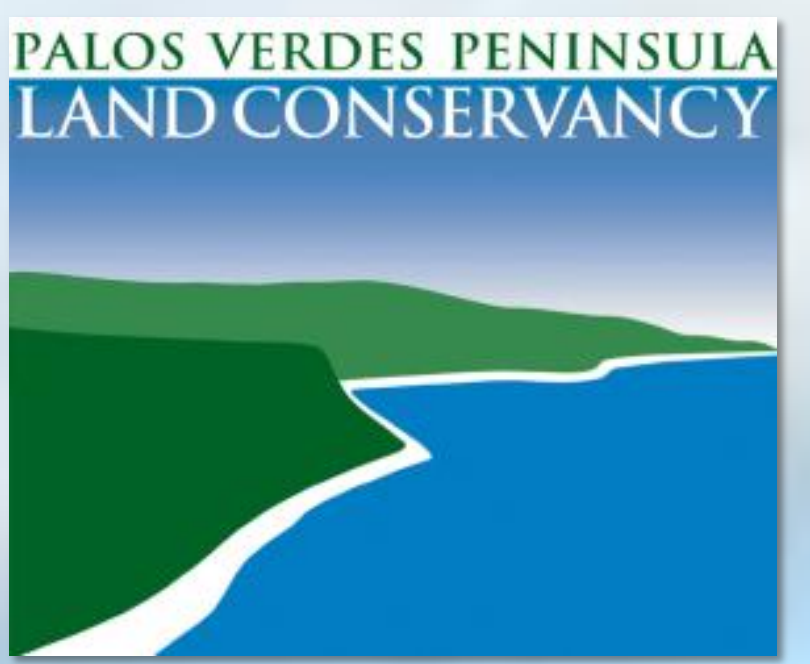


# MICROCLIMATE TRENDS FOR THREE SPECIES OF COASTAL SAGE SCRUB ON THE PALOS VERDES PENINSULA



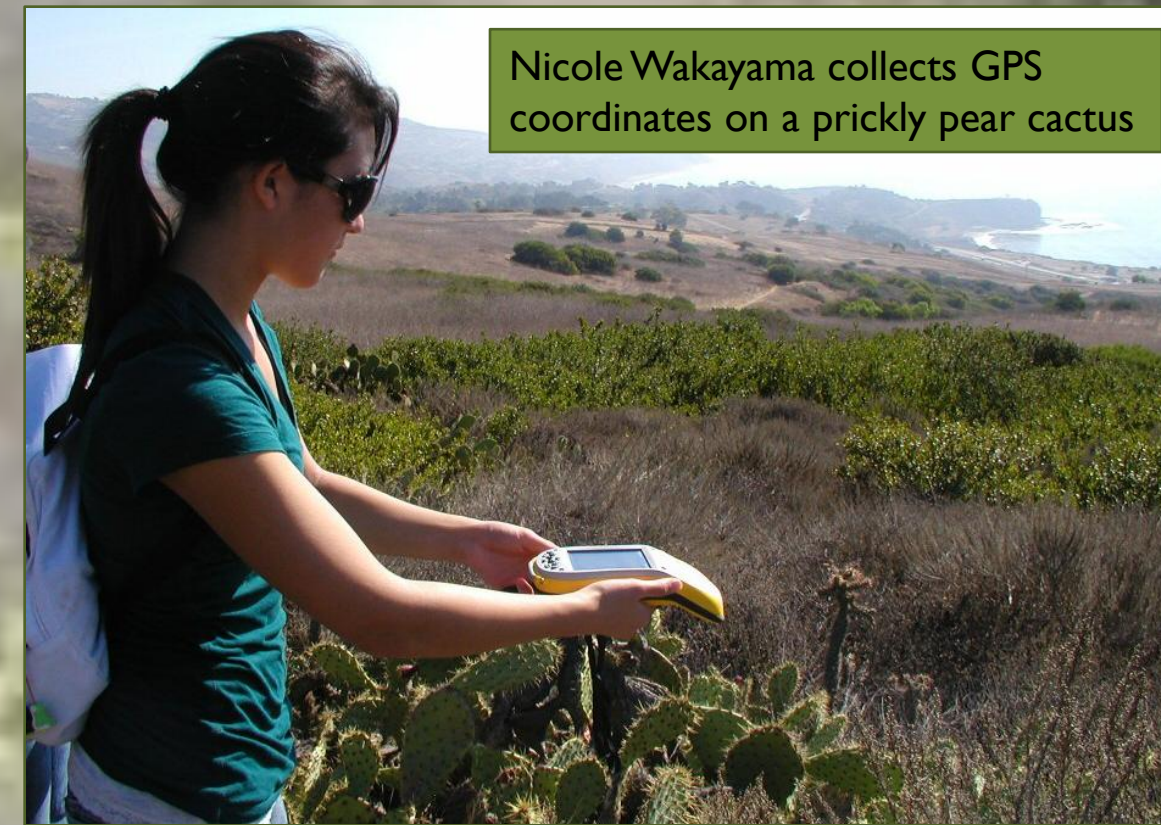
ANN DALKEY, NICOLE LIM, OLOLADE SALIU, AND NICOLE WAKAYAMA



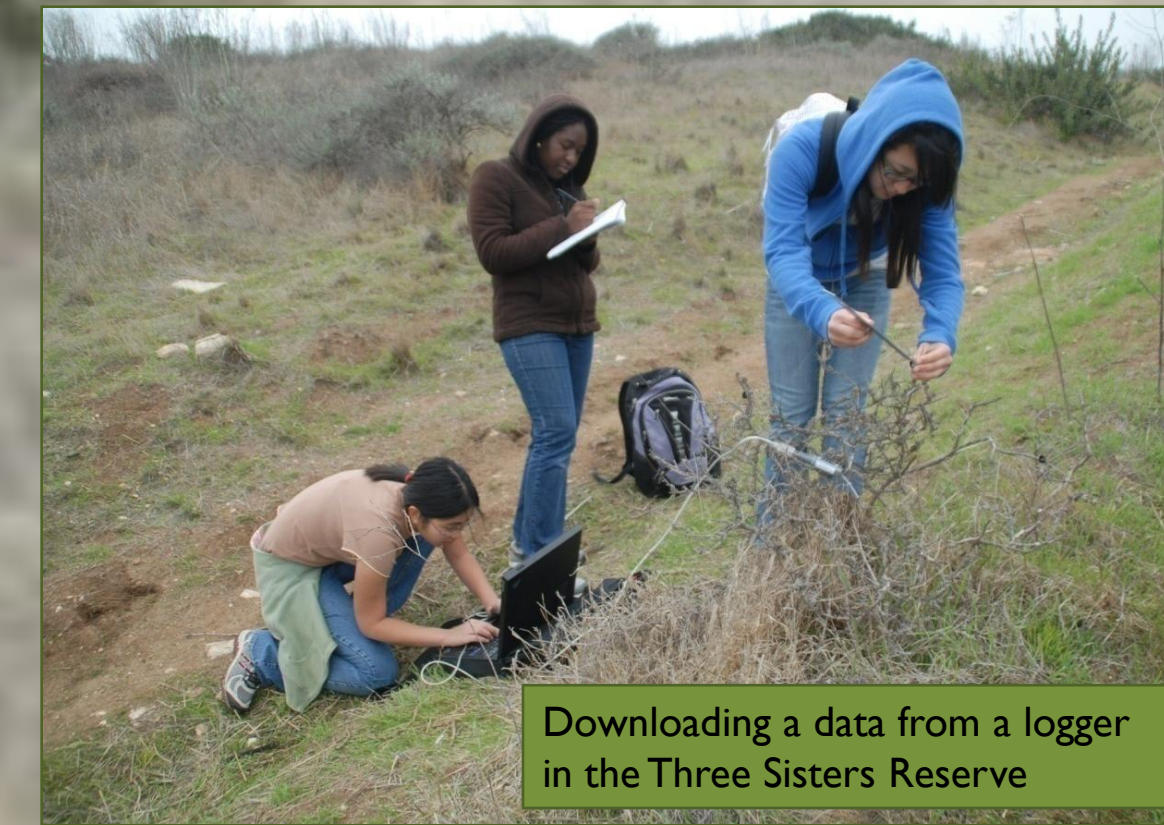
Ololade Saliu selects the first prickly pear cactus to study



Niccole Lim installs a data logger onto a purple sage shrub



Nicole Wakayama collects GPS coordinates on a prickly pear cactus



Downloading a data from a logger in the Three Sisters Reserve

## ~ The Idea ~

Can differences in microclimate on a 1 m - 1 km scale be detected and related to plant distribution? And, if so, can the information be helpful for coastal sage scrub restoration projects?



