2016 Flowers Penstemon Monitoring Report

By:

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Introduction

Monitoring of overall survival, health, and plant herbivory for Flowers Penstemon (*Penstemon flowersii*) in the Uinta Basin, Utah, was conducted by the Plants, Soils and Climate Department at Utah State University during 2016 for The Nature Conservancy. The 2016 monitoring season was the second monitoring year for Flowers Penstemon at the Dude Young and Collier properties, and was completed on the 20th and 21st of May.

All monitoring plots were previously identified in 2015, and 35 plants were tagged in their respective monitoring plots. Plots were monitored for plant survival, seedling recruitment, and population life stage. The monitoring transects were surveyed for population abundance, and showed a slight growth in the population.

The study plots and transects were in good condition, all plant tags were in place though some had been covered with soil. The #15 transect stake had been removed and a target practice area had been set up near the plot with a saw horse and metal targets. Increased off-road activity was noted on the Dude Young property with multiple new trails throughout the property. Fortunately, none of the study plots or transects were directly impacted.

The overall threat to Flowers Penstemon continues to be habitat destruction and invasive species. Our recommendations are to continue working with stakeholders to protect Flowers Penstemon habitat and list it as sensitive species with the Bureau of Land Management (BLM). This report documents the results of 2016 monitoring season.

Plant Monitoring

Plant Survival and Growth

All 35 tagged plants were alive in 2016. Three plants had a cover class of two (5 - 25% canopy cover) and the remaining plants had a cover class of one (0 - 5% canopy cover). Stems were again counted to identify any correlation between age, the number of stems, and the ability to measure reproductive potential. Plant stem counts from 2015 were compared to the counts of 2016 and showed an increase overall; 22 plants had more stems, 8 plants had fewer stems, and 5 plants stayed the same. The average increase was 2 stems and the maximum increase was 9 stems.

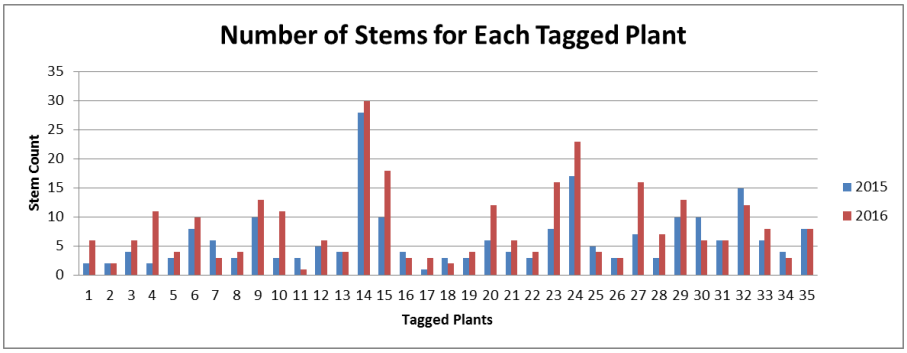

Figure 1 – Flower's penstemon stem counts 2015 – 2016 (Boyd and Jones 2015).

The irregular rate of stem growth and the loss of stems in some plants raise questions such as:

- Do broken stems regrow?
- Does herbivory impact stem growth (positively or negatively)?
- Does rate of stem increase change with age?

Beginning with 2017 monitoring, any stems broken during monitoring or missing due to herbivory will be noted on the updated monitoring form (Appendix A). This information will then be considered on stem counts to gain a better understanding of damage and herbivory on stem growth and ultimately reproductive potential.

Plant Health

The majority of tagged plants were in either excellent or good condition. Four plants were in fair condition, but overall conditions did not differ significantly from 2015 (Boyd and Jones 2015).

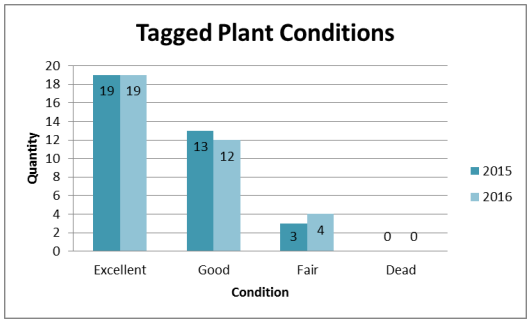

Figure 2 – Condition of tagged plants 2015 – 2016.

