

Resurveying the 1998 Monitoring Plots for *Astragalus sabulosus* and *vehiculus*



Prepared for

U.S. Fish and Wildlife Service
2369 Orton Circle, Suite 50
West Valley City, Utah 42119

Prepared by

Blake Wellard and Mindy Wheeler
Utah Natural Heritage Program
1594 West North Temple, Suite 2110
Salt Lake City, Utah 84114

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Introduction

Monitoring plots for *Astragalus sabulosus* M. E. Jones and *A. vehiculus* S. L. Welsh, were established by Ben Franklin and Duane Atwood in late April in 1998. The monitoring plots were established to track individual plants through time to learn more about the life history of the species. The monitoring plots were only surveyed at the time of establishment, likely due to plant mortality caused by dry conditions reported by Franklin and Atwood (Franklin 1999). On April 13th and April 15th, 2021, the original monitoring plots were relocated by the Utah Rare Plant Team (URPT) and were surveyed using the same methodology established by Atwood and Franklin. A description of the sampling methodology has been in-part adapted from Wellard and Wheeler (2021) and updated based on what was learned while conducting the surveys.

Materials and Methods

Atwood and Franklin used a 100' decimal measuring tape to create a 200' diameter circular plot in which individuals or groups of plants were marked with metal tags and tracked over time within the circumference. Individuals and groupings of plants were mapped by tag number, position along the tape measure, and drawings, but with the small number of plants alive in 2021, plants were marked with a GPS point instead of a drawing. The 1 grouping of *A. sabulosus* and solitary *A. vehiculus* were marked with railroad spikes to help distinguish plants found during 2021 vs. plants that were marked with a metal tag and a nail in 1998. The life history data was assessed within the plots by sampling the following characters:

- Estimated Age Class (Dead, Seedling/Juvenile, 2nd Year, mature (3 or more years))
- Height in CM (length of longest stem)
- Number of live stems
- Number of dead stems

- Number of flowers per plant
- Number of fruits per plant (Not sampled in 2021 due to drought conditions)
- Notes – e.g. pods from previous year persisting, disturbance etc.

Atwood and Franklin established two of these plots with one to monitoring *A. sabulosus* near Cisco named White House (38.947937°, -109.390555°) and one for *A. vehiculus* at Courthouse Rock (38.713848°, -109.719743°). The plots were apparently named after the 7.5 minute map in which they occurred.

Results

The original locations of the plots were not georeferenced but were easily located by cross-referencing the topo maps provided by Franklin and Atwood (Franklin 1998) with aerial images. The original rebar starting points were still in place and georeferenced when the plot was surveyed. Maps to the *A. sabulosus* White House plot (Figure 1) and *A. vehiculus* Courthouse Rock plot (Figure 2) are provided.

Astragalus sabulosus White House – A total of 8 plants were found on April 13th 2021, and of these 3 individuals were reproductive and 5 individuals were non-reproductive. The reproductive individuals averaged 10 flowers per plant. Most plants had less than 5 living stems were generally around 5 cm in height (Table 1). No dead individuals were observed within the plot (Figure 3). In 1998, surveyors found 77 plants (Table 2).

Astragalus vehiculus Courthouse Rock – One non-reproductive plant was located within the plot on April 15th 2021. The individual was barely alive and only had a few green leaves (Table 1). The individual was marked with a metal tag labeled #10 that was found within the plot (Figure 4). Three sparsely

flowering individuals were observed just outside the plot boundary to the north. No dead individuals were observed within the plot. In 1998, surveyors found 32 plants (Table 2).

Discussion and Future Work

The twenty-three-year survey gap between survey the plots make it difficult to comment on any trends or life history characteristics of the *A. sabulosus* and *A. vehiculus* at the monitoring locations. General survey data collected by the URPT from within the plot boundary and the surrounding vicinity does suggest that plants have continuously occupied the general area at least since the time of the original surveys in 1998.

The next known survey of the White House plot area after 1998 occurred on May 8th, 2012, by Robert Fitts. He reported a total of 36 plants in the area near the plot and two of those plants occurred within the plot boundary. Later in 2020, Ben Gibbons and Garrett Billings surveyed the general area and found 287 plants, and 36 of those were georeferenced by Ben Gibbons that occurred within the plot boundary (Figure 1). In the data point notes, Gibbons reported that the plants were young and small, and that many more likely occurred downslope of his survey point. The sharp decline from 34 plants to 8 plants within the plot from 2020 to 2021 could likely be attributed to 2020 being the driest year on record for Utah and the driest summer ever recorded (NOAA 2021). The only known survey in the area near the Courthouse Rock plot occurred on June 7th, 2012 and 89 plants were observed near but not within the plot boundary (Figure 2).

