Summary Report
Grasslands Monitoring Project
East Bay Regional Park District
2006 Field Season – Year 5
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EXECUTIVE SUMMARY

Introduction

The Grassland Monitoring Project continues to develop and implement improved quantitative monitoring methods to determine the response to management of Park District grassland plant, bird, and small mammal communities. Better descriptions of the variation from park to park and from year to year combined with an understanding of the relationships between vegetation structure and animal abundance will help guide reliable and informed management decisions.

In 2006, we focused on analyses that could inform management and monitoring of the Valley Grassland. Valley Grassland is the Park District's most extensive grassland vegetation type, it has high bird conservation value, and results may have application to other grassland types. Native plant and grassland bird diversity are of particular interest, and the effect of livestock grazing on this diversity is an important focus of this project.

Sixty-three vegetation plots were sampled in 2006 in Brushy Peak, Fairmont Ridge in Lake Chabot (hereafter called "Chabot Ridge"), Morgan Territory, Pleasanton Ridge, Sunol-Ohlone, Sycamore Valley, and Vasco Caves. For the 2006 field season, we implemented a plan to increase our ability to test management differences by adding an additional 3 cattle-grazed and 3 ungrazed plots for a total of 16 plots in Morgan Territory.

Bird field work in 2006 followed the same plan as 2005, consisting of 52 Valley Grassland bird point count stations, 17 ungrazed and 35 grazed.

Variation in the grassland vegetation

Analysis in the first years of the study clearly showed that the Park District's grassland properties fell into at least three distinct vegetation communities: Coastal Prairie, Valley Grassland, and Riparian Grassland. We found early on that plant species composition and abundance of each plant species vary dramatically between parks; even between plots within a single park, there can be significant variation. These differences notwithstanding, various analytic techniques showed that plots exhibited similarities based on spatial proximity rather than on whether they were grazed or ungrazed. In other

words, underlying site characteristics influenced a plot's vegetation more than presence or absence of livestock grazing did; only when we looked at the individual park level did we find plot differentiation based on grazing status. The underlying site characteristics, such as soil chemistry and topography, have a complex relationship to species composition, however, and only a few associations have been found so far. We have established that native plant abundance is greater at sites with low amounts of soil phosphorus and nitrogen.

The overall level of native plant cover (a measure of the abundance of native plants) in the Park District's Valley Grassland is very low, although native species make up about 50% of the total number of species. Total native cover and native plant species richness (the number of native species in an area) declined slightly in 2006 from the high levels we found in 2005, a year which had rainfall amount and timing conducive to very high native plant abundance. We have found over the course of the Project that variation in native cover and species richness appears to be driven in large part by factors such as weather and soil characteristics. The effects of management at the landscape scale are likely to be swamped by the effects of rainfall, temperature, and differences in soil chemistry, texture, and depth. At the landscape level, there is no evidence that grazing is harmful to native cover and species richness.

At specific locations, however, management actions may cause changes in native plant cover and species richness, at least temporarily. As noted above, we added more plots to Morgan Territory in 2006, with the result that we can now reliably determine that, despite the overriding weather-driven trends, native cover and species richness are greater on grazed plots as compared to ungrazed plots in that park (Tables 1 and 2). The same holds true for Sunol-Ohlone. Chabot Ridge's ungrazed plots have higher native cover (but not species richness) than its cattle-grazed plots, but these ungrazed plots are affected by mowing and oak planting and so may not be representative of other Valley Grassland areas. The other parks do not generally show a statistically significant difference in native plants between grazed and ungrazed plots.

Annual forbs (wildflowers, etc.) make up more than 50% of the parks' native species richness so they are of particular importance for management activities aimed at maintaining or increasing native biodiversity. We found that the cattle-grazed plots have significantly greater native annual forb richness and cover than do the ungrazed plots. This finding corroborates other recent studies of native annual forbs and livestock grazing in California's coastal grassland.

