Characterizing the Ecology of White-Margined Penstemon (*Penstemon albomarginatus*) in Nevada (2008-2010)

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Presentation Outline

- Project Goals and Hypothesis
- Experimental Design/Study Site Locations
- Results
    - Climatic Data
    - Soils Data
    - Community Structure
    - *P. albomarginatus* Phenology and Distribution
    - Sediment Transport Data
    - 2010 Growth and Genetic analysis
- Summary

Project Goals

- Quantify ranges in climatic and soils properties supporting *P. albomarginatus* populations
  - *Precipitation, temperature, wind, solar radiation, soil texture, chemistry, hydraulic conductivity and moisture*
- Quantify characteristics of *P. albomarginatus* populations in Clark and Nye Counties NV

  Phenology, age structure/size class distribution, root structure, population sizeand spatial patterns
- Estimate aeolian sediment transport within and adjacent to *P. albomarginatus* Habitat
  - *Determine if P. albomarginatus relies on transport of sand or dust for sources of abrasion or nutrients*

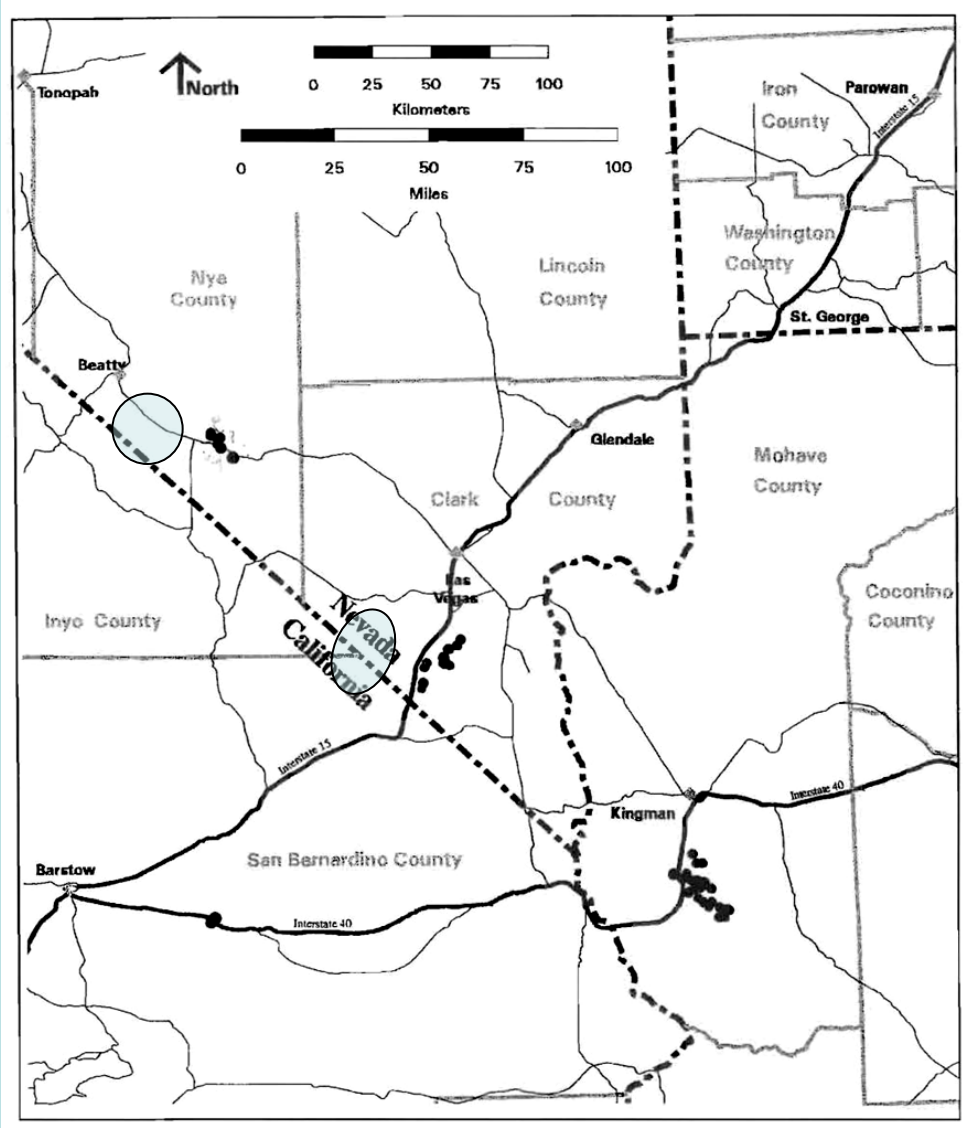
Project Hypotheses

Sandy habitats for white-margined penstemon east of Interstate highway15 are actively maintained by the movement of local source materials (sand and dust) within the valleys where *P. albomarginatus* occurs

Construction of a proposed Clark County airport on Roach Lake playa will disrupt essential sediment transport processes and adversely impact the local *P.albomarginatus* population

Study Sites

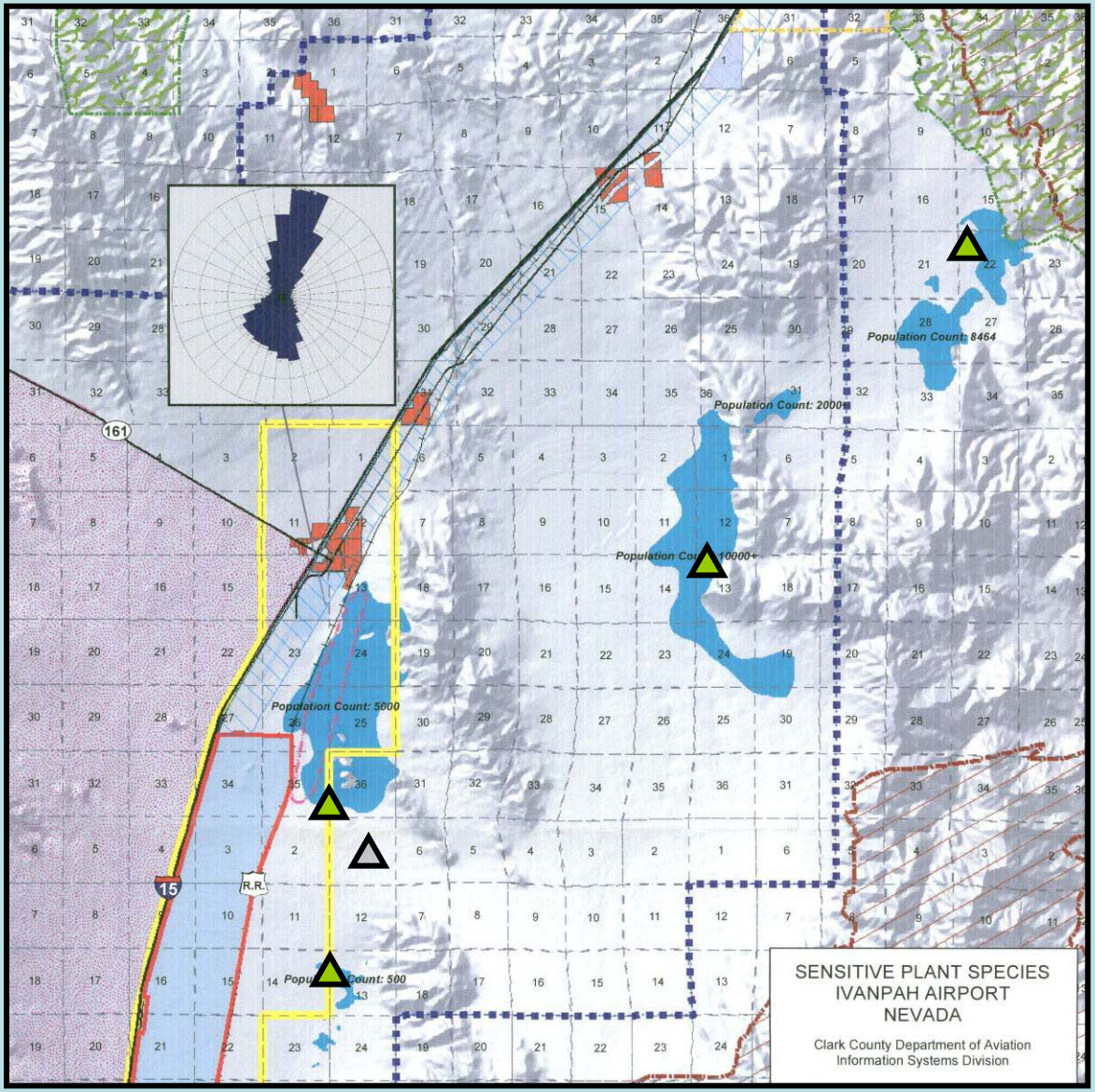
- Seven study sites in Clark and Nye County NV
- Five sites support Penstemon populations
- Two comparison sites nearby that do not support Penstemon populations



