Native Willamette Valley Prairie and Oak Habitat Restoration
Site-Preparation and Seeding Information

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NEW NOTES ARE IN YELLOW:

Note: These are techniques that I, personally, have tried or learned about from other sources. For a full list of a variety of site prep and seedling techniques, please see **Appendix A** on pg 13.

APPENDIX A - Additional Resources
APPENDIX B - Target Chemicals for Weed Control Seed Production and Restorations
APPENDIX C – Shrub Treatments
APPENDIX D - Resources for Wildlife Habitat Conservation in Oregon

Grassland Site-Preparation: Define Your Starting Conditions

1) Remnant prairie with a good native component
2) Meadow with a good native component
3) Meadow with only a few natives
4) Uncultivated old fields and pasture with no natives
5) Cultivated agricultural field
6) Highly disturbed (excavation, logging etc)
7) Steep areas where erosion is a concern
8) Few bare areas for native pollinator nest sites

(1 or 2) You need to tiptoe around the natives and only use herbicide in weedy areas with few or no natives. These areas can be planted with plugs of native plants in the fall, or seeded if the area is free of major weeds. In the native rich areas, you can spot-spray weeds or use mechanical control methods such as weed-eaters, pruners or hand-pulling.

New Information: Many of our native remnant sites are rich in forb diversity but lack native grasses; or the native grasses are in low abundance. If this is the case, you could use a grass-specific herbicide to target the non-native grasses, then enhance the site by adding native grasses and more forbs as the non-native component is reduced. Currently,

The Institute for Applied Ecology is conducting research that addresses the efficacy of the grass-specific herbicide Poast® as a restoration tool in prairie remnants.

Please see the following link for more information.

http://www.appliedeco.org/conservation-research/prairie-restoration-research

In general, care must be taken anytime herbicides are used to remove unwanted vegetation. The space created may often be filled with another undesirable species. It is imperative that the desired plant material be available to fill that space as quickly as possible. Initial findings of the study indicate one of the most difficult non-native grass to reduce is creeping bentgrass (*Agrostis spp.*) [see also # 5 below as well]. The native grasses *Festuca roemeri* and *Danthonia californica* have some tolerance for grass herbicides depending on the time of application and the age of the plants.

(3) You must decide if it's OK to lose the few native species you have and then try to reestablish them from seed or plants. For example, many of our old fields have yarrow and buttercup but little else; since these species are commercially available, you can focus your efforts on preparing a site substantially reduced of weeds, and re-seed or re-plant them. If possible, you can also try to collect seed from these populations prior to site-preparation. For preparation suggestions using herbicides see #4 and 5 below.

A non-herbicide option for adding diversity to the site without herbicides would be solarization of small patches and interplanting plugs of native species.

(4 and 5) Use herbicide (glyphosate) for AT LEAST two seasons to kill existing vegetation. This should be applied as soon as you can get into the site. Suggested rate is 2 quarts/acre in cooler weather and 1 quart/acre in warmer weather [1 – 2% glyphosate solution] and 0.25-0.5% surfactant. Herbicide should be applied fall, early spring, summer, and fall at a MINIMUM. Please, <u>no tilling</u>! Many grasses will be killed in one season; however, many of our **deep-rooted** or **rhizomatous** forbs such as Queen Anne's lace, perennial vetch, St. John's-wort, Canadian thistle, and clover take more than one season to control. In addition, hard-seeded species and annuals such as sow thistle, crane's bill, mustard, and speedwell will take advantage of the newly opened space and become flush the second season. Timing of the herbicide application is crucial. It is desirable to eliminate each suite of weeds prior to flowering.

<u>Note:</u> Cultivation is not necessary in the age of no-till drills. Tilling only brings weed seed continually to the surface and you will NEVER, EVER, EVER, exhaust the weed seed that has built up in the soil for generations.

A 2005 restoration site-preparation forum hosted by the Lane Council of Governments and attended by restorationists, researchers, water and soil scientists, and farmers concluded that the best way to prepare a pasture or agricultural field for native prairie seed reintroduction is herbicide application for at least two years <u>without cultivation</u>. Or, if you must till, do it ONLY ONCE and start the herbicide regime. If bare soil is a concern, plant a cereal cover crop such as wheat, oats, or barley in September to control erosion and

suppress weeds. According to The Oregon State Extension Service (see Appendix A Below) cover crops "protect the soil surface, smother weeds, …and scavenge nitrogen from the soil before it is leached below the root zone by winter rains."

It is important to look at each site realistically and realize the weed seed bank is bigger than you are and that it will never be exhausted. The seed drill will invariably dredge up weed seed no matter how "clean" it may seem post-herbicide application. In **uncultivated** old fields and pasture, aggressive, non-native grasses such as **perennial bentgrass** (the hardest to eliminate), tall oatgrass, and velvetgrass can be the long-term competitive issue for successful native plant reestablishment. In **cultivated** fields, the long-term issue is often broadleaf weeds. (See Seeding Options below for herbicide strategies depending on existing vegetation).

Warnings: If not controlled, **perennial bentgrass** will completely take over a restoration site even after the native grasses have established. This grass eliminates the "bunchgrass" prairie structure (which allows open ground for nesting sites, forbs, and native pollinator habitat) if not **aggressively** spot-sprayed the each season.

Another scourge of restoration sites is rattail fescue (*Vulpia myuros*). This annual grass species takes advantage of the space provided by herbicide treatments and can quickly fill the space as the natives try to establish. It cannot be controlled with grass-specific herbicides. There are a couple of pre-emergent herbicides labeled for this species on non-crop/restoration lands but care must be taken to understand the mode of action, the chemical specificity, and soil life of pre-emergent herbicides. Non-herbicide control of this species is very difficult due to its stature and desire to do nothing but flower and set seed.

Why proper site preparation is necessary: Many native species (both grasses and forbs) are very slow to establish. They need a site free of other vegetation in order to germinate unimpeded and to mature. Most bunchgrasses and perennial forbs grow slowly and don't set seed until their second season (some forbs not until the third or fourth.) They are also poor competitors. Once the prairie species are established, it is critically important to burn the site every 2 – 5 years. If you can't burn, mow. Burning, however, is the most effective tool to maintain native prairie. Willamette Valley Prairie species evolved with fire. Fire reduces the competition from thatch and woody species, stimulates the root crowns of the native grasses and forbs, and reopens the site for native annual species. Burning may also discourage the non-native grasses and forbs that did not evolve with fire. Burning yearly is not recommended because it increases the abundance of weedy non-native annual species and noxious thistles. It may also be necessary to continually augment the area with new native seed and/or plants after burning or mowing to try and tip the balance to a sustainable native stand.

A note on mowing: If there is heavy residue from mowing, it should be removed from the site. This thatch will reduce the vigor of the native plants. If the site is open, options

include swathing and bailing the straw or using a silage machine that cuts the material and discharges it into a trailer.

