Sediment Transport to White-Margined Penstemon Habitat (*Penstemon Albomarginatus*)

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Project Number: 2005-NSHE-502A-P

Annual Project Review Report Presentation

Presentation Outline

- Project goals
- Project hypothesis
- Project Approach
- Results
    - Climatic Data
    - Soils Data
    - Sediment transport data
    - *P. albomarginatus* growth and phenology
    - *P. albomarginatus* density and distribution
- Trends Summary
- Remaining work plan

Project Goals

- Define the ranges in soils, geomorphology, and climatic properties supporting the population
    - *Soil texture, chemistry, hydraulic conductivity, moisture, rainfall, temperature, wind, solar radiation*
- Investigate the extent that aeolian sediment transport occurs
    - *Determine if P. albomarginatus relies on transport of sand or dust for sources of nutrients or favorable conditions*
- Quantify characteristics of *P. albomarginatus populations*
    - *Survival, growth, phenology, herbivory, reproduction, rooting depth, age structure, distribution, and density*

Project Hypothesis

Sandy habitats for white-margined penstemon east of I-15 are maintained by the movement of local source materials within the valleys where the plants reside

Project Locations:

1) South of Las Vegas, east of I-15 corridor near Jean including Hidden Valley, Jean Lake Valley, and Ivanpah Valley
2) North of Las Vegas, along US95, approximately 8 miles east of Lathrop Wells in Nye County

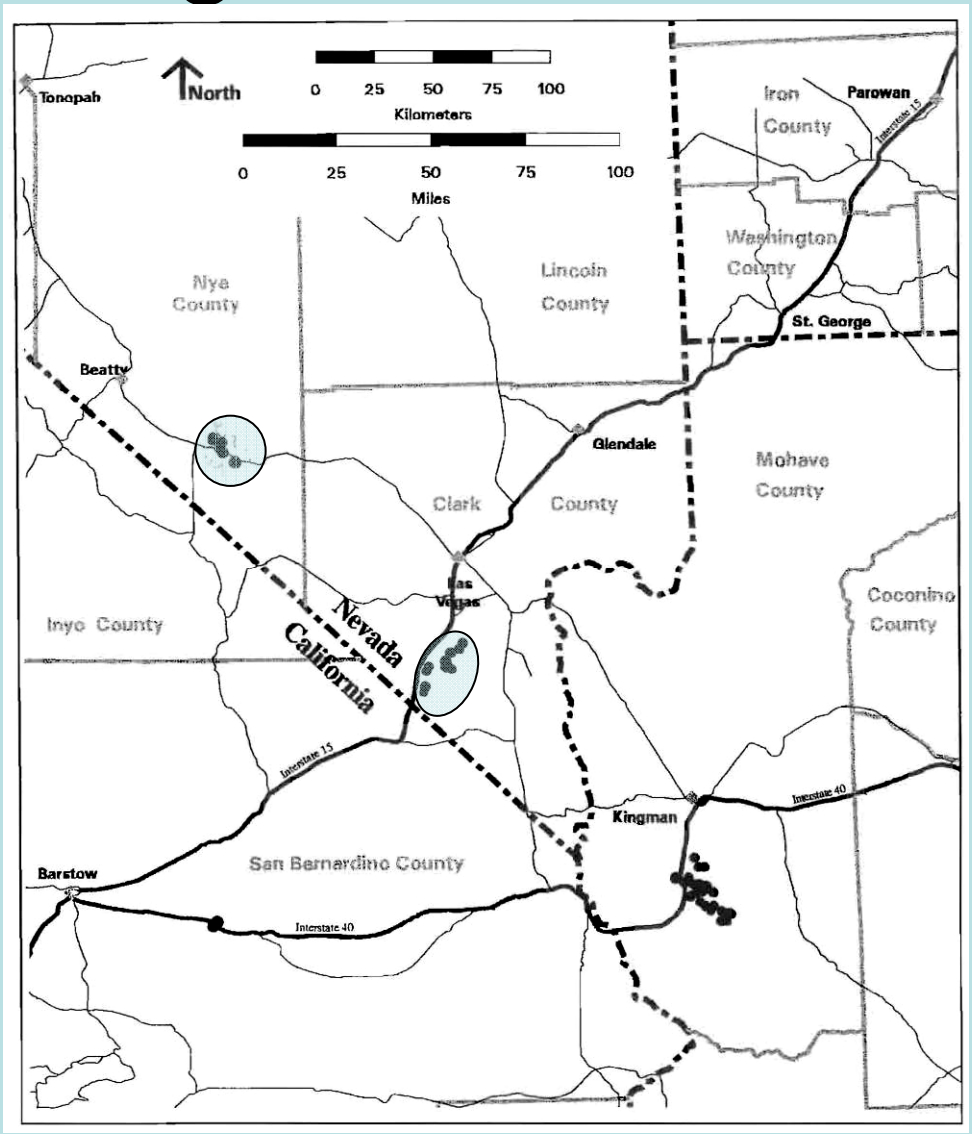
Project Approach

Establish measurement sites within the study areas to:

- Characterize wind regimes
- Record microclimatic variables
- Record the frequency and magnitude of aeolian sediment transport events
- Detail the plant community structure
- Document the growth cycle and extent of *P. albomarginatus*