Clark County Study Sites

Penstemon Site

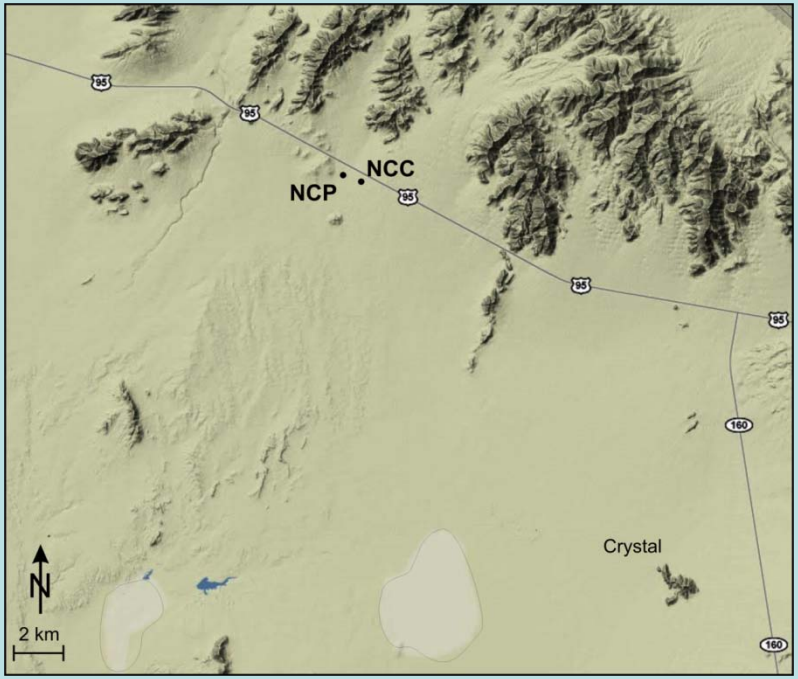
Comparison Site

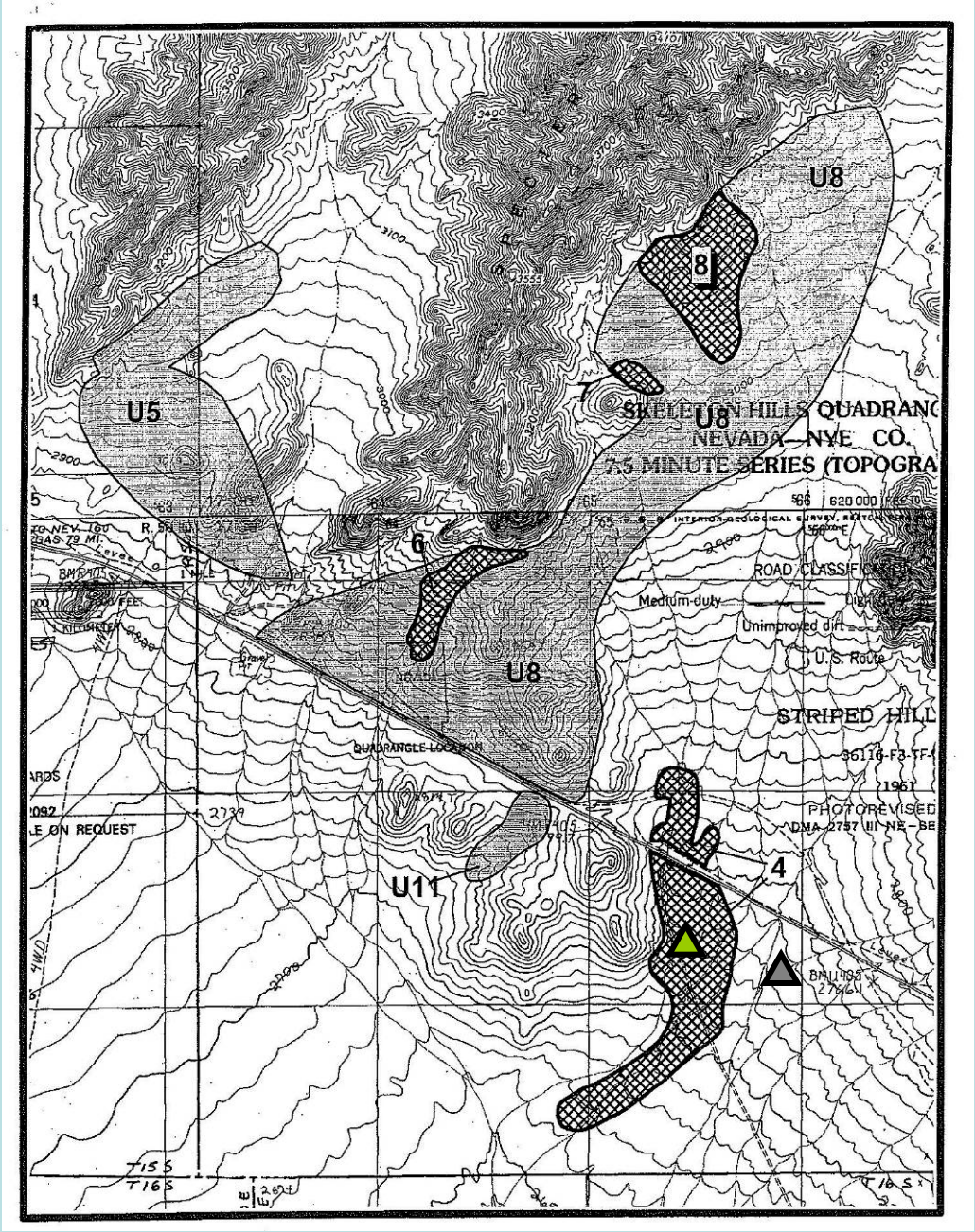


Nye County Study Sites

Penstemon Site

Comparison Site

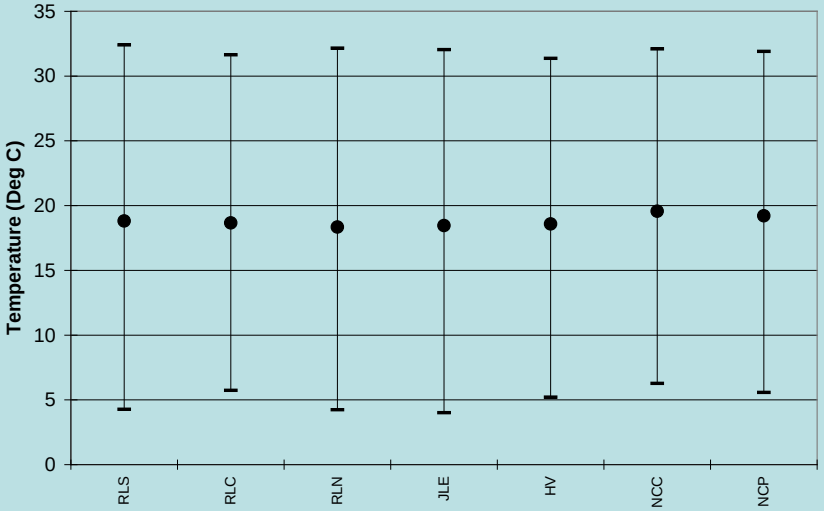




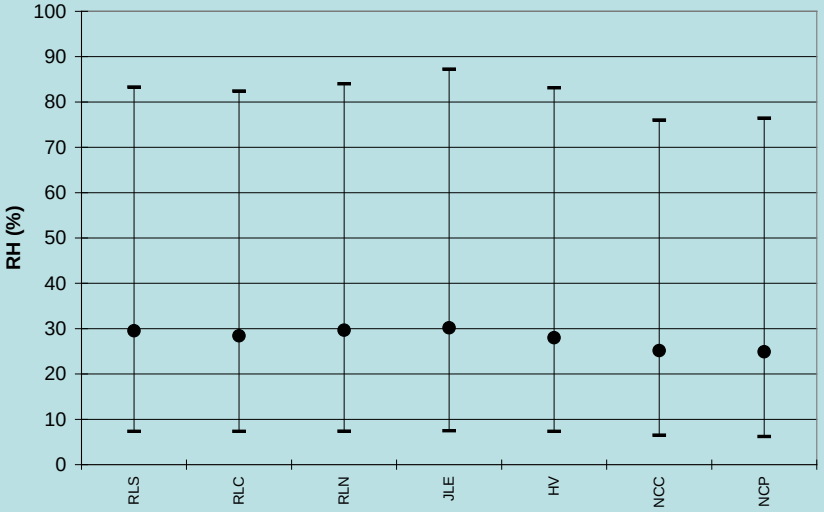
Instrumentation

- Anemometers
- Relative Humidity
- Temperature
- Precipitation
- Solar Radiation
- Soil Moisture (TDR)
- Sediment Transport

