Prairie Landowner Guide

FOR WESTERN WASHINGTON

Written by

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ESA

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April 2011

The Nature Conservancy
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CHAPTER

1

Introduction

Within the southern reaches of Puget Sound country and western Washington is a unique land of prairies and oak woodlands. Once sustained by native peoples, prairies are one of the rarest and most endangered ***ecosystems*** in the nation. Today, as in the past, they are once again dependent on human activity to protect and sustain them.

The word "prairie" is a French word meaning simply a "meadow," "grassland," or "pasture." It typically refers to a flat or rolling land that historically supported grasses and ***forbs***. Trees are absent or few, and the moisture supply is moderate. A key characteristic of Washington prairies is their gravelly structure and nutrient-poor soils, a legacy of the region's glacial past.

Why do we care about prairies? The prairies of western Washington are a valuable ecological and cultural landscape, supporting rare and threatened species that contribute to our region's rich ***biological diversity***. The prairies are a reminder of western Washington's glacial past and its first human inhabitants. They offer residents an opportunity to observe and spend time in a rare and unique landscape.

PHOTO BY: Rod Gilbert

Photo 1-1. Harsh Paintbrush (*Castilleja hispida*) is a distinctive orange-red colored flower.

A Brief Prairie History

The prairies of western Washington originated some 15,000 years ago, when the Vashon ice sheet blanketed the region. This ice sheet, or glacier, was 1,500 feet thick at Tacoma, extending south to what is now Thurston County. As this massive glacier retreated, it scraped and carved the terrain, leaving behind layered deposits of water-sculpted, rounded rocks and gravel of mixed sizes. Over thousands of years, rocks broke down, and organic matter accumulated to make up the soils we have today. These soils have a poor capacity to hold water and are classified as excessively well-drained and nutrient poor. Unlike the deep soils of the Great Plains tall-grass prairies, western Washington prairies have relatively shallow, stony soils.

Northwest Coast tribes sustained these areas as grassy, open plains by setting fires in the summer and fall. The fires kept the encroaching trees at bay, improving hunting and gathering, particularly for wildflowers and edible bulbs like camas. Bulbs of the native camas or wild onion were harvested in great numbers and eaten as a carbohydrate staple. Camas bulbs were traded with tribes living on the eastern slopes of the Cascades and plains of eastern Washington.

When homesteaders from the east arrived in Washington in the 1840s, they found knee-high grasses and wildflowers, with groves of gnarled oaks interspersed within the vast prairie lands. The prairies supported elk, deer, hawks, larks, butterflies, and a profusion of berries and flowering plants.

Today, our native prairies are one of the most ***endangered ecosystems*** in the United States. What was once over 150,000 acres of prairie in the Northwest has been reduced by 90 percent. Our remaining prairies face many continued threats, such as conversion for agriculture or land development, invasive weeds, overgrazing, and a lack of the periodic fires that once maintained these areas as grasslands. With only a fragment of the original prairie and oak woodland habitats protected in parks or reserves, private landowners hold the key to maintaining this important natural legacy.

Purpose of this Handbook

This handbook focuses on the prairies of western Washington. It provides a short history of these special places and explains where they are located. The handbook will tell you about the plants and animals that live in our prairies. It provides photographs, maps, and diagrams to help you understand the “where” and the “what” of the prairie world.

Most importantly, the handbook suggests how you as a prairie landowner can take care of these special places. Caretaking might mean practicing land management that will reduce your impact on prairies, while remaining compatible with other uses you may have for the land, such as pastures, farming, gardens, and lawns.

This handbook explains the current ***best management practices*** we can use to reduce impacts on prairie lands, as well as information about ***restoration*** tools that are specific to prairies of the Pacific Northwest.

Finally, this handbook will provide details on incentive programs available to you, as a private landowner, to assist with the process of restoring the prairie lands that are important to you.

Learn more!
Throughout the handbook, you will find words that are in *bold and italicized*. These terms are defined in the Glossary section of this handbook.

Who Should Use this Handbook?

This handbook is intended for people who own, live, work on, or manage prairie lands in western Washington. Chapters 2, 3, and 4 provide information that anyone can use to plan and implement a prairie restoration project. Later chapters of the handbook are tailored to certain types of prairie lands:

- Chapter 5 applies specifically to residential lands. Homeowners will find information about how to incorporate prairie plants into a garden setting, and how to enhance small or remnant prairie areas.
- Chapter 6 is specific to working lands: areas that produce food or fiber, such as croplands, grazing lands, pastures, rangelands, and forested lands. Land managers will find tools to continue these uses while incorporating the historic use or the cultural perspective of native prairies.

The appendices of this handbook provide resources for landowners, such as sources for native plants, methods for control of common weed species, and references for more information about prairies, funding and incentive programs.

We have developed this handbook to inspire landowners to actively manage their prairie lands and to provide guidance in creating a work plan to protect and restore prairies on their lands. Whether you own a small lot or manage hundreds of acres, the goal is to create and implement a plan that best fits your needs as a landowner, a plan that you can implement and sustain to maintain the legacy of nature and history that is a western Washington prairie.

PHOTO BY: ESA Adolfson

CHAPTER

2

Getting to Know Prairies

Where Are Prairies Found?

Some prairies in western Washington are well known and hard to miss. The distinctive topography of the Mima Mounds or fields of camas in bloom are familiar icons of local prairies. However, much of what was once prairie land is now difficult to discern. Once maintained by Native Americans through periodic burning, the open prairies are now often invaded by non-native vegetation. Throughout the range of historic prairie, fire suppression has allowed fast-growing native trees such as Douglas-fir to become established.

In addition to fire suppression and resulting invasion of trees and weedy species, most historic prairies in our region have been altered in other ways—through development, grazing, raising of crops, recreation, or other activities. These altered areas tend to have been invaded by plants and animals that are not native to western Washington. For example, the weedy Scot's broom is highly invasive and covers many acres of prairie land. Non-native wildlife species, such as the eastern gray squirrel or European starling, may be more common than native prairie species such as the western gray squirrel or western meadowlark.

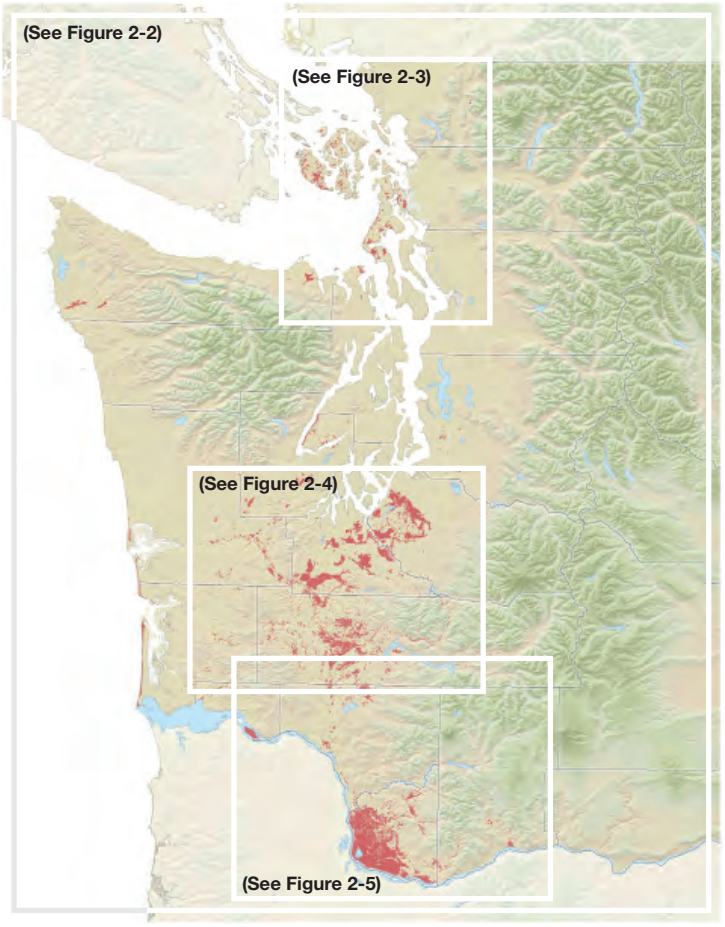
Given these altered conditions, scientists have turned to a variety of tools to map areas of western Washington that likely supported native prairies before European settlement. One of these tools is soils mapping. The soils of an area have a major influence on the plants that can grow there and what species of wildlife may be present. Soils in the prairies of western Washington were formed by retreating glaciers and tend to be gravelly, excessively well-drained, and nutrient poor.

This chapter discusses prairie soils of western Washington and provides maps of where these soils are concentrated. Wet prairies and oak woodlands (a type of habitat often associated with prairies) are described in later sections. The last part of this chapter provides a field guide to the plant and animal species typical of local prairie habitats.

Prairie Soils

The local soil survey produced by the Natural Resources Conservation Service or NRCS (formerly the Soil Conservation Service) is a standard reference for soils mapping. The published soil surveys for each county are available at local libraries, NRCS field offices, and on the internet. Using the maps in the soil survey for your county, you can determine what soil types are likely present on your land. It's important to remember that the soil survey maps were prepared at a broad scale, and the soils on your land may not match exactly what is shown on the soil survey maps, but this is a good place to start.

The NRCS West Area Office has provided a list of soil types characteristic of western Washington prairies and grasslands (Table 2-1). As shown on the accompanying soil maps, most of the core prairie soils are concentrated between Tacoma and Vancouver, Washington, with scattered areas on Whidbey Island, the Olympic Peninsula, and the San Juan Islands. Once you have determined the soil type that the NRCS has mapped for your property, see whether the soil type is listed in Table 2-1. If it is listed, this means your property has a type of soil that typically supports prairie or other native grassland communities or "ecosites." The Resources for Landowners appendix provides descriptions of each ecosite, including where it is found in the landscape and typical plant species.



SOURCE: The Nature Conservancy

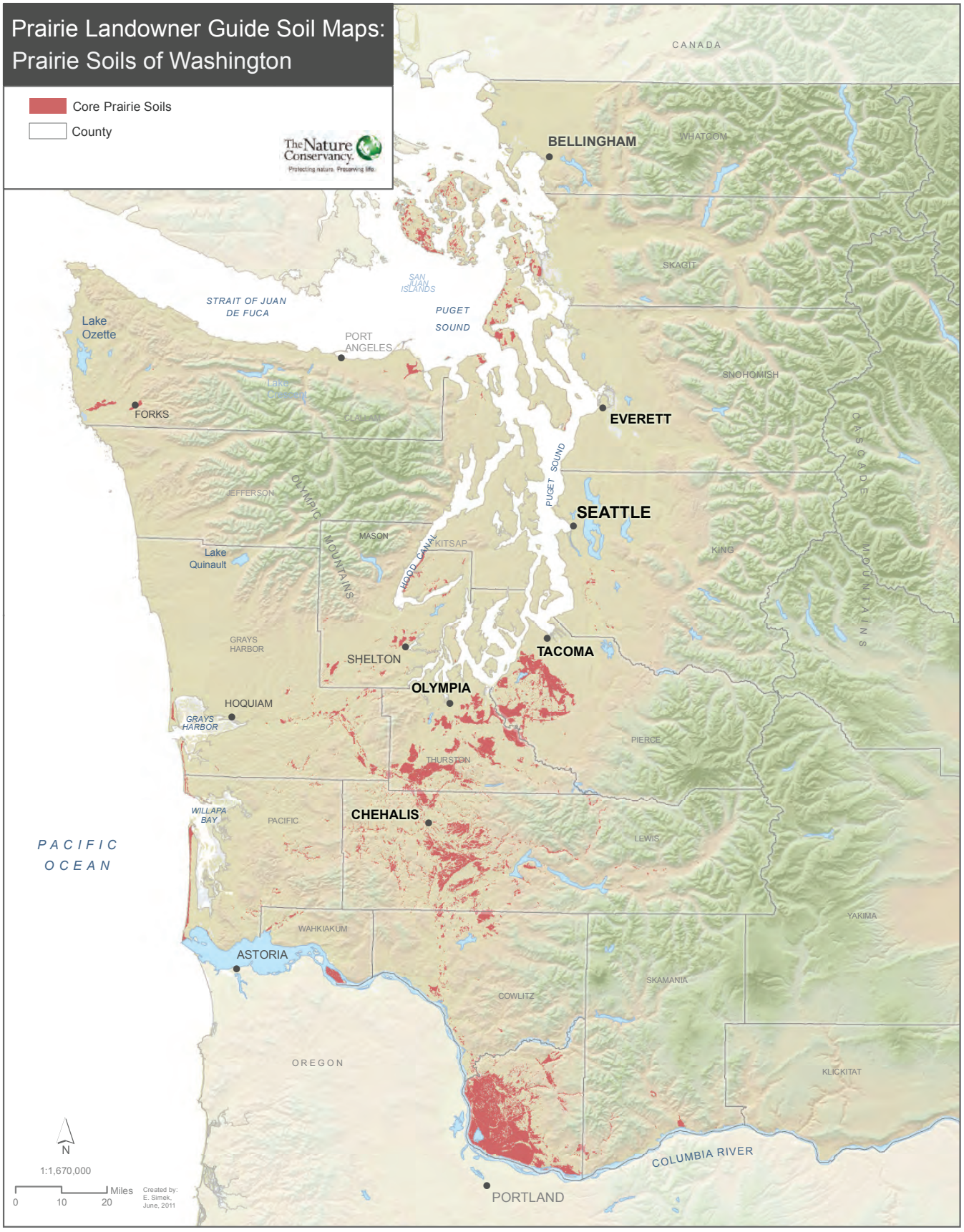
Figure 2-1. The core prairie soils (in red) of Western Washington are illustrated on the following pages. These lands are a valuable ecological and cultural landscape, supporting rare and threatened species that contribute to our region's rich biological diversity.

PHOTO BY: ESA Adolfson

Table 2-1. Grassland Soils of Western Washington

SOIL	County	ECOSITE (typical)
BOZARTH	Island	XERIC PRAIRIE
BEAR PRAIRIE	Clark	LOAMY PRAIRIE
CARSTAIRS	Mason, Grays Harbor	XERIC PRAIRIE - HIGH PPT ZONE >70"
COUPEVILLE, prairie	Island	COOL WET PRAIRIE
COVE	Clark	WARM WET PRAIRIE
COVELAND, prairie	Island	COOL WET PRAIRIE
DOTY	Lewis	LOAMY PRAIRIE
DUGUALLA	San Juan, Island	TIDAL MEADOW
EBEYS	Island	XERIC PRAIRIE
ENDOAQUENTS, TIDAL	San Juan, Island	TIDAL MEADOW
GALVIN	Lewis, Thurston	WARM WET PRAIRIE
GEE	Clark	LOAMY PRAIRIE
HARO	San Juan, Island	PRAIRIE BALD
HIDDENRIDGE	San Juan, Island	PRAIRIE BALD
HILLSBORO	Clark	LOAMY PRAIRIE
HOCKINSON	Clark	WARM WET PRAIRIE
LAUREN	Clark	LOAMY PRAIRIE
MINNIECE	Clark,Cowlitz, Lewis	WARM WET PRAIRIE
MOSSYROCK	Clark, Lewis	LOAMY PRAIRIE
NEPTUNE	Whatcom	COASTAL GRASSLAND
NEWBERG	Clark, King, Pierce, Cowlitz, Thurston, Grays Harbor, Pacific, Wahkiakum	LOAMY PRAIRIE
NISQUALLY	Pierce, Thurston, Lewis	XERIC PRAIRIE
OCOSTA	Grays Harbor, Pacific	TIDAL MEADOW
ORCAS	San Juan, Island, Snohomish, King, Mason, Grays Harbor, Pacific, Wahkiakum	BOG OR FEN
PILEPOINT	San Juan, Island	XERIC PRAIRIE
POWELL	Clark	WARM WET PRAIRIE
PRATHER	Lewis, Thurston	LOAMY PRAIRIE
QUILLAYUTE	Clallam	LOAMY PRAIRIE
SAN JUAN	San Juan	XERIC PRAIRIE
SARA	Clark, Cowlitz	LOAMY PRAIRIE
SAUVIE	Clark	WARM WET PRAIRIE
SEMIAHMOO	San Juan, Island, Jefferson, Kitsap, mason, Thurston, Pierce, Lewis, Cowlitz, Clark	BOG OR FEN
SEQUIM	Clallam	XERIC PRAIRIE
SHALCAR	San Juan, Island, Whatcom, Kitsap, King, Pierce, Thurston	BOG OR FEN
SIFTON	Clark	XERIC PRAIRIE
SNAKELUM	Island	XERIC PRAIRIE
SPANA	Pierce, Thurston	WARM WET PRAIRIE
SPANAWAY	Pierce, Thurston, Lewis, GH	XERIC PRAIRIE
SUCIA, prairie	Island	XERIC PRAIRIE
TACOMA	Whatcom, Skagit, Island, Kitsap, Pierce, Mason, Thurston	TIDAL MEADOW
TOWNSEND	Jefferson, Island	XERIC PRAIRIE
WASHOUGAL	Clark	XERIC PRAIRIE
WELLMAN	Clallam	XERIC PRAIRIE
WESTPORT	Grays Harbor, Pacific	COASTAL GRASSLAND
WIND RIVER	Clark	XERIC PRAIRIE
XERORTHENTS	San Juan, Island	SALT WATER BLUFF
YACOLT	Clark	LOAMY PRAIRIE

SOURCE: NRCS West Area Office

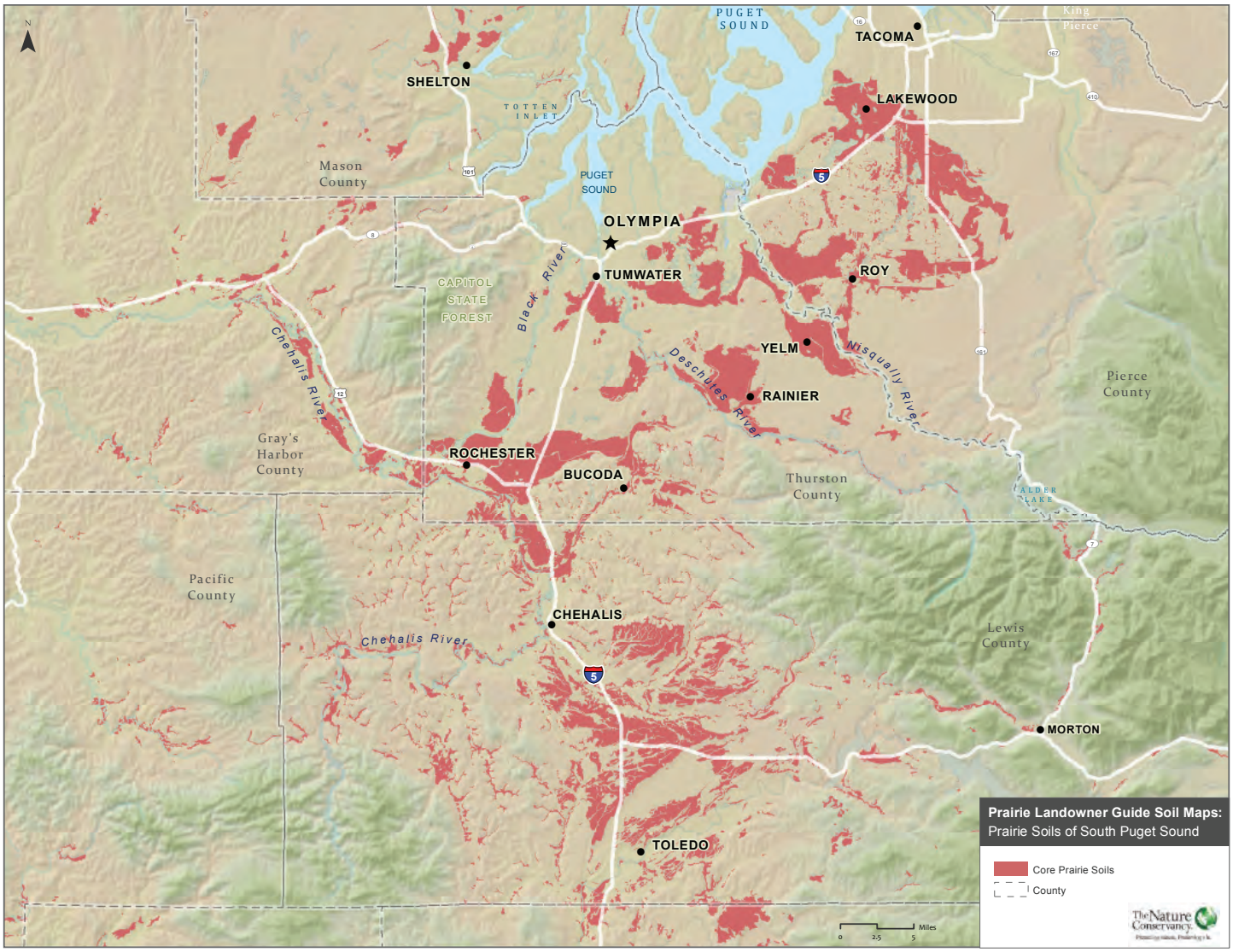


SOURCE: The Nature Conservancy

Figure 2-2. Prairie Soils of Washington

SOURCE: The Nature Conservancy

Figure 2-3. Prairie Soils of North Puget Sound



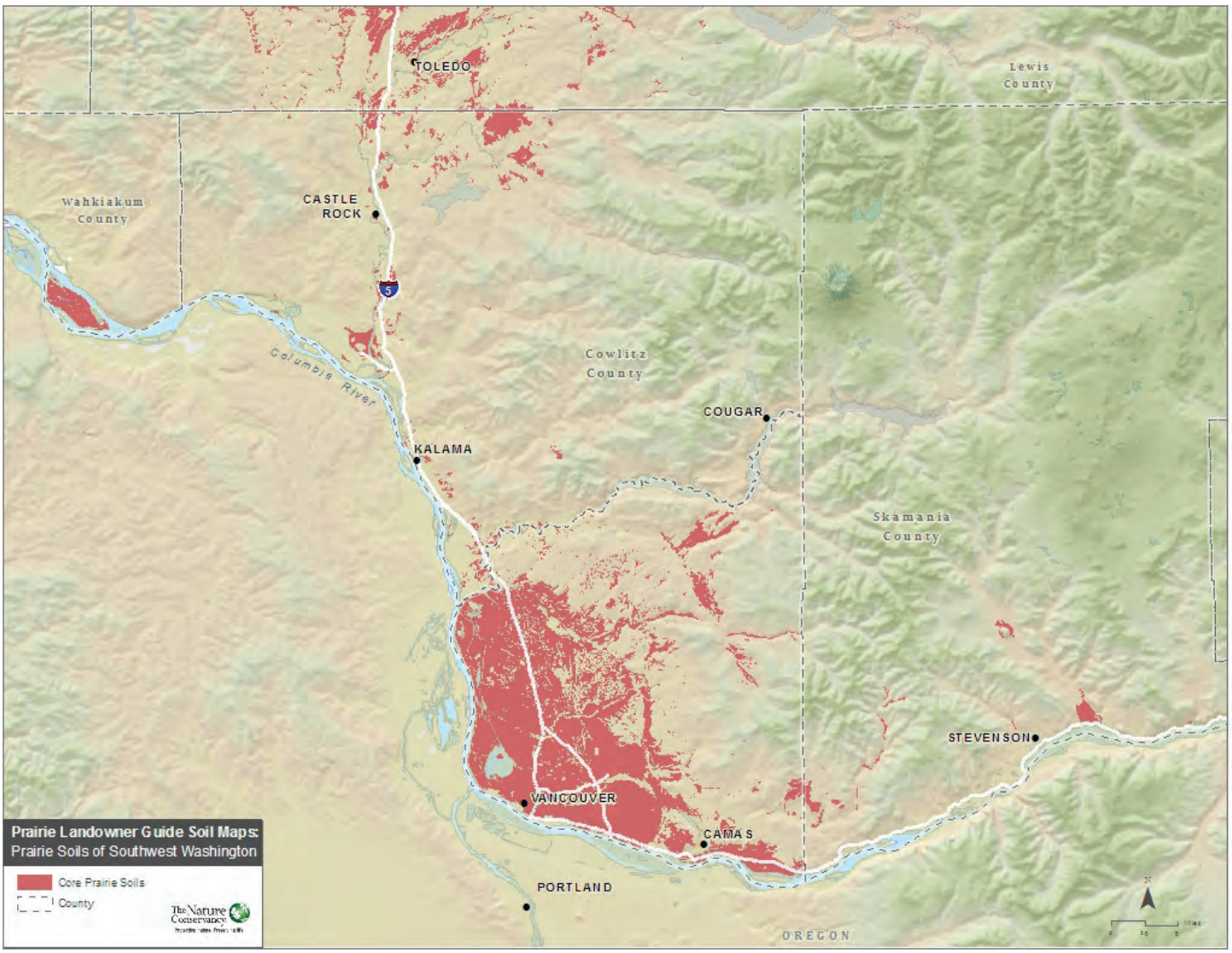
SOURCE: The Nature Conservancy

Figure 2-4. Prairie Soils of South Puget Sound

Other tools can be used to explore whether a specific area was likely an historic prairie. For example, surveyors from the General Land Office made detailed maps of western Washington in the 1800s, noting the layout of prairie lands, forest edges, and other natural features. Scientists have used these survey maps along with other data to select historic prairie areas in which to search for rare plants and butterfly habitat. More information about these and other tools is provided in subsequent chapters.

