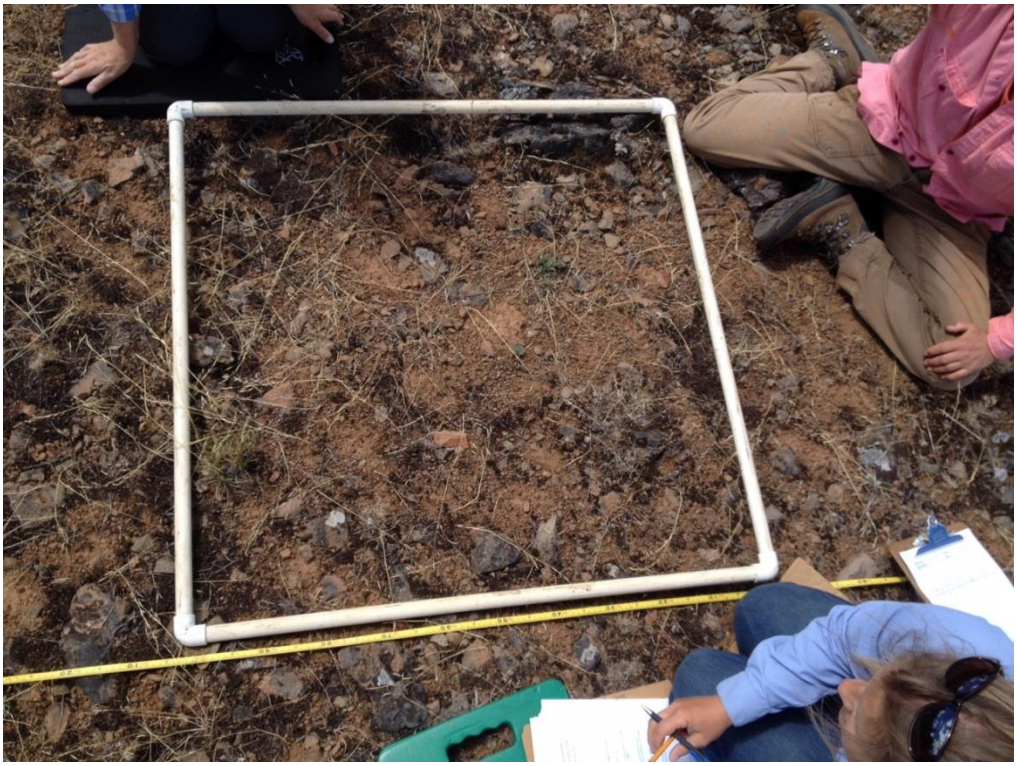
Interagency Special Status and Sensitive Species Program
Final Report for FY 2015 Funded Project

DATE: April 8, 2016
PROJECT TITLE: Long Term Monitoring and Habitat Assessment of *Achnatherum wallowaense* (Wallowa needlegrass) Populations
SPECIES LIST AND RANKS: *Achnatherum wallowaense* (Wallowa needlegrass) G2/G3, S2/S3, FS Sensitive, ORBIC List 1
FIELD UNIT: Ochoco National Forest
PROJECT LEAD: Jill Welborn, Botanist, Ochoco National Forest (jillewelborn@fs.fed.us)



SUMMARY: The five known populations of Wallowa needlegrass on the Ochoco National Forest were monitored using a standardized sampling and data collection protocol. Wallowa needlegrass populations appear to be relatively stable compared to prior population estimates. Data indicate that recruitment of young plants is very low. Invasive annual grasses are established at all sites. These invasive grasses, drought, and low population numbers appear to be the greatest threats to species viability on the Ochoco National Forest. A monitoring plan and management recommendations are included.

1. Introduction

The project's purpose is to establish a monitoring plan, collect population data, and provide a habitat assessment of Wallowa needlegrass populations on the Ochoco National Forest. We established permanent plots at each of the five known populations of Wallowa needlegrass on the forest. These plots will provide a basis for the collection of consistent, long-term population data and will allow for a way to measure change over time of key habitat condition indicators at the population sites.

Baseline demographic data on Wallowa needlegrass were collected and recorded at each plot. Habitat condition indicators, such as the amount of bare soil, and cover of introduced, annual grasses, were also recorded. The data provide a snapshot of the plant's current status on the Ochoco National Forest. It also serves as a baseline for comparison to future monitoring, as part of the monitoring plan for Wallowa needlegrass, also presented in this report. Monitoring results will help us evaluate whether a change in management or other conservation measures are needed to meet objectives for Wallowa needlegrass and its habitat.

