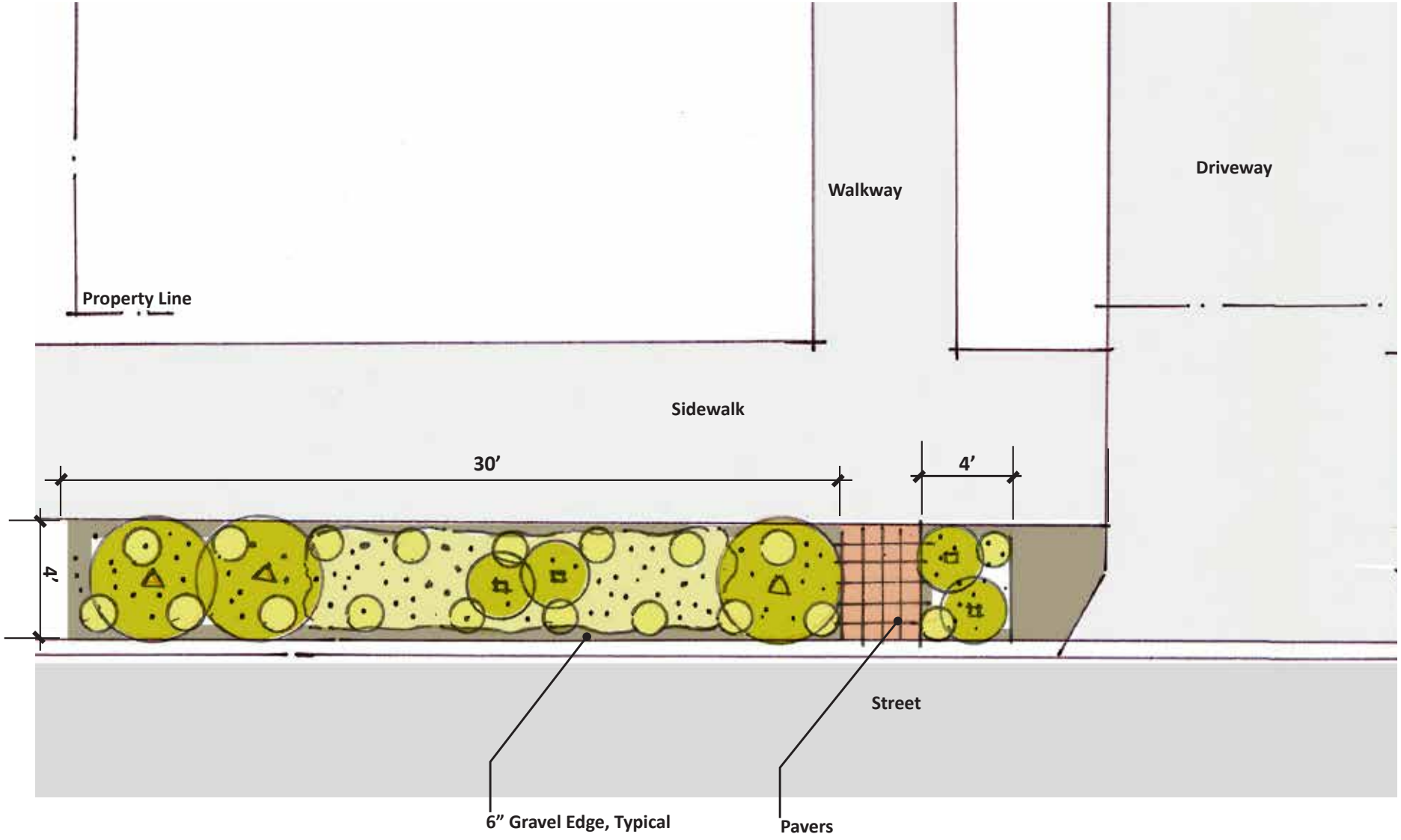
GREENWORKS

Photo Credit: Mary Logalbo, West Multnomah Soil & Water Conservation District

Photo Credit: Eric Mader, The Xerces Society

Photo Credit: Mary Logalbo, West Multnomah Soil & Water Conservation District

WILLAMETTE VALLEY PLANTING STRIP MEADOW



Scale: 3/16” = 1’-0”

0 2’ 4’ 6’

LEGEND

Willamette Valley Strip Meadow

Establish a planting strip meadow on seasonlly moist soils in full sun by seeding and/or planting plugs of a single species or variable amounts of several species. Interplant native shrubs for structure and bulbs and perennials for seasonal color.

Species	Plant Type	Spacing/Seed Rate
Perennial Grass/Rush/Sedge Matrix*		3’ O.C.
(25%) *Carex tumulicola*	Plug	
(25%) *Danthonia californica*	Plug	
(25%) *Festuca romeri*	Plug	
(25%) *Juncus tenuis*	Plug	
*Distribute matrix species evenly throughout the entire planting area.		
Wildflower Patch		
Achillea millefolium	Plug	6’ O.C.
Camassia leitchlinii	Bulb	10 bulbs/100 s.f. in groups
Ranunculus occidentalis	Plug	6’ O.C./groups of 3-7
Symphyotrichum hallii	Plug	6’ O.C.
Annual Wildflower/Grass Matrix		
Deschampsia elongata	Seed	< .01 oz./100 s.f.
Clarkia amoena	Seed	< .01 oz./100 s.f.
Collomia grandiflora	Seed	< .01 oz./100 s.f.
Shrub Patches		
Symphoricarpos albus	Container	3-5/100 s.f.
Mahonia repens	Container	3-5/100 s.f.

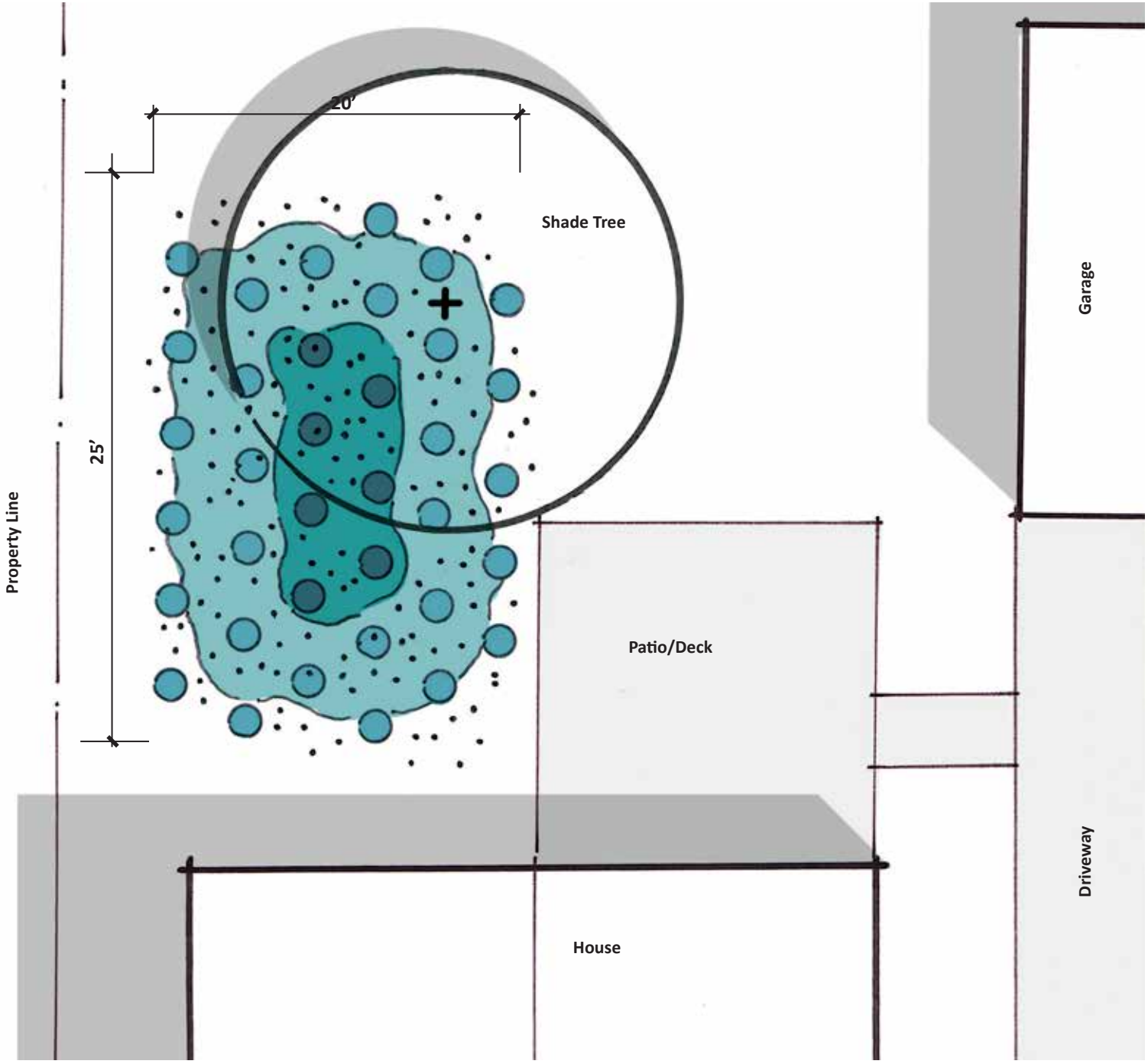
GREENWORKS


GREENWORKS

Photo Credit: Mary Logalbo, West Multnomah Soil & Water Conservation District

Photo Credit: Gaylen Beatty, Columbia Land Trust

WILLAMETTE VALLEY WET MEADOW



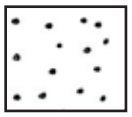
Scale: 3/16” = 1’-0”

0 2’ 4’ 6’

LEGEND

Willamette Valley Wet Meadow

Wet meadow plants are selected for their varying tolerance of seasonal wetland conditions such as wet soil during the rainy season. Some of the selected species below are appropriate for sun, others for part-sun or shade.