Monitoring Stations

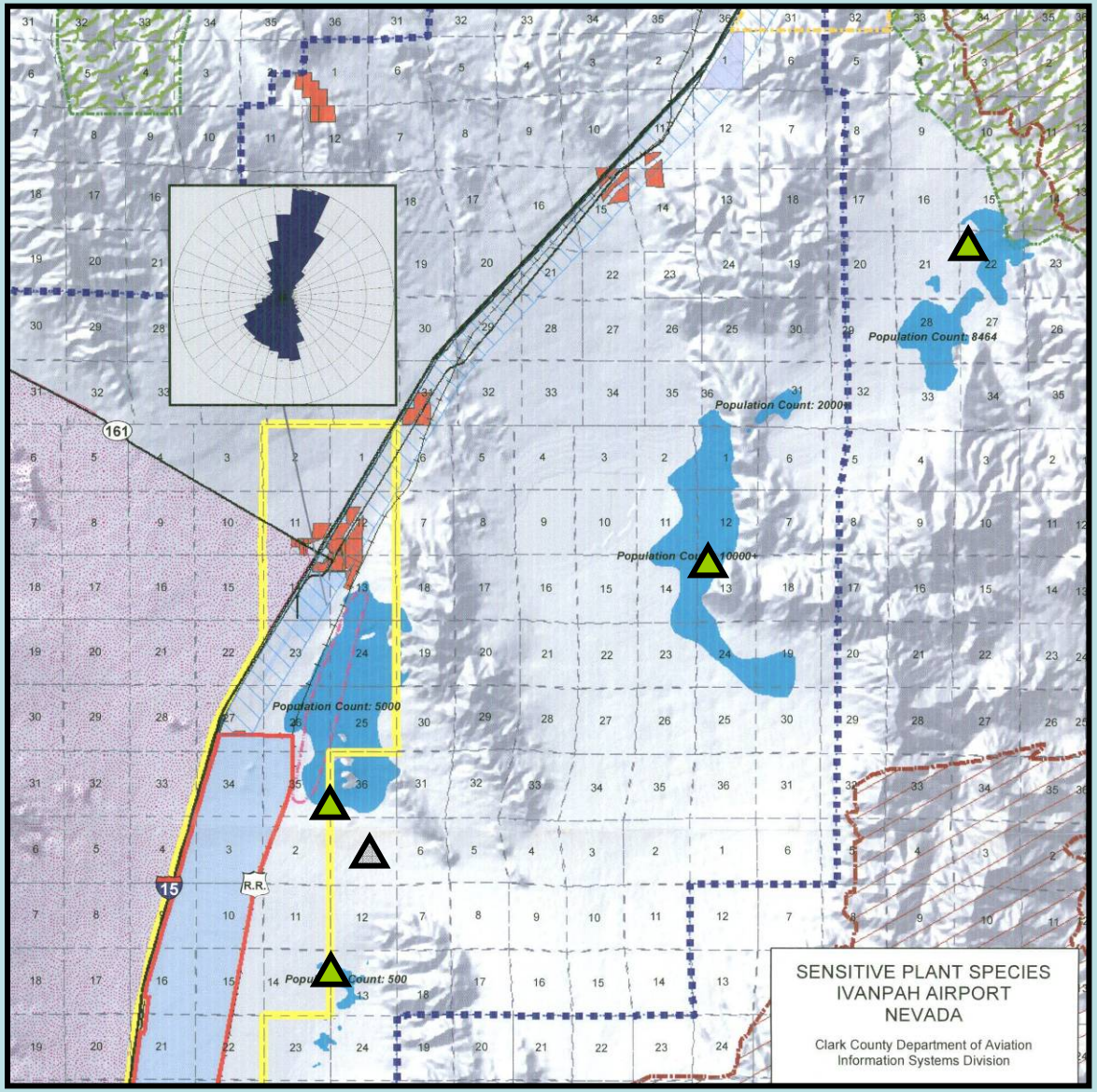
- Seven stations within Clark and Nye County
- Five are in areas that have W-M Penstemon
- Two are in areas nearby with no documented W-M Penstemon