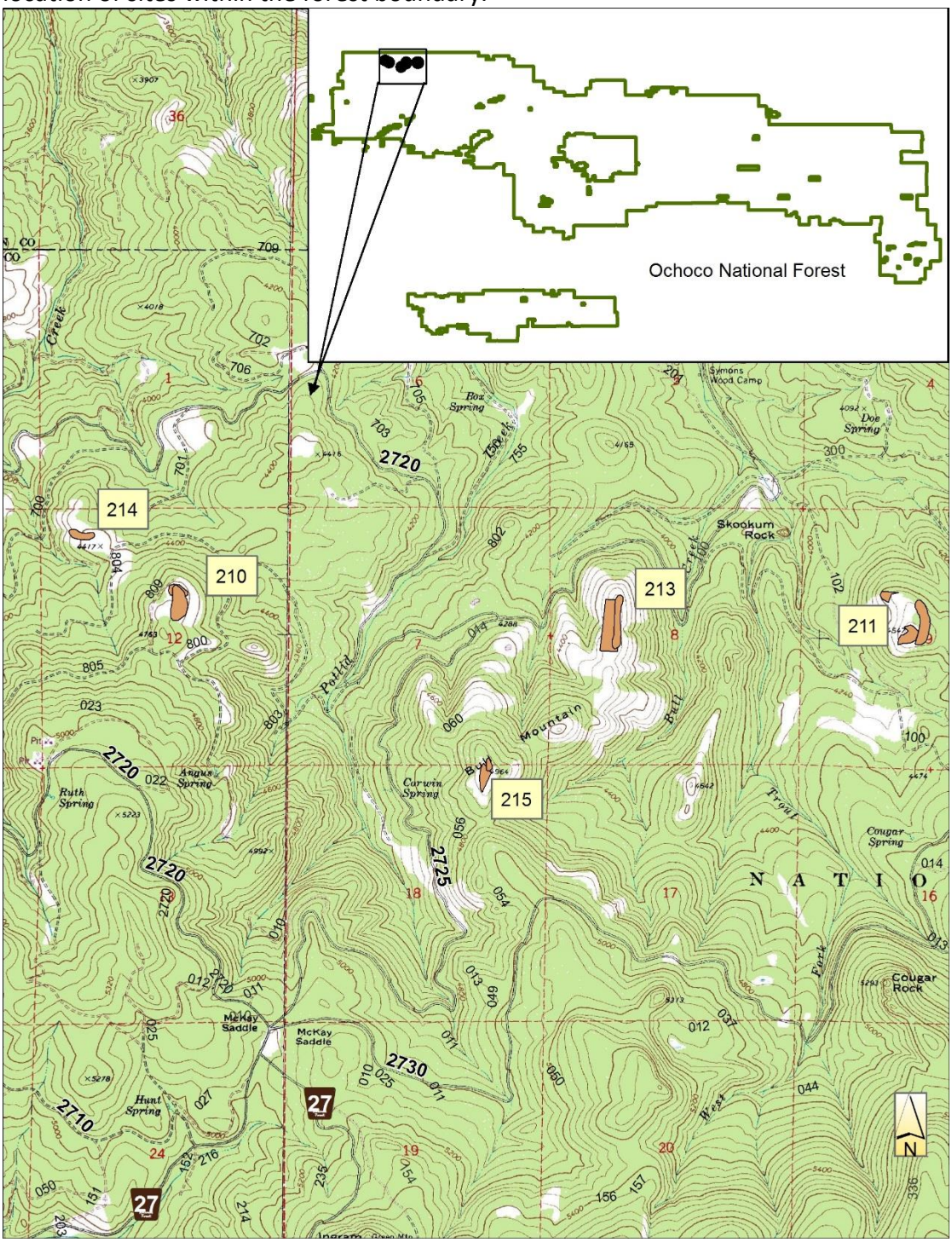
2. Background

Wallowa needlegrass is a rare, regionally endemic, perennial bunchgrass that is restricted to the Blue Mountains ecoregion of northeastern and central Oregon. Wallowa needlegrass has narrow habitat requirements and is strongly associated with scablands. These scablands are non-forested openings on ridgetop settings with shallow, rocky soil. Generally, occupied scablands support low plant cover, the dominant vegetation being *Poa secunda* (Sandberg's bluegrass) and other native bunchgrasses. Threats to Wallowa needlegrass include invasive plants, livestock grazing, timber and fuels management, off-road vehicle use, and climate change (Dewey 2013). Of these, invasive plants, livestock grazing, and a long-term drying trend (potentially related to climate change) likely pose the highest risks and are also the most difficult to manage. The primary invasive plant threat is that of introduced annual grasses, including *Ventenata dubia* (Ventenata grass or North Africa grass), *Bromus tectorum* (cheatgrass), *Bromus commutatus* (meadow brome), *Bromus japonicus* (Japanese brome and similar species), and *Taeniatherum caput-medusae* (medusahead). It is thought these grasses compete with Wallowa needlegrass and other native bunchgrasses for spring moisture and nutrient resources, or may otherwise competitively exclude native bunchgrasses on sites where they co-occur. A high density of annual invasive grasses may also alter the local fire regime, potentially causing the ordinarily barren and fire-resistant habitat occupied by Wallowa needlegrass to burn in wildfires.

