PALOUSE GOLDENWEED (*HAPLOPAPPUS LIATRIFORMIS*) MONITORING AT CRAIG MOUNTAIN, IDAHO - 1996 RESULTS.

by

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Abstract

Palouse goldenweed *(Haplopappus liatriformis*) is a perennial forb endemic to the Palouse Prairie region of eastern Washington and adjacent Idaho. It is one of the most serious plant conservation concerns in both states. Several of the largest Palouse goldenweed populations known occur at Craig Mountain and have been identified as critical to the species' long-term conservation. Permanent monitoring plots at three Palouse goldenweed populations were established and originally sampled in 1994 using nested frequency plot methods. The monitoring plots were resampled in 1996 and results from the two year data set are summarized in this report. The primary objective of monitoring is to assess vegetation trends at the three Palouse goldenweed populations sites managed by the Idaho Department of Fish and Game. Department management at Craig Mountain includes protecting rare plant populations.

Frequency data for each nested quadrat size was entered into CALCFREQ, a statistical software program designed to calculate percent frequency and test for significant differences in frequency between two different time periods. Based on a comparison of 1994 and 1996 data, no clear changes in vegetation trend are apparent. Cover class and nested plot frequency results indicate that the mid-seral conditions characterizing the three monitoring sites are largely unchanged between 1994 and 1996. The Department recognizes that maintaining good condition habitat is important for the long-term conservation of Palouse goldenweed. These results indicate that present IDFG management is compatible with the conservation of Palouse goldenweed habitat at the three Craig Mountain monitoring sites.

Acknowledgments

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Table of Contents

List of Tables

List of Appendices

Introduction

Palouse goldenweed (*Haplopappus liatriformis*) is a perennial forb endemic to the Palouse Prairie region of eastern Washington and adjacent Idaho. It is known from approximately 65 extant occurrences in the two states, the majority being in Idaho. Populations at Craig Mountain represent the species' southeastern distribution limit. Throughout its range, most populations are located on private land and consist of fewer than 100 individuals. The most vigorous populations of Palouse goldenweed occur within good condition grassland or grassland-forest transition zone plant communities. At Craig Mountain, livestock grazing and other disturbances have adversely affected large areas of canyon grassland habitat that are now in early to mid-seral condition. Degradation and loss of high quality habitat are recognized as the primary threat to the long-term conservation of Palouse goldenweed throughout its range (Gamon 1991). Several of the largest known populations of Palouse goldenweed occur at Craig Mountain and have been identified as critical for the species' long-term conservation (Mancuso and Moseley 1994).

Palouse goldenweed is one of 13 Idaho rare plant species known to occur at Craig Mountain. It is a former federal candidate species and presently on the U.S. Fish and Wildlife Service's Species of Concern list. Palouse goldenweed is a serious conservation concern in Idaho because of its limited range, the nearly complete conversion of its prairie habitat to agriculture, the fragmented nature of remaining habitat, the limited conservation options for private lands, and the small size of most populations and their many threats.

Three permanent monitoring plots for Palouse goldenweed were established at Craig Mountain in 1994. The monitoring plots were resampled during 1996, and results from the two year data set are summarized in this report. The primary objective of the monitoring plan is to assess vegetation trend at three Palouse goldenweed populations in areas managed by the Idaho Department of Fish and Game (IDFG). Trend data quantifies direction of change, if any, away or towards specific management objectives. IDFG management of the canyon grasslands at Craig Mountain will influence the long-term conservation of numerous rare plant populations occurring within this ecosystem. The IDFG recognizes that maintaining good condition habitat is important for the long-term conservation of Palouse goldenweed.

Methods

Craig Mountain is located south of Lewiston in north-central Idaho. The three permanently marked Palouse goldenweed monitoring plots are located on lands managed by the IDFG (Appendix 1). All three plots represent *Festuca idahoensis* (Idaho fescue) habitat types. They were established and initially sampled in 1994. Direction to the plots and plot layouts are found in Appendix 2. General vegetation and site information was collected in 1994 and follows the protocol of Bourgeron et al. (1991). Western Heritage Task Force Form II (Community Survey Form) and Form III (Ocular Plant Species Data) were completed for each plot. The Community Survey Form summarizes site characteristics such as location, environmental features, description, and conservation assessment. Because these site characteristics changed little if any between 1994 and 1996, a new form was not completed in 1996. Copies of the 1994 Community Survey Forms are found in Appendix 3. The Ocular Plant Species Data Form catalogs the plant species and their associated cover values within the macroplot. Because sampling took place one month earlier in 1996 compared to 1994, we were able to identify a number of new species for each plot this year. We completed a new Ocular Plant Species Data Form for each plot in 1996 that updates the 1994 list. Ocular Plant Species Data Forms for both years are found in Appendix 4.