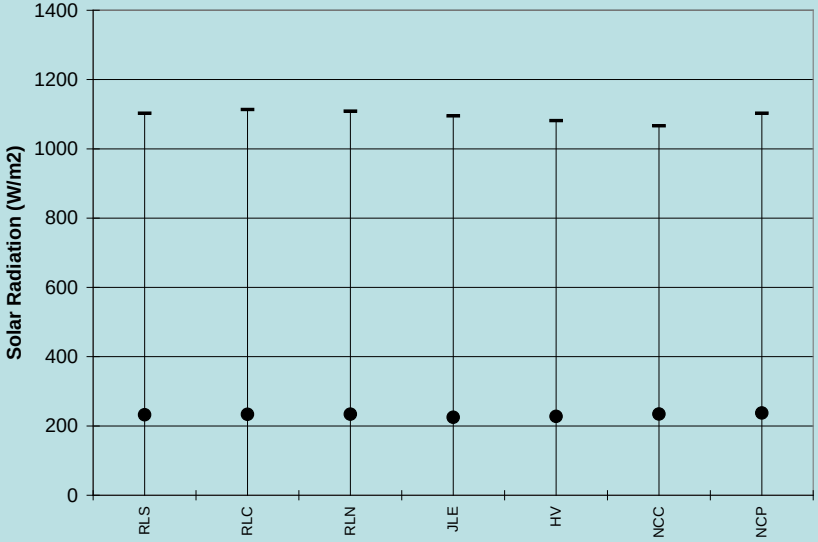
Climate Results



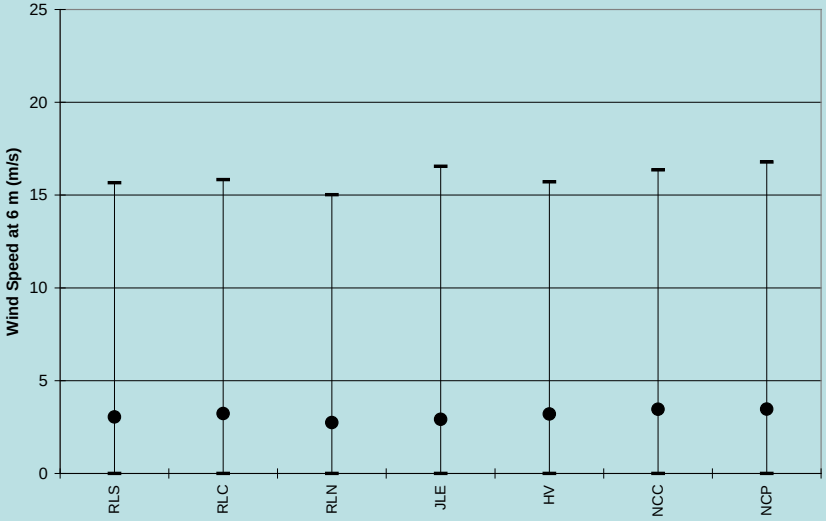
Temperature



Relative Humidity

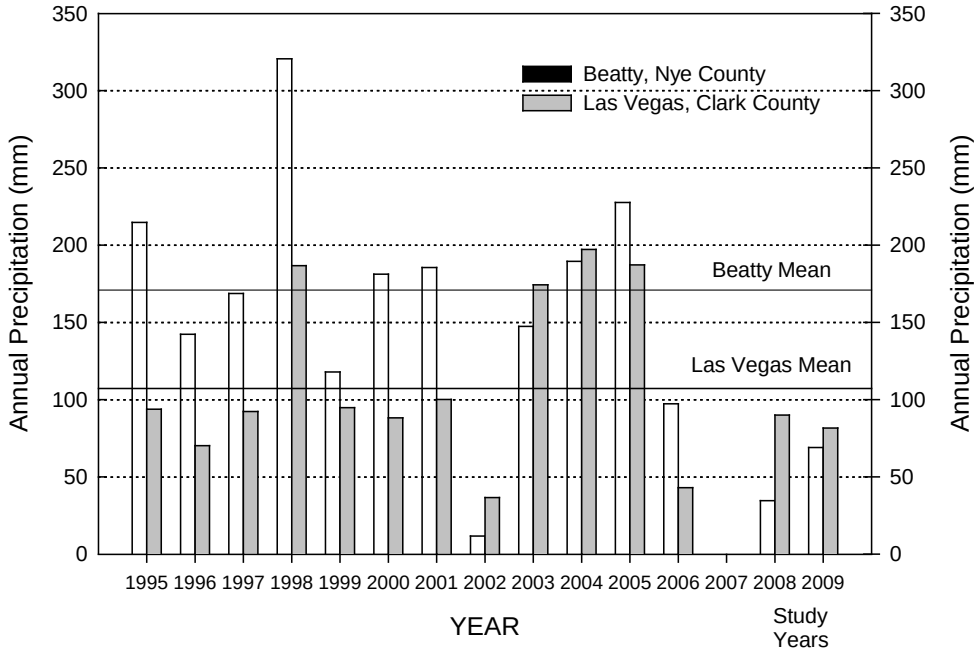


Solar Radiation



Wind Speed

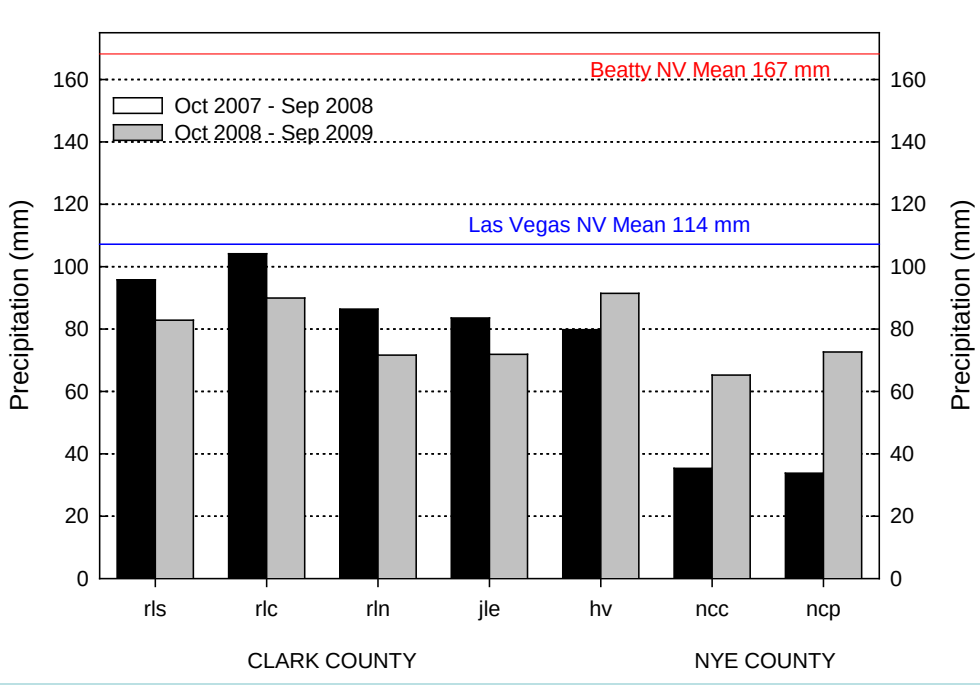
Precipitation



Long-Term Comparisons

Study Years 2008 and 2009
20-80 % below annual averages

Nye County about 46% wetter than Clark County



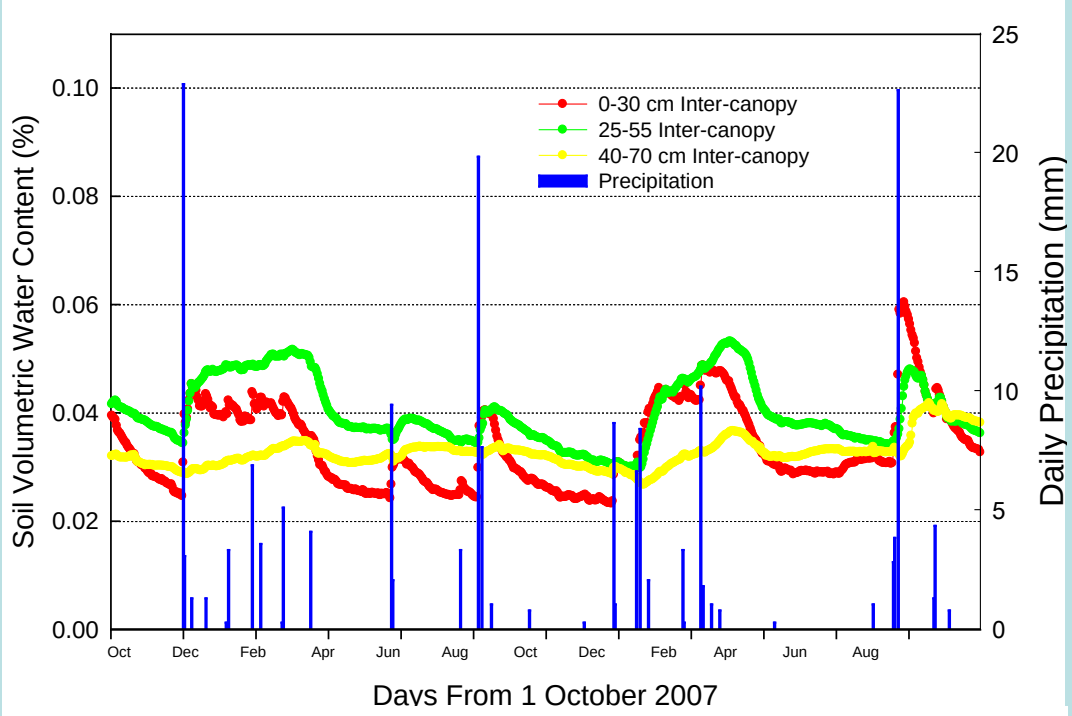
Study Year Comparisons

Nye County extremely dry in 2008 and still < 50 % of annual mean in 2009

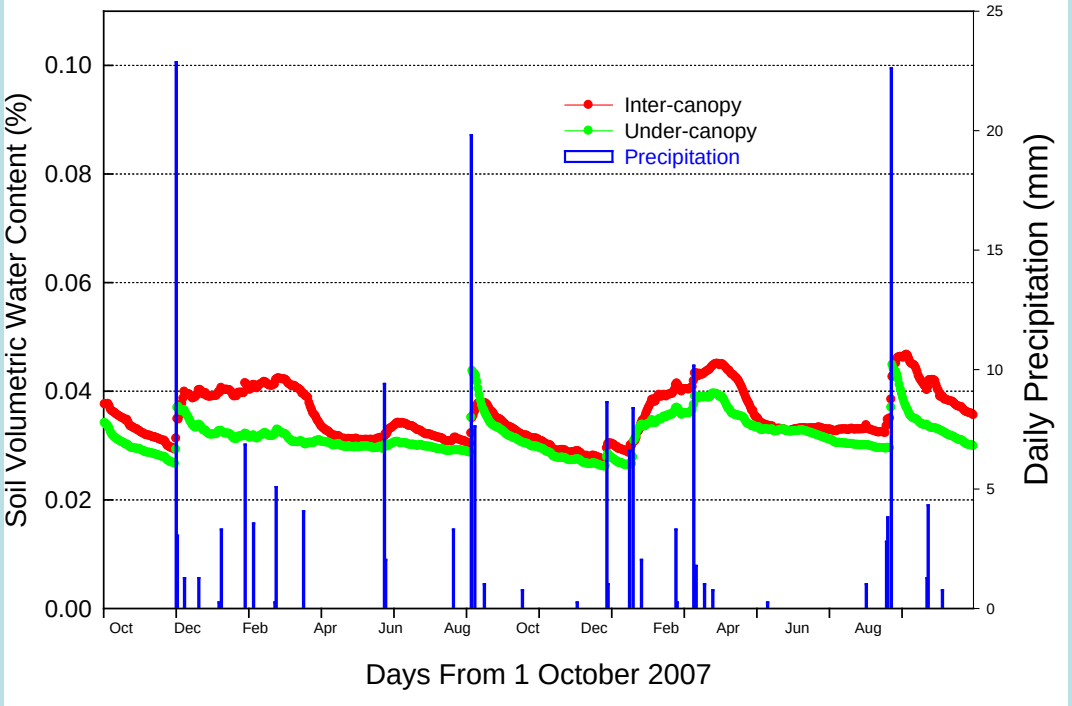
Clark County wetter than Nye County in 2008, but similar in 2009

Soil Moisture

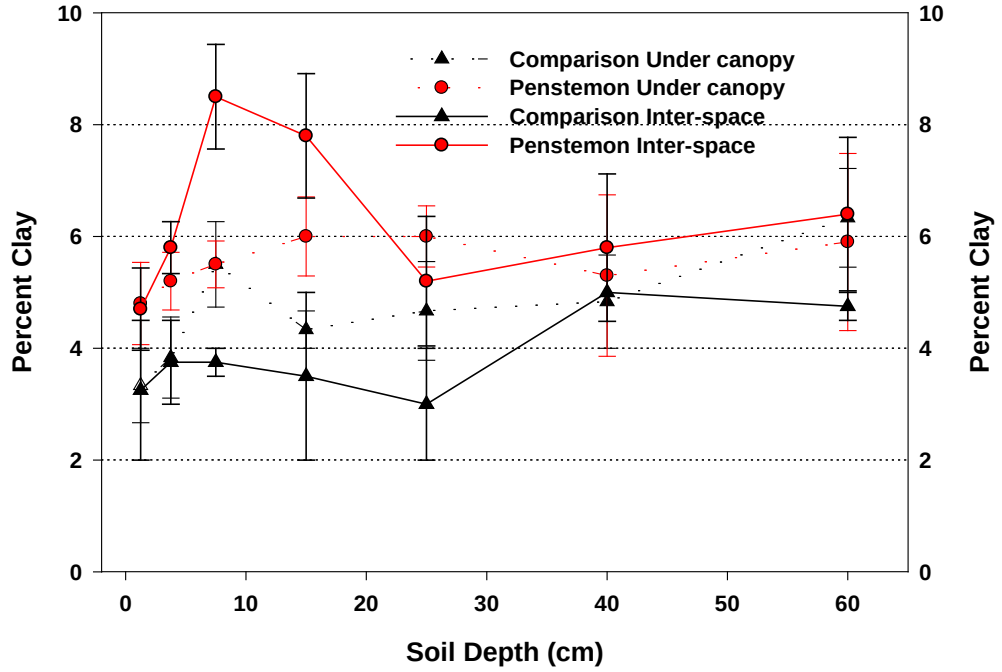
Roach Lake South Data

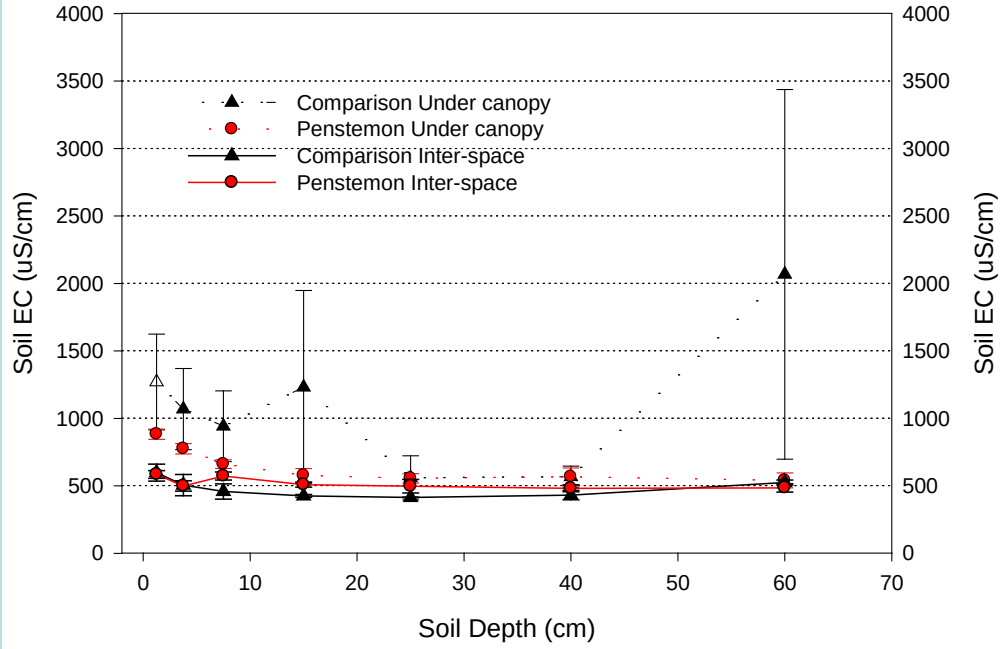


Soil moisture was relative low, but highest during the growing season (Jan-May)



Inter-canopy spaces tended to have greater soil moisture than under-canopy spaces