Dead plants were not observed within either survey plot but many dead plants, or at least presumed dead, were observed just outside the plot boundary along a sheep trail adjacent the White House plot (Figure 5). While some of these individuals were impacted by sheep grazing, many others simply looked like they were dying back for the year with just traces life evidenced by the presence of green leaflets and stem segments, which may suggest the possibility the plants are capable of vegetative

dormancy during periods of inadequate growing conditions. This strategy is known within the genus (Gremer et al. 2012) and has been reported for two other Utah species, *Astragalus anserinus* N.D. Atwood, Goodrich & S.L. Welsh (Mancuso personal communication 2021), and *Astraglaus holmgreniorum* (Rominger et al. 2019). To confirm this possibility, additional demography monitoring and studies will be needed in the future to determine vegetation dormancy and other life history characteristics of the Sabulosus Complex.

Table 1 Data summaries of *A. sabulosus* White House and *A. vehiculus* Courthouse Rock monitoring plots. Fruit was not sampled due to the low number of reproductive individuals observed. Height is recorded in CM.

<i>Astragalus sabulosus</i>					<i>Astragalus vehiculus</i>
Characteristics	Dead	Seedling/Juvenile/Non-Reproductive	Mature	All Ages	(Non-reproductive)
# by Age Class	N/A	5	3	8	1
Height Range	N/A	5-5	4-6	4-6	18
Height Average	N/A	5	5	5	18
Live Stem Range	N/A	1-4	2-5	1-5	4
Live Stem Average	N/A	2.4	2.67	2.5	0
Dead Stem Range	N/A	0-3	1-2	0-3	0
Dead Stem Average	N/A	1	1	1	0
Flowers Range	N/A	0	8-12	0-12	0
Flower Average	N/A	0	10	3.75	0
Fruit Range	N/A	N/A	N/A	N/A	N/A
Fruit Average	N/A	N/A	N/A	N/A	N/A

Table 2 Data summaries from 1998 demography monitoring at the *A. sabulosus* population at White House (Cisco) and the *A. vehiculus* population at Courthouse Rock.

White House <i>Astragalus sabulosus</i> Demography Plot					
Characteristics	Dead	Seedling/Juvenile	2nd Year	3 or More Years	All Ages
# by Age Class	3	23	42	9	77
Height Range	0.2 to 0.2	0.1 to 3	0.1 to 1	0.1 to 0.5	0.1 to 3
Height Average	0.2	0.29	0.22	0.3	0.26
Live Stem Range	NA	0	4 to 4	4 to 8	8-Apr
Live Stem Average	NA	0	4	6	5.33
Dead Stem Range	0 to 8	0 to 1	0 to 3	0 to 4	0 to 8
Dead Stem Average	2.6	0.31	0.62	1.66	0.78
Flowers Range	NA	0 to 10	0 to 37	2 to 93	0 to 93
Flower Average	NA	0.43	5.61	40.78	7.99
Fruit Range	NA	0	0-5	0 to 10	0 to 10
Fruit Average	NA	0	0.58	4.29	0.74
Courthouse Rock <i>Astragalus vehiculus</i> Demography Plot					
Characteristics	Dead	Seedling/Juvenile	2nd Year	3 or More Years	All Ages
# by Age Class	NA	1	18	13	32
Height Range	NA	0.7 to 0.7	0.1 to 0.35	0.3 to 0.7	0.1 to 0.7
Height Average	NA	0.1	0.23	0.49	0.34
Live Stem Range	NA	1 to 1	1 to 4	2 to 10	1 to 10
Live Stem Average	NA	1	2	4.69	3.06
Dead Stem Range	NA	0 to 1	0 to 1	0 to 3	0 to 3
Dead Stem Average	NA	0.12	0.12	1.38	0.65
Flowers Range	NA	1 to 1	1 to 4	3 to 13	1 to 13
Flower Average	NA	1	2.11	6.08	3.69
Fruit Range	NA	NA	0 to 4	1 to 20	0 to 20
Fruit Average	NA	NA	1.14	9.54	5.19

