2017 Flowers Penstemon Monitoring Report

By:

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2017

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 2017 for The Nature Conservancy. The 2017 monitoring season was the third monitoring year for Flowers Penstemon at the Dude Young and Collier properties, and was completed on the 13th and 19th of May using the 2015 monitoring plan (Boyd & Jones, 2015).

All 35 tagged monitoring plots, identified in 2015, were located and the tagged plant assessed for health, herbivory, and cover class. Each monitoring plot was assessed for plant survival, seedling recruitment, and population life stage. The monitoring plot transects were surveyed for population abundance, and showed a decrease in numbers.

The overall threat to Flowers Penstemon continues to be habitat destruction and invasive species. A significant increase in OHV disturbance was noted at the Dude Young property with tracks going through two study plots. Photos were taken, and this will be discussed more completely under threats.

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 2017 monitoring season.

Plant Monitoring

Plant Survival and Growth

All 35 tagged plants were found to be alive in 2017. However, plants in general were smaller, and fewer were fruiting this year (Figure 1). Only 14 of the 35 tagged plants were flowering or fruiting. Many of the plants appeared to be much smaller and less developed when compared to photos from 2016.

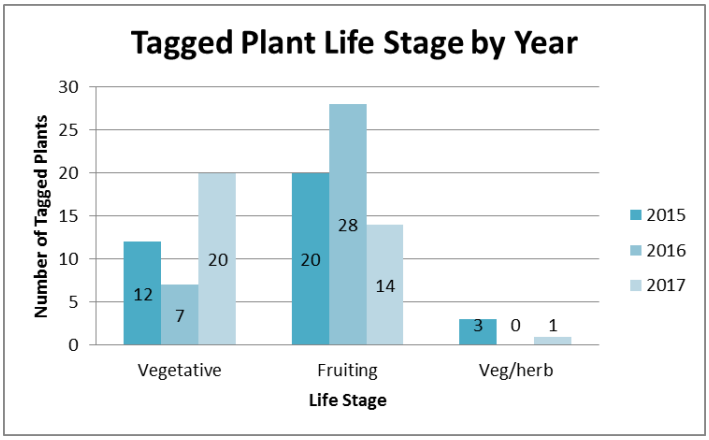

Figure 1 - Number of tagged plants at each life stage, by year.

While some of the plants appeared to be past bloom, most appeared to be just starting to grow for the season. This may be a result of lower than average temperatures in 2017 (Figure 2).

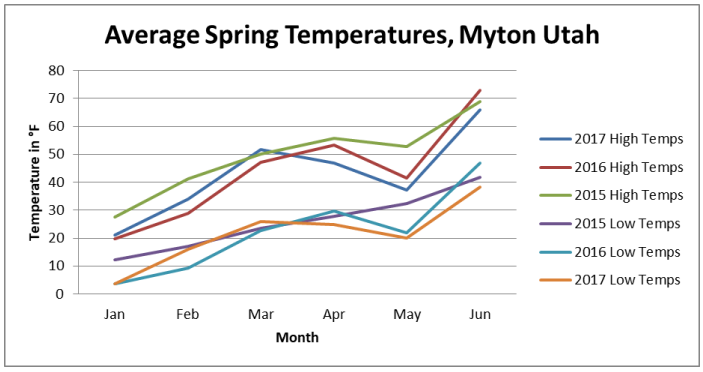

Figure 2 - Average Spring Temperatures (High and Low) for Myton, UT
https://www.usclimatedata.com/climate/myton/utah/united-states/usut0177/2015/2

The average high temperature for May in 2016 was 41.4 °F. The average high temperature for May in 2017 was 37.1 °F. Unfortunately, accurate precipitation data were not available for analysis.

There were three plants with a cover class of two (5-25% canopy cover) in 2016, but only one in 2017. However, this may have changed if the plants had been given an additional two to three weeks to grow.

