Restoration Prescriptions for WNPS Shrub-Steppe Restoration Pilot Project

by Aaron Rosenblum

Introduction

The Waterville Plateau in Douglas County, Washington was historically covered in an expanse of shrub-steppe habitat. Over the course of the past century, approximately 75 percent of the land area has been converted from natural habitat to agricultural production. Foster Creek Conservation District (FCCD), in cooperation with federal and state agencies and local landowners, has developed a plan to increase the quantity and quality of shrub-steppe habitat in Douglas County. The Multiple Species General Conservation Plan (MSGCP) for Douglas County, Washington uses habitat as a proxy for the recovery of four species of concern in the county: Columbia Basin pygmy rabbit (*Brachylagus idahoensis*), Washington ground squirrel (*Urocitel-lus washingtoni*), Columbian sharp-tailed grouse (*Tympanuchus phasianellus* ssp. *columbianus*), and greater sage-grouse (*Cen-trocercus urophasianus*). The MSGCP outlines a process where landowners receive an Endangered Species Act Section 10 in-cidental take permit in exchange for implementing a variety of conservation actions that will restore and improve shrub-steppe habitat. One of the conservation options available to landown-ers to receive an incidental take permit is to convert areas of low production wheat back to native shrub-steppe habitat.

While extensive information exists on the restoration of shrub-steppe habitat, spatial and temporal variations in biotic and abiotic factors can make restoration success difficult to predict. The conversion of low production agricultural fields back to native habitat is not a new concept; however, in Douglas County little research has been conducted comparing the success of different restoration activities. This pilot project tested the success of five different restoration prescriptions, Rx # 1–5. The lessons learned and knowledge gained from this project will be applied to future restoration activities undertaken by FCCD.

Wenatchee Valley Chapter members Bill Deters, Jessica Gonzales, and Don Schaechtel help install restoration test plots at The Nature Conservancy's Moses Coulee Preserve in south central Douglas County PHOTO: AARON ROSENBLUM

Site Descriptions

Two sites in Douglas County were selected with the help of local cooperators to establish test plots. The sites can be considered representative of agricultural fields throughout the county in that neither has obvious unique or extraordinary characteristics. Larger scale conversion to habitat is planned or underway at both sites, allowing for additional future comparison.

The first site (TNC) is located on The Nature Conservancy's Moses Coulee Preserve in south central Douglas County. This site was historically used for agricultural production, but has not been in use for approximately 15 years. A previous restoration attempt was made at the site, but was largely unsuccessful due to invasion by cheatgrass (*Bromus tectorum*) and Russian thistle (*Salsola tragus*). Some native bunchgrasses, including bluebunch wheatgrass (*Pseudoroegneria spicata*) and Sandberg's bluegrass (*Poa secunda*), persist from the first restoration attempt. To prepare the site, a controlled burn took place followed by an application of a pre-emergent herbicide targeting cheatgrass in the fall of 2017. Broadleaf herbicide was applied in the spring of 2018.

The second site (NE DOCO) is located on a private agricultural field in northeast Douglas County within an area that is concurrently being converted to habitat through a program funded by The Sage Grouse Initiative. Prior to the fall of 2018, the field was managed in a no-till, three-year winter wheat, canola and deferment cycle. Weed control prior to implementation was conducted by the landowner using non-selective herbicides.

Methods

Restoration seed mixes were developed based on information from Ecological Site Descriptions (NRCS), reference areas, WNPS species lists, and Burke Herbarium records specific to north central Washington. Seeds were locally sourced and matched to Douglas County climatic conditions to the extent possible. Where possible, flowering phenology was considered to maximize wildlife/pollinator habitat throughout the year.

Establishment of test plots included the following elements: weed control prior to restoration activities (described above), seed bed preparation through hand raking, broadcast seeding of various mixes at a rate of 20 pounds of pure live seed (PLS)/acre (0.5 pounds PLS per plot), and seed to soil contact enhancement accomplished by walking over the plot after seeding. TNC was established with the help of WNPS Native Plant Steward Volunteers.

Rx #1 "Basic Ecological Site Description" This seed mix is designed to match species compositions found in the Ecological Site Description (ESD) Loamy 9-15 PZ. ESDs are developed by NRCS and are commonly used as a reference by local, state, and federal natural resource practitioners. ESDs provide the historical climax plant community composition. This is the "basic" mix because it contains only four species that are commonly available from local vendors with local genetics. Due to the low diversity and lack of forbs, this mix is the most economical of the prescriptions.

Rx #2 "CRP mix" This seed mix is based on a standard Conservation Reserve Program (CRP) mix for the appropriate rainfall zone in Douglas County. CRP is currently the primary way that agricultural fields are converted to habitat in Douglas County.

Rx #3 "Early Seral" This species mix contains high proportions of early successional species. Early successional species are disturbance adapted and more readily compete with undesired weed species.

Rx #4 "Sage-grouse" This restoration prescription is designed to reflect quality sage grouse habitat. All forb species are sage grouse preferred forbs as identified by NRCS and the Sage Grouse Habitat Assessment Framework. This is the most expensive seed mix due to the higher percentage of forbs in the seed mix.

