Figure 18. ***Overall, Native, and Vernal Pool* Plant Species Richness for Sampled Preserves, Spring 2003, Western Placer County, California***

(*Plants designated as "vernal pool associates" or "vernal pool indicators" per CDFG 1996)

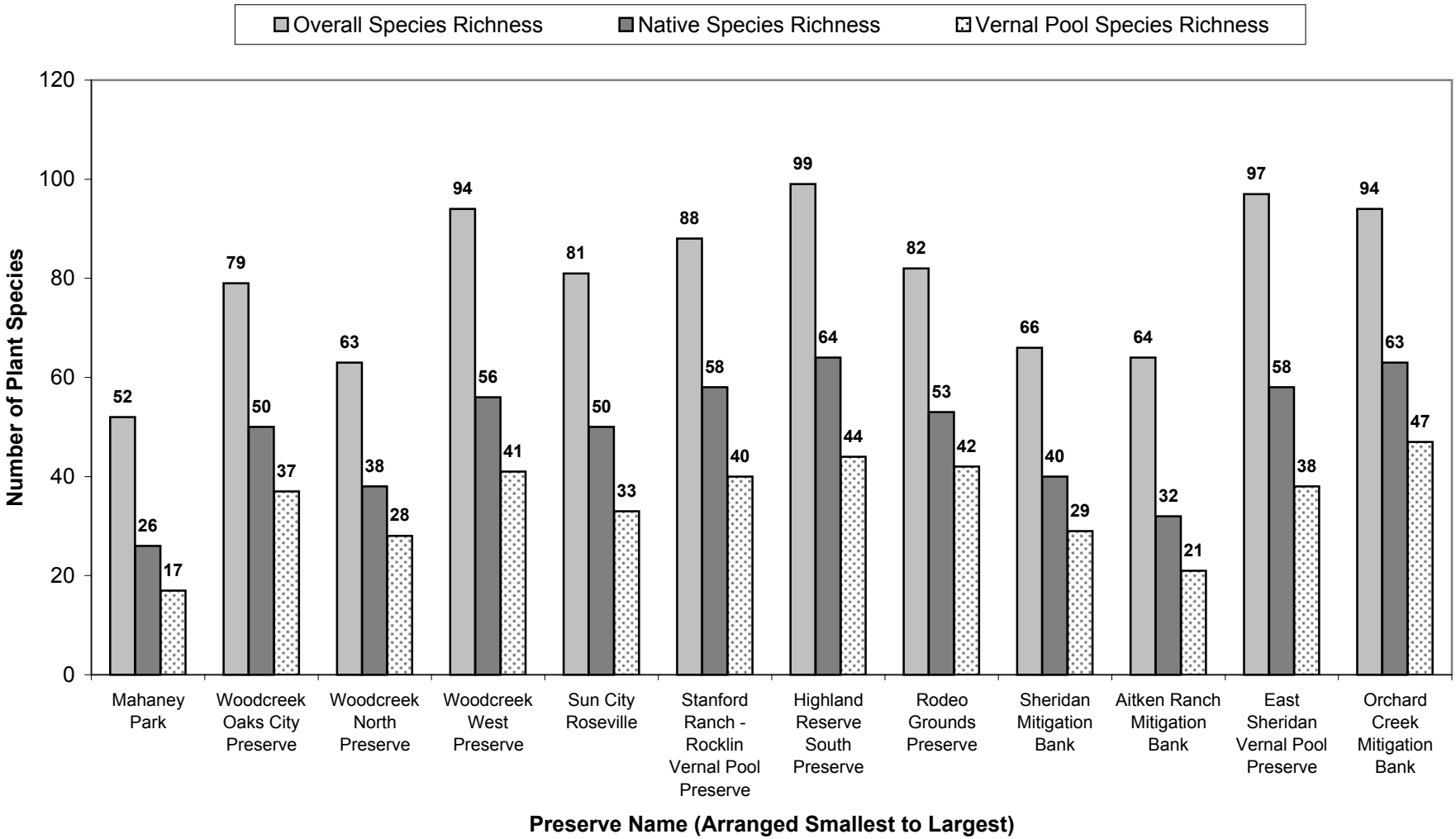


Figure 19. ***Percent of Overall Plant Species Richness Comprised of Native Species and of Vernal Pool Species for Sampled Preserves, Spring 2003, Western Placer County, California***

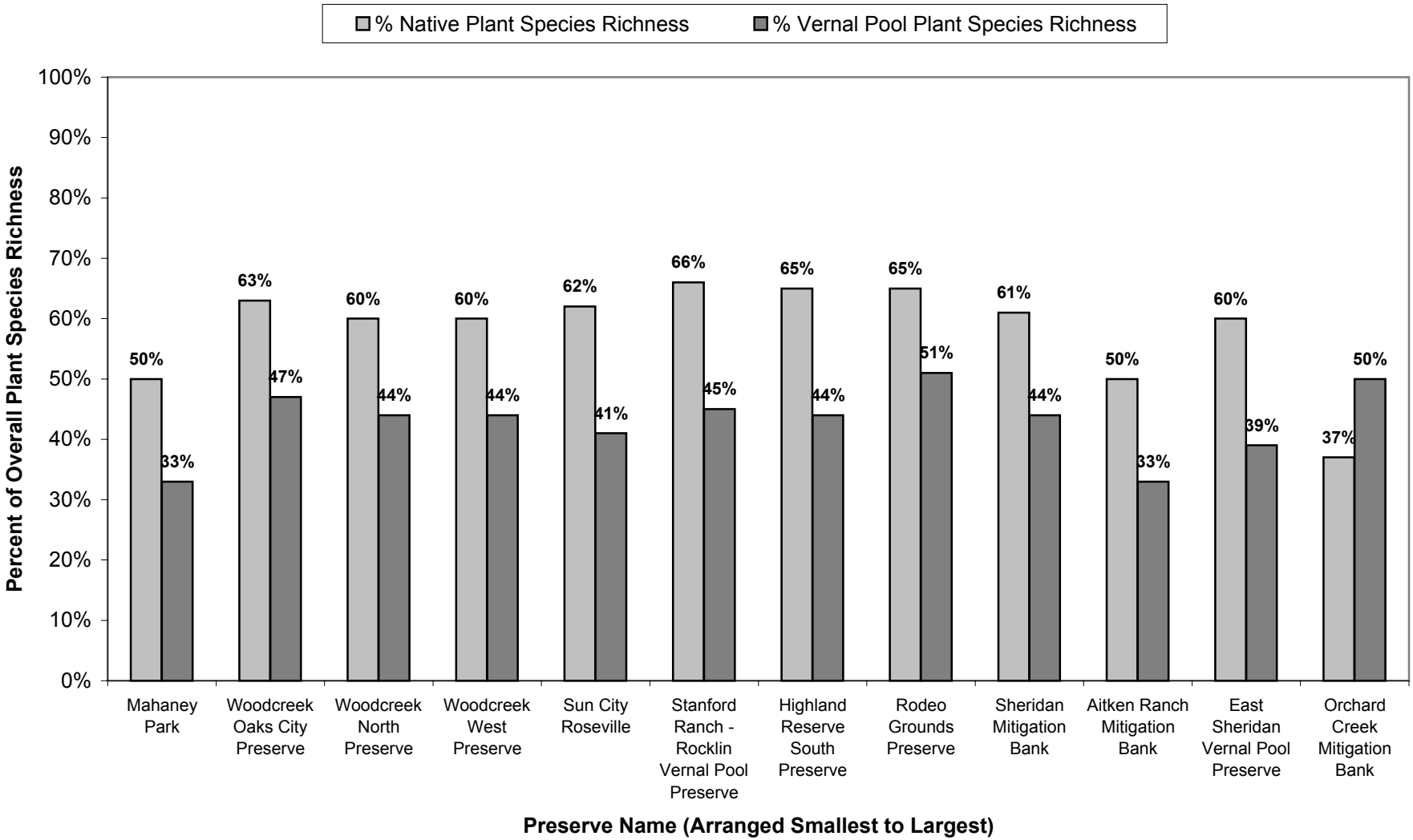
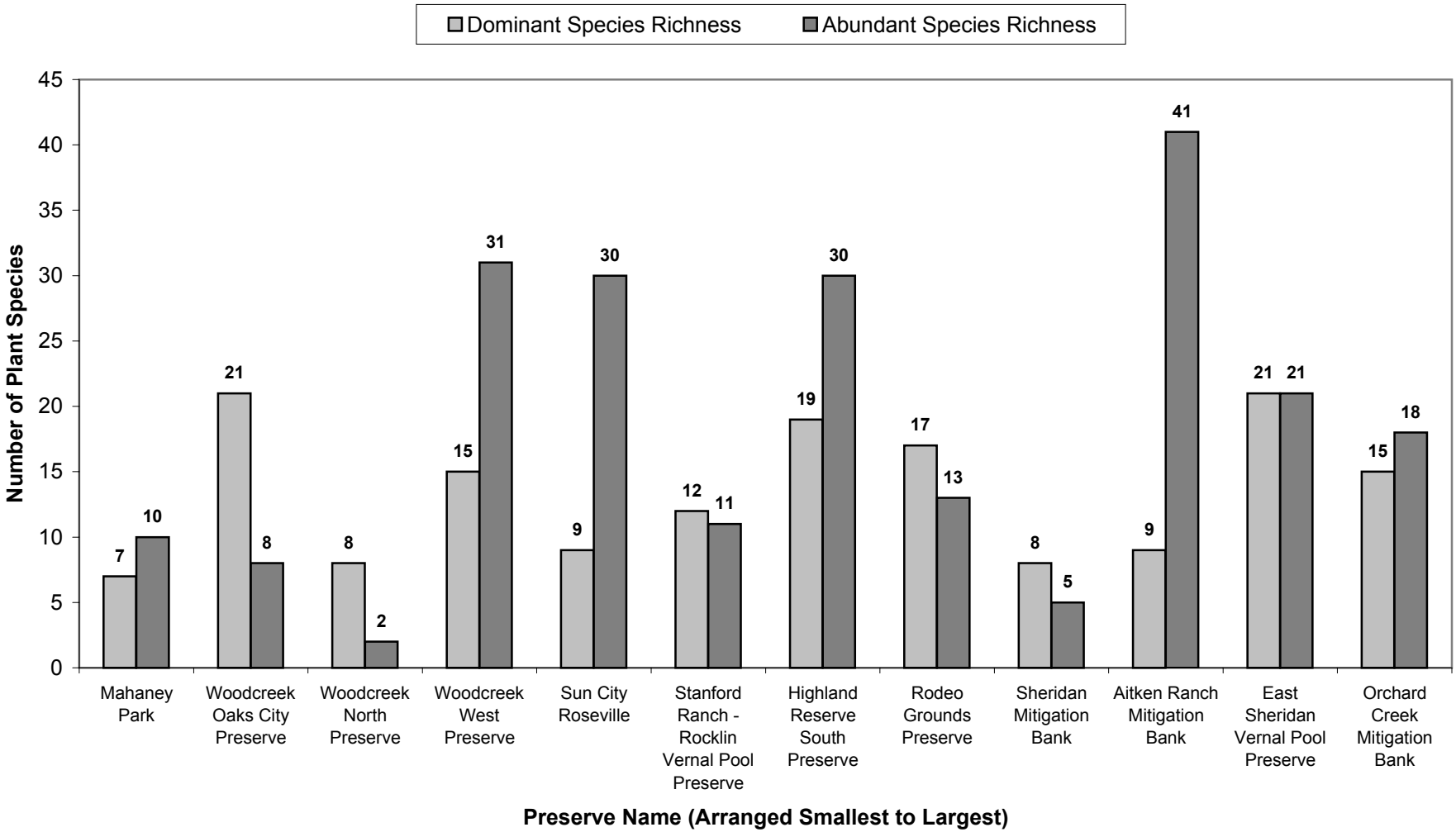


Figure 20. ***Number Dominant (Cover Class of 3 or Greater) Plant Species and Number of Abundant Vernal Pool Plant Species Within Each Sampled Preserve, Spring 2003, Western Placer County, California***



Abundant species richness refers to the number of species that appeared to have a distinctively patchy distribution within a pool. Sampled preserves had between 2 and 41 different species that occurred as "abundant," a significant variation (X^2=90.36365, df=11, p<0.001) (Figure 20). An average of 19.2% of the species within a preserve have a patchy distribution in one or more of the sampled pools. Of these abundant species, an average of 69% were "vernal pool" species. Starting with the most common, the six most common species with patchy distributions were: *Eleocharis macrostachya, Hordeum marinum, Lasthenia fremontii, Navarretia leucocephala, Glyceria* sp., and *Ranunculus bonariensis*.

Comparing the dominant species to the abundant species suggests that certain species (e.g., *Eryngium vaseyi*) are dominant but generally distributed through a pool while other species (e.g., *Eleocharis macrostachya, Lasthenia fremontii,* and *Navarretia leucocephala*) may more likely occur in patches of 25% or greater cover.

Simply stating the overall species richness for a particular preserve has the potential to mask important information about the nature of the individual vernal pool units within each preserve. A site with a large overall number of species could have a low number of species per pool and vice versa a site with a lower number of overall species could have a large number of species (or high diversity) within each individual pool. Thus, the mean value of species richness, native species richness, and vernal pool species richness **per pool** was also calculated for each site. As shown in Table 8 (page 38), the mean species richness per pool for the different preserves ranged from 7.7 to 27.6, a significant variation (ANOVA, F=2.51, p<0.005) (Figure 21). Mean native species richness and mean vernal pool species richness also varied significantly among the different preserves ($ANOVA_{native}$, F=4.12, p<0.001; $ANOVA_{VP\text{-}SPP}$, F=4.80, p<0.001) (Figure 22 and 23). As shown in Figure 21, Highland Reserve South has the highest number of species but the average number of species per pool is close to average. The reverse trend did not occur, however, and those sites with lower overall diversity tended to have lower diversity per pool (i.e., Mahaney Park, Woodcreek North, and Aitken Ranch).

Figure 21. ***Mean Species Richness and Mean Species Richness Per Pool for Each Sampled Preserve, Spring 2003, Western Placer County, California***

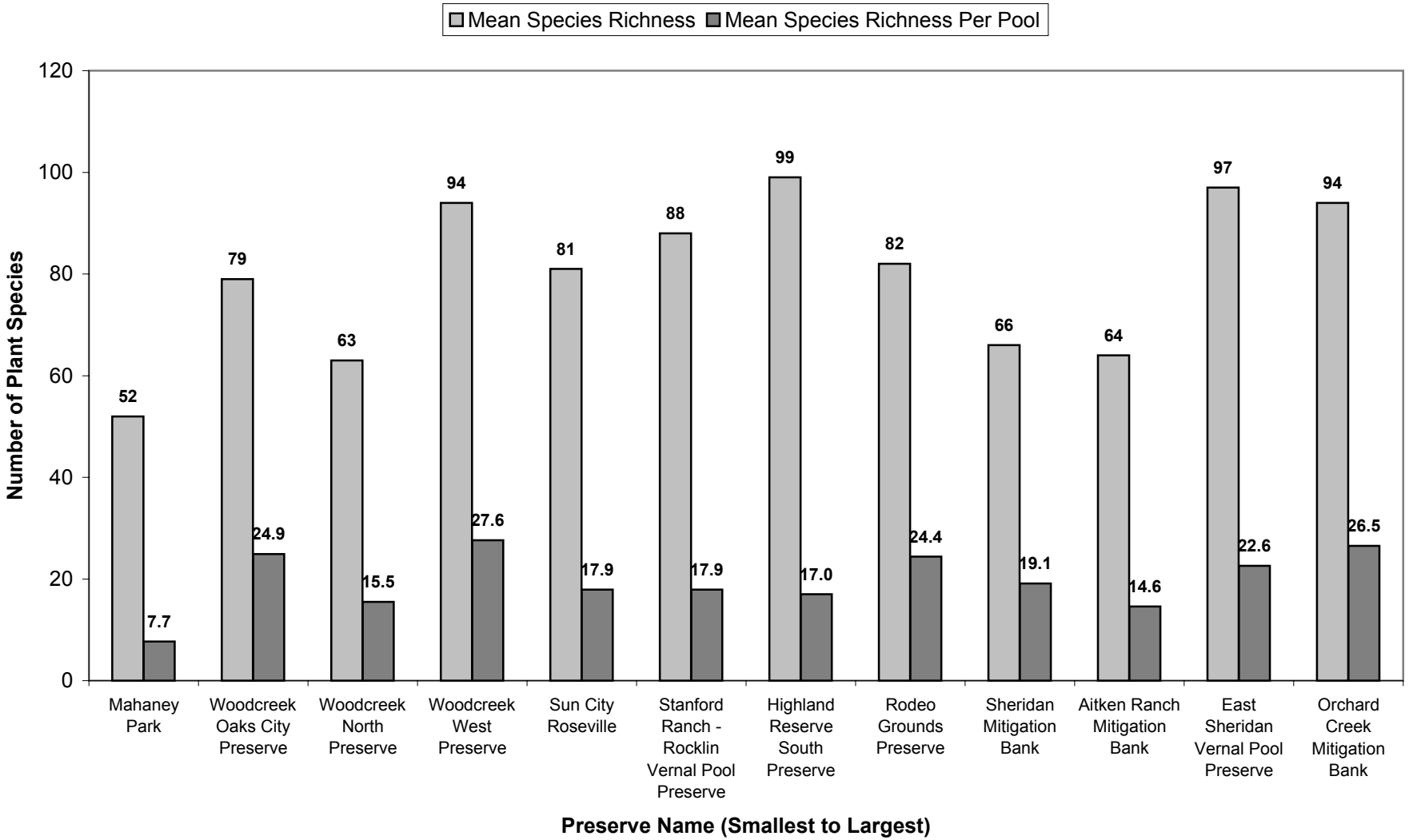


Figure 22. ***Mean Native Species Richness and Mean Native Species Richness Per Pool for Each Sampled Preserve, Spring 2003, Western Placer County, California***

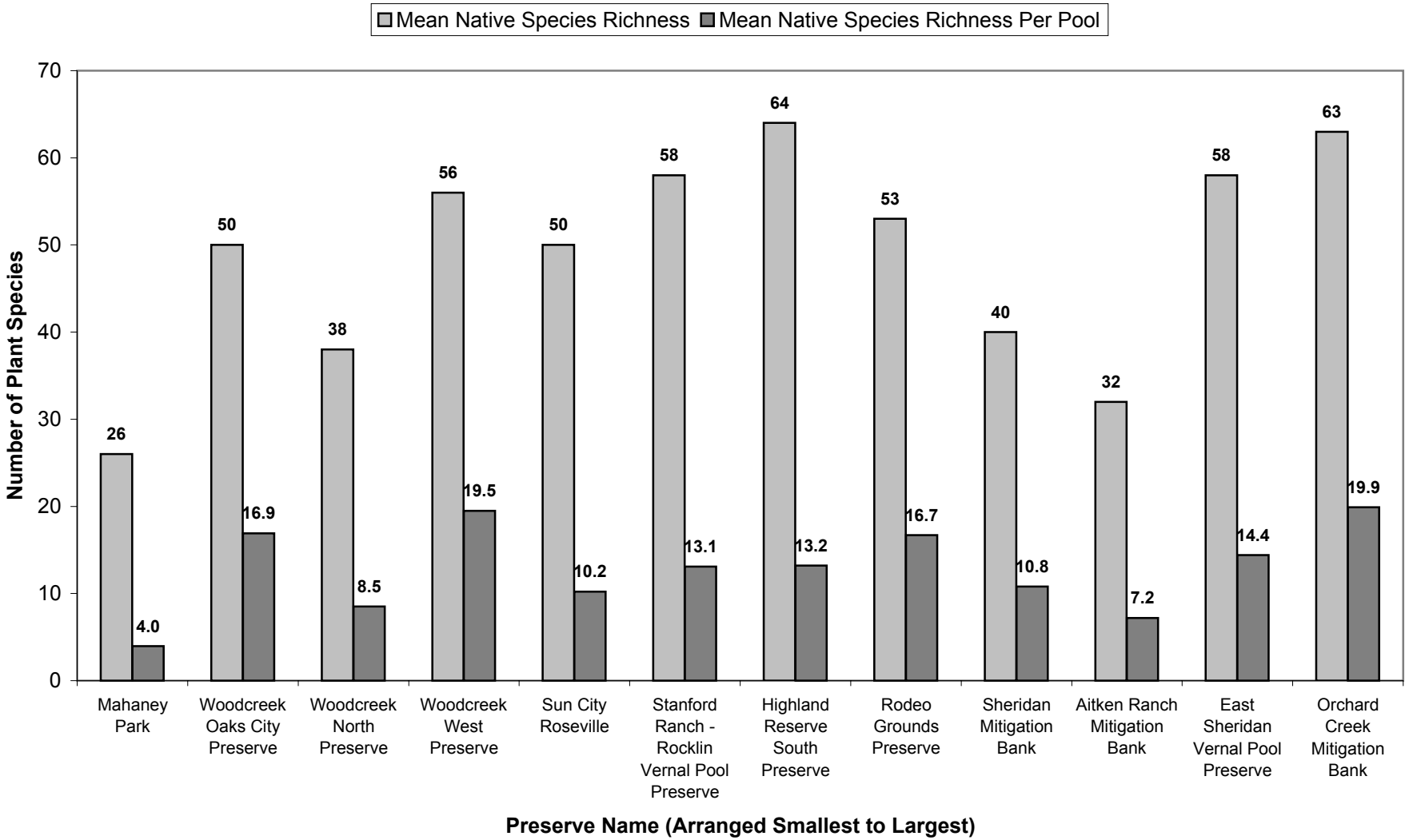
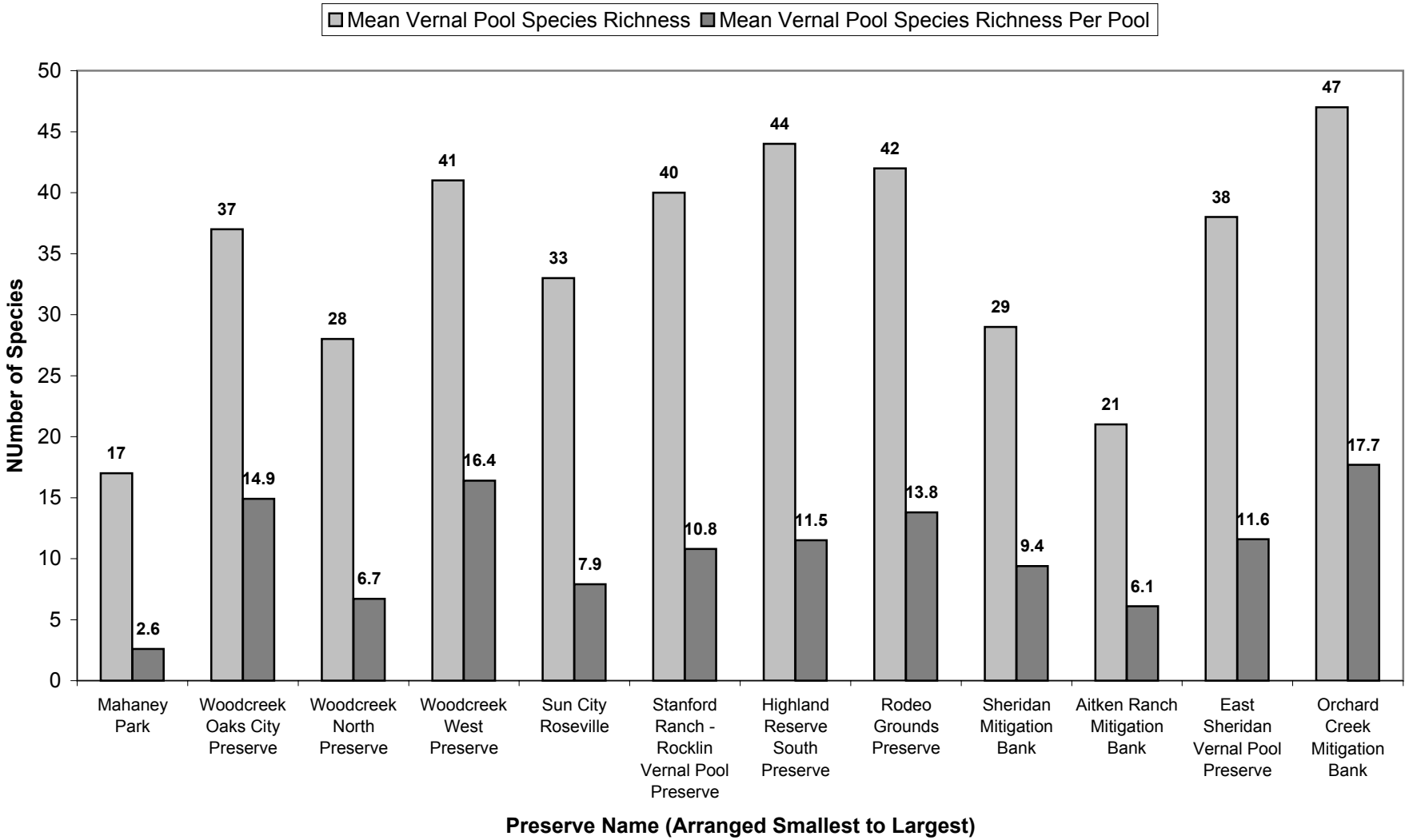


Figure 23. ***Mean Vernal Pool Species Richness and Mean Vernal Pool Species Richness Per Pool for Each Sampled Preserve, Spring 2003, Western Placer County, California***



4.2.2 Vernal Pool Plants and Habitat/Landscape Characteristics

As discussed in section 4.2.1 above, a number of statistically significant differences were noted among the different preserves in regards to various measures of plant species richness (dependent variables – see Appendix C for definitions). In order to address the key questions of this study, the next step is to determine if these differences are related to measurable characteristics of the sampled preserves (independent variables – see Appendix C for definitions), and if they are related, to determine if they provide some predictive value.

As shown in Table 9, there was no clear correlation between preserve size and any of the plant species richness values (Figure 24). This conclusion is supported by Figures 18-23, which present data such that any preserve size related trends would be evident. Similarly there was no clear correlation between the species richness values and the amount of potential edge effect, as measured by either a higher area to perimeter ratio or percent of perimeter with altered or potentially altered hydrology (Figures 25 and 26).

Table 9. ***Summary of Pearson's Correlations Between Plant Species Richness Variables and Landscape and Habitat Characteristics, Spring 2003***

	Preserve Acreage (acres)	**Area to Perimeter Ratio**	**Number of Vernal Pools**	**Length of Linear Features**	**Percent of Perimeter w/Altered Hydrology**	**Number of Vegetation Communities**
Species Richness	r^2=0.469, p=0.124	r^2=-0.543, p=0.068	**r^2=0.694 p=0.012**	r^2=0.305, p=0.336	r^2=-0.091, p=0.778	**r^2=-0.628, p=0.029**
Native Species Richness	r^2=0.442, p=0.150	r^2=-0.502, p=0.096	**r^2=0.663, p=0.019**	r^2=0.379, p=0.224	r^2=-0.032, p=0.922	**r^2=-0.605, p=0.037**
Vernal Pool Species Richness	r^2=0.406, p=0.191	r^2=-0.441, p=0.152	**r^2=0.643, p=0.024**	r^2=0.301, p=0.342	r^2=-0.098, p=0.762	**r^2=-0.583, p=0.046**
Dominant Species Richness	r^2=0.275, p=0.388	r^2=-0.236, p=0.460	r^2=0.496, p=0.101	r^2=0.049, p=0.879	r^2=-0.035, p=0.913	r^2=-0.492, p=0.104
Abundant Species Richness	r^2=0.364, p=0.244	r^2=-0.539, p=0.070	r^2=0.536, p=0.070	r^2=0.077, p=0.812	r^2=0.025, p=0.940	r^2=-0.221, p=0.490
Dominant Vernal Pool Species Richness	r^2=0.144, p=0.655	r^2=-0.155, p=0.631	r^2=0.401, p=0.197	r^2=0.007, p=0.983	r^2=0.081, p=0.803	r^2=-0.392, p=0.207
Mean Species Richness	r^2=0.242, p=0.449	r^2=-0.004, p=0.991	r^2=0.259, p=0.416	r^2=-0.133, p=0.680	r^2=-0.403, p=0.194	**r^2=-0.596, p=0.041**
Mean Native Species Richness	r^2=0.287, p=0.366	r^2=-0.147, p=0.649	r^2=0.406, p=0.191	r^2=0.028, p=0.931	r^2=-0.245, p=0.443	**r^2=-0.666, p=0.018**
Mean Vernal Pool Species Richness	r^2=0.287, p=0.366	r^2=-0.147, p=0.649	r^2=0.406, p=0.191	r^2=0.028, p=0.931	r^2=-0.245, p=0.443	**r^2=-0.666, p=0.018**

*__Bold__ indicates statistically significance ($p<0.05$)

Figure 24. ***Plant Species Richness Relative to Preserve Size, Spring 2003, Western Placer County, California***
(No statistically significant correlations)

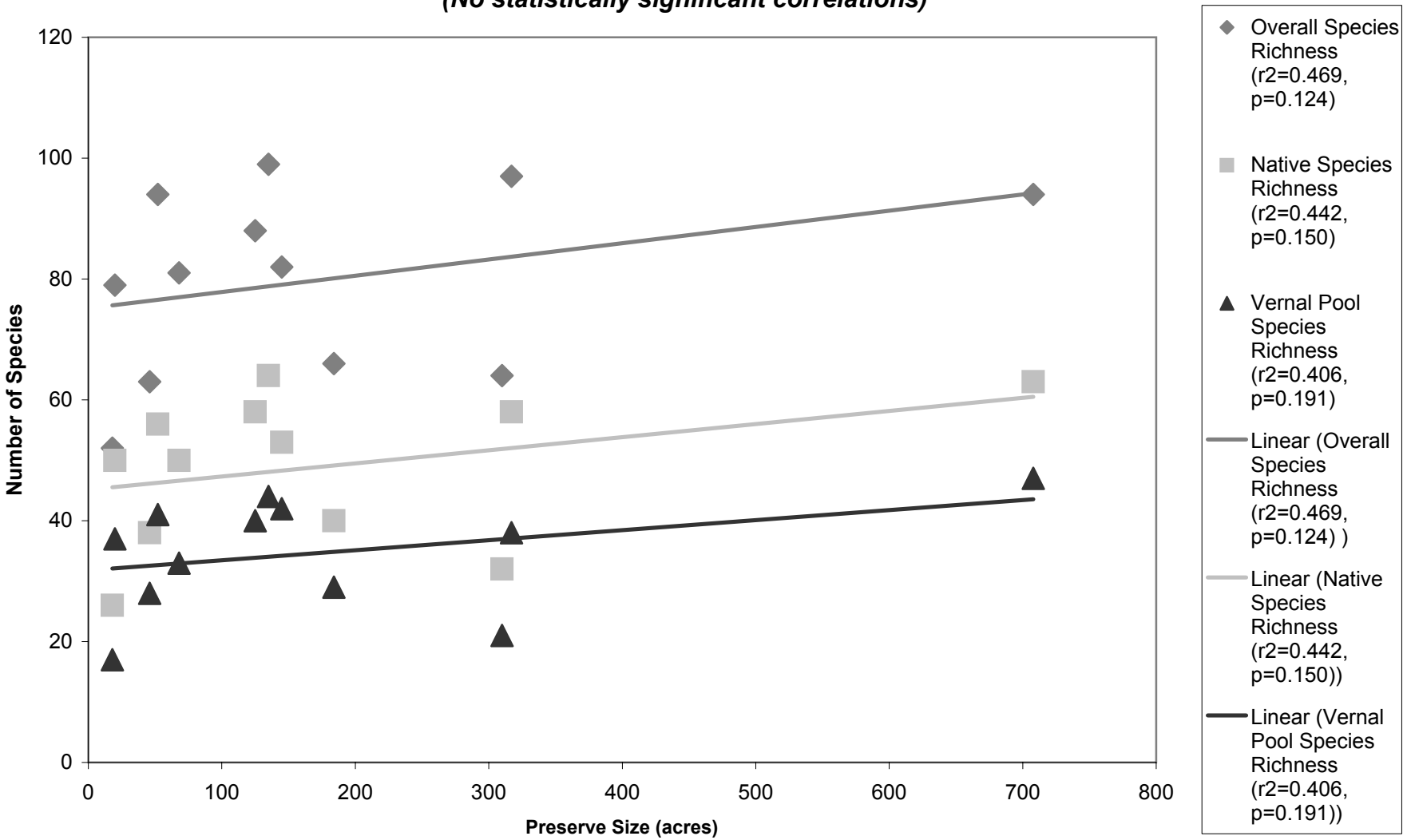


Figure 25. ***Plant Species Richness Relative to Preserve "Area to Perimeter" Ratio, Spring 2003, Western Placer County, California***

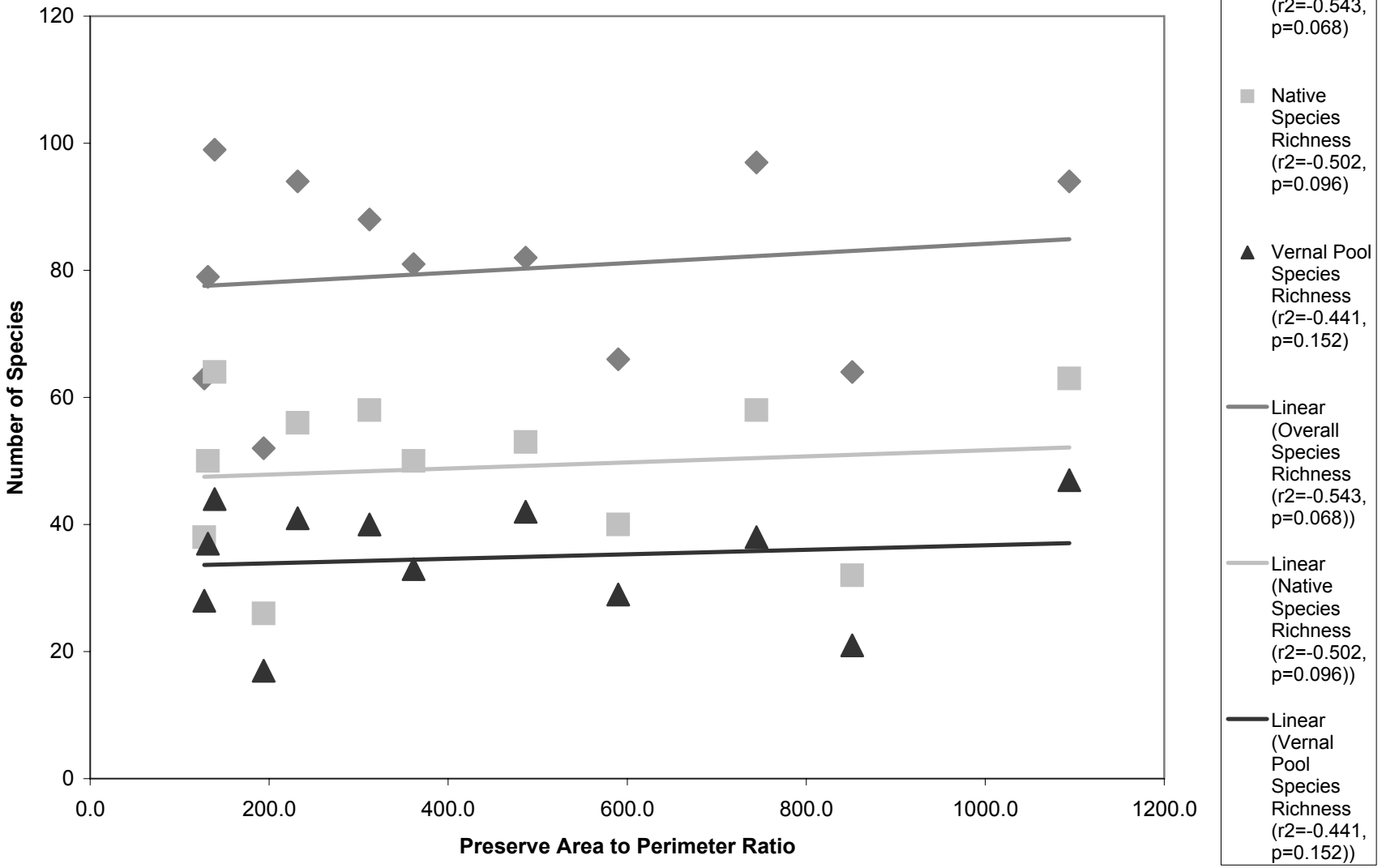
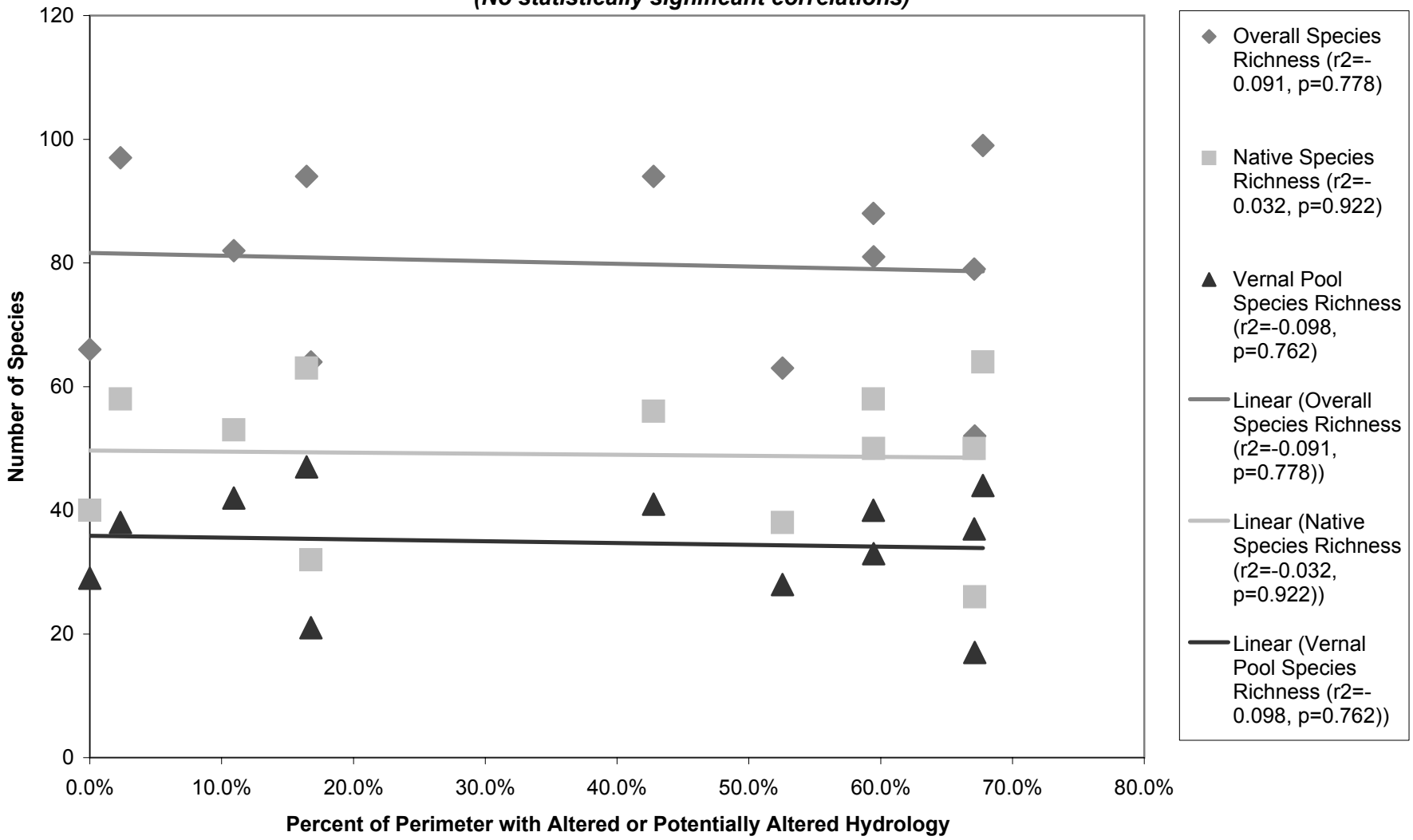


Figure 26. ***Plant Species Richness Relative to Percent of Perimeter with Altered or Potentially Altered Hydrology, Spring 2003, Western Placer County, California***
(No statistically significant correlations)



Aside from preserve size and edge effects, there were several significant correlations with plant species richness. The number of pools within a preserve was positively correlated with species richness, native species richness, and vernal pool species richness (Table 9) (Figure 27). Thus, preserves with a larger number of vernal pools tended to have a larger number of species. While this result is not surprising, it points to the fact that the number of pools on a site (and possibly the subsequent diversity of sizes and types of vernal pools on the site) is a better indicator of species diversity than just overall size of the preserve.

