# 2011

# PULLMAN PLANT MATERIALS CENTER TECHNICAL REPORT

**1935**

**2011**

# INTRODUCTION

The mission of the Pullman, Washington Plant Materials Center (PMC) that serves the eastern halves of Washington and Oregon and the northern portion of Idaho is to develop and transfer state-of-the-art plant science technology to meet customer and resource needs. The purpose of the Plant materials program is to:

1) assemble, test, and release plant materials for conservation use,
2) determine techniques for successful use and management of conservation species,
3) facilitate the commercial increase of conservation species,
4) provide for the timely development and transfer of effective state-of-the-art applied science technology to solve conservation problems and
5) promote the use of plant science technology to meet goals and objectives of the NRCS Strategic Plan.

The Pullman PMC land boundaries underwent no changes in 2011.

The PMC program has enjoyed the support of numerous cooperators in 2011. We thank all that contributed to our program.

To obtain additional information on the Pullman Plant Materials Center, contact:

USDA – NRCS
Pullman Plant Materials Center
P.O. Box 646211
Pullman, WA 99164-6211
Phone: (509) 335-6892 or (509) 335-6894
Email: mark.stannard@wa,usda.gov or pamela.pavek@wa.usda.gov

Website: http://Plant-Materials.nrcs.usda.gov

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# PERSONNEL

Mark Stannard continued to serve as the PMC manager and the plant science specialist.

Pamela Scheinost, agronomist, primarily focused on invasive species suppression and development of technology for improving habitat for pollinators.

Dallas Spellman, PMC farmer, focused on updating inventorying equipment & seed stocks, and preparing fields for the 2011 crop year.

Jake Tribelhorn and Patrick Behre assisted with plantings, field maintenance, and other "farm hand" activities during the summer.

# INFRASTRUCTURE AND EQUIPMENT

The windows on the growth chamber, seedbarn main floor, and shop were replaced with high quality energy efficient windows.

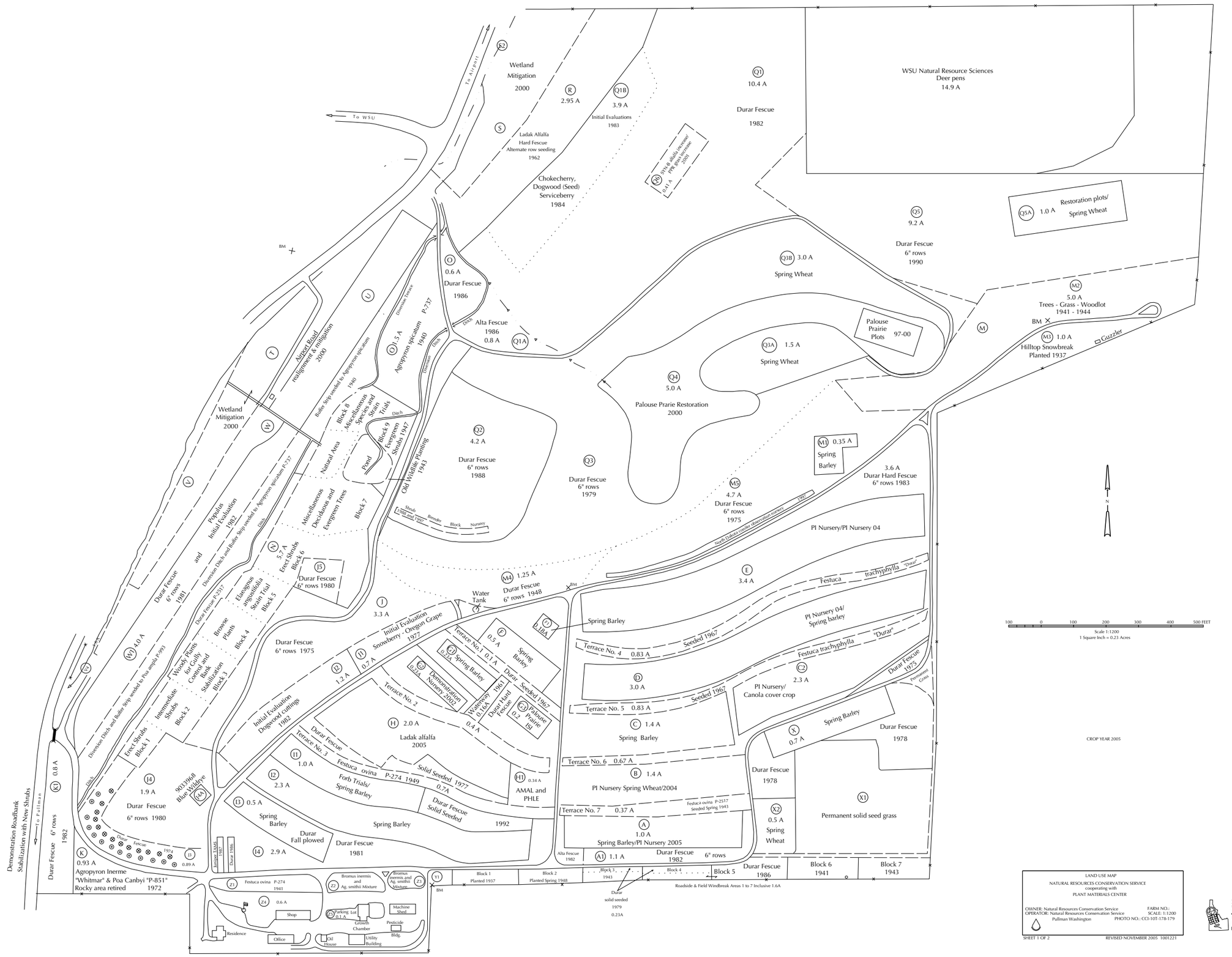
A Toyota forklift was acquired to replace the 1953 AC forklift.

An Almaco stationary thrasher was acquired.

A 22-foot gooseneck trailer was acquired. This trailer enables the PMC to transport the JD5200 + implements.

A 2011 Chevy ½ ton pickup replaced a 1981 Dodge D50 pickup.

Dallas removed the alleyways between several fields on the south farm. The alleyways were infested with Canada thistle and large tillage berms had developed over the years. We will replace the alleyways if needed.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To WSU
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Alternate row seeding
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Chokecherry,
Dogwood (Seed)
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Q5A 1.0 A
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Q3B 3.0 A
Spring Wheat
M2
5.0 A
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M3 1.0 A
Hilltop Snowbreak
Planted 1937
Guzzler
BM
M
Palouse
Prairie
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97-00
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Shrubs
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Erect Shrubs
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Diversion Ditch and Buffer Strip seeded to Poa ampla P-983
W1 4.0 A
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90339868
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1978
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1943
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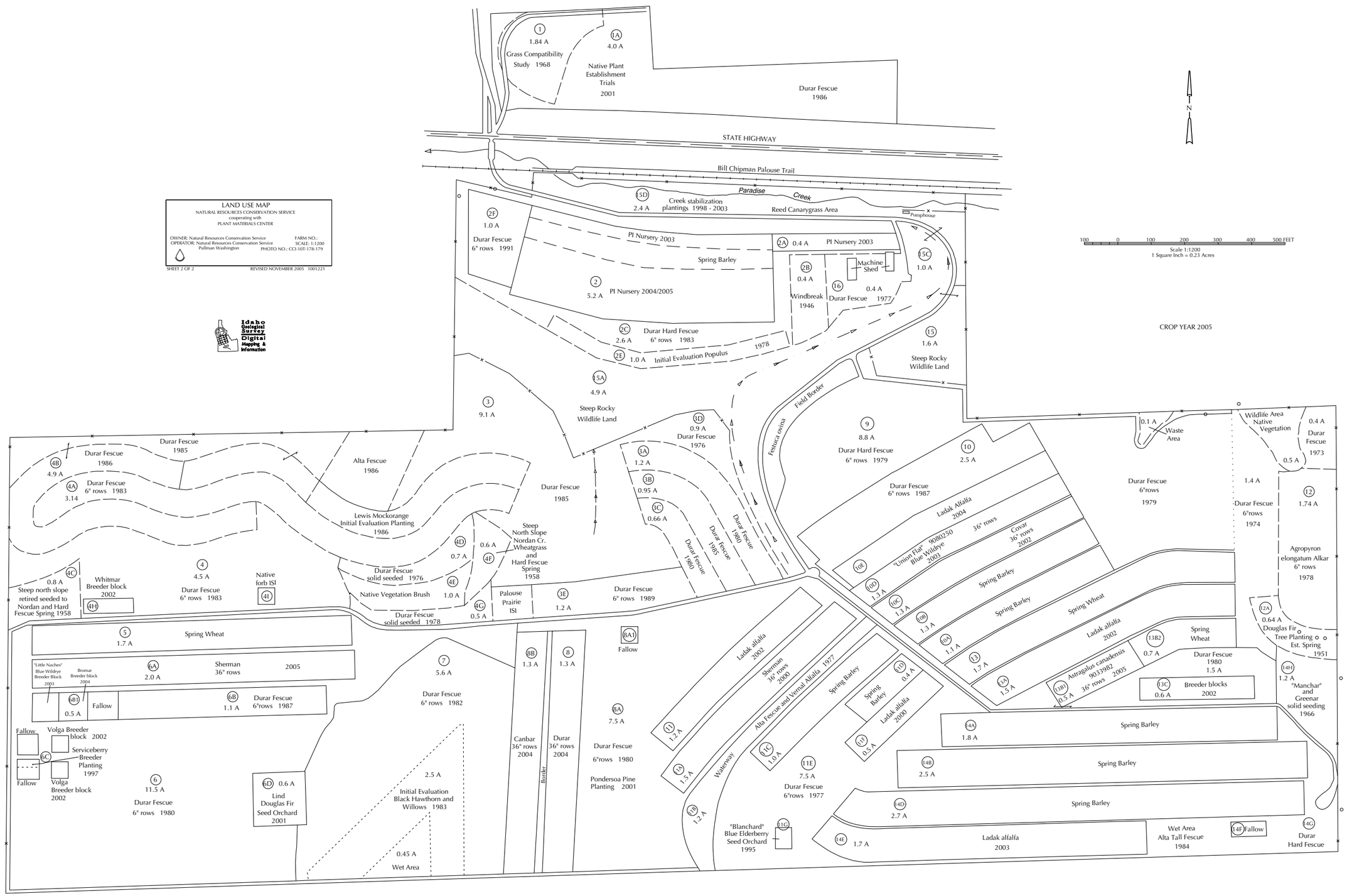
BM
Z1
Festuca ovina P-274
1941
Z4
0.6 A
Shop
Z2
Bromus inermis
and
Ag. smithii Mixture
Z3
Bromus
inermis and
Ag. smithii
Mixture
Z5
Parking Lot
0.1 A
Growth
Chamber
Machine
Shed
Pesticide
Bldg.
Residence
Office
Oil
House
Utility
Building
N
100 0 100 200 300 400 500 FEET
Scale 1:1200
1 Square Inch = 0.23 Acres
CROP YEAR 2005
LAND USE MAP
NATURAL RESOURCES CONSERVATION SERVICE
cooperating with
PLANT MATERIALS CENTER
OWNER: Natural Resources Conservation Service
OPERATOR: Natural Resources Conservation Service
Pullman Washington
FARM NO.:
SCALE: 1:1200
PHOTO NO.: CCI-10T-178-179
SHEET 1 OF 2
REVISED NOVEMBER 2005 1001221
Idaho Geological Survey
Digital Mapping & Information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N
100 0 100 200 300 400 500 FEET
Scale 1:1200
1 Square Inch = 0.23 Acres
CROP YEAR 2005
STATE HIGHWAY
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3B 0.95 A
Durar Fescue 1985
Durar Fescue 6" rows 1987
Durar Fescue 6"rows 1979
1.4 A
Durar Fescue 6"rows 1974
12 1.74 A
Lewis Mockorange Initial Evaluation Planting 1986
3C 0.66 A
Durar Fescue 1980
Durar Fescue 1985
Durar Fescue 1980
Durar Fescue 1985
Durar Fescue 1980
Ladak Alfalfa 2004
36" rows
Covar 36" rows 2002
"Union Flat" 9080250 Blue Wildrye 2003
10E
10D 1.3 A
10C 1.3 A
10B 1.3 A
10A 1.1 A
13 1.7 A
13A 1.5 A
Spring Barley
Spring Barley
Spring Wheat
Ladak alfalfa 2002
Astragalus canadensis 9033982 36" rows 2005
13B1 0.5 A
13B2 0.7 A
Spring Wheat
Durar Fescue 1980 1.5 A
13C 0.6 A Breeder blocks 2002
Agropyron elongatum Alkar 6" rows 1978
12A 0.64 A Douglas Fir Tree Planting Est. Spring 1951
14H 1.2 A "Manchar" and Greenar solid seeding 1966
4D 0.7 A
0.6 A
4F
4E 1.0 A
4G 0.5 A
Steep North Slope Nordan Cr. Wheatgrass and Hard Fescue Spring 1958
Durar Fescue solid seeded 1976
Native Vegetation Brush
Durar Fescue solid seeded 1978
Palouse Prairie ISI
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Durar Fescue 6" rows 1989
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Whitmar Breeder block 2002
4H
4 4.5 A Durar Fescue 6" rows 1983
Native forb ISI
4I
5 1.7 A Spring Wheat
"Little Naches" Blue Wildrye Breeder Block 2003
Bromar Breeder block 2004
6A 2.0 A Sherman 36" rows 2005
6B1 0.5 A Fallow
6B 1.1 A Durar Fescue 6"rows 1987
Fallow
Volga Breeder block 2002
Serviceberry Breeder Planting 1997
6C
Fallow
Volga Breeder block 2002
6 11.5 A Durar Fescue 6" rows 1980
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7 5.6 A Durar Fescue 6" rows 1982
2.5 A Initial Evaluation Black Hawthorn and Willows 1983
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8B 1.3 A
8 1.3 A
Canbar 36" rows 2004
Durar 36" rows 2004
Border
8A1 Fallow
8A 7.5 A Durar Fescue 6"rows 1980
Pondersoa Pine Planting 2001
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Sherman 36" rows 2008
Alta Fescue and Vernal Alfalfa 1977
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Spring Barley
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11B 1.2 A
11C 1.0 A
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11F 0.5 A
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11E 7.5 A Durar Fescue 6"rows 1977
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**UNITED STATES DEPARTMENT OF AGRICULTURE**
**NATURAL RESOURCES CONSERVATION SERVICE**

**STUDY TYPE:** Plant Demonstration Nursery

**LAND USES:**

**VEGETATIVE PRACTICES:** PRIMARY:
SECONDARY:

**DESCRIPTION:** Demonstration plantings of the major conservation plants used in the area served by the Pullman PMC are needed. The plantings are used as training aids to familiarize NRCS employees with the materials available for use in their work areas. The plants are also available for viewing by the general public.

The objective is to establish and maintain demonstration nurseries that are functional and require minimal input to maintain. The nurseries will contain conservation plants commonly used in the area served by the PMC. They will be used as training aids by NRCS employees, district supervisors, university and high school students, and other interested groups. By familiarizing NRCS employees and the public, it is hoped that use of conservation plants will ultimately increase. The nurseries will also serve as a source of material for plant mounts and sheaths.

**DURATION OF STUDY:**

**STUDY LEADER:** Dave Skinner

**LOCATION:** Pullman, WA Lind, WA

**COOPERATORS:**

**EXPERIMENTAL DESIGN:**

**PROCEDURE:** In 2008 the nursery was re-established in Field G1. All plants were grown from seed in the growth chamber, then transplanted to the field.

Since the Lind demonstration nursery received little use, it was decided not to re-establish it in 2002 due to staffing shortages and subsequent time constraints. The 1996 nursery at Lind was removed in 2003.

**PROGRESS:**
The Pullman Nursery was planted in field G1 on May 8, 2008 from transplants grown in the PMC Growth Chamber. The planting was weeded as needed throughout the summer. Seed of Sand Hollow Bottlebrush squirreltail could not be obtained and that portion of the row was left open.
A demonstration planting of the Lind selection of Douglas fir, *Pseudotsuga menziesii*, was established at the Lind Dryland Research Unit in 2001. It is located in the old woody block west of the headquarters buildings. 100 plants of 3/1 stock were planted in 10 rows with a 10 foot spacing between rows and between plants within the row. Each row was covered with weed barrier fabric. There was no survival in the 2 western most rows of the planting. See “Lind Tree & Shrub Demo Planting” below for layout.

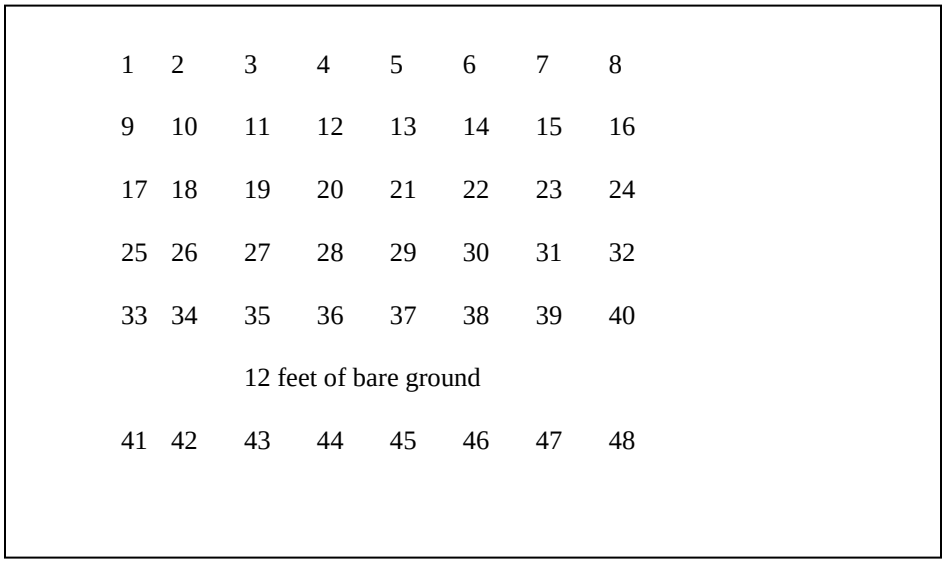
A shrub demonstration planting was established at the Lind Dryland Research Unit in 2004. On 4/19/04, 5 Bridger Select Rocky Mountain juniper, *Juniperus scopulorum*, 5 Basin big sage, *Artemisia tridentata*, and 5 gray rabbitbrush, *Ericameria nauseosa*, were planted in 2 strips of existing weed barrier on the south end of the 2001 Douglas fir planting. 5 golden currant, *Ribes aureum*, and 5 Snake River Plains fourwing saltbush, *Atriplex canescens*, were added on 5/12/05. See "Lind Tree & Shrub Demo Planting" below for layout.

# Demonstration Nursery
# Pullman WA Plant Materials Center

Plants in this nursery were selected for demonstration based on current usefulness and popularity. They were planted in spring 2008 with plugs grown in greenhouse.

# Layout

North



1 ---- Sandberg Bluegrass *Poa secunda*

Local germplasm –not released

Native bunchgrass. Sandberg bluegrass is one of the earliest-growing perennial grasses in the Pacific Northwest. It escapes summer drought and is capable of growing on very shallow soils. This particular collection is a native Palouse Prairie ecotype.

2 Canbar Canby bluegrass *Poa secunda*

Pullman WA PMC 1979

Native bunch grass. Associated with bluebunch wheatgrass and ponderosa pine plant communities. Primary use: as understory species in mixture on sites that need an early spring grass to compete with annual weeds. Grows well in regions with 24+" rainfall.

3 Sherman Big bluegrass *Poa secunda*

Pullman WA PMC 1945

Native bunch grass. Collected in Sherman County, Oregon. Selected for productivity of forage, roots and seeds. Has distinctive blue color. Adapted to well-drained soils in PNW and Great Basin states, at elevations 300 – 8,000 feet with 10 – 20" annual rainfall. Used for seeding dryland pasture and range, stabilizing soil, reseeding after wildfires, and restoring natural areas.

4 Common Kentucky bluegrass *Poa pratensis*

Many cultivars available. Native and introduced sod-forming grass. Valued for quality forage and ability to withstand heavy impact. Considered to be most important turf grass in the U.S.

5 P-6435 Idaho fescue *Festuca idahoensis*

Identical to 'Winchester' germplasm released by Benson Farms, Inc.

Native bunch grass. Useful for late season grazing. Is found on all aspects and on wide variety of soil types. Most common at elevations of 5,000 – 8,000 feet.

6 Covar Sheep fescue *Festuca ovina*

Pullman WA PMC 1977

Introduced bunch grass developed from material collected in Konya, Turkey. Slow to establish, but once established, is very persistent, winter hardy and drought tolerant. Recommended for controlling erosion in 10 – 17 inch rainfall zones of the Pacific Northwest. Not intended for forage.

7 Durar Hard fescue *Festuca brevipila*

Pullman WA PMC 1949

Bunch grass introduced from Europe. Originally evaluated in Union, Oregon. Competitive with other grasses and weeds. Low palatability. Useful anywhere a long-lived, low-maintenance ground cover is needed.

8 Hi-Mag Tall fescue *Schedonorus phoenix*

Missouri Agricultural Experiment Station and USDA-ARS 1997

Endophyte-free. Has higher levels of magnesiumthan other tall fescue cultivars. Developed for purpose of minimizing effects of grass tetany in cattle and sheep. (Grass tetany is nutritional disorder caused by magnesium deficiency.)

9 Bannock Thickspike wheatgrass *Elymus lanceolatus* ssp. *lanceolatus*

Aberdeen ID PMC 1995

Native sod-forming grass. Composite of germplasm collected near The Dalles, OR; Pocatello, ID; and Quincy, WA. Establishes quickly, produces large amounts of forage and is drought tolerant. Recommended for rangeland erosion control, forage and cover in 8 – 16" precipication zones, critical area stabilization, filter strips, and areas infested with annual weeds.

10 Critana Thickspike wheatgrass *Elymus lanceolatus* ssp. *lanceolatus*
Bridger MT PMC 1971
Native sod-forming grass. Developed from germplasm collected near Havre, MT. Selected because establishes more rapidly than other native species and is drought tolerant. Grows within the 10 – 20" precipitation zones in the northern Rocky Mountains and adjacent Great Plains regions.

11 Whitmar Beardless Bluebunch wheatgrass *Pseudoroegnaria spicata* ssp. *inermis*
Pullman WA PMC 1946
Bunch grass native to Palouse prairie. Germplasm collected near Colton, WA. Beardless form bluebunch wheatgrass. Adapted to 12+" precipitation zones. Selected for forage quality and seedling vigor. Intended for rangeland within Palouse region and re-establishment of native plant communities.

12 Secar Snake River wheatgrass *Elymus wawawaiensis*
Pullman WA PMC, ID-OR-WY-MT Agricultural Experiment Station, and WA Agriculture Research Center 1980
Native bunch grass. Originally released as cultivar of Bluebunch wheatgrass, but has been found to be different species. Germplasm collected from Snake River gorge near Lewiston, ID. Intended for rangeland and re-establishment of native plant communities in areas receiving 8 or more inches of rainfall. One of the most drought tolerant native grass cultivars available.

13 Goldar Bluebunch wheatgrass *Pseudoroegnaria spicata*
Aberdeen ID PMC, ID-UT Agriculture Experiment Station, USDA-ARS 1989
Native bunch grass. Developed from seed collected near Asotin, WA. Selected for rapid establishment, high forage production and ability to survive at 12+" rainfall. Intended for rangeland, re-establishment of native plant communities, firebreaks, and critical area stabilization.

14 p7 polycross Bluebunch wheatgrass *Pseudoroegnaria spicata*
Utah Agriculture Experiment Station, USDA-ARS 2001
Native bunch grass. Composite of 23 open-pollinated, native site collections from WA, OR, NV, UT, ID, MT and BC; and 2 cultivars: Whitmar and Goldar. Intended to provide genetic diversity with a single germplasm for reclamation of semi-arid to mesic sites where Bluebunch wheatgrass was component of original vegetation.

15 NewHy Hybrid wheatgrass *Pseudoroegnaria spicata* X *Elymus repens*
Utah Agriculture Experiment Station, USDA-ARS, USDA-NRCS 1989
Bluebunch wheatgrass X Quackgrass hybrid. Intended to combine the vigor, productivity, salinity tolerance, and persistence of quackgrass with the drought resistance, caespitose growth habit, seed quality, and forage quality of bluebunch wheatgrass. Recommended for range sites with moderate salinity problems and receive 14" rainfall.

16 Latar Orchardgrass *Dactylis glomerata*
Pullman WA PMC 1957
Introduced bunch grass. Selected for low lignin (fiber) content and late maturing characteristic. Matures 10 to 14 days later than common orchardgrass and is usually in the pre-bloom stage when alfalfa is at the optimum growth stage for cutting hay.

17 Rosana Western wheatgrass *Pascopyrum smithii*
Bridger MT PMC 1972
Native rhizomatous grass. Developed from germplasm collected in north central MT. Selected for seedling vigor and ease of establishment. Recommended for seeding degraded rangeland and disturbed sites in the northern Great Plains and Intermountain regions.

18 Alkar Tall wheatgrass *Thinopyrum ponticum*
Pullman WA PMC 1958
Introduced bunch grass. Original germplasm presented to the USDA by Vavilov in 1932. Intended for pasture in wet, alkaline soils and semi-arid regions of the west within 270 – 5500 feet elevation.

19 Pryor Slender wheatgrass *Elymus trachycaulus*
Briudger MTPMC 1988
Native bunch grass. Developed from germplasm collected in the Pryor Mountains of Southcentral Montana. Selected for salinity tolerance and rapid growth. Adapted to short-lived dryland seedings receiving 12+" precipitation.

20 Manska Intermediate (Pubescent) wheatgrass *Thinopyrum intermedium*
Bismark ND PMC, North Dakota Agriculture Experiment Station, USDA-ARS, University of Nebraska 1992
Introduced rhizomatous grass. Developed from material originating in Russia. Very nutritious and highly palatable. Recommended for pasture and grass alfalfa hay mixtures in the northern and central Great Plains regions that receive 14+" rainfall.

21 Reliant Intermediate wheatgrass *Thinopyrum intermedium*
Bismark ND PMC, North Dakota Agriculture Experiment Station, USDA-ARS 1991
Introduced rhizomatous grass. Developed from material adapted to the Great Plains region. Selected for persistence and sustained productivity under hayland management in mixes with alfalfa.

22 Rush Intermediate wheatgrass *Thinopyrum intermedium*
Aberdeen ID PMC, Idaho Agriculture Experiment Station 1994
Introduced rhizomatous grass. 'Rush' was initially considered a separate species, *Agropyron varnens,* but cytology studies determined that it was a member of the intermediate wheatgrasses. Developed from seed originating in Germany. Selected for superior seedling emergence and vigor compared to other wheatgrasses.

23 Manifest Intermediate wheatgrass *Thinopyrum intermedium*
Bismarck NDPMC, USDA ARS, ND Experiment Station 2007
Introduced rhizomatous grass. Manifest exhibits excellent persistence under Grazing and consistently high forage yield. It is adapted to areas that receive 14+ inches of annual precipitation.

24 ---- Prairie Junegrass *Koeleria macrantha*
Local Germplasm – not released
Native bunchgrass. This collection originates from a Palouse Prairie remnant. It differs from prairie junegrass that occurs east of the continental divide in chromsome number and maturity date. It is an important understory grass .

25 Garrison Creeping foxtail *Aleopecarus arundinaceus*
Bismarck, ND PMC 1963
Long-lived introduced rhizomatous grass. Adapted to wet soils at high elevations with 18+" precipitation. Has been recommended for streambank stabilization and wet pastures. Palatable only during early stages of growth and sometimes considered to be too aggressive.

26 Bromar Mountain bromegrass *Bromus marginatus*
Pullman WA PMC, WA and ID Agriculture Experiment Stations 1946
Native, short-lived bunch grass. Developed from seed collected on the WSU campus in 1933. Taller, more productive, more disease resistant and later maturing than other bromegrass cultivars. Recommended for alternate row plantings with sweet clover (green manure), and pasture seedings.

27 Regar Meadow bromegrass *Bromus bierersteinii*
Aberdeen ID PMC and Idaho Agriculture Experiment Station 1966
Introduced bunch grass that may produce short rhizomes. Developed from germplasm collected in Turkey in 1949. Ideal pasture grass. Highly palatable and maintains green growth for extended period of time.

28 Vavilov Siberian wheatgrass *Agropyron fragile*
Utah Agriculture Experiment Station, USDA-ARS 1996
Introduced bunch grass. Developed from germplasm originating in the former USSR, Turkey and Kazakhstan. Used for forage. Similar to cultivars of Crested wheatgrass, though more drought tolerant and better adapted to sandy soils. Can be grown in regions with 8+" of precipitation and up to 7,000 feet elevation.

29 Douglas Crested wheatgrass *Agropyron cristatum*
Utah Agriculture Experiment Station, USDA-ARS, USDA-NRCS 1994
Introduced bunch grass. Derived from germplasm originating in the former USSR, Turkey and Iran. Named in honor of Douglas Dewey, who established the germplasm for the grass breeding program for the USDA-ARS at Logan. Produces less forage than other cultivars, but is leafier and remains green longer into the growing season. Requires 13-14" or more annual precipitation. Valued for forage.

30 Nordan Crested wheatgrass *Agropyron desetorum*
North Dakota Agriculture Experiment Station, USDA-ARS 1953
Introduced bunch grass. Selected for forage quality, seedling vigor and long-term productivity. More drought tolerant than *A. crisatutum*

31 Roadcrest Crested wheatgrass *Agropyron cristatum*
Logan, UT USDA-ARS 1998
Introduced. One of the only two cultivars of Crested wheatgrass that is rhizomatous. Recommended for use along roadsides or low-maintenance turf in 10 inch and higher rainfall areas.

32 HyCrest II Crested wheatgrass (cross) *Agropyron cristatum* x *Agropyron desertorum*
Logan, UT USDA-ARS 1996
Introduced bunch grass valued for forage. Released to preserve genetic purity of the cultivar HyCrest. Selected for productivity and drought and disease resistence.

33 Climax Timothy *Phleum pretense*
Canada
Short-lived introduced spreading grass. Spreads via culms rather than rhizomes. One of the most palatable and productive grasses grown for hay. Thrives well in rich, fine-textured soils. Does not tolerate drought or prolonged high temperatures.

34 Union Flat germplasm Blue wildrye *Elymus glaucus*
Pullman WA PMC 2008
Native bunch grass recommended for Palouse prairie restoration, wildlife habitat and roadside revegetation. Germplasm collected from Palouse prairie site at 1800 feet elevation. Selected for rapid emergence and growth rate.

35 Little Nachez germplasm (Source identified) Blue wildrye *Elymus glaucus*
Pullman WA PMC proposed release date 2010
Native bunch grass similar to Union Flat Blue wildrye, but has distinctive red color. Originates from a stand in the Nachez River drainage west of Yakima. This selection exhibits excellent vigor, high seed

production, and greater longevity than 225 other genotypes in a common garden study. Will be recommended for roadside revegetation and landscaping.

36 Bozoisky-select Russian wildrye *Psathyrostachys juncea*
Logan, UT USDA-ARS 1984
Long-lived introduced bunch grass valued for pasture in dry areas. Selected for seedling vigor and high forage yields. Provides excellent protein source even when fully mature.

37 Shoshone Beardless wildrye *Leymus triticoides*
Bridger MTPMC 1990.
Long-lived rhizomatous grass. Extremely tolerant of saline and saline-sodic soil conditions. Provides excellent soil stabilization and weed suppression.

38 Magnar Basin wildrye *Leymus cinerus*
Aberdeen ID PMC 1979
Native bunch grass with large coarse leaves. Germplasm was provided by the Saskatchewan Experiment Station but may originate from Nelson BC. Selected for high forage production and good winter cover. Adapted to Northwest and Intermountain regions receiving 8 or more inches of rainfall. Recommended for rangeland, soil stabilization and wildlife cover.

39 Trailhead Basin wildrye *Leymus cinerus*
Bridger MT PMC 1981
Native bunch grass with large coarse leaves. Germplasm collected near Roundup, MT. Selected for stand longevity and drought tolerance. Adapted to Northwest and Intermountain regions receiving 8 or more inches of rainfall. Recommended for rangeland, soil stabilization and wildlife cover.

40 Volga Mammoth wildrye *Leymus racemosus*
Pullman WA PMC 1949
Introduced rhizomatous grass developed to control wind erosion on sand dunes in the Pacific Northwest. Other uses include mine reclamation, wildlife habitat, and soil stabilization on pivot corners.

41 Richfield Firecracker penstemon *Penstemon eatonii*
Aberdeen ID PMC 1994
Native forb with bright red flowers and fibrous root system. Germplasm collected near Richfield, UT. Adapted to full sunlight, moderately well drained soils and 10 – 16" rainfall in areas at 3,300 – 8,000 feet elevation. Intended uses include erosion control, diversification, beautification and pollinator habitat.

42 Clearwater Apline penstemon *Penstemon venustus*
Aberdeen ID PMC 1994
Native forb with violet to violet-purple flowers. Germplasm collected in the Clearwater River drainage in Idaho. Adapted to full sunlight, moderately well to well drained soils and 20 to 35 inch rainfall in areas at 1,000 to 6,000 feet elevation. Intended uses include erosion control, diversification, beautification and pollinator habitat.

43 Syn-B Alfalfa *Medicago sativa*
Germplasm in development- not released.
Introduced legume typically seeded for hay. Alfalfa performs well in deep well-drained soils. Syn-B originates from 11 plants growing in a 7" precipitation area. Heritability of drought tolerance of Syn-B is under evaluation.

44 Appar Blue flax *Linum perenne*

USDA-NRCS, Idaho Agricultural Experiment Station, Utah Division of Wildlife Resources, Forest Service Forest and Range Experiment Station 1980.

Native forb with deep blue flowers. Germplasm collected in Black Hills, SD. Originally released as native flax, *Linum lewisii*, however since has been determined to be naturalized Blue flax introduced from Europe. Selected for vigor, beauty and ability to compete with grasses. Adapted to sunny open slopes, well-drained soils, and 10 to 18 inch rainfall areas at 1,000 to 6,000 feet elevation. Intended for erosion control, reclamation, highway right-of-ways, homes, gardens, parks, diversity, and beautification.

45 Delar Small burnet *Sanguisorba minor*

Aberdeen ID PMC, Idaho Agriculture Experiment Station 1981

Introduced, long-lived, evergreen, non-leguminous, perennial forb. Germplasm from European sources. Selected for forage production, cold tolerance, and palatability for both livestock and wildlife.

46 ---- Blanketflower *Gaillardia aristata*

Cultivar not released

Native forb with bright yellow and orange flowers. Adapted to wide range of soil types, precipitation zones and elevations within Pacific Northwest and Intermountain regions. Recommended for diversification, beautification, and pollinator habitat.

47 Timp Utah sweetvetch *Hedysarum boreale*

Upper Colorado Environmental Plant Center, Utah Division of Wildlife Resources, Colorado State University Agricultural Experiment Station, Utah State University Agricultural Experiment Station, and USDA-NRCS 1994

Native perennial legume with bright pink flowers, deep taproots and several lateral roots. Germplasm collected in Utah. Selected for seedling vigor, site adaptability, persistence, seed production, nitrogen fixation, and stability. Recommended for erosion control, beautification, forage for livestock and wildlife and pollinator habitat. Grows best in areas with 15+" precipitation.

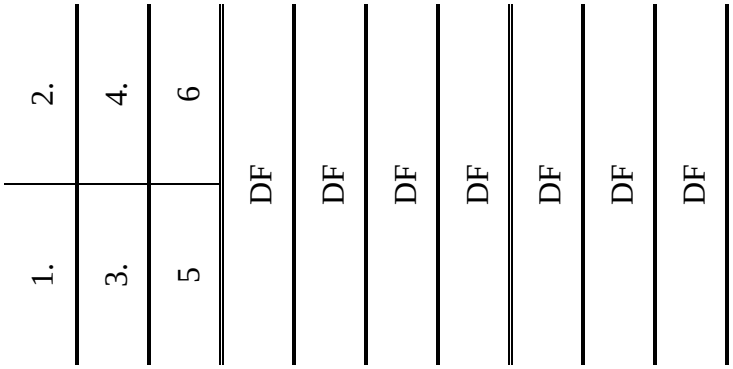
48 9033982 Canadian milkvetch *Astragalus canadensis*

Pullman WA PMC 2012?

Native perennial legume with cream colored flowers. Adapted to wide range of habitats throughout North America. Looks similar to closely related poisonous locoweeds, so its use as forage is not recommended unless positive identification can be made. However, is recommended for native community revegetation and pollinator habitat.

**Lind Tree & Shrub Demo Planting**: Lind Dryland Research Unit

**N↑**




1. Snake River Plains fourwing saltbush, *Atriplex canescens*, 5 ea planted 5/12/05. Source: Aberdeen PMC
2. gray rabbitbrush (2004) #1, #2 (from S.) replanted 5/12/05. Source: Plants of the Wild.
3. Rocky Mountain juniper (2004). Replanted plant #1 5/12/05. Source: Bridger PMC.
4. Basin big sage (2004) Replanted #3, #5 5/12/05.
5. golden currant planted, 5 ea 1 gal pots 5/12/05.
6. existing Douglas fir planting. Originally 10 rows of Douglas fir were planted in 2001.

**UNITED STATES DEPARTMENT OF AGRICULTURE**
**NATURAL RESOURCES CONSERVATION SERVICE**
**2012 Progress Report**

**Title** Pollinator Habitat: Pollinator Habitat Demonstration Planting

**Study Number** N/A

**Study Leader** Pamela Pavek, WAPMC Agronomist

**Duration** 2010 - 2020

**Description** A variety of vegetation types were planted at the Pullman Plant Materials Center to demonstrate options for enhancing pollinator and beneficial insect habitat. The plantings include:

1) Conventional Reclamation Planting
2) Native Range Planting
3) Conventional Hedgerow
4) Native Hedgerow
5) Native Perennial legume
6) Special plants
7) Pasture
8) Annual Cover Crops

**Status of Knowledge** Quality and quantity of habitat for pollinators and other beneficial insects has been steadily declining throughout the world. Urban, industrial and agricultural expansion continues to eliminate, fragment and degrade natural areas, which insects depend on for food and shelter. Because pollinators and beneficial insects enhance the productivity of many plants, including agricultural crops and native vegetation, there is great concern about the loss of pollinator and beneficial insect habitat. Efforts to restore or improve habitat have been increasing, however information about what species to plant and how to manage the habitat is lacking.

**Materials and methods** The demonstration block will be implemented according to the specifications outlined below:

**Pollinator Demo Block Specifications**

- There will be a 6 ft border on all sides of the demo block that will be periodically rototilled with the JD670 for weed control
- Weed control inside of the plot will consist of spot spraying herbicide, mowing and hand-hoeing
- All seeding within the block will be done cross-slope
- Each hedgerow planting will consist of three to four rows of trees and shrubs, and each will be planted into landscape fabric.
- Specifications for each planting are as follows:

<u>Conventional Reclamation Planting (0.4 ac)</u>

* An introduced grass (Intermediate WG), blue flax, and introduced legumes (yellow clover, alfalfa, and sweetvetch) were seeded into a prepared seedbed.

Native Range Planting (0.4 ac)

* Bluebunch wheatgrass and Idaho fescue were seeded into a prepared seedbed. Immediately following, over 700 cone seedlings of 12 native forb species were transplanted throughout the area in a clustered pattern (5 – 20 or 30 plants of one species in a clump). In Spring 2011 approximately 700 cones of 12 additional species will be added.

Conventional Hedgerow (200ft)

* From the outside > in:

| Row | Species | Spacing | Number needed |
|---|---|---|---|
| 1 | Rocky Mountain Juniper | 8 | 25 |
| 2 | Caragana | 4 | 50 |
| 3 | Russian sage, Monarda, Rocky Mtn Beeplant | 2 | 33 each |
| 4 | Lavender + Hyssop | 2 | 33 each |

Native Hedgerow (300ft)

* From the outside > in:

| Row | Species | Spacing | Number needed |
|---|---|---|---|
| 1 | Douglas Hawthorn | 8 | 38 |
| 2 | Serviceberry, Mockorange, Chokecherry, Golden Currant | 6 | 16 - 17 each (50 total) |
| 3 | Douglas Spirea, Ocean spray, Shrubby cinquefoil, Skunkbush Sumac, Woods Rose, Ninebark | 4 | 5 – 10 each (75 total) |

Special Plants (0.1 ac)

* Goldenrods, western prairie clover, and basalt milkvetch were transplanted as cone seedlings in 2010.
* Western mountain aster and additional goldenrods will be transplanted in 2011.

Native Perennial Legum

* Canada milkvetch was seeded cross-slope

Pasture

* A pasture mix was direct seeded into a prepared seedbed. The mix consists of:

  25% Orchardgrass
  20% Perennial Ryegrass
  15% Meadow Brome
  20% Alfalfa
  10% Utah sweetvetch
  10% Small Burnet

* The mature stand will be allowed to head out and will be cut the following spring.

Annual Cover Crops (0.4 ac)

* Sainfoin (a perennial), sunflowers, camelina and peas were seeded in separate blocks in 2010.
* Peas, vetches, camelina, and other annual cover crops will be seeded together in 2011 and be allowed to reseed.

**2011 Update**

All plots were established in May 2010. The seedings were successful, however in the first year prickly lettuce dominated the Conventional Reclamation and Native Range Seedings. In time the perennial vegetation may be able to outcompete the annual weeds. Within the conventional hedgerow, all Rocky mountain juniper seedlings died due to poor storage conditions (not enough moisture). They will be replaced this year by another species (one that blooms). Most of the native shrub seedlings appear to have survived; the ones that did not will be replaced this year with the same species if possible. The Canada milkvetch and Sainfoin plots established well in the first few rows seeded however seed ran low for the last few rows. The sainfoin plot will become part of the cover crop plot. The pasture appears to be well established; the most successful of all perennial seeded plots.

The plants that bloomed the first year include the lavenders, hyssop, blanketflower, western prairie clover, blanketflower, camelina, sunflowers and peas. The plants most popular with the pollinators were the lavenders, hyssop, and sunflowers.

**Hedgerow with early, mid and late blooming plants**

**Butterfly visiting a blanketflower**

**Plot of sunflowers**

Insects were collected in the plots August through September 2010 and identified by an ARS entomologist, Gene Miliczky. They are listed here:

**Insects Collected at the Pullman PMC Pollinator Habitat Demonstration Planting**

| Species | Family | Location | Date | Host Plant | Specimen # | Common name | |
|---|---|---|---|---|---|---|---|
| *Agapostemon virescens* (Fabricius) (male) | Halictidae | Pullman | 9/8/2010 | Int. hedgerow | 40 | sweat bee | communal, ground-nesting bee |
| *Apis mellifera* L. (worker) | Apidae | Pullman | 8/12/2010 | Sunflowers | 25 | honeybee | highly social |
| *Bombus bifarius* Cresson (male) | Apidae | Pullman | 8/12/2010 | Sunflowers | 29 | bumblebee | ground-nesting, social bee |
| *Bombus californicus* F. Smith (male) | Apidae | Pullman | 9/8/2010 | Int. hedgerow | 44 | bumblebee | ground-nesting, social bee |
| *Bombus griseocollis* (Degeer) (male) | Apidae | Pullman | 9/8/2010 | Int. hedgerow | 42 | bumblebee | ground-nesting, social bee |
| *Bombus huntii* Greene (male) | Apidae | Pullman | 9/8/2010 | Int. hedgerow | 45 | bumblebee | ground-nesting, social bee |
| *Bombus nevadensis* Cresson (female) | Apidae | Pullman | 9/8/2010 | Int. hedgerow | 19 | bumblebee | ground-nesting, social bee |
| *Bombus rufocinctus* Cresson (female) | Apidae | Pullman | 9/8/2010 | Int. hedgerow | 34 | bumblebee | ground-nesting, social bee |
| *Bombus rufocinctus* Cresson (female) | Apidae | Pullman | 9/8/2010 | Int. hedgerow | 35 | bumblebee | ground-nesting, social bee |
| *Bombus rufocinctus Cresson (female)* | Apidae | Pullman | 9/8/2010 | Int. hedgerow | 36 | bumblebee | ground-nesting, social bee |
| *Bombus rufocinctus* Cresson (female) | Apidae | Pullman | 8/12/2010 | Sunflowers | 27 | bumblebee | ground-nesting, social bee |
| *Bombus rufocinctus* Cresson (female) | Apidae | Pullman | 8/17/2010 | Sunflowers | 23 | bumblebee | ground-nesting, social bee |
| *Bombus rufocinctus* Cresson (female) | Apidae | Pullman | 8/17/2010 | Sunflowers | 22 | bumblebee | ground-nesting, social bee |
| *Bombus rufocinctus* Cresson (female) | Apidae | Pullman | 8/12/2010 | Sunflowers | 33 | bumblebee | ground-nesting, social bee |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| *Bombus rufocinctus* Cresson (male) | Apidae | Pullman | 9/8/2010 | Int. hedgerow | 37 | bumblebee | ground-nesting, social bee |
| *Bombus rufocinctus* Cresson (male) | Apidae | Pullman | 9/8/2010 | Int. hedgerow | 48 | bumblebee | ground-nesting, social bee |
| *Bombus rufocinctus* Cresson (male) | Apidae | Pullman | 9/8/2010 | Int. hedgerow | 38 | bumblebee | ground-nesting, social bee |
| *Bombus rufocinctus* Cresson (male) | Apidae | Pullman | 8/17/2010 | Sunflowers | 28 | bumblebee | ground-nesting, social bee |
| *Bombus rufocinctus* Cresson (male) | Apidae | Pullman | 9/8/2010 | Int. hedgerow | 32 | bumblebee | ground-nesting, social bee |
| *Bombus vagans* F. Smith (female) | Apidae | Pullman | 9/8/2010 | Int. hedgerow | 47 | bumblebee | ground-nesting, social bee |
| *Halictus ligatus* Say (female) | Halictidae | Pullman | 9/8/2010 | Int. hedgerow | 50 | sweat bee | social, ground-nesting bee |
| *Melissodes (Eumelissodes) agilis* Cresson (female) | Apidae | Pullman | 8/17/2010 | Sunflowers | 24 | digger bee | solitary, ground-nesting bee; sunflower specialist |
| *Polistes aurifer* Saussure | Vespidae, Polistinae | Pullman | 9/8/2010 | Int. hedgerow | 39 | golden paper wasp | social, aerial-nesting wasp; determined by Pete Landolt |
| | Sarcophagidae | Pullman | 9/8/2010 | Int. hedgerow | 46 | flesh fly | |
| | Sarcophagidae | Pullman | 9/8/2010 | Int. hedgerow | 50 | flesh fly | |

**2012 Update**

May 20 – 23, 2011. In the Intermediate Hedgerow planted: savory, variegated marjoram, mint and sage in empty spaces where hyssop and Russian may have died, or where Rocky Mountain bee plant was never planted (because it died in the cold frame.) Also planted 25 western sandcherry, 2 ninebark and 1 American plum where the juniper had been planted and died. In the Native Hedgerow planted: in north row 8 Nootka rose, in other two rows 5 chokecherry, 2 ninebark, 4 American plum and 1 Nootka rose where other plants had died.