	Species	Plant Type	Spacing/Seed Rate
	**Perennial Grass/Rush Matrix***		3’ O.C.
	(50%) *Deschampsia caespitosa (sun)*	Plug	
	(50%) *Juncus tenuis (part sun/sun)*	Plug	
	**Sedge/Rush Matrix***		
	(50%) *Carex obnupta (shade)*	Plug	
	(50%) *Juncus effusus v. pacificus (part sun/sun)*	Plug	
	*Distribute matrix species evenly throughout the entire planting area.		
	**Slope Wildflower Patch**		
	Geum macrophyllum (part sun/shade)	Plug	18” O.C./groups of 3-7
	Polystichum munitum (part sun/shade)	Container	3’ O.C./groups of 3-7
	Tellima grandiflora (shade)	Plug	1’ O.C./groups of 3-7
	Tolmiea menziesii (shade)	Plug	1’ O.C./groups of 3-7
	Hydrophyllum tenuipes (shade)		1’ O.C./roups of 3-7
	**Wetland Wildflower Patch**		
	Helenium autumnalis (sun)	Plug	6’ O.C. /groups of 3-7
	Scirpus microcarpus (shade)	Plug	2’ O.C.
	Camassia quamash (sun)	Bulb	10 Per 100 SF
	**Annual Wildflower/Grass Matrix**		
	Deschampsia elongata (sun)	Seed	< .01 oz./100 s.f.
	Coreopsis tinctoria v. atkinsonia (sun)	Seed	< .01 oz./100 s.f.

GREENWORKS


GREENWORKS

Meadowscaping Design References

Bornstein, Carol, David Fross, and Bart O'Brien. Reimagining the California Lawn: Water conserving plants, practices and designs. Cachuma Press, Los Olivos, CA. 2011.

Brooks, John. Garden Design Workbook: A practical ste-by-step course. Dorling Kindersley Publishing. NYC, NY. 1995. Sections 1 + 2: Design Principles + Practical Skills.

Diekelmann, John and Robert Schuster. Natural Landscaping: Designing with native plant communities. University of Wisconsin Press. Madison, WI. 2002.

Greenlee, John. The American Meadow Garden: Creating a natural alternative to the traditional lawn. Timber Press, Portland, OR. 2009.

Keator, Glenn and Alrie Middlebrook. Designing California Native Gardens: A plant community approach to artful ecological gardens. University of California Press. Berkeley, CA. 2007.

Photo Credit: Laura Taylor, West Multnomah Soil & Water Conservation District

C – Illustrative Plant Guide and Comprehensive Plant Lists

	Illustrative Plant Guide	Common Name *Scientific Name*	Moisture Regime	Exposure	Height	Width	Time of Bloom
GRASSES		slough sedge *Carex obnubta*			2’	2’	N/A
		splitawn sedge *Carex tumulicola*			12”	12”	N/A
		California oatgrass *Danthonia californica*			12”	18”	N/A
		tufted hairgrass *Deschampsia caespitosa*			18”	12”	N/A

GRASSES

	Common Name *Scientific Name*	Moisture Regime	Exposure	Height	Width	Time of Bloom
	slender hairgrass *Deschampsia elongata*			18”	18”	N/A
	Roemer’s fescue *Festuca roemeri*			2’	12”	N/A
	Pacific rush *Juncus effusus v. pacificus*			2’	12”	N/A
	soft rush *Juncus tenuis*			12”	18”	N/A
	panicled bulrush *Scirpus microcarpus*			3’	2’	N/A

		Common Name *Scientific Name*	Moisture Regime	Exposure	Height	Width	Time of Bloom
FORBS		common yarrow *Achillea millefolium*			2.5’	2’	mid-April - June
		western columbine *Aquilegia formosa*			2’	2’	May - June
		streambank lupine *Lupinus rivularis*			3’	2’	April - June
		great camas *Camassia leitchlinii*			2’	12”	April - May
		common camas *Camassia quamash*			18”	12”	April - May

		Common Name *Scientific Name*	Moisture Regime	Exposure	Height	Width	Time of Bloom
FORBS		farewell-to-spring *Clarkia amoena*			2.5’	2’	June - July
		grand collomia *Collomia grandiflora*			18”	18”	May - July
		Columbia tickseed *Coreopsois tinctoria v. atkinsoniana*			2’	12”	May - July
		Oregon sunshine *Eriophyllum lanatum*			2’	18”	June - August
		western alpine strawberry *Fragaria virginiana v. platypetala*			6”	12”	April - July

		Common Name *Scientific Name*	Moisture Regime	Exposure	Height	Width	Time of Bloom
FORBS		large-leaved avens *Geum macrophyllum*			2’	12”	May - August
		bluehead gilia *Gilia capitata*			2’	18”	June - August
		Puget Sound gumweed *Grindelia integrifolia*			2’	2’	August - September
		common sneezeweed *Helenium autumnale*			3’	3’	July - October
		Pacific waterleaf *Hydrophyllum tenuipes*			2’	5’	Mid-April - May

		Common Name *Scientific Name*	Moisture Regime	Exposure	Height	Width	Time of Bloom
FORBS		slender cinquefoil *Potentilla gracilis*			2.5’	2’	May - July
		western buttercup *Ranunculus occidentalis*			18”	10”	April
		rose checker-mallow *Sidalcea virgata*			3.5’	12”	July - August
		Hall’s aster *Symphyotrichum hallii*			3’	2’	August - October
		fringecup *Tellima grandiflora*			3’	12”	April - July

		Common Name *Scientific Name*	Moisture Regime	Exposure	Height	Width	Time of Bloom
FORBS		Piggyback plant *Tolmiea menziesii*			12”	12”	April - May
SHRUBS		Oregon grape *Mahonia repens*			18”	3’	April - May
		sword fern *Polystichum munitum*			3’	3’	N/A
		snowberry *Symphoricarpos albus*			4’	4’	May - June

Key

Wet		Sun	
Moist		Part Shade	
Moist-dry		Shade	

Illustrative Guide Photo Credit, In order of plants listed**:**
Toby Query, City of Portland, BES; Lynda Boyer, Heritage Seedlings & Liners; Lynda Boyer; Laura Taylor, WMSWCD; Mary Bushman, City of Portland, BES; Lynda Boyer; Lynda Boyer; Lynda Boyer; Matt Lavin; Elaine Stewart, Metro; Matthew Shepard, The Xerces Society; Lynda Boyer; Lynda Boyer; Mary Bushman; Mary Bushman; Terry Glase; Mary Bushman; Thomas L Muller; Kammy Kern-Korot, WMSWCD; Mary Bushman; WD Bransford and Dophia; Sally and Andy Wasowski; Michael Ahr, WMSWCD; Lynda Boyer; Lynda Boyer; Kammy Kern-Korot; Lynda Boyer; Laura Taylor; Toby Query; Toby Query; Toby Query; and Laura Taylor.

Native Prairie Plants Suitable for an Upland Meadow

	Genus Species + Common Name	Soil Conditions	Horticulture/Notes	Plant Spacing/ Amount Seed
GRASSES	Bromus carinatus (California brome)	moist-dry	sun - deciduous/seed/self-sowing/aggressive	
	Bromus vulgaris (Columbia brome)	moist-dry/FACU	part sun - deciduous/seed/self-sowing/aggressive	
	Carex tumulicola (foothill sedge)	**moist-dry/FACU**	**sun - deciduous+rhizomatous/plug**	**3' OC**
	Danthonia californica (California oatgrass)	**moist/FAC**	**sun - semi evergreen/plug/self-sowing**	**3' OC**
	Deschampsia elongata (hair grass)	moist/FAC	sun part shade - deciduous/seed/self-sowing	
	Elymus glaucus (blue wildrye)	moist-dry/FACU	sun part shade - deciduous/seed/self-sowing/aggressive	
	Festuca californica (California fescue)	moist-dry/FACU	part shade - semi-evergreen/plug	
	Festuca roemeri (Roemer's fescue)	**moist-dry**	**sun - deciduous/plug**	**3' OC**
	Juncus tenuis (slender rush)	**moist/FAC**	**sun part shade - deciduous/plug/self-sowing**	**3' OC**
	Koeleria cristata (June grass)	moist-dry	sun - deciduous/plug	
	Poa secunda (one-sided bluegrass)	dry/FACU	sun - deciduous/seed/erosion control	
FORBS	**Achillea millefolium (Western yarrow)**	**moist-dry/FACU**	**sun - deciduous+rhizomatous/plug-seed/aggressive**	**10' OC/<.01 oz. per 100 sq.ft.**
	Alium amplectens (slim-leaf onion)	moist-dry	sun - deciduous/BR bulb	
	Anaphalis margaritacea (pearly everlasting)	moist-dry/FACU	sun - deciduous+rhizomatous/plug	
	Aquilegia formosa (Western columbine)	**moist/FAC**	**sun - deciduous/plug or containers**	**6' OC**
	Asclepias speciosa (showy milkweed)	moist/FAC	sun - deciduous+rhizomatous/plug or container	10' OC
	Brodiaea coronaria (crown brodiaea)	**moist/FAC**	**sun - deciduous/BR bulb**	
	Camassia leitchlinii (great camas lily)	**moist**	**sun - deciduous/BR bulb/self-sowing**	**10 bulb/100 sq.ft. in patches**
	Clarkia amoena (farewell to spring)	**moist-dry**	**sun - deciduous/seed/self-sowing/annual**	**<.01 oz. per 100 sq.ft.**
	Clarkia purpurea (farewell to spring)	moist-dry	sun - deciduous/seed/self-sowing/annual	
	Collomia grandiflora (large-leaf collomia)	**moist-dry**	**sun - deciduous/seed/self-sowing/annual**	**<.01 oz. per 100 sq.ft.**
	Dichelostemma congestum (ookow)	moist-dry	sun - deciduous/BR bulb/self-sowing	
	Erigeron speciosus (showy fleabane)*	moist-dry	sun - deciduous/plug	
	Eriophyllum lanatum (Oregon sunshine)	**moist-dry**	**sun - deciduous/plug or container**	**10' OC in patches of 3-7**
	Erythronium oreganum (fawn lily)	moist-dry	part shade - deciduous/BR bulb/self-sowing	
	Fragaria virginiana v. platypetala (strawberry)	**moist-dry**	**sun - deciduous+stoloniferous/plug/colonizer**	**10' OC in patches of 3-7**