Each plot is identified using a unique alphanumeric code, 94MM013 (Madden-Redbird creeks divide),

94MM014 (Tepee Peaks), and 94MM015 (Head of Wapshilla Creek). In both 1994 and 1996, plots were intensively sampled using a nested plot frequency protocol. Information regarding plot establishment, monitoring methods, and other sampling protocols have been previously detailed (Mancuso and Moseley 1994). Resampling took place between July 1 and July 3, 1996.

Results

Frequency data for each nested quadrat size was entered into CALCFREQ (Patton and Nyren 1992), a statistical software program designed to calculate percent frequency and test for significant differences in frequency between two different time periods. The probability of a Type I error (falsely concluding that two frequency values are significantly different when they actually are not) for each comparison was calculated using 2x2 contingency table analysis based on Yates' corrected chi-square statistic at the 0.05 alpha level. LOTUS spreadsheet files listing the plot percentages and significance values for all species in each plot are found in Appendix 5. The original 1994 and 1996 nested plot frequency field data sheets are on file at the Conservation Data Center (CDC) in Boise, with copies on file at the IDFG Region 2 office in Lewiston. A photographic slide record of the monitoring plots is on file at the CDC office.

Plant community monitoring

With only two years of data separated by a time period of two years it is not yet possible to decipher long-term vegetation trend at the three Palouse goldenweed monitoring sites. For the most part, the grass and forb vegetation appears to have changed little between 1994 and 1996. The majority of species showed no significant ($p<0.05$) changes in frequency values between the two sampling years, including the dominant native grasses, or Palouse goldenweed itself. All significant changes were increases in 1996 frequency values compared to 1994, and involved what are commonly termed "increaser" species. The few examples include *Agoseris glauca* (plots 013, 015), *Astragalus sheldonii* (plots 013, 015), *Eriogonum heracleoides* (plot 014), *Lupinus sericeus* (plots 013, 014, 015), and *Taraxacum officinale* (common dandelion; plot 015). The 1996 plot percentage increases are likely related at least in part to the species' relatively early phenology, and the fact sampling was conducted one month earlier in 1996. Another contributing factor may be that 1994 was a hot, dry summer that limited the size, flowering, or duration of these perennial forbs. The relative abundance of these species is indicative of a livestock disturbance history. "Increaser" species such as these will be important indicators when analyzing vegetation trend over the long-term.

In 1996, significant increases were also found for several annual species such as *Bromus* sp. (014), *Clarkia pulchella* (013, 014), *Microsteris gracilis* (013), and *Stellaria nitens* (015). It is not unusual for annual species to have large annual population fluctuations typically associated with variability in seasonal precipitation patterns. A sampling artifact probably contributed to these differences because of the earlier sampling date in 1996 made observing these species much easier compared to 1994. Annual invasive weeds will be more important indicators of vegetation trend than the native annual species for the Craig Mountain grasslands. None of the plots showed an increase in yellow starthistle (*Centaurea solstitalis*).

Based on a comparison of 1994 and 1996 data, no clear changes in vegetation trend are apparent, although increased coverage of a few forb species indicate the vegetation at these sites is not entirely static. Cover class and nested plot frequency results indicate that the mid-seral conditions characterizing monitoring plots 94MM013, 94MM014, and 94MM015 are largely unchanged between 1994 and 1996. These results indicate that present IDFG management is compatible with the conservation of Palouse goldenweed habitat at the three Craig Mountain monitoring sites.

Palouse goldenweed monitoring

A portion of the monitoring design is specific to Palouse goldenweed. It is intended to provide a measure of reproductive potential, herbivory, and insect seed predation damage at each site. This information is compiled on two additional data sheets - *Haplopappus liatriformis* Monitoring Data Sheet #1 and #2. Data Sheet #1 provides information on the height, phenology, number of flower heads, and evidence and degree of insect herbivory and/or seed predation on the first 15 Palouse goldenweed plants encountered during nested plot sampling. It also has a field for the total number of Palouse goldenweed plants counted within the macroplot. Data Sheet #2 provides further information concerning reproductive output and degree of herbivory and/or seed predation for five plants randomly selected outside of the macroplot.