May 25 – 27, 2011. In the Native Range plot planted: 53 SYP, 105 SOMI, 56 PECO, 98 GABO, 98 SIOR, 98 ACMI, 98 POGR, 98 ERHE and 48 PYLI.

June 6, 2011. Planted cover crops with the double disk drill: 65.5 lb (131 lb/ac) mixture of: hairy vetch, subterranean clover, red clover, flax and buckwheat.

Fall, 2011. HEDGEROWS. All transplants appear to be surviving. Had very long wet spring, which has been beneficial to the plants.

INTRODUCED RANGE. Tumble mustard and prickly lettuce were still problematic this year, but not as bad as last year. Stand was kept mowed to prevent weed seeds from disseminating.

NATIVE RANGE. Prickly lettuce was not as bad this year, but pineapple weed (*Matricaria discoidea*) was. It formed a bright green mat as soon as snow melted, and continued to grow and compete with forbs. Stand was kept mowed to prevent prickly lettuce seed from disseminating, but the pineapple weed continued to grow and proliferate because of its low stature. Forbs that did really well this year were the taperleaf pentstemon and tall cinquefoil. There was not as much gallardia blooming this year as last year. The forbs that were blooming were left as unmowed islands when the remainder of the stand was mowed.

COVER CROPS. The cover crops did not fare well, maybe due to late planting date. Also due to infestation of prickly lettuce. Flax and buckwheat plants were abundant, but were very few vetch or clovers. Stand was mowed when most plants were heading and seed was mature; problem is this was the same time prickly lettuce was producing seed also. May have to plant

CANADA MILKVETCH continued to be weedy this year, mostly prickly lettuce. It was kept mowed.

SPECIAL SPECIES PLOT. The Dalea searlsie, Dalea ornata, and basalt milkvetch were very slow to grow. I thought they were dead until late June, when they finally produced green leaves. They flowered and seed was collected from the plants. The basalt milkvetch had fairly uniform seed maturity and the seed remained in the pods for a while after maturing, making them easy to harvest. The Dalea plants had very indeterminate seed maturity. Maturity on each plant occurred over the time span of one month. Seed was collected when possible on multiple occasions. The western mountain aster and Missouri goldenrod bloomed until late in the season (late October). Seed was not collected from these plants because at the time of seed maturity, I was planting experiments all over the state.

PASTURE. The pasture did well again this year, with hardly any weeds present. It is by far the most successful seeded stand in the Demo planting.

SAINFOIN. The sainfoin also continues to do well and attracts many pollinators when blooming.

October 3, 2011. Dallas sprayed the Introduced Range, Native Range, Canada milkvetch, special species plot, and Pasture with 1.25 qt/ac Surflan.

**Bumble bee visiting a *Penstemon attenuatus* flower in the Native Range Planting.**

**Bumble bee visiting a *Monarda fistulosa* flower in the Introduced Hedgerow Planting.**

**Bumble bee 'buzz pollinating' a *Dasiphora fruticosa* flower in the Native Hedgerow Planting.**

**Bumble bee visiting a *Lavandula angustifolia* flower in the Introduced Hedgerow Planting.**

**UNITED STATES DEPARTMENT OF AGRICULTURE**
**NATURAL RESOURCES CONSERVATION SERVICE**
**STUDY PLAN**
**Pullman Plant Materials Center**

**TITLE: Initial Evaluation of *Caragana* species**
**STUDY NUMBER:** WAPMC-T-0802-CP

**NATIONAL PROJECT NUMBER:** Cropland 3.1 Controlling erosion on cropland by crop conversion to perennial crops or less erosive annuals

**STUDY TYPE:** Initial Evaluation for Technology Development
**LOCATION:** Horse Heaven Hills study site on the Mike Schmidt farm.
**STUDY LEADER:** Mark Stannard
**DURATION OF STUDY:** 2008-2013
**COOPERATORS:** Washington Benton County CD, Mike Schmidt.
**LAND USE:** Cropland
**VEGETATIVE PRACTICES:** 386 – Field Border, 422 – Hedgerow Planting, 380 – Windbreak/Shelterbelt Establishment, 645 – Upland Wildlife Habitat Management

**PROBLEM:** *Caragana arborescens* Lam. is a drought hardy, deciduous, nitrogen-fixing shrub adapted to less than 10 and up to 20+ inch precipitation areas in Washington State. It has long been used for windbreaks, hedges and secondarily for wildlife food.

Currently *C. arborescens* is being tested in the Horse Heaven Hills area of Washington State for wind erosion control and dust abatement. Other source materials for *C. arborescens* in addition to other *Caragana* species need to be tested in the area for adaptation and wind protection attributes.

**OBJECTIVE:** Collect *Caragana* species including different *C. arborescens* accessions, propagate and install an initial evaluation planting in the Horse Heaven Hills area. Determine adaptability and suitability for wind erosion/dust abatement.

**STUDY DESIGN**: 6 plants per accession, spacing 8 feet. Spring plant in 2008. Plant in 6 foot wide weed barrier.

**MATERIALS AND METHODS:** Deepot potted plants of *Caragana* species, additional commercial source plants of *Caragana*, weed barrier. Install weed barrier and plant *Caragana* plants into it.

**EVALUATIONS:** Assess growth rate (height and canopy measurements), form, adaptability to the site, ability to reduce wind erosion/blowing dust, disease and insect problems and other pertinent parameters.

**TECHNOLOGY TRANSFER PRODUCTS:** Plant guide(s)/fact sheet(s), Current Developments article, revision of Technical Notes or new Technical Note, local newspaper or other appropriate news article geared to landowners.

**REFERENCES:** *Caragana* literature review, 2007

**Progress:**

17 of 150 plants dead 4/12/11

List of Accessions Collected

| Source | Species | plant symbol | acc. no. | their acc. no. | origin |
|---|---|---|---|---|---|
| NC RPI Sta | C. arborescens | CAAR18 | 9080252 | Ames 17776 | Poland |
| " | " | CAAR18 | PI 310390 | -- | Uzbekistan |
| " | " | CAAR18 | PI 369217 | -- | Russian Federation |
| " | " | CAAR18 | PI 371524 | -- | Former Soviet Union |
| " | " | CAAR18 | PI 483449 | -- | US Michigan |
| " | " | CAAR18 | PI 633648 | -- | Russian Federation, Irkutsk |
| " | " | CAAR18 | PI 636378 | -- | Lublin, Poland |
| " | C. frutex | CAFR80 | 9080250 | Ames 13823 | US Iowa |
| " | C. manschurica | CAMA60 | PI 107663 | -- | China |
| East Lansing PMC | C. arborescens var. pendula | CAAR18 | PI 483449 | -- | |
| Bridger PMC | *Caragana* | CARAG | 9078680 | -- | Anaconda, MT |
| Lawyer Nursery | C. arborescens | CAAR18 | 9080253 | -- | |
| Lincoln-Oakes Nursery | C. arborescens | CAAR18 | 9019579 | -- | Lincoln-Oakes local collection |
| DLEG | C. boisii | CABO19 | 9080254 | 940005 | |
| DLEG | C. brevispina | CABR40 | 9080255 | 940006 | |
| DLEG | C. intermedia | - | 9080256 | 940135 | |
| DLEG | C. korshinskii | CAKO6 | 9080257 | 940136 | |
| DLEG | C. zahlbruckneri subsp. zahlbruckneri var. pekinensis | CAZAP | 9080258 | 940009 | Jamie Wahl |

NC RPI Sta – USDA ARS North Central PI Station, Ames, IA
DLEG – Desert Legume Program, Tucson, AZ

January 16, 2007: Planted available seed. On January 22, 2007 most of the seed was beginning to germinate. (9 ARS accessions were planted with 25 cones each. 4 other accessions were planted with 42 cones each. Five accessions from DLEG arrived late. They were planted on February 8, 2007. Germination occurred on 9080256 and 9080257.

June 4, 2007: Counts were made on available plants as follows:

| Acc. No. | Species | Source | No. avail plants | Comments |
|---|---|---|---|---|
| 483449 | C. arborescens | USDA, ARS, PI, Ames, IA | 25 | |
| 633648 | C. arborescens | same | 25 | |
| 636378 | C. arborescens | same | 25 | |
| 9078680 | *Caragana* | Bridger PMC | 31 | |
| 483449 | C. arborescens var. pendula | MI PMC | 42 | |
| 9080253 | C. arborescens | Lawyer Nursery | 42 | |
| 9019579 | C. arborescens | Lincoln-Oakes Nursery | 42 | |
| 9080250 | C. frutex | USDA, ARS, PI, Ames, IA | 25 | |
| 369217 | C. arborescens | same | 25 | |
| 371524 | C. arborescens | same | 25 | |
| 107663 | C. manschurica | same | 25 | |
| 9080252 | C. arborescens | same | 25 | |
| 310390 | C. arborescens | USDA, ARS, PI, Ames, IA | 25 | |
| 9080256 | C. intermedia | DLEG | 10 | |
| 9080257 | C. korshinskii | DLEG | 12 | |
| | | | | |
| | | | | |
| | | | | |

| | Block | position | accession code | Accession | Vigor 0-5 * 5/28/2008 | Survival 5/7/2009 0=dead, 1=alive | Replant 10/28/2009 0=no, 1=yes | Heights 7/8/2011 (cm) |
|---|---|---|---|---|---|---|---|---|
| | 1 | 1 | 1 | 9019579 | 0 | 0 | 1 | 23 |
| | 1 | 2 | 1 | | 1 | 0 | 1 | 0 |
| **North** | 1 | 3 | 1 | | 1 | 0 | 1 | 80 |
| ^ | 1 | 4 | 1 | | 2 | 0 | 1 | 0 |
| | 1 | 5 | 2 | 9078680 | 4 | 0 | 1 | 61 |
| **South** | 1 | 6 | 2 | | 4 | 0 | 1 | 50 |
| | 1 | 7 | 2 | | 1 | 0 | 1 | 62 |
| | 1 | 8 | 2 | | 1 | 0 | 1 | 87 |
| 8 feet spacings | 1 | 9 | 3 | 9080250 | 1 | 1 | | 58 |
| 1200 feet length | 1 | 10 | 3 | | 3 | 1 | | 0 |
| date planted | 1 | 11 | 3 | | 1 | 0 | 1 | 0 |
| 4/16/2008 | 1 | 12 | 3 | | 2 | 0 | 0 | 31 |
| | 1 | 13 | 4 | 9080252 | 4 | 0 | 1 | 65 |
| | 1 | 14 | 4 | | 4 | 0 | 1 | 15 |
| | 1 | 15 | 4 | | 5 | 0 | 0 | 80 |
| | 1 | 16 | 4 | | 5 | 0 | 0 | 80 |
| | 1 | 17 | 5 | 9080253 | 3 | 0 | 1 | 40 |
| | 1 | 18 | 5 | | 3 | 0 | 1 | 51 |
| | 1 | 19 | 5 | | 1 | 0 | 1 | 30 |
| | 1 | 20 | 5 | | 3 | 0 | 1 | 33 |
| | 1 | 21 | 6 | 107663 | 4 | 0 | 1 | 13 |
| | 1 | 22 | 6 | | 5 | 0 | 1 | 37 |
| | 1 | 23 | 6 | | 4 | 0 | 1 | 92 |
| | 1 | 24 | 6 | | 4 | 0 | 1 | 27 |
| | 1 | 25 | 7 | 310390 | 5 | 0 | 1 | 35 |
| | 1 | 26 | 7 | | 1 | 0 | 0 | 62 |
| | 1 | 27 | 7 | | 5 | 0 | 0 | 90 |
| | 1 | 28 | 7 | | 3 | 0 | 0 | 82 |
| | 1 | 29 | 8 | 369217 | 3 | 0 | 1 | 27 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | 30 | 8 | | 2 | 0 | 1 | 67 |
| 1 | 31 | 8 | | 1 | 0 | 1 | 12 |
| 1 | 32 | 8 | | 4 | 1 | | 115 |
| 1 | 33 | 9 | 371524 | 2 | 0 | 1 | 45 |
| 1 | 34 | 9 | | 3 | 0 | 1 | 54 |
| 1 | 35 | 9 | | 0 | 0 | 1 | 0 |
| 1 | 36 | 9 | | 1 | 0 | 1 | 38 |
| 1 | 37 | 10 | 483449 | 3 | 0 | 1 | 37 |
| 1 | 38 | 10 | | 3 | 0 | 1 | 33 |
| 1 | 39 | 10 | | 4 | 0 | 1 | 50 |
| 1 | 40 | 10 | | 4 | 0 | 1 | 0 |
| 1 | 41 | 11 | 633648 | 3 | 0 | 1 | 100 |
| 1 | 42 | 11 | | 5 | 0 | 1 | 105 |
| 1 | 43 | 11 | | 5 | 0 | 1 | 72 |
| 1 | 44 | 11 | | 1 | 0 | 0 | 70 |
| 1 | 45 | 12 | 636378 | 3 | 1 | | 0 |
| 1 | 46 | 12 | | 2 | 1 | | 0 |
| 1 | 47 | 12 | | 2 | 0 | 1 | 0 |
| 1 | 48 | 12 | | 2 | 0 | 1 | 0 |
| 1 | 49 | 13 | 9080256 | 5 | 1 | | 80 |
| 1 | 50 | 13 | | 5 | 1 | | 0 |
| 1 | 51 | 13 | | 4 | 0 | 0 | 71 |
| 1 | 52 | 13 | | 3 | 0 | 0 | 80 |
| 1 | 53 | 14 | 9080257 | 5 | 0 | 0 | 98 |
| 1 | 54 | 14 | | 5 | 1 | | 0 |
| 1 | 55 | 14 | | 0 | 0 | 0 | 75 |
| 1 | 56 | 14 | | 5 | 0 | 0 | 71 |
| 1 | 57 | 15 | dnr | 5 | 0 | 0 | 80 |
| 1 | 58 | 15 | | 5 | 0 | 0 | 0 |
| 1 | 59 | 15 | | 0 | 0 | 0 | 72 |
| 1 | 60 | 15 | | 5 | 1 | | 110 |
| 2 | 61 | 5 | | 3 | 1 | 1 | 81 |
| 2 | 62 | 5 | | 4 | 0 | 1 | 55 |
| 2 | 63 | 5 | | 4 | 1 | | 99 |
| 2 | 64 | 10 | | 5 | 1 | | 90 |
| 2 | 65 | 10 | | 1 | 1 | | 40 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 2 | 66 | 10 | 3 | 1 | | 68 |
| 2 | 67 | 15 | 5 | 1 | | 90 |
| 2 | 68 | 15 | 5 | 1 | | 115 |
| 2 | 69 | 15 | 5 | 0 | 0 | 115 |
| 2 | 70 | 13 | 2 | 1 | | 100 |
| 2 | 71 | 13 | 3 | 0 | 0 | 90 |
| 2 | 72 | 13 | 2 | 1 | | 0 |
| 2 | 73 | 7 | 2 | 0 | 1 | 125 |
| 2 | 74 | 7 | 5 | 1 | | 80 |
| 2 | 75 | 7 | 3 | 1 | | 115 |
| 2 | 76 | 9 | 1 | 0 | 1 | 99 |
| 2 | 77 | 9 | 2 | 0 | 1 | 72 |
| 2 | 78 | 9 | 1 | 0 | 1 | 41 |
| 2 | 79 | 1 | 2 | 1 | 1 | 84 |
| 2 | 80 | 1 | 2 | 1 | | 58 |
| 2 | 81 | 1 | 2 | 0 | 1 | 72 |
| 2 | 82 | 6 | 3 | 0 | 1 | 32 |
| 2 | 83 | 6 | 1 | 0 | 1 | 30 |
| 2 | 84 | 6 | 2 | 0 | 1 | 0 |
| 2 | 85 | 4 | 2 | 0 | 0 | 98 |
| 2 | 86 | 4 | 1 | 0 | 0 | 100 |
| 2 | 87 | 4 | 0 | 0 | 0 | 110 |
| 2 | 88 | 12 | 1 | 0 | 1 | 70 |
| 2 | 89 | 12 | 2 | 0 | 0 | 63 |
| 2 | 90 | 12 | 5 | 0 | 0 | 120 |
| 2 | 91 | 11 | 3 | 1 | | 72 |
| 2 | 92 | 11 | 2 | 1 | | 80 |
| 2 | 93 | 11 | 5 | 0 | 0 | 102 |
| 2 | 94 | 2 | 2 | 0 | 1 | 96 |
| 2 | 95 | 2 | 5 | 0 | 1 | 33 |
| 2 | 96 | 2 | 2 | 0 | 1 | 65 |
| 2 | 97 | 14 | 4 | 0 | 0 | 94 |
| 2 | 98 | 14 | 5 | 0 | 0 | 68 |
| 2 | 99 | 14 | 4 | 0 | 0 | 47 |
| 2 | 100 | 8 | 2 | 0 | 1 | 78 |
| 2 | 101 | 8 | 5 | 0 | 0 | 112 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 2 | 102 | 8 | 4 | 0 | 0 | 51 |
| 2 | 103 | 3 | 2 | 0 | 1 | 46 |
| 2 | 104 | 3 | 3 | 1 | | 33 |
| 2 | 105 | 3 | 2 | 1 | | 70 |
| 3 | 106 | 12 | 1 | 0 | 0 | 93 |
| 3 | 107 | 12 | 1 | 0 | 0 | 79 |
| 3 | 108 | 12 | 0 | 0 | 0 | 101 |
| 3 | 109 | 3 | 1 | 0 | 0 | 95 |
| 3 | 110 | 3 | 1 | 0 | 0 | 92 |
| 3 | 111 | 3 | 1 | 0 | 0 | 103 |
| 3 | 112 | 7 | 2 | 0 | 1 | 105 |
| 3 | 113 | 7 | 4 | 0 | 0 | 71 |
| 3 | 114 | 7 | 3 | 0 | 0 | 60 |
| 3 | 115 | 1 | 3 | 0 | 1 | 39 |
| 3 | 116 | 1 | 3 | 0 | 1 | 51 |
| 3 | 117 | 1 | 3 | 0 | 1 | 80 |
| 3 | 118 | 14 | 4 | 0 | | 51 |
| 3 | 119 | 14 | 5 | 0 | 0 | 100 |
| 3 | 120 | 14 | 5 | 0 | 0 | 73 |
| 3 | 121 | 9 | 0 | 0 | 1 | 65 |
| 3 | 122 | 9 | 3 | 0 | 1 | 0 |
| 3 | 123 | 9 | 1 | 0 | 1 | 61 |
| 3 | 124 | 6 | 4 | 0 | 0 | 91 |
| 3 | 125 | 6 | 1 | 0 | 0 | 46 |
| 3 | 126 | 6 | 1 | 0 | 0 | 77 |
| 3 | 127 | 2 | 5 | 0 | 1 | 51 |
| 3 | 128 | 2 | 4 | 0 | 1 | 73 |
| 3 | 129 | 2 | 1 | 0 | 1 | 74 |
| 3 | 130 | 8 | 1 | 0 | 0 | 94 |
| 3 | 131 | 8 | 2 | 0 | 0 | 80 |
| 3 | 132 | 8 | 4 | 0 | 0 | 83 |
| 3 | 133 | 15 | 5 | 0 | 0 | 77 |
| 3 | 134 | 15 | 5 | 0 | 0 | 82 |
| 3 | 135 | 15 | 5 | 0 | 0 | 77 |
| 3 | 136 | 4 | 2 | 0 | 0 | 78 |
| 3 | 137 | 4 | 4 | 0 | 0 | 81 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 3 | 138 | 4 | 3 | 0 | 0 | 84 |
| 3 | 139 | 13 | 4 | 0 | 0 | 100 |
| 3 | 140 | 13 | 4 | 1 | | 58 |
| 3 | 141 | 13 | 5 | 1 | | 71 |
| 3 | 142 | 5 | 3 | 1 | 1 | 30 |
| 3 | 143 | 5 | 3 | 0 | 1 | 23 |
| 3 | 144 | 5 | 2 | 0 | 1 | 91 |
| 3 | 145 | 10 | 2 | 0 | 1 | 55 |
| 3 | 146 | 10 | 2 | 0 | 1 | 47 |
| 3 | 147 | 10 | 2 | 0 | 1 | 47 |
| 3 | 148 | 11 | 5 | 1 | | 97 |
| 3 | 149 | 11 | 4 | 1 | | 94 |
| 3 | 150 | 11 | 3 | 0 | 0 | 91 |

* 0= dead, 1= regrowth from base, 2= stagnate growth, 3= minor growth, 4= mod. Growth, 5= hi vigor good growth

# NATURAL RESOURCES CONSERVATION SERVICE
# PLANT MATERIALS CENTER
# PULLMAN, WASHINGTON

## PMC STUDY PLAN

I. Study Title: CFT: Horse Heaven Hills buffer demo planting.

Study Number: WAPMC-F-0406-BU

II. Problem: The Horse Heaven Hills lie between the Columbia and Yakima rivers in southcentral Washington. Rain fall is some the lowest in the Pacific Northwest, and dryland wheat growers almost exclusively utilize a crop-fallow system. Wind erosion is a serious concern, and growers need more options to protect their soil resource.

III. Objective: Initiate a project in 2004 to evaluate and demonstrate a number of conservation plant species.

IV. Procedure:

HORSE HEAVEN HILLS BUFFER DEMO PLANTING

E
N ← S
W

CROPLAND

| | | | | |
|---|---|---|---|---|
| 6’ WIDE WEED FABRIC | 6’ WIDE WEED FABRIC | 6’ WIDE WEED FABRIC | 6’ WIDE WEED FABRIC + BARE GRD | 6’ WIDE WEED FABRIC |
| 17 CARAGANA ON 6’ SPACING | 17 JUNIPERS ON 6’ SPACING | 21 BIG SAGE ON 5’ SPACING | 21 RABBITBRUSH ON 5’ SPACING | 15 SALTBUSH ON 6’ SPACING --- |
| 6’ WIDE WEED FABRIC | 6’ WIDE WEED FABRIC | 6’ WIDE WEED FABRIC | 6’ WIDE WEED FABRIC | 6’ WIDE WEED FABRIC |
| MAG VOLG BOZ ALKR CLEM | MAG VOLG BOZ ALKR CLEM | MAG VOLG BOZ ALKR CLEM | MAG VOLG BOZ ALKR CLEM | MAG VOLG BOZ ALKR |
| MAG VOLG BOZ ALKR CLEM | MAG VOLG BOZ ALKR CLEM | MAG VOLG BOZ ALKR CLEM | MAG VOLG BOZ ALKR CLEM | MAG VOLG BOZ ALKR |
| CLEAN TILL 6’ WIDE | CLEAN TILL 6’ WIDE | CLEAN TILL 6’ WIDE | CLEAN TILL 6’ WIDE | CLEAN TILL 6’ WIDE |

GRASSES ARE PAIRED ROWS WITH 2’ SPACINGS IN THE ROW, 3’ BETWEEN ROW
CLEMATIS ARE A SINGLE ROW OF 5 PLANTS WITH 4’ SPACINGS

TOTAL LENGTH OF DEMO IS 484’ LONG

APRIL 7, 2004 CARAGANA, JUNIPER, BIG SAGE, RUBBER RABBITBRUSH PLANTED AND WATERED
APRIL 8, 2004 ALL GRASSES PLANTED AND WATERED,
MAY 18, 2004 SALTBUSH AND CLEMATIS PLANTED AND WATERED

CARAGANA (1 GAL POT) PROVIDED BY POW
JUNIPERS (40 CU IN) PROVIDED MY MT FOREST NURSERY
BIG SAGE (10 CUIN) PROVIDED BY POW
RUBBER RABBITBRUSH (10 CUIN) PROVIDED BY POW
SALTUSH (40 CUIN, PMC STOCK

V. Progress:

**Establishment:**

Rooted plants of 8 of 10 species were transplanted into fallowed soil on April 7-8, 2004. Western clematis and fourwing saltbush plants were transplanted on May 18, 2004.

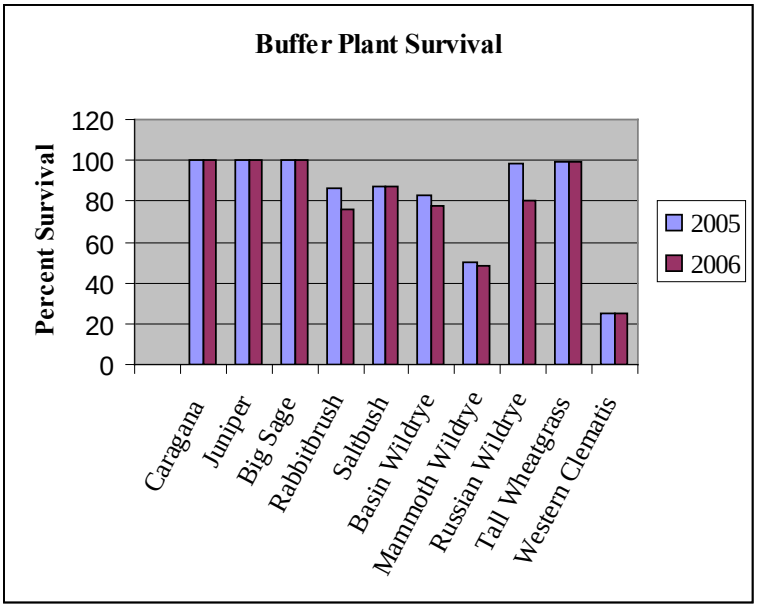
The entire planting was space planted to minimize competition. The shrubs were spaced 5-6 feet apart. Weed barrier cloth was laid in the shrub row to reduce weed growth and conserve moisture. The effective width of the barrier cloth was 10 feet (5 feet on each side of the row). The grasses were spaced 2 feet apart with a row and 3 feet between rows, and the western clematis was spaced 4 feet apart. The grass and clematis rows were maintained with clean tillage.

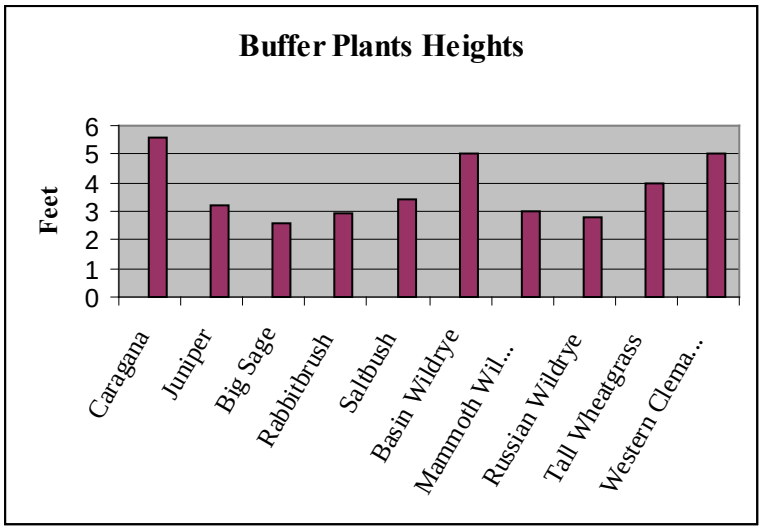
Each plant was watered the day of transplanting. Additional watering occurred on April 20th, May 5th, May 26th, June 18th, and August 4th, 2006. A 200 gallon tank of water in the bed of a pick up supplied each plant with approximately 1 liter of water at each watering.

Survival of all the plants was outstanding the year of establishment.

Rocky Mountain Juniper Seedling

## Growth and Survival:




**Caragana** is one of the best performing plants in the planting. We pruned it back in the fall of 2004 to a height of 18-inches to stimulate stem numbers. Some of the plants are now 8-feet tall. Most of the plants were 2-4 feet wide and the canopy should close within a few years. While a closed canopy within the row will reduce wind, it will catch more Russian thistle carcasses and hand removal of the carcasses will be needed. The landowner reported that it tolerated 2,4-D herbicide drift quite well.

**Rocky Mountain Juniper** is performing very well. It is not as fast as growing as the caragana but it more trouble free. It did not require pruning and it catches far fewer Russian thistle carcasses.

**Big Sage** is one of the fastest growing shrubs in the planting and probably is reaching its maximum height. The plants vary considerably in size, shape, leaf density, and seed production.

Some very tall native big sage plants occur a few miles west of the planting. These tall native plants should have better genetic potential for use as a buffer plant material.

**Rubber Rabbitbrush** is the most variable shrub in the planting. None of the plants are over 4 feet tall and a few are only 18 inches tall. Survival is not great and would be worse had barrier cloth not been laid to reduce weed competition.

**Fourwing Saltbush** should achieve a maximum height of 6 feet in the Horse Heaven Hills. This plant grows wider than tall and should reach a width of 10 feet.
Survival and growth are excellent considering that the seedlings were not well developed at planting. A major concern about saltbush is its ability to catch Russian thistle carcasses. As many as 22 carcasses were pulled from a single saltbush plant in the spring of 2005!

**'Magnar' Basin Wildrye** is the tallest grass in the planting. Basin wildrye occurs naturally in moist draws in the Horse Heaven Hills and scattered plants can be found on upland CRP plantings. While it is tall, it lacks sufficient stem density to be a useful herbaceous wind barrier in the Horse Heaven Hills.

**'Volga' Mammoth Wildrye** is not performing well in this planting. Survival is poor, stem density is poor, and its height is inadequate. It is spreading via rhizomes so it has some potential for stilling blow-out areas along roadsides in the area.

**'Bozoisky' Russian Wildrye** is performing fairly well. It is too short and the stem density is only fair which make it marginally useful as an herbaceous wind barrier in the Horse Heaven Hills. It is very competitive and weeds are noticeably reduced around the plants.

**'Alkar' Tall Wheatgrass** is the best performing grass in this planting. It has excellent stem density and the stems are very robust. It competes very well with weeds in the row. Since this plant normally needs higher precipitation, clean tillage around the plants is needed to reduce competition during the first growing season.

**'Trailar' Western Clematis** is a slow growing on this site. Weed growth around the plants was heavy and difficult to control without injuring the plants. Layering (rooting at the stem nodes) is not occurring. This plant frequently climbs fences and other upright structures. Placing a short upright support at the base of each plant should enable this plant to climb and provide some wind barrier effect. Our research has shown this plant to be very persistent once established. The crown is below the soil surface and the plant tolerates fire well. This might prove useful for Russian thistle carcass management.

The shrub row was roto-tilled immediately prior to planting. Six-foot wide **Weed Barrier Cloth** was laid and the edges were buried to prevent wind throw. Shrub plants were planted along the east edge of the weed barrier. A layer of weed barrier cloth was then laid along the west edge of the shrub row. This effectively eliminated all weed competition in the row and retarded soil moisture evaporation. Some tearing of the weed barrier is occurring after three years but it is

holding up well. Dust accumulating on the surface of the barrier is reducing UV damage to the barrier cloth.

**Russian thistle and mustard carcasses** are a major issue in this planting. The grasses were planted on the windward side of the shrubs, and we hoped that the grasses would catch the carcasses. This did not occur. Hand removal of carcasses in the shrub row has been needed each spring. **Cheatgrass** numbers have been generally low in the planting but they are very large and produce huge amounts of seed.

2010—
All of the caragana and junipers are alive. Heights were not taken.

The big sage, rabbitbrush, and saltbush were removed because none acquired much height. These species were replaced with MT state nursery barerrot caragana plants.

Weed barrier is holding up well.

The grasses were also removed from the study. Approximately 50% of the clematis plants were alive.

2011—
All the caraganas and junipers are alive. Height changes from 2006 to 2011 are negligible. It appears that these shrubs have attained a maximum height given the arid conditions.

Survival of the clematis plants remains at approximately 50%.

**UNITED STATES DEPARTMENT OF AGRICULTURE**
**PULLMAN PLANT MATERIALS CENTER**
**STUDY PLAN**

**STUDY TITLE:** Cover Crops: Evaluation of 4 grass mixes for filter strips on a silt clay loam soil (Hackner Farm).

**STUDY NUMBER: WAPMC-T-1107-CP**

**STUDY TYPE:** Advanced Evaluation

**LAND USES:** Annual irrigated cropland filter strip

**PROBLEM:** Furrow irrigation erosion results in sediments that impair water quality of the receiving Toppenish Creek.

**OBJECTIVE:** Compare efficacy of an annual small grain, alfalfa, mountain brome and intermediate wheatgrass to reduce off-field transport of sediments.

**DURATION OF STUDY:** 2011-2012

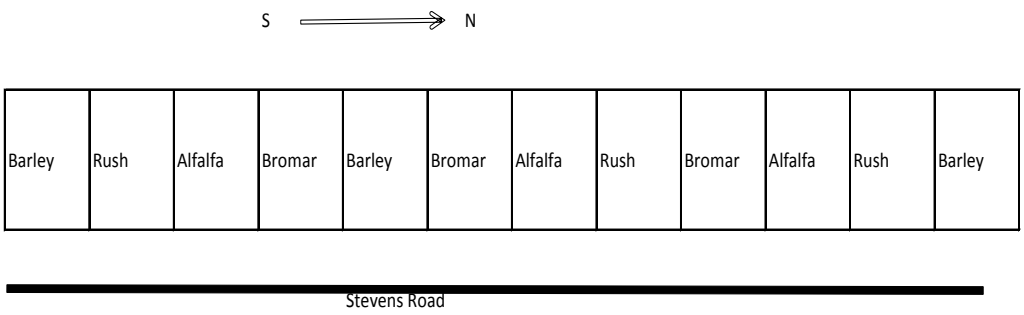
**STUDY LEADERS:** Jeff Ullman WSU, Brian Bodah WSU, Mark Stannard PMC

**LOCATION:** SE ¼, Se ¼, Sec 23, R20E, T10N; ¼ mile north of Chambers Rd x Stevens Rd intersection; Toppenish, WA; Mark Hackner Farm

**COOPERATORS:** Washington State University, Yakama Indian Nation

**STUDY DESIGN:** RCB, 3 reps x 4 treatments. Each plot 30’ x 30’.

**Layout:**



**TREATMENTS:**

| | | |
|---|---|---|
| 1. | ‘Baronesse’ barley | 160 lb/ac |
| 2. | ‘Rush’ Intermediate wheatgrass | 20 lb/ac |
| 3. | Alfalfa + White clover | 16 lb/ac + 4 lb/ac |
| 4. | ‘Bromar’ Mountain brome | 20 lb/ac |

**PROGRESS:** Field will be seeded to corn in May 2011 and furrow irrigated. Filter strip area (30’ x 360’) was rototilled with the JD670, harrowed three directions to smooth the furrows, rolled, broadcast seeded, and rolled again on March 10, 2011.

Barley stands were uniform and exceeded 15 plants/sq ft on April 12, 2011. Alfalfa + clover just emerging and plant counts will easily exceed 10 plants/sqft. Bromar was just beginning to emerge. The other grasses had not emerged yet.

Sediment capture data were taken in 2011 by WSU. Data and analysis not available at this time.

**UNITED STATES DEPARTMENT OF AGRICULTURE**
**PULLMAN PLANT MATERIALS CENTER**
**STUDY PLAN**

**STUDY TITLE:** Cover Crops: Evaluation of 4 grass mixes for filter strips on a fine sandy loam soil (Harris Farms, Pasco Road).

**STUDY NUMBER: WAPMC-T-1108-CP**

**STUDY TYPE:** Advanced Evaluation

**LAND USES:** Annual irrigated cropland filter strip

**PROBLEM:** Furrow irrigation erosion results in sediments that impair water quality of the receiving Yakima River.

**OBJECTIVE:** Compare efficacy of an annual small grain, alfalfa, mountain brome and intermediate wheatgrass to reduce off-field transport of sediments.

**DURATION OF STUDY:** 2011-2012

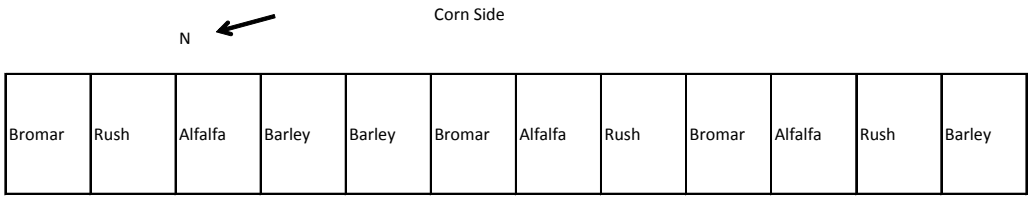
**STUDY LEADERS:** Jeff Ullman WSU, Brian Bodah WSU, Mark Stannard PMC

**LOCATION:** NW ¼, Sec 7, R22E, T8N; ¼ mile southeast of Pasco Rd x Pierre Rd intersection; Toppenish, WA; Harris Farm

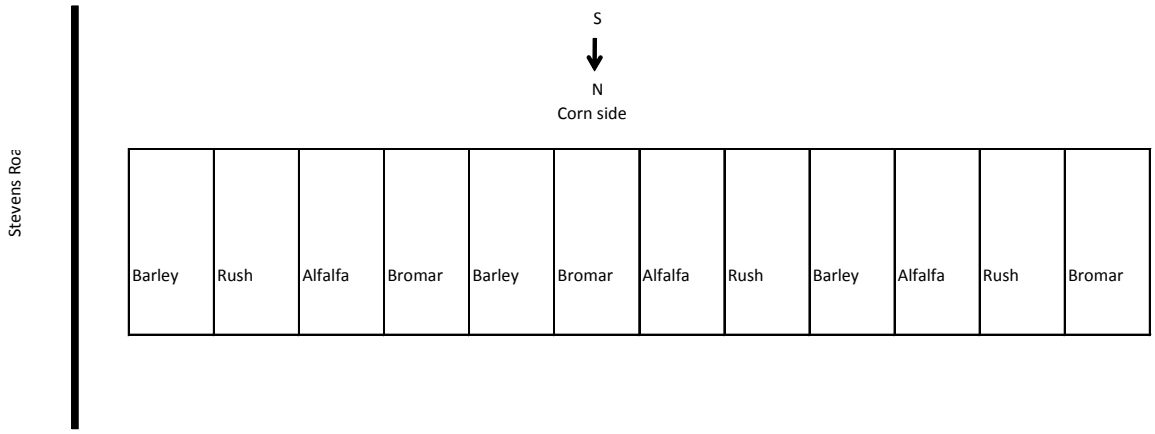
**COOPERATORS:** Washington State University, Yakama Indian Nation

**STUDY DESIGN:** RCB, 3 reps x 4 treatments. Each plot 30’ x 30’.

**Layout (west planting):**



**Layout (east planting):**




**TREATMENTS:**

| | | |
|---|---|---|
| 1. | 'Baronesse' barley | 160 lb/ac |
| 2. | 'Rush' Intermediate wheatgrass | 20 lb/ac |
| 3. | Alfalfa + White clover | 16 lb/ac + 4 lb/ac |
| 4. | 'Bromar' Mountain brome | 20 lb/ac |

**PROGRESS:** Field will be seeded to corn in May 2011 and furrow irrigated. Filter strip area (30' x 360') was disked and basket harrowed on Mar 8, rototilled with the JD670, harrowed three directions to smooth the furrows, rolled, broadcast seeded, and rolled again on March 11, 2010.

Barley stands were uniform and exceeded 15 plants/sq ft on April 12, 2011. Alfalfa + clover just emerging and plant counts will easily exceed 10 plants/sqft. The grasses had not emerged yet.

Sediment capture data collected by WSU in 2011. Data and analysis are not available at this time.

**UNITED STATES DEPARTMENT OF AGRICULTURE**
**PULLMAN PLANT MATERIALS CENTER**
**STUDY PLAN**

**STUDY TITLE:** Cover Crops: Evaluation of 4 grass mixes for filter strips on a silt loam soil (Loza Farm, Brown Road).

**STUDY NUMBER: WAPMC-T-1109-CP**

**STUDY TYPE:** Advanced Evaluation

**LAND USES:** Annual irrigated cropland filter strip

**PROBLEM:** Furrow irrigation erosion results in sediments that impair water quality of the receiving Yakima River.

**OBJECTIVE:** Compare efficacy of an annual small grain, alfalfa, mountain brome and intermediate wheatgrass to reduce off-field transport of sediments.

**DURATION OF STUDY:** 2011-2012

**STUDY LEADERS:** Jeff Ullman WSU, Brian Bodah WSU, Mark Stannard PMC

**LOCATION:** North planting—NE ¼, NE ¼, Sec 17, T11N, R18E; ¼ mile WS of Brown Rd X W Wapato Rd; Leo Loza Farm

South planting—NW ¼, NE ¼, Sec 20, T11N, R18E; south side of Evans Rd and ¼ mile west of Brown Rd; Leo Loza Farm

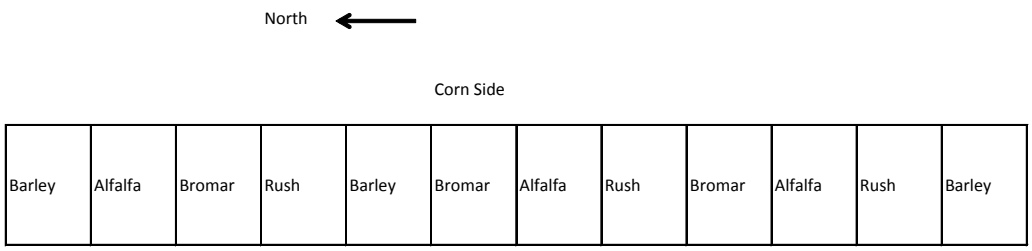
**COOPERATORS:** Washington State University, Yakama Indian Nation

**STUDY DESIGN:** RCB, 3 reps x 4 treatments. Each plot 30’ x 50’.

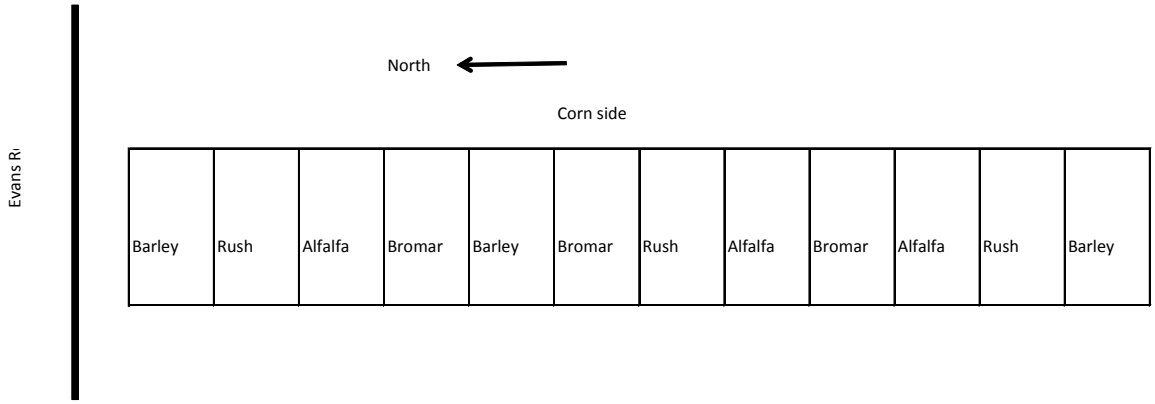
**TREATMENTS:**

| | | |
|---|---|---|
| 1. | ‘Baronesse’ barley | 160 lb/ac |
| 2. | ‘Rush’ Intermediate wheatgrass | 20 lb/ac |
| 3. | Alfalfa + White clover | 16 lb/ac + 4 lb/ac |
| 4. | ‘Bromar’ Mountain brome | 20 lb/ac |

**Layout (north planting):**




**Layout (south planting):**




**PROGRESS:** Field will be seeded to corn in May 2011 and furrow irrigated. Filter strip area (50’ x 360’) was rototilled with the JD670, harrowed three directions to smooth the furrows, rolled, broadcast seeded, and rolled again on March 11, 2010.

Barley stands were uniform and exceeded 15 plants/sq ft on April 12, 2011. Alfalfa + clover just emerging and plant counts will easily exceed 10 plants/sqft. The grasses had not emerged yet.

Herbicide carryover prevented establishment of the grasses. The study was abandoned by WSU.

**UNITED STATES DEPARTMENT OF AGRICULTURE**
**NATURAL RESOURCES CONSERVATION SERVICE**

| | |
|---|---|
| **Title** | Dryland Legumes: Western Prairie Clover and Basalt Milkvetch Seed Treatment and Planting Time |
| **Study Number** | WAPMC-T-1105-WL |
| **Study Leader** | Pamela Pavek, WAPMC Agronomist |
| **Study Cooperator** | USDA-ARS Forage and Range Research Lab, Logan, Utah<br>Contact: Doug Johnson |
| **Duration** | 2010 - 2011 |
| **Description** | Optimal establishment techniques for western prairie clover and basalt milkvetch will be determined by comparing seed treatments and planting time. Seeds will be physically scarified, chemically scarified, and not treated, and planted in the fall and spring. |

**Status of Knowledge**

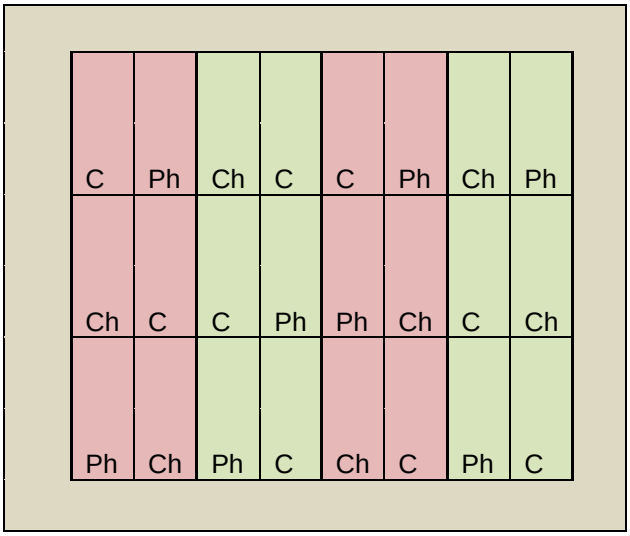
The ARS in Logan, UT, is developing populations of three native forb species that will improve diversity and forage quality of rangeland, and enhance pollinator and wildlife habitat throughout many western states. The three species are: Searls' prairie clover (*Dalea searlsiae*), western prairie clover (*Dalea ornata*) and basalt milkvetch (*Astragalus filipes*). Of these three species, western prairie clover and basalt milkvetch are adapted to the service area of the Pullman Plant Materials Center.

The ARS collected seed of these species from multiple locations and analyzed the population structure of the collections. They determined western prairie clover has two distinct populations. The SS population encompasses a large area including the Palouse, the Blue Mountains, eastern Oregon and western Idaho. The SB population is found only within the Deschutes River watershed in north-central Oregon. Basalt milkvetch also has a population that covers a large area, including Washington, Oregon, Idaho, northern California and northern Nevada. This population was released in 2008 as NBR-1 Germplasm (pre-variety germplasm). Two additional populations are found in British Columbia and central Nevada.

The ARS plans to make releases of the various populations of western prairie clover in the near future; however, information is lacking on agronomic practices such as seed treatment, planting time, planting depth and spacing. Information generated from this study will improve the ability of landowners, commercial seed producers and government agencies to successfully establish these forbs.