Tagged plant #11 was concerning, however. Skeletons of two stems were visible with only one stem remaining alive. There was significant encroachment from lesser rushy milkvetch (*Astragalus convularis*) and cheat grass (*Bromus tectorum*), but this plant also sits down in a small gulley, where light is somewhat restricted. Considering that many other penstemon plants are found growing within and near other vegetation, lack of direct sunlight should be considered as a possible cause of this plant being in fair condition.

Plant Herbivory

Herbivory was slightly increased in 2016, with four more plants having signs of predation. However, the majority of the herbivory was mild (usually only one stem), even with an increase in mammalian stem herbivory. This may indicate low palatability or some other deterrent. The majority of herbivory appeared to be from lagomorphs on the Collier property and white-tailed prairie dogs (*Cynomys leucurus*) on the Dude Young property.

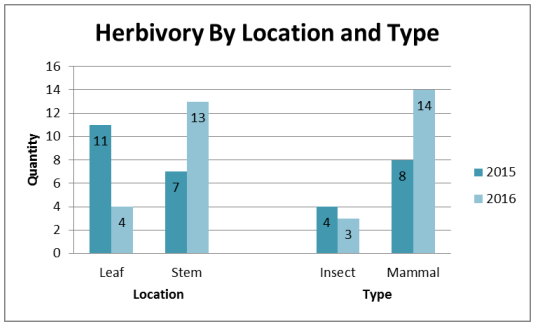

Figure 3 – Flower's penstemon herbivory 2015 – 2016.

Plot Monitoring

Survival

Annual survivorship was calculated using the formulae in the monitoring plan (Appendix A). Mature annual survivorship was high (99%) with only one plant missing in 2016. Seedling survivorship was negative (-0.14), due to recruitment being less than the number of new seedlings. Overall survivorship

was somewhat low (83%) due to the low seedling survivorship. The low seedling survivorship may not be an accurate representation of seedling survival with such a large difference in seedling counts between 2015 and 2016.

Table 1 – Flower's penstemon survivorship.

Annual Survivorship	Percentage
Mature	0.99
Seedling	-0.14
Overall	0.83

The large difference in seedling counts between 2015 and 2016 will require multiple years of additional monitoring to identify which count most closely represents the norm. The large clusters of seedlings found in 2015 were only found in two plots on the monitoring done May 1st, 2015. No clusters of seedlings were seen in monitoring done later in 2015 or in 2016, which may indicate the clusters were a large flush of short-live seedlings early in spring.

Seedling Recruitment

Of the 26 seedlings from 2015, there were 7 still present; 5 vegetative and 2 flowering. The seedlings from 2015 were found in plots #1, #3, #6, and #8. Recruitment occurred with 1 plant in plot #1, and 6 plants in plot #6 (Boyd and Jones 2015).

Population Life Stage

Overall plants appeared very healthy with 24 vegetative, 69 fruiting, 8 seedlings, 2 vegetative due to herbivory, and 20 dead (19 seedlings, 1 mature). Given the present numbers, 2016 had a much better opportunity for reproductive output. However, as noted last year, more plants were fruiting with the later monitoring, and herbivory also increased later in the season. Doing monitoring at the same time from year-to-year will allow for a more accurate comparison.

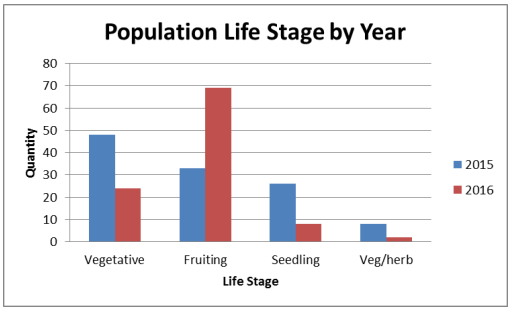

Figure 4 – Flower's penstemon life stages 2015 - 2016.

A seed collection was completed in July which showed significant insect and mammalian herbivory. The herbivory was much greater on the Dude Young property than the Collier property. Most of the seed

pods had already begun to open, so an accurate seed count could not be completed. A few pods were counted with an average of 13-15 seeds per pod, but an accurate seed count should be completed in 2017.