During the first and second growing season, it is VERY IMPORTANT to spot treat noxious weeds with herbicide or hand-pulling. It is more advantageous to target perennial broadleaf weeds such as St. John's wort, Canadian thistle, tansy ragwort, clover, and perennial grasses – especially bentgrass! Hand pulling is NOT recommended for rhizomatous species since this may increase the plants. Annual weeds will not persist in great numbers once the native perennials have established during the second and third growing season.

(6) If the site has been disturbed by earthmoving it is absolutely **essential** to not let it lay fallow. Both erosion concerns and the tendency of weeds to occupy bare soil emphasize the need to sow <u>something</u> on the site as soon as possible. If the desire is to re-vegetate the site with native plant species, try to allow any weed seeds that might be present to germinate and then spray them with glyphosate. Species to be sown should be fall and/or winter germinating grasses and forbs that compete well with non-native species. This ensures that they 1) establish prior to erosion problems; 2) they occupy the spot before fall and winter weeds establish; and 3) they can compete with any non-native species that may still be present on the site. For suggested species, see option 3 below. If the area has been disturbed in the spring or early summer and must be occupied by vegetation (some agencies stipulate this) sow a summer cover crop (Sudan grass works well). Then, mow or spray out the cover before seed set and sow native seed in the fall.

(7) Native species are **extremely** small, even those that germinate in the fall or winter, so they will NOT hold soil on steep sites. It might be advantageous on erodible sites to either 1) sow a summer cover crop such as Sudan grass at about 70 lbs/acre, then mow and bail it when in flower or 2) sow a late summer nurse crop of a <u>spring</u> cereal grain such as **oats** at about 20-30 lbs/acre. Sowing the spring grain in late summer will ensure it establishes good roots and holds the soil during the fall and early winter. These crops usually winter kill. Oversow the area in October with the native seed crop. Just in case the nurse crop does not winter kill, the native grasses sown should only be low bunchgrasses that do not flower the first year (*Roemer's fescue*, *Koeleria macrantha*, *Poa secunda*, *Danthonia californica*). Then the cover crop can be mowed to a height of 6-8 inches before flowering. The grain can be drilled at the moderate rate suggested and, perhaps, on wider spacing than the native seed. This should ensure little competition from the nurse crop. Barley has been recommended due to its lack of regrowth if mowed. Mowing when the barley is just starting to flower will also reduce the chance of regrowth. Wheat is fine as a cover crop prior to seeding as long as it is killed before sowing but **wheat should <u>never</u> be used as a nurse crop due to its suspected allelopathic effects**.

8) In all cases above, some bare patches should be retained in order to provide vital pollinator nesting sites. Most native bee species nest in bare soil. The best sites to retain would be cut banks or areas by down trees and snags that face the morning sun. To keep

the area free of vegetation, herbicide can be applied very early in the morning or late in the evening when the bees are in their nests. For more information on native pollinator conservation see **Appendix A**.

NATIVE SEEDING: WHEN TO SEED WHAT

– SITE ASSESSMENT OF THE AREA IS CRITICAL, KNOW YOUR WEEDS!

Note: We have had the most success doing Option 3 (multiple herbicide applications following by broadcast seeding forbs and drilling native grasses). These sites have the greatest establishment rate and highest diversity of native species. See below for details.

Option 1 – sow grasses first then forbs later

If the site is clean of established weedy grasses but non-native forbs are still a problem (common in **pastures** and some **fallow agricultural fields**), you can seed grasses only the first year, then overseed with native forbs. This will allow additional growing seasons where a broadleaf herbicide can be applied (make sure the grasses are at least 3-5 blades before applying). Some herbicides, such as 2,4-D, are only completely effective on a relatively small group of weeds. Depending on the weed issue, it might be advisable to use a wider spectrum herbicide (see **Appendix B** for suggestions).

a. Native bunchgrasses can be sown as a mix with the majority of the mix (85%) comprised of slower growing bunchgrasses: *Festuca roemeri* (Roemer's fescue), *Poa secunda/scabrella* (pine bluegrass), and *Koeleria macrantha* (prairie junegrass); 10-15% of mix the quickly establishing species *Elymus trachycaulus* (slender wheatgrass) and *Elymus glaucus* (blue wildrye). If the most aggressive native grass, *Bromus carinatus* (California brome) is used, it should be **no more** than 2-5% of a mix if at all. Remember, though, you want to be able to sow forbs the following fall. Brome will set-seed the first summer and cover the area with grass seed and leave little room for forbs to germinate (I know of what I speak)!

b. *Danthonia californica* (California oatgrass) is a special case and should be planted in mono-culture plots (see photo below). This grass **does not germinate until late-February/early March** and may not be able to germinate well if sown with the grasses listed in part "a" which germinate in fall. This also allows an additional application of glyphosate mid-winter which will further clean up the site and assure less competition for the germinating *Danthonia*. If erosion is a concern, it can be sown with a SMALL amount of *Deschampsia elongata* (slender hairgrass) which germinates in the fall but is not very aggressive. Suggested sowing rate for *Danthonia californica* is 8-10 lbs/acre (drilled). It is important to note that California oatgrass can be very small the first growing season (3-5 blades) so it leaves a lot of room for weedy species. The tufts will get larger the following year - about 1 ft in diameter.

The problems I have found with this method are:

1) Chemical application timing and knowledge of germination dates is crucial to eliminating non-native grasses in the seed bank AND
2) The native grasses take up the space and resources needed for the forb seed to establish