**Experimental Design**

The design of this experiment will be a split-plot design, with planting time as the main factor and seed treatment as the sub factor. There will be four replications of each of the 6 treatment combinations; a total of 24 plots for each species. An example of how the plots will be laid out is illustrated here:




= Fall Plant
= Spring Plant

Ph = Physical scarification
Ch = Chemical scarification
C = Control

**Materials and methods**

Plots will be planted with a Hege dual-cone seeder. Plots will be 4 rows wide (half of the cone seeder width) and 10 ft long. Rows will be spaced at 8 inches, and plot area will equal 35 sq ft. Seed will be planted at a 5 lbs PLS/ac rate. A total of 0.1 lb (45 g) of each species is needed for this study.

Seed of western prairie clover (SS population) and basalt milkvetch (NBR-1 population) will be provided by ARS. In mid to late October, 2010, the fall planted seed will be divided into three batches and treated with one of three methods:

1) Physical scarification with hand rubbing between sandpaper
2) Chemical scarification with 100% Sulfuric acid ($H_2SO_4$) for five minutes and air-dried
3) No treatment

The seed will then be divided into 4 replications of each treatment and seeded in randomized plots.

In early May, 2011, these steps will be repeated for the spring planted seed.

Seedlings will be counted in late June 2011. Counts will be made per linear foot at four points within each plot, averaged and compared to other plots. Results will be analyzed statistically to determine significant differences among treatments.

**2011 Update**

The fall planted plots were seeded on October 22, 2010. The spring planted plots were seeded May 25, 2011. On May 6, all plots were sprayed with 12 oz/ac Assure II for cheatgrass control. Plots were also infested with pennycress, but did not spray Round Up due to concerns about small affecting DAOR or ASFI

seedlings. Also prior to seeding the spring plots, the plots were lightly rototilled and packed.

**Results**

There was no emergence of DAOR in any of the plots, and only a handful of plants emerged in the ASFI plots. This may have been caused by our very cold, wet winter and spring, and the soil conditions being unsuitable for these species. The study will be re-established Fall 2011 in a new field.

**2011 Replanting**

The new field for the DAOR and ASFI Seed Treatment and Planting Time Study is 3E1 on the South Farm. The field had been planted to barley previous spring. The barley stubble was mowed, rototilled (2 passes) and the field was packed (2 passes) prior to planting the fall-seeded DAOR and ASFI plots on October 20, 2011. There is a new layout due to field shape. The seed planted was sent by ARS and had been inoculated and physically or chemically scarified, or unscarified (control).

all plots: 10 ft long, 3.5 ft wide

3 treatments, 2 planting times, 4 reps

^
N

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| C | Ph | Ch | Ph | C | Ph | Ch | Ph |
| Ph | Ch | C | Ch | Ph | Ch | C | Ch |
| Ch | C | Ph | C | Ch | C | Ph | C |
| C | Ph | Ch | C | C | Ph | Ch | C |
| Ch | C | Ch | Ph | Ch | C | Ch | Ph |
| Ph | Ch | Ph | C | Ph | Ch | Ph | C |

= Dalea Fall Plant
= Dalea Spring Plant

= Astragalus Fall Plant
= Astragalus Spring Plant

Ph = Physical scarification
Ch = Chemical scarification

C = Control

The spring planted plots will be planted in May 2012.

**UNITED STATES DEPARTMENT OF AGRICULTURE**
**NATURAL RESOURCES CONSERVATION SERVICE**

| | |
|---|---|
| **Title** | Dryland Legumes: Western Prairie Clover and Basalt Milkvetch Seeding Depth |
| **Study Number** | WAPMC-T-1106-WL |
| **Study Leader** | Pamela Pavek, WAPMC Agronomist |
| **Study Cooperator** | ARS, Logan, Utah<br>Contact: Doug Johnson |
| **Duration** | 2010 - 2011 |
| **Description** | Optimal seeding depth for western prairie clover and basalt milkvetch will be determined by comparing germination of seeds planted at 5 depths: 0", ¼", ½", ¾", and 1". |

**Status of Knowledge**

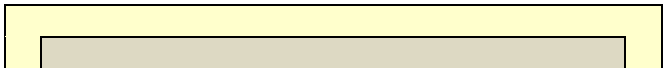
The ARS in Logan, UT, is in the process of developing populations of three native forb species to improve diversity and forage quality of rangeland, and enhance pollinator and wildlife habitat throughout many western states. The three species are: Searls' prairie clover (*Dalea searlsiae*), western prairie clover (*Dalea ornata*) and basalt milkvetch (*Astragalus filipes*). Of these three species, western prairie clover and basalt milkvetch are adapted to the service area of the Pullman Plant Materials Center; Searls' prairie clover is not.

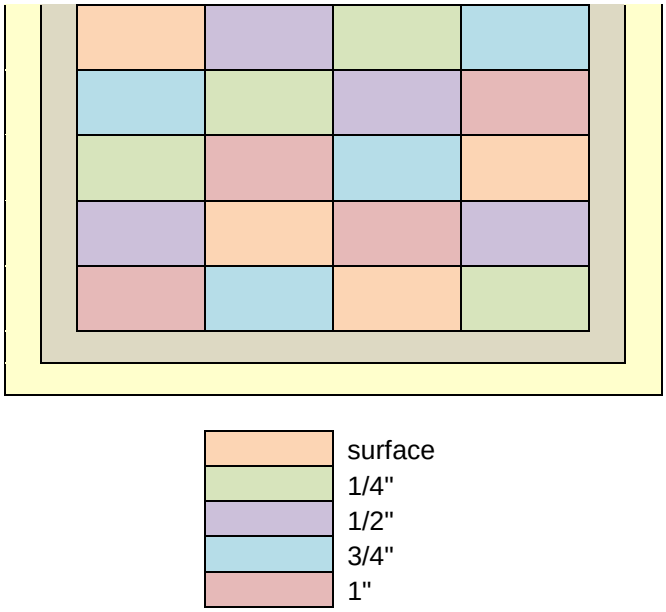
The ARS collected seed of the three species from multiple locations and analyzed the population structure of the collections. They determined western prairie clover has two distinct populations. The SB population encompasses a large area including the Palouse, the Blue Mountains, eastern Oregon and western Idaho. The other population is found only within the Deschutes Mountains in central Oregon. Basalt milkvetch also has a population that covers a large area, including Washington, Oregon, Idaho, northern California and northern Nevada. This is the NBR-1 population. Two separate populations are found in British Columbia and central Nevada.

The ARS plans to make releases of these populations in the near future, however information is lacking on agronomic practices such as seed treatment, planting time, planting depth and spacing. This study will complement the USDA-NRCS Study WAPMC-T-1001-WL: Western Prairie Clover and Basalt Milkvetch Seed Treatment and Planting Time. Information generated from this study will improve the ability of landowners, commercial seed producers and government agencies to successfully establish these forbs.

**Experimental Design**

The design of this experiment is a randomized complete block. There are four replications of each of the 5 seeding depth treatments; a total of 20 plots for each species. The plot design is illustrated here:






**Materials and methods**

Two 56” x 48” plot frames (one for each species) was constructed of 2” x 4” pine lumber. (Internal dimensions will equal 52” x 44”). The frames were imbedded into cultivated soil so that the top of the frames will be flush with the ground surface, and the frames will be evenly filled with soil. There is a 2” border between the wood frame and the plots. Plots will be 12” long and 8” wide.

On October 22, 2011, seed provided by ARS (western prairie clover SB population and basalt milkvetch NBR-1 population) was planted at 5 specified depths within the middle of each randomized plot. Furrows were created by moving the soil with a ruler. Seed was placed in the furrow at a rate of 40 seeds per linear foot. After the seed was placed, the soil was moved back to cover the furrow.

(Because this study was conducted at the same time as the study to determine optimal planting time and seed treatment, an assumption was made: fall planting with chemical seed treatment will result in adequate seedling establishment.)

Seedlings will be counted in late June 2011. Results will be analyzed statistically to determine significant differences among treatments.

**2011 Update**

Plots were planted on October 22, 2010.

**Results**

There were no discernable seedlings in any of the plots. The lack of germination or seedling immortality may have been caused by the cold and wet conditions that persisted into late May.

This Study was not replanted in 2011 due to workload of other studies. It has been cancelled.

**UNITED STATES DEPARTMENT OF AGRICULTURE**
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| | |
|---|---|
| **Title** | Ventenata: Determination of rate of infestation in three vegetation regimes |
| **Study Number** | WAPMC-T-0806-IN |
| **Study Leader** | Pamela Pavek, WAPMC Agron. |
| **Duration** | 2008 - 2013 |
| **Description** | Plots will be established at the PMC in three vegetation regimes having three levels of existing Ventenata infestation. The plots will be monitored annually to determine infestation trends. |

**Status of Knowledge**

Within the last 50 years, Ventenata (*Ventenata dubia* (Leers) Coss.) has invaded the Pacific Northwest. Ventenata first occupied disturbed areas, and more recently has moved into areas with established perennial vegetation. Little is known about the rate of infestation in various vegetation regimes, such as rhizomatous grasses, bunch grasses or a mixture of rhizomatous and bunch grasses. If a difference in infestation rate of Ventenata can be determined, this information could be used to make recommendations to land managers for preventing or managing infestations.

In addition, little is known about the effect Ventenata may have on the existing perennial vegetation, such as by robbing water and nutrients from the system. This study will provide an opportunity to monitor not only the rate of the spread of Ventenata, but also the rate of perennial vegetation growth or decline.

At the Pullman PMC, trends in invasion of Ventenata have paralleled the PNW. The PMC is an ideal location for this study because of the variances in the levels of Ventenata, as well as variances in vegetation regimes throughout the landscape.

**Experimental Design**

Three 1 m x 1 m plots will be established randomly in each of three vegetation regimes: 1) rhizomatous grass, 2) bunch grass and 3) mixture of rhizomatous and bunch grasses, all having three levels of current Ventenata infestation: 1) low, 2) medium and 3) high. Total number of plots = 27.

**Materials and methods**

The plots will be established using 1 m long fiberglass rods set into the ground in each corner of the plot.

The rhizomatous grass plots consist of intermediate wheatgrass (*Thinopyrum intermedium*), meadow foxtail (*Alopecurus pratensis*), tall oatgrass (*Arrhenatherum elatius*), or bluebunch wheatgrass (*Pseudoroegnaria spicata*). The bunch grass plots consist of hard fescue (*Festuca brevipila*) and one or more of the rhizomatous grasses.

The plots will be rated on a scale of 0 – 10 for level of Ventenata infestation, and grouped into three catagories: low (0 – 3), medium (4 – 7) and high (8 – 10). Three plots with each of the three levels of infestation will be chosen initially for each vegetation type to establish benchmark conditions.

The plots will also be rated on cover of perennial vegetation to determine if it is being replaced by Ventenata over time. 0 = 0%, 10 = 100% cover.

The plots will be rated and pictures of each plot will be taken in August every year during the study.

**Technology Transfer** The information generated in this study could potentially be useful in developing recommendations for land managers.

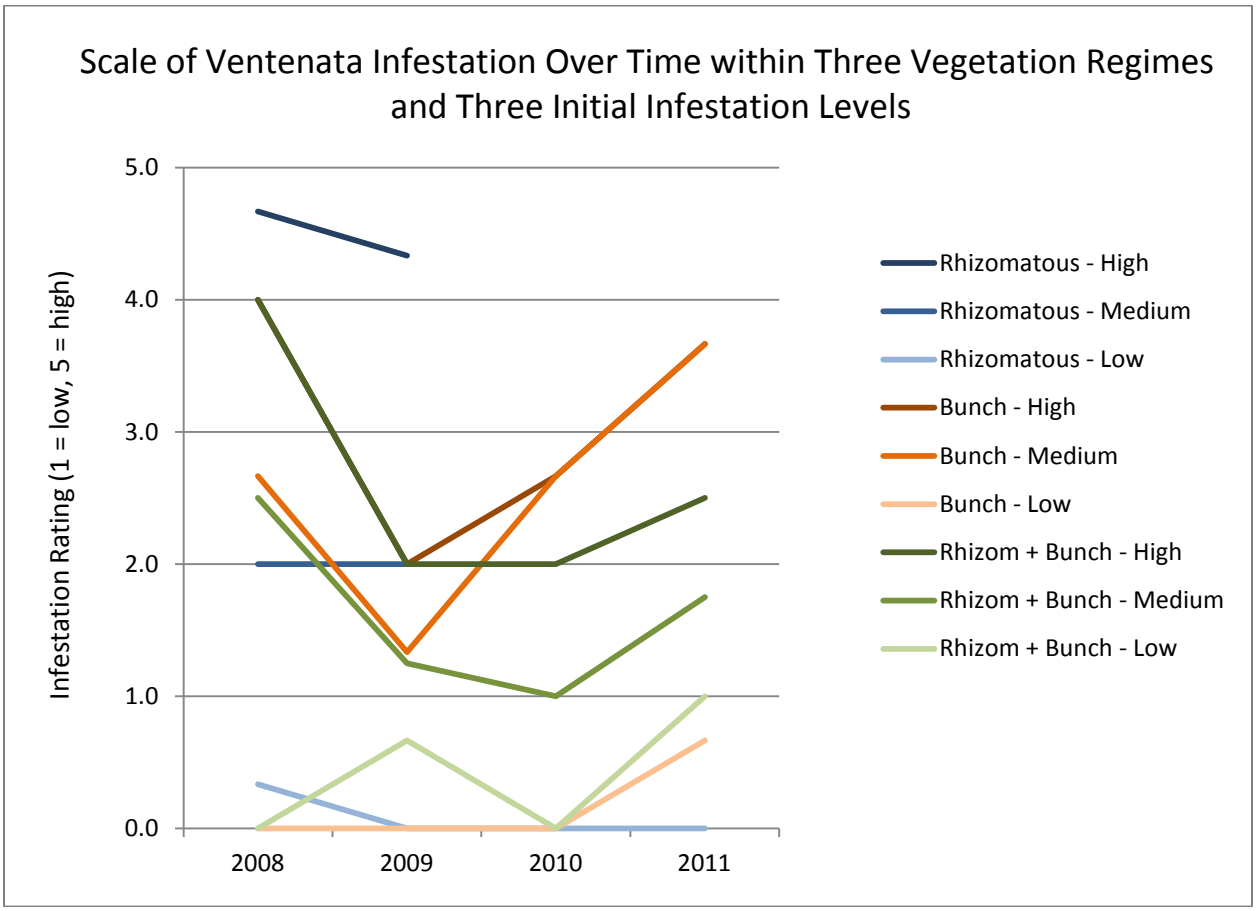
**Results**

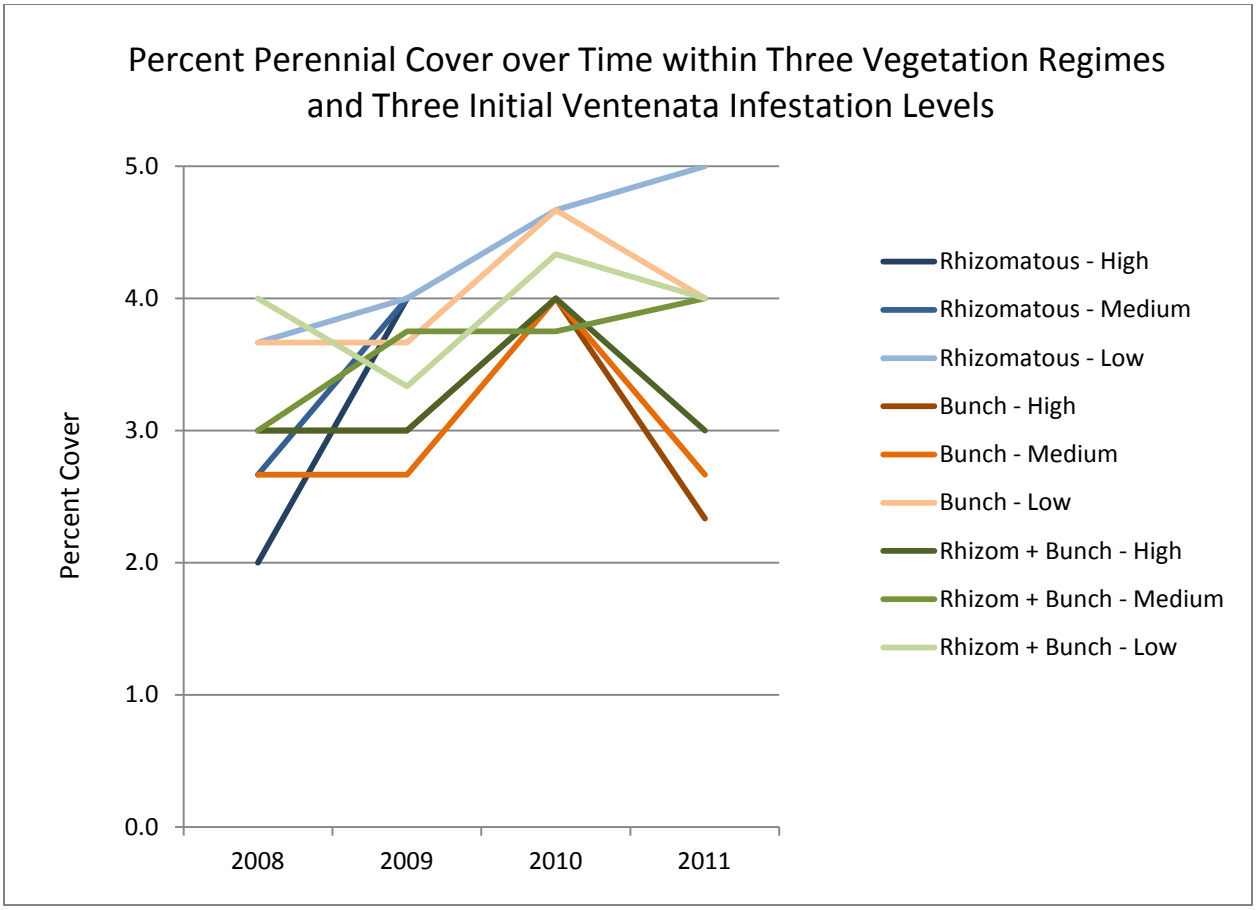
| | Infestation Rating | | | | % Perennial Cover | | | |
|---|---|---|---|---|---|---|---|---|
| | 2008 | 2009 | 2010 | 2011 | 2008 | 2009 | 2010 | 2011 |
| 19 | 4 | 4 | | | 3 | 4 | | |
| 21 | 5 | 5 | | | 1 | 4 | | |
| 27 | 5 | 4 | | | 2 | 4 | | |
| AVE | 4.7 | 4.3 | | | 2.0 | 4.0 | | |
| 5 | 2 | 0 | 0 | 2 | 2 | 4 | 5 | 4 |
| 20 | 2 | 3 | | | 4 | 4 | | |
| 22 | 2 | 3 | | | 2 | 4 | | |
| AVE | 2.0 | 2.0 | 0.0 | 2.0 | 2.7 | 4.0 | 5.0 | 4.0 |
| 2 | 1 | 0 | 0 | 0 | 4 | 4 | 5 | 5 |
| 7 | 0 | 0 | 0 | 0 | 2 | 4 | 4 | 5 |
| 17 | 0 | 0 | 0 | 0 | 5 | 4 | 5 | 5 |
| AVE | 0.3 | 0.0 | 0.0 | 0.0 | 3.7 | 4.0 | 4.7 | 5.0 |
| 4 | 4 | 2 | 2 | 3 | 3 | 3 | 5 | 3 |
| 6 | 4 | 2 | 3 | 3 | 3 | 3 | 4 | 3 |
| 10 | 4 | 2 | 3 | 5 | 3 | 3 | 3 | 1 |
| AVE | 4.0 | 2.0 | 2.7 | 3.7 | 3.0 | 3.0 | 4.0 | 2.3 |
| 3 | 2 | 3 | 3 | 4 | 3 | 3 | 4 | 2 |
| 9 | 3 | 1 | 3 | 4 | 3 | 2 | 4 | 2 |
| 15 | 3 | 0 | 2 | 3 | 2 | 3 | 4 | 4 |
| AVE | 2.7 | 1.3 | 2.7 | 3.7 | 2.7 | 2.7 | 4.0 | 2.7 |
| 1 | 0 | 0 | 0 | 0 | 4 | 4 | 5 | 4 |
| 11 | 0 | 0 | 0 | 1 | 4 | 3 | 5 | 4 |
| 16 | 0 | 0 | 0 | 1 | 3 | 4 | 4 | 4 |
| AVE | 0.0 | 0.0 | 0.0 | 0.7 | 3.7 | 3.7 | 4.7 | 4.0 |
| 24 | 4 | 2 | 0 | 1 | 3 | 3 | 5 | 3 |
| 26 | 4 | 2 | 4 | 4 | 3 | 3 | 3 | 3 |
| AVE | 4.0 | 2.0 | 2.0 | 2.5 | 3.0 | 3.0 | 4.0 | 3.0 |
| 8 | 2 | 1 | 3 | 3 | 1 | 3 | 3 | 3 |
| 13 | 3 | 2 | 0 | 3 | 4 | 4 | 3 | 4 |
| 18 | 3 | 2 | 0 | 0 | 4 | 4 | 5 | 5 |
| 25 | 2 | 0 | 1 | 1 | 3 | 4 | 4 | 4 |
| AVE | 2.5 | 1.3 | 1.0 | 1.8 | 3.0 | 3.8 | 3.8 | 4.0 |
| 12 | 0 | 0 | 0 | 1 | 4 | 3 | 5 | 4 |
| 14 | 0 | 2 | 0 | 2 | 4 | 3 | 3 | 3 |
| 23 | 0 | 0 | 0 | 0 | 4 | 4 | 5 | 5 |
| AVE | 0 | 1 | 0 | 1 | 4 | 3 | 4 | 4 |

Scale of Infestation: 1 = low, 5 = high

Percent Perennial Cover: 1 = 1-20%; 2 = 21-40%; 3 = 41-60%; 4 = 61-80%; 5 = 81-100%

| | Perennial Grass Type | | |
|---|---|---|---|
| Scale of Infestation | Rhiz | Bunch | Rhiz + Bunch |
| High (4-5) | 19, 21, 27 | 4, 6, 10 | 24, 26 |
| Medium (2-3) | 5, 20, 22 | 3, 9, 15 | 8, 13, 18, 25 |
| Low (0-1) | 2, 7, 17 | 1, 11, 16 | 12, 14, 23 |






**Conclusions To-Date**

Data is missing for several rhizomatous plots with medium or high initial levels of ventenata because these plots are now under arboretum jurisdiction and the plot stakes have been removed. Only the benchmark and first year data are represented on the graphs for these plots.

The overall trend in level of ventenata infestation in the remaining plots during the last three years has been as follows: year 1 slight decrease or no change, year 2 too many differences to tell, and year 3 a slight increase in VEDU levels. The overall trend in percent perennial cover in all plots has been somewhat inversely correlated with the VEDU trends: year 1 increase or no change, year 2 increase, and year 3 decrease in percent cover.

These plots will continue to be monitored in future years.

**Plot of bunchgrass (Durar hard fescue) infested with a high level of ventenata**

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| | |
|---|---|
| **Title** | Invasive Species: Evaluation of plant species and cultivation techniques in sites infested with ventenata (*Ventenata dubia*) |
| **Study Number** | WAPMC-T-0902-IN |
| **Study Leader** | Pamela Scheinost, WAPMC Agron. |
| **Duration** | 2008 - 2012 |
| **Description** | Five species of legumes and 11 species of grasses will be evaluated for their ability to outcompete ventenata (*Ventenata dubia*). Tillage and no-till cultivation methods will also be examined. Two trials will be established; one in Whitman, County, WA and one in Asotin Co, WA, both on private land and in cooperation with the respective NRCS Field Offices. |
| **Status of Knowledge** | Within the last 50 years, Ventenata (*Ventenata dubia* (Leers) Coss.) has invaded the Pacific Northwest. It first occupied disturbed, open areas and more recently has moved onto land with established perennial vegetation, such as pastures, range, hay and CRP fields. Ventenata is undesirable because it has no forage value for livestock or wildlife, causes soil to be prone to erosion due to its shallow rooting depth, limits functions of waterways, causes a decline in productivity and degrades land values. It has proven very difficult to control with chemical and mechanical treatment. Where infestation is severe, reseeding is the only viable management option. Landowners have expressed an urgent need to know what species will out-compete ventenata and what methods of cultivation, where feasible, should be used. |
| **Experimental Design** | These trials were established using a strip-plot design, with tillage as the horizontal factor and plant species as the vertical factor, and four replications of each interaction. Tillage treatments include tilled and untilled. Plant species include 5 legumes and 11 grasses, which are randomized within separate blocks in order to prevent herbicide damage. These blocks will be treated as side-by-side trials. |
| **Materials and methods** | In October of 2008, the trials were laid out and plots with tillage were roto-tilled. All plots were harrowed and packed with a roller. In April of 2009, plots were sprayed with glyphosate to control weeds. In May 24 and 25, 2009, plots were planted with a Plant-it Junior on the Asotin County site. The Whitman County site was too wet to plant in the spring, and was planted on October 21, 2009. The seeding rate for each species was based on rates provided in Tech Note 2. Species evaluated are: |

| Cultivar | Common name | Species name | Species code |
|---|---|---|---|
| Lutana | Cicer Milkvetch | *Astragalus cicer* | ASCI4 |
| Ladak | Alfalfa | *Medicago sativa* | MESA |
| Delaney | Sanfoin | *Onobrychis viciifolia* | ONVI |
| Delar | Small burnet | *Sanguisorba minor* | SAMI3 |
| Dutch | White Clover | *Trifolium repens* | TRRE3 |
| Regar | Meadow brome | *Bromus biebersteinii* | BRBI2 |
| Paiute | Orchardgrass | *Dactylis glomerata* | DAGL |
| Union Flat | Blue wildrye | *Elymus glaucus* | ELGL |
| Sodar | Streambank wheatgrass | *Elymus lanceolatus* | ELLA3 |
| Pryor | Slender wheatgrass | *Elymus trachycaulus* | ELTR7 |
| Tuscany II | Tall fescue | *Schedonorus phoenix* | SCPH |
| Foothills | Canada bluegrass | *Poa compressa* | POCO |
| Sherman | Big bluegrass | *Poa secunda* | POSE |
| Canbar | Canby bluegrass | *Poa secunda* | POSE |
| Whitmar | Bluebunch wheatgrass | *Psuedoroegneria spicata* | PSSP6 |
| Rush | Intermediate wheatgrass | *Thinopyrum intermedium* | THIN6 |

Grass plots will be sprayed with broad-leaf herbicide to control weeds on an as-needed basis. Nitrogen and potassium will be surface applied at a rate based in fertilizer guide recommendations to all plots in 2010 and 2011.

To determine seed availability in the soil, four to six 1" samples were collected in each of the tilled and non-tilled treatments and grown out in a growth chamber during the first and last years of the study (2008 and 2011).

Composite soil samples (to 1 foot) were also taken in the tilled and untilled plots prior to tillage in the first year (2008) and following data collection in the last year of the study (2011). The samples will be analyzed for organic matter and nutrient content.

The plants will be evaluated annually in July 2009 – 2011 for stand vigor, stand uniformity, and presence of ventenata; each rated on a scale of 1 – 10, 1 = poor, 10 = excellent. Photos will be taken of each plot at the time of evaluation. Biomass of each plot will be measured during the last year of the study (2011). Data will be analyzed to determine statistical differences among the species' performance.

NORTH
V

**SPECIES ARRANGEMENT - ANATONE**

| RANGE V | legumes | | | | | grasses | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | Lutana Cicer Milkvetch | Ladak Alfalfa | Delaney Sainfoin | Delar Small Burnet | Dutch White Clover | Regar Meadow Brome | Paiute Orchardgrass | Union Flat Blue WR | Sodar Streambank WG | Pryor Slender WG | Tuscany II Tall Fescue | Foothills Canda BG | Sherman Big BG | Canbar Canby BG | Whitmar BB WG | Rush Intermediate WG | till |
| | Lutana Cicer Milkvetch | Ladak Alfalfa | Delaney Sainfoin | Delar Small Burnet | Dutch White Clover | Regar Meadow Brome | Paiute Orchardgrass | Union Flat Blue WR | Sodar Streambank WG | Pryor Slender WG | Tuscany II Tall Fescue | Foothills Canda BG | Sherman Big BG | Canbar Canby BG | Whitmar BB WG | Rush Intermediate WG | no till |
| 3 | Ladak Alfalfa | Delar Small Burnet | Lutana Cicer Milkvetch | Dutch White Clover | Delaney Sainfoin | Union Flat Blue WR | Tuscany II Tall Fescue | Whitmar BB WG | Sherman Big BG | Paiute Orchardgrass | Canbar Canby BG | Regar Meadow Brome | Rush Intermediate WG | Pryor Slender WG | Foothills Canda BG | Sodar Streambank WG | no till |
| | Ladak Alfalfa | Delar Small Burnet | Lutana Cicer Milkvetch | Dutch White Clover | Delaney Sainfoin | Union Flat Blue WR | Tuscany II Tall Fescue | Whitmar BB WG | Sherman Big BG | Paiute Orchardgrass | Canbar Canby BG | Regar Meadow Brome | Rush Intermediate WG | Pryor Slender WG | Foothills Canda BG | Sodar Streambank WG | till |
| 2 | Delar Small Burnet | Delaney Sainfoin | Dutch White Clover | Ladak Alfalfa | Delar Small Burnet | Pryor Slender WG | Rush Intermediate WG | Canbar Canby BG | Regar Meadow Brome | Foothills Canda BG | Whitmar BB WG | Sodar Streambank WG | Paiute Orchardgrass | Union Flat Blue WR | Tuscany II Tall Fescue | Sherman Big BG | till |
| | Delar Small Burnet | Delaney Sainfoin | Dutch White Clover | Ladak Alfalfa | Delar Small Burnet | Pryor Slender WG | Rush Intermediate WG | Canbar Canby BG | Regar Meadow Brome | Foothills Canda BG | Whitmar BB WG | Sodar Streambank WG | Paiute Orchardgrass | Union Flat Blue WR | Tuscany II Tall Fescue | Sherman Big BG | no till |
| 1 | Dutch White Clover | Lutana Cicer Milkvetch | Ladak Alfalfa | Delaney Sainfoin | Lutana Cicer Milkvetch | Foothills Canda BG | Whitmar BB WG | Sodar Streambank WG | Tuscany II Tall Fescue | Union Flat Blue WR | Pryor Slender WG | Sherman Big BG | Canbar Canby BG | Regar Meadow Brome | Rush Intermediate WG | Paiute Orchardgrass | no till |
| | Dutch White Clover | Lutana Cicer Milkvetch | Ladak Alfalfa | Delaney Sainfoin | Lutana Cicer Milkvetch | Foothills Canda BG | Whitmar BB WG | Sodar Streambank WG | Tuscany II Tall Fescue | Union Flat Blue WR | Pryor Slender WG | Sherman Big BG | Canbar Canby BG | Regar Meadow Brome | Rush Intermediate WG | Paiute Orchardgrass | till |
| ROW > | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | |

| | |
|---|---|
| 0 | no plants present |
| 1 | very few plants |
| 3 | 50% stand |
| 5 | 100% stand |

**Anatone Ventenata Revegetation Study Planted 5/26/09**

**Row 1-Range 1 on NE corner**

| | | | | | 6/8/2010 | | 7/6/2010 | | |
|---|---|---|---|---|---|---|---|---|---|
| **Row** | **Range** | **Cult** | **Cultivar** | **Species** | **Stand** | **VEDU** | **Stand** | **VEDU** | **Notes** |
| 1 | 1 | cult | Dutch | White clover | 0 | 4 | 0 | 5 | |
| 1 | 1 | non-cult | Dutch | White clover | 2 | 4 | 2 | 4 | |
| 1 | 2 | non-cult | Delar | Small burnet | 4 | 3 | 2 | 4 | |
| 1 | 2 | cult | Delar | Small burnet | 3 | 4 | 2 | 4 | |
| 1 | 3 | cult | Ladak | Alfalfa | 5 | 2 | 4 | 3 | VEDU shorter than in other plots |
| 1 | 3 | non-cult | Ladak | Alfalfa | 5 | 3 | 4 | 3 | VEDU shorter than in other plots |
| 1 | 4 | non-cult | Lutana | Cicer milkvetch | 2 | 5 | 2 | 4 | |
| 1 | 4 | cult | Lutana | Cicer milkvetch | 2 | 5 | 2 | 4 | |
| 2 | 1 | cult | Lutana | Cicer milkvetch | 1 | 5 | 1 | 5 | |
| 2 | 1 | non-cult | Lutana | Cicer milkvetch | 1 | 5 | 1 | 5 | |
| 2 | 2 | non-cult | Delaney | Sanfoin | 5 | 3 | 3 | 4 | |
| 2 | 2 | cult | Delaney | Sanfoin | 5 | 3 | 3 | 4 | yellowish |
| 2 | 3 | cult | Delar | Small burnet | 3 | 3 | 3 | 2 | VEDU shorter than in other plots |
| 2 | 3 | non-cult | Delar | Small burnet | 3 | 3 | 3 | 2 | VEDU shorter than in other plots |
| 2 | 4 | non-cult | Ladak | Alfalfa | 3 | 3 | 2 | 3 | VEDU shorter than in other plots |
| 2 | 4 | cult | Ladak | Alfalfa | 4 | 3 | 2 | 3 | |
| 3 | 1 | cult | Ladak | Alfalfa | 4 | 3 | 2 | 4 | |
| 3 | 1 | non-cult | Ladak | Alfalfa | 3 | 3 | 2 | 4 | |
| 3 | 2 | non-cult | Dutch | White clover | 5 | 3 | 4 | 4 | flowering |
| 3 | 2 | cult | Dutch | White clover | 4 | 2 | 4 | 2 | flowering |
| 3 | 3 | cult | Lutana | Cicer milkvetch | 1 | 2 | 1 | 2 | smooth brome in plot |
| 3 | 3 | non-cult | Lutana | Cicer milkvetch | 1 | 3 | 1 | 4 | |
| 3 | 4 | non-cult | Delaney | Sanfoin | 5 | 2 | 4 | 3 | VEDU shorter than in other plots |
| 3 | 4 | cult | Delaney | Sanfoin | 4 | 3 | 4 | 3 | |
| 4 | 1 | cult | Delaney | Sanfoin | 4 | 3 | 3 | 4 | |
| 4 | 1 | non-cult | Delaney | Sanfoin | 4 | 3 | 3 | 4 | |
| 4 | 2 | non-cult | Ladak | Alfalfa | 2 | 4 | 2 | 4 | |
| 4 | 2 | cult | Ladak | Alfalfa | 2 | 3 | 2 | 3 | |
| 4 | 3 | cult | Dutch | White clover | 3 | 3 | 3 | 4 | flowering |
| 4 | 3 | non-cult | Dutch | White clover | 4 | 4 | 3 | 4 | flowering + smooth brome |
| 4 | 4 | cult | Delar | Small burnet | 3 | 4 | 3 | 4 | flowering |
| 4 | 4 | non-cult | Delar | Small burnet | 3 | 3 | 2 | 4 | |
| 5 | 1 | cult | Lutana | Cicer milkvetch | 1 | 4 | 1 | 5 | |
| 5 | 1 | non-cult | Lutana | Cicer milkvetch | 1 | 4 | 1 | 5 | |
| 5 | 2 | non-cult | Delar | Small burnet | 3 | 3 | 3 | 4 | flowering |
| 5 | 2 | cult | Delar | Small burnet | 4 | 3 | 3 | 4 | |
| 5 | 3 | cult | Delaney | Sanfoin | 5 | 2 | 3 | 3 | |
| 5 | 3 | non-cult | Delaney | Sanfoin | 5 | 3 | 3 | 3 | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 5 | 4 | non-cult | Dutch | White clover | 3 | 4 | 3 | 5 | VEDU overstory |
| 5 | 4 | cult | Dutch | White clover | 1 | 4 | 3 | 4 | VEDU overstory |
| 6 | 1 | cult | Foothills | Canada Bluegrass | too | early | 2 | 4 | |
| 6 | 1 | non-cult | Foothills | Canada Bluegrass | | | 1 | 4 | |
| 6 | 2 | non-cult | Pryor | Slender Wheatgrass | | | 3 | 3 | |
| 6 | 2 | cult | Pryor | Slender Wheatgrass | | | 3 | 3 | |
| 6 | 3 | cult | Union Flat | Blue wildrye | | | 1 | 4 | smooth brome in plot |
| 6 | 3 | non-cult | Union Flat | Blue wildrye | | | 1 | 4 | smooth brome in plot |
| 6 | 4 | non-cult | Regar | Meadow brome | | | 2 | 4 | |
| 6 | 4 | cult | Regar | Meadow brome | | | 2 | 4 | |
| 7 | 1 | cult | Whitmar | Bluebunch wheatgrass | | | 1 | 4 | |
| 7 | 1 | non-cult | Whitmar | Bluebunch wheatgrass | | | 1 | 4 | |
| 7 | 2 | non-cult | Rush | Intermediate wheatgrass | | | 1 | 4 | |
| 7 | 2 | cult | Rush | Intermediate wheatgrass | | | 3 | 3 | |
| 7 | 3 | cult | Tuscany II | Tall Fescue | | | 0 | 4 | |
| 7 | 3 | non-cult | Tuscany II | Tall Fescue | | | 0 | 4 | smooth brome in plot |
| 7 | 4 | non-cult | Paiute | Orchardgrass | | | 3 | 4 | |
| 7 | 4 | cult | Paiute | Orchardgrass | | | 0 | 5 | |
| 8 | 1 | cult | Sodar | Streambank wheatgrass | | | 1 | 4 | smooth brome in plot |
| 8 | 1 | non-cult | Sodar | Streambank wheatgrass | | | 2 | 4 | smooth brome in plot |
| 8 | 2 | non-cult | Canbar | Canby bluegrass | | | 1 | 4 | |
| 8 | 2 | cult | Canbar | Canby bluegrass | | | 1 | 4 | |
| 8 | 3 | cult | Whitmar | Bluebunch wheatgrass | | | 0 | 4 | |
| 8 | 3 | non-cult | Whitmar | Bluebunch wheatgrass | | | 0 | 4 | |
| 8 | 4 | non-cult | Union Flat | Blue wildrye | | | 3 | 4 | |
| 8 | 4 | cult | Union Flat | Blue wildrye | | | 0 | 5 | |
| 9 | 1 | cult | Tuscany II | Tall Fescue | | | 0 | 4 | |
| 9 | 1 | non-cult | Tuscany II | Tall Fescue | | | 0 | 4 | |
| 9 | 2 | non-cult | Regar | Meadow brome | | | 4 | 3 | |
| 9 | 2 | cult | Regar | Meadow brome | | | 3 | 3 | |
| 9 | 3 | cult | Sherman | Big bluegrass | | | 1 | 4 | |
| 9 | 3 | non-cult | Sherman | Big bluegrass | | | 1 | 4 | |
| 9 | 4 | non-cult | Sodar | Streambank wheatgrass | | | 1 | 5 | |
| 9 | 4 | cult | Sodar | Streambank wheatgrass | | | 1 | 4 | |
| 10 | 1 | cult | Union Flat | Blue wildrye | | | 1 | 5 | |
| 10 | 1 | non-cult | Union Flat | Blue wildrye | | | 1 | 5 | |
| 10 | 2 | non-cult | Foothills | Canada Bluegrass | | | 1 | 5 | |
| 10 | 2 | cult | Foothills | Canada Bluegrass | | | 1 | 5 | |
| 10 | 3 | cult | Paiute | Orchardgrass | | | 0 | 4 | foxtail + smooth brome |
| 10 | 3 | non-cult | Paiute | Orchardgrass | | | 0 | 4 | foxtail + smooth brome |
| 10 | 4 | non-cult | Pryor | Slender Wheatgrass | | | 0 | 5 | |
| 10 | 4 | cult | Pryor | Slender Wheatgrass | | | 0 | 5 | |
| 11 | 1 | cult | Pryor | Slender Wheatgrass | | | 0 | 5 | |
| 11 | 1 | non-cult | Pryor | Slender Wheatgrass | | | 0 | 5 | |
| 11 | 2 | non-cult | Whitmar | Bluebunch wheatgrass | | | 1 | 5 | |
| 11 | 2 | cult | Whitmar | Bluebunch wheatgrass | | | 1 | 4 | |
| 11 | 3 | cult | Canbar | Canby bluegrass | | | 0 | 5 | |
| 11 | 3 | non-cult | Canbar | Canby bluegrass | | | 0 | 5 | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 12 | 1 | cult | Sherman | Big bluegrass | | | 0 | 5 | |
| 12 | 1 | non-cult | Sherman | Big bluegrass | | | 0 | 5 | |
| 12 | 2 | non-cult | Sodar | Streambank wheatgrass | | | 0 | 5 | |
| 12 | 2 | cult | Sodar | Streambank wheatgrass | | | 0 | 5 | |
| 12 | 3 | cult | Regar | Meadow brome | | | 0 | 5 | |
| 12 | 3 | non-cult | Regar | Meadow brome | | | 0 | 5 | |
| 12 | 4 | non-cult | Foothills | Canada Bluegrass | | | 0 | 5 | |
| 12 | 4 | cult | Foothills | Canada Bluegrass | | | 0 | 5 | |
| 13 | 1 | cult | Canbar | Canby bluegrass | | | 0 | 5 | |
| 13 | 1 | non-cult | Canbar | Canby bluegrass | | | 0 | 5 | |
| 13 | 2 | non-cult | Paiute | Orchardgrass | | | 1 | 5 | |
| 13 | 2 | cult | Paiute | Orchardgrass | | | 0 | 4 | several other spp |
| 13 | 3 | cult | Rush | Intermediate wheatgrass | | | 2 | 3 | |
| 13 | 3 | non-cult | Rush | Intermediate wheatgrass | | | 1 | 4 | |
| 13 | 4 | non-cult | Sherman | Big bluegrass | | | 0 | 5 | |
| 13 | 4 | cult | Sherman | Big bluegrass | | | 0 | 5 | |
| 14 | 1 | cult | Regar | Meadow brome | | | 2 | 4 | |
| 14 | 1 | non-cult | Regar | Meadow brome | | | 1 | 5 | |
| 14 | 2 | non-cult | Union Flat | Blue wildrye | | | 0 | 5 | |
| 14 | 2 | cult | Union Flat | Blue wildrye | | | 1 | 5 | |
| 14 | 3 | cult | Pryor | Slender Wheatgrass | | | 3 | 4 | |
| 14 | 3 | non-cult | Pryor | Slender Wheatgrass | | | 3 | 4 | |
| 14 | 4 | non-cult | Canbar | Canby bluegrass | | | 0 | 5 | |
| 14 | 4 | cult | Canbar | Canby bluegrass | | | 0 | 5 | |
| 15 | 1 | cult | Rush | Intermediate wheatgrass | | | 1 | 4 | |
| 15 | 1 | non-cult | Rush | Intermediate wheatgrass | | | 0 | 5 | |
| 15 | 2 | non-cult | Tuscany II | Tall Fescue | | | 0 | 5 | |
| 15 | 2 | cult | Tuscany II | Tall Fescue | | | 0 | 5 | |
| 15 | 3 | cult | Foothills | Canada Bluegrass | | | 3 | 4 | yarrow |
| 15 | 3 | non-cult | Foothills | Canada Bluegrass | | | 3 | 4 | yarrow |
| 15 | 4 | non-cult | Whitmar | Bluebunch wheatgrass | | | 0 | 5 | |
| 15 | 4 | cult | Whitmar | Bluebunch wheatgrass | | | 0 | 5 | |
| 16 | 1 | cult | Paiute | Orchardgrass | | | 0 | 5 | |
| 16 | 1 | non-cult | Paiute | Orchardgrass | | | 0 | 5 | |
| 16 | 2 | non-cult | Sherman | Big bluegrass | | | 0 | 5 | |
| 16 | 2 | cult | Sherman | Big bluegrass | | | 0 | 5 | |
| 16 | 3 | cult | Sodar | Streambank wheatgrass | | | 1 | 5 | |
| 16 | 3 | non-cult | Sodar | Streambank wheatgrass | | | 1 | 5 | |
| 16 | 4 | non-cult | Rush | Intermediate wheatgrass | | | 0 | 5 | |
| 16 | 4 | cult | Rush | Intermediate wheatgrass | | | 0 | 5 | |

6/8/10 Notes

In some of the Alfalfa and Sainfoin plots, VEDU shorter than other plots

In plots where VEDU 4 or 5, taller than other plots

Too early to distinguish grasses

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 7/6/2010 Notes | | | | | | | | | |
| No distinguishable difference between cultivated & non-cult plots | | | | | | | | | |
| dense stands of smooth brome and meadow foxtail in middle of plot | | | | | | | | | |