Wet Prairies

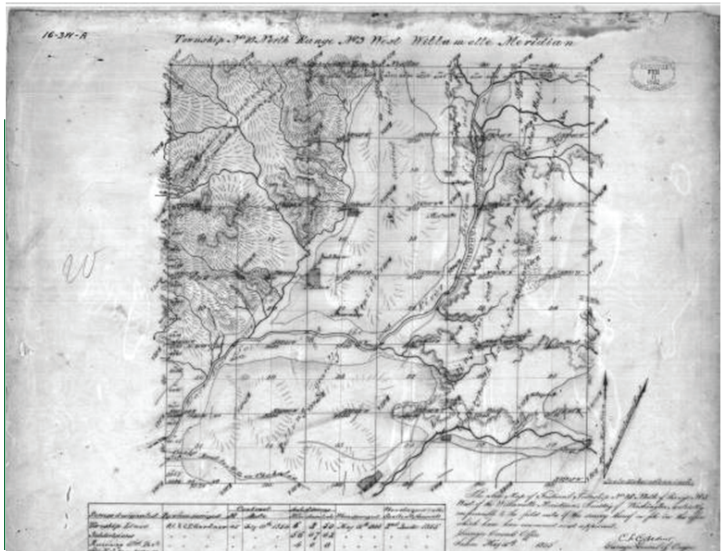
Some prairies contain low-lying areas with a seasonally high water table. These are known as wet prairies, swales, or kettles. These depressional areas are wetter than most upland prairies, but dry enough that they could still burn during periods of drought, ***prescribed burning***, or periodic wildfires. The high productivity of wet prairie soils meant that most of these areas were historically used for agriculture or grazing. In the absence of fire, woody plants such as Oregon ash, red-osier dogwood, and Douglas' spirea rapidly invaded many wet prairie sites. A number of threatened plant species depend on the moist and dry cycle found in wet prairie sites, such as water howellia



SOURCE: The Nature Conservancy

Figure 2-5. Prairie Soils of Southwest Washington

and rose checker mallow. In addition, nectar plants used by butterflies may be able to flower later into the growing season in wet prairie sites, possibly stabilizing sensitive butterfly populations. For more information, see *Wet Prairie Swales of the South Puget Sound, Washington* (Easterly, et al., 2005).



SOURCE: http://www.blm.gov/or/landrecords/survey/ySrvy1.php

Figure 2-6. The image to the right is an example General Land Office map. The web page to access these maps is: http://www.blm.gov/or/landrecords/survey/ySrvy1.php

Oak Woodlands

No discussion of western Washington prairies would be complete without mention of oak woodlands. Garry oak, also known as Oregon white oak, is a native tree species that often occupies the zone between prairies and conifer forests. Sometimes the oak trees are widely spaced and form oak savannahs interspersed with prairie meadows; in other areas the trees are dense and form oak stands or woodlands. Garry oak communities support more than 200 vertebrate species and uncounted invertebrates. As with prairies, Garry oak communities were historically maintained through periodic burning. Low-intensity fires spurred new oak trees to sprout, as well as suppressing the growth of competing tree species. The suppression of fire has allowed oak stands to be overgrown by faster growing conifers such as Douglas-fir.

For more information on oak woodlands see:

- *A Practical Guide to Oak Release* (Harrington and Devine, 2006)
- *Planting Native Oak in the Pacific Northwest* (Devine and Harrington, 2010)
- *A Landowner's Guide for Restoring and Managing Oregon White Oak Habitats* (Vesely and Tucker, 2004)
- *The Garry Oak Gardener's Handbook* (Garry Oak Ecosystems Recovery Team, 2009)
- *Management Recommendations for Washington's Priority Habitats: Oregon White Oak Woodlands* (WDFW, 1998)

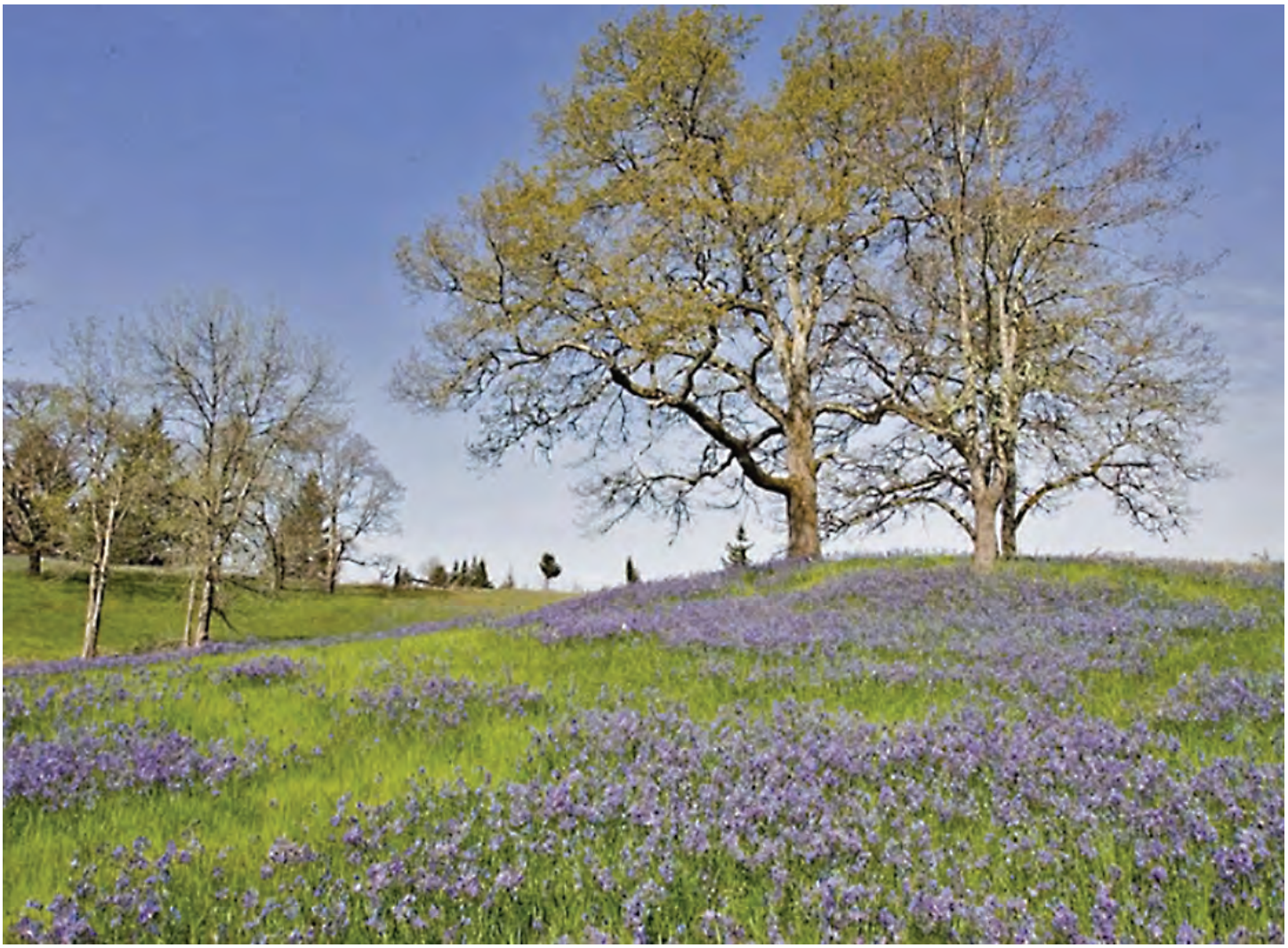


PHOTO BY: Rod Gilbert

What Plants and Animals Live on Prairies?

Western Washington prairies support many unique plant and animal species. Even on degraded sites it is often possible to find remnants of these native communities. This section provides a description and photos of the plant and animal species commonly observed on local prairies.

Native Prairie Plants

Roemer's Fescue

Scientific Name: *Festuca idahoensis var. roemeri*

Leaves/stalks (vegetation): ***Perennial*** bunchgrass that is short, finely textured, and densely ***tufted***.

Flowers: The flowering stems can grow 14 to 40 inches tall and range from light green to dark purple or red.

Ecology: Roemer's fescue is only found west of the Cascades and northern Sierra Nevada Mountains. It is a mid to late ***succession*** species in its natural habitat. It prefers moderately acid to slightly alkaline, fine to medium textured mineral soils. The species generally grows in full sun but will tolerate partial shade near forest edges and oaks.

Other Information: Roemer's fescue is easily confused with other grass species, and positive identification takes experience. This species is commonly used in prairie restoration efforts to reestablish native grasses after a ***prescribed burn***.

PHOTO BY: Cathie Conolly

Red Fescue

Scientific Name: *Festuca rubra*

Leaves/stalks (vegetation): This species has very narrow leaves and flowering stems that grow 8 to 40 inches tall with a reddish-purple base.

Flowers: The ***inflorescence*** is often reddish as well.

Roots: Spreads by ***stolons***.

Ecology: Tidal marshes, beaches, stream banks, mountain meadows, river flats, clearings, roadsides, fields. Common from sea level to high elevations.

Other Information: This species is widespread and commonly used as both a lawn and pasture grass.

PHOTO BY: Robert Soreng

Long-stoloned Sedge

PHOTO BY: Dean W. Taylor

Scientific Name: *Carex inops*

Leaves/stalks (vegetation): This species is bright green in color with purplish leaf ***sheaths*** and creeping underground stems. This species spreads by long creeping ***rhizomes*** or stolons.

Flowers: In mid to late spring, the plant usually produces around 10 flowering stems, 8 to 20 inches tall, that are reddish-brown toward the base. The ***scales*** of the flower clusters have a dark central line and white edges.

Ecology: Well drained, relatively dry open forests, gravelly or rocky slopes and flats, cutbanks, roadsides, clearings, at low to middle elevations and grassy meadows.

Other Information: Long-stoloned sedge is a fairly common native sedge from the Strait of Georgia-Puget Sound south to California.

California Oatgrass

Scientific Name: *Danthonia californica*

Leaves/stalks (vegetation): California oatgrass is a common and long-lived spreading ***bunchgrass*** with very hairy leaf sheaths. Plants are up to 20 inches tall.

Flowers: Often purplish ***spikelets***.

Ecology: Rocky slopes, meadows, beaches, grassy openings, from low to high elevations.

Other Information: This species is able to grow in a variety of conditions, resilient to grazing and trampling, and good for soil stabilization.

Poverty Oatgrass

PHOTO BY: Louis M. Landry

Scientific Name: *Danthonia spicata*

Leaves/stalks (vegetation): A short, curly-leaved bunchgrass similar to California oatgrass.

Flowers: Often purplish spikelets.

Ecology: Rocky slopes, meadows, beaches, grassy openings, from low to high elevations.

Other Information: This species ***recolonizes*** burned or disturbed sites and grows best on sandy or rocky, well-drained soil. Its ability to colonize after a disturbance is due to long periods of seed ***dormancy***.

Native Prairie Plants (continued)

Prairie Junegrass

Scientific Name: *Koeleria macrantha*

Leaves/stalks (vegetation): A tufted bunchgrass, with narrow, rolled leaves that can grow up to 2 feet tall.

Flowers: The spikelets are pale green to purplish in color.

Ecology: Rangelands, plains and open forestlands.

Other Information: A "cool-season" ***perennial***, putting on new leaves in spring and fall. One of first grasses to emerge in early spring.

Puget Balsamroot

Scientific Name: *Balsamorhiza deltoidea*

Leaves/stalks (vegetation): Thick, triangular-shaped, hairy leaves.

Flowers: Dramatic golden-yellow flowerheads.

Ecology: Dry, open, grassy habitats and moist disturbed areas.

Other Information: This relative of the sunflower is a late spring perennial that grows 8 to 36 inches tall and blooms in late May to early June.

PHOTO BY: Rod Gilbert

Narrow-leaf Mule's Ear

Scientific Name: *Wyethia angustifolia*

Leaves/stalks (vegetation): The glossy, green leaves can grow up to 16 inches long, stand erect, and are shaped like mule's ears.

Flowers: A showy yellow flower easily confused with balsamroot.

Ecology: Open, grassy habitats and disturbed, moist soil.

Other Information: Narrow-leaf mule's ear starts blooming in late May, shortly after balsamroot is blooming.

PHOTO BY: Rod Gilbert

Common Camas

Scientific Name: *Camassia quamash*

Leaves/stalks (vegetation): This common species in the lily family grows up to 28 inches tall. It has ***basal***, grass-like leaves, up to 2 cm wide and 50 cm long.

Flowers: Pale to deep blue-purple flowers growing up to 1.5 inches long.

Ecology: Grassy slopes and meadows, low to middle elevations.

Other Information: Extreme caution should be taken not to confuse common camas with the poisonous death camas, which it resembles, and which may be found in the same locations. Common camas has a bulb that was gathered as food by the native people in this area.

PHOTO BY: Cathie Conolly

Meadow Death Camas

Scientific Name: *Zigadenus venenosus*

Leaves/stalks (vegetation): Death camas has a black-brown scaly ***bulb*** and narrow grass-like leaves that grow up from the lower part of the plant.

Flowers: Creamy white, bell-shaped with green ***glands*** at the base of the petals, foul-smelling.

Ecology: Open forests and forest edges, meadow and rocky or grassy slopes.

Other Information: All parts of this plant are poisonous and ingestion can be fatal. The vegetation is extremely difficult to differentiate from common camas until the creamy-white flowers bloom, distinguishing death camas from the blue flowers of common camas.

PHOTO BY: Rosemary Baker

Nine-leaf Desert Parsley

Scientific Name: *Lomatium triternatum*

Leaves/stalks (vegetation): Thin, nine-segmented leaves.

Flowers: The long flower stalk is topped with a flat inflorescence of yellow flowers.

Ecology: Dry, open rocky slopes or grassy bluffs.

Other Information: Nine-leaf desert parsley is a mid-spring perennial that can grow up to 30 inches tall.

PHOTO BY: Al Schneider
USDA NRCS Plants Database

Spring Gold

Scientific Name: *Lomatium utriculatum*

Leaves/stalks (vegetation): The soft, fernlike leaves are finely ***dissected***.

Flowers: Small, bright yellow flowers in a flat-topped inflorescence.

Ecology: Dry, open rocky slopes or grassy bluffs.

Other Information: "Spring gold" describes the splashes of yellow flowers that appear in early spring. This type of lomatium is one of the longest blooming prairie flowers, starting as early as January and continuing into July. This species is more densely vegetated than the similar nine-leaf desert parsley.

PHOTO BY: Rod Gilbert

Early Blue Violet

Scientific Name: *Viola adunca*

Leaves/stalks (vegetation): This perennial has oval to heart-shaped leaves growing from the base.

Flowers: Clumps of blue to deep violet flowers grow to a half inch long.

Ecology: Dry to moist meadows, open woods, grasslands and open, disturbed ground.

Other Information: This species provides nectar for the Mardon Skipper butterfly, which is increasingly rare and found primarily in western Washington prairies.

PHOTO BY: Tom Noland

Prairie Lupine

Scientific Name: *Lupinus lepidus*

Leaves/stalks (vegetation): ***Compound leaves*** have 5 to 8 leaflets, shaggy or hairy beneath.

Flowers: A short, small species with spikes of densely-clustered, pea-like, dark blue to purple flowers (sometimes tinged white).

Ecology: Gravelly or sandy soils at subalpine elevations.

Other Information: This lupine is a key species for local butterflies, particularly the Puget Blue which is ***endemic*** to the region and currently a Washington State ***candidate species***.

PHOTO BY: Rod Gilbert

Fool's Onion

Scientific Name: *Triteleia hyacinthina*

Leaves/stalks (vegetation): Fool's onion has 1 to 2 ***basal*** grass-like leaves.

Flowers: Numerous flowers, which grow in a cluster at the top of the stem, are white with a bluish green ***mid-vein***.

Ecology: Open, grassy areas at low elevations to mountain meadows.

Other Information: This plant somewhat resembles an onion but without the flavor or smell.

PHOTO BY: Rod Gilbert

Harvest Brodiaea

Scientific Name: *Brodiaea coronaria*

Leaves/stalks (vegetation): Plants have 1-3 basal grasslike leaves which grow in spring then wither before the flowers appear.

Flowers: Violet-purple, vase-shaped flowers are striped with dark purple lines.

Ecology: Open, often gravelly sites at low elevations.

Other Information: The fruits are non-stalked egg-shaped ***capsules***.

PHOTO BY: Rod Gilbert

Oregon Sunshine

Scientific Name: *Eriophyllum lanatum*

Leaves/stalks (vegetation): A perennial, wooly ***forb*** that grows 1 to 2 feet tall. The foliage is light green and slightly hairy.

Flowers: The bright yellow flowers resemble daisies and bloom from May through August.

Ecology: Dry, open habitats, rocky slopes and bluffs, low to middle elevations.

Other Information: Oregon sunshine is a member of the sunflower family.

PHOTO BY: Rod Gilbert

Western Buttercup

Scientific Name: *Ranunculus occidentalis*

Leaves/stalks (vegetation): Western buttercup's stiff, hairy stems and fibrous roots distinguish it from the invasive creeping buttercup (Ranunculus repens), which is lax (as opposed to stiff), hairless, and forms dense colonies connected by ***rhizomes***.

Flowers: Five or six shiny yellow petals at the end of a long stalk.

Ecology: Moist meadows, grassy slopes, clearings, open or shaded forests, sea level to subalpine elevations.

Other Information: A native perennial commonly used for prairie restoration.

PHOTO BY: ESA Adolfson

Broad-leaf Shooting Star

Scientific Name: *Dodecatheon hendersonii*

Leaves/stalks (vegetation): The leaf blades are smooth, veined, and egg-shaped.

Flowers: Magenta to lavender, with 5 petals that sweep backwards and are connected to a red-purple ***stamen*** tube. Blooms from late April to May.

Ecology: Dry grassy meadows and open woods from sea level to subalpine elevations.

PHOTO BY: Rod Gilbert

Serviceberry

Scientific Name: *Amelanchier alnifolia*

Alternate Name: Saskatoon

Leaves/stalks (vegetation): A shrub or small tree with smooth stems having dark-gray to reddish bark. The oval leaves are toothed, mostly near the tip of the leaf.

Flowers: Showy white flowers bloom from April to June, with edible, sweet-tasting, purple to black berries.

Ecology: Dry to moist open forest, meadows, bluffs and thickets, well-drained soil from low to middle elevations.

Other Information: The species spreads by ***rhizomes*** or rooting branches, and can form dense thickets.

PHOTO BY: Tom Noland

Harsh Paintbrush

Scientific Name: *Castilleja hispida*

Leaves/stalks (vegetation): The stems and leaves are covered with short, stiff hairs.

Flowers: A distinctive orange-red colored flower. The flower clusters are found at the top of stiff hairy stems.

Ecology: Grassy slopes, dry meadows, forest openings and edges, from low to middle elevations.

Other Information: This species is often associated with Roemer's fescue.

PHOTO BY: Rod Gilbert

Golden Paintbrush

Scientific Name: *Castilleja levisecta*

Leaves/stalks (vegetation): ***Alternate*** leaves, rough-hairy to nearly hairless, lance-shaped leaves.

Flowers: Golden yellow, sticky inflorescence.

Ecology: Grassy, low elevation meadows of western Washington and Vancouver Island.

Other Information: A small forb that is dependent upon occasional fires to limit habitat encroachment by competing vegetation. This species is rare; it is listed as "federally threatened" and is endangered in Washington State. Golden paintbrush derives nutrients from a host plant such as Oregon sunshine.

PHOTO BY: Rod Gilbert

Wild Strawberry

Scientific Name: *Fragaria virginiana*

Leaves/stalks (vegetation): Leathery, short-stemmed, ***trifoliate*** leaves that are dark bluish-green on top.

Flowers: White, five-petaled flowers bloom in April and May.

Ecology: Low to middle elevations.

Other Information: Like garden varieties, wild strawberry produces bright red, creeping runners (stolons) that spread outward from each plant and may produce an edible red fruit.

PHOTO BY: Rod Gilbert

Woodland Strawberry

Scientific Name: *Fragaria vesca*

Leaves/stalks (vegetation): Thin, non-leathery leaves. Each leaf of woodland strawberry has stemless ***leaflets***.

Flowers: Small white flowers appear in early spring followed by strawberry fruits in early summer.

Ecology: Low to middle elevations, wooded areas.

Other Information: Woodland strawberry is similar to wild strawberry and overlaps in distribution.

PHOTO BY: Rod Gilbert

Native Prairie Plants (continued)

Chocolate Lily

Scientific Name: *Fritilleria affinis*

Leaves/stalks (vegetation): 1-3 ***whorls*** of lance-shaped leaves

Flowers: Flowers mottled brown, red, or purple. The narrow petals have pointed tips.

Ecology: Commonly found in western Washington in moist areas where encroachment of invasive plants is limited.

Other Information: Beneath the ground, chocolate lily has a large, white bulb, often covered with rice-like ***nodules***.

PHOTO BY: Rod Gilbert

Red Columbine

Scientific Name: *Aquilegia formosa*

Leaves/stalks (vegetation): The leaves are mainly basal, twice divided in threes. They are greener above and paler beneath.

Flowers: The nodding red flowers with yellow stamens have ***spurs*** with rounded tips extending backward from the flower's face.

Ecology: Meadows, clearings, moist and open forests, sea level to timberline.

Other Information: This species' showy red and yellow flowers attract hummingbirds and butterflies.

PHOTO BY: Cathie Conolly

Graceful Cinquefoil

Scientific Name: *Potentilla gracilis*

Leaves/stalks (vegetation): Five deeply ***serrated***, shiny, dark green leaflets are attached at one point, resembling the spread fingers of a hand.

Flowers: Bright yellow flowers similar to a buttercup.

Ecology: Marshy or wet spots, clearings, low to middle elevations.

Other Information: Tolerant of moderately saline soil.

PHOTO BY: ESA Adolfson

Native Prairie Plants (continued)

Yarrow

Scientific Name: *Achillea millefolium*

Leaves/stalks (vegetation): Aromatic, fern-like, hairy, lacy stems and leaves.

Flowers: Flat-topped inflorescences that range from white to pink and attract butterflies.

Ecology: Dry to moist, well-drained, open sites at all elevations.

Other Information: A common native species, a member of the carrot family.

PHOTO BY: Wikimedia Commons

White-topped Aster

Scientific Name: *Sericocarpus rigidus*

Leaves/stalks (vegetation): Lower leaves are lance-shaped, stalked, soon withering.

Flowers: Small white flowers found at the tip of the stem. Flowers in late summer.

Ecology: Dry, low elevation, open areas.

Other Information: White-topped aster is perennial from a creeping underground stem or rhizome. This species is relatively rare and is protected as a Washington State sensitive species, and a federal ***species of concern***.

PHOTO BY: Rod Gilbert

Meadow Goldenrod

Scientific Name: *Solidago canadensis*

Alternate Name: Canada Goldenrod

Leaves/stalks (vegetation): Grows 16 inches to 5 feet tall with lance-like leaves; mostly hairless except on the upper part of the stem. Long, creeping rhizomes connect underground to create large colonies.

Flowers: Clusters of small yellow flowers that resemble tiny sunflowers.

Ecology: Grassy slopes, meadows, rocky bluffs, disturbed areas at low to middle elevations.

Other Information: An important food source for butterfly larvae, this species also has many traditional medicinal uses.

PHOTO BY: Rod Gilbert

Wet Prairie Plants

Tufted Hairgrass

PHOTO BY: Wikimedia Commons

Scientific Name: *Deschampsia cespitosa*

Leaves/stalks (vegetation): Densely tufted grass with stems ranging from several inches to 4 feet tall. Leaves are stiff and can be flat or folded.

Flowers: Bronze and glistening ***spikelets***, usually darkening with maturity.

Ecology: This highly variable and resilient species ranges from coastal salt marsh to alpine tundra, with occasional occurrence in the swales between the Mima Mounds. Found from sea level to alpine elevations.

Other Information: Tufted hairgrass is commonly used in wetland restoration and revegetation efforts.

Hall's Aster

PHOTO BY: Rod Gilbert

Scientific Name: *Aster chilensis var. hallii*

Leaves/stalks (vegetation): Lance-like, early ***deciduous*** leaves.

Flowers: White flowers in the top third of the stem (as opposed to at the top of the stem as in white-topped aster).

Ecology: Dry to moist, open places in valleys and plains.

Other Information: A perennial forb that prefers moist prairie soils in Washington and Oregon.

Bigleaf Lupine

PHOTO BY: Rod Gilbert

Scientific Name: *Lupinus polyphyllus*

Leaves/stalks (vegetation): Bigleaf lupine grows up to 5 feet tall, with 10 to 17 large leaflets (up to 5 inches long) arranged ***palmately***.

Flowers: A spike of densely clustered flowers ranging from blue to violet.

Ecology: Moist to wet, disturbed or open habitat.

Other Information: Widely cultivated as a garden species.

Wet Prairie Plants (continued)

Rose Checker Mallow

Scientific Name: *Sidalcea virgata*

Leaves/stalks (vegetation): Basal, long-stalked round-toothed leaves, heart shaped at base.

Flowers: Large, five-petaled, pink blossoms.

Ecology: Prefers wet prairies and marshes at low elevations.

Other Information: This species is a nectar source for the Fender's blue butterfly, a prairie endemic species.

PHOTO BY: USFS

Water Howellia

Scientific Name: *Howellia aquatilis*

Leaves/stalks (vegetation): An annual aquatic species. Leaves are very narrow, ***linear*** and ***alternate***, up to 2 inches long. Stems and leaves may be seen floating at the surface.

Flowers: Flowers in May and June. Small flowers ranging from white to light purple in color may be visible just above the water surface.

Ecology: An annual species adapted to grow in ***kettles***, or glacial potholes, that are filled with water for the first part of the season and dry out in summer.

Other Information: Water howellia is a rare species with limited distribution due to its unique habitat requirements. It is listed as threatened at both the federal and state levels.

Non-native Invasive Plants of Prairies

Scot's Broom

Scientific Name: *Cytisus scoparius*

Alternate Name: Scotch Broom

Leaves/stalks (vegetation): Alternate, deciduous, small leaves with 3 leaflets. Groups of long stalks resemble a broom.

Flowers: Showy, bright yellow, pea-shaped flowers.

Ecology: Open sites, disturbed areas.

Other Information: Scot's broom is an extremely invasive shrub species and very widespread throughout the region. It was introduced as an ornamental species for its showy flowers. It can grow in dense stands that out-compete most other plants. Seeds remain viable in soil for up to 80 years. Continuous maintenance is required to keep this species out of prairie habitats.

PHOTO BY: Cathie Conolly

Non-native Invasive Plants of Prairies (continued)

Tall Oatgrass

PHOTO BY: Richard Old, www.xidservices.com

Scientific Name: *Arrhenatherum elatius*

Leaves/stalks (vegetation): Grows up to 6 feet tall from bulb-like root structures. The leaves are flat, roughened, often hairy and bluish green.