Clark County Site Locations

W-M Penstemon Site

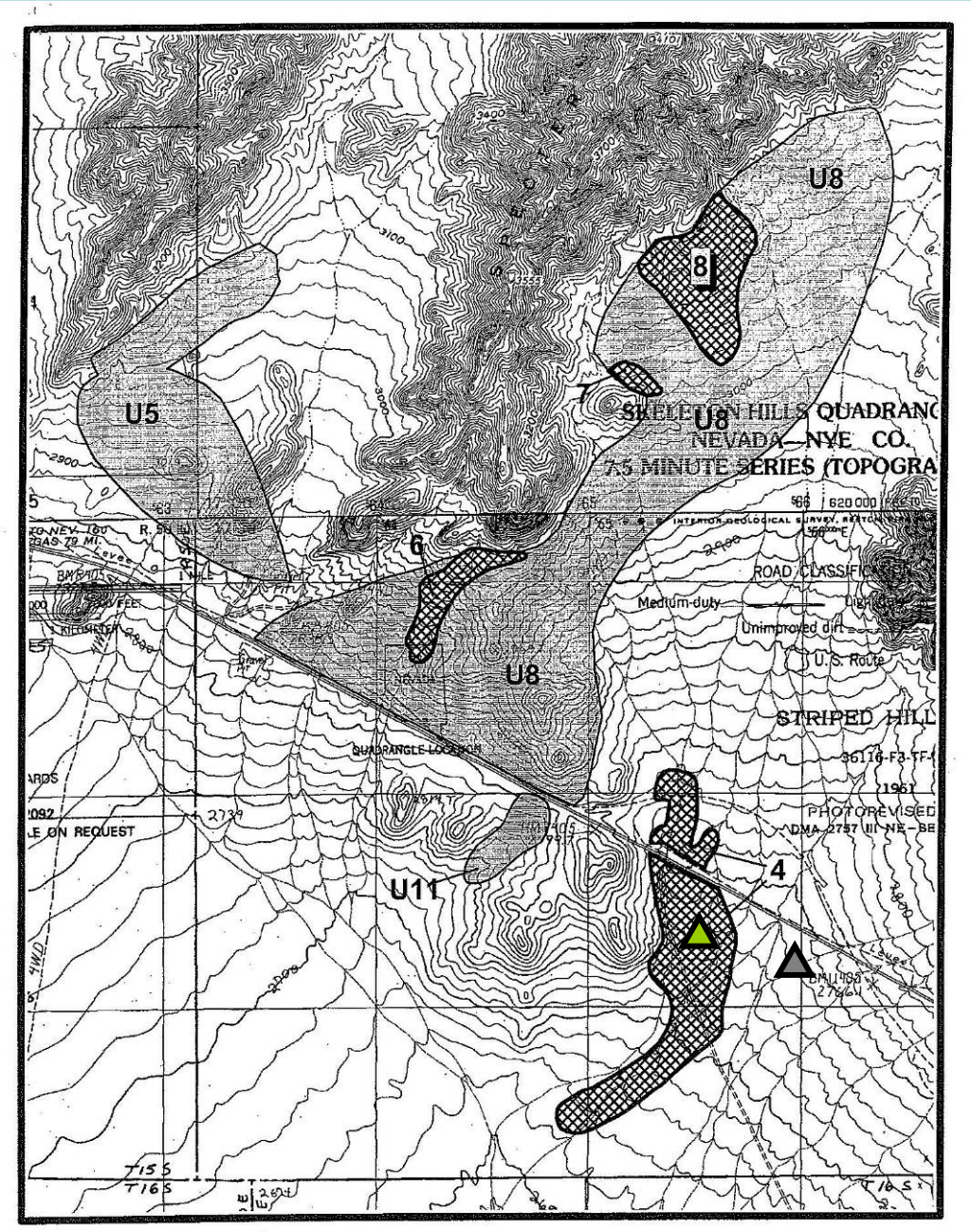
Comparison Site



Nye County Site Locations

W-M Penstemon Site

Comparison Site



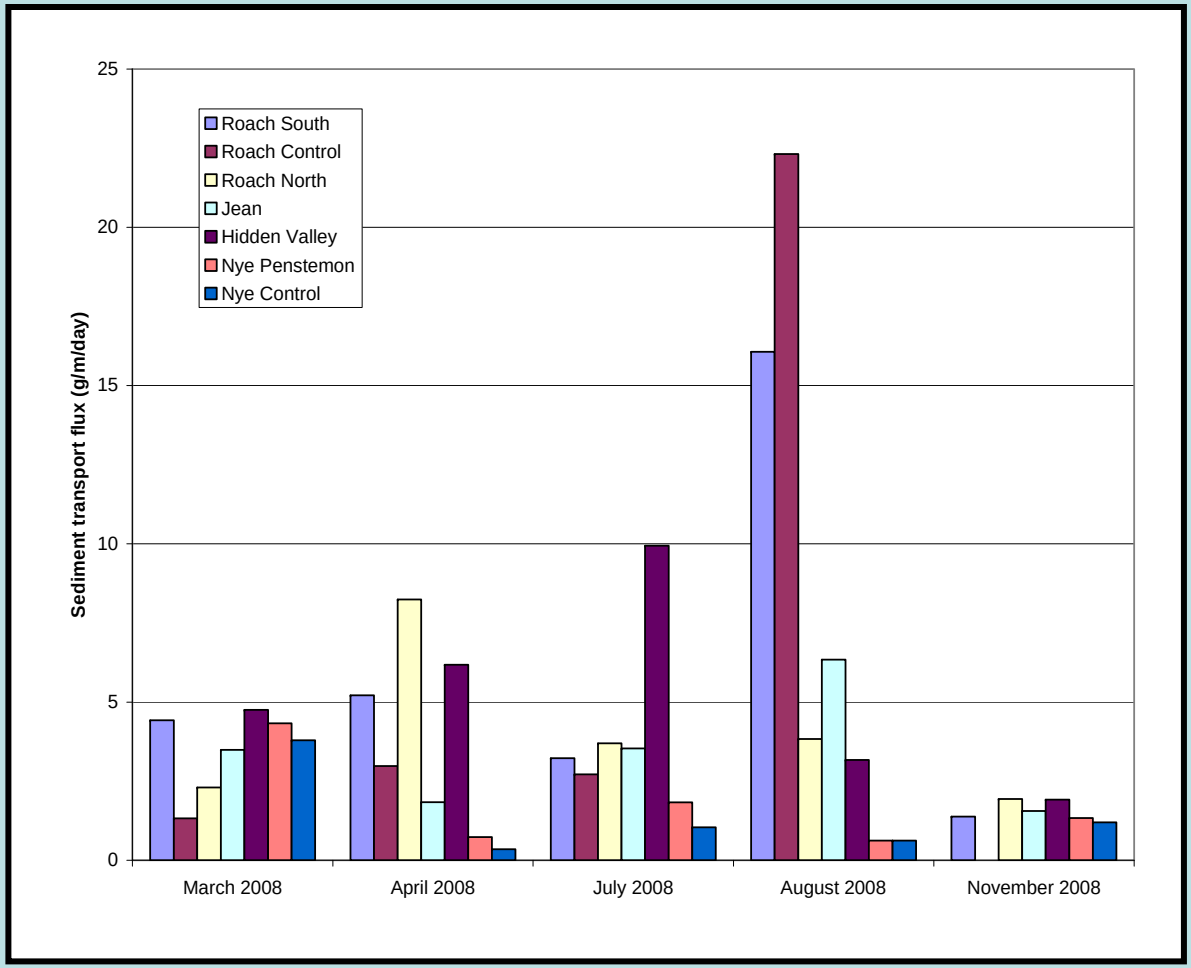
Monitoring Sites

- Anemometers
- Relative Humidity
- Temperature
- Pressure
- Precipitation
- Solar Radiation
- Soil Moisture
- Sediment Transport
- Vegetation Surveys

Results

- Average monthly meteorology (Nov 2007–Jun 2009)
  - Relative humidity and air temperature showed very little difference between sites for the same month
  - Wind speeds are highest in spring at all sites
  - Roughness lengths (m) at all sites were similar at around 10 cm
  - Total precipitation varies from site to site with Clark County receiving more rain and the Jean Lake Exclosure receiving the least out of those.

Sediment Transport

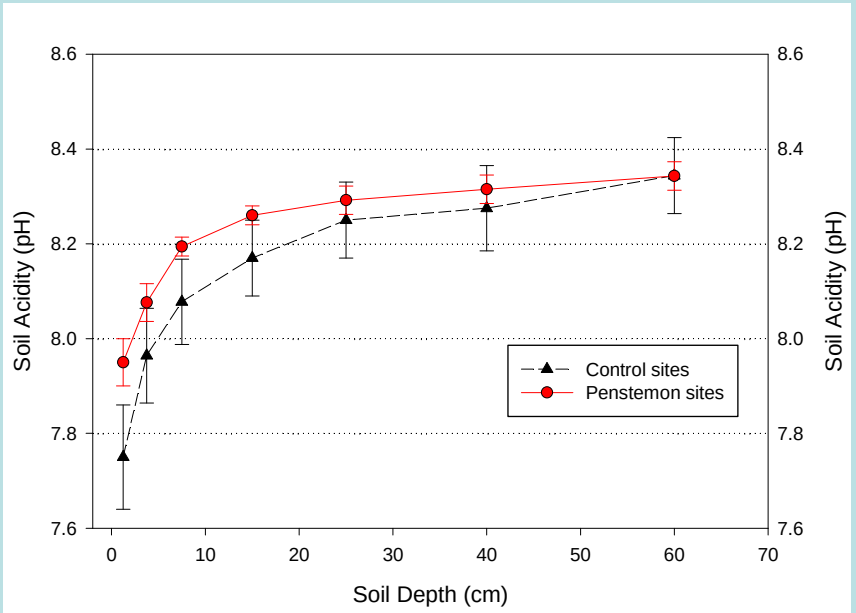


- Nye County has highest rates during winter
- RLN and JLE had highest rates in the April 08
- HV highest rate in July 08
- Very high rates in August 08 at RLS and RLC could be from OHV activity
- Low rates of transport activity