Location of preserves used for the experiment.

## ~ Introduction ~

The Palos Verdes Peninsula Land Conservancy (PVPLC) actively restores coastal sage scrub habitat on the preserves that it manages on the Palos Verdes Peninsula. PVPLC grows most of the plants used for restoration using locally-sourced seed, thereby insuring the specimens are genetically adapted to the locale.

When installed, the new natives are placed in clumps of 5-7 species, similar to the patchiness exhibited in extant populations. We became curious over whether or not microhabitat partitioning on a 1 m – 1 km scale drove the natural establishment of species stands.

A year-long study was initiated to look into the microhabitat variation within the Palos Verdes Nature Preserve. Added value was gained by the addition of the junior authors, local high school students who utilized the study as part of their curriculum. This poster presents results at the mid-point of this study.

## ~ Methods ~

- Three coastal sage scrub species were selected for study;
  - *Encelia californica* – California bush sunflower
  - *Opuntia littoralis* – prickly pear cactus
  - *Salvia leucophylla* – purple sage

Stands of each species were selected within two reserves of the Palos Verdes Nature Preserve, Three Sisters and Forrestal (Figure 1). At each site, parameters for slope, aspect, and elevation were measured along with soil type. One individual was tagged with a data logger (Measurement Computing USB-502) that recorded temperature, relative humidity, and dew point along with a date/time stamp at 30-minute intervals.

Data were plotted using SigmaPlot ver 10 and statistical analysis using SigmaStat ver 3.5. A Pearson Product Movement Correlation was performed on 30-min temperature data to test for within species differences. A Friedman Repeated Measures Analysis of Variance on Ranks was performed on averaged monthly data to test for differences between species.