There was also a negative correlation between most of the species richness values and the number of vegetation communities on the site (Table 9). Preserves with only one or two vegetation communities actually had greater species diversity within their vernal pools than did preserves with a variety of vegetation communities.

T-tests were performed to compare the various preserve summary species richness values as divided between each of the categorical variable classes. For a majority of these values, there was no significant difference. For example, there was no significant difference between grazed and non-grazed site in terms of species richness (t=0.048, p=0.963), native species richness (t=-0.1330, p=0.900), and vernal pool species richness (t=-0.232, p=0.826) (Figure 28). Similarly, no significant differences were found in the species richness data between the following: urban vs. rural sites, outfalls vs. no outfalls, irrigation run-off vs. no irrigation run-off, paved paths vs. no paved paths, and public access vs. no public access. Also notable, was the lack of statistical significance between plant data sets from preserves with natural pools only and from preserves with both natural and constructed pools (t=-0.108 to 0.095, p=0.923 to 1.000) (Figure 29).

The one categorical variable that did show some statistically significant results was the presence of beavers on-site. The number of vernal pool species, the number of dominant species, and the number dominant species that are vernal pool species was significantly lower in sites that have beaver activity ($t_{vp\ spp}$=2.644, p=0.028; $t_{dom\ spp}$=3.623, p=0.005, $t_{dom\ vp\ spp}$=4.257, p=0.003) (Figure 30). Similarly, the total species richness and the native species richness were significantly lower for sites with perennial water features ($t_{spp\ richness}$=3.738, p=0.004, $t_{vp\ spp\ richness}$=2.274, p=0.047).

As discussed at the end of section 4.2.1, the overall species richness values may mask important floristic characteristics of individual pools within each site and thus mean species richness values per pool per site were also calculated. Using T-tests to compare these mean values among the different categorical variable classes, a number of statistically significant relationships were noted.

Mean species richness, mean native species richness, and mean vernal pool species richness per pool was significantly higher for preserves with no outfalls ($t_{all\ spp}$=4.055, p<0.001; $t_{native\ spp}$=6.123, p<0.001; $t_{vp\ spp}$=5.857, p<0.001), for preserves with no perennial water features ($t_{all\ spp}$=2.976, p=0.003; $t_{native\ spp}$=7.353, p<0.001; $t_{vp\ spp}$=8.638, p<0.001), and for preserves with no paved trails ($t_{all\ spp}$=3.872, p<0.001; $t_{native\ spp}$=7.101, p<0.001; $t_{vp\ spp}$=7.268 p<0.001) (Figures 31 – 33). The presence of outfalls and perennial water features both are indicators of the potential for additional water to be influencing the preserved vernal pool ecosystem and these data indicate that that influence may result in slightly lower mean species richness per pool.

Figure 27. ***Plant Species Richness Relative to Number of Pools in a Preserve, Spring 2003, Western Placer County, California, Statistically Signifcant Correlations (p<0.05)***

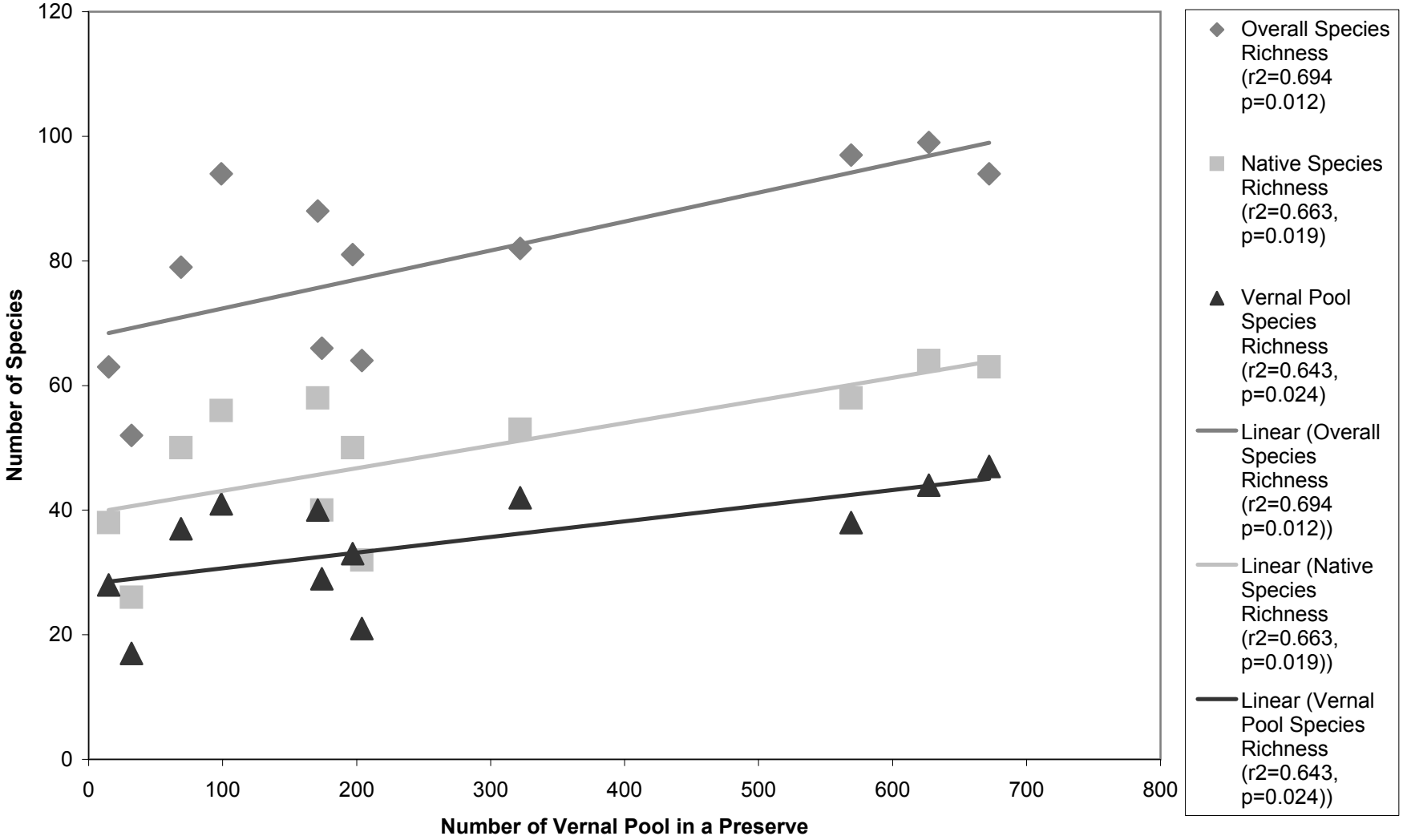


Figure 28. ***Comparison of Plant Species Richness Between Grazed and Non-Grazed Preserves,***
Spring 2003, Western Placer County, California
(No statistically significant differences)

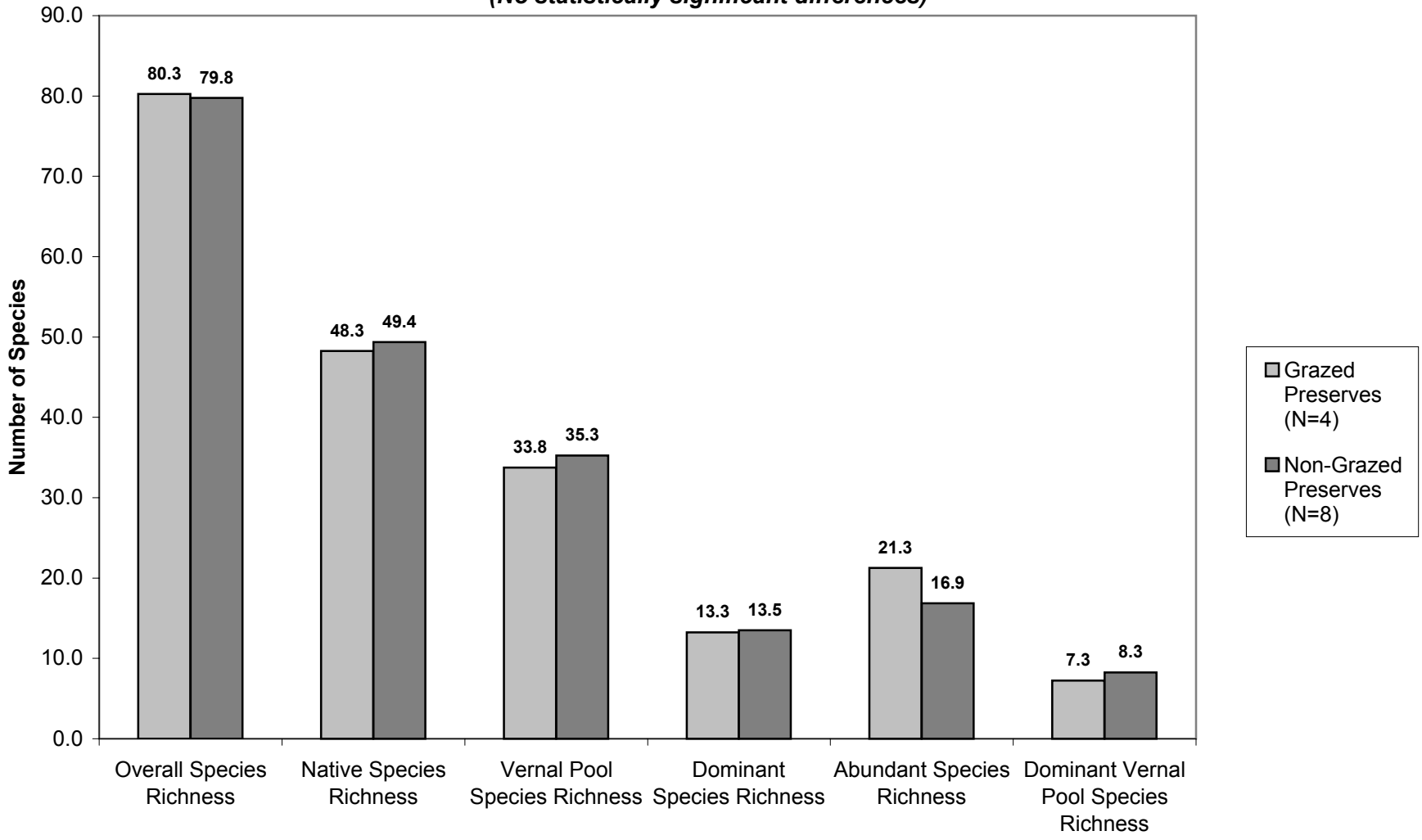


Figure 29. ***Comparison of Plant Species Richness Between Preserves with Only Natural Pools and Preserves with Natural and Constructed Pools, Spring 2003, Western Placer County, California***
(No statistically significant differences)

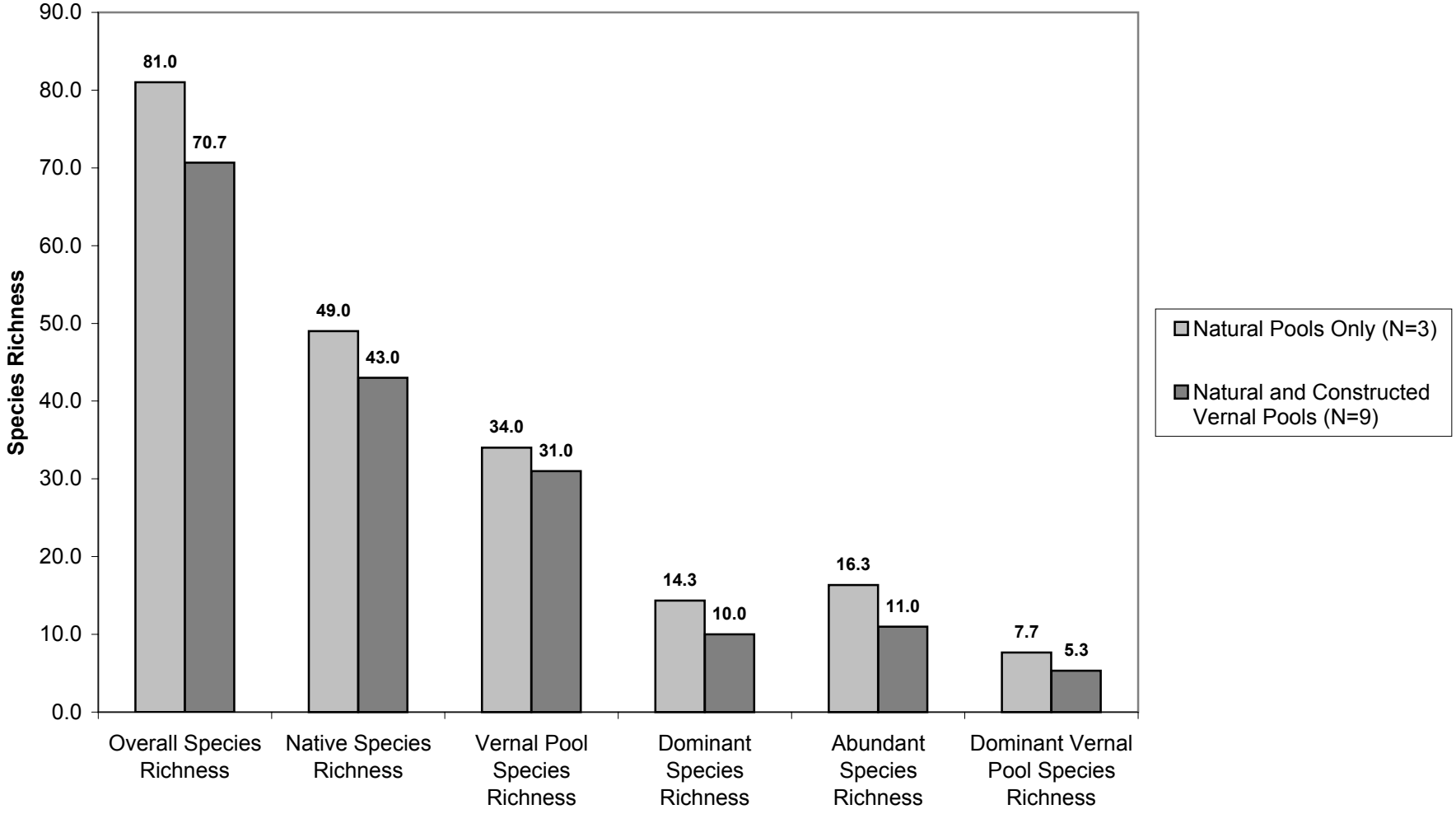


Figure 30. ***Comparison of Plant Species Richness Between Preserves with Beaver Activity and Preserves without Beaver Activity, Spring 2003, Western Placer County, California (Statistically significant differences noted)***

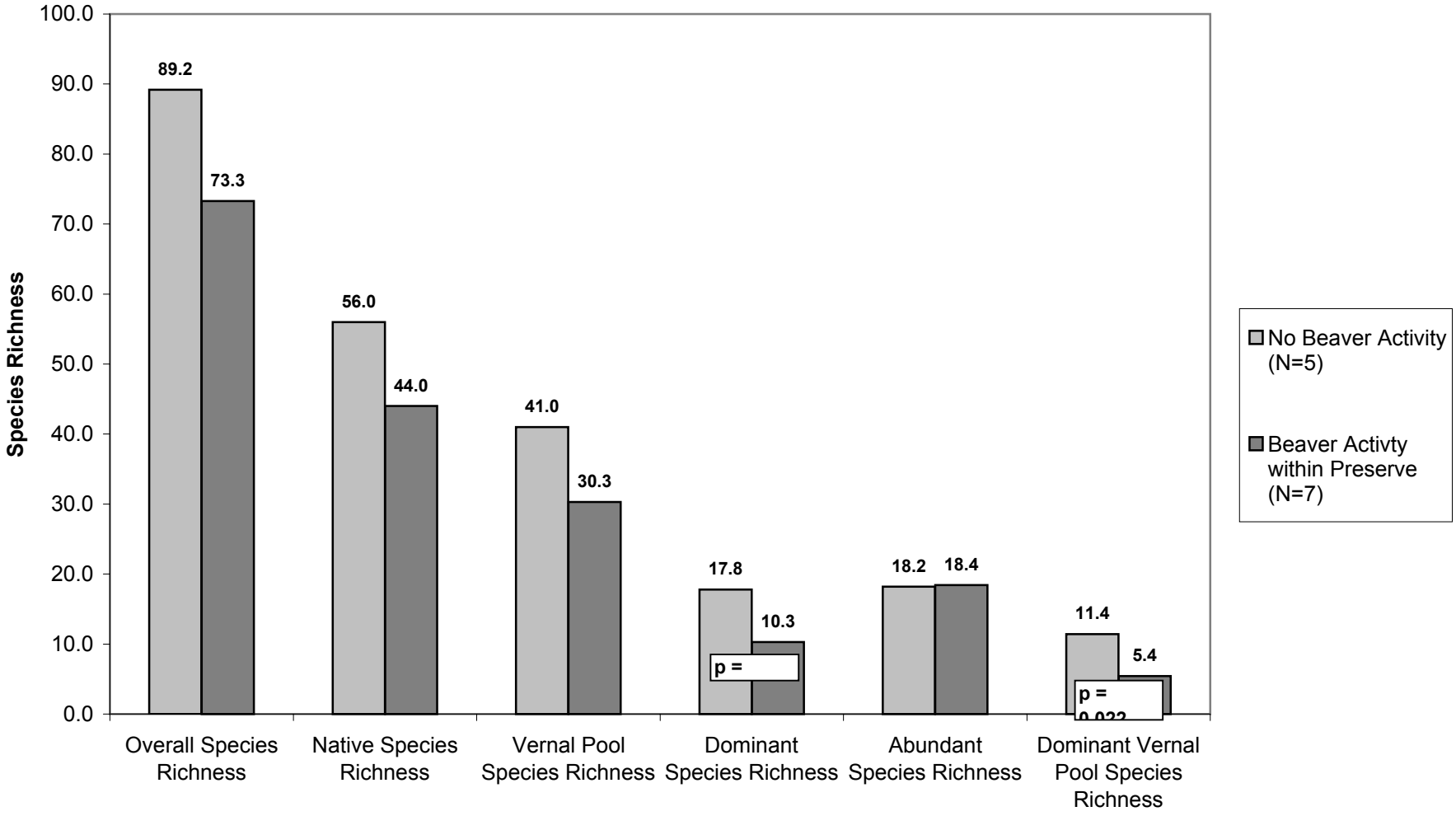


Figure 31. ***Mean Plant Species Richness Per Pool for Different Categorical Variables, Spring 2003, Western Placer County, California (Statistically significant differences noted)***

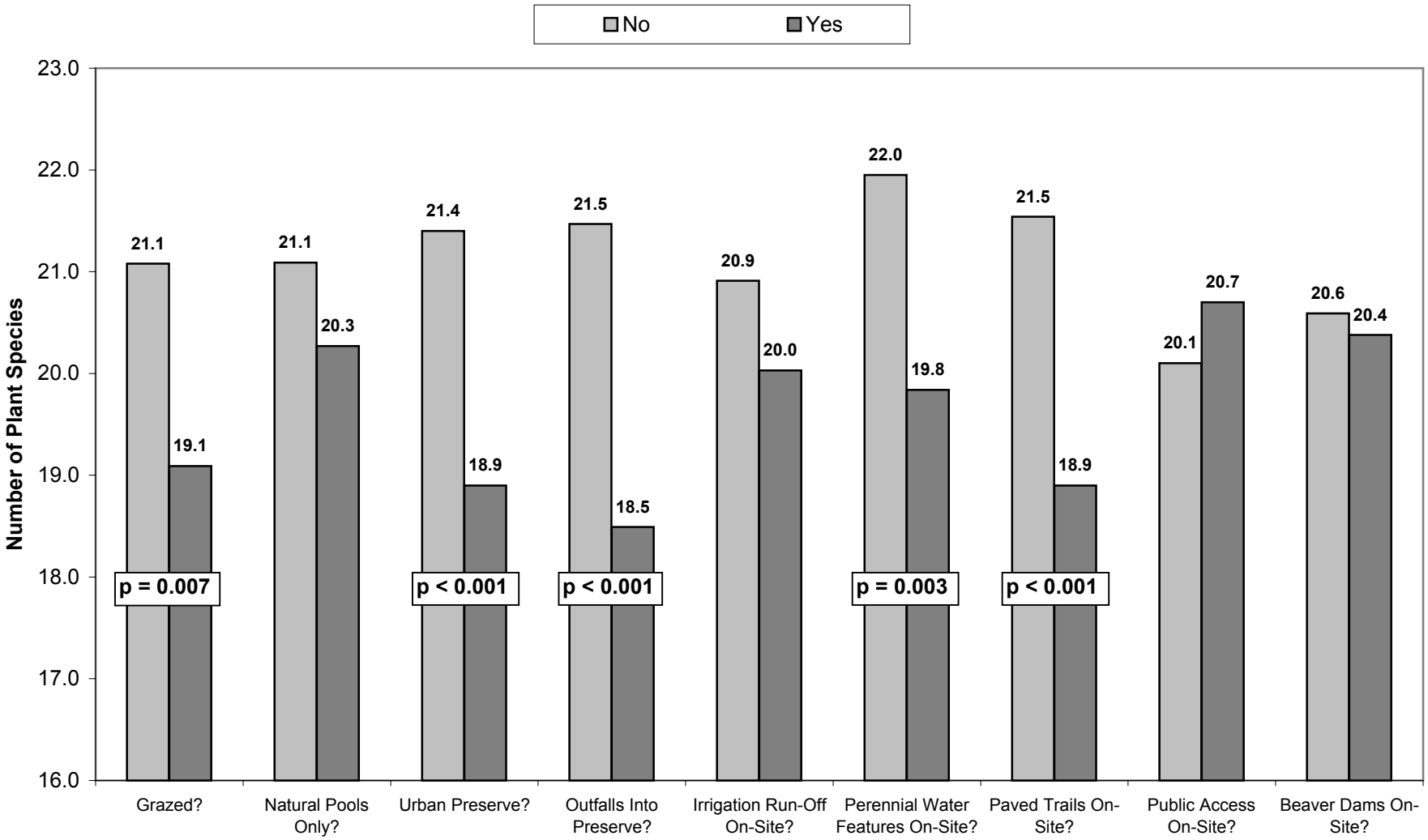


Figure 32. ***Mean Native Plant Species Richness Per Pool for Different Categorical Variables, Spring 2003, Western Placer County, California (Statistically significant differences noted)***

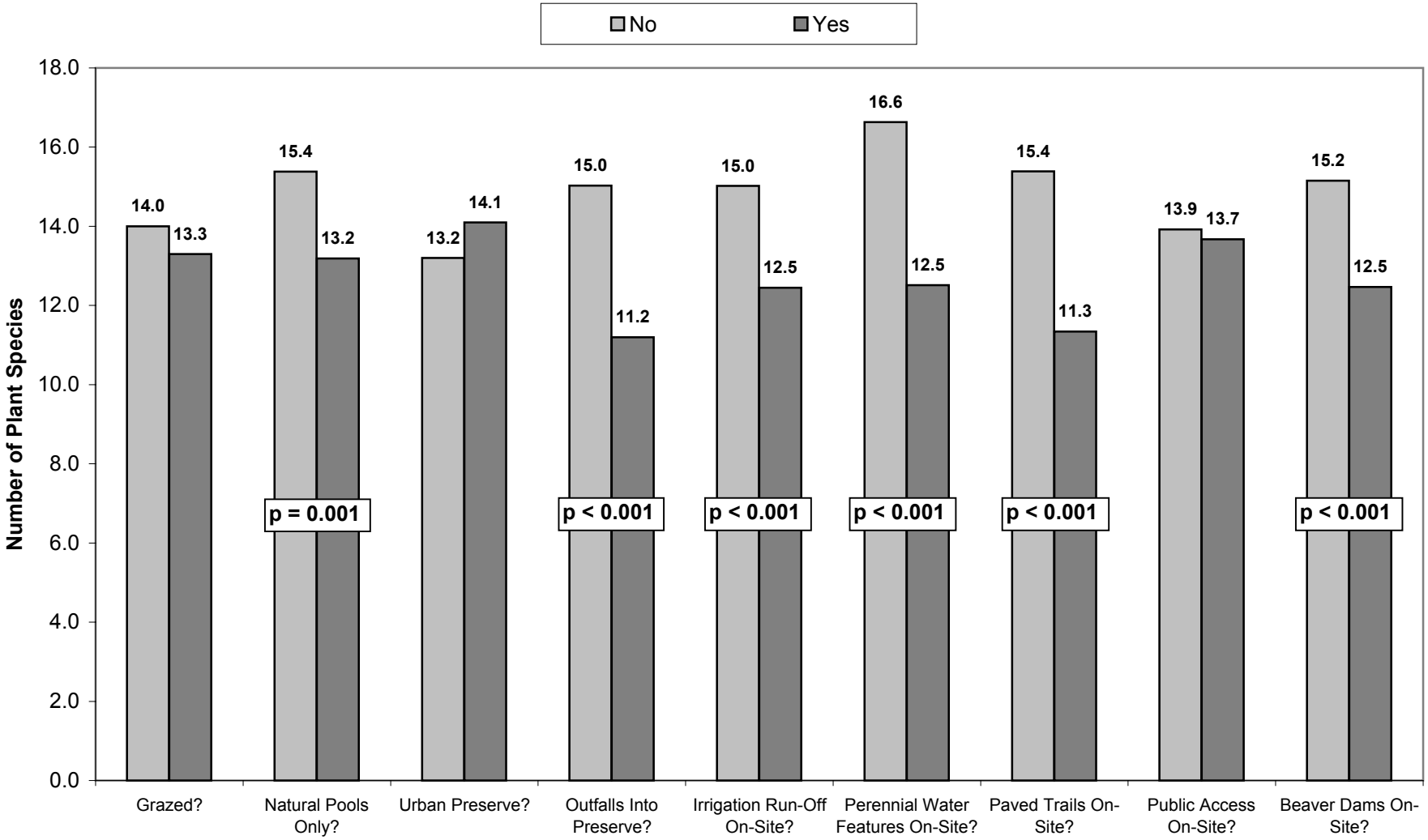
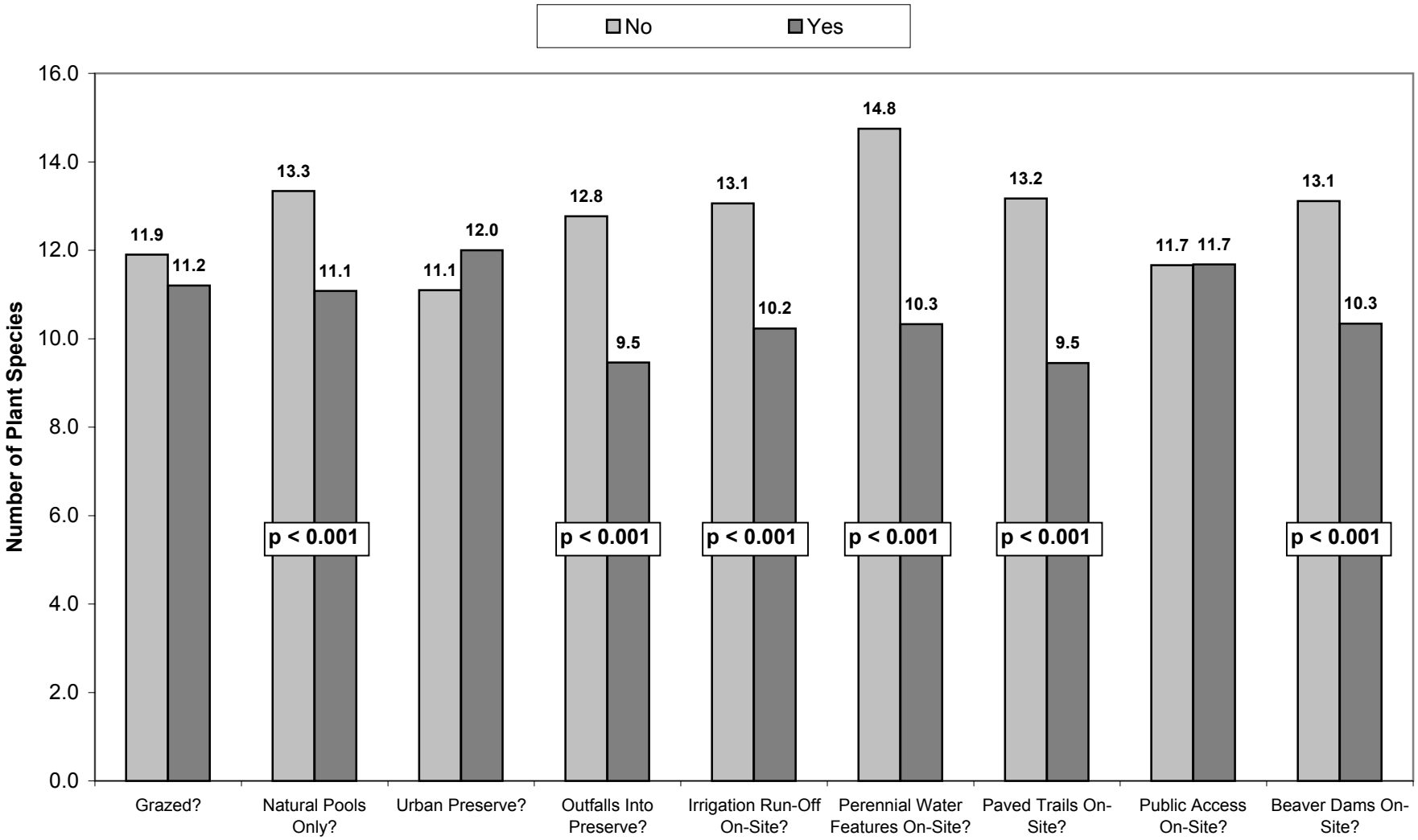


Figure 33. ***Mean Vernal Pool Plant Species Richness Per Pool for Different Categorical Variables, Spring 2003, Western Placer County, California (Statistically significant differences noted)***



Additionally, while mean species richness was not significantly different, mean native species richness and mean vernal pool species richness were significantly lower in preserves with the presence of irrigation run-off ($t_{all\ spp}$=1.315, p=0.189; $t_{native\ spp}$=4.547, p<0.001; $t_{vp\ spp}$=5.579, p<0.001) and the presence of beaver activity within a preserve ($t_{all\ spp}$=0.312, p=0.756; $t_{native\ spp}$=4.739, p<0.001; $t_{vp\ spp}$=5.441 p<0.001). Again, these values are most likely related to altered hydrology. The presence of paved trails may indicate increase human influences on a site; however there was no significant difference for these values between preserves with and without public access ($t_{all\ spp}$=-0.866, p=0.387; $t_{native\ spp}$=0.436, p=0.663; $t_{vp\ spp}$=-0.024, p=0.981).

Mean species richness per pool per preserve was significantly higher for non-grazed preserves (t=-2.719, p=0.007) but was significantly lower for rural preserves (t=3.808, p<0.001) (Figure 31). These differences appear contradictory because all of the grazed preserves are in fact rural preserves. The only rural preserve that is not grazed is the Rodeo Grounds Preserve. This site had a mean species richness per pool of 24.4, one of the highest values among the sampled preserves. This illustrates how data from a single preserve can change the direction of significance and cautions against conclusions made from only one data type (e.g., mean species richness per pool).

Finally, while mean species richness was not significantly different, mean native species richness and mean vernal pool species richness were significantly lower in preserves with both natural and constructed vernal pools ($t_{all\ spp}$=1.040, p=0.299; $t_{native\ spp}$=3.483, p=0.001; $t_{vp\ spp}$=4.106, p<0.001) (Figures 31 – 33).

4.2.3 Case Study: Floristic Trends in Vernal Pool Preserves Over a Decade

The bulk of the data and analyses for this project compared a single season of data among a number of different preserves. This design does not account for temporal variation that occurs with a preserve among different years. Thus, for a small subset of the preserves, the 2003 data were compared with previous years data, where available. Table 10 shows the total, native, vernal pool, and dominant species richness values for four of the study's preserves. In terms of total species richness, these data show that, over a ten-year period, Highland Reserve South and Woodcreek West had an increase in species richness. The remainder of the values varied from year to year but there were no clear trends toward a general increase or decrease of native species richness, vernal pool species richness, or dominant species richness. This data does not address if there were any changes in the actual species composition as may be predicted by normal successional processes.

Table 10. *1993 to 2003 Plant Species Richness Values Comparison*

	Year			
	1993	**1994**	**1995**	**2003**
Total Species Richness:				
Highland Reserve South	88	92	100	102
Woodcreek West	75	78	87	94
Woodcreek North	61	68	68	63
Woodcreek Oaks	72	80	82	79
Native Species Richness:				
Highland Reserve South	63	69	71	66
Woodcreek West	54	55	63	56
Woodcreek North	43	46	52	38
Woodcreek Oaks	51	54	53	50
Vernal Pool Species Richness				
Highland Reserve South	41	42	44	44
Woodcreek West	34	33	38	41
Woodcreek North	27	31	29	28
Woodcreek Oaks	35	35	34	37
Dominant Species Richness:				
Highland Reserve South	*	23	24	19
Woodcreek West	*	9	17	15
Woodcreek North	*	5	6	8
Woodcreek Oaks	*	9	18	21
% of Dominant Species that are Vernal Pool Species				
Highland Reserve South	*	65%	67%	63%
Woodcreek West	*	67%	65%	73%
Woodcreek North	*	40%	83%	50%
Woodcreek Oaks	*	78%	67%	62%

Table 11 examines the more specific case of two vernal pools from the Highland Reserve South Preserve, comparing historical data with the results of the current study. The data for VP180 shows a decrease in the number of vernal pool species within the pool, a shift in dominant species towards "wetter" vernal pool species, and the presence of *Typha* sp., a marsh plant, in this pool by 2003. On the other hand, over the past 15 years, VP590 had the same percentage of vernal pool species, the same dominant vernal pool species, and no encroachment of marsh species. Both of these vernal pools are within 50 feet of a preserve boundary so both have the potential to be influenced by adjacent land uses but VP180 is showing the floristic signs of the influence of altered hydrology and VP590 is not.

Table 11. ***Selected Plant Data (1989-2003) from Two Vernal Pools Within the Highland Reserve South Preserve***

	1989	**1993**	**2003**
VP180			
% Species Richness that were Vernal Pool Species	72%	74%	38%
Relative cover of *Eleocharis macrostachya*	0%	<5%	>75%
Dominant Species	--	*Navarretia leucocephala, Psilocarphus brevissimus, Lolium perenne*	*Eleocharis macrostachya, Eryngium vaseyi*
Typha sp. Present?	No	No	Yes
VP590			
% Species Richness that were Vernal Pool Species	--	57%	53%
Dominant Species	--	*Lasthenia fremontii*	*Lasthenia fremontii*
Typha sp. Present?	--	No	No

4.3 Birds

4.3.1 Avian Use

A total of 102 bird species were detected at the 12 study sites during our spring 2003 surveys (Table 12). The total number of bird species detected at any one site ranged from 18 to 73 (median = 32) , a significant variation (X^2=102.8965, df=11, p<0.001) (Figure 34) (Appendix F). Many species were detected at only one (18 species) or two sites (18 species). Only five species (killdeer [*Charadrius vociferous*], mourning dove [*Zenaida macroura*], western kingbird [*Tyrannus verticalis*], western meadowlark [*Sturnella neglecta*], and house finch [*Carpodacus mexicanus*]) were detected at all 12 sites.