Native Prairie Plants Suitable for an Upland Meadow Continued

	Genus Species + Common Name	Soil Conditions	Horticulture/Notes	Plant Spacing/ Amount Seed
FORBS	Fritillaria affinis (checker lily)	moist-dry	sun - deciduous/BR bulb	
	Geranium oreganum (Oregon geranium)	moist	sun - deciduous/plug or containers	
	Gilia capitata (blue field gilia)	**moist-dry**	**sun - deciduous/seed/self-sowing/annual**	**<.01 oz. per 100 sq.ft.**
	Grindelia integrifolia (gum weed)	**moist/FAC**	**sun - deciduous /plug/self-sowing**	**6' OC**
	Iris tenax (tough-leafed iris)	moist-dry	sun - deciduous+tuberous/BR rhizomes	
	Lomatium dissectum (fernleaf biscuitroot)	moist-dry	sun - deciduous+tuberous/containers	
	Lomatium nudicaule (barestem biscuitroot)	moist-dry/FACU	sun - deciduous+tuberous/containers	
	Lomatium utriculatum (common biscuitroot)	moist-dry	sun - deciduous+tuberous/containers	
	Lotus unifoliatus [purshiana] (single-leaf clover)	moist-dry/FACU	sun - deciduous/seed/self-sowing/annual	
	Lupinus rivularis (riverbank lupine)	**moist**	**sun - deciduous/containers/aggressive**	
	Lupinus polyphyllus (large leaf lupine)	moist/FAC	sun - deciduous/containers	
	Heuchera chlorantha (alumroot)	moist-dry/FACU	sun - deciduous/containers	
	Penstemon ovatus (broad-leaf penstemon)	moist-dry	sun - deciduous/containers	
	Phacelia heterophylla (varileaf phacelia)*	moist-dry	sun - deciduous/containers	
	Perideridia oregana (Oregon yampah)	moist-dry/FACU	sun - deciduous/containers	
	Potentilla glandulosa (sticky cinquefoil)	moist-dry	sun - deciduous/plug or containers	
	Potentilla gracilis (slender cinquefoil)	**moist/FAC**	**sun - deciduous/plug or containers/self-sowing**	**10' OC**
	Pteridium aquilinum (bracken fern)	moist-dry/FACU	part shade - deciduous+rhizomatous/plug/aggressive	
	Ranunculus occidentalis (Western buttercup)	**moist /FAC**	**sun - deciduous/plug or containers/self-sowing**	**10' OC in patches of 3-7**
	Sedum spathulifolium (stonecrop)	dry	sun - evergreen/cuttings or containers	
	Sidalcea campestris (field mallow)	moist-dry/FACU	sun - deciduous+rhizomatous/plug	
	Sidalcea virgata (rose checkermallow)*	**moist**	**sun - deciduous+rhizomatous/plug or containers**	**10' OC**
	Solidago canadensis (goldenrod)	moist-dry/FACU	sun - deciduous+rhizomatous/plug/aggressive	
	Symphyotrichum hallii (Hall's aster)	**moist**	**sun - deciduous+rhizomatous/plug**	**6' OC**
	Symphyotrichum subspicatum (Douglas' aster)	moist/FAC	sun - deciduous+rhizomatous/plug/aggressive	
	Triteleia hyacinthina (white brodiaea)	moist/FAC	sun - deciduous/BR bulb	
	Wyethia angustifolia (mule's ears)	moist-dry/FACU	sun - deciduous+rhizomatous/plug	

Native Prairie Plants Suitable for a Planting Strip Meadow

	Genus Species + Common Name	Soil Conditions	Horticulture/Notes	Plant Spacing/ Amount Seed
GRASS	**Carex tumulicola (foothill sedge)**	**moist-dry/FACU**	**sun - deciduous+rhizomatous/plug**	**2' OC**
	Danthonia californica (California oatgrass)	**moist-dry/FACU**	**sun - semi evergreen/plug/self-sowing**	**2' OC**
	Deschampsia elongata (hair grass)	**moist/FAC**	**sun part shade - deciduous/seed/self-sowing**	**<.01 oz. per 100 sq.ft.**
	Festuca roemeri (Roemer's fescue)	**moist-dry**	**sun - deciduous/plug**	**2' OC**
	Juncus tenuis (slender rush)	**moist/FAC**	**sun - deciduous+rhizomatous/plug/self-sowing**	**2' OC**
FORBS	**Achillea millefolium (Western yarrow)**	**moist-dry/FACU**	**sun - deciduous+rhizomatous/plug-seed/aggressive**	**6' OC/<.1 oz. per 100 sq.ft.**
	Camassia leitchlinii (great camas lily)	**moist**	**sun - deciduous/BR bulb/self-sowing**	**10 bulb/100 sq.ft. in patches**
	Clarkia amoena (farewell to spring)	**moist-dry**	**sun - deciduous/seed/self-sowing/annual**	**<.01 oz. per 100 sq.ft.**
	Collomia grandiflora (large-leaf collomia)	**moist-dry**	**sun - deciduous/seed/self-sowing/annual**	**<.01 oz. per 100 sq.ft.**
	Epilobium angustifolia (fireweed)	moist/FAC	sun part shade - deciduous+rhizomatous/plug/aggressive	
	Heracleum lanatum (cow parsnip)	moist/FAC	sun - deciduous+rhizomatous/plug/self-sowing	
	Iris douglasiana (Douglas' iris)	moist-dry	sun - semi evergreen+tuberous/BR rhizomes	
	Pteridium aquilinum (bracken fern)	moist-dry/FACU	sun part shade - deciduous+rhizomatous/plug/aggressive	
	Ranunculus occidentalis (Western buttercup)	**moist/FAC**	**sun - deciduous/plug or containers/self-sowing**	**6' OC in patches of 3-7**
	Symphyotrichum hallii	**moist**	**sun - deciduous+rhizomatous/plug**	**6' OC**
	Symphyotrichum subspicatum	moist/FAC	sun - deciduous+rhizomatous/plug/aggressive	
SHRUBS	**Mahonia repens (creeping Oregon grape)**	**moist-dry**	**sun - evergreen/1 g containers**	**3-5/100 sq.ft.**
	Symphoricarpos albus (common snowberry)	**moist-dry/FACU**	**part shade - deciduous+rhizomatous/containers**	**3-5/100 sq.ft.**

Native Plants Suitable for a Wet Meadow

	Genus Species + Common Name	Soil Conditions	Horticulture/Notes	Plant Spacing/ Amount Seed
GRASS	Agrostis exarata (spike bentgrass)	wet-moist/FACW	sun - deciduous/seed-plug/self-sowing	
	Carex leptopoda (taperfruit sedge)	moist/FAC	shade - deciduous/plug/self-sowing	
	Carex obnupta (slough sedge)	**wet-moist/FACW**	**part shade - rhizomatous/plug/aggressive**	**3' OC**
	Carex stipata (sawbeak sedge)	wet/OBL	part shade - rhizomatous/plug	
	Deschampsia caespitosa (tufted hair grass)	**wet-moist/FACW**	**sun - deciduous/seed-plug/self-sowing**	**3' OC**
	Deschampsia elongata (slender hair grass)	**moist/FAC**	**sun part shade - deciduous/seed/self-sowing**	**<.01 oz. per 100 sq.ft.**
	Hordeum brachyantherum (meadow barley)	wet-moist/FACW	sun - deciduous/seed/self-sowing	
	Juncus balticus Baltic Rush	wet-moist/FACW	sun - evergreen+rhizomatous/plug	
	Juncus effusus v. pacificus (soft rush)	wet-moist/FACW	sun part shade - evergreen+rhizomatous/plug	
	Juncus ensifolius (dagger-leaf Rush)	**wet-moist/FACW**	**sun - deciduous+rhizomatous/plug**	**3' OC**
	Juncus tenuis (slender rush)	**moist/FAC**	**sun part shade - deciduous+rhizomatous/plug**	**3' OC**
	Scirpus microcarpus (bulrush)	**wet/OBL**	**part shade - deciduous+rhizomatous/plug**	**2' OC**
FORBS	Aruncus sylvester (goatsbeard)	moist	part shade - deciduous/plug	
	Athyrium filix-femina (lady fern)	moist	shade - deciduous/container	
	Bidens cernua (nodding beggars-tick)	wet/OBL	sun - deciduous/seed/self-sowing/annual	
	Bidens frondosa (leafy beggars-tick)	wet-moist/FACW	sun - deciduous/seed/self-sowing/annual	
	Camassia quamash (common camas lily)	**wet-moist/FAC**	**sun - deciduous/BR bulb**	**10 bulb/100 sq.ft. in patches**
	Collinsia grandiflora (Large Blue-eyed Mary)	wet-moist	sun - deciduous/seed/self-sowing/annual	
	Collinsia parviflora (Small Blue-eyed Mary)	wet-moist	sun - deciduous/seed/self-sowing/annual	
	Coreopsis tinctoria v. atkinsonia (tickseed)	**moist/FAC**	**sun - deciduous/seed/self-sowing/annual**	**<.1 oz. per 100 sq.ft.**
	Corydalis scouleri (western corydalis	moist/FAC	shade - deciduous/container	
	Dicentra formosa (Pacific bleedingheart)	moist-dry/FACU	shade - deciduous/container	
	Epilobium angustifolium (fireweed)	moist/FAC	sun part shade - deciduous+rhizomatous/plug/aggressive	
	Geum macrophyllum (Oregon avens)	**moist/FAC**	**part shade - deciduous/plug**	**18" OC in patches of 3-7**
	Helenium autumnalis (sneezeweed)	**wet-moist/FACW**	**sun - deciduous+rhizomatous/plug/aggressive**	**6' OC in patches of 3-7**
	Hydrophyllum tenuipes (waterleaf)	**wet-moist/FAC**	**shade - deciduous/rhizomes or plug**	**3' OC in patches of 3-7**
	Petasites frigidus (coltsfoot)	moist	shade - deciduous+rhizomatous/plug/aggressive	
	Polystichum munitum (sword fern)	**moist-dry/FACU**	**part shade - evergreen/container**	**3' OC in patches of 3-7**
	Pteridium aquilinum (bracken fern)	moist-dry/FACU	sun part shade - deciduous+rhizomatous/plug/aggressive	
	Tellima grandiflora (fringecup)	**moist-dry/FACU**	**part shade - deciduous/plug or container**	**1' OC in patches of 3-7**
	Tolmiea menziesii (youth on age)	**moist/FAC**	**part shade - deciduous/plug or container**	**1' OC in patches of 3-7**
	Veratrum californicum (corn lily)	moist/FAC	part shade - deciduous/container	

Native Plants Suitable for an Annual Wildflower Meadow

	Genus Species + Common Name	Soil Conditions	Horticulture/Notes	Plant Spacing/ Amount Seed
FORBS	Clarkia amoena (farewell to spring)	moist-dry	sun - deciduous/seed/self-sowing/annual	
	Collinsia grandiflora (blue-eyed Mary)	wet-moist	sun - deciduous/seed/annual	
	Collomia grandiflora (grand collomia)	moist-dry	sun - deciduous/seed/self-sowing/annual	
	Coreopsis tinctoria v. atkinsonia (tickseed)	moist/FAC	sun - deciduous/seed/self-sowing/annual	<.1 oz. per 100 sq.ft.
	Epilobium densiflorum (dense-spike primrose)	wet-moist/FACW	sun - deciduous/seed/annual	
	Eschscholzia californica (California poppy)*	moist-dry	sun - deciduous/seed/self-sowing/annual	
	Gilia capitata (blue field gilia)	moist-dry	sun - deciduous/seed/self-sowing/annual	
	Lotus micranthus (deervetch)	moist-dry	sun - deciduous/seed/annual	
	Lotus unifoliolatus [purshiana] (clover)	moist-dry	sun - deciduous/seed/self-sowing/annual	
	Lupinus bicolor (bi-color lupine)	moist-dry	sun - deciduous/seed/annual	
	Lupinus polycarpus (small flower lupine)	moist-dry	sun - deciduous/seed/annual	
	Madia elegans (common tarweed)	moist-dry	sun - deciduous/seed/self-sowing/annual	
	Madia gracilis (slender tarweed)	moist-dry	sun - deciduous/seed/annual	
	Plectritis congesta (rosy plectritis)	moist-dry/FACU	sun - deciduous/seed/annual	
	Sanguisorba annua [S. occidentalis] (prairie burnet)	moist-dry	sun - deciduous/seed/annual	

Key
OBL: Obligate Wetland Almost always occurs in wetlands
FACW: Facultative Wetland Usually occurs in wetlands, but may occur in non-wetlands
FAC: Facultative Occurs in wetlands and non-wetlands
FACU: Facultative Upland Usually occurs in non-wetlands, but may occur in wetlands
BR: Bare Root

Please Note: Plants listed in **bold** text are found in the Illustrative Plant Guide.