Results

Soils

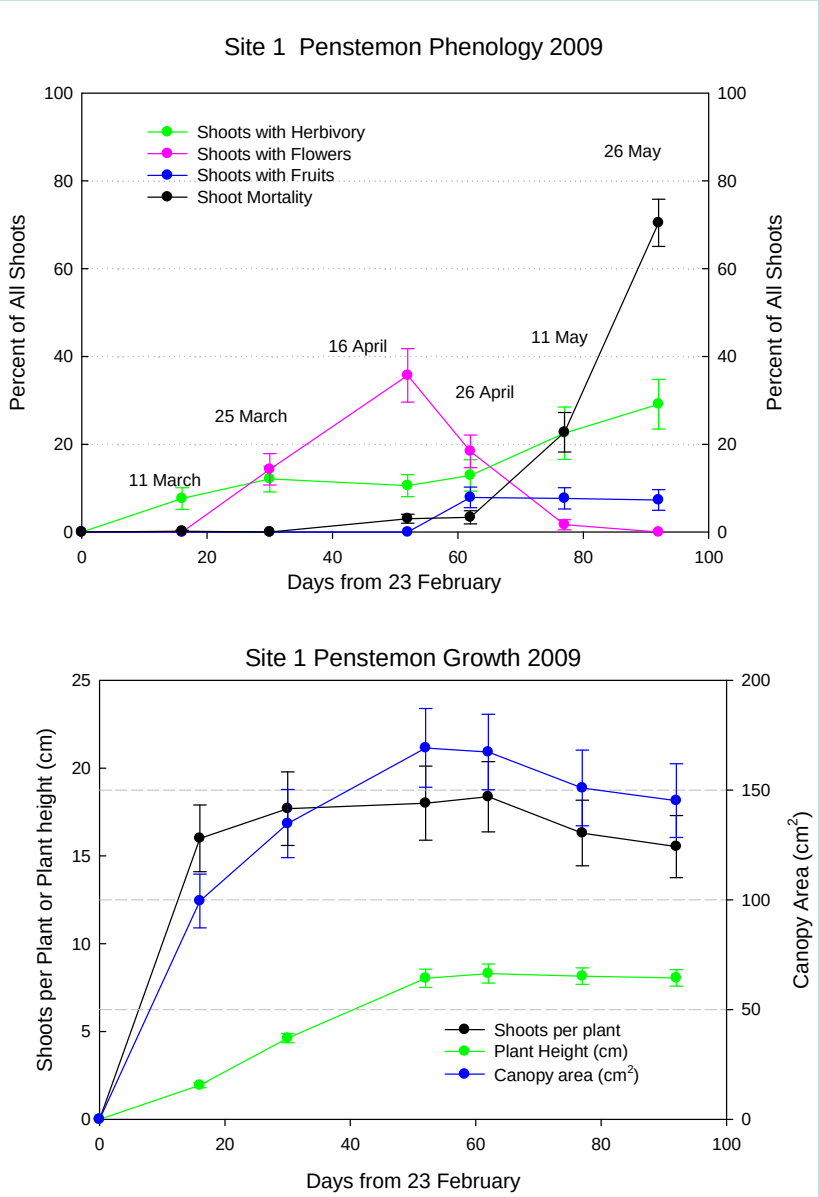
- Soil acidity near the surface is slightly lower for *P.albomarginatus* sites
- Soil texture is very sandy and similar at all sites (86-93%)
- Phosphorus, nitrate, ammonium, carbonate, and organic carbon levels were similar at all sites, but varied with depth



Survival and Growth

- Survival (emergence) from April 2008 through March 2009 during below average winter precipitation was almost 100% (157/160 plants).

- Growth (shoot number, height and canopy area) for 2008 was comparable to 2009



Flower and Fruit Production

- Overall percent of shoots with flowers in 2008 (35%) and 2009 (34%) were similar, but there was significant within population variation.
- A similar trend occurred for fruit production, but with slightly greater fruit production in 2009 (14 % of shoots with fruits) compared to 2008 (9%)
- Seed viability of 2008 and 2009 collections will be determined during winter 2009-2010.

Plant Herbivory

- 2008 - Grasshoppers were the dominant herbivore with 57% of all shoots impacted
- 2009 – Caterpillars were the dominant herbivore with 64% of all shoots impacted
- Herbivory was not correlated with reproductive success