Flowers: Narrow, silvery green inflorescence, growing purplish with age.

Ecology: Fields, lawns, roadsides, abundant at low elevations often near human settlement.

Other Information: This perennial, cool-season bunchgrass is found in the western regions of North and South America but is native to the Mediterranean. Tall oatgrass was introduced to the area around 100 years ago as a forage grass for livestock.

Bent Grasses

PHOTO BY: K. Kindscher

Scientific Name: *Agrostis sp.*

Leaves/stalks (vegetation): Flat, rough leaves about 2 to 10 mm wide.

Flowers: Minute flowers clustered into inflorescences near the top of stems up to 20 inches tall.

Ecology: Dry to wet disturbed areas, especially clearings and roadsides from low to middle elevations.

Other Information: A widespread non-native, invasive group of grass species that aggressively outcompete native grasses throughout North America. Several bentgrass species were introduced in western Washington as pasture and lawn grasses, and they continue to be a problem for management of prairies.

Common Velvetgrass

PHOTO BY: Ben Legler

Scientific Name: *Holcus lanatus*

Leaves/stalks (vegetation): Fine, gray hairs throughout that create a soft, velvety appearance. Grows up to 3 feet tall in dense tufts that outcompete native grasses.

Flowers: Pale grayish, but usually purple-tinged spikelets.

Ecology: Common velvetgrass is widespread in pastures, along roadsides, and in other disturbed places.

Other Information: Common velvetgrass was introduced from Europe as a pasture grass.

Non-native Invasive Plants of Prairies (continued)

Orchardgrass

PHOTO BY: CES NCSU

Scientific Name: *Dactylis glomerata L.*

Leaves/stalks (vegetation): Hollow stems that can reach 5 feet in height.

Flowers: This hairless, bluish green grass has one-sided inflorescences.

Ecology: Flourishes in disturbed habitat and along roadsides.

Other Information: Introduced as a forage grass.

Reed Canarygrass

PHOTO BY: Richard Old, www.xidservices.com

Scientific Name: *Phalaris arundinacea*

Leaves/stalks (vegetation): A tall, perennial grass with wide, roughened leaves.

Flowers: Three-flowered spikelets, crowded at side.

Ecology: Lawns, pastures, meadows, roadsides, disturbed areas, wetlands and stream banks.

Other Information: Reed canarygrass is invasive in Washington in open wetlands (including wet prairies) and particularly in disturbed areas. The leaves are broad and tough. When reed canarygrass invades a wetland, it often takes over and suppresses the growth of native vegetation. The grass propagates by both seed and rhizome, and once established is difficult to eradicate.

Kentucky Bluegrass

PHOTO BY: Carl Farmer

Scientific Name: *Poa pratensis*

Leaves/stalks (vegetation): Can reach 12 to 40 inches in height, forming dense sod as it spreads by rhizomes. A pointed, prow-shaped leaf tip is common to this genus of grasses.

Flowers: The minute flowers have a white edge at maturity.

Ecology: Meadows, pastures, clearings, roadsides and forests from low to middle elevations.

Other Information: Kentucky bluegrass was introduced as a lawn and pasture grass.

Silver Hairgrass

PHOTO BY: Ben Legler

Scientific Name: *Aira caryophyllea*

Leaves/stalks (vegetation): A diminutive grass species (2 to 12 inches tall). The leaves are short and very narrow.

Flowers: Compact spikelets, 1 to 3 cm long.

Ecology: Disturbed sites and dry, open habitats.

Other Information: Native to Eurasia and Africa.

Non-native Invasive Plants of Prairies (continued)

Soft Brome

Scientific Name: *Bromus hordeaceus*

Alternate Name: Soft Chess

Leaves/stalks (vegetation): A short, tufted grass with stems 8 to 32 inches tall, with finely hairy leaves that are both flat and narrow.

Flowers: Long, narrow, dense spikelets.

Ecology: Common along roadsides and other disturbed sites.

Other Information: Introduced from Europe.

PHOTO BY: Richard Old, www.xidservices.com

Barren Fescue

Scientific Name: *Vulpia bromoides*

Leaves/stalks (vegetation): A tufted, hairless, annual grass, ranging from 4 to 20 inches in height. Leaves are short and slender.

Flowers: Flowers are large in proportion and have long ***awns***.

Ecology: Fields, roadsides, clearings, dry open forests at low elevations.

Other Information: Introduced from Europe.

PHOTO BY: Sheri Hagwood, USDA NRCS Plants Database

Common Dandelion

Scientific Name: *Taraxicum officinale*

Leaves/stalks (vegetation): Broken stems produce milky juice. Leaves are oblong, toothed.

Flowers: Bold, yellow flower heads.

Ecology: A widespread introduced species found throughout lowland western Washington.

Other Information: Imported to North America on early sailing ships.

PHOTO BY: Jeff McMillian, USDA NRCS Plants Database

Sheep Sorrel

Scientific Name: *Rumex acetosella*

Leaves/stalks (vegetation): A perennial forb with slender creeping roots, somewhat woody at the base. Distinctive arrowhead-shaped leaves.

Flowers: Numerous, minute reddish or yellowish flowers in loose inflorescences.

Ecology: Disturbed places at low elevations.

Other Information: Introduced from Europe.

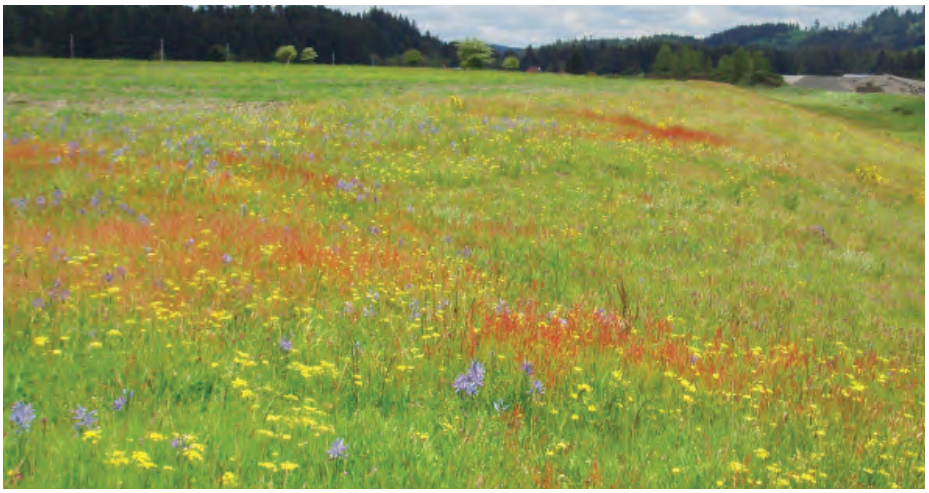


PHOTO BY: ESA Adolfson

Himalayan Blackberry

Scientific Name: *Rubus discolor (or Rubus armeniacus)*

Leaves/stalks (vegetation): Canes (stems) have sharp, hooked thorns. Each leaf consists of 3 to 5 toothed leaflets.

Flowers: Five-petaled white flowers and blackberry fruits.

Ecology: Can grow in a variety of conditions but favors disturbed areas.

Other Information: If not controlled, Himalayan blackberry produces impenetrable thickets several feet high that overrun native plant communities. The growing tips of the stems sprout roots if they remain in contact with moist soil.

PHOTO BY: Tom Noland

Evergreen Blackberry

Scientific Name: *Rubus laciniatus*

Leaves/stalks (vegetation): Deeply serrated, multi-toothed leaves. Canes with sharp thorns.

Flowers: Five-petaled white flowers and blackberry fruits.

Ecology: Can grow in a variety of conditions but favors disturbed areas.

Other Information: This invasive shrub was introduced from Europe. Not as common as Himalayan blackberry.

PHOTO BY: Wikimedia Commons

White Clover

Scientific Name: *Trifolium repens*

Leaves/stalks (vegetation): Leaves that are composed of three leaflets. Can grow in mats up to 2 feet across.

Flowers: Flowerheads consist of multiple white flowers that may have a pinkish hue.

Ecology: Disturbed areas from low to subalpine elevations.

Other Information: Introduced from Europe.

PHOTO BY: Wikimedia Commons

Non-native Invasive Plants of Prairies (continued)

Hairy Cat's Ear

Scientific Name: *Hypochaeris radicata*

Leaves/stalks (vegetation): Densely haired leaves, which form a ***basal rosette***.

Flowers: Similar to dandelion but with smaller yellow flower heads.

Ecology: Roadsides, lawns, pastures, disturbed sites at low elevations.

Other Information: A perennial forb in the sunflower family. Similar in appearance to dandelion but can grow up to 2 feet tall.

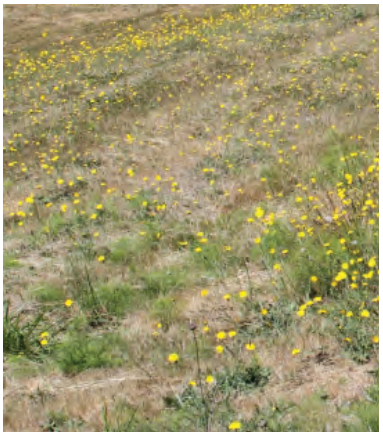


PHOTO BY: Tom Noland

Oxeye Daisy

Scientific Name: *Leucanthemum vulgare*

Leaves/stalks (vegetation): A perennial growing from woody rhizomes. Leaves are small and rounded or oblong. Stems are 20 to 80 cm tall.

Flowers: White flowers with yellow centers.

Other information: This European species is common on disturbed areas throughout the south Puget Sound prairie region. Oxeye daisy is unpalatable to grazing animals and insects.

PHOTO BY: Wikimedia Commons

Common St. John's Wort

Scientific Name: *Hypericum perforatum*

Leaves/stalks (vegetation): Stems grow to 18 inches tall with numerous branches. When held up to the light, the leaves have small transparent dots. The leaves are narrow and lance-shaped.

Flowers: Small yellow flowers with many stamens.

Ecology: Moist, open sites from low to subalpine elevations.

Other information: Introduced from Europe to North America, common St. John's wort has been used as a medicinal plant for many years.

PHOTO BY: Tom Noland

Tansy Ragwort

Scientific Name: *Senecio jacobaea*

Leaves/stalks (vegetation): Stems grow 2 to 3 feet tall. Leaves are twice divided and have a frilly appearance.

Flowers: Clusters of flowers with yellow centers and narrow yellow petals at the end of each stem.

Ecology: Disturbed upland areas.

Other Information: All plant parts are toxic to livestock and humans. Regulated as a noxious weed by the state of Washington and local county noxious weed boards.

PHOTO BY: Tom Noland

Aggressive Native Prairie Plants

Nootka Rose

PHOTO BY: Rod Gilbert

Scientific Name: *Rosa nutkana*

Leaves/stalks (vegetation): A shrub growing up to 10 feet tall. Stems have a pair of thorns at the base of each leaf. Leaflets are small and toothed, with 5 to 7 per leaf.

Flowers: Pink flowers reach 1.5 to 3 inches across. The fruits are large, purplish red, round hips.

Ecology: Flourishes in open, disturbed habitat.

Other Information: Provides food and shelter for birds, insects, and mammals. This species is often used in restoration projects where the goal is to create dense shrub thickets, but it can invade grasslands.

Snowberry

PHOTO BY: Wikimedia Commons

Scientific Name: *Symphoricarpos albus*

Leaves/stalks (vegetation): Shrub species. Leaves and branches arise opposite one another. Leaves are highly variable in shape, from oval to asymmetrically lobed. Branches are thin, rigid, and grayish brown.

Flowers: Produces small, pink or white flowers during late spring, and white berries that persist through fall into winter.

Ecology: Dry to moist, open forests and rocky slopes from low to middle elevations.

Other Information: Berries of snowberry are white, waxy, and poisonous. This species is often used in restoration projects where the goal is to create dense shrub thickets, but it can be invasive in prairies. Snowberry tolerates drought conditions and spreads rapidly.

Douglas-fir

PHOTO BY: Wikimedia Commons

Scientific Name: *Pseudotsuga menziesii*

Leaves/stalks (vegetation): A large evergreen tree common throughout the south Puget Sound region. Can reach 300 feet in height. Needles are arranged along the ends of branches.

Flowers: The distinctive cones have ***bracts*** that protrude from the cone scales. The bracts look like the tail of a mouse entering a hole.

Ecology: From extremely dry, low elevation sites to mountainous sites.

Other Information: Active removal and management practices such as controlled burns are necessary to keep this conifer species from overtaking prairie landscapes.

Aggressive Native Prairie Plants (continued)

Shore Pine

Scientific Name: *Pinus contorta var. contorta*

Leaves/stalks (vegetation): An often irregularly shaped tree with a crooked trunk. Bark is scaly and dark brown to blackish. The needles are paired and 3/4 inch to 3 inches long, often curved or twisted in shape.

Flowers: Reddish-green clusters of cones on tips of branches in spring.

Ecology: Open habitat and rocky soils, marine shorelines.

Other Information: Active removal and management practices such as controlled burns are necessary to keep this conifer species from overtaking prairie landscapes.

PHOTO BY: Wikimedia Commons

Prairie Birds

Western Bluebird

Scientific Name: *Sialia mexicana*

Distinguishing Features: Male has a deep blue head, wings, and tail with rust coloring on the breast and between the shoulders. The female is similar but less vivid, with a white eye-ring.

Habitat: ***Cavity-nesters***, using a natural hollow in a tree, an old woodpecker hole, or a man-made nest box.

Other Information: A nest box program has helped a population in the Fort Lewis area to rebound, though numbers have declined overall due to habitat destruction and competition with non-native birds such as European starlings and house sparrows. The species has state "monitor" status, meaning it is a species of potential concern.

PHOTO BY: Wikimedia Commons

Western Meadowlark

Scientific Name: *Sturnella neglecta*

Distinguishing Features: Well ***camouflaged*** with streaked brown upperparts and solid yellow underparts and a distinct black collar. Long legs and short tails with white outer tail-feathers which are obvious in flight.

Habitat: Grasslands, prairies, pasturelands.

Other Information: In early spring, western meadowlarks sing continually from shrub tops, fence posts, utility poles, or any other high structure.

PHOTO BY: Wikimedia Commons

Streaked Horned Lark

PHOTO BY: Rod Gilbert

Scientific Name: *Eremophila alpestris ssp. strigata*

Distinguishing Features: Dark facial mask and a dark breast band. In flight, a dark tail with narrow white edges is evident. The "horns" are two small tufts of black feathers on the head.

Habitat: This species is found locally on the Fort Lewis prairies and south Sound airports. Horned larks nest on bare ground or amongst grasses.

Other Information: The streaked horned lark is increasingly rare and is a Washington State endangered species and a federal candidate species. Urbanization, conversion of prairies to agriculture, and the introduction of exotic plants have contributed to its decline.

American Robin

PHOTO BY: Rod Gilbert

Scientific Name: *Turdus migratorius*

Distinguishing Features: A very common, large songbird with long legs, a light yellowish bill, and a long tail. It has a rusty-orange breast, a dark gray-brown back, and a distinct white ring around the eye.

Habitat: American Robin is common in suburban and rural areas. It forages on berries and consumes invertebrates such as earthworms from mowed lawns.

Other Information: The male robin's long and elaborate song during the mating season marks the arrival of spring.

Tree Swallow

PHOTO BY: Rod Gilbert

Scientific Name: *Tachycineta bicolor*

Distinguishing Features: The tree swallow has a white underside, iridescent blue-green back, and moderately forked tail.

Habitat: Tree swallows require nest cavities, either natural or man-made. This social bird is often found in ***flocks***. Highly acrobatic, swallows ***forage*** mostly in flight, often swooping low over open water or fields to catch insects.

Other Information: Tree swallow is often used as an ***indicator species***, since high levels of pesticides have been found in some western Washington tree swallow populations.

Violet-green Swallow

PHOTO BY: Rod Gilbert

Scientific Name: *Tachycineta thalassina*

Distinguishing Features: Similar in appearance and behavior to the tree swallow, but violet-green swallows have white patches extending up the sides of the ***rump*** that can be seen in flight. White facial patches also extend above the eyes.

Habitat: This species is found in open areas including woodlands, cities, and agricultural lands. Violet-green swallows forage in flight for insects. This species forms large flocks during migration. Violet-greens nest in cliff crevices, under eaves, in birdhouses, or in natural cavities.

Other Information: When perched, the wings of violet-green swallows extend beyond the tail, while those of tree swallows do not.

Prairie Birds (continued)

American Kestrel

PHOTO BY: Rod Gilbert

Scientific Name: *Falco sparverius*

Distinguishing Features: Males are brightly colored, with reddish-brown backs, slate-blue wings streaked with black, and tan breasts with black spots. The male's head is blue and brown, and both sexes have bold, black eyespots at the napes of their necks. Females are brown streaked with black on the back, and white streaked with brown on the breast. The female has multiple bands on her tail. Both sexes have two bold, vertical face stripes.

Habitat: The kestrel can be seen ***hovering*** over the prairie, waiting to dive on voles, grasshoppers, and small birds.

Other Information: The American kestrel is a small hawk with a wingspan of 21 inches.

Northern Harrier

PHOTO BY: Rod Gilbert

Scientific Name: *Circus cyaneus*

Distinguishing Features: A slender, medium-sized ***raptor*** with a long, barred tail and distinctive white rump. An owl-like ***facial disk*** is visible at close range.

Habitat: These are open-country birds, often seen flying rapidly or soaring low over grasslands and prairies.

Other Information: Another common name is the marsh hawk.

Red-tailed Hawk

PHOTO BY: Rod Gilbert

Scientific Name: *Buteo jamaicensis*

Distinguishing Features: This hawk has highly variable ***plumage***, including dark and reddish ***phases***, with long, broad wings and short, wide tails. Most red-tails in our region have dark brown heads, light breasts with dark streaks forming a mottled "belly-band." The underwings are mottled dark and light brown.

Habitat: Red-tailed hawks are found in grasslands, pastures, forests, and perched along roadways.

Other Information: ***Vocalization*** includes a loud, harsh shriek commonly associated with birds of prey.

Slender-billed White-breasted Nuthatch

PHOTO BY: Rod Gilbert

Scientific Name: *Sitta carolinensis aculeata*

Distinguishing Features: This nuthatch is a small bird with a blue-gray back and wings and a white face.

Habitat: Nuthatches nest in tree cavities and occasionally in bird houses.

Other Information: The loss of suitable oak woodland habitat has led to the decline of this subspecies, which is found only in the vicinity of Vancouver, Washington. It is a Washington State candidate species and a federal species of concern.

Prairie Butterflies

Mardon Skipper

Scientific Name: *Polites mardon*

Distinguishing Features: A small, orange-brown butterfly found in less than 10 locations in Washington.

Habitat: This species is thought to depend upon Idaho fescue (Festuca idahoensis) as a ***larval*** host plant. As an adult, uses a variety of spring-flowering ***nectar*** sources, including the western blue violet (Viola adunca).

Other Information: The Mardon skipper is a Washington state endangered species and a federal candidate species.

PHOTO BY: Rod Gilbert

Woodland Skipper

Scientific Name: *Ochlodes sylvanoides*

Distinguishing Features: A small, common, brownish orange butterfly.

Habitat: The woodland skipper lives in open spaces and fringes of woodlands. The larvae use grasses as host plants.

Other Information: Adults use nectar sources not typically used by native butterflies, such as non-native English oxeye daisy (Leucanthemum vulgare).

PHOTO BY: Rod Gilbert

Two-banded Skipper

Scientific Name: *Pyrgus ruralis ruralis*

Distinguishing Features: A small brown butterfly with white spots.

Habitat: The two-banded skipper lives in forest clearings, meadows, pastures and prairies of western North America. Males search for females in low areas such as valleys and swales. Larvae host plants include much of the rose family (Rosaceae). Adults feed on a variety of nectar sources.

Other Information: Flies from April through June in lowland areas.

PHOTO BY: Rod Gilbert

Prairie Butterflies (continued)

Taylor's Checkerspot

Scientific Name: *Euphrydryas editha taylori*

Distinguishing Features: Upper wings have a checkerboard pattern of dark brown, dark orange, and white. Lower wings have a checkerboard pattern of white, light orange, and light brown.

Habitat: Larval food consists of primarily paintbrush (Castilleja sp.) and plantains (Plantago sp.). Adults acquire nectar from a variety of plants including Puget Balsamroot (Balsamorhiza deltoidea) and desert parsley (Lomatium sp.) and camas (Cammasia sp.).

Other Information: Taylor's checkerspot once ranged widely on Puget Sound prairies, San Juan Islands, and Straits of Juan de Fuca, but is now a state endangered species and a federal candidate species.

PHOTO BY: Rod Gilbert

Puget Blue

Scientific Name: *Plebejus icarioides blackmorei*

Distinguishing Features: Female has light blue wing margins and dark brown upper wings. Male has light blue wing margins with dark blue upper wings.

Habitat: The Puget blue is a state candidate species found only on south Puget Sound and Sequim prairies. This species uses lupine as a larval host plant.

Other Information: This species is ***colonial*** and usually rare. Many localized populations have declined or become ***extinct*** because of development, grazing, and the use of herbicides and pesticides.

PHOTO BY: Rod Gilbert

Silvery Blue

Scientific Name: *Glaucopsyche lygdamus columbia*

Distinguishing Features: Wings are dusty gray underneath and startlingly blue on top, with a black border and a fine white fringe.

Habitat: The silvery blue butterfly uses lupines and other ***legumes*** as larval host plants. The species is opportunistic about adult nectar sources, using camas and many other plants.

Other Information: Silvery blues can sometimes be observed flying with Puget blue butterflies.

PHOTO BY: Rod Gilbert

Echo Blue or Spring Azure

Scientific Name: *Echo echo*

Distinguishing Features: Wings of males are blue, and females are blue with some black at the outer edge of the ***forewing***.

Habitat: Larvae utilize a variety of woody shrubs and herbs including dogwood (Cornus florida), New Jersey tea (Ceanothus americana), and Collinsia. Adults acquire nectar from dogbane (Apoccynum androsaemifolium), privet (Lingustrum sp.), blackberry, common milkweed (Ascelpias syriaca), and others.

Other Information: The spring azure is widespread in North America, from Alaska and Canada through most of the United States.

PHOTO BY: Rod Gilbert

Ochre Ringlet

Scientific Name: *Coenonympha tullia*

Distinguishing Features: A common, velvety butterfly with brownish, light yellow and light orange wings.

Habitat: This species usually has more than one brood per year and uses different types of grasses as host plants. As adults, they utilize a large variety of nectar sources, including aster species.

Other Information: Seen in our region from March through October, with a peak in May and late August.

PHOTO BY: Rod Gilbert

Common Ringlet

Scientific Name: *Coenonympha tullia eunomia*

Distinguishing Features: Underside of forewing usually has a small eyespot near the tip, and underside of ***hindwing*** is gray-green with a white midline.

Habitat: This species is commonly found in moist, low lying areas. Larval host plants include grasses and rushes; adult nectar is acquired from a variety of flowers.

Other Information: A poor flyer and can often be found on the ground. Adults may be mistaken for moths because of their size and color. The species ranges throughout Northern Europe, across Asia and North America.

PHOTO BY: Wikimedia Commons

Great Spangled Fritillary

Scientific Name: *Speyeria cybele pugetensis*

Distinguishing Features: A large and colorful butterfly; males have bright orange wings with black spots, and females have brown and cream coloring.

Habitat: Violets are the larval host plant.

Other Information: This species is commonly observed from June to August. This species is also known as the Puget Sound silverspot.

PHOTO BY: Rod Gilbert

Prairie Butterflies (continued)

Western Meadow Fritillary

Scientific Name: *Boloria epithore chermocki*

Distinguishing Features: Wings are orange on the underside, and may have lavender or brown mottling toward the tips.

Habitat: The western meadow fritillary is usually seen on the prairie from late April through May. The species uses violets as larval host plants, and prefers strawberries (Fragaria sp.), blackberries (Rubus sp.), and cinquefoil (Potentilla sp.) as adult nectar sources.

Other Information: Usually the first fritillary butterfly to fly in the spring.

PHOTO BY: Rod Gilbert

Zerene Fritillary

Scientific Name: *Speyeria zerene bremnerii*

Distinguishing Features: A large butterfly with a brown body and colorful wings: brown with light spotting, or reddish orange with brown.

Habitat: The Zerene fritillary uses violets as larval host plants, and thistles (Circium sp.) or blackberries as adult nectar sources.

Other Information: This species is a Washington State candidate and a federal species of concern. It is already extinct in Oregon's Willamette Valley.

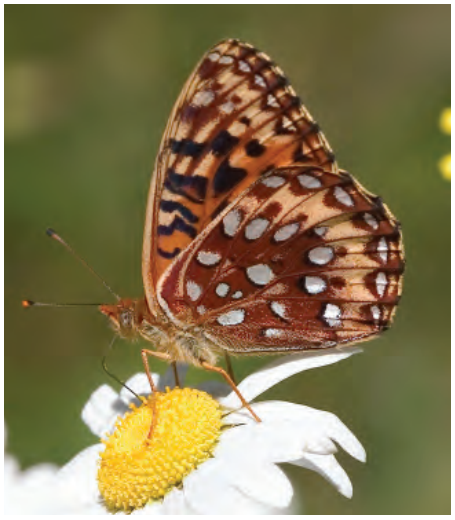


PHOTO BY: Rod Gilbert

Puget Fritillary

Scientific Name: *Argynnis (Speyeria) cybele*

Distinguishing Features: A relatively large butterfly. Males have bright orange wings with black spotting; females have coffee and cream coloring.

Habitat: The Puget fritillary is found in open fields, valleys, meadows, woodlands, and prairies throughout the northern United States south to central California, northern New Mexico, Arkansas, and northern Georgia. Adults can be seen around violets (the larval host plants) from early June to August. Adult nectar sources include dogbane, thistles, verbena, mountain laurel (Kalmia latifolia), vetch (Vicia sp.), red clover (Trifolium pratense), and purple coneflower (Echinacea purpurea).

Other Information: Adults can be hard to locate and males may be confused with other fritillary species.