Stems were again counted this year along with making a note of any stems that were broken or missing. The total number of stems dropped from 288 to 260, with the average dropping from 8.23 to 7.43

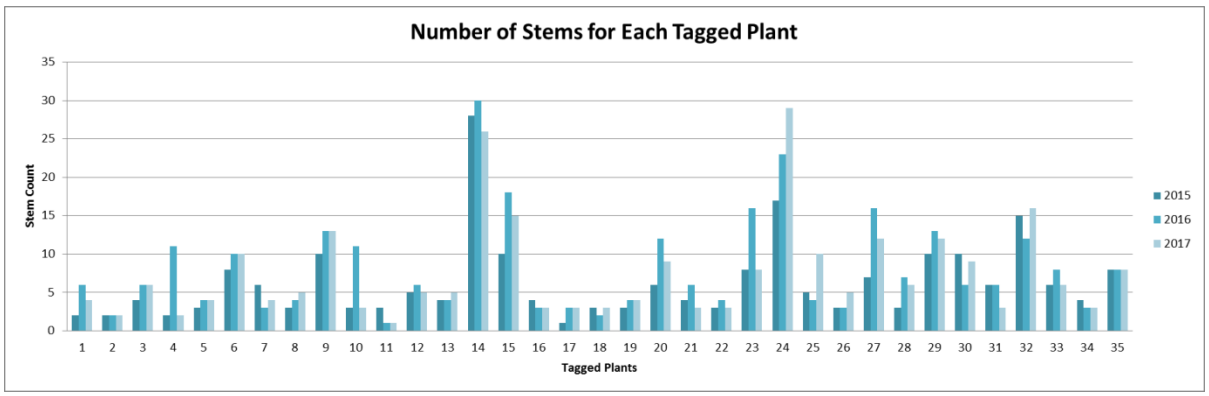

Figure 3 - Number of stems for each tagged plant.

(Figure 3). The decline in stems could possibly be a result of the smaller size and level of development of the plants this year.

Plant Health

The number of plants in excellent condition decreased slightly from 19 in 2016, to 13 in 2017 (Figure 3). Only one plant was in fair condition, the remainder were either good or excellent. However,

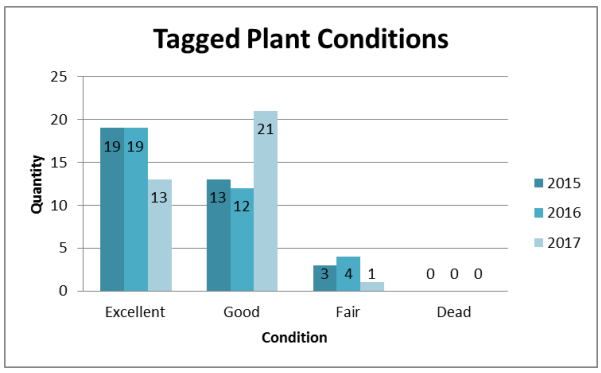

Figure 4 - Conditions of tagged plants in 2017.

Figure 5 - Plant #11

Tagged plant #11 was again very small and concerning, but still alive (Figure 5).

Review of the tagged plant photos showed most of the plants looking in very good condition, but there was increased herbivory in 2017, accounting for the decrease in excellent condition plants.

Plant Herbivory

There was a total of 14 plants without herbivory in 2017, down from 20 in 2016 (Figure 6). The majority of the herbivory was mild and occurred on leaves (Figures 6 & 7). Herbivory appears to be highly variable as to location and type, but insect herbivory was up significantly in 2017 from 8.6% to 31.4% (Figure 7). Mammalian and stem herbivory were also noted to be less in 2017.

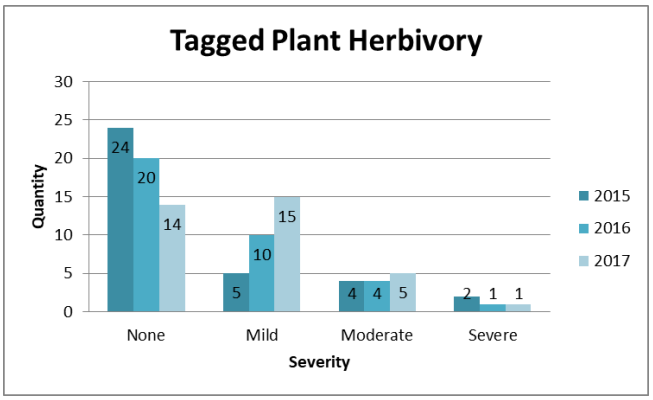

Figure 6 - Severity of Tagged Plant Herbivory

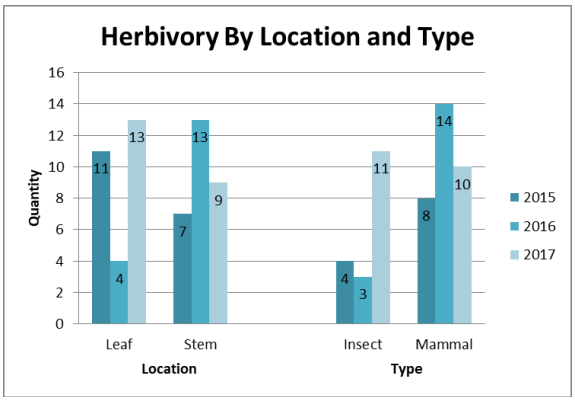

Figure 7 - Herbivory Location on leaf or stem, and the type - insect or mammal.