D – Wildflower Bloom Time Chart

	Genus Species	Common Name	Color	Pollinator		Bloom Time							
				Host	Food	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
FORBS (WILDFLOWERS)	Aquilegia formosa	Red columbine	Orange										
	Collomia grandiflora	Large flowered collomia	Orange										
	Lilium columbianum	Columbia lily	Orange										
	Cardamine nuttallii	Spring beauty	Pink										
	Dodecatheon hendersonii	Broadleaf shooting star	Pink		Bumble Bees								
	Lithophragma parviflorum	Small flowered fringecup	Pink		**X**								
	Dicentra formosa	Bleeding heart	Pink	X									
	Plectritis congesta	Rosy plectritis	Pink		X								
	Dodecatheon pulchellum	Shooting star	Pink										
	Microsteris gracilis	Slender phlox	Pink		X								
	Allium acuminatum	Tapertip onion	Pink		X								
	Asclepias speciosa	Showy milkweed	Pink	X	X								
	Clarkia amoena	Farewell to spring	Pink		**X**								
	Sidalcea campestris	Meadow checkermallow	Pink		**X**								
	Synthyris reniformis	Snow queen	Purple										
	Cynoglossum grande	Pacific hounds' tongue	Blue		**X**								
	Viola adunca	Hookedspur violet	Purple	**X**									
	Iris tenax	Oregon iris	Purple										
	Collinsia grandiflora	Blue-eyed Mary	Blue		**X**								
	Camassia leichtlinii	Large camas	Blue		**X**								
	Camassia quamash	Small camas	Blue		**X**								
	Dichelostema congestum	Ookow	Purple										
	Hydrophyllum tenuipes	Pacific waterleaf	Purple		**X**								
	Sisyrinchium idahoense	Blue-eyed grass	Purple										
	Prunella vulgaris	Self-heal	Purple		**X**								
	Brodiaea coronaria	Crown brodiaea	Purple		**X**								
	Micranthes occidentalis	Western mountain saxifrage	White										
	Micranthes integrifolia	Wholeleaf saxifrage	White										
	Fragaria vesca	Woods strawberry	White		**X**								
	Micranthes oregana	Oregon saxifrage	White										

	Genus Species	Common Name	Color	Pollinator		Bloom Time							
				Host	Food	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
FORBS (WILDFLOWERS)	Heuchera micrantha	Alumroot	White										
	Plagiobothrys figuratus	Fragrant popcornflower	White		X								
	Triteleia hyacinthina	Hyacinth brodiaea	White										
	Fragaria virginia	Prairie strawberry	White		X								
	Plagiobothrys scouleri	Scouler's popcornflower	White										
	Achillea millefolium	Yarrow	White	X	X								
	Allium amplectens	Slim leaf onion	White		X								
	Anaphalis margaritacea	Pearly everlasting	White	X	X								
	Ranunculus orthorhyncus	Straightbeak buttercup	Yellow										
	Lomatium (various)	Biscuitroot	Yellow	X	X								
	Mimulus guttatus	Seep monkeyflower	Yellow		X								
	Ranunculus occidentalis	Western buttercup	Yellow										
	Viola praemorsa	Canary violet	Yellow										
	Sedum spathulifollium	Stonecrop	Yellow		X								
	Potentilla gracilis	Graceful cinquefoil	Yellow		X								
	Geum macrophyllum	Avens	Yellow		X								
	Madia gracilis	Slender tarweed	Yellow		X								
	Eriophyllum lanatum	Oregon sunshine	Yellow		X								
	Solidago elongata	West coast goldenrod	Yellow		X								
	Solidago lepida	Western Canada goldenrod	Yellow		X								
GRAMINOIDS (GRASS-LIKE PLANTS)	Agrostis exarata	Spike bentgrass	Green										
	Carex densa	Dense sedge	Green										
	Carex leptopoda	Dewey's sedge	Green										
	Carex scoparia	Broom sedge	Green										
	Carex tumulicola	Foothill sedge	Green										
	Festuca roemeri	Roemer's fescue	Green										
	Koeleria macrantha	Junegrass	Green										
	Luzula comosa	Wood rush	Green										

Wildflower Bloom Time Chart Continued

	Genus Species	Common Name	Color	Pollinator		Bloom Time							
				Host	Food	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
SHRUBS	Ribes sanguineum	Red-flowering currant	Pink		X								
	Rosa gymnocarpa	Baldhip rose	Pink	X	X								
	Symphoricarpos albus	Snowberry	Pink	X	X								
	Rubus spectabilis	Salmonberry	Pink	X	X								
	Rubus parviflorus	Thimbleberry	White		X								
	Gaultheria shallon	Salal	White	X	X								
	Philadelphus lewisii	Mock orange	White		X								
	Holodiscus discolor	Oceanspray	White		X								
	Berberis aquifolium	Tall Oregon grape	Yellow	X	X								
	Salix spp.	Willow	Green	X	X								

*Chart adapted from source material provided by Metro and The Xerces Society.

E – Seeding Information

Information Regarding the Germination Requirements, Flowering date, Seed-set, Seed yields and Seeds/lb of Willamette Valley Native Prairie Species and Sedge/Rush Species
Prepared by: Lynda Boyer, Restoration Biologist/Native Plants Manager, Heritage Seedlings & Liners
Updated May, 2018 – Work in progress

Plant Characteristics:
These will vary depending on seasonal weather conditions. For example, in warm, dry years, species will re-emerge up to 2 weeks early. Establishing some species with irrigation the first summer will produce more robust plants in year 1 and 2.

Suggested field sowing season: Prairie grasses and forbs - fall; sedges/rushes - spring with irrigation

Protocol Field (no irrigation): Grasses and forbs - For Flat Beds - disc, field cultivate with harrow, cultipack, roll (spray 1 FULL season with glyphosate prior to planting to ensure all weed suites are eliminated); drill seed in the **fall** using med-grade vermiculite as cutting agent (do not mulch if drilled, not enough light for germination)
*Even species that need no stratification seem to need cool temperatures to germinate. Plants sown later than the fall will be much less robust than those sown Oct-Nov.
*Legumes - most legumes should be scarified with abrasion or acid to break the seed coat (contact me for acid protocol)
*Sedges and Rushes - cold soak seed for 48 hours; mix with vermiculite and cold/moist stratify 1 month; prior to sowing, mix with more vermiculite; sow in **spring** (April-May) using a fertilizer spreader to spread seed; press into soil with water drum; water with microsprayer for short periods throughout the day; reduce when plants are established (note: all need soil contact, heat, and light to germinate)
*Juncus sp - no strat required, sow the same as Carex and Scirpus
*Perennials - first year plants will flower later than second year plants

Protocol Greenhouse: *Times and protocol are provided by Eric Hammond, Heritage Seedlings Perennial Manager*
*Stratification requirements (in general) - fall germ annuals (often none); fall germ perennials (2-4 weeks); winter germ annuals/perennials (4-6 weeks); spring germ perennials (11-15 weeks)
*If sowing in individual pots, place seed in zip-lock bags, add a little water (mister sprayer works well), turn seed every 2 days (prevents mold), when seed is imbibed, add a little more water, watch for radical emergence, sow in potting soil mixture, grow in ambient greenhouse.
*If sowing in a communal flat, seed can be stratified using moist (not wet) vermiculite, then spread on soil and cover with a light dusting of soil.
*Sedges are stratified in fine sawdust, sown in pots (seed not covered), placed on heat bench (surface temperature 75 deg), and irrigated.

Notes If using this document as a guide for restoration work, note that species that germinate in the spring and/or are slow-growing will be poor competitors with existing vegetation. If you choose to use them, these species need to be sown on a VERY CLEAN site.
Heritage Native Seedlings & Liners Information (Edited by Dickens)
*T&E species listed in the document are collected and propagated with proper permits and used solely for restoration purposes.