**Plot of sainfoin and significantly reduced growth of ventenata at Anatone plot**

^
NORTH

**SPECIES ARRANGEMENT - KAMIAK**

| RANGE V | legumes | | | | | grasses | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | Lutana Cicer Milkvetch | Ladak Alfalfa | Delaney Sainfoin | Delar Small Burnet | Dutch White Clover | Regar Meadow Brome | Paiute Orchardgrass | Union Flat Blue WR | Sodar Streambank WG | Pryor Slender WG | Tuscany II Tall Fescue | Foothills Canada BG | Sherman Big BG | Canbar Canby BG | Whitmar BB WG | Rush Intermediate WG |
| 3 | Ladak Alfalfa | Delar Small Burnet | Lutana Cicer Milkvetch | Dutch White Clover | Delaney Sainfoin | Union Flat Blue WR | Tuscany II Tall Fescue | Whitmar BB WG | Sherman Big BG | Paiute Orchardgrass | Canbar Canby BG | Regar Meadow Brome | Rush Intermediate WG | Pryor Slender WG | Foothills Canada BG | Sodar Streambank WG |
| 2 | Delar Small Burnet | Delaney Sainfoin | Dutch White Clover | Ladak Alfalfa | Lutana Cicer Milkvetch | Pryor Slender WG | Rush Intermediate WG | Canbar Canby BG | Regar Meadow Brome | Foothills Canada BG | Whitmar BB WG | Sodar Streambank WG | Paiute Orchardgrass | Union Flat Blue WR | Tuscany II Tall Fescue | Sherman Big BG |
| 1 | Dutch White Clover | Lutana Cicer Milkvetch | Delar Small Burnet | Delaney Sainfoin | Ladak Alfalfa | Foothills Canada BG | Whitmar BB WG | Sodar Streambank WG | Tuscany II Tall Fescue | Union Flat Blue WR | Pryor Slender WG | Sherman Big BG | Canbar Canby BG | Regar Meadow Brome | Rush Intermediate WG | Paiute Orchardgrass |
| ROW > | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | 0 | no plants present | | | |
| | | | | | 1 | very few plants | | | |
| | | | | | 3 | 50% stand | | | |
| | | | | | 5 | 100% stand | | | |
| | | | | | | | | | |
| **Kamiak Ventenata Revegetation Study** | | | **Planted 10/21/09** | | | | | | |
| **Row 1-Range 1 on SW corner** | | | | | | | | | |
| | | | | **6/8/2010** | | **7/6/2010** | | **9/8/2010** | |
| **Row** | **Range** | **Cultivar** | **Species** | **Stand** | **VEDU** | **Stand** | **VEDU** | **Stand** | **VEDU** |
| 1 | 1 | Dutch | White clover | 0 | 0 | | 5 | | |
| 1 | 2 | Delar | Small burnet | 3 | 0 | | 5 | | |
| 1 | 3 | Ladak | Alfalfa | 0 | 0 | | 5 | | |
| 1 | 4 | Lutana | Cicer milkvetch | 3 | 0 | | 5 | | |
| 2 | 1 | Lutana | Cicer milkvetch | 0 | 0 | | 5 | | |
| 2 | 2 | Delaney | Sanfoin | 1 | 0 | | 5 | | |
| 2 | 3 | Delar | Small burnet | 1 | 0 | | 5 | | |
| 2 | 4 | Ladak | Alfalfa | 0 | 0 | | 5 | | |
| 3 | 1 | Delar | Small burnet | 0 | 0 | | 5 | | |
| 3 | 2 | Dutch | White clover | 0 | 0 | | 5 | | |
| 3 | 3 | Lutana | Cicer milkvetch | 0 | 0 | | 5 | | |
| 3 | 4 | Delaney | Sanfoin | 0 | 0 | | 5 | | |
| 4 | 1 | Delaney | Sanfoin | 0 | 0 | | 5 | | |
| 4 | 2 | Ladak | Alfalfa | 0 | 0 | | 5 | | |
| 4 | 3 | Dutch | White clover | 0 | 0 | | 5 | | |
| 4 | 4 | Delar | Small burnet | 1 | 0 | | 5 | | |
| 5 | 1 | Ladak | Alfalfa | 0 | 0 | | 5 | | |
| 5 | 2 | Lutana | Cicer milkvetch | 0 | 0 | | 5 | | |
| 5 | 3 | Delaney | Sanfoin | 0 | 0 | | 5 | | |
| 5 | 4 | Dutch | White clover | 0 | 0 | | 5 | | |
| 6 | 1 | Foothills | Canada Bluegrass | 0 | 0 | | 5 | | |
| 6 | 2 | Pryor | Slender Wheatgrass | 0 | 0 | | 5 | | |
| 6 | 3 | Union Flat | Blue wildrye | 0 | 0 | | 5 | | |
| 6 | 4 | Regar | Meadow brome | 0 | 0 | | 5 | | |
| 7 | 1 | Whitmar | Bluebunch wheatgras | 0 | 0 | | 5 | | |
| 7 | 2 | Rush | Intermediate wheatg | 0 | 0 | | 5 | | |
| 7 | 3 | Tuscany II | Tall Fescue | 0 | 0 | | 5 | 5 | |
| 7 | 4 | Paiute | Orchardgrass | 0 | 0 | | 5 | 3 | |
| 8 | 1 | Sodar | Streambank wheatgra | 0 | 0 | | 5 | | |
| 8 | 2 | Canbar | Canby bluegrass | 0 | 0 | | 5 | | |
| 8 | 3 | Whitmar | Bluebunch wheatgras | 0 | 0 | | 5 | | |
| 8 | 4 | Union Flat | Blue wildrye | 0 | 0 | | 5 | | |
| 9 | 1 | Tuscany II | Tall Fescue | 0 | 0 | | 5 | | |
| 9 | 2 | Regar | Meadow brome | 0 | 0 | | 5 | | |
| 9 | 3 | Sherman | Big bluegrass | 0 | 0 | | 5 | | |
| 9 | 4 | Sodar | Streambank wheatgra | 0 | 0 | | 5 | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 10 | 1 | Union Flat | Blue wildrye | 0 | 0 | | 5 | | |
| 10 | 2 | Foothills | Canada Bluegrass | 0 | 0 | | 5 | | |
| 10 | 3 | Paiute | Orchardgrass | 0 | 0 | | 5 | 2 | |
| 10 | 4 | Pryor | Slender Wheatgrass | 0 | 0 | | 5 | | |
| 11 | 1 | Pryor | Slender Wheatgrass | 0 | 0 | | 5 | | |
| 11 | 2 | Whitmar | Bluebunch wheatgras | 0 | 0 | | 5 | | |
| 11 | 3 | Canbar | Canby bluegrass | 0 | 0 | | 5 | | |
| 11 | 4 | Tuscany II | Tall Fescue | 0 | 0 | | 5 | 5 | |
| 12 | 1 | Sherman | Big bluegrass | 0 | 0 | | 5 | | |
| 12 | 2 | Sodar | Streambank wheatgra | 0 | 0 | | 5 | | |
| 12 | 3 | Regar | Meadow brome | 0 | 0 | | 5 | | |
| 12 | 4 | Foothills | Canada Bluegrass | 0 | 0 | | 5 | | |
| 13 | 1 | Canbar | Canby bluegrass | 0 | 0 | | 5 | | |
| 13 | 2 | Paiute | Orchardgrass | 0 | 0 | | 5 | | |
| 13 | 3 | Rush | Intermediate wheatg | 0 | 0 | | 5 | | |
| 13 | 4 | Sherman | Big bluegrass | 0 | 0 | | 5 | | |
| 14 | 1 | Regar | Meadow brome | 0 | 0 | | 5 | | |
| 14 | 2 | Union Flat | Blue wildrye | 0 | 0 | | 5 | | |
| 14 | 3 | Pryor | Slender Wheatgrass | 0 | 0 | | 5 | | |
| 14 | 4 | Canbar | Canby bluegrass | 0 | 0 | | 5 | | |
| 15 | 1 | Rush | Intermediate wheatg | 0 | 0 | | 5 | | |
| 15 | 2 | Tuscany II | Tall Fescue | 0 | 0 | | 5 | 3 | |
| 15 | 3 | Foothills | Canada Bluegrass | 0 | 0 | | 5 | | |
| 15 | 4 | Whitmar | Bluebunch wheatgras | 0 | 0 | | 5 | | |
| 16 | 1 | Paiute | Orchardgrass | 0 | 0 | | 5 | 1 | |
| 16 | 2 | Sherman | Big bluegrass | 0 | 0 | | 5 | | |
| 16 | 3 | Sodar | Streambank wheatgra | 0 | 0 | | 5 | | |
| 16 | 4 | Rush | Intermediate wheatg | 0 | 0 | | 5 | 1 | |
| | | | | | | | | | |
| 6/8/10 Notes | | | | | | | | | |
| Forb plots taken over by prickly lettuce | | | | | | | | | |
| In grass plots, prickly lettuce set back by spray but new flush coming | | | | | | | | | |
| Too soon to distinguish grasses | | | | | | | | | |
| VEDU heading out in middle of plot, wettest area | | | | | | | | | |
| | | | | | | | | | |
| 7/6/10 Notes | | | | | | | | | |
| All of plot is VEDU and prickly lettuce | | | | | | | | | |

**2011 Update**

At the Anatone site the forbs have established well however the grasses are struggling. An herbicide such as Plateau will be used on the grass plots in 2011 to try to release the grasses from annual weed competition. Currently it appears sainfoin and alfalfa have are the most competitive with ventenata. Using these species in revegetation efforts allows for additional options of grass herbicides, which will be used in the forb plots in 2011. There appears to be no difference in species establishment among the tilled and untilled plots. There is a greater

presence/health of ventenata within the plot as a whole compared to the surrounding area.

At the Kamiak site, no plots have established well. In the spring of 2010 the entire plot was a prickly lettuce jungle with an understory of ventenata. The prickly lettuce was mowed several times and sprayed with 2-4-D in the grass plots. The herbicide seemed to stunt the prickly lettuce for a while but did not eliminate it. More herbicides will be tried in 2011 to try to release the planted species.

**2012 Update**

It was planned in Spring 2011 the forb plots would be sprayed with a selective-grass herbicide to provide them a competitive advantage, however they had all been eaten, presumably by elk since there were elk tracks within the plot and holes in the ground where the plants had once been. It also appeared the grasses were out-competed by ventenata. A thick ventenata thatch covered the plots, and visible rows in the grass plots could no longer be seen.

This study will be cancelled and a new study will be implemented this spring to try a new approach.

**UNITED STATES DEPARTMENT OF AGRICULTURE**
**NATURAL RESOURCES CONSERVATION SERVICE**

| | |
|---|---|
| **Title** | Inavasive Species: Ventenata Seed Longevity |
| **Study Number** | WAPMC-T-0905-IN |
| **Study Leader** | Pamela Scheinost, WAPMC Agron. |
| **Duration** | 2009-2019 |
| **Description** | Ventenata seed will be collected on the farm in 2009, buried, and tested for viability 1, 6 and 13 months after burial, then once a year for the following 9 years. |
| **Status of Knowledge** | The WAPMC Farm Manager has observed ventenata seed to be viable for 2 – 3 years, however this observation has not been tested using scientific methods. There is no information in the literature regarding the longevity of ventenata seed. |
| **Experimental Design** | The experiment is a 2 x 12 x 2 factorial study (split-split-plot design) with 2 burial depths (2 and 8 cm) (subplots) 12 sampling times (1, 6 months and 1 – 9 years after burial) (sub-subplots), and 2 burial locations (Pullman Plant Materials Center and U of I location) (main plots). There are 4 replications of each treatment. |
| **Materials and Methods** | In July 2009, seed was collected from mature ventenata plants at the PMC. Seed was immediately separated from the plants using a hammer mill and office clipper. Seed was then hand separated and counted into groups of 100 and placed into envelopes. A total of 240 envelopes (24,000 seeds) were assembled. Seed from 192 envelopes (2 burial depths x 12 sampling times x 2 locations x 4 replications) was placed into packets constructed of 4 x 4 inch nylon mesh fabric squares containing 2 tsp of soil. The packets were closed with zip ties. The remaining 48 envelopes of seed were kept in the seed storage room as controls (12 sampling times x 4 replications).<br><br>On or around September 30, the packets were buried in side-by-side pits in ventenata-infested areas at both locations. The soil type, aspect, slope, and existing vegetation of each location was recorded. The locations are well marked and protected from farm equipment operations. |

**Seed Burial: 9/30/09**

**Retrieval Intervals:**

| | |
|---|---|
| 11/20/09 | 1 month |
| 4/20/10 | 6 months |
| 10/20/10 | 1 year |
| 10/20/11 | 2 years |
| 10/20/12 | 3 years |
| 10/20/13 | 4 years |
| 10/20/14 | 5 years |
| 10/20/15 | 6 years |
| 10/20/16 | 7 years |
| 10/20/17 | 8 years |
| 10/20/18 | 9 years |
| 10/20/19 | 10 years |

***** The selection of timing of the seed burial and retrieval correlate with how the seed may be treated in natural conditions. Seed may be buried by tillage operations around 9/30. For maximum germination the seed may need to be exposed to fluctuation or decline in

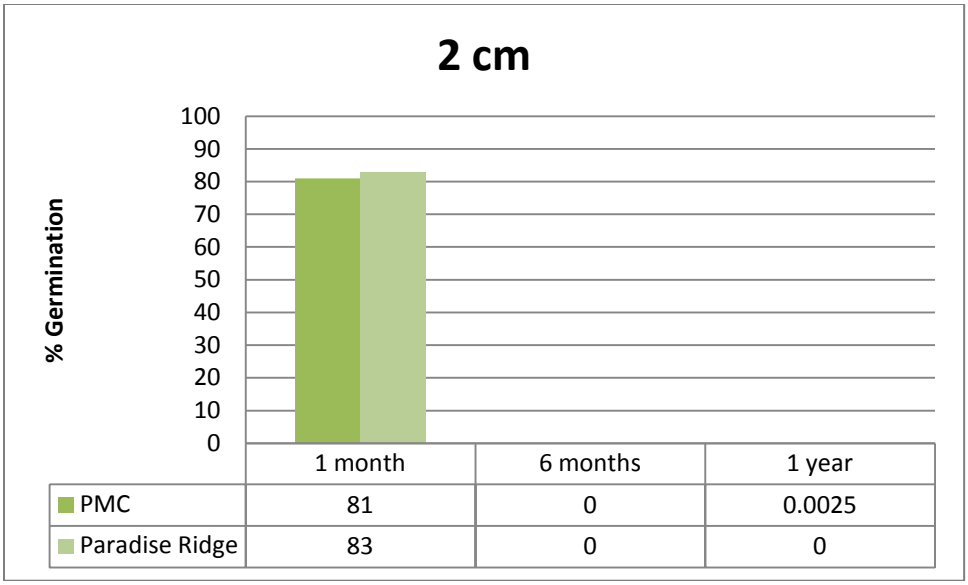
At the above-mentioned intervals, one packet from each depth for each replication at both locations was retrieved. The seeds was removed from the packets, separated from the soil, air dried and counted. All seeds, including control seeds will be surface sterilized using 5% bleach solution (0.25% sodium hypochlorite) for 5 – 10 seconds and rinsed with deionized water 3 times. Seeds was placed in 9mm diameter petri dishes on top of two pieces of moistened germination paper. Petri dishes was moved to a germinator set at 18° C (Based on findings by Northam and Callihan, 1986). Percent germination was recorded once a week for 4 weeks.

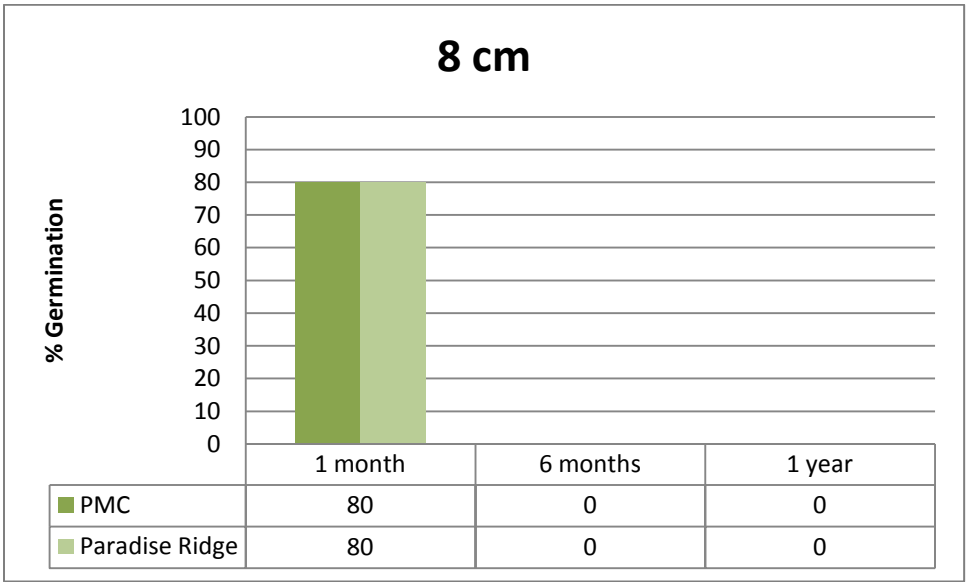
If germination is found to be below 1% for two years in a row, this study will cease and the remaining buried seeds will be retrieved and tested for viability using tetrazolium chloride.

Results will be analyzed to determine percent germination differences between burial depth, duration and location.

**2011 Update**

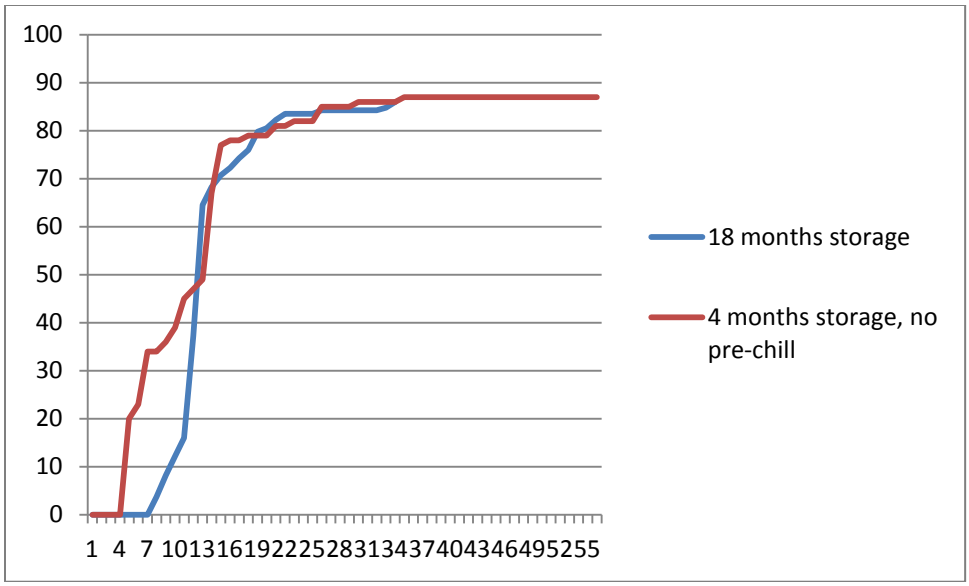
Seed packets collected after one month of burial had 81 and 83 germinating seeds at the 2 cm depth the PMC and Paradise Ridge, respectively, and packets from both sites had 80 germinating seeds at the 8 cm depth. After six months of burial, there were no germinating seeds, and after 1 year of burial there was one germinating seed at the 2 cm depth at the PMC site.




Seed packets were sent to WSDA for viability (Tetrazolium chloride) testing; 96% of the seed was found to be viable.

Seed viability was also tested after 4 months and 18 months storage at room temperature. Seed maintained viability after 18 months, with 87% germination.




Ventenata in a field setting appears to have an initial flush of germination, similar to cheatgrass (*Bromus tectorum*), with approximately 80% of the seeds germinating within the first year. Light does not appear to be a factor in germination; rates at the 8 cm depth were similar to the rates at the 2 cm depth. One germinating seed after one year of burial indicates there may be slight variability in seed dormancy.

VEDU Seed Longevity Study Layout - Pullman Plant Materials Center

Block 1

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| S | D | D | S | D | D | 11/20 2009 | 11/20 2009 | S | D | S | S |
| D | S | S | 12/14 2010 | S | 12/14 2010 | D | S | D | S | D | D |

Block 2

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| D | S | D | S | S | S | S | D | 11/20 2009 | D | S | D |
| S | D | 12/14 2010 | 12/14 2010 | D | D | D | S | 11/20 2009 | S | D | S |

Block 3

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 12/14 2010 | S | D | D | D | S | D | D | S | 11/20 2009 | D | D |
| 12/14 2010 | D | S | S | S | D | S | S | D | 11/20 2009 | S | S |

Block 4

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 12/14 2010 | 11/20 2009 | S | D | D | D | D | S | S | D | S | S |
| 12/14 2010 | 11/20 2009 | D | S | S | S | S | D | D | S | D | D |

SPRUCE TREE

ROAD

This is the actual layout

^
N

white rectangles are stakes
S = Shallow (2 - 4cm)
D = Deep (8 - 10 cm)

Dates in squares = dates of extraction

VEDU Seed Longevity Study Layout - Paradise Ridge

Block 1

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| D | 4/20 2010 | D | 12/14 2010 | D | S | S | S | 11/19 2009 | D | D | D |
| S | 4/20 2010 | S | 12/14 2010 | S | D | D | D | 11/19 2009 | S | S | S |

Block 2

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| S | D | S | S | 11/19 2009 | S | 4/20 2010 | 4/20 2010 | D | S | 12/14 2010 | S |
| D | S | D | D | 11/19 2009 | D | S | D | S | D | 12/14 2010 | D |

Block 3

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 11/19 2009 | D | S | D | S | D | D | 12/14 2010 | D | D | S | D |
| 11/19 2009 | S | D | S | 4/20 2010 | 4/20 2010 | S | 12/14 2010 | S | S | D | S |

Block 4

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| S | S | 11/19 2009 | D | D | D | D | 12/14 2010 | 4/20 2010 | S | D | D |
| D | D | 11/19 2009 | S | S | S | S | 12/14 2010 | 4/20 2010 | D | S | S |

white rectangles are stakes

S = Shallow (2 - 4cm)

D = Deep (8 - 10 cm)

Actual Layout:

Block 1 Block 2

Block 3 Block 4

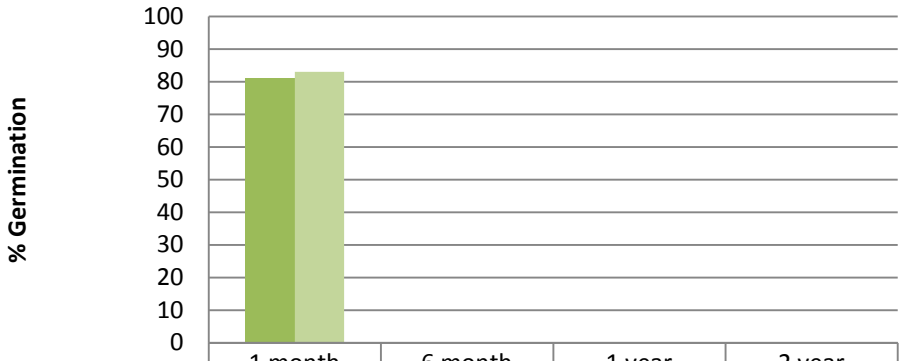
^

N

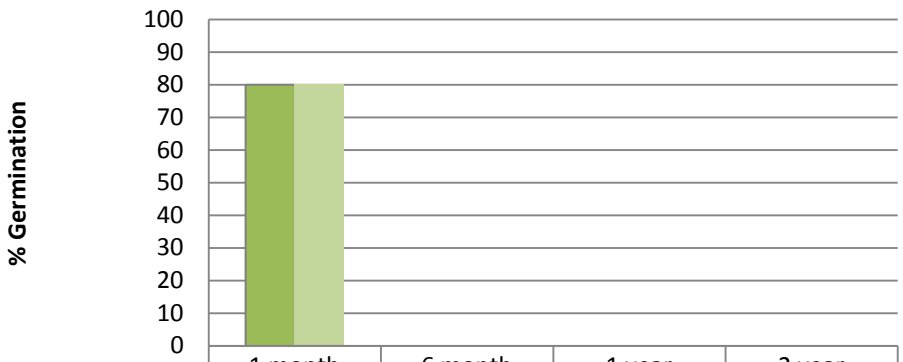
Dates in squares = dates of extraction

**2012 Update**

Packets were collected on November 20, 2011. There appeared to be one germinating seed. It had green endosperm and a radical and was in a 2cm packet from Paradise Ridge.




| | 1 month | 6 month | 1 year | 2 year |
|---|---|---|---|---|
| PMC | 81 | 0 | 0.0025 | 0 |
| Paradise Ridge | 83 | 0 | 0 | 0.0025 |




| | 1 month | 6 month | 1 year | 2 year |
|---|---|---|---|---|
| PMC | 80 | 0 | 0 | 0 |
| Paradise Ridge | 80 | 0 | 0 | 0 |

**UNITED STATES DEPARTMENT OF AGRICULTURE**
**NATURAL RESOURCES CONSERVATION SERVICE**

| | |
|---|---|
| **Title** | Invasive Species: Evaluation of treatments to control ventenata (*Ventenata dubia*) in Spokane County CRP Fields |
| **Study Number** | WAPMC-T-1116-IN |
| **Study Leader** | Pamela Pavek, WAPMC Agronomist |
| **Study Cooperators** | John Spring, Soil Conservationist, Spokane FO |
| **Duration** | 2011 - 2014 |
| **Description** | Eight CRP fields will be monitored to determine effectiveness of herbicide treatments to control ventenata. Four of the fields have adequate density of desirable perennial vegetation and will be sprayed with herbicide this fall. Four other fields do not have adequate density of desirable vegetation; these fields will be chem-fallowed for 2 years and re-seeded in spring 2013. Percent cover and stem count data will be collected from treated and control plots to determine changes. |
| **Status of Knowledge** | Within the last 12 years, the presence of Ventenata (*Ventenata dubia* (Leers) Coss.) has increased dramatically in the Pacific Northwest. It first occupied disturbed, open areas and more recently has moved onto land with established perennial vegetation, such as pastures, range, hay and CRP fields. Ventenata is undesirable because it has no forage value for livestock or wildlife, causes soil to be prone to erosion due to its shallow rooting depth, limits functions of waterways, causes a decline in productivity and degrades land values. It has proven very difficult to control with mechanical or cultural treatments. Where infestation is severe, reseeding may be the only viable management option. Landowners have expressed an urgent need to know what herbicides and management methods are effective for controlling ventenata. |
| **Materials and methods** | This September, each field will be paced to determine at least two similar representative areas, one for the treatment assessment and one for the control. If there is a large amount of variability within the stand, up to three sites in each the treated area and control area may be chosen. At each transect starting point, a spray-painted stake will be pounded into the ground and a waypoint will be made with a GPS unit. A direction will be selected for the transect (N, S, E or W) and a photo will be taken. A transect will be made by laying out a measuring tape 30 m and throwing a range hoop randomly to either side of the tape every 3 m. Percent cover estimations will be made within the hoop for perennial grasses, perennial forbs, perennial weeds, ventenata, other annual weeds, and bare ground. Other measurements will include: a qualitative assessment for scale of ventenata infestation, and stem counts of desirable perennial species. One plant will be defined as a collection of stems with less than a 10 cm gap among the stems. Observations will be recorded on the data collection forms. Baseline data will be collected for all sites in September 2011. Follow-up monitoring will be done on in-tact stands receiving herbicide treatments in September of 2012 and 2013, and follow-up monitoring will be done on reseeded stands in September of 2013 and 2014. |

The CRP fields are comprised of various perennial species, including native and introduced grasses and forbs. The herbicide treatments for the in-tact stands and the chem-fallow reseeded stands will also vary, depending on recommendations of local chemical dealers, the cost of the chemicals and the preference of the landowners. At each site the effectiveness of the demography, and if there are similar or divergent trends among sites.

**Technology Transfer**

Results from this study will be written into a Technical Note and shared with all NRCS employees in the states of WA, ID and OR, and other conservation agencies such as Fish and Wildlife/Fish and Game, Conservation Districts, County Weed Extension, WSU and U of I Extension, the Forest Service and the BLM.

**2012 Update**

Data was collected at all 8 sites September 9, 2011 through October 3, 2011.

Where a certain vegetation type was detected but was present at less than 10%, it was recorded on the data sheets as 'Trace' however it was entered into Excel as '0' for data analysis.

Data collectors attempted to find similar areas for comparison between the treatment and control at each site. Analysis of the numbers reveals more differences than were apparent in the field, particularly at Sites 1, 2 and 8. The treated and control areas at each of these sites may have to be evaluated separately, and not compared. At Site 6, there was no similar site in an area that could easily be separated from the treated area, so there was no control for this site. At Sites 3, 4, 5, and 7, the percent cover and species composition between the treated areas and control are similar enough to compare.

Sites 2, 3, 5 and 8 will be treated with an herbicide application this fall. The herbicide to be applied, rate and date of application will be determined by the landowners' chemical dealers. Data will be collected again on these sites in Fall 2012 and Fall 2013. Sites 1, 4, 6 and 7 will be fallowed one year and reseeded in Spring 2013. Data will be collected on these sites again in Fall 2013 and Fall 2014.

Landowner Williams
Date 9/9/2011
Photo 681
Soil Type ChB
Aspect South

Site Number 1a
Transect Treated Area X or Control
Direction of Transect from Starting Pt N
Tract Number 28
Precip 16

Transect Number 1

Seeded Species: AGCR, THIN, BRIN (could have been BRBI)

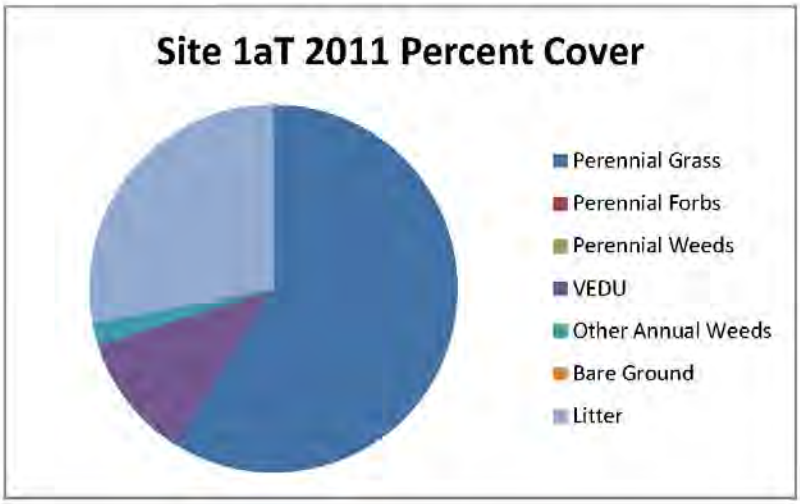
Perennial Weeds Present: mullein

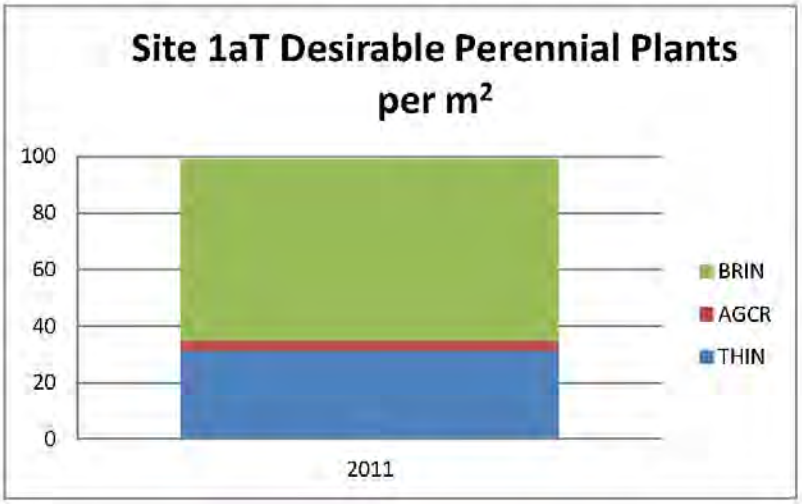
Annual Weeds Present: rattail fescue, bulbous bg

Planned Treatment: Reseed

| | PERCENT COVER | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Veg Type | Perennial Grass | Perennial Forbs | Perennial Weeds | VEDU | Other Annual Weeds | Bare Ground | Litter | VEDU Density |
| Plot 1 | 30 | 0 | 0 | 60 | 0 | 0 | 10 | 3 |
| Plot 2 | 30 | 0 | 0 | 10 | 0 | 0 | 60 | 1 |
| Plot 3 | 60 | 0 | 0 | 10 | 0 | 0 | 30 | 2 |
| Plot 4 | 50 | 0 | 0 | 20 | 0 | 0 | 30 | 2 |
| Plot 5 | 60 | 0 | 0 | 0 | 0 | 0 | 40 | 0 |
| Plot 6 | 60 | 0 | 0 | 10 | 10 | 0 | 20 | 2 |
| Plot 7 | 80 | 0 | 0 | 0 | 0 | 0 | 20 | 0 |
| Plot 8 | 80 | 0 | 0 | 0 | 0 | 0 | 20 | 0 |
| Plot 9 | 80 | 0 | 0 | 0 | 10 | 0 | 10 | 0 |
| Plot 10 | 60 | 0 | 0 | 0 | 0 | 0 | 40 | 0 |
| AVERAGE | 59 | 0 | 0 | 11 | 2 | 0 | 28 | 1 |

| | STEM COUNT OF DESIRABLE PERENNIAL SPECIES | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Species | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Plant Symb | THIN | AGCR | BRIN | | | | | |
| Plot 1 | 5 | 3 | 12 | | | | | |
| Plot 2 | 19 | 0 | 33 | | | | | |
| Plot 3 | 23 | 0 | 32 | | | | | |
| Plot 4 | 14 | 0 | 36 | | | | | |
| Plot 5 | 15 | 0 | 44 | | | | | |
| Plot 6 | 8 | 5 | 27 | | | | | |
| Plot 7 | 18 | 3 | 42 | | | | | |
| Plot 8 | 18 | 4 | 45 | | | | | |
| Plot 9 | 25 | 4 | 39 | | | | | |
| Plot 10 | 22 | 0 | 33 | | | | | |
| AVE | 17 | 2 | 34 | | | | | |
| Plants/m2 | 31 | 4 | 64 | | | | | |
| % of Total | 32% | 4% | 65% | | | | | |


Site 1aT 2011 Percent Cover
Perennial Grass
Perennial Forbs
Perennial Weeds
VEDU
Other Annual Weeds
Bare Ground
Litter


Site 1aT Desirable Perennial Plants per m²
100
80
60
40
20
0
2011
BRIN
AGCR
THIN

Landowner Williams
Date 9/9/2011
Photo 679
Soil Type ChB
Aspect South

Site Number 1a
Transect Treated Area
Direction of Transect from Starting Pt W
Tract Number 28
Precip 16

Transect Number 4
or Control X

Seeded Species: AGCR, THIN, BRIN (could have been BRBI)

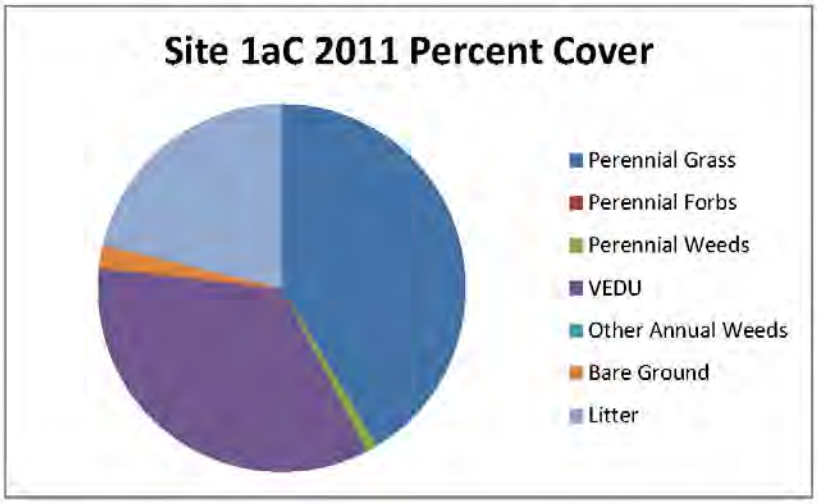
Perennial Weeds Present: mullein

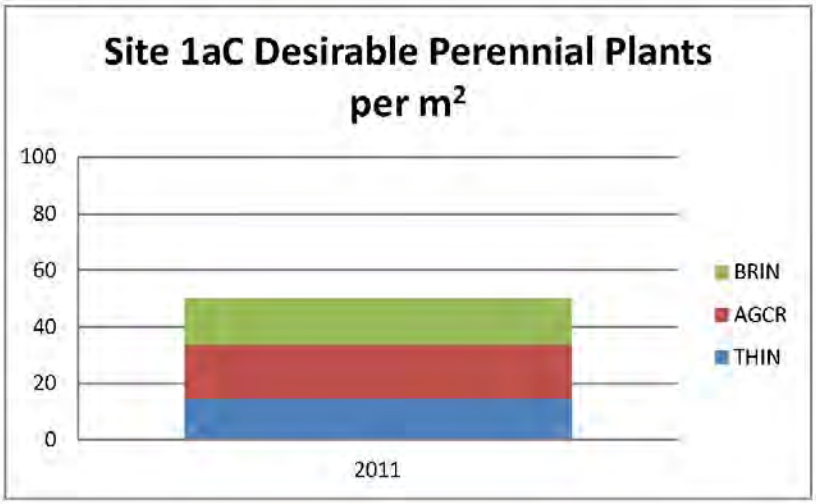
Annual Weeds Present: rattail fescue, bulbous bg

Planned Treatment: None, Control

| | PERCENT COVER | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Veg Type | Perennial Grass | Perennial Forbs | Perennial Weeds | VEDU | Other Annual Weeds | Bare Ground | Litter | VEDU Density |
| Plot 1 | 60 | 0 | 0 | 10 | 0 | 0 | 30 | 1 |
| Plot 2 | 50 | 0 | 0 | 20 | 0 | 0 | 30 | 1 |
| Plot 3 | 50 | 0 | 0 | 30 | 0 | 0 | 20 | 2 |
| Plot 4 | 40 | 0 | 10 | 20 | 0 | 10 | 20 | 1 |
| Plot 5 | 50 | 0 | 0 | 40 | 0 | 0 | 10 | 2 |
| Plot 6 | 40 | 0 | 0 | 10 | 0 | 0 | 50 | 1 |
| Plot 7 | 30 | 0 | 0 | 60 | 0 | 0 | 10 | 3 |
| Plot 8 | 20 | 0 | 0 | 60 | 0 | 0 | 10 | 3 |
| Plot 9 | 30 | 0 | 0 | 50 | 0 | 10 | 10 | 3 |
| Plot 10 | 40 | 0 | 0 | 40 | 0 | 0 | 20 | 2 |
| AVERAGE | 41 | 0 | 1 | 34 | 0 | 2 | 21 | 2 |

| | STEM COUNT OF DESIRABLE PERENNIAL SPECIES | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Species | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Plant Symb | BRIN | THIN | AGCR | | | | | |
| Plot 1 | 7 | 17 | 20 | | | | | |
| Plot 2 | 2 | 18 | 0 | | | | | |
| Plot 3 | 10 | 3 | 24 | | | | | |
| Plot 4 | 20 | 0 | 16 | | | | | |
| Plot 5 | 43 | 0 | 0 | | | | | |
| Plot 6 | 0 | 40 | 0 | | | | | |
| Plot 7 | 0 | 0 | 12 | | | | | |
| Plot 8 | 4 | 0 | 9 | | | | | |
| Plot 9 | 0 | 0 | 10 | | | | | |
| Plot 10 | 0 | 0 | 11 | | | | | |
| AVE | 9 | 8 | 10 | | | | | |
| Plants/m2 | 16 | 15 | 19 | | | | | |
| % of Total | 32% | 29% | 38% | | | | | |


Site 1aC 2011 Percent Cover
Perennial Grass
Perennial Forbs
Perennial Weeds
VEDU
Other Annual Weeds
Bare Ground
Litter


Site 1aC Desirable Perennial Plants per m²
100
80
60
40
20
0
2011
BRIN
AGCR
THIN

Landowner Williams
Date 9/9/2011
Photo 678
Soil Type ChB
Aspect South

Site Number 1b
Transect Number 2
Transect Treated Area X or Control
Direction of Transect from Starting Pt N
Tract Number 28
Precip 16

Seeded Species: AGCR, THIN, BRIN (could have been BRBI)

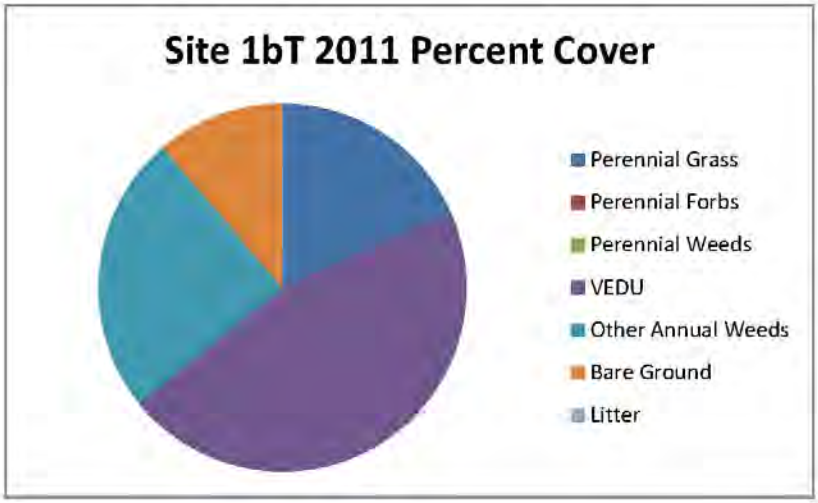
Perennial Weeds Present: mullein

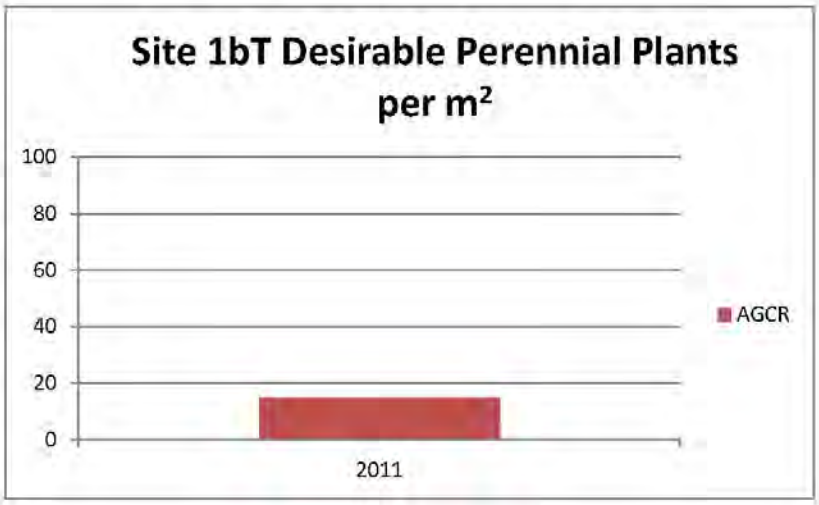
Annual Weeds Present: rattail fescue, bulbous bg

Planned Treatment: Reseed

| | PERCENT COVER | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Veg Type | Perennial Grass | Perennial Forbs | Perennial Weeds | VEDU | Other Annual Weeds | Bare Ground | Litter | VEDU Density |
| Plot 1 | 20 | 0 | 0 | 60 | 0 | 20 | 0 | 4 |
| Plot 2 | 10 | 0 | 0 | 90 | 0 | 0 | 0 | 5 |
| Plot 3 | 10 | 0 | 0 | 40 | 20 | 30 | 0 | 3 |
| Plot 4 | 10 | 0 | 0 | 60 | 20 | 10 | 0 | 4 |
| Plot 5 | 20 | 0 | 0 | 60 | 10 | 10 | 0 | 4 |
| Plot 6 | 20 | 0 | 0 | 70 | 10 | 0 | 0 | 3 |
| Plot 7 | 30 | 0 | 0 | 20 | 10 | 20 | 0 | 2 |
| Plot 8 | 20 | 0 | 0 | 10 | 60 | 10 | 0 | 1 |
| Plot 9 | 20 | 0 | 0 | 20 | 50 | 10 | 0 | 2 |
| Plot 10 | 20 | 0 | 0 | 20 | 60 | 0 | 0 | 2 |
| AVERAGE | 18 | 0 | 0 | 45 | 24 | 11 | 0 | 3 |

| | STEM COUNT OF DESIRABLE PERENNIAL SPECIES | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Species | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Plant Symb | AGCR | | | | | | | |
| Plot 1 | 6 | | | | | | | |
| Plot 2 | 5 | | | | | | | |
| Plot 3 | 5 | | | | | | | |
| Plot 4 | 5 | | | | | | | |
| Plot 5 | 7 | | | | | | | |
| Plot 6 | 10 | | | | | | | |
| Plot 7 | 11 | | | | | | | |
| Plot 8 | 9 | | | | | | | |
| Plot 9 | 11 | | | | | | | |
| Plot 10 | 9 | | | | | | | |
| AVE | 8 | | | | | | | |
| Plants/m2 | 15 | | | | | | | |
| % of Total | 100% | | | | | | | |


Site 1bT 2011 Percent Cover
Perennial Grass
Perennial Forbs
Perennial Weeds
VEDU
Other Annual Weeds
Bare Ground
Litter


Site 1bT Desirable Perennial Plants per m²
100
80
60
40
20
0
2011
AGCR

Landowner Williams
Date 9/9/2011
Photo
Soil Type ChB
Aspect South

Site Number 1b
Transect Treated Area
Direction of Transect from Starting Pt W
Tract Number 28
Precip 16

Transect Number 3
or Control X

Seeded Species: AGCR, THIN, BRIN (could have been BRBI)

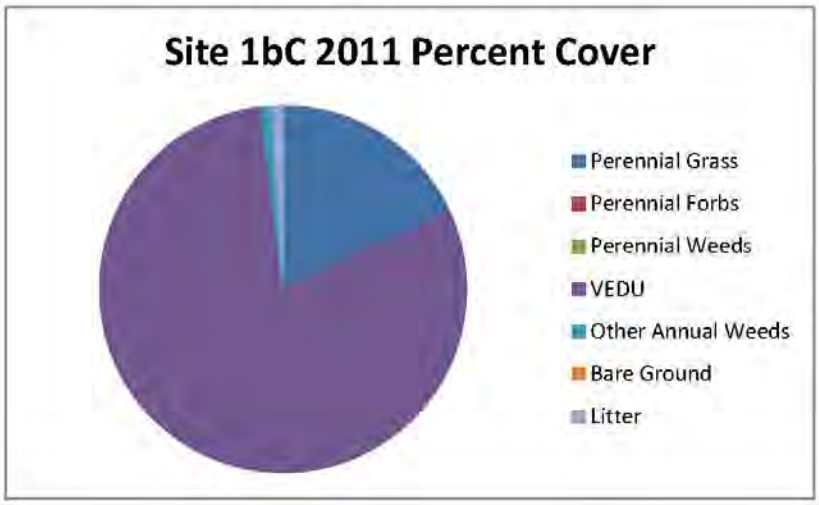
Perennial Weeds Present: mullein

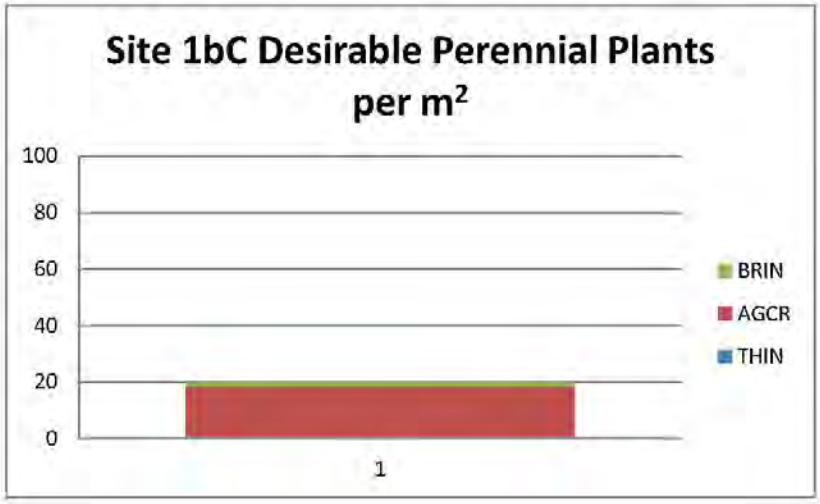
Annual Weeds Present: rattail fescue, bulbous bg