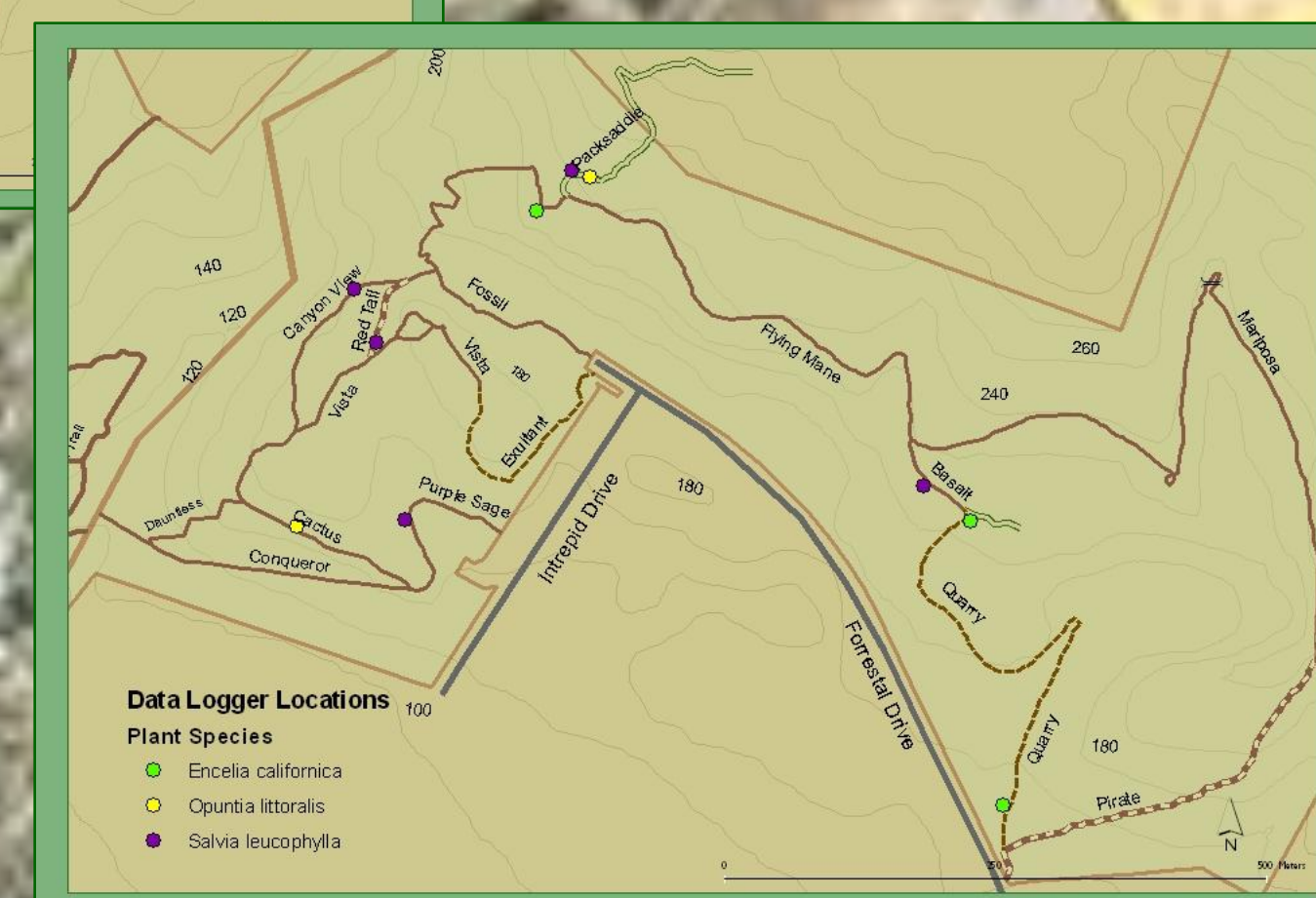
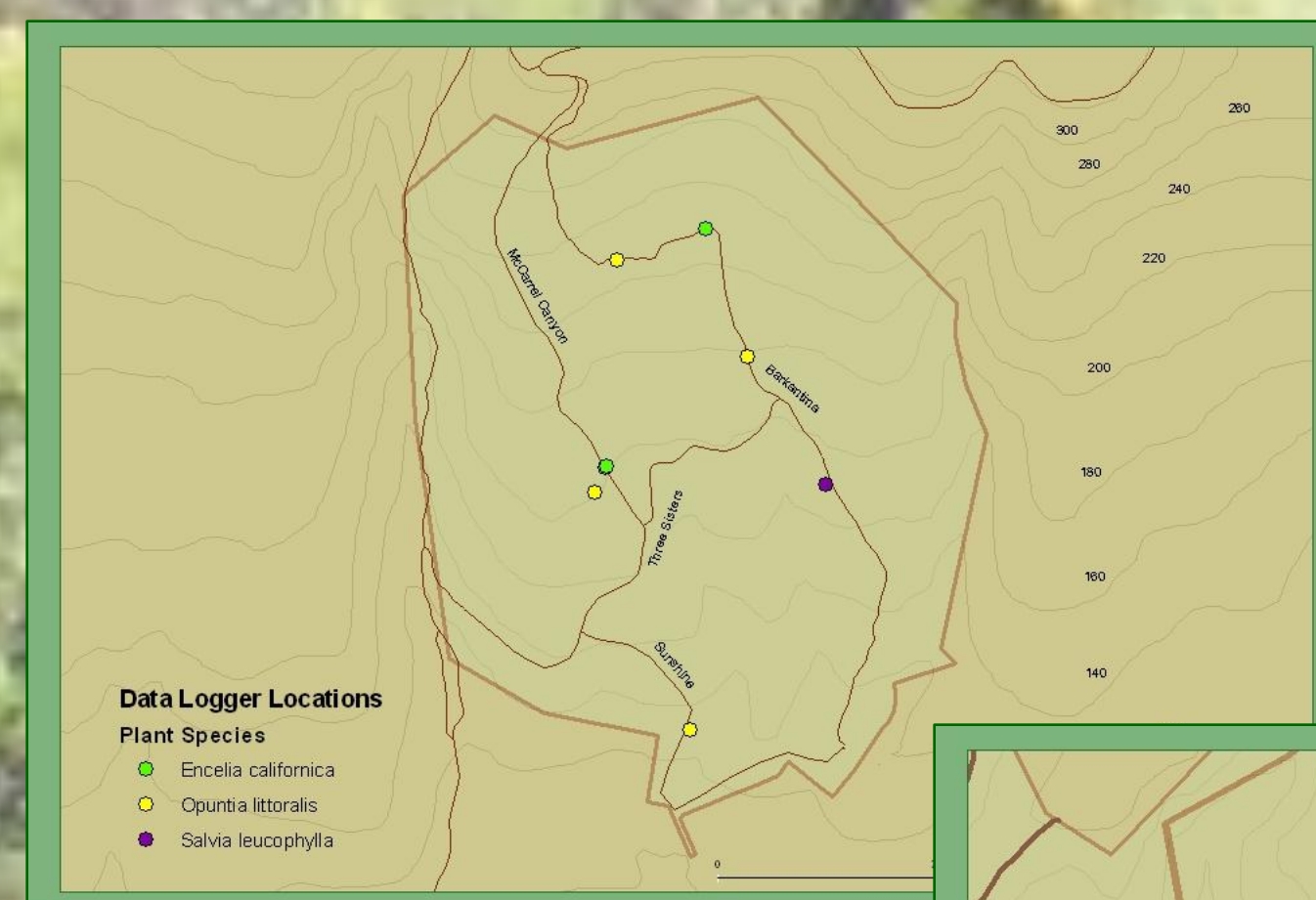