PHOTO BY: Rod Gilbert

Prairie Butterflies (continued)

Margined White

Scientific Name: *Pieris marginalis marginalis*

Distinguishing Features: Spring form has a black-tipped upper forewing, while summer appearance is pure white above and below.

Habitat: Adults can be observed flying and nectaring on flowers from spring through summer. Like many white butterfly species, larval caterpillars feed on plants in the mustard family.

Other Information: A common butterfly of the western United States.

PHOTO BY: Rod Gilbert

European Cabbage White

Scientific Name: *Pieris rapae*

Distinguishing Features: Upper sides of the wings are white with a black-tipped forewing. The female has two black spots on each forewing and the male has one spot on each.

Habitat: This widespread species is often found in gardens and croplands.

Other Information: The cabbage white is widespread across Europe, North Africa, and Asia and has been introduced to North America, Australia and New Zealand where they have become pests on cultivated cabbages and other mustard family crops.

PHOTO BY: Rod Gilbert

Mylitta Crescent

Scientific Name: *Phyciodes mylitta mylitta*

Distinguishing Features: The upper side is bright reddish orange with narrow dark markings. The underside is yellow-orange with rusty orange markings.

Habitat: This species uses a variety of ecosystems including mountains, fields, meadows and prairies. Larvae utilize native and non-native thistles (Circium sp.). Adults acquire nectar from a variety of sources.

Other Information: Relatively common from southern British Columbia southeast through the Rocky Mountain region to Mexico; found in Washington, Oregon, and California.

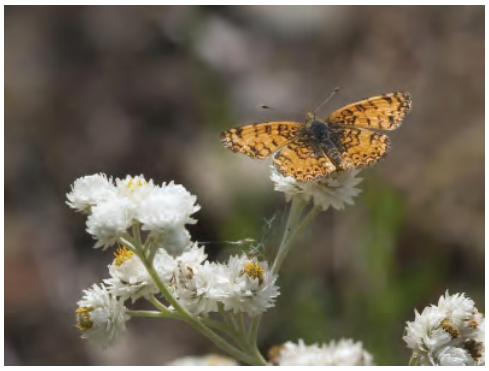


PHOTO BY: Rod Gilbert

Anise Swallowtail

Scientific Name: *Papilio zelicaon zelicaon*

Distinguishing Features: A large yellow butterfly with narrow “tails” extending from the hindwings. The upper surface of the hindwing has a yellow-orange eyespot near the tail. The ***anal cell*** of the hindwing is primarily yellow.

Habitat: Larvae utilize the parsley (Apiaceae) and citrus (Rutaceae) families. This species has benefited from the spread of fennel, on which the larvae feed.

Other Information: This species ranges from British Columbia and North Dakota south to the Baja California peninsula and other parts of Mexico, and is occasionally reported from the southeastern United States.

PHOTO BY: Rod Gilbert

Prairie Butterflies (continued)

Orange Sulphur

PHOTO BY: Rod Gilbert

Scientific Name: *Colias eurytheme*

Distinguishing Features: The upper surface of the male is bright orange or yellow-orange. Females have two forms: pink-white or yellow-orange.

Habitat: The orange sulphur is found throughout North America from southern Canada to Mexico, but is absent from the central and southeastern United States. Larvae feed at night from various species in the pea family including lupine (Lupinus sp.). Adult nectar sources include the flowers of verbena (Lantana sp.), shepherd's needle (Bidens pilosa), Bougainvillea species, rose periwinkle (Catharanthus roseus), Turk's cap (Malvaviscus arboreus), and Hibiscus species.

Other Information: Found throughout the United States; congregate by the thousands in alfalfa fields.

Prairie Reptiles and Amphibians

Red-legged Frog

PHOTO BY: Wikimedia Commons

Scientific Name: *Rana aurora*

Distinguishing Features: Dark brown, gray, olive or reddish-brown with small black specks on the back. The belly and underside of the legs are bright red. Males have darkened thumbs during the breeding season.

Habitat: Adults are terrestrial outside of the breeding season and often found in forested areas near streams. Eggs are laid during January and February in wetlands, ponds, and slow-moving streams.

Other Information: Populations are declining due to loss of habitat, use of herbicides and pesticides, and predation by introduced, non-native bull frogs. It is a federal species of concern.

Pacific Chorus Frog (or Tree Frog)

PHOTO BY: Wikimedia Commons

Scientific Name: *Pseudacris regilla*

Distinguishing Features: Grows to about 2 inches in length. Skin color is variable, from bright green to brown, reddish, or gray, sometimes with dark stripes or spots on the back. A dark facial band extends from the nostrils to the shoulders. This species can change color to blend in with the surroundings.

Habitat: Outside of the breeding season, this species uses a variety of habitats such as woodlands, meadows, pastures, and even suburban areas, sometimes far from water bodies. Eggs are laid in the spring in wetlands, including seasonal ponds, where they are attached to thin-stemmed emergent vegetation.

Other Information: This is the most common frog species on the West Coast, ranging from southern British Columbia to southern Baja California.

Rough-skinned Newt

Scientific Name: *Taricha granulosa*

Distinguishing Features: A medium to large, stocky, brown salamander with a rounded snout, rough ***glandular skin***, and a bright orange underside.

Habitat: The rough-skinned newt is active year-round in western Washington at low elevations in ***terrestrial*** and ***aquatic*** habitats. Outside of the breeding season, it uses forested areas. This species ***migrates*** to streams and ponds starting in January. ***Courtship*** takes place during March and April and eggs are laid soon after.

Other Information: When agitated, this species displays the bright colored underside of its neck and tail in warning. It produces a poisonous ***neurotoxin*** which it ***secretes*** through the skin, appearing like white foam along the body.

PHOTO BY: Wikimedia Commons

Pacific Gopher Snake

Scientific Name: *Pituophis catenifer catenifer*

Distinguishing Features: A beige or tan snake with dark brown or black, square-shaped blotches down the back and smaller blotches on the sides. Has a distinct eye stripe and a banded tail that tapers to the tip. Adults range from 2 to 7 feet in length.

Habitat: This species is found east of the Cascades in shrub-steppe, Garry oak, and ponderosa pine habitat. A small, local population has been documented in the south Puget Sound prairie region.

Other Information: May exhibit dramatic defensive behaviors including hissing, coiling, vibrating of the tail, and striking, but these snakes are ***non-venomous***, harmless, and serve an important function in wildlife communities by preying extensively on small rodents and insects.

PHOTO BY: Wikimedia Commons

Sharp-tailed Snake

Scientific Name: *Contia tenuis*

Distinguishing Features: Slender with copper or reddish back, dark sides, and white belly. Grows from 1 to 2 feet in length.

Habitat: Found mainly along the eastern slope of the Cascades and the Columbia River Gorge, this species is occasionally sighted in south Puget Sound prairies. It uses rocky slopes and open pine or oak woodlands.

Other Information: Increasingly rare due to habitat destruction from development and gravel mining, this species is a Washington candidate species and a federal species of concern. This species has special long teeth for biting and eating small slugs.

PHOTO BY: Steve Ryan

Prairie Reptiles and Amphibians (continued)

Northwestern Garter Snake

PHOTO BY: Rod Gilbert

Scientific Name: *Thamnophis ordinoides*

Distinguishing Features: Base color varies between brown and black with usually three yellow, orange, or red stripes.

Habitat: This widespread snake is common in south Puget Sound prairies from spring through fall. It ranges west of the Cascades, from northwestern California to British Columbia. The snake consumes insects, spiders, slugs, and amphibians.

Other Information: The northwestern garter snake is non-venomous and relatively harmless to humans. In defense, it releases musky smelling urine.

Rubber Boa

PHOTO BY: Wikimedia Commons

Scientific Name: *Charina bottae*

Distinguishing Features: Grows up to approximately 2.5 feet long. Color varies from olive green to dark brown, usually with a yellow belly.

Habitat: The rubber boa occurs in a wide variety of habitats including moist forests, dry pine forest, meadows, and shrubby habitats throughout Washington, though population sizes are limited.

Other Information: A non-venomous snake that kills prey, primarily young rodents, by constriction. It prefers cool temperatures and is most active during the night.

Northern Alligator Lizard

PHOTO BY: Wikimedia Commons

Scientific Name: *Elgaria coerulea*

Distinguishing Features: One of the largest lizards in Washington, the species ranges from 2.75 to over 5 inches long. Color ranges from light or medium brown, gray, or olive with olive-gray to brown cross-bars on the back. Black and white spots are present along the sides, and the tail is long and slender.

Habitat: This species is found in dry, open woodlands of ponderosa pine or oak within the Columbia River Gorge and south Puget Sound prairies.

Other Information: The northern alligator lizard is subject to habitat loss due to agriculture, logging, and development. Active during the day, it feeds on small insects, slugs, and worms. In defense, this species detaches its squirming tail in order to distract an attacker.

Western Fence Lizard

PHOTO BY: Cary Bass

Scientific Name: *Sceloporus occidentalis*

Distinguishing Features: Black, gray, or brown with a blotchy pattern. Grows to over 6 inches long.

Habitat: The western fence lizard uses drier habitats, such as grasslands, clearings, and recently logged areas. This species basks in the sun and feeds on insects and other small invertebrates. It emerges from hibernation in spring, when males can be observed on elevated perches such as rocks, logs and stumps.

Other Information: During defense and courtship, males display bluish throats and vents. This species loses or detaches its tail during an attack.

Prairie Mammals

Western Gray Squirrel

Scientific Name: *Sciurus griseus*

Distinguishing Features: Gray with numerous white-tipped hairs on the back and a white belly. Large feet, prominent ears that are reddish brown on the back, and a long, bushy tail with bands of gray, white, and black. The largest native tree squirrel in Washington, with bodies and tails reaching a total length of 2 feet.

Habitat: This species feeds primarily on pinecones, acorns and other nuts, fungi, berries, and insects. Western gray squirrel relies heavily on Garry oak trees for food.

Other Information: Habitat is increasingly rare due to loss of oak woodlands, disease, mortality from road-kill and illegal hunting, and competition from the non-native eastern gray squirrel. The western gray squirrel is a Washington State threatened species and a federal species of concern.

PHOTO BY: Rod Gilbert

Meadow Vole

Scientific Name: *Microtus pennsylvanicus*

Distinguishing Features: Total length 5.5 to 7.5 inches. Fur is yellow-brown to reddish or blackish-brown with a gray underside.

Habitat: The most widely distributed vole in the United States, this species builds underground burrow systems. Aboveground runways are easily distinguished as small trails through prairie grasses. Its diet is highly variable including grasses, seeds, roots, bark, bulbs and insects.

Other Information: Voles are ***prey*** for many species such as coyotes, snakes, hawks, and owls, and play an important role in the function of prairie ecosystems. They are most active at night during the summer and during the day in the winter. The meadow vole does not hibernate and therefore eats constantly, consuming as much as its body weight daily. They breed frequently and have up to 12 litters a year.

PHOTO BY: Wikimedia Commons

Mazama Pocket Gopher

Scientific Name: *Thomomys mazama*

Distinguishing Features: Fur is brown, yellowish-brown or gray. Adults measure 8 inches in length. Cheek pouches are used for carrying food. Large claws on the front paws and large teeth are used for digging. Small eyes and ears, sensitive whiskers.

Habitat: Native to western Washington prairies.

Other Information: The Mazama pocket gopher is listed as a Washington State threatened species and is a federal candidate species. Half of the known populations are on private lands where their survival is threatened by residential development and agriculture. This vegetarian species eats roots, bulbs, and leaves and can pull entire plants into their tunnels. They are an important species within the prairie ecosystem due to their digging and burrowing activities which ***aerate*** soils and help circulate ***nutrients***. Their abandoned tunnels also provide habitat for other wildlife.

PHOTO BY: Rosemary Baker

Pocket gopher being examined as part of a WDFW study

Prairie Mammals (continued)

Townsend's Mole

Scientific Name: *Scapanus townsendii*

Distinguishing Features: A large, black mole reaching up to 9.25 inches in length. Tiny eyes, numerous and crooked teeth. Snout and short tail are hairless and pink.

Habitat: Fields, meadows and lawns from southern British Columbia to southern California.

Other Information: This species spends most of its time underground digging burrows, forming mounds and ridges and foraging for earthworms, insects, slugs, and small mammals. Barn owls, rubber boas, dogs, cats, weasels, and skunks prey upon Townsend's mole.

PHOTO BY: Wikimedia Commons

Roosevelt Elk

Scientific Name: *Cervus elaphus canadensis*

Distinguishing Features: This species is the largest North American elk, reaching up to 5 feet tall at the shoulder and 9 feet long. Males grow thick antlers with vertical points, and a distinctive crown or three-point tip. It has a dark brown to black neck, light brown to tan body, and beige to white rump patch.

Habitat: Large herds of Roosevelt elk migrate through western Washington, grazing on a variety of grasses, plants, leaves, and bark in a range of habitats.

Other Information: Elk grow new coats and antlers yearly.

PHOTO BY: PNW Nature

Black-tailed Deer

Scientific Name: *Odocoileus hemionus*

Distinguishing Features: A medium-sized deer with a stocky body, long legs and large ears. Summer coat is reddish brown or yellow brown above and cream or tan below. It has a relatively small rump patch and a wide, black tail. It ranges between 3 to 3.5 feet tall and 4 to 7.5 feet long. Male antlers are regrown annually.

Habitat: Found in Pacific Northwest lowland forests, this species prefers to forage along forest edges for grasses and herbs, while quickly finding cover from predators and harsh weather. Black-tailed deer are most active at dawn and dusk.

Other Information: Winter ranges are often shared with Roosevelt elk.

PHOTO BY: Rod Gilbert

Coyote

Scientific Name: *Canis latrans*

Distinguishing Features: Small to medium sized ***canine*** with a thick grayish-brown to yellowish-brown coat and a white underside. Large triangular ears, a long, narrow ***muzzle***, a black nose, yellow eyes, and a long bushy tail. A typical adult male weighs from 25 to 40 pounds and females weigh between 20 and 30 pounds.

Habitat: This species is widespread throughout North America and common on South Puget Sound prairies. They form packs, and prey on a variety of wildlife including rodents, rabbits, birds, and snakes. Coyotes also ***scavenge*** on ***carrion*** and feed on fruits, vegetables, and berries in the fall and winter.

Other Information: Coyotes can be distinguished from dogs and wolves by carrying their tails downward while running (dogs carry them up and wolves carry them straight out).

PHOTO BY: Rod Gilbert

Red Fox

Scientific Name: *Vulpes vulpes*

Distinguishing Features: A small, solitary canine with a rusty red to silver coat, pale neck and underparts, dark legs and paws, and a long bushy tail.

Habitat: This species is widespread across the northern hemisphere. It uses a range of habitats including forest, prairie, desert, mountains, farmlands, and urban areas. The red fox prefers mixed vegetation communities, such as edge habitats and mixed scrub and woodland. The species feeds upon rodents, rabbits, insects and fruit.

Other Information: Red foxes store food in ***caches***.

PHOTO BY: Rod Gilbert

CHAPTER

3

Getting Started

This chapter covers the first steps in beginning a prairie restoration project:

1. **Assessing your site**
2. **Setting goals**
3. **Making a work plan**

PHOTO BY: ESA Adolfson

Step 1: Assessing Your Site

The first step in restoring a prairie is to observe and document its soils, plants, and animals, as well as its human uses and history. Why is this important? In order to have a successful project, you need to understand where you are starting from. This ***ecological baseline*** information that has been established based on the soils, plant communities and animals present on your property will help you decide how to focus your time and resources.

You may choose to hire a consultant or restoration specialist to perform a site assessment, or you can do it yourself using the recommendations below. Your assessment may include all or only some of these topics, depending on the scale of your project and the condition and current use of your land.

PHOTO BY: ESA Adolfson

Soils

Why are soils important? The types of soil on your property are one of the principal factors in determining the composition and growth of the plant community. Dry, mesic (moderately moist), and wet prairies each sustain different plant communities. By knowing the soil type, drainage, and ***pH***, you will be able to make better seed selection and planting decisions. A description and assessment of soils may also reveal potential management problems such as soils that are prone to erosion or compaction.

Chapter 2 presented a list of soil types mapped by the Natural Resources Conservation Service (NRCS) that are considered typical of prairies. Detailed soils information can be found in soil survey reports prepared for your county and published by the NRCS. Information can also be found on the Washington Soil Survey web site at www.or.nrcs.usda.gov/pnw_soil/wa_reports.html. These resources include maps and information about the physical and biological characteristics of different soil types. Soil survey reports are also available at many local libraries.

In addition to looking at maps and soil surveys, we recommend sampling the soils on your property. This can be as simple as digging shallow holes or soil pits around the property and examining the soils. Do the soil characteristics seem consistent with the soil types mapped for your area, or are there differences? Are there areas of the site where the soil stays saturated most of the year? Is there anything that might affect the growth of native plants, such as debris or fill material? Keep in mind you may have different soil types on different parts of your property.

Soil pH. Soil pH is measured on a scale from 1 to 14, with 1 being the most acidic and 14 the most alkaline or basic. Most plants do best with soil that has a neutral pH, between 6 and 7.5. That is when nutrients are most available to the plants. A soil test is needed to determine soil pH. Very simple soil pH tests are available at local hardware stores, or you can ask your local county soil conservation district office for assistance. Typically, is it not necessary to change the pH of your soil. If it does not have a neutral pH, that may be its normal condition. You can select plants adapted to acidic soils or soils high in lime. If you want or need to amend your soil to change its pH, ask a professional about how this will affect plant growth, the cost involved, and the necessary time commitment.

Plants

Depending on the size and setting of your property, the site may have from one to several ***vegetation communities***, or groupings of different plant species. If you have a small lot in a suburban area, your vegetation community may be dominated by landscaped vegetation such as a lawn and flowerbeds. Larger parcels in less developed areas may contain landscaping near a residence but also have forests, shrublands, grasslands, or wetlands. Working lands may be dominated by pastures, crop fields, or tree farms, perhaps with hedgerows of native shrubs growing along fences or property lines.

One of the vegetation communities on the site may be a remnant native prairie. Or perhaps there is an area that now has a different community plant type (such as a lawn or pasture) that you wish to restore to prairie conditions. In any case, it is helpful to start with a sketch of the existing vegetation communities on your property so you can plan for how a prairie will fit in with the other uses of your land.

A vegetation community sketch is an "eagle's eye" view of plants on your site. You may next want to work on a "mouse's eye" view by identifying as many plant species as you can within your existing prairie or prairie restoration areas. Chapter 2 provides an introductory field guide to common prairie plant species. Additional plant guides are listed in the resources appendix. Your local native plant society can also provide lists of prairie plants common to your area (see resources appendix).

In addition, make a visit to a native prairie in your area, particularly during peak bloom time (usually early April through early June). A list of Western Washington prairies open for visitation is below. This can give you a good idea of what prairie species grow well in your area.

PHOTO BY: Rod Gilbert

Sun and shade. In order to flourish, prairie plants need about 10 hours of sunshine each day. Shady areas may be best suited for woodland or savanna habitats that will complement your prairie. Slope and aspect affect both the available sunlight and soil drainage. Hilltops and steep slopes tend to be drier than depressions and valleys. Slopes that face south and west will be hotter and drier than other aspects. Slopes facing east generally have more moderate conditions, and north-facing slopes are usually cooler and wetter.

PHOTO BY: Rod Gilbert

Table 3-1. Western Washington prairies open for visitation

Name of Prairie Reserve	Location	Web Page
Mima Mounds Natural Area Preserve	Thurston County near Littlerock, WA	http://www.southsoundprairies.org/visit.htm
Scatter Creek Wildlife Area	Thurston County near Littlerock, WA	http://www.southsoundprairies.org/visit.htm
Black River-Mima Prairie Glacial Heritage Preserve	Thurston County	http://www.co.thurston.wa.us/parks/parks-glacial-heritage.htm (currently closed to public access except for county approved events)
West Rocky Wildlife Area	Thurston County near Tenino, WA	http://www.ims.issaquah.wednet.edu/teachers/wieland/west_rocky_prairie.htm http://www.friendsofrockyprairie.com/
Clover Creek Reserve	Tacoma, WA	http://www.cascadeland.org/events/volunteer-event-at-clover-creek/
Smith Prairie at Pacific Rim Institute	Whidbey Island	http://www.pacificriminstitute.org/
American Camp Young Hill	San Juan Island	http://www.nps.gov/sajh/naturescience/prairie-restoration-project.htm
Yellow Island	San Juan Islands	http://www.nature.org/wherewework/northamerica/states/washington/preserves/art6383.html

Wildlife

Many people undertake restoration as a way to attract more wildlife to their properties. By providing for the basic needs of animals—food, water, shelter, and space—property owners can both help to sustain native wildlife populations and provide a source of enjoyment for themselves throughout the year.

You may already be aware of some of the wildlife species that use your site. If you have not already done so, start keeping a list of species you observe, when you see them, and how they are using the property. For example, do some bird species use certain plants for perching or feeding? Are there particular flowers that attract insects? Your list can provide a ***phenology*** that allows you to track wildlife on your site through the seasons. After your prairie restoration project is installed, you can see whether the changes attract different species.

Chapter 2 provides an introduction to wildlife species typically found on local prairies. See also http://www.southsoundprairies.org/animals.htm.

Rare and sensitive species. If your land supports rare or sensitive species such as those listed below, you are very fortunate. We recommend that you talk to an expert at your state Department of Fish and Wildlife, Department of Natural Resources, or Nature Conservancy office and the U.S. Fish and Wildlife Service before making changes to your landscape that could affect habitat for these species. You can check the status of wildlife species at http://www.fws.gov/endangered/.

- Mazama pocket gopher
- Streaked horned lark
- Puget blue butterfly
- Mardon skipper butterfly
- Taylor's checkerspot butterfly
- Golden paintbrush plant

Human Uses of the Land

Part of the appeal of restoring native prairie is the sense of returning the land to a historic condition—a simpler time before the advent of modern life. But what did that historic condition look like? Property owners whose land has been in the family for generations may have access to a lot of historical information, while newer property owners may need to do more research. Some questions you may want to ask about the history of your property include:

- What was the extent of historic prairie on the site?
- Was the site likely to have been used by Native Americans, and if so, how?
- When was the site inhabited by European settlers, and how did they use the land?
- What kind of modifications did people make to the property—for example, moving or creating drainage features, clearing forests for farming, building roads?

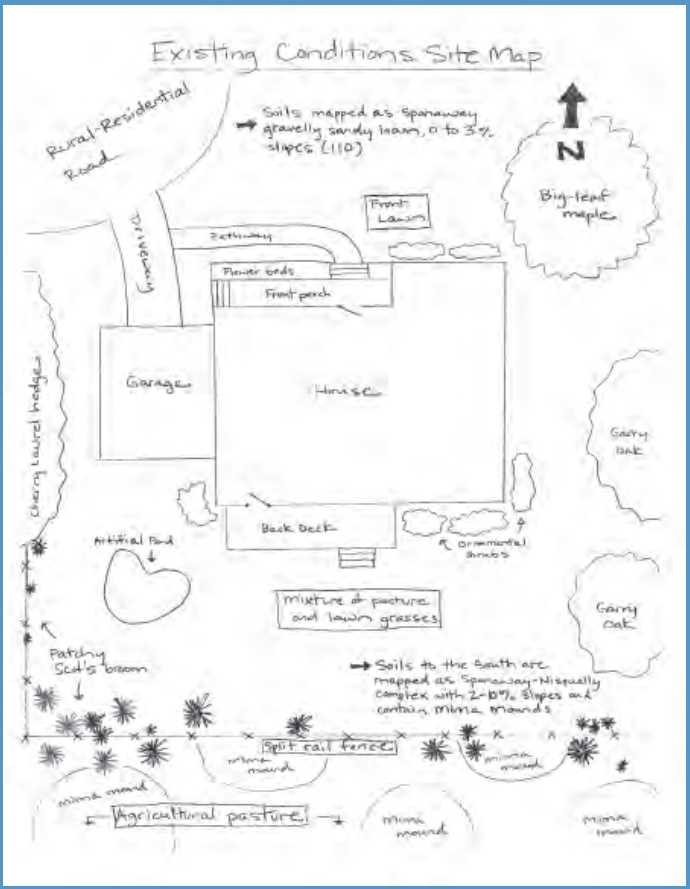
The answers to these questions can help shape your restoration plans. For example, you might find that land in your area once supported abundant camas plants used by Native Americans, and so restoring a camas population might be important to you. Or perhaps part of the property was filled to support buildings that have since disappeared, and you might want to remove the fill material to allow revegetation of native prairie soils underneath.

In addition to historic uses, assess how your property is being used today, and how a prairie restoration project will fit with those uses. This is a key to the next step, setting goals for your site.

PHOTO BY: ESA Adolfson

Make a Map. Early in your project, you will want to draw a map of your site. If possible, draw the map to scale. Include such details as roads, trees, streams or ponds, hills, utility poles, fences, and buildings. Also map the borders of your site and label adjacent land uses. Note the soil type and slope, and sketch in the vegetation communities.

If you are working on restoration of a large site, topographic maps and aerial photographs will be helpful as a base. See the resources appendix for sources of maps and photographs. Aerial photos can be purchased as prints or as digital images from the U.S. Geological Survey, Natural Resources Conservation Service, or private vendors. Black and white photos are suitable for most planning purposes. Tax lot maps are useful for showing your property boundaries and local road access. Landowners can acquire tax lot maps from their county assessor. You may want to consider having resource maps and photos prepared by a natural resource consultant. Some federal and state habitat conservation programs will cover the cost of preparing natural resource maps when your property is enrolled in one of their programs.



SOURCE: Rosemary Baker, Olallie Landscapes

Step 2: Setting Goals

As you learn more about the ecology and human history of your property, you can start making a list of goals for your restoration project. Actually it's helpful to keep several lists as you do your research, such as:

- Your reasons for undertaking a prairie restoration project.
- What you want your site to look like in the future (a few years from now, decades from now).
- Your current resources available for a restoration project (finances, available materials, grant opportunities, friends who can help, etc.).
- The time and energy you have available to install and maintain a restoration project.
- Challenges you are likely to face in implementing and maintaining the project.