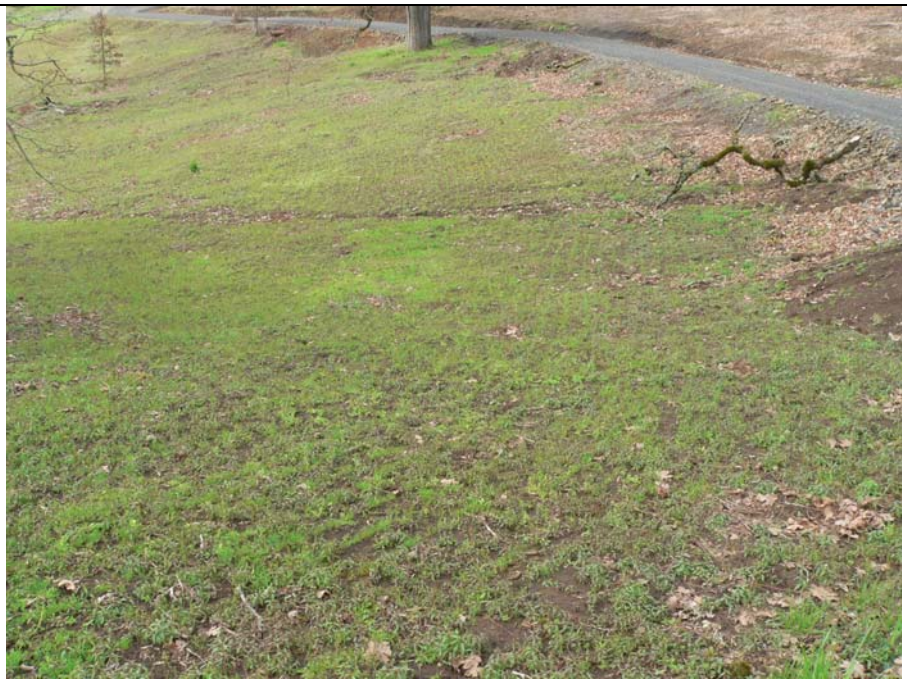
Problem 1: When the native grasses in 1a, above, are sown in the fall; even if the area has been treated with herbicide for two seasons. Non-native annual (especially rattail fescue) and perennial grasses in the seed bank will germinate the same time as the native grasses. Since the general herbicide window has now been shut due the winter germination of the native grasses, there is nothing to do but watch these grasses set seed the following summer and add even more weed seed to the site. The broadleaf herbicide used will have no effect on the grasses; thus, when you sow your forbs the following fall, they are in heavy competition with the grass seed load now present in the native grasses.

A possible way to avoid this would be to try and sow these native grasses in late-winter if a weather window appears and you can get onto the site. This would allow one more late-fall/early winter application of glyphosate to kill grasses (and other weeds) after they germinate. This would make an enormous difference in the amount of grass weed seed the forbs must compete with the following fall. It would be prudent not to sow the native grasses too late since 1) they do need a short cold period in order to germinate and 2) the longer they have to grow, the healthier that stand of grass during the summer drought months. In addition, to avoid a dense stand of native grass and give more room for forbs the following year, sow the grasses at a lower rate [15 seeds/ft drilled, 30 seed/ft for broadcast]

If it is necessary to sow in the fall and it is apparent that non-native grasses will still be a problem, an option would be to sow only *Festuca roemeri*. Then, control the non-native seed load the following summer by mowing prior to seed set. The second year, a grass-specific herbicide such as Poast® or Fusilade® can be used [the latter is the best]. Studies have shown that *Festuca roemeri* is very tolerant of these herbicides due to its fine leaves and tough cuticle. As noted in the site –preparation section, other fine-leaved grasses such as rattail fescue **are also tolerant** of these herbicides and other treatment options need to be considered.

This problem became apparent when I compared areas sown with the fall germinating grass mix in 1a with areas sown only with the spring germinating *Danthonia californica* (California oatgrass) (see #1 b above) at our Jefferson Farm restoration site. We were able to apply glyphosate in February just prior to the germination of the *Danthonia*, and most non-native grasses were eliminated. This produced a much cleaner site on which to sow forbs the following fall.

March 2007: Area 1a and 1b spring after sowing grasses fall 2006



1a: Jefferson Prairie March 07 after fall sowing a mix of native grasses that germinate in the fall. Annual forbs and grasses very heavy (light green areas in background are grasses)

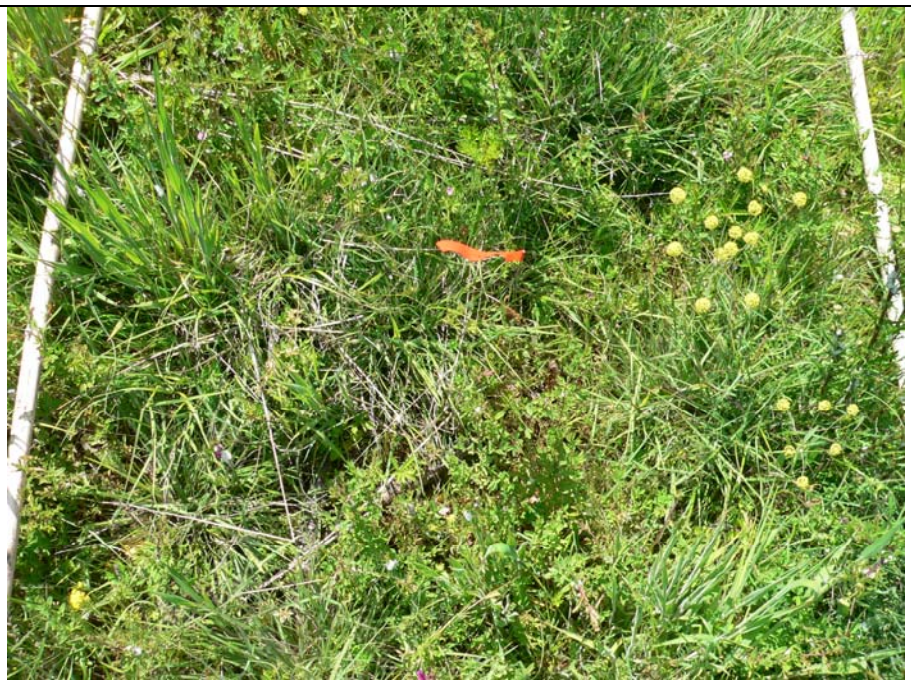
1b: Jefferson Prairie March 07 after fall planting *Danthonia californica* and applying glyphosate in February. Mostly just young *Danthonia*. (yeah!)

Problem 2: When forb seed was **broadcast** seeded into the established first year stand of native grass the germination rate was moderate to poor. It was almost non-existent in the grass mix area (1a) due to the heavy competition from the non-native grass seed bank as well as the dense stand of native grass! In the *Danthonia californica* areas (1b), there seemed to be more "room" for forbs between the native grass rows but the germination rate where the stand was robust was low (although is was **better** that 1a). The forbs did the best where grass density was low or non-existent. This leads me to conclude that more **dirt** and a lower level of competition are needed in order to establish a rich array of native forbs in high density.

If you must seed into 1 year old native grass stands no-till drilling (rather than broadcast seeding) and using species that germinate in early-mid winter may give better results. If forb seed is to be applied later than the first year, the site must be re-opened to give the seed dirt to germinate. Both **burning [best]** and **mowing** the site prior to the second native seed application are good methods for opening up the site [see photo below]. However, you may be limited to species that germinate in early winter and this limits the number of species that can be sown considerably.