Table 1. Physical data for each site. Not all soil type data have been collected at present.

Species	Plant Number	Slope	Aspect	Soil Type*	Elevation (m)
<i>Encelia californica</i>	1	7	185	silty clay	190
	2	30	130	sandy clay	119
	3	16	130	sandy clay	144
	4	16	130	sandy clay	144
	5	20	200	silty clay	171
	6	12	205	sandy clay	188
<i>Opuntia littoralis</i>	1	21	165		192
	2	20	150		143
	3	36	200		75
	4	12	165		206
	5	5	200		115
	6	35	210		144
<i>Salvia leucophylla</i>	1	25	180		136
	2	25	75		110
	3	24	205		177
	3	12	280		205
	4	22	205		144
	5	20	295		

\* Data still being assembled

Table 2. Monthly averaged data for all three parameters. Bolded pairs are significantly different.

Species	Nov 08	Dec 08	Jan 09	Feb 09	Mar 09	Apr 09	May 09
<b>Temperature (°C)</b>							
<i>Encelia californica</i>	19.052	13.003	17.366	14.474	15.297	18.072	19.813
<i>Opuntia littoralis</i>	20.056	14.104	10.626	12.940	14.286	17.404	18.371
<i>Salvia leucophylla</i>	18.713	13.079	11.030		14.828	16.897	18.375
<b>Relative Humidity (%)</b>							
<i>Encelia californica</i>	56.19	66.88	45.06	66.84	65.34	57.18	64.69
<i>Opuntia littoralis</i>	<b>54.36</b>	<b>63.30</b>	<b>82.90</b>	<b>48.45</b>	<b>55.08</b>	<b>57.14</b>	<b>67.60</b>
<i>Salvia leucophylla</i>	<b>59.38</b>	<b>71.56</b>	<b>83.99</b>		<b>67.59</b>	<b>60.92</b>	<b>70.31</b>
<b>Dew Point (°C)</b>							
<i>Encelia californica</i>	7.184	5.782	2.298	6.861	7.493	6.879	11.509
<i>Opuntia littoralis</i>	7.176	<b>5.864</b>	7.335		7.211	6.479	11.300
<i>Salvia leucophylla</i>	8.103	6.823	8.099		7.908	7.282	12.026

## ~ Results ~

A large body of data was collected despite numerous problems encountered in the field including:

- loss of data from battery failure,
- total data logger failure,
- removal from the plant by a hiker, and
- browsing and trampling incurred by goat grazing at three sites within a restoration area.

*Encelia californica* were found on less steep slopes than the other two species (Table 1). Slope aspect for *Encelia californica* was more southeastern, *Salvia leucophylla* was more southwestern, and *Opuntia littoralis* was southern (Table 1).

Intra species measurements correlated well with no significant differences ( $p < 0.5$ ). *Salvia leucophylla* sites had higher humidity and higher dew points than *Opuntia littoralis* ( $p < 0.05$ ) otherwise, no trends were apparent (Table 2).

We were able to capture the variability of all parameters, which are considerable as shown in Figures 1 and 2.