Sampling in 1996 was conducted too early in the summer for Palouse goldenweed to be in bloom, although a few plants had flower buds at the Tepee Peaks population (94MM014). Flower stems were elongating on plants that would likely be reproductive in 1996, but a majority of plants were vegetative with only basal leaves. Without mature plants the utility of Data Sheets #1 and #2 is very limited. It also makes comparisons between 1994 and 1996 impossible. The small stature and lack of infloresences for Palouse goldenweed in early July makes the plant relatively difficult to see or to differentiate from other lanceolate basal leave clusters such as for *Agoseris glauca*. I believe the lower 1996 tally (on Data Sheet #1) of Palouse goldenweed plants compared to 1994 for plots 94MM013 and 94MM014 is at least partially an artifact of the plants being more difficult to distinguish in early July than in August. For plot 94MM013, I now realize the original 1994 total was probably inflated by mistakenly counting a number of *Agoseris glauca* (which is common in the plot) basal leaves as vegetative plants of Palouse goldenweed.

Mature plants from outside the plot area are required to complete Data Sheet #2, as it entails dissecting flower heads to count the number of achenes. Because of the lack of mature Palouse goldenweed plants in early July, Data Sheet #2 was not completed for 1996. Appendix 6 contains copies of completed Data Sheet #1 for 1994 and 1996, and Data Sheet #2 for 1994. Monitoring Palouse goldenweed is designed to be conducted when plants are mature. Because this was not done in 1996, the Palouse goldenweed monitoring data cannot be analyzed. Prime phenology for monitoring Palouse goldenweed is early August, contrasting with the late June time to best sample the vegetation. It is imperative that future resampling be conducted later in the summer for accurate monitoring of Palouse goldenweed. Future sampling of Palouse goldenweed at the right time of year will help clarify the species' status at the monitoring sites.

Shrub sampling

Monitoring protocol calls for using the Line Intercept Canopy Method instead of the nested plot frequency for sampling erect shrubs such as wild rose and common snowberry. This entails tallying the amount of live canopy cover above and below the transect line for each shrub species. Canopy cover is computed as follows: total live canopy cover intercepted (cm) / total line intercept length (three 20m transects equals 6000cm) x 100 = percent cover. Results of the 1994 and 1996 shrub sampling are summarized in Table 1.
The data suggests there has been a dramatic increase in common snowberry canopy cover in plots 94MM013 and 94MM014. For plot 94MM014, this is in agreement with my observation that the amount of common snowberry approximately doubled between 1994 and 1996 (see the 1996 Ocular Plant Species Data Form for this plot in Appendix 2). Although common snowberry is capable of rapid vegetative spread, the reason(s) for this apparent increase is unclear. A release from livestock grazing pressure may be one possible contributing factor. I also suspect the results are compromised by poor sampling standards related to the degree of subjectivity inherent when tallying shrub line intercept. To minimize problems with consistency in the future,

one person should do all the shrub measurements in a plot.

Increases in the cover of Wood's rose are also apparent for plots 94MM013 and 94MM014, although percentages are substantially less compared to common snowberry. It is interesting to note that no significant differences were found for shrub frequency values (with the exception of an increase in *Rosa woodsii* in plot 014) when analyzed with the nested plot data. A more in-depth interpretation of changes in shrub cover will be possible pending future results.

Table 1. 1994 and 1996 shrub coverage for three Palouse goldenweed monitoring plots.

		Shrub Cover		
Plot	Year	Common snowberry	Wood's rose	White spiraea
		% (cm)	% (cm)	% (cm)
94MM013	1994	0.6 (34)	0.7 (46)	0 (0)
	1996	4.9 (294)	0.2 (10)	0 (0)
94MM014	1994	7.6 (455)	0.08 (5)	0.03 (2)
	1996	18.7 (1123)	0.5 (29)	0.1 (6)
94MM015	1994	0 (0)	0.5 (30)	0 (0)
	1996	0 (0)	0 (0)	0 (0)

Discussion

All permanent plot markers were in place and we had no problems relocating the plots in 1996. No new disturbances were observed at plots 94MM014 and 94MM015. The grassy ridgetop area in the vicinity of plot 94MM013 did have signs of recent disturbance, however. This included a fire ring and scattered woody debris, off-trail ORV tracks, and evidence of trampling. None of these disturbances were present in 1994. In addition, it appeared that someone had loosened several of the baseline transect foot markers. To help prevent this from happening again, we hammered the markers further into the ground. This makes them harder to see as well as more secure.