Rx # 5 "Early + Amendment" This prescription is the same as the "early seral", but will include biochar being incorporated into the soil prior to seeding. Biochar is a carbon-rich organic material produced during slow exothermic decomposition of biomass at temperatures ≤700°C under zero oxygen or low oxygen conditions (Lehmann and Joseph 2009). Some studies have shown that Biochar improves soil physical characteristics such as organic matter, bulk density, and soil water holding capacity.

Monitoring Protocol:

For each of the two sites, TNC and NE DOCO, six plots, five prescriptions, and one control were established. For each of the 12 plots, three 0.5m² sampling units were randomly chosen using a random number generator. Sampling units were denoted and centered upon their X and Y coordinates in meters (relative to an arbitrary baseline) for each plot. Each sampling frame was permanently established and re-sampled during each subsequent monitoring visit.

For each sampling unit, density of each species was measured by counting the number of individuals rooted within the sampling frame. If species could not be determined (such as in the first spring after seeding), individuals were grouped into functional groups and native vs. non-native categories if possible.

For each sampling unit, percent cover by species was estimated by the observer. Each species was estimated independently

Name	Common Name	1	2	3	4	5	Flower Date
		% PLS in mix	% PLS in mix	% PLS in mix	% PLS in mix	% PLS in mix	
Pseudoroegneria spicata	bluebunch wheatgrass	72	47	35	45	35	June-July
Festuca idahoensis	Idaho fescue	9		5	12	5	May-June
Poa secunda	Sandberg's bluegrass	9	15.6	35	23	35	April-June
Elymus lanceolatus ssp. *lanceolatus*	thickspick wheatgrass		20.8				May-July
Artemisia tridentata spp. *tridentata*	Wyoming big sagebrush	10	1				August-October
Ericameria nauseosa	rubber rabbitbrush			15	5	15	July-September
Lomatium dissectum	fernleaf biscutroot			4	3	4	April-May
Achillea millefolium	common yarrow			6	2	6	May-June
Eriogonum umbellatum	sulfur flower buckwheat				8		June-September
Erigeron speciosus	showy fleabane				2		June-August
Linum lewisii	blue flax		15.6				May-July

Seed mixes used for the pilot study to determine best restoration prescriptions for converting wheat fields to shrub-steppe habitat in Douglas County, Washington, March 2017.

without exclusion by overstory, if it existed. Therefore, total cover may sum to greater than 100 percent. Bare ground and litter cover were also estimated by the observer and were counted if there was no vegetation in the overstory. As above, if species could not be determined, individuals were grouped into functional groups and native vs. non-native categories if possible.

Conclusions

It is difficult to make any sweeping or concrete statements about the data gathered in this study. The sample size was simply too small. However, the purpose of this pilot study was to look for trends or patterns in the data related to the success of five different restoration prescriptions.

The strongest signal observed in the data is the initial success of two seeded species across seed mixes and at both sites. These two species are Sandberg's bluegrass (*Poa secunda*) and common yarrow (*Achillea millefolium*). This trend was especially strong at the TNC site, where the abundance of these two species accounted for the majority of all observed species. Sandberg's bluegrass did not perform quite as well at the NE DOCO site, but was still observed at high densities.

Plots for Rx #s 3, 4, and 5 contained the highest average densities of seeded species at both sites. At the TNC site these densities were essentially equal. At the NE DOCO site, average seeded species densities were higher in Rx #'s 3 and 5 than in 4, but this observed difference may not be significant. These seed mixes contained the largest proportions of early successional species.

Overall, seeded shrub species performed poorly. Only seven rabbitbrush seedlings were observed in sample frames across all plots and sites. This is counterintuitive to what is observed in nature, as rabbitbrush is typically a rapid colonizer of disturbed sites. Sagebrush was observed in promising densities at the TNC site, but only one seedling was observed within all plots at the NE DOCO site. This could be due to differences in soil across the two sites, or it could be due to natural recruitment from mature sagebrush in close proximity to plots at the TNC site.

A few aspects of this pilot study did not work well, or failed to produce observable differences in Rx's. Little to no difference was observed at the biochar amended plots (Rx #5) at either site. Seeded forbs, with the exception of yarrow, were largely absent across all plots at both sites. Based on this, it would be hard to justify the extra investment required to implement Rx #4 on a large scale. However, other forb species, sources, and methods of planting should be investigated.

Restoration prescriptions with the highest proportion of early successional species performed the best on density data gathered the first spring after seeding. This trend is largely due to the success of Sandberg's bluegrass and common yarrow. This knowledge could be used by resource management professionals in Douglas County to inform future conservation actions. Follow up visits to test sites will be necessary in the future to determine if the observed seeded species continue to establish and outcompete invasive weeds.

References:

Foster Creek Conservation District et.al. 2015. Multiple Species General Conservation Plan (MSGCP) for Douglas County, Washington (http://www.fostercreekcd.org/app/download/7246519466/DCGCP_Full_Document_formatted.pdf)

Lehmann, J. and S. Joseph. 2009. Biochar for Environmental Management: Science and Technology. *Earthscan*, London, 405 p.

University of Washington, Burke Herbarium Image Collection: http://biology.burke.washington.edu/herbarium/imagecollection.php

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