Species (current name given first) *=T&E; (!) = scarification by nature or mechanical best; (g) = ground cloth capture for highest seed yield	Upland (up), wet prairie (wp), oak wood (ow), riparian (r), mixed woods (mw)	Annual (a) Perennial (p) Biennial (b)	Cold-moist stratification time (weeks)	Germination (when sown mid-Oct with sufficient rain)	Flower	Mature Fruit (med-dough for grasses and 25% shatter for forbs)	Senescence	New growth	Seed year 1	Seed year 2	Seed year 3	Seed Yield [lb/ac]	Seeds/lb
Achillea millefolium	up, wp	p	7	mid-Nov	May-June	early-July	n		x			250	1,418,947
Achnatherum (Stipa) lemmonii	up	p	12	Feb	early-May	early-June	n		some	x		400-800	106,680
Acmispon americanus (Lotus purshianus) (!) (g)	up, wp	a	12	early Feb (direct sown)	June	late -July-early Aug	n/a		x			322	86,806
Acmispon parviflorus (Lotus micranthus) (!) (g)	up, wp	a	4	mid-Dec (direct sown)	May	late-June	n/a		x			200	156,551
Agoseris grandiflora	up	b, p	1	late-Nov	June-July	early-July	n		x			500	273,665
Allium amplectens	up, wp	p	12	late-March	June	early-July	y	Jan/Feb		some	x		351,529
Aquilegia formosa (g)	up,ow, mw	p	12	late-Feb	early May-June	mid-June	some	Jan/Feb		x		200-500	248,000
Artemesia douglasii	up, ow, r, mw	p	?	May	Sept	Nov-Dec	n		x				5,000,000
Asclepias fascicularis	up, wp	p	2	mid-May	late-July - mid-August	August-Sept	y	April		some	x	6	80,353
Asclepias speciosa	up, wp	p	2	mid-May	July	late-Sept-early Oct	y	April		some	x	300-500	72,000
Balsamorhiza deltoidea	up, ow	p	10	late-April	April	mid-May	y	Jan/Feb		a little	x	180	52,587
Beckmannia syzigachne	wp	a/p	?	Jan	early-June	early-July	n		x				238,000
Brodiaea coronaria	up, wp	p	12	mid-March	July	August	y	Jan/Feb			x	80	302,667
Bromus carinatus	up	p	1	late-Oct	late-May	late-June	n		x				106,680
Calochortus tolmiei	up	p	12	mid-March	May	early-July	y	Jan/Feb			x	80	203,284
Camassia leichtlinii	up, wp, ow	p	12	mid-March	May	mid-late June	y	Jan/Feb			x	200-600	49,890
Camassia quamash	wp	p	12	mid-March	April-May	early-June	y	Jan/Feb			x	400-600	100,057
Cardamine penduliflora	wp	p	?		April		?						?
Carex tumulicola	up	p	12	late-April	June	July/Aug	n			some	x	300-400	324,000
Castilleja tenuis (Orthocarpus hispidus)	wp	a	?	mid-May	June	late-July	n/a		x				7,559,833
Clarkia amoena	up, wp	a	0	Sept	July	early-Aug	n/a		x			300-500	1,031,818
Clarkia purpurea ssp quadrivulnera	up, wp	a	0	Sept	July	early-Aug	n/a		x			438	1,890,000
Clarkia rhomboidea	up	a	0	Sept	July	mid-July	n/a		x			337	581,818
Collinsia grandiflora (g)	up	a	0	Sept	May	late-June	n/a		x			277	464,687
Collomia grandiflora (g)	up	a	1	Oct	May-June	late-July	n/a		x			370	121,715
Cynoglossum grande	ow	p	?	late-April	April	early-June	?			?			?
Danthonia californica	up, wp	p	12 to 13	mid-Mar	late-May	late-June	n		some	x		300-500	140,000
Delphinium menziesii	up	p	12	March	April	May	y	Jan/Feb		x			?
Delphinium oreganum*	up, wp	p	12	mid-Mar	May-June	July	y	Jan/Feb		x		small	850,000
Delphinium pavonaceum*	wp	p	12	mid-Mar	May-June	July	y	Jan/Feb		x		small	?
Deschampsia cespitosa	wp	p	0	Nov	May	late-June	n			x		468	1,500,000
Deschampsia danthonioides	wp	a	0	late-Oct	early-May	July	n/a		x			50-350	1,000,000
Deschampsia elongata	wp	p	0	mid-Nov	May	mid-June	n		x				1,860,000
Dicentra formosa	ow, mw	p	?		April	June	y	March					?
Dichanthelium acuminatum var. fasciculatum (Panicum occidentalis)	wp	p	?		June				?				1,049,977

Species (current name given first) *=T&E; (!) = scarification by nature or mechanical best; (g) = ground cloth capture for highest seed yield	Upland (up), wet prairie (wp), oak wood (ow), riparian (r), mixed woods (mw)	Annual (a) Perennial (p) Biennial (b)	Cold-moist stratification time (weeks)	Germination (when sown mid-Oct with sufficient rain)	Flower	Mature Fruit (med-dough for grasses and 25% shatter for forbs)	Senescence	New growth	Seed year 1	Seed year 2	Seed year 3	Seed Yield [lb/ac]	Seeds/lb
Dichelostemma congestum (Brodiaea congesta)	up	p	12	mid-Mar	May-June	July	y	Jan/Feb			x	small	315,000
Dodecatheon hendersoniii	up	p	12	March	April	June	y	Jan/Feb		x		small	?
Dodecatheon pulchellum	wp	p	12	early-April	April	June	y	Jan/Feb		x		80	707,997
Downingia elegans (g)	wp	a	heat	April	June	July	n/a		x				1,955,129
Elymus elymoides (Sitanion hystrix)	up	p	0	mid-Dec	early-June	mid-July	n		x				190,000
Elymus glaucus	up, ow, mw	p	0	mid Dec	May	early-July	n		x		short lived	650	120,000
Elymus trachycaulus (Agropyron caninum)	up	p	0	mid-Nov	mid-June	mid-July	n		x		short lived	375	134,500
Epilobium densiflorum	wp	a	0	Sept	June-July	Aug	n/a		x			340	850,694
Eranthe guttata (Mimulus guttatus) (g)	wp, r	a	0	Nov	May-June	July	n/a		x			50	millions
Erigeron decumbens*	up, wp	p	12	late-April	June	mid-July	n			x		160	11,577,000
Eriophyllum lanatum	up, wp	p	2 to 12	early-Feb	June	mid-late Aug	n		some	x		150-350	1,169,047
Erythronium oregonum	up	p	12	late-Feb	late March	early June	y	Jan/Feb			year 4	small	85,822
Festuca californica	up	p	0	late-Nov	May	early-June	n			x		150	450,000
Festuca roemerii	up	p	0	mid-Nov	mid-May	late-June	n			x		350-500	500,000
Fritillaria affinis	up	p	12	March	April		y	Jan/Feb					?
Gentiana sceptrum	wp	p	?		August	Oct	?						6,670,441
Geranium oreganum	up, ow	p	10	mid-Mar	June	late June-July	some	Jan/Feb		some		145	30,266
Geum macrophyllum	up, wp, ow, r	p	12	March	early May-June	mid-July	n		x			240	760,037
Gilia capitata	up	a	0	late-Oct	June	mid-July	n/a		x			526	1,008,888
Grindelia integrifolia	up, wp	b, p	12	March	July-Aug	Sept	n			x	short lived	500-900	127,508
Heracleum lanatum	wp, r, ow	p	warm/ cold	March	June-July	Aug	n			x		?	35,999
Horkelia congesta*	up	p	12	early March	June-July	Aug	n		x		short lived		434,890
Hosackia pinnata (Lotus pinnatus) (!) (g)	wp	p	12	late-March	April-June	July	y	Jan/Feb	some	x		125-185	130,080
Hydrophyllum tenuipes	ow, mw	p	?		early-April		?						?
Iris tenax	up, ow, mw	p	warm/ cold	early-April	April-June	early-mid July	n			x		60-400	46,000
Koeleria macrantha	up	p	0	mid-Nov	May	late-June	n			x		300-500	2,315,000
Lathyrus holochlorus*	up, ow	p	?	mid-Mar	April	early-July	some			?			?
Lathyrus nevadensis	ow, mw	p	?		April		?						?
Leptosiphon (Linanthus) bicolor (g)	up, wp	a	0	late-Oct	late-April		n/a		x				3,200,000.00
Ligusticum apiifolium	up, ow	p	12	late-Mar	June	mid-July	some	Jan/Feb		some	x	250-375	112,000
Lilium columbianum	up, ow, mw	p	?	early April	May-June	mid-July	y	Jan/Feb			?		157,913
Lithophragma parviflorum	up	p	?	mid Mar	April	mid-June	?			x			millions
Lomatium bradshawii*	wp	p	12	mid-Mar	April	early-June	y	late-Feb		some	x	500-900	59,737
Lomatium dissectum	up, ow	p	11	early-Feb	April-May	mid-June	y	Jan/Feb		x		200-650	45,031

Species (current name given first) *=T&E; (!) = scarification by nature or mechanical best; (g) = ground cloth capture for highest seed yield	Upland (up), wet prairie (wp), oak wood (ow), riparian (r), mixed woods (mw)	Annual (a) Perennial (p) Biennial (b)	Cold-moist stratification time (weeks)	Germination (when sown mid-Oct with sufficient rain)	Flower	Mature Fruit (med-dough for grasses and 25% shatter for forbs)	Senescence	New growth	Seed year 1	Seed year 2	Seed year 3	Seed Yield [lb/ac]	Seeds/lb
Lomatium nudicaule	up, wp	p	11	late-Dec	early-May	early-mid July	y	Jan/Feb		x		922	39,557
Lomatium utriculatum	up	p	3	Nov	late April-May	late-June	n		x			570	277,765
Lomatium triternatum	up	p	11	March	early-May	early July	short	Nov		x		500	63,812
Lupinus albicaulus !	up	p	2	late-Oct (with scarification)	May-June	early-mid July	y	early-Mar	x			295	27,000
Lupinus polycarpus (micranthus) (!)	up	a	2	late-Oct (with scarification)	April-May	late May/early June	n/a		x			380	58,589
Lupinus polyphyllus (!)	wp	p	2	late-Oct (with scarification)	May-June	early-July	partial	late-Feb		x		200-500	28,700
Lupinus rivularis (!)	wp	b	2	late-Oct (with scarification)	May-June	early-July	n			x		200-500	28,917
Luzula comosa (L. campestris) (g)	up, wp	p	2	mid-Nov	April	late-May	n		some	x	short lived	285	944,979
Madia elegans (g)	up, wp	a	0	Sept	June-July	mid July-mid August	n/a		x			300-500	213,145
Madia gracilis (g)	up, wp	a	0	Sept	June	early-July	n/a		x			769	413,856
Madia sativa	up, wp	a	0	Sept	June	early-July	n/a		x			?	185,720
Microseris lacinata	wp	p	2	late-Oct	June	July	short		x			300-500	316,753
Microsteris gracilis	up, wp	a	0	Sept	late April-May	May	n/a		x			300-400	416,392
Micranthes (Saxifraga) integrifolia	up, wp	p	warm/ cold	late-Oct	May	mid-June	n			x			17,000,000
Micranthes (Saxifraga) oregana	up, wp	p	warm/ cold	late-Oct	June	mid-June	n			x		30-100	14,057,541
Myosotis laxa	wp. R	a	?	?	June		n/a		x				1,343,572
Orthocarpus bracteosus	wp	a	?	mid-May	June/July	early Aug	n/a		x				859,072
Perideridia gairdneri	up, wp	p	12	Aug	July-August	early-Oct	y	early Feb		x		?	648,571
Perideridia oregana	up, wp	p	12	late-March	July-August	early-Aug	y	early Feb		x		200-400	472,500
Phacelia heterophylla (g)	up, ow	b	0	early-Oct	late-May	July	n			x		400	559,172
Plagiobothyrus figuratus (g)	wp	a	1	late-Oct	May-June	mid-July	n/a		x			522	881,553
Plagiobothrys nothofulvus	up	a	1	late-Oct	June	early Aug	n/a		x			340	767,324
Plagiobothrys scouleri (g)	up, wp	a	0	early-Oct	May	early-July	n/a		x			200	?
Plectritis congesta (g)	up, wp	a	0	early-Oct	April - May	mid-June	n/a		x			261	1,311,698
Poa secunda (P. scabrella)	up, wp	p	2	late-Oct	May	early-July	n		some	x		500-700	1,200,000
Potentilla (Drymocallis) glandulosa	up, ow	p	12	late-March	May	late-June	n		some	x		568	1,135,000
Potentilla gracilis	up, wp	p	13	late-March	May-June	mid-July	n		some	x		300-500	1,417,469
Prunella vulgaris v. lanceolata	up, wp, ow	b, p	0	late-Nov	June	mid-late July	n		some	x		300-500	400,228
Pyrrocoma racemosa	wp, r	p	12?	late-March	July	late-August	n			x		250	90,800
Ranunculus alismifolius	wp	p	2 to 4	Dec	April	May	?			?			?
Ranunculus occidentalis (g)	up, wp	p	2	mid-Nov	April	early-June	n			x		50-150	199,999
Ranunculus orthorhyncus (g)	wp	p	2	mid-Nov	May	early-July	n		x			100-200	141,924
Ranunculus uncinatus	wp, ow, r	b	2	Dec	April	mid-June	n		x			344	313,103
Rumex salicifolius	up, wp	p	0	Oct	June	July	n		some	x		1000-3000	261,923
Rupertia physodes (Psoralea p) (!) (g)	up, ow	p	0	mid-Jan	June	early-July	y	early-Apr		some	x	400-650	21,050

