

Palouse Prairie Restoration

David M. Skinner, USDA NRCS Plant Materials Center, Pullman, WA Bertie Weddell, Draba Consulting, Pullman, WA Mark Stannard, USDA NRCS Plant Materials Center, Pullman, WA

The Palouse region (the rolling hills of eastern Washington and northern Idaho) is home to some of the nation's best wheat growing soil, but what was here before the wheat? The Palouse was blanketed with a mosaic of native vegetation. Bunchgrasses were the dominant feature; shrubs, wildflowers (forbs), and even mosses and lichens also were important. This grand complex, known as the Palouse Prairie, impressed early settlers in the region. One Moscow homesteader in the 1880's wrote "Its beauty was wild and untrammelled and the undulating hills were covered with luxuriant grasses."

Native Palouse Prairie vegetation has become extremely rare, in part because the fertile soils of the Palouse are so well suited to agriculture. In 2001, a group of local citizens concerned about preserving the remaining fragments of Palouse Prairie formed the Palouse Prairie Foundation (PPF). The PPF promotes the preservation and restoration of native Palouse Prairie in Latah and Whitman Counties.

This brochure contains information about how to grow native grasses and wildflowers that were once more widespread and abundant in the Palouse. We are learning new things about Palouse Prairie restoration all the time. This brochure is a work in progress. Watch for future updates, as we learn more about the workings of this complex ecosystem and how we can restore some of its parts.

Why restore or recreate a patch of Palouse Prairie?

Many people find it deeply rewarding to recover a part of their natural heritage. In addition, native plants:

- **are beautiful,**
- **provide food and cover for wildlife,**
- **help prevent erosion,** and
- **tolerate our dry summers.** Once established, they do not need to be watered or mowed, so planting natives conserves resources.

Although Palouse Prairie restoration can be rewarding, it is also challenging.

As every gardener and farmer knows, weeds are very good at taking over bare ground. In our region, introduced weeds are usually better at this than native grasses and wildflowers, so you will probably have to battle weeds until native plants become well established. Make sure you are willing to commit the time and money to do this before you start.

Obtaining native plants

Buy seeds, rather than collecting your own, if at all possible!

- **Make sure to use plants or seeds from eastern Washington or northern Idaho.** Native plants are uniquely adapted to their local environment. If plants are brought in from other regions they can undermine the genetic adaptations of local plants, or the imported plants can become invasive and replace the natives. Also, if you use plants that are from a different region, these may not be adapted to Palouse conditions, and they may struggle or die out.
 - **If a plant is labeled “native” that may just mean that it is native to North America.** You will probably have to ask your suppliers to provide more information about exactly where the material they provide comes from.
- **Read the label for all seed purchases.** Make sure that:
 - **The seed you are buying is free of noxious weeds, contains only minimal amounts of other weeds, and does not contain crop seeds** which might cause problems in a restoration. (Some troublesome non-native grasses such as smooth brome, meadow foxtail, and Kentucky bluegrass are common contaminants in grass seed, but they are considered crops and may not be listed on the label. If you see “other crops” listed on the label, be sure to find out what they are.)
 - **Grass seed should have been tested for germination within the past year.** At present, standards have not been established for many forb and shrub seeds, so you may not be able to obtain germination data for your seed. It is expected that this information will be available in the future as more seed enters the market.

You can obtain seeds and plants of some native Palouse species from:

Business Name	Address, Email, and Website	Phone and Fax
Benson Farms, Inc.	1145 Jefferson, Moses Lake WA 98837 http://www.bfinativeseeds.com/	509-765-6348
Clearwater Seed, Inc.	27 W. 1st Avenue, Ste 307, Spokane, WA 99201 http://www.clearwaterseed.com/	509-343-3108
Connell Grain Growers	P.O. Box 220, Connell WA 99326 http://www.connellgg.com/	509-234-2641 509-234-2642 Fax
Derby Canyon Natives	P.O. Box 385, Peshastin WA 98847 http://www.derbycanyonnatives.com/	509-548-9404
Dye Seed Ranch	203 Connell Hill, Pomeroy WA 99347	509-843-1690
Grassland West	PO Box 489, Clarkston WA 99403 http://www.grasslandwest.com	509-758-9100 509-758-6601 Fax
Great Basin Seeds	1040 Russell, Mesa WA 99343	509-265-4250
Jacklin Seed Co	PO Box 181, Ritzville WA 99169 http://www.jacklin.com	509-659-1065
Landmark Seed	N 120 Wall St, Ste 400, Spokane WA 99201 http://www.landmarknative.com	800-268-0180
L&H Seeds	4756 W. Hwy 260, Connell, WA 99326 http://www.lhseeds.com/	509-234-4433
McLean Seed Co.	PO Box 815, Coulee City WA 99115	509-632-8709
Mosman Seed Ranch	Rt. 2, Box 43, Craigmont ID 83523	208-937-2552
Plants of the Wild	PO Box 866, Tekoa WA 99033 http://www.plantsofthewild.com/	509-284-2848
Pleasant Hill Nursery	Anderson Rd, Troy ID 83871 pdmason@moscow.com	208-877-1434
Rainier Seeds, Inc.	PO Box 187, Davenport WA 99122 http://www.rainierseeds.com/	509-725-1235 509-725-7015 Fax
Rimrock Nursery	5511 S. Dorset, Spokane WA 99224 http://www.rimrocknursery.com/	509-455-7405
Seeds Inc.	PO Box 866, Tekoa WA 99033	509-284-2848 509-284-6464 Fax
Seed Specialists	10260 N. Taryne, Hayden Lake, ID 83835	208-762-8308 208-762-9267 Fax
Sun Mountain Natives	1406 East F, Moscow ID 83843 http://sunmountainnatives.com/	208-883-7611
Thorn Creek Native Seed Farm	1461 Thorn Creek Rd, Genesee ID 83832 http://www.nativeseedfarm.com/	208-596-9122
UI Pitkin Forest Nursery Staff	PO Box 441137, Moscow ID 83843-1137 http://seedlings.uidaho.com/	208-885-3888 208-885-6226 Fax

This may not be an exhaustive list. If we have omitted your company, or you know of a company we have omitted, please inform us.

For larger projects, you may want to consult the Native Seed Network, <http://www.nativeseednetwork.org> for more information on sources of seed. Be sure to order seeds from an appropriate ecoregion. For Palouse Prairie restoration in our area that means ordering seed from either the “ID Columbia Plateau” or the “WA Columbia Plateau.”

If you do collect

- **Be a responsible collector!** Native plants can become imperiled and native habitats can be damaged by careless collectors.
- **Be sure to follow these guidelines:**
 - **Never dig up forbs and shrubs from the wild.**
 - **Do make sure that you have permission to collect seeds.**
 - **Do make sure that you know what seeds you are collecting.**
 - **Don't collect seed of rare plants.** Quite a few Palouse Prairie plants are restricted to our region; they don't occur anywhere else in the world. Their limited distribution makes them very vulnerable! Seeds of the following should not be collected:
 - Spalding's catchfly (this species is listed as threatened under the federal Endangered Species Act),
 - Palouse goldenweed,
 - Jessica's aster,
 - Palouse thistle,
 - Broad-fruit mariposa, and
 - Palouse milkvetch.
 - **Don't overcollect.** You should never take seed from more than one out of every 20 plants, and don't take more than 5% of the seeds from any one plant.
 - **Do find out how to store and propagate seeds that you collect.** If you don't do this, the seeds you collect may be wasted. Information is available from the Native Plant Network <http://nativeplants.for.uidaho.edu/network/search.asp>. In order to search this database, you will need to know the scientific names of the plants you are interested in. You can find out scientific names by going to <http://palouseprairie.org/plants>.

- **Don't disturb the habitat where you collect by leaving trails or other areas of bare ground.** If you are not careful, you will create new opportunities for weeds to invade what's left of Palouse Prairie vegetation.
- **Don't move weed seeds around.** Remove mud and seeds from your boots, clothing, and backpacks and dispose of them where they won't start a new infestation.
- **Don't use plants that are not adapted to your site.** For example, plants of wet sites should not be planted on dry slopes.

Before you begin

You will save a lot of time if you ask yourself a few important questions:

- **How large is your project?** Will you be working with a few square yards in your garden, a fraction of an acre, or one or more acres? The methods you use will depend on the scale of your project. For small projects, weeding, spraying herbicide, and planting by hand may be adequate; for larger ones, you will need to use farm equipment.
- **What kinds of plants are growing on the site now?** You don't need to be able to identify the actual plants, but it will be helpful if you know a little about the *kinds* of plants you have. Are they annuals or perennials? Grasses or broad-leafed plants? Are they green in winter and dried up by spring, or do they begin growth in spring and flower in summer or fall? Do they spread aggressively? Do you have any noxious weeds? The strategies you use for getting rid of unwanted plants will depend on the answers to these questions.

