

POWER ANALYSIS OF THE 10-LONG TERM MONITORING SITES

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This report analyzes woody riparian cover for the 10 long-term monitoring sites along the Escalante River. The goal is to detect change, in particular increases, in native riparian species following removal of Russian olive. In order to be able to detect change, statistical power analysis was applied to a subset of the data to determine if any of the 10 sites have sufficient power. This is a companion analysis to the more detailed analysis of the monitoring program completed by Dr. Eduardo Gonzalez and Dr. Laura Perry, CSU.

This preliminary analysis looks at the native woody riparian species as a guild, thus all data is combined for the following species at each site: *Acer negundo*, *Baccharis salicina*, *Populus angustifolia*, *P. fremontii*, *Salix exigua*, *S. gooddingii*, and *S. lutea*. Two other woody species that are considered facultative phreatophytes, *Quercus gambelii* and *Rosa woodsii*, are not included.

Power was calculated using a one-sample paired T-test, examining both one and two-way tests, with an α of 0.10. Computations were done using Statistix 10.0. Effect sizes were set at 10%, 20% and 30% change between observations (years). Results for each of the monitoring sites are in Table 1. In addition to calculating power, sample size N (within site number of transects) was estimated to reach power of 0.800.

Table 1. Power analysis for woody riparian species at 10 long-term monitoring plots on the Escalante River. Number of transects (N), Mean riparian cover (X) and one standard deviation (SD) are listed for each site. The significance level used is $\alpha=0.10$, with effect sizes (changes between observations) of 10-30% for both one and two-tailed tests. The power values and sites where power ≥ 0.800 are highlighted in red.

Long-term Monitoring Site	N ¹	\bar{X}	1 SD	1-Way 10%	1-Way 20%	1-Way 30%	2-Way 10%	2-Way 20%	2-Way 30%	N to Reach 0.80 Power ²
Headwaters ³	15	37.1	13.8	0.392	0.768	0.959	0.260	0.629	0.906	17/23
Death Hollow	15	42.2	25.1	0.257	0.490	0.727	0.164	0.342	0.581	42/57
Highway Bridge ³	15	60.3	19.5	0.450	0.848	0.986	0.308	0.733	0.960	13/18
Boulder Creek	7	52.3	24.1	0.227	0.413	0.625	0.144	0.268	0.454	26/35
The Gulch	11	63.5	13.5	0.589	0.956	0.999	0.430	0.895	0.997	7/9
Park Boundary	13	58.6	18.7	0.430	0.823	0.979	0.289	0.695	0.943	13/17
Silver Falls	10	65.0	18.4	0.414	0.801	0.972	0.274	0.662	0.925	10/14
Fence Canyon	11	53.5	17.6	0.361	0.715	0.932	0.233	0.559	0.850	13/18
25 Mile Wash	10	68.6	20.9	0.447	0.845	0.985	0.305	0.728	0.958	13/18
Scorpion Gulch	10	72.0	8.4	0.903	1.000	1.000	0.803	1.000	1.000	3/4

¹N=transects; ²one-way/two-way T-tests for a 20% effect size at $\alpha=0.10$; ³Based on 2010 data

The principal change of interest in the monitoring program is an increase in woody native riparian species. Based on the current number of transects per site, a 20% increase between observations can be detected for six sites, Highway Bridge, The Gulch, Park Boundary, Silver Falls, 25 Mile Wash and Scorpion Gulch. Two sites lacked sufficient power even at large effect sizes of 30%, Boulder Creek and Death Hollow. Headwaters also lacks sufficient power at changes below ca. 25%. With minor increases in the number of transects, sufficient power would exist to detect 20% changes for a one-way test for eight sites.

Based on these preliminary results, it is recommended that Boulder Creek and Death Hollow be dropped from the monitoring program. A new site can potentially be established in the Upper Gorge. Also, if possible, two additional transects should be added at Headwaters and Fence Canyon to increase power.

The 2016 data for Headwaters and Highway Bridge can be examined based on these analyses. For Highway Bridge, there was an increase between 2010 and 2016 of 22% in native woody riparian cover. Since there is sufficient power to detect 20% or higher changes, it can be concluded that there was a significant increase in native woody riparian species cover at this site at a significance of $\alpha=0.10$.

The change at Headwaters was a 9% decline in native woody riparian species from 2010 to 2016. Since there is not sufficient power to detect changes below ca. 25% at this site, the null hypothesis of no change cannot be rejected.