Plot Monitoring

Survival

Overall annual survivorship from 2016 to 2017 was 98%, mature annual survivorship was 97%, and seedling survivorship was 100%. Three mature plants were missing or dead in 2017.

Seedling Recruitment

Of the eight plants identified as seedlings in 2016, all were still present in 2017. The 100% survival rate is rather unusual and raises the question of whether the new plants were truly seedlings or if they were previously dormant plants. A review of photos was done to see if cotyledons were present, but the review was inconclusive. Four of the new plants are suspected to be new growth from an existing tap root. New plants should be more carefully examined for cotyledons in future years and photographing new plants will help to better document seedlings versus formerly dormant plants.

Population Life Stage

A total of 102 plants were counted in plots during 2017 monitoring; 43 vegetative, 53 fruiting, 2 seedlings, and 4 vegetative due to herbivory (Figure 8). The decrease in fruiting plants this year was likely due to immaturity, and

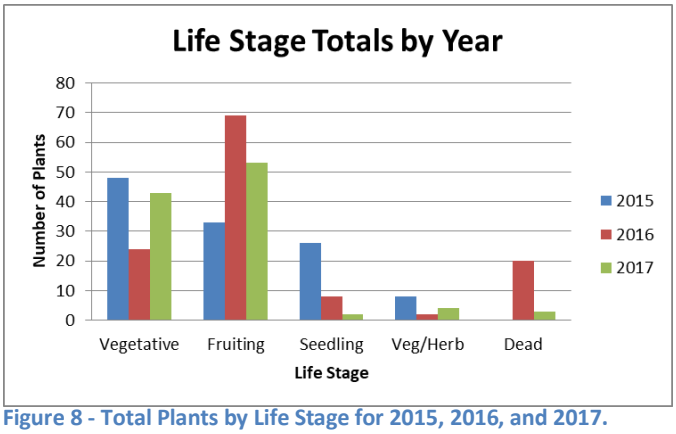

Figure 8 - Total Plants by Life Stage for 2015, 2016, and 2017.

may have increased a few weeks later. An increase in flowering and fruiting was also noted in 2015 after spring rains.

More than half of the plants observed were fruiting or flowering, with only 4 plants being vegetative due to herbivory. The majority of plants were fruiting in 2016 as well, indicating that flowering is likely not a concern for this plant.

Transect Monitoring

Population abundance

A total of 267 plants were counted in transects in 2017. There was an increase of 28 plants from 2015 to 2016, then a decrease of 35 plants from 2016 to 2017 (Figure 9). The large increase followed by the large decrease is inconsistent with the trends seen in the study plots (Figure 10). All plants counted in plots were graphed, and then only mature plants counted in plots were graphed. Both trends lines were significantly different from the transect graph.