SUMMER 2009: Area 1a and 1b two years after sowing forbs The area in 1a showed very poor establishment for forbs compared to the area in 1b where more established than previously thought [larger and easier to identify]

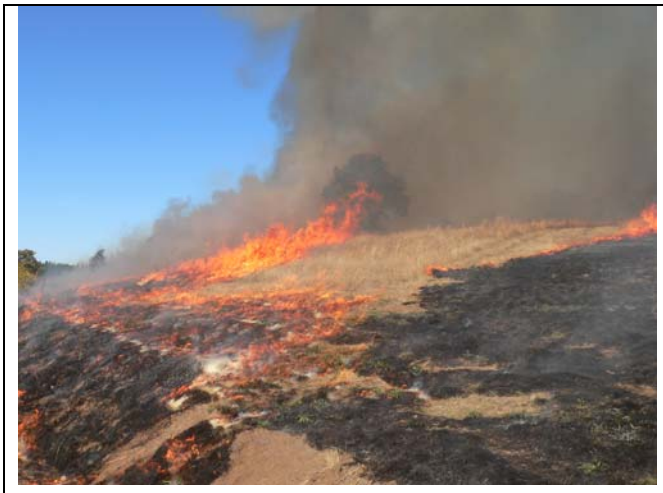
1a: Jefferson Prairie May 2009 *Festuca roemeri* plot area showing no forbs established

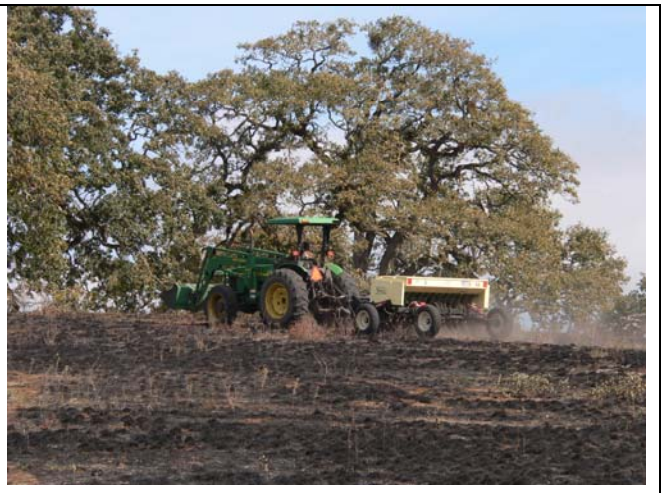


1b: Jefferson Prairie May 2009 higher density *Danthonia californica* showing moderate forb establishment

1b: Jefferson Prairie March 2009 **low** density *Danthonia californica* showing robust forb establishment

Fall 2009: Burning and reseeding using a no-till drill [stay tuned for the results]





Option 2 – forbs first then grass later

If the site is clean of weedy forbs but non-native grasses are still a problem (common in **fallow grass seed fields**), seed native forbs only the first year, then overseed with native grasses. This will allow additional growing seasons where grass-specific herbicides such as Fusilade®, Poast®, or Envoy® can be applied. However, forbs do not occupy the same amount of space as grasses and this can make the site susceptible to weeds. I tried this method in **old upland pasture** treated with glyphosate for two years that still had bentgrass issues and it resulted in great establishment of native forbs but also a great establishment of invasive species such as St John's wort, Tansy ragwort, and Queen-Anne's lace. There was also a lot of rattail fescue which the grass-specific herbicides do not affect. There was no way to control any of these after the fact due the size of the site. **Note:** this problem is not as bad on **wet prairie** sites due to the hydrological exclusion of many weedy forbs.

- The next problem with this method was that when *Festuca roemeri* was sown into the stand of forbs, the establishment was poor. The site was too occupied with vegetation (seedlings of native and weedy annuals, established perennials, and rattail fescue) that there was not enough room for this very slow growing upland grass to germinate and thrive. The same results would apply for other bunchgrasses such as *Poa secunda* and *Koeleria macrantha*. If you must do forbs first (in areas where grasses need to be controlled) you should only sow perennial forbs in **low density** and then increase the grass sowing rate to 50-100 seed/ft.

Option 3 (your patience will be rewarded!)

If the site is very clean (when the top layer of weed seed has been reduced considerably) you can apply grasses and forbs at the same time [this might be the case in grass seed fields with little residual seed, fields and pastures with multiple herbicide applications, or areas solarized for a long-period].

The advantage to this method is **numerous:**

1) Every inch of dirt is taken up by a native seed ☺
2) Every seed has the best chance of establishing ☺
3) There is no competition from existing vegetation (native or non-native) ☺
4) A diversity of species can be sown including species that need a long stratification period. ☺

Comments, Cautions, and Considerations (most to least favorite):

Broadcast forbs and drill grasses: Broadcast the forbs using a hand-crank spreader, a large spinner-spreader pulled by an ATV or tractor (rented at your local farm store), or removing the seeding tubes from drill openers so that the tubes just dangle while spreading seed, or by hand. If this option is chosen, the forbs should be sown at a higher rate than drilling due to poorer soil contact and possible predation (see below for details). Drill grasses **over** the broadcast seed or press into the soil with a cement or water drum roller. We just used this method on two areas and the results were good for the most part.

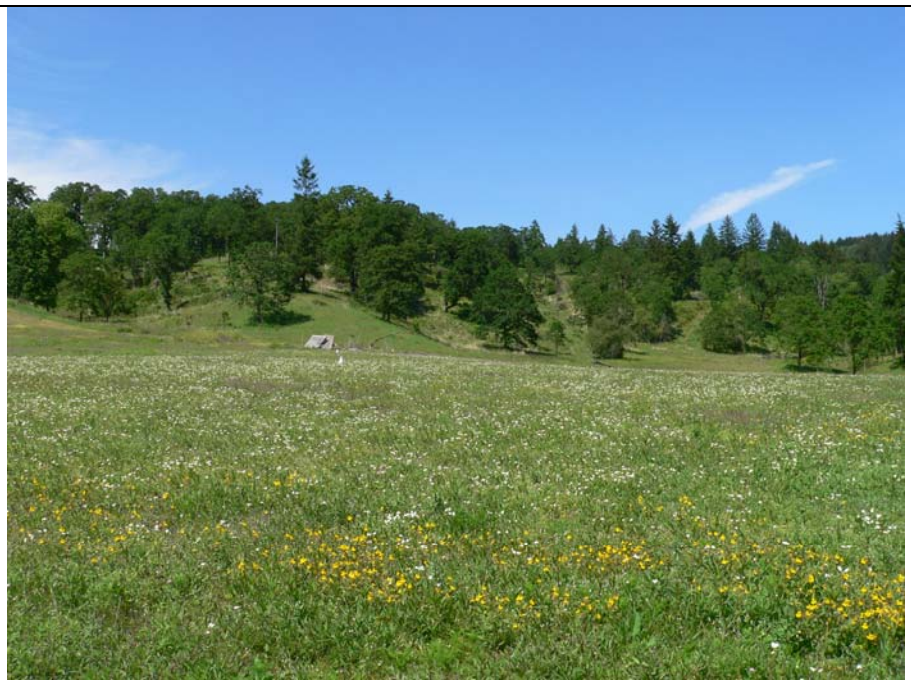
Notes on Grass and forb choices: Just as in Option 1 above, I chose two different grasses. One area was drilled with *Festuca roemeri* and the other I drilled with the *Danthonia californica*. The *Festuca roemeri* area did super! It germinates in the fall and was able to establish with or before the forbs. The *Danthonia californica*, unfortunately, did not do as well since many forbs germinated in the fall (especially the annuals) and reduced the room needed for the grass to germinate. *Danthonia* is very small the first year so, perhaps, summer 2010 surveys will show greater establishment than previously thought.