You also might want to learn about Palouse Prairie before you begin:

Visit a Palouse Prairie remnant to get an idea of the types of plants that grow there, how big they are, how close together they grow, and so on.

Some good places to visit a remnant are:

- **Kamiak Butte County Park**
<http://www.whitmancounty.org/Parks/Index_Pages/Kamiak.htm>,
- **Steptoe Butte State Park**
<<http://www.parks.wa.gov/parkpage.asp?selectedpark=Steptoe%20Butte>>, and
- **The Nature Conservancy's Rose Creek Preserve**
<http://nature.org/wherewework/northamerica/states/washington/preserves/art6368.html>

The best time to see native plants in bloom is in the spring and early summer. You might want to go several times, from April through July, so that you see things that bloom at different times.

Bear in mind that you are not allowed to collect plants or plant parts at any of these sites.

- **Check out the Palouse Prairie Foundation website:**
<<http://www.palouseprairie.org>>

Site preparation

- **Don't fertilize, even if your soil is not very rich.** Many weeds thrive in soils that are high in nitrogen, so fertilizing favors weeds over natives.
- **Learn what you have growing on your site.** If your site is an agricultural field which was planted to grain in the previous growing season, you can begin the restoration process the first spring that the field is not in production. If the field was in peas or lentils, it is best to grow a grain crop (wheat or barley) for a year and wait until the following spring to seed grasses. Many weeds usually go to seed in pea and lentil fields because these crops provide little competition to keep down weeds and because control of broad-leafed weeds within broad-leafed crops is difficult. Growing a grain crop will leave more residue on the soil to protect it from erosion before and during the grass establishment period and will provide better opportunities to control broad-leafed weeds before beginning restoration.
- **Once you know what's there, get information about how, and when, to control it.** You can get information by consulting:
 - **Your local extension service** <<http://ext.wsu.edu/>> for Washington State University or <<http://www.uidaho.edu/extension/>> for the University of Idaho)
 - **The Pacific Northwest Weed Management Handbook** (available at <<http://weeds.ippc.orst.edu/pnw/weeds>>
 - **The Nature Conservancy's Global Invasive Species Team website** <<http://tncinvasives.ucdavis.edu/>> and <<http://wiki.bugwood.org/Invasipedia>>
 - **The University of Idaho Erickson Weed Diagnostic Laboratory,** <<http://www.uiweb.uidaho.edu/weeds/Erickson/Erickson.htm>>

- **Weeds can be controlled by spraying herbicides, mowing, hand pulling, or some combination of these methods:**
 - **Hand pulling** is suitable for small areas and has minimal impact when done while the weeds are small.
 - **Mowing** won't eliminate weeds, but it can reduce weed seed production.
Repeated mowing can reduce problems from annual weeds (such as dog fennel, lambs' quarters, and fiddleneck tarweed).
It is important to set the mower blade high enough to avoid damaging the native grasses. The mower should be high enough to remove very little of the native grass foliage. The exact height depends on the stage of growth and the species.
 - **Spraying** must be done carefully to avoid harming native vegetation. Follow the label and consult experts (see the web sites listed above) if you have any questions.
- **Perennial grasses are especially hard to get rid of.**
 - **Reed canarygrass, smooth brome, quackgrass, and other perennial grasses that spread by rhizomes are extremely troublesome.**
 - **It may take several growing seasons and several different control methods—tilling, spraying, and mowing—to get rid of them,** but it is essential that they be eliminated before you begin planting. If you skimp on this critical step, these troublesome grasses will quickly reinvade.

What to plant

Grasses

- **Idaho fescue, bluebunch wheatgrass, and prairie junegrass are the most common and readily available species to use in restoration.** Sandberg bluegrass may also be used on shallow soils.
- **Use mountain brome with caution.** This native perennial grass grows rapidly, but it also reseeds aggressively. If you include it, seed it at a low rate.
- **If your soil is very shallow and rocky, you should plant bluebunch wheatgrass, and perhaps Sandberg bluegrass, but not Idaho fescue.** Sites

with shallow soil present some special problems, not only because the plant species may differ, but because traditional agricultural methods cannot be employed. They often cannot be cultivated or sprayed very easily.