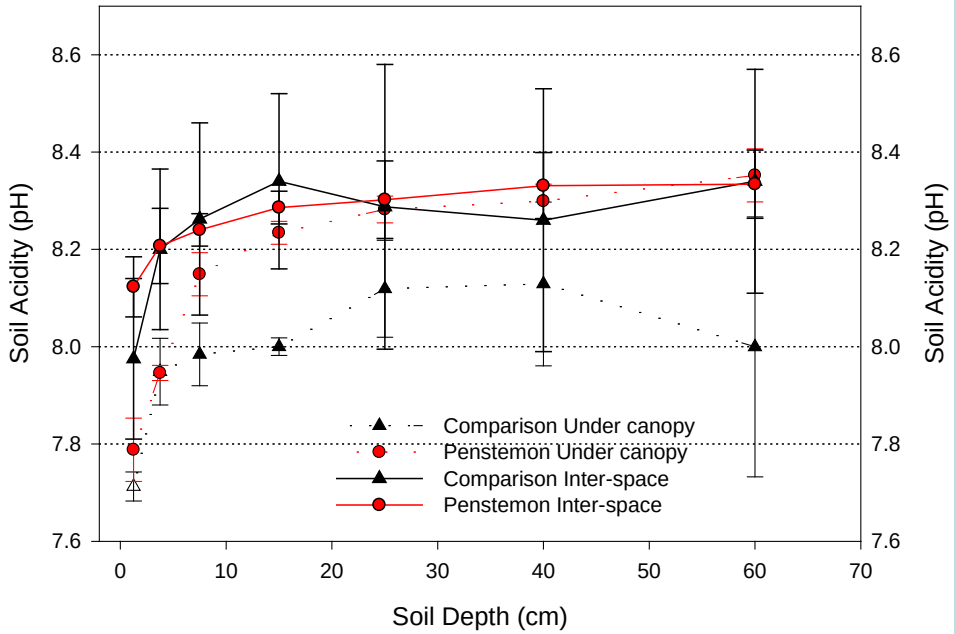


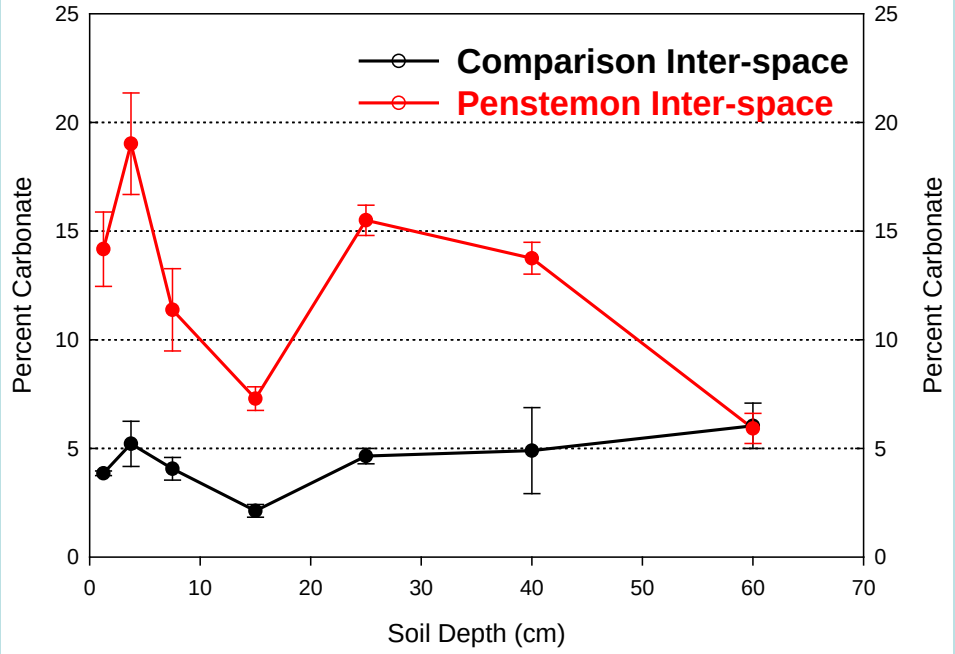


SOIL TEXTURE AND ELECTRICAL CONDUCTIVITY

Slight but significant increases in clay content in the top 10 cm of penstemon soils were discovered. Penstemon soils were > 90% sand and commonly included the Bluepoint soil series classified as a,
Mixed, thermic Typic Torripsamment

Soil electrical conductivity does not seem to limit the suitable or inability to define sustainable penstemon habitat



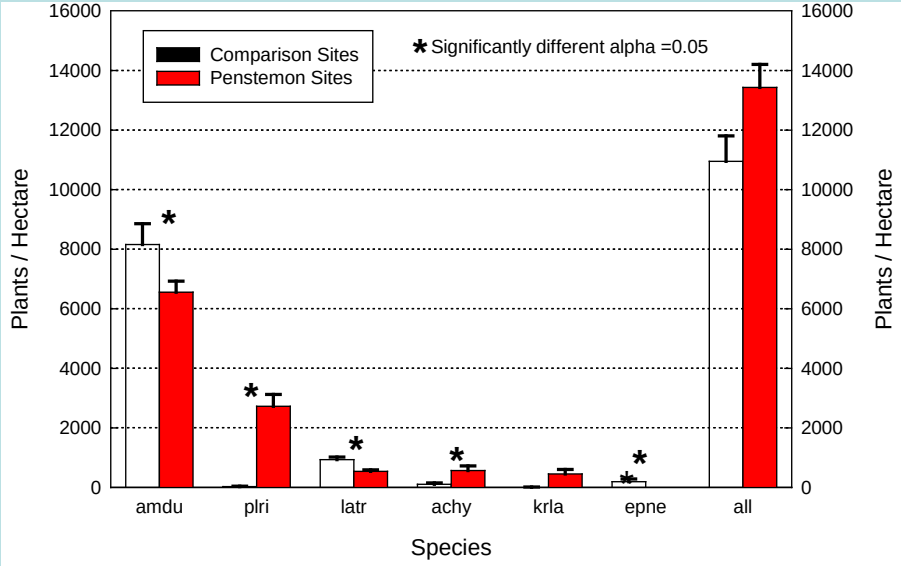


SOIL CHEMISTRY

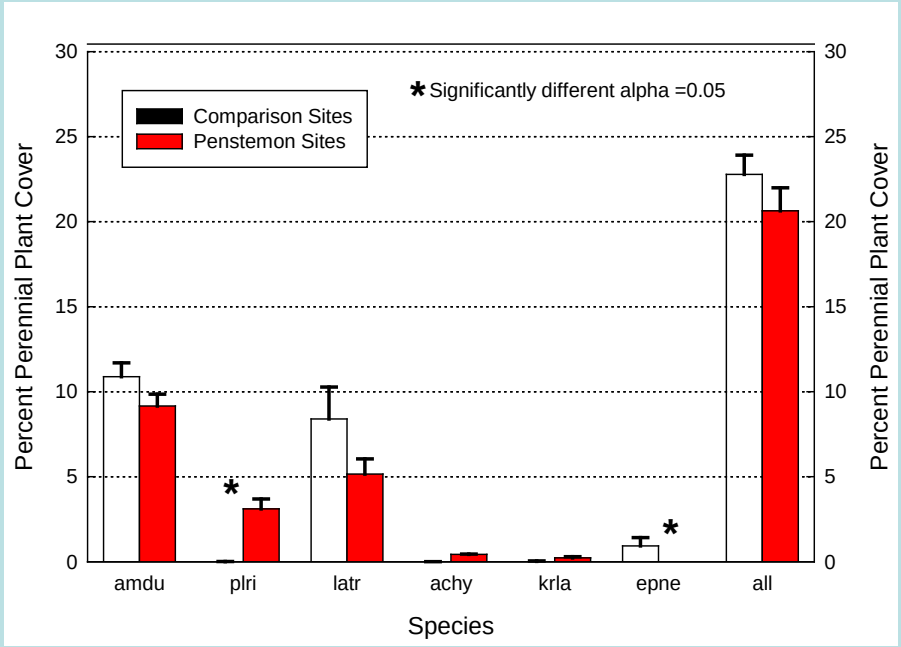
Soil chemical properties, including pH, nitrate, ammonium, phosporus and organic matter content do not uniquely define penstemon habitat, but within penstemon habitat the probability of penstemon occurring in canopy interspaces was > 90%.

Inter-space penstemon soils do have a significantly higher carbonate content in the top 40 cm of soil than adjacent soils without penstemon.

