



United States
Department of
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Cover Crop Cocktails for Soil Health

In 2012-2013, the Corvallis PMC completed the first year of a 3-year national study looking at the effects of different cover crop mixes, or “cocktails”, and seeding rates on soil health. The results from this study will help inform local recommendations for effective cover crop mixes and seeding rates to control weeds and add organic matter, N, and biological activity to depleted soils.

The trial includes three mixes (2-, 4-, and 6-species) seeded at three rates (20, 40 and 60 seeds/ft²), along with a non-cover cropped control. In the spring all plots were rolled and

sprayed to kill the cover crop and no-till seeded to a commodity crop, sweet corn.

Initial results showed the best early cover and weed suppression in plots seeded at the higher rates with the 4- and 6-species mixes, largely due to the early growth of the broadleaved radishes. Sweet corn yields were highest from the plots seeded at 40 seeds/ft² with the 4-species mix (cereal rye, crimson clover, hairy vetch, and forage radish). All cover cropped plots showed an increase in soil C levels and a decrease in compaction, but it was too soon to see differences among cover crop treatments.



Elwha Dam Removal and Restoration

Rarely do we have a chance to install a restoration project on a site with no weed seed bank. But when a site has been underwater for almost a hundred years, it remains virtually free of weeds. The PMC has been working with Olympic National Park for almost ten years, preparing to sow seed over the



Trial plots six months after seeding native forbs and grasses at the lower Elwha River dam removal site. Bare, un-seeded lakebed is visible in the background to the right.

exposed lakebeds created by the removal of two dams on the Elwha River. The early years of the project included selecting species from the watershed to determine their suitability for large-scale seed increase. The PMC produced over 7,000 pounds of seed in four years to provide enough seed to restore to two exposed lakebeds, totaling over 500 acres. After the dams were removed in 2011, a study site was chosen to trial four seed mixes in order to determine how these species would establish together in a mix (Table 1). There was concern that some of the slower growing species, such as *Carex*, might be outcompeted by the rapid growing brome and blue wildrye. Slender hairgrass could be a great companion to the sedges because it comes up

quickly but is not a very competitive or long-lived plant. A separate forb mix was also made to study how well these species establish in the absence of the grasses.

High seeding rates were used because the site was broadcast seeded using “belly-grinder” spreaders.

The “soil” is comprised of glacial fines, with no structure. Early successional species were chosen specifically for this project because of their adaptability to poor soils. The site was seeded in early March of 2012.

Six months later, we were amazed to see the high rates of establishment by the natives, good species composition, and nearly complete lack of weeds. Many restoration seedings fail due to weed pressure and poor establishment of native plants, but all species were present in each of the four mixes. This project was a beautiful example of how well native species can establish in the absence of weeds, and it reinforces the importance of site preparation and weed control in every restoration project.

Table 1. Seed mixes used in a restoration trial at the lower Elwha Dam removal site in Olympic National Park in 2012.

Mix	Species	Seeding Rate
Aggressive grasses	blue wildrye, California brome	20 lbs/acre
Slow grasses/sedges	thickheaded sedge, Dewey’s sedge, spiked bentgrass, slender hairgrass	6 lbs/acre
Forbs only	Oregon sunshine, yarrow, coastal wormwood	5 lbs/acre
All species	All above	12 lbs/acre

Restoring Coastal Meadows for the Oregon Silverspot Butterfly

The PMC has been working with the US Fish and Wildlife Service (USFWS) since 2005 to increase seed of early blue violet (*Viola adunca*) and other species for use in recovery efforts for the endangered Oregon silverspot butterfly. Loss of coastal meadow habitat, and degradation from encroachment of tall, spreading, exotic plants, are responsible for the butterfly's threatened status. So far the PMC has produced over 700 lbs of seed of more than 15 species to use in restoration.