There are five known populations of Wallowa needlegrass on the Ochoco National Forest, all distributed within a small area of the northwestern portion of the forest within Crook County (Figure 1). Approximately 27 sites are known within Wallowa County, Oregon. A conservation assessment compiling existing information on the species was prepared in 2013 (Dewey 2013). The conservation assessment presented population trend data for the Ochoco populations that included approximate population census counts from site visits in the 1990s (some sites were visited in 1992, and some in 1996), and a similar recount for most sites in 2006. At the time of

the conservation assessment, results indicated a mixed trend, with estimated population numbers decreasing for two out of four sites, and increasing for one. Estimated area of occupation appeared to increase at two sites and decrease at two sites (Dewey 2013). A comparison of these rough population estimates with current data will be presented below.

Figure 1. Map of Wallowa needlegrass sites on the Ochoco National Forest. Inset map depicts location of sites within the forest boundary.



3. Methods

Each of the five Wallowa needlegrass sites were included in the study. At each site, a permanent 50 m x 50 m macroplot was established centered on the core of each population where Wallowa needlegrass plants were most dense, with the plot sides aligned to cardinal directions (Figure 2). Rebar markers were installed at each corner of the macroplot and at 5 m intervals on the east and west axes of the plot. Plot corner locations were determined using GPS and coordinates recorded, and the macroplot site was photographed. Each macroplot was divided into transects spaced 5 m apart. Transects began at the 5 m mark at the southwest corner of the macroplot (working south to north along the west macroplot axis). A measuring tape was laid and secured using the rebar markers to establish each transect. The zero end of each transect was located on the west side of the macroplot and transects were read working from west to east. On the south side of each 50 m transect, a m² plot frame was placed when a Wallowa needlegrass (ACWA) plant was encountered (Figure 3). The plot frame was placed at the nearest meter to where the first plant was found (i.e., plant found at 3.4 m, frame placed between 3 and 4 m). The plots were numbered according to their meter location along the transect. The first plot on each transect was photographed looking down on the plot frame.

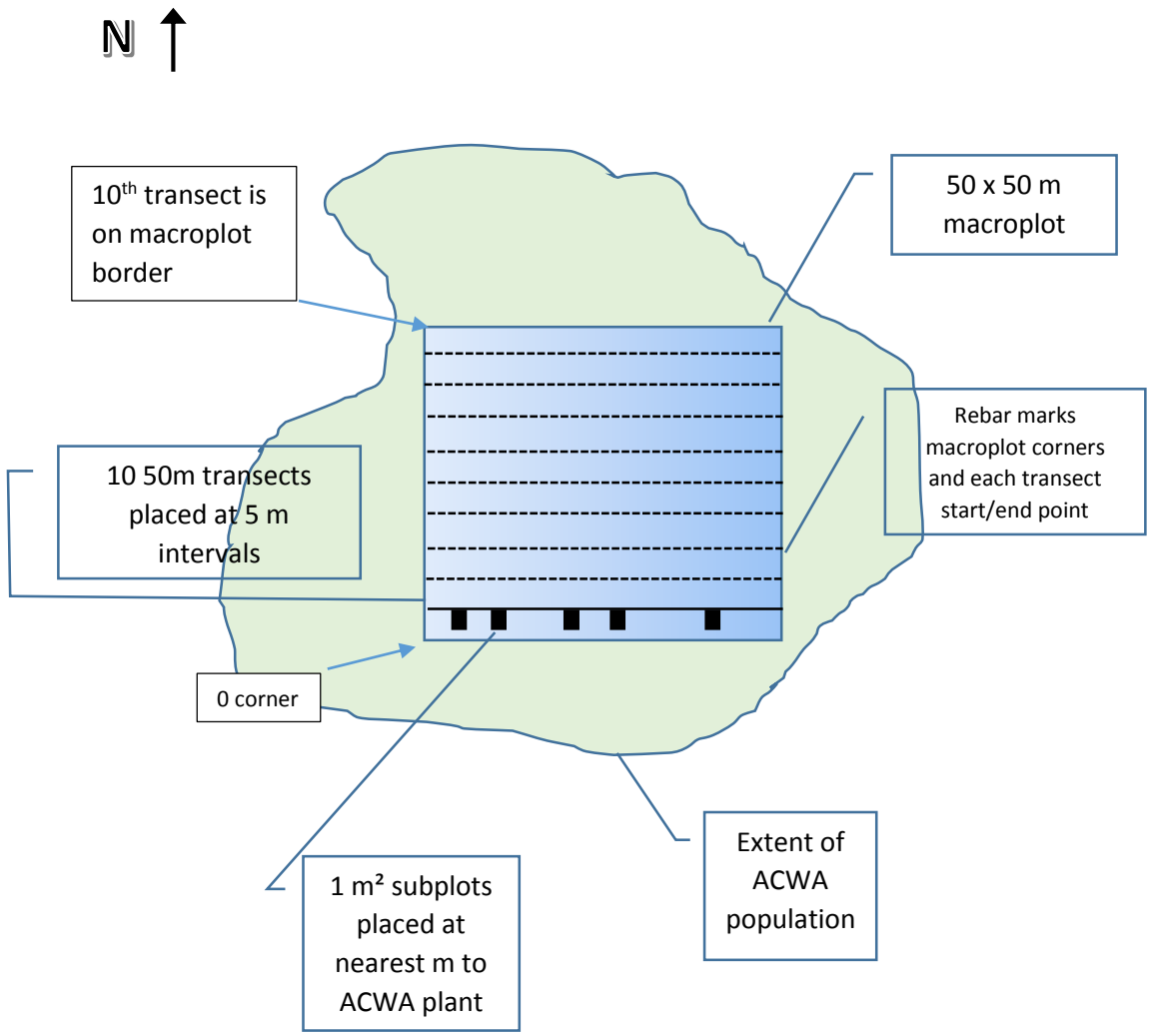
Within each m² plot, the following metrics were recorded:

- Count ACWA seedlings (small plants with just a few leaf blades)
- Count ACWA juveniles (plants larger than seedlings, up to 2 cm diameter, lacking flowering culms)
- Each mature ACWA plant clump, including basal diameter and number of current-year flowering culms (if plant was bisected by the plot frame, it was counted in only one plot)
- Invasive plants by species, estimated number of culms, estimated cover class (Table 1)
- Estimated bare ground (exposed soil) by cover class (Table 1)
- Estimated biocrust (lichen and/or moss cover) by cover class (Table 1)

Table 1. Cover class categories for all cover class estimates

Cover class category	Cover range %
1	0-5%
2	5-25%
3	25-50%
4	50-75%
5	75-100%

Figure 2. Study design graphic



All data was recorded by hand in the field and subsequently entered into an Excel spreadsheet for analysis. Hard copy data sheets have been retained for future reference.

Some data that were included in the original proposal were not collected. Percent cover for forbs, shrubs, and trees was not recorded in the m² plots. These may have been overlooked in implementation. However, trees, shrubs, and forbs had very minimal cover in most of the Wallowa needlegrass sites. Soil characteristics, including soils classification and laboratory analysis of soil samples were also not included in the study. Likewise, the risk analysis included in the original proposal was not carried out. This was due to the project changing lead botanists early in the data collection phase of the project. The new project lead had no information regarding the prior development of risk models proposed for adaptation for this project.