Penstemon Community Structure



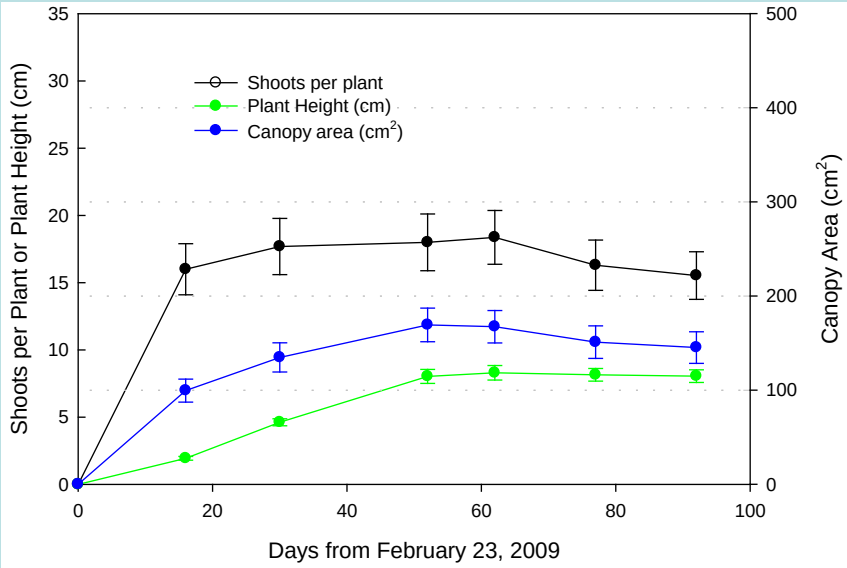
Hidden Valley, Clark County



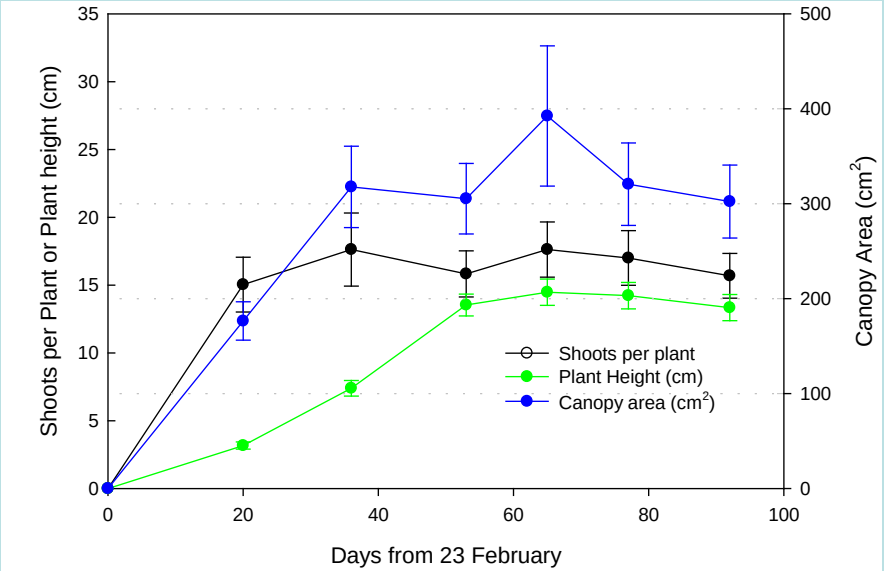
Nye County

Penstemon Growth 2009

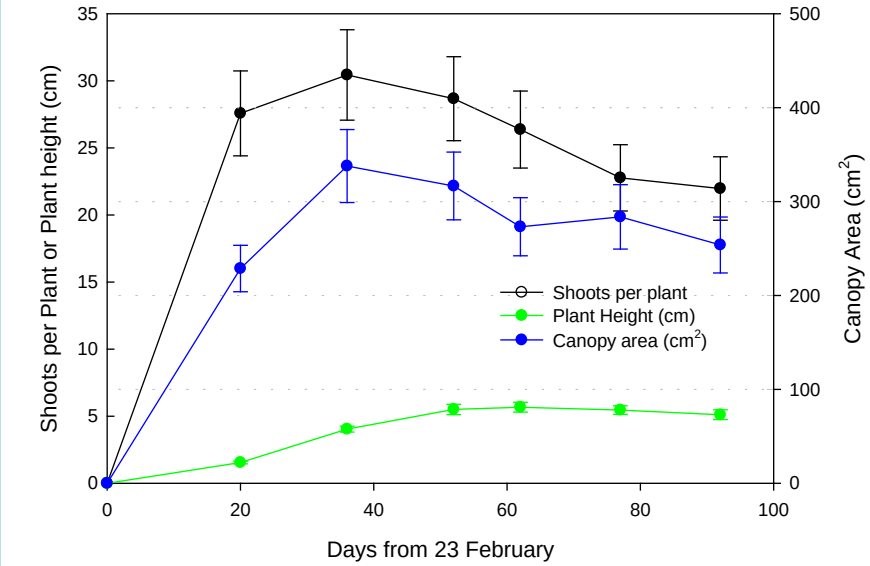
Roach Lake South



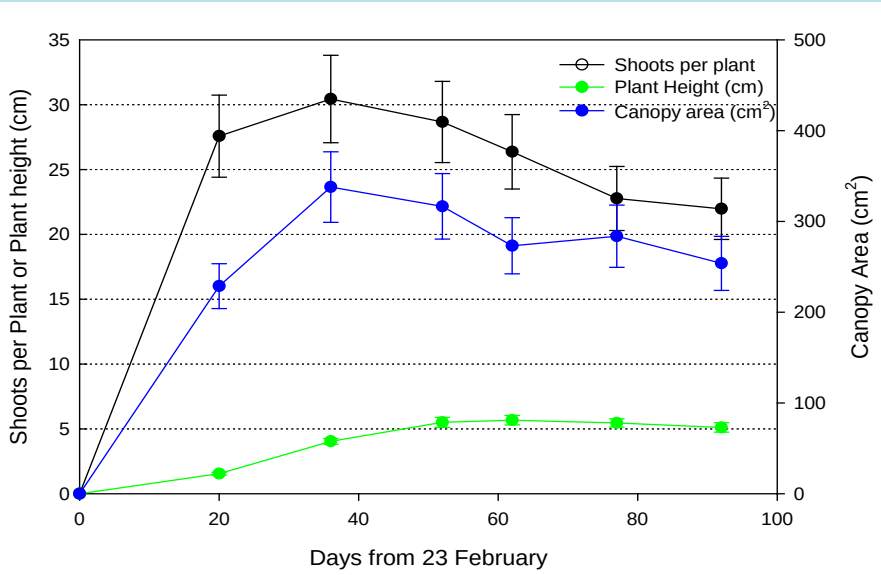
Hidden Valley



Jean Lake Exclosure

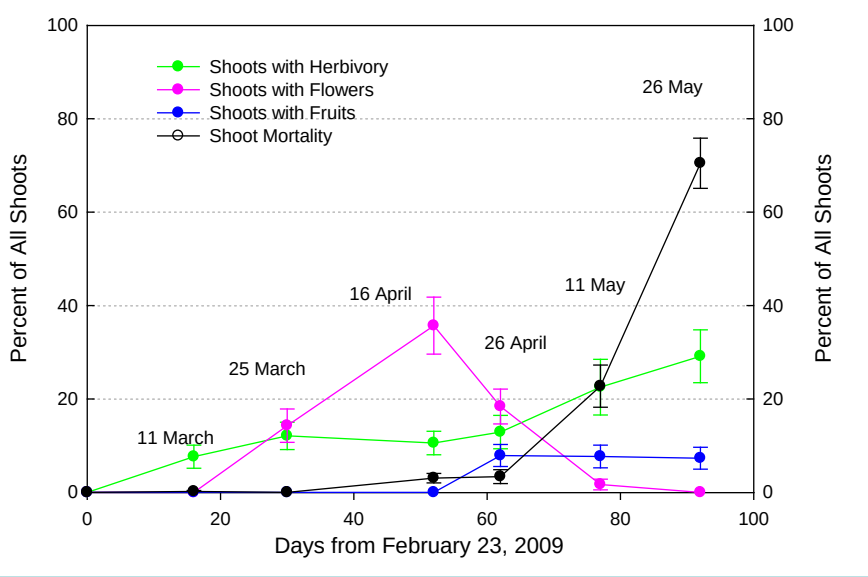


Nye County

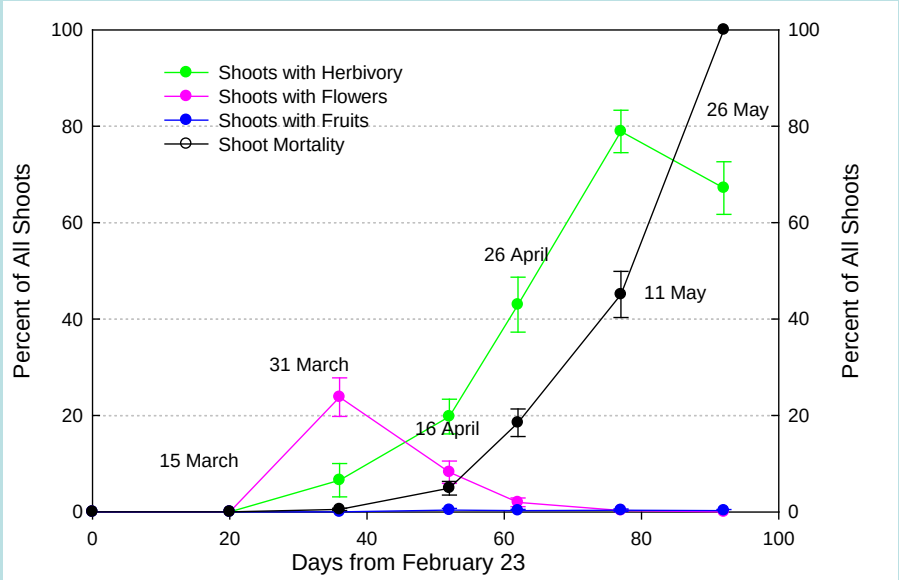


Penstemon Phenology 2009

Roach Lake South



Jean Lake Exclosure



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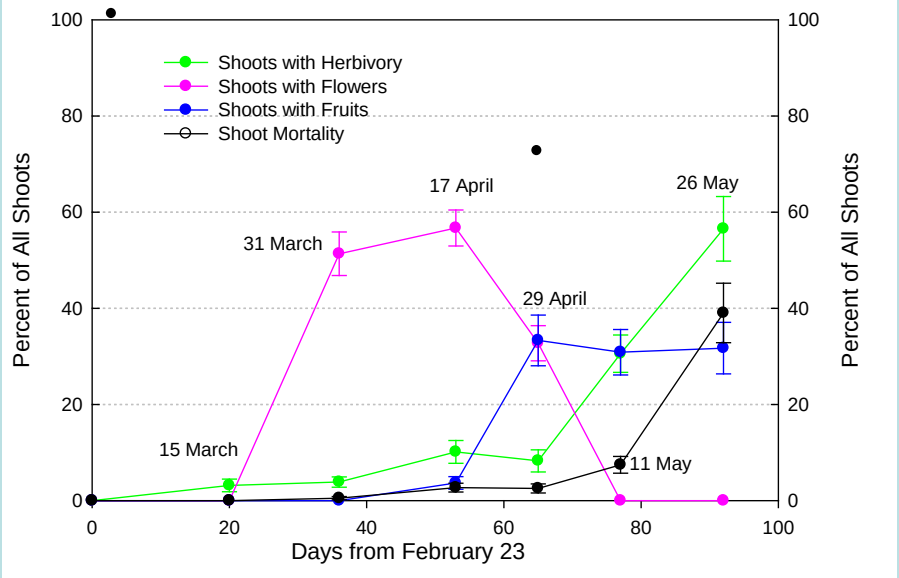
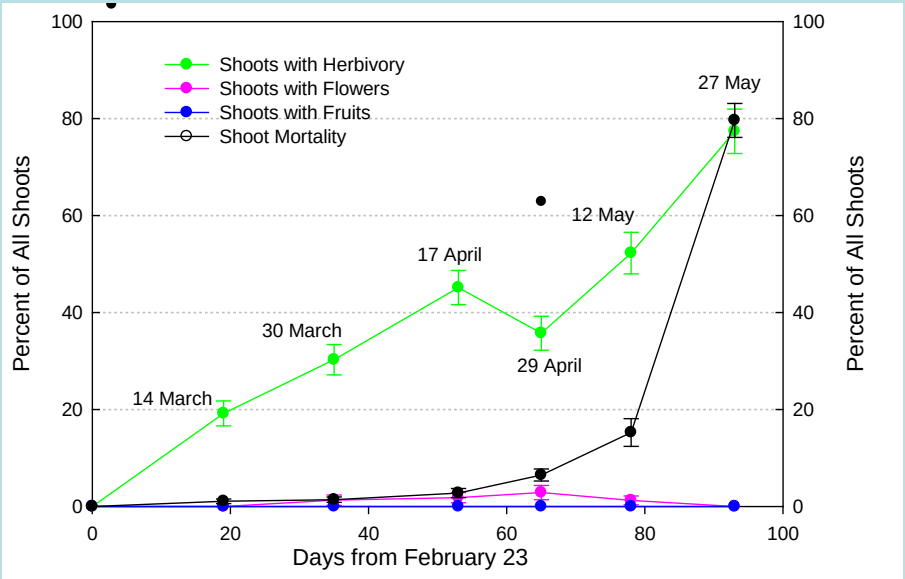
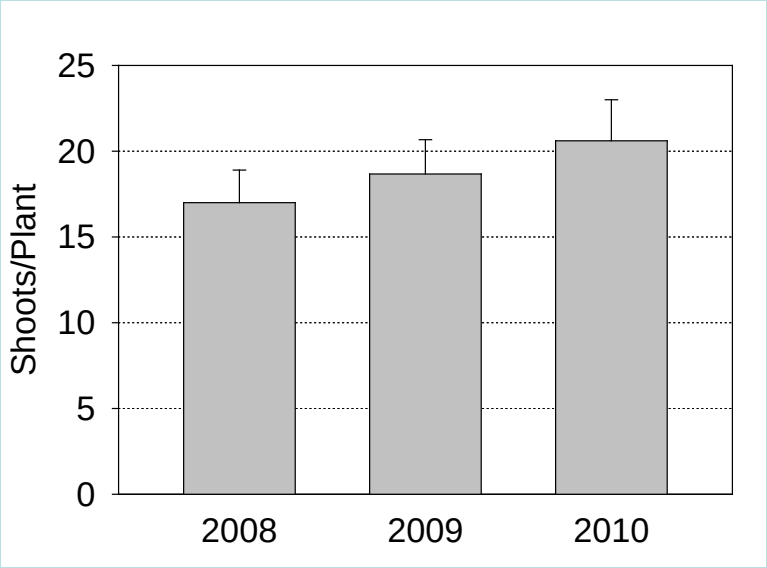
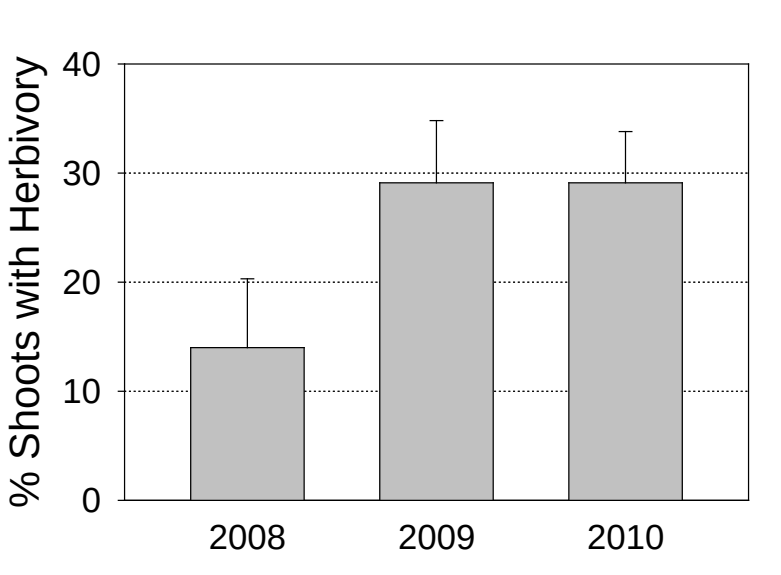