Forbs and Shrubs

- **On shallow or rocky sites, Wyeth buckwheat, biscuitroots (see list below), and tapertip onion are well adapted species.**
- **On deep soil sites the choices are more numerous.** Western yarrow, blanketflower, false sunflower, Lewis flax, cinquefoils (sticky, five-finger, and tall), Missouri goldenrod, biscuitroots (fern-leaf, big fruit, Gorman's, Gray's, and nine-leaf), prairie smoke, arrowleaf balsamroot, silky and velvet lupine, and sticky geranium were common forbs of the Palouse Prairie.
- **Common shrubs included snowberry, Nootka or Wood's roses, Douglas' hawthorn, serviceberry, and chokecherry.**

How to plant

Planting grasses

- **If you are going to be restoring a sizable area, it is advisable to get some native perennial grasses established first.** There are several advantages to starting with grasses.
 - **Grasses are easier to grow than most of our native forbs.**
 - **Native grass seed is widely available.**
 - **In a grass planting you can control broad-leaved plants with herbicides.**
 - **Once the grasses are well established, they will compete with weeds.** At that point, you will be able to plant forbs in smaller areas within your grass planting.
- **Getting ready to plant grass seed**
 - **Calculate the seeding rate and the amount of seed you will need** (see box below, page 10).
 - **Seed grasses in the spring.**
 - **Make sure you have a firm seed bed.** A firm seed bed holds soil moisture near

the surface and assures shallow seed placement, which is essential for our native grasses. (Their seeds are quite small, so if they are buried far down in the soil, the young seedling will run out of stored energy before it reaches light.)

- **Plant seeds about ¼ inch deep and no deeper than ½ inch.**
- **Drilling grass seed**
 - **Grass seed can be broadcast in small areas, but for larger areas you will need a drill.** There are specially designed drills for sowing grass seed. If one is not available, a regular grain drill works quite well. Either a conventional drill or a no-till drill can be used.
 - **You may need to dilute your seed.** Your seed dealer may have equipment to blend the mixture for you. Otherwise, you can spread the seed and the material you want to dilute it with on a tarp and thoroughly mix them with a shovel. Rice hulls are a common and readily available substance that can be used for this purpose.
 - **Set the drill to a shallow planting depth.**
 - **Calibrate the drill to assure it is delivering the seed at the desired rate.** Run the drill over a hard surface or a tarp laid down in the field and count the seeds from several different openers for several feet and take an average.
 - **Check seed placement and depth after you begin drilling.**
 - **If you are using a grain drill, you will need to stir up the seed while you are drilling to keep it flowing through the drill.** Grass drills are designed so that manual stirring is not necessary.
- **Broadcasting grass seed**
 - **Broadcast seed in early spring.**
 - **Use twice as much seed as you would use for drilling** (see box below, page 10).
 - **Push the seed down into the soil.** A roller or a harrow will work well. Small areas can be raked. Assuring good soil/seed contact is critical!

How to Calculate Seeding Rate

Dave Skinner, USDA Plant Material Center, Pullman, WA

Pure Live Seed, or PLS, is an indicator of seed quality and should be used in determining seeding rate. Purity and germination percentages for the lot of seed must be shown on the seed label. PLS is calculated by converting the % purity and the % germination to decimal numbers (divide each by 100). The two decimal numbers are then multiplied together to calculate PLS.

$$\frac{\% \text{ purity}}{100} \times \frac{\% \text{ germination}}{100} = \text{PLS}$$

Seeding rate: Determine how many seeds per linear foot (LF) of row you wish to plant. I like to use 20 seeds/LF for species with relatively large seeds, such as bluebunch wheatgrass, and 30 seeds/LF for small-seeded species such as Idaho fescue. Determine drill row spacing for the equipment you will use. Determine how many linear feet of row there are in an acre with the drill spacing you have. For example, for Whitmar beardless wheatgrass:

- **A square acre is roughly 209 feet by 209 feet.** With a drill row spacing of 6 inches, one side of the acre will contain 418 rows. The rows will all be 209 feet long, so **multiply length by number of rows**. 209 feet x 418 rows = 87,362 linear feet of row.
- **Multiply the number of seeds desired per linear foot by the total number of linear feet.** 87,362 LF x 20 seeds/LF = 1,747,240 seeds required to seed 1 acre.
- **Divide the total number of seeds required for one acre by the number of seeds per pound for that species.** Whitmar beardless wheatgrass has 135,000 seeds per pound. 1,747,240 seeds ÷ 135,000 seeds/lb = 12.9 lbs of seed per acre.
- **Adjust the seeding rate for PLS by dividing the seeds/acre by the PLS.** Assume a PLS ratio of .85 for this example. 12.9 lbs/acre ÷ 0.85 PLS = 15.2 lbs of seed needed to seed one acre.