Penstemon Density

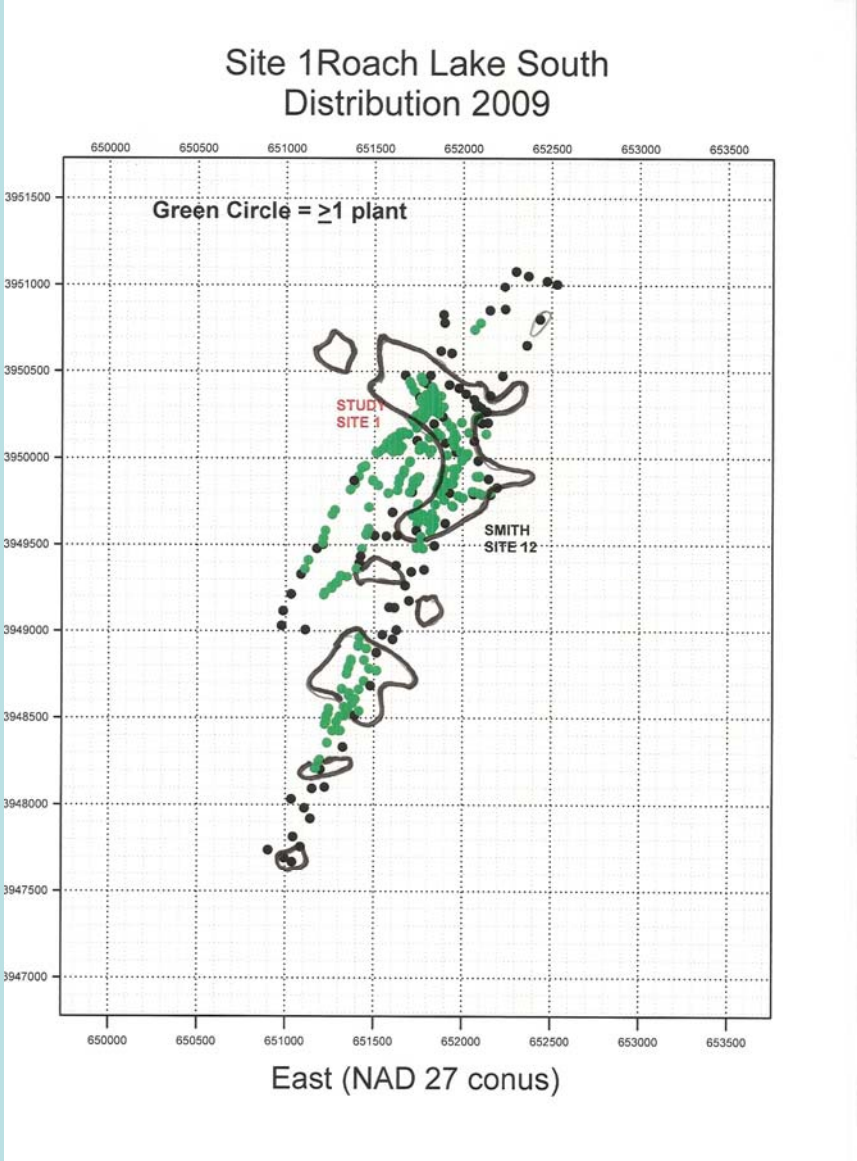
CLARK COUNTY													
site #		area (acres)					Total Plants			Plants/acre			
Study	Smith	Study acres	Smith acres	% Smith survyed	new acres	Percent Increase	plants counted	Study est	Smith est	Study	Smith	Percent change	
1	12	284	157	0.5	127	80.89	516	**1032**	**500**	3.63	3.18	14.10	
3	9	766	2464	0.36	52	2.11	1494	**4150**	**5000**	1.68	2.03	-17.00	
4	10	652	2063	0.22	7	0.34	3024	**13745**	**10000**	6.66	4.85	37.45	
5	1	240	1154	0.14	89	7.71	5481	**39150**	**8464**	33.93	7.33	362.55	
	11	0	124.6	.	.	.	.	**.**	**2000**	.	16	.	
totals		1942	5962.6	0.33	275	22.76	10515	**58077**	**25964**	11.48	4.35	99.28	
						38.88				15.11	7.55	127.67	
NYE COUNTY													
6	4	237	106	0.47	104	98.11	2437	**5185**	**5000**	21.88	47.17	-53.62	
	7	2.5	5.1	0.5	2	39.22	191	**382**	**200**	74.90	39.22	91.00	
	8	0	57	0	.	.	.	.	3000	.	52.63	.	
	2	0	16	0	.	.	.	.	1000	.	62.50	.	
	3	0	31	0	.	.	.	.	8000	.	258.06	.	
	5	0	236	0	.	.	.	.	20000	.	84.75	.	
	6	0	22	0	.	.	.	.	5000	.	227.27	.	
total		239.5	473.1		106	68.66	2628	5567	42200	48.39	110.23	18.69	
						41.65				37.49	92.03	102.26	