Table 12. Avian Species Detected at Placer County Vernal Pool Preserves, Spring 2003

Common name	Scientific name	No. sites detected	Guild			
			Development[a]			Habitat[b]
Pied-billed Grebe	*Podilymbus podiceps*	2		W		Water
American White Pelican[c]	*Pelecanus erythrorhynchos*	2		W		Water
Double-crested Cormorant[c]	*Phalacrocorax auritus*	1		W		Water
American Bittern[c]	*Botaurus lentiginosus*	3		W		Water
Great Blue Heron[c]	*Ardea herodias*	6		W		Wader
Great Egret[cd]	*Ardea alba*	8		W		Wader
Snowy Egret[cd]	*Egretta thula*	3		W		Wader
Green Heron	*Butorides virescens*	1		W		Wader
White-faced Ibis[c]	*Plegadis chihi*	1		W		Wader
Turkey Vulture	*Cathartes aura*	9		W		Raptor
Canada Goose[d]	*Branta canadensis*	5		N		Water
Wood Duck	*Aix sponsa*	3		W		Water
Gadwall	*Anas strepera*	2		W		Water
American Wigeon[d]	*Anas americana*	5		W		Water
Mallard[d]	*Anas platyrhynchos*	11		N		Water
Cinnamon Teal[d]	*Anas cyanoptera*	4		W		Water
Green-winged Teal	*Anas crecca*	1		W		Water
Common Merganser	*Mergus merganser*	1		W		Water
White-tailed Kite[c]	*Elanus leucurus*	5		W		Raptor
Northern Harrier[c]	*Circus cyaneus*	6		W		Raptor
Sharp-shinned Hawk[c]	*Accipiter striatus*	1		W		Raptor
Cooper's Hawk[c]	*Accipiter cooperii*	2		W		Raptor
Red-shouldered Hawk	*Buteo lineatus*	3		W		Raptor
Swainson's Hawk[c]	*Buteo swainsoni*	1		W		Raptor
Red-tailed Hawk	*Buteo jamaicensis*	10		W		Raptor
American Kestrel	*Falco sparverius*	6		W		Raptor
Ring-necked Pheasant	*Phasianus colchicus*	11		W		TL
Wild Turkey	*Meleagris gallopavo*	1		W		TL
California Quail	*Callipepla californica*	2		W		TL

Table 12. Avian Species Detected at Placer County Vernal Pool Preserves, Spring 2003

Common name	Scientific name	No. sites detected	Guild			
			Development[a]			Habitat[b]
Virginia Rail	*Rallus limicola*	2		W		Water
Sora	*Porzana carolina*	1		W		Water
Common Moorhen	*Gallinula chloropus*	4		W		Water
American Coot	*Fulica americana*	4		W		Water
Killdeer[d]	*Charadrius vociferus*	12		N		Shore
Black-necked Stilt[d]	*Himantopus mexicanus*	5		W		Shore
American Avocet	*Recurvirostra americana*	1		N		Shore
Greater Yellowlegs[d]	*Tringa melanoleuca*	10		W		Shore
Spotted Sandpiper	*Actitis macularia*	1		W		Shore
Long-billed Curlew[c]	*Numenius americanus*	2		W		Shore
Western Sandpiper	*Calidris mauri*	2		W		Shore
Least Sandpiper[d]	*Calidris minutilla*	5		W		Shore
Dunlin	*Calidris alpina*	2		W		Shore
Long-billed Dowitcher	*Limnodromus scolopaceus*	1		W		Shore
Common Snipe[d]	*Gallinago gallinago*	6		W		Shore
Rock Dove	*Columba livia*	7		U		TL
Mourning Dove	*Zenaida macroura*	12		N		AL
Great Horned Owl	*Bubo virginianus*	1		W		AL
Anna's Hummingbird	*Calypte anna*	7		N		AL
Belted Kingfisher	*Ceryle alcyon*	2		W		Water
Acorn Woodpecker	*Melanerpes formicivorus*	3		N		AL
Nuttall's Woodpecker	*Picoides nuttallii*	5		W		AL
Downy Woodpecker	*Picoides pubescens*	2		W		AL
Northern Flicker	*Colaptes auratus*	2		N		AL
Black Phoebe	*Sayornis nigricans*	9		N		TL
Ash-throated Flycatcher	*Myiarchus cinerascens*	2		W		AL
Western Kingbird	*Tyrannus verticalis*	12		W		TL
Loggerhead Shrike[c]	*Lanius ludovicianus*	2		W		TL
Western Scrub-Jay	*Aphelocoma californica*	5		N		TL

Table 12. Avian Species Detected at Placer County Vernal Pool Preserves, Spring 2003

Common name	Scientific name	No. sites detected	Guild			
			Development[a]			Habitat[b]
Yellow-billed Magpie	*Pica nuttalli*	8		N		AL
American Crow	*Corvus brachyrhynchos*	6		N		AL
Horned Lark	*Eremophila alpestris*	2		W		TL
Tree Swallow[d]	*Tachycineta bicolor*	10		N		TL
Northern Rough-winged Swallow[d]	*Stelgidopteryx serripennis*	3		N		TL
Barn Swallow[d]	*Hirundo rustica*	6		N		TL
Cliff Swallow[d]	*Petrochelidon pyrrhonota*	8		N		TL
Oak Titmouse	*Baeolophus inornatus*	4		W		AL
Bushtit	*Psaltriparus minimus*	7		W		AL
White-breasted Nuthatch	*Sitta carolinensis*	4		W		AL
Bewick's Wren	*Thryomanes bewickii*	2		W		TL
House Wren	*Troglodytes aedon*	4		W		TL
Marsh Wren	*Cistothorus palustris*	3		W		TL
Ruby-crowned Kinglet	*Regulus calendula*	2		N		AL
Western Bluebird	*Sialia mexicana*	5		W		TL
Hermit Thrush	*Catharus guttatus*	1		W		AL
American Robin	*Turdus migratorius*	6		N		AL
Wrentit	*Chamaea fasciata*	1		W		TL
Northern Mockingbird	*Mimus polyglottos*	7		U		TL
European Starling	*Sturnus vulgaris*	7		U		TL
American Pipit	*Anthus rubescens*	6		W		TL
Orange-crowned Warbler	*Vermivora celata*	4		W		AL
Nashville Warbler	*Vermivora ruficapilla*	3		W		TL
Yellow-rumped Warbler	*Dendroica coronata*	7		W		AL
Black-throated Gray Warbler	*Dendroica nigrescens*	1		W		AL
Common Yellowthroat	*Geothlypis trichas*	3		W		TL
Wilson's Warbler	*Wilsonia pusilla*	2		W		TL
California Towhee	*Pipilo crissalis*	1		W		TL
Savannah Sparrow	*Passerculus sandwichensis*	9		W		TL

Table 12. Avian Species Detected at Placer County Vernal Pool Preserves, Spring 2003

Common name	Scientific name	No. sites detected	Guild			
			Development[a]			Habitat[b]
Song Sparrow	*Melospiza melodia*	3		N		TL
Lincoln's Sparrow	*Melospiza lincolnii*	3		W		TL
White-crowned Sparrow	*Zonotrichia leucophrys*	7		N		TL
Golden-crowned Sparrow	*Zonotrichia atricapilla*	3		N		TL
Dark-eyed Junco	*Junco hyemalis*	1		N		AL
Red-winged Blackbird	*Agelaius phoeniceus*	11		N		TL
Tricolored Blackbird[c]	*Agelaius tricolor*	3		W		TL
Western Meadowlark	*Sturnella neglecta*	12		N		TL
Brewer's Blackbird	*Euphagus cyanocephalus*	11		N		TL
Brown-headed Cowbird	*Molothrus ater*	7		N		TL
Bullock's Oriole	*Icterus bullockii*	3		W		AL
House Finch	*Carpodacus mexicanus*	12		U		AL
Lesser Goldfinch	*Carduelis psaltria*	3		N		AL
American Goldfinch	*Carduelis tristis*	5		N		AL
House Sparrow	*Passer domesticus*	4		U		TL

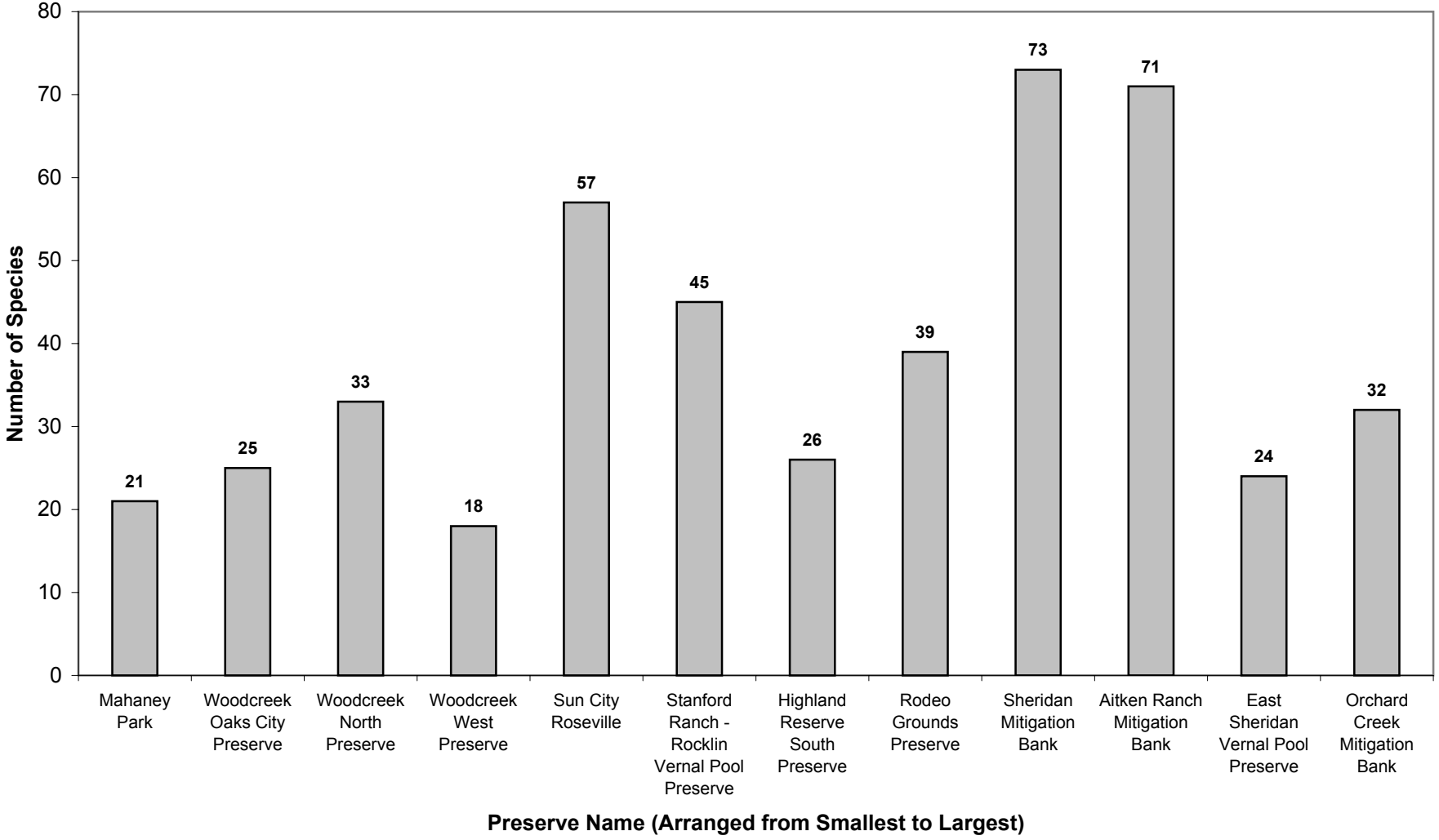
[a] N=Neutral bird, U=Urban bird, W = Wild bird.

[b] AL=Arboreal Landbird, Shore=Shorebird, TL=Terrestrial Landbird, Wader=Wader bird, Water=Water bird.

[c] indicates special-status species.

[d] indicates species observed using vernal pools.

Figure 34. ***Bird Species Richness Per Preserve, Spring 2003, Western Placer County, California***



At least one species was detected from each of the three "development" guilds (Urban, Wild, and Neutral) at every site. In addition, every site had at least one species from the Arboreal Landbird, Terrestrial Landbird, and Shorebird guilds. Of the remaining three guilds, there were no detections of any Waterbirds at one site, no Raptors at two sites, and no Waders at three sites. There were also no detections of any gull or tern species at any of the sites, therefore the Gull and Tern guild was omitted from analysis.

Species composition varied considerably among sites. Analysis of the Development guilds indicated that some sites were predominately comprised of Neutral birds (e.g., Mahaney Park had 62% Neutral birds and 33% Wild birds), whereas others were predominately comprised of Wild birds (e.g., Sheridan had 68% Wild birds and 27% Neutral birds) (Figure 35). Of the 12 sites, the four smallest sites had a relatively higher proportion of Neutral birds, whereas the eight largest sites had a relatively higher proportion of Wild birds. Comparison of the relative composition of Habitat guilds indicated that all but one site (Woodcreek Oaks City Preserve) were comprised predominately of Terrestrial Landbirds. Thereafter, however, relative guild composition varied; some sites were comprised of relatively more Arboreal Landbirds or Raptors, whereas others were comprised of relatively more Shorebirds or Waterbirds (Figure 36). Within any given habitat guild, relative composition varied greatly among sites. For example, relative composition of Arboreal Landbirds at a site ranged from 8% (East Sheridan) to 52% (Woodcreek Oaks), and relative composition of Shorebirds ranged from 3% (Woodcreek North) to 19% (Orchard Creek).

Special-Status Species

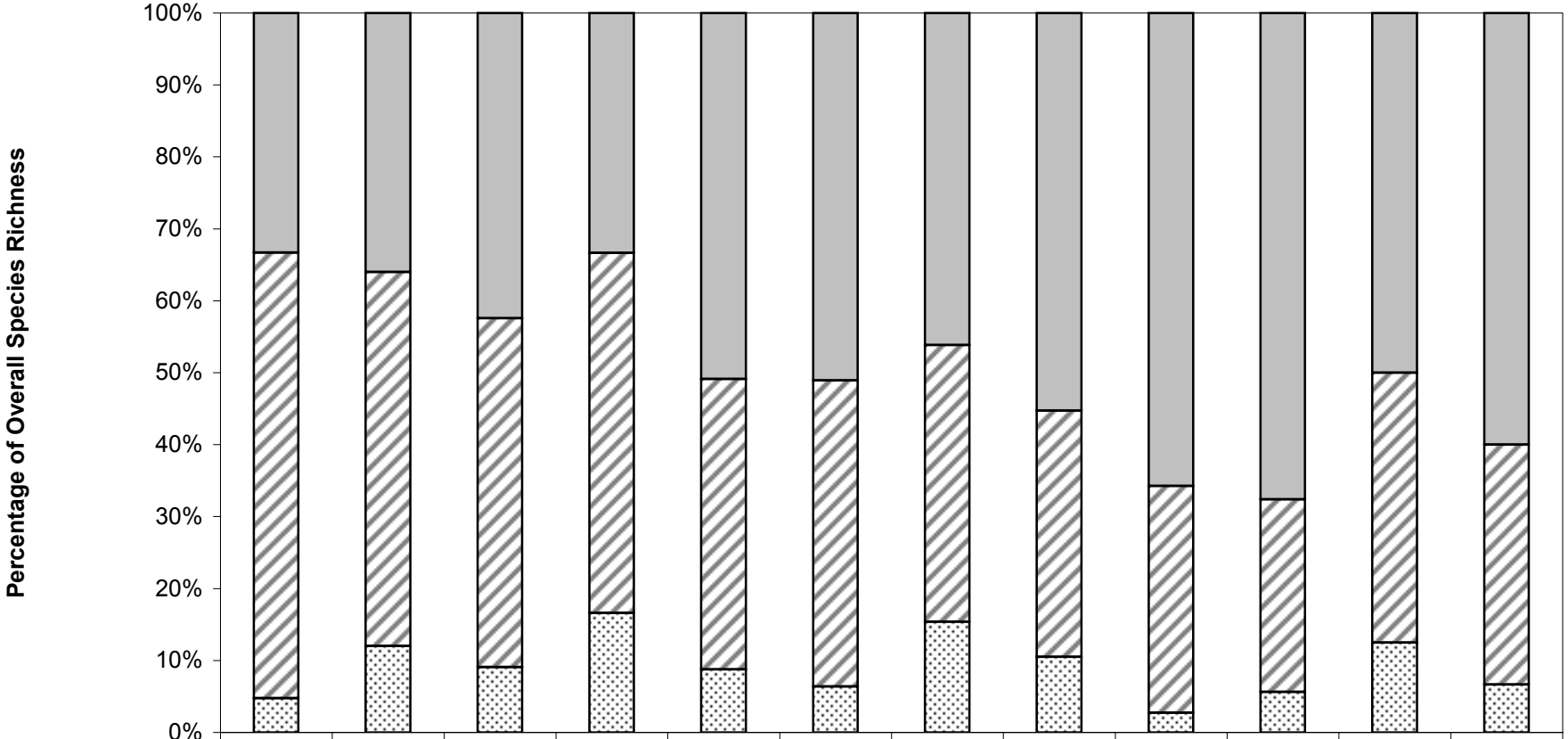
Fourteen of the 102 species (13.7%) detected are listed as "Species of Special Concern" by the California Department of Fish and Game (Appendix F). Of these, one (American white pelican [*Pelecanus erythrorhynchos*]) is listed as "Endangered" by the state of California and Federal Government, and one (Swainson's hawk [*Buteo swainsoni*]) is listed as "Threatened" by the state of California. The number of Species of Special Concern detected at any one site ranged from 0 (all 3 Woodcreek sites) to 10 (Sheridan Mitigation Bank). The median number of Species of Special Concern detected at each site was 3.5.

Breeding activity was documented for two of the special-status bird species:

1. A northern harrier (*Circus cyaneus*) nest was detected in the grassland adjacent to an emergent wetland at the Sheridan Mitigation Bank site.
2. A pair of Swainson's hawks was repeatedly observed at the Aitken Ranch Mitigation Bank site. Nesting habitat at the site is very good, and repeated territorial behavior provided evidence of nesting.

American bitterns (*Botaurus lentiginosus*) and loggerhead shrikes (*Lanius ludovicianus*) were "probable" breeders at one or more of the sites. This was indicated by territorial behavior or the presence of a singing male present at the same location on at least 2 different days, 7 days apart (Brauning 1992).

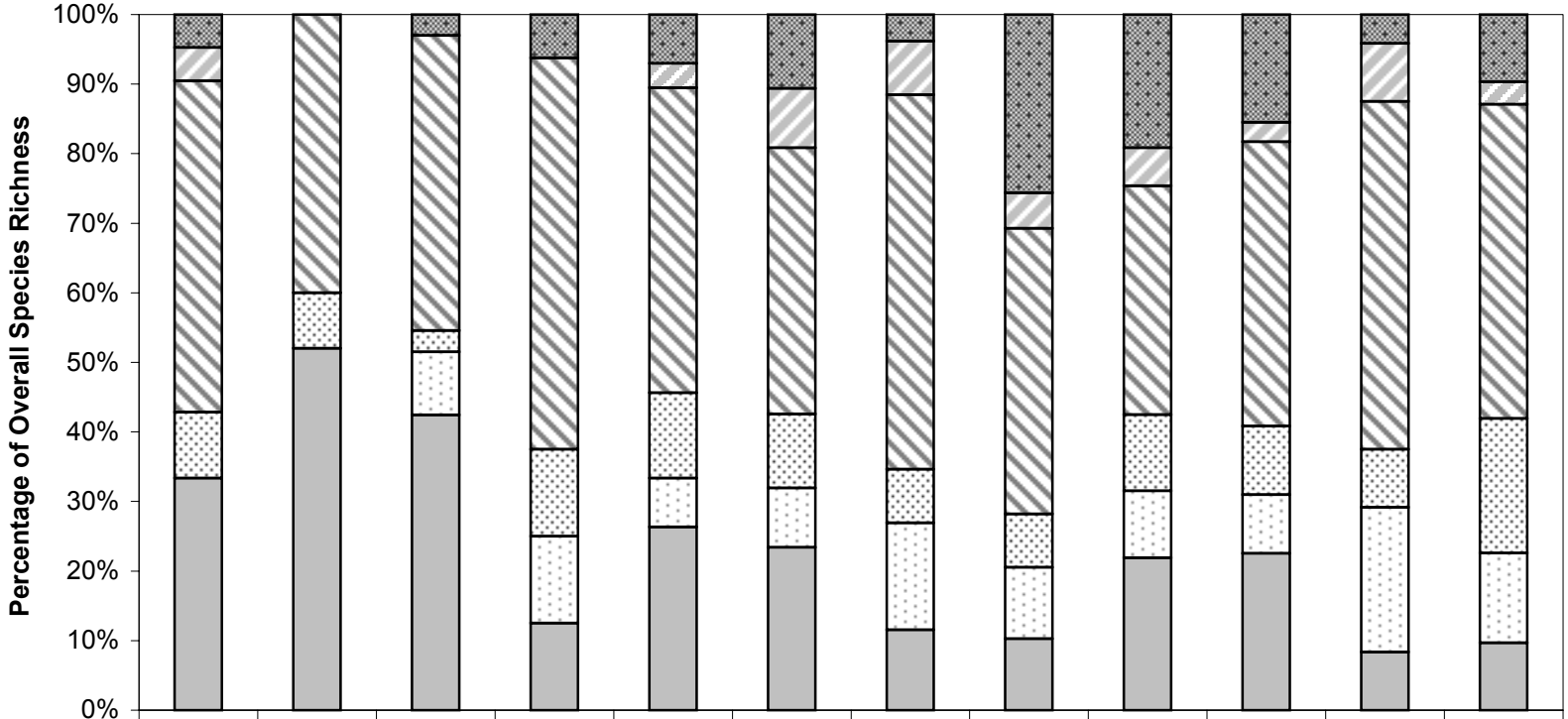
Figure 35. ***Distribution of Bird Species Among "Development Guilds" within Sampled Preserve Sites, Spring 2003, Western Placer County, California***



	Mahaney Park	Woodcreek Oaks City Preserve	Woodcreek North Preserve	Woodcreek West Preserve	Sun City Roseville	Stanford Ranch - Rocklin	Highland Reserve South	Rodeo Grounds Preserve	Sheridan Mitigation Bank	Aitken Ranch Mitigation	East Sheridan Vernal Pool	Orchard Creek Mitigation
Wild Bird Guild	33.3%	36.0%	42.4%	33.3%	50.9%	53.3%	46.2%	53.8%	65.8%	67.6%	50.0%	56.3%
Neutral Bird Guild	61.9%	52.0%	48.5%	50.0%	40.4%	44.4%	38.5%	33.3%	31.5%	26.8%	37.5%	31.3%
Urban Bird Guild	4.8%	12.0%	9.1%	16.6%	8.8%	6.7%	15.4%	10.3%	2.7%	5.6%	12.5%	6.3%

Preserve Name (arranged smallest to largest)

Figure 36. ***Distribution of Bird Species Among "Habitat Guilds" within Sampled Preserve Sites, Spring 2003, Western Placer County California***



	Mahaney Park	Woodcreek Oaks City Preserve	Woodcreek North Preserve	Woodcreek West Preserve	Sun City Roseville	Stanford Ranch - Rocklin	Highland Reserve South	Rodeo Grounds Preserve	Sheridan Mitigation Bank	Aitken Ranch Mitigation	East Sheridan Vernal Pool	Orchard Creek Mitigation
Waterbird Guild	4.8%	0.0%	3.0%	5.6%	7.0%	11.1%	3.8%	25.6%	19.2%	15.5%	4.2%	9.4%
Wader Guild	4.8%	0.0%	0.0%	0.0%	3.5%	8.9%	7.7%	5.1%	5.5%	2.8%	8.3%	3.1%
Terrestrial Landbird Guild	47.6%	40.0%	42.4%	50.0%	43.9%	40.0%	53.8%	41.0%	32.9%	40.8%	50.0%	43.8%
Shorebird Guild	9.5%	8.0%	3.0%	11.1%	12.3%	11.1%	7.7%	7.7%	11.0%	9.9%	8.3%	18.8%
Raptor Guild	0.0%	0.0%	9.1%	11.1%	7.0%	8.9%	15.4%	10.3%	9.6%	8.5%	20.8%	12.5%
Arboreal Landbird Guild	33.3%	52.0%	42.4%	11.1%	26.3%	24.4%	11.5%	10.3%	21.9%	22.5%	8.3%	9.4%

Preserve Name (arranged smallest to largest)

4.3.2 Comparison to Habitat and Landscape Characteristic Variables

Total Avian Species Richness and Special-Status Species Richness

A significant positive relationship was detected between total bird species richness and two variables: preserve area to edge ratio ($p = 0.013$) and number of vegetation communities ($p < 0.001$) (Table 13). In addition, two significant predictors of special-status species richness were detected. "Urban" (a binary variable in which the site was scored "1" if it was considered urban, and "0" if it was considered rural) was a significant negative predictor, whereas "Emergent" (a binary variable in which the site was scored "1" if it had wetlands, and "0" if it did not) was a significant positive predictor.

Development Guild Richness and Relative Composition

A significant positive relationship was detected between the number of vegetation communities present within a preserve, and both Wild bird species richness and Neutral bird species richness ($p < 0.001$ and $p = 0.005$, respectively). The regression model for Wild bird species richness also contained the preserve area to edge ratio variable ($p = 0.001$). No significant relationship was detected between Urban bird species richness and any of the landscape variables.

Significant relationships were detected between landscape variables and the relative composition of two of the three Development guilds. As with the guild's richness, the number of vegetation communities ($p = 0.002$) and preserve area to edge ratio ($p < 0.001$) were significant positive predictors of the percent composition of Wild birds at a site. Also, a significant positive relationship was detected between the percent of Neutral birds at a site and the "Urban" landscape variable. No significant landscape variable predictors were detected for the percent of Urban birds at a site.

Habitat Guild Richness and Relative Composition

At least two statistically significant ($p < 0.05$) landscape variable predictors were detected for species richness of each habitat guild, except for the Shorebird guild, which had only one significant predictor (Table 13). The number of vegetation communities present within a preserve was a significant positive predictor for four of the guilds (Terrestrial Landbird, Arboreal Landbird, Raptor, and Waterbird); other landscape variables were significant predictors for one or two of the guilds (Table 13). All of the significant predictors indicated a positive relationship, except "Public" (indicating a site was open to the public) and "Paltered" (percent of the perimeter with altered hydrology), which were negative predictors.

Table 13. *Regression Values and Results for Bird Data, Spring 2003*

Guild[a]	Intercept	Parameter[a]	Coefficient	SE	P
Total bird richness	-17.495	Ratio	0.027	0.009	0.013
		Vegcomm	23.142	4.181	<0.001
Special-status species	4.853	Urban	-4.529	0.974	0.001
		Emergent	2.912	0.961	0.014
Development guilds					
Wildbird	-23.513	Ratio	0.025	0.005	0.001
		Vegcomm	17.367	2.625	<0.001
Neutral bird	3.593	Vegcomm	5.864	1.654	0.005
Urban bird	__[b]				
PWildbird	0.184	Ratio	0.0003	0.000	<0.001
		Vegcomm	0.098	0.023	0.002
PNeutral bird	0.321	Urban	0.159	0.039	0.002
PUrban bird	__[b]				
Habitat guilds					
Arboreal landbird	-5.295	Vegcomm	6.568	1.168	<0.001
		Woodland	6.159	1.726	0.006
Terrestrial landbird	-1.878	Ratio	0.009	0.004	0.030
		Vegcomm	7.326	1.725	0.002
Raptor	-4.668	Ratio	0.004	0.001	0.031
		Urban	10.207[c]	2.023	0.002
		Vernal pools	0.007	0.001	0.002
		Vegcomm	2.924	0.417	<0.001
		Paltered	-17.811	2.921	0.001
Shorebird	5.600	Public	-2.886	1.237	0.042
Waterbird	-0.778	Paltered	-10.674	2.162	0.001
		Vegcomm	4.814	0.878	<0.001
Wader	1.735	Emergent	1.441	0.522	0.022
		Public	-1.353	0.529	0.031
PArboreal landbird	0.263	Vernal pools	-0.0003	0.000	0.026
		Woodland	0.166	0.166	0.017
PTerrestrial landbird	0.541	Vegcomm	-0.053	0.021	0.030
PRaptor	__[b]				
PShorebird	0.076	Size	0.0001	0.000	0.015

Table 13. *Regression Values and Results for Bird Data, Spring 2003 cont.*

Guild[a]	Intercept	Parameter[a]	Coefficient	SE	P
PWaterbird	0.150	Grazed	-0.135[d]	0.029	0.002
		Urban	-0.147	0.032	0.003
		Vegcomm	0.053	0.012	0.003
		Paved	-0.073	0.022	0.014
PWader	__[b]				

[a] See Appendix C for definition of guilds and parameters.
[b] No significant predictors ($P < 0.05$).
[c] Coefficient was negative when parameter was tested independently.
[d] Coefficient was positive when parameter was tested independently.

Significant relationships were detected between landscape variables and the relative composition of four (percent Arboreal Landbirds, percent Terrestrial Landbirds, percent Shorebirds, and percent Waterbirds) of the six Habitat guilds (Table 13). The regression model for percent Waterbirds at a site had four significant predictors (three negative and one positive); the relative composition of the other guilds was predicted by only one or two variables. In general, parameters that were significant predictors of a guild's richness were not predictors of the guild's relative composition. For example, "Public" was a significant predictor for shorebird species richness, whereas preserve size was a significant predictor for the relative composition of shorebirds at a site.

Correlation of Independent Variables

Several of the independent variables were highly correlated ($r^2 > 0.60$) (Table 6 on page 37). Often several of these variables provided a significant ($p < 0.05$) contribution to the model when tested independently, but because of their high correlation, usually only the most significant variable was ever present in the final model. For example, preserve size was a significant predictor for the relative composition of Shorebirds at a site. When tested independently (i.e., not using stepwise regression), however, the preserve area to edge ratio was also a significant predictor.

We considered 12 landscape variables in the avian portion of our analysis. Of these 12 variables, nine were highly correlated with most other variables in the group (Table 6 on page 37). The group of highly correlated variables included Size, Ratio, Grazed, Urban, Vernal Pools, Length Linear, Paved, Public, and Paltered (see Appendix C for variable descriptions). The other three variables (Woodland, Emergent, and Vegcomm) were not highly correlated with any of the other independent variables.

Only two models contained ≥ 2 highly correlated independent variables: (1) Ratio, Urban, and Paltered were all predictors for Raptor guild richness, and (2) Grazed, Urban, and Paved were all predictors for the relative composition of Waterbirds at a site. Considering these two models, when each variable in the multiple regression model was tested independently, each one remained a significant predictor for the dependent variable being tested. However, as is often the case when multicolinearity exists, the response surface changed depending on the number of variables in the model. The effects of two variables in particular are worth

mentioning. Five independent variables were in the regression model for Raptor richness. "Urban" was a significant positive predictor for Raptor richness, but in the simple regression model, "Urban" was a significant negative predictor. Similarly, "Grazed" was a significant negative predictor for the relative composition of Waterbirds in the multiple regression model, but was a significant positive predictor in the simple regression model. In all cases, multiple regression analysis resulted in higher r^2 values and lower standard errors (than simple regression models), thus we chose not to omit any of the variables from the final model.

4.4 Mammals

Whereas some species or animal groups were observed within small portions of sites, some mammal groups were identified in nearly all, if not all, preserve sites. Table 14 summarizes species observations as a result of live trapping and mammal sign survey data for all preserve sites. Unidentified small rodents (mice and voles), unidentified small mammals (rat, rabbit, pocket gopher), valley pocket gopher, and blacktail jackrabbit were commonly encountered species. In contrast, California ground squirrel, striped skunk, fox, and mule deer signs were observed at fewer sites in significantly less frequencies.

4.4.1 Nocturnal Live Trapping

A total of four mammals, all rodent species, were captured during live trapping at the preserve study sites. Species included house mouse (*Mus musculus*), deer mouse (*Peromyscus maniculatus*), California mouse (*Peromyscus californicus*), and California vole (*Microtus californicus*). Zero to three individuals were captured at each site. Incidentally, most of the captured mammals were male. Overall, live trapping had a very low success rate and all captures were achieved within Sherman box traps, no Tomahawk traps. The number of traps, trap dates, and capture results are represented in Table 15.

The greatest number of captures (3 mice) occurred at Mahaney Park (18 acres), Woodcreek West Preserve (52 acres), and Aitken Ranch Mitigation Bank (310 acres). Two mice were captured at Woodcreek Oaks City Preserve (20 acres). One captured rodent was observed at Highland Reserve South (135 acres), Rodeo Grounds Preserve (145 acres), and Sheridan Mitigation Bank (184 acres). There were no captures within the remaining five preserve sites.

Table 14. *Species Identified by Site During Live Trapping and Surveys for Mammal Signs, Summer 2003*

	Preserve Location											
SPECIES	**Mahaney Park**	**Woodcreek Oaks City Preserve**	**Woodcreek North**	**Woodcreek West**	**SunCity Roseville**	**Stanford Ranch - Rocklin**	**Highland Reserve South Preserve**	**Rodeo Grounds Preserve**	**Sheridan**	**Aitken Ranch**	**East Sheridan**	**Orchard Creek**
Small rodent[1]	•	•	•	•	•	•	•	•	•	•	•	•
Small mammal[2]	•	•	•			•	•	•	•	•	•	•
CA ground squirrel			•		•							
Valley pocket gopher	•	•	•	•		•	•	•	•		•	•
woodrat										•		
Blacktail jackrabbit	•	•	•	•	•	•	•		•	•		
Raccon	•			•		•	•		•	•		
Skunk	•		•	•								
Bobcat										•		
Fox[3]				•			•	•				
Coyote	•				•			•	•	•	•	
Domestic dog	•		•	•			•					
Mule deer				•					•	•		
Acreage	18	20	46	52	68	125	135	145	184	310	317	708

[1] 'Small rodent' includes both signs postitively identifed as California vole and trapping of house mouse, deer mouse,
[2] 'Small mammal' includes signs postitively identifed as desert cottontail.
[3] Fox sign can belong from either red or gray fox species

Table 15. ***Dates and Results of Nocturnal Live Trapping, Summer 200 3***

Site	Preserve Size (acres)	Date	No.of Traps Set [1]	Species Captured		
				Scientific Name	Common Name	No. and Sex Caught
Mahaney Park	18	06/23/03	34(s), 5(t)	*Mus musculus*	House mouse	3 male
Woodcreek Oaks City Preserve	20	07/29/03	30(s), 5(t)	*Mus musculus*	House mouse	2 male
Woodcreek North Preserve	46	07/30/03	30(s), 5(t)	-	-	0
Woodcreek West Preserve	52	06/05/03	32(s), 5(t)	*Mus musculus*	House mouse	1 female, 1 male
Sun City Roseville	68	08/12/03	30(s)	-	-	0
Stanford Ranch Rocklin Vernal Pool Preserve	125	08/18/03	31(s)	-	-	0
Highland Reserve South	135	08/15/03				
-Parcel 84/91			30(s)	*Mus musculus*	House mouse	1 male
-Parcel 93			31(s)	-	-	
Rodeo Grounds Preserve	145	07/06/03	30(s), 5(t)	*Microtus californicus*	California vole	1 male
Sheridan Mitigation Bank	184	06/27/03	35(s), 5(t)	*Mus musculus*	House mouse	1 male
Aitken Ranch Mitigation Bank	310	06/26/03	36(s), 5(t)	*Peromyscus californicus*	California mouse	1 female, 1 male
East Sheridan Vernal Pool Preserve	317	07/01/03	30(s), 5(t)	-	-	0
Orchard Creek Mitigation Bank	708	07/05/03	34(s), 4(t)	-	-	0

[1] Trap type = (s) Sherman Box (t) Tomahawk

4.4.2 Mammal Sign Surveys

Several different types of mammal signs and species (or animal groups) were documented throughout the surveys (Appendix G). Many of the frequently observed signs were not identified to a particular taxonomic group. These unidentified signs have been categorized as either "unidentified small rodent" or "unidentified small mammal." Predominantly, those signs designated to the "unidentified small rodent" category were small burrow entrances, presumably those of California vole. However, these small burrows may have been concurrently used by one or more mouse species. "Unidentified small mammal" signs consisted of scat and burrows, typical of medium-sized rodents or rabbits. A list of those mammal species potentially accountable for the unidentified signs is presented in Table 16. The most commonly observed type of sign for each species is provided in Table 17.

Table 16. ***Potential Species Responsible for Signs Identified as "Small Mammal" and "Small Rodent," Summer 2003***

Category	Predominant Sign Observed	Species
Small Rodent	-Burrow openings less than 3 in. diameter	California vole (*Microtus californicus*)
		House mouse (*Mus musculus*)
		Deer mouse (*Peromyscus maniculatus)*
		California mouse (*Peromyscus californicus*)
		Western harvest mouse (*Reithrodontomys*
Small Mammal	-Burrow openings 3 in. diameter or greater. -Scat pellets	Desert cottontail (*Sylvilagus auduboni*)
		Valley pocket gopher (*Thamomys bottae)*
		Norway rat (*Rattus norvegicus*)

Table 17. ***Prevalent Type of Sign Observed for each Species, Summer 2003***

Species	Predominant Sign Observed
California vole (*Microtus californicus*)	Visual
California ground squirrel (*Spermophilus beecheyi*)	Audio
Valley pocket gopher (*Thomomys bottae*)	Burrow
Dusky-footed woodrat (*Neotoma fuscipes*)	Carcass
Desert cottontail (*Sylvilagus audubonii*)	Visual
Blacktail jackrabbit (*Lepus californicus*)	Scat, Visual
Raccoon (*Procyon lotor*)	Tracks
Striped skunk (*Mephitis mephitis*)	Tracks
Bobcat (*Lynx rufus*)	Tracks
Fox - red or gray (*Vulpes fulva or Urocyon*	Scat
Coyote (*Canis latrans*)	Scat, Trail
Domestic dog (*Canis familiaris*)	Scat
Mule deer (*Odocoileus hemionus*)	Scat

A disproportionate amount of observed mammal signs were classified within the unidentified small rodent category. This category contained between 25% and 82% of total signs recorded per site (average = 47%) (Table 18). Blacktail jackrabbit signs, specifically scat and visual observations, were the second largest sign type observed at preserve sites (range = 3 to 33%, average = 18%). Unidentified small mammal and Valley pocket gopher signs each averaged 15% of the total signs observed within preserve sites.

Small rodent signs dominated most sites. Small rodent signs were a particularly large proportion of the signs at the Rodeo Ground Preserve and Sheridan Mitigation Bank, consisting of 74% to 82% of all mammal signs recorded. In contrast, no small rodent signs were recorded at Aitken Ranch Mitigation Bank. However, three California mice were captured at this site, inconsistent with small rodent sign observation results. At Aitken Ranch, blacktail jackrabbit (25%), raccoon (36%), and coyote (25%) comprised the total observed mammal signs. Of all surveyed preserve sites, this site contained the second largest quantity (seven) of signs from different species, or animal types.

The greatest frequency of small rodent signs observed per survey hour (75 burrows or trails) occurred at Sheridan Mitigation Bank. In addition, Sheridan Mitigation Bank contained blacktail jackrabbit signs (17 scat piles and 6 visuals per hour), the second largest incidence of small rodent signs among all sites (Table 19). Unidentified small mammal (rat, gopher, rabbit) and Valley pocket gopher sign were adequately represented (4 signs/hour and 3 signs/hour, respectively) at Sheridan Mitigation Bank. Raccoon and coyote signs were also detected at this site.

Highland Reserve South contained high frequencies of mammal signs for three species (or types), including unidentified small rodents (4 per hour), Valley pocket gopher (3 per hour), and blacktail jackrabbit (5 per hour). Several incidences of unidentified small mammal, raccoon, fox, coyote, and domestic dog signs were also observed (1 per hour). Although a minimal number of signs per species occurrences were observed, this site encompassed the largest species signs diversity (eight).

Finally, the Stanford Ranch – Rocklin site also contained a substantial number of signs from different species (six). Unidentified small rodents (7 per hour), California vole (1 per hour), unidentified small mammals (2 per hour), Valley pocket gopher (4 per hour), blacktail jackrabbit (4 per hour), and raccoon (1 per hour) were also observed at this site.

Table 18. *Percent of Sign Obserbved by Mammal Type and by Site, Summer 2003*

Species or Mammal Type	Mahaney Park	Woodcreek Oaks City Preserve	Woodcreek North Preserve	Woodcreek West Preserve	Sun City Roseville	Stanford Ranch - Rocklin	Highland Reserve South Preserve	Rodeo Grounds Preserve	Sheridan Mitigation Bank	Aitken Ranch	East Sheridan	Orchard Creek	Average % sign by site
Unidentified small rodent	35	53	37	48	56	38	25	74	82	0	60	59	47
California vole	0	0	0	0	0	6	2	5	1	0	7	5	2
Unidentified small mammal	3	15	10	13	8	12	5	14	5	3	17	22	10
California ground squirrel	0	0	3	0	4	0	0	0	0	0	0	0	1
Valley pocket gopher	0	15	20	15	4	21	18	5	3	0	7	14	10
Dusky-footed woodrat	0	0	0	0	0	0	0	0	0	3	0	0	0
Desert cottontail	0	0	0	0	0	0	2	0	0	0	0	0	0
Blacktail jackrabbit	32	18	13	10	16	21	33	0	8	25	3	0	15
Racoon	14	0	0	3	0	3	4	0	1	36	0	0	5
Skunk	3	0	3	3	0	0	0	0	0	0	0	0	1
Bobcat	0	0	0	0	0	0	0	0	0	6	0	0	0
Gray fox	0	0	0	8	0	0	4	2	0	0	0	0	1
Coyote	8	0	0	3	12	0	4	2	1	25	7	0	5
Domestic dog	5	0	13	0	0	0	5	0	0	0	0	0	2
Mule deer	0	0	0	0	0	0	0	0	0	3	0	0	0
Acreage	18	20	46	52	68	125	135	145	184	310	317	708	
Area to Perimeter Ratio	194	131.7	127.6	231.9	361.5	312.2	139	486.5	590.1	851.3	744.4	1093.9	

Table 19. *Number of Signs Observed per Survey Hour by Mammal Type and by Site, Summer 2003*

	Number of Signs per Hour Surveyed												
Species or Mammal Type	**Mahaney Park**	**Woodcreek Oaks City Preserve**	**Woodcreek North Preserve**	**Woodcreek West Preserve**	**Sun City Roseville**	**Stanford Ranch - Rocklin**	**Highland Reserve South Preserve**	**Rodeo Grounds Preserve**	**Sheridan Mitigation Bank**	**Aitken Ranch Mitigation Bank**	**East Sheridan Vernal Pool Preserve**	**Orchard Creek Mitigation Bank**	**Average no. signs per hr. surveyd**
Unidentified small rodent	4	7	5	4	4	7	4	14	75	0	6	8	11
California vole	0	0	0	0	0	1	0	1	1	0	1	1	0
Unidentified small mammal	0	2	1	1	1	2	1	3	4	0	2	3	2
California ground squirrel	0	0	0	0	0	0	0	0	0	0	0	0	0
Botta's pocket gopher	0	2	3	1	0	4	3	1	3	0	1	2	2
Dusky-footed woodrat	0	0	0	0	0	0	0	0	0	0	0	0	0
Desert cottontail	0	0	0	0	0	0	0	0	0	0	0	0	0
Blacktail jackrabbit	4	2	2	1	1	4	5	0	7	3	0	0	2
Racoon	2	0	0	0	0	1	1	0	1	4	0	0	1
Striped skunk	0	0	0	0	0	0	0	0	0	0	0	0	0
Bobcat	0	0	0	0	0	0	0	0	0	1	0	0	0
Fox (red or gray)	0	0	0	1	0	0	1	0	0	0	0	0	0
Coyote	1	0	0	0	1	0	1	0	1	3	1	0	1
Domestic dog	0	0	2	0	0	0	1	0	0	0	0	0	0
Mule deer	0	0	0	0	0	0	0	0	0	0	0	0	0
Acreage	18	20	46	52	68	125	135	145	184	310	317	708	
Area to Perimeter Ratio	194	131.7	127.6	231.9	362	312.2	139	486.5	590.1	851.3	744.4	1093.9	

4.4.3 Comparison to Habitat and Landscape Characteristic Variables

No apparent patterns could be detected for mammal sign diversity, distribution by preserve size, and size–to–edge ratio. While the mammal diversity did vary among different preserves (Table 14 on page 81), the limited quantity of mammal collection data is not sufficient to justify statistical analysis and no apparent patterns could be detected for mammal sign diversity, distribution by preserve size, and size–to–edge ratio.

4.5 Amphibians

Table 20 presents amphibian occurrence data collected during aquatic surveys.

Table 20. ***Amphibian Survey Results (Present/Not Observed), Spring and Summer 2003***

Preserve	Pacific Treefrog	Western Toad	Western Spadefoot	Bullfrog
Mahaney Park	•			•
Woodcreek Oaks City Preserve	•			
Woodcreek North	•			•
Woodcreek West	•			•
Sun City Roseville	•			•
Stanford Ranch - Rocklin	•	•		•
Highland Reserve South	•	•		•
Rodeo Grounds Preserve	•			•
Sheridan Mitigation Bank	•			•
Aitken Ranch	•			•
East Sheridan	•			•
Orchard Creek	•			•

- = Species observed within the preserve

The Pacific treefrog (*Hyla regilla*) was observed within all of the study preserves and represented the most abundant and commonly observed amphibian species during this study. The mean percent of sampled features that were occupied by Pacific treefrogs during the survey visits was 55 percent, with a range of 21 to 90 percent (Table 21). Breeding activity (i.e., presence of egg masses or larvae) was confirmed at all study sites. Larvae were the most commonly observed lifestage of this species.

Western toads (*Bufo boreas)* were only observed at two of the study sites (Stanford Ranch-Rocklin and Highland Reserve South) (Table 22). In both instances, larvae represented the only lifestage observed. Specifically, the larvae were observed in several relatively large vernal pools and a seasonal wetland. Two of the features within Stanford Ranch-Rocklin in which toad larvae were observed were bermed which likely resulted in an increased hydroperiod for these features.