For multiple species plantings, determine how many seeds per linear foot of each species you wish to plant, then perform the above calculations for each species in the mix. For example, for a mixed planting of bluebunch wheatgrass and Idaho fescue where a 50% stand of each is desired, use 10 seeds/LF of bluebunch wheatgrass and 15 seeds/LF of Idaho fescue. Because a field is rarely a perfect square, you will want to purchase additional seed to compensate for turning corners and overlapping passes of the drill.

Average number of seeds/lb for some common Palouse Prairie grass species:

Whitmar beardless wheatgrass	135,000
Secar bluebunch wheatgrass	168,000
Idaho fescue	450,000
Big bluegrass	917,000
Sandberg bluegrass	1,046,960
Basin wildrye	165,000
Blue wildrye	131,000

Seed statistics for many other species may be found on the PLANTS Database website at

<<http://plants.usda.gov>>.

- **The easiest way to get forbs established is to transplant young plants (plugs) started in pots or tubes.** At present, seeding forbs directly isn't recommended because:
 - **Broadcasting forb seeds is wasteful and costly,** because rodents, insects, and fungi will destroy many of the seeds.
 - **Drilling forb seed is uneconomical, because the seeds are expensive.**
 - **Many forb seeds have a dormancy which must be overcome by cool, moist winter conditions,** thus the timing for seeding is not the same as for grasses.

An exception: Forbs that don't have special requirements for breaking dormancy can be seeded at the same time you seed grasses, but this will restrict you to non-chemical weed control, since you won't be able to use herbicides to control broadleaf weeds.

- **Purchase your plugs.** Growing your own is challenging, because many kinds of forb seeds require special treatment before they will germinate. (Remember: never dig up plants from the wild!)
- **Planting forb plugs**
 - **Select one or a few small areas for forb plantings.** It's best not to try to plant a large area to forbs because forb plugs are expensive, and getting forbs established is labor intensive.
 - **If you are planting into an established stand of grasses, you may want to till narrow strips in the grass before planting plugs.** This will reduce competition for your plugs, but you will have to deal with weeds invading the tilled ground around them.

Planting shrubs

- **Obtain potted shrubs from a nursery.** Because shrubs are difficult to start from seeds and their seeds are expensive, it's a good idea to buy young shrubs and transplant them. Be sure to use plants that have been grown from locally collected seeds. Many of our shrubs are wide-ranging, but local material will be most successful. Don't remove shrubs from the wild.
- **Plant early in spring.** This allows plants to take advantage of early spring soil moisture. Late fall planting is also an option.

- **Water shrubs each week throughout their first summer.** Use about 1 or 2 quarts per plant each week. This is critical because summer drought is the biggest threat to young shrubs, which have not yet developed deep roots that can exploit soil moisture late in the season.
- **Protect shrubs from rodents by surrounding them with plastic tubes.** Otherwise the shrubs will be killed by girdling, and your time and money will be wasted.

Post-planting management

- **Do not expect that your planting will manage itself.**
- **Continue to control unwanted vegetation.** For small plots, periodic hand pulling and careful hoeing can be very effective. Do not let the weeds go to seed.
- **Keep track of what you do.** Photograph your planting, mark down where you placed certain plants, record which techniques work and which don't, keep track of your ideas on how you might do things differently in the future.

Something to remember

There's a lot we don't know about the Palouse Prairie ecosystem; but we are learning more all the time. So start small, figure out what works, and then expand your planting. Observe your project carefully, learn as you go along, be flexible and willing to adapt to surprises, and share what you have learned with others!

Acknowledgements

David Hall and Trish Heekin provided many helpful suggestions during the development of this document. Louise Freeman-Toole located the quote from a Moscow homesteader.