Since the site was clean, the forb sowing rate could have been as low as 4 lbs/acre even broadcast sown (mine was twice that). This might eliminate some of the competition issues when *Danthonia* is sown with forbs. In addition, care should be taken with using *Achillea millefolium* and *Lupinus rivularis*. These really establish quickly and the lupine gets HUGE which adds to the shading of the site. They should comprise a **low** percentage of any mix.

Option 3: Broadcasting forbs and drilling grasses.

Summer 2009: *Festuca roemeri* with annual forbs the summer after sowing

Winter 2010: *Festuca roemeri* and TONS of native forbs [pictured: *Sidalcea campestris*, *Prunella vulgaris* var. *lanceolata*, *Eriophyllum lanatum*, *Clarkia* sp., *Potentilla glandulosa*, and *Lotus unifoliolatus*.



Summer 2009: *Danthonia californica* area swamped with native annuals (pretty but low grass establishment ☹)

Winter 2010: Small tufts of *Danthonia californica* in a sea of forbs (it took a while to find these)

Drilling grasses and forbs in alternating rows: I haven't tried it yet but think it would work great! To do this, place the grass seed in every other hopper in the "fluffy seed" box and calibrate to your desired sowing rate. In the "small seed" box (used for granular seed) block off the holes to the tubes that the grass seed will be going through with duct tape. Then, calibrate the aperture openings to give you the desired seeding rate for the forbs. The calibration would be the tricky part and may entail cutting the forb seed with a carrier.

Broadcast seeding grasses and forbs: If no drill is available, broadcast seeding everything together is still effective [best if fall sowing] (see below for sowing rate suggestions.) Some seed drills can be set for the lower seeding rates needed for natives; however, if this is not the case, as well as for broadcast seeding, the seed should be mixed with a cutting agent. Medium-grade vermiculite (available from nursery supply stores) or sifted, moist sawdust works well. Rice hulls, corn cob animal bedding, diatomaceous earth, or crushed hazelnut shells have also been suggested.

I do NOT recommend this if sowing in **late winter** and you are using slow growing bunchgrasses such as *Festuca roemeri*. Just as with the problems noted in Option 2 (forbs first then grass) there is poor establishment of the grass due to the robustness of the native forbs sown (I used a mix of annual and perennial forbs that only needs a short-cold period).

Drilling grasses and forbs together: All native species **do not germinate at the same time**; most of our grasses and some of our forbs germinate in the fall but many species need weeks of cold/moist stratification. Therefore, it is **unwise** to drill both grasses and forbs together since the early germinating species will out-compete the later germinating species. This is not the case with mid-western prairie seed which all germinate in the spring after the winter freeze.

Drilling grasses in one direction and forbs in another: This disturbs the ground twice and may intensify the weed issue.

NATIVE SEEDING: WHAT TO SEED AND HOW TO APPLY

Note: Make sure not to sow too heavy, there is a fine line between taking up space as defense against weeds, getting a good native stand, and natives out competing each other (especially annuals when perennials trying to establish).

-PLEASE SEE SEEDING RATES AND METHODS FOR CALCULATIONS WHICH IS AVAILABLE IN THE SUPPORTING DOCUMENTS SECTION

Drilling vs Broadcasting

For drilled seed, the suggested sowing rate is 5 – 10 lbs/acre for large seeded grass species and 3-8 lbs/acre for small-intermediate seeded forbs. For seed that is broadcast or hydroseeded this rate should be 1/3-twice the rate of drilled seed (this allows for seed predation and loss due to erosion, desiccation, and poor soil contact). Seed size should be taken into consideration with higher rates used for large seeds and lower rates for small seeds. Seed mixes can be calculated to take into account the seeds/lb of species desired Drill seed to a maximum depth of ¼". Mulching is not recommended for drilled seed due the necessity of light for most native prairie species to germinate. For broadcast seed, light mulch may be applied (although the jury is still out on this one) but it must be weed free! This will help increase contact with the soil and prevent predation by birds. The best method for insuring good germination of broadcast seed is to use a drum **roller** (heavy metal or water-filled) over the seed. Soil contact is VITAL for good germination.

Application Window

In general, the best time to sow our native prairie species is in the fall (Oct-Nov). This will allow any stratification (moisture and cold so seed will imbibe water and germinate) requirements to be met. Many species of native annuals and some perennials do not need long stratification; however, they still need some amount of cold and wet to germinate. They may be sown as late as early March, however, they will produce very small plants and the annuals will produce very little seed.

Forb Seed (grass seed covered above)

Forb mixes should have no more that 10 -12 species, with annuals comprising 25% of the mix and perennials comprising 75% (see **Seed Mixes** on our website Natives page for examples). This increases the chance of successful establishment of each species. Establishing the perennial forb species while the soil is bare gives a greater chance of long-term persistence as the grass starts to dominate the site. The annuals will drop out in significant numbers by the third year, but periodic disturbance by burning or mowing will re-open the site for the annuals. This also maintains the diversity of species on a site. Diversity can be achieved by sowing a variety of mixes to a site by designating plots. This patchwork approach will give the site a more "natural" look over time. In our current restoration project at the Joseph St. farm (see photos below), the most successful forb species by the second season were *Sidalcea campestris* (meadow checkerbloom), *Sidalcea malviflora* ssp *virgata* (rose checkermallow), *Prunella vulgaris* var. *lanceolata* (self-heal), *Achillea millefolium* (yarrow) and *Eriophyllum lanatum* (Oregon sunshine). The success of most of these species is due to their capability to spread via rootstock and they are ready self-sowers after fire. Other perennials such as *Lomatium dissectum* (fern-leaved lomatium) and *Lupinus albicaulus* (sickle-keeled lupine) are still small the second season but they are robust and flowering the third. Another successful species is *Ranunculus occidentalis* (Western buttercup); it is a ready self-sower and it seems to increase each year.

Joseph Street Prairie west plot year 2 – *Sidalcea campestris* and native bunch grasses

Joseph Street Prairie year east plot 3 – *Lupinus albicaulus*, *Eriophyllum lanatum*, *Collinsia grandiflora*

c. Many annual species are great nectar and seed sources for birds and butterflies. Since they become reduced by perennial dominance by the third season, sowing a border area with a mix of annual forbs and no grass, will allow the populations of these species to be maintained on the site and add additional color and habitat value to the restoration area. However, make sure to monitor these areas for invasive weeds.