Table 21. *Summary of Pacific Treefrog Survey Results for each Preserve, Spring and Summer 2003*

Preserve	Lifestage(s) Observed[1]	Number of Features Sampled	Number of Features Occupied	% (Features Occupied/Features Sampled)
Mahaney Park	L	4	2	50
Woodcreek Oaks City Preserve	L, J	16	14	88
Woodcreek North	L	19	6	32
Woodcreek West	L, J	30	27	90
Sun City Roseville	L, J	13	11	85
Stanford Ranch - Rocklin	L, J, A	7	5	71
Highland Reserve South	L, J, A	45	26	58
Rodeo Grounds Preserve	L	19	5	26
Sheridan Mitigation Bank	L, A	40	19	48
Aitken Ranch	E, L, A	33	8	24
East Sheridan	E, L	56	12	21
Orchard Creek	L, J	34	8	24

[1] Lifestage: E=egg mass, L=larvae, J=juvenile, A=adult

Table 22. *Summary of Western Toad Survey Results for each Preserve, Spring and Summer 2003*

Preserve	Lifestage(s) Observed[1]	Number of Features Sampled (N)	Number of Features Occupied	% (Features Occupied/Features Sampled)
Mahaney Park	None	4	0	0
Woodcreek Oaks City Preserve	None	16	0	0
Woodcreek North	None	19	0	0
Woodcreek West	None	30	0	0
Sun City Roseville	None	13	0	0
Stanford Ranch - Rocklin	L	7	3	43
Highland Reserve South	L	45	3	7
Rodeo Grounds Preserve	None	19	0	0
Sheridan Mitigation Bank	None	40	0	0
Aitken Ranch	None	33	0	0
East Sheridan	None	56	0	0
Orchard Creek	None	34	0	0

[1] Lifestage: E=egg mass, L=larvae, J=juvenile, A=adult

No western spadefoot toads (*Spea hammondii),* a locally occurring state and federal Species of Special Concern, were observed during the amphibian surveys or other field efforts conducted in conjunction with this study. However, the survey effort was not sufficient to confirm the absence of western spadefoot toads within the selected preserves.

Finally, bullfrogs (*Rana catesbeiana)* were observed at all of the study sites, except Woodcreek Oaks City Preserve. Of the sites in which bullfrogs were observed, breeding was confirmed (i.e., presence of larvae) at Highland Reserve South, Aitken Ranch, Rodeo Grounds Preserve, and Orchard Creek (Table 23). At preserves in which bullfrogs were observed, the mean percentage of sampled features that were occupied during the survey visits was 13 percent, with a range of 2 to 25 percent (Table 23).

Table 23. ***Summary of Bullfrog Survey Results for each Preserve, Spring and Summer 2003***

Preserve	Lifestage(s) Observed[1]	Number of Features Sampled (N)	Number of Features Occupied	% (Features Occupied/Features Sampled)
Mahaney Park	A	4	1	25
Woodcreek Oaks City Preserve	None	16	0	0
Woodcreek North	J	19	2	11
Woodcreek West	A	30	1	3
Sun City Roseville	J	13	1	8
Stanford Ranch - Rocklin	A	7	1	14
Highland Reserve South	L, J, A	45	11	24
Rodeo Grounds Preserve	L	19	1	5
Sheridan Mitigation Bank	J, A	40	7	18
Aitken Ranch	L, J, A	33	3	9
East Sheridan	A	56	1	2
Orchard Creek	L, J, A	34	6	18

[1] Lifestage: E=egg mass, L=larvae, J=juvenile, A=adult

Adult and/or juvenile bullfrogs were observed in a variety of aquatic feature types, as shown in Table 24. The hydro-period of these feature types ranged from relatively short-lived vernal pools and seasonal wetlands to perennial stock ponds and creeks. Bullfrog larvae were observed in the following aquatic feature types: vernal pool, intermittent drainage, marsh, and perennial creek (Table 24). In general, these features were perennial or had relatively long hydro-periods relative to other available aquatic features within each preserve. There was only one instance of bullfrog breeding activity within a vernal pool. While, this feature was historically a vernal pool, it now functions as a part of a perennial marsh adjacent to a drainage.

Table 24. *Aquatic Feature Types in which Larvae, Juvenile, and Adult Bullfrogs were Observed, Spring and Summer 2003*

Preserve	Ephemeral Drainage	Vernal Pool	Seasonal Wetland	Intermittent Drainage	Marsh	Perennial Creek	Slough/ Canal	Pond
Mahaney Park						A		
Woodcreek North								J
Woodcreek West		A						
Sun City Roseville				J				
Stanford Ranch - Rocklin		A						
Highland Reserve South		L, J	J, A	L, J, A	J, A			
Rodeo Grounds Preserve						L		
Sheridan Mitigation Bank		J	J		A		J, A	
Aitken Ranch					L, J	A	J, A	
East Sheridan								A
Orchard Creek	J, A	J, A	J			L, J, A		

Lifestage: E=egg mass, L=larvae, J=juvenile, A=adult

As with the mammal data, while there was some variation in amphibian species richness among the different vernal pool preserve study sites, the dataset is not robust enough for quantitative analysis and no apparent patterns could be detected for mammal sign diversity, distribution by preserve size, and size–to–edge ratio.

4.6 Insect Pollinators

4.6.1 Summary Data

The number of pollinating insects collected per site ranged from 152 (at the 145-acre Rodeo Grounds Preserve) to 587 insects (at the 75-acre Sun City Roseville). A total of 159 pollinating insects were collected at the 46-acre Woodcreek North, the smallest site. At Orchard Creek (708 acres), the largest site, a total of 304 pollinating insects were collected. Pollinating insect density, calculated as insects per sweep (IPS), ranged from 0.4 IPS at Woodcreek North (46 acres) to 1.5 IPS at the Sheridan Mitigation Bank (101 acres). The pollinating insect density value for Orchard Creek was 0.6 IPS. Pollinating insect diversity ranged from 10 families at Sun City Lincoln and Woodcreek North to 14 families at Woodcreek Oaks (180 acres) (Table 25). A complete summary of pollinating insect diversity is presented in Table 26.

Table 25. ***Total, Density, and Diversity of Pollinating Insects Captured in the Placer County Vernal Pool Pollinating Insect Survey, Spring 2003.***

Site	Orchard Creek	Woodcreek North	Woodcreek Oaks	Woodcreek West	Highland Reserve South
Size (acres)	708	46	180	48	135
Date Sampled	5/15/03	3/31/03	5/20/03	5/06/03	5/14/03
Number Captured	304	159	476	585	387
Insects / Sweep	0.6	0.4	1.0	1.1	0.9
Diversity (Families)	13	10	14	13	12
Site	**Sun City Roseville**	**Sheridan Mitigation Bank**	**East Sheridan Property**	**Rodeo Grounds Preserve**	
Acres	75	101	317	145	
Date Sampled	5/06/03	5/14/03	5/14/03	5/13/03	
Total Captured	587	571	553	152	
Insects / Sweep	1.4	1.5	0.9	0.5	
Diversity (Families)	12	13	11	10	

The most abundant pollinating insect guilds at all sites except Woodcreek North and Aitken Ranch were families belonging to the Ephidridae, Lauxaniidae, Chamaemyiidae, Milichiidae, and Chloropidae (grouped as unidentified Diptera) (Figure 37). At the Woodcreek North Preserve, the Melyridae beetle family (Coleoptera) was most abundant. Syrphidae were the second most abundant pollinators at all sites, with the exception of the Orchard Creek, Woodcreek North, and Woodcreek West Preserves. Solitary bees, in the Andrenidae and Halictidae families (Hymenoptera), comprised no more than 10.9% (observed at Orchard Creek Preserve) of the pollinating insects at any site. Solitary bees were captured in less than 1% of the pollinating insect samples at four sites (Highland Reserve South, Sun City Roseville, Sheridan Mitigation Bank, and Rodeo Grounds Preserve). Overall, the Andrenidae and Halictidae families were more abundant at larger sites with existing vernal pools. Raw data including the amount of insects per family at each pool are presented in Appendix I.

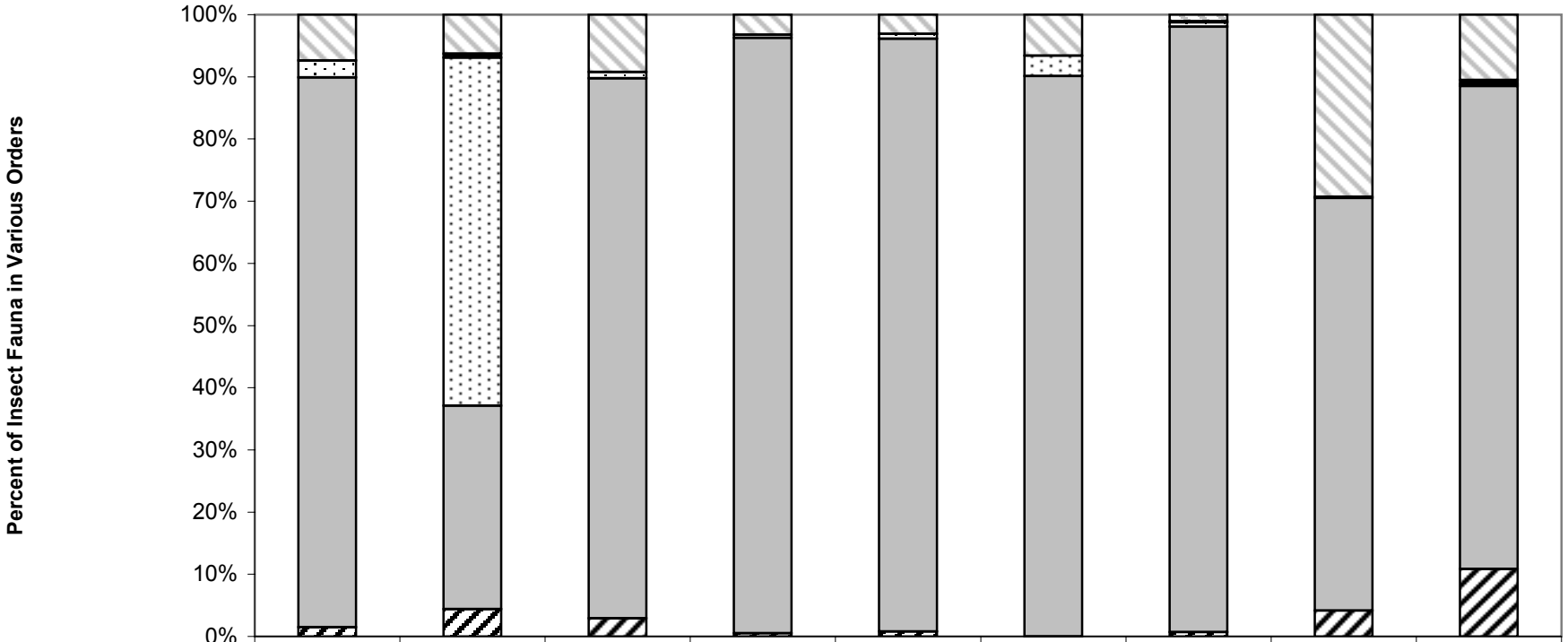
Climatic conditions on sampling dates were all similar. The Woodcreek North Preserve was the only site where sampling was completed prior to any heavy spring rain events. Surveys at this site were completed approximately five to seven weeks earlier than the remainder of the sites. In addition, plant species observed at each site were largely consistent. Downingia (*Downingia sp.*), coyote thistle (*Eryngium sp.*), Fremont's goldfields (*Lasthenia fremontii*), hawkbit (*Leontodon taraxacoides*), white-headed navarettia (*Navarretia leucocephala*), and stalked popcorn-flower (*Plagiobothrys stipitatus*), were abundant at all sites.

Again, due to the preliminary nature of the insect pollinator data, no quantitative analyses were conducted relative to the habitat and landscape characteristics, but these data serve as baseline information on known and possible pollinator species.

Table 26. *Insect Taxa Identified, Pollinating Insect Survey, Spring 2003.*

Order	Family	Total # Identified
Hymenoptera	Andrenidae	34
	Apidae	2
	Brachonidae	6
	Halictidae	53
	Megachilidae	1
	Sphecidae	1
Diptera	Anthomyiidae	47
	Bombyliidae	348
	Calliphoridae	16
	Dolichopodidae	- -
	Empididae	49
	Luaxaniidae	5
	Muscidae	81
	Syrphidae	470
	Tephritidae	53
	Unidentified	2003
Coleoptera	Coccinelidae	38
	Demerstidae	8
	Melyridae	75
Lepidoptera	Hesperidae	- -
	Incurvariidae	4
	Pieridae	1
	Lycaenidae	- -
Hemiptera	Miridae	334

Figure 37. ***Percentage of Pollinating Insect Orders by Site, Placer County Vernal Pool Preserves, Spring 2003***



	Woodcreek Oaks City Preserve	Woodcreek North Preserve	Woodcreek West Preserve	Sun City Roseville	Highland Reserve South	Rodeo Grounds Preserve	Sheridan Mitigation Bank	East Sheridan Vernal Pool Preserve	Orchard Creek Mitigation Bank
Percent Hemiptera	7.4%	6.3%	9.2%	3.2%	3.1%	6.6%	1.1%	29.3%	10.5%
Percent Lepidoptera	0.0%	0.6%	0.0%	0.0%	0.0%	0.0%	0.2%	0.2%	0.7%
Percent Coleoptera	2.7%	56.0%	1.0%	0.5%	0.8%	3.3%	0.7%	0.0%	0.3%
Percent Diptera	88.2%	32.7%	86.8%	95.7%	95.3%	90.1%	97.4%	66.4%	77.6%
Percent Hymenoptera	1.5%	4.4%	2.9%	0.5%	0.8%	0.0%	0.7%	4.2%	10.9%

Preserve Name (Arranged Smallest to Largest)

4.7 Other Anecdotal Species Observations

While not the focus of surveys included in this study, a number of other reptiles, fish, and invertebrate species were noted at the various field sites (Table 27). These data are anecdotal and the lack of data about these species at other sites or the lack of detections of other species should not be considered determinant.

Table 27. ***Incidental Animal Observations, Spring and Summer 2003***

Common Name	Scientific Name	Preserves Where Species were Observed
Invertebrates		
Vernal pool fairy shrimp	*Branchinecta* sp.	East Sheridan
California linderiella	*Linderiella occidentalis*	Sheridan
Crayfish		Highland Reserve South; Rodeo Grounds Preserve; Orchard Creek; Mahaney Park
Fish		
Bass	*Micropteris* sp.	Sheridan (pond); Orchard Creek (vernal pool)
Mosquitofish	*Gambusia affinis*	Highland Reserve South; Mahaney Park
Reptiles		
Pond turtle	*Clemmys marmorata marmorata*	Sheridan Mitigation Bank
Kingsnake	*Lampropeltis getula californiae*	Sheridan Mitigation Bank
Valley garter snake	*Thamnophis sirtalis fitchi*	Orchard Creek; Sheridan
Mountain garter snake	*Thamnophis elegans elegans*	Woodcreek West; Highland Reserve South; Sun City Roseville; Woodcreek Oaks City Preserve; Stanford Ranch Rocklin
Gopher snake	*Pituophis catenifer*	Highland Reserve South; Rodeo Grounds Preserve
Racer	*Coluber constrictor*	Sun City Roseville; Stanford Ranch Rocklin
Western fence lizard	*Sceloporus occidentalis*	Rodeo Grounds Preserve; Orchard Creek; Sheridan; Sun City Roseville; Woodcreek North
Gilbert's skink	*Eumeces gilberti*	Woodcreek North

5.0 DISCUSSION

5.1 Biodiversity of Placer County's Vernal Pool Landscapes

The results of this study have provided preliminary data on the flora and fauna of Placer County's vernal pool landscapes. In summary:

- A total of 184 plant species were documented within sampled vernal pools.
- Of those 184 plant species, 60.3% were vernal pool species and 32.6% were native species.
- The most frequently encountered plants found in the local vernal pools were *Plagiobothrys stipitatus*, *Lolium multiflorum*, *Eryngium vaseyi*, *Hordeum marinum*, *Lasthenia fremontii*, and *Lythrum hyssopifolium*. These include vernal pool indicator or obligate species with a few wetland generalist species.
- A total of 102 different bird species were documented using vernal pool landscapes.
- The diversity of birds documented using vernal pool landscapes during spring surveys included waterfowl, shorebirds, raptors, and various other terrestrial birds; the five most common bird species encountered were killdeer, mourning dove, western kingbird, western meadowlark, and house finch.
- Special status species documented included one plant (*Downingia pusilla*), 14 birds including four breeding or potentially breeding birds, and the federally-listed vernal pool fairy shrimp (*Branchinecta lynchi*); no special status mammals or amphibians were detected.
- The most common mammals within the vernal pool landscape were jackrabbits and small rodents such as California vole, mice, and gophers. Other occasionally occurring wild mammals included ground squirrel, wood rat, raccoon, skunk, fox, bobcat, coyote, and mule deer.
- Pacific tree frogs and bullfrogs were ubiquitous within the study sites while western toads only occurred at a few study sites. Western spadefoot toads were not encountered.
- A total of 14 families of pollinating insects, including the solitary bees in the Andrenidae and Halictidae families (Hymenoptera) and other potential pollinators were documented within sampled vernal pools.

5.1.1 Plants

Vernal pools in western Placer County support several floristic communities. Vernal pools within and among the study sites included shallow pools and deep pools and their floristic composition reflected this diversity. Barbour et al. (2003) concluded that there are sixteen different floristic communities that occur within California's vernal pools, with a single vernal pool potentially supporting several of these communities. The most common dominant species from our study (*Eryngium vaseyi, Lasthenia fremontii, Plagiobothrys stipitatus, Navarretia leucocephala, Hordeum marinum, Ranunculus bonariensis, Lolium multiflorum,* and *Eleocharis macrostachya*) were species that the Barbour et al. (2003) study found to occur commonly across a number of different vernal pool community types. Our data also documented the presence of a number of dominant species in both the "Lasthenia glaberrima group" (100 pools) and the "Achyrachaena mollis group" (21 pools). According to Barbour et al. (2003) these groups

represent the two ends of the vernal pool floristic spectrum ranging from the deepest vernal pools or pool bottoms to very shallow vernal pools or pool edges.

In addition to the range of vernal pool communities represented, there were also a few wetland features originally mapped and preserved as vernal pools that now have a more marsh-like floristic composition. For example, this study documented cattails (*Typha* sp.) in four vernal pools within the Highland Reserve South preserve. These pools were originally delineated as vernal pools by Sugnet & Associates (now ECORP Consulting, Inc.) and verified by the U.S. Army Corps of Engineers in the late 1980's. They have been part of the Highland Reserve South vernal pool preserve since the early 1990's. These pools are discussed in the altered hydrology discussion below.

In terms of native species, this study supports the conclusion, also documented in Barbour et al. (2003), that while vernal pools are generally dominated by native species, their floristic composition is not exclusively dominated by native species, and in shallower pools, non-native species like *Hordeum marinum* and *Lolium multiflorum* are often ubiquitous.

As a cautionary note, it is important to remember that this study only collected plant data from vernal pools and not from the surrounding grasslands. Thus, the overall plant species richness of each site would be higher if data from the surrounding grassland matrix were included in the overall assessment of biodiversity. An additional increase in overall floristic diversity would be expected with the presence of other vegetation communities such as blue oak woodland or valley foothill riparian.

Further discussions of the factors potentially influencing variability in plant species richness among the different preserves is discussed in Section 5.2 (*Factors Influencing Vernal Pool Landscape Biodiversity*) below.

5.1.2 Birds

As with plant species diversity, western Placer County vernal pool landscapes support a diverse array of bird species. However, while most sites had at least one species in each of the guild categories, the composition of bird species appeared to vary from site to site. By quantifying the relative composition of each guild at each site, the similarities and differences in avian composition were compared among sites. Relative species composition data further documents variability in bird use among vernal pool preserves in Placer County. Of the nine relative composition variables (e.g., percent wildbirds, percent shorebirds), there was only one variable (percent Terrestrial Landbirds) for which the maximum value was not at least twice as large as the minimum value. For example, Arboreal Landbirds comprised 52% of the species detected at the Woodcreek Oaks site but only 8% of the species at the East Sheridan site.

Silveira (1998) states that many types of avian species use vernal pool landscapes and suggests that vernal pools are important to the survival of many species. In particular, Silveira (1998) states that vernal pools are important refueling stations for migratory waterbirds, and that vernal pools function as "pair water" in the breeding territory of local nesting ducks such as mallards (*Anas platyrhynchos*) and cinnamon teal (*A. cyanoptera*). With regards to seasonal use, Silveira (1998) states that vernal pools are used by several dabbling duck species during

February and March, and that greatest shorebird use occurs in March and April. Surpisingly, in this study, relatively few bird species or individuals were detected using vernal pools during March and April. Instead, most of the species we detected were using the surrounding landscape. Of the 102 species detected, only 15 species (Table 28) were observed using vernal pools. In addition, all of the species observed using vernal pools also were observed in other habitats and many appeared relatively more abundant in other non-vernal pool landscape habitat types (e.g., emergent marsh, pond). Although we are unaware of any research that has attempted to quantify bird selection of vernal pool landscape over other landscape types, Silveira (1998) seems to suggest that vernal pools are a highly used and preferred landscape type during many seasons of the year. Our results from the Spring of 2003 do not appear to support that suggestion.

Table 28. ***Bird Species Observed Using Vernal Pools, Spring 2003***

Common Name	**Scientific Name**
Great Egret	*Ardea alba*
Snowy Egret	*Egretta thula*
Canada Goose	*Branta canadensis*
American Wigeon	*Anas americana*
Mallard	*Anas platyrhynchos*
Cinnamon Teal	*Anas cyanoptera*
Killdeer	*Charadrius vociferous*
Black-necked Stilt	*Himantopus mexicanus*
Greater Yellowlegs	*Tringa melanoleuca*
Least Sandpiper	*Calidris minutilla*
Common Snipe	*Gallinago gallinago*
Tree Swallow	*Tachycineta bicolor*
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*
Barn Swallow	*Hirundo rustica*
Cliff Swallow	*Petrochelidon pyrrhonota*

There are several possible explanations for why we detected such infrequent bird use of vernal pools including survey timing and possible preferential use of other wetland habitat types. Silveira (1998) suggests three alternate explanations: (1) surveying bird use of vernal pools is difficult because of the ephemeral nature of vernal pools, and the temporal variability in which they produce invertebrates; (2) because vernal pools mostly occur in small, isolated basins, there are difficulties in survey access and coverage; or (3) the social structure of birds in late winter and spring makes their detection difficult. We believe that our survey effort was extensive enough to adequately determine the bird species using vernal pools at our study sites during the time in which the surveys were conducted. However, we acknowledge that especially during spring migration, bird use of an area is often very dynamic, and that most wetland bird species exploit vernal pool resources for only a few days before moving on. These characteristics present two situations, that if they occurred, could have influenced the study's results: (1) surveys missed part (or all) of the time period when certain migratory bird species were present, and/or (2) surveys missed part (or all) of the time period when bird species were exploiting vernal pool resources. We suspect that both of these situations at least partially

occurred because of the limited number of surveys per site, and the amount of effort that is required to thoroughly document bird use of an area during spring migration. The results of the Sun City Roseville surveys provide a good example of the variability that occurs in bird use of vernal pools during spring migration. During the 15 April survey, numerous common snipe were detected using several of the vernal pools at the site. One week later, however, no common snipe were detected at the site. A single snipe was detected at the site during the final survey (30 April).

Further discussions of the factors potentially influencing variability in bird species richness among the different preserves is discussed in Section 5.2 (*Factors Influencing Vernal Pool Landscape Biodiversity*) below.

5.1.3 Mammals

Overall, qualitative survey data indicated that the diversity of mammals varied somewhat from site to site. Most of the species found within the study sites are common, generalist species, typical of annual grassland communities and species that do well in close proximity to human development and in fragmented landscapes. These include various rodents such as voles, gophers and deer mice, and other urban wildlife species such as black-tailed jackrabbit, coyote, striped skunk, and raccoon. More specialized or disturbance-prone species such as bobcat and dusky-footed woodrat occurred at only one of the 12 sites (Aitken Ranch). Also, while historically known to occur in the study area (e.g. Woodcreek North Preserve), no American badgers (or sign) were detected during this study.

Obviously, a much more intensive sampling effort would be needed better to assess mammal diversity and use patterns. Further, it is very likely that preserve setting is an important influence on these patterns, particularly in relation to wildlife corridors and proximity to other vegetation communities. The presence of corridors such as creeks either onsite or adjacent to a site may permit movements of some larger mammals such as deer. Thus, relatively small preserves such as Woodcreek North may have had deer use not because of the size of the preserve, but instead because of the creek that provides a corridor for some species through the site, connecting it with other open space areas. In rare cases, mammals not typical of vernal pool landscapes have accessed local vernal pool sites by following creek corridors. For example, in 2000, a black bear was observed in a vernal pool complex just south of Rock Creek, west of Fiddyment Road, by California Department of Fish and Game personnel (J. Stewart, personal communication, 15 January 2000).

5.1.4 Amphibians

Amphibian results were similar among the different study sites. Pacific treefrogs (chorus frogs) were encountered at all sites and bullfrogs were also present but in much fewer numbers. Pacific treefrogs, which exhibit highly opportunistic breeding behavior, were found to breed at all of the study sites. In some instances several cohorts of Pacific treefrogs were documented. Bullfrogs observed consisted almost entirely of adult or juvenile frogs. Bullfrog larvae were identified in only one feature labeled as a vernal pool. As discussed earlier, this wetland is a historic vernal pool that is immediately adjacent and hydrologically connected to a perennial

drainage. Thus, while the data show bullfrogs breeding in a vernal pool, that feature would more accurately be characterized as a "seasonal marsh."

Bullfrogs are an increasingly common visitor to vernal pool landscapes (Balfour and Morey 1993). Increases in the hydroperiod of once ephemeral drainages and pools have allowed bullfrogs to access vernal pool landscapes. Adult and juvenile bullfrogs disperse to vernal pool grasslands during the rainy season. They have been documented to travel over five miles across land during these dispersal events (Schwalbe and Rosen 2002). While the effects bullfrogs have on vernal pool fauna are not understood, there is reason to believe that they have the potential to negatively resident wildlife. Bullfrogs are highly voracious in their feeding habitats and have been implicated in local declines of some native species (Moyle 1973). They are known to feed on various vernal pool organisms including vernal pool crustaceans, Pacific treefrogs, and larvae of both California tiger salamander and Western spadefoot toad (Hayes and Warner 1985; Balfour and Morey 2003; Balfour and Stitt 2003; J. Ranlett, personal communication, 15 April 2004).

Western toads were the least commonly observed amphibians in our study. This species typically requires large vernal pools, stock ponds and drainages that hold water for an extended period. Most of the naturally occurring vernal pools in western Placer County are very ephemeral and often do not represent reliable breeding ponds. As such, toad breeding usually occurs in longer-lived waterbodies.

Western spadefoot toads were not encountered on any of the study sites. While Placer County lies within the broader range of the Western spadefoot toad, there are few documented records for the County (CDFG 2003). This species is uncommon in the County and some historically documented populations may no longer exist due to habitat modifications. The species is known to occur in the Rocklin area, portions of western Roseville, and a site west of Lincoln, California (CDFG 2003, P. Balfour, personal observation, 4 April 2003; B. Williams, personal communication, 1 March 2004). In the early 1990's, spadefoot toads were documented to breed in drainages and a constructed vernal pool within a Merhten vernal pool complex near the location of the current Roseville Galleria (P. Balfour, personal observation, 2 March 1991). Larval western spadefoots were encountered in a railroad side pool, an historical locality, during the 2003 survey season (P. Balfour, personal observation, 21 March 2003).

As with the western toad, western spadefoots typically require relatively long-lived pools, intermittent drainage plunge pools, and stock ponds for breeding. Many of the vernal pools in western Placer County do not pond for sufficient periods to support successful breeding. Spadefoots in Placer County are known to breed in relatively deep man-made features such as ponded areas adjacent to railroad tracks and in intermittent drainage plunge pools that hold water through late spring. Spadefoots were historically known to breed in an intermittent portion of Kaseburg Creek (P. Balfour, personal observation, 12 April 1992). This and several other drainages have since become perennial and currently support an array of predatory species such as non- native warm water fish species, bullfrogs, and crayfish. While it is possible that western spadefoot populations still persist within some of the study areas (e.g., Sun City Roseville), none were observed during the current study. A more intensive focused study conducted over several years would be needed to establish presence.

5.1.5 Insect Pollinators

In general, while the number of insects captured varied among the different sites, there were no notable differences in pollinating insect diversity among the vernal pool preserve sites, with the exception of the Woodcreek North Preserve. Woodcreek North was sampled early in the season and only two families were collected; thus, the observable difference between Woodcreek North and the other preserves was most likely due to the bias of an earlier sampling date.

Flies, belonging to the families Ephidridae, Lauxaniidae, Chamaemyiidae, Milichiidae, and Chloropidae (grouped as unidentified Diptera), were the most abundant pollinating insect guild at all sites, except Woodcreek North. While these flies were observed on flowers (primarily *Lasthenia fremontii*) at all sites, they may not be important pollinators for most vernal pool plant species. This is because the relatively small size of these flies (1-3 mm), coupled with their lack of pollen gathering setae, does not permit them to collect, or transport, appreciable amounts of pollen. However, Diptera species in the families Syrphidae and Bombyliidae were also captured during surveys and they are important pollinators, as they actively forage for pollen and nectar. The relatively large members (mostly 6-12 mm) of Bombyliidae family possess numerous long setae that are ideal for the adhesion and transport of pollen.

Although solitary bees (in Andrenidae, Halictidae, and Megachilidae families) did not comprise a large overall percentage of the pollinating insects captured in this survey, they are likely important as pollinators (Leong and Thorp, 1998, Thorp 1976). Andrenidae, Halictidae, and Megachilidae actively forage for pollen for brood production, completing numerous flower visits per day (Thorp 1976). Like the honeybee, they possess specialized pollen gathering setae forming "baskets" to optimize pollen collection. The Andrenidae, Halictidae, and Megachilidae families have specialized upland habitat requirements for nesting. For their underground nests, most require relatively sandy, upland sites that are largely devoid of vegetation. As discussed in the next section of this document, grazing may be important to solitary bees by reducing thatch and maintaining potential nesting areas. We are not aware of any studies that have evaluated this question, but we suggest it as a possible topic of future research.

5.2 Factors Influencing Vernal Pool Landscape Biodiversity

As summarized in section 5.1, spring and summer 2003 data shows that local Placer County vernal pool landscapes support a variety of plant, bird, mammal, amphibian, and insect pollinator species and the composition of species at any one site appears to vary within certain of these taxa groups. The results of our study suggest that some factors (e.g., preserve area to perimeter ratio, diversity of vegetation communities, and several anthropogenic influences) influence specific aspects of this variability, whereas others (e.g., preserve size) do not.

5.2.1 Preserve Size

As discussed in the introduction, the general theoretical prediction is that larger reserves will support a greater number of species (Meffe et al. 1997). Because this study included sites ranging from 18 acres to 708 acres, the expectation would be that the largest preserves would

have the highest species richness. However, no statistically significant relationships were detected between species richness of the studied taxa and vernal pool preserve size. For example, the overall plant species richness at Orchard Creek (708 acres) was the same as the overall plant species richness at Woodcreek West (52 acres). Similarly, in terms of bird species richness, the largest two preserves had 24-31 bird species, the smallest three preserves had 21-33 bird species, with two in-between preserves supporting over 70 different bird species.

The relationship of patch size has been more extensively studied for birds and numerous studies have detected a positive relationship between avian species richness and habitat patch size (e.g., Hemesath and Dinsmore 1993, Brown 1995, Findlay and Houlahan 1997). In addition, it is believed that many avian species are area-dependent, and are restricted to only large "patches" of habitat (Lynch and Whitcomb 1978, Tyser 1983). To reconcile the results of this study with this previous research, we conclude there must be other factors more strongly influencing species diversity than preserve size. Factors such as the heterogeneity of habitat and other variables among sites are all potential contributors and are discussed below.

While not statistically analyzed, the relative percentage of the pollinating insects that were solitary bees (Andrenidae, Halictidae, and Megachilidae families) was noticeably larger at the largest preserve (Orchard Creek). Because the proportion of solitary bees did not show any kind of gradual increase as preserve size increased with any of the other sites, we cannot conclude that there are more solitary bees at larger sites. To do so would require a much more rigorous sampling program. The increased presence of solitary bees at Orchard Creek may be worthy of further investigation to try to determine if there are specific management practices (e.g., limited grazing, mowing, burning) that may facilitate the presence of these important pollinators.

Finally, there are some factors that one would presume are directly related to preserve size such as number of vernal pools and acreage of vernal pools at a site; however, these factors are not necessarily linked. This is an important distinction for this study because, while there was no significant relationship between plant species diversity and preserve size, three plant species richness values (overall plant species richness, vernal pool species richness, and native plant species richness) were all significantly related to the number of vernal pools. These data may suggest that sites with more individual vernal pool features have greater plant species diversity. This could be explained by the fact that an increase in the number of pools probably results in an increase in different microtopographic configurations leading to a greater variety of vernal pool plant communities. An alternative explanation is that this could be explained as the result of a sampling bias caused by having larger sample sizes for sites with more vernal pools.

5.2.2 Perimeter to Area Ratio

The area to perimeter ratio represents a measure of a relative amount of protected interior habitat to the amount of edge habitat. A high ratio may indicate potential success of a preserve in protecting interior species that presumably require undisturbed habitat away from edges. This seems to imply that preserves with a higher area to perimeter ratio should have higher species diversity but a second ecological phenomenon alters this assumption. Habitat edges or where two habitats meet tend to have greater species richness. Thus, preserves with a low ratio may have a higher species richness simply because there is more edge habitat for habitat

generalists to invade. Where the edge is characterized by human disturbances (development, farming, etc.), those generalist species that are especially tolerant of human activity are expected to be even more common along these edges.

In this study, the area to perimeter ratio was a significant predictor of spring avian species richness but not of vernal pool plant species richness. In terms of the Development guild, a high area to perimeter ratio was also a significant predictor of the increased richness and relative composition of Wild birds. This positive relationship could be attributed to: (1) the confounding effects of preserve size and other variables highly correlated with preserve area to perimeter ratio, and (2) some species (e.g., northern harrier) requiring unfragmented interior habitat.

The fact that vernal pool plant species richness was not significantly related to area to perimeter ratio may be due the fact that "interior" species are replaced by "edge" species as the ratio decreases or it may be due to the fact that vernal pools function as their own ecosystem within the grassland matrix and their "edge" is surrounding each pool not the overall landscape. A separate analysis of the changes in plant community composition would be necessary to further understand the potential effect of preserve edge on vernal pool plants.

5.2.3 Vegetation Community Diversity

The relationship of species richness to vegetation community diversity varied with different taxa groups. Not surprisingly, more bird species were detected during the spring at sites having more vegetation communities. However, there was no relationship between the number of vegetation communities and overall plant species richness and vernal pool plant species richness was actually significantly lower for sites with more vegetation communities.

For birds, because they are resource-dependent, a site with several different vegetation communities is more likely to meet the resource needs of any given species, and more likely to support different types of species (e.g., Arboreal Landbirds, Shorebirds). Other researchers have detected similar results. For example, Skagen and Knopf (1994) reported that the number of shorebirds occupying a site during migration was positively correlated with the amount of wet mud present within the site. In this study, which was limited to spring bird surveys, sites without emergent wetlands generally did not have wet mud and thus were less likely to support use by many shorebird species, a factor that reduced overall species richness. The number of vegetation communities at a site appeared to be the single best predictor of guild species richness; it was a significant predictor for six of the nine guilds. Again, this can likely be explained by a resource-dependent relationship: the more different types of resources, the more likely the needs of a given species will be met. This is probably especially true for guilds with diverse species and resource needs (e.g., Arboreal Landbirds and Terrestrial Landbirds) as opposed to guilds that are primarily dependent on the presence of one key resource (as in Shorebirds with wet mud).

One landscape variable that was a significant predictor of special-status bird species richness in this study was the presence of emergent freshwater marsh habitat on-site. The resource-dependency concept is again a likely explanation for why more special-status bird species were

detected at sites with emergent wetlands. Of the 14 special-status species detected, 10 are considered wetland birds and several occur primarily in emergent wetland habitat.

The decrease in vernal pool plant species richness at sites with more vegetation communities may suggest that a preserve with more habitat diversity is determinental to vernal pool plants. However, the study was not specifically designed to include replicates of different vegetation communities in association with vernal pool landscapes so this result may be an artifact of small sample size. Another explanation may be that the number of vegetation communities was an indicator of the influence of other factors. For example, the number of vegetation communities was positively correlated with the presence of irrigation run-off, perennial water features, and beaver activity on site. It seems more likely that the associated impacts of altered hydrology (as discussed below) rather than the presence of different vegetation communities are the real factor behind this result for the sites included in this study.

Finally, in terms of the qualitative mammal observations, Aitken Ranch Mitigation Bank and Sheridan Mitigation Banks had the highest documented number of mammal species (as measured by observed sign). Seven and eight species, respectively, were observed at these two sites, whereas four to five species were recorded for the remaining sites. These two sites were the only sites with both a well-developed riparian corridor and emergent marsh habitat in addition to their vernal pool grasslands. This habitat combination creates an edge whereby animals can use the shrubby vegetation of the riparian zone for protection, nest/den cavities, and a favorable microclimate, but they can also venture into the grassland to forage. Three species (California mouse, bobcat, and dusky footed woodrat) were documented only at Aitken Ranch. All three of these additional species are more closely associated with shrubby woodland and chaparral habitats. California mice are known to use woodrat nests for cover and the two species often occur in close association.

5.2.4 Anthropogenic Influences

Human activities have a variety of influences, both direct and indirect, on vernal pool preserves. Direct effects include management actions (e.g., grazing, construction of man-made vernal pools, allowing public access) and on-site vandalism (e.g., damage by off-road vehicles, trash dumping etc.). Indirect effects, or edge effects, are the usually unintended effects of off-site activities on the preserve itself. Even the most "pristine" ecosystems may not be self-sustaining as the effects of adjacent lands may adversely affect the preserved ecosystem. Edge effects can be both biotic (increased introduced predators, competitors) and abiotic (more variable weather, non-seasonal water inputs etc.). Probably the most significant indirect effect human activity has on preserved vernal pools is altered hydrology.

Understanding how anthropogenic influences impact biodiversity is difficult because the effects may be subtle and interrelated. Of the anthropogenic influences measured in this study, there were no significant relationships detected for either overall plant or spring bird species richness. However, a number of significant differences were noted when the plant data were summarized as a mean per pool value rather than an overall richness number per preserve. Additionally, significant relationships were also detected for special-status bird species and two anthropogenic influences. These results are discussed in more detail below.

Preserve Location

Preserves in this study were classified as either urban or rural with the assumption that this classification may be a surrogate for a number of additional anthropogenic influences. Presumably, urban reserves would have more negative influences, resulting in lower biodiversity through time. Our study showed that an Urban or Rural preserve location was not a good predictor for any of the summary species richness values; however, Urban reserves did have fewer mean plant species per pool and fewer special-status bird species during spring migration.

The preserves used in this study varied in age with Highland Reserve South being in place since the early 1990's and with the East Sheridan Vernal Pool Preserve in the beginning stages of preserve establishment. However, "age of preserve" was not included in the study's analyses for several reasons: (1)because of the difficulty in defining each preserve's age, (2) because of the bias that would be associated with comparing age across different sites, and (3) because of the small sample size and the limited number of sites within each age group (from which results would be based). Although we did not analyze preserve age in our study, scientists (e.g., Gleason 1917, Van der Valk 1981) believe a wetland's vegetation composition, structure, and cover are highly correlated with its age. This may be especially true at preserves with created vernal pools. Succession usually occurs relatively rapidly at newly created wetlands as plant species become established in exposed soil. Following plant establishment. successional changes may continue for many years as the result of competition, immigration, and extirpation. Because many animal species have vegetation structure and cover requirements, it is believed that species composition and diversity changes as vegetation changes.

The presence of paved trails and public access are also presumed indicators of increased human affects on a preserve; and because both of these factors were significantly correlated with Urban preserves, it is difficult to distinguish the actual effect of a site's urban status on these diversity values. The availability of public access had no discernable effect on plant species richness (overall or mean per pool). Sites with paved paths however, showed significantly lower numbers for mean plant species per pool, mean vernal pool plant species per pool, and mean native plant species richness per pool. This is a contrast to Urban sites that saw a significant decrease in mean plant species richness per pool but no significant changes in native or vernal pool species richness per pool. Thus, paved paths appear to have a more important negative effect on vernal plant composition than urban or rural locations; this factor is probably related to altered hydrology as discussed below.