Planned Treatment: None, Control

| | PERCENT COVER | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Veg Type | Perennial Grass | Perennial Forbs | Perennial Weeds | VEDU | Other Annual Weeds | Bare Ground | Litter | VEDU Density |
| Plot 1 | 10 | 0 | 0 | 80 | 10 | 0 | 0 | 4 |
| Plot 2 | 10 | 0 | 0 | 90 | 0 | 0 | 0 | 5 |
| Plot 3 | 20 | 0 | 0 | 80 | 0 | 0 | 0 | 5 |
| Plot 4 | 10 | 0 | 0 | 90 | 0 | 0 | 0 | 5 |
| Plot 5 | 30 | 0 | 0 | 70 | 0 | 0 | 0 | 4 |
| Plot 6 | 20 | 0 | 0 | 70 | 0 | 0 | 10 | 4 |
| Plot 7 | 30 | 0 | 0 | 70 | 0 | 0 | 0 | 4 |
| Plot 8 | 20 | 0 | 0 | 80 | 0 | 0 | 0 | 4 |
| Plot 9 | 20 | 0 | 0 | 80 | 0 | 0 | 0 | 4 |
| Plot 10 | 10 | 0 | 0 | 90 | 0 | 0 | 0 | 4 |
| AVERAGE | 18 | 0 | 0 | 80 | 1 | 0 | 1 | 4 |

| | STEM COUNT OF DESIRABLE PERENNIAL SPECIES | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Species | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Plant Symb | AGCR | THIN | BRIN | ELWA | | | | |
| Plot 1 | 6 | 4 | 0 | 0 | | | | |
| Plot 2 | 8 | 0 | 0 | 0 | | | | |
| Plot 3 | 9 | 0 | 0 | 0 | | | | |
| Plot 4 | 6 | 0 | 0 | 1 | | | | |
| Plot 5 | 12 | 0 | 0 | 0 | | | | |
| Plot 6 | 16 | 0 | 0 | 0 | | | | |
| Plot 7 | 11 | 0 | 0 | 0 | | | | |
| Plot 8 | 11 | 0 | 0 | 0 | | | | |
| Plot 9 | 5 | 0 | 8 | 0 | | | | |
| Plot 10 | 10 | 0 | 0 | 0 | | | | |
| AVE | 9 | 0 | 1 | 0 | | | | |
| Plants/m2 | 18 | 1 | 2 | 0 | | | | |
| % of Total | 89% | 4% | 7% | 8% | | | | |


Site 1bC 2011 Percent Cover
Perennial Grass
Perennial Forbs
Perennial Weeds
VEDU
Other Annual Weeds
Bare Ground
Litter


Site 1bC Desirable Perennial Plants per m²
100
80
60
40
20
0
1
BRIN
AGCR
THIN

Landowner Colvin-Nealy
Date 9/9/2011
Photo
Soil Type UhB/CqB
Aspect East

Site Number 2
Transect Number 2
Transect Treated Area X or Control
Direction of Transect from Starting Pt W
Tract Number 335
Precip 16-18

Seeded Species: THPO, FEOV, Sherman POSE, alfalfa and small burnet in 1997

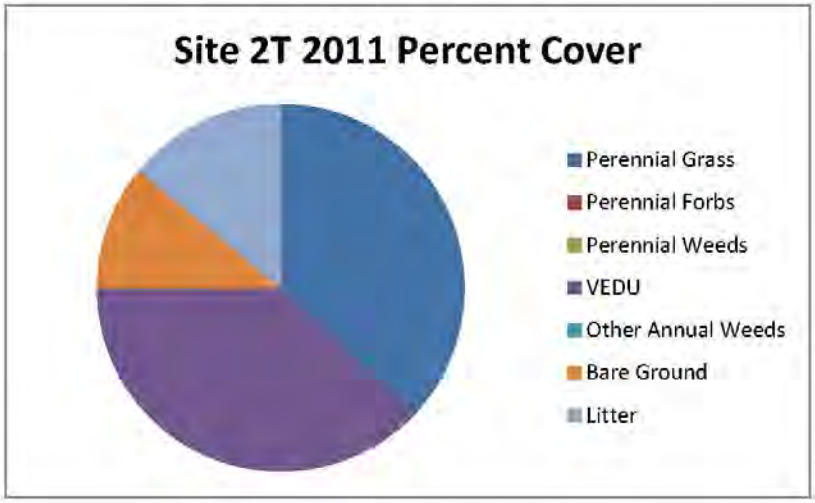
Perennial Weeds Present:

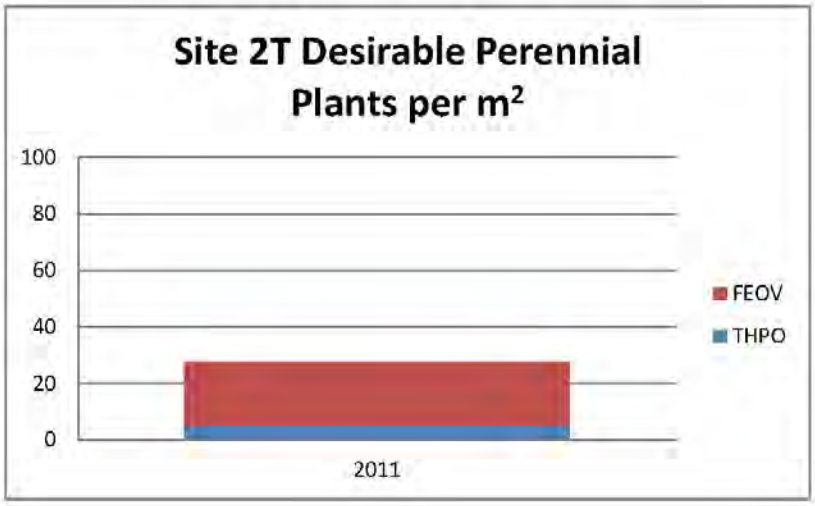
Annual Weeds Present:

Planned Treatment: Herbicide

| | PERCENT COVER | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Veg Type | Perennial Grass | Perennial Forbs | Perennial Weeds | VEDU | Other Annual Weeds | Bare Ground | Litter | VEDU Density |
| Plot 1 | 70 | 0 | 0 | 20 | 0 | 0 | 10 | 2 |
| Plot 2 | 50 | 0 | 0 | 20 | 0 | 0 | 30 | 2 |
| Plot 3 | 30 | 0 | 0 | 50 | 0 | 0 | 20 | 3 |
| Plot 4 | 80 | 0 | 0 | 10 | 0 | 0 | 10 | 1 |
| Plot 5 | 40 | 0 | 0 | 30 | 0 | 20 | 10 | 3 |
| Plot 6 | 50 | 0 | 0 | 10 | 0 | 30 | 10 | 1 |
| Plot 7 | 30 | 0 | 0 | 30 | 0 | 10 | 30 | 3 |
| Plot 8 | 0 | 0 | 0 | 70 | 0 | 10 | 20 | 5 |
| Plot 9 | 10 | 0 | 0 | 60 | 0 | 30 | 0 | 4 |
| Plot 10 | 10 | 0 | 0 | 80 | 0 | 10 | 0 | 4 |
| AVERAGE | 37 | 0 | 0 | 38 | 0 | 11 | 14 | 3 |

| | STEM COUNT OF DESIRABLE PERENNIAL SPECIES | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Species | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Plant Symb | THPO | FEOV | | | | | | |
| Plot 1 | 3 | 12 | | | | | | |
| Plot 2 | 4 | 11 | | | | | | |
| Plot 3 | 6 | 7 | | | | | | |
| Plot 4 | 2 | 22 | | | | | | |
| Plot 5 | 0 | 21 | | | | | | |
| Plot 6 | 3 | 26 | | | | | | |
| Plot 7 | 3 | 16 | | | | | | |
| Plot 8 | 0 | 0 | | | | | | |
| Plot 9 | 2 | 1 | | | | | | |
| Plot 10 | 3 | 5 | | | | | | |
| AVE | 3 | 12 | | | | | | |
| Plants/m2 | 5 | 23 | | | | | | |
| % of Total | 18% | 82% | | | | | | |


Site 2T 2011 Percent Cover
Perennial Grass
Perennial Forbs
Perennial Weeds
VEDU
Other Annual Weeds
Bare Ground
Litter


Site 2T Desirable Perennial Plants per m²
100
80
60
40
20
0
2011
FEOV
THPO

Landowner Colvin-Nealy
Date 9/9/2011
Photo
Soil Type ChB
Aspect South

Site Number 2
Transect Treated Area
Direction of Transect from Starting Pt W
Tract Number 28
Precip 16

Transect Number 1
or Control X

Seeded Species: THPO, FEOV, Sherman POSE, alfalfa and small burnet in 1997

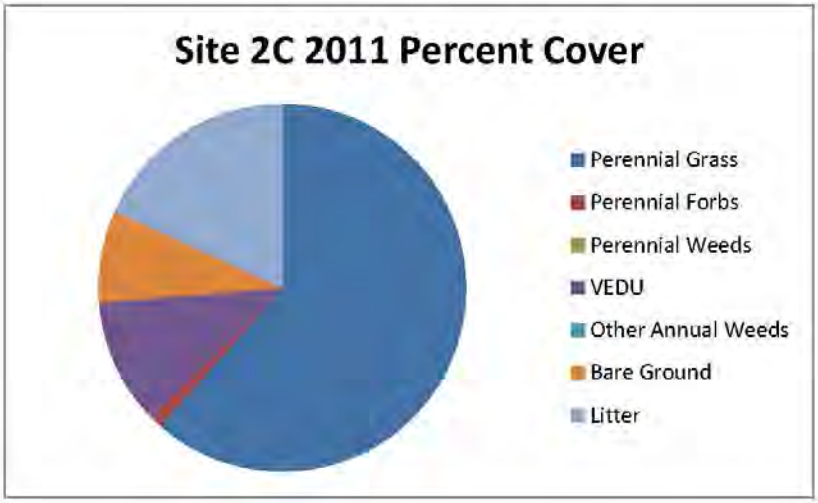
Perennial Weeds Present:

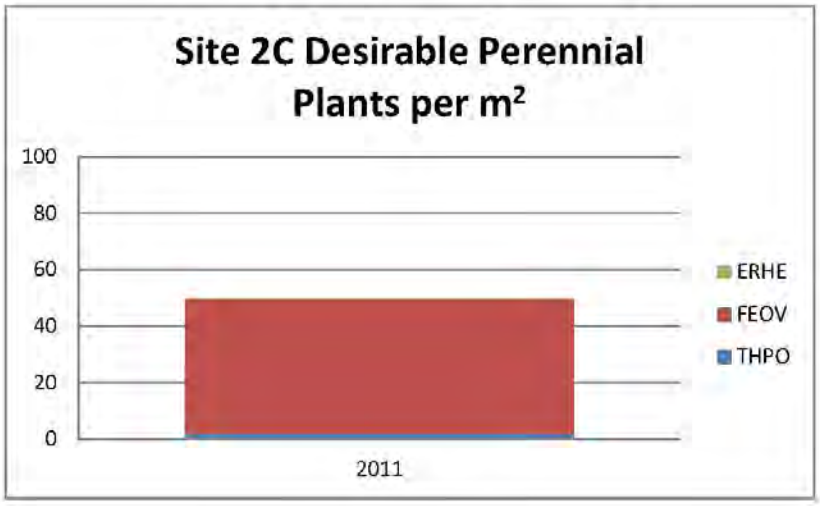
Annual Weeds Present:

Planned Treatment: None, Control

| | PERCENT COVER | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Veg Type | Perennial Grass | Perennial Forbs | Perennial Weeds | VEDU | Other Annual Weeds | Bare Ground | Litter | VEDU Density |
| Plot 1 | 40 | 0 | 0 | 10 | 0 | 40 | 10 | 1 |
| Plot 2 | 80 | 0 | 0 | 10 | 0 | 10 | 0 | 1 |
| Plot 3 | 60 | 0 | 0 | 10 | 0 | 20 | 0 | 1 |
| Plot 4 | 70 | 10 | 0 | 10 | 0 | 10 | 0 | 1 |
| Plot 5 | 80 | 0 | 0 | 0 | 0 | 0 | 20 | 1 |
| Plot 6 | 80 | 0 | 0 | 0 | 0 | 0 | 20 | 1 |
| Plot 7 | 40 | 0 | 0 | 20 | 0 | 0 | 40 | 1 |
| Plot 8 | 60 | 0 | 0 | 10 | 0 | 0 | 30 | 1 |
| Plot 9 | 60 | 0 | 0 | 10 | 0 | 0 | 30 | 2 |
| Plot 10 | 40 | 0 | 0 | 30 | 0 | 0 | 30 | 2 |
| AVERAGE | 61 | 1 | 0 | 11 | 0 | 8 | 18 | 1 |

| | STEM COUNT OF DESIRABLE PERENNIAL SPECIES | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Species | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Plant Symb | THPO | FEOV | ERHE | | | | | |
| Plot 1 | 0 | 34 | 0 | | | | | |
| Plot 2 | 0 | 36 | 0 | | | | | |
| Plot 3 | 0 | 31 | 0 | | | | | |
| Plot 4 | 0 | 25 | 1 | | | | | |
| Plot 5 | 0 | 28 | 0 | | | | | |
| Plot 6 | 0 | 27 | 0 | | | | | |
| Plot 7 | 0 | 25 | 0 | | | | | |
| Plot 8 | 3 | 17 | 0 | | | | | |
| Plot 9 | 0 | 23 | 0 | | | | | |
| Plot 10 | 7 | 9 | 0 | | | | | |
| AVE | 1 | 26 | 0 | | | | | |
| Plants/m2 | 2 | 48 | 0 | | | | | |
| % of Total | 4% | 96% | 0% | | | | | |


Site 2C 2011 Percent Cover
Perennial Grass
Perennial Forbs
Perennial Weeds
VEDU
Other Annual Weeds
Bare Ground
Litter


Site 2C Desirable Perennial Plants per m²
100
80
60
40
20
0
2011
ERHE
FEOV
THPO

Landowner Mueller
Date 9/16/2011
Photo
Soil Type BhD
Aspect S

Site Number 3
Transect Number 1
Transect Treated Area X or Control
Direction of Transect from Starting Pt SE
Tract Number 15299
Precip 22

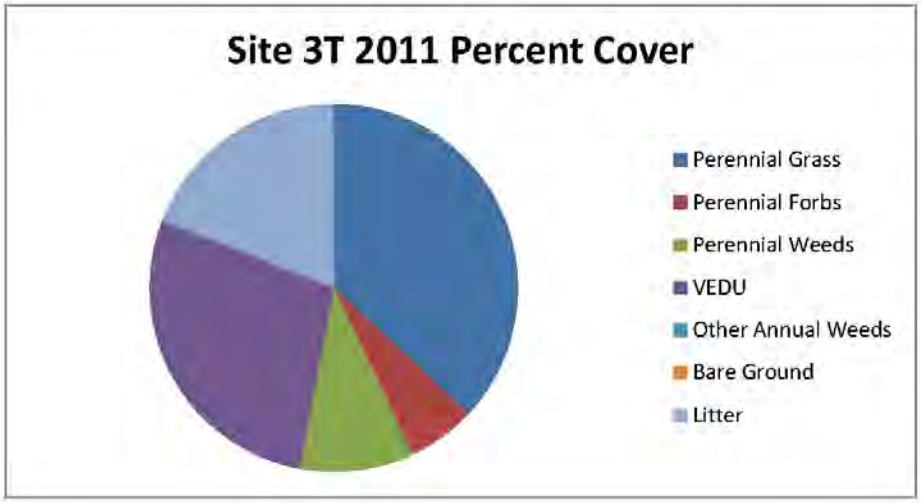
Seeded Species: SCPH, DAGL and alsike clover (TRHY) seeded in 1997(?)

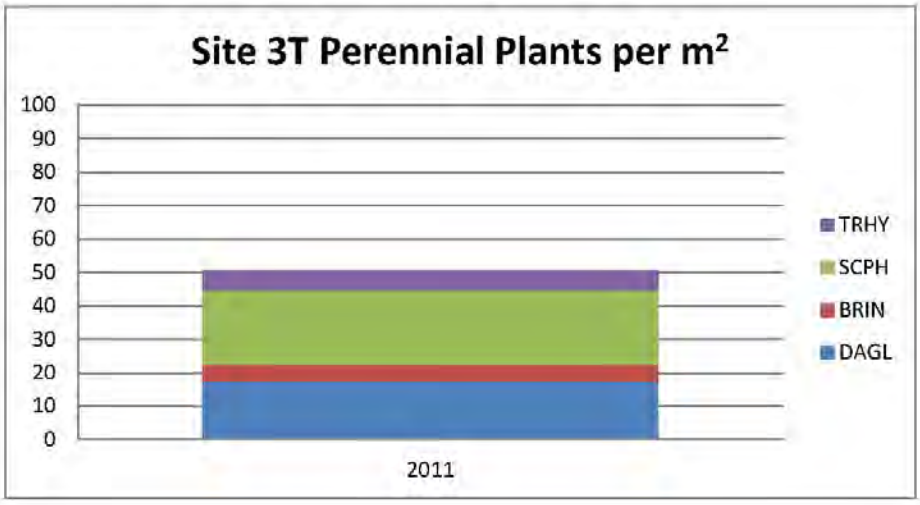
Perennial Weeds Present: mullein, oxeye daisy, multiflora rose, sulfur cinquefoil, buckhorn plantain, sheep sorrel
Annual Weeds Present: rattail fescue

Planned Treatment: Herbicide

| | PERCENT COVER | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Veg Type | Perennial Grass | Perennial Forbs | Perennial Weeds | VEDU | Other Annual Weeds | Bare Ground | Litter | VEDU Density |
| Plot 1 | 10 | 10 | 30 | 40 | 0 | 0 | 10 | 2 |
| Plot 2 | 30 | 0 | 10 | 0 | 0 | 0 | 60 | 1 |
| Plot 3 | 40 | 10 | 10 | 30 | 0 | 0 | 10 | 2 |
| Plot 4 | 60 | 0 | 10 | 10 | 0 | 0 | 20 | 1 |
| Plot 5 | 30 | 0 | 0 | 40 | 0 | 0 | 30 | 2 |
| Plot 6 | 70 | 0 | 10 | 10 | 0 | 0 | 10 | 1 |
| Plot 7 | 40 | 20 | 0 | 30 | 0 | 0 | 10 | 2 |
| Plot 8 | 40 | 0 | 10 | 30 | 0 | 0 | 20 | 2 |
| Plot 9 | 20 | 0 | 10 | 60 | 0 | 0 | 10 | 3 |
| Plot 10 | 30 | 20 | 10 | 30 | 0 | 0 | 10 | 2 |
| AVERAGE | 37 | 6 | 10 | 28 | 0 | 0 | 19 | 2 |

| | STEM COUNT OF DESIRABLE PERENNIAL SPECIES | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Species | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Plant Symb | DAGL | BRIN | SCPH | TRHY | | | | |
| Plot 1 | 7 | 2 | 0 | 5 | | | | |
| Plot 2 | 13 | 1 | 0 | 2 | | | | |
| Plot 3 | 11 | 0 | 7 | 5 | | | | |
| Plot 4 | 14 | 4 | 26 | 0 | | | | |
| Plot 5 | 14 | 1 | 3 | 1 | | | | |
| Plot 6 | 5 | 0 | 49 | 5 | | | | |
| Plot 7 | 7 | 18 | 0 | 4 | | | | |
| Plot 8 | 15 | 0 | 11 | 2 | | | | |
| Plot 9 | 6 | 0 | 2 | 1 | | | | |
| Plot 10 | 1 | 0 | 22 | 6 | | | | |
| AVE | 9 | 3 | 12 | 3 | | | | |
| Plants/m2 | 17 | 5 | 23 | 6 | | | | |
| % of Total | 34% | 10% | 44% | 18% | | | | |


Site 3T 2011 Percent Cover
Perennial Grass
Perennial Forbs
Perennial Weeds
VEDU
Other Annual Weeds
Bare Ground
Litter


Site 3T Perennial Plants per m2
100
90
80
70
60
50
40
30
20
10
0
2011
TRHY
SCPH
BRIN
DAGL

Landowner Mueller/Nelson
Date 9/16/2011
Photo
Soil Type BhD
Aspect S

Site Number 3
Transect Number 2
Transect Treated Area
or Control X
Direction of Transect from Starting Pt S
Tract Number 15299
Precip 22

Seeded Species: SCPH, DAGL and alsike clover seeded in 1997(?)

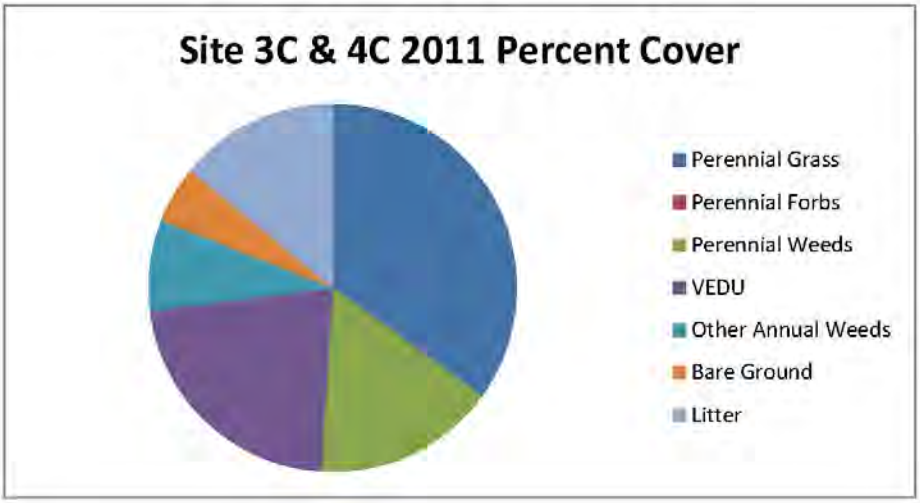
Perennial Weeds Present: mullein, oxeye daisy, multiflora rose, sulfur cinquefoil, buckhorn plantain, sheep sorrel
Annual Weeds Present: madia, prickly lettuce

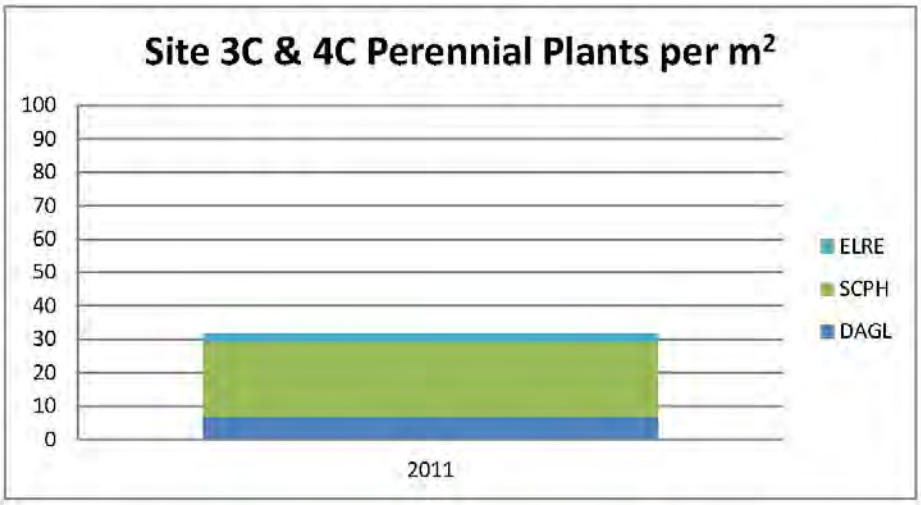
Planned Treatment: None, Control (for Treated Sites 3 & 4)

| | PERCENT COVER | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Veg Type | Perennial Grass | Perennial Forbs | Perennial Weeds | VEDU | Other Annual Weeds | Bare Ground | Litter | VEDU Density |
| Plot 1 | 10 | 0 | 10 | 50 | 10 | 0 | 20 | 2 |
| Plot 2 | 40 | 0 | 0 | 30 | 20 | 0 | 10 | 2 |
| Plot 3 | 10 | 0 | 40 | 20 | 10 | 0 | 20 | 2 |
| Plot 4 | 80 | 0 | 0 | 0 | 0 | 0 | 20 | 0 |
| Plot 5 | 20 | 0 | 30 | 40 | 0 | 10 | 0 | 2 |
| Plot 6 | 80 | 0 | 0 | 0 | 10 | 0 | 10 | 1 |
| Plot 7 | 20 | 0 | 20 | 10 | 10 | 20 | 20 | 1 |
| Plot 8 | 20 | 0 | 40 | 0 | 10 | 10 | 20 | 1 |
| Plot 9 | 10 | 0 | 10 | 50 | 10 | 10 | 10 | 2 |
| Plot 10 | 60 | 0 | 10 | 20 | 0 | 0 | 10 | 2 |
| AVERAGE | 35 | 0 | 16 | 22 | 8 | 5 | 14 | 2 |

| | STEM COUNT OF DESIRABLE PERENNIAL SPECIES | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Species | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Plant Symb | DAGL | SCPH | ELRE | | | | | |
| Plot 1 | 2 | 14 | 7 | | | | | |
| Plot 2 | 0 | 8 | 2 | | | | | |
| Plot 3 | 3 | 1 | 0 | | | | | |
| Plot 4 | 12 | 29 | 2 | | | | | |
| Plot 5 | 3 | 9 | 2 | | | | | |
| Plot 6 | 4 | 25 | 0 | | | | | |
| Plot 7 | 4 | 16 | 0 | | | | | |
| Plot 8 | 0 | 11 | 0 | | | | | |
| Plot 9 | 3 | 0 | 0 | | | | | |
| Plot 10 | 5 | 7 | 0 | | | | | |
| AVE | 4 | 12 | 1 | | | | | |
| Plants/m2 | 7 | 23 | 2 | | | | | |
| % of Total | 21% | 71% | 8% | | | | | |

ELRE = quackgrass



Landowner Nelson
Date 9/16/2011
Photo
Soil Type SpC, BaD, DaB
Aspect S

Site Number 4
Transect Number 1
Transect Treated Area X or Control
Direction of Transect from Starting Pt N
Tract Number 15300
Precip 22

Seeded Species: SCPH, DAGL and alsike clover (TRHY) seeded in 1997(?)

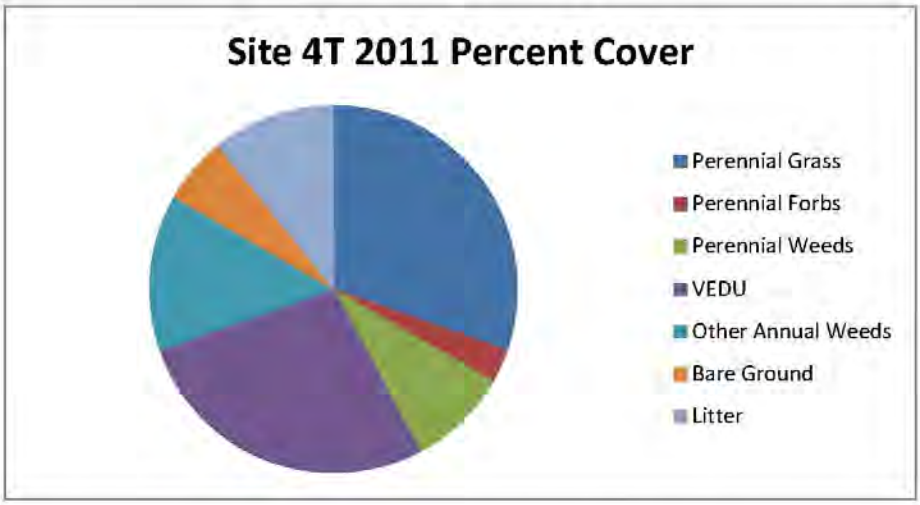
Perennial Weeds Present: mullein, oxeye daisy, multiflora rose, sulfur cinquefoil, buckhorn plantain, sheep sorrel, toadflax, rush skeleton weed
Annual Weeds Present: rattail fescue

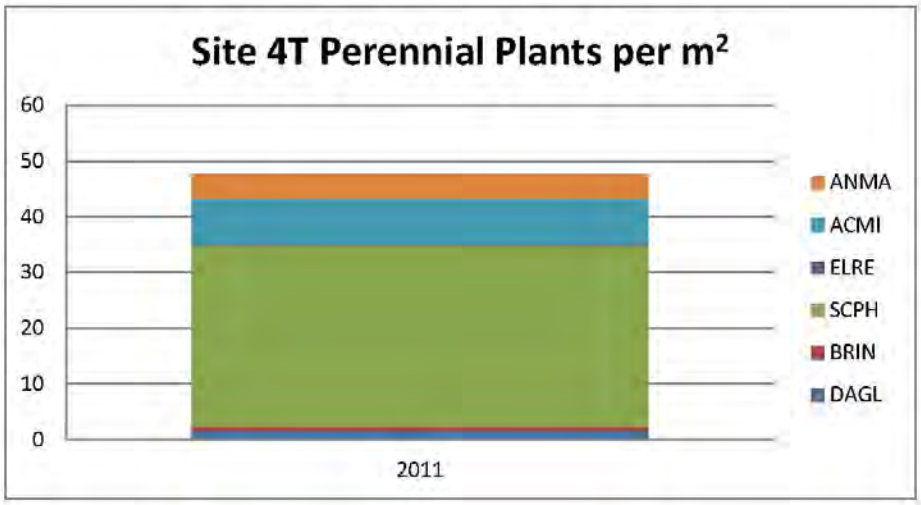
Planned Treatment: Reseed

| | PERCENT COVER | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Veg Type | Perennial Grass | Perennial Forbs | Perennial Weeds | VEDU | Other Annual Weeds | Bare Ground | Litter | VEDU Density |
| Plot 1 | 50 | 0 | 20 | 30 | 0 | 0 | 0 | 2 |
| Plot 2 | 50 | 0 | 10 | 30 | 0 | 0 | 10 | 2 |
| Plot 3 | 40 | 10 | 0 | 10 | 0 | 10 | 30 | 1 |
| Plot 4 | 30 | 10 | 10 | 20 | 10 | 10 | 10 | 2 |
| Plot 5 | 10 | 0 | 0 | 60 | 20 | 0 | 10 | 2 |
| Plot 6 | 30 | 0 | 10 | 10 | 30 | 10 | 10 | 1 |
| Plot 7 | 10 | 0 | 0 | 40 | 20 | 20 | 10 | 2 |
| Plot 8 | 0 | 10 | 10 | 30 | 40 | 10 | 10 | 1 |
| Plot 9 | 80 | 0 | 10 | 10 | 0 | 0 | 10 | 1 |
| Plot 10 | 10 | 0 | 20 | 40 | 20 | 0 | 10 | 2 |
| AVERAGE | 31 | 3 | 9 | 28 | 14 | 6 | 11 | 2 |

| | STEM COUNT OF DESIRABLE PERENNIAL SPECIES | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Species | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Plant Symb | DAGL | BRIN | SCPH | ELRE | ACMI | ANMA | | |
| Plot 1 | 3 | 0 | 36 | 0 | 1 | 0 | | |
| Plot 2 | 0 | 0 | 29 | 0 | 2 | 0 | | |
| Plot 3 | 0 | 0 | 30 | 0 | 18 | 0 | | |
| Plot 4 | 0 | 0 | 12 | 0 | 6 | 1 | | |
| Plot 5 | 0 | 0 | 8 | 0 | 0 | 4 | | |
| Plot 6 | 0 | 0 | 17 | 0 | 4 | 2 | | |
| Plot 7 | 5 | 0 | 1 | 0 | 2 | 4 | | |
| Plot 8 | 0 | 4 | 0 | 1 | 2 | 7 | | |
| Plot 9 | 0 | 0 | 28 | 0 | 3 | 4 | | |
| Plot 10 | 0 | 0 | 13 | 0 | 6 | 1 | | |
| AVE | 1 | 0 | 17 | 0 | 4 | 2 | | |
| Plants/m2 | 2 | 1 | 33 | 0 | 8 | 4 | | |
| % of Total | 3% | 2% | 69% | 0% | 17% | 9% | | |

ELRE = quackgrass
ACMI = yarrow
ANMA = Anaphalis margaritacea, pearly everlasting



Landowner Mueller/Nelson
Date 9/16/2011
Photo
Soil Type BhD
Aspect S

Site Number 3 & 4
Transect Treated Area
Direction of Transect from Starting Pt S
Tract Number 15299
Precip 22

Transect Number 2
or Control X

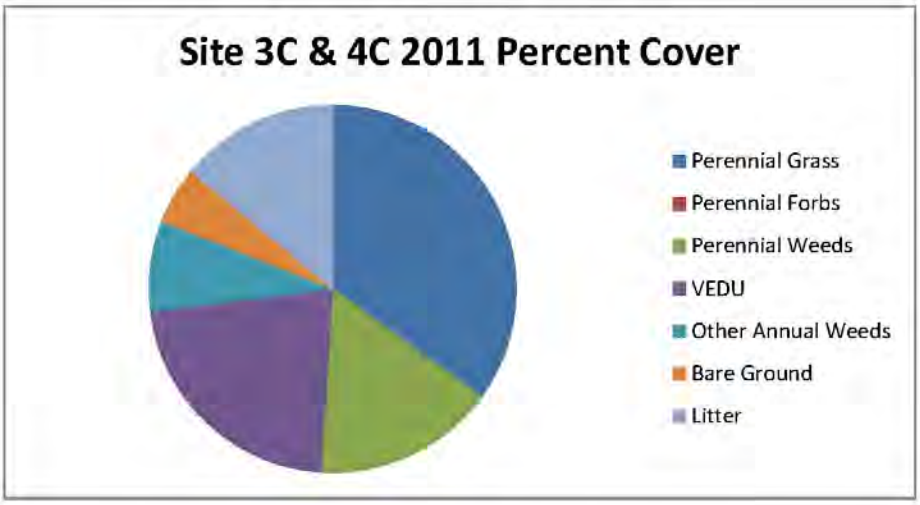
Seeded Species: SCPH, DAGL and alsike clover (TRHY) seeded in 1997(?)

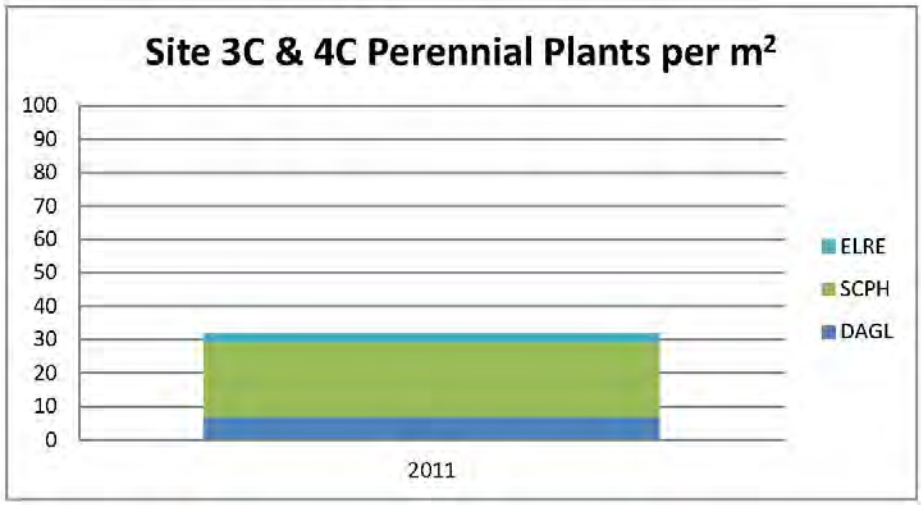
Perennial Weeds Present: mullein, oxeye daisy, multiflora rose, sulfur cinquefoil, buckhorn plantain, sheep sorrel
Annual Weeds Present: rattail fescue

Planned Treatment: None, Control

| | PERCENT COVER | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Veg Type | Perennial Grass | Perennial Forbs | Perennial Weeds | VEDU | Other Annual Weeds | Bare Ground | Litter | VEDU Density |
| Plot 1 | 10 | 0 | 10 | 50 | 10 | 0 | 20 | 2 |
| Plot 2 | 40 | 0 | 0 | 30 | 20 | 0 | 10 | 2 |
| Plot 3 | 10 | 0 | 40 | 20 | 10 | 0 | 20 | 2 |
| Plot 4 | 80 | 0 | 0 | 0 | 0 | 0 | 20 | 0 |
| Plot 5 | 20 | 0 | 30 | 40 | 0 | 10 | 0 | 2 |
| Plot 6 | 80 | 0 | 0 | 0 | 10 | 0 | 10 | 1 |
| Plot 7 | 20 | 0 | 20 | 10 | 10 | 20 | 20 | 1 |
| Plot 8 | 20 | 0 | 40 | 0 | 10 | 10 | 20 | 1 |
| Plot 9 | 10 | 0 | 10 | 50 | 10 | 10 | 10 | 2 |
| Plot 10 | 60 | 0 | 10 | 20 | 0 | 0 | 10 | 2 |
| AVERAGE | 35 | 0 | 16 | 22 | 8 | 5 | 14 | 2 |

| | STEM COUNT OF DESIRABLE PERENNIAL SPECIES | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Species | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Plant Symb | DAGL | SCPH | ELRE | | | | | |
| Plot 1 | 2 | 14 | 7 | | | | | |
| Plot 2 | 0 | 8 | 2 | | | | | |
| Plot 3 | 3 | 1 | 0 | | | | | |
| Plot 4 | 12 | 29 | 2 | | | | | |
| Plot 5 | 3 | 9 | 2 | | | | | |
| Plot 6 | 4 | 25 | 0 | | | | | |
| Plot 7 | 4 | 16 | 0 | | | | | |
| Plot 8 | 0 | 11 | 0 | | | | | |
| Plot 9 | 3 | 0 | 0 | | | | | |
| Plot 10 | 5 | 7 | 0 | | | | | |
| AVE | 4 | 12 | 1 | | | | | |
| Plants/m2 | 7 | 23 | 2 | | | | | |
| % of Total | 21% | 71% | 8% | | | | | |


Site 3C & 4C 2011 Percent Cover
Perennial Grass
Perennial Forbs
Perennial Weeds
VEDU
Other Annual Weeds
Bare Ground
Litter


Site 3C & 4C Perennial Plants per m²
100
90
80
70
60
50
40
30
20
10
0
2011
ELRE
SCPH
DAGL

Landowner Buntrock
Date 9/28/2011
Photo
Soil Type BaB, BaC
Aspect S

Site Number 5
Transect Number 2
Transect Treated Area X or Control
Direction of Transect from Starting Pt W
Tract Number 3085
Precip 18-20

Seeded Species: smooth brome or meadow brome, hairy vetch

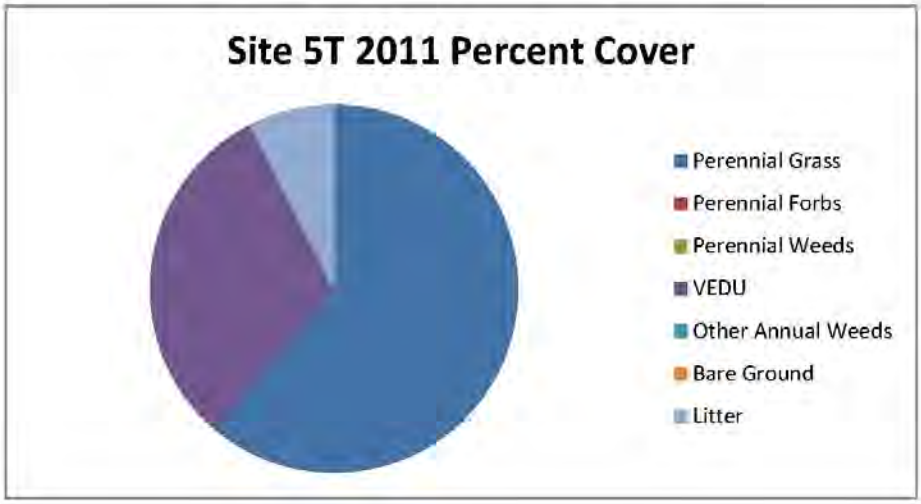
Perennial Weeds Present: st. johnswort, sulfur cinquefoil

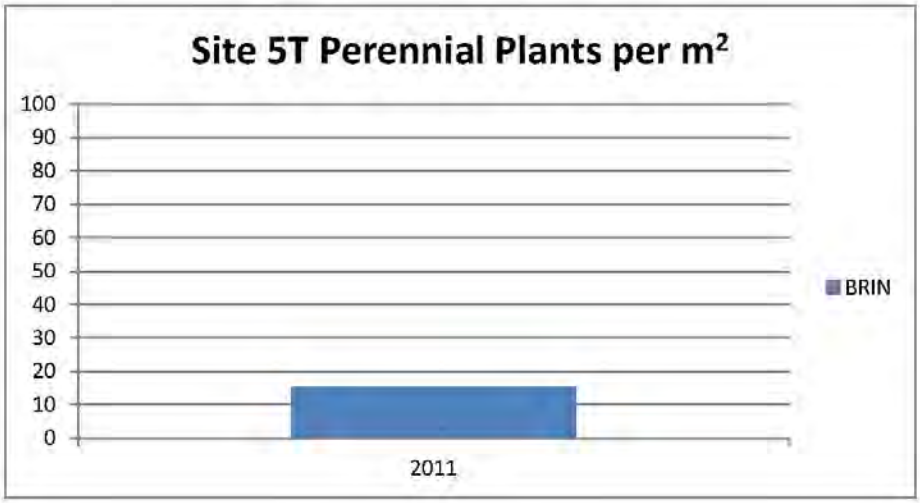
Annual Weeds Present:

Planned Treatment: Herbicide

| | PERCENT COVER | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Veg Type | Perennial Grass | Perennial Forbs | Perennial Weeds | VEDU | Other Annual Weeds | Bare Ground | Litter | VEDU Density |
| Plot 1 | 60 | 0 | 0 | 30 | 0 | 0 | 10 | 3 |
| Plot 2 | 60 | 0 | 0 | 20 | 0 | 0 | 20 | 2 |
| Plot 3 | 70 | 0 | 0 | 20 | 0 | 0 | 10 | 2 |
| Plot 4 | 90 | 0 | 0 | 10 | 0 | 0 | 0 | 2 |
| Plot 5 | 90 | 0 | 0 | 10 | 0 | 0 | 0 | 2 |
| Plot 6 | 60 | 0 | 0 | 40 | 0 | 0 | 0 | 3 |
| Plot 7 | 80 | 0 | 0 | 10 | 0 | 0 | 10 | 2 |
| Plot 8 | 10 | 0 | 0 | 20 | 0 | 0 | 10 | 3 |
| Plot 9 | 10 | 0 | 0 | 80 | 0 | 0 | 0 | 4 |
| Plot 10 | 40 | 0 | 0 | 50 | 0 | 0 | 10 | 3 |
| AVERAGE | 57 | 0 | 0 | 29 | 0 | 0 | 7 | 3 |

| | STEM COUNT OF DESIRABLE PERENNIAL SPECIES | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Species | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Plant Symb | BRIN | | | | | | | |
| Plot 1 | 6 | | | | | | | |
| Plot 2 | 7 | | | | | | | |
| Plot 3 | 2 | | | | | | | |
| Plot 4 | 3 | | | | | | | |
| Plot 5 | 5 | | | | | | | |
| Plot 6 | 11 | | | | | | | |
| Plot 7 | 0 | | | | | | | |
| Plot 8 | 12 | | | | | | | |
| Plot 9 | 8 | | | | | | | |
| Plot 10 | 28 | | | | | | | |
| AVE | 8 | | | | | | | |
| Plants/m2 | 15 | | | | | | | |
| % of Total | 100% | | | | | | | |


Site 5T 2011 Percent Cover
Perennial Grass
Perennial Forbs
Perennial Weeds
VEDU
Other Annual Weeds
Bare Ground
Litter


Site 5T Perennial Plants per m²
100
90
80
70
60
50
40
30
20
10
0
2011
BRIN

Landowner Buntrock
Date 9/28/2011
Photo
Soil Type BaB, BaC
Aspect S

Site Number 5
Transect Number 1
Transect Treated Area
or Control X
Direction of Transect from Starting Pt W
Tract Number 3085
Precip 18-20

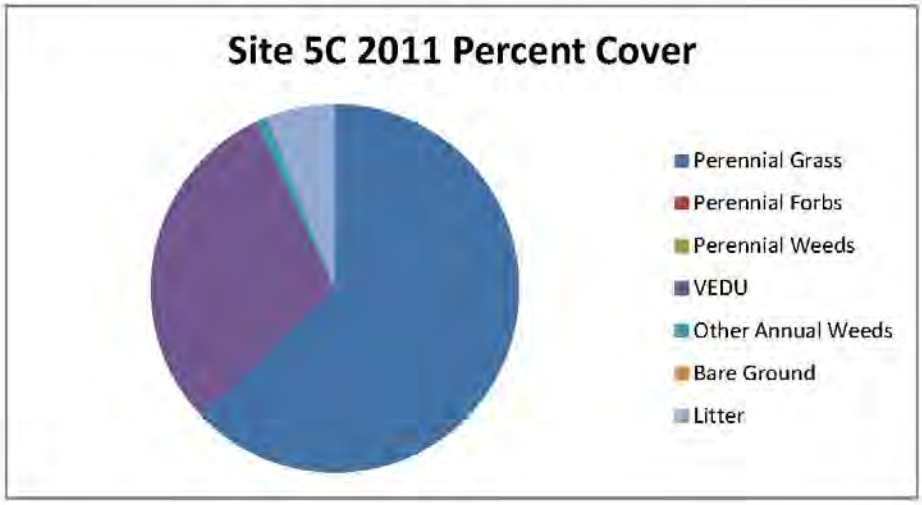
Seeded Species: smooth brome or meadow brome, hairy vetch

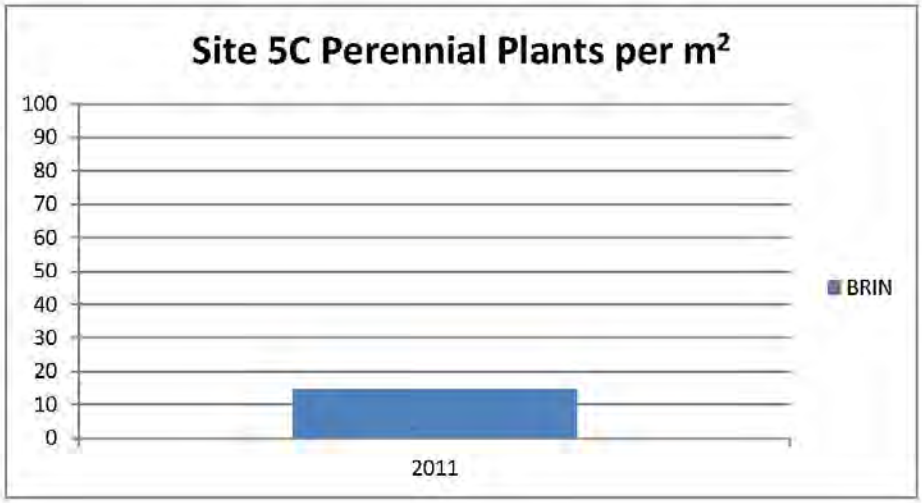
Perennial Weeds Present: st. johnswort, sulfur cinquefoil
buckhorn plantain, sorrel
Annual Weeds Present:

Planned Treatment: None, Control

| | PERCENT COVER | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Veg Type | Perennial Grass | Perennial Forbs | Perennial Weeds | VEDU | Other Annual Weeds | Bare Ground | Litter | VEDU Density |
| Plot 1 | 60 | 0 | 0 | 30 | 0 | 0 | 10 | 2 |
| Plot 2 | 40 | 0 | 0 | 60 | 0 | 0 | 0 | 3 |
| Plot 3 | 30 | 0 | 0 | 50 | 10 | 0 | 10 | 3 |
| Plot 4 | 50 | 0 | 0 | 40 | 0 | 0 | 10 | 3 |
| Plot 5 | 70 | 0 | 0 | 20 | 0 | 0 | 10 | 2 |
| Plot 6 | 60 | 0 | 0 | 40 | 0 | 0 | 0 | 3 |
| Plot 7 | 80 | 0 | 0 | 10 | 0 | 0 | 10 | 2 |
| Plot 8 | 80 | 0 | 0 | 20 | 0 | 0 | 0 | 2 |
| Plot 9 | 70 | 0 | 0 | 20 | 0 | 0 | 10 | 2 |
| Plot 10 | 90 | 0 | 0 | 10 | 0 | 0 | 0 | 1 |
| AVERAGE | 63 | 0 | 0 | 30 | 1 | 0 | 6 | 2 |

| | STEM COUNT OF DESIRABLE PERENNIAL SPECIES | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Species | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Plant Symb | BRIN | | | | | | | |
| Plot 1 | 9 | | | | | | | |
| Plot 2 | 23 | | | | | | | |
| Plot 3 | 14 | | | | | | | |
| Plot 4 | 10 | | | | | | | |
| Plot 5 | 4 | | | | | | | |
| Plot 6 | 4 | | | | | | | |
| Plot 7 | 0 | | | | | | | |
| Plot 8 | 8 | | | | | | | |
| Plot 9 | 4 | | | | | | | |
| Plot 10 | 2 | | | | | | | |
| AVE | 8 | | | | | | | |
| Plants/m2 | 15 | | | | | | | |
| % of Total | 100% | | | | | | | |


Site 5C 2011 Percent Cover
Perennial Grass
Perennial Forbs
Perennial Weeds
VEDU
Other Annual Weeds
Bare Ground
Litter


Site 5C Perennial Plants per m²
100
90
80
70
60
50
40
30
20
10
0
2011
BRIN

Landowner Jovan
Date 9/29/2011
Photo
Soil Type HnB, Wh
Aspect W

Site Number 6
Transect Number 1
Transect Treated Area X
or Control
Direction of Transect from Starting Pt NNE
Tract Number 9787
Precip 20-22

Seeded Species: THIN, AGFR?, SCPH? (small patches)

Perennial Weeds Present: toadflax, st. johnswort

Annual Weeds Present: borage, tarweed, bulbous bg, mustard, japanese/soft brome

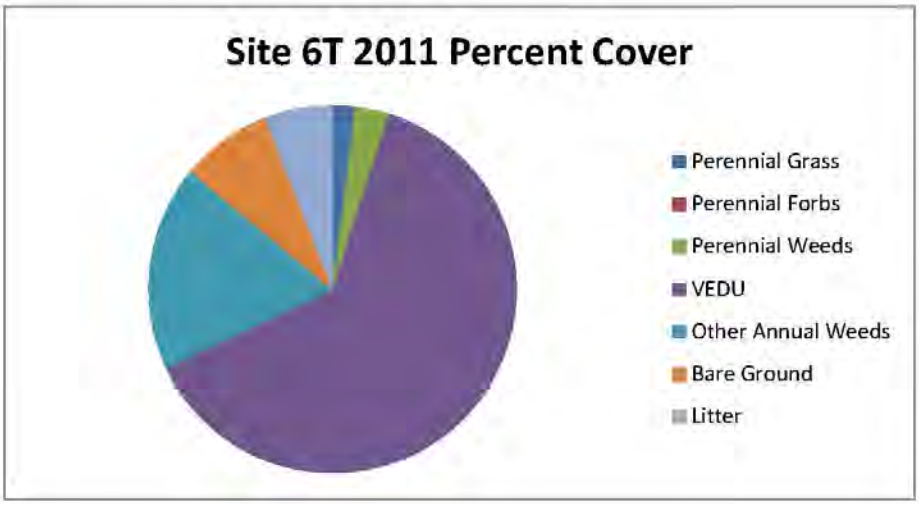
Planned Treatment: Reseed

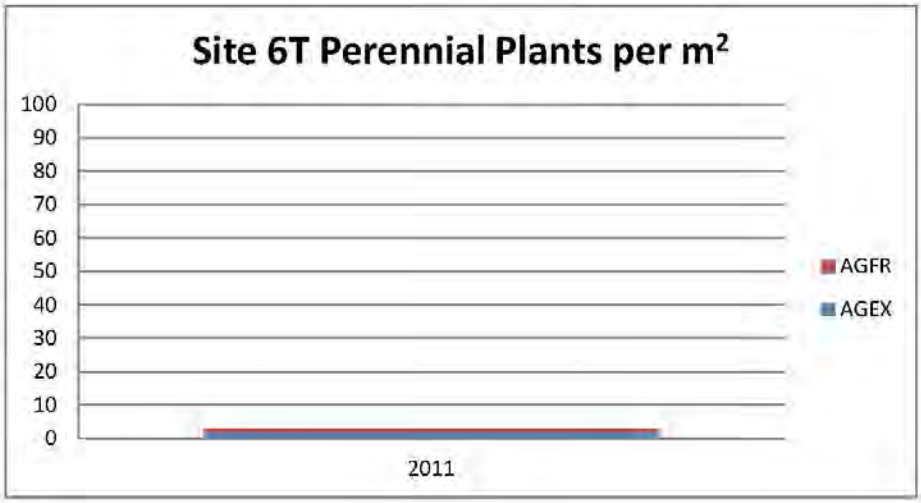
No Control because no similar area

| | PERCENT COVER | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Veg Type | Perennial Grass | Perennial Forbs | Perennial Weeds | VEDU | Other Annual Weeds | Bare Ground | Litter | VEDU Density |
| Plot 1 | 0 | 0 | 0 | 90 | 0 | 0 | 10 | 3 |
| Plot 2 | 0 | 0 | 10 | 50 | 20 | 20 | 0 | 2 |
| Plot 3 | 0 | 0 | 0 | 40 | 30 | 10 | 20 | 2 |
| Plot 4 | 0 | 0 | 0 | 90 | 10 | 0 | 0 | 4 |
| Plot 5 | 0 | 0 | 0 | 10 | 70 | 10 | 10 | 1 |
| Plot 6 | 0 | 0 | 10 | 80 | 10 | 0 | 0 | 3 |
| Plot 7 | 10 | 0 | 0 | 70 | 10 | 10 | 0 | 3 |
| Plot 8 | 0 | 0 | 0 | 80 | 0 | 10 | 10 | 4 |
| Plot 9 | 10 | 0 | 10 | 80 | 0 | 0 | 0 | 4 |
| Plot 10 | 0 | 0 | 0 | 40 | 30 | 20 | 10 | 2 |
| AVERAGE | 2 | 0 | 3 | 63 | 18 | 8 | 6 | 3 |

| | STEM COUNT OF DESIRABLE PERENNIAL SPECIES | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Species | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Plant Symb | AGEX | AGFR | | | | | | |
| Plot 1 | 0 | 0 | | | | | | |
| Plot 2 | 0 | 0 | | | | | | |
| Plot 3 | 0 | 0 | | | | | | |
| Plot 4 | 0 | 0 | | | | | | |
| Plot 5 | 0 | 0 | | | | | | |
| Plot 6 | 11 | 0 | | | | | | |
| Plot 7 | 0 | 0 | | | | | | |
| Plot 8 | 0 | 0 | | | | | | |
| Plot 9 | 0 | 3 | | | | | | |
| Plot 10 | 0 | 2 | | | | | | |
| AVE | 1 | 1 | | | | | | |
| Plants/m2 | 2 | 1 | | | | | | |
| % of Total | 69% | 31% | | | | | | |

AGEX = Agrostis exarata
AGFR = Agropyron fragile



Landowner Hill View Farms
Date 9/29/2011
Photo
Soil Type AaC, AaD
Aspect N > S

Site Number 7
Transect Treated Area X
Direction of Transect from Starting Pt NNE
Tract Number 1371
Precip 16-18

Transect Number 1
or Control

Seeded Species: THIN, THPO, FEOV, BRIN?

Perennial Weeds Present: none

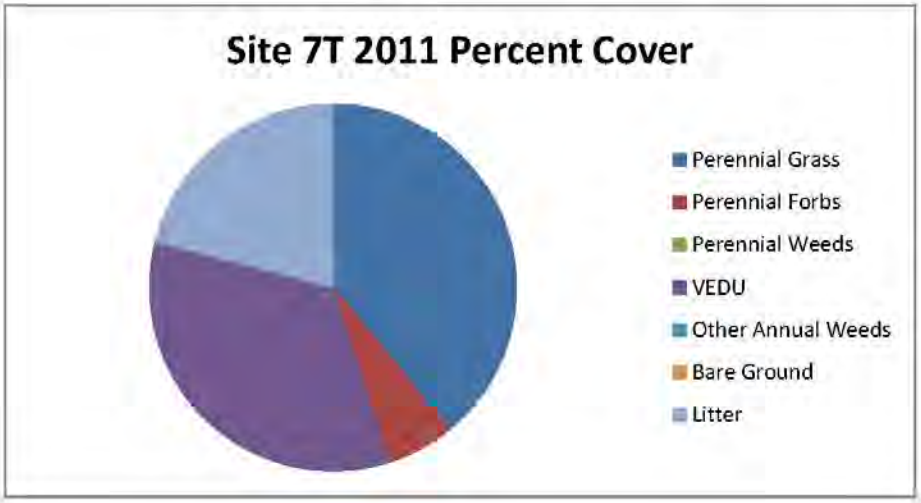
Annual Weeds Present:

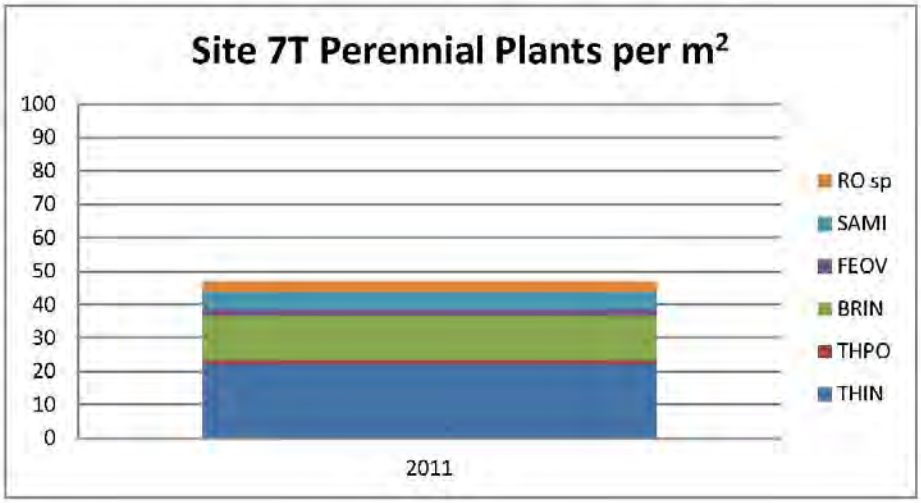
Planned Treatment: Reseed

| | PERCENT COVER | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Veg Type | Perennial Grass | Perennial Forbs | Perennial Weeds | VEDU | Other Annual Weeds | Bare Ground | Litter | VEDU Density |
| Plot 1 | 10 | 10 | 0 | 70 | 0 | 0 | 10 | 3 |
| Plot 2 | 10 | 10 | 0 | 60 | 0 | 0 | 20 | 3 |
| Plot 3 | 40 | 0 | 0 | 40 | 0 | 0 | 20 | 3 |
| Plot 4 | 40 | 10 | 0 | 40 | 0 | 0 | 10 | 3 |
| Plot 5 | 30 | 0 | 0 | 60 | 0 | 0 | 10 | 3 |
| Plot 6 | 50 | 0 | 0 | 40 | 0 | 0 | 10 | 2 |
| Plot 7 | 50 | 0 | 0 | 10 | 0 | 0 | 40 | 1 |
| Plot 8 | 70 | 0 | 0 | 10 | 0 | 0 | 20 | 1 |
| Plot 9 | 40 | 30 | 0 | 0 | 0 | 0 | 30 | 0 |
| Plot 10 | 50 | 0 | 0 | 10 | 0 | 0 | 40 | 1 |
| AVERAGE | 39 | 6 | 0 | 34 | 0 | 0 | 21 | 2 |

| | STEM COUNT OF DESIRABLE PERENNIAL SPECIES | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Species | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Plant Symb | THIN | THPO | BRIN | FEOV | SAMI | RO sp | | |
| Plot 1 | 14 | 0 | 0 | 0 | 7 | 0 | | |
| Plot 2 | 0 | 0 | 0 | 10 | 14 | 0 | | |
| Plot 3 | 21 | 0 | 0 | 0 | 2 | 0 | | |
| Plot 4 | 16 | 0 | 0 | 0 | 3 | 0 | | |
| Plot 5 | 17 | 0 | 0 | 0 | 2 | 0 | | |
| Plot 6 | 12 | 5 | 0 | 0 | 0 | 0 | | |
| Plot 7 | 21 | 0 | 1 | 0 | 0 | 0 | | |
| Plot 8 | 4 | 1 | 30 | 0 | 0 | 0 | | |
| Plot 9 | 1 | 1 | 26 | 0 | 0 | 16 | | |
| Plot 10 | 13 | 0 | 13 | 0 | 0 | 0 | | |
| AVE | 12 | 1 | 7 | 1 | 3 | 2 | | |
| Plants/m2 | 22 | 1 | 13 | 2 | 5 | 3 | | |
| % of Total | 49% | 3% | 29% | 4% | 11% | 7% | | |

SAMI = Sanguisorba minor
RO sp = native rose sp (nutkana or woodsii)



Landowner Hill View Farms
Date 9/29/2011
Photo
Soil Type AaC, AaD
Aspect N > S

Site Number 7
Transect Treated Area
Direction of Transect from Starting Pt NNE
Tract Number 1371
Precip 16-18

Transect Number 2
or Control X

Seeded Species: THIN, THPO, FEOV, BRIN?

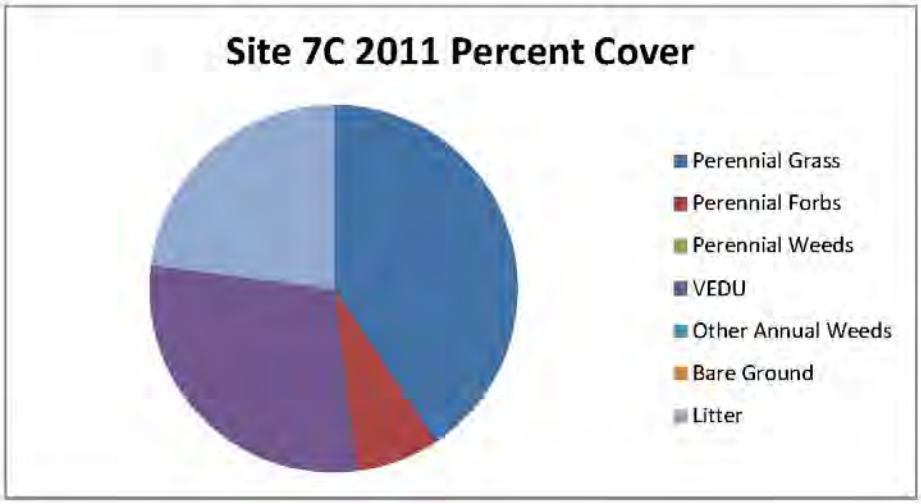
Perennial Weeds Present: none

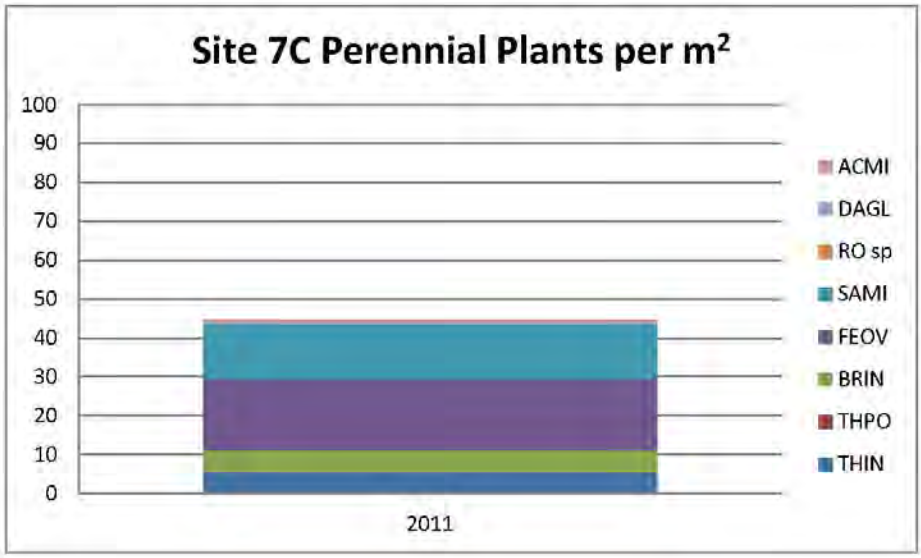
Annual Weeds Present:

Planned Treatment: None, Control

| | PERCENT COVER | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Veg Type | Perennial Grass | Perennial Forbs | Perennial Weeds | VEDU | Other Annual Weeds | Bare Ground | Litter | VEDU Density |
| Plot 1 | 30 | 10 | 0 | 40 | 0 | 0 | 20 | 2 |
| Plot 2 | 50 | 10 | 0 | 10 | 0 | 0 | 30 | 1 |
| Plot 3 | 40 | 10 | 0 | 30 | 0 | 0 | 20 | 2 |
| Plot 4 | 40 | 10 | 0 | 20 | 0 | 0 | 30 | 2 |
| Plot 5 | 50 | 10 | 0 | 20 | 0 | 0 | 20 | 2 |
| Plot 6 | 50 | 10 | 0 | 30 | 0 | 0 | 10 | 2 |
| Plot 7 | 40 | 0 | 0 | 40 | 0 | 0 | 20 | 2 |
| Plot 8 | 50 | 0 | 0 | 10 | 0 | 0 | 40 | 1 |
| Plot 9 | 20 | 0 | 0 | 70 | 0 | 0 | 10 | 4 |
| Plot 10 | 20 | 10 | 0 | 10 | 0 | 0 | 20 | 1 |
| AVERAGE | 39 | 7 | 0 | 28 | 0 | 0 | 22 | 2 |

| | STEM COUNT OF DESIRABLE PERENNIAL SPECIES | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Species | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Plant Symb | THIN | THPO | BRIN | FEOV | SAMI | RO sp | DAGL | ACMI |
| Plot 1 | 1 | 0 | 0 | 9 | 3 | 0 | 0 | 0 |
| Plot 2 | 0 | 0 | 0 | 18 | 6 | 0 | 0 | 0 |
| Plot 3 | 0 | 0 | 1 | 15 | 7 | 0 | 0 | 0 |
| Plot 4 | 0 | 0 | 22 | 17 | 10 | 0 | 0 | 0 |
| Plot 5 | 10 | 0 | 7 | 4 | 8 | 0 | 2 | 0 |
| Plot 6 | 0 | 0 | 0 | 13 | 11 | 0 | 0 | 3 |
| Plot 7 | 10 | 0 | 0 | 1 | 13 | 0 | 0 | 0 |
| Plot 8 | 0 | 0 | 0 | 13 | 7 | 0 | 0 | 0 |
| Plot 9 | 8 | 0 | 0 | 1 | 3 | 0 | 0 | 0 |
| Plot 10 | 0 | 0 | 0 | 7 | 8 | 0 | 0 | 0 |
| AVE | 3 | 0 | 3 | 10 | 8 | 0 | 0 | 0 |
| Plants/m2 | 5 | 0 | 6 | 18 | 14 | 0 | 0 | 1 |
| % of Total | 12% | 0% | 13% | 42% | 32% | 0% | 1% | 1% |


Site 7C 2011 Percent Cover
Perennial Grass
Perennial Forbs
Perennial Weeds
VEDU
Other Annual Weeds
Bare Ground
Litter


Site 7C Perennial Plants per m²
100
90
80
70
60
50
40
30
20
10
0
2011
ACMI
DAGL
RO sp
SAMI
FEOV
BRIN
THPO
THIN

Landowner Petropoulus
Date 10/3/2011
Photo
Soil Type AaC, AlD,LmC3
Aspect W

Site Number 8
Transect Number 2
Transect Treated Area X or Control
Direction of Transect from Starting Pt E
Tract Number 12086
Precip 16-18

Seeded Species: THPO

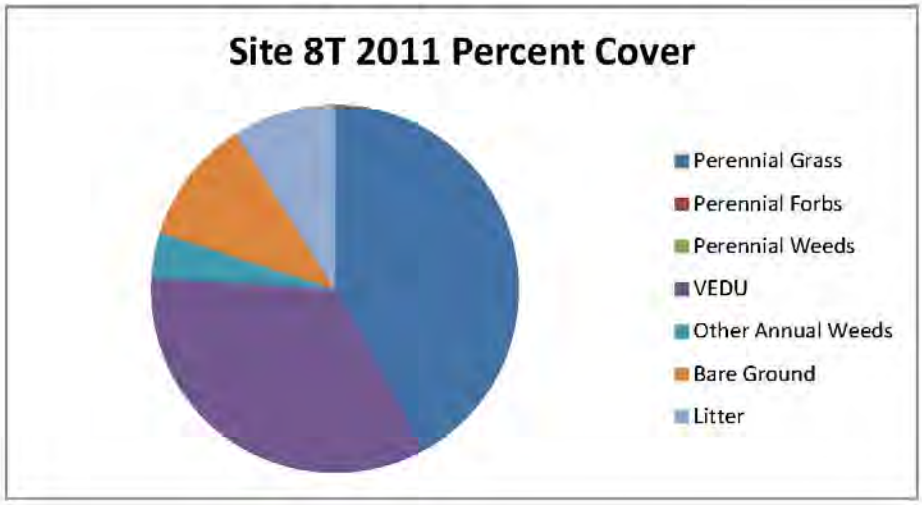
Perennial Weeds Present: mullein, sheep sorrel, damation toadflax

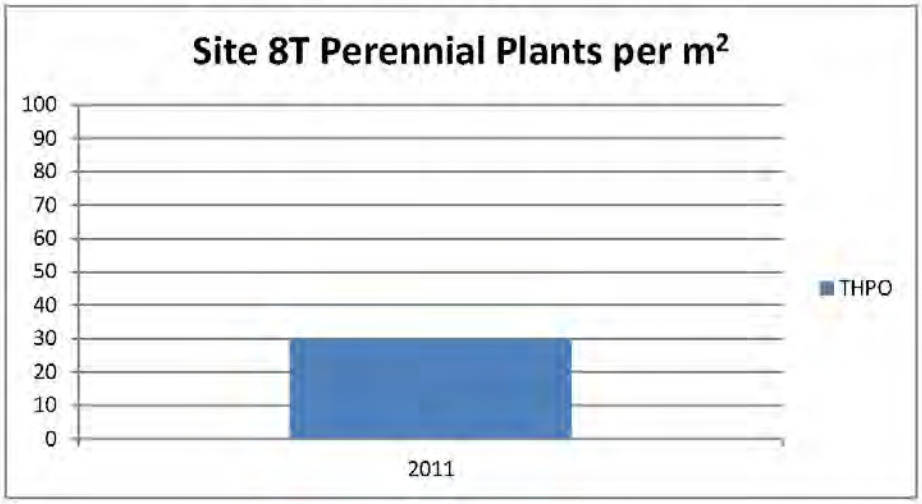
Annual Weeds Present:

Planned Treatment: Herbicide

| | PERCENT COVER | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Veg Type | Perennial Grass | Perennial Forbs | Perennial Weeds | VEDU | Other Annual Weeds | Bare Ground | Litter | VEDU Density |
| Plot 1 | 20 | 0 | 0 | 60 | 10 | 10 | 0 | 3 |
| Plot 2 | 20 | 0 | 0 | 30 | 20 | 20 | 10 | 3 |
| Plot 3 | 30 | 0 | 0 | 60 | 0 | 0 | 10 | 3 |
| Plot 4 | 50 | 0 | 0 | 40 | 0 | 0 | 10 | 3 |
| Plot 5 | 20 | 0 | 0 | 50 | 10 | 10 | 10 | 3 |
| Plot 6 | 50 | 0 | 0 | 40 | 0 | 10 | 0 | 3 |
| Plot 7 | 60 | 0 | 0 | 30 | 0 | 10 | 0 | 3 |
| Plot 8 | 70 | 0 | 0 | 0 | 0 | 20 | 10 | 1 |
| Plot 9 | 50 | 0 | 0 | 30 | 0 | 10 | 10 | 2 |
| Plot 10 | 50 | 0 | 0 | 0 | 0 | 20 | 30 | 1 |
| AVERAGE | 42 | 0 | 0 | 34 | 4 | 11 | 9 | 3 |

| | STEM COUNT OF DESIRABLE PERENNIAL SPECIES | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Species | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Plant Symb | THPO | | | | | | | |
| Plot 1 | 9 | | | | | | | |
| Plot 2 | 9 | | | | | | | |
| Plot 3 | 11 | | | | | | | |
| Plot 4 | 18 | | | | | | | |
| Plot 5 | 17 | | | | | | | |
| Plot 6 | 15 | | | | | | | |
| Plot 7 | 22 | | | | | | | |
| Plot 8 | 22 | | | | | | | |
| Plot 9 | 15 | | | | | | | |
| Plot 10 | 19 | | | | | | | |
| AVE | 16 | | | | | | | |
| Plants/m2 | 29 | | | | | | | |
| % of Total | 100% | | | | | | | |


Site 8T 2011 Percent Cover
Perennial Grass
Perennial Forbs
Perennial Weeds
VEDU
Other Annual Weeds
Bare Ground
Litter


Site 8T Perennial Plants per m²
100
90
80
70
60
50
40
30
20
10
0
2011
THPO

Landowner Petropoulus
Date 10/3/2011
Photo
Soil Type AaC, AlD,LmC3
Aspect W

Site Number 8
Transect Number 1
Transect Treated Area
or Control X
Direction of Transect from Starting Pt E
Tract Number 12086
Precip 16-18

Seeded Species: THPO

Perennial Weeds Present: mullein, sheep sorrel, damation toadflax

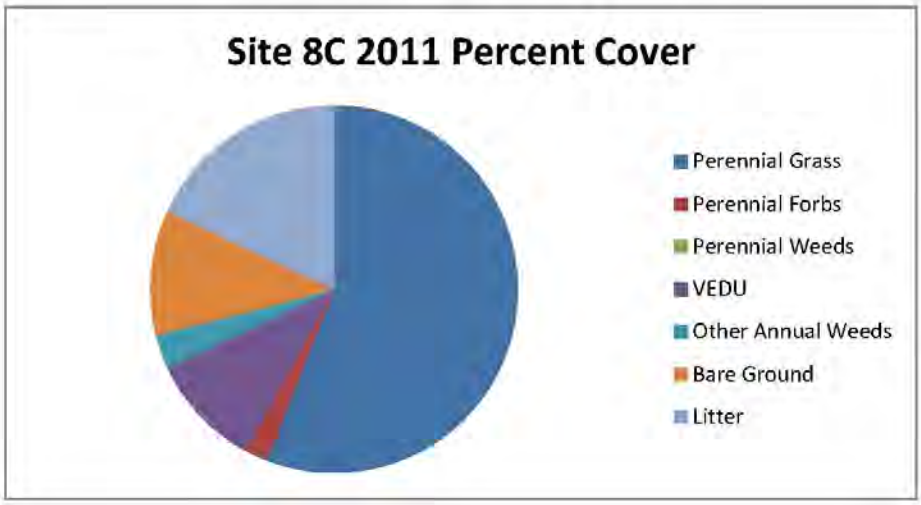
Annual Weeds Present:

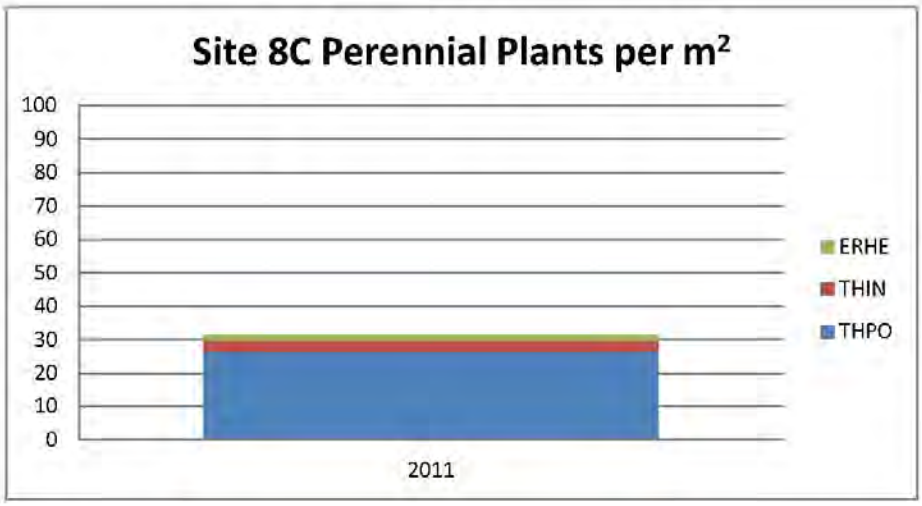
Planned Treatment: None, Control

| | PERCENT COVER | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Veg Type | Perennial Grass | Perennial Forbs | Perennial Weeds | VEDU | Other Annual Weeds | Bare Ground | Litter | VEDU Density |
| Plot 1 | 50 | 0 | 0 | 30 | 0 | 10 | 10 | 2 |
| Plot 2 | 60 | 0 | 0 | 20 | 0 | 10 | 10 | 2 |
| Plot 3 | 50 | 0 | 0 | 10 | 0 | 0 | 40 | 1 |
| Plot 4 | 50 | 0 | 0 | 10 | 10 | 10 | 20 | 1 |
| Plot 5 | 40 | 20 | 0 | 30 | 0 | 0 | 10 | 2 |
| Plot 6 | 60 | 0 | 0 | 0 | 10 | 0 | 30 | 1 |
| Plot 7 | 70 | 0 | 0 | 0 | 0 | 20 | 10 | 1 |
| Plot 8 | 70 | 0 | 0 | 0 | 0 | 10 | 20 | 1 |
| Plot 9 | 50 | 0 | 0 | 0 | 10 | 30 | 10 | 0 |
| Plot 10 | 60 | 0 | 0 | 0 | 0 | 20 | 20 | 1 |
| AVERAGE | 56 | 2 | 0 | 10 | 3 | 11 | 18 | 1 |

| | STEM COUNT OF DESIRABLE PERENNIAL SPECIES | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Species | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Plant Symb | THPO | THIN | ERHE | | | | | |
| Plot 1 | 15 | 0 | 0 | | | | | |
| Plot 2 | 4 | 9 | 0 | | | | | |
| Plot 3 | 10 | 5 | 0 | | | | | |
| Plot 4 | 10 | 4 | 0 | | | | | |
| Plot 5 | 15 | 0 | 8 | | | | | |
| Plot 6 | 15 | 0 | 0 | | | | | |
| Plot 7 | 20 | 0 | 0 | | | | | |
| Plot 8 | 18 | 0 | 0 | | | | | |
| Plot 9 | 17 | 0 | 0 | | | | | |
| Plot 10 | 17 | 0 | 0 | | | | | |
| AVE | 14 | 2 | 1 | | | | | |
| Plants/m2 | 26 | 3 | 2 | | | | | |
| % of Total | 84% | 11% | 5% | | | | | |

ERHE = Eriogonum heracleoides



**Title** Invasive Species: Ventenata Seed Longevity

**Study Number** WAPMC-T-1117-IN

## Effect of Litter on Ventenata Demography

## 2011 Field Study

**By John Wallace, Graduate Research Assistant, University of Idaho**

**Justification.** Plant litter influences plant community dynamics through multiple direct and indirect processes including: shading, soil evaporation, temperature, decomposition rates, microbial activity, nutrient cycling, germination and seedling establishment. Studies have shown that plant litter can result in either positive or negative effects on plant establishment, growth and persistence. Multiple studies have demonstrated the importance of litter dynamics in the establishment and persistence of exotic annual grasses. Ventenata is a winter annual grass that forms thick monospecific stands, generating high litter layers. A preliminary study suggests that ventenata litter is high in silica content, which may lead to slower decomposition rates in comparison to perennial grass stands. Other studies have demonstrated that ventenata allocates a greater percentage of assimilated nitrogen to leaves in comparison to roots. These studies suggest that ventenata litter may alter nitrogen cycling in time and space at invaded sites. Further investigation of ventenata litter effects would have important implications for identifying mechanisms for invasion and potential management techniques. Study objectives are as follows.

### I. VEDU Litter Effects on VEDU demography

*Objective I.* Determine the effects of litter on ventenata demography including transitions from seedling emergence and establishment to overwintering juveniles and from juveniles to flowering adults.

*Objective II.* Quantify the effect of litter on the primary environmental properties critical for ventenata recruitment including soil moisture, soil temperature and shading.

*Objective III.* Monitor decomposition rates and C:N ratios of varying levels of ventenata litter through the growing season.

*Methods.* A garden study will be established at a University of Idaho research station in the fall of 2011. Ventenata seed will be collected from a known CRP infestation within 5 km of the research station. Ventenata seed and litter was collected along field margins of timothy-hay and CRP land in Harvard ID in September. Litter layers will be sampled and weighed (fresh weight) to determine the range of litter found in ventenata infested perennial grass stands. Foliar cover

(%), litter depth (cm) and biomass yields (g) were collected in a random sample of 40 plots (400 $cm^2$). Linear regression was performed to estimate litter treatments (g) that correlated to 33, 66 and 100% ventenata cover. Litter treatments were 0, 5, 10 and 20 grams per pot. Ventenata litter will be harvested at the site, transported to the research station, and weighed to the treatment target weight. Litter weights will be determined by randomly sampling litter depths within-field and then sampling a 5-cm dia core. Litter will be removed from the core and weighed (fresh weight). Linear regressions will be performed to determine the correlation between depth and weight and the 33%, 66% and 100% quantiles of litter depth will be chosen. The corresponding weight will be scaled to 10 in dia pots.

A randomized complete block design will be used to implement treatments. There will be four litter-depth treatments and eight harvest dates. There will be four replicates per litter treatment per harvest date for a total of 128 experimental units. An experimental unit will be a 10 in diameter by 10 in deep pot.

Field soil will be collected at the research station and sifted to achieve uniform texture and to remove plant debris. Pots will be placed at soil level and field soil will be filled to within ½ in of the surface. Forty ventenata seeds will be sown randomly into pots on Sept 15. Litter treatments will be added immediately after planting. Seed was sown in pots and litter treatments established on October 6, 2011. Soil moisture probes were also established on this date. Harvest dates will approximate seven phenological transition periods of ventenata (Oct 15, Nov 15, Dec 15, Mar 15, Apr 15, May 15, Jun 15). These dates approximate germination and seedling emergence, seedling establishment, juvenile growth, and adult flowering. Seedling emergence is defined as the coleoptiles or cotyledon appearing above the soil surface. One harvest treatment will be preserved for monitoring to schedule harvest dates. Seedling establishment is defined as a seedling possessing a fully expanded leaf. Juvenile survival will be monitored by recording density of seedlings in early winter dormancy (Dec 15) and later winter dormancy (Mar 15). Juvenile growth and adult flowering will be monitored from (Apr 15 to Jun 15). At harvest dates, pots will be removed and inspected in the laboratory for ventenata density and phenological stage will be recorded. Remaining litter will be dried and weighed to estimate decomposition rates. At harvest dates starting at Mar 15, ventenata plants will be harvested for above- and below-ground biomass to estimate root:shoot biomass ratios.

In addition to phenological response variables, litter treatment effects will be tested on environmental response variables. A subset of experimental units per litter treatment will be monitored for soil moisture and soil surface temperature using Decagon devices. Precipitation and ambient air temperature will be obtained from the Plant Science Research Farm weather station. Pending resources, illuminance just below the litter layer will be measured with a lux meter.

Pending resource availability, a sub-sample of experimental units per litter treatment at each harvest will be analyzed for plant available nitrogen (PAN) in upper soil profile and ventenata litter will be analyzed to determine C:N ratios.

The study will be terminated prior to seed set and replicated in the 2013 growing season.

**II. VEDU Litter Effects on PSSP establishment**

*Objective I.* Determine the effects of ventenata litter on establishment of bluebunch wheatgrass

*Methods.* Within the above study, an additional bluebunch wheatgrass planting will be added. A single bluebunch wheatgrass will be transplanted into pots from the greenhouse and 10 seeds will be sown into pots. Four litter-depth treatments (see above) will be implemented with a no litter control and an strawnet mulch only control. Plants will be monitored similarly throughout the season but no harvest treatments will be implemented, yielding 20 experimental units (1 PSSP planting x 5 litter treatments x 4 replications). Density and biomass data will be collected at the conclusion of the study.

**Resources.** Taylor Ortiz (undergraduate) and John Wallace will be the principal investigators of this project with possible assistance from undergraduate interns in Range Ecology and Management and a graduate research assistant. Travel and equipment costs will be minimal. Additional costs may include analysis of plant or soil samples at the UI Soil Analysis Laboratory.

**Summary (Fall 2011).** Ventenata germination was observed 21 d after seeding (Oct 27) across all litter treatments. Three harvests were conducted in the fall of 2011 (Oct 27, Nov 11, Dec 08). Pots were brought back to the laboratory and ventenata seedling density was measured per pot. In addition, 10 random plants were measured per pot to compute an average height of new seedlings. Preliminary analysis indicates a significant litter treatment by harvest date interaction ($P < 0.001$; Figure 1). At the first harvest date, 100% ventenata germination (density equal to 100) was observed in the 10 and 20 g litter treatments, which were greater than the 5 g litter treatment and the untreated control. The 5 g litter treatment resulted in 90% germination, compared to 36% germination in the untreated control. Trends suggest that seedling density declined from the first harvest date to the third harvest date (Dec 08) in the untreated control and the 5 g litter treatment. Litter treatments also significantly affected ($P < 0.001$) the mean height of ventenata seedling through the fall growing season (Figure 2). Seedling height was greater in the 10 and 20 g litter treatments compared to the 5 g litter treatment and the untreated control approximately six weeks after seeding (3$^{rd}$ harvest date). These preliminary results suggest that

ventenata litter exceeding 50% cover may increase fitness of ventenata at the critical phenological stage of germination and fall growth.

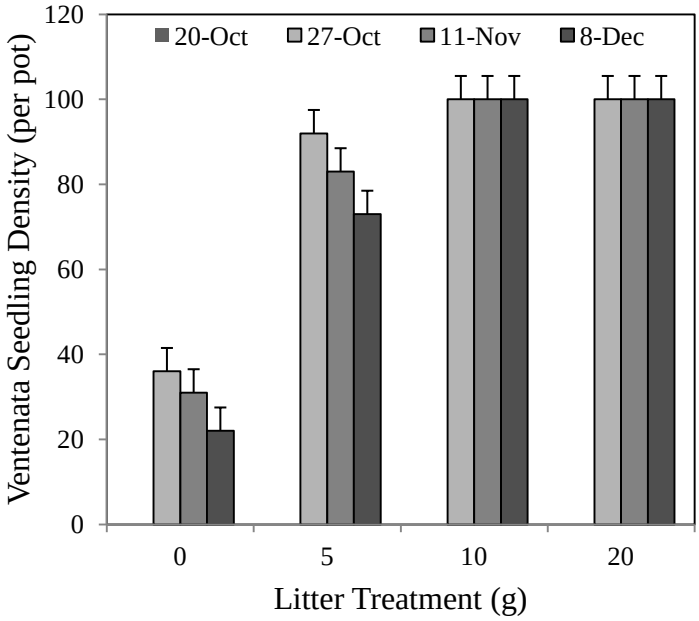



*Figure 1.* Effect of ventenata litter on germination and seedling survival at four harvest dates in a garden study near Pullman WA.

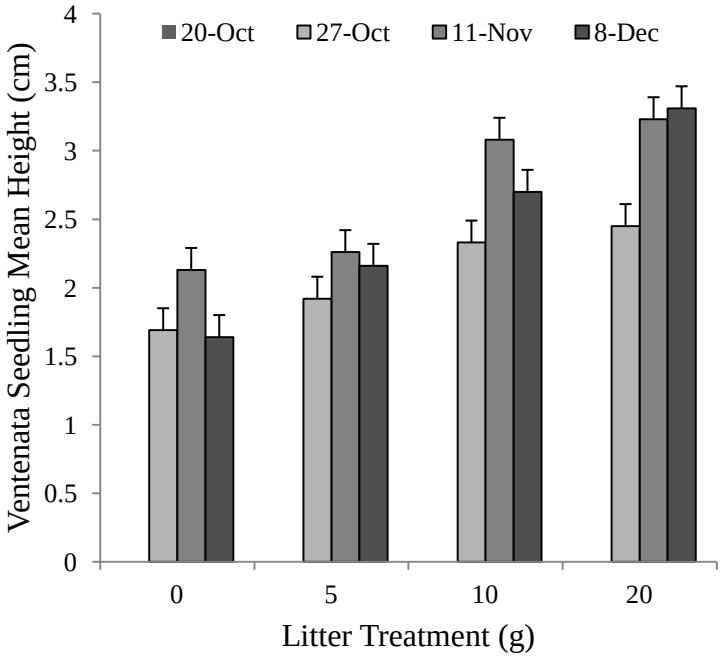



*Figure 2.* Effect of ventenata litter on growth of germinated ventenata seedlings at four harvest dates in a garden study near Pullman WA.

**UNITED STATES DEPARTMENT OF AGRICULTURE**
**NATURAL RESOURCES CONSERVATION SERVICE**

| | |
|---|---|
| **Title** | Pollinator Habitat: Initial evaluation to improve upland diversity and beneficial insect habitat in the Columbia River Basin |
| **Study Number** | WAPMC-T-0901-WL |
| **Study Leader** | Pamela Pavek, WAPMC Agronomist |
| **Duration** | 2008 - 2018 |
| **Description** | Seeds will be collected from forbs in the Columbia Basin, propagated at the Pullman PMC, transplanted to the Othello, WA research station (9" precipitation) and evaluated for vigor, survival and desirable seed production characteristics. Top performing plants will be increased, and seed will be placed into advanced trials to determine methods of establishing forbs into CRP and other natural areas. |
| **Status of Knowledge** | Within the last several years there has been a great deal of attention focused on improving wildlife values of CRP land and on improving pollinator habitat in agricultural areas. Both of these objectives can be achieved by planting forbs. In the Columbia River Basin, there is no seed commercially available for several desirable forb species. Propagation protocols have already been developed for many of the species or species of the same genus, but protocols have not been developed for stand establishment. |
| **Materials and methods** | Species selected for evaluation include:<br><br>*Anaphalis* sp.<br>*Eriogonum niveum*<br>*Eriogonum thymoides*<br>*Gaillardia aristata*<br>*Lomatium dissectum*<br>*Mentzelia laevicaulis*<br>*Penstemon pruinosus*<br>*Salvia dorrii*<br>*Sphaeralcea munroana*<br><br>Seeds of *E. thymoides, G. aristata, P. pruinosus* and *S. munroana* were collected from Dry Moses Coulee on 8/26/08. Seeds of *E. niveum, E. thymoides, G. aristata, L. dissectum* and *S. munroana* were ordered from GRIN on 9/9/08. More seeds will be collected from Dry Moses Coulee in subsequent years. |

Seeds were propagated at the Pullman PMC. They were planted into 10 cu. in. Ray Leach Super cell conetainers filled with Sunshine #4 mix and covered with pea gravel. The containers were watered frequently and kept outside for 90 days to stratify. They were moved into a greenhouse in January and to a cold frame in April. In May the plants were transplanted to field at Othello. The plants have been evaluated for survivability, time and length of flowering, and number of flowers produced. Plants with desirable characteristics have been increased and used in advanced trials.

5/14/09 The following plants were planted:

162 GAAR HC
91 GAAR W6 30198
42 SADO BLM 87
12 SPMU W6 32635
5 SPMU PI 564589
140 SPMU HC
230 PEPR BLM 85
111 ERTH HC

5/21/09 The remainder of the plants were planted:

60 ERTH HC
10 ERNI W6 27040
65 ERNI PI 537595

Holes were drilled using a power auger. Plants were watered same afternoon for period of 3 hours with hand line irrigation.

4/13/10 Planted additional plants:

60 AN__ HC
335 MELA HC
272 PEPR HC
305 SADO HC
172 SPMU2 HC

**Othello plot in June 2010 with Bio Aid Luke Nofsinger**

NORTH -->
1' plant spacing
88'
80'
25 ERNI PI 537595
28 ERNI PI 537595
HC + 10 ERNI W6 27040 + 12 ERNI P
28 ERSP HC
41 AN
60 MELA HC + 18 AN
28 ERSP HC
49 MELA HC
80 MELA HC
74 ERSP HC + 5 ERTH W6 27239
80 MELA HC
47 PEPR BLM85 + 32 ERSP HC
28 PEPR HC + 52 MELA HC
80 PEPR BLM85
80 PEPR HC
80 PEPR BLM85
80 PEPR HC
59 SPMU HC + 21 PEPR BLM85
80 PEPR HC
81 SPMU HC
80 SPMU2 HC
W6 30198 + 42 SADO BLM87 + 12 SPMU W6 32635 + 5 SPMU PI 564589
10 SADO HC + 70 SPMU2 HC
81 GAAR W6 30198
80 SADO HC
81 GAAR HC
80 SADO HC
81 GAAR HC
80 SADO HC
4' grass border
|----------102'----------|
|---------- 110' ----------|
ROAD

**2009 and 2010 Results**

The earliest and longest blooming species in this study include blanketflower, Munro's globemallow and purple sage. The latest blooming plants are round-headed buckwheat and snow buckwheat, however snow buckwheat had significantly more pollinator visits. Throughout the season insects were collected and have been identified by an ARS entomologist. Seed was also collected from the plot an used to evaluate seeding methods.