Figure 3. Reading a m² plot at Site 210

4. Results

Demography and population trend

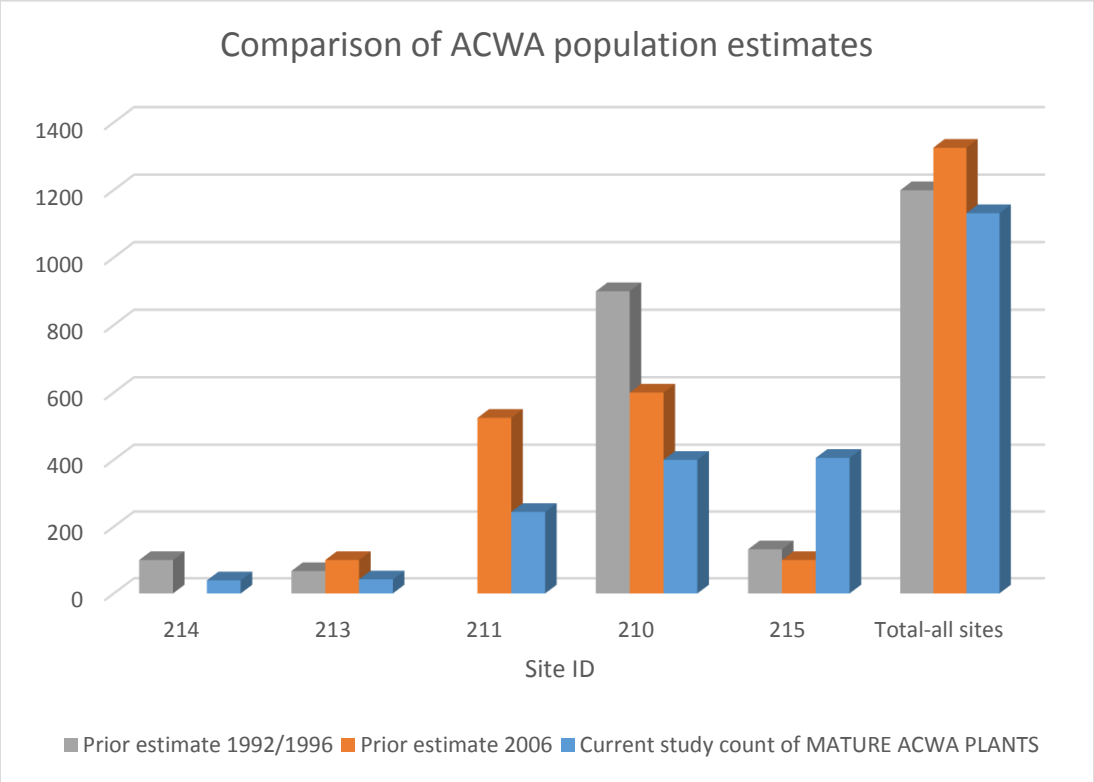
The number of mature ACWA plants recorded in the plots ranged from 39 at site 214 to 405 at site 215 (Table 2). Each distinct plant clump was counted as one mature plant; the larger clumps may include more than one genet, but many clumps appeared to be a single genet. Seedlings ranged from 0 at site 211 (5 dead seedling plants were recorded at site 211) to 25 at site 210. The low seedling numbers could represent either the difficulty of detecting all seedlings in a plot or a low level of recent recruitment. While the former cannot be ruled out, the data collection crew was well trained and skilled in seedling identification, suggesting that low recruitment could be responsible for some portion of the low numbers. Juvenile plant numbers were higher than seedlings across all sites. Site 213 appeared to have the highest recruitment levels as a percentage of the adult plant population.

Table 2. Wallowa needlegrass demographic data

Site Number	Count of MATURE ACWA PLANTS	Count of SEEDLINGS	% of MATURE PLANTS	Count of JUVENILES	% of MATURE PLANTS
210	400	25	6%	76	19%
211	244	0	0%	27	11%
213	42	11	26%	19	45%
214	39	1	3%	2	5%
215	405	4	1%	140	35%
Total-all sites	1130	41	4%	264	23%

The conservation assessment for Wallowa needlegrass included tentative population trend data for the Ochoco Wallowa needlegrass populations (Dewey 2013). These were rough population estimates based on field visits made in 2006 and in either 1992 or 1996, depending on the site. Only four of five sites were included in both sets of prior visit data, but these were different sites (site 214 is lacking 2006 data; site 211 is lacking 1992 or 1996 data). Since the prior estimates were for the total population, while the current project only included a census of plants captured within plots, it is not valid to conclude that populations are declining by comparing the population estimates with plot data. However, some sense of population expansion or contraction may be inferred while keeping these caveats in mind (Figure 4).

Figure 4. Plot census data in current project compared to prior population estimates



Of particular interest is site 215, which increased in number compared to prior population estimates, especially considering the smaller area sampled by the plots compared to a total population estimate. To assist with inferring trend, an analysis of the area occupied by plants in the previous estimates is compared to the area sampled by the plots in the current project (Table 3).

Table 3. Area sampled in current project and prior estimates of area occupied

Site Number	Current project-number of plots	Current project area sampled (ac)	Prior estimate area-2006 (ac)	% of area sampled based on 2006 estimate	Prior estimate area-1992/1996 (ac)	% of area sampled based on 1992/1996 estimate
210	159	0.03928	1.8	2.18%	4.3	0.91%
211	123	0.03039	3.2	0.95%	4.1	0.74%
213	26	0.006424	8.1	0.08%	3.4	0.19%
214	14	0.003459			1.6	0.22%
215	199	0.04917	1.7	2.89%	0.6	8.20%

Despite the small area sampled by the plots in the current project study design, it is notable that these plots seem to have detected a substantial portion of the populations, as evidenced by the comparison of prior population estimates to the number of adult plants counted in the plots.

Measures of mature plant basal diameter and number of flowering culms reveal that these are likely positively related (Figure 4). Values for basal diameter ranged from 0.2 cm to 19.0 cm. As mentioned earlier, the larger clumps may represent multiple, genetically distinct individuals (Figure 6). The larger plants clearly tended to have more flowering culms. The number of culms ranged from 0 to 32.