The decreased diversity of special status birds in Urban preserves during the spring may the result of increased human activity in Urban preserves. Many special status bird species are known to be sensitive to human disturbance, especially during the breeding season. Special status bird species detected in our study that are known to be susceptible to human disturbance include the American bittern, great egret, and snowy egret (among others). Other studies have also documented lower avian diversity in urban areas. For example, although not limited to special status species, Friesen et al. (1995) concluded that the richness and abundance of neotropical migrant birds decreased with increased urban development. Some studies (e.g., Matessi and Bogliani 1999) have attempted to determine the causation for the decline, and have

pointed to factors such as reduced nesting success and higher predation associated with human disturbance.

Some researchers (e.g., Gutzwiller et al. 1998) have found that low levels of human intrusion (one person for 1 or 2 hours per week) are tolerable to many bird species. However, most research indicates that human intrusion can alter bird behavior and community structure. Fernadez-Juricic (2000) found that disturbance by pedestrians and vehicles reduced species persistence, guild density, and probability of occupation by individual bird species. Bias et al. (1997) reported that frequent disturbance has been shown to greatly reduce bird use of an area, negatively impact a bird's energy budget, and cause reproductive failure. For example, human disturbance to nesting colonies of colonial bird species (e.g., herons, egrets) has been directly linked to nest abandonment and reproductive failure (e.g., Cogswell 1977, Tremblay and Ellison 1979).

Finally, California vole, gopher, deer mice, house mice, and blacktailed jackrabbit were fairly common throughout all the study sites. A number of these herbivorous species are fossorial and semifossorial (respectively) species that are tolerant of human disturbance. They may even benefit by land uses that stimulate the growth of forbs and grasses and loosen the soil, all of which provide abundant foraging and burrowing opportunities. They are common inhabitants of both disturbed and non-disturbed environments, and occur in a variety of habitats including woodlands and grasslands. Additionally, they have little problem adapting to human presence and, as in the case of the introduced house mouse, may prefer proximity to human habitation. In spite of being common, disturbance tolerant species, all of these mammals constitute important prey items for a variety of predators including omnivorous mammals, raptorial birds, and snakes. Thus, while there was some apparent variation between urban and rural preserves, the bulk of the mammals detected are disturbance tolerant species and the variation in mammal occurrence is not explained primarily by preserve location. Preserve location in relation to wildlife corridors on adjacent lands is likely very important. For example, preserves with a creek corridor on or adjacent to the preserve would likely receive higher levels of wildlife use.

Vernal Pool Construction

Over the past 15 years, over 80 acres of vernal pools have been constructed in western Placer County. Most of these vernal pools were constructed as part of a Clean Water Act and/or Endangered Species Act mitigation program or as part of a Mitigation Bank and they have been incorporated into a number of vernal pool preserves. Of the 12 preserves used in this study, nine had at least some constructed vernal pools and constructed vernal pools were included in the sampling for this study. Contrary to the general belief that constructed vernal pools are floristically inferior, our data did not show a statistically significant difference between preserves with and without constructed vernal pools in terms of overall plant species richness and actually showed a significantly higher mean native and vernal pool plant species richness per pool for sites that had both constructed and natural vernal pools. It is important to note that this study did not attempt to separately analyze constructed and natural pools and the sampling design did not attempt to stratify data among these two categories; rather, these data should be interpreted to mean that having constructed vernal pools in a preserve does not necessarily significantly decrease the floristic diversity within that preserve.

Grazing

Grazing is a common land use for many western Placer County vernal pool landscapes and a number of studies have recently documented that a certain amount of grazing may be beneficial to maintenance of plant and invertebrate species diversity within vernal pools (Marty 2003). The idea is that the diversity of the native ephemeral fauna and flora in the water increases when cows or other grazers keep weedy, nonnative grasses under control. When grazing is absent, non-native annual grasses get established and out compete several of the native herb species. Joe Silveira, a wildlife biologist working for the U.S. Fish and Wildlife Service at the Sacramento National Wildlife Refuge Complex in Willows, has gathered similar evidence. He found that when cattle there were removed to manage water routes, the diversity of fauna found in a twice-monthly count went down. Reduced cattle grazing can also reduce the hydroperiod of vernal pools, negatively affecting both flora and fauna (Marty 2003).

The results of this study found no significant differences in overall plant species richness between grazed and non-grazed sites; although, again, the study was not designed specifically to stratify sampling among grazed and non-grazed sites. The mean overall number of species per pool was significantly higher for non-grazed sites, but the mean number of native species and the mean number of native species per pool was not significantly different between grazed and non-grazed sites. This suggests that the non-grazed sites had additional species richness per pool but that that richness was composed of non-native, non-vernal pool species just as predicted by previous studies.

These results and recent studies by others (Marty 2003) support the conclusion that implementation of a grazing program is an important preserve management tool. Because grazing is only feasible on medium to large preserves, this suggests that the minimum desirable vernal pool preserve size would be a function of a minimum area that could still support grazing. Looking at the preserves included in this site, the grazed preserves were the largest, rural preserves. They have the necessary infrastructure (secure fencing, gates, water troughs, loading areas) to run a grazing program. Often, this kind of infrastructure is in place in larger, rural preserves but would require additional expenditures to establish in a more urban preserve. Many of urban preserves, particularly those in the City of Roseville, have also been designed to function as open space amenities for local residents. This design can be compatible with vernal pool conservation but, with bike paths and easy public access, it is rarely compatible with a regular grazing regime. Thus, consideration of the potential for grazing should be an important part of the preserve selection process. Once a preserve is selected, a grazing management plan should be developed as part of a long-term monitoring program including adaptive management provisions to ensure the type of grazer and the intensity/timing of grazing will be appropriate for vernal pool conservation.

Altered Hydrology

Altered hydrology refers to the introduction of additional water to the landscape either in greater volume, or more significantly, outside the normal wet period of vernal pools (December-April). The reason this is so important is that their restricted hydroperiod is what makes vernal pools such a unique ecosystem. If pools stay wet longer or receive summer run-off, a number of other marsh generalist species including various plants, aquatic insects, and

bullfrogs, can establish themselves. These generalists can potentially out compete or prey upon the native vernal pool flora and fauna resulting in the loss of their unique biodiversity.

Several factors including the percentage of the preserve perimeter with altered or potentially altered hydrology were measured to assess the effects of altered hydrology on species diversity. This factor was included to acknowledge that surrounding land-use is generally considered very important in how a particular preserve will function. For example, the Environmental Protection Agency (EPA), in developing their draft California Rapid Assessment Method for Wetlands (CRAM), has recognized that the "landscape context" (as measured by adjacent land uses) is an important component of assessing wetland ecosystem conditions (P. Jones, personal communication, 17 March 2003). However, in this study, the percent of perimeter with altered and potentially altered hydrology was not a significant factor predicting plant or spring bird species richness. For the birds, this is not a surprising result because bird species richness was more related to diversity of vegetation communities. For the plants on the other hand, a significant difference would be predicted. We believe the lack of differences is most likely an artifact of the coarse level of the analysis used for this landscape level study. For example, we documented several wetland features preserved as vernal pools that were receiving a significant amount of irrigation run-off from the backyards of adjacent houses. The adjacent vernal pools were now filled with sedges and cattails. Thus, housing developments adjacent to preserves were classified as perimeter with potentially altered hydrology. However, there are large sections of the adjacent housing development that do not currently contribute any run-off to the preserve. By lumping all housing developments into "altered hydrology," potentially significant differences in plant species richness may have been masked by areas with this adjacent land use but no associated run off.

Other factors such as the presence of outfalls into the preserve, irrigation run-off, and perennial water features appeared to be better indicators of the influence of altered hydrology on plant species richness. The presence of each of these factors resulted in a significant decrease in mean overall, native, and vernal pool plant species richness per pool. Because these factors seemed to influence the species richness per pool but not the overall species richness, these factors probably are influencing a subset of vernal pools in their immediate vicinity only. Thus, the overall preserve species richness is maintained but the mean values per pool are pulled down by those pools with less diverse, marsh-dominated floras.

If the goal of the preserve is to conserve the diversity within the vernal pools themselves, irrigation run-off into the preserve, outfalls into the preserve, perennial water features on-site, and beaver dams on-site were all important factors involved in assessing: 1) the degree of on-site altered hydrology; and, 2) the potential for future altered hydrology on-site.

Existing irrigation run-off is a potentially significant, ongoing edge effect, but site-specific topography will influence the degree to which irrigation run-off impacts a preserve. Therefore, the location of the preserve's vernal pools, relative to the irrigation run-off, will dictate the level of altered hydrology. As a general rule, irrigation run-off rarely decreases and a preserve with adjacent irrigation at the time of preserve establishment should be avoided. Outfalls are similar to irrigation runoff as they represent a potential source of aseasonal water, but again, the location of the outfall is key with outfalls causing sheet flow into vernal pools being a significant immediate problem. Outfalls into existing deeper channels or creek pose less of an

immediate problem but still could be a future issue. Irrigation and outfalls are generally more common in urban areas, so while urban areas do not automatically have this edge effect, they should be more carefully scrutinized for existing or future hydrology problems.

Reserve design for the conservation of vernal pools should also assess the distribution, physical configuration, and extent of linear water features within the site. Generally, run-off from adjacent properties will only have an affect a certain distance into the preserve. Linear water features, however, represent a potential method for non-seasonal water to be introduced to the interior of the preserve. This is particularly significant in western Placer County as development proceeds and additional storm water run-off is increasing water flows in areas upstream of preserves. For example, the largest preserve in the study is bisected by Orchard Creek. Historically, this creek has been seasonal. Upstream developments including Lincoln Sun City and the Thunderhill Casino have added additional water flow in the winter and additional summer water inputs. More upstream developments are in the planning/permitting stages. The effects of these additional water inputs at the Orchard Creek Preserve are unknown at this time, but the changes documented at a number of other preserves tell a cautionary tale. Mahaney Park is bisected by an unnamed branch of Pleasant Grove Creek. Ten years ago, this drainage was seasonal and the surrounding wetlands were typical seasonal wetland/vernal pool habitat located on the flood plain bench just above the drainage. While they were in the creek flood plain, they rarely flooded. Today, the drainage is perennial and because the drainage is not very deep, it cannot hold winter flows and the entire preserve floods regularly each winter. It is a small, narrow preserve so the water doesn't dissipate over a large area but instead keeps the whole preserve saturated. The previously isolated wetland features regularly become interconnected with each other and the drainage, reducing the potential for most vernal pool associated crustaceans to persist and allowing access for non-native species such as crayfish and bullfrogs. The extended hydroperiod also supports the growth of marsh plant species and excludes the unique vernal pool floristic assemblage.

The mere presence of a linear feature, however, may not be reason to eliminate a potential site from consideration. If the drainage is deeply cut into the landscape, that feature may be able to hold additional run-off without flooding up into the vernal pool landscape. The Woodcreek North Preserve, for example, is bounded by the South Fork of Pleasant Grove Creek, a deeply incised creek channel. The creek's normal high water mark is well below the vernal pool grassland and rather than threatening the hydrology of that landscape, it serves as an effective barrier that captures excess water rather than adding to it. Parcel 93 (a subset of the Highland Reserve South Preserve) has a drainage along its southern boundary but because of the micro-topography of this preserve sub-unit, excess water drains into this drainage and away from the vernal pools and any large water flows move into a larger downstream channel rather than flooding horizontally into the vernal pool habitat.

Perennial features and beaver activity, like the linear features discussed above, may or may not suggest a potential hydrologic problem for a site. As more water is added to urban creeks, beavers have been able to establish farther and farther up stream corridors. Once present, beavers can rapidly change a narrow, incised creek channel into a wide slow, moving marsh. The side effect of this is that previously hydrologically isolated vernal pools are now flooded and are regularly inundated outside of their normal inundation period.

The presence of perennial water within once ephemeral landscapes has allowed for increased breeding opportunities for bullfrogs and expanded their dispersal into these areas (Balfour and Morey 2003). This is an important additional consideration for vernal pool landscapes with altered hydrology because bullfrogs have been implicated in the declines of a variety of native amphibians and other vertebrates (Moyle 1973, Hayes and Jennings 1986, Schwalbe and Rosen 1988, USFWS 1994, USFWS 1996, Balfour and Stitt 2003).

The Highland Reserve South Preserve site is a good case study for the complexities of how a preserve may or may not be affected by altered hydrology. The 135-acre site is made up a number of subsets, several of which are long, linear units with a significant amount of edge and a large number of linear water features (several perennial) on-site (Figure 2 on page 8). Based on these characteristics, the logical prediction is that this site would have significant altered hydrology issues. In fact, the persistence of the vernal pool plant community varies within the site itself. Table 11 (see page 68) compares two individual pools within the Highland Reserve South preserve, one with a changing plant community and one with a relatively constant plant community. The key difference between these two pools is the different characteristics of the preserve subset in which they occur (Figure 2 on page 8).

Both VP590 and VP180 have potential run-off from adjacent land uses, but the topography of VP590's preserve subunit is such that all run-off moves away from the preserve rather than into it. The apartment complex to the north is graded to drain away from the preserve. Roseville Parkway is several feet lower than the preserve elevation so water runs north or south on the road rather than west into the preserve. Finally, the southern and western boundaries have drainages that capture water and that are deep enough so that there is no flooding into the preserve. Essentially, these drainages are acting as moats that protect the internal vernal pool landscape from hydrological intrusion. On the other hand, the preserve subunit that contains VP180 is located on a gentle slope between a housing development and a drainage. This topography results in run-off from the housing development and the school moving directly through the preserve, adding excessive water to the vernal pool preserved in that area. There is a paved path running through this subunit and there are outfalls into this unit of the preserve as well. This is one small case study but it suggests that examination of the microtopography of a potential preserve and the immediately adjacent lands is probably one of the most important factors is designing a reserve that will successfully conserve vernal pools in the long run.

5.3 Study Limitations

The purpose of this study was to collect preliminary data on various taxonomic groups and landscape variables rather than allocate more intensive effort and resources on any one group or variable. As such, while this study generated a number of significant results, there are several study limitations, mainly in regards to sample size and survey effort that must be noted.

5.3.1 Sample Size

The largest preserve (Orchard Creek) is more than twice as large as the second largest preserve (East Sheridan). Thus, preserves between 320 and 700 acres in area were not represented in this study. Having a single, very large preserve could results in an "outlier" data point, which has the potential to overly influence data analyses. However, Orchard Creek is a prime example of

a classic Placer County vernal pool landscape. Therefore, it is highly unlikely that additional emphasis placed on simply one preserve significantly skewed the data or masked important trends.

Secondly, rigorous scientific studies require replication to account for results that reflect site-specific anomalies. This study represented a range of preserve sizes but did not attempt to have replicates within specific preserve sizes. Accordingly, the conclusions of this study should be considered along with the caveat that no internal replication was implemented.

The small sample size in this study likely had a significant effect on the results. Perhaps the most significant concern associated with our small sample size is that study sites do not accurately represent all vernal pool preserves or potential future reserves in Placer County, and corresponding bird and plant data do not accurately reflect bird use or plant occurrence within most vernal pool landscapes in the County. With small sample sizes, there is the additional concern regarding the probability that a "Type I" or "Type II" error was committed. Both problems raise the possibility that significant differences discussed above are artifact of sample size rather than actual biological trends.

5.3.2 Survey Effort

For plants, the survey effort was sufficient to document a majority of the plant species, especially the dominant species in the study sites' vernal pools. While multiple visit to the same features and quadrat sampling methods certainly would have added more detailed data to the survey, we believe the methodology employed was adequate for the comparative assessment of vernal pool plant diversity needed for this study.

Similarly, for birds, the survey effort was sufficient enough to document the majority of species using the study sites during spring migration. However, we recognize that in most cases bird use varies on many temporal scales. This is especially true during migration when avian composition of an area is known to change on a weekly, daily, and even hourly basis. Several bird species populations fluctuate on a yearly basis depending on food resources, predator populations, and other population dynamics. In addition, several studies (e.g., Brown 1995) have demonstrated that the avian composition of an area depends on its age, and successional changes. As a result, our data should be thought of as a "snapshot in time," and not totally indicative of bird use of sites in the future. Fall/winter surveys may identify very different patterns of bird usage of vernal pools in this region, changing some of the conclusions presented in this report.

For both mammals and amphibians, the limited survey effort provided only preliminary information and was not sufficient to generate a comprehensive species lists for either of these groups. For example, with live mammal trapping, a much more extensive field effort would be required to adequately sample small mammal populations. Mammals are generally wary of unfamiliar objects in their environment and more than a single night to become habituated to traps. Furthermore, some species are less 'trappable' than other species due to their inherent wariness and/or low population numbers. For example, deer mice are an extremely common and intrepid species, and may need to be trapped out before additional species can be captured

(Ingles 1947). Our low capture results are due to the minimal trapping effort allocated during this study (i.e., single night trapping).

When interpreting the results of the mammal sign surveys, it is important to consider the limitations of the surveying method as well as the variability in habitat characteristics between sites, and the variability in weather conditions between surveys. These factors will contribute to inter-site differences in mammal occurrence and detection, which may be difficult to tell apart. For example, soft clay soils are a more suitable medium for registering tracks (i.e., footprints) than sandy or rocky soils. At the same time mammal tracks are most likely to be detected in newly moistened soil, after a rain event, than during the summer when the soils had harden. Thus, the absence of some signs (e.g., fox tracks, etc.) may be due to the lack of appropriate conditions and may not necessarily mean they are absent from the site. Similarly, certain species will be more visible at certain sites (i.e., jackrabbits are less visible at taller grass sites).

There are additional inherent difficulties in attempting to detect the presence of mammal species by their signs. Some animals, such as many prey species, leave few signs in the open because they spend most of their time underground or under cover. This is particularly true of many prey species such as cottontail rabbits, moles and other medium-sized rodents. An additional complication involves determining the species responsible for a particular sign. Individuals from different species will often use the same wildlife trails or will share or adopt burrows made by other species, hence our use of categories such as 'small rodent' or 'small mammal'. Finally, there are complications related to the relative abundance of various species. Whereas, small prey species (i.e., rodents and rabbits) are typically abundant, carnivorous species or species with large home range requirements (e.g., coyote, fox, bobcat, skunk, raccoon or deer) will occur in smaller numbers. Thus, encountering their tracks, scat, or dens is less likely.

In this study, small rodent signs such as burrows and scat present at all study sites and were readily visible, especially in wetland areas with open grassland and shallow dry pools. One exception was at Aitken Ranch were no such signs were documented. Aitken Ranch had unseasonably tall grass (approx. 2 feet in height) and rodent signs such as burrows, trails, and scat may have not have been visible to the observer. Alternatively, burrowing rodents may indeed be less abundant. Although signs of burrowing rodents were not documented, California mice were captured on this site during live trapping. However, the California mouse is a non-burrowing rodent closely associated with shrubby environments. Thus, their presence is not typically visible via trails and burrows. Overall, a comprehensive investigation of small mammal species diversity and abundance requires a significantly larger trapping effort, which would consist of a large number of traps and several consecutive trap nights along with other sampling methods such as track plates and camera stations.

For amphibians, because a single diurnal aquatic amphibian survey was conducted at each of the study sites, it is possible that not all species present within a given preserve were observed during this survey effort. For instance, a species may have been present in an aquatic feature that was not sampled or a species may have occurred in low numbers and was not observed by chance alone.

As for insect pollinators, multiple site visits and sampling sites over several days with similar weather conditions etc. would allow for more statistical analysis of these results.

5.3.3 Statistical Analyses

All of the dependent variables used in our analyses were based on species richness numbers. Although a relative abundance value for some of the studied taxa was provided, those values were not incorporated into our statistical analysis because of the lack of rigor in which they were collected and the risk of making Type I or II errors.

For the plant data, while not all of the data were normally distributed, parametric statistics were used. Complementary non-parametric statistics were run for several datasets and the results were the same in terms of what was significant. Thus, the parametric tests were used even though several assumptions were violated.

Regression analyses were used for the bird data sets and five basic assumptions must be met to validly test hypotheses about regressions (Zar 1999):

1. Y-values (i.e., dependent variables) and error terms are normally distributed.
2. Variances are homogeneous.
3. The relationship between dependent and independent variables is linear.
4. Y-values are independent from one another.
5. X-values are obtained without error.

Regression statistics are known to be robust with respect to at least some of these underlying assumptions (e.g., Zar 1996), so violations of them are not usually of concern unless they are severe. In this study, several of the assumptions associated with linear regression were not met. Two factors in particular greatly influenced our results: the lack of normally distributed Y-values and presence of several "outliers", and multicolinearity of X-variables.

Outliers are generally only a problem if they have high leverage on the fitted regression equation. In this study, most outliers did have a significant effect on the regression results. For example, no significant relationship was detected between total species richness and preserve size ($p = 0.68$), but when the two outlying data cases were omitted from analysis, the relationship was highly significant ($p = 0.01$). However, as discussed previously, these "outliers" (Orchard Creek and East Sheridan) also represent the two most pristine vernal pool landscapes in this study and are far from marginal data points that can be easily discarded.

Several problems occur when multicolinearity exists. In this study, the most severe problem relates to the interpretation of regression coefficients. The common interpretation of regression coefficients as measuring the change in the expected value of the dependent variable when the corresponding independent variable is increased by one unit (while all other independent variables are held constant) is not fully applicable when multicolinearity exists. This problem was explicitly demonstrated in the dramatic change (e.g., from positive to negative) in the values of several coefficients depending on the number of variables included in the model.

Violations of regression assumptions can sometimes be treated by remedial measures. Remedial measures exist for both influential cases (i.e., outliers) and multicolinearity. However,

the scope of this study and budget constraints precluded additional statistical analysis and measures.

5.3.4 Temporal Variation

This study was conducted over a single season, and vernal pool hydrology, floristics, and wildlife use vary from season to season based on annual rainfall fluctuations. While there is rarely a truly "normal" rainfall season, 2003 had an unusually dry early season followed by a cool, rainy period during the beginning of April and early May. The later rains results in pools refilling and covering flowering plants with water. This reinundation also could have altered the plant data results if, for example, certain species did not flower a second time. However, because all the preserves experienced the same atypical weather conditions, this should not have impacted comparisons made among the different study sites. The reinundation also likely influenced the diversity and species composition of the pollinating insects. These insects would have been forced to switch to available upland plant species for pollen and nectar. Solitary bees, in particular, would have to continue foraging for pollen upon initiation of brood development by relying on upland areas if vernal pools were re-inundated.

5.4 Conservation Considerations in Vernal Pool Landscape Reserve Design

Ultimately, this study does not establish a minimum size for viable vernal pool landscape preserves in western Placer County. Instead, the data suggest that there are a number of considerations that should be investigated at any potential site that will influence the diversity that will be supported there in the long-term. These specific considerations include:

- the number of vernal pools
- preserve microtopography
- surrounding land-uses
- existing or the potential for altered hydrology (through adjacent land-uses and the characteristics of on-site linear features
- the potential for implementation of a grazing program.

Data from this study indicate that larger preserves generally have less potential negative edge effects related to altered hydrology but clearly this needs to be assessed on a case-by-case basis. Equally as important, the future potential land-use for adjacent lands should also be researched to determine if there is the potential for hydrology related issues to arise in the future.

Other important, more general considerations for conservation of vernal pool landscapes include:

- Establishment of a specific preserve goal
- Determination of a target species or group of species for conservation
- Species composition in addition to species diversity
- Preserve connectivity with other preserves and natural habitats

Establishing a goal for the preserve is an essential step in setting up a preserve that will function in the long term. If the goal is to protect the diversity of vernal pool plant communities, this study suggests optimal sites should be vernal pool grasslands with a large number of pools that are removed from influences of unseasonable sources of water. As discussed above, Barbour et al. (2003) provided evidence indicating that vernal pools are not homogenous and are often a

mosaic of several vernal pool plant communities. Having a large number of vernal pools tends to ensure that more of the different vernal pool plant communities are represented within a site. However, this study showed that these same sites have relatively lower diversity of birds in the spring. On the other hand, if the goal is to protect a diverse community of vertebrate species, the study suggests optimal sites should include as many different vegetation communities (i.e., emergent marsh, riparian, oak woodland) as possible. This may come at the expense of the diversity of plants within individual vernal pools unless the preserve is large enough to buffer the vernal pool landscape from other communities such as emergent marsh or valley foothill riparian. These conflicting preserve design parameters may force preserve designers to pick between which groups they hope to optimize within the preserve.

Soule and Simberloff (1986) address the idea that minimum preserve size is best set by use of a target species or target group rather than using overall biodiversity. They suggest: 1) identifying a target or keystone species (a species whose disappearance will be followed by a decrease in the area's species diversity); 2) determining the minimum viable population size for that target species; and, 3) estimating the area required to support the target species. Some researchers (e.g., Thorp and Leong 1998, Thorp 1976) have suggested the solitary bee may be a keystone species for the vernal pool ecosystem. Target species, if used, could be a group such as a group similar to Barbour's et al. (2003) community groups or a specific group of shorebirds or waterfowl.

Another important concept in reserve design is connectivity with other preserves. Connectivity can be important to maintaining viable populations by allowing gene flow and recolonization events (Meffe et al. 1997). Corridor size requirements vary among species. While this study did not address connectivity specifically, many animal species require corridors to access preserves and the occurrence of corridors (rather than the size of the preserve) may be a key factor in their occurrence. For example, in this study, deer were observed in one of the smallest urban preserves (Woodcreek North); this preserve is connected a number of larger open space parcels by a tributary to Pleasant Grove Creek.

Finally, although high species diversity generally results in a more complex and stable community, landscape-level conservation efforts should also consider other important several ecological indicators in reserve design decisions. Specifically, species composition has frequently been undervalued in reserve design. Too often reserve designers and managers focus on maximizing the diversity (i.e., richness and abundance) of the ecological community, and pay too little attention to the specific species that comprise it. In certain circumstances, reserves with high species diversity may have less conservation value than those with lower species diversity. With respect to species composition, some cases where lower species diversity is preferable may include when:

1. the site has a higher percentage of native species, or is more ecologically intact.
2. the site supports one or more species of explicit value (e.g., special-status species), especially when few other sites support that (those) species.
3. the site supports one or more species that provide a unique function to the natural community, especially when few other sites support that (those) species.
4. the site has a higher diversity of the types of species it supports than other sites.
5. the site supports high reproductive productivity, and serves as a "source" to other populations.

In this study, a practical example of this concept may be the East Sheridan site. We detected only 24 bird species at the East Sheridan site, the third lowest number of all sites. However, three special-status species were detected at the site, more than was detected at several (5) of the other sites. In addition, the East Sheridan site was relatively unaffected by anthropogenic disturbances and contained a relatively large patch of undisturbed grassland and vernal pool habitat. Several previous studies have suggested the importance of large, undisturbed habitats, especially for forest (Robbins et al. 1989), grassland (Vickery 1992), and wetland birds (Cashen 1998). Most of these studies provide evidence suggesting large patch-sized habitats are required to sustain certain avian species populations.

Finally, one of the questions regarding the efficacy of vernal pool preserve is whether a specific preserve will allow the protected species to persist over time. Since vernal pool preserves are still relatively new (none of the preserves in this study have been official "preserves" for more than 15 years), it is not clear if there are significant changes in species richness and diversity over time. Concerns have been expressed that smaller preserves will be subject to edge effects that, overtime, will reduce overall species diversity. In terms of plant species diversity within the vernal pools themselves, the data from this study do not support these concerns. However, ongoing monitoring over 20 to 50-year time scales would be needed to make a valid conclusion about this issue.

5.5 Future Research Recommendations

We recommend that the County allocate its financial resources towards site specific investigations of properties that are preserve candidates rather than pursue additional research. If further research is of interest to the County, then we suggest that studies focus on land management practices such as grazing. Current research by others (Marty 2003) is demonstrating the benefits of grazing regimes on both plant and aquatic invertebrate communities. ECORP and North Fork Associates' collective experience working in regional vernal pool landscapes over the last decade reflect similar observations. Ultimately, an appropriate grazing regime and maintenance of hydrologic integrity are likely the two most important factors influencing vernal pool landscapes.

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LIST OF APPENDICES

APPENDIX A

Summary of Project Personnel

ECORP Consulting, Inc.

Peter Balfour, M.S.	Senior Biologist and Project Manager, amphibian surveys, report author
Susan Ramones, M.S.	Floristic and mammal surveys, landscape/habitat variables, data analysis, report author
Scott Cashen, M.S.	Bird Surveys, data analysis, report author
Marc Beccio	Insect surveys, data analysis, report author
Stacia Hoover, M.S.	Amphibian and mammal surveys, report author
Adam Ballard	Bird and amphibian surveys, report author
Jessica Miller, M.S.	Floristic surveys, report author
Keith Kwan	Bird Surveys
Lourdes Rugge, M.S.	Mammal surveys
Cameron Johnson	Mammal surveys
Larry Lacunza	Mammal Surveys
Jinnah Hansen	Floristic Surveys
Sarah Egan	Landscape/habitat variables
Jenny Hill	AutoCAD/GIS Analysis
Michael Wood	GIS Analysis
Robert Tobys	GIS Analysis

North Fork Associates

Jeff Glazner	Floristic surveys, report review
Barry Anderson	Floristic surveys, report review
Erin Gottschalk	Floristic surveys

APPENDIX B

Sample Datasheets

Floristic Survey Datasheet

Mammal Sign Survey Datasheet

Mammal Trapping Survey Datasheet

Amphibian Survey Datasheet

Pollinator Survey Datasheet

ECORP Consulting, Inc. PLACER VP FLORISTIC MONITORING DATA SHEET

Wetland No.: _____ Date: _____ % ***Cover*** ~ Vegetation: _____
Preserve Location: _____ Biologist(s): _____ Bare Ground: _____
Wetland Type: ( ) VP ( ) SW ( ) Litter ( ) Erosion ( ) Tire Marks Rocks: _____
( ) Constructed ( ) Reference ( ) High Rodent Activity Other (specify): _____
TOTAL: *100%*

PLANTS OBSERVED:

⓪①②③④⑤ Achyrachaena mollis
⓪①②③④⑤ Aira caryophyllea
⓪①②③④⑤ Alopecurus saccatus
⓪①②③④⑤ Amsinckia spp.
⓪①②③④⑤ Anthemis cotula
⓪①②③④⑤ Avena spp.
⓪①②③④⑤ Blennosperma nanum
⓪①②③④⑤ Briza minor
⓪①②③④⑤ Brodiaea spp.
⓪①②③④⑤ Bromus diandrus
⓪①②③④⑤ Bromus hordeaceus
⓪①②③④⑤ Calandria ciliata
⓪①②③④⑤ Callitriche heterophylla
⓪①②③④⑤ **Callitriche marginata**
⓪①②③④⑤ Callitriche spp.
⓪①②③④⑤ Capsella bursa-pastoris
⓪①②③④⑤ Cardamine oligosperma
⓪①②③④⑤ Castilleja attenuata
⓪①②③④⑤ Castilleja campestris
⓪①②③④⑤ Castilleja exserta
⓪①②③④⑤ **Centunculus minimus**
⓪①②③④⑤ Cicendia quadrangularis
⓪①②③④⑤ Convolvulus arvensis
⓪①②③④⑤ **Crassula aquatica**
⓪①②③④⑤ Cuscuta howelliana
⓪①②③④⑤ Cynodon dactylon
⓪①②③④⑤ Cyperus eragrostis
⓪①②③④⑤ Damasonium californicum
⓪①②③④⑤ **Deschampsia danthonioides**
⓪①②③④⑤ Downingia bicornuta
⓪①②③④⑤ Downingia cuspidata
⓪①②③④⑤ Downingia ornatissima
⓪①②③④⑤ Downingia pusilla
⓪①②③④⑤ Downingia spp.
⓪①②③④⑤ **Elatine spp.**
⓪①②③④⑤ Eleocharis acicularis
⓪①②③④⑤ **Eleocharis macrostachya**
⓪①②③④⑤ Epilobium brachycarpum
⓪①②③④⑤ Epilobium cleistogamum
⓪①②③④⑤ Epilobium densiflorum
⓪①②③④⑤ Epilobium spp.
⓪①②③④⑤ Eremocarpus setigerus
⓪①②③④⑤ Erodium spp.
⓪①②③④⑤ **Eryngium vaseyi**
⓪①②③④⑤ Eschscholzia californica
⓪①②③④⑤ Eschscholzia lobbii
⓪①②③④⑤ Geranium spp.
⓪①②③④⑤ Glyceria occidentalis
⓪①②③④⑤ Glyceria spp.
⓪①②③④⑤ Gnaphalium spp.
⓪①②③④⑤ **Gratiola ebracteata**
⓪①②③④⑤ Gratiola heterosepala
⓪①②③④⑤ Hemizonia fitchii
⓪①②③④⑤ Holocarpha virgata
⓪①②③④⑤ **Hordeum marinum**
⓪①②③④⑤ Hordeum murinum
⓪①②③④⑤ Hypochaeris glabra
⓪①②③④⑤ Isoetes spp.
⓪①②③④⑤ Juncus balticus
⓪①②③④⑤ Juncus bufonius
⓪①②③④⑤ Juncus capitatus
⓪①②③④⑤ Juncus spp.
⓪①②③④⑤ Juncus uncialis
⓪①②③④⑤ Juncus xiphioides
⓪①②③④⑤ Lactuca serriola
⓪①②③④⑤ **Lasthenia fremontii**
⓪①②③④⑤ **Lasthenia glaberrima**
⓪①②③④⑤ Layia fremontii
⓪①②③④⑤ Legenere limosa
⓪①②③④⑤ Lepidium latipes
⓪①②③④⑤ Lepidium nitidum
⓪①②③④⑤ **Lilaea scilloides**
⓪①②③④⑤ Limnanthes alba
⓪①②③④⑤ Limnanthes douglasii
⓪①②③④⑤ Limosella acaulis
⓪①②③④⑤ Lolium perenne
⓪①②③④⑤ Lupinus bicolor
⓪①②③④⑤ Lythrum hyssopifolium
⓪①②③④⑤ Marsilea vestita
⓪①②③④⑤ Medicago polymorpha
⓪①②③④⑤ Mimulus guttatus
⓪①②③④⑤ Mimulus tricolor
⓪①②③④⑤ Montia fontana
⓪①②③④⑤ Myosurus minimus
⓪①②③④⑤ Navarretia intertexta
⓪①②③④⑤ **Navarretia leucocephala**
⓪①②③④⑤ Phalaris lemmonii
⓪①②③④⑤ Phyla nodiflora
⓪①②③④⑤ Pilularia americana
⓪①②③④⑤ Plagiobothrys greenei
⓪①②③④⑤ Plagiobothrys nothofulvus
⓪①②③④⑤ **Plagiobothrys stipitatus**
⓪①②③④⑤ Plantago elongata
⓪①②③④⑤ Plantago spp.
⓪①②③④⑤ Poa annua
⓪①②③④⑤ Pogogyne zizyphoroides
⓪①②③④⑤ Polygonum spp.
⓪①②③④⑤ **Polypogon monspeliensis**
⓪①②③④⑤ **Psilocarphus brevissimus**
⓪①②③④⑤ Psilocarphus oregonus
⓪①②③④⑤ Psilocarphus tenellus
⓪①②③④⑤ Ranunculus aquatilis
⓪①②③④⑤ **Ranunculus bonariensis**
⓪①②③④⑤ Ranunculus muricatus
⓪①②③④⑤ Rumex crispus
⓪①②③④⑤ Rumex pulcher
⓪①②③④⑤ Sidalcea calycosa
⓪①②③④⑤ Sidalcea malvaeflora
⓪①②③④⑤ Spergularia ruba
⓪①②③④⑤ Stellaria media
⓪①②③④⑤ Taeniatherum caput-medusae
⓪①②③④⑤ Trichostema lanceolatum
⓪①②③④⑤ Trifolium depauperatum
⓪①②③④⑤ Trifolium fucatum
⓪①②③④⑤ Trifolium hirtum
⓪①②③④⑤ Trifolium spp.
⓪①②③④⑤ Trifolium variegatum
⓪①②③④⑤ Triphysaria eriantha
⓪①②③④⑤ Triteleia hyacinthina
⓪①②③④⑤ Typha spp.
⓪①②③④⑤ Veronica peregrina
⓪①②③④⑤ Vicia spp.
⓪①②③④⑤ Vulpia bromoides
⓪①②③④⑤ Vulpia spp.
⓪①②③④⑤ Xanthium strumarium
==========
⓪①②③④⑤ Alisma plantago-aquatica
⓪①②③④⑤ Ammannia coccinea
⓪①②③④⑤ Anagallis arvensis
⓪①②③④⑤ Bacopa eisenii
⓪①②③④⑤ Brassica nigra
⓪①②③④⑤ Centaurea solstitialis
⓪①②③④⑤ Centaurium muehlenbergii
⓪①②③④⑤ Chamomilla suaveolens
⓪①②③④⑤ Cotula coronopifolia
⓪①②③④⑤ Crypsis schoenoides
⓪①②③④⑤ Cyperus spp.
⓪①②③④⑤ Echinochloa crusgalli
⓪①②③④⑤ Epilobium ciliatum
⓪①②③④⑤ Epilobium pygmaeum
⓪①②③④⑤ Erodium botrys
⓪①②③④⑤ Geranium dissectum
⓪①②③④⑤ Geranium molle
⓪①②③④⑤ Hordeum brachyantherum
⓪①②③④⑤ Juncus effusus
⓪①②③④⑤ Leersia oryzoides
⓪①②③④⑤ Lemna spp.
⓪①②③④⑤ Leontodon taraxicoides
⓪①②③④⑤ Lepedium latifolium
⓪①②③④⑤ Leptochloa fascicularis
⓪①②③④⑤ Leymus triticoides
⓪①②③④⑤ **Lolium multiflorum**
⓪①②③④⑤ Lotus corniculatus
⓪①②③④⑤ Lotus purshianus
⓪①②③④⑤ Ludwigia peploides
⓪①②③④⑤ Mentha pulegium
⓪①②③④⑤ Mentha spp.
⓪①②③④⑤ Paspalum dilatatum
⓪①②③④⑤ Paspalum distichum
⓪①②③④⑤ Phalaris spp.
⓪①②③④⑤ Picris echioides
⓪①②③④⑤ Plantago lanceolata
⓪①②③④⑤ Pogogyne douglasii
⓪①②③④⑤ Polygonum arenastrum
⓪①②③④⑤ Polygonum lapathifolium
⓪①②③④⑤ Polygonum punctatum
⓪①②③④⑤ Populus fremontii
⓪①②③④⑤ Potomogeton spp.
⓪①②③④⑤ Rorippa nasturtirum-aquaticum
⓪①②③④⑤ Rorippa curvisiligua
⓪①②③④⑤ Rumex congloremutus
⓪①②③④⑤ Sagittaria montevidensis
⓪①②③④⑤ Salix exigua
⓪①②③④⑤ Salix spp.
⓪①②③④⑤ Scirpus acutus
⓪①②③④⑤ Senecio vulgaris
⓪①②③④⑤ Sonchus asper
⓪①②③④⑤ Sonchus oleraceus
⓪①②③④⑤ Spergula arvensis
⓪①②③④⑤ Verbena bonariensis
⓪①②③④⑤ Veronica anagalis-aquatica
⓪①②③④⑤ _____
⓪①②③④⑤ _____
⓪①②③④⑤ _____
⓪①②③④⑤ _____
⓪①②③④⑤ _____
⓪①②③④⑤ _____
⓪①②③④⑤ _____

NOTES / COMMENTS: _____

ABUNDANCE CLASSES: 0 = Very Rare (<5%), 1 = Rare (5-25% cover), 2 = Occasional (25-50% cover), 3 = Locally Abundant (abundant in dense patches), 4 = Abundant (50-75% cover), or 5 = Dominant (~75-100% cover).

ECORP Consulting, Inc.
ENVIRONMENTAL CONSULTANTS

Mammal Sign Survey Data Sheet

Site:___________________________________ Date:______________

Start time:_________ End time:____________ Surveyor :__________

Ambient temp (C°):_____________

Transect length (m):____________ Transect width (m)___________ Transect Area (m^2)__________

Description of transect location (proximity to road/trail, habitat type, veg.community, etc.):______________________________

____

Item #	Species	Type of sign T=track S=scat V=visual A=audio B=burrow	Age of sign F = 1-5 days O = > 5 days A=active or I =inactive (for burrows)	Photo #	Comments

ECORP Consulting, Inc. **Mammal Trapping Data Sheet**

ENVIRONMENTAL CONSULTANTS

Site:_____ Date:_____

Set date/time:_____ Check date/time:_____ Surveyor :_____

Ambient temp (C°) range:_____

Trap transect length (m):_____ Trap type:_____

Description of transect location (proximity to road/trail, habitat type, veg.community, etc.):_____

Trap #	Species	Sex m=male, f=female	Photo #	Comments
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				
29				
30				

Total Number of Traps:_____ Species Caught Number of Individuals

Number of Traps Occupied:_____

ECORP Consulting, Inc.