Transect Monitoring

Population abundance

Transects were counted in 2016 with a total of 302 plants. This is an increase of 28 plants from the total of 274 in 2015, and indicates a growth rate (λ) of 1.10 using the formula $\lambda=N_{t+1}/N_t$. For λ, a value greater than 1 indicates population growth, and less than 1 indicates population decline.

While study plots showed a population decline because of the large loss of seedlings, transects showed a slight increase. This may be another indicator that the high seedling count of 2015 was unusual, and continued monitoring will be required for a better understanding.

Threats

Habitat

Fragmentation, loss, and disturbance of habitat continue to be the greatest threats to this species. While oil and gas drilling is currently in a lull, the potential for the oil and gas industry to boom is still present, and there are multiple wells approved on Windy Ridge. The damage from recreational activities on the Dude Young property is increasing and will likely continue to do so if action is not taken.

Options discussed previously included signage and fencing or placement of boulders to prevent off-road vehicle activity in general and specifically, from disrupting the knoll on the Dude Young property with a population of sclerocactus and Flowers penstemon. Maps of the knoll and recommended placement of boulders are included in this report (Google Earth 2017) (Appendix B).

Invasive Species

Russian knapweed (*Acroptilon repens*) is encroaching in penstemon habitat along the east boundary of the Collier property, and in multiple areas along the road at the Dude Young property. The Russian knapweed should be spot treated with an herbicide mixture such as Milestone and Telar.

Multiple other invasive species such as cheat grass (*Bromus tectorum*) and halogeton (*Halogeton glomeratus*) are scattered throughout the habitat, but don't represent a significant threat at present. However, these will likely continue to spread if off-road activities continue and if oil and gas drilling begin to increase. However treatment of these species would be extremely costly and time consuming

Summary and Recommendations

Transect monitoring showed an increase in population size from 2015 to 2016. However, there were several clusters of seedlings counted in 2015 that were missing in 2016. Because the large clusters of seedlings were only seen in early May of 2015, it may be possible the clusters represented a spring flush of short-lived seedlings. Future monitoring should be completed around the 15th to 20th of May with particular attention being paid to any unusual timing such as a late or early spring. If clusters of seedlings are again noted, they should be carefully photographed and counted and any special or unusual conditions noted.

Monitoring showed Flower's penstemon had a high annual survival once mature, and stems appeared to increase with age providing a better opportunity for reproductive output. These are good reasons to focus on conserving and protecting mature plants. The populations being monitored appear to have good health, which would indicate focus should be placed on protecting habitat and existing populations from disturbance. Working with landowners, the Ute Tribe, and energy companies may be helpful in securing safe zones.

Proceeding with signage and placement of boulders to reduce off-road recreation at the Dude Young property should be considered (Appendix C). Additionally, the sclerocactus and Flower's penstemon on the Dude Young property may be better protected if the property were managed by the Bureau of Land Management (BLM).

Having Flower's penstemon listed as a BLM sensitive species would make the minerals department aware of the need to avoid and protect the species when permitting oil and gas drilling of federal minerals in the area. Additionally, the Vernal Field Office has a law enforcement officer available to help enforce regulations and stop off-road activities.

Any efforts to write a conservation agreement should take into consideration the November 2016, court decision regarding the *Conservation Agreement and Strategy for Graham's Beardtongue (Penstemon grahamii) and White River Beardtongue (P. scariosus var. albifluvis)*.

The agreement was signed in 2014 to last for 15 years, and imposed a 300 foot buffer zone around each penstemon plant (Agreement 2014). The court decision cited three weaknesses: first the agreement did not satisfy the "existing regulatory mechanisms" required by the Endangered Species Act (ESA), second the document failed to consider the 15-year limit of the agreement when addressing threats in "the foreseeable future," and finally there were multiple issues with the buffer zone (USDC 2016).

Because Flowers penstemon is located mainly on private and tribal lands, a conservation agreement may still provide the best protection from extinction. However, monitoring may need to be expanded to include other factors such as an appropriate buffer zone and economic impacts.

Literature Cited

(2017, January). Retrieved from Google Earth.

Boyd, L., & Jones, C. (2015). *Monitoring Plan for Flowers Penstemon (Penstemon flowersii).* Vernal, Utah, USA.

Rocky Mountain Wild et. al. v U.S. Fish and Wildlife, 15-cv-0615-WJM (The United States District Court of Colorado October 25, 2016).