Species (current name given first) *=T&E; (!) = scarification by nature or mechanical best; (g) = ground cloth capture for highest seed yield	Upland (up), wet prairie (wp), oak wood (ow), riparian (r), mixed woods (mw)	Annual (a) Perennial (p) Biennial (b)	Cold-moist stratification time (weeks)	Germination (when sown mid-Oct with sufficient rain)	Flower	Mature Fruit (med-dough for grasses and 25% shatter for forbs)	Senescence	New growth	Seed year 1	Seed year 2	Seed year 3	Seed Yield [lb/ac]	Seeds/lb
Sanguisorba annua (occidentalis)	up, wp	a	12	early-March	June	early-July	n/a		x			300-700	242,780
Sanicula bipinnatifida	up, ow	p	12	early-March	April-May	June	y	Feb		x		100-200	65,306
Sericocarpus rigidus (Aster curtus)*	up, wp	p	?	mid-Mar	August	late-Sept	n		x				millions
Sidalcea campestris (!)	up, wp	p	0	Dec	May-June	early-mid July	n		x			250-500	100,000
Sidalcea malviflora ssp. virgata (!)	up	p	0	Dec	May-June	late-June	n		some	x		200-400	133,000
Sidalcea nelsoniana* (!)	wp	p	0	Dec	May-June	mid-July	n		x			300-600	140,813
Silene hookerii	up	p	12	March	May	June	y	Feb		x			156,552
Solidago elongata	up, wp	p	0	May	August	Oct-Nov	n		x			180-400	4,600,000
Symphyotrichum (Aster) hallii	up, wp	p	0	early-May	July-August	early-Oct	n		x			10-150	2,640,000
Symphyotrichum (Aster) subspicatum	up, wp	p	0	early-May	July-August	Oct-Nov	n		x				millions
Tellima grandiflora	ow, mw	p	?		May	early-June	n			x			millions
Thalictrum polycarpum (male and female plants)	ow, mw, r	p	12	May	April	July	short	Nov		x		100-170	151,333
Thermopsis gracilis (montana) (!)	ow, mw	p	?	mid-Mar	June	mid-July	y	Feb			x	200	37,213
Trifolium willdenovii (T. triternatum)	up, wp	a	2	mid-Nov	May-June	late-June	n/a		x			184	281,232
Trillium albidum	ow, mw	p	?		early-April	July	y	Feb					?
Trillium chloropetalum	ow, mw	p	?		early-April	July	y	Feb					?
Triteleia hyacinthina (Brodiaea hyacinthina)	up, wp	p	12	mid March	June	mid-July	y	Feb			x	small	333,000
Vicia americana (!)	up, ow	p	?	mid-Jan	April-May	early-mid July	some				some	small	35,000
Viola adunca (g)	up, wp	p	11	late Feb	April-May	June	n		x			180	686,488
Viola glabella	mw	p	?	Dec	April	May	?			?			?
Viola praemorsa (g)	up, wp	p	12	late Feb	April-May	June-July	y	Feb	x			200-400	168,148
Wyethia angustifolia	up, wp	p	12	late Feb	June-July	late-July	y	Feb			year 4	400	33,230
Zigadenus venenosus	up, wp	p	12	March	June	late-June	y	Jan/Feb			x	400-800	160,468
SPRING SOWN TAXA - or sow fall but surface sow only													
Carex densa	r	p		June		late July	y	Mar		x			507,750
Carex feta	r	p		June		late July	y	Mar	x				1,000,000
Carex pachystachya	r	p		June		late July	y	Mar	x				1,000,000
Carex obnupta	r	p		June		late July	n				?		408,000
Carex scoparia	r	p		June		late July	y	Mar	x				1,280,000
Carex stipata	r	p		June		mid July	y	Mar		x			570,000
Carex unilateralis	r	p		June		late July	y	Mar		x			1,100,000
Juncus accumintatus	r	p		June		late July	y	Mar	x				
Juncus tenuis	r	p		June		early July	?			?			20,000,000
Juncus effusus	r	p		June		mid-July	n	Mar		x			
Juncus ensifolius	r	p		June		mid July	n	Mar	x				
Scirpus validus	r	p		June		mid Aug	y	Mar			?		438,356
Scirpus microcarpus	r	p		June		mid Aug	y	Mar		x			4,536,000

F – Native Plant Nurseries and Seed Producers

Please Note: The nurseries and seed producers listed here include wholesale growers, retail nurseries and producers specializing in Willamette Valley native plants. Some of the listed nurseries have minimum purchase requirements and/or require ordering plants ahead of purchase. This list does not constitute as an official endorsement or approval by West Multnomah Soil & Water Conservation District.

This list was modified from the PlantNative list (http://www.plantnative.org/) with a focus on nurseries that specialize in native plant production and/or sales in the Willamette Valley. There are likely additional sources that haven't been identified in this list. If you are a native plant nursery or seed producer that would like to be listed, please contact WMSWCD – info (at) wmswcd.org.

Alder View Natives
28315 SW Grahams Ferry Rd.
Wilsonville, OR 97070
T: 503.570.2894
F: 503.570.9904

Aurora Nursery, Inc.
Tim Vande Kamp
22821 Boones Ferry Road N.E.
Aurora, OR 97070
T: 503.678.7903
F: 503.678.7901
sales@auroranursery.com
auroranursery.com

Balance Restoration Nursery, LLC
27995 Chambers Mill Road
Lorane, OR 97451-9707
T: 541.942.5530
F: 541.942.7265
balancenursery@yahoo.com

BeaverLake Nursery
Troy or Kelly Martin
21200 S. Ferguson Road
Beavercreek, OR 97004
T: 503.632.4787
F: 503.632.5412
info@beaverlakenursery.com
beaverlakenursery.com

Beaverpond Natives
Claudia Coke
48070 NW John Lee Road
Buxton, OR 97109
T: 503.324.5067

Bosky Dell Natives
23311 SW Bosky Dell Lane
West Linn, OR 97068
T: 503.638.5945
F: 503.638.8047
boskydellnatives@aol.com
boskydellnatives.com

Champoeg Nursery, Inc.
9661 Yergen Road NE
Aurora, OR 97002
T: 503.678.6348
F: 503.678.4348
info@champoegnursery.com
champoegnursery.com

D. Wells Farm
P.O. Box 336
Hubbard, OR 97032
T: 503.982.1012
F: 503.981.8420
info@dwellsfarms.com

Echo Valley Natives
Laurie J. Hoffman & Elizabeth A. Bluemmel
18883 S. Ferguson Road
Oregon City, OR 97045
T/F: 503.631.2451
info@echovalleynatives.com
echovalleynatives.com

Emerald Seed and Supply
9330 NE Halsey Street
Portland, OR 97220
T: 800.826.8873
emeraldss@ykwc.net
emeraldseedandsupply.com

Heritage Seedlings & Liners
4194 71st Ave. SE
Salem, OR 97317
T: 503.585.9835
F: 503.371.9688
heritageseedlings.com

Karma's Forest Wholesale Nursery and Organic Gardens
23223 Hwy 36
Cheshire, OR 97419
T: 541.998.2436
F: 541.998.3437
karmasforest@yahoo.com
karmasforest.com

Livingscape Nursery
3926 N. Vancouver
Portland, OR 97227
T: 503.248.0104
F: 503.248.0105
inbox@livingscapenursery.com
livingscapenursery.com

Mahonia Vineyards & Nursery, Inc.
4985 Battlecreek Rd. SE, Suite 205
Salem, OR 97302
T: 971.701.1921
F: 503.361.2419
sales@mahonianursery.com
mahonianursery.com

Minto Island Growers
3394 Brown Island Rd. S.
Salem, OR 97302
T: 503.931.6840
elizabeth@mintogrowers.com

Native Grounds Nursery
37545 Highway 228
Brownsville, OR 97327
T: 541.954.0148
F: 541.466.3500
nativegroundsnursery@gmail.com
nativegroundsnursery.com

Northwest Native Plants Inc.
23501 S. Beatie Rd.
Oregon City, OR 97045
T: 503.632.7079
F: 503.632.7087

Oak Point Nursery
2300 Independence Hwy.
Independence, OR 97351
T: 503.508.9555
sales@oakpointnursery.com
oakpointnursery.com

Oregon Native Plant Nursery
Douglas M. Chadwick
PO Box 886
Woodburn, OR 97071-0886
T: 503.981.2353
oregonnativeplant@yahoo.com
wildflower.org

Oregon Wholesale Seed Co.
P.O. Box 885
Silverton, OR 97381
T: 503.874.8221
F: 503.873.8861
flowerseed@frontier.com
oregonwholesaleseed.com

Pacific Northwest Natives
Craig Edminster
1525 Laurel Heights Drive NW
Albany, OR 97321
T: 541.928.8239
F: 541.924.8855
pacificnwnatives@comcast.net
pacificnwnatives.com