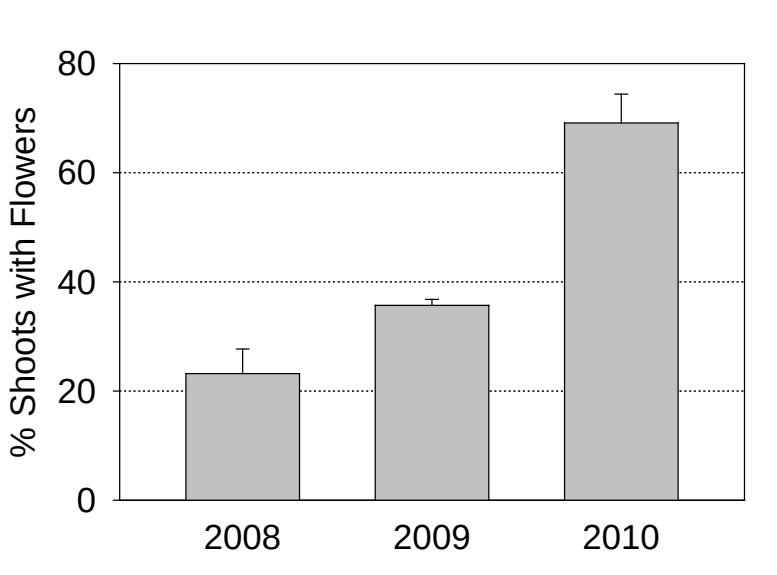
Nye County

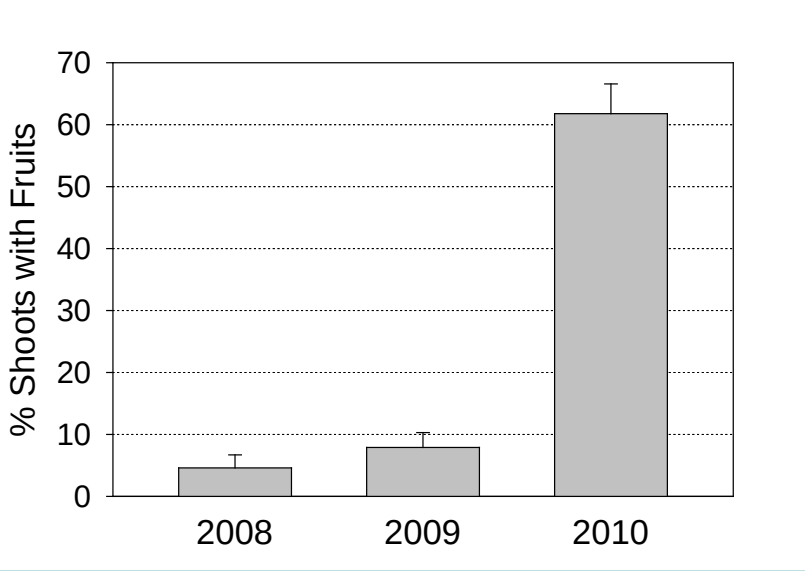


Roach Lake South 2008-2010
Penstemon Growth, Herbivory and Reproduction

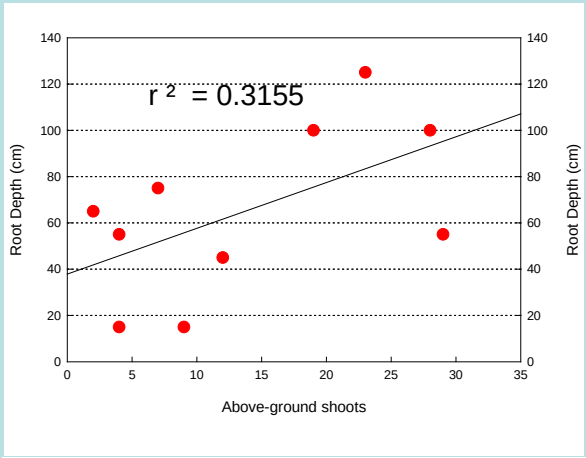


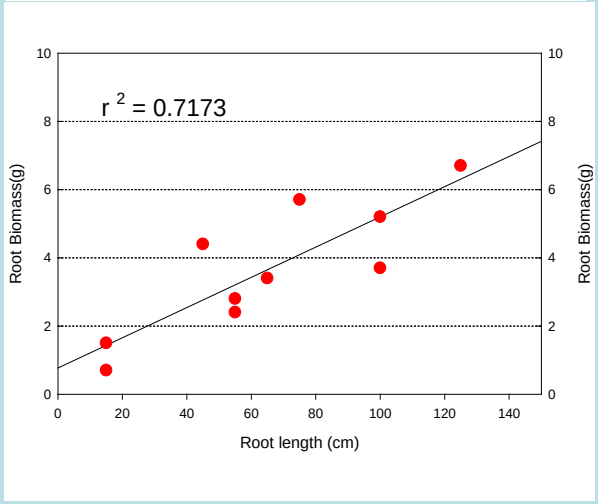


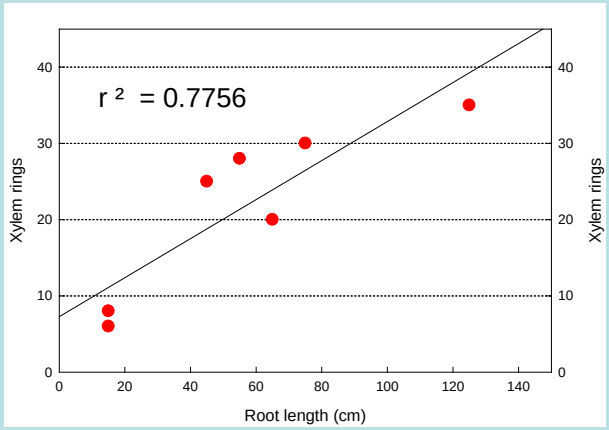




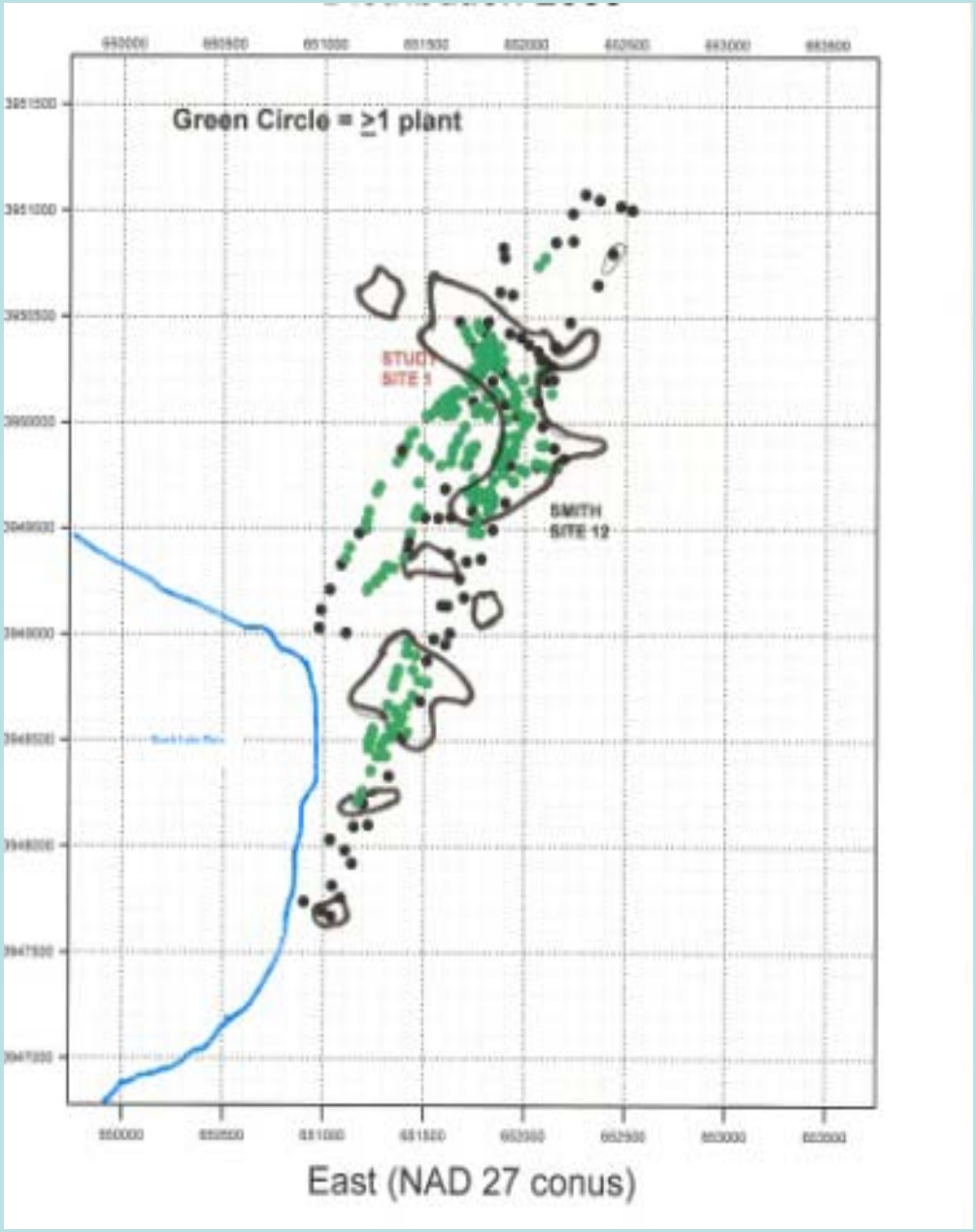
Rooting Characteristics of White-margined Penstemon