**Bumble bee visiting a blazing star flower**

**A white-lined sphinx moth (*Hyles lineata*) extracting nectar from a purple sage flower (*Salvia dorrii*).**

| **Insects Collected at the Othello Experiment Station Pollinator Plot** | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| **Species** | **Family** | **Location** | **Date** | **Host Plant** | **Specimen #** | **Common name** | |
| *Agapostemon texanus* Cresson (female) | Halictidae | Othello | 8/11/2010 | | 17 | sweat bee | solitary,ground-nesting bee |
| *Apis mellifera* L. (worker) | Apidae | Othello | 9/15/2010 | Eriogonum niveum | 3 | honeybee | highly social |
| *Apis mellifera* L. (worker) | Apidae | Othello | 8/11/2010 | | 26 | honeybee | highly social |
| *Bombus centralis* Cresson (female) | Apidae | Othello | 8/11/2010 | | 15 | bumblebee | ground-nesting, social bee |
| *Bombus griseocollis* (DeGeer) (female) | Apidae | Othello | 8/11/2010 | | 16 | bumblebee | ground-nesting, social bee |
| *Bombus griseocollis* (DeGeer) (male) | Apidae | Othello | 9/15/2010 | Eriogonum niveum | 43 | bumblebee | ground-nesting, social bee |
| *Cerceris* sp. | Sphecidae, Philanthinae | Othello | 9/15/2010 | Eriogonum niveum | 8 | sphecid wasp | solitary, ground-nesting wasp |
| *Cerceris* sp. | Sphecidae, Philanthinae | Othello | 9/15/2010 | Eriogonum niveum | 49 | sphecid wasp | solitary, ground-nesting wasp |
| *Colletes simulans nevadensis* Swenk (male) | Colletidae | Othello | 9/15/2010 | Eriogonum niveum | 2 | Plasterer bee | solitary, ground-nesting bee |
| *Diadasia diminuta* (Cresson) (male) | Apidae | Othello | 8/11/2010 | | 20 | digger bee | solitary, ground-nesting bee |
| *Halictus ligatus* Say (female) | Halictidae | Othello | 8/11/2010 | | 31 | sweat bee | social, ground-nesting bee |
| *Hyles lineata* (Fabricius) | Sphingidae | Othello | 8/11/2010 | | 51 | white-lined sphinx moth | |
| *Lasioglossum (Dialictus)* sp. (female) | Halictidae | Othello | 8/11/2010 | | 18 | sweat bee | ground-nesting bee |
| *Melissodes (Eumelissodes) semilupina* Cockerell? (male) | Apidae | Othello | 9/15/2010 | Eriogonum niveum | 10 | digger bee | solitary, ground-nesting bee |
| *Melissodes (Eumelissodes)* sp. (male) | Apidae | Othello | 8/11/2010 | | 14 | digger bee | solitary, ground-nesting bee |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| *Melissodes (Eumelissodes) semilupina* Cockerell? (male) | Apidae | Othello | 9/15/2010 | Eriogonum niveum | 10 | digger bee | solitary, ground-nesting bee |
| *Melissodes (Eumelissodes)* sp. (male) | Apidae | Othello | 8/11/2010 | | 14 | digger bee | solitary, ground-nesting bee |
| *Melissodes (Eumelissodes)* sp. (male) | Apidae | Othello | 8/11/2010 | | 21 | digger bee | solitary, ground-nesting bee |
| *Nomada* sp. (female) | Apidae | Othello | 9/15/2010 | Eriogonum niveum | 1 | parasitic bee | probable host is a solitary, ground-nesting bee in the genus *Andrena* |
| *Polistes dominula* (Christ) | Vespidae, Polistinae | Othello | 9/15/2010 | Eriogonum niveum | 4 | paper wasp | social, aerial-nesting wasp; determined by Pete Landolt |
| *Polistes dominula* (Christ) | Vespidae, Polistinae | Othello | 9/15/2010 | Eriogonum niveum | 5 | paper wasp | social, aerial-nesting wasp; determined by Pete Landolt |
| Small moth | Pyralidae | Othello | 9/15/2010 | Eriogonum niveum | 12 | | determined by Pete Landolt |
| Unidentified small fly (Diptera) | | Othello | 9/15/2010 | Eriogonum niveum | 11 | | |
| | Sphecidae, Sphecinae | Othello | 9/15/2010 | Eriogonum niveum | 9 | sphecid wasp | solitary, ground-nesting wasp |
| | Vespidae, Eumeninae | Othello | 9/15/2010 | Eriogonum niveum | 7 | mason wasp | solitary wasp |
| | Chrysididae | Othello | 9/15/2010 | Eriogonum niveum | 6 | cuckoo wasp | parasite of solitary bee or wasp |
| | Chrysididae | Othello | 9/15/2010 | Eriogonum niveum | 13 | cuckoo wasp | parasite of solitary bee or wasp |
| | Calliphoridae | Othello | 9/15/2010 | Eriogonum niveum | 30 | blow fly | |
| | Braconidae | Othello | 8/11/2010 | | 41 | parasitoid wasp | |

October 6, 2010. Mark, Dallas and I cut down the plot with hedge trimmers and hauled away plant debris. We decided to retro fit the 6' cultivator and use that next week to eliminate the weed seedlings.

October 14, 2010. Cultivated with a Glencoe Cultivator in between rows, hoed within rows, and sprayed 1.2 qt/ac Prowl 3.3 EC Herbicide (total 5 oz. product, 415 oz. water, 1.2 % solution) with Solo single nozzle backpack sprayer. This is minimum rate. Max rate is 4.8 qt/ac. May reappy in March. Asked John to irrigate for 1 hour to incorporate.

**2012 Update**

June 3, 2011. Prowl seems to have been very effective; very few weeds present. PEPR in full bloom, buzzing with honey bees and other bees of various sizes. GAAR, SPMU and SADO beginning to bloom.

June 16, 2011. Removed all pipe and stopped irrigating. PEPR senescing. GAAR, SPMU and SADO in full bloom. Not many bees present; cold and windy day.

July 15, 2011. PEPR done, needs to be harvested soon. GAAR, SPMU almost done. MELA (reseeded from last year) starting to bloom). SADO and ERSP in full bloom. Significantly less weeds than last year due to Prowl and less water.

August 15, 2011. Harvested PEPR, SADO and SPMU. GAAR ready to harvest but we don't need the seed. MELA just past bloom, seed will be ready to harvest in two weeks? ERSP still in bloom and ERNI beginning to bloom.

October 17, 2011. Harvested MELA seed and removed all plant material from plot. Sprayed 1.2 qt/ac Prowl 3.3 EC Herbicide (total 5 oz. product, 415 oz. water, 1.2 % solution) with Solo single nozzle backpack sprayer, and then cultivated with Gencoe cultivator. Smoothed out ridges created by cultivator with hoes.

**UNITED STATES DEPARTMENT OF AGRICULTURE**
**NATURAL RESOURCES CONSERVATION SERVICE**

**Title** Pollinator Habitat: Assessing native species for pollinator habitat planted with a drill and irrigated during the first year of establishment in the 6 to 9 inch precipitation zone.

**Study Number** WAPMC-T-1101-WL

**Study Leader** Pamela Pavek, WAPMC Agronomist

**Duration** 2011 - 2015

**Description** A 0.2 ac field at the Othello experiment station will be seeded to nine species of forbs and one species of grass in spring 2011 to evaluate establishment and persistence of native plant species recommended in Biology Technical Note 24.

**Status of Knowledge** There is a significant interest in planting forbs for pollinator habitat and upland diversity in CRP, field borders, pivot corners and other marginal land, however knowledge about forb establishment is extremely limited. For many species, information about basic germination and seeding requirements is either minimal or non-existent. This lack of knowledge causes difficulty and an uncomfortable level of uncertainty in the development of planting protocols. Developers of such protocols have used information learned from previous plantings and experiments conducted with grass species, such as in CRP. However whether these protocols can also be used to successfully establish stands with high proportion of forbs (>25% forbs) remains to be seen.

**Materials and methods** The seeded area is a 0.2 acre field north of the existing pollinator plot at the WSU Othello Experiment Station. The field has silt-loam soil and no slope or aspect. The field was previously planted with alfalfa, and was roto-vated twice in the fall 2010.

Immediately prior to planting, the field was disked and roller-packed. The drill used for seeding was a 10' John Deere with disks spaced at 6". Tubes were pulled on the drill.

Species seeded include:

| | |
|---|---|
| *Achillea millefolium* | western yarrow |
| *Gaillardia aristata* | blanketflower |
| *Sphaeralcea munroana* | Munro's globemallow |
| *Linum lewisii* | Lewis' flax |
| *Penstemon pruinosis* | Chelan penstemon |
| *Mentzelia laevicaulis* | blazingstar |

| | |
|---|---|
| *Salvia dorrii* | purple sage |
| *Machaeranthera canescens* | hoary tansyaster |
| *Ericameria nauseosa* | rubber rabbitbrush |
| *Poa secunda* | Sandberg's bluegrass |

February 10, 2011 the plot was seeded with:

## Seeding Calculator Ordering Information

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Land Owner | Othello | Soils | silt loam | Date | 11/19/10 | Acres | 0.15 |
| Conservationist | P. Pavek | Precipitation Zone | 8 | inches | | Program | |
| Tract & Field | | Seeding Method | drill | | | | |

### Forbs & Shrubs

| - | | | | Ordering Information | | | |
|---|---|---|---|---|---|---|---|
| | Bloom Time | Scientific Name | Common Name | Seeds per lb | Seeding Rate (PLS lbs/ac) | Seeds per sq ft (PLS) | PLS lbs needed |
| 1 | s & s | Achillea millefolium | yarrow | 2,500,000 | 0.10 | 5.7 | 0.02 |
| 2 | spring | Gaillardia aristata | blanketflower | 200,000 | 1.00 | 4.6 | 0.15 |
| 3 | s & s | Sphaeralcea munroana | Munro's globemallow | 500,000 | 0.50 | 5.7 | 0.08 |
| 4 | spring | Linum lewisii | Lewis' flax | 420,000 | 0.50 | 4.8 | 0.08 |
| 5 | summer | Penstemon pruinosis | Chelan penstemon | 800,000 | 0.30 | 5.5 | 0.05 |
| 6 | summer | Mentzelia laevicaulis | blazing star | 300,000 | 0.75 | 5.2 | 0.11 |
| 7 | spring | Salvia dorrii | purple sage | 310,000 | 0.30 | 2.1 | 0.05 |
| 8 | s & f | Machaeranthera canescens | hoary aster | 1,300,000 | 0.15 | 4.5 | 0.02 |
| 9 | s & f | Ericameria nauseosa | rubber rabbitbrush | 693,000 | 0.25 | 4.0 | 0.04 |
| | | | | **TOTALS** | | **42.2** | **0.58** |

### Grasses

| - | | Scientific Name | Common Name | Seeds per lb | Seeding Rate (PLS lbs/ac) | Seeds per sq ft (PLS) | PLS lbs needed |
|---|---|---|---|---|---|---|---|
| 10 | | Poa secunda | Sandberg bluegrass | 1,000,000 | 0.45 | 10.6 | 0.07 |
| 11 | | | | | | 0.0 | 0.00 |
| | | | | **TOTALS** | | **10.6** | **0.07** |

**PERCENT GRASS** 25.1%

# Seeding Calculator Seeding & Planting Information

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Land Owner | Othello | Soils | silt loam | Date | 11/19/10 | Acres | 0.15 |
| Conservationist | P. Pavek | Precipitation Zone | 8 | inches | | Program | 0 |

## Forbs & Shrubs

| - | | | | Seeding & Planting Information | | | |
|---|---|---|---|---|---|---|---|
| | Seeding Depth | Scientific Name | Common Name | PLS (from seed tag) | Bulk lbs per Acre | Bulk Seeds per sq ft | Bulk lbs Planted |
| 1 | | Achillea millefolium | yarrow | 90% | 0.11 | 6.4 | 0.017 |
| 2 | | Gaillardia aristata | blanketflower | 50% | 2.00 | 9.2 | 0.300 |
| 3 | | Sphaeralcea munroana | Munro's globemallow | 80% | 0.63 | 7.2 | 0.094 |
| 4 | | Linum lewisii | Lewis' flax | 87% | 0.57 | 5.5 | 0.086 |
| 5 | | Penstemon pruinosis | Chelan penstemon | 50% | 0.60 | 11.0 | 0.090 |
| 6 | | Mentzelia laevicaulis | blazing star | 25% | 3.00 | 20.7 | 0.450 |
| 7 | | Salvia dorrii | purple sage | 50% | 0.60 | 4.3 | 0.090 |
| 8 | | Machaeranthera canescens | hoary aster | 25% | 0.60 | 17.9 | 0.090 |
| 9 | | Ericameria nauseosa | rubber rabbitbrush | 50% | 0.50 | 8.0 | 0.075 |
| | | | | **TOTALS** | | **90.1** | **1.3** |

## Grasses

| - | Seeding Depth | Scientific Name | Common Name | PLS (from seed tag) | bulk lbs per acre | bulk seeds per sq ft | bulk lbs planted |
|---|---|---|---|---|---|---|---|
| 10 | | Poa secunda | Sandberg bluegrass | 91% | 0.50 | 11.4 | 0.1 |
| 11 | | 0 | 0 | 0.00 | 0.00 | 0.0 | 0.0 |
| | | | | **TOTALS** | | 11.4 | 0.1 |

Seed of several species was collected by hand from the Othello pollinator plots and CRP stands. These are: blanketflower, hoary tansyaster, blazingstar, Chelan penstemon, purple sage, and Munro's globemallow. This seed was cleaned at the PMC. Additional seed was purchased from BFI (Benson Farms Inc) of: yarrow, blanketflower, Chelan penstemon, rubber rabbitbrush and Sandberg bluegrass. Lewis flax seed was obtained from the Aberdeen Plant Materials Center.

The species requiring stratification are: Munro's globemallow, Chelan penstemon, hoary tansyaster, rubber rabbitbrush, and purple sage. Due to

weather and administrative blockages we were not able to seed in November or December as planned. In January it was decided seed would be primed in a sand medium for 90 days prior to planting in April. The procedure used was recommended by Joe Scianna, MTPMC. Seed was soaked in water for 12 to 24 hours, the water was drained off and the seeds were placed in a ziplock with sand. Fungicide was added to the bag to prevent the seeds from rotting. The ziplock was kept in a box in a refrigerator with the temperature at 33 – 35 F.

The seed was kept there for only one week, because the farm manager at Othello (John) called and said the field had dried out enough to plant. The seed was dried by placing it on a screen in a drying room with fans. The farm manager roto-vated and roller packed to prepare the field. The dried seed was combined with seed not needing stratification and rice hulls, and planted using the Experiment Station's JD 10ft double disk drill with tubes pulled. The openers were set at 3.5 for first few passes, moved up to 8, then 10, then 12. We made 3 full passes and a few diagonal passes at the end. Removed all seed from drill box and tubes using shop vac and air hose and scattered by hand on plot (mostly within first three passes). The field was roller packed again.

**2011 Update**

April 19, 2011. Species emerging are Sandbergs BG throughout the plot and Kochia along eastern edge.

June 3, 2011. Seeding appears to be a failure. Only a few Sandberg and Lewis' flax plants present. Remainder of stand is dominated by kochia. Farm managers were instructed to no longer irrigate.

August 15, 2011. The stand was mowed several times to prevent kochia and other weed seed from disseminating. John sprayed field August 12 with glyphosate, warned may not be effective because plants not actively growing. Found seedlings of SADO, SPMU, LILIE, and GAAR, but very few. New Plan: Spray out field again if needed, seed western wheatgrass this fall, spray broadleaf herbicides to control weeds next year, and next fall or in two years spray out grass with glyphosate and mimic no-till situation.

**2012 Update**

October 17, 2011. Field still green, John sprayed again with 60 oz/ac glyphosate.

November 3, 2011. John rotovated.

November 9, 2011. Soil very dry and fluffy. Field was roller packed once, and twice was attempted but did not appear to make a difference. Broadcast seeded 'Recovery' western wheatgrass with Scott fertilizer spreader at a rate of 16 lb/ac. I had to add more, total seed applied = 6.5 lb. Did not roller pack again because seed would be buried too deep.

**Seed bed after seeding western wheatgrass Nov 9, 2011.**

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| | |
|---|---|
| **Titles** | Pollinator Habitat: Establishment of Native Forbs into an Existing 20- year-old Stand of CRP Using No-Till Techniques<br><br>Pollinator Habitat: Establishment of Native Forbs into an Existing 7- year-old Stand of CRP Using No-Till Techniques<br><br>Pollinator Habitat: Establishment of Native Forbs into an Existing 3- year-old Stand of CRP Using No-Till Techniques |
| **Study Numbers** | WAPMC-T-1104-WL<br>WAPMC-T-1103-WL<br>WAPMC-T-1102-WL |
| **Study Leader** | Pamela Pavek, WAPMC Agronomist |
| **Study Cooperators** | Wayne and Jacie Jensen (Thorn Creek Native Seeds), Trish Heekin (Latah Soil and Water Conservation District) and Tiege Ulschmid (Idaho Fish and Game) |
| **Duration** | 2010 - 2014 |
| **Description** | Native forbs were seeded into existing one 20-year-old and two 3-year-old stands of CRP using two ground preparation methods and two no-till drills. |

**Status of Knowledge**

Native forbs in a landscape provide many ecological benefits to various species of upland wildlife. Small mammals, game birds, migratory birds and beneficial insects utilize forbs for forage and shelter. Many landscapes with perennial vegetation, such as fields enrolled in the Conservation Reserve Program (CRP) are devoid of forbs. Forbs were often planted in the original CRP mix, however died out because they were short-lived species, they were overtaken by the more competitive grasses, or they were killed by broadleaf herbicides when weeds were managed.

Currently there is a desire by many state, federal, and private agencies to improve upland diversity by re-establishing native forbs in perennial landscapes. Due to the steepness of many of these landscapes, there is also a desire to establish forbs while maintaining the perennial grass stubble. Therefore, an evaluation of no-till techniques is warranted. There have been no similar studies conducted to evaluate the establishment of forbs into existing stands of perennial vegetation in the Palouse Prairie region.

**Experimental Design**

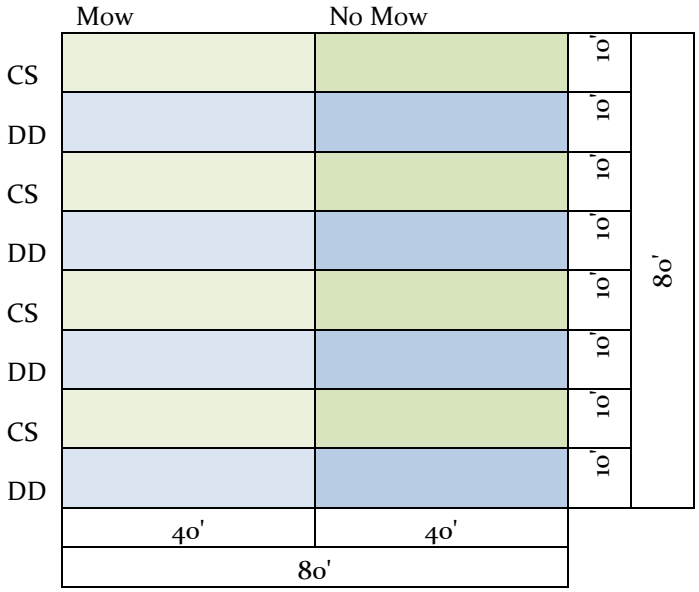
Two ground preparation methods will be compared:

1) spring application of glyphosate + mow + fall application of glyphosate + drill
2) spring application of glyphosate + fall application of glyphosate + drill (not mowed)

Two types of drills will also be compared

1) cross-slot no-till drill
2) double disk no-till drill with coulters

There are a total of 4 treatment combinations. Each treatment combination will be replicated 4 times.



## Materials and methods

The study will be conducted on one 20-year old and two 3-year-old CRP fields managed by Wayne and Jacie Jensen (Thorn Creek Native Seeds). The fields are on the southeast-facing slope of Paradise Ridge south of Moscow, Idaho. The 20-year-old stand consists primarily of intermediate wheatgrass, and the 3-year-old stands consist primarily of native bunch grasses (bluebunch and Idaho fescue).

Seed for the study was provided by Thorn Creek Native Seeds. It was comprised of a mixture of native forb species available at the time of seeding (16 species). The total plot area is 80 ft wide and 80 ft long. Individual plots are 40 ft long and 10 ft wide.

In June 2010 the plots were staked out and sprayed with 32 oz/ac glyphosate. In mid-October, half of the plots were mowed and all plots were sprayed again with 32 oz/ac glyphosate. On October 21, plots were seeded at a rate of 40 PLS per linear foot.

**Seeding native forbs with a Great Plains double disk drill**

**Seeding native forbs with a Cross Slot drill**

The following species and rates were used:

pass length: 40' cross-slot drill: 10' wide, 12 openers spaced at 10" number of PLS seeds per pass: 38,400

dd drill: 8' wide, 12 openers spaced at 7.5" number of PLS seeds per pass: 38,400

goal: 40 PLS seeds per linear foot

| | Common Name | Scientific name | Seeds/lb | PLS Seeds per pass (38,400 total seeds) | PLS Lbs of seed per pass | PLS Oz. of seed per pass | Bulk Seed per pass (75% PLS) | Minus 25% (to account for seed that remains in drill) Bulk Oz per pass | Bulk Oz per site per drill |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Western aster | *Symphyotrichum spathulatum* | 1,292,309 | 2,954 | 0.0023 | 0.037 | 0.049 | 0.065 | 0.26008 |
| 2 | Little sunflower | *Helianthella uniflora* | 41,087 | 2,954 | 0.0719 | 1.150 | 1.534 | 2.045 | 8.18019 |
| 3 | Arrowleaf balsamroot | *Balsamorhiza sagittata* | 61,630 | 2,954 | 0.0479 | 0.767 | 1.023 | 1.363 | 5.45351 |
| 4 | Nine-leaf lomatium | *Lomatium triternatum* | 63,812 | 2,954 | 0.0463 | 0.741 | 0.988 | 1.317 | 5.26703 |
| 5 | Slender cinquefoil | *Potentilla gracilis* | 1,711,698 | 2,954 | 0.0017 | 0.028 | 0.037 | 0.049 | 0.19635 |
| 6 | Tall cinquefoil | *Potentilla arguta* | 4,403,883 | 2,954 | 0.0007 | 0.011 | 0.014 | 0.019 | 0.07632 |
| 7 | Blanketflower | *Gaillardia aristata* | 186,436 | 2,954 | 0.0158 | 0.254 | 0.338 | 0.451 | 1.80276 |
| 8 | Taper-leaf penstemon | *Penstemon attenuatus* | 3,000,000 | 2,954 | 0.0010 | 0.016 | 0.021 | 0.028 | 0.11203 |
| 9 | Oregon sunshine | *Eriophyllum lanatum* | 818,000 | 2,954 | 0.0036 | 0.058 | 0.077 | 0.103 | 0.41088 |
| 10 | Grand collomia | *Collomia grandiflora* | 146,986 | 2,954 | 0.0201 | 0.322 | 0.429 | 0.572 | 2.28661 |
| 11 | Western yarrow | *Achillea millefolium* | 2,835,000 | 2,954 | 0.0010 | 0.017 | 0.022 | 0.030 | 0.11855 |
| 12 | Missouri goldenrod | *Solidago missouriensis* | 1,988,238 | 2,954 | 0.0015 | 0.024 | 0.032 | 0.042 | 0.16904 |
| 13 | Sticky purple geranium | *Geranium viscosissimum* | 54,809 | 295 | 0.0054 | 0.086 | 0.115 | 0.153 | 0.61239 |
| 14 | Lupines | *Lupinus spp.* | 12,900 | 295 | 0.0229 | 0.3659 | 0.487855 | 0.6504737 | 2.60189 |
| 15 | Prairie smoke | *Geum triflorum* | 450,000 | 1182 | 0.0026 | 0.042 | 0.056036 | 0.0747141 | 0.29886 |
| 16 | Wyeth's buckwheat | *Eriogonum heracleoides* | 145,720 | 1182 | 0.0081 | 0.1298 | 0.173044 | 0.2307256 | 0.9229 |
| | | | | 38,402 | | | | | |

Weeds will be managed within the plots in subsequent years by mowing and application of appropriate herbicides.

In June 2011, 2012, 2013 and 2014, forb frequency and density measurements will be made using a grid at 6 random locations within each plot. Data will be analyzed statistically to determine differences among treatments.

**Results**

April 14, 2011 Jacie reported *Lomatium triternatum* and *Collomia grandiflora* are emerging.

**Evaluating emergence of no-till seeded forbs in 20-year old stand of intermediate wheatgrass, May 10.**

July 2011 Summary:
The three CRP sites seeded last fall with 16 species of native forbs using no-till drills had fair to excellent establishment this spring. Data was collected from these sites on June 30.

**Site 1** had a three-year old stand of native bunch grasses with a level aspect. This site was the first to be seeded, and the drills may have gone too deep. This factor, combined with the level aspect which resulted in cold, wet soils, caused the site to have latest and poorest emergence of all sites. This site was also heavily infested with ventenata. Drills were raised slightly for Sites 2 and 3.

**Site 2** had a 20-year old stand of intermediate wheatgrass and an east facing aspect. This site had the best emergence and least amount of weeds of all sites. Forb counts averaged 10 plants per linear foot and included: western yarrow, grand collomia (an annual), Wyeth's buckwheat, Oregon sunshine, blanket flower, sticky purple geranium, little sunflower, nine-leaf lomatium,

lupine species, taper-leaf penstemon, tall/slender cinquefoil, and western mountain aster. Forbs blooming in June were grand collomia and Oregon sunshine. Only a few weeds were present: fiddleneck, bedstraw and pennycress.

**Site 3** had a four-year old stand of native bunch grasses and a south-facing aspect. This site had better emergence than Site 1, but not as good as Site 2. This site is dominated by prickly lettuce, which will be mowed during the growing season.

All sites have been sprayed with 12 oz/ac Select herbicide to control the annual and perennial grass growth. Forb counts will be made again next June to track the changes in species composition.

Thus far, it appears seeding forbs with no-till techniques is a successful strategy. The strategy results in minimal disturbance to the weed seed bank, reduces opportunities for new weed seed to establish, and does not significantly alter the soil carbon:nitrogen balance. We will soon develop plans to replicate this study at other locations.

**First-year growth of native forbs established with no-till drills in 20-year old stand of intermediate wheatgrass, June 30.**

Data was collected June 30, 2011. A tape was laid diagonal across each plot from the lower left corner to the upper right corner, and data was collected four times (subsamples) along the tape: at row 3 (10 ft), row 5 (15 ft), row 7 (20 ft) and row 9 (25 ft). A two foot rod was laid alongside the row from each point on the tape, and seedlings of each species were counted. It was too difficult to distinguish between the two *Potentilla* species (*P. arguta* and *P. gracilis*) so they were counted as *Potentilla spp.* The lupine species were unknown at time of planting and they were counted as *Lupinus spp.* Linear foot measurements were possible for data collection because both drills had the same number of openers (12). However the spacing and overall width of the Double Disk Drill was more narrow (8') than the Cross Slot (10'). In the future, if rows are no longer discernable, seedlings per area measurements will have to be made, and the differences in density of each planting will have to be taken into account.

Site 1: North Site 4 year old stand of native bunch grasses

< **N**

| | Mow | No Mow | | |
|---|---|---|---|---|
| CS | CS1-M | CS1-NM | 10' | 80' |
| DD | DD1-M | DD1-NM | 10' | |
| CS | CS2-M | CS2-NM | 10' | |
| DD | DD2-M | DD2-NM | 10' | |
| CS | CS3-M | CS3-NM | 10' | |
| DD | DD3-M | DD3-NM | 10' | |
| CS | CS4-M | CS4-NM | 10' | |
| DD | DD4-M | DD4-NM | 10' | |
| | 40' | 40' | | |
| | 80' | | | |

Methods:

Count seedlings of each species along 2 ft linear measure 4 times in each plot

Count 1: row 3 @ 10'

Count 2: row 5 @ 15'

Count 3: row 7 @ 20'

Count 4: row 9 @ 25'

JENSEN'S NO-TILL FORB ESTABLISHMENT DATA SHEET

SITE: 1 DATE: 6/30/2011 NUMBER OF SEEDLINGS per TWO FEET

| | | SPECIES | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PLOT | CNT | ACMI | BASA | COGR | ERHE | ERLA | GAAR | GETR | GEVI | HEUN | LOTR | LU sp | PEAT | PO sp | SOMI | SYSP | TTL |
| CS1-M | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 3 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| CS1-NM | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | 3 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| DD1-M | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 3 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| | 4 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| DD1-NM | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| CS2-M | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| CS2-NM | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | 3 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |

| PLOT | CNT | ACMI | BASA | COGR | ERHE | ERLA | GAAR | GETR | GEVI | HEUN | LOTR | LU sp | PEAT | PO sp | SOMI | SYSP | TTL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DD2-M | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 3 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| | 4 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| DD2-NM | 1 | 0 | 0 | 2 | 0 | 2 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 6 |
| | 2 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| | 3 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | 4 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| CS3-M | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 4 | 0 | 0 | 3 | 0 | 1 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 7 |
| CS3-NM | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 2 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| | 3 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| DD3-M | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 4 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| DD3-NM | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | 2 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| | 3 | 0 | 0 | 1 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 5 |
| | 4 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 |
| CS4-M | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 3 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | 4 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 7 |
| CS4-NM | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| | 4 | 0 | 0 | 3 | 0 | 1 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 7 |

| PLOT | CNT | ACMI | BASA | COGR | ERHE | ERLA | GAAR | GETR | GEVI | HEUN | LOTR | LU sp | PEAT | PO sp | SOMI | SYSP | TTL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DD4-M | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 4 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| DD4-NM | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 3 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 3 |
| | 4 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 3 | 0 | 0 | 5 |
| TOTALS | | 2 | 0 | 57 | 0 | 18 | 0 | 0 | 2 | 44 | 0 | 0 | 0 | 5 | 0 | 0 | 128 |
| | | ACMI | BASA | COGR | ERHE | ERLA | GAAR | GETR | GEVI | HEUN | LOTR | LU sp | PEAT | PO sp | SOMI | SYSP | |

Site 2: By cabin 20 year old stand of intermediate WG

**N**

v

| | Mow | No Mow | | |
|---|---|---|---|---|
| CS | CS1-M | CS1-NM | 10' | 80' |
| DD | DD1-M | DD1-NM | 10' | |
| CS | CS2-M | CS2-NM | 10' | |
| DD | DD2-M | DD2-NM | 10' | |
| CS | CS3-M | CS3-NM | 10' | |
| DD | DD3-M | DD3-NM | 10' | |
| CS | CS4-M | CS4-NM | 10' | |
| DD | DD4-M | DD4-NM | 10' | |
| | 40' | 40' | | |
| | 80' | | | |

Methods:

Count seedlings of each species along 2 ft linear measure 4 times in each plot

Count 1: row 3 @ 10'

Count 2: row 5 @ 15'

Count 3: row 7 @ 20'

Count 4: row 9 @ 25'

JENSEN'S NO-TILL FORB ESTABLISHMENT DATA SHEET

SITE: 2 DATE: 6/30/2011 Number of Seedlings per TWO LINEAR FEET

| | | SPECIES | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PLOT | CNT | ACMI | BASA | COGR | ERHE | ERLA | GAAR | GETR | GEVI | HEUN | LOTR | LU sp | PEAT | PO sp | SOMI | SYSP | TTL |
| CS1-M | 1 | 0 | 0 | 5 | 0 | 1 | 0 | 0 | 0 | 5 | 0 | 1 | 0 | 0 | 0 | 0 | 12 |
| | 2 | 0 | 0 | 5 | 0 | 1 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 11 |
| | 3 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 1 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 8 |
| | 4 | 1 | 0 | 2 | 0 | 2 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 7 |
| CS1-NM | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| | 2 | 1 | 0 | 3 | 0 | 1 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 1 | 0 | 0 | 9 |
| | 3 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 2 | 0 | 0 | 0 | 7 |
| | 4 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 3 | 0 | 1 | 1 | 0 | 0 | 0 | 7 |
| DD1-M | 1 | 0 | 0 | 4 | 0 | 4 | 0 | 0 | 0 | 5 | 0 | 0 | 1 | 2 | 0 | 0 | 16 |
| | 2 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| | 3 | 1 | 0 | 2 | 0 | 2 | 0 | 0 | 0 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 9 |
| | 4 | 0 | 0 | 3 | 0 | 3 | 0 | 0 | 0 | 5 | 0 | 0 | 4 | 2 | 0 | 1 | 18 |
| DD1-NM | 1 | 1 | 0 | 6 | 0 | 1 | 0 | 0 | 0 | 4 | 0 | 0 | 1 | 1 | 0 | 0 | 14 |
| | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| | 3 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 9 |
| | 4 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 4 |
| CS2-M | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| | 2 | 0 | 1 | 0 | 3 | 1 | 0 | 0 | 0 | 4 | 0 | 1 | 0 | 0 | 0 | 2 | 12 |
| | 3 | 2 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 1 | 0 | 1 | 9 |
| | 4 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| CS2-NM | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 4 |
| | 2 | 0 | 0 | 4 | 1 | 0 | 0 | 0 | 0 | 4 | 2 | 0 | 0 | 0 | 0 | 0 | 11 |
| | 3 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 2 | 4 | 1 | 0 | 0 | 0 | 0 | 9 |
| | 4 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 9 |
| DD2-M | 1 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 6 | 3 | 0 | 0 | 0 | 0 | 1 | 12 |
| | 2 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 7 |
| | 3 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| DD2-NM | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 4 | 0 | 1 | 0 | 0 | 0 | 0 | 7 |
| | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| | 3 | 0 | 0 | 12 | 0 | 0 | 0 | 0 | 0 | 2 | 3 | 1 | 0 | 0 | 0 | 0 | 18 |
| | 4 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 6 |
| CS3-M | 1 | 0 | 0 | 2 | 0 | 2 | 0 | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 8 |
| | 2 | 1 | 0 | 8 | 0 | 2 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 13 |
| | 3 | 1 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 11 |
| | 4 | 1 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 1 | 11 |
| CS3-NM | 1 | 0 | 0 | 4 | 0 | 3 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 8 |
| | 2 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| | 3 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 7 |
| | 4 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| DD3-M | 1 | 0 | 1 | 1 | 0 | 2 | 0 | 0 | 0 | 1 | 5 | 0 | 1 | 0 | 0 | 1 | 12 |
| | 2 | 0 | 0 | 5 | 0 | 3 | 0 | 0 | 0 | 8 | 3 | 0 | 0 | 0 | 0 | 1 | 20 |
| | 3 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 2 | 4 | 0 | 0 | 0 | 0 | 0 | 9 |
| | 4 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 7 |
| DD3-NM | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 6 |
| | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 2 | 5 | 0 | 0 | 0 | 0 | 0 | 9 |
| | 3 | 0 | 0 | 5 | 1 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 8 |
| | 4 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 5 | 0 | 1 | 0 | 0 | 0 | 8 |
| CS4-M | 1 | 0 | 0 | 5 | 0 | 1 | 0 | 0 | 0 | 4 | 3 | 1 | 0 | 0 | 0 | 0 | 14 |
| | 2 | 1 | 1 | 5 | 0 | 2 | 0 | 0 | 0 | 2 | 2 | 1 | 0 | 0 | 0 | 1 | 15 |
| | 3 | 1 | 1 | 7 | 2 | 4 | 0 | 0 | 0 | 3 | 7 | 0 | 0 | 2 | 0 | 3 | 30 |
| | 4 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 9 |
| CS4-NM | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 3 |
| | 2 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 5 |
| | 3 | 0 | 0 | 1 | 3 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 6 |
| | 4 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| DD4-M | 1 | 0 | 0 | 2 | 0 | 2 | 0 | 0 | 0 | 3 | 2 | 0 | 1 | 0 | 0 | 1 | 11 |
| | 2 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 3 | 5 | 1 | 1 | 0 | 0 | 0 | 12 |
| | 3 | 1 | 0 | 1 | 0 | 3 | 0 | 0 | 0 | 3 | 3 | 1 | 0 | 1 | 0 | 1 | 14 |
| | 4 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 5 | 1 | 0 | 1 | 0 | 0 | 0 | 8 |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DD4-NM | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 2 |
| | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 1 | 4 |
| | 3 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| | 4 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 4 |
| TOTALS | | 21 | 5 | 147 | 17 | 56 | 1 | 0 | 2 | 167 | 74 | 14 | 14 | 12 | 0 | 19 | 549 |
| | | ACMI | BASA | COGR | ERHE | ERLA | GAAR | GETR | GEVI | HEUN | LOTR | LU sp | PEAT | PO sp | SOMI | SYSP | |

Site 3: North Site 3 year old stand of native bunch grasses

**N >**

| | Mow | No Mow | | |
|---|---|---|---|---|
| CS | CS1-M | CS1-NM | 10' | 80' |
| DD | DD1-M | DD1-NM | 10' | |
| CS | CS2-M | CS2-NM | 10' | |
| DD | DD2-M | DD2-NM | 10' | |
| CS | CS3-M | CS3-NM | 10' | |
| DD | DD3-M | DD3-NM | 10' | |
| CS | CS4-M | CS4-NM | 10' | |
| DD | DD4-M | DD4-NM | 10' | |
| | 40' | 40' | | |
| | 80' | | | |

Methods:

Count seedlings of each species along 2 ft linear measure 4 times in each plot

Count 1: row 3 @ 10'

Count 2: row 5 @ 15'

Count 3: row 7 @ 20'

Count 4: row 9 @ 25'

JENSEN'S NO-TILL FORB ESTABLISHMENT DATA SHEET

SITE: 3 DATE: 6/30/2011 Number of Seedlings per TWO LINEAR FEET

| | | SPECIES | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PLOT | CNT | ACMI | BASA | COGR | ERHE | ERLA | GAAR | GETR | GEVI | HEUN | LOTR | LU sp | PEAT | PO sp | SOMI | SYSP | TTL |
| CS1-M | 1 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| CS1-NM | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| DD1-M | 1 | 0 | 0 | 3 | 1 | 1 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 7 |
| | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 2 |
| | 3 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| | 4 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| DD1-NM | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 2 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 2 |
| | 3 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 3 |
| | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| CS2-M | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| CS2-NM | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 2 | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| DD2-M | 1 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| | 2 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| DD2-NM | 1 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| CS3-M | 1 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 8 |
| | 2 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 4 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| CS3-NM | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 1 | 0 | 0 | 0 | 0 | 4 |
| | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 4 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| DD3-M | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 3 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| DD3-NM | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 1 | 0 | 0 | 0 | 0 | 4 |
| | 3 | 1 | 0 | 1 | 0 | 4 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 2 | 0 | 1 | 10 |
| | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| CS4-M | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 4 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| CS4-NM | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 3 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 4 |
| | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| DD4-M | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | 2 | 3 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 7 |
| | 3 | 3 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 2 | 0 | 0 | 1 | 0 | 0 | 1 | 8 |
| | 4 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |

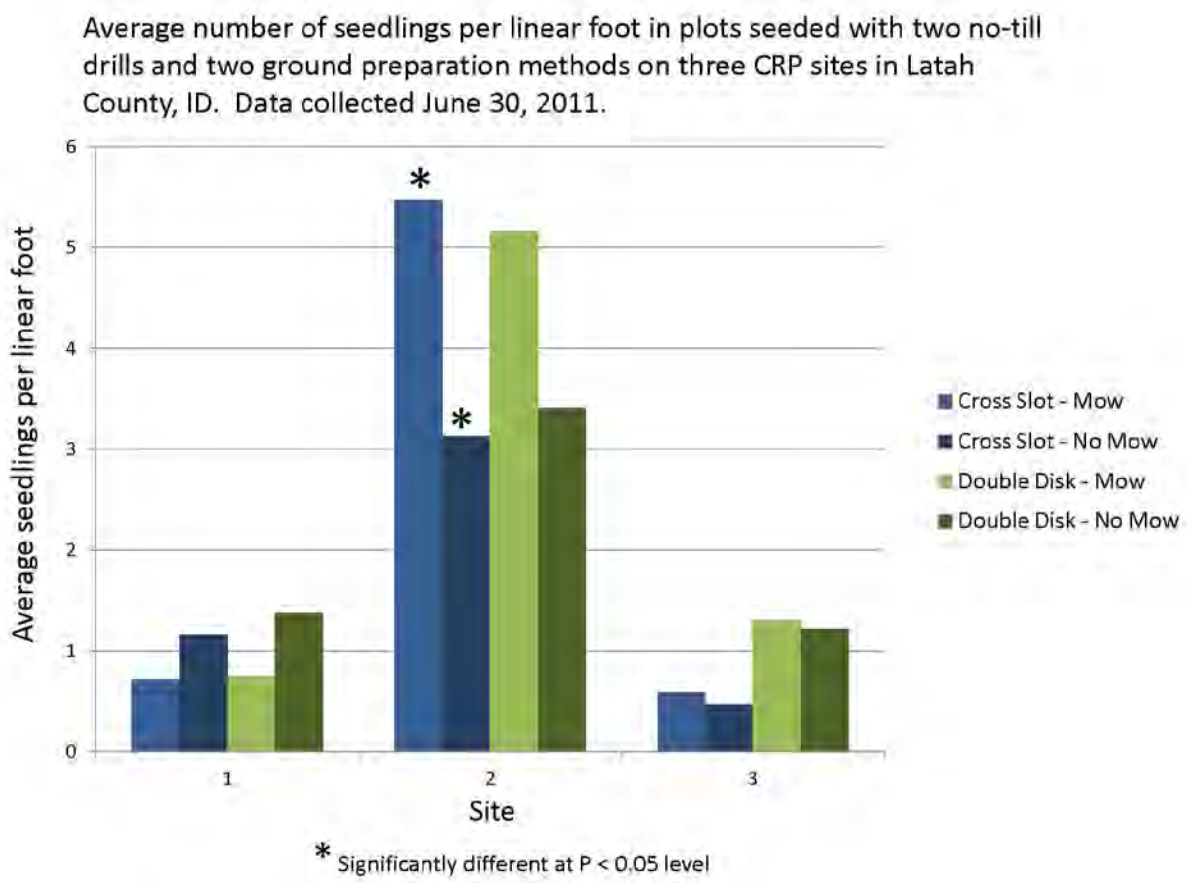
| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DD4-NM | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| | 2 | 2 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 6 |
| | 3 | 0 | 0 | 0 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 5 |
| | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTALS | | 12 | 0 | 27 | 11 | 22 | 0 | 0 | 1 | 24 | 0 | 7 | 3 | 5 | 0 | 3 | 115 |
| | | ACMI | BASA | COGR | ERHE | ERLA | GAAR | GETR | GEVI | HEUN | LOTR | LU sp | PEAT | PO sp | SOMI | SYSP | |

| | ACMI | BASA | COGR | ERHE | ERLA | GAAR | GETR | GEVI | HEUN | LOTR | LU sp | PEAT | PO sp | SOMI | SYSP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Site 1 | 2 | 0 | 57 | 0 | 18 | 0 | 0 | 2 | 44 | 0 | 0 | 0 | 5 | 0 | 0 |
| Site 2 | 21 | 5 | 147 | 17 | 56 | 1 | 0 | 2 | 167 | 74 | 14 | 14 | 12 | 0 | 19 |
| Site 3 | 12 | 0 | 27 | 11 | 22 | 0 | 0 | 1 | 24 | 0 | 7 | 3 | 5 | 0 | 3 |
| TOTAL | 35 | 5 | 231 | 28 | 96 | 1 | 0 | 5 | 235 | 74 | 21 | 17 | 22 | 0 | 22 |

Prior to data analysis, all counts were divided by 2 to obtain seedlings per linear foot.

Mean number of seedlings per linear foot for each treatment at each site and statistical differences ($P < 0.05$):

| Site | Treatment | Mean | Homogenous Group |
|---|---|---|---|
| 1 | CS-M | 0.72 | A |
| 1 | CS-NM | 1.16 | A |
| 1 | DD-M | 0.75 | A |
| 1 | DD-NM | 1.38 | A |
| 2 | CS-M | 5.47 | A |
| 2 | CS-NM | 3.13 | B |
| 2 | DD-M | 5.16 | AB |
| 2 | DD-NM | 3.41 | AB |
| 3 | CS-M | 0.59 | A |
| 3 | CS-NM | 0.47 | A |
| 3 | DD-M | 1.31 | A |
| 3 | DD-NM | 1.22 | A |

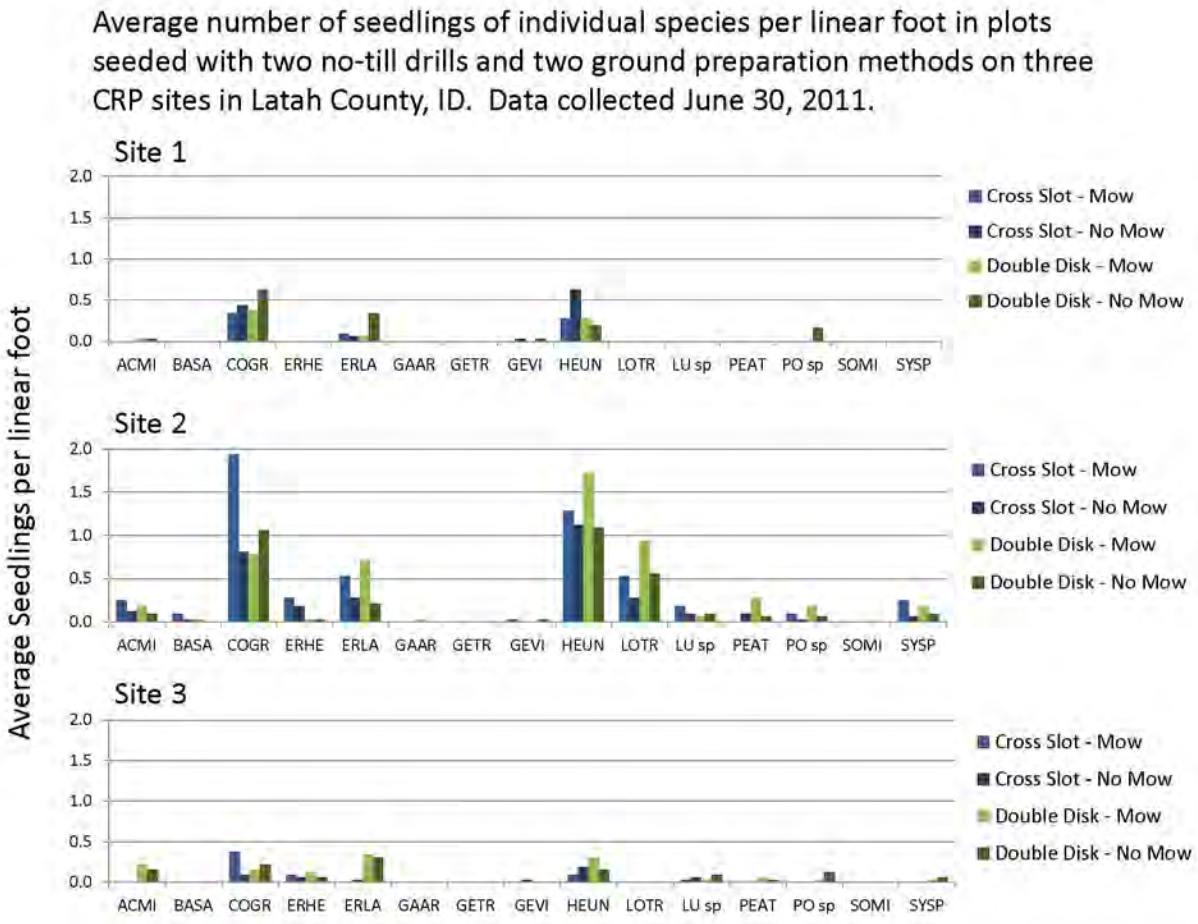


*Drill Type*
The Double Disk drill resulted in more seedlings per linear foot compared to the Cross Slot drill for all treatments at all sites, except the mowed plots at site 2, however none of the differences were statistically significant ($P < 0.05$).