Scholls Valley Native Nursery, LLC
Sara Kral
P.O. Box 231088
Tigard, OR 97281-1088
T: 503.624.1766
F: 503.624.2766
schollsvalley@aol.com
schollsvalley.com

Second Growth Nursery
P.O. Box 11080
Eugene, OR 97440
T: 541.485.3250
F: 541.345.4481
secondgrowthinc@qwestoffice.net

Seven Oaks Native Nursery
29730 Harvest Drive SW
Albany, OR 97321
T: 541.757.6520
info@SevenoaksNativeNursery.com
sevenoaksnativenursery.com

Silver Falls Seed Company
5648 Evans Valley Lp. NE
Silverton, OR 97381
T: 503.874.8221
silverfallsseed.com

Valley Growers Nursery & Landscape
P.O. Box 610
30570 S. Barlow Rd.
Hubbard, OR 97032
T: 503.651.3535
F: 503.651.3044
info@valleygrowers.com
valleygrowers.com

Willamette Gardens
Esther Gruber McEvoy
3290 SW Willamette Avenue
Corvallis, OR 97333
T/F: 541.754.0893
natives@willamettegardens.com
willamettegardens.com

Willamette Wildlings
80692 Turkey Run Road
Creswell, OR 97426
T: 541.767.9142
natives@willamettewildlings.com
willamettewildlings.com

Wolf Nursery
Chris Wolf
13413 Silverfalls Hwy.
Sublimity, OR 97385-9739
T: 503.769.2975
F: 503.769.0495

Small Scale Prairie Design
Eric Hammond, Heritage Seedlings, Inc., Perennial program manager

May 23, 2005

Coupled with our restoration efforts we have started a wholesale perennial program with an emphasis on ornamental natives in addition to perennials from around the world. Most species we are now growing are western Oregon natives; we will be expanding into species from other parts of the country. As well as selecting natives for their ornamental quality, when possible, we will try to offer source-identified species that can be used for restoration purposes. We are very excited about this opportunity to offer perennials we feel are unrecognized ornamental gems; they make for beautiful gardens, and are environmentally beneficent.

Small Scale Prairie Planting Concept

In small settings it is feasible to approach the establishment of native grassland as you would a typical perennial garden with common techniques employed.

Your soil is full of weed seed and you will never get rid of them. There are no exceptions! Therefore weed-free mulch will be your friend. Operating on this principle prepare your planting area as you normally would and apply mulch after planting, to a dept of 2” to completely exclude exposure of weed seeds to conditions that would otherwise encourage germination. Also be careful not to have the crowns on your new plants too deep. A grass dominated meadow will have a species mix of nearly 80% grasses while a forb dominated prairie will be between 50-60% grasses. Maintain at least 50% grasses in your planting for the best look. In the Pacific Northwest the best time to plant is in autumn because the winter rains will help to establish the plants and annuals can be sown immediately on the fresh mulch.

In a garden situation annuals can add a desirable element and they help to mimic the natural environment. The best way to establish annuals in your wildflower garden is by broadcasting seed on the weed-free mulch in autumn. Our native annuals all require light for germination so they need to be sown on the soil surface. The annual rains will keep the mulch moist and germination will occur on a nature cycle.

In restorations the goal is a replicating system with lots of reseeding going on. While this may not be important in a garden the principle helps to give the garden a more natural feel. Design the plantings around mixes of species that overlap like the links of a chain. Confine each mix to ten or fewer species planting them randomly in their allotted area with the edges of each concentrated mix overlapping the next like the teeth of a zipper. The more species you want to include in a garden the more mixes, or links you will have in your design.

Distilled: 1.) Plant 2.) Mulch 3.) Over seed annuals

Enjoy, Eric

Heritage Seedlings, Inc. • 4194 71st Ave Se Salem OR 97301 • www.heritageseedlings.com
Ph:(503) 585-9835 • Fax:(503) 371-9688 • Fax:(877) 643-0110 • ehammond@heritageseedlings.com


"If we and the rest of the back-boned animals were to disappear overnight, the rest of the world would get on pretty well. But if the invertebrates were to disappear, the land's ecosystems would collapse."
Sir David Attenborough
BBC documentary *Life in the Undergrowth*

G – Pollinators That May Be Found in Urban Portland Gardens *

BUMBLEBEES	Bombus vosnesenskii (yellow faced)	
	Bombus melanopygus (blacktailed)	
	Bombus mixtus (fuzzy horned)	
CHAP LEGGED BEES	Bombus californicus (California)	

*Adapted from Appendix A of the Maritime Northwest Citizen Science Monitoring Guide, Xerces Society, 2014 (unpublished) / corroborated by Mace Vaughn, personal communication (February 2015)

MEDIUM DARK BEES	Andrena spp. + Melandrena spp. (mining bees)	
METALLIC HAIRY BELLY BEES	Osmia spp. + Hoplitis spp. (mason bees)	
SWEAT BEES	Agapostemon spp. (green sweat bee)	
	Halictus spp. (striped sweat bee)	

Photo Credit:
Left Column (top to bottom): Mace Vaughan, The Xerces Society; Kammy Kern-Korot, WMSWCD; Mace Vaughan; Mace Vaughan
Right Column (top to bottom): Mace Vaughan; Mace Vaughan; Matthew Shepard, The Xerces Society; Mace Vaughan

H – Pacific Northwest Prairie and Oak Resources

Natural History

Willamette Valley / PNW prairie/oak history, flora and fauna

A pocket guide to identifying the Western Bumblebee (Bombus occidentalis). The Xerces Society, Portland Oregon. Available from: xerces.org.

Amphibians of Oregon, Washington and British Columbia. C.Corkran and C.Thoms. 2006.

Birds of Oregon, A general reference. D.Marshall, M.Hunter and A. Contreras. OSU Press, Corvallis, OR. 2003.

Historic Vegetation of the Willamette Valley, Oregon, circa 1850. J.Christy and E.Alverson. Published in Northwest Science Vol. 85, No. 2, 2011.

Insects of the Pacific Northwest. P.Haggard and J.Haggard. Timber Press, Portland Oregon. 2006.

Land manager's guide to Bird Habitat and Populations in Oak Ecosystems of the Pacific Northwest. B.Altman and J.Stephens. American Bird Conservancy, US Fish and Wildlife and Klamath Bird Conservancy. 2012.

Native Plant Society of Oregon, npsoregon.org.

Oregon Flora Project, oregonflora.org.

Quercus garryana communities in the Puget Trough, Washington. D.Thysell and A.Carey. Pacific Northwest Research Station, US Forest Service, Olympia, WA. Published by Northwest Science, Vol.75, No. 3. 2001. fs.fed.us/pnw.

The Butterflies of Cascadia: A field guide to all the species of Washington, Oregon and surrounding territories. R.M.Pyle. Seattle Audubon Society. 2002.

The Portland Plant List, portlandoregon.gov/citycode.

The Quercus garryana Forests of the Willamette Valley. J.Thilenius. Oregon State University. Published in Ecology Vol. 49: 1124-1133. 1968. fs.fed.us/pnw.

Urbanizing Flora of Portland Oregon 1806-2008. J.A.Christy, A. Kimpo, V.Mattala, P.K.Gaddis, & N.L. Christy. 2009. Native Plant Society of Oregon. Occasional Paper 3: 1-319.

Willamette Valley Ecoregion, dfw.state.or.us/conservationstrategy.

Xerces Society Pollinator Conservation Resource Center, xerces.org.

Natural Resource Planning & Restoration

Attracting Native Pollinators, Protecting North America's Bees and Butterflies. E.Mader, M.Shepard, M.Vaughn, et al. Storey Publishing, North Adams, MA. 2011. xerces.org.

Backyard Habitat Certification Program, backyardhabitats.org.

Bringing Nature Home, bringingnaturehome.net.

Conservation Cover for Pollinators: Western Oregon and Washington, Specifications and Implementation Requirements. The Xerces Society, xerces.org. June 2013.

Meadow Planning and Design. M.G.Wilson, Pacific Northwest Urban Meadow Project (PNUM), wmswcd.org.

National Vegetation Classification System (NVCS), usnvc.org.

Natural Resources Conservation Service, nrcs.usda.gov/plantmaterials.

Plants for Pollinators in Oregon (NRCS Technical Notes), plants.usda.gov/pollinators.

Pollinator Conservation in the Portland Metro Area: a regional stakeholders report. The Xerces Society, Portland, OR. 2012.

Prairies in Portland. M.G.Wilson. Society of Ecological Restoration, Restoration and Management Notes. University of Wisconsin Press. Summer 1995.

Restoration of Urban Natural Areas. M.G.Wilson and E.M.Roth. From: Restoring the Pacific Northwest: The Art and Science of Ecological Restoration in Cascadia. Edited by Dean Apostol and Marcia Sinclair. Society of Ecological Restoration International, Island Press. 2006.

Saving the oaks of Portland's Elk Rock Island. A.Saker. The Oregonian, September, 17, 2010. oregonlive.com/environment.

Westlake [Oak] Woodland Owners Manual. D.Apostol and M.G.Wilson. City of Lake Oswego, Oregon. Westlake Homeowners Association. 1999.

Wild in the City: Exploring the Intertwine. 2nd Edition. M.Houck and M.Cody. Audubon Society of Portland. 2011.

Wildlife-Habitat Relationships in Oregon and Washington. D.Johnson and T.O'Neil. OSU Press. 2001.

Conservation, restoration and management of Pacific Northwest Prairie/Oak habitats

A Landowners Guide to Restoring and Managing Oregon White Oak Habitats. G.Vesely and G.Tucker. US Department of Interior, Oregon Department of Forestry, Oregon State University, et all. A Pacific Wildlife Research publication: blm.gov.

A grassland restoration project autopsy. M.V. Wilson, C.Ingersoll, M.G.Wilson and D.Clark. Restoration Ecology. Society for Ecological Restoration. University of Wisconsin. Summer 1996.

A Landowners Guide to Creating Grassland Habitat for the western meadowlark and Oregon's other grassland birds. Oregon Department of Fish and Wildlife. 2000.

A Practical Guide to Oak Release. C.Harrington and W.Devine. General Technical Report PNW-GTR-866, USDA Forest Service Research Station, Portland, OR. February 2006.

A Survey of the native upland prairies of the Willamette Valley. M.V. Wilson, Bureau of Land Management: Eugene District. 1996 (unpublished). Available from: people.oregonstate.edu.

Biology and Management of the Western Gray Squirrel and Oregon White Oak Woodlands: with emphasis on Puget Trough. L.Ryan and A.Carey. General Technical Report PNW-GTR-348. USDA Forest Service Pacific Northwest Research Station, Olympia WA. May 1995. fs.usda.gov.