PHOTO BY: The Nature Conservancy

As you work on these lists, you will be able to prioritize the restoration tasks you want and are able to tackle right away and those that will need to wait. Starting with just a few tasks, or with one small section of your property at a time, can help you avoid becoming overwhelmed and discouraged. Start small and expand as you are able to. Anticipate successes as well as some failures.

While it's great to think big, here are a few things to keep in mind:

- A prairie restoration project, even a small one, is not cheap, easy, or fast. It requires planning and site preparation.
- Controlling weeds is likely to be your number-one challenge. Weed control will need to be done several times a year, perhaps for many years.
- The first native plants you install may not succeed. You may have to experiment to find the right combination of native species for your site. Be persistent: a second planting may yield different results than your first planting.
- There is a great difference between maintaining a lawn and maintaining a prairie. A prairie will not look neat and tidy all year.
- You will likely need to make changes to your plans as the project goes along—to adapt to site conditions and unexpected changes.
- The work you invest to plan, install, and maintain a prairie restoration project will be just as rewarding as the "end product." What you learn along the way can benefit others, too.

The later chapters of this guide provide examples of goals specific to residential lands and working lands.

Step 3: Making a Work Plan

Now that you have made a list of the general goals for your property, it is time to develop a work plan. The work plan says what you will do, where it will occur, when it will happen, and what you need in order to accomplish each task. While each work plan is tailored to the specific restoration project, here are some basic items that should be included:

- A map or sketch showing your restoration area in relation to existing site features.
- A list of site preparation tasks that will need to be completed before native plants can be installed (for example, initial weed control).
- A list of native plants you have selected for the site, including species names (common and scientific names), quantities, nursery sources, and costs.
- A maintenance schedule for the restoration area, showing when tasks such as weed control will occur each year.
- A list of materials and equipment needed for each stage of the project.
- A schedule for monitoring the site and making adjustments to your plan as needed.

It is important to revisit and revise the work plan periodically to make sure it's still in line with the overall goals for your property, and that it reflects lessons learned along the way.

Write it down. Make sure you have a place to record details such as where and when you ordered plant materials; how and when you performed weed control, and what worked or didn't; what species bloomed and when; and so on. Photographs are a great way to record changes to your site as well. Written documentation will provide records of your activities and can become a very useful tool as time goes on.

CHAPTER

4

On the Ground

This chapter outlines the basic steps needed to implement a prairie restoration project on the ground. These steps include:

1. **Preparing the site**
2. **Installing native plants**
3. **Maintaining the site over the long term**

The site assessment, work plan, goals, and site map described in the previous chapter should guide your on-the-ground efforts. Subsequent chapters of this guide will build on this overview to provide recommendations specific to residential and working lands.

Step 1: Preparing the Site

Site preparation is one of the most critical steps to ensure the success of a restoration project. Do not cut corners with this step! By preparing the site properly, you will control competing weeds, prepare the seedbed, and help native plants become established.

There are a number of methods for on-the-ground site preparation that vary according to your goals and resources as well as the size of your restoration area. Basic methods are described below.

Initial Weed Control Methods

Several methods can be used to control weeds when you are first starting on a prairie restoration project. A few common methods are discussed below. Keep in mind that (1) the more thorough you are in controlling weeds at the beginning, the less weed control will be needed later, and (2) some level of weed control will be needed throughout the life of the project.

Hand Pulling

On small sites with limited weeds, hand pulling can be effective. Weeds should be pulled early in the season, before seed set. It is easiest to pull weeds when the soil is moist. Be sure to remove all of the roots as well as the aboveground portions. A shovel or trowel is usually all that is needed for smaller weeds. A weed wrench is very helpful for removing larger, woody plants with deep roots such as Scot's broom.

What should be done with weeds that have been pulled? Believe it or not, some weeds that are in flower will continue to develop and set seeds even after they have been pulled. If you are working on a project at your home and you have commercial yard waste pickup, it is usually acceptable to put weeds in the yard waste bin—but check with your service provider. Home composting of weeds is not a good idea unless your compost pile gets hot enough to kill weed seeds.

Some weeds such as knotweed can form new plants from small pieces of roots or stems. For these species, hand pulling is not recommended since it can actually spread the infestation by creating fragments that can sprout new plants. See the resources appendix for recommendations about which species should be manually pulled.

Sheet Mulching or Smothering

Smothering and ***mulching*** should be used in areas where there is little to no existing prairie vegetation to be concerned about; in other words, these methods are used to sterilize the ground and then "start fresh" with native prairie vegetation. With this method, first apply a layer of overlapping newspaper, cardboard, or plastic sheets, and then a layer of mulch on top that is three to four inches thick. Leave it in place for a full growing season. This is most useful for smaller sites. Sheet mulching or smothering can be performed at any time of the year but is best applied in winter before plants begin to grow or produce seeds. Remove the mulch and other layers of materials when you are ready to proceed with planting. Smothering is effective for killing vegetation, but does not generate sufficient heat to kill seeds in the soil. To do this, ***solarization*** is recommended.

PHOTO BY: The Nature Conservancy

Solarization

In spring, cover the area with a layer of clear plastic and anchor the edges. Leave the plastic in place through the summer months. The heat that builds up under the plastic will kill weed seeds and leave a blank slate for planting native species the following year. Remove all layers of plastic when solarization is complete. Keep in mind this is a full-sun method that may not work well in shady or part shade conditions.

Cultivation

Tilling, disking, plowing, and harrowing are often used to temporarily reduce or suppress non-native plants and prepare a seedbed prior to sowing native prairie seeds. To follow this method, till the soil to remove unwanted vegetation. Remove grass roots. Wait for the weeds to grow back and then remove them. Repeat these steps until invasive and/or unwanted vegetation is under control, which may take more than one season.

Prescribed Burning

By setting fire to a prairie restoration site, you mimic the historic processes that sustained native prairies before European settlement. Burning removes built-up thatch and stimulates weed growth, since many weeds rapidly recolonize disturbed or burned areas. When the weeds resprout after the fire, an herbicide can then be applied.

Herbicides

When used properly, herbicides can be an effective part of the weed control toolbox. See the resources appendix for more details about herbicides recommended for each type of weed. When using herbicides, follow all label directions, including what type of site the chemical is licensed for (pasture, forest, agricultural land, residential, etc.). Often there are different formulations or trade names for different site types.

Mowing

If you are unable to use the methods listed above, mowing can provide a stop-gap measure for initial weed control. Mowing prior to seed set reduces the future weed seed bank. Repeated mowing removes the aboveground portion of the weeds and can weaken the root system over time.

Burning permits and precautions. Outdoor burning requires a permit. See the Washington State Department of Ecology's web page at: http://www.ecy.wa.gov/programs/air/outdoor_woodsmoke/outdoorburnpermits.htm. In addition, check with your local city or state government and your local fire department for permit requirements.

Be sure to keep the following safety precautions in mind when using fire as a prairie management tool:

1. Carefully plan the burn.
2. Notify your local fire department and obtain proper permits.
3. Time the burn to avoid drought or extremely wet conditions.
4. Notify neighbors.
5. Make sure you are aware of current weather forecast and wind direction.
6. Prepare firebreaks such as roads, paths, and mowed buffers. The wider the firebreak, the less chance for escape or loss of control.
7. Have experienced people present.

PHOTO BY: The Nature Conservancy

Table 4-1. Summary of initial weed control methods

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

The Institute for Applied Ecology has performed extensive research on the use of mowing, burning, and spraying in different combinations to restore prairie sites in Washington, Oregon, and British Columbia. For further information, see the Institute's web site at http://appliedeco.org/conservation-research/prairie-restoration-research.

Adding Soil Amendments

If you have already tested your soil during the site evaluation and planning process (Chapter 3), then you know what your soil needs. Lab results will usually include a list of recommendations for soil amendments, such as adding organic content or lime to raise the pH.

In general, maintaining low soil fertility favors native plants over non-native weeds. Use of chemical fertilizers or nitrogen-based fertilizers should be avoided. Research on prairie restoration has shown that adding soil amendments rich in nitrogen favors non-native annual weeds that prevent the establishment of native forbs and grasses. If the soils lack organic content, a layer of compost could be added to the soil either as a top dressing or worked into the soil during the tilling process. Adding carbon-based amendments like sawdust or wood chips to soils with high nitrogen content can reduce nitrogen availability for weeds during your initial attempts to establish native plants.

Often the sites with the least competing vegetation are those that are the least hospitable—they have low nutrient levels or are droughty. Nitrogen is often used more effectively by non-native vegetation (a reason *not* to add it). However, you may want to apply lime, phosphorus or potassium to a site, especially if you want to favor forbs.

Step 2: Installing Native Plants

Native plants can be purchased in a variety of forms, such as seeds, ***plugs***, or containerized (potted) plants. If you are restoring a large area, you may want to consider using mostly seed. If planting a prairie garden or restoring a smaller area, plugs may be more appropriate. Woody species such as oaks are typically found in pots or containers. Several methods can be used to install native plants. The more common methods are summarized in the table below.

PHOTO BY: The Nature Conservancy

Table 4-2. Summary of planting methods

Type of Plant Material	Planting Method	Description
Seeds	Direct or broadcast seeding	Scatters seed over the planting site either by hand or with a grass seed spreader.
	Drill seeding	Uses a specialized tractor implement (a drill seeder) to drill into the ground at a desired depth while filling the holes with seed of a desired mixture and density.
	Hydroseeding	Uses a specialized piece of equipment to spray a slurry of wet mulch and/or soil, fertilizer, and seed.
Plugs	Hand Planting	Uses a ***dibble*** or other hand tool to create plug-sized holes. Plug is removed from its container and placed in the hole with the crown just below the surface of the ground. Tamp down so that the plant is firmly in the ground.
Containerized	Hand Planting	Involves digging a hole slightly deeper than the height of the soil in the pot, gently roughing the roots of the plant if root-bound, and placing the plant in the hole. Tamp soil firmly around the plant and water if newly planted in dry months. Woody plants are often protected from wildlife browsing with wire mesh or a tree protector.

Purchasing Native Plants. The resources appendix provides a list of native plant suppliers that may carry prairie plants. If possible, it is best to obtain seed or plants from a local source so that your plants are genetically similar to plants adapted to grow in your area. Be aware that there are many prairie plants for which plugs and seeds are not yet available. But don't give up: Making prairie plant seeds more widely available is a priority for conservation organizations, and the species you are looking for may become available in the future.

Step 3: Maintaining the Site over the Long Term

Restoring a prairie site is a long-term commitment—not just months but many years. During the first few years of your project, it may seem that your native plants aren't growing much, but be assured that they will be putting most of their energy into root growth. It is common for restoration projects to "take off" after about three years, once the plants have a well-established root system.

Once your project is installed and native vegetation is growing, you will move into the maintenance phase. You will likely spend most of your maintenance resources on weed control. Patrol your site for weeds often—at least once a month during the growing season. When you find weeds, either perform control immediately or note the area for later work if you're using a control method that is best done at a specific time of year.

If you have a small restoration area, such as a backyard prairie garden, it may be possible to control weeds simply by hand pulling before they go to seed. For larger sites, a combination of burning, mowing, and herbicide treatment may be needed to prevent weeds from overwhelming the site.

Keep in mind that in order to successfully compete with taller vegetation (non-native or native, grasses, shrubs or trees), prairie plants require some form of control of overtopping vegetation, either through cutting, mowing, pulling, burning, grazing, or selective herbicide use. They need sunlight throughout the growing season, but especially at the beginning, in the spring when they are performing most of their growth for the year.

Many prairie plants are specifically adapted to benefit in some way from fire. Fire can rejuvenate prairie plants by causing plants to produce more seed and become more robust. Fire can help control invasive species such as Scot's broom. Burning can remove accumulated thatch, moss, and litter that form a dense mat and prevent native species from germinating. It is important that any prescribed fire is planned to be patchy—to burn some areas of the prairie while leaving others intact. Unburned areas provide a refuge for invertebrates to escape the fire, as well as areas where lichens and native plant seeds can remain intact.

If burning is not possible, mowing or selective herbicide use are other options for larger restoration sites. Mowing can keep weeds from growing large and going to seed, as well as preventing invasion by trees and shrubs. Mowing different parts of the site at different times can provide wildlife foraging corridors and refuge areas for small animals such as butterfly larvae.

Oak Release. If your site contains a Garry oak stand that is being overgrown by conifers, you may want to use methods for oak release as part of your site maintenance routine. Oak release refers to removing the competing vegetation (usually faster-growing conifers) to allow a Garry oak tree enough sun and room to grow and develop a full healthy crown. A full crown absorbs more sunlight, water, and nutrients and stimulates the production of acorns. For more information, see:

- *A Practical Guide to Oak Release* published by the U.S. Forest Service Pacific Northwest Research Station (Harrington and Devine, 2006)
- *A Landowner's Guide for Restoring and Managing Oregon White Oak Habitats* published by the Bureau of Land Management (Vesely and Tucker, 2004)
- The South Puget Sound Prairie Landscape Working Group web page has additional recent publications: http://www.southsoundprairies.org/documents.htm.

PHOTO BY: The Nature Conservancy

CHAPTER

5

Residential Lands

This chapter focuses on how residential landowners can create or enhance prairies in their own yards. Whether you have a tiny backyard or a house on several acres, you can incorporate a prairie project into your property. Most residential landowners will either (1) create a small prairie garden from scratch, or (2) enhance or restore an existing remnant prairie area.

If you live in the areas with prairie soils shown on the maps in Chapter 2, there is a good chance that your land is or was part of a historic prairie and would be an excellent candidate for restoration. Even if you live outside of these mapped areas, you can still incorporate native prairie plants into your landscaping scheme.

As discussed in the previous chapters, there are six overall steps that any property owner, including the residential landowner, will want to follow in planning and implementing a prairie project:

1. **Assessing the site**
2. **Setting goals**
3. **Making a work plan**
4. **Preparing the site**
5. **Installing native plants**
6. **Maintaining the site over the long term**

This chapter discusses these steps from a homeowner's point of view, presenting ways to accomplish these tasks on a budget and using skills and tools that are readily at hand. For those who wish to hire professional help, these same steps apply—you can expand the project or incorporate more complex elements with assistance from a landscape designer or landscape installation and maintenance crew. Just be sure anyone you hire shares your interest in restoring prairie ecosystems and has experience with native plant species.

Assessing the Site

As described in Chapter 2, the first step in restoring a prairie is to observe and document the soils, plants, and animals, as well as its human uses and history. This ***ecological baseline*** information will help you decide how to focus your time and resources.

You may choose to hire a consultant, a restoration specialist, or a residential landscaper who specializes in prairie restoration to perform a site assessment, or you can do it yourself using the suggestions below. Your assessment may include all or only some of these topics, depending on the scale of your project and the condition and current use of your land.

Your site assessment should include:

- Property map. You can use existing maps or aerial photos as a base or start from scratch. A map can be created using a computer program, but a hand drawing is just as good. Include important elements such as driveways, buildings, fences, utilities, decks, patios, vegetable gardens, and play areas, as well as existing vegetation you want to keep.
- Soil description. Dig around and take a look at the soil in areas where you would like to establish prairie plants. Most residential soils have been disturbed, often with all of the topsoil removed. Your site may contain fill such as sand, gravel, or other materials. Prairie plants require a soil that is moist in spring and dry in summer. Even if you do not have a typical prairie soil you may be able to create a small, appropriately drained soil in your planting areas. See Chapters 2 and 3 for suggestions on soil testing.
- Plant and wildlife inventory. Make a list of existing plants and animals, both native and non-native. Use a field guide to identify those you aren't sure about (see Chapter 2). Observe your property closely and note the dominant and less-dominant species. Make observations of wildlife, especially prairie-dependent species such as Mazama pocket gopher and prairie butterfly species. Note which plants are used by wildlife and for what purpose (e.g., obtaining nectar, perching, or nesting).
- Shade assessment. Prairie plants need full to partial sun. Note how much sun your existing or potential prairie area receives. If you have full or partial shade, consider planting a native woodland community instead.
- Human uses. Be sure to include the human elements of your property—walking trails or pathways, places that are used by children or pets, vegetation that provides privacy from neighbors.

If possible, observe your property for a full year before you begin installing your project. Different plants and animals will use your land at different times of year. You may discover depressional areas that become saturated or even ponded with water during winter and early spring.

After this initial assessment, you will be prepared to set goals for your residential prairie project.

Setting Goals

Defining the goals of your prairie garden or restoration project will determine the actions you take. Goals should account for time, budget, resources, and your ability to keep up with maintenance of the project. Starting with a small area of your property and setting a few goals at a time will improve your success and level of satisfaction. Do not underestimate how much work goes into even a small-scale prairie restoration or garden project. And keep in mind that when it comes to prairies, tidiness is not necessarily a realistic goal. You will not be creating a manicured lawn look.

Here are some example goals for a residential project:

- Attracting native prairie insects such as bees and butterflies.
- Supporting native birds and small mammals.
- Conserving water and reducing chemical use by transforming part of a lawn into native prairie.
- Increasing native plant diversity.
- Adding spring and summer wildflowers for color.
- Creating a display or educational garden.

Here is an example of a chart you can make to help clarify your goals and start thinking about some of the challenges you may face with your project:

Things to Consider...	My Answers...
My reasons for undertaking a prairie restoration project (this is your project goals)	*Attract butterflies.* *Convert some lawn to native vegetation.* *Incorporate wildflowers.*
What I want my project to look like in the future	*Small wildflower meadow contained within a rock border; lots of color in summer.*
Resources I have available for the project	*Limited financial resources, but my neighbor is a landscaper and I have a friend who is a naturalist—they can help.* *Can scavenge unused materials from other parts of yard (like those old pavers out back—move and use for a garden path).*
The time and energy I have available to install and maintain a restoration project	*I can spend a lot of time next summer and fall on site prep and planting. Then one weekend a month on weeding during the growing season for the following few years.*
Challenges I'm likely to face in implementing and maintaining the project	*My neighbors like perfect lawns! I will need to explain my project and help them understand that it may look a little messy but it is beautiful in its own way and helps native prairies.*

Making a Work Plan

The work plan for your project says what you will do, where it will occur, when it will happen, and what you need in order to accomplish each task. Chapter 3 discussed the general items that should be included in a work plan. These include:

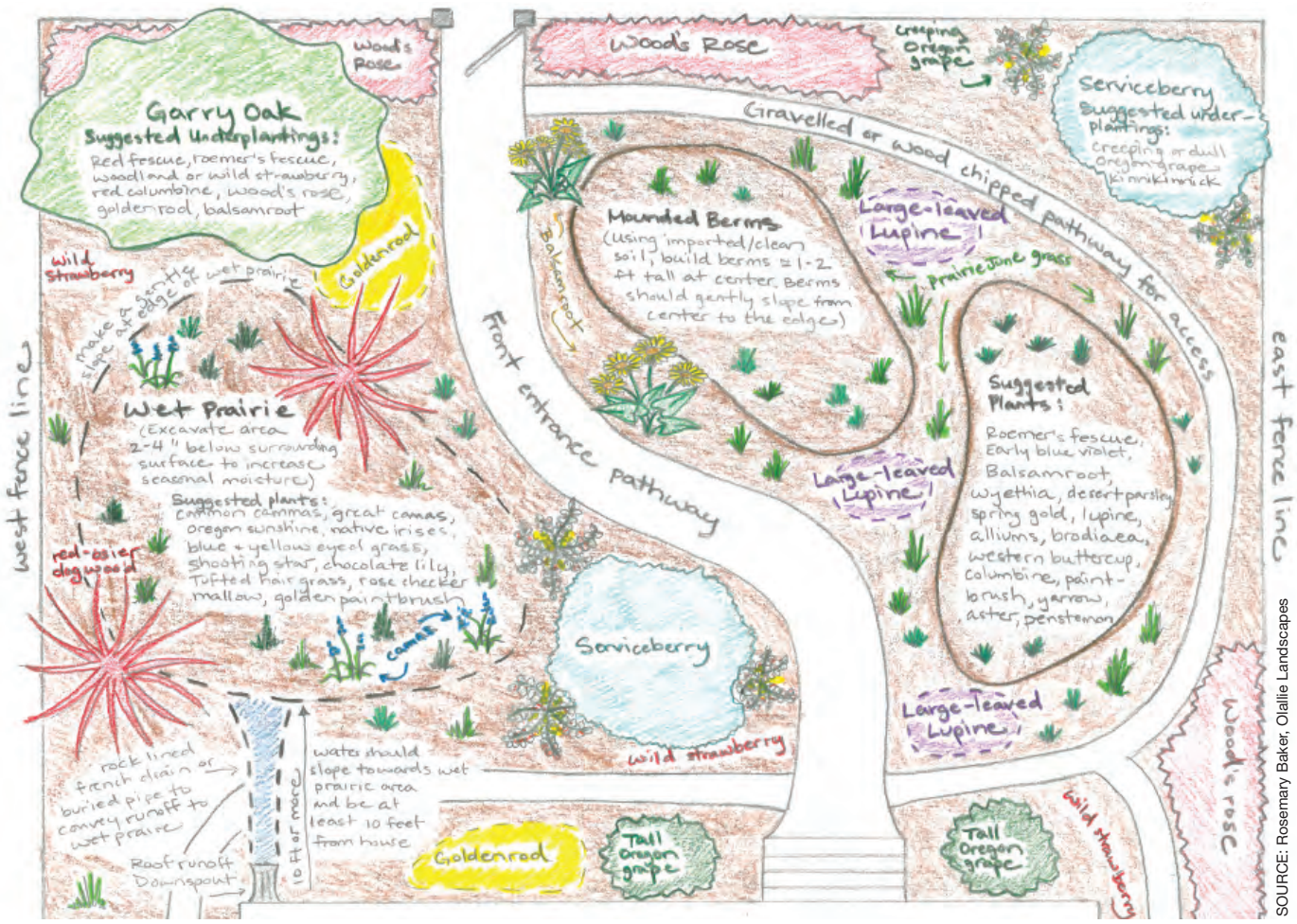
- A map or sketch showing the project area in relation to existing site features.
- A list of site preparation tasks that will need to be completed before native plants can be installed (for example, initial weed control).
- A list of native plants selected for the site, including species names (common and scientific names), quantities, nursery sources, and costs.
- A maintenance schedule for the project, showing when tasks such as weed control will occur each year.
- A list of materials and equipment needed for each stage of the project.
- A schedule for monitoring the site and making adjustments as needed.

Beginning with the map you made showing your property as it currently exists (see earlier discussion under "Assessing the Site"), create a second map showing the areas you want to dedicate to your prairie project. This could include wildflower beds, patches of native shrubs, a wet prairie swale, and other elements. Work these project elements in with the existing features of your property that you want to maintain. The accompanying drawing provides an example of the type of sketch a landowner can make or have prepared by a landscape designer (see **Figure 5-1**).

PHOTO BY: Tom Noland

Using your map or sketch as a guide, mark out the project areas on the ground with wooden stakes or other readily available materials. Now that you can see your project actually laid out, be sure you are still happy with how the project fits with the rest of your property. If not, revise your sketch and remark the areas on the ground.

The following sections provide further guidance and examples of how a residential landowner might develop and implement a work plan for a prairie project.



SOURCE: Rosemary Baker, Olallie Landscapes

Figure 5-1. A sample work plan sketch

Can natural be neighbor-friendly? Residential areas often come with the pressure of appearances—neighbors may expect a garden that looks tidy year-round. While a native landscape is by nature a little messy to the inexperienced eye, you can include elements of landscape design that will improve the appeal to you and your neighbors while creating habitat for prairie species. Design elements to consider:

- Incorporating vertical components such as berms, rocks, or shrubs.
- Designating focus gardens for plants that benefit butterflies, bees, or birds.
- Adding pathways to allow people to tour the garden while preventing trampling and soil compaction.
- Grouping like plants in drifts and clumps, rather than in strict rows.
- Adding small labels or signs to native plants, especially along public paths or roadways.

Wildlife features. Creating habitat for backyard wildlife has become very popular, and there are numerous references available (see the resources appendix). Examples of wildlife-friendly elements include:

- Bluebird boxes
- Bat boxes
- Bird perching poles
- Water sources
- Butterfly basking rocks
- Rock shelters
- Bee nest sites
- Brush piles
- Logs
- Snags

Preparing the Site

It is vital to carefully think through the tasks that will need to be done to prepare your site for planting. Take a look at your project map or sketch. For each element or area of your project, what must be done ahead of time? Make a list and include it in your work plan. The following chart provides examples of typical site preparation tasks for a residential prairie project:

Project Element	Site Preparation Tasks
Convert lawn area to native prairie garden.	Kill lawn grasses through sheet mulching and/or solarization.
Add native shrubs to an area with compacted clay soils.	Add a compost soil amendment to improve topsoil.
Restore a side yard overgrown with Himalayan blackberry, dandelions, and other weeds.	Cut down blackberry and dig out roots. Pull weeds or treat small infestations with Roundup. Apply sheet mulch (wood fiber mulch, cardboard, etc.) to prevent weed growth.
Create a new walking path between planting beds.	Apply weed control fabric and desired path surface material (bark, gravel) to suppress weed growth.

Chapter 4 provides a discussion of various weed control methods, and the resources appendix gives more detail on methods specific to individual weed species. **Prescribed burning is *never* an advisable method** for controlling invasive species on residential lands due to the proximity of homes and danger of damage.

Irrigation is not usually required for prairie restoration projects. Native species are by their nature adapted to local conditions, and watering can encourage weeds that will compete with the native vegetation. However, you may want to water your plants immediately after installation or if they appear drought-stressed in their first year. Consider how you will address potential short-term watering needs for your project.

Installing Native Plants

The goals of your project, and the areas of your property that you have available to work with, will influence your choice of native plant species. If your goal is to provide habitat for butterflies, then plants that provide habitat for larvae and nectar for adult butterflies will be central to your plant selection list. If you want to attract birds, native prairie bunchgrasses are appropriate. The amount of shade and sun your property receives also influences which species are likely to thrive.

While you are staking your project areas on the ground (as discussed earlier under “Making a Work Plan”), take some measurements and calculate the area of your project in square feet. You will need this information to determine how many plants or how much seed to order. If you are applying sheet mulch to help with weed control, knowing the square footage is also necessary to calculating how many cubic yards of mulch to purchase.