Site 3 Sandy slope

Site 3 Rocky drainage

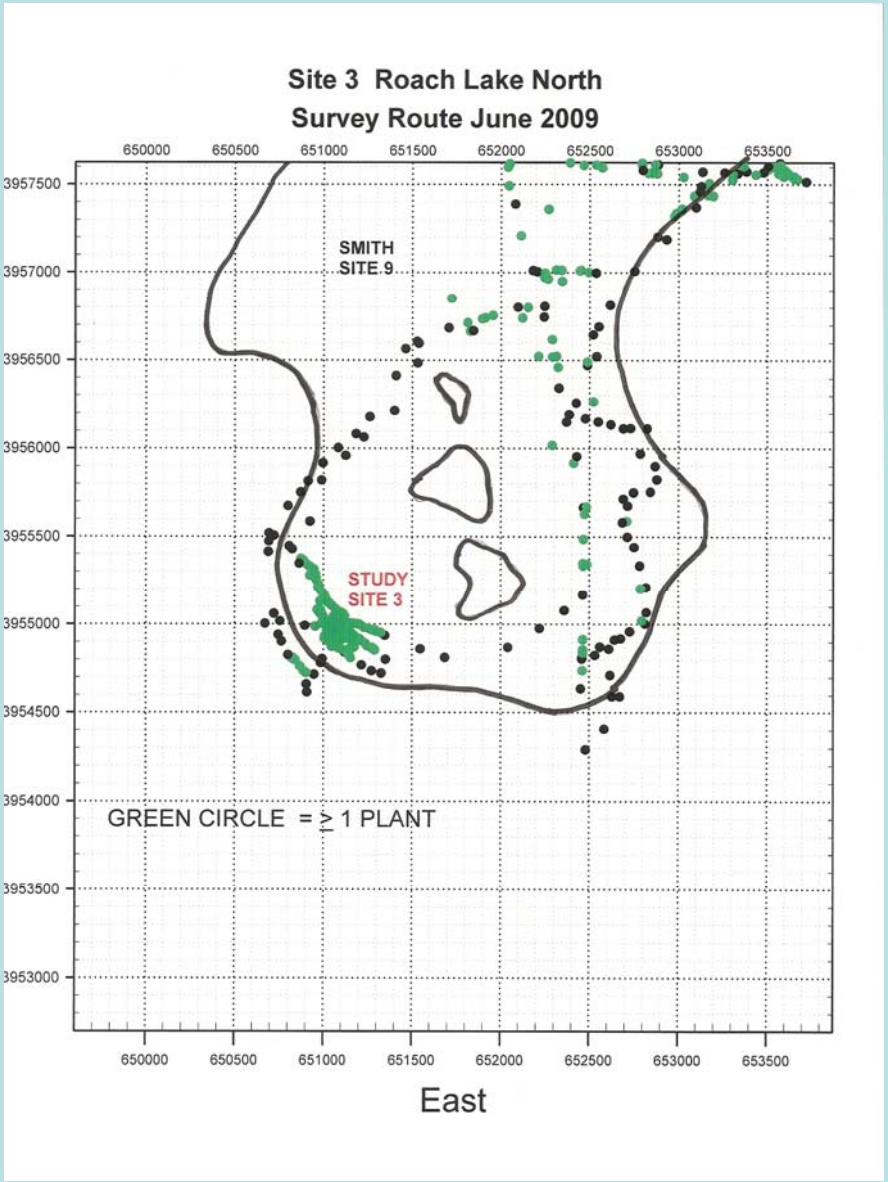
Site 4 Galleta stand

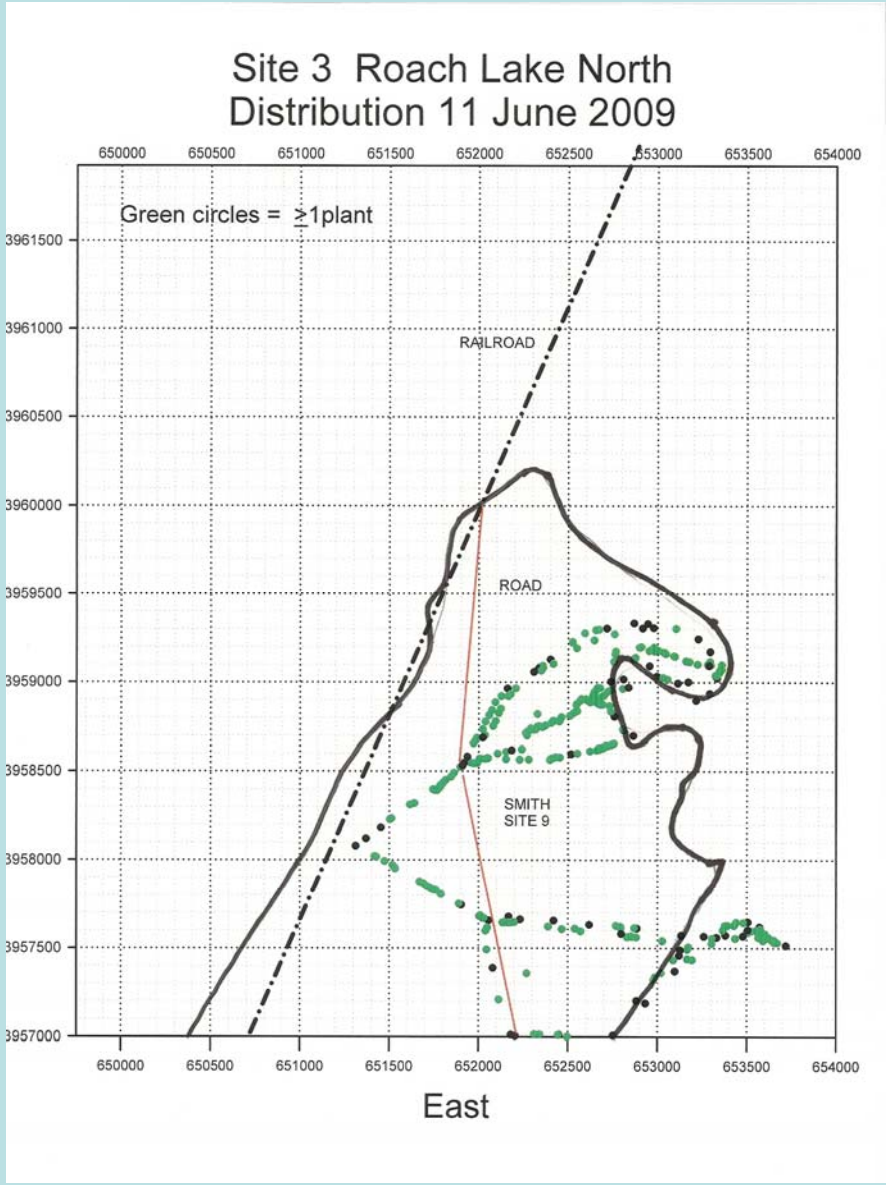
Comparison of penstemon distributions mapped in 1998 and 2009 site 1 Clark County.



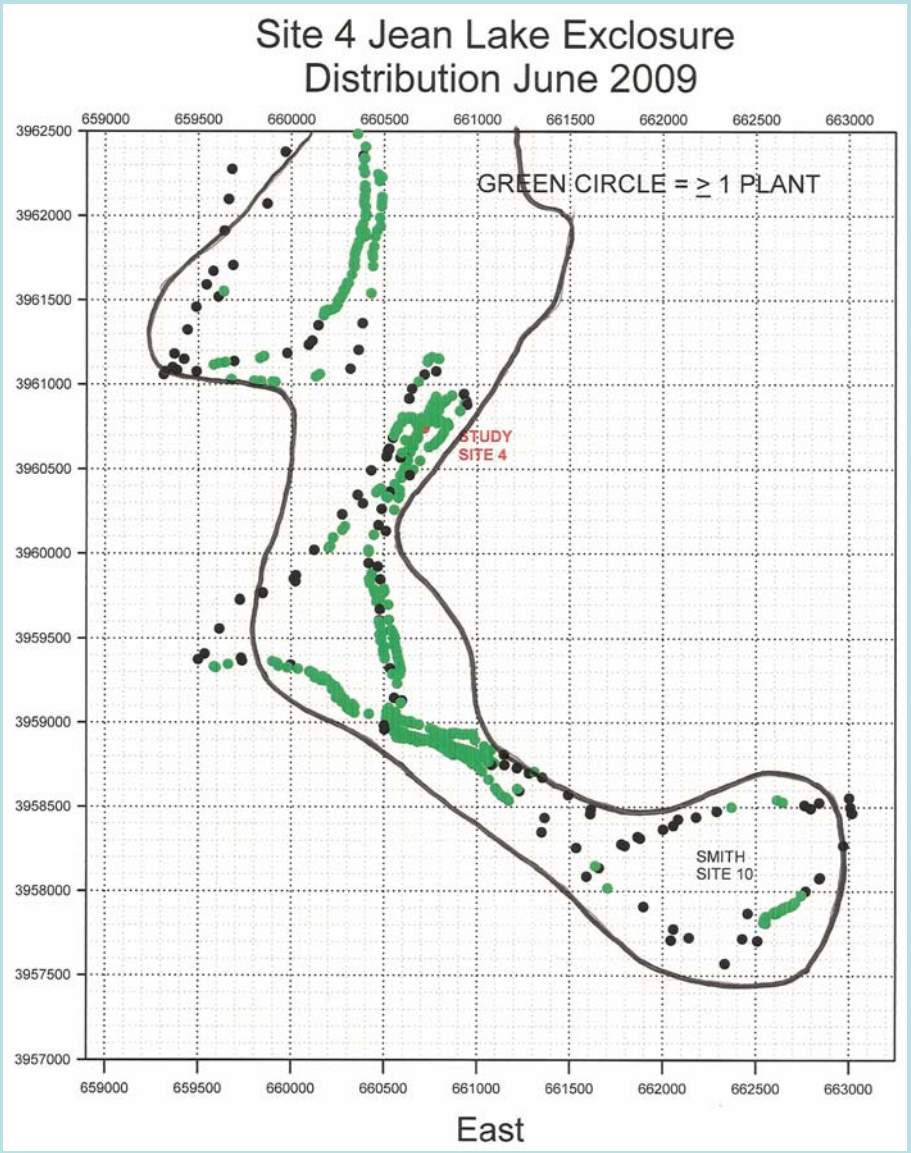
Penstemon extending into an Atriplex community at site 1.