ENVIRONMENTAL CONSULTANTS

Placer County Vernal Pool Preserve Study

Amphibian Survey Data Sheet

Date:_____ Site Name_____ Visit #_____

Surveyors:_____ Survey time: start_____end_____ Total survey time_____

Start Air Temp (C): _____ End Air Temp: _____

Cloud cover: clear (0-10%) partly cloudy (11-50%) cloudy (>50%) Wind Speed (*Beaufort): (0-1) (2-4) (5+)

Herpetofauna Observed:_____

Feature Number	Max Depth (cm)	Water Temp (C)	Surface Area (m^2)	Comments

Additional comments/Incidental wildlife observations:

*Beaufort scale: 0-1: (0-3 mph) calm to light air (rising smoke drift) 2-4: (4-18 mph) light breeze to moderate breeze (raises dust and paper) 5+: (>18 mph) fresh breeze (small trees sway)

ECORP Consulting, Inc.

ENVIRONMENTAL CONSULTANTS

Placer County Vernal Pool Preserve Study

Pollinator Survey Data Sheet

Date:_____ Site Name_____

Surveyors:_____ Survey time: start_____end_____ Total survey time_____

Start Air Temp (C): _____ End Air Temp: _____

Cloud cover: clear (0-10%) partly cloudy (11-50%) cloudy (>50%)

Wind Speed (mph):_____ Wind Direction:_____

Feature Number	Number of Sweeps	Sample ID	Flowering Plant Genera Sampled

Additional comments/Incidental wildlife observations:

ECORP Consulting, Inc.

ENVIRONMENTAL CONSULTANTS

Placer County Vernal Pool Preserve Study

Pollinator Survey Data Sheet

Use Separate Data Sheet for Each Vernal Pool Sample

Feature Number: _____ Site Name: _____

Date Sampled: _____

Collectors: _____

Taxa	Number	Comments
Hymenoptera		
Andrenidae		
Anthophoridae		
Apidae		
Halictidae		
Chrysididae		
Colletidae		
Megachilidae		
Diptera		
Anthomyiidae		
Bombyliidae		
Calliphoridae		
Conopidae		
Empididae		
Ephydridae		
Rhagionidae		
Syrphidae		
Tachinidae		
Coleoptera		
Buprestidae		
Cantharidae		
Ceramycidae		
Chrysomelidae		
Coccinelidae		
Dasytidae		
Elateridae		
Lepidoptera		
Hesperiidae		
Lycaenidae		
Noctuidae		
Hemiptera		
Miridae		
Lygaeidae		
Other (specify)		

Total Taxa Collected: _____ Total Number Collected:_____

APPENDIX C

List of Independent and Dependent Variables Used in Study

Appendix C. ***List of Independent and Dependant Variables Used in Study, Spring and Summer 2003***

PARAMETER	MEASUREMENT
Independent	
Size	Total surface area of the preserve (acres).
Ratio	Preserve area / preserve perimeter.
Grazed	A binary variable in which the preserve was scored "1" if it experienced livestock grazing in 2003, and "0" if it did not.
Natural	A binary variable in which the preserve was scored "1" if it had only natural vernal pools, and "0" if it did not.
Urban	A binary variable in which the preserve was scored "1" if it was considered urban, and "0" if it was considered rural.
Vernal Pools	Total number of vernal pools within the preserve.
Grassland	A binary variable in which the preserve was scored "1" if it had an annual grassland community, and "0" if it did not.
Riparian	A binary variable in which the preserve was scored "1" if it had a riparian community, and "0" if it did not.
Woodland	A binary variable in which the preserve was scored "1" if it had an oak woodland community, and "0" if it did not.
Emergent	A binary variable in which the preserve was scored "1" if it had an emergent wetland, and "0" if it did not.
Vegcomm	Total number of differing vegetation communities within the preserve (range 1 to 4).
Outfalls	A binary variable in which the preserve was scored "1" if it had outfall into the preserve and "0" if it did not.
Irrigation	A binary variable in which the preserve was scored "1" if it had irrigation running into the preserve and "0" if it did not.
Perennial	A binary variable in which the preserve was scored "1" if it had perennial water features, and "0" if it did not.
Lengthlinear	Total length of linear wetland features within the preserve.

Appendix C. ***List of Independent and Dependant Variables Used in Study, Spring and Summer 2003***

PARAMETER	MEASUREMENT
Paved	A binary variable in which the preserve was scored "1" if it had paved trails, and "0" if it did not.
Public	A binary variable in which the preserve was scored "1" if it had public access, and "0" if it did not.
Beaver	A binary variable in which the preserve was scored "1" if it had beaver activity, and "0" if it did not.
Paltered	Percent of perimeter with altered hydology or potential for dry season water.
Dependent (Plants)	
SppRichness	Total number of plant species detected within a preserve.
Native SppRichness	Total number of native plant species detected within a preserve.
VP SppRichness	Total number of vernal pool plant species detected within a preserve.
Dom SppRichness	Total number of dominant (cover class >25%) plant species detected within a preserve.
Abund SppRichness	Total number of abundant plant species detected within a preserve.
MeanSppRichness	Mean number of plant species per pool per preserve.
MeanNativeSppRichness	Mean number of native plant species per pool per preserve.
MeanVPSppRichness	Mean number of vernal pool plant species per pool per preserve.
Dependent (Birds)	
Wildbird	Total number of "wild" bird species detected within the preserve (species occur primarily in wild areas).
Neutral bird	Total number of "neutral" bird species detected within the preserve (species occur in both wild and urban areas).
Urban bird	Total number of "urban" bird species detected within the preserve (species occur primarily in urban areas).
Arboreal landbird[a]	Total number of "arboreal landbird" species detected within the preserve (species associated primarily with trees).

Appendix C. ***List of Independent and Dependant Variables Used in Study, Spring and Summer 2003***

PARAMETER	MEASUREMENT
Terrestrial landbird[a]	Total number of "terrestrial landbird" species detected within the preserve (species associated primarily with agricultural areas and grasslands).
Raptor	Total number of raptor species detected within the preserve.
Shorebird	Total number of shorebird species detected within the preserve.
Waterbird	Total number of waterbird species detected within the preserve.
Wader	Total number of wading bird species detected within the preserve.
PWildbird	Percent of birds detected that were Wild birds (Wildbird/total species richness).
PNeutral bird	Percent of birds detected that were Neutral birds (Neutral bird/total species richness).
PUrban bird	Percent of birds detected that were Urban birds (Urban bird/total species richness).
PArboreal landbird	Percent of birds detected that were Arboreal landbirds (Arboreal landbird/total species richness).
PTerrestrial landbird	Percent of birds detected that were Terrestrial landbirds (Terrestrial landbird/total species richness).
PRaptor	Percent of birds detected that were Raptors (Raptor/total species richness).
PShorebird	Percent of birds detected that were Shorebirds (Shorebird/total species richness).
PWaterbird	Percent of birds detected that were Waterbirds (Waterbird/total species richness).
PWader	Percent of birds detected that were Waders (Wader/total species richness).

[a] Source: Jones and Stokes 2003.

APPENDIX D

Landscape and Habitat Variable Data

Appendix D. ***Landscape and Habitat Variable Data, Spring and Summer 2003***

Site ID	Site Name	Preserve Size (Acres)	Preserve Area to Perimeter Ratio	Grazed Preserve (1) or Non-Grazed Preserve (2)	Natural Pools Only (1) or Natural and Constructed Pools (2)
1	**Mahaney Park**	18	194.0	2	1
2	**Woodcreek Oaks City Preserve**	20	131.7	2	2
3	**Woodcreek North Preserve**	46	127.6	2	2
4	**Woodcreek West Preserve**	52	231.9	2	2
5	**Sun City Roseville**	68	361.5	2	2
6	**Stanford Ranch - Rocklin Vernal Pool Preserve**	125	312.2	2	2
7	**Highland Reserve South Preserve**	135	139.0	2	2
8	**Rodeo Grounds Preserve**	145	486.5	2	2
9	**Sheridan Mitigation Bank**	184	590.1	1	2
10	**Aitken Ranch Mitigation Bank**	310	851.3	1	2
11	**East Sheridan Vernal Pool Preserve**	317	744.4	1	1
12	**Orchard Creek Mitigation Bank**	708	1093.9	1	1
	Median	130	336.8		
	Minimum	18	127.6		
	Maximum	708	1093.9		
	Mean	177.3	438.7		
	Standard Deviation	195.3	319.6		

*** Data Not Available**

Appendix D. ***Landscape and Habitat Variable Data, Spring and Summer 2003***

Site ID	Site Name	Urban Preserve (1) or Rural Preserve (2)	# of Vernal Pools	Vernal Pool Acreage	Vernal Pool Density	# of Vegetation Communities	Outfalls Into Preserve
1	**Mahaney Park**	1	32	0.74	4.1%	2	1
2	**Woodcreek Oaks City Preserve**	1	69	*	*	2	1
3	**Woodcreek North Preserve**	1	15	0.91	2.0%	2	1
4	**Woodcreek West Preserve**	1	99	10.99	21.1%	1	0
5	**Sun City Roseville**	1	197	*	*	2	0
6	**Stanford Ranch - Rocklin Vernal Pool Preserve**	1	171	*	*	2	1
7	**Highland Reserve South Preserve**	1	627	9.76	7.2%	2	1
8	**Rodeo Grounds Preserve**	2	322	*	*	2	0
9	**Sheridan Mitigation Bank**	2	174	*	*	3	0
10	**Aitken Ranch Mitigation Bank**	2	204	6.57	2.1%	3	0
11	**East Sheridan Vernal Pool Preserve**	2	569	*	*	1	0
12	**Orchard Creek Mitigation Bank**	2	672	31.41	4.4%	1	0
	Median		185.5	8.165	4.3%	2	
	Minimum		15	0.74	2.0%	1	
	Maximum		672	31.41	21.1%	3	
	Mean		262.6	10.1	6.8%	1.9	
	Standard Deviation		233.6	11.3	7.3%	0.7	

*** Data Not Available**

Appendix D. ***Landscape and Habitat Variable Data, Spring and Summer 2003***

Site ID	Site Name	Irrigation Run-Off On-Site	Perennial Water Features On-Site?	Length of Linear Wetland Features?	Wetland Features	Paved Trails On-Site?
1	**Mahaney Park**	1	1	2165	Kaseberg Creek	1
2	**Woodcreek Oaks City Preserve**	1	1	1346	unamed	1
3	**Woodcreek North Preserve**	0	1	5589	Pleasant Grove Creek	1
4	**Woodcreek West Preserve**	0	0	0	none	0
5	**Sun City Roseville**	1	1	1702	Pleasant Grove Creek	1
6	**Stanford Ranch - Rocklin Vernal Pool Preserve**	1	1	8066	unamed	0
7	**Highland Reserve South Preserve**	1	1	18130	unamed	1
8	**Rodeo Grounds Preserve**	0	1	6115	unamed	0
9	**Sheridan Mitigation Bank**	1	1	11869	unamed	0
10	**Aitken Ranch Mitigation Bank**	1	1	10056	Auburn Ravine	0
11	**East Sheridan Vernal Pool Preserve**	0	0	8683	unamed	0
12	**Orchard Creek Mitigation Bank**	0	1	21360	Orchard Creek	0
	Median			7090.5		
	Minimum			0		
	Maximum			21360		
	Mean			7923.4		
	Standard Deviation			6688.2		

*** Data Not Available**

Appendix D. ***Landscape and Habitat Variable Data, Spring and Summer 2003***

Site ID	Site Name	Public Access On-Site?	Beaver dams/ Activity in Vernal Pool Area?	Beaver Dams On-Site?	% of Perimeter with Altered Hydrology or Potential for Dry Season Water
1	**Mahaney Park**	1	0	1	67.1%
2	**Woodcreek Oaks City Preserve**	1	0	0	67.1%
3	**Woodcreek North Preserve**	1	0	1	52.5%
4	**Woodcreek West Preserve**	1	0	0	42.8%
5	**Sun City Roseville**	1	0	1	59.5%
6	**Stanford Ranch - Rocklin Vernal Pool Preserve**	0	0	1	59.4%
7	**Highland Reserve South Preserve**	1	0	1	67.8%
8	**Rodeo Grounds Preserve**	1	0	0	10.9%
9	**Sheridan Mitigation Bank**	0	0	1	0.0%
10	**Aitken Ranch Mitigation Bank**	0	0	1	16.8%
11	**East Sheridan Vernal Pool Preserve**	0	0	0	2.3%
12	**Orchard Creek Mitigation Bank**	0	0	0	16.4%
	Median				47.7%
	Minimum				0.0%
	Maximum				67.8%
	Mean				38.6%
	Standard Deviation				27.1%

*** Data Not Available**

Appendix D. ***Landscape and Habitat Variable Data, Spring and Summer 2003***

Site ID	Site Name	Northern Clay Hardpan Vernal Pools (1) or Mehrton Formation Vernal Pools (2)	Natural Pools Only (1) or Natural and Constructed Pools (2)
1	**Mahaney Park**	1	1
2	**Woodcreek Oaks City Preserve**	1	2
3	**Woodcreek North Preserve**	1	2
4	**Woodcreek West Preserve**	1	2
5	**Sun City Roseville**	1	2
6	**Stanford Ranch - Rocklin Vernal Pool Preserve**	1	2
7	**Highland Reserve South Preserve**	2	2
8	**Rodeo Grounds Preserve**	1	2
9	**Sheridan Mitigation Bank**	1	2
10	**Aitken Ranch Mitigation Bank**	1	2
11	**East Sheridan Vernal Pool Preserve**	1	1
12	**Orchard Creek Mitigation Bank**	1	1
	Median		
	Minimum		
	Maximum		
	Mean		
	Standard Deviation		

*** Data Not Available**

APPENDIX E

Floristic Data Summary

Appendix E. *Floristic Data Summary, Spring 2003*

Site ID	Plant Project ID	Site Name	Preserve Size (Acres)	Plant Survey Sample Size	% of Monitored Pools that Were Constructed	Overall Species Richness	Native Species Richness
1	2002-034-2	**Mahaney Park**	18	25	0.0%	52	26
2	2002-034-1	**Woodcreek Oaks City Preserve**	20	28	78.6%	79	50
3	2002-034-10	**Woodcreek North Preserve**	46	15	60.0%	63	38
4	2002-034-12	**Woodcreek West Preserve**	52	29	100.0%	94	56
5	2002-034-9	**Sun City Roseville**	68	33	36.4%	81	50
6	2002-034-8	**Stanford Ranch - Rocklin Vernal Pool Preserve**	125	34	35.3%	88	58
7	2002-034-11	**Highland Reserve South Preserve**	135	72	72.2%	99	64
8	2002-034-6	**Rodeo Grounds Preserve**	145	35	0.0%	82	53
9	2002-034-7	**Sheridan Mitigation Bank**	184	37	100.0%	66	40
10	2002-034-3	**Aitken Ranch Mitigation Bank**	310	39	100.0%	64	32
11	2002-034-5	**East Sheridan Vernal Pool Preserve**	317	70	0.0%	97	58
12	2002-034-4	**Orchard Creek Mitigation Bank**	708	78	0.0%	94	63
		Median	130	34.5	48.2%	81.5	51.5
		Minimum	18	15	0.0%	52	26
		Maximum	708	78	100.0%	99	64
		Mean	177.3	41.3	48.5%	79.9	49.0
		Standard Deviation	195.3	20.4	41.9%	15.5	12.3

*** Data Not Available**

Appendix E. *Floristic Data Summary, Spring 2003*

Site ID	Plant Project ID	Site Name	VPI/VPA Species Richness	Dominant Species Richness	Abundant Species Richness	Dominant VPI/VPA Species Richness	Mean Species Richness
1	2002-034-2	**Mahaney Park**	17	7	10	2	7.7
2	2002-034-1	**Woodcreek Oaks City Preserve**	37	21	8	13	24.9
3	2002-034-10	**Woodcreek North Preserve**	28	8	2	4	15.5
4	2002-034-12	**Woodcreek West Preserve**	41	15	31	11	27.6
5	2002-034-9	**Sun City Roseville**	33	9	30	4	17.9
6	2002-034-8	**Stanford Ranch - Rocklin Vernal Pool Preserve**	40	12	11	8	17.9
7	2002-034-11	**Highland Reserve South Preserve**	44	19	30	12	17
8	2002-034-6	**Rodeo Grounds Preserve**	42	17	13	12	24.4
9	2002-034-7	**Sheridan Mitigation Bank**	29	8	5	3	19.1
10	2002-034-3	**Aitken Ranch Mitigation Bank**	21	9	41	5	14.6
11	2002-034-5	**East Sheridan Vernal Pool Preserve**	38	21	21	10	22.6
12	2002-034-4	**Orchard Creek Mitigation Bank**	47	15	18	11	26.5
							0
		Median	37.5	13.5	15.5	9	18.5
		Minimum	17	7	2	2	7.7
		Maximum	47	21	41	13	27.6
		Mean	34.8	13.4	18.3	7.9	19.6
		Standard Deviation	9.3	5.3	12.3	4.1	5.8

*** Data Not Available**

Appendix E. *Floristic Data Summary, Spring 2003*

Site ID	Plant Project ID	Site Name	Mean Native Species Richness	Mean VPI/VPA Richness	% of Dominant Species that are VPI/VPA Species	% of Abundant Species that are VPI/VPA Species
1	2002-034-2	**Mahaney Park**	4.0	2.6	29.0%	50.0%
2	2002-034-1	**Woodcreek Oaks City Preserve**	16.9	14.9	62.0%	75.0%
3	2002-034-10	**Woodcreek North Preserve**	8.5	6.7	50.0%	100.0%
4	2002-034-12	**Woodcreek West Preserve**	19.5	16.4	73.0%	55.0%
5	2002-034-9	**Sun City Roseville**	10.2	7.9	44.0%	67.0%
6	2002-034-8	**Stanford Ranch - Rocklin Vernal Pool Preserve**	13.1	10.8	67.0%	36.0%
7	2002-034-11	**Highland Reserve South Preserve**	13.2	11.5	63.0%	73.0%
8	2002-034-6	**Rodeo Grounds Preserve**	16.7	13.8	71.0%	46.0%
9	2002-034-7	**Sheridan Mitigation Bank**	10.8	9.4	38.0%	100.0%
10	2002-034-3	**Aitken Ranch Mitigation Bank**	7.2	6.1	56.0%	39.0%
11	2002-034-5	**East Sheridan Vernal Pool Preserve**	14.4	11.6	48.0%	71.0%
12	2002-034-4	**Orchard Creek Mitigation Bank**	19.9	17.7	73.0%	89.0%
		Median	13.2	11.2	59.0%	69.0%
		Minimum	4.0	2.6	29.0%	36.0%
		Maximum	19.9	17.7	73.0%	100.0%
		Mean	12.9	10.8	56.2%	66.8%
		Standard Deviation	4.9	4.5	14.5%	22.1%

*** Data Not Available**

APPENDIX F

Avian Survey Results

Appendix F. ***Avian Species Detected per Preserve, Spring 2003***

Common name	Scientific name	Mahaney Park	Woodcreek Oaks City	Woodcreek North	Woodcreek West	Sun City Roseville	Stanford Ranch Rocklin	Highland Reserve South	Rodeo Grounds	Sheridan Mitigation Bank	Aitken Ranch	East Sheridan	Orchard Creek
Total Species Detected		**21**	**25**	**33**	**18**	**57**	**47**	**26**	**39**	**73**	**71**	**24**	**31**
Pied-billed Grebe	*Podilymbus podiceps*								•	•			
American White Pelican[c]	*Pelecanus erythrorhynchos*									•			•
Double-crested Cormorant[c]	*Phalacrocorax auritus*									•			
American Bittern[c]	*Botaurus lentiginosus*								•	•	•		
Great Blue Heron[c]	*Ardea herodias*						•	•	•	•	•		•
Great Egret[cd]	*Ardea alba*	•				•	•	•	•	•	•	•	
Snowy Egret[cd]	*Egretta thula*					•	•			•			
Green Heron	*Butorides virescens*						•						
White-faced Ibis[c]	*Plegadis chihi*									•			
Turkey Vulture	*Cathartes aura*			•	•	•		•	•	•	•	•	•
Canada Goose[d]	*Branta canadensis*					•	•		•	•	•		
Wood Duck	*Aix sponsa*					•				•	•		
Gadwall	*Anas strepera*									•	•		
American Wigeon[d]	*Anas americana*								•	•	•	•	•
Mallard[d]	*Anas platyrhynchos*	•		•	•	•	•	•	•	•	•	•	•
Cinnamon Teal[d]	*Anas cyanoptera*						•		•	•	•		
Green-winged Teal	*Anas crecca*										•		
Common Merganser	*Mergus merganser*					•							
White-tailed Kite[c]	*Elanus leucurus*						•		•	•	•	•	
Northern Harrier[c]	*Circus cyaneus*						•	•	•	•		•	•
Sharp-shinned Hawk[c]	*Accipiter striatus*										•		
Cooper's Hawk[c]	*Accipiter cooperii*					•				•			
Red-shouldered Hawk	*Buteo lineatus*			•		•				•			

Appendix F. ***Avian Species Detected per Preserve, Spring 2003***

Common name	Scientific name	Mahaney Park	Woodcreek Oaks City	Woodcreek North	Woodcreek West	Sun City Roseville	Stanford Ranch Rocklin	Highland Reserve South	Rodeo Grounds	Sheridan Mitigation Bank	Aitken Ranch	East Sheridan	Orchard Creek
Swainson's Hawk[c]	*Buteo swainsoni*										•		
Red-tailed Hawk	*Buteo jamaicensis*			•	•	•	•	•	•	•	•	•	•
American Kestrel	*Falco sparverius*						•	•		•	•	•	•
Ring-necked Pheasant	*Phasianus colchicus*	•	•		•	•	•	•	•	•	•	•	•
Wild Turkey	*Meleagris gallopavo*										•		
California Quail	*Callipepla californica*					•					•		
Virginia Rail	*Rallus limicola*									•	•		
Sora	*Porzana carolina*								•				
Common Moorhen	*Gallinula chloropus*						•		•	•	•		
American Coot	*Fulica americana*						•		•	•	•		
Killdeer[d]	*Charadrius vociferus*	•	•	•	•	•	•	•	•	•	•	•	•
Black-necked Stilt[d]	*Himantopus mexicanus*					•	•			•	•		•
American Avocet	*Recurvirostra americana*									•			
Greater Yellowlegs[d]	*Tringa melanoleuca*	•	•		•	•	•	•		•	•	•	•
Spotted Sandpiper	*Actitis macularia*					•							
Long-billed Curlew[c]	*Numenius americanus*									•			•
Western Sandpiper	*Calidris mauri*					•				•			
Least Sandpiper[d]	*Calidris minutilla*					•	•		•	•	•		
Dunlin	*Calidris alpina*										•		•
Long-billed Dowitcher	*scolopaceus*										•		
Common Snipe[d]	*Gallinago gallinago*					•	•		•	•	•		•
Rock Dove	*Columba livia*		•		•	•	•	•	•		•		
Mourning Dove	*Zenaida macroura*	•	•	•	•	•	•	•	•	•	•	•	•
Great Horned Owl	*Bubo virginianus*										•		
Anna's Hummingbird	*Calypte anna*	•		•		•	•		•	•			•
Belted Kingfisher	*Ceryle alcyon*								•	•			

Appendix F. ***Avian Species Detected per Preserve, Spring 2003***

Common name	Scientific name	Mahaney Park	Woodcreek Oaks City	Woodcreek North	Woodcreek West	Sun City Roseville	Stanford Ranch Rocklin	Highland Reserve South	Rodeo Grounds	Sheridan Mitigation Bank	Aitken Ranch	East Sheridan	Orchard Creek
Acorn Woodpecker	*Melanerpes formicivorus*		•	•		•							
Nuttall's Woodpecker	*Picoides nuttallii*		•	•		•				•	•		
Downy Woodpecker	*Picoides pubescens*									•	•		
Northern Flicker	*Colaptes auratus*						•			•			
Black Phoebe	*Sayornis nigricans*	•	•	•		•	•	•	•	•	•		
Flycatcher	*Myiarchus cinerascens*									•	•		
Western Kingbird	*Tyrannus verticalis*	•	•	•	•	•	•	•	•	•	•	•	•
Loggerhead Shrike[c]	*Lanius ludovicianus*										•		•
Western Scrub-Jay	*Aphelocoma californica*	•		•		•				•	•		
Yellow-billed Magpie	*Pica nuttalli*	•	•	•	•	•	•	•			•		
American Crow	*Corvus brachyrhynchos*	•	•	•	•					•	•		
Horned Lark	*Eremophila alpestris*							•	•				
Tree Swallow[d]	*Tachycineta bicolor*		•	•		•	•	•	•	•	•	•	•
Northern Rough-winged Swallow[d]	*Stelgidopteryx serripennis*			•		•					•		
Barn Swallow[d]	*Hirundo rustica*					•	•		•	•	•		•
Cliff Swallow[d]	*Petrochelidon pyrrhonota*			•		•	•		•	•	•	•	•
Oak Titmouse	*Baeolophus inornatus*		•	•		•					•		
Bushtit	*Psaltriparus minimus*	•	•	•		•	•			•	•		
White-breasted Nuthatch	*Sitta carolinensis*		•	•		•					•		
Bewick's Wren	*Thryomanes bewickii*					•					•		
House Wren	*Troglodytes aedon*			•		•				•	•		
Marsh Wren	*Cistothorus palustris*						•			•	•		
Ruby-crowned Kinglet	*Regulus calendula*		•							•			

Appendix F. ***Avian Species Detected per Preserve, Spring 2003***

Common name	Scientific name	Mahaney Park	Woodcreek Oaks City	Woodcreek North	Woodcreek West	Sun City Roseville	Stanford Ranch Rocklin	Highland Reserve South	Rodeo Grounds	Sheridan Mitigation Bank	Aitken Ranch	East Sheridan	Orchard Creek
Western Bluebird	*Sialia mexicana*		•	•		•				•	•		
Hermit Thrush	*Catharus guttatus*			•									
American Robin	*Turdus migratorius*		•			•	•		•	•	•		
Wrentit	*Chamaea fasciata*										•		
Northern Mockingbird	*Mimus polyglottos*		•	•		•	•	•	•			•	
European Starling	*Sturnus vulgaris*			•	•	•				•	•	•	•
American Pipit	*Anthus rubescens*				•		•	•		•		•	•
Orange-crowned Warbler	*Vermivora celata*					•	•			•	•		
Nashville Warbler	*Vermivora ruficapilla*			•						•	•		
Warbler	*Dendroica coronata*	•	•	•		•	•			•	•		
Black-throated Gray Warbler	*Dendroica nigrescens*					•							
Common Yellowthroat	*Geothlypis trichas*					•				•	•		
Wilson's Warbler	*Wilsonia pusilla*					•				•			
California Towhee	*Pipilo crissalis*									•			
Savannah Sparrow	*sandwichensis*	•				•	•	•	•	•	•	•	•
Song Sparrow	*Melospiza melodia*	•					•			•			
Lincoln's Sparrow	*Melospiza lincolnii*						•			•	•		
White-crowned Sparrow	*Zonotrichia leucophrys*	•		•		•	•	•		•	•		
Golden-crowned Sparrow	*Zonotrichia atricapilla*					•				•	•		
Dark-eyed Junco	*Junco hyemalis*									•			
Red-winged Blackbird	*Agelaius phoeniceus*	•	•		•	•	•	•	•	•	•	•	•
Tricolored Blackbird[c]	*Agelaius tricolor*								•		•		•
Western Meadowlark	*Sturnella neglecta*	•	•	•	•	•	•	•	•	•	•	•	•

Appendix F. ***Avian Species Detected per Preserve, Spring 2003***

Common name	Scientific name	Mahaney Park	Woodcreek Oaks City	Woodcreek North	Woodcreek West	Sun City Roseville	Stanford Ranch Rocklin	Highland Reserve South	Rodeo Grounds	Sheridan Mitigation Bank	Aitken Ranch	East Sheridan	Orchard Creek
Brewer's Blackbird	*Euphagus cyanocephalus*	•	•	•	•	•	•	•	•		•	•	•
Cowbird	*Molothrus ater*				•	•	•		•	•		•	•
Bullock's Oriole	*Icterus bullockii*			•						•	•		
House Finch	*Carpodacus mexicanus*	•	•	•	•	•	•	•	•	•	•	•	•
Lesser Goldfinch	*Carduelis psaltria*		•			•	•						
American Goldfinch	*Carduelis tristis*			•		•	•			•	•		
House Sparrow	*Passer domesticus*					•		•	•		•		

[c] indicates special-status species.

[d] indicates species observed using vernal pools.

APPENDIX G

Mammal Sign Survey Data

Appendix G. ***Results Summary of Mammal Sign Surveys, Summer 2003***

Common Name / Scientific Name	Mammal Signs	Orchard Creek Mitigation Bank	Aitken Ranch Mitigation Bank	East Sheridan Vernal Pool Preserve	Sheridan Mitigation Bank	Rodeo Grounds Preserve	Highland Reserve South Preserve - Parcels 84, 91, 93	Stanford Ranch - Rocklin Vernal Pool Preserve	Sun City Roseville	Woodcreek West Preserve	Woodcreek North Preserve	Woodcreek Oaks City Preserve
	Site Acreage	**708**	**310**	**317**	**184**	**145**	**135**	**125**	**68**	**52**	**46**	**20**
	Search Time (min.)	269	180	180	210	200	237	120	240	285	130	150
Unidentified small rodent	Scat piles	21		1	3	9	1	4	1	4		1
--	Visual				1				1			
	Track							1				
	Trail			7	4	12	3		7	5		
	Burrow	16		10	254	27	10	8	5	10	11	17
	Carcass				2							
	TOTAL	**37**	**0**	**18**	**264**	**48**	**14**	**13**	**14**	**19**	**11**	**18**
	No. Sign/min.	**0.14**	**0**	**0.10**	**1.26**	**0.24**	**0.06**	**0.11**	**0.06**	**0.07**	**0.08**	**0.12**
	% of total	**59**	**0**	**60**	**82**	**74**	**25**	**38**	**56**	**48**	**37**	**53**
California vole	Scat piles											
Microtus californicus	Visual			2	4	3						
	Track						1					
	Trail	3						2				
	Burrow											
	Carcass											
	TOTAL	**3**	**0**	**2**	**4**	**3**	**1**	**2**	**0**	**0**	**0**	**0**
	No. Sign/min.	**0.01**	**0**	**0.01**	**0.02**	**0.02**	**0.00**	**0.02**	**0**	**0**	**0**	**0**
	% of total	**5**	**0**	**7**	**1**	**5**	**2**	**6**	**0**	**0**	**0**	**0**
Unidentified small mammal	Scat piles	5		1	2	5	1	3		1		
--	Visual											
	Track											
	Trail				1							
	Burrow	9	1	4	12	4	2	1	2	4	3	5
	Carcass											
	TOTAL	**14**	**1**	**5**	**15**	**9**	**3**	**4**	**2**	**5**	**3**	**5**
	No. Sign/min.	**0.05**	**0.01**	**0.03**	**0.07**	**0.045**	**0.01**	**0.03**	**0.01**	**0.02**	**0.02**	**0.03**
	% of total	**22**	**3**	**17**	**5**	**14**	**5**	**12**	**8**	**13**	**10**	**15**
California ground squirrel	Scat piles											
Spermophilus beecheyi	Visual								1			
	Track											
	Trail											

Appendix G. ***Results Summary of Mammal Sign Surveys, Summer 2003***

Common Name / Scientific Name	Mammal Signs	Orchard Creek Mitigation Bank	Aitken Ranch Mitigation Bank	East Sheridan Vernal Pool Preserve	Sheridan Mitigation Bank	Rodeo Grounds Preserve	Highland Reserve South Preserve - Parcels 84, 91, 93	Stanford Ranch - Rocklin Vernal Pool Preserve	Sun City Roseville	Woodcreek West Preserve	Woodcreek North Preserve	Woodcreek Oaks City Preserve
	Site Acreage	**708**	**310**	**317**	**184**	**145**	**135**	**125**	**68**	**52**	**46**	**20**
	Search Time (min.)	269	180	180	210	200	237	120	240	285	130	150
	Burrow											
	Carcass											
	Audio										1	
	TOTAL	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**1**	**0**
	No. Sign/min.	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0.00**	**0**	**0.01**	**0**
	% of total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**4**	**0**	**3**	**0**
Valley pocket gopher	Scat piles											
Thamomys bottae	Visual											
	Track											
	Trail											
	Burrow	9		2	9	3	10	7	1	6	6	5
	Carcass											
	TOTAL	**9**	**0**	**2**	**9**	**3**	**10**	**7**	**1**	**6**	**6**	**5**
	No. Sign/min.	**0.03**	**0**	**0.01**	**0.04**	**0.02**	**0.04**	**0.06**	**0.00**	**0.02**	**0.05**	**0.03**
	% of total	**14**	**0**	**7**	**3**	**5**	**18**	**21**	**4**	**15**	**20**	**15**
Dusky-footed woodrat	Scat piles		1									
Neotoma fuscipes	Visual											
	Track											
	Trail											
	Burrow											
	Carcass											
	TOTAL	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
	No. Sign/min.	**0**	**0.01**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
	% of total	**0**	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Desert cottontail	Scat piles											
Sylvilagus auduboni	Visual						1					
	Track											
	Trail											
	Burrow											
	Carcass											
	TOTAL	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**

Appendix G. ***Results Summary of Mammal Sign Surveys, Summer 2003***

Common Name / Scientific Name	Mammal Signs	Orchard Creek Mitigation Bank	Aitken Ranch Mitigation Bank	East Sheridan Vernal Pool Preserve	Sheridan Mitigation Bank	Rodeo Grounds Preserve	Highland Reserve South Preserve - Parcels 84, 91, 93	Stanford Ranch - Rocklin Vernal Pool Preserve	Sun City Roseville	Woodcreek West Preserve	Woodcreek North Preserve	Woodcreek Oaks City Preserve
	Site Acreage	**708**	**310**	**317**	**184**	**145**	**135**	**125**	**68**	**52**	**46**	**20**
	Search Time (min.)	269	180	180	210	200	237	120	240	285	130	150
	No. Sign/min.	**0**	**0**	**0**	**0**	**0**	**0.00**	**0**	**0**	**0**	**0**	**0**
	% of total	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**
Black-tailed jackrabbit	Scat piles		6	1	17		10	4	3	4	4	6
Lepus californicus	Visual		2		6		8	3	1			
	Track											
	Trail						1					
	Burrow											
	Carcass		1		2							
	TOTAL SIGNS	**0**	**9**	**1**	**25**	**0**	**19**	**7**	**4**	**4**	**4**	**6**
	No. Sign/min.	**0**	**0.05**	**0.01**	**0.12**	**0**	**0.08**	**0.06**	**0.02**	**0.01**	**0.03**	**0.04**
	% of total	**0**	**25**	**3**	**8**	**0**	**33**	**21**	**16**	**10**	**13**	**18**
Racoon	Scat piles		1				1			1		
Procyon lotor	Visual											
	Track		12					1				
	Trail											
	Burrow				3		1					
	Carcass											
	TOTAL	**0**	**13**	**0**	**3**	**0**	**2**	**1**	**0**	**1**	**0**	**0**
	No. Sign/min.	**0**	**0.07**	**0**	**0.01**	**0**	**0.01**	**0.01**	**0**	**0.00**	**0**	**0**
	% of total	**0**	**36**	**0**	**1**	**0**	**4**	**3**	**0**	**3**	**0**	**0**
Striped skunk	Scat piles											
Mephitis mephitis	Visual											
	Track										1	
	Trail											
	Burrow									1		
	Carcass											
	TOTAL	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**0**
	No. Sign/min.	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0.00**	**0.01**	**0**
	% of total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**3**	**0**
Bobcat	Scat piles											
Lynx rufus	Visual											

Appendix G. ***Results Summary of Mammal Sign Surveys, Summer 2003***

Common Name / Scientific Name	Mammal Signs	Orchard Creek Mitigation Bank	Aitken Ranch Mitigation Bank	East Sheridan Vernal Pool Preserve	Sheridan Mitigation Bank	Rodeo Grounds Preserve	Highland Reserve South Preserve - Parcels 84, 91, 93	Stanford Ranch - Rocklin Vernal Pool Preserve	Sun City Roseville	Woodcreek West Preserve	Woodcreek North Preserve	Woodcreek Oaks City Preserve
	Site Acreage	**708**	**310**	**317**	**184**	**145**	**135**	**125**	**68**	**52**	**46**	**20**
	Search Time (min.)	269	180	180	210	200	237	120	240	285	130	150
	Track		2									
	Trail											
	Burrow											
	Carcass											
	TOTAL	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
	No. Sign/min.	**0**	**0.01**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
	% of total	**0**	**6**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Fox (red or gray)	Scat piles					1	2					
Vulpes fulva or	Visual											
Urocyon cinereoargenteus	Track									3		
	Trail											
	Burrow											
	Carcass											
	TOTAL	**0**	**0**	**0**	**0**	**1**	**2**	**0**	**0**	**3**	**0**	**0**
	No. Sign/min.	**0**	**0**	**0**	**0**	**0.01**	**0.01**	**0**	**0**	**0.01**	**0**	**0**
	% of total	**0**	**0**	**0**	**0**	**2**	**4**	**0**	**0**	**8**	**0**	**0**
Coyote	Scat piles		1	1	2	1	1		1			
Canis latrans	Visual			1					1			
	Track		7									
	Trail		1				1		1	1		
	Burrow											
	Carcass											
	TOTAL	**0**	**9**	**2**	**2**	**1**	**2**	**0**	**3**	**1**	**0**	**0**
	No. Sign/min.	**0**	**0.05**	**0.01**	**0.01**	**0.01**	**0.01**	**0**	**0.01**	**0.00**	**0**	**0**
	% of total	**0**	**25**	**7**	**1**	**2**	**4**	**0**	**12**	**3**	**0**	**0**
Domestic dog	Scat piles						3				3	
Canis familiaris	Visual											
	Track										1	
	Trail											
	Burrow											
	Carcass											

Appendix G. ***Results Summary of Mammal Sign Surveys, Summer 2003***

Common Name / Scientific Name	Mammal Signs	Orchard Creek Mitigation Bank	Aitken Ranch Mitigation Bank	East Sheridan Vernal Pool Preserve	Sheridan Mitigation Bank	Rodeo Grounds Preserve	Highland Reserve South Preserve - Parcels 84, 91, 93	Stanford Ranch - Rocklin Vernal Pool Preserve	Sun City Roseville	Woodcreek West Preserve	Woodcreek North Preserve	Woodcreek Oaks City Preserve
	Site Acreage	**708**	**310**	**317**	**184**	**145**	**135**	**125**	**68**	**52**	**46**	**20**
	Search Time (min.)	269	180	180	210	200	237	120	240	285	130	150
	TOTAL	**0**	**0**	**0**	**0**	**0**	**3**	**0**	**0**	**0**	**4**	**0**
	No. Sign/min.	**0**	**0**	**0**	**0**	**0**	**0.01**	**0**	**0**	**0**	**0.03**	**0**
	% of total	**0**	**0**	**0**	**0**	**0**	**5**	**0**	**0**	**0**	**13**	**0**
Mule deer	Scat piles											
Odocoileus hemionus	Visual											
	Track		1									
	Trail				1							
	Burrow											
	Carcass											
	TOTAL	**0**	**1**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
	No. Sign/min.	**0**	**0.01**	**0**	**0.00**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
	% of total	**0**	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Appendix G. ***Results Summary of Mamma***

Common Name / Scientific Name	Mammal Signs	Mahaney Park
	Site Acreage	**18**
	Search Time (min.)	195
Unidentified small rodent	Scat piles	1
--	Visual	
	Track	
	Trail	
	Burrow	12
	Carcass	
	TOTAL	**13**
	No. Sign/min.	**0.07**
	% of total	**35**
California vole	Scat piles	
Microtus californicus	Visual	
	Track	
	Trail	
	Burrow	
	Carcass	
	TOTAL	**0**
	No. Sign/min.	**0**
	% of total	**0**
Unidentified small mammal	Scat piles	
--	Visual	
	Track	
	Trail	
	Burrow	1
	Carcass	
	TOTAL	**1**
	No. Sign/min.	**0.01**
	% of total	**3**
California ground squirrel	Scat piles	
Spermophilus beecheyi	Visual	
	Track	
	Trail	

Appendix G. ***Results Summary of Mamma***

Common Name / Scientific Name	Mammal Signs	Mahaney Park
	Site Acreage	**18**
	Search Time (min.)	195
	Burrow	
	Carcass	
	Audio	
	TOTAL	**0**
	No. Sign/min.	**0**
	% of total	**0**
Valley pocket gopher	Scat piles	
Thamomys bottae	Visual	
	Track	
	Trail	
	Burrow	8
	Carcass	
	TOTAL	**0**
	No. Sign/min.	**0**
	% of total	**0**
Dusky-footed woodrat	Scat piles	
Neotoma fuscipes	Visual	
	Track	
	Trail	
	Burrow	
	Carcass	
	TOTAL	**0**
	No. Sign/min.	**0**
	% of total	**0**
Desert cottontail	Scat piles	
Sylvilagus auduboni	Visual	
	Track	
	Trail	
	Burrow	
	Carcass	
	TOTAL	**0**

Appendix G. ***Results Summary of Mamma***

Common Name / Scientific Name	Mammal Signs	Mahaney Park
	Site Acreage	**18**
	Search Time (min.)	195
	No. Sign/min.	**0**
	% of total	**0**
Black-tailed jackrabbit	Scat piles	11
Lepus californicus	Visual	1
	Track	
	Trail	
	Burrow	
	Carcass	
	TOTAL SIGNS	**12**
	No. Sign/min.	**0.06**
	% of total	**32**
Racoon	Scat piles	
Procyon lotor	Visual	
	Track	5
	Trail	
	Burrow	
	Carcass	
	TOTAL	**5**
	No. Sign/min.	**0.03**
	% of total	**14**
Striped skunk	Scat piles	
Mephitis mephitis	Visual	
	Track	
	Trail	1
	Burrow	
	Carcass	
	TOTAL	**1**
	No. Sign/min.	**0.01**
	% of total	**3**
Bobcat	Scat piles	
Lynx rufus	Visual	

Appendix G. ***Results Summary of Mamma***

Common Name / Scientific Name	Mammal Signs	Mahaney Park
	Site Acreage	**18**
	Search Time (min.)	195
	Track	
	Trail	
	Burrow	
	Carcass	
	TOTAL	**0**
	No. Sign/min.	**0**
	% of total	**0**
Fox (red or gray)	Scat piles	
Vulpes fulva or	Visual	
Urocyon cinereoargenteus	Track	
	Trail	
	Burrow	
	Carcass	
	TOTAL	**0**
	No. Sign/min.	**0**
	% of total	**0**
Coyote	Scat piles	2
Canis latrans	Visual	
	Track	
	Trail	1
	Burrow	
	Carcass	
	TOTAL	**3**
	No. Sign/min.	**0.02**
	% of total	**8**
Domestic dog	Scat piles	2
Canis familiaris	Visual	
	Track	
	Trail	
	Burrow	
	Carcass	

Appendix G. ***Results Summary of Mamma***

Common Name / Scientific Name	Mammal Signs	Mahaney Park
	Site Acreage	**18**
	Search Time (min.)	195
	TOTAL	**2**
	No. Sign/min.	**0.01**
	% of total	**5**
Mule deer	Scat piles	
Odocoileus hemionus	Visual	
	Track	
	Trail	
	Burrow	
	Carcass	
	TOTAL	**0**
	No. Sign/min.	**0**
	% of total	**0**

APPENDIX H

Amphibian Survey Datasheets

Placer County Vernal Pool Preserve Study
Amphibian Survey Data Forms

Date: 03-26-03 Site Name Aitken's Ranch Visit # 1

Surveyors: PB/AB Survey time: start 12:30 end 16 45 Total survey time 4 15"

Start Air Temp (C): 68°F End Air Temp: 65°F

Cloud cover: clear (0-10%) partly cloudy (11-50%) cloudy (>50%) Wind Speed (*Beaufort): (0-1) (2-4) (5+)

Herpetofauna Observed: Pseudacris adult, eggs, +LARVAE chorus ∅ tiger tadpoles ∅ in natural + constructed pools. Bullfrog

Feature Number	Max Depth (cm)	Water Temp (C)	Surface Area (m^2)	Comments
~~160~~	15	21		clear ∅
151	~~17~~	22		∅
142	~~18~~	24		clear / ↑ hemiptera, dytiscid, cladocera, chiro
139	11	23		↑ nutrient rich / cattle.
122	10	24		10 Adult Pseudacris - most are small - under sediment wood boards
—	—	—	—	↑ Six adult chorus frogs (small) under board in grass
~~146~~	~~19~~			↑ amphipod in drainage swale.
115	9	24		∅ ↑ dytiscids
116	6	24		∅
97	8	24		∅
96	7	24		∅
Marsh-SW corner			—	∅ Typha, Polygonum ↑ snails 1 chorus frog adult 4 others calling
88	6	24		∅
A west/central drainage swale			6cm²	∅ variable depth - Rumex 6± cm
B w/central main swale 10±				∅ glyceria, eleocharis, Rumex - amphipods↑.
78	15	23		irritia, drainage swale - Thousands ∅ cladocera some amphipoda
77	9	23		∅ amphipods - 2 adult Pseudacris under board.
72	5	23		∅
70	9	24		∅ clear ↑ inverts
68	10	23		clam shrimp (Cyzicus), some amphipods. - some in fringe, but generally sparse
67	~~17~~	-24		Chiromus - ∅
11	6	24		∅ 1 treefrog calling.
17	9	23		5 Pseudacris egg masses 1 calling
18	10	23		∅ ∅
64	4	24		∅ 1 calling.
62	5	24		∅
63	11	23		clam shrimp 1 Pseudacris egg mass
61	5	23		∅
59	4	24		∅
54	3	24		∅

Additional comments/Incidental wildlife observations: KILL, CURLEW RNPH, Sandpiper sp. 1 RWBB, ROCK dove. BARS, BARL SANS, WITH, INCANE NOMA MALL RWBB KILL, GRMB, CLESW = CLSW

↓ rain ↑ Today pride may have accelerated amphib development. signs of pride here below.