Figure 5. Mature plant basal diameter plotted against number of flowering culms per plant

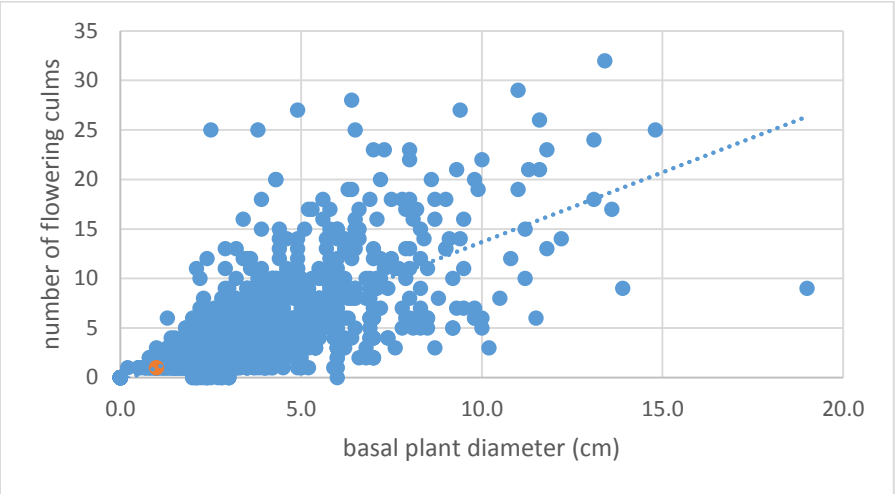


Figure 6. A robust Wallowa needlegrass plant at site 211. A sparse cover of Ventenata is also visible.

Average mature plant basal diameter varied somewhat by site (Table 4). It is possible that this could indicate a somewhat older population where the average basal diameter is larger. Demographic studies for other grass species have found that plant size and age were significantly positively correlated (Laurenroth and Adler 2008).

Table 4. Mature Wallowa needlegrass plants, average basal clump diameter, and average number of culms per clump

Site Number	Count of MATURE ACWA PLANTS	Average DIAMETER (CM)	Average CULMS (#)
210	400	4.59	6.00
211	244	3.26	5.39
213	42	3.24	3.64
214	39	3.38	3.64
215	405	3.09	3.36

Site Number	Count of MATURE ACWA PLANTS	Average DIAMETER (CM)	Average CULMS (#)
Total/av-all sites	**1130**	**3.68**	**4.75**

Habitat condition and invasive plants

Habitat condition was evaluated through cover class estimates of bare soil, biotic soil crust, and invasive annual grasses (Table 5). Ventenata (VEDU) had the highest cover class values where present, while cheatgrass (BRTE) tended to have similar frequency as Ventenata (the number of plots with an annual invasive grass species present) but with generally lower cover (Table 6). *Bromus commutatus* (BRCO) and similar *Bromus* species were detected only at site 210, while medusahead (TACA8) was detected at two sites. The latter two invasive grasses had very low cover and frequency. Stem counts were estimated for annual invasive grasses, but accuracy was likely lower where a high density of annual grass plants had to estimated by the observers. Cover class seems a more consistent measure and also allows for comparison with bare soil and biotic soil crust data.

Table 5. Average cover class values by site for habitat indictor measures

Site ID	Average VEDU COVER CLASS	Average BRTE COVER CLASS	Average BRCO COVER CLASS	Average TACA8 COVER CLASS	Average BARE GROUND COVER CLASS	Average BIOCRUST COVER CLASS
210	22.6%	3.1%	1.9%	0.6%	51.5%	40.7%
211	13.7%	9.9%	0.0%	0.0%	63.6%	32.8%
213	0.1%	9.1%	0.0%	0.0%	58.8%	27.9%
214	21.3%	3.2%	0.0%	0.0%	68.0%	29.1%
215	47.5%	4.3%	0.0%	0.5%	34.8%	49.7%
Av-across all sites	29.0%	5.5%	0.6%	0.4%	48.7%	41.4%

Bare ground and biotic soil crust values vary somewhat by site. Sites 210 and 215 support the largest Wallowa needlegrass populations and also had the highest biotic soil crust cover estimates. However, these sites also supported high cover of Ventenata.

Table 6. Frequency of invasive annual grasses by site

Site Number	Total number of plots	VEDU in plot (n)	VEDU-% frequency	BRTE in plot (n)	BRTE-% frequency	TACA8 in plot (n)	TACA8-% frequency	BRCO in plot (n)	BRCO-% frequency
210	159	159	100%	139	87%	1	1%	3	2%
211	123	122	99%	123	100%	0	0%	0	0%
213	26	1	4%	26	100%	0	0%	0	0%
214	14	14	100%	13	93%	0	0%	0	0%
215	199	199	100%	180	90%	1	1%	0	0%

While the sites differ substantially with respect to Ventenata frequency and cover, comparison with demographic data reveals little in the way of patterns (Table 7). There may be too few sites to draw reasonable conclusions. Site 213 is the only site where Ventenata is not pervasive, and while seedling/juvenile plants as a percentage of the adult population is relatively higher at this site, the overall number of Wallowa needlegrass plants is relatively low. It is noteworthy that site 213 was the only site thought to have an increase in population trend in the conservation assessment (Dewey 2013).