SWCA. (2014). *Conservation Agreement and Strategy for Graham's Beardtongue (Penstemon grahamii) and White River Beard Tongue (P. Scariosus var. albifluvis).*

Appendices

Appendix A: 2017 Monitoring Form

Appendix B: Annual Survivorship Formulae

Appendix C: Dude Young Disturbance Maps

Appendix A - 2017 Monitoring Form

Plant/Plot #:		**Photo #s:** $_{Plant}$		/ $_{Plot}$		/$_{Tran}$	**Life Stage:**	**V**	**F**	**S**	**VH**	**D**
Date:		**Stems:**		**Broken/Missing:**			**Condition:**	**Dead**	**Fair**	**Good**	**Excellent**	
Herbivory:	None	Mild	Moderate	Severe	**Location**:	Leaf	Stem	**Type**:	Insect		Mammal	
Cover Class Plant:				Plot:				**Transect Count:**				

Cover Classes:	
1 = 0-5%	2 = 5-25%
3 = 25-50%	4 = 50-75%
5 = 75-95%	6 = 95-100%

Life Stage: V = Vegetative F = Flowering/Fruiting S = Seedling VH = Vegetative due to herbivory X = Dead

Diagram - Draw penstemon locations with a circle and put life stage symbol in the center.

Notes:

Penstemon Totals							
New: Seedlings (S):		Flowering:		Vegetative:		Total New (R):	
Seedlings last year, now		Vegetative last year, now		Fruiting last year, now:			Totals
Vegetative (V_1)		Vegetative (V_2)		Vegetative (V_3)		Total Vegetative (M_1)	
Fruiting (F_1)		Fruiting (F_2)		Fruiting (F_3)		Total Fruiting (M_2)	
Dead (D_1)		Dead (D_2)		Dead (D_3)		Total Dead (D)	
						Total Living Plants (N)	
						Total New (R):	
						Seedlings last year (S_t)	
						Mature Dead = $D_{(t+1)}$	
						Mature Alive = $M_{(t+1)}$	
						Seedlings Alive = $S_{(t+1)}$	

S = Total seedlings in present year

R = Total new plants in present year

D = Total plants dead in present year

N = Total living plants in present year

S_t = the number of seedlings alive last year or (S) on last year's form

D_1 = Number of seedlings from last year NOT alive this year

$D_{(t+1)}$ = Number of plants alive last year, but dead this year or $D_2 + D_3$

$M_{(t+1)}$ = Total mature plants alive in present year or $M_1 + M_2$

$S_{(t+1)}$ = Number of seedlings from last year still alive this year or $V_1 + F_1$

Definitions of terminology and abbreviations

Life Stage - circle one

V = vegetative; mature plants that did not bloom.

F = flowering; mature plants with blooms or seed pods.

S = seedlings; new plants from seed.

VH = vegetative due to herbivory; mature plants not blooming due to too much damage from herbivory.

X = Dead plants on diagram should be a circle with an "X"

Condition - circle one

Dead = plant that is dead or missing after being recorded the previous year.

Fair = plant with significant discoloration, wilting, loss of foliage, etc.

Good = plant with mild to moderate discoloration, wilting, loss of foliage, etc.

Excellent = plant extremely healthy, no discoloration, wilting, loss of foliage, etc.

Appendix B

Red Butte Garden Formulae for survivorship	**Abbreviation Format**
Overall annual survivorship from year t to year t+1: (# alive in year t+1) – (# new plants in year t+1) (# alive in year t+1) – (# new plants in year t+1) + (# dead in t+1)	$\frac{N-R}{N-R+D}$
Seedling annual survivorship from year t to year t+1: (# seedlings alive year t+1) – (# new seedlings year t+1) (# seedlings alive year t) – (# seedling MIA in year t+1)	$\frac{(V_1+F_1)-S}{S_t-D_1}$
Mature annual survivorship from year t to year t+1: (# mature alive in year t+1) – (# new plants in year t+1) (# mature alive in year t+1) – (# new plants in year t+1) + (# mature dead in t+1)	$\frac{M_{(t+1)}-R}{M_{(t+1)}-R+D_{(t+1)}}$

FLPE Points Near Disturbed Knoll

Disturbed Area

Proposed Barrier Placement