Red-tail hawk, skunk scat, 4 chorus frogs + calls. ∅ tadpoles

BLACK-TAILED JACKRABBIT

*Beaufort scale: 0-1: (0-3 mph) calm to light air (rising smoke drift) 2-4: (4-18 mph) light breeze to moderate breeze (raises dust and paper) 5+: (>18 mph) fresh breeze (small trees sway)

Placer County Vernal Pool Preserve Study
Amphibian Survey Data Forms

Date: 03-26-03 Site Name Aitken Ranch Visit #_____

Surveyors: PB/AB Survey time: start_____ end_____ Total survey time_____

Start Air Temp (C): _____ End Air Temp: _____

Cloud cover: clear (0-10%) partly cloudy (11-50%) cloudy (>50%) Wind Speed (*Beaufort): (0-1) (2-4) (5+)

Herpetofauna Observed:_____

Feature Number	Max Depth (cm)	Water Temp (C)	Surface Area (m^2)	Comments
53	3	14		Ø Primer dry down
22	14	23		~~very Aregetation~~ Ø
DISTANT CANAL				BULLFROG - SUBADULT ? ADULT ?
NURSERY POOLS				BULLFROG - ADULT ?
MARSH NEAR CANAL SIDE				BULLFROG - LARVAE ? SUBADULTS, PSEUDACRIS LARVAE

Additional comments/Incidental wildlife observations:_____

*Beaufort scale: 0-1: (0-3 mph) calm to light air (rising smoke drift) 2-4: (4-18 mph) light breeze to moderate breeze (raises dust and paper) 5+: (>18 mph) fresh breeze (small trees sway)

ECORP Consulting, Inc.

ENVIRONMENTAL CONSULTANTS

Placer County Vernal Pool Preserve Study

Amphibian Survey Data Sheet

Date: 04/10/03 Site Name City Preserve Visit # 1

Surveyors: PB Survey time: start 8:30am end _____ Total survey time _____

Start Air Temp (C): 15° End Air Temp: _____

Cloud cover: clear (0-10%) partly cloudy (11-50%) cloudy (>50%) Wind Speed (*Beaufort): (0-1) (2-4) (5+)

Herpetofauna Observed: Thamnophis elegans, PSRE

	Feature Number	Max Depth (cm)	Water Temp (C)	Surface Area (m^2)	Comments
South Preserve	15	25	20		several PSRE tads.
	7	10			a few PSRE tads
	6	10			Ø
	10	3			a few PSRE tads
	X	10			several PSRE tads, historic swale with fill; it has created a vernal pool - ↑ thatch, transects
	—				
North Preserve	58/M				Both dry - no evidence of Lepidurus use
	51	3			several PSRE tads - several morphs
	40	10			PSRE tads - various stages
	44	8			numerous PSRE - metamorphs
	43	11			" " "
	South Swale	32			South swale now - now a large vp - ↑ lg. PSRE tads
	40	22			↑ PSRE tads
	35	20			1 PSRE tads
	36	30cm			Numerous PSRE tads - morphs to new tads
	34	12			" " " "
	32	3			several small PSRE tads

Additional comments/incidental wildlife observations:

Northern Preserve adjacent to Golf Course, Southern with some residential - ↑ several golf balls

*Beaufort scale: 0-1: (0-3 mph) calm to light air (rising smoke drift) 2-4: (4-18 mph) light breeze to moderate breeze (raises dust and paper) 5+: (>18 mph) fresh breeze (small trees sway)

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Placer County Vernal Pool Preserve Study
Amphibian Survey Data Sheet

Date: 03/28/03 Site Name: East Sheridan Visit #: 1

Surveyors: PB Survey time: start 11:30 end 1615 Total survey time 4'45"

Start Air Temp (C): 24 End Air Temp: 21

Cloud cover: clear (0-10%) (partly cloudy) (11-50%) cloudy (>50%) Wind Speed (*Beaufort): (0-1) (2-4) (5+)

Herpetofauna Observed: PCFR & BULLFROG

	Feature Number	Max Depth (cm)	Water Temp (C)	Surface Area (m²)	Comments → Road – 1.5m? → gets very deep at overpass of road Ranagu,	
	AA	40cm	21°	—	terminous (west) of drainage, Ø elemac, lidpod, Junxip	– Flowing
	~~BB~~	~~>1m~~	21°	—	~~insect typical~~ ~~uptab~~ amphipods, ephem,	
*	BB	>1m	21°		Deep stock pond, 4 adult Rana cat, several Ranlacris larvae	Rain scatter
	CC	10	22°		↑ veg. – Ø elemac ↑VP veg. Plagio etc.	
	DD	15	21°		Ø very clear – eam bun, desdan, Gly, Elemac – typical	late ?
	EE	25	21°	Ø	nice VP – good veg cover – Plag, Eryn Ø etc. – Good Shrimp potential → L.O. potential	– Pytin
	FF	10	21°		Good Branchinecta potential Ø	– Lasip – Nota
	GG	12±	21°		Swale with three excavated pools. – Ø	
*	HH	40	20°		mallards Great egret, deep VP – Bevaldaris egg masses (2)	
	II	18	21°		Good shr. potential Ø, BF	
	JJ	27	21°		Good shrimp potential Ø, signs of prev. lower H2O – grazing grazed veg	under H2O
	KK	12	↓		Ø	
	LL	20			Good B.L potential, clear – Ranbin Ø	
	MM	20			~~pseudacris? probable~~ definite ~~About as many egg masses~~ cluster + Fountain	
*?	NN	20±		some very small tads	drainage – some small pools 20cm – potential – caddis larvae	=
	~~OO~~	~~none~~			another aggregation – turbid pool (clay)? – 2 more recent PR – hatched eggs	Linen eggmass
	~~PP~~ OO	to 40			cobble bottom – intermittent pools in drainage	
	PP	18			VP – clear Ø	
	QQ	10			Ø ↑veg. – drying down.	
	RR	10			" " "	
	SS	12			Clear – Ø excellent pools in area. ~~Good~~ B.L. possibilities	
	TT	18			Clear – Ø " " "	
	UU	10	↓		" Ø " "	
	VV	15	21°		coyote seen at pool – Ø clear	
**	WW	16	21° 10's		Clear Also has Branchinecta! 10's early stage 10's	
**	YY	18	21° none collected	15x27	pool 180 – clear Ø ↑ veg – Ranbin/Elemac * B.sp!	♂ + ♀ early stage
	ZZ	20	↓		Ø	
	AA1	20			Ø clear – open	
	AA2	18	↓		Ø 1/2 on property –	
	(Next Page)					

Branchinecta in YY – early stages ♂ + ♀ with developing eggs * in open H2O + hoof print bottoms

Additional comments/incidental wildlife observations: swallow nests under road crossing

* recommend Follow-up visit. mallard in creek/drainage, turkey, whistl.., great egret.

walked drainage when could – many deep pools – ~~[illegible]~~ back eddy pools possible to [illegible]

** B.sp. p.count

*Beaufort scale: 0-1: (0-3 mph) calm to light air (rising smoke drift) 2-4: (4-18 mph) light breeze to moderate breeze (raises dust and paper) 5+: (>18 mph) fresh breeze (small trees sway)

* ~~[illegible]~~ main drainage/creek has good series of deep pools – + often small cobble substrate. – Flows probably high in winter.

* Ranagu 1° (ID)

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Placer County Vernal Pool Preserve Study

Amphibian Survey Data Sheet

Date: 03/28/03 Site Name East Sheridan Visit # 1

Surveyors: PB Survey time: start _____ end _____ Total survey time _____

Start Air Temp (C): _____ End Air Temp: _____

Cloud cover: clear (0-10%) partly cloudy (11-50%) cloudy (>50%) Wind Speed (*Beaufort): (0-1) (2-4) (5+)

Herpetofauna Observed: _____

Feature Number	Max Depth (cm)	Water Temp (C)	Surface Area (m^2)	Comments
AA3	12	21.0	22'x10'	BL, ♂ (combined) 10's -
AA4	18	21°	21'x27'	~~Ø eggs~~ Branchiopods could be present in very low numbers, in suitable freq
AA5	25	21°	—	Ø

Additional comments/Incidental wildlife observations: _____

*Beaufort scale: 0-1: (0-3 mph) calm to light air (rising smoke drift) 2-4: (4-18 mph) light breeze to moderate breeze (raises dust and paper) 5+: (>18 mph) fresh breeze (small trees sway)

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Placer County Vernal Pool Preserve Study

Amphibian Survey Data Sheet

Date: 28 MARCH 2003 Site Name ROSTRANO Visit # 1

Surveyors: AB & PB Survey time: start 11:30 end 1615 Total survey time 4' 45"

Start Air Temp (C): 24 End Air Temp: 21

Cloud cover: clear (0-10%) partly cloudy (11-50%) cloudy (>50%) Wind Speed (*Beaufort): (0-1) (2-4) (5+)

Herpetofauna Observed: PCFR & BULL

Feature Number	Max Depth (cm)	Water Temp (C)	Surface Area (m^2)	Comments
A	15	20		VP Ø
B	18	18		VP Ø
C	17	18		VP Ø
511	20	18		VP Ø
D	25	19		VP AVE. DEPTH <20 PCFR - LARVAE 10s, ELK MARSH 1
E	20	19		VP Ø
F	19	20		VP Ø
G	24	20		VP Ø
H	25	20		VP PCFR LARVAE 10s
I	15	19		VP PCFR LARVAE 10s - FEW WEARING METAMORPHOSE
J	23	20		VP Ø
K	22	21		VP AVE DEPTH <15 PCFR LARVAE 10s - LATE DEVELOPMENT STAGES
L	13	21		VP Ø
M	22	20		VP PCFR LARVAE 100s VARIOUS DEVELOPMENT STAGES
O	17	20		VP Ø
P	21	20		VP Ø
Q	20	20		VP Ø
R	18	21		VP PCFR LARVAE 100s - ALL DEVELOPMENT PHASES
S	15	21		VP Ø
T= 2226	21	21		VP PCFR LARVAE 100s - ALL STAGES
U	19	21		VP Ø
V	12	21		VP Ø
W	20	21		VP PCFR LARVAE 1000s - LARGE SURFACE AREA POOL
X	12	21		VP Ø
Y	11	21		VP Ø
Z	18	21		VP PCFR LARVAE 10s

Additional comments/Incidental wildlife observations:

ACTIVE RTHA NEST - SEE MAP FOR LOCATION

*Beaufort scale: 0-1: (0-3 mph) calm to light air (rising smoke drift) 2-4: (4-18 mph) light breeze to moderate breeze (raises dust and paper) 5+: (>18 mph) fresh breeze (small trees sway)

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Placer County Vernal Pool Preserve Study

Amphibian Survey Data Sheet

Date: 4-10-03 Site Name HPS Parcel 84 upper/83 upper Visit # 1

Surveyors: SH Survey time: start ~~1315~~ 1210 end ~~1440~~ 1360 Total survey time ~~1:25~~ 1 hr 50 min

Start Air Temp (C): 23° End Air Temp: 23°

Cloud cover: clear (0-10%) partly cloudy (11-50%) cloudy (>50%) Wind Speed (*Beaufort): (0-1) (2-4) (5+)

Herpetofauna Observed: HYRE larvae, RACA larvae & juv.

Feature Number	Max Depth (cm)	Water Temp (C)	Surface Area (m^2)	Comments
parcel 84 upper 1	18	23?		HYRE larvae (10's)
2	15	—		—
3	20	—		RACA larvae (100's)
parcel 83 1	>50			RACA larvae (>50) + juv
2	25			RACA larvae (100's)

Additional comments/Incidental wildlife observations: mosquitofish (3), crawfish, blk tailed jackrabbit (P83)

*Beaufort scale: 0-1: (0-3 mph) calm to light air (rising smoke drift) 2-4: (4-18 mph) light breeze to moderate breeze (raises dust and paper) 5+: (>18 mph) fresh breeze (small trees sway)

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Placer County Vernal Pool Preserve Study

Amphibian Survey Data Sheet

Date: 4-8-03 Site Name HRS- parcel 87 Visit # 1

Surveyors: SH Survey time: start 1215 end 1520 Total survey time 3 hr 05 min.

Start Air Temp (C): 24 End Air Temp: 26

Cloud cover: clear (0-10%) partly cloudy (11-50%) cloudy (>50%) Wind Speed (*Beaufort): (0-1) (2-4) (5+) with 2-4 gusts

Herpetofauna Observed: HYRE larvae & juvenile, RACA larvae + adult/juv, BUBU larvae

Feature Number	Max Depth (cm)	Water Temp (C)	Surface Area (m^2)	Comments
1 (inter. drainage)	40	22	1.5 wide	RACA larvae (>100) & adults/juv, mosq. fish, snails, crawfish
2 (271)	25	24	37×7	HYRE larvae (>100)
3	15	—	25×3	HYRE larvae, metamorph, juv, crawfish
4	25	—	8×5	HYRE larvae (20s)
5	30	—	33×7	HYRE larvae, BUBU larvae (1000s), 2 RACA juv./adult
6	25	—	25×12	HYRE larvae (100s)
7	25	—	22×12	HYRE larvae (>100)
8	35	—	38×20	BUBU larvae (1000s), RACA juv/adult
9	15	—	18×6	HYRE larvae (20s)
10	30	—	8×8	" " (100s)
11	18	29	12×23	" " (20s)
12	31	—	22×6	—
13	25	—	10×4	—
14	13	—	(10×4.5)+(3×3)	HYRE larvae (20s), BUBU (1000s)
15	19	—	6×23	HYRE larvae (50s) & (1) juv.
16 (350)	15	—	4×5	HYRE larvae (20s)
17 (marsh/culvert)	35	—	7×7	3 RACA adult/juv.

Additional comments/Incidental wildlife observations: mosquito fish, snails, crawfish

*Beaufort scale: 0-1: (0-3 mph) calm to light air (rising smoke drift) 2-4: (4-18 mph) light breeze to moderate breeze (raises dust and paper) 5+: (>18 mph) fresh breeze (small trees sway)

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Placer County Vernal Pool Preserve Study

Amphibian Survey Data Sheet

Date: 4-9-03 Site Name: LRS Parcel 91, 84 lower Visit #: 1

Surveyors: SH Survey time: start 1030 end 1140 Total survey time 1 hr 10 min

Start Air Temp (C): 21° End Air Temp: 23°

Cloud cover: clear (0-10%) [circled] partly cloudy (11-50%) cloudy (>50%) Wind Speed (*Beaufort): (0-1) (2-4) [circled] (5+)

Herpetofauna Observed: HYRE larvae + metamorph, RACA larvae & juv., gopher snake, 2 THEL

	Feature Number	Max Depth (cm)	Water Temp (C)	Surface Area (m^2)	Comments
Parcel 91	1	5	—		HYRE larvae
	2	10	—		HYRE adult
	3	22	18°		HYRE larvae & metamorphs
	4	15	—		HYRE larvae
Parcel 84	5	45	21°		(2) RACA juv., HYRE larvae + metamorphs
	6	>50	—		(4) RACA juv. & larvae (>50)
	7 (91)	22	—		HYRE larvae
	9	15	—		" "
	9	dry	—		(see below)

Additional comments/Incidental wildlife observations: 3 blk-tailed jackrabbit, mosquitofish (6), clams (5), crawfish (6), [illegible]

*Beaufort scale: 0-1: (0-3 mph) calm to light air (rising smoke drift) 2-4: (4-18 mph) light breeze to moderate breeze (raises dust and paper) 5+: (>18 mph) fresh breeze (small trees sway)

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Placer County Vernal Pool Preserve Study

Amphibian Survey Data Sheet

Date: 4-18-03 Site Name HRS- parcel 93 Visit # 1

Surveyors: SH Survey time: start 0905 end 1140 Total survey time 2 hr 35 min

Start Air Temp (C): 14° End Air Temp: 24°

Cloud cover: clear (0-10%) partly cloudy (11-50%) cloudy (>50%) Wind Speed (*Beaufort): (0-1) (2-4) (5+)

Herpetofauna Observed: HYRA larvae & heard adult chorus, RACA adult/juv. & larvae
2 THEL, 1 gopher snake

Feature Number	Max Depth (cm)	Water Temp (C)	Surface Area (m^2)	Comments
1	21	14.5	3×7	—
2	19	—	8×3	HYRE larvae (10s)
3	23	—	12×2.5	
4	24	15	9×3	
5	13	—	12×1.5	
6	15	—	7×4	
7	13	—	4×1.5	
8	21	15	(7×4)+(7.5×3)	
9	12	—	5×2	
10	12	—	19×2	HYRE larvae (10s)
11	14	—	6×4.5	HYRE larvae (20s)
12	5	—	30×3	HYRE larvae (100s), 2 THEL (~40 cm long)
13	15	—	22×5	HYRE larvae (20s)
iter. → 14	0-30	14	2 wide	7 RACA (4 larvae, 3 adult), HYRE chorus, mosquito fish, crawfish
rainage → 15	5-30	14	<1 wide	2 RACA (adult), gopher snake (~1m long), mosquito fish

Additional comments/Incidental wildlife observations: Black-tailed jackrabbit scat

*Beaufort scale: 0-1: (0-3 mph) calm to light air (rising smoke drift) 2-4: (4-18 mph) light breeze to moderate breeze (raises dust and paper) 5+: (>18 mph) fresh breeze (small trees sway)

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Placer County Vernal Pool Preserve Study

Amphibian Survey Data Sheet

Date: 04/08/03 Site Name Mahaney Park Visit # 1

Surveyors: PB Survey time: start 10:45 end _____ Total survey time _____

Start Air Temp (C): _____ End Air Temp: _____

Cloud cover: clear (0-10%) partly cloudy (11-50%) cloudy (>50%) Wind Speed (*Beaufort): (0-1) (2-4) (5+)

Herpetofauna Observed: bullfrogs, PS

Feature Number	Max Depth (cm)	Water Temp (C)	Surface Area (m^2)	Comments
SW1	ø			Juncus effusus w/ Typha - saturated | small rut with Hyla
SW10	—			recent dry down, snails, dead PSRE tad, crayfish # + burrows of crayfish
SW13	—			" " " "
others	dry			
Per. Stream	variable			Gambusia, large adult bullfrogs & PSRE tadpoles

Additional comments/Incidental wildlife observations: Mallards / pheasant
Numerous outfalls, many choked with veg. — VP constructed over these.
coyote scat

*Beaufort scale: 0-1: (0-3 mph) calm to light air (rising smoke drift) 2-4: (4-18 mph) light breeze to moderate breeze (raises dust and paper) 5+: (>18 mph) fresh breeze (small trees sway)

Mx 4 bicycle trails exit 1 cows in creek - trash & ditch lines. native?

Placer County Vernal Pool Preserve Study
Amphibian Survey Data Forms

Date: 9 APRIL 2003 Site Name ORCHARD CRK - WETLANDS Visit # 1

Surveyors: K KUHAN, A BENJAMIN Survey time: start 1045 end 1530 Total survey time 4'45"

Start Air Temp (C): 22 End Air Temp: 28

Cloud cover: clear (0-10%) (partly cloudy) (11-50%) cloudy (>50%) Wind Speed (*Beaufort): ((0-1)) (2-4) (5+)

Herpetofauna Observed: P. CHORUS FEMALE, BULLFROG, COMMON GARTER SNAKE (2), W. FENCE LIZARD

Feature Number	Max Depth (cm)	Water Temp (C)	Surface Area (m^2)	Comments
A	>40	21		PERENNIAL CRK BULLFROG - ADULT (5), SUBADULT (8), LARVAE (2), CATFISH UNID. FISH
B	>40	18		S. WETLAND SWALE BULLFROG SUBADULT (7)
C	>60	23		VP BULLFROG ADULT (1) SUBADULT (3), PCFR LARVAE 100s
D	20	23		VP PCFR LARVAE 100s
E	18	21		VP PCFR LARVAE 100s
F	10	22		VP BULLFROG SUBADULT (1)
G	20	22		VP Ø
H	<10	23		VP Ø
I	25	22		VP Ø
J	15	23		VP AVE DEPTH <10, HIGH ALGAL CONTENT Ø
K	13	23		VP AVE DEPTH ≤ 5 Ø
L	18	23		VP AVE DEPTH <10, Ø
M	25	22		VP PCFR LARVAE 10s - NEARING METAMORPHS
N	15	23		VP Ø
O	40	23		WETLAND SWALE — H2O PREVENTED FROM SCOUR POOL - Ø
P	20	24		VP Ø
Q	18	24		VP AVE DEPTH <10, SIGNIFICANT PORTION OF POOL IS DRY - Ø
R	15	24		VP Ø
S	20	24		VP Ø HIGH ALGAL CONTENT
T	10	24		VP PCFR JUVENILE (1) ALONG MARGIN
U	15	24		VP, SCIRPUS BECOMING ESTABLISHED Ø
V	35	23		EPHEMERAL DRAINAGE PCFR LARVAE 10s, BULLFROG - SUBADULT (6), ADULT (1)
W	17	24		DEPRESSION IN WETLAND SWALE, PCFR LARVAE 100s, SIGNIFICANT PORTION DRY
X	20	26		VP AVE DEPTH <10, Ø
AA	10	21		VP BULLFROG - SUBADULT (2)
BB	20	21		VP Ø
CC	15	21		VP Ø
DD	>50	20		VP PCFR LARVAE 1000s CHIRONOMIDS SP.
EE	5	22		SWALE, Ø 4" BASS SP. (2)
FF	15	22		VP Ø

Additional comments/Incidental wildlife observations: LARGE % OF POOLS ARE DRY OR NEARLY SO

RTHA - ACTIVE NEST ALONG WESTERN BOUNDARY, LOSH - POT NEST, 1 IN OBS. IN WILLOW - IMMED SOUTH OF RTHA NEST TREE

KILL - NEST - 4 ECGS - NORTH OF SAMPLE POOL Q - SEE MAP FOR LOCATIONS

Ø IN COMMENTS = NO AMPHIBIAN OBS.

*Beaufort scale: 0-1: (0-3 mph) calm to light air (rising smoke drift) 2-4: (4-18 mph) light breeze to moderate breeze (raises dust and paper) 5+: (>18 mph) fresh breeze (small trees sway)

Placer County Vernal Pool Preserve Study
Amphibian Survey Data Forms

Date: 9 APRIL 2003 Site Name ORCHARD CRK - WETLANDS Visit # 1

Surveyors: K Fuerst A Gallardo Survey time: start _____ end _____ Total survey time _____

Start Air Temp (C): _____ End Air Temp: _____

Cloud cover: clear (0-10%) partly cloudy (11-50%) cloudy (>50%) Wind Speed (*Beaufort): (0-1) (2-4) (5+)

Herpetofauna Observed: _____

Feature Number	Max Depth (cm)	Water Temp (C)	Surface Area (m^2)	Comments
GG	10	23		VP Ø
HH	10	24		VP Ø
II	20	24		VP Ø
JJ	10	24		VP Ø

Additional comments/Incidental wildlife observations: _____

*Beaufort scale: 0-1: (0-3 mph) calm to light air (rising smoke drift) 2-4: (4-18 mph) light breeze to moderate breeze (raises dust and paper) 5+: (>18 mph) fresh breeze (small trees sway)

Placer County Vernal Pool Preserve Study
Amphibian Survey Data Sheet

Date: 21 APR 03 Site Name: LINCOLN SUN CITY

Surveyors: KCK, MGB Survey time: Start 11:20 End: 2:00 Total survey time 2.6 HOURS

Start Air Temp (C): 13 End Air Temp: 15

Cloud cover: clear (0-10%) partly cloudy (11-50%) cloudy (>50%) ✓ SOME RAIN SHOWERS

Wind Speed (mph): 10-20 Wind Direction: SW

Herpetofauna Observed: PACIFIC CHORUS FROG (PSEUDACRIS REGILLA), BULLFROG (RANA CATESBEIANA) (PCF)

Feature Number	Max Depth (cm)	Water Temp (C)	Species Found & Comments
A	13	16	NO AMPHIBIAN LARVAE - VP
B	3	19	NO AMPHIBIAN LARVAE - VP
C	24	16	NO AMPHIBIAN LARVAE - VP
D	9	15	NO AMPHIBIAN LARVAE - SIDE CHANNEL OF MAIN DRAINAGE - LOW FLOW, VELOCITY
E	<20	20	NO AMPHIBIAN LARVAE
F	12	19.5	NO AMPHIBIAN LARVAE
G	25	15	4 PCF LARVAE
H	30	14	1 PCF LARVA
I	25	14	4 PCF LARVAE
J	19	14	4 PCF LARVAE
K	40	16	6 PCF LARVAE
L	25	16	NO AMPHIBIAN LARVAE
M	40+	15	1 BULLFROG LARVA
N	12	16	NO AMPHIBIAN LARVAE
O	15	16	NO AMPHIBIAN LARVAE

Additional comments/Incidental wildlife observations:

Placer County Vernal Pool Preserve Study
Amphibian Survey Data Sheet

Date: 21APR03 Site Name: LINCOLN SUN CITY

Surveyors: KCK, MCB Survey time: Start 11:20 End: 2:05 Total survey time 2.6 HOURS

Start Air Temp (C): 13 End Air Temp: 15

Cloud cover: clear (0-10%) partly cloudy (11-50%) cloudy (>50%) ✓ SOME RAIN SHOWERS

Wind Speed (mph): 10-20 Wind Direction: SW

Herpetofauna Observed: _____

Feature Number	Max Depth (cm)	Water Temp (C)	Species Found & Comments
P	15	16	NO AMPHIBIANS; VERY TURBID WATER
Q	13	15	NO AMPHIBIANS
R	27	15	NO AMPHIBIANS; VERY TURBID WATER
S	16	16	—

Additional comments/Incidental wildlife observations: _____

Placer County Vernal Pool Preserve Study
Amphibian Survey Data Forms

Date: 11 APRIL 2003 Site Name SUNCITY ROSEVILLE Visit # 1

Surveyors: PB ; AS Survey time: start 1115 end 1330 Total survey time 2'15"

Start Air Temp (C): 19 End Air Temp: 24

Cloud cover: clear (0-10%) partly cloudy (11-50%) cloudy (>50%) Wind Speed (*Beaufort): (0-1) (2-4) (5+)
LOW END OF SCALE - CLEAR DIRECTLY ABOVE SITE

Herpetofauna Observed: PCFR, W. YELLOW-BELLIED RACER (1), W. FENCE LIZARD (1), BULLFROG
HT CHAPTER SNAKE (T ELEGANS)

Feature Number	Max Depth (cm)	Water Temp (C)	Surface Area (m^2)	Comments
1	10	21		PCFR RECENT METAMORPHS 100s, LARVAE 10s
				LARGE PORTION OF FEATURE IS DRY - H2O PRIMARILY RESTRICTED TO AREA NEAR PONDED AREA
				RACCOON PRINTS, GOLF BALL
2	20	21		CATTAILS BECOMING ESTABLISHED - CONNECTED TO FEATURE 1
3	12	21		PCFR LARVAE 100s - MALE & W/ BROOD
4	30	22		DRAINAGE, H2O RESTRICTED TO SCOUR POOLS - PCFR LARVAE 100s
				POT AREA FOR W. SPADEFOOT TOADS - UNLIKELY LOOKED AT EARLIER IN THE YEAR
				BULLFROG - SUBADULT (III = 3)
5	10	22		LARGE % IS DRY - PUDDLE WATER REMAINS, PCFR LARVAE 10s
				SOME THATCH ENCROACHMENT
6	15	21		PCFR LARVAE
7	5	22		PCFR LARVAE 100s
8	18	22		PCFR LARVAE 100s
9	10	24		PCFR LARVAE 10s
10	5	24		Ø - NOT MAPPED AS A DISTINCT FEATURE - CURRENTLY ISOLATED FROM PRIMARY FEATURE
11	15	24		T. ELEGANS (1), PCFR LARVAE 10s - LARGE % IS DRY
12	11	26		PCFR LARVAE 10s - POT. SITE FOR B. WOODHI
13	28	24		PCFR LARVAE 1000s - LOC. ON MAP APPEARS A BIT OFF
				MAJORITY OF POOLS WERE DRY

Additional comments/Incidental wildlife observations: SNEG, BNST, HOFI, RWBL, TRES, SAVS, MALL, LESA (LEAST SANDPIPER), GRME, WESP

PCFR RECENT METAMORPHS COMMON IN AREAS PERIPHERAL TO VPS — CAGO (NESTING), ♀ MALL W/ BROOD (~15), BARS, NOMO, WBNU, GCSP, ACWO

AND RELATIVELY DENSE VPS - VERY ABUNDANT — TUVU, RSHA, BNST, KILL, RWBL, CLSW, COSN, RODO

THATCH IN POOLS - HIGH GRASS COMPONENT IN MANY POOLS — BLK-TAILED JACKRABBIT

*Beaufort scale: 0-1: (0-3 mph) calm to light air (rising smoke drift) 2-4: (4-18 mph) light breeze to moderate breeze (raises dust and paper) 5+: (>18 mph) fresh breeze (small trees sway)

PHOTO 1: REPRESENTIVE PHOTO OF THATCH IN VP
PHOTO 2 FEATURE 5 - THATCH

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Placer County Vernal Pool Preserve Study

Amphibian Survey Data Sheet

Date: 4-11-03 Site Name Rocklin - Stanford Ranch Visit # 1

Surveyors: SME Survey time: start 9:55 end 12:50 Total survey time 2h55m

Start Air Temp (C): _____ End Air Temp: 61°F

Cloud cover: clear (0-10%) partly cloudy (11-50%) cloudy (>50%) Wind Speed (*Beaufort) (0-1) (2-4) (5+)

Herpetofauna Observed: Pacific ch frog, mountain garter snake, western toad, bullfrog

Feature Number	Max Depth (cm)	Water Temp (C)	Surface Area (m^2)	Comments
11	4	14	-	W. toad tadpoles
78	22	12	-	Bull frog adult - pac chorus. tad + meta stays wet longer - more Ele Mac, but has VP spp
by road	from 476	12	-	Part of swale / bermed pool - much deeper than natural W. toad tp pac ch. tp
Nunes pool	29	12	-	pac chorus adult, meta.
85	15	13	-	dom by Ele mac - W. toad tads, pac. chorus tads
82	35	14	-	↑ same
152?	10	16	-	Pac. chorus frog tad. bermed by road

Additional comments/Incidental wildlife observations:

garter snake pheasant, mallards, coot
bull frog in drainages on both sides

*Beaufort scale: 0-1: (0-3 mph) calm to light air (rising smoke drift) 2-4: (4-18 mph) light breeze to moderate breeze (raises dust and paper) 5+: (>18 mph) fresh breeze (small trees sway)

Placer County Vernal Pool Preserve Study
Amphibian Survey Data Forms

Date: 8 APRIL 2003 Site Name SHERIDAN - WILDLANDS Visit # 1

Surveyors: MRB, KCK, STC Survey time: start 1030 end 1430 Total survey time 4 HRS

Start Air Temp (C): _____ End Air Temp: 28

Cloud cover: (clear) (0-10%) partly cloudy (11-50%) cloudy (>50%) Wind Speed (*Beaufort): ((0-1)) (2-4) (5+)

Herpetofauna Observed: COMMON KINGSNAKE, BULLFROG, P. CHRYSUS FROGS, W. FENCE LIZARD

INCIDENTAL SIGHTINGS OF COMMON GARTER SNAKE (T. SIRTALIS) DURING EARLIER SITE VISIT (WILDLANDS ORIENTATION)

Feature Number	Max Depth (cm)	Water Temp (C)	Surface Area (m^2)	Comments
A	>60	19		PERENNIAL MARSH. BULLFROG - 5
B	<15	22		REMNANT POOLS IN SEASONAL MARSH PCFR LARVAE - 100s
C	>50	22		SLOUGH BULLFROG - 2 SUBADULTS
D	25	22		VP PCFR LARVAE - 10s
42	8	22		VP Ø
E	15	22		VP Ø
F	18	22		VP Ø
28	—	—		VP DRY
38	—	—		VP DRY
G	5	23		VP Ø
46	10	23		VP Ø
H	20	22		VP/SW Ø - CONNECTED TO SWALE, MANY WET FEATURES IN THIS AREA ARE UNMAPPED
I	15	22		VP/SW Ø - CONNECTED TO SWALE - SMALL FISH - CYPRINID?
J	10	23		VP BULLFROG - 2 SUBADULTS
47	—	—		VP DRY
49	—	—		VP DRY
K	<40	22		SWALE BULLFROG - 4 - SA
L	15	22		VP PCFR - LARVAE 100s
62	15	22		VP PCFR - LARVAE 100s
M	12	22		VP PCFR - LARVAE 10's
65	10	22		VP PCFR - LARVAE 100s
69	14	22		VP PCFR - LARVAE 10s
N	10	23		VP PCFR - LARVAE
O	15	23		VP PCFR - LARVAE 10s - ★ L.O. 100s ★
P	12	23		VP Ø
Q	20	22		VP Ø
R	10	23		VP PCFR LARVAE 100s
22	—	—		VP DRY
21	—	—		VP DRY
13	—	—		VP DRY

Additional comments/Incidental wildlife observations: BLK-TAILED JACKRABBIT (3)

PERENNIAL MARSH & SLOUGH ENVIRONMENTS MICA (2 ADULTS, 1 YOUNG) UNDER COVER BOARD

DIFFICULT TO SURVEY DUE TO SEDGES, JUNCUS, ETC

MARSH MARGINS ½ H2O DEPTH - LOOKED INTO

THESE AREAS OPPORTUNISTICALLY.