Plots were sampled one month earlier in 1996 compared to 1994. Plants commonly in flower during this year's sampling period included common yarrow (*Achillea millefolium*), pale agoseris (*Agoseris glauca*), deer horn (*Clarkia pulchella*), Wyeth's buckwheat (*Eriogonum heracleoides*), lanceleaved stonecrop (*Sedum lanceolatum*), slender cinquefoil (*Potentilla gracilis*), common snowberry (*Symphoricarpos albus*), grass pink (*Dianthus armeria*), and all the grasses. Weather during the 1996 sampling period was sunny and warm. A brief summary of observations for each plot is given below.

Plot 94MM013

Palouse goldenweed plants were difficult to discern in this plot and none were in flower. The basal leaves are superficially similar to the basal leaves of pale agoseris, which is abundant in the plot. Time constraints did not allow us to check (feel for course hairs present on the foliage of Palouse goldenweed) each basal leave

cluster to differentiate the basal leaves of the two species. This plot is located near the edge of a Douglas-fir stand. Encroachment into the plot area may be underway as there appeared to be a greater number of Douglas-fir seedlings compared to 1994. Sampling also indicates an increase in common snowberry cover has occurred since 1994. This increase was not readily apparent to me when I looked at the plot, however. Although occurring nearby, no yellow starthistle was observed within the plot, compared to trace amounts in 1994.

Plot 94MM014

Insect herbivory on Palouse goldenweed in the plot varied from light to medium. Last year's flower stems were still standing and attached to many plants. Trace amounts of yellow starthistle were present in the plot in 1994, while in 1996 it was observed on nearby southerly slopes, but not within the plot. Wooly vetch (*Vicia villosa*) is an invasive weedy forb that was not observed in the plot vicinity during 1994. It was found near and within plot this plot in 1996. The amount of common snowberry within the plot appears to have increased since 1994, from a canopy cover class of 10 to 20. No evidence of recent livestock use of the area was observed

Plot 94MM015

Remnant Palouse goldenweed flower stems from 1995 average approximately 30 cm tall. This is shorter than either of the other two plots and the same pattern that was observed in 1994. Palouse goldenweed basal leaves appeared to be fairly common in the vicinity of the plot, similar to what I observed in 1994. The transect bearing for this plot is 300^0, however, transect # 2 was mistakenly read at a bearing of 320^0. Theoretically, this should have no effect on the data collected. No new disturbances were observed in or near the plot.

Recommendations

1. Palouse goldenweed has a relatively late phenology compared to most associated grassland forbs. Sampling should be conducted when the majority of Palouse goldenweed plants are in bloom. For most years this will be late July to early August. It is important that future sampling always be conducted during the same time of year to minimize the introduction of sampling bias due to seasonal plant phenology differences. I feel this bias may explain some of the frequency value differences between 1994 and 1996. The sampling protocol is also based on all three plots being sampled during the same year. Because it is most practical to conduct nested plot sampling concurrently with Palouse goldenweed sampling (for *Haplopappus liatriformis* Data Sheets 1 and 2), I recommend plots be read around late July to early August. In the future, if sampling must take place earlier in the season, then I recommend the separate (Data Sheets 1 and 2) Palouse goldenweed sampling not be done.

2. As originally recommended (Mancuso and Moseley 1994), resampling can be scheduled for approximately every five years. An extra round of sampling is recommended the year after a major disturbance occurs at a monitoring site.

3. Prior to sampling in 1996, the IDFG aerial sprayed herbicides in the vicinity of plot 94MM014. Direct herbicide application or drift appears to have missed the Palouse goldenweed population. This was more fortuitous than the result of careful planning. Rare plant location maps (see Appendix 5 in Mancuso and Moseley 1994) should be consulted when planning herbicide application on Craig Mountain. This will prevent accidental poisoning of rare plant populations.

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Appendix 1

Palouse goldenweed monitoring plot locations at Craig Mountain.

Appendix 2

Directions and plot layouts for Palouse goldenweed monitoring sites at Craig Mountain.

Note: Compass bearings for plot layouts are with a 20^0 east declination.

Appendix 3

1994 Community Survey Forms for Craig Mountain Palouse goldenweed monitoring plots.

Appendix 4

1994 and 1996 Ocular Plant Species Data Forms for Craig Mountain Palouse goldenweed monitoring plots.

Appendix 5

LOTUS files with nested frequency plot percentages and Yates' chi-square values.

Appendix 6

Haplopappus liatriformis Data Sheet #1 for 1994 and 1996, and Data Sheet #2 for 1994.