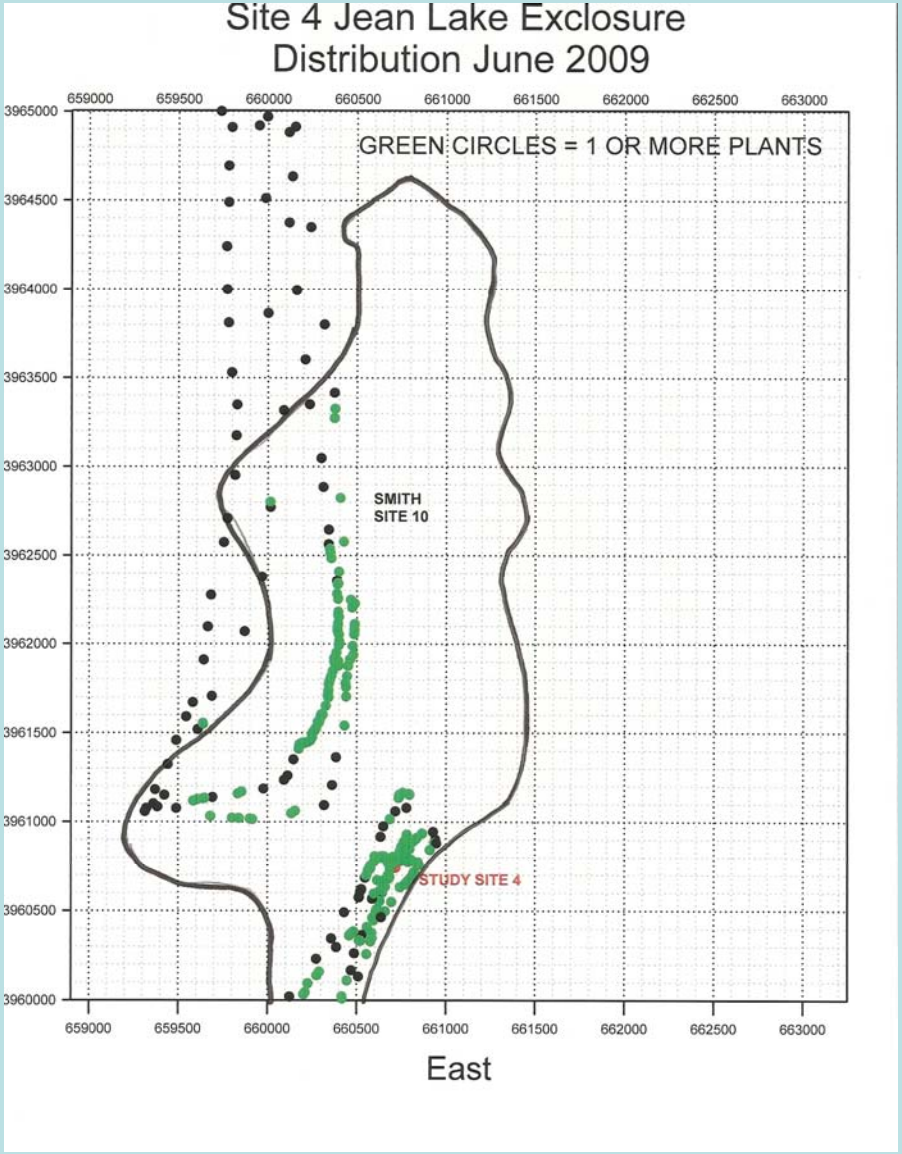
Comparison of penstemon distributions mapped in 1998 and 2009 site 3 Clark County.