*Beaufort scale: 0-1: (0-3 mph) calm to light air (rising smoke drift) 2-4: (4-18 mph) light breeze to moderate breeze (raises dust and paper) 5+: (>18 mph) fresh breeze (small trees sway)

Placer County Vernal Pool Preserve Study
Amphibian Survey Data Forms

Date: 8 APRIL 2003 Site Name SHELDON - WETLANDS Visit # 1

Surveyors: MSB, KLK, STE Survey time: start _____ end _____ Total survey time _____

Start Air Temp (C): _____ End Air Temp: _____

Cloud cover: clear (0-10%) partly cloudy (11-50%) cloudy (>50%) Wind Speed (*Beaufort): (0-1) (2-4) (5+)

Herpetofauna Observed: _____

Feature Number	Max Depth (cm)	Water Temp (C)	Surface Area (m^2)	Comments
9	—	—		VP DRY
5	—	—		VP DRY
S	15			SLOUGH - CANOPY BULLFROG -3 SUBADULT - DEPTH AT OBS LOCATION - >15 ELSEWHERE
T	>40			SLOUGH/MARSH PCFR 1 ADULT CALLING ALONG SHORE OF OPEN H_2O
T	?			SLOUGH - CANOPY BULLFROG ~ 12 H/J RIPARIAN CANOPY - NEAR ROAD TURBID WATER
U	20	22		VP ∅
145	10	23		VP ∅
151	10	23		VP ∅
155	15	24		VP PCFR LARVAE 100s
156	10	23		VP PCFR LARVAE 10s
164	—	—		VP DRY
160	—	—		VP DRY
168	—	—		VP DRY
169	—	—		VP DRY
V	15	23		VP PCFR LARVAE 100s
100	—	—		VP DRY
101	—	—		VP DRY
99	—	—		VP DRY
96	—	—		VP DRY
103	—	—		VP DRY
W	10	23		PCFR LARVAE 10s
X	12	23		VP PCFR LARVAE 100s
118	—	—		VP DRY
126	15	23		VP PCFR LARVAE 100s
125	10	23		VP ∅
133	10	23		VP PCFR LARVAE 100s
Y	10	23		VP PCFR LARVAE 10s
Z	>20	22		SLOUGH BULLFROG - 11

Additional comments/Incidental wildlife observations: _____

*Beaufort scale: 0-1: (0-3 mph) calm to light air (rising smoke drift) 2-4: (4-18 mph) light breeze to moderate breeze (raises dust and paper) 5+: (>18 mph) fresh breeze (small trees sway)

Placer County Vernal Pool Preserve Study
Amphibian Survey Data Forms

Date: 8 APRIL 2003 Site Name SHEARMAN - WILDHORSE Visit # 1

Surveyors:_____ Survey time: start_____ end_____ Total survey time_____

Start Air Temp (C): _____ End Air Temp: _____

Cloud cover: clear (0-10%) partly cloudy (11-50%) cloudy (>50%) Wind Speed (*Beaufort): (0-1) (2-4) (5+)

Herpetofauna Observed:_____

Feature Number	Max Depth (cm)	Water Temp (C)	Surface Area (m^2)	Comments
AA	—	—		VP DRY
BB	—	—		VP DRY
CC	—	—		VP DRY
DD	—	—		VP DRY
EE	—	—		VP DRY
FF				SEASONAL MARSH - REMNANT POOLS Ø

Additional comments/Incidental wildlife observations:

*Beaufort scale: 0-1: (0-3 mph) calm to light air (rising smoke drift) 2-4: (4-18 mph) light breeze to moderate breeze (raises dust and paper) 5+: (>18 mph) fresh breeze (small trees sway)

ECORP Consulting, Inc.
ENVIRONMENTAL CONSULTANTS

Placer County Vernal Pool Preserve Study
Amphibian Survey Data Sheet

Date: 04/08/03 Site Name: Woodcreek North Visit #: 1

Surveyors: RB Survey time: start 9:00 end 10:30 Total survey time: ______

Start Air Temp (C): 68°F End Air Temp: ______

Cloud cover: (clear (0-10%)) partly cloudy (11-50%) cloudy (>50%) Wind Speed (*Beaufort): ((0-1)) (2-4) (5+)

Herpetofauna Observed: western fence lizard, PSRE

Feature Number	Max Depth (cm)	Water Temp (C)	Surface Area (m^2)	Comments
Pond 1	35	22°		~~Greater than~~ Consists of separate ponds — Numerous PSRE tadpoles —
Pond 2	40	22°		Numerous PSRE tads, new to some with legs.
Pond 3	50+	21°		Numerous PSRE, 5 juv. bullfrogs, Cyzicus, lg. dytiscidae
VP 5	—			Blooming, nice species composition, likely to support FS
VP 6	—			" " "
VP 7	—			" " " "
VP 3	—			Ø ↑ grasses
VP 4	—			Ø "
VP 8	—			Ø "
VP 9	—			"
VP 10	—			"
VP 12	—			to shallow
VP 11	4 cm	23°		Ø ↑ cattail — due to outfall
Upper Pond	45+ cm	22°		↑ PSRE tads, 4 juv bullfrog, clam shrimp
13	—			Shallow ~~grassy~~ ~~dominated~~
15	—			" " "
VP 14	10	23°		↑ recent/small PSRE, Culex.
VP A	18	23°		small PSRE tad., up veg in spillway swale ~~to~~
VP 2	—			grassy - some good up veg. between ponds.

Additional comments/incidental wildlife observations:

*Beaufort scale: 0-1: (0-3 mph) calm to light air (rising smoke drift) 2-4: (4-18 mph) light breeze to moderate breeze (raises dust and paper) 5+: (>18 mph) fresh breeze (small trees sway)

* several boards placed in "pond 2" + "pond 3"
* Downed logs have been turned by kids not replaced — * Eumeces gilberti skink — with recent broken tail —

ECORP Consulting, Inc.

ENVIRONMENTAL CONSULTANTS

Placer County Vernal Pool Preserve Study

Amphibian Survey Data Sheet

Date: PB 4/10/03 Site Name Woodcreek West ~~East~~ Visit # 1

Surveyors: PB Survey time: start 12:06 end _____ Total survey time _____

Start Air Temp (C): 70° End Air Temp: _____

Cloud cover: clear (0-10%) partly cloudy (11-50%) cloudy (>50%) Wind Speed (*Beaufort): (0-1) (2-4) (5+)

Herpetofauna Observed: Thamnophis elegans

Feature Number	Max Depth (cm)	Water Temp (C)	Surface Area (m^2)	Comments
N1 ~~85~~	10			Psre wetter than used to be – used to be margin
VP 24	7			– Corridor drying down.
VP 24	16			1000's numerous Psre tads some metamorphs
VP 26	22			" " "
N 27	20			" " " (Thamnophis elegans foraging) *
VP 28	20			" " "
VP 32	18			" " " Hot up upland rodent burrows. *
VP 33	15			a few Psre ads with Eleocharis
43	8			" "
42	15			" " marsilea?
41	10			" " "
45	10			" " "
50	10			" "
54	10			numerous Psre
55	15			" " * Thamnophis elegans
53	25			" "
52	32			" "
61	15			" "
63	8			a few Psre tads
64	8			drying down
72	10 cm			a few Psre Egrets * foraging.
73	11			" "
81	12			" "
80	15			" "
82	20			" "
86	10			" "
85	Sat			Ø
N2	25 at deepest			* Psre 1 adult bullfrog
87	20			" "
88	17			" "

Additional comments/Incidental wildlife observations: Yellow legs, red tail hawk, RW blackbird, Downspout going to next door – recommend continued monitoring

*Beaufort scale: 0-1: (0-3 mph) calm to light air (rising smoke drift) 2-4: (4-18 mph) light breeze to moderate breeze (raises dust and paper) 5+: (>18 mph) fresh breeze (small trees sway)

* fence boards in # 20

APPENDIX I

Insect Pollinators Survey Data

Appendix I.

Insect Pollinator Raw Data.

		Orchard Creek (708 acres)										
Pool Number		VP-04	VP-05	VP-06	VP-07	VP-08	VP-09	VP-10	VP-28	VP-55	VP-75	**Total**
# Sweeps		40	92	134	52	58	66	36	6	32	6	**522**
Order	**Family**											
Hymenoptera	Andrenidae	1		1	2	2	4			6		**16**
	Apidae											
	Brachonidae											
	Halictidae	1		2			2			10	1	**16**
	Megachilidae											
	Sphecidae	1										**1**
Diptera	Anthomyiidae	1			3		4	1		8		**17**
	Bombyliidae	1		1	64	8	21	5				**100**
	Calliphoridae			1	1	2	1	1				**6**
	Dolichopodidae		1		1							**2**
	Empididae											
	Luaxaniidae											
	Muscidae											
	Syrphidae	4	1	3	14	5	8	9				**44**
	Tephritidae											
	Unidentified	8	9	4	19	5	5	12	2	3		**67**
Coleoptera	Coccinelidae		1									**1**
	Demerstidae											
	Melyridae											
Lepidoptera	Hesperidae											
	Incurvariidae					1	1					**2**
	Pieridae											
	Lycaenidae											
Hemiptera	Miridae		1	4	11	12	3			1		**32**
Total		17	13	16	115	35	49	28	2	28	1	**304**
Number of Insects per Sweep		0.4	0.1	0.1	2.2	0.6	0.7	0.8	0.3	0.9	0.2	**0.6**
Total Insect Families		7	5	7	8	7	9	5	1	5	1	**12**
Total Hymenoptera Families		3	0	2	1	1	2	0	0	2	1	**3**
Total Diptera Families		4	3	4	6	4	5	5	1	2	0	**6**
Total Coleoptera Families		0	1	0	0	0	0	0	0	0	0	**1**
Total Lepidoptera Families		0	0	0	0	1	1	0	0	0	0	**1**
Total Hemiptera Families		0	1	1	1	1	1	0	0	1	0	**1**
Percent Hymenoptera		17.6	0.0	18.8	1.7	5.7	12.2	0.0	0.0	57.1	100.0	**10.9**
Percent Diptera		82.4	84.6	56.3	88.7	57.1	79.6	100.0	100.0	39.3	0.0	**77.6**
Percent Coleoptera		0.0	7.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.3**
Percent Lepidoptera		0.0	0.0	0.0	0.0	2.9	2.0	0.0	0.0	0.0	0.0	**0.7**
Percent Hemiptera		0.0	7.7	25.0	9.6	34.3	6.1	0.0	0.0	3.6	0.0	**10.5**

Appendix I.

Insect Pollinator Raw Data.

		Orchard Creek (708 acres)										
		Orchard Creek (1 in species column denotes presence in pool)										
Flowering Plants Present at Sampling Date		VP-04	VP-05	VP-06	VP-07	VP-08	VP-09	VP-10	VP-28	VP-55	VP-75	**Total**
Brodiaea sp.												
Castilleja attenuata												
Castilleja campestris		1						1				**2**
Downingia spp.		1	1	1		1	1	1				**6**
Geranium dissectum												
Erodium sp.												
Eryngium vaseyi		1			1	1	1					**4**
Lasthenia fremontii		1	1	1	1	1	1	1	1		1	**9**
Lasthenia glaberrima										1		**1**
Leontodon taraxicoides		1			1							**2**
Lupinus bicolor												
Medicago polymorpha					1							**1**
Navarretia leucocephala		1	1	1		1	1	1				**6**
Plagiobothrys greenei											1	**1**
Plagiobothrys stipitatus		1		1	1	1	1	1	1	1	1	**9**
Psilcarphus brevissimus												
Pogogyne zizphoroides												
Ranunculus bonariensis									1		1	**2**
Trifolium depauperatum			1								1	**2**
Trifolium hirtum												
Trifolium variegatum										1	1	**2**
Trifolium spp.			1	1			1					**3**
Triphysaria eriantha												
Triteleia hyacynthina		1	1	1				1				**4**
Total Flowering Plant Taxa		**8**	**6**	**6**	**5**	**5**	**6**	**6**	**3**	**3**	**6**	

Appendix I.

Insect Pollinator Raw Data.

		Woodcreek North (46 acres)										
Pool Number		VP-02	VP-03	VP-04	VP-05	VP-07	VP-08	VP-10	VP-12	VP-13	VP-15	**Total**
# Sweeps		64	16	10	122	82	16	20	24	20	6	**380**
Order	**Family**											
Hymenoptera	Andrenidae											
	Apidae		1									**1**
	Brachonidae											
	Halictidae				6							**6**
	Megachilidae											
	Sphecidae											
Diptera	Anthomyiidae											
	Bombyliidae											
	Calliphoridae											
	Dolichopodidae											
	Empididae	1			4	1						**6**
	Luaxaniidae											
	Muscidae											
	Syrphidae				1							**1**
	Tephritidae											
	Unidentified	4	6		32			3				**45**
Coleoptera	Coccinelidae	4	1					1	1	1	2	**10**
	Demerstidae				4							**4**
	Melyridae	2	2		53	11	2		1	1	3	**75**
Lepidoptera	Hesperidae											
	Incurvariidae											
	Pieridae				1							**1**
	Lycaenidae											
Hemiptera	Miridae	1				1		4		4		**10**
Total		12	10	0	101	13	2	8	2	6	5	**159**
Number of Insects per Sweep		0.2	0.6	0.0	0.8	0.2	0.1	0.4	0.1	0.3	0.8	**0.4**
Total Insect Families		5	4	0	7	3	1	3	2	3	2	**10**
Total Hymenoptera Families		0	1	0	1	0	0	0	0	0	0	**2**
Total Diptera Families		2	1	0	3	1	0	1	0	0	0	**3**
Total Coleoptera Families		2	2	0	2	1	1	1	2	2	2	**3**
Total Lepidoptera Families		0	0	0	1	0	0	0	0	0	0	**1**
Total Hemiptera Families		1	0	0	0	1	0	1	0	1	0	**1**
Percent Hymenoptera		0.0	10.0	0.0	5.9	0.0	0.0	0.0	0.0	0.0	0.0	**4.4**
Percent Diptera		41.7	60.0	0.0	36.6	7.7	0.0	37.5	0.0	0.0	0.0	**32.7**
Percent Coleoptera		50.0	30.0	0.0	56.4	84.6	100.0	12.5	100.0	33.3	100.0	**56.0**
Percent Lepidoptera		0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.6**
Percent Hemiptera		8.3	0.0	0.0	0.0	7.7	0.0	50.0	0.0	66.7	0.0	**6.3**

Appendix I.

Insect Pollinator Raw Data.

		Woodcreek North (46 acres)										
		Woodcreek North (1 in species column denotes presence in pool)										
Flowering Plants Present at Sampling Date		VP-02	VP-03	VP-04	VP-05	VP-07	VP-08	VP-10	VP-12	VP-13	VP-15	**Total**
Brodiaea sp.												
Castilleja attenuata												
Castilleja campestris												
Downingia spp.												
Geranium dissectum								1		1		2
Erodium sp.							1				1	2
Eryngium vaseyi												
Lasthenia fremontii			1	1	1	1						4
Lasthenia glaberrima												
Leontodon taraxicoides												
Lupinus bicolor		1	1	1		1	1					5
Medicago polymorpha							1					1
Navarretia leucocephala			1	1	1	1						4
Plagiobothrys greenei							1	1				2
Plagiobothrys stipitatus		1	1			1			1			4
Psilcarphus brevissimus					1							1
Pogogyne zizphoroides												
Ranunculus bonariensis										1		1
Trifolium depauperatum					1	1			1	1		4
Trifolium hirtum												
Trifolium variegatum		1									1	2
Trifolium spp.							1					1
Triphysaria eriantha		1	1									2
Triteleia hyacynthina												
Total Flowering Plant Taxa		**4**	**5**	**3**	**4**	**5**	**5**	**2**	**2**	**3**	**2**	

Appendix I.

Insect Pollinator Raw Data.

		Woodcreek Oaks (180 acres)										
Pool Number		VP-0X	VP-01	VP-02	VP-05	VP-13	VP-14	VP-15	VP-18	VP-19	VP-20	**Total**
# Sweeps		38	36	34	68	48	40	124	34	40	28	**490**
Order	**Family**											
Hymenoptera	Andrenidae	1				1						**2**
	Apidae											
	Brachonidae		1		1							**2**
	Halictidae				1			1		1		**3**
	Megachilidae											
	Sphecidae											
Diptera	Anthomyiidae							1				**1**
	Bombyliidae									1		**1**
	Calliphoridae				2						2	**4**
	Dolichopodidae	1			2		2	4			1	**10**
	Empididae											
	Luaxaniidae											
	Muscidae	1		1	5			8				**15**
	Syrphidae	3			7	5	6	18	7	1	3	**50**
	Tephritidae			2	8	2	1	3	2		1	**19**
	Unidentified	34	4	34	168	7	8	6	25		34	**320**
Coleoptera	Coccinelidae		1		1			8			2	**12**
	Demerstidae		1									**1**
	Melyridae											
Lepidoptera	Hesperidae											
	Incurvariidae											
	Pieridae											
	Lycaenidae			1								
Hemiptera	Miridae	1	3		8	3	7		7	4	2	**35**
Total		41	10	38	203	18	24	49	41	7	45	**476**
Number of Insects per Sweep		1.1	0.3	1.1	3.0	0.4	0.6	0.4	1.2	0.2	1.6	**1.0**
Total Insect Families		6	5	4	10	5	5	8	4	4	7	**14**
Total Hymenoptera Families		1	1	0	2	1	0	1	0	1	0	**3**
Total Diptera Families		4	1	3	6	3	4	6	3	2	5	**8**
Total Coleoptera Families		0	2	0	1	0	0	1	0	0	1	**2**
Total Lepidoptera Families		0	0	1	0	0	0	0	0	0	0	**0**
Total Hemiptera Families		1	1	0	1	1	1	0	1	1	1	**1**
Percent Hymenoptera		2.4	10.0	0.0	1.0	5.6	0.0	2.0	0.0	14.3	0.0	**1.5**
Percent Diptera		95.1	40.0	97.4	94.6	77.8	70.8	81.6	82.9	28.6	91.1	**88.2**
Percent Coleoptera		0.0	20.0	0.0	0.5	0.0	0.0	16.3	0.0	0.0	4.4	**2.7**
Percent Lepidoptera		0.0	0.0	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
Percent Hemiptera		2.4	30.0	0.0	3.9	16.7	29.2	0.0	17.1	57.1	4.4	**7.4**

Appendix I.

Insect Pollinator Raw Data.

		Woodcreek Oaks (180 acres)										
		Woodcreek Oaks (1 in species column denotes presence in pool)										
Flowering Plants Present at Sampling Date		VP-0X	VP-01	VP-02	VP-05	VP-13	VP-14	VP-15	VP-18	VP-19	VP-20	**Total**
Brodiaea sp.			1	1		1	1					**4**
Castilleja attenuata												
Castilleja campestris												
Downingia spp.		1	1	1	1	1	1	1	1	1	1	**10**
Geranium dissectum												
Erodium sp.												
Eryngium vaseyi		1	1	1	1	1	1	1	1	1	1	**10**
Lasthenia fremontii			1	1			1		1		1	**5**
Lasthenia glaberrima												
Leontodon taraxicoides		1	1	1	1	1	1	1	1	1	1	**10**
Lupinus bicolor												
Medicago polymorpha												
Navarretia leucocephala			1		1	1	1	1		1	1	**7**
Plagiobothrys greenei				1								**1**
Plagiobothrys stipitatus		1		1	1				1	1	1	**6**
Psilcarphus brevissimus												
Pogogyne zizphoroides							1		1			**2**
Ranunculus bonariensis												
Trifolium depauperatum												
Trifolium hirtum												
Trifolium variegatum												
Trifolium spp.												
Triphysaria eriantha												
Triteleia hyacynthina		1								1	1	**3**
Total Flowering Plant Taxa		**5**	**6**	**7**	**5**	**5**	**7**	**4**	**6**	**6**	**7**	

Appendix I.

Insect Pollinator Raw Data.

		Woodcreek West (48 acres)										
Pool Number		VP-04	VP-05	VP-07	VP-08	VP-09	VP-20	VP-27	VP-36	VP-43	VP-53	**Total**
# Sweeps		48	42	62	38	55	76	64	44	54	50	**533**
Order	**Family**											
Hymenoptera	Andrenidae	1		2		1			1			**5**
	Apidae											
	Brachonidae						1					**1**
	Halictidae	1	3	1	1	4					1	**11**
	Megachilidae											
	Sphecidae											
Diptera	Anthomyiidae		1	1	1			3		1	1	**8**
	Bombyliidae	2	1	9		22	2	93	7	25		**161**
	Calliphoridae	1										**1**
	Dolichopodidae		1					1			4	**6**
	Empididae											
	Luaxaniidae											
	Muscidae		2	3		2	3	1	3	6	2	**22**
	Syrphidae	9	13	12	8	9	15	4	8	8	2	**88**
	Tephritidae		1		4	2		3	3	1	1	**15**
	Unidentified	9	17	6	19	12	33	34	16	43	18	**207**
Coleoptera	Coccinelidae			5			1					**6**
	Demerstidae											
	Melyridae											
Lepidoptera	Hesperidae											
	Incurvariidae											
	Pieridae											
	Lycaenidae											
Hemiptera	Miridae	1	1	33	13	3			3			**54**
Total		24	40	72	46	55	55	139	41	84	29	**585**
Number of Insects per Sweep		0.5	1.0	1.2	1.2	1.0	0.7	2.2	0.9	1.6	0.6	**1.1**
Total Insect Families		7	9	9	6	8	6	7	7	6	7	**13**
Total Hymenoptera Families		2	1	2	1	2	1	0	1	0	1	**3**
Total Diptera Families		4	7	5	4	5	4	7	5	6	6	**8**
Total Coleoptera Families		0	0	1	0	0	1	0	0	0	0	**1**
Total Lepidoptera Families		0	0	0	0	0	0	0	0	0	0	**0**
Total Hemiptera Families		1	1	1	1	1	0	0	1	0	0	**1**
Percent Hymenoptera		8.3	7.5	4.2	2.2	9.1	1.8	0.0	2.4	0.0	3.4	**2.9**
Percent Diptera		87.5	90.0	43.1	69.6	85.5	96.4	100.0	90.2	100.0	96.6	**86.8**
Percent Coleoptera		0.0	0.0	6.9	0.0	0.0	1.8	0.0	0.0	0.0	0.0	**1.0**
Percent Lepidoptera		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
Percent Hemiptera		4.2	2.5	45.8	28.3	5.5	0.0	0.0	7.3	0.0	0.0	**9.2**

Appendix I.

Insect Pollinator Raw Data.

		Woodcreek West (48 acres)										
		Woodcreek West (1 in species column denotes presence in pool)										
Flowering Plants Present at Sampling Date		VP-04	VP-05	VP-07	VP-08	VP-09	VP-20	VP-27	VP-36	VP-43	VP-53	**Total**
Brodiaea sp.												
Castilleja attenuata											1	**1**
Castilleja campestris												
Downingia spp.		1	1	1	1	1		1	1	1	1	**9**
Geranium dissectum												
Erodium sp.												
Eryngium vaseyi		1		1	1	1	1	1	1	1	1	**9**
Lasthenia fremontii				1	1	1		1	1	1		**6**
Lasthenia glaberrima												
Leontodon taraxicoides		1	1	1	1	1	1		1		1	**8**
Lupinus bicolor							1				1	**2**
Medicago polymorpha												
Navarretia leucocephala		1		1	1	1		1	1	1	1	**8**
Plagiobothrys greenei												
Plagiobothrys stipitatus												
Psilcarphus brevissimus												
Pogogyne zizphoroides												
Ranunculus bonariensis												
Trifolium depauperatum												
Trifolium hirtum							1				1	**2**
Trifolium variegatum												
Trifolium spp.			1									**1**
Triphysaria eriantha												
Triteleia hyacynthina		1		1		1	1			1		**5**
Total Flowering Plant Taxa												

Appendix I.

Insect Pollinator Raw Data.

		Highland Reserve South (135 acres)										
Pool Number		VP-01	VP-02	VP-03	VP-04	VP-05	VP-06	VP-07	VP-08	VP-09	VP-10	**Total**
# Sweeps		39	62	28	38	36	66	50	56	42	36	**453**
Order	**Family**											
Hymenoptera	Andrenidae											
	Apidae											
	Brachonidae											
	Halictidae						2			1		**3**
	Megachilidae											
	Sphecidae											
Diptera	Anthomyiidae							1		1		**2**
	Bombyliidae				3	4	15	3		2		**27**
	Calliphoridae							1		1		**2**
	Dolichopodidae					1		1			1	**3**
	Empididae											
	Luaxaniidae											
	Muscidae	1		2							1	**4**
	Syrphidae		3	3	1	4	13	3	5	3	9	**44**
	Tephritidae										1	**1**
	Unidentified	19	7	51	46	17	24	20	44	36	22	**286**
												0
Coleoptera	Coccinelidae						1		1		1	**3**
	Demerstidae											
	Melyridae											
Lepidoptera	Hesperidae											
	Incurvariidae											
	Pieridae											
	Lycaenidae											
Hemiptera	Miridae						1	4	3	3	1	**12**
Total		20	10	56	50	26	56	33	53	47	36	**387**
Number of Insects per Sweep		0.5	0.2	2.0	1.3	0.7	0.8	0.7	0.9	1.1	1.0	**0.9**
Total Insect Families		2	2	3	3	4	6	7	4	7	7	**12**
Total Hymenoptera Families		0	0	0	0	0	1	0	0	1	0	**1**
Total Diptera Families		2	2	3	3	4	3	6	2	5	5	**8**
Total Coleoptera Families		0	0	0	0	0	1	0	1	0	1	**1**
Total Lepidoptera Families		0	0	0	0	0	0	0	0	0	0	**0**
Total Hemiptera Families		0	0	0	0	0	1	1	1	1	1	**1**
Percent Hymenoptera		0.0	0.0	0.0	0.0	0.0	3.6	0.0	0.0	2.1	0.0	**0.8**
Percent Diptera		100.0	100.0	100.0	100.0	100.0	92.9	87.9	92.5	91.5	94.4	**95.3**
Percent Coleoptera		0.0	0.0	0.0	0.0	0.0	1.8	0.0	1.9	0.0	2.8	**0.8**
Percent Lepidoptera		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
Percent Hemiptera		0.0	0.0	0.0	0.0	0.0	1.8	12.1	5.7	6.4	2.8	**3.1**

Appendix I.

Insect Pollinator Raw Data.

		Highland Reserve South (135 acres)										
		Highland Reserve (1 in species column denotes presence in pool)										
Flowering Plants Present at Sampling Date		VP-01	VP-02	VP-03	VP-04	VP-05	VP-06	VP-07	VP-08	VP-09	VP-10	**Total**
Brodiaea sp.												
Castilleja attenuata												
Castilleja campestris												
Downingia spp.			1		1	1	1	1	1	1	1	**8**
Geranium dissectum												
Erodium sp.												
Eryngium vaseyi						1	1	1	1	1		**5**
Lasthenia fremontii		1	1	1	1	1	1	1			1	**8**
Lasthenia glaberrima												
Leontodon taraxicoides		1			1	1	1	1	1	1	1	**8**
Lupinus bicolor												
Medicago polymorpha												
Navarretia leucocephala		1	1	1	1		1	1	1	1		**8**
Plagiobothrys greenei												
Plagiobothrys stipitatus		1	1	1			1					**4**
Psilcarphus brevissimus												
Pogogyne zizphoroides												
Ranunculus bonariensis												
Trifolium depauperatum												
Trifolium hirtum												
Trifolium variegatum												
Trifolium spp.												
Triphysaria eriantha												
Triteleia hyacynthina						1			1		1	**3**
Total Flowering Plant Taxa		**4**	**4**	**3**	**4**	**5**	**6**	**5**	**5**	**4**	**4**	

Appendix I.

Insect Pollinator Raw Data.

		Sun City Roseville (75 acres)										
Pool Number		VP-01	VP-02	VP-03	VP-04	VP-05	VP-06	VP-07	VP-08	VP-09	VP-10	**Total**
# Sweeps		38	42	58	38	28	22	24	62	92	24	**428**
Order	**Family**											
Hymenoptera	Andrenidae				1							**1**
	Apidae											
	Brachonidae								1			**1**
	Halictidae			1								**1**
	Megachilidae											
	Sphecidae											
Diptera	Anthomyiidae	7	3	1						4	2	**17**
	Bombyliidae	13	2	3	1				7	23	3	**52**
	Calliphoridae											
	Dolichopodidae						1			1	3	**5**
	Empididae											
	Luaxaniidae											
	Muscidae	7	2	7					3		4	**23**
	Syrphidae	2		6	22	1	8	8	7	10	6	**70**
	Tephritidae	3	1						2	12		**18**
	Unidentified	56	52	104	34	4	12	5	32	55	23	**377**
Coleoptera	Coccinelidae											
	Demerstidae									3		**3**
	Melyridae											
Lepidoptera	Hesperidae									1		
	Incurvariidae											
	Pieridae											
	Lycaenidae											
Hemiptera	Miridae	1			12	1	2		3			**19**
Total		89	60	122	70	6	23	13	55	109	41	**587**
Number of Insects per Sweep		2.3	1.4	2.1	1.8	0.2	1.0	0.5	0.9	1.2	1.7	**1.4**
Total Insect Families		7	5	6	5	3	4	2	7	8	6	**12**
Total Hymenoptera Families		0	0	1	1	0	0	0	1	0	0	**3**
Total Diptera Families		6	5	5	3	2	3	2	5	6	6	**7**
Total Coleoptera Families		0	0	0	0	0	0	0	0	1	0	**1**
Total Lepidoptera Families		0	0	0	0	0	0	0	0	1	0	**0**
Total Hemiptera Families		1	0	0	1	1	1	0	1	0	0	**1**
Percent Hymenoptera		0.0	0.0	0.8	1.4	0.0	0.0	0.0	1.8	0.0	0.0	**0.5**
Percent Diptera		98.9	100.0	99.2	81.4	83.3	91.3	100.0	92.7	96.3	100.0	**95.7**
Percent Coleoptera		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.8	0.0	**0.5**
Percent Lepidoptera		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	**0.0**
Percent Hemiptera		1.1	0.0	0.0	17.1	16.7	8.7	0.0	5.5	0.0	0.0	**3.2**

Appendix I.

Insect Pollinator Raw Data.

		Sun City Roseville (75 acres)										
		Sun City Roseville (1 in species column denotes presence in pool)										
Flowering Plants Present at Sampling Date		VP-01	VP-02	VP-03	VP-04	VP-05	VP-06	VP-07	VP-08	VP-09	VP-10	**Total**
Brodiaea sp.												
Castilleja attenuata												
Castilleja campestris												
Downingia spp.		1	1	1	1	1	1		1	1	1	**9**
Geranium dissectum												
Erodium sp.												
Eryngium vaseyi		1	1	1	1	1	1		1	1	1	**9**
Lasthenia fremontii		1	1	1	1		1		1	1	1	**8**
Lasthenia glaberrima												
Leontodon taraxicoides					1	1	1	1				**4**
Lupinus bicolor												
Medicago polymorpha												
Navarretia leucocephala		1	1	1	1	1			1	1	1	**8**
Plagiobothrys greenei												
Plagiobothrys stipitatus		1	1	1								**3**
Psilcarphus brevissimus												
Pogogyne zizphoroides												
Ranunculus bonariensis												
Trifolium depauperatum												
Trifolium hirtum												
Trifolium variegatum												
Trifolium spp.												
Triphysaria eriantha												
Triteleia hyacynthina					1	1	1	1				**4**
Total Flowering Plant Taxa		**5**	**5**	**5**	**6**	**5**	**5**	**2**	**4**	**4**	**4**	

Appendix I.

Insect Pollinator Raw Data.

		Sheridan Mitigation Bank (101 acres)										
Pool Number		VP-01	VP-02	VP-03	VP-04	VP-05	VP-06	VP-07	VP-08	VP-09	VP-10	**Total**
# Sweeps		52	38	34	42	34	28	20	24	26	84	**382**
Order	**Family**											
Hymenoptera	Andrenidae											
	Apidae				1							**1**
	Brachonidae				1	1						**2**
	Halictidae											
	Megachilidae									1		**1**
	Sphecidae											
Diptera	Anthomyiidae											
	Bombyliidae							1				**1**
	Calliphoridae			1								**1**
	Dolichopodidae						3				12	**15**
	Empididae											
	Luaxaniidae			1			1					**2**
	Muscidae	5			1		2		1	1	6	**16**
	Syrphidae	4	1	7	4	2	7	5	3	3	11	**47**
	Tephritidae											
	Unidentified	51	51	24	28	27	43	36	30	44	140	**474**
Coleoptera	Coccinelidae						3				1	**4**
	Demerstidae											
	Melyridae											
Lepidoptera	Hesperidae											
	Incurvariidae							1				**1**
	Pieridae											
	Lycaenidae											
Hemiptera	Miridae										6	**6**
Total		60	52	33	35	30	59	43	34	49	176	**571**
Number of Insects per Sweep		1.2	1.4	1.0	0.8	0.9	2.1	2.2	1.4	1.9	2.1	**1.5**
Total Insect Families		3	2	4	5	3	6	4	3	4	6	**13**
Total Hymenoptera Families		0	0	0	2	1	0	0	0	1	0	**3**
Total Diptera Families		3	2	4	3	2	5	3	3	3	4	**7**
Total Coleoptera Families		0	0	0	0	0	1	0	0	0	1	**1**
Total Lepidoptera Families		0	0	0	0	0	0	1	0	0	0	**1**
Total Hemiptera Families		0	0	0	0	0	0	0	0	0	1	**1**
Percent Hymenoptera		0.0	0.0	0.0	5.7	3.3	0.0	0.0	0.0	2.0	0.0	**0.7**
Percent Diptera		100.0	100.0	100.0	94.3	96.7	94.9	97.7	100.0	98.0	96.0	**97.4**
Percent Coleoptera		0.0	0.0	0.0	0.0	0.0	5.1	0.0	0.0	0.0	0.6	**0.7**
Percent Lepidoptera		0.0	0.0	0.0	0.0	0.0	0.0	2.3	0.0	0.0	0.0	**0.2**
Percent Hemiptera		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.4	**1.1**

Appendix I.

Insect Pollinator Raw Data.

		Sheridan Mitigation Bank (101 acres)										
		Sheridan West (1 in species column denotes presence in pool)										
Flowering Plants Present at Sampling Date		VP-01	VP-02	VP-03	VP-04	VP-05	VP-06	VP-07	VP-08	VP-09	VP-10	**Total**
Brodiaea sp.												
Castilleja attenuata												
Castilleja campestris												
Downingia spp.		1	1	1			1	1	1	1	1	**8**
Geranium dissectum												
Erodium sp.												
Eryngium vaseyi		1	1		1	1	1					**5**
Lasthenia fremontii		1		1								**2**
Lasthenia glaberrima												
Leontodon taraxicoides		1	1	1	1	1		1	1	1	1	**9**
Lupinus bicolor									1			**1**
Medicago polymorpha					1	1						**2**
Navarretia leucocephala			1	1			1	1		1		**5**
Plagiobothrys greenei												
Plagiobothrys stipitatus		1	1				1				1	**4**
Psilcarphus brevissimus												
Pogogyne zizphoroides												
Ranunculus bonariensis												
Trifolium depauperatum												
Trifolium hirtum					1	1			1			**3**
Trifolium variegatum												
Trifolium spp.												
Triphysaria eriantha												
Triteleia hyacynthina												
Total Flowering Plant Taxa		**5**	**5**	**4**	**4**	**4**	**4**	**3**	**4**	**3**	**3**	

Appendix I.

Insect Pollinator Raw Data.

		East Sheridan Property (317 acres)										
Pool Number		VP-01	VP-02	VP-03	VP-04	VP-05	VP-06	VP-07	VP-08	VP-09	VP-10	**Total**
# Sweeps		36	24	44	62	42	96	110	84	46	62	**606**
Order	**Family**											
Hymenoptera	Andrenidae						8		2			**10**
	Apidae											
	Brachonidae											
	Halictidae			1		3		2	6		1	**13**
	Megachilidae											
	Sphecidae											
Diptera	Anthomyiidae						1	1				**2**
	Bombyliidae						1	2	2	1		**6**
	Calliphoridae			1		1						**2**
	Dolichopodidae								1	1		**2**
	Empididae											
	Luaxaniidae								2	1		**3**
	Muscidae											
	Syrphidae	11		16	5	19	12	18	35	1	8	**125**
	Tephritidae											
	Unidentified	24	10	12	8		59	19	64	15	16	**227**
Coleoptera	Coccinelidae											
	Demerstidae											
	Melyridae											
Lepidoptera	Hesperidae											
	Incurvariidae						1					**1**
	Pieridae											
	Lycaenidae											
Hemiptera	Miridae	39	2	39	24	9	1	16	3	7	22	**162**
Total		74	12	69	37	32	83	58	115	26	47	**553**
Number of Insects per Sweep		2.1	0.5	1.6	0.6	0.8	0.9	0.5	1.4	0.6	0.8	**0.9**
Total Insect Families		3	2	5	3	4	7	6	8	6	4	**11**
Total Hymenoptera Families		0	0	1	0	1	1	1	2	0	1	**2**
Total Diptera Families		2	1	3	2	2	4	4	5	5	2	**7**
Total Coleoptera Families		0	0	0	0	0	0	0	0	0	0	**0**
Total Lepidoptera Families		0	0	0	0	0	1	0	0	0	0	**1**
Total Hemiptera Families		1	1	1	1	1	1	1	1	1	1	**1**
Percent Hymenoptera		0.0	0.0	1.4	0.0	9.4	9.6	3.4	7.0	0.0	2.1	**4.2**
Percent Diptera		47.3	83.3	42.0	35.1	62.5	88.0	69.0	90.4	73.1	51.1	**66.4**
Percent Coleoptera		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
Percent Lepidoptera		0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0	0.0	0.0	**0.2**
Percent Hemiptera		52.7	16.7	56.5	64.9	28.1	1.2	27.6	2.6	26.9	46.8	**29.3**

Appendix I.

Insect Pollinator Raw Data.

		East Sheridan Property (317 acres)										
		Rostano Property (1 in species column denotes presence in pool)										
Flowering Plants Present at Sampling Date		VP-01	VP-02	VP-03	VP-04	VP-05	VP-06	VP-07	VP-08	VP-09	VP-10	**Total**
Brodiaea sp.		1				1				1	1	**4**
Castilleja attenuata												
Castilleja campestris							1	1				**2**
Downingia spp.		1		1	1		1	1	1	1	1	**8**
Geranium dissectum												
Erodium sp.												
Eryngium vaseyi		1	1				1	1	1	1	1	**7**
Lasthenia fremontii		1	1	1	1		1	1	1	1		**8**
Lasthenia glaberrima												
Leontodon taraxicoides		1	1	1	1	1			1		1	**7**
Lupinus bicolor												
Medicago polymorpha												
Navarretia leucocephala		1	1	1		1				1	1	**6**
Plagiobothrys greenei												
Plagiobothrys stipitatus			1			1	1	1	1	1		**6**
Psilcarphus brevissimus												
Pogogyne zizphoroides												
Ranunculus bonariensis												
Trifolium depauperatum												
Trifolium hirtum					1							**1**
Trifolium variegatum												
Trifolium spp.					1							**1**
Triphysaria eriantha												
Triteleia hyacynthina		1			1			1				**3**
Total Flowering Plant Taxa		**7**	**5**	**4**	**6**	**3**	**4**	**5**	**5**	**5**	**4**	

Appendix I.

Insect Pollinator Raw Data.

		Rodeo Grounds Preserve (145 acres)								Aitken Ranch (310 acres)	
Pool Number		VP-01	VP-02	VP-03	VP-04	VP-05	VP-06	VP-07	**Total**	VP-22	**Total**
# Sweeps		52	34	54	48	24	100	24	**336**	84	**84**
Order	**Family**										
Hymenoptera	Andrenidae										
	Apidae										
	Brachonidae										
	Halictidae										
	Megachilidae										
	Sphecidae										
Diptera	Anthomyiidae						1		**1**		
	Bombyliidae	3	2	2			2		**9**		
	Calliphoridae	1	1	1	1	1	1		**6**		
	Dolichopodidae	2							**2**		
	Empididae										
	Luaxaniidae										
	Muscidae	4	1		5	2		3	**15**	1	**1**
	Syrphidae	8	2	2	12	3	14		**41**	1	**1**
	Tephritidae										
	Unidentified			4	31		15	13	**63**		
Coleoptera	Coccinelidae	1					2	1	**4**	2	**2**
	Demerstidae		1						**1**		
	Melyridae										
Lepidoptera	Hesperidae										
	Incurvariidae										
	Pieridae										
	Lycaenidae										
Hemiptera	Miridae	1	2	1			6		**10**	1	**1**
Total		20	9	10	49	6	41	17	**152**	**5**	**5**
Number of Insects per Sweep		0.4	0.3	0.2	1.0	0.3	0.4	0.7	**0.5**	0.1	**0.1**
Total Insect Families		7	6	5	4	3	7	3	**10**	4	**4**
Total Hymenoptera Families		0	0	0	0	0	0	0	**0**	0	**0**
Total Diptera Families		5	4	4	4	3	5	2	**7**	2	**2**
Total Coleoptera Families		1	1	0	0	0	1	1	**2**	1	**1**
Total Lepidoptera Families		0	0	0	0	0	0	0	**0**	0	**0**
Total Hemiptera Families		1	1	1	0	0	1	0	**1**	1	**1**
Percent Hymenoptera		0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**	0.0	**0.0**
Percent Diptera		90.0	66.7	90.0	100.0	100.0	80.5	94.1	**90.1**	40.0	**40.0**
Percent Coleoptera		5.0	11.1	0.0	0.0	0.0	4.9	5.9	**3.3**	40.0	**40.0**
Percent Lepidoptera		0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**	0.0	**0.0**
Percent Hemiptera		5.0	22.2	10.0	0.0	0.0	14.6	0.0	**6.6**	20.0	**20.0**

Appendix I.

Insect Pollinator Raw Data.

		Rodeo Grounds Preserve (145 acres)								Aitken Ranch (310 acres)	
		n City Lincoln (1 in species column denotes presence in po								Aitken Ranch	
Flowering Plants Present at Sampling Date		VP-01	VP-02	VP-03	VP-04	VP-05	VP-06	VP-07	**Total**	VP-22	**Total**
Brodiaea sp.		1	1		1		1	1	**5**		
Castilleja attenuata											
Castilleja campestris										1	**1**
Downingia spp.		1	1	1	1	1	1		**6**		
Geranium dissectum											
Erodium sp.											
Eryngium vaseyi				1		1	1		**3**		
Lasthenia fremontii		1	1	1	1	1	1	1	**7**		
Lasthenia glaberrima											
Leontodon taraxicoides		1	1				1		**3**		
Lupinus bicolor											
Medicago polymorpha											
Navarretia leucocephala					1		1		**2**		
Plagiobothrys greenei											
Plagiobothrys stipitatus		1			1	1		1	**4**	1	**1**
Psilcarphus brevissimus											
Pogogyne zizphoroides											
Ranunculus bonariensis											
Trifolium depauperatum							1		**1**		
Trifolium hirtum										1	**1**
Trifolium variegatum											
Trifolium spp.											
Triphysaria eriantha											
Triteleia hyacynthina			1	1		1		1	**4**		
Total Flowering Plant Taxa		**5**	**5**	**4**	**5**	**5**	**7**	**4**		**3**	