Figure 1. Daily averaged data illustrating variability in temperature, relative humidity, and dew point.

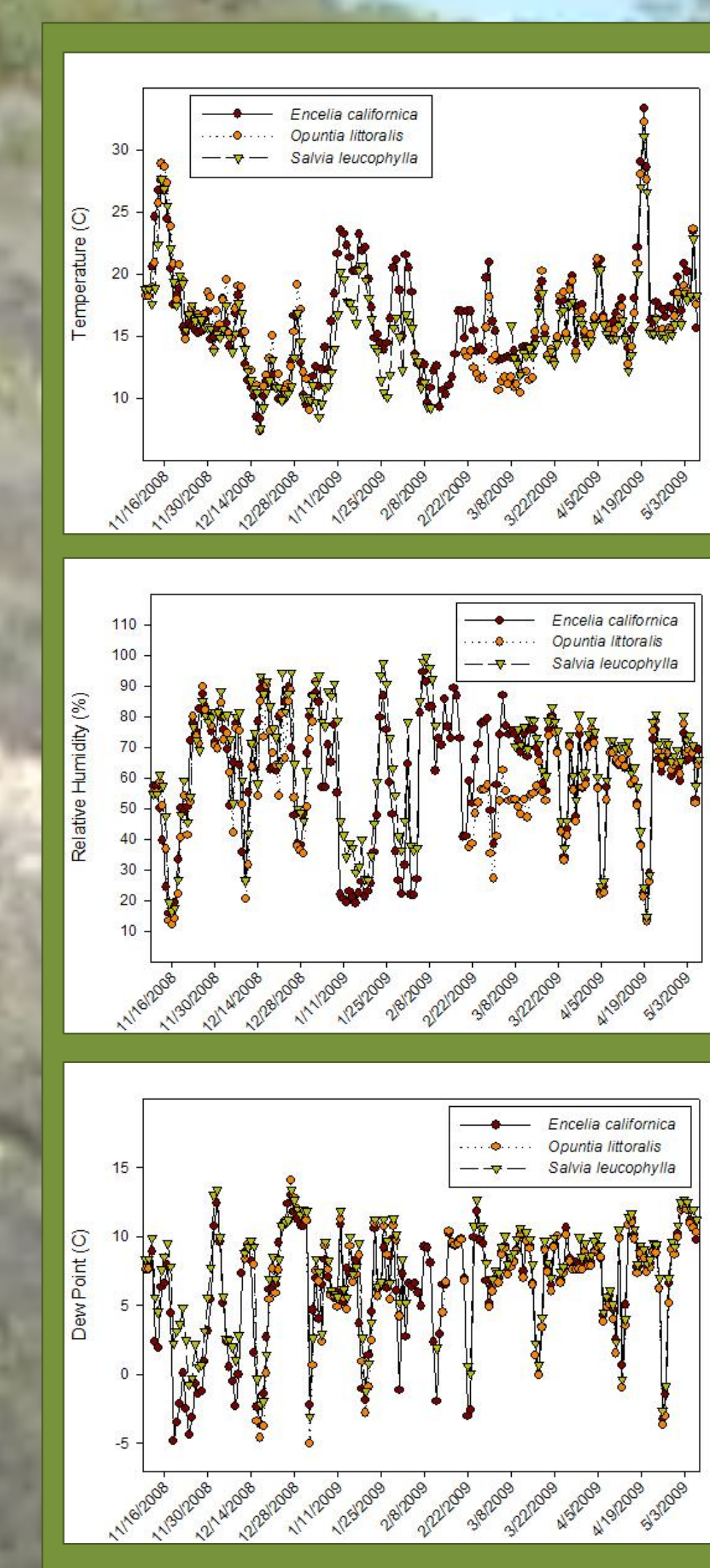
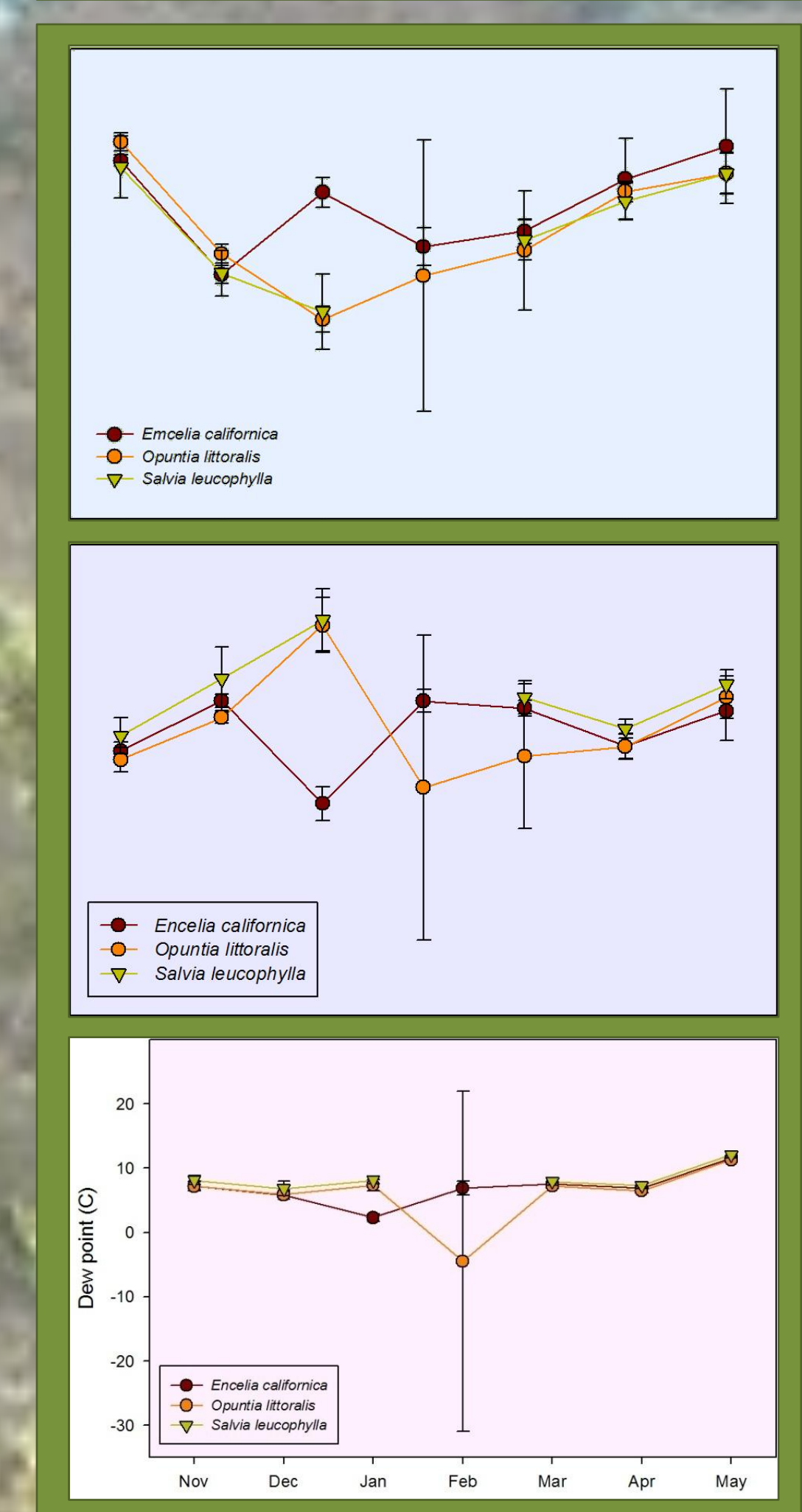


Figure 2. Monthly averaged temperature, relative humidity, and dew point data, with standard deviation.



## ~ Conclusions ~

- *Encelia californica* tends to occur on more easterly facing slopes in level places. No discernable trend was determined for this species regarding temperature, relative humidity, and dew point values.

- *Opuntia littoralis* fulfills our image of cactus, preferring a hotter, drier habitat via a direct southern exposure that results in lower relative humidity and dew point values.

- *Salvia leucophylla* prefers greater humidity, occupying locations that avoid morning sun, as evidenced by their more westerly exposure and higher relative humidity and dew point values.

- Minor variations in slope and aspect exist on the steeply pitched slopes and appear important at this point.

- This information will be helpful for PVPLC's stewardship staff for installing plants at restoration sites.

- The next step will be to examine whether these trends continue through the next six months.