Astragalus sabulosus White House Monitoring Plot

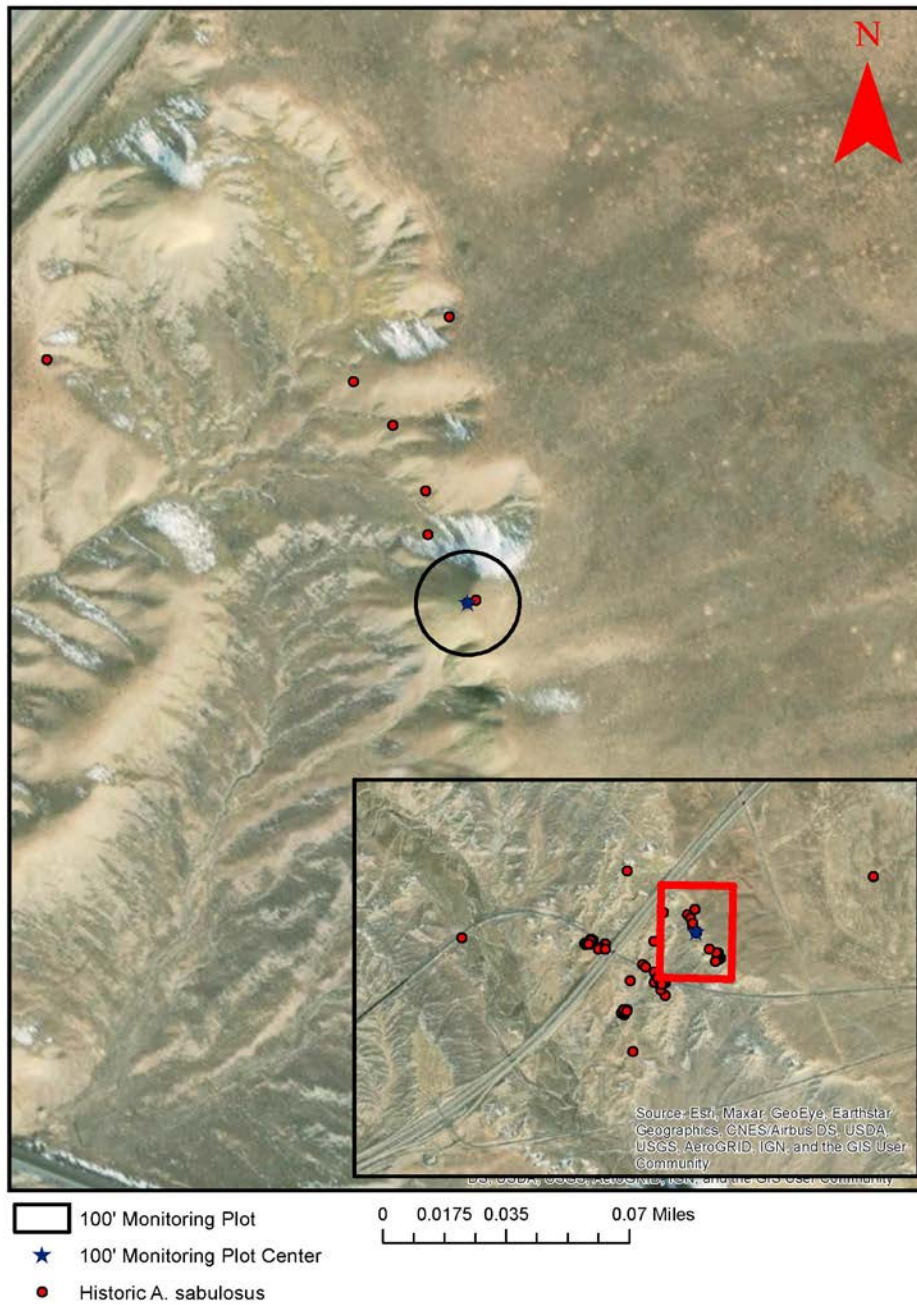


Figure 1 The White House monitoring plot is located at 38.947937° , -109.390555° and was surveyed by the URPT on April 13th. Only 8 very small individuals were found.