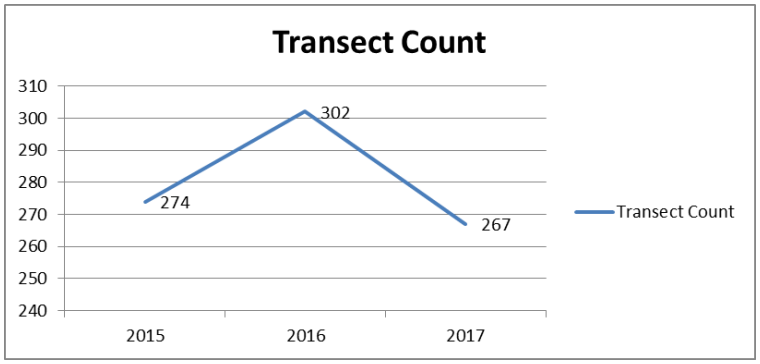

Figure 9 - Transect Counts Trend Line

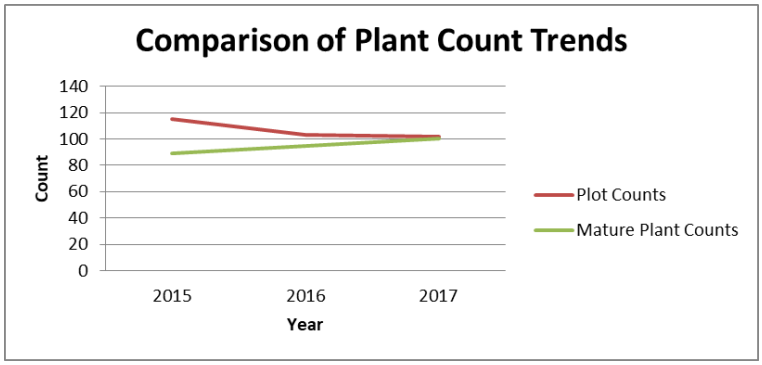

Figure 10 - Trend lines of Study Plot Counts and Mature Plant Only Counts

This difference raises the question of the accuracy of the transect counts in 2016. A comparison of the count in 2015 and 2017 shows a decline of 7 plants, which is more consistent with the trends seen in the study plots.

Additional training for transect counts may be needed and the trends should be watched closely over the next few years.

Threats

Habitat

Fragmentation, disturbance and loss of habitat continue to be a threat to this species. Oil and gas drilling has created significant loss of habitat and fragmentation in the past. Presently drilling has slowed and this may be the best opportunity to work with multiple agencies to create a conservation agreement. Should another oil and gas boom hit, massive drilling would occur on Windy Ridge without any consideration for *F. penstemon.*

Recreation activities are increasing rapidly on the Dude Young property and tracks were found going through two study plots in 2017 (Figures 11, 12, & 13). The OHV trails are spreading throughout the

Figure 11 - OHV tracks on hill slopes south of plots 12 and 13.

Figure 12 - OHV tracks on hill slopes south and east of plots 14 and 15.

Figure 13 - OHV tracks on hill north west of plots 18 and 19.

entire property and spreading invasive species. Without intervention, there will almost certainly be significant impacts to *F. penstemon* as well as the *Sclerocactus* present on the property.

Invasive Species

The Russian knapweed (*Acroptilon repens*) continues to spread on the Collier property, but was scheduled to be sprayed in 2017. The knapweed on the Dude Young property is still present, but not spreading as rapidly. Unfortunately, the cheat grass (*Bromus tectorum*), Russian thistle (*Salsola tragus*), and halogeton (*Halogeton glomeratus*), are spreading rapidly with the increase in off-road recreation.

The cheat grass on the east end of the Dude Young property has spread to almost 100% cover in areas, and represents a significant fire risk. The risk of fire is increased by recreation activities including the discovery of burn pits and what appear to be "party sites."

Summary and Recommendations

Both transect and plot counts showed a decrease in numbers from 2016 to 2017. Given the number of plants that were flowering and fruiting, it is concerning that more seedlings are not being seen. This raises the question of adequate pollination and maturation of seed. Follow-up monitoring of flowering plants may be beneficial to measure the percentage of plants that actually produce seed.

Issues that have been observed in the past are herbivory - both insect and mammalian, and seed pods drying-up prior to maturation. Identification of the insects eating the seed pods may be helpful and pollinator studies have been discussed in the past and would also be beneficial.

Stopping the off-road recreation at the Dude Young site is essential and needs to be accomplished as soon as possible. Options would include using signage, boulders, and law enforcement to stop the activities. The property is also being used as a party location with burn pits being found. The burn pits and off-road vehicles in an area covered in cheat grass makes the risk of fire extremely high.

The Dude Young property may be the best option for protecting a large population of Flowers Penstemon. There are many features about the Dude Young property which make it ideal for protection. Being federally owned comes with the obligation to conserve special status species such as the *Sclerocactus* which is federally listed as a threatened species. The riparian areas on the property are considered valuable habitat for wildlife, and there are archaeologic sites. An archaeology survey could better delineate these and recommend protections.

These features could be used to provide protection from oil and gas drilling and may provide an avenue for funding to manage the property.

References

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

Appendices

Appendix A: 2018 Monitoring Form

Appendix B: Annual Survivorship Formulae

Appendix A - 2018 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)	$\frac{M_{(t+1)} - R}{M_{(t+1)} - R + D_{(t+1)}}$