For your work plan, make a list of all the plant species and quantities needed for your project. As described in Chapter 4, native plants can be obtained in a variety of forms—seeds, plugs, containers. One species may only be readily available in seed, while another may be most available in potted form. Do some research with local native plant sources to find out more about prices and availability. If the species you want is not available from one source, they may be able to recommend another source or even a different species that would suit your project just as well. A list of local prairie plant sources is provided in the resources appendix.

If you are new to gardening, ask the nursery where you buy your plants for tips about how to install them. For example, containerized plants may be somewhat root-bound, and it is important to loosen the roots and maybe even prune them before planting to encourage the roots to spread out into the soil. You may want to add a ring of wood fiber mulch around each installed plant to help retain moisture and suppress weeds. The mulch should be several inches deep to be most effective—but keep it away from the plant stems to prevent rot.

A few other tips:

- Space the plants so they will not be too crowded when they are full grown. Shrubs are typically planted three to six feet apart.
- Plant so that the plant ***crown*** is flush with or slightly below ground level.
- After the plant is installed, gently compress the soil around the stem using your hand or foot to eliminate air pockets (they can kill the roots of the plant).

Timing is also important. Native plants are typically installed during the rainy season, which is usually late October through February in the Pacific Northwest. Installation during rainy, cool weather allows the plants to get roots established before they are stressed by summer drought conditions. If planting occurs during the spring (March through May), supplemental watering will be needed through the summer.

The benefits of seeding instead of using containerized plants include reduced cost, and the ability to cover more ground. However, this method also means increased germination of weed seeds, and a potentially lower survival rate of native seedlings. If you decide to use seeds, disperse the seed by hand. Rake it in or cover with a thin layer of mulch to prevent the seeds from being blown away by the wind or washed off by rain.

Restoration practitioners are learning that establishing prairie plants is difficult. The survival rate for installed plantings is often low the first year. Expect that you will need to replant some species during subsequent years, or find replacement species that may fare better on your site. Don't give up! Even the experts have to overcome plant mortality, and with patience you can do the same.

Enhancing Native Vegetation. If you already have existing remnants of native prairie vegetation on your property, you will likely choose to enhance these elements instead of starting from scratch. The following steps are helpful:

- Mark the locations of existing prairie plants with stakes, pin flags or other means.
- Pull, cut and grub competing vegetation away from the plants, being careful not to damage the plants or disturb their roots.
- Plant or seed additional native prairie species around existing plants to cover bare ground and enhance diversity.
- Apply mulch around new and existing plantings to help retain moisture and suppress weeds.

PHOTO BY: Tom Noland

Maintaining the Site

Diligent maintenance will determine the success of your project. Prairie projects need regular maintenance for three to seven years following planting, depending on conditions. Delicate and slow-growing prairie plants need time to establish. It is important to regularly maintain your site by weeding, potentially watering for the first year, and replacing diseased or dying plants. In some cases, plants will need protection from browsing animals and insects, as well as from foot traffic or domestic pets.

Weeding should be done regularly, by hand pulling or using a shovel or weed wrench for large or woody weeds. Use a rake to remove accumulated ***thatch*** and create areas for native species to germinate.

Most importantly perhaps, don't try to keep your prairie too "perfect." A neat and tidy prairie does not necessarily benefit wildlife. For example, some insects overwinter in leaf litter and provide a food source for resident birds. Rotting logs and debris provide habitat for snakes and amphibians. Uneven ground creates puddles used by birds and other creatures, and establishes microclimates that harbor different insects. Dead seed heads and stalks of native plants provide a seed source. And dead limbs and trees provide valuable cavities and food for many wildlife species.

Once a season or at least once a year, take the time to assess the prairie landscape you have created. Assess the need for replanting, weeding, and expansion. Look for wildlife damage from animals such as deer, voles, and rabbits. Consult a gardening guide, such as Russell Link's *Landscaping for Wildlife*, for environmentally friendly wildlife control methods. Keep a record of your successes and failures; adjust your plans accordingly, and share what you have learned with others who may desire to attempt similar projects.

PHOTO BY: ESA Adolfson

CHAPTER

6

Working Lands

Working lands are defined as those areas that produce food or fiber. They include croplands, grazing lands (improved pastures and rangelands), grasslands including prairie, and forests. A prairie restoration project can be compatible with agricultural use—whether by setting aside specific areas that will be used only for prairie restoration, or by changing management practices to integrate prairie species in areas that will continue to be used for agricultural production.

Prairies and oak woodlands were historically sustained by Native Americans, who periodically set fires that regenerated the prairie ecosystem and kept out invading trees. Prairie species and oaks provided a vital food source for early people. By taking the time to understand the ecology of your property and the needs of prairie species, you can continue this historic association of people and prairies on your working lands.

This chapter describes the following steps in planning and implementing a prairie project on working lands:

1. **Assessing the site**
2. **Setting goals**
3. **Making a work plan**
4. **Preparing the site**
5. **Installing native plants**
6. **Maintaining the site over the long term**

A section at the end of this chapter also highlights some voluntary incentive programs for prairie projects which are available to help agricultural landowners with prairie restoration projects.

Assessing the Site

If you have a farm, an orchard, or another type of working land, you probably know your property well. You have likely observed the site through the seasons, perhaps for many years. Your family may have worked or owned the land for generations. It is likely that you already have portions of your property in mind that you would like to restore as prairie habitat. Even if this is the case, we still recommend making a good map of your land and completing the site assessment tasks described in Chapter 3. If you are new to your property, then a site assessment is even more important in helping you understand the plants, animals, soils, and human aspects of the site.

The Natural Resources Conservation Service (NRCS) emphasizes the importance of knowing the cropping history of a field, particularly soil fertility and residual herbicides. Your local NRCS and university extension offices can provide helpful baseline information and technical guidance. If non-native plants are a concern (and they probably are), consult your county noxious weed board for help in identifying the species and the effective control methods for reducing or eliminating noxious weeds. Chapter 2 of this guide will also help you identify both non-native and native prairie species.

PHOTO BY: ESA Adolfson

Take advantage of whatever information your county assessor's office can provide—aerial photos, parcel maps, ownership history. Consult the resources appendix of this guide for additional information sources.

A GPS unit can be very helpful in making a detailed map of your property showing structures, vegetation types, and so on. If you don't have access to GPS, you can sketch the important features on an aerial photo.

After an initial assessment, you are prepared to set prairie restoration goals.

Setting Goals

Many factors play into setting realistic goals for a prairie restoration project on working lands. A few key things to consider:

- The condition of the land—particularly whether it is dominated by non-native plants, native prairie species, or a combination.
- Whether you will continue using this part of your property to produce food or fiber, or you plan to retire the land from production.
- How much time and money you can invest in the restoration project—from site preparation through several years of monitoring and maintenance.
- What tools and resources can support your efforts (for example, NRCS technical assistance, federal farm conservation programs).

Prairie species in unexpected places. In 2004, botanists from the Washington Department of Natural Resources undertook a survey to look for rare prairie plant species in southwestern Washington. Using GIS and other information, they narrowed the search to areas historically recorded as prairies, and that had prairie soil types and the right elevations to support prairie habitat. Then they headed into the field to assess these areas. Surprisingly, they found that even in historic prairies that had been almost entirely converted to agriculture, remnant populations of rare plant species could be found. "Nearly all of the rare plant populations found in the course of the survey were found along fencerows, and in most cases the vegetation on either side of the fence was dominated by non-native species," the researchers report. "Some rare plants were seen in fields that were completely dominated by non-native species." For more information, see *Southwestern Washington Prairies: Using GIS to Find Rare Plant Habitat in Historic Prairies* by Florence Caplow and Janice Miller, Washington Department of Natural Resources – Natural Heritage Program, December 2004.

The following table presents example goals for different types of situations.

Table 6-1. Example Goal-setting

Existing Condition	Planned Uses/Goals	Methods to Achieve Goals
Fallow cropland—dominated by non-native vegetation	Retire land from crop production, restore to native prairie and Garry oak habitat.	Reduce cover of non-native vegetation across the site. Reseed most of site with native prairie grasses and forbs. Plant Garry oak seedlings in remaining area.
Pasture land, heavily grazed	Continue grazing but at a lower intensity. Integrate native prairie species.	Set up a rotational grazing program timed to benefit native plant species growth and reproduction. Seed bare areas and fence lines with native prairie grasses and herbs.
Pasture and adjacent forests (mixed conifer/oak) used for grazing	Restore Garry oak woodland habitat.	Control/manage livestock access to forest. Thin conifers to allow growth of existing oaks. Supplement with planting of native forbs in the understory.
Persistent wet area within crop field or pasture	Restore to a native wet prairie habitat.	Control/manage livestock access or equipment damage. Retire the wet area from production. Reseed with native wet prairie grasses and herbs.
Small hobby farm and fruit stand located on historic prairie	Continue to operate farm, integrate native prairie species to improve habitat and provide visual interest.	Control non-native plants in areas selected for restoration (e.g., prairie gardens, fencerows). Replant these areas with native prairie grasses and forbs. Add signs to identify native plants for visitors.

If you are planning to restore a large area, consider dividing it into smaller, manageable sections that you will tackle in phases. For example, if you want to restore 20 acres of fallow cropland that is heavily infested by noxious weeds, your goal for the first year might be to control the weeds and restore native species on five acres. Not only does this make the project more manageable, it allows time for you to see whether the methods you're using are appropriate and will be successful on your site. You can adjust those methods as you continue to maintain the first five acres and restore additional acres in the future.

Making a Work Plan

The work plan for your project describes how you will accomplish your restoration goals. For each goal, make a list of the tools, equipment, materials, and labor needed. For example, control of non-native vegetation may require a mower, herbicide, weed wrenches, and workers. Planting native species requires seed and a means to apply it (such as a drill seeder). Depending on the project, you may also need fencing materials and equipment.

Don't forget maintenance! Ongoing control of non-native plants and noxious weeds is imperative. Plan on monitoring and doing weed control at least twice a year (spring and fall) for several years.

The work plan should also include an estimated schedule and budget for each task. This is a good reality check, to make sure your goals are reasonable given your resources.

Preparing the Site

The preparation of your site is the next step. Thorough preparation, including removal of non-native and invasive species, will increase success. Depending on your goals, you may be dealing with a large tract of land or a narrow hedgerow – this will influence your site preparation methods. Chapter 4 of this guide provides an overview of site preparation methods. For specific control methods for common non-native plant species, see the resources appendix.

During the last year of crop production prior to conversion to native species, consider using herbicides that degrade quickly and leave only low residual levels in the soil. The NRCS also recommends focusing on weed control in heavily infested fields for a year or two prior to planting natives. See the NRCS Technical Notes on *Planning Site and Seedbed Preparation for Cropland Conversion to Native Species* (August 2009) and *Seedbed Preparation and Seed to Soil Contact* (October 2005) for additional recommendations.

Controlling non-native vegetation is the bane of prairie restoration, and the subject of ongoing work by site managers and scientists. Lynda Boyer, a restoration biologist and native plant manager with Heritage Seedlings, Inc., of Salem, Oregon, has prepared detailed, practical information about techniques to restore prairie and oak habitat. Her document, last updated in March 2010, is available at http://www.heritageseedlings.com/PDF/stewardship/PrairieandOakRestorationMethodsMarch2010.pdf. While

Elements of a Work Plan. In your work plan, remember to include the following:

- A map or sketch showing the project area in relation to existing site features.
- A list of site preparation tasks that will need to be completed before native plants can be installed (for example, initial control of non-native vegetation).
- A list of native plants selected for the site, including species names (common and scientific names), quantities, nursery sources, and costs.
- A maintenance schedule for the project, showing when tasks such as weed control will occur each year.
- A list of materials and equipment needed for each stage of the project.
- A schedule for monitoring the site and making adjustments as needed.

her work is in the Willamette Valley, the methods she describes are applicable to Puget Sound prairies. The methods described depend on the starting conditions—whether remnant prairie with a lot of native plants, fallow fields with no native species, cultivated fields, etc. In particular, these conditions influence the methods used to reduce non-native plants while protecting desirable native species.

Another recent study is *Regional Strategies for Restoring Invaded Prairies* (Stanley *et al.*, 2010), available at http://appliedeco.org/conservation-research/prairie-restoration-research. This report describes a five-year study to test combinations of treatment methods for restoring degraded prairies and oak savannas in the Pacific Northwest. Test plots were established at 10 sites between the Willamette Valley and Vancouver Island, BC. The researchers experimented with combinations of summer and fall mowing, grass-specific and broad-spectrum herbicide, and fall burning, as well as reseeding with native species. Key findings include:

- Grass-specific herbicide is effective for control of invasive grasses, with minimal damage to native species.
- Fire is useful as a site preparation tool but may need to be followed by herbicide application to control non-native plants that resprout.
- Mowing is not effective in reducing the abundance of non-native plants and can negatively affect native species depending on timing.
- Reseeding of native species following weed control treatment is vital to increasing native plant abundance and diversity. Most remnant prairie sites have no existing native seed bank (see next section on Installing Native Plants).

PHOTO BY: Abbey Brown

Installing Native Plants

Controlling non-native invasive species will give any existing native plants room to spread, but your project will be more successful if you supplement natural regeneration with installation of native species.

How to Plant

Chapter 4 discusses planting methods for seed, plugs, and containerized plants. For large areas, seeding is the most cost-effective approach. Large-scale seeding equipment, such as a seed drill or a hydroseeder, may be the most efficient method for planting on working land, especially if that equipment is already available to you. Broadcast or direct seeding by hand or with a mechanical broadcast seeder are also good options. Sowing rates are different for drill and broadcast seeding; see sources such as Boyer (2010) in the resources appendix for guidance.

If you are restoring a small area, you may want to go to the residential lands discussion in Chapter 5 for tips on prairie gardening. Planting plugs can be very effective in giving plants a healthy start, albeit it is expensive for large-scale restorations.

When to Plant

Native plants are typically installed during the rainy season, typically late October through February in the Pacific Northwest. Installation during rainy, cool weather allows the plants to establish before they are stressed by summer drought conditions. Planting during the winter also allows for seed ***stratification***. If planting occurs during the spring (March through May), supplemental watering will likely be needed through the summer.

Installation of native plants should be closely coordinated with weed control. For example, pastures often are infested with non-native forbs but relatively little non-native grass. In this situation, you can seed native grasses only the first year, continue application of an herbicide specific to broadleaf forbs, and then seed native forbs later. Or you may choose to focus on intensive weed control only for a few years, followed by seeding native grasses and forbs at the same time after the weed seed bank is exhausted. We recommend review of the two studies described above (Boyer, 2010, and Stanley et al., 2010) for detailed information about the timing of non-native plant control and native seeding.

What Species to Plant

When choosing which species to plant, consider the growing conditions of your site—how much sun it receives, whether it is wet or dry, and so on. Your goals for the project are also important, particularly if you want to improve habitat for certain types or species of wildlife. For example, butterflies require specific plants as hosts for caterpillars and to provide nectar sources for adults.

Restoring Oak Habitat. For information on restoring Garry oak woodlands, see the following documents:

- *A Practical Guide to Oak Release* published by the U.S. Forest Service Pacific Northwest Research Station (Harrington and Devine, 2006)
- *A Landowner's Guide for Restoring and Managing Oregon White Oak Habitats* published by the Bureau of Land Management (Vesely and Tucker, 2004)
- *Native Willamette Valley Prairie and Oak Habitat Restoration—Site Preparation and Seeding Information* (Boyer, Heritage Seedlings, Inc., 2010)
- *Planting Native Oak in the Pacific Northwest* published by the U.S. Forest Service (Devine and Harrington, 2010)

When making your plant species list, include some alternates if your first choices are not available from native plant nurseries. The resources appendix includes a list of nurseries to contact about availability and prices.

Where to Plant

Even if you don't have the opportunity to restore large blocks of land to prairie habitat, there are likely places on your property where prairie species can flourish. Field borders, hedgerows, filter strips, and swales take up relatively little productive area but can greatly benefit wildlife. These linear features can also trap sediment and pollutants in runoff, control erosion, intercept wind and dust, and provide a visual amenity to the site.

Maintaining the Site

As with all types of prairie restoration, maintenance is vital. Battling invasive plants is one of the biggest jobs in a restoration project. Both before and several years after planting native seeds or plugs is the prime time to weed out invasive plants, because that is when newly installed native plants are the most vulnerable. They need space, light, and nutrients to become well established.

Specific control methods for common non-native plant species are provided in the resources appendix. These include mechanical methods, such as pulling, cutting, grubbing, mulching, ***solarization***, and mowing; chemical methods (herbicides); and prescribed fire. The installation of native plants (discussed above) is also a type of weed control, in that well established native species compete with weeds for light, water, space and nutrients. A combination of methods is likely to be the most effective way to control non-native vegetation over the long term.

Grazing as a Maintenance Tool

Managed grazing can be a very helpful tool in controlling weeds. This method is even being used in urban areas, where herds of goats are used to graze on Himalayan blackberry. In agricultural areas, cattle, horses, sheep, and other livestock can also be managed to reduce non-native vegetation, prevent encroachment by woody vegetation, recycle nutrients, and otherwise improve conditions for prairie species. Grazing should be combined with other weed control techniques for maximum effectiveness.

The Nature Conservancy's Wildland Invasive Species Team has several general recommendations for using grazing as a weed control method (Tu et al., 2001):

- Introduce livestock when they are most likely to damage the invasive species while minimizing damage to natives (for example, during weed flowering and before weed seed production).
- Closely monitor grazing herds to ensure that overgrazing does not occur. Overgrazing can damage the native species cover and disturb soils, creating an environment conducive to increased weed establishment.
- Several years of intensive grazing, followed by annual brief periods of grazing by the same type of livestock, may be needed to control an infestation of non-native plants.
- Prevent weed seed from moving to new areas. Livestock removed from an infested area should not be transported to weed-free areas until all seeds have passed through their digestive tracts (five to nine days). Livestock should also be schecked for weed seeds trapped in manes and hair.
- Some noxious weed species, such as tansy ragwort, are poisonous to most livestock. Know which toxic weeds are present and should not be grazed. Your local university extension office or weed control board can provide assistance.

PHOTO BY: ESA Adolfson

Timing the presence of livestock to the seasons of the year is key to success. By allowing grazing at certain times of the year, and restricting grazing at other times, the livestock can actually provide weed control while avoiding damage to prairie species. The NRCS has provided the following guidelines for grazing on western Washington native prairies (Chaney, 2010):

- Defer grazing during the critical period for native plant species (typically mid-March until June 15 in western Washington) by moving livestock to fields seeded with introduced forage species. If all the fields contain native vegetation, avoid using a field during at least of portion of the critical period during one of every three years. The critical period will vary each year depending on annual weather conditions. Camas is typically a good indicator species: when camas leaves show evidence of grazing on approximately 10 percent of the plants, livestock should be deferred. When camas seedpods have formed, grazing can begin again. Try to maintain deferment until some of the camas seeds are mature, but it's more important to graze any overtopping introduced vegetation.
- If fields containing native species must be used in the spring critical period, maintain a minimum four-inch stubble height for camas and Roemer's (Idaho) fescue on more than 75 percent of the plants.
- During the rest of the year, maintain a minimum two-inch stubble height on at least half of the plants. This lower height will stress the non-native species and reduce litter buildup while not adversely affecting native species. Native plants are semi-dormant to dormant during this period, but invasive vegetation is actively growing.
- Avoid addition of fertilizers and compost in order to reduce competition from introduced grass and forbs.
- Avoid developing concentrated winter feeding areas that also tend to concentrate nutrients and non-native plants.

PHOTO BY: The Nature Conservancy

Other Management Practices

A number of other management tools can also be used for long-term maintenance of prairie habitats on working lands. These are summarized below. For more detailed information, worksheets, and specific recommendations about the following management practices, go to http://www.nrcs.usda.gov/partners/for_farmers.html.

A **firebreak** is a strip of bare land or vegetation that retards wildfires. Rather than leaving these areas bare all year, they can be used to grow native annual species outside of fire season. These areas can then be disked after the natives have set seed and established their own seed bank to resprout the following year. Or, the seeds can be harvested for sale.

A **cover crop** is typically planted to protect the soil from erosion during winter, and to provide nutrients when the cover crop is tilled under the following spring. Annual native species can be seeded in as part of the cover crop, especially around the edges of a field. If the farming schedule allows, wait until after the native species have set seed; then either collect the seed or till it into the soil to create a native plant seed bank.

Nutrient management can also benefit prairie species. Addition of certain nutrients or reduction of others such as nitrogen can create soil nutrient levels more typical of historic conditions. Through soil testing, it is possible to balance nutrient levels to benefit prairie species without adversely affecting crop production.

Forage harvest management is the strategic harvest of hay, silage, and other crops in a way that benefits wildlife. This involves maintaining appropriate harvest schedules, cover patterns, and plant height to provide suitable habitat for the desired species. For prairie species, consider the plant flowering periods, bird nesting periods, and butterfly utilization times.

Voluntary Incentive Programs for Prairie Projects. Numerous voluntary programs are available to help agricultural landowners with prairie restoration projects. Following are a few examples. Additional programs and detailed information including web pages are provided in the resources appendix.

- The **Grassland Reserve Program (GRP)** is a voluntary program that helps landowners protect, restore, and enhance grassland, rangeland, pastures, and shrubland. The program conserves prairie habitat while maintaining agricultural operations. The property owner works with Natural Resources Conservation Service (NRCS) to develop a grazing plan.
- The **Wildlife Habitat Incentives Program (WHIP)** is a national program administered by NRCS. WHIP is a voluntary program for private landowners to develop and improve quality habitat for important wildlife populations. The NRCS provides technical and financial assistance through cost-share agreements to implement habitat restoration and enhancement projects. During fiscal year 2009, prairies and oak woodlands were among the top priority habitat types for the program.
- The **Conservation Stewardship Program (CSP)** is another voluntary program for private and tribal agricultural landowners. The CSP encourages landowners to install and adopt additional conservation activities and improve existing activities on their lands. Proposals from landowners are evaluated through a competitive ranking process. Selected participants receive payment for their conservation activities.
- The **Partners for Wildlife Program** is a voluntary program funded by the U.S. Fish and Wildlife Service. This program encourages private landowners to develop native habitat to contribute to conservation of wildlife and plants.

PHOTO BY: Tom Noland

APPENDIX

A

Resources for Landowners

1. Bibliography

The South Puget Sound Prairie Landscape Working Group has an extensive online collection of prairie-related technical reports. Some but not all of those reports are listed here. For additional reports, see: http://www.southsoundprairies.org/documents.htm.

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2. Weed Control Options

Scot's Broom Control Options

Cytisus scoparius

Control Method	Description	Use Where . . .	Timing	Pros	Cons
Pulling	Pull small plants by hand; use a weed wrench for larger plants. Remove entire plant, including roots.	Scot's broom is interspersed with native plants. Restoration site or infested area is small. Good for residential lands.	Winter or spring, while soil is moist and before seed set.	Minimal training required – can be done by volunteers or laborers. Targeted - avoids damage to native vegetation.	Labor-intensive and time consuming. Soil disturbed by removal of Scot's broom roots provides an opportunity for establishment of other weeds. Does not destroy Scot's broom seed bank. A large amount of nitrogen-rich vegetation to dispose of. If not burned or disposed of off-site, provides nitrogen source for future weed infestations.
Cutting and herbicide (always read label instructions prior to use)	Use a saw or loppers to cut larger plants at ground level. Paint cut stems with herbicide to prevent resprouting. Leave roots in the ground. Herbicides such as Garlon and Crossbow can be foliar sprayed using backpack sprayers, or Round-up painted onto cut stems.	Scot's broom plants are large, and removal with a weed wrench would significantly disturb soils. Scot's broom is interspersed with native plants. Restoration site or infested area is relatively small.	Before seed set. Fall applications are used at Mima Mounds Natural Area after native plants have gone dormant and before fall rains.	Targeted – reduces drift and damage to native vegetation, soils, and native invertebrates. Less labor-intensive than removing roots.	Use of toxic chemicals. May require assistance from a licensed herbicide applicator, depending on site conditions and type of herbicide used. Slow mortality from foliar spraying alone. Does not destroy Scot's broom seed bank. A large amount of nitrogen-rich cuttings to dispose of. If not burned or disposed of off-site, provides nitrogen source for future weed infestations.
Mowing	Cutting mature plants with a tractor-pulled rotary mower; small tractors with 6-foot cutters; motorized brush cutters.	Most effective over large areas (tens or hundreds of acres). Small tractor mowers have been used within oak woodlands and on the Mima Mounds.	Summer drought will reduce regrowth; however, any time of year if soils are well drained. Otherwise wait until the dry season if using large equipment.	Can easily treat large areas of land.	A large amount of nitrogen-rich cuttings to dispose of. If not burned or disposed of off-site, provides nitrogen source for future weed infestations. Use of large mowing equipment and tractors can cause soil compaction. Can control populations but is not a permanent solution.
Burning	Prescribed and permitted burns.	Best over large areas where control barriers such as roads are in place. Not for residential use. No more than one-third of an area should be burned at a time.	When burn bans are not in effect. Late winter (February when rains have stopped for 1-2 weeks) or summer (mid-late July and September).	Summer burns can cause 90% Scot's broom mortality. Reduces long-term seed bank by stimulating germination of seed.	Can be costly depending on local regulations. Weather, safety, air quality and permit conditions can prevent burns at the last minute. Fire stimulates the germination of Scot's broom seed, which may necessitate spraying or other retreatment. Special consideration for native or rare invertebrates such as butterflies is needed.
Planting or Replanting	The planting of native prairie trees, shrubs, and groundcovers to create competition.	Any location can be planted as long as plants are suited to the water, soil, and sunlight conditions.	Planting in prairie regions is best in fall or early spring.	In conjunction with weed removal, helps to reduce space and water availability for weeds through competition.	Not effective by itself but in conjunction with weed removal or treatment. Scot's broom removal or treatment must occur first. Will require watering for at least two seasons during plant establishment. Continual maintenance and removal of Scot's broom will be necessary for survival of native plants.