Another native species of particular concern is the bunchgrass Purple needlegrass. Although by far the most common native species in the Park District's grassland, it has declined in cover over the past four years. However, previous years' declines in Purple needlegrass occurred primarily on two ungrazed plots in Chabot Ridge, which are disturbed by mowing and tree planting (although in 2006, these two plots increased in cover). This year's decline occurred on many plots, suggesting weather-related causes. There is no clear pattern in Purple needlegrass dynamics related to livestock grazing; weather and soil characteristics appear to be the primary drivers. Nonetheless, there is some evidence that Purple needlegrass is generally associated with grazing. In a "cluster and indicator species analysis" that identifies stable plant sub-communities within the grassland, we found that many of these sub-communities, dominated by one to three non-native species, occur on either grazed or ungrazed plots only. Purple needlegrass, the

only native species indicator for a sub-community, was a member of a sub-community found only in grazed areas.

Three annual, non-native grasses (representing only 3% of the total species richness) made up more than half of the total plant cover in 2006. As in all years of the study, the non-native grass, annual ryegrass, was the overall dominant species, and in 2006, it produced almost 1/3 of the total cover of all plants and three times more cover than the next most abundant species. Such high cover values for a single species are likely to have significant ecological effects, such as reducing native species diversity. Likely causes for the dominance of annual ryegrass include "nitrogen fertilization" from air pollution and warmer and wetter weather. Cattle grazing may help to mitigate some of the negative effects of annual ryegrass dominance because cows prefer to eat grass species (annual ryegrass is very palatable) and so tend to reduce grasses' competitive impact on native plant species.

Plant species composition and abundance in the Valley Grassland vary from place to place and from year to year. Determining the primary source of variation, spatial or temporal, would allow for more effective design of monitoring protocols and future vegetation research in the Park District. We found that, contrary to traditional views, site to site differences in the Park District's Valley Grassland were much greater than year to year differences. This finding could have important implications for management and conservation concerns such as native plant diversity, invasion of exotic plants, community structure, and small-scale wildlife habitat values. Monitoring for these concerns may have to be conducted at more sites than previously thought if important changes in vegetation are to be detectable. Consequently, monitoring costs may increase significantly. On the other hand, it may not be necessary to monitor plots every year as temporal variability is less than anticipated so any increase in monitoring costs may be less than expected.

Grassland bird sampling overview 2004-2006

Bird species with direct associations to a particular habitat type are good indicators of ecosystem health. We chose four species to represent our grassland bird guild for their association with and dependence on grassland habitat within our sites: Grasshopper Sparrow, Savannah Sparrow, Horned Lark, and Western Meadowlark. Grasshopper Sparrow, Savannah Sparrow and Horned Lark were detected primarily on grazed plots. Western Meadowlarks were found on both grazed and ungrazed plots in all three years. The change in grazing status of four plots in Vasco Caves, from grazed to ungrazed in 2005, suggests caution in interpreting these results. Landscape factors, such as elevation, ridge top location, and rock outcrops, can also affect the results for some bird species like the Horned Lark, which appears to only occur in areas where these factors are present and may not be responding primarily to management. The planned addition of an ungrazed comparison area on Valpe Ridge in Ohlone will help clarify some of these issues.

Over the three years, 2004-2006, we found a trend of higher presence of the grassland bird guild on grazed plots than ungrazed plots. In 2004, grassland birds were present on 60% of the grazed plots and on 30% of the ungrazed plots, a statistically

significant result (Figure 1). While 2005 and 2006 also show higher grassland bird presence on grazed plots, their percent differences are not statistically significant. The addition of Sunol-Ohlone park and the change from grazed to ungrazed status of four plots at Vasco Caves in 2005, as well as, the small sample size may explain the lack of a significant result for 2005 and 2006. Possible reasons for this trend of higher presence in grazed plots include the greater native plant presence and associated higher structural diversity (i.e., a mix of tall and short plants) found in grazed areas. Without disturbance, non-native annual grasses tend to create homogeneous and dense patches of vegetation. Some grassland-dependent bird species, Grasshopper Sparrows, may prefer native areas for their higher quality insect foraging and nesting habitat and in large part may be relying on the diverse structure associated with native and grazed grasslands.

Grassland birds in the Park District, Grasshopper Sparrow, Savannah Sparrow, Horned Lark and Western Meadowlark, appear overall to utilize cattle grazed areas more often than ungrazed areas. However, individual species show a less clear response to management. The bird response to livestock grazing may be confounded by larger landscape-level factors which are being investigated in two graduate student theses and a dissertation.