Table 7. Comparison of ACWA demographic data to average invasive grass cover

Site Number	Count of MATURE ACWA PLANTS	Count of SEEDLINGS	Count of JUVENILES	Average of VEDU COVER CLASS VALUE	Average of BRTE COVER CLASS VALUE
210	400	25	76	22.6%	3.1%
211	244	0	27	13.7%	9.9%
213	42	11	19	0.1%	9.1%
214	39	1	2	21.3%	3.2%
215	405	4	140	47.5%	4.3%
Total-all sites	**1130**	**41**	**264**	**29.0%**	**5.5%**

5. Discussion

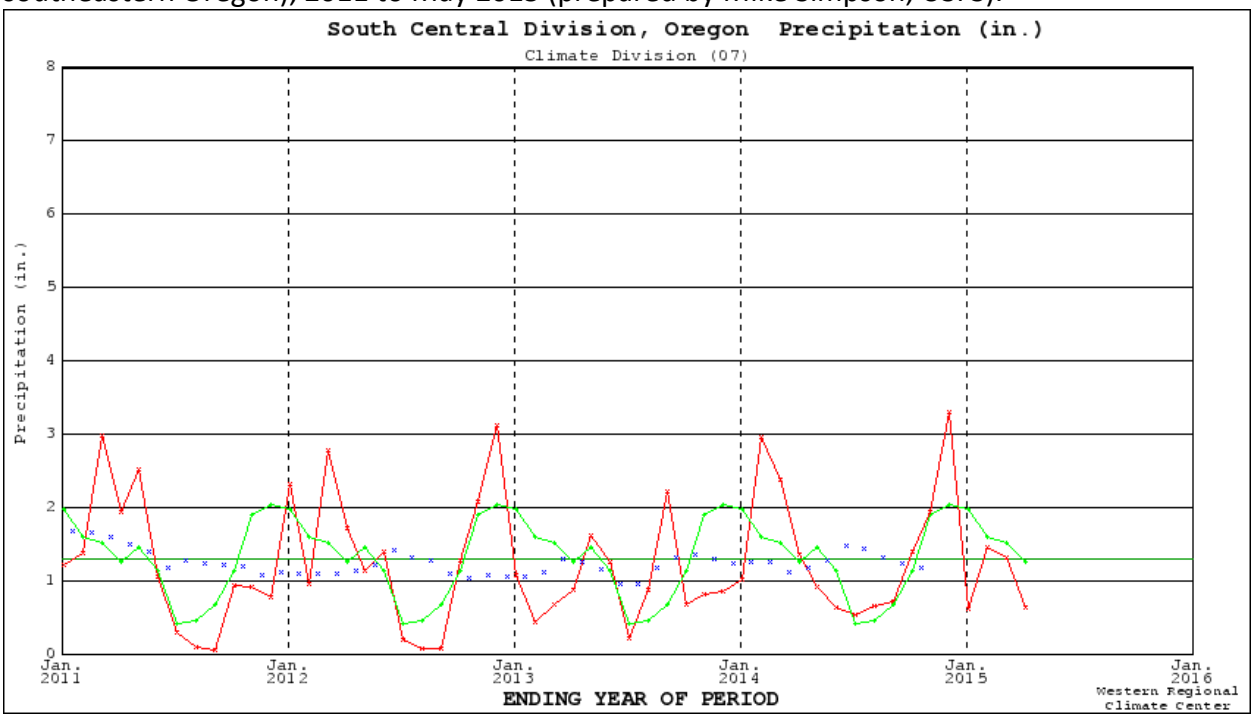
Demography and population trend

The limited number of sites and the lack of consistent data to compare temporal patterns of change limit interpretations of available data. It appears that the five Ochoco Wallowa needlegrass populations are stable but there is significant cause for concern. Continued monitoring will be an important management response (see section 6, Monitoring Plan, below).

All sites appear to exhibit very limited recruitment. This is unsurprising given the apparent drying trend in the years leading up to data collection, with precipitation regionally hovering below average (Figure 7). Mortality of young plants was observed at four of five sites. Factors such as plant competition may interact with water limitation in complex ways that simple monitoring measures cannot reveal. Continued monitoring through moister conditions would

help us determine the magnitude of plant responses to varied and challenging moisture conditions over time.