*Mowing Treatment*
Plots mowed prior to seeding had higher numbers of seedlings per linear foot for both drills at Sites 2 and 3, but not at Site 1. The only statistically significant difference in treatments ($P < 0.05$) was between the Cross Slot Mowed and Cross Slot Unmowed plots at site 2, with 5.47 and 3.13 seedlings per linear foot, respectively. The higher number of seedlings per linear foot in the mowed plots may have resulted from more sunlight and warmth reaching the plants from lack of a canopy.

The lower number of seedlings per linear foot in the mowed plots at Site 1 may have resulted from differences in the sites' environmental conditions and the timing of data collection. Site 1 has a nearly level aspect and soils remained wet and cold longer into the growing season than the other two sites. Litter on the soil surface may have caused the soil to retain even more moisture and colder temperatures. Also, this site is infested with ventenata. Preliminary data from a University of Idaho Study indicates increased levels of ventenata litter cause an increase in germination rate of ventenata the following year, which would have increased competition. It is possible forb seedlings emerged later in the year when the soil dried and temperatures increased.

*Individual species*
The species with the highest rates of emergence in all plots were (in order of highest to lowest): *Collomia grandiflora* (an annual), *Helianthella uniflora, Lomatium triternatum, Eriophyllum lanatum, Achillea millefolium, Eriogonum heracleoides, Potentilla spp, Symphyotrichum spathulatum, Lupine spp, Penstemon attenuatus, Balsamorhiza sagittata, Geranium viscosissimum,* and *Gaillardia aristata.* All species seeded were observed as seedlings except two: *Geum triflorum* and *Solidago missouriensis*. These species may have emerged at a later date; the *Solidago* in particular is a warm season species.




One or two years of additional data will be collected prior to making any definite practice recommendations.

**UNITED STATES DEPARTMENT OF AGRICULTURE**
**PULLMAN PLANT MATERIALS CENTER**
**STUDY PLAN**

**STUDY TITLE:** Range Revegetation: Evaluation of 10 populations of bluebunch wheatgrass

**STUDY NUMBER: WAPMC-T-1002-RA**

**STUDY TYPE:** Advanced Evaluation

**LAND USES:** Range, CRP, Upland Wildlife Habitat

**PROBLEM:** Bluebunch wheatgrass ecotypes in the commercial seed market have not been adequately tested in Washington.

**OBJECTIVE:** Compare 9 populations of bluebunch wheatgrass + Secar snake river wheatgrass.

**DURATION OF STUDY:** 2010-2013

**STUDY LEADERS:** Mark Stannard PMC

**LOCATION:** Field G2, PMC

**STUDY DESIGN:** CRD, 3 reps x 10 treatments.

**Layout:**

North

| | 7 ft | 7 ft | 7 ft | 7 ft | 7 ft |
|---|---|---|---|---|---|
| 20ft | Secar | Whitmar | Wahluke | Anatone | P32 |
| 20ft | Goldar | Duffy Ck | Boardman | P7 | White Bluff |
| 20ft | White Bluff | Boardman | P32 | Whitmar | Anatone |
| 20ft | Duffy Ck | Wahluke | Secar | Goldar | P7 |
| 20ft | Anatone | Goldar | Wahluke | Whitmar | Boardman |
| 20ft | P32 | P7 | Duffy Ck | White Bluff | Secar |

PMC Road

**TREATMENTS:**

1. ‘Secar’ Snake River wheatgrass 8 lb/ac
2. ‘Whitmar’ beardless wheatgrass 8 lb/ac
3. ‘Wahluke’ SI bluebunch wheatgrass 8 lb/ac
4. ‘Anatone’ bluebunch wheatgrass 8 lb/ac
5. ‘P32’ germplasm bluebunch wheatgrass 8 lb/ac
6. ‘Goldar’ bluebunch wheatgrass 8 lb/ac
7. ‘Duffy Creek’ SI bluebunch wheatgrass 8 lb/ac
8. ‘Boardman’ SI bluebunch wheatgrass 8 lb/ac
9. ‘P7’ bluebunch wheatgrass 8 lb/ac
10. ‘White bluff’ SI bluebunch wheatgrass 8 lb/ac

**PROGRESS:** Field G2 was in green manure in 2009. Seedbed was fall disked, spring rodweeded, and packed. Seeding was made May 18, 2010 using Hege seeder.

Emergence observed May 28, 2010. MCPA applied June 17, 2010.

2011—All accessions are well established. No winter damage seen. The accessions (wahluke, white bluff and boardman) from drier regions are shorter and earlier.

| Rep | Accession | Stand 8/9/2010 | Ht 8/9/2010 | Vigor* 6/2/2011 |
|---|---|---|---|---|
| 1 | P32 | 95 | 20 | 5 |
| 1 | P7 | 95 | 20 | 5 |
| 1 | DUFFY CREEK | 100 | 15 | 5 |
| 1 | WHITE BLUFF | 90 | 15 | 4 |
| 1 | SECAR | 100 | 20 | 5 |
| 1 | ANATONE | 95 | 20 | 5 |
| 1 | GOLDAR | 95 | 25 | 5 |
| 1 | WAHLUKE | 90 | 15 | 4 |
| 1 | BOARDMAN | 90 | 20 | 5 |
| | | | | |
| 2 | DUFFY CREEK | 100 | 20 | 5 |
| 2 | WAHLUKE | 100 | 20 | 5 |
| 2 | SECAR | 95 | 25 | 5 |
| 2 | GOLDAR | 95 | 25 | 5 |
| 2 | P7 | 90 | 20 | 5 |
| 2 | WHITE BLUFF | 100 | 15 | 5 |
| 2 | BOARDMAN | 90 | 15 | 4 |
| 2 | P32 | 100 | 20 | 5 |
| 2 | WHITMAR | 95 | 20 | 5 |
| 2 | ANATONE | 95 | 20 | 5 |

| | | | | |
|---|---|---|---|---|
| 3 | GOLDAR | 90 | 25 | 5 |
| 3 | DUFFY CREEK | 90 | 15 | 5 |
| 3 | BOARDMAN | 95 | 20 | 5 |
| 3 | P7 | 100 | 20 | 5 |
| 3 | WHITE BLUFF | 100 | 15 | 5 |
| 3 | SECAR | 90 | 25 | 5 |
| 3 | WHITMAR | 95 | 25 | 5 |
| 3 | WAHLUKE | 95 | 20 | 5 |
| 3 | ANATONE | 100 | 20 | 5 |
| 3 | P32 | 95 | 20 | 5 |

* 1=poor, 5=excellent

**UNITED STATES DEPARTMENT OF AGRICULTURE**
**PULLMAN PLANT MATERIALS CENTER**
**STUDY PLAN**

**STUDY TITLE:** Range Revegetation: Evaluation of 10 populations of Idaho fescue

**STUDY NUMBER: WAPMC-T-1110-RA**

**STUDY TYPE:** Advanced Evaluation

**LAND USES:** Range, CRP, Upland Wildlife Habitat

**PROBLEM:** Idaho fescue wheatgrass ecotypes in the commercial seed market have not been adequately tested in Washington.

**OBJECTIVE:** Compare 10 populations of Idaho fescue.

**DURATION OF STUDY:** 2010-2013

**STUDY LEADERS:** Mark Stannard PMC

**LOCATION:** Field G2, PMC

**STUDY DESIGN:** RCB, 3 reps x 10 treatments.

**Layout:**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| rep 3 | 10.0707 | 9.875 | 9.1869 | 9.1891 | 9.1749 | 9.874 | 9.873 | 9.839 | 9.1892 | 9.1742 |
| rep 2 | 9.875 | 9.1891 | 9.873 | 10.0707 | 9.1742 | 9.839 | 9.1749 | 9.874 | 9.1869 | 9.1892 |
| rep 1 | 9.1749 | 9.873 | 9.839 | 9.1742 | 9.875 | 9.874 | 9.1891 | 9.1892 | 10.0707 | 9.1869 |

**Idaho Fescue Plots**

**TREATMENTS:**

1. 10.0707 Joseph, certified
2. 0.875 Lake Chelan SI
3. 9.1869 Spring Creek SI
4. 9.1891 Zumwalt SI
5. 9.1749 Green Mountain, BLM SI

6. 9.874 Deschutes Basin SI
7. 9.873 Deschutes Basin SI
8. 9.839 CTUIR SI
9. 9.1892 Mt Emily SI
10. 9.1742 Malheur SI

**PROGRESS:** East end of Field G2 was in green manure in 2010. Seedbed was fall cultivated, spring rototilled, and packed. Seeding was made May 23, 2011 using Hege seeder at 8 lb/ac. Rain followed on the 24th. Each plot is comprised of 4 rows on 8" centers.

'Covar' sheep fescue was seeded as a single row between plots 2-3, 4-5, 6-7, and 8-9. This filled the gap left by the Hege. Victor Shaul indicated that one or more of the Idaho Fescue accessions might be a sheep fescue so the 'Covar' will prove useful for comparisons.

Emergence was poor throughout the entire study. We will give it an additional year.

**UNITED STATES DEPARTMENT OF AGRICULTURE**
**PULLMAN PLANT MATERIALS CENTER**
**STUDY PLAN**

**STUDY TITLE:** ALMANAC: Evaluation of growth of bluebunch wheatgrass

**STUDY NUMBER: WAPMC-T-1111-RA**

**STUDY TYPE:** Advanced Evaluation

**LAND USES:** Range, CRP, Upland Wildlife Habitat

**PROBLEM:** NRCS initiated the Conservation Effects Assessment Project (CEAP) in 2003 with the intent to develop science supported methodologies that will allow NRCS to better estimate environmental benefits and effects attributable to NRCS conservation practices. Following discussions in 2006, CEAP efforts were expanded to go beyond estimating effects of practices to include developing new or improved tools and methodologies to enhance the effectiveness of conservation planning in meeting environmental goals. One of the specific objectives identified for CEAP is "reduce uncertainty in model estimates of conservation benefits" (Maresch et. al., 2008) which is the thrust of this proposal.

To assess the environmental benefits and effects of grazing lands practices the Rangeland Hydrology and Erosion Model (RHEM) is being developed as the tool to measure impacts and benefits of grazing lands practices (prescribed grazing; prescribed burning; brush management; rangeland seeding; pest management) within the CEAP. A model known as ALMANAC (Agricultural Land Management Alternative with Numerical Assessment Criteria) is an important component of RHEM. Plant communities represented by functional plant groups (short grass, tall grass, shrub, etc.) and their biophysical outputs (canopy cover, plant height, standing biomass, root distribution and mass, ground cover, etc.) (Weltz et. al., 2008) are the major drivers of the ALMANAC model and are key to accurate predictions of effects and ultimately better up-front conservation planning. The biophysical component requires attribute data over the many ecological zones found throughout the United States, at the Ecological Site Descriptions (ESD) scale, to be efficient and accurate.

In addition to providing good data to measure conservation practice impacts through CEAP, the field scale ALMANAC model could prove useful to NRCS field office staff, providing improved estimates of forage availability, potential wildfire fuel loads, and wildlife habitat suitability, as well as erosion potential on ecological sites. The data provided for use in the ALMANAC model is also expected to be of value in other modeling efforts such as SWAT (Soil and Water Assessment Tool), WEPS (Wind Erosion Prediction System) and assessment efforts such as those required in the Soil and Water Resources Conservation Act (RCA) of 1977.

**OBJECTIVE:** Document growth of bluebunch wheatgrass at various stages using various measurements.

**DURATION OF STUDY:** 2009-2011

**STUDY LEADERS:** Jim Briggs, WNTC PMS (Mark Stannard on-site data collector)

**LOCATION:** Field G2, PMC

**STUDY DESIGN:** Wahluke bluebunch wheatgrass, 3 reps.

**Layout:**

North

| | 7 ft | 7 ft | 7 ft | 7 ft | 7 ft |
|---|---|---|---|---|---|
| 20ft | Secar | Whitmar | Wahluke | Anatone | P32 |
| 20ft | Goldar | Duffy Ck | Boardman | P7 | White Bluff |
| 20ft | White Bluff | Boardman | P32 | Whitmar | Anatone |
| 20ft | Duffy Ck | Wahluke | Secar | Goldar | P7 |
| 20ft | Anatone | Goldar | Wahluke | Whitmar | Boardman |
| 20ft | P32 | P7 | Duffy Ck | White Bluff | Secar |

PMC Road

**PROGRESS:**

## Study Evaluation Worksheet

*Bluebunch wheatgrass*

*Wahluke SI*

*Date first green up observed:* *4/20/2011*

*Date 50% stand greened up:* *5/18/2011*

*Other Evaluations as required:*

PHOTOS TAKEN: ☐ Yes ☑ No

Photo File Stored: C:\[File Name]

| Evaluation Date | PLOT # | Life Cycle of Plot at Evaluation | Uniformity of Plot 1=poor 9=BEST | Height (cm) | Vigor - Overall Plot 1=Poor 9=BEST | Insect Pressure / Damage 1=Severe 9=NONE | Disease Pressure / Damage 1= Dead 9=None | Cold Injury 1=Major Damage 9=No Visible Damage | Heat Injury 1=Major Damage 9=NoVis Damage | Other Injury Fertilizer or Pesticide 1=None 9=BEST | Dormancy Begin/End |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 5/18/2011 | | vegetative | 7 | 18 | 6 | 9 | 9 | 9 | 9 | 9 | |
| 5/31/2011 | | early boot | 6 | 33 | 6 | 9 | 6 | 9 | 9 | 9 | |
| 6/14/2011 | | headed pre-anthesis | 6 | 51 | 6 | 9 | 6 | 9 | 9 | 9 | |
| 6/28/2011 | | late anthesis | 7 | 80 | 7 | 9 | 7 | 9 | 9 | 9 | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

| | |
|---|---|
| Year: | 2011 |
| Species: | Wahluke SI bluebunch wheatgrass |
| Age of material being evaluated (yrs): | 2 |
| Field (PMC location): | |
| Soils: | Palouse SiL |
| Series: | Palouse SiL |
| Texture: | SiL |
| Previous 3 year history (Narrative): | 2008 barley, 2009 green manure, 2010 bbwg plots, 2011 bbwg plots |
| Site prep summary (Narrative): | Disked fall 2009, Disked - rodweeded spring 2010, seeded with Hege plot drill May 2010 |
| Irrigation (date, type, amount applied, amount needed): | None |
| Weed Control (date, type, chemical, application rate, application method): | MCPA 20 oz/ac applied June 2010 |
| Tillage (date, type, comments): | None |
| Fertilizer (date, type, amount applied, application method, Other): | 100 N applied May 20 2011 |

| **Species:** | **Bluebunch Wheatgrass** | | | **Rep 1** |
|---|---|---|---|---|
| Date: | 5/18/2011 | 5/31/2011 | 6/14/2011 | 6/28/2011 |
| | | | | |
| FIPAR | | | | |
| | | | | |
| Above Canopy | 1759 | 940 | 1349 | 1222 |
| 0 | 1612 | 648 | 1401 | 111 |
| 4 | 1119 | 431 | 742 | 124 |
| 8 | 1248 | 421 | 1075 | 213 |
| 12 | 1213 | 460 | 490 | 174 |
| 16 | 1570 | 418 | 860 | 184 |
| 20 | 1298 | 513 | 714 | 142 |
| 24 | 1285 | 487 | 1070 | 268 |
| 28 | 962 | 460 | 777 | 107 |
| 32 | 1147 | 309 | 1006 | 152 |
| 36 | 950 | 503 | 262 | 163 |

| **Species:** | **Bluebunch Wheatgrass** | | | **Rep 2** |
|---|---|---|---|---|
| Date: | 5/18/2011 | 5/31/2011 | 6/14/2011 | 6/28/2011 |
| | | | | |
| FIPAR | | | | |
| | | | | |
| Above Canopy | 1817 | 1199 | 1511 | 1182 |
| 0 | 1458 | 780 | 429 | 488 |
| 4 | 1397 | 739 | 582 | 266 |
| 8 | 1533 | 551 | 771 | 278 |
| 12 | 1528 | 763 | 472 | 240 |
| 16 | 1264 | 499 | 750 | 325 |
| 20 | 1208 | 684 | 491 | 269 |
| 24 | 1186 | 462 | 465 | 267 |
| 28 | 1432 | 668 | 250 | 159 |
| 32 | 1301 | 521 | 401 | 203 |
| 36 | 1590 | 908 | 359 | 125 |

| **Species:** | **Bluebunch Wheatgrass** | | | **Rep 3** |
|---|---|---|---|---|
| Date: | 5/18/2011 | 5/31/2011 | 6/14/2011 | 6/28/2011 |
| | | | | |
| FIPAR | | | | |
| | | | | |
| Above Canopy | 1834 | 1592 | 1422 | 1046 |
| 0 | 1155 | 561 | 590 | 184 |
| 4 | 1172 | 1037 | 244 | 116 |
| 8 | 757 | 955 | 491 | 119 |
| 12 | 1227 | 1330 | 425 | 76 |
| 16 | 1488 | 1259 | 900 | 113 |
| 20 | 1235 | 1111 | 483 | 88 |
| 24 | 985 | 706 | 1100 | 101 |
| 28 | 1531 | 1231 | 806 | 92 |
| 32 | 1005 | 952 | 933 | 105 |
| 36 | 1625 | 1251 | 400 | 104 |

| **Species:** | **Bluebunch Wheatgrass** | | | **Rep 4** |
|---|---|---|---|---|
| Date: | 5/18/2011 | 5/31/2011 | 6/14/2011 | 6/28/2011 |
| | | | | |
| FIPAR | | | | |
| | | | | |
| Above Canopy | 1860 | 1770 | 1521 | 1121 |
| 0 | 593 | 1043 | 662 | 255 |
| 4 | 1407 | 1266 | 312 | 227 |
| 8 | 1515 | 888 | 588 | 153 |
| 12 | 1433 | 1363 | 644 | 137 |
| 16 | 694 | 966 | 987 | 184 |
| 20 | 1379 | 1347 | 481 | 154 |
| 24 | 1063 | 1032 | 653 | 186 |
| 28 | 1663 | 1188 | 704 | 148 |
| 32 | 744 | 886 | 1101 | 218 |
| 36 | 1468 | 1370 | 623 | 214 |

**UNITED STATES DEPARTMENT OF AGRICULTURE**
**PULLMAN PLANT MATERIALS CENTER**
**STUDY PLAN**

**STUDY TITLE:** ALMANAC: Evaluation of growth of intermediate wheatgrass

**STUDY NUMBER: WAPMC-T-1112-RA**

**STUDY TYPE:** Advanced Evaluation

**LAND USES:** Range, CRP, Upland Wildlife Habitat

**PROBLEM: PROBLEM:** NRCS initiated the Conservation Effects Assessment Project (CEAP) in 2003 with the intent to develop science supported methodologies that will allow NRCS to better estimate environmental benefits and effects attributable to NRCS conservation practices. Following discussions in 2006, CEAP efforts were expanded to go beyond estimating effects of practices to include developing new or improved tools and methodologies to enhance the effectiveness of conservation planning in meeting environmental goals. One of the specific objectives identified for CEAP is "reduce uncertainty in model estimates of conservation benefits" (Maresch et. al., 2008) which is the thrust of this proposal.

To assess the environmental benefits and effects of grazing lands practices the Rangeland Hydrology and Erosion Model (RHEM) is being developed as the tool to measure impacts and benefits of grazing lands practices (prescribed grazing; prescribed burning; brush management; rangeland seeding; pest management) within the CEAP. A model known as ALMANAC (Agricultural Land Management Alternative with Numerical Assessment Criteria) is an important component of RHEM. Plant communities represented by functional plant groups (short grass, tall grass, shrub, etc.) and their biophysical outputs (canopy cover, plant height, standing biomass, root distribution and mass, ground cover, etc.) (Weltz et. al., 2008) are the major drivers of the ALMANAC model and are key to accurate predictions of effects and ultimately better up-front conservation planning. The biophysical component requires attribute data over the many ecological zones found throughout the United States, at the Ecological Site Descriptions (ESD) scale, to be efficient and accurate.

In addition to providing good data to measure conservation practice impacts through CEAP, the field scale ALMANAC model could prove useful to NRCS field office staff, providing improved estimates of forage availability, potential wildfire fuel loads, and wildlife habitat suitability, as well as erosion potential on ecological sites. The data provided for use in the ALMANAC model is also expected to be of value in other modeling efforts such as SWAT (Soil and Water Assessment Tool), WEPS (Wind Erosion Prediction System) and assessment efforts such as those required in the Soil and Water Resources Conservation Act (RCA) of 1977.

**OBJECTIVE:** Document growth of intermediate wheatgrass at various stages using various measurements.

**DURATION OF STUDY:** 2009-2011

**STUDY LEADERS:** Jim Briggs, WNTC PMS (Mark Stannard on-site data collector)

**LOCATION:** Plot 21, Demo Block, Field G1, PMC

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| 17 | 18 | 19 | 20 | **21** | 22 | 23 | 24 |
| 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 |
| 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| | | 12 feet of bare ground | | | | | |
| 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 |

**PROGRESS:**

## Study Evaluation Worksheet

*Intermediate wheatgrass*
*Reliant*
*Date first green up observed:* *5/1/2011*
*Date 50% stand greened up:* *5/18/2011*

*Other Evaluations as required:*

PHOTOS TAKEN: ☐ Yes ☑ No
Photo File Stored: C:\[File Name]

| Evaluation Date | PLOT # | Life Cycle of Plot at Evaluation | Uniformity of Plot 1=poor 9=BEST | Height (cm) | Vigor - Overall Plot 1=Poor 9=BEST | Insect Pressure / Damage 1=Severe 9=NONE | Disease Pressure / Damage 1= Dead 9=None | Cold Injury 1=Major Damage 9=No Visible Damage | Heat Injury 1=Major Damage 9=NoVis Damage | Other Injury Fertilizer or Pesticide 1=None 9=BEST | Dormancy Begin/End |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 5/18/2011 | | vegetative | 9 | 22 | 9 | 9 | 9 | 9 | 9 | 9 | |
| 5/31/2011 | | vegetative | 9 | 30 | 9 | 9 | 9 | 9 | 9 | 9 | |
| 6/14/2011 | | early boot | 9 | 53 | 9 | 9 | 9 | 9 | 9 | 9 | |
| 6/28/2011 | | late anthesis | 9 | 110 | 9 | 9 | 9 | 9 | 9 | 9 | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

| | |
|---|---|
| Year: | 2011 |
| Species: | Reliant intermediate wheatgrass |
| Age of material being evaluated (yrs): | 6 |
| Field (PMC location): | |
| Soils: | Palouse SiL |
| Series: | Palouse SiL |
| Texture: | SiL |
| Previous 3 year history (Narrative): | PMC demo planting |
| Site prep summary (Narrative): | N/A |
| Irrigation (date, type, amount applied, amount needed): | None |
| Weed Control (date, type, chemical, application rate, application method): | MCPA 20 oz/ac applied June 2010 |
| Tillage (date, type, comments): | Between row cultivation 2/yr |
| Fertilizer (date, type, amount applied, application method, Other): | 100 N applied Oct 2010 |

| **Species:** | **Intermediate Wheatgrass** | | | **Rep 1** |
|---|---|---|---|---|
| Date: | 5/18/2011 | 5/31/2011 | 6/14/2011 | 6/28/2011 |
| | | | | |
| FIPAR | | | | |
| | | | | |
| Above Canopy | 2054 | 1600 | 1730 | 1131 |
| 0 | 2158 | 1439 | 1665 | 926 |
| 4 | 2052 | 1440 | 1374 | 879 |
| 8 | 1974 | 714 | 721 | 574 |
| 12 | 1476 | 257 | 213 | 417 |
| 16 | 752 | 265 | 92 | 161 |
| 20 | 833 | 284 | 143 | 79 |
| 24 | 1580 | 729 | 488 | 125 |
| 28 | 2008 | 1043 | 1029 | 213 |
| 32 | 2067 | 1198 | 1536 | 322 |
| 36 | 2092 | 1210 | 1735 | 426 |
| Average | | | | |

| **Species:** | **Intermediate Wheatgrass** | | | **Rep 2** |
|---|---|---|---|---|
| Date: | 5/18/2011 | 5/31/2011 | 6/14/2011 | 6/28/2011 |
| | | | | |
| FIPAR | | | | |
| | | | | |
| Above Canopy | 2015 | 1508 | 1770 | 1010 |
| 0 | 2067 | 1328 | 1343 | 1008 |
| 4 | 1734 | 1116 | 967 | 864 |
| 8 | 812 | 707 | 373 | 400 |
| 12 | 725 | 655 | 340 | 183 |
| 16 | 393 | 341 | 270 | 71 |
| 20 | 634 | 348 | 382 | 59 |
| 24 | 1509 | 914 | 375 | 96 |
| 28 | 1599 | 1223 | 744 | 164 |
| 32 | 1994 | 1313 | 1434 | 197 |
| 36 | 2051 | 1322 | 1495 | 253 |

| **Species:** | **Intermediate Wheatgrass** | | | **Rep 3** |
|---|---|---|---|---|
| Date: | 5/18/2011 | 5/31/2011 | 6/14/2011 | 6/28/2011 |
| FIPAR | | | | |
| Above Canopy | 1969 | 1555 | 1775 | 990 |
| 0 | 2002 | 1393 | 1528 | 843 |
| 4 | 1720 | 1239 | 880 | 822 |
| 8 | 1128 | 997 | 484 | 633 |
| 12 | 303 | 583 | 213 | 278 |
| 16 | 202 | 425 | 60 | 103 |
| 20 | 1018 | 460 | 96 | 84 |
| 24 | 1502 | 959 | 182 | 117 |
| 28 | 2018 | 1387 | 404 | 165 |
| 32 | 2082 | 1390 | 1297 | 212 |
| 36 | 2109 | 1409 | 1517 | 252 |

| **Species:** | **Intermediate Wheatgrass** | | | **Rep 4** |
|---|---|---|---|---|
| Date: | 5/18/2011 | 5/31/2011 | 6/14/2011 | 6/28/2011 |
| FIPAR | | | | |
| Above Canopy | 2151 | 1763 | 1827 | 900 |
| 0 | 2233 | 1342 | 1419 | 916 |
| 4 | 2166 | 770 | 856 | 828 |
| 8 | 1697 | 439 | 206 | 520 |
| 12 | 807 | 378 | 129 | 214 |
| 16 | 296 | 341 | 56 | 61 |
| 20 | 261 | 716 | 101 | 39 |
| 24 | 1364 | 1336 | 255 | 80 |
| 28 | 1954 | 1509 | 913 | 156 |
| 32 | 2068 | 1571 | 1377 | 113 |
| 36 | 2150 | 1583 | 1750 | 251 |

**UNITED STATES DEPARTMENT OF AGRICULTURE**
**PULLMAN PLANT MATERIALS CENTER**
**STUDY PLAN**

**STUDY TITLE:** ALMANAC: Evaluation of growth of western yarrow

**STUDY NUMBER: WAPMC-T-1113-RA**

**STUDY TYPE:** Advanced Evaluation

**LAND USES:** Range, CRP, Upland Wildlife Habitat

**PROBLEM: PROBLEM:** NRCS initiated the Conservation Effects Assessment Project (CEAP) in 2003 with the intent to develop science supported methodologies that will allow NRCS to better estimate environmental benefits and effects attributable to NRCS conservation practices. Following discussions in 2006, CEAP efforts were expanded to go beyond estimating effects of practices to include developing new or improved tools and methodologies to enhance the effectiveness of conservation planning in meeting environmental goals. One of the specific objectives identified for CEAP is "reduce uncertainty in model estimates of conservation benefits" (Maresch et. al., 2008) which is the thrust of this proposal.

To assess the environmental benefits and effects of grazing lands practices the Rangeland Hydrology and Erosion Model (RHEM) is being developed as the tool to measure impacts and benefits of grazing lands practices (prescribed grazing; prescribed burning; brush management; rangeland seeding; pest management) within the CEAP. A model known as ALMANAC (Agricultural Land Management Alternative with Numerical Assessment Criteria) is an important component of RHEM. Plant communities represented by functional plant groups (short grass, tall grass, shrub, etc.) and their biophysical outputs (canopy cover, plant height, standing biomass, root distribution and mass, ground cover, etc.) (Weltz et. al., 2008) are the major drivers of the ALMANAC model and are key to accurate predictions of effects and ultimately better up-front conservation planning. The biophysical component requires attribute data over the many ecological zones found throughout the United States, at the Ecological Site Descriptions (ESD) scale, to be efficient and accurate.

In addition to providing good data to measure conservation practice impacts through CEAP, the field scale ALMANAC model could prove useful to NRCS field office staff, providing improved estimates of forage availability, potential wildfire fuel loads, and wildlife habitat suitability, as well as erosion potential on ecological sites. The data provided for use in the ALMANAC model is also expected to be of value in other modeling efforts such as SWAT (Soil and Water Assessment Tool), WEPS (Wind Erosion Prediction System) and assessment efforts such as those required in the Soil and Water Resources Conservation Act (RCA) of 1977.

**OBJECTIVE:** Document growth of western yarrow at various stages using various measurements.

**DURATION OF STUDY:** 2009-2011

**STUDY LEADERS:** Jim Briggs, WNTC PMS (Mark Stannard on-site data collector)

**LOCATION:** Field I1A, PMC

**PROGRESS:** The yarrow plots selected for this study were sprayed with Sethoxydim in an attempt to control rattail fescue. The treatment was only marginally effective. Prickley lettuce quickly responded to the reduction in rattail fescue. Accurate readings using the sceptometer were impossible. This study was abandoned.

**UNITED STATES DEPARTMENT OF AGRICULTURE**
**PULLMAN PLANT MATERIALS CENTER**
**STUDY PLAN**

**STUDY TITLE:** ALMANAC: Evaluation of growth of blanketflower

**STUDY NUMBER: WAPMC-T-1114-RA**

**STUDY TYPE:** Advanced Evaluation

**LAND USES:** Range, CRP, Upland Wildlife Habitat

**PROBLEM: PROBLEM:** NRCS initiated the Conservation Effects Assessment Project (CEAP) in 2003 with the intent to develop science supported methodologies that will allow NRCS to better estimate environmental benefits and effects attributable to NRCS conservation practices. Following discussions in 2006, CEAP efforts were expanded to go beyond estimating effects of practices to include developing new or improved tools and methodologies to enhance the effectiveness of conservation planning in meeting environmental goals. One of the specific objectives identified for CEAP is "reduce uncertainty in model estimates of conservation benefits" (Maresch et. al., 2008) which is the thrust of this proposal.

To assess the environmental benefits and effects of grazing lands practices the Rangeland Hydrology and Erosion Model (RHEM) is being developed as the tool to measure impacts and benefits of grazing lands practices (prescribed grazing; prescribed burning; brush management; rangeland seeding; pest management) within the CEAP. A model known as ALMANAC (Agricultural Land Management Alternative with Numerical Assessment Criteria) is an important component of RHEM. Plant communities represented by functional plant groups (short grass, tall grass, shrub, etc.) and their biophysical outputs (canopy cover, plant height, standing biomass, root distribution and mass, ground cover, etc.) (Weltz et. al., 2008) are the major drivers of the ALMANAC model and are key to accurate predictions of effects and ultimately better up-front conservation planning. The biophysical component requires attribute data over the many ecological zones found throughout the United States, at the Ecological Site Descriptions (ESD) scale, to be efficient and accurate.

In addition to providing good data to measure conservation practice impacts through CEAP, the field scale ALMANAC model could prove useful to NRCS field office staff, providing improved estimates of forage availability, potential wildfire fuel loads, and wildlife habitat suitability, as well as erosion potential on ecological sites. The data provided for use in the ALMANAC model is also expected to be of value in other modeling efforts such as SWAT (Soil and Water Assessment Tool), WEPS (Wind Erosion Prediction System) and assessment efforts such as those required in the Soil and Water Resources Conservation Act (RCA) of 1977.

**OBJECTIVE:** Document growth of blanketflower at various stages using various measurements.

**DURATION OF STUDY:** 2009-2011

**STUDY LEADERS:** Jim Briggs, WNTC PMS (Mark Stannard on-site data collector)

**LOCATION:** Plot 46, Demo Block, Field G1, PMC

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 |
| 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| | | 12 feet of bare ground | | | | | |
| 41 | 42 | 43 | 44 | 45 | **46** | 47 | 48 |

# Study Evaluation Worksheet

*Blanketflower*
*Palouse SI*
*Date first green up observed:* *6/1/2011*
*Date 50% stand greened up:* *6/10/2011*

*Other Evaluations as required:*

PHOTOS TAKEN: ☐ Yes ☑ No
Photo File Stored: C:\[File Name]

| Evaluation Date | PLOT # | Life Cycle of Plot at Evaluation | Uniformity of Plot 1=poor 9=BEST | Height (cm) | Vigor - Overall Plot 1=Poor 9=BEST | Insect Pressure / Damage 1=Severe 9=NONE | Disease Pressure / Damage 1= Dead 9=None | Cold Injury 1=Major Damage 9=No Visible Damage | Heat Injury 1=Major Damage 9=NoVis Damage | Other Injury Fertilizer or Pesticide 1=None 9=BEST | Dormancy Begin/End |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 6/14/2011 | | bud-early flwr | 5 | 11 | 5 | 9 | 9 | 9 | 9 | 9 | |
| 6/28/2011 | | flowering | 5 | 32 | 6 | 8 | 9 | 9 | 9 | 9 | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

| | |
|---|---|
| Year: | 2011 |
| Species: | Palouse SI blanketflower |
| Age of material being evaluated (yrs): | 5 |
| Field (PMC location): | |
| Soils: | Palouse SiL |
| Series: | Palouse SiL |
| Texture: | SiL |
| Previous 3 year history (Narrative): | Palouse prairie eval planting |
| Site prep summary (Narrative): | N/A |
| Irrigation (date, type, amount applied, amount needed): | None |
| Weed Control (date, type, chemical, application rate, application method): | hand weed |
| Tillage (date, type, comments): | Between row tillage 2/yr |
| Fertilizer (date, type, amount applied, application method, Other): | none |

| **Species:** | **Blanketflower** | **Rep 1** |
|---|---|---|
| Date: | 6/14/2011 | 6/28/2011 |

FIPAR

| | | |
|---|---|---|
| Above Canopy | 2000 | 1065 |
| 0 | 1797 | 1023 |
| 4 | 1845 | 1005 |
| 8 | 1794 | 690 |
| 12 | 1004 | 277 |
| 16 | 604 | 121 |
| 20 | 799 | 242 |
| 24 | 1003 | 423 |
| 28 | 1396 | 483 |
| 32 | 1781 | 613 |
| 36 | 1913 | 837 |

| **Species:** | **Blanketflower** | **Rep 2** |
|---|---|---|
| Date: | 6/14/2011 | 6/28/2011 |

FIPAR

| | | |
|---|---|---|
| Above Canopy | 1981 | 1339 |
| 0 | 1995 | 1213 |
| 4 | 1950 | 1200 |
| 8 | 1941 | 1201 |
| 12 | 1714 | 973 |
| 16 | 751 | 717 |
| 20 | 479 | 216 |
| 24 | 621 | 283 |
| 28 | 1518 | 441 |
| 32 | 1968 | 1137 |
| 36 | 1977 | 1188 |

| **Species:** | **Blanketflower** | **Rep 3** |
|---|---|---|
| Date: | 6/14/2011 | 6/28/2011 |

FIPAR

| | | |
|---|---|---|
| Above Canopy | 2165 | 1353 |
| 0 | 1983 | 1202 |
| 4 | 2012 | 1217 |
| 8 | 2020 | 1164 |
| 12 | 1944 | 800 |
| 16 | 1039 | 112 |
| 20 | 575 | 112 |
| 24 | 1240 | 244 |
| 28 | 1045 | 442 |
| 32 | 2029 | 988 |
| 36 | 2082 | 1175 |

| **Species:** | **Blanketflower** | **Rep 4** |
|---|---|---|
| Date: | 6/14/2011 | 6/28/2011 |

FIPAR

| | | |
|---|---|---|
| Above Canopy | 2031 | 1343 |
| 0 | 2197 | 1307 |
| 4 | 2177 | 1258 |
| 8 | 2140 | 1162 |
| 12 | 1832 | 888 |
| 16 | 1089 | 339 |
| 20 | 786 | 244 |
| 24 | 1427 | 234 |
| 28 | 1908 | 869 |
| 32 | 1850 | 1246 |
| 36 | 1849 | 1330 |

**UNITED STATES DEPARTMENT OF AGRICULTURE**
**PULLMAN PLANT MATERIALS CENTER**
**STUDY PLAN**

**STUDY TITLE:** ALMANAC: Evaluation of growth of snowberry

**STUDY NUMBER: WAPMC-T-1115-RA**

**STUDY TYPE:** Advanced Evaluation

**LAND USES:** Range, CRP, Upland Wildlife Habitat

**PROBLEM: PROBLEM:** NRCS initiated the Conservation Effects Assessment Project (CEAP) in 2003 with the intent to develop science supported methodologies that will allow NRCS to better estimate environmental benefits and effects attributable to NRCS conservation practices. Following discussions in 2006, CEAP efforts were expanded to go beyond estimating effects of practices to include developing new or improved tools and methodologies to enhance the effectiveness of conservation planning in meeting environmental goals. One of the specific objectives identified for CEAP is "reduce uncertainty in model estimates of conservation benefits" (Maresch et. al., 2008) which is the thrust of this proposal.

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In addition to providing good data to measure conservation practice impacts through CEAP, the field scale ALMANAC model could prove useful to NRCS field office staff, providing improved estimates of forage availability, potential wildfire fuel loads, and wildlife habitat suitability, as well as erosion potential on ecological sites. The data provided for use in the ALMANAC model is also expected to be of value in other modeling efforts such as SWAT (Soil and Water Assessment Tool), WEPS (Wind Erosion Prediction System) and assessment efforts such as those required in the Soil and Water Resources Conservation Act (RCA) of 1977.

**OBJECTIVE:** Document growth of snowberry.

**DURATION OF STUDY:** 2009-2011

**STUDY LEADERS:** Jim Briggs, WNTC PMS (Mark Stannard on-site data collector)

**LOCATION:** Field J1, PMC

**Study Evaluation Worksheet**

*Common Snowberry*

*Palouse SI*

*Date first green up observed:* *6/14/2011*

*Date 50% stand greened up:* *6/28/2011*

*Other Evaluations as required:*

PHOTOS TAKEN: ☐ Yes ☑ No

Photo File Stored: C:\[File Name]

| Evaluation Date | PLOT # | Life Cycle of Plot at Evaluation | Uniformity of Plot 1=poor 9=BEST | Height (cm) | Vigor - Overall Plot 1=Poor 9=BEST | Insect Pressure / Damage 1=Severe 9=NONE | Disease Pressure / Damage 1= Dead 9=None | Cold Injury 1=Major Damage 9=No Visible Damage | Heat Injury 1=Major Damage 9=NoVis Damage | Other Injury Fertilizer or Pesticide 1=None 9=BEST | Dormancy Begin/End |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 9/29/2011 | | fruiting | 7 | 45 | 6 | 9 | 6 | 9 | 9 | 9 | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

| | |
|---|---|
| Year: | 2011 |
| Species: | Snowbar snowberry |
| Age of material being evaluated (yrs): | 20 |
| Field (PMC location): | |
| Soils: | Palouse SiL |
| Series: | Palouse SiL |
| Texture: | SiL |
| Previous 3 year history (Narrative): | snowberry patch |
| Site prep summary (Narrative): | N/A |
| Irrigation (date, type, amount applied, amount needed): | None |
| Weed Control (date, type, chemical, application rate, application method): | none |
| Tillage (date, type, comments): | None |
| Fertilizer (date, type, amount applied, application method, Other): | none |

| **Species:** | **Snowberry** | | |
|---|---|---|---|
| Date: | | 9/29/2011 | 9/29/2011 |
| | pre-clip | | post-clip |
| FIPAR | | | |
| Above Canopy | | 1285 | 1288 |
| 0 | | 407 | 860 |
| 4 | | 387 | 727 |
| 8 | | 404 | 709 |
| 12 | | 419 | 863 |
| 16 | | 526 | 928 |
| 20 | | 671 | 996 |
| 24 | | 599 | 981 |
| 28 | | 772 | 1053 |
| 32 | | 685 | 912 |
| 36 | | 932 | 1008 |

| **Species:** | **Blanketflower** | | **Rep 2** |
|---|---|---|---|
| Date: | | 9/29/2011 | 9/29/2011 |
| | pre-clip | | post-clip |
| FIPAR | | | |
| Above Canopy | | 1288 | 1252 |
| 0 | | 365 | 736 |
| 4 | | 381 | 679 |
| 8 | | 341 | 835 |
| 12 | | 562 | 796 |
| 16 | | 698 | 880 |
| 20 | | 745 | 848 |
| 24 | | 716 | 897 |
| 28 | | 480 | 648 |
| 32 | | 349 | 743 |
| 36 | | 379 | 556 |

| **Species:** | **Blanketflower** | **Rep 3** |
|---|---|---|
| Date: | 9/29/2011 | 9/29/2011 |
| | pre-clip | post-clip |
| FIPAR | | |
| Above Canopy | 1184 | 1246 |
| 0 | 353 | 665 |
| 4 | 364 | 789 |
| 8 | 413 | 727 |
| 12 | 392 | 749 |
| 16 | 429 | 918 |
| 20 | 462 | 806 |
| 24 | 478 | 734 |
| 28 | 470 | 614 |
| 32 | 587 | 682 |
| 36 | 388 | 664 |

| **Species:** | **Blanketflower** | **Rep 4** |
|---|---|---|
| Date: | 9/29/2011 | 9/29/2011 |
| | pre-clip | post-clip |
| FIPAR | | |
| Above Canopy | 1253 | 1324 |
| 0 | 357 | 764 |
| 4 | 419 | 750 |
| 8 | 523 | 727 |
| 12 | 351 | 789 |
| 16 | 562 | 790 |
| 20 | 563 | 808 |
| 24 | 439 | 771 |
| 28 | 579 | 693 |
| 32 | 575 | 667 |
| 36 | 732 | 688 |

**UNITED STATES DEPARTMENT OF AGRICULTURE**
**WASHINGTON PLANT MATERIALS SPECIALIST**
**STUDY PLAN**

**STUDY TITLE:** Range Revegetation: Evaluation of 9 populations of bluebunch wheatgrass + 1 population of Snake River wheatgrass

**STUDY NUMBER: WAPMS-T-1001-RA**

**STUDY TYPE:** Advanced Evaluation

**LAND USES:** Range, CRP, Upland Wildlife Habitat

**PROBLEM:** Bluebunch wheatgrass ecotypes in the commercial seed market have not been adequately tested in Washington.

**OBJECTIVE:** Compare 9 populations of bluebunch wheatgrass + Secar snake river wheatgrass.

**DURATION OF STUDY:** 2010-2013

**STUDY LEADERS:** Richard Fleenor

**LOCATION:** WSU Prosser Experiment Station

**STUDY DESIGN:** RCB, 3 reps x 10 treatments.

**TREATMENTS:**

1. 'Secar' Snake River wheatgrass
2. 'Whitmar' beardless wheatgrass
3. 'Wahluke' SI bluebunch wheatgrass
4. 'Anatone' bluebunch wheatgrass
5. 'P32' germplasm bluebunch wheatgrass
6. 'Goldar' bluebunch wheatgrass
7. 'Duffy Creek' SI bluebunch wheatgrass
8. 'Boardman' SI bluebunch wheatgrass
9. 'P7' bluebunch wheatgrass
10. 'White bluff' SI bluebunch wheatgrass

**PROGRESS:**

**2011--** Nine different bluebunch wheatgrass plant materials and one Snake River wheatgrass cultivar were sampled in late November for the amount of fall "green-up" produced. Fall green-up production may indicate ability to compete with winter annuals.
The field trial was in the 6-9 inch precipitation zone of Washington State. During the period from Sept 1 to Nov 29, 2011 (data collection day) the site received 0.77 inches of rain. Samples were taken by clipping all new growth 2 inches above the ground in a 1 linear foot section of an

established drill row. Results are presented below; data were transformed using a Square root Transformation.

| Cultivar | Mean (grams, dry weight) | Homogeneous Groups* |
|---|---|---|
| Secar (Snake River cultivar) | 1.82 | A |
| P-7 | 1.42 | AB |
| White Bluff (Source Id) | 1.3 | AB |
| Anatone | 1.26 | ABC |
| Wahluke (Source Id) | 1.0 | ABCD |
| Whitmar | 0.92 | BCD |
| P-32 | 0.66 | CD |
| Boardman (Source Id) | 0.56 | CD |
| Goldar | 0.44 | DE |
| Duffy Creek (Source Id) | 0.14 | E |

*Homogeneous group letters indicate significant differences, i.e. cultivars containing the same letter/s are not significantly different.

Data shows significant differences between some of the sampled materials which could indicate differences in competitive ability with winter annuals.

1. Bluebunch wheatgrass, Anatone green-up

**UNITED STATES DEPARTMENT OF AGRICULTURE**
**WASHINGTON PLANT MATERIALS SPECIALIST**
**STUDY PLAN**

**STUDY TITLE:** Range Revegetation: Evaluation of native grass forb mix for improving wildlife habitat, Swanson Lake.

**STUDY NUMBER: WAPMS-T-1002-RA**

**STUDY TYPE:** Conservation Field Trial

**LAND USES:** Range, Upland Wildlife Habitat

**PROBLEM:** Data on forb/grass mixes is lacking.

**OBJECTIVE:** Compare establishment of forbs and grasses on an upland site.

**DURATION OF STUDY:** 2009-2013

**STUDY LEADERS:** Richard Fleenor

**LOCATION:** WDFW Swanson Lake Refuge

**STUDY DESIGN:** N/A

**PROGRESS:**

**2011--** In the fall of 2009 to improve wildlife habitat native bunchgrasses and wildflowers were planted on the Swanson Lake Wildlife Refuge. A fall dormant planting was done with an air seeder followed by a tine harrow. To determine individual species establishment success, frequency data were collected in the spring of 2011.
Bunchgrass establishment was very successful with Sandberg bluegrass dominating much of the stand. Bluebunch wheatgrass and Idaho fescue were present but in much lesser amounts (i.e. < 5% cover).

1 . Swanson Lake Seeding

Eleven source identified wildflower species (balsamroot, silky lupine, blue flax, Yarrow, buckwheat, shaggy fleabane, tapertip hawksbeard, Blue Mt. penstemon, fire cracker penstemon, globemallow, and annual sunflower) were included in the mix. Frequency data for wildflower species were collected from two transects with 10 sample quadrats each, see results below.

| Species | Occurrence (% of plots found in) |
|---|---|
| yarrow | 60 |
| shaggy daisy | 50 |
| blue flax | 5 |
| firecracker penstemon | 5 |
| Blue Mt. penstemon | 5 |
| Tapertip hawksbeard | 5 |
| all others | 0 |

Yarrow and shaggy daisy were easily the most successful in terms of establishment. The other species occurred much less often, if at all. The plant materials varied considerably in terms of PLS, and dormancy, which very likely contributed to their presence/absence within the seeding.