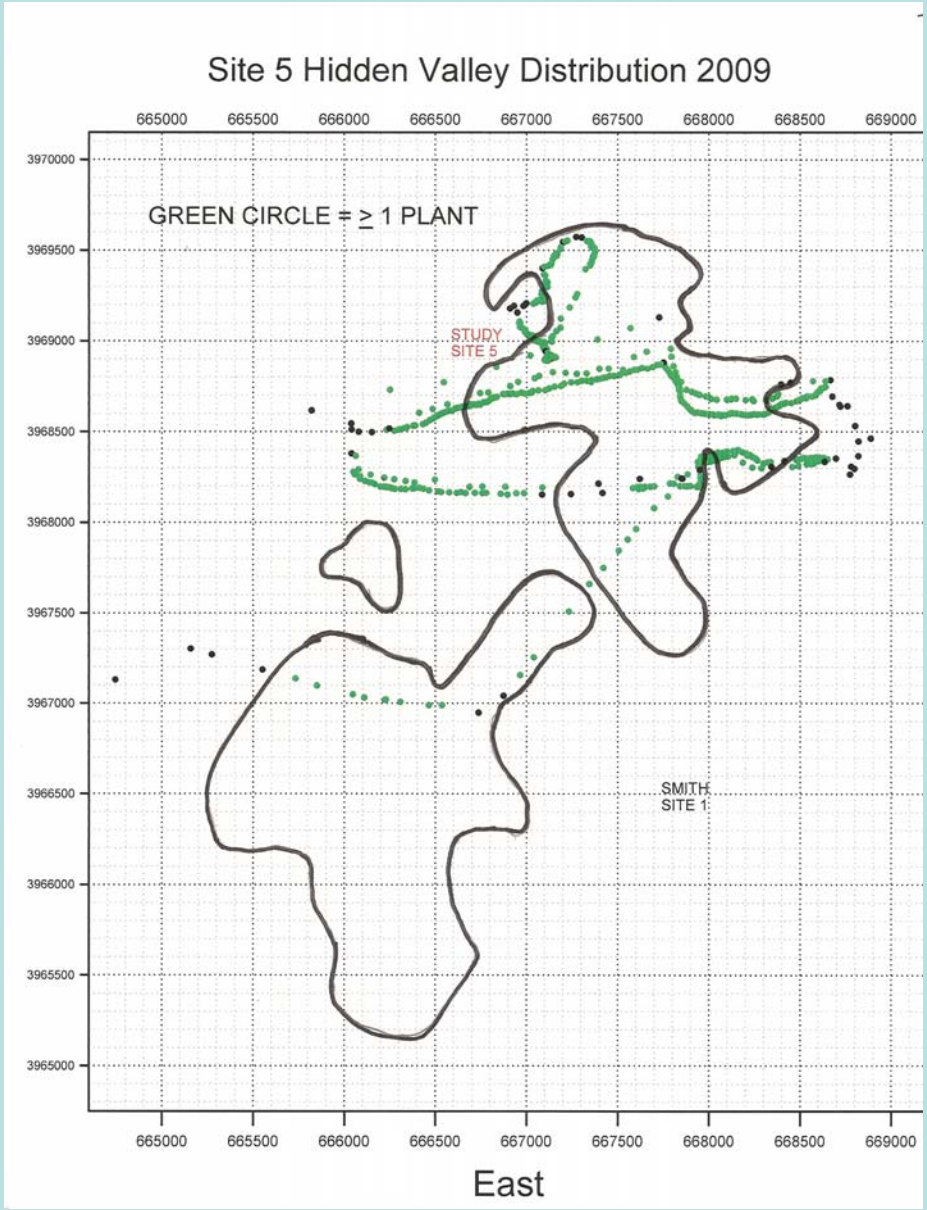


Comparison of penstemon distributions mapped in 1998 and 2009 site 4 Clark County.



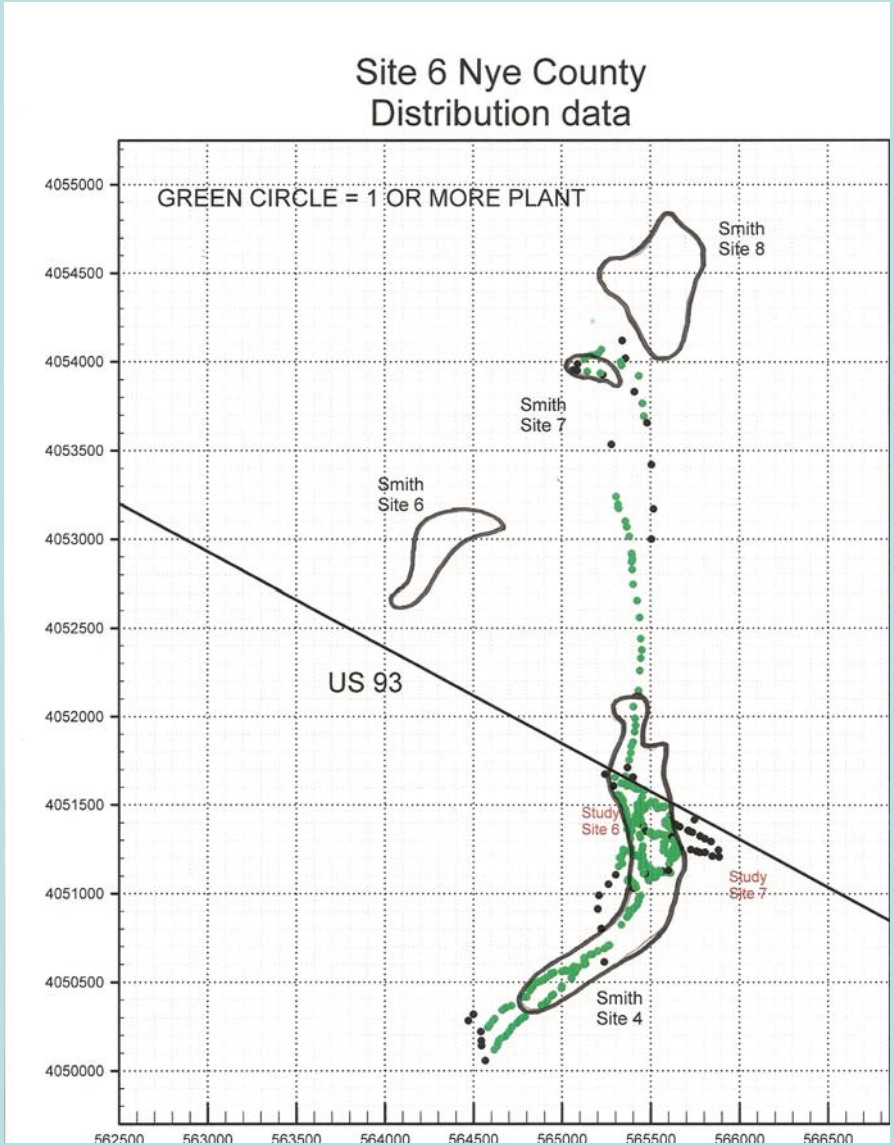


Comparison of penstemon distributions mapped in 1998 and 2009 site 5 Clark County.



Site 5 Hidden Valley has the largest Penstemon population in Clark County, about 40,000 plants.

- Comparison of penstemon distributions mapped in 1998 and 2009 site 6 Nye County.



Penstemon found here were not seen in 1998.

Preliminary Trends

- Sediment transport of sand is occurring at all sites but only at low rates
- Soil properties do not provide a limiting habitat
- Rainfall is higher in Clark County and variable between sites
- Penstemon growth and reproduction were similar for two slightly below average precipitations years, while mortality was negligible
- Based on density and distribution data some penstemon populations appear to be stable, while others appear to be expanding, though no actual mortality or recruitment was observed

Continuing work plan

- Finish climate data collection, Oct. 1, 2009
- Deposited dust analysis
- Further sediment transport analysis
- Collect more community data and conduct an ordination analysis
- Correlate rainfall activity/soil infiltration with *P. albomarginatus* activity
- Determine root structure and seed viability