2. If the site is in poor condition or has been disturbed you can sow species that germinate quickly and are good competitors. *Elymus glaucus*, *Elymus trachycaulus* (99% of grass mix) and *Bromus carinatus* (1% of grass mix) germinate quickly and are robust the first year. Bromes are **very aggressive** so a little goes A LONG WAY. The following forbs germinate in the fall and early winter: Perennials - *Achillea millefolium*, *Lomatium utriculatum*, *Lomatium nudicaule*, *Lupinus albicaulus*, *Lupinus rivularis*, *Prunella vulgaris* var. *lanceolata* , *Eriophyllum lanatum,* and *Ranunculus occidentalis* (75% of forb mix) and annuals - *Clarkia amoena, Clarkia purpurea*, *Collinsia grandiflora*, *Collomia grandiflora*, *Gilia capitata*, *Lotus unifoliolatus*, *Madia elegans and M. gracilis*, and *Sanguisorba occidentalis (25%* of forb mix.*)*

What to Sow?

For a *comprehensive* list of Willamette Valley prairie plant communities, please visit the Native Seed Network at http://www.appliedeco.org/native-seed-network

Follow the link at the bottom of the page "species lists and recommendations".

OAK HABITAT – SITE PREPARATION:
WHAT ARE YOUR STARTING CONDITIONS????

1) Mature oak woodland with conifers over-topping the oaks and young conifer and oak in the understory
2) Young oak in very thick stands
3) Invasive shrubs
4) Bare-ground after tree and shrub removal
5) Canadian thistle, knapweed, and biennial thistle infestations
6) Oak savanna (grassland with large, open-growth oaks spaced 2-10 trees/acre)
7) No/Few Oak

(1) Remove conifers by hand-cutting. Conifers that would harm oaks if felled can be limbed and topped to provide wildlife habitat. Also, some conifers can be partially limbed and left for replacement snags. The longest lived snags are created using conifers greater

than 10 inches DBH (the larger the better). Young, skinny oaks with no lower branches should be thinned. Retain any oaks that are in more open habitat and have developed lower branches. Woodland target density should be approximately 40 – 50 trees/acre.

(2) Remove the majority of the oaks so that grassland can be reestablished or enhanced. Retain oaks with lower branches and remove the others. The trees with lower branches will be able to mature into open-grown oaks with large crowns. These large branches will contain numerous microhabitats for invertebrates, will become draped with nutritious lichens, and produce abundant acorns. Target density should be 2 – 5 trees/acre. Hand-cutting is one option but there are low-impact (rubber-tracked) skid-steers available that can mechanically remove the smaller diameter trees and apply herbicide to the stump (oaks re-sprout). Since it is desirable to re-seed immediately after exposing bare soil (see #4 below), logging should be done just before spring rains stop or fall rains begin.

(3) Mow or hand-cut invasive shrubs such as Himalayan and evergreen blackberry, poison-oak (native but can become noxious if not controlled), scotchbroom, English hawthorn, holly, and sweetbriar rose. Many rubber-tracked skid-steers have brushing mowers that can handle large areas of tall brush. Smaller areas can be mowed down with power equipment such as DR® or Billy Goat® walk behind brush mower. Hawthorn will re-sprout so application of herbicide to the freshly cut stump is imperative. Loppers, Poison oak and English ivy climbing trees can be cut from the base of the trees using a strong pair of loppers; however, if the job is large and the money available, electric clippers from Pellenc® work very well. When working with or near poison oak it is very important to be fully clothed. Be careful to where gloves before removing clothing and wash the clothing immediately. You may not be susceptible but someone else you or your clothing comes into contact might be. A very good product for the removal of poison oak oil is Technu®; apply it before working near poison oak and immediately after. English ivy growing on the ground can be hand-pulled or cut. However, it roots at the nodes so must be put onto plastic to dry and die. For long-term maintenance and control of brush, see #4 below. Very good information on the control of invasive species can be found at http://tncweeds.ucdavis.edu.

(4) Bare soil is an open invitation to weeds (especially thistles) so it must be immediately seeded native grasses such as *Elymus trachycaulus* and *Elymus glaucus*. They will germinate readily if sown while there is rain. Depending on the site characteristics and the ability to control weedy forbs, quickly germinating forb species can also be added to the mix (taking the best advantage of the bare soil!). Sowing prairie species will also reestablish native grassland in these areas and allow for long-term shrub control by periodic fire. After seeding the grass and/or forbs, the broad-leaf weeds can be spot-sprayed until under control. Allow two years before burning the area to ensure hardiness of the crown. If burning is not an option, mowing is the best alternative. If the grasses were introduced first and area is clean of invasive broadleaf species, sow native forbs after the burning or mowing treatment.

Notes:

1. Both of these grass and fall germinating forb species germinate really well on the residue left after a brush pile has been burned and ensure that weeds to not overtake the bare ground.
2. Some bare patches should be retained in order to provide vital pollinator nesting sites. Most native bee species nest in bare soil. The best sites to retain would be cut banks that face the morning sun. To keep the area free of vegetation, herbicide can be applied very early in the morning or late in the evening when the bees are in their nests. For more information on native pollinator conservation see **Appendix A**.

What to Plant?

For a comprehensive list of grasses and forbs of the Willamette Valley oak woodland habitat, please visit the Native Seed Network at http://www.appliedeco.org/native-seed-network

Follow the link at the bottom of the page "species lists and recommendations".

Below is a list of small trees and shrubs appropriate for oak woodland habitat.

Small Trees & Shrubs		
Amelanchier alnifolia	P	Serviceberry
Corylus cornuta var. californica	P	Western hazelnut
Holodiscus discolor	P	Ocean spray
Mahonia (Berberis) aquifolium	P	Oregon grape
Oemleria cerasiformis	P	Osoberry or Indian plum
Rhamnus purshianus	P	Cascara
Ribes sanguineum	P	Red-flowering current
Rosa gymnocarpa	P	Baldhip rose
Symphoricarpos albus	P	White snowberry

(5) Canadian thistle and knapweed are rhizomatous perennials and must not be pulled or tilled as a weed control method. The most effective method of control is to spot-spray the rosettes with a composite-specific herbicide (containing clopyralid) very early in the spring before the grass becomes too tall. Note: herbicides with clopyralid are long-lived in soil and compost so the chemical should only be applied to the target plant. Biennial thistles (bull, Italian, milk) can be treated with glyphosate in the rosette stage. If they are in the early flowering stage, it is best to treat them early with a general broadleaf herbicide, which will kill the plants more quickly, and before seed set.