Site prep has been the biggest obstacle in restoration projects. Herbicide use has not been approved on the federal lands in the Critical Habitat area. Weather conditions usually prevent burning, and steep slopes and cliffs make equipment use impossible. In 2010, a relatively flat acre of salal was mowed and chipped. Chips left on site were too thick to seed into, so they were removed in the fall of 2011, along with most of the topsoil. At first, this was seen as a detriment to plant establishment, but species that are native to coastal meadows are adapted to sandy, low nutrient soils. This site was sown using "belly grinder" spreaders in the fall of 2011 with three different mixes: 1) a mowing-tolerant

mix with a lot of violet (violet, sand fescue, sand clover, dune tansy, and dune goldenrod; 7 lbs/ac); 2) a taller, non-mowed mix of mostly nectar species without violet (aster, yarrow, edible thistle, goldenrod, and sand fescue; 7 lbs/ac); and 3) a heavily-seeded mix of sand fescue and sand clover as a border to help slow weed invasion (12 lbs/ac). In addition to the seeding, two large areas were also heavily planted with violet plugs.

Establishment was patchy, especially in places where topsoil removal had exposed sandstone. The native plants were small in their first year (2012), which is typical of natives, but were considerably larger by the spring of 2013. The absence of weeds allowed the native plants to slowly establish without competition. Sand fescue and yarrow were dominant across the site. Some species had very low establishment from seed despite high seeding rates (goldenrod and violets). Although it is costly and impractical for most sites, topsoil removal (and simultaneous removal of the weed seed bank) was an effective site prep technique for this project, giving the native species the competitive edge they needed to become established.



Fescue, yarrow, and edible thistle in spring 2013 (seeded in fall of 2011).



Following topsoil removal, establishment of fall-seeded native species was moderate and plants were small but relatively weed-free in the summer of 2012.

Partnerships

The PMC partners with many federal agencies to provide plant materials for projects on federal lands when suitable materials are not available from private growers. In 2013, the PMC contracted with:

- USFWS for production of 6 Threatened & Endangered plant species and over 20 additional species to support habitat for endangered butterflies.
- Four BLM districts to produce seed and plants of over 60 species.
- Six National Forest districts for technology development on 20 species.
- Four National Parks to provide seeds and plants for restoration projects within the parks.

There is no published information regarding propagation or seed production for many of these species. Once they are in production at the PMC, we often discover special traits that make a plant particularly suited as a restoration species. New this year is horsemint (*Agastache urticifolia*). It is native to southern Oregon and California. It appeared to be a favorite resting place for bumblebees in late summer, and might be a nice addition to Conservation Cover or Hedgerow plantings for pollinator habitat.



On August mornings, hundreds of sleepy bumblebees were found in the horsemint flowers.

Direct Seeding Forb Mixes for Pollinator Plantings

In 2010, the PMC and the Xerces Society installed a replicated trial to evaluate the establishment and persistence of direct-seeding 12 commonly available, hardy native forbs for pollinator plantings, both in single-species plots and mixes (Early-mid Season bloom, Mid-late Season bloom, and All Species).

Riverbank lupine (a biannual) dominated the Early-mid Season mix and All Species mix, crowding out many of the slower growing perennials. Seeding rates should be lowered to about 1 seed/m² or less, but this species is a great choice for weed suppression and N-fixation. Annuals (farewell to spring and rosy plectritis) provided good first season coverage and weed suppression, acting as a nurse crop for slow-growing perennials, and then tended to fall out of the mixes. In particular, farewell to spring

dominated Mid-late Season mix the first season, but was replaced by a good mix of Pacific aster, Puget Sound gumweed, and Canada goldenrod in the second and third season. This seems to be a good way to ensure establishment of late-season species that didn't show up as much in the All Species mix with the lupines.

Best second season single-species coverage (>50%) was provided by riverbank lupine, lance selfheal, aster, gumweed, and Oregon sunshine. Other perennials (goldenrod, meadow checkerbloom, and slender cinquefoil) were slower to establish, but were still present in the mixes. Sulphur-flower buckwheat and showy milkweed had very poor establishment from seed, appearing unable to compete with weeds or other aggressive species. Milkweed might best be established from rhizomes or container plants.

Soil Health Workshop



Ron Raney, NRCS Soil Quality Specialist, gives a demonstration on infiltration rates at the Soil Health Workshop.

On May 2, 2013, NRCS co-hosted a workshop titled “Soil Health: Cover Crops and Precision Agriculture” at the Corvallis PMC along with the Benton Soil and Water Conservation District (SWCD) and the Oregon chapter of the Soil and Water Conservation Society. The event attracted over 70 attendees, including NRCS and SWCD personnel, farmers, students, and agricultural professionals. The agenda included presentations on soil health assessments, nitrate issues in the Southern Willamette Valley Groundwater Management Area (GWMA), use of cover crops for soil health, the OSU cover crop calculator, and nutrient management in precision agriculture. There were also field demonstrations of assessments to track soil health (infiltration and aggregate stability), cover crop sample collection for nutrient analysis, precision agriculture equipment, and the PMC cover crop cocktail trial.