Cascadia Prairie-Oak Partnership (CPOP) 2nd Annual Eco-regional Conference Program, Central College, Centralia, WA. March 2010.

Ecology and Conservation of South Puget Sound Prairie Landscape. Edited by: P.Dunn and K.Ewing. The Nature Conservancy of Washington, Seattle, WA. 1997.

Establishing Pollinator Meadows from Seed, xerces.org.

How to manage small prairie fires. W. Pauly. Dane County Park Commission, Madison, WI. 1988.

Management Recommendations for Washington's Priority Habitats-Oregon White Oak Woodlands. E.Larsen and J.Morgan. Washington Department of Fish and Wildlife. January 1998.

Move over Douglas fir: Oregon White Oaks Need Room to Grow. USDA Forest Service Research Station, Olympia, WA. Published in Science Findings, Issue 98, December 2007. fs.fed.us/pnw.

Native Plant Nursery Directory, plantnative.org.

Oregon Conservation Strategy. Oregon Department of Fish & Wildlife, oregonconservationstrategy.org.

Oregon white oak publications available from USDA Forest Service Research Station, Olympia, WA. fs.fed.us/pnw.

Pacific Northwest Weed Management Handbook. E.Peach, et al. Oregon State University Extension, pnwhandbooks.org.

Planting Native Oak in the Pacific Northwest. W.Devine and C.Harrington. General Technical Report PNW-GTR-804, USDA Forest Service Research Station, Portland, OR. February 2010. fs.fed.us/pnw.

Pacific Northwest Urban Meadowscaping Resources & Updates, https://wmswcd.org/programs/pacific-northwest-urban-meadowscaping/.

Pracical Guidelines for the Restoration of Wet Prairie in the Willamette Valley, Oregon. Krueger, et al. cascadiaprairieoak.org.

Prairie Landowner Guide for Western Washington. S.Noland and L.Carver. The Nature Conservancy, NRCS, US Fish and Wildlife Service, Thurston County Conservation District, et al. April 2011.

Proceedings of a Symposium on Oak Woodlands: Ecology, Management and Urban Interface Issues. Pacific Southwest Research Station. General Technical Report PSW-GTR-160. March 1996.

Regional Conservation Strategy for the Greater Portland-Vancouver Region, The Intertwine, theintertwine.org.

Release of Oregon White Oak from Overtopping Douglas-fir: Effects on Soil Water and Microclimate. W.Devine and C.Harrington. USDA Forest Service Pacific Northwest Research Station, Olympia WA. Published in NW Science, Vol. 81. No. 2, 2007, fs.fed.us/pnw/olympia/.

Restoring Rare Native Habitats in the Willamette Valley, nlwl.org/.documents.

Restoring British Columbia's Garry Oak Ecosystems: Principles & Practices. Garry Oak Ecosystems Recovery Team (GOERT), Victoria, BC V8X 3E1. 2010. Available for download at: goert.ca/.

The California Native Grasslands Association, cnga.wildapricot.org/.

The Future of Restoration and Management of Prairie-Oak Ecosystems in the Pacific Northwest. P.Dunwiddie and J.Bakker. School of Natural Resources, University of Washington. Published in NW Science 85(2): 83-92. 2011.

The Meadow Project, themeadowproject.com/.

The Willamette Valley Landowner's Guide to Creating Habitat for Grassland Birds. dfw.state.or.us/conservationstrategy/.

West Eugene Wetlands. City of Eugene OR, Eugene-or.gov/wetlands/.

Wildlife Conservation in the Willamette Valley's Remnant Prairies and Oak Habitats: A Research Synthesis. D.Vesely and D.Rosenberg. Oregon Wildlife Institute. January 2010.

Willamette Valley Prairies: research from Oregon State University. Corvallis, OR. 2008. people.oregonstate.edu/.

I – References

Attenborough, David. Quote from BBC Documentary series *Life in the Undergrowth.*

Barry, Wendell. Quote from *Preserving Wilderness*, Wilderness magazine. 1987.

Boyd, Robert (editor). *Indians, Fire and the Land in the Pacific Northwest.* OSU Press. 1999.

Boyer, Lynda. *Native Willamette Valley Prairie and Oak Habitat Restoration, Site Preparation and Seeding,* heritageseedlings.com. 2013.

Campbell, Bruce. *Restoring Rare Native Habitats in the Willamette Valley.* Defenders of Wildlife, West Linn. OR. 2004. P. 3, 54 – 57.

Helzer, Chris. *The Prairie Ecologist*, prairieecologist.com. 2008-2015.

Nassauer, Joan. *Messy Ecosystems, Orderly Frames.* Landscape Journal 14(2). 1995. P. 161-170.

Oregon State University Extension Service, Lane County. *No-Turn Cold Composting*, extension.oregonstate.edu/.

Pendergrass, Kathy, et al. *Technical Notes: Plants for Pollinators in Oregon.* Portland, OR. 2008. p3, 5.

Pickett, Steward. Baltimore Ecosystem Study. Quote selected from *Wild Cities – It's a jungle out there*. New York Times. 2002.

Savonen, Carol. Quote selected from *Willamette Valley Wilds*. 1991. Unpublished.

Selbig, William, U.S. Geological Survey, and Nicholas Balster, University of Wisconsin. *Evaluation of Turf-Grass and Prairie-Vegetated Rain Gardens in a Clay and Sand Soil, Madison, Wisconsin, Water Years. 2004–08,* pubs.usgs.gov/. 2010.

Talamy, Douglas. Quote selected from *Asking More of the Landscape.* A.Raven, The New York Times. February 4, 2015.

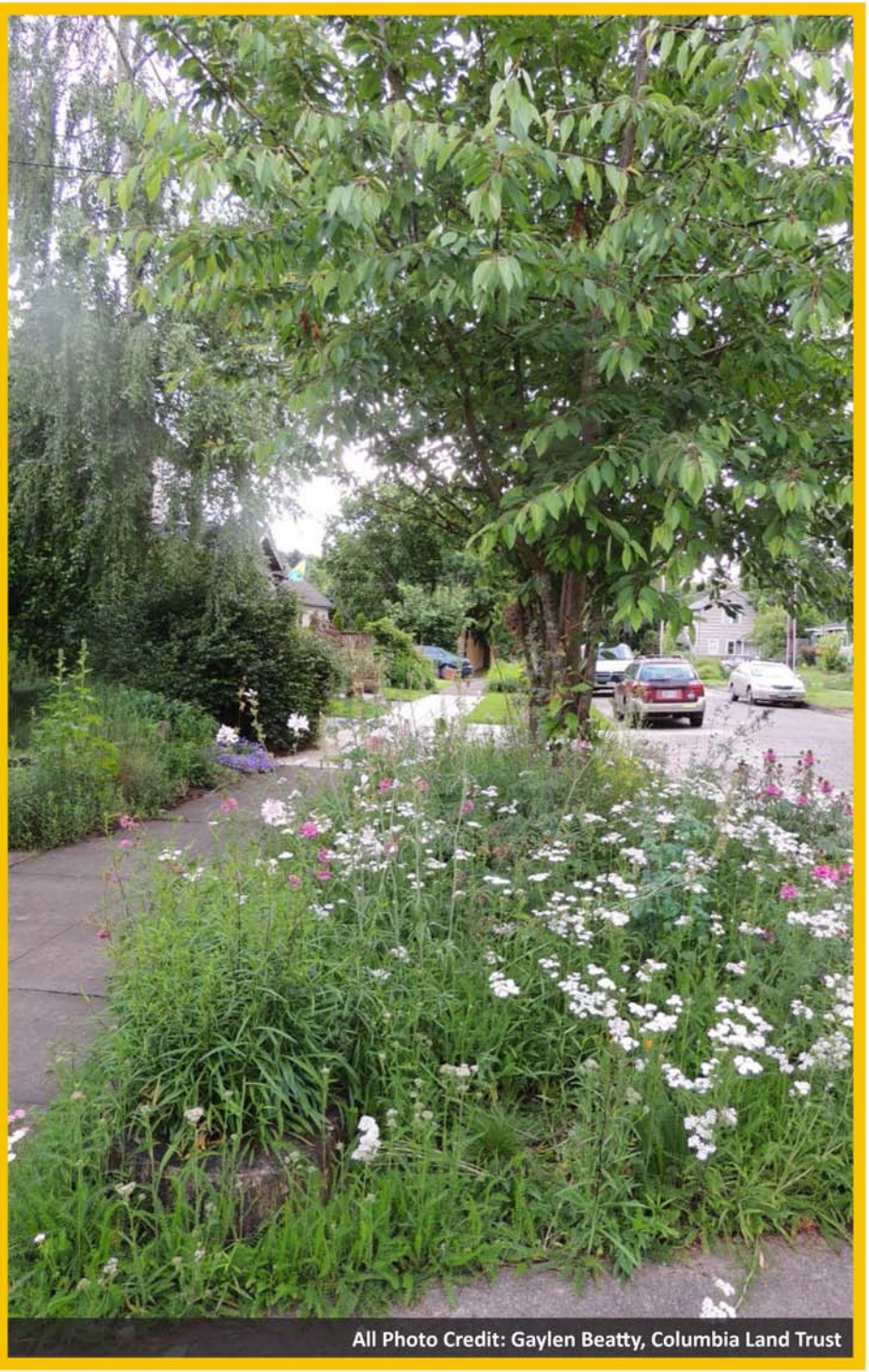
The Intertwine Alliance. Biodiversity Guide for the Greater Portland-Vancouver Region. A.Sihler, editor. The Intertwine Alliance, Portland, OR, theintertwine.org/. 2012. P. 47-53.

The Xerces Society for Invertebrate Conservation. *Establishing Pollinator Meadows from Seed.* Portland, OR. 2013. p2-11.

The Xerces Society for Invertebrate Conservation and Minnerath, Ashley. *Pollinator Conservation in the Portland Metro Region*. A Regional Stakeholders Report, Proceedings of the Portland Pollinator Conservation Workgroup meeting, held on November 10th, 2011 at West Multnomah Soil & Water Conservation District in Portland, OR. 2012. P. 5, 9.

US EPA. *Integrated Pest Management Principles,* epa.gov/. 2014.

Notes



All Photo Credit: Gaylen Beatty, Columbia Land Trust

WEST MULTNOMAH
Soil & Water Conservation District

West Multnomah Soil & Water
Conservation District
wmswcd.org
info@wmswcd.org

Printed January 2022

GREENWORKS

GreenWorks, P.C.
Portland, OR
greenworkspc.com
info@greenworkspc.com