Astragalus vehiculus Courthouse Rock Monitoring Plot

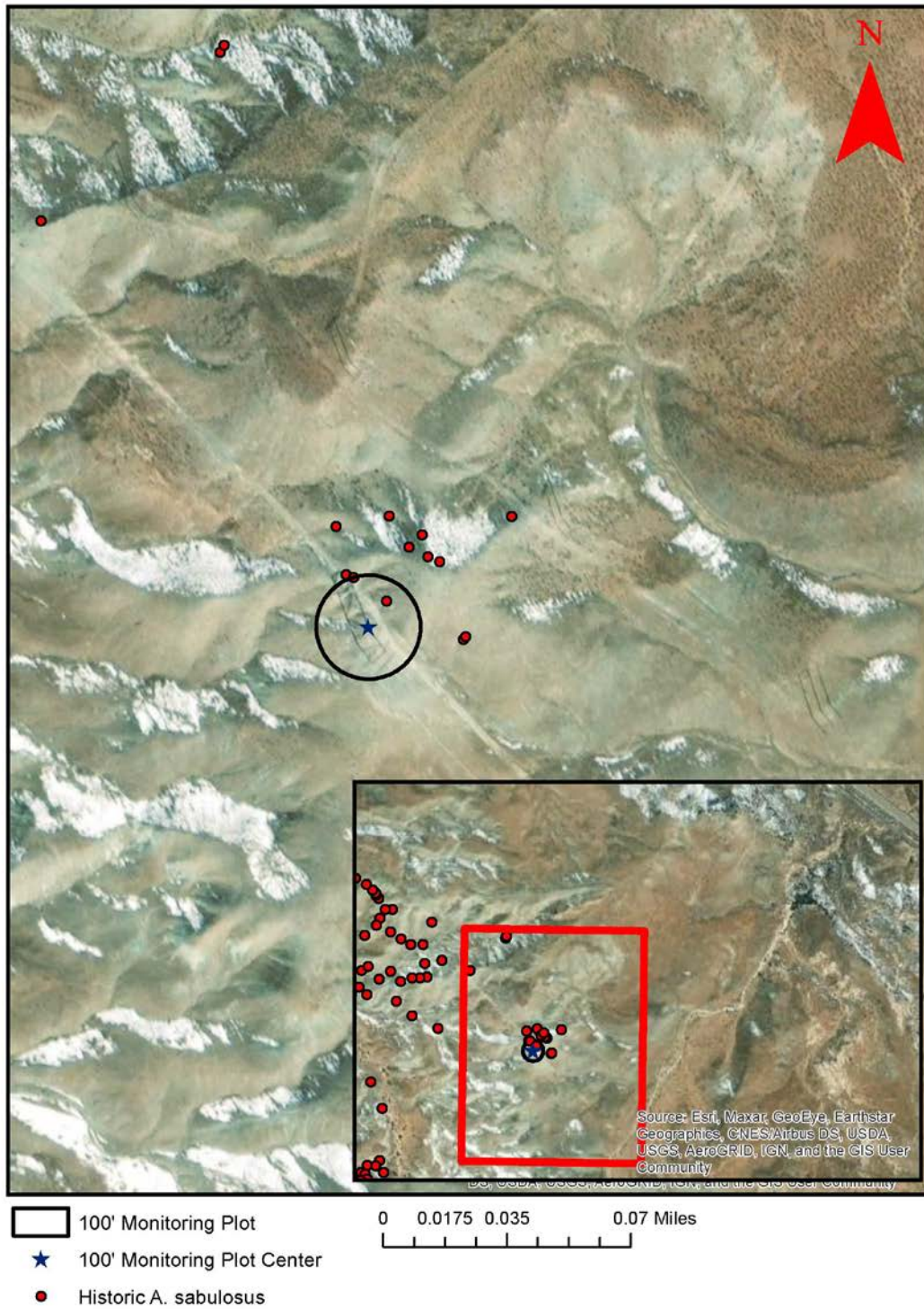


Figure 2 The Courthouse Rock monitoring plot for *A. vehiculus* is located at 38.713848°, -109.719743° and was surveyed on April 15th. Only one individual was found.



Figure 3 All living plants observed in the plot were found along this single rivulet near the bottom of a slope. B. Rolling hills covered in invasive annual grasses and steep exposed gravelly slopes characterized the habitat in the White House plot.



Figure 4 A. The only living individual found in the courthouse rock plot. B. Sparsely vegetated clay and gravelly slopes characterized the Courthouse Rock plot. Original rebar marker visible at the base of the power pole.



Figure 5 A cluster of live, dead/dying or vegetatively dormant individuals along the margin of sheep trail. The large living cluster of individuals showed some signs of grazing by sheep.

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