For more information:
http://www.southsoundprairies.org/documents.htm
http://www.co.thurston.wa.us/tcweeds/weeds/fact-sheets/scotch%20broom.pdf

Non-native Grasses Control Options

Bent grasses *(Agrostis sp.),* tall oatgrass *(Arrhenatherum elatius),* common velvet grass *(Holcus lanatus),* orchardgrass *(Dactylus glomerata),* Kentucky bluegrass *(Poa pratensis)*

Control Method	Description	Use Where . . .	Timing	Pros	Cons
Pulling	Hand pulling using hand tools or shovels.	In small locations; residential gardens or where interspersed with native plants.	In spring before seed set.	Effective in small areas, targeted, protects native plants.	Labor intensive, requires detailed precision. May leave root segments that resprout
Sheet mulching	Smothering by overlapping layers of cardboard or burlap and mulching with 4-6 inches of compost, soil, or wood chips.	Small areas such as residential gardens.	Any time of year; should be left on the ground for at least one full season.	Can be very effective if no gaps or holes are made in the sheet mulch.	Regular pulling of newly sprouted stems and roots at edges or in gaps is required until grasses die. If no maintenance occurs, reinfestation is probable. Sheet mulch materials should be removed when ready to plant with native species.
Herbicide (always read label instructions prior to use)	Foliar spray application of grass-specific herbicides such as Fusilade, Poast, and Verdict.	In small or large areas depending on density of grasses and permit requirements. Use in aquatic areas or wetlands is regulated and may require a permit.	Annually in the spring for up to three years; rest for a year and see what regrows. Replant with natives.	If properly applied, can have effective and rapid results.	Use of toxic chemicals; potential for damage to desirable natives. May require a licensed applicator.
Grazing	Use of livestock such as goats, cattle, or horses to keep grasses mowed and prevent seed set.	In non-native grass monocultures over small or large areas. Preferably as a pre-treatment to other methods.	During the growing season.	Can reduce seed banks and reduce energy of grasses before a secondary treatment. Provides feed for livestock.	Does not kill grasses; if natives are present those too will be eaten by grazers. Can cause significant soil disturbance during wet season.
Mowing	Use of power mowers or weed-whackers to mow non-native grasses.	Where burning is not feasible. Large or small areas. Residential areas. Relatively open and even ground.	As the most abundant invasive species is flowering, or at the two most common flowering times, to cut back on seed production.	Easy and economical over large areas.	Some grass species have seed heads that will mature if they are cut and left lying on the ground. Difficult or unsuitable in uneven topography or if numerous obstacles are present. Generally not a permanent solution.
Burning	Prescribed and permitted burns.	Small or large areas where control barriers such as roads are in place. Not for residential use. No more than one-third of an area should be burned at a time.	When burn bans are not in effect. Late winter (February when rains have stopped for 1-2 weeks) or summer (mid-late July and September).	Removes thatch, revitalizes native grasses and forbs; creates spaces for new plants to germinate; stimulates new growth. Can return the soil to nutrient levels that favor natives over invasive grasses.	Can be costly depending on local regulations. Weather, safety, air quality and permit conditions can prevent burns at the last minute. Special consideration for native or rare invertebrates such as butterflies is needed.
Seeding	Broadcast or direct seeding, drill seeding, or hydroseeding with native grasses and forbs to increase competition.	Anywhere with available soil surface.	Fall or early spring.	Seeding is a relatively inexpensive way to cover large areas with native grasses and forbs.	Must be combined with other methods (spraying/burning) in order to be effective.

For more information:

Boyer, L. March 2010. Native Willamette Valley Prairie and Oak Habitat Restoration Site-Preparation and Seeding Information – Appendix B. Heritage Seedlings Inc. www.heritageseedlings.com (specific herbicide use information)

Exotic Broadleaf Forbs Control Options

hairy cat's ear *(Hypochaeris radicata),* common dandelion *(Taraxacum officinale),* oxeye daisy *(Leucanthemum vulgare),* common St. John's wort *(Hypericum perforatum),* white clover *(Trifolium repens),* sheep sorrel *(Rumex acetosella)*

Control Method	Description	Use Where . . .	Timing	Pros	Cons
Pulling	Hand pulling using hand tools or shovels.	Small areas such as residential gardens, or where native species are interspersed.	Spring or fall, when the ground is moist and before seed set.	Minimizes damage to desirable native plants.	Disturbed soil must be seeded or mulched to reduce opportunities for re-infestation. Time consuming and labor intensive. Does not kill seed bank.
Sheet mulching	Smothering by overlapping layers of cardboard or burlap and mulching with 4-6 inches of compost, soil, or wood chips.	Small areas such as residential gardens.	Any time of year; should be left on the ground for at least one full season.	Can be very effective if no gaps or holes are made in the sheet mulch.	Regular pulling of newly sprouted stems and roots at edges or in gaps is required until weeds die. If no maintenance occurs, reinfestation is likely. Sheet mulch materials should be removed when ready to plant or sow seed.
Herbicide (always read label instructions prior to use)	Glyphosate – all-purpose 2,4-D – thistles, dandelions, mustards, geraniums Mecoprop "MCPP" – all-purpose except for vetch and St. John's wort Clopyralid and Triclopyr – thistles and legumes/clovers (spot spray only)	Large infestations or small and scattered.	Prior to flowering or pollination. Late winter/early spring.	If properly applied, can have effective and rapid results.	Use of toxic chemicals; may require a licensed applicator. Potential for damage to desirable native vegetation.
Grazing	Use of livestock such as goats, cattle, or horses to keep weeds mowed and prevent seed set.	In non-native forb monocultures over small or large areas. Preferably as a pre-treatment to other methods.	During the growing season.	Can naturally reduce seed banks, and reduce energy of non-native forbs before a secondary treatment. Provides feed for livestock.	May not have an even grazing effect on all non-native species. If natives are present, those too will be eaten. Can cause significant soil disturbance during wet season.
Mowing	Use of power mowers or weed-whackers to mow non-native grasses.	Where burning is not feasible. Large or small areas. Residential areas. Relatively open and even ground.	Before seed set.	Easy and economic over large areas.	Some species have seed heads that will mature if they are cut and left lying on the ground after mowing. Difficult or unsuitable in uneven topography or if numerous obstacles are present. Generally not a permanent solution.
Burning and herbicide combination	Prescribed burning followed by application of herbicide on weeds that resprout (refer to herbicide information above).	Small or large areas where control barriers such as roads are in place. Not for residential use. No more than one-third of an area should be burned at a time.	When burn bans are not in effect. Late winter (February when rains have stopped for 1-2 weeks) or summer (mid-late July and September).	Removes thatch, revitalizes native grasses and forbs; creates spaces for new plants to germinate; stimulates new growth. Can return the soil to nutrient levels that favor natives over invasive grasses.	Can be costly depending on local regulations. Weather, safety, air quality and permit conditions can prevent burns at the last minute. Special consideration for native or rare invertebrates such as butterflies is needed.
Seeding	Broadcast or direct seeding, drill seeding, or hydroseeding with native grasses and forbs to increase competition.	Anywhere with available soil surface.	Fall or early spring.	Seeding is a relatively inexpensive way to cover large areas with native grasses and forbs.	Must be combined with other methods (spraying/burning) in order to be effective.

For more information:

Boyer, L. March 2010. Native Willamette Valley Prairie and Oak Habitat Restoration Site-Preparation and Seeding Information – Appendix B. Heritage Seedlings Inc. www.heritageseedlings.com (specific herbicide use information)

Institute for Applied Ecology – Prairie Restoration Research. http://appliedeco.org/conservation-research/prairie-restoration-research.

Himalayan Blackberry and Evergreen Blackberry Control Options

Rubus discolor or Rubus armeniacus *Rubus laciniatus*

Control Method	Description	Use Where . . .	Timing	Pros	Cons
Cutting and grubbing	Hand tools or brush cutters to cut down blackberry canes (vines). Dig out roots using shovels or other grubbing tools.	Individual plants or thickets in small patches or larger areas.	Any time of year. If possible, avoid the spring bird-nesting period.	Very effective if root balls are removed.	Requires removal of entire root ball. Requires maintenance to control resprouts for two to three years. Removal of large roots causes soil disturbance.
Cutting and mulching	Hand tools or brush cutters to cut down blackberry canes (vines). Cover with 10-12 inches of arborist chips.	Small patches or thickets.	Any time of year. If possible, avoid the spring bird-nesting period.	Reduced soil disturbance. Can be effective if regularly maintained.	Requires regular pulling of resprouting canes for several years. When blackberry is eliminated, arborist chips should be removed when ready to plant or sow seed.
Herbicide (always read label instructions prior to use)	Foliar spray or painting of cut stems with non-selective glyphosate herbicide (Round-up).	On large patches or thickets where hand removal is not feasible. Do not use herbicide near aquatic habitats.	Glyphosate best applied in September for 3-5 years.	Can be cost effective on large areas of blackberry.	Use of toxic chemicals that may require a licensed applicator. If replanting, dead canes and roots still need to be removed. Glyphosate is non-selective and drift can kill or harm neighboring plants, and harm fish and amphibians.
Grazing	Use of goats to eat patches or thickets of blackberry.	Large or small patches in small or large areas.	Any time of year. If possible, avoid the spring bird-nesting period.	Very effective at eliminating large infestations, especially on steep slopes. Reduces the need for gas-powered mowers or herbicide.	Grazers will eat desirable native plants if present. Can be expensive.
Mowing	Use of power mowers or weed-whackers to mow blackberry patches or thickets.	Patches or thickets where native shrubs and forbs are absent.	Any time of year. If possible, avoid the spring bird nesting period.	Can be fast and economical for thickets over large areas.	Difficult or unsuitable in uneven topography or if numerous obstacles are present. Generally not a permanent solution.
Replanting	Planting of trees or shrubs to create shade in areas that will not be restored to grassland prairie. Planting of native grasses and forbs following initial control and removal treatments.	Plant trees or shrubs in thickets or patches that will not be restored to grassland prairie. Plant native grasses and forbs in large or small areas that will be restored to a native prairie community.	Fall and winter dormant season. Spring planting also works but may require additional watering.	Effective at long-term control. Utilizes natural processes.	Regular weeding and watering is required to ensure establishment of plantings.

For more information:
http://www.co.thurston.wa.us/tcweeds/documents/blackberry.pdf
Boyer, L. March 2010. Native Willamette Valley Prairie and Oak Habitat Restoration Site-Preparation and Seeding Information – Appendix B. Heritage Seedlings Inc.
www.heritageseedlings.com (specific herbicide use information)

Tansy Ragwort Control Options

(Senecio jacobaea)

Control Method	Description	Use Where . . .	Timing	Pros	Cons
Pulling	Use of hand tools or hand pulling. Tansy ragwort is toxic and gloves should be used at all times when handling this plant.	Small infestations or individuals.	Pull mature second year plants before seed set. Pull when soils are moist, allowing the roots to be easily removed.	Can be effective on small number of plants.	The plant can regrow if roots break off and remain in the soil after the plant is pulled. Pulled plants will still go to seed and must be disposed of off-site (landfill). Does not kill seed bank.
Herbicide (always read label instructions prior to use)	Foliar spray or spot application of leaves and stems with non-selective glyphosate herbicide (Round-up) or selective aminopyralid herbicide (Milestone).	Individuals, small and scattered patches.	When the plant is growing its flowering stalk, before full flower stage.	Can be effective if timed properly.	Does not prevent germination of tansy ragwort seed. Ineffective beyond the brown-petal stage. Use of toxic chemicals that may require a licensed applicator.
Grazing	This should not be used as a control method.	Never – Plant is toxic to most livestock (not sheep).			Highly toxic – should not be ingested by most livestock or humans.
Mowing	Use of power mowers or weed-whackers to mow growing stems.	Large or small infestations where hand-pulling is not possible.	During stem growth before flowering or seeding.	Effective control to reduce seed bank.	Does not kill or remove plants. Will only keep populations in check. Cut flowering stems will still produce seed; bag for disposal.
Replanting	Broadcast or direct seeding, drill seeding, or hydroseeding with native grasses and forbs to increase competition.	Large or small areas where tansy ragwort has been controlled. Anywhere with available soil surface.	Fall or early spring. Spring planting may require additional watering.	Effective at longer term control. Utilizes natural processes. Seeding is a relatively inexpensive way to cover large areas with native grasses and forbs.	Regular weeding and watering is required to ensure establishment of plantings.

For more information:
http://www.co.thurston.wa.us/tcweeds/weeds/fact-sheets/Tansy%20Ragwort_2011.pdf
http://www.nwcb.wa.gov/weed_info/Senecio_jacobaea.html

Thistles Control Options

Canada thistle *(Cirsium arvense),* bull thistle *(Cirsium vulgare)*

Control Method	Description	Use Where . . .	Timing	Pros	Cons
Pulling	Use of hand tools or hand pulling.	Small infestations or individual plants.	Pull mature plants before seed set. Best when soils are moist, allowing the roots to be easily removed.	Can be effective on small number of plants.	Generally not effective on large infestations due to root masses with large energy reserves.
Tilling	Tilling for cultivation to break up the root system.	Cropland or pastures with patchy or large infestations where burning or herbicide is not preferred.	Till to a depth of 2 – 4 inches every 21 days.	Can reduce thistle shoots up to 98 percent.	Best for transitioning cropland or pasture to prairie. Can take several years before site is ready for prairie plantings.
Herbicide (always read label instructions prior to use)	Spot spray application of leaves and stems with selective 2,4-D or Clopyralid and Triclopyr (Milestone) herbicides. Spot spray of non-selective glyphosate herbicide (Round-up).	Small patches, scattered individuals or large infestations.	Early to mid spring before flower or seed production; in fall before a killing frost.	Can effectively eliminate infestations.	Retreatment may be necessary for long-term control. Use of toxic chemicals that may require a licensed applicator.
Grazing	Generally not an effective method.	Livestock may not eat the prickly mature stems.			
Mowing	Use of power mowers or weed-whackers to mow growing stems.	For control (not removal) of large or small infestations where chemical treatment is not possible.	Before seed set at a 7-28 day interval for several years.	Generally easy and economical over large areas.	Will control but not eliminate infestations. Flowering heads may go to seed if they are cut and left lying on the ground after mowing; bag for disposal. Difficult or unsuitable in uneven topography or if numerous obstacles are present.
Burning and herbicide	Prescribed burning followed by application of herbicide on weeds that resprout (refer to herbicide information above).	Small or large areas where control barriers such as roads are in place. Not for residential use. No more than one-third of an area should be burned at a time.	When burn bans are not in effect. Late winter (February when rains have stopped for 1-2 weeks) or summer (mid-late July and September).	Removes thatch, revitalizes native grasses and forbs; creates spaces for new plants to germinate; stimulates new growth. Can return the soil to nutrient levels that favor natives over invasive grasses.	Can be costly depending on local regulations. Weather, safety, air quality and permit conditions can prevent burns at the last minute. Special consideration for native or rare invertebrates such as butterflies is needed.
Seeding	Broadcast or direct seeding, drill seeding, or hydroseeding with native grasses and forbs to increase competition.	Large or small areas where thistle has been controlled. Anywhere with available soil surface.	Fall or early spring. Spring planting may require additional watering.	Effective at longer term control. Utilizes natural processes. Seeding is a relatively inexpensive way to cover large areas with native grasses and forbs.	Regular weeding and watering is required to ensure establishment of plantings.

For more information:
http://www.co.thurston.wa.us/tcweeds/weeds/fact-sheets/Canada_thistle_2011.pdf
http://www.agdepartment.com/NoxiousWeeds/pdf/CANADATHISTLE.pdf

Knotweeds Control Options

Japanese knotweed *(Polygonum cuspidatum),* Bohemian knotweed *(Polygonum x bohemicum),* giant knotweed *(Polygonum sachalinense),* Himalayan knotweed *(Polygonum polystachyum)*

Control Method	Description	Use Where . . .	Timing	Pros	Cons
Pulling and grubbing roots	Pulling stems and digging out root masses to reduce biomass and overall energy.	Individuals, small patches within gardens. Best in concert with herbicide.	During the growing season.	If soils are loose, removal by hand and shovel is relatively easy.	Requires constant pulling and digging for years and may encourage stem growth. Can create erosion issues on slopes. Cut stems and roots can grow new plants if left on site; must be landfilled, not composted.
Herbicide (always read label instructions prior to use)	Stem injection or foliar spray using imazapyr, triclopyr, or glyphosate products.	Stem injection when native plants are present, or foliar spray in large monocultural knotweed stands.	During the growing season for foliar spray. Stem injection requires the thick stems which develop during late spring and early summer (early June) on mature plants.	Very effective method of control and eradication if used properly. Stem injection of stands in riparian and wetland areas is the safest method of application.	Can only apply herbicide in a certain square footage at a time. Must treat re-growth to prevent reinfestation. Use of toxic chemicals that may require a licensed applicator.
Covering or Smothering	Cover stands loosely with heavy-duty geotextile fabric or black plastic weighted down by stones and blocks; stomping of regrowth.	Isolated and smaller patches on open terrain.	Smothering best started in early growing season or later in the season following multiple cutting treatments.	Method is still being studied as to its effectiveness. May reduce the need for herbicides.	Fabrics and plastics can be expensive. If fabric is not left loose, knotweed will burst through, making holes. Materials must be kept on and maintained for up to five years. Requires crushing of regrowth every 2-4 weeks.
Grazing	Use of livestock such as goats to mow and control knotweed stems.	Knotweed forms a monoculture and native plants are absent.	During the growing season.	Can reduce biomass, seed, and eliminate the need for removal of cut stalks from mowing.	Only provides control; does not eradicate roots. In some cases, may encourage spread of roots and stem growth.
Mowing or crushing	Use of power mowers, weed-whackers, or other equipment to crush individual stems or large stands.	When herbicide and grazing are not applicable.	Multiple times throughout the growing season.	Rapid method due to the fleshy nature of stems during the growing season. Stems easily break.	Stems and roots grow new plants if left on site; must be bagged for disposal, not composted. Cut plant parts create opportunity to spread infestations. May not be a permanent solution.
Replanting	Replant with natives to create competition.	Only following initial treatments to eradicate knotweed infestations.	After knotweed has been eliminated from the site.	Establishing native tree and shrub cover can create competition for future infestations.	Native prairie grasses and forbs will not compete with knotweed. Must eliminate knotweed first.

For more information:
http://www.co.thurston.wa.us/tcweeds/documents/knotweedIDPNW0610.pdf
http://www.pullman-wa.gov/content/WYSIWYG/Recreation/Japanese%20knotweed.pdf

Reed Canarygrass Control Options

Phalaris arundinacea

Control Method	Description	Use Where . . .	Timing	Pros	Cons
Herbicide (always read label instructions prior to use)	Foliar spray application of non-specific glyphosate (Round-up or Glyfos) or imazapyr (Habitat or Arsenal) herbicides.	In small or large areas depending on density of grass and permit requirements. Use within 50 feet of aquatic areas or wetlands is regulated and requires a permit and use of an aquatic-safe mixture (Aquamaster, Rodeo, Habitat).	Glyphosate and imazapyr are best applied on early young growth; however these can be applied at any time during active growth. Mowing then spraying regrowth can be an effective method.	If properly applied and used in conjunction with other techniques, can have effective and rapid results.	Use of toxic chemicals; may require the need for a licensed applicator. Potential for damage to desirable native species.
Solarization	Use of large sheets of plastic or fabrics to kill plants by solarization.	Small pastures, yards, or small infestations in larger areas.	For 1-3 consecutive years.	Facilitates sterile soils for seeding or planting of natives.	Materials can be expensive and unattractive. Not desirable when natives are mixed with reed canarygrass, on large sites, or areas with uneven topography.
Grazing	Use of livestock such as goats, cattle, or horses to keep grasses mowed and prevent seed set.	Large or small fields or pastures.	During early to mid-spring or following burns when regrowth is palatable.	Can naturally reduce seed banks, and reduce energy of grasses following or prior to a secondary treatment. Provides feed for livestock.	Not for sites with a significant number of native plants. Can cause significant soil disturbance during wet season.
Mowing	Use of power mowers or weed-whackers to reduce aboveground biomass. Best used in combination with herbicide treatment.	Where burning or herbicide application is not feasible. Large or small areas. Residential areas. Relatively open and even ground.	Before the emergence of seed heads.	Easy and economical over large areas.	Seed heads will mature if they are cut and left lying on the ground. Difficult or unsuitable in uneven topography or if numerous obstacles are present. Remaining reed canarygrass rootmass may impede establishment of native vegetation. Controls but does not eliminate weed population.
Burning and herbicide	Prescribed and permitted burns followed by herbicide application on regrowth. Treat with glyphosate or sethoxydim.	Small or large areas where control barriers such as roads are in place. Not for residential areas. No more than one-third of an area should be burned at a time.	When burn bans are not in effect. In spring when reed canarygrass is growing, but before natives break dormancy.	Removes thatch, revitalizes native grasses and forbs; creates spaces for new plants to germinate; stimulates new growth. Can return the soil to nutrient levels that favor natives over invasive grasses.	Can be costly depending on local regulations. Weather, safety, air quality and permit conditions can prevent burns at the last minute. Special consideration for native or rare invertebrates such as butterflies is needed.
Replanting	Replant with natives to create competition and shade out reed canarygrass.	Anywhere reed canarygrass control is occurring.	Fall or early spring. Spring planting may require additional watering.	Native trees and shrubs can be planted in infested areas to eventually shade out reed canarygrass. Increases biodiversity and wildlife habitat.	Regular weeding and watering is required to ensure establishment of plantings. Prairie grasses and herbs can't compete; reed canarygrass root mass must be eliminated first.

For more information:
http://www.co.thurston.wa.us/tcweeds/weeds/fact-sheets/Reed%20Canary%20Grass_2011.pdf
Wisconsin Reed Canary Grass Management Working Group. 2009. Reed Canary Grass (Phalarais arundinacea) Management Guide: Recommendations for Landowners and Restoration Professionals.

Douglas-fir Control Options

Pseudotsuga menziesii

Control Method	Description	Use Where . . .	Timing	Pros	Cons
Pulling	Pull seedlings and saplings by hand if soils are loose; use shovels or other digging tools on larger plants.	In areas of prairie or oak woodland being invaded by Douglas fir.	Any time of year.	Effective maintenance method to help maintain or restore prairie and oak stands.	Hand pulling or digging not possible on mature fir trees.
Cutting/Logging	Cut small trees or hire a licensed arborist or logging company to selectively log large undesirable Douglas fir trees.	Where Douglas firs have invaded prairie or oak woodland.	Any time of year.	Effective at removing competition for light and nutrients. Logged firs may generate some revenue.	Can be expensive even if logs are sold for lumber. Disturbs soil, creating opportunity for weed infestations.
Girdling	Cut and peel away bark of mature tree in a complete ring around base of trunk. Tree will eventually die, leaving a dead snag.	In oak stands to increase light availability over time. Can be done in residential areas if the trees are also topped to reduce hazards.	Late winter before leaves emerge. Girdling kills the tree within one full year.	Reduces the need for logging. Dead standing trees (snags) provide habitat.	Slower process than logging. Can be hazardous to leave standing dead trees.

Notes:

Douglas-fir is a native species but is considered invasive in prairies and Garry oak stands. Felling large trees in residential lands is hazardous and should always be performed by a professional arborist. Leaving tall snags close to structures is not advised; however, a portion of the trunk can be retained (depending on its diameter), which can reduce risks while still providing snags for wildlife. Large trees are increasingly rare in residential and urban areas. If your property contains large Douglas-fir trees, consider whether eliminating them is an overall ecological benefit for your property and neighborhood.

3. Native Plant Suppliers

The following list provides contact information for some of the many western Washington native plant suppliers and salvage programs. This list is not exhaustive, nor is it intended to endorse these particular companies or programs. It is simply a starting point for landowners wishing to obtain native prairie plants or seeds.