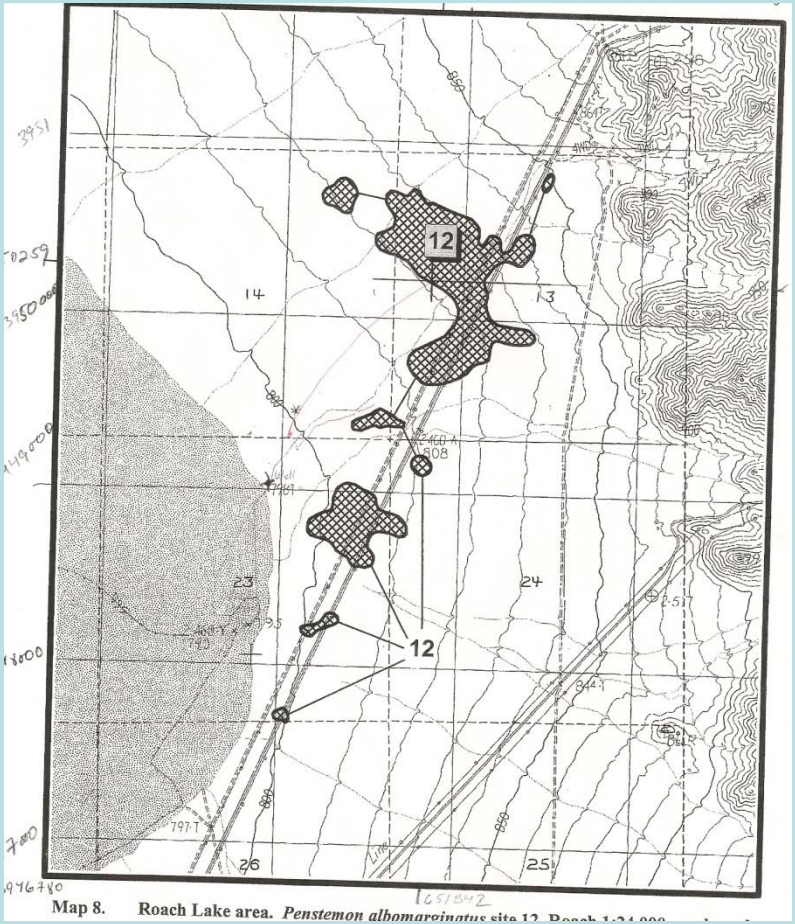


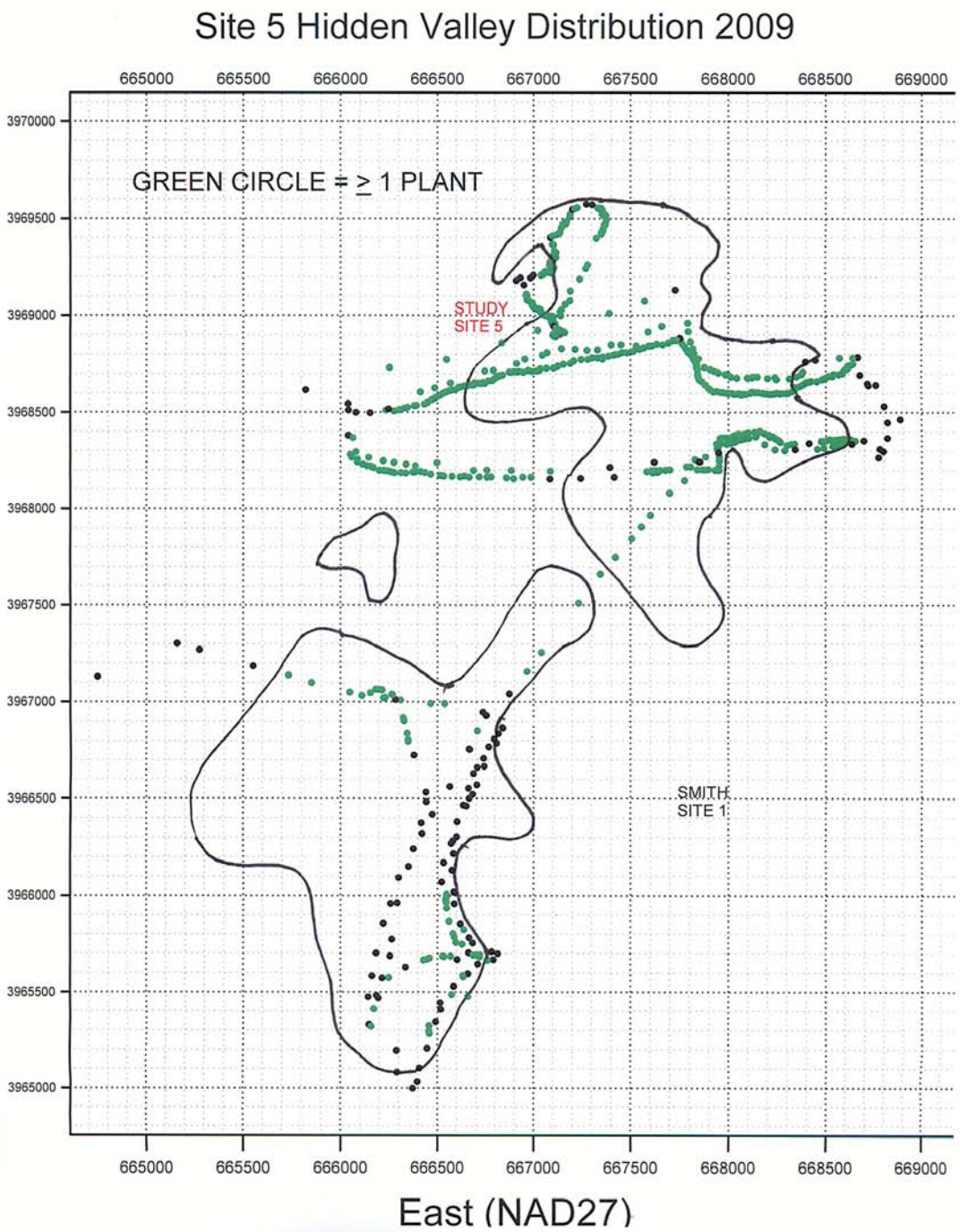


Penstemon Distribution

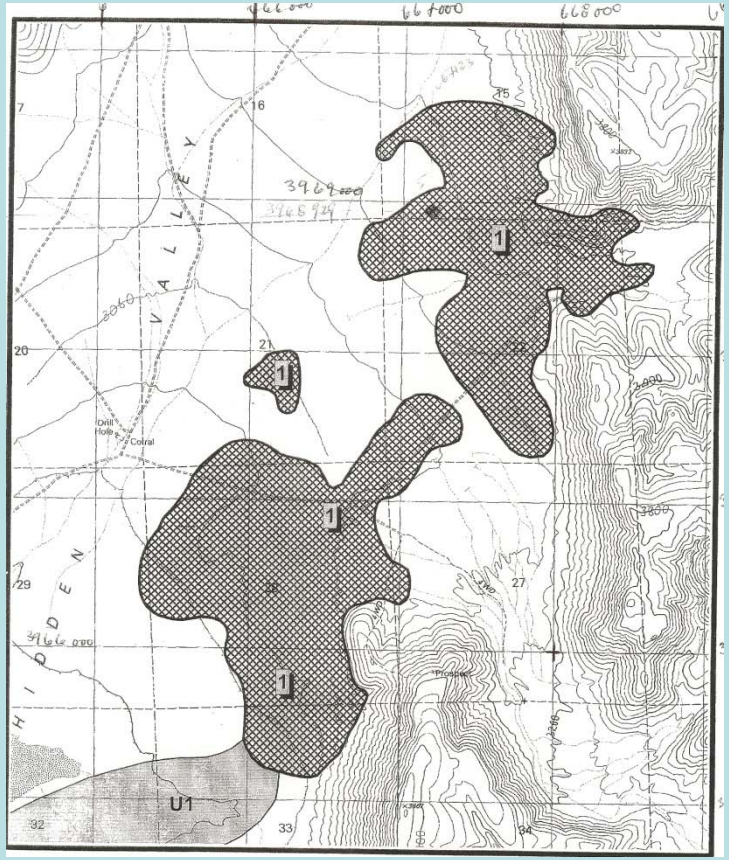


Roach Lake South Distribution relative to the 19978-mapped distribution





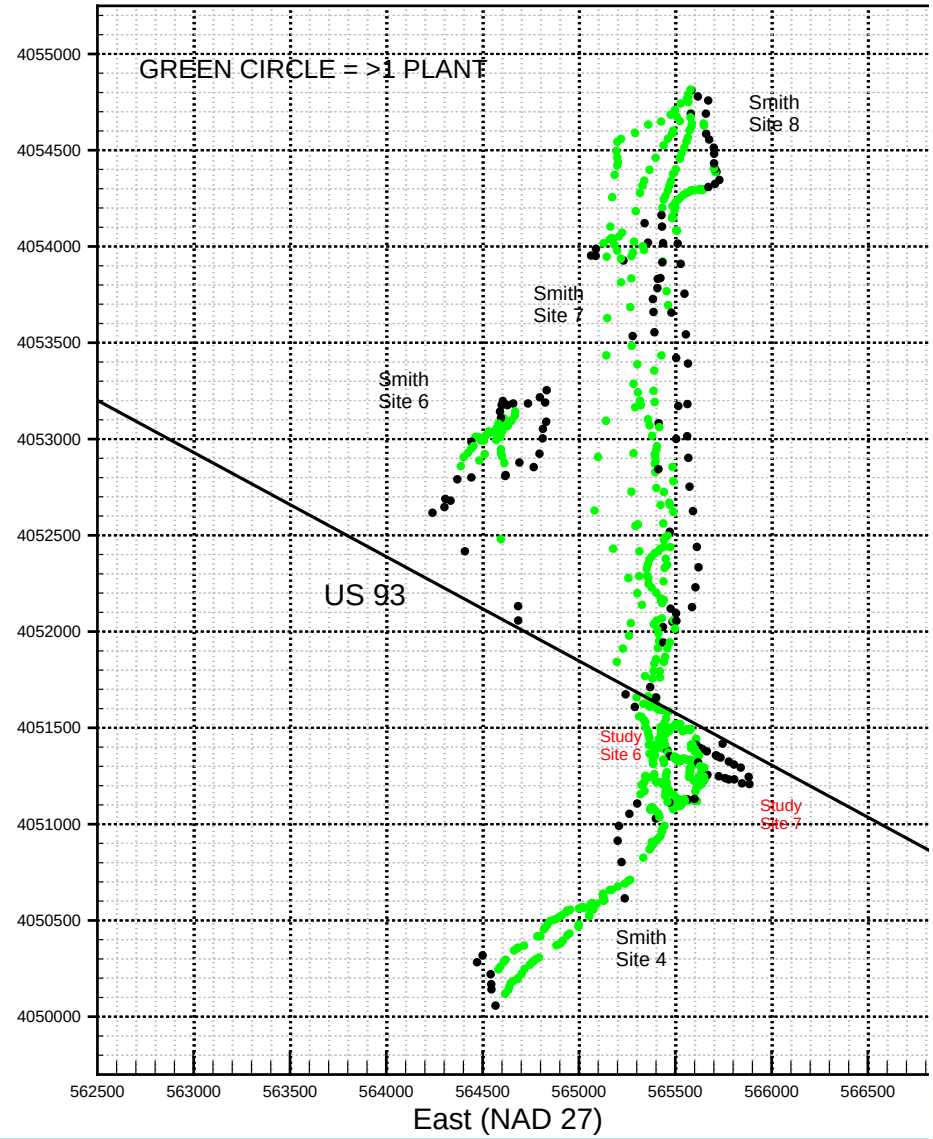
Hidden Valley penstemon Distribution based on 2009 surveys compared with the 1997-8 mapped distribution