(6) Work to improve the grassland for ground nesting species (see *Conservation Strategy for Landbirds in Lowlands and Valleys of Western Oregon and Washington* listed in

Suggested References and the Grassland Section above). Retain some smaller oaks as replacement trees.

Note: Retain or plant some native shrubs where appropriate (ravines or around mature trees). Good wildlife shrub species are: *Amelanchier alnifolia*, *Rhamnus purshianus*, and *Holodiscus* bicolor. Non-native shrubs such as Himalayan /evergreen blackberry, English hawthorn, and scotchbroom should be removed. Again, there are low-impact skid-steers available that can mow these species down. Re-growth of blackberry can be spot-sprayed with glyphosate in October. Spot spraying for three years has proven very effective. Regular maintenance of the site by burning or mowing should keep the invasive shrubs in control.

(7) If you want to plant oak on your site AND want native grassland habitat, establish the prairie first (see above for suggested methods). When the grassland is established (in 2 – 3 years), mow or burn the site in the fall and plant oaks in clusters of 4 – 5 trees. Plant the clusters at a savanna density (2 – 5 clusters/acre). Oaks (and other native trees and shrubs) establish best when planted in the winter. Spring is often iffy due to unpredictable rainfall. When the oaks are 5-10 years old, the clusters can be thinned to ensure open-growth oaks are established at a savanna density.

APPENDIX A

SUGGESTED ADDITIONAL RESOURCES

- **Literature Cited** for Willamette Valley Proposed Critical Habitat

  http://www.fws.gov/oregonfwo/species/PrairieSpecies/Documents/FR2000Jan25WVCHReferencesCited.pdf

- **Techniques for Restoring Native Plant Communities** in Upland and Wetland Prairies in the Midwest and West Coast Regions of North America by Greg Fitzpatrick (TNC White Paper)

  http://www.lcog.org/wewresearch/ AND

  http://www.lcog.org/wewresearch/PDF/FitzpatrickLiteratureSearch.pdf

- You can download PDF versions of the two PowerPoint presentations from a Wet Prairie and Upland Prairie Workshop conducted by the West Eugene Wetlands Partnership on, summaries of management costs, a comparison of no-till drill versus broadcast seeding, a brief summary of some of the equipment, and two documents from the Society for Ecological Restoration.

  ftp://ftp.ris.lane.or.us/cedp/outgoing/Wetlands/ORPA/

  Additional information is also available from the following web-site (the three most relevant links on this web site are the "Native Plants", "Research", and "Reports" links).
  http://www.eugene-or.gov/wetlands

- **Guidelines for Planting Native Seed** – Pacific Northwest Natives web-site
  http://www.pacificnwnatives.com/

- **Native Seed Network** http:www.nativeseednetwork.org

- **OSU Professor of Botany, Mark Wilson**
  http://www.onid.orst.edu/~wilsomar/Index.htm

- **The Institute for Applied Ecology** http://www.appliedeco.org/

- **Conservation Strategy for Landbirds in Lowlands and Valleys of Western Oregon and Washington** – Partners In Fight
  http://community.gorge.net/natres/pif/con_plans/west_low/west_low_plan.html

- **Restoring Rare Native Habitats in the Willamette Valley** *by Bruce Campbell, ODFW.*

  http://www.biodiversitypartners.org/pubs/index.shtml

- **A Landowner's Guide for Restoring and Managing Oregon White Oak Habitats** Oak ecology, site assessment, restoration planning/methods, controlling invasive

species, and wildlife enhancement. *Dave Vesely and Gabe Tucker, Pacific Wildlife Research*. Order on-line at http://www.oregonoaks.org/landguide.shtml

- **Landowner Video Guide for Restoring and Managing Oregon White Oak Habitats** *(65 min)* On-the ground coverage of habitat conditions, management opportunities, restoration projects, common landowner goals, and controlling invasive species. *Hugh Snook, BLM, and Barry Schreiber, Flora & Fauna Video Production.* Available free at www.OR.BLM.gov/Salem
- **R-J Consulting Services, LLC (contract brush and tree removal with low-impact skid steer and spraying).** Jason Garland, R-J Consulting Services (541) 979-7282 rjconsulting@croisan.com
- **USFW Partners for Fish and Wildlife Program** http://partners.fws.gov/, **Steve Smith, Willamette Valley Administrator 541-757-7236** mailto:Steve_Smith@fws.gov
- **Natural Resource Conservation Service** (local offices): WHIP, EQUIP, CREP, CRP Programs, Salem office contact: Les Bachelor 503-399-5741 x122 les.bachelor@or.usda.gov
- **OSU Extension Service**, Private Landowner Workshops for Conservation and Restoration of Native Woodlands. Brad Withrow-Robinson 503-434-7517 brad.w-r@oregonstate.edu
- **OSU Extension Service.** Cereal Grains as Cover Crops http://eesc.orst.edu/agcomwebfile/edmat/html/EM/EM8692/EM8692.html
- **Pollinator Conservation Handbook.** The Xerces Society http://www.xerces.org/
- **Willamette Valley Prairies**; Research from Oregon State University, http://people.oregonstate.edu/~wilsomar/Index.htm
- **Willamette Valley Prairie**; Benton County Prairies Species Conservation Plan http://www.co.benton.or.us/parks/hcp/prairieinformation.php
- **Farmscaping for Beneficials Project**, Gwendolyn Ellen; IPPC/OSU, 2036 Cordley Hall, Corvallis, OR 97331, 541-737-6272
- **Willamette Prairie Wet Prairie Restoration**; The Wetlands Conservancy http://oregonstate.edu/media/zfbts
- **Institute for Applied Ecology; Prairie research** http://www.appliedeco.org/conservation-research/prairie-restoration-research

APPENDIX B

Target Chemicals for Weed Control
Seed Production and Restorations

Note: Always read chemical labels before applying – for restorations, it should be labeled for: non-crop land, CRP, habitat management, wildlife openings etc.

There is a lot of Information on the Web – Here are some sites I have found helpful

http://www.greensmiths.com/herbicides.htm
http://www.ipaw.org/herbicides.htm
http://grounds-mag.com/mag/grounds_maintenance_new_pest_controls/
http://grounds-mag.com/mag/grounds_maintenance_understand_mode_action/
http://stephenville.tamu.edu/~butler/foragesoftexas/weedcontrol/hermode.pdf
http://www.utextension.utk.edu/publications/pbfiles/PB1728_sec2.pdf
http://www.maltawildplants.com/ASTR/Docs/CNZBO/Weedchart.pdf

Weeds susceptible to various herbicides

My Experience

- Glyphostate [short lived in soil]
  - Kills everything! [However, spraying post-pollination, they will set seed]
  - Fall applied to blackberry 3-5 years, effective control
- Envoy® , Poast®, and Fusilade (grass-specific)
  - Works on all wide-leaf grasses (even perennials)
  - Doe not kill rattail fescue, red fescue (skinny leaves)
  - Hit while young and growing (ineffective in flower)
  - Safe for non-grass monocots (lilies, iris, sedges, rushes)
  - Poast and Fusilade does NOT harm *Festuca roemeri* [Fusilade shows the most promise]
- 2,4-D (broadleaf) [short-lived in soil]
  - Good for: composites (thistles, dandelion ect), pearlwort, mustards, geraniums
  - Not good for: clover, speedwell, chickweeds, miners lettuce, vetch
  - Do not spray over grasses and forb monocots that are sending up flowering stems or will harm seed set – spray on graminoids no later than February/March
- Mecoprop "MCPP" (broadleaf) – Combined with MCPA and dicamba or MCPA and 2,4-DP [short lived in soil] (Tri-Power®)
  - Kills pretty much everything (not very effective on vetch)!