Name	Contact Information
Fourth Corner Nurseries	5652 Sand Rd. Bellingham, WA 98226 (360) 592-2250 http://www.fourthcornernurseries.com/
Heritage Seedlings, Inc.	4194 71st Ave SE Salem, OR 97317-9208 (503) 585-9835 http://www.heritageseedlings.com/index.htm
Inside Passage	PO Box 639 Port Townsend, WA 98368 (360) 385-6114 www.insidepassageseeds.com
Native Plant Salvage Alliance	http://www.ssstewardship.org/index.htm
Native Plant Salvage Foundation	4131 Mud Bay Rd W Olympia, WA 98502 (360) 867-2166 http://www.nativeplantsalvage.org/index.php
Native Seed Network	www.nativeseednetwork.org
Pacifica Restoration	4625 5th Ave. NW Olympia, WA 98502 (360) 556-4271 gonetoseed@gmail.com
Sound Native Plants	PO Box 7505 Olympia WA 98507 (360) 352-4122 www.soundnativeplants.com
Washington Native Plant Society	List of nurseries: www.wnps.org/landscaping/nurserylist.html

4. Funding and Incentive Programs

Program	Description	Agency or Organization and Web Page
Grassland Reserve Program	A voluntary program that helps landowners protect, restore, and enhance grassland, rangeland, pastures, and shrubland. The program conserves prairie habitat while maintaining agricultural operations. The property owner works with NRCS to develop a grazing plan.	**Natural Resources Conservation Service** http://www.nrcs.usda.gov/programs/grp/
Wildlife Habitat Incentives Program	A voluntary program for private landowners to develop and improve quality habitat for important wildlife populations. The NRCS provides technical and financial assistance through cost-share agreements to implement habitat restoration and enhancement projects.	**Natural Resources Conservation Service** http://www.wa.nrcs.usda.gov/programs/whip/WHIP11/index.html
Conservation Stewardship Program	A voluntary program for private and tribal agricultural landowners. Encourages landowners to install and adopt additional conservation activities and improve existing activities on their lands. Proposals from landowners are evaluated through a competitive ranking process. Selected participants receive payment for their conservation activities.	**Natural Resources Conservation Service** http://www.wa.nrcs.usda.gov/programs/csp/CSP11/index.html
Conservation Technical Assistance Program	A voluntary program to help landowners make sound natural resource management decisions. Assistance may be in the form of resource assessment, practice design, resource monitoring, or follow-up of installed practices. Landowners should contact their local NRCS office for assistance.	**Natural Resources Conservation Service** http://www.nrcs.usda.gov/programs/cta/
Partners for Wildlife Program	A voluntary program funded by the U.S. Fish and Wildlife Service. This program encourages private landowners to conserve or restore native ecosystems that provide important habitat for rare, declining, or protected species.	**U.S. Fish and Wildlife Service** http://www.fws.gov/grants/
Landowner Incentive Program	A competitive grant program designed to provide financial assistance to private landowners for the protection, enhancement or restoration of habitat to benefit species at risk on privately owned lands.	**Washington Department of Fish and Wildlife** http://wdfw.wa.gov/grants/lip/index.html
Native Plant Conservation Initiative	Grant program that funds multi-stakeholder projects focused on the conservation of native plants and pollinators under any of the following focal areas: conservation, education, restoration, research, sustainability, and data linkages.	**National Fish and Wildlife Foundation** http://www.nfwf.org/AM/Template.cfm?Section=Charter_Programs_List&TEMPLATE=/CM/ContentDisplay.cfm&CONTENTID=17849

5. Agencies and Organizations

Agency or Organization	Website
Audubon Washington	http://wa.audubon.org/
Cascade Land Conservancy	http://www.cascadeland.org/
Cowlitz County	Noxious Weed Control Board: http://www.co.cowlitz.wa.us/noxiousweeds/ Geographic information systems (mapping): http://www.co.cowlitz.wa.us/gis/
Garry Oak Ecosystems Recovery Team	http://www.goert.ca/
Institute for Applied Ecology	Prairie restoration research page: http://appliedeco.org/conservation-research/prairie-restoration-research
Island County	Assessor's office: http://www.islandcounty.net/assessor/ Noxious Weed Control Board: http://www.islandcounty.net/weedcontrol/weedweb/wdtext/index.htm
Land Trust Alliance	http://www.landtrustalliance.org/
Lewis County	Weed Control: http://lewiscountywa.gov/weedcontrol Parcel map viewer: http://ims.lewiscountywa.gov/webmaps/composite2/viewer.htm
National Invasive Species Council	http://www.invasivespecies.gov/
National Wildlife Federation	Certified Wildlife Habitat Program: http://www.nwf.org/Get-Outside/Outdoor-Activities/Garden-for-Wildlife/Create-a-Habitat.aspx
Natural Resources Conservation Service	Main web page: http://www.nrcs.usda.gov/ Washington state office: http://www.wa.nrcs.usda.gov/ Washington NRCS field office contacts: http://www.wa.nrcs.usda.gov/contact/fieldoffices.html Washington Soil Survey web site: www.or.nrcs.usda.gov/pnw_soil/wa_reports.html Management practices for agricultural lands: http://www.nrcs.usda.gov/partners/for_farmers.html Washington NRCS Farm Bill Programs and Services (grants, incentive programs, etc.): http://www.wa.nrcs.usda.gov/programs/index.html

Agency or Organization	Website
Pacific Rim Institute for Environmental Stewardship	http://www.pacificriminstitute.org/
Pierce County	Geographic information systems (mapping): http://matterhorn.co.pierce.wa.us/publicgis/presentation/map.cfm?Cmd=INIT Noxious Weed Control Board: http://piercecountyweedboard.wsu.edu/
San Juan County	Assessor's office: http://sanjuanco.com/assessor/parcelsearch.aspx GIS data download library: http://sanjuanco.com/gis/gislib.aspx Noxious Weed Control Board: http://sanjuan.wsu.edu/noxious/
South Puget Sound Prairie Landscape Working Group	http://www.southsoundprairies.org/
The Nature Conservancy in Washington	http://www.nature.org/wherewework/northamerica/states/washington/
The Xerces Society for Invertebrate Conservation	http://www.xerces.org/
Thurston County	Noxious Weed Control Agency: http://www.co.thurston.wa.us/tcweeds/ Thurston GeoData Center: http://www.geodata.org/home.htm
U.S. Bureau of Land Management	Historic survey mapping: http://www.blm.gov/or/landrecords/survey/ySrvy1.php
USDA Farm Service Agency	Conservation programs: http://www.fsa.usda.gov/FSA/webapp?area=home&subject=copr&topic=crp)
U.S. Fish and Wildlife Service	Endangered species program: http://www.fws.gov/endangered/ Grant programs: http://wsfrprograms.fws.gov/Subpages/GrantPrograms/GrantProgramsIndex.htm
Washington Association of Conservation Districts	http://www.wacd.org/
Washington Biodiversity Project	http://www.biodiversity.wa.gov/index.html

Agency or Organization	Website
Washington Department of Fish and Wildlife	Main web page: http://www.wdfw.wa.gov/ Priority habitats and species: http://wdfw.wa.gov/conservation/phs/ Backyard Wildlife Sanctuary Program: http://wdfw.wa.gov/living/backyard/
Washington Department of Natural Resources	http://www.dnr.wa.gov/Pages/default.aspx
Washington Invasive Species Council	http://www.invasivespecies.wa.gov/
Washington Native Plant Society	Main web page: http://www.wnps.org/ Native Plants for Western Washington Gardens and Restoration Projects: http://www.wnps.org/landscaping/herbarium/index.html Contact information for local chapters: http://www.wnps.org/chapters.html
Washington Natural Heritage Program	Rare plant, animal, and ecological communities information: http://www.dnr.wa.gov/ResearchScience/Topics/NaturalHeritage/Pages/amp_nh.aspx
Washington State Department of Ecology	Outdoor burning information: http://www.ecy.wa.gov/programs/air/outdoor_woodsmoke/outdoorburnpermits.htm
Washington State Noxious Weed Control Board	http://www.nwcb.wa.gov/index.htm
Washington State University Extension	Main web page: http://ext.wsu.edu/ Office locations by county: http://extension.wsu.edu/locations/Pages/default.aspx

6. Government Sources for Maps and Aerial Photos

Agency	Products	Website
Cowlitz County	Online mapping of parcels in the county.	http://www.co.cowlitz.wa.us/gis/
Island County	Assessor's office parcel data.	http://www.islandcounty.net/assessor/
Lewis County	Online mapping of parcels in the county.	http://ims.lewiscountywa.gov/webmaps/composite2/viewer.htm
Natural Resources Conservation Service	Soil surveys.	Washington Soil Survey web site: www.or.nrcs.usda.gov/pnw_soil/wa_reports.html
San Juan County	Online mapping of parcels in the county.	Assessor's office: http://sanjuanco.com/assessor/parcelsearch.aspx GIS data download library: http://sanjuanco.com/gis/gislib.aspx
Thurston GeoData Center	Mapping and data for Thurston County (parcels, natural resources, etc.).	http://www.geodata.org/online.htm
U.S. Bureau of Land Management	Historical survey maps and information.	http://www.blm.gov/or/landrecords/survey/ySrvy1.php
U.S. Fish and Wildlife Service	Natural resources mapping, endangered species and habitats.	National Wetlands Inventory: http://www.fws.gov/wetlands/Data/Mapper.html Environmental Conservation Online System and Mapping: http://ecos.fws.gov/ecos/indexPublic.do
U.S. Geological Survey	Topographic maps.	http://nationalmap.gov/ustopo/index.html
Washington Department of Natural Resources	GIS mapping data; rare plants and ecological communities; oaks and grasslands of the Puget Trough Ecoregion.	http://www1.dnr.wa.gov/nhp/refdesk/gis/index.html

7. Native Grassland Communities

The following summary descriptions of native grassland communities in western Washington have been provided by the NRCS West Area Office. The grassland community or "ecosite" names correspond to those listed in Table 2-1 in Chapter 2.

Name	Description
Prairie Bald	**Landscape Position:** The soils which support this native plant community typically occur on south or west-facing slopes, in complex with stringers of deeper soil, and patches of rock outcrop. The soils are generally shallow, with very dark A horizons in the soil profile. Typical soil series are Haro and Rainier-Rock Outcrop complex. These areas were historically kept free of extensive brush and tree cover by burning. Typical native plant species found on the site include Roemer's fescue (*Festuca roemeri*), red fescue (*Festuca rubra*), Camas (*Camassia quamash*), Prairie Junegrass (*Koeleria macrantha*), California oatgrass (*Danthonia californica*), Field Chickweed (*Cerastium arvense ssp strictum*) and Oregon White Oak (*Quercus garryana*). In some areas, these soils are influenced by various abiotic factors such as prevailing winds (especially across marine waters), proximity to unprotected marine waters, or elevation, which will cause these locales to be cooler than the climate generally associated with these soil series. This is referred to as the Cold Phase in the ecosite description. The effect on the plant community is generally the absence of Oregon White Oak from the community.
Loamy Prairie	**Landscape Position:** The soils which support this native plant community typically occur on floodplains and terraces. The soils are generally deep, finer-textured soils with good internal drainage with dark A horizons in the soil profile. These areas were historically kept free of extensive brush and tree cover by burning. Oak is common on these soils. Typical series include Hillsboro and Doty. Typical native plant species found on the site include Roemer's fescue (*Festuca idahoensis v. roemeri*), Camas (*Camassia quamash*), Blue Wildrye (*Elymus glaucus*), Slender Wheatgrass (*Elymus trachycaulus*), and Field Chickweed (*Cerastium arvense ssp. strictum*) and Oregon White Oak (*Quercus garryana*).
Xeric Prairie	**Landscape Position:** The soils which support this native plant community typically occur on outwash plains. The soils are generally deep, coarse-textured soils with good internal drainage with very dark A horizons in the soil profile. They often contain significant amounts of sand or gravels. These areas were historically kept free of extensive brush and tree cover by burning. Generally, oak occurs on aspects protected from strong marine winds and regenerates slowly. Typical series include Ebeys, Snakelum and Spanaway. Typical native plant species found on the site include Roemer's fescue (*Festuca idahoensis v. roemeri*), Camas (*Camassia quamash*), Blue Wildrye (*Elymus glaucus*), Slender Wheatgrass (*Elymus trachycaulus*), and Field Chickweed (*Cerastium arvense ssp strictum*) and Oregon White Oak (*Quercus garryana*). In some areas, these soils are influenced by various abiotic factors such as prevailing winds (especially across marine waters), proximity to unprotected marine waters, or elevation, which will cause these locales to be cooler than the climate generally associated with these soil series. This is referred to as the Cold Phase in the ecosite description. The effect of this cooler regime on the plant community is generally the absence of Oregon White Oak from the community.
Xeric Prairie — High Precipitation Zones (>70")	**Landscape Position:** The soils which support this native plant community typically occur on outwash plains. The soils are generally deep, coarse-textured soils with good internal drainage with very dark A horizons in the soil profile. They often contain significant amounts of sand or gravels. These areas were historically kept free of extensive brush and tree cover by burning. Generally, oak occurs on aspects protected from strong marine winds and regenerates slowly. A typical series is Carstairs. Typical native plant species found on the site include Red fescue (*Festuca rubra*), Camas (*Camassia quamash*), Blue Wildrye (*Elymus glaucus*), Slender Wheatgrass (*Elymus trachycaulus*), and Field Chickweed (*Cerastium arvense ssp strictum*) and Oregon White Oak (*Quercus garryana*). In some areas, these soils are influenced by various abiotic factors such as high precipitation of cold winter rains, prevailing winds, or elevation, which will cause these locales to be cooler than the climate generally associated with these soil series. The effect of this cooler regime on the plant community is generally the absence of Oregon White Oak from the community except in protected areas.

Name	Description
Warm Wet Prairie	**Landscape Position:** The soils which support this native plant community typically occur on floodplains or in depressional areas with high water tables, often remnant shallow lake basins or other water laid sediments. The soils generally have a water table at or near the soil surface for much of the winter and spring, and the watertable is often within a few feet of the soil surface for the remainder of the year. Typical soil series are Cove and Sauvie. These areas were historically kept free of extensive brush and tree cover by burning. These ecosites occur in areas with warmer spring weather and warmer summer nights, resulting in more available heat units for plant growth and soil warming. Typical native plant species include Tufted Hairgrass (*Deschampsia caespitosa*), Great Camas (*Camassia leichtlinii*), and various sedge species (*Carex spp.*)
Bog or Fen	**Landscape Position:** The soils which support this native plant community typically occur in depressional areas with accumulations of undecomposed or partially decomposed organic matter and high water tables. The soils generally have a water table at or near the soil surface for much of the winter and spring, and the watertable is often at or within a few feet of the soil surface for the remainder of the year. These soils are typically nutrient-poor and have an acidic pH. A soil series on which this site occurs is Semiahmoo. These areas may have historically been kept free of extensive brush and tree cover by burning. Typical native plant species include Labrador tea (*Ledum groenlandicum*), salal (*Gaultheria shalon*), spirea (*Spiraea douglasii*), sedges (*Carex spp.*), and minor amounts of shore pine (*Pinus contorta*).
Cool Wet Prairie	**Landscape Position:** The soils which support this native plant community typically occur on floodplains or in depressional areas with high water tables, often remnant shallow lake basins or other water laid sediments. The soils generally have a water table at or near the soil surface for much of the winter and spring, and the watertable is often within a few feet of the soil surface for the remainder of the year. A soil series this site may occur on is Coupeville. These areas were historically kept free of extensive brush and tree cover by burning. These ecosites occur in areas with cooler spring weather and cooler summer nights, resulting in fewer available heat units for plant growth and soil warming. Typical native plant species include Tufted Hairgrass (*Deschampsia caespitosa*), Great Camas (*Camassia leichtlinii*), and various sedge species (*Carex spp.*)
Salt Water Bluff	**Landscape Position:** The soils which support this native plant community typically occur on steep bluffs directly above unprotected marine waters. This ecosite may also occur on flatter slopes adjacent to or at the toe-slopes of the bluffs. The soils are generally sandy and droughty, with very dark A horizons in the soil profile. Typical soil series are Xerorthents and Umbric Dystrochrepts. These soils are influenced by the various "Cold Phase" abiotic factors such as prevailing winds (especially across marine waters) and proximity to unprotected marine waters, which will cause these locales to be cooler than the climate generally associated with these soil series. The effect on the plant community is generally the absence of Oregon White Oak (*Quercus garryana*) from the community. In comparison to other native prairie plant communities, these communities generally show an increase in Red Fescue (*Festuca rubra*) with a related reduction in the amount of Roemer's fescue (*Festuca roemeri*). Other common native plants are Barestem Desert Parsley (*Lomatium nudicaule*) and Camas (*Camassia quamash*)
Coastal Grassland	**Landscape Position:** The soils which support this native plant community developed in wind-deposited sand with cool marine wind influence. They are typically coarse-textured sands and are droughty because of excessive internal drainage. A typical soil series is Westport. This plant community often occurs immediately adjacent to and higher in elevation than either the Tidal Meadow plant community, or beaches. Typical native plant species include American Dunegrass (*Leymus mollis*), Red Fescue (*Festuca rubra*), Seashore Bluegrass (*Poa macrantha*), Large-Headed Sedge (*Carex macrocephala*), Coastal Strawberry (*Fragaria chiloensis*), Dune Tansy (*Tanacetum bipinnatum*), Sea Pea (*Lathryrus japonicus*), and Springbank Clover (*Trifolium wormskjoldii*).
Tidal Meadow	**Landscape Position:** The soils which support this native plant community occur adjacent to marine waters and are affected by high tides and salt-water intrusion. These soils characteristically are almost level and have an internal water table very close to the soil surface year around. Typical soil series are Endoaquents and Tacoma. In the Puget Trough area, these ecosites occur in areas which are cooler than the rest of the area, because they occur on sites exposed to prevailing winds from across unprotected marine waters. Typical native plant species will occur in a continuum dependent on their location in relation to typical high tide elevations. Species include American Dunegrass (*Leymus mollis*), Tufted Hairgrass (*Deschampsia caespitosa*), Red Fescue (*Festuca rubra*), Oregon Gumweed (*Grindellia stricta*), Douglas aster (*Aster subspicatus*), Fat Hen (*Atriplex patula*), Pacific silverweed (*Argentina egedii*), Saltgrass (*Distichlis spicata*), Seaside Arrowgrass (*Triglochin maritimum*), Lyngby sedge (*Carex lyngbyei*), Pickleweed (*Salicornia virginica*), Fat Hen (*Atriplex patula*) and Seaside plantain (*Plantago maritima*).

Glossary

Abdomen – In insects, the abdomen is the posterior section of the body furthest from the head.

Aerate – To expose soils or any medium to the air or to oxygen.

Alternate – Refers to leaves arranged singly, on alternating sides of the stem.

Anal cell – The anal cell of a butterfly is the posterior or farthest portion of the hindwing from the head.

Aquatic – Referring to life or growth that takes place in water.

Aspect – The side or surface facing a given direction (as in the direction of the sun).

Awn – A bristle-shaped appendage of a plant located on the empty bracts at the base of a spikelet.

Basal – Refers to leaves that arise at ground level.

Basal rosette – A circular cluster of leaves or other plant parts originating at the ground level or base of the plant. Dandelions have classic basal rosette leaf arrangement.

Beak – The bill or mouthpart of a bird.

Best management practices (BMPs) – Methods or techniques proven to be most effective for achieving success. In the case of restoration, for example, they may be the best way to control weeds or to plant trees.

Biological diversity – The variation of different life forms within a given habitat or ecosystem such as a forest, watershed, or region.

Bract – A specialized leaf or leaflike part of a plant, usually located at the base of a flower cluster or inflorescence. The white "petals" of a dogwood flower are actually bracts.

Bulb – A swollen, subterranean stem.

Bulblet – A small bulb or bulblike structure.

Bunchgrass – The general name for perennial grass species that tend to grow in discrete tufts or clumps (i.e., bunches); they spread by seed only.

Cache – A hiding place below or above ground where an animal stores food.

Camouflage – The concealment of an animal by some means such as skin, fur, or feather color which alters or obscures its appearance to blend with the surroundings.

Candidate species – A plant or animal species that is a candidate for local, state, or federal designation as threatened or endangered.

Canine – An animal species in the dog family, such as coyote and fox.

Capsule – A dry fruit that splits into two parts.

Carrion – The carcasses of dead animals which are an important food source for carnivorous wildlife and scavengers.

Cavity-nester – An animal that nests and raises young in the cavities, openings, or holes created or naturally occurring in trees.

Colonial – A species of organisms living in a large group.

Compound leaf – A leaf that is divided into two or more separate parts (leaflets).

Constrictor – A snake that kills its prey by coiling tightly around it and causing death by suffocation.

Courtship – The period of an organism's life cycle in which the male and female form a breeding pair.

Crown – The top of the root mass of a plant, where the roots join the stem.

Deciduous – Refers both to leaves that fall after the growing season, or to the plant whose leaves fall after the growing season.

Dibble – A pointed gardening tool used to make holes in soil for planting bulbs or seedlings.

Dissected – Deeply divided into numerous leaf segments.

Dormancy – A state of rest without vegetative growth (during the winter or summer seasons).

Ecological baseline – The existing ecological characteristics of a particular site or habitat that provides a basis for comparison to future changes.

Ecosystem – A community of organisms and their habitat conditions, including the soil, climate and weather conditions, and disturbance elements such as wildfires or flooding.

Endangered ecosystem – A community of organisms and their associated habitat that is uncommon or rare and in danger of disappearing or going extinct.

Endemic – Belonging or confined to a particular place.

Extinct – A species no longer existing at present day.

Facial disk – The concave collection of feathers on the face of some birds, surrounding the eyes.

Falcon – Several species of birds of prey in the genus Falco, distinguished by long, pointed wings, a hooked beak with a toothlike notch on each side of the upper bill, and swift, acrobatic flight to catch prey.

Flock – A group of birds that keep or feed together.

Forage – The act of searching or obtaining food.

Forb – Any herbaceous plant that is not a grass or grasslike.

Forewings – The front and usually smaller pair of wings in butterflies or insects that have four wings.

Fringe – The outer edge or margin of a habitat; like the edge of a forest.

Genus (Genera) – The usual major subdivision of a family or subfamily in the scientific classification of organisms. The genus is the first word in a scientific name. For example, in the scientific name of common velvetgrass (Holcus lanatus), “Holcus” is the genus and “lanatus” is the species.

Gland – An anatomical structure of a plant or animal that secretes a substance.

Glandular skin – Skin that contains numerous glands and usually has a rough or bumpy appearance and texture, such as on a rough-skinned newt. Glandular skin performs functions including the exchange of oxygen and production of neurotoxins for defense.

Hemiparasitic – A plant that obtains some nourishment from its host but also by photosynthesis. Also called semiparasitic.

Hibernating – The winter habits of animals that retreat to underground dens, caves, or deep within soils in a dormant condition, often sleeping and not foraging or feeding until spring.

Hindwing – The second, posterior, or furthest wing from the head of an insect.

Host – A living animal or plant from which a parasite obtains nutrition.

Hovering – The acrobatic flight of insects and birds such as hummingbirds and kestrels, in which they are suspended mid-air or hang in the same location over a point on the ground.

Indicator species – A sensitive species that has a predictable response to environmental changes in climate, outbreaks of disease, or pollution. For example, amphibians are used as indicator species because of their sensitivity to water pollution and other environmental changes.

Inflorescence – The flowering part or flower cluster of a plant.

Invasive species – A typically non-native plant or animal that has negative impacts on a community or ecosystem, usually outcompeting native plants and animals. Some native plants also have invasive growth habits.

Kettle – A kettle hole is a geological term to describe potholes or deep, kettle-shaped depressions in the ground formed by glaciers.

Larval – The larval form of an insect is the immature, wingless, feeding stage followed by metamorphosis or change to the adult form.

Lax – Refers to a plant whose stem is not stiff, and typically lies on the ground.

Leaflet – One of the separate blades or divisions of a compound leaf.

Legume – Any plant of the pea family.

Linear – A term describing a narrow, flat leaf shape.

Midvein – The vein in the center of a leaf.

Migrate – To move from one region to another, based on changes in the seasons or an animal's life cycle.

Mottled – Spotted or blotched in coloring.

Muzzle – The projecting part of the head of an animal, specifically a dog or canine, which includes the jaws, mouth, and nose.

Native species – A plant or animal that was present in the U.S. prior to European settlement.

Nectar – A sugary or sweet secretion produced by a plant in order to attract insects or birds to pollinate the flower.

Neurotoxin – A poisonous substance produced by an animal for defense or to kill prey; it affects the nervous system and often causes paralysis.

Nodule – A small growth of tissue.

Non-native species – A plant or animal that was introduced to the U.S. during or after European settlement.

Non-venomous – An organism that does not contain or produce venom or poison.

Noxious weed - A general term for weed species that are poisonous to humans or livestock. Also a regulatory term for non-native plant species that must be controlled according to state and county noxious weed board requirements.

Nutrients – Chemicals that an organism needs to sustain life and growth, or a substance used during metabolism which must be obtained from the environment.

Opportunistic – Opportunistic organisms have the ability to take advantage of environmental conditions, usually allowing for a better chance at survival.

Palmately (palmate) – A leaf shape or arrangement having four or more lobes or leaflets radiating from a single point in the shape of an open palm or hand.

Perennial – A plant having a life cycle lasting more than two years.

pH – A measure of how acidic or basic a substance is; measured on a scale from pH 1 (most acidic) to pH 14 (most basic).

Phase – A stage in a process of change or development.

Phenology – The study of plant and animal life cycles and habits such as flowering, production of seeds, and breeding and how these are affected by seasonal weather patterns and climate.

Plugs - Live plants in small tube-like containers.

Plumage –The entire collection of feathers on a bird.

Prescribed burn – An intentionally set, controlled burn, whose purpose is to reduce or remove vegetation.

Prey – An animal which is hunted for food.

Proliferation – A rapid or excessive spread or increase.

Raptor – A term describing all birds of prey, usually having a hooked beak for tearing animal flesh, sharp and strong talons for grasping, sharp sight, and generally rapid and acrobatic flight for chasing prey.

Recolonize – The return of a species to a former location, usually following a disturbance.

Restoration – A term describing efforts to return a place, organism, or thing back to its original and natural form. In the U.S., the natural form is usually considered the state prior to European settlement or change.

Rhizome – A root-like underground stem that produces roots below and sends up shoots, stalks, or stems from the upper surface.

Rump – The hind part or hindquarters of the body of an animal.

Scale – A thin, membranous part of a plant that may cover or enclose a new flowering structure or leaf.

Scavenge – To take, gather, or feed from discarded or leftover kills (carrion) or road kill.

Secrete – To discharge, generate, or release a substance generally through the skin.

Seed bank – The collection of seeds present in the soil.

Serrated – Having a notched or toothed leaf edge.

Sheath – Part of the leaf base when it forms a vertical or upright coating surrounding the stem.

Solarization – Sterilization of soil or plant material through heating by the sun.

Songbird – A general term for smaller birds that vocalize calls or songs (for example, western meadowlark and American robin).

Species – A group of genetically related organisms that resemble one another, and are able to breed within their group or species but not with members of another species. This term also describes the major subdivision of a genus in scientific classification.

Species of concern – In wildlife conservation, a term referring to species that are declining or appear to be in need of extra protection.

Spike – In grasses, sedges, or rushes a spike is the entire flower stalk.

Spikelet – One of the flower clusters of a spike or a unit of the inflorescence, made of two or more flowers.

Spur – A slender, usually hollow, projection from some part of a flower.

Stamen – The pollen-bearing organ of a flower.

Sterile – A lack of ability to produce offspring or seed.

Stolon - A prostrate stem at or just below ground level that produces new plants from buds or nodes at its tips.

Stratification – The process of stimulating seeds to germinate by mimicking natural winter conditions and breaking seed dormancy; as in cold stratification.

Succession - The progressive replacement of one ecological community by another.

Terrestrial – Life on land, as opposed to aquatic (in water).

Thatch - A layer of grass, stems, roots, and debris that settles on the ground and either slowly decomposes or accumulates over time.

Thoracic – An adjective describing the thorax.

Thorax – In insects, the portion of the body between the head and the abdomen, where legs and wings are attached.

Trifoliate – Having three leaflets, lobes, or sections of a leaf.

Tufted – A cluster of short-stalked flowers or leaves growing from a common point.

Vegetation community – All species of plants living in a given habitat or location.

Vocalization – A call, song, speech, or sound made by the vocal chords of a living organism in order to communicate.

Weed – A plant that is undesirable in a given setting, typically because it is non-native, grows quickly following disturbance, and/or outcompetes desirable plant species.

Whorl – Three or more leaves attached at one point on the stem.