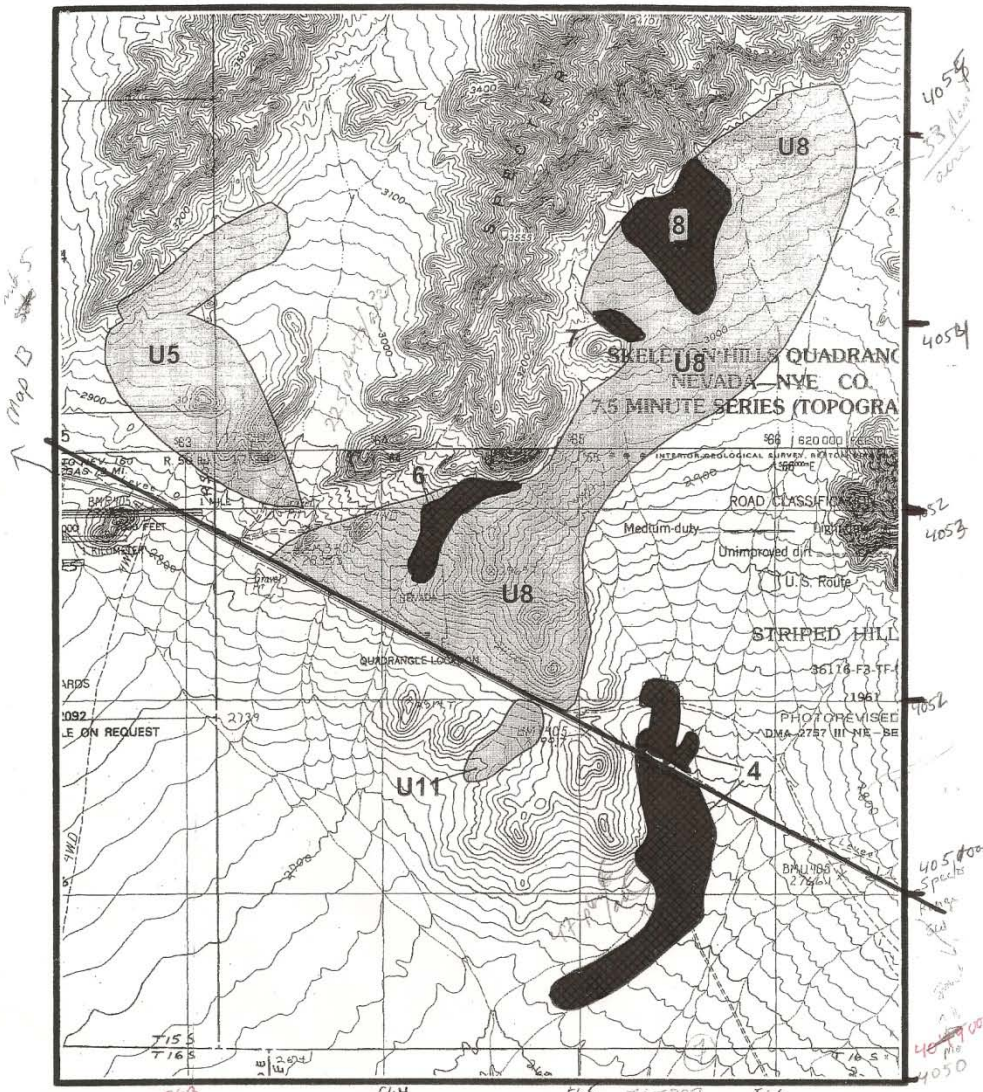


Penstemon Distribution at the Nye County Study site

March 2010

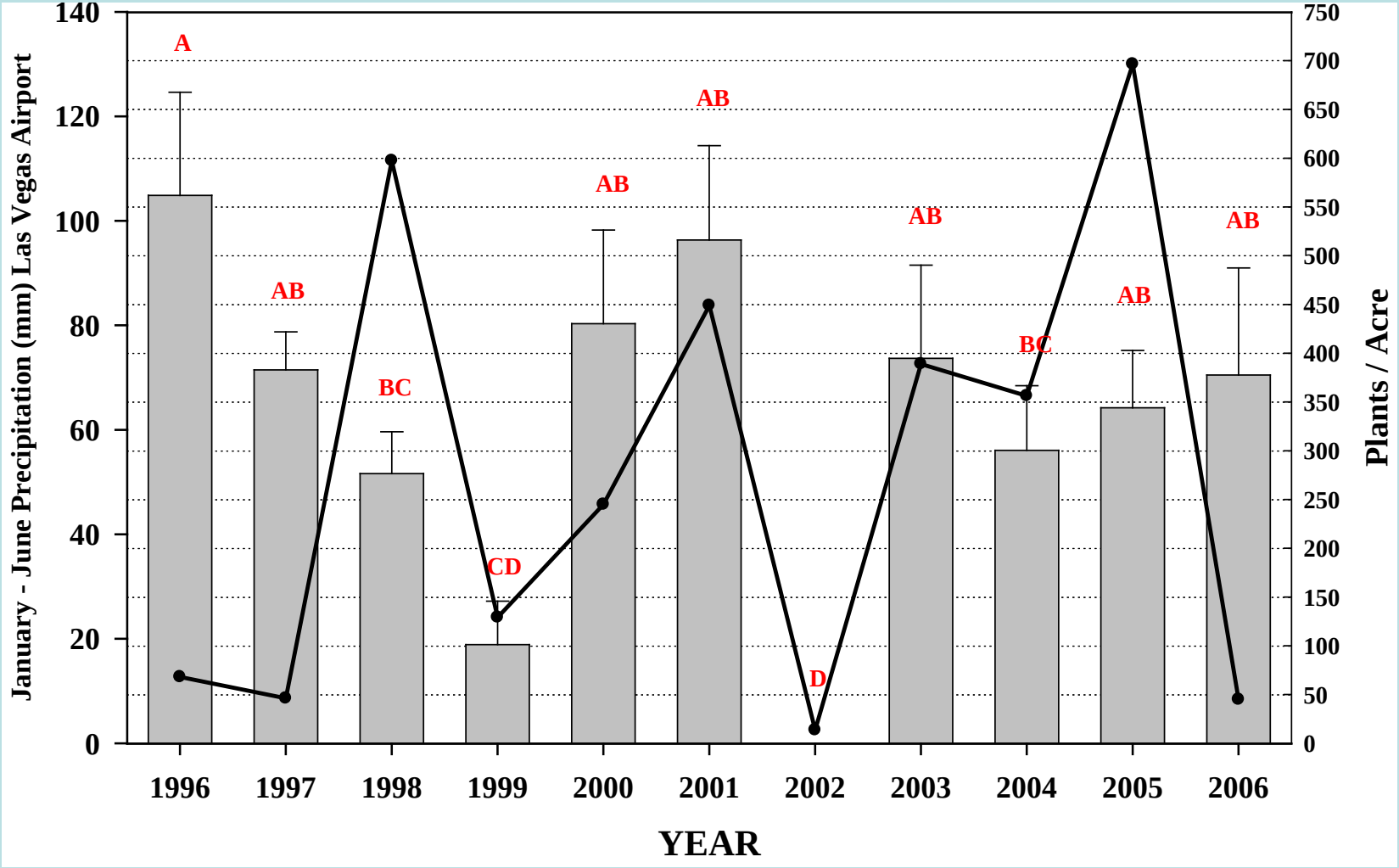
1997-8





Map 12. South end of the Specter Range. *Penstemon albomarginatus* sites 4 and 6-8, and unoccupied sites U5, U8, and U11, Striped Hills and Skeleton Hills 1:24,000 quadrangles, Nye County, Nevada.

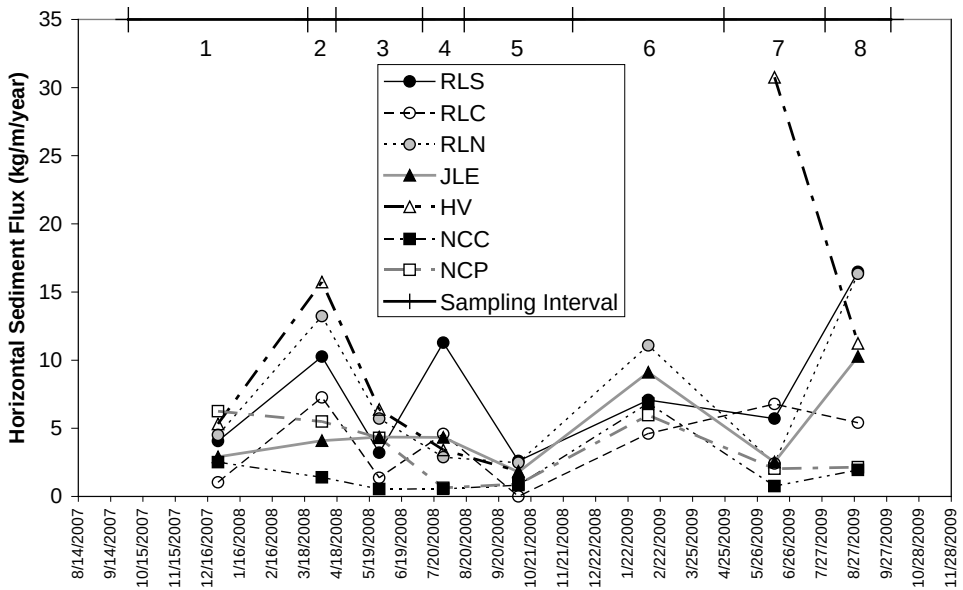
Annual Variation in Penstemon Density (gray bars) for the Jean Lake Exclosure in relation to Precipitation (black Line) based on BLM Monitoring data



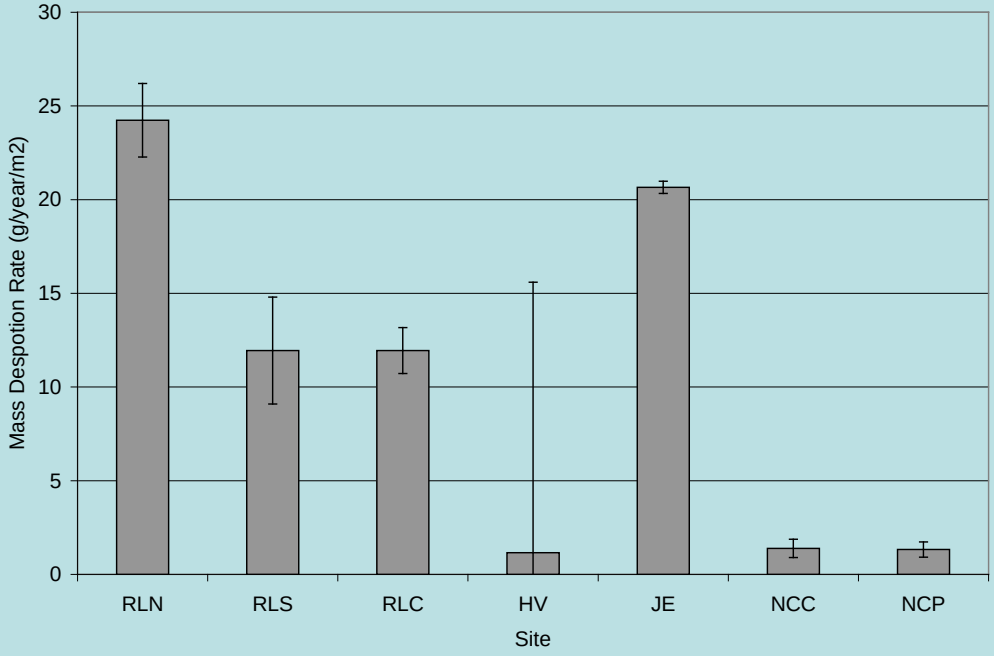
Penstemon Population Density, Area and Size Estimate Comparison between 1997-8 and 2008-10

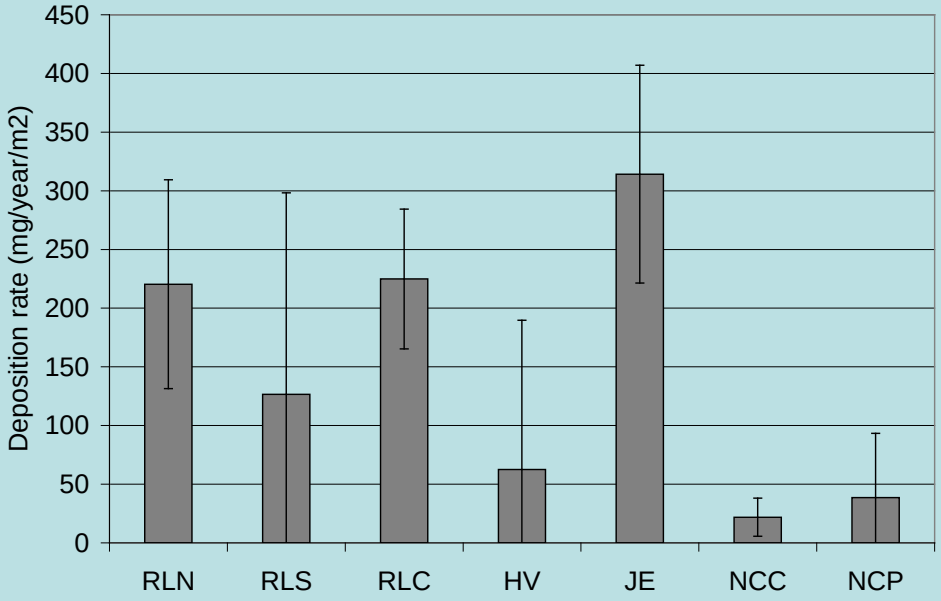
Study	Smith	distance walked (m)	UTM stops	Acres surveyed	plants counted	Survey pl/acre	transect pl/acre	BLM pl/acre	Smith acres	Smith plants	Smith pl/acre	wt pl/ac	wt total
CLARK COUNTY													
RLS	12	24987	428	61.7	513	67 ± 6	84 ± 22		157	500	3.2	8.29	1302
RLN	9	66784	823	165	1494	75 ± 5	146 ± 28		2464.4	5000	2.0	9.03	22254
JLE	10	44829	666	110.7	2981	149 ± 11	202 ± 61	412 ± 72	2063.7	>10000	4.9	26.7	55018
HVs	1	9084	121	22.4	175	19 ± 5			693			4.2	2904
HVn	1	22574	653	55.8	5164	228 ± 16	462 ± 235		461	8464	18.4	92.6	42689
Hvex	11	5320	130	13.1	175	42 ± 7			124.6	>2000	16.0	13.3	1660
totals		173578	2821	428.7	10502	24.50			5963.7	**25964**	8.9		**125825**
NYE COUNTY													
	2	2226	31	5.5	115	107 ± 23			16.1	1000	62.1	15.1	242
	3	2560	37	6.2	83	73 ± 23			30.7	8000	261.0	18.2	558
NCP	4, 7, 8	19647	494	48.5	3459	185 ± 18	1049 ± 304		106	>5000	47.3	71.3	7554
	5	14725	225	36.4	10744	1840 ± 251			236	20000	84.7	295.4	69714
	6	5351	65	13.2	532	240 ± 32			22	5000	227.3	40.3	886
	7				191				5.1	200	39.2		
	8								57	3000	52.6		
total		44509	852	109.8	15124				472.9	**42200**	110.61		**78954**
all		218087	3673	538.5	25626				6436.6	**68164**			**204779**

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
- In general all transport rates were low compared to other eolian habitats





Sediment Deposition and Chemistry

Deposition rates were equivalent to less than.001 cm of soil depth per year.

Nitrate deposition rates ranged from 0.25 to 3.1 kg/ha year

Summary

White-margined penstemon habitats are characterized by deep stable eolian sands, typically of the Bluepoint Soil series (Typic Torripsamments) and all Nevada populations occur on BLM managed lands. However, many suitable sites do not support penstemon populations.

Within Penstemon habitats > 90% of the plants occur in canopy interspaces surrounded by perennial communities dominated by *Ambrosia dumosa, Larrea tridentata* and *Pleuraphis rigida.*

Populations in Clark and Nye County appear to be larger than previous estimates, while variations in annual precipitation and herbivory are significantly correlated with growth and reproductive output.

Though the Ivanpah airport project is currently on hold, it is not expected to adversely impact Clark County penstemon populations, conversely and ironically, proposed solar projects may become a major threat.

Propagation of new populations in suitable habitat could be an effective management tool for maintaining sustainable penstemon populations in Clark County.