- Kills Clover, speedwell (MCPA), chickweeds, burdock, bedstraw!
- Best to target prior to pollination or seed-set may still take place.
- Can be sprayed on monocot forbs before flower stems emerge BUT they will bolt and look ugly **(2,4-D is less harsh)**
- Warning! Does **NOT** kill **St. John's wort** so if not careful, can select for that weed by killing off its competition!
- Do not spray over grasses that are sending up flowering stems or will harm seed set (no later than February)

- Clopyralid and Triclopyr [long-lived in soil]
  - Targets are composites (especially Canadian thistle) and legumes (great on clover).
  - **Spot-spray ONLY**.

APPENDIX C

Shrub Treatments

Information from our own experience and representative of Helena Corp Bruce Kelpsas

•Cut hardwood stumps & spray with a 25% sol of Garlon 3A within 20 min (a 50% concentration of glyphosate shows promise)

•Blackberry – mow, survey for natives, if chemical chosen, use
glyphosate in October (1%) – repeat multiple years
Garlon 4A in cool weather
If confident no natives will be affected, then the more foliage the better – do not mow OR wait one season to get good growth

•Poison oak
2,4-D or Garlon 3A when leaves still green (if less than 50%, it's not effective), cut from trees with linoleum scraper (really)
•Glyphosate (2-5%) in July

•English hawthorn - mow &, if can, spray stumps with
Garlon 3A or keep mowing/burning
Small shrubs whole plant with glyphosate (5%) + extra surfactant mid-late summer

•Scotch broom - mow, does not resprout, (seed, though viable for a long, long time). If chose to use herbicide use
Garlon 3A
Glyphosate (5-10%) with surfactant

•English ivy – cut from trees with bow saw & apply 100% glyphosate to cut end; ground plants - shovel/pull and pile onto plastic (do not leave on ground!) or use 2% 2,4-D

APPENDIX D

Resources for Wildlife Habitat Conservation in Oregon
Prepared by Katie Frerker, Wild Food Alliance 2006

At-Risk Species: The Oregon Department of Fish and Wildlife compiled a complete list of all vertebrate, invertebrate, and plant species in Oregon that have a federal or state at-risk conservation status. The list include species that are federal or state endangered, threatened, or candidate species, state sensitive or vulnerable, or natural heritage conservation status. The most recent list can be found at www.dfw.state.or.us/LIP/species_list.pdf with an explanation of the codes at www.dfw.state.or.us/LIP/species_list_explain.pdf.

Incentive Programs and Funding: Incentive programs are offered by a variety of public and private sources, including federal agencies (Natural Resources Conservation Service, the U.S. Fish and Wildlife Service, and the U.S. Forest Service), state agencies, regional or local agencies, and private organizations. For a complete summary of conservation incentive programs available in Oregon, go to www.biodiversitypartners.org/state/or/incentives.shtml.

Land Trusts: Land trusts are nonprofit organizations that, as all or part of their mission, actively work to conserve land by undertaking or assisting in land or conservation easement acquisition, or by their stewardship of land or easements. There are land trusts in some, but not all, parts of Oregon. To find a land trust near you, go to www.ltanet.org/findlandtrust and click on "Oregon", then "local land trusts".

Natural Resources Conservation Service: The NRCS provides leadership in a partnership effort to help people conserve, maintain, and improve natural resources and environment. The NRCS also offers several incentive programs specifically for wildlife habitat conservation. Find your local office or technical specialist in Oregon at www.or.nrcs.usda.gov/contact.

Oregon Wildlife Conservation Strategy: This new action plan identifies at-risk native habitats and species in each ecoregion of the state, including: oak woodlands, oak savannas, prairies, wetlands, wet prairies, riparian areas, aquatic habitats, grasslands, ponderosa pine woodlands, and sagebrush steppe / shrublands. For information about where, how, and why to conserve native habitats in Oregon, go to www.dfw.state.or.us/conservationstrategy, or call 503-947-6315 to get a copy on CD.

OSU Extension Service: The OSU extension service offers assistance to landowners in many subject areas, including agriculture and forestry. The Master Watershed Steward Program provides excellent, in-depth training including: watershed and stream processes,

riparian area functions and management, salmonid biology, stream assessment, restoration, water quality monitoring, wetland evaluation and enhancement, soils and erosion, and working together to create successful groups. For more information, go to seagrant.oregonstate.edu/wsep/masterprogram.html.

Restoration of Priority Habitats in the Willamette Valley: This landowner guidebook, produced by Bruce Campbell and Defenders of Wildlife, provides detailed information about restoring priority habitats in the Willamette Valley. It is an excellent guide, but it's out of print. To print your own copy, go to www.biodiversitypartners.org/pubs/Campbell/Landownerguide.pdf.

Soil and water conservation districts: SWCDs help landowners, land managers, and residents use conservation measures and management practices to protect near-stream areas and reduce the transport of chemicals and nutrients to streams in sedimentation or runoff. These conservation efforts cool water temperatures, stabilize streambanks, and protect water bodies from impacts by farm and ranch animals. Find your SWCD at www.oacd.org.

Watershed councils: Watershed councils are locally organized, voluntary groups established to improve the condition of local watersheds. They include the diverse interests in the watershed and are balanced in their makeup. They provide an opportunity to independently evaluate watershed conditions and identify opportunities to restore or enhance the watershed. Partnerships between landowners, local, state, and federal agencies, and other groups integrate local efforts. Find your watershed council at www.oweb.state.or.us/OWEB/WSHEDS/wsheds_councils_list.shtml.

Wildlife Habitat Conservation and Management Program – Rules and Statutes: Statutes for the wildlife habitat special assessment are ORS 308A 400-430 and ORS 308A 700-743, which can be found at www.leg.state.or.us/ors/308a.html. Administrative rules for the habitat program are OAR 635.430, which can be found at arcweb.sos.state.or.us/rules/OARS_600/OAR_635/635_430.html.