Figure 7. Precipitation for South Central Oregon (Division 7-includes a large area of central and southeastern Oregon), 2011 to May 2015 (prepared by Mike Simpson, USFS).



red - monthly data value
blue - 12 month running mean
green - average monthly value
dark green - average annual value

Habitat condition and invasive plants

Ventenata has heavily invaded four of the five Ochoco Wallowa needlegrass populations, and the one remaining site is at high risk, based on the presence of Ventenata at the site and susceptible habitat. Cheatgrass may have occupied the sites fully, as frequency is high across all sites. The presence of medusahead and other annual bromes indicate a high risk of increase of these plants. Japanese brome, meadow brome, and similar annual brome species are ubiquitous on similar scabland habitats occupied by the closely-related rare plant Henderson's needlegrass (*Achnatherum hendersonii*). This suggests these invasive annual grasses also have the potential to expand into Wallowa needlegrass sites. Treatment of medusahead populations near and within Wallowa needlegrass habitat should be prioritized (particularly near site 210, where a medusahead population associated with a road threatens to spread, and where medusahead was detected in a plot). All medusahead encountered in plots was pulled and removed from the site after data were collected.

Few management options currently exist to prevent annual grass spread. These high value sites may be good candidates for experimental deployment of new tools such as the annual grass

suppressant bacteria based on *Pseudomonas*. Limited use of selective herbicides with pre-emergent action on annual grasses, such as imazapic (Plateau) or aminopyralid (Milestone), could also be tried in conjunction with careful monitoring. Aminopyralid is not currently authorized for use on the Ochoco National Forest.

Conservation and promotion of increased biotic soil crust formation could also benefit Wallowa needlegrass populations. While biotic soil crusts clearly did not exclude exotic annual grasses, sites with the most robust Wallowa needlegrass populations also had the highest cover of biotic soil crust. At a minimum, formation of biotic soil crusts require time and lack of disturbance. The five Wallowa needlegrass sites had little evidence of significant disturbance or management activity, which suggests differences in biotic soil crust cover are at least in part due to intrinsic site characteristics.

Elk and deer scat was frequently observed, particularly at sites 210 and 215, possibly indicating relatively heavy wildlife use on these scablands. Wildlife can impact Wallowa needlegrass by direct herbivory, as a vector for invasive plants, and can modify habitat through soil disturbance and hoof action. Rodent burrowing was observed at site 210. Wildlife and livestock impacts (though no significant livestock impacts were noted at any of the sites) should be included in future monitoring efforts.

The data collected is most valuable as a baseline as we move forward with implementing the monitoring plan presented below.

6. Monitoring plan

Monitoring time frame

It is recommended that annual monitoring of Wallowa needlegrass populations continue for a period of five years. Annually and at the end of the initial five-year period, this monitoring plan should be evaluated and adjusted as we learn what works in monitoring and respond to monitoring results and/or changed conditions.

Management objectives and response

The management objectives for continued monitoring are:

- Maintain the number of mature Wallowa needlegrass plants detected in plots within 10% of baseline (as measured by current project) at each site over the five year monitoring period.
- Maintain the number of seedling and juvenile Wallowa needlegrass plants detected in plots within 20% of baseline (as measured by current project) at each site over the five year monitoring period.

While younger plants may be a better indicator of population viability, naturally high mortality and variability make the younger cohort a less reliable measure of trend. The disadvantage of using adults as an indicator is that they are long-lived and slower to respond to change. The

use of the two objectives together is intended to blend the two approaches to minimize the drawbacks of each.
If monitoring results indicate that a population has declined below either given threshold, the district botanist will attempt to determine potential causes and propose management actions designed to address the problem. If the cause or mechanism cannot be directly determined, the botanist may initiate additional investigations or consult experts to help determine an appropriate response.

Methods
The same macroplot, transect, and subplot design will be utilized for continued monitoring. Due to limited capacity and resources, only one site will be remeasured each year. Over the five year period, this will produce one data set for each site that can be compared to baseline data. Monitoring results will be analyzed annually for the one site that is remeasured, and for all sites at the end of the five year period.

Site conditions and evidence of management or disturbance will also be described during the revisit. Site photo monitoring points will be recollected.

Information collected will be presented in a report at the end of the five year monitoring period, along with management recommendations.

7. References

Dewey, R. 2013 (April). Conservation Assessment for Henderson's Needlegrass (*Achnatherum hendersonii*) and Wallowa Needlegrass (*Achnatherum wallowaense*). USDA Forest Service Region 6 and USDI Bureau of Land Management, Washington and Oregon. Available online at http://www.fs.fed.us/r6/sfpnw/issssp/species-index/flora-vascular-plants.shtml.

Laurenroth, W.K. and Adler, P.B. 2008. Demography of perennial grassland plants: survival, life expectancy, and life span. Journal of Ecology 96:1023-1032.