5th Annual Field Day on Farmscaping with Native Plants



Field Day participants try their hand at catching and identifying native bees and other beneficial insects in a field of goldenrod.

Once again the Corvallis PMC teamed up with OSU’s Integrated Plant Protection Center and the Xerces Society to put on a full day workshop on “Farmscaping with Native Plants.” This year’s event, held June 18th, had 29 participants including farmers, landowners, students, agricultural professionals, NRCS and SWCD personnel. The day included talks on beneficial insects, site preparation for hedgerows and meadows, seed rates and calculators, and top choices for native plants, as well as field demonstrations of native grasses, hedgerows, a replicated forb seeding trial, seeding and maintenance equipment, and insect discovery.

Woody Plant Propagation Workshop

On February 20, 2013, the PMC and Oregon State University's Integrated Plant Protection Center (IPPC) conducted a workshop entitled "Woody Plant Use and Propagation for Beneficial Habitat".

Attended by 26 farmers and landowners as well as Soil and Water Conservation District and NRCS employees, it included classroom presentations on traits of woody native plants for pollinators, how to use woody natives, woody plant propagation using dormant hardwood cuttings, and winter twig identification. There was also a group exercise on hedgerow planning and field exercises on making woody cuttings and planting a hedgerow using cuttings, containers, and bareroot stock.



Workshop attendees practice taking willow cuttings before planting them in a new hedgerow at the Corvallis PMC during the Woody Plant Propagation Workshop.

Staff News



Dale discusses the benefits of native grasses at PMC Field Day in 2011.

Dale Darris retired from NRCS on December 31, 2013 after nearly 35 years of service, the last 27 of which were spent working in Oregon at the Corvallis PMC, both as a PMC manager and as an agronomist.

During his tenure at the Corvallis PMC, he had leadership and oversight of new construction and facility improvements for the Center that totaled over a million dollars (including a new office, laboratory, and greenhouse) and authored or co-authored over 200 technical publications on the establishment, propagation, seed increase, and conservation use of plants (primarily native shrubs and grasses found in the Pacific Northwest). He felt his most significant contribution was completing the "release" of 20 of the 23 conservation plant varieties ever developed by the Corvallis PMC.

We wish him the best in his future endeavors!

2013 Publications

This year we published a cover crop Plant Guide on crimson clover, and a number of Plant Fact Sheets and Plant Guides on native pollinator species including: farewell to spring, Idaho blue-eyed grass, big leaf lupine, grassy tarweed, mountain tarweed, Oregon saxifrage, shortspur seablush, naked buckwheat, sulphur-flower buckwheat, hookspurred violet, Western buttercup, and poverty rush.

These publications are available on the PLANTS database (<http://plants.usda.gov/>) or the Corvallis PMC Publications page

(<http://www.nrcs.usda.gov/wps/portal/nrcs/publications/plantmaterials/pmc/west/orpmc/pub/>).

We also updated many of our Conservation Plant Release Brochures, which are available on the Corvallis PMC Conservation Plants page

(<http://www.nrcs.usda.gov/wps/portal/nrcs/pmreleases/plantmaterials/pmc/west/orpmc/cp/>).

Corvallis Plant Materials Center

Since 1957, the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Corvallis Plant Materials Center (PMC) has selected conservation plants and developed innovative planting technology to solve natural resource concerns. The Corvallis PMC service area covers six ecoregions including the northern Pacific Coast Range, Willamette Valley, and Puget Sound Lowlands, as well as the Olympic, Cascade, and Siskiyou Mountains. The Corvallis PMC serves 19 counties in western Washington, 18 counties in western Oregon, and 6 counties in northern California.



Corvallis Plant Materials Center Personnel

- Kathy Pendergrass, Plant Materials Specialist & Acting PMC Manager
- Amy Bartow, Seed & Plant Production Manager
- Dale Darris, Conservation Agronomist
- Annie Young-Mathews, Conservation Agronomist
- Vanessa East, Technician
- John Knox, Technician
- Tyler Ross, Technician

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