Park District overall bird species richness and diversity

Species richness for the 2004-2006 field seasons were calculated for each park based on detections of individuals within 100 meters of the plot center, summed over total number of visits (3 in most areas). Species richness represents the total number of species detected. Comparing all parks 2004-2006, Sunol-Ohlone has the highest bird species richness, while Vasco Caves has the smallest. Over 2004-2006, 2006 had the highest cumulative species richness (63) as well as the highest park value (Sunol-Ohlone, 36) (Table 3). The addition of data from subsequent years will allow us to determine the stability of this trend.

Ground squirrel sampling

In 2005-2006, we included a California ground squirrel count during each bird point count survey. Ground squirrel abundance, based on the count with the highest number of squirrel detections, appears to have a strong relationship with livestock grazing. No ground squirrels were seen on point count surveys within 100 meters of the plot center in ungrazed areas. Sunol-Ohlone had the highest abundance of squirrels, driven by a population in High Valley (Figure 2). It is not surprising that there is high spatial variation in squirrel abundance as colonies are known to have a patchy distribution. Less than one-third of the project's total plots (27%) had detections of squirrels using this survey method.

Overall management implications

Based on project data to date, environmental factors rather than management activities drive overall trends within both the grassland plant species community and the grassland bird guild. In other words, rainfall, air temperature, and soil chemistry, among other factors, cause fluctuations in grassland plant populations. Rocky outcrops, ridge-top location, and presence of nearby trees and shrubs, among other factors, cause variation in grassland bird populations.

Regardless of the direction of the overall trends however, where native plant species exist, native cover and species richness are generally higher in cattle grazed areas than in ungrazed areas. The relationship between livestock grazing and grassland bird distribution is more complex. Birds respond to environmental and vegetation variables at both the landscape and local level. Three of our grassland bird focal species, Grasshopper Sparrow, Savannah Sparrow, and Horned Lark appear to be more present in grazed areas than in ungrazed areas. Ground squirrels, however, are only found on plots within livestock-grazed areas, which suggests a stronger response to management.

Published work and presentations

To date, the Project has resulted in one master's thesis and two soon-to-be published scientific articles. A third article and a doctoral dissertation based on Project data will be forthcoming in 2007, and other manuscripts are in preparation. We have made over twenty presentations about the Project findings at public agency meetings and scientific conferences, including one by Sasha Gennet that won 1st place in the Ph.D. Graduate Student Paper Contest at the 2006 Annual Meeting of the Society for Range Management.

Table 1: 2006 average native percent relative cover by management type within park (all plots; plots in the same color are paired grazed/ungrazed plots within the same park) and p-values (significant ones bolded) from 2-tailed t-tests with unequal variances comparing cover;
* Chabot Ridge plot CR1 excluded from t-test because it is Harding grass (*Phalaris aquaticus*)-dominated

Park	Grazing status of plots	Native % relative cover	p-values from t-tests
Chabot Ridge	ungrazed	24.2*	**0.068**
Chabot Ridge	cattle	6.3	
Morgan Territory	ungrazed	1.4	**0.105**
Morgan Territory	cattle	3.6	
Sunol-Ohlone	ungrazed	0.2	**0.006**
Sunol-Ohlone	cattle	16.9	

Table 2: 2006 average native species richness by management type within park (all plots; plots in the same color are paired grazed/ungrazed plots within the same park) and p-values (significant ones bolded) from 2-tailed t-tests with unequal variances comparing native species richness

Park	Grazing status of plots	Average native species richness	p-values from t-tests
Brushy Peak	cattle	0.5	
Chabot Ridge	ungrazed	3.3	0.744
Chabot Ridge	cattle	2.7	
Morgan Territory	ungrazed	1.5	**0.023**
Morgan Territory	cattle	5.3	
Pleasanton Ridge	cattle	3.7	0.433
Pleasanton Ridge	sheep	1.0	
Sunol-Ohlone	ungrazed	0.7	**0.006**
Sunol-Ohlone	cattle	8.5	
Sycamore Valley	ungrazed	0.3	1.000
Sycamore Valley	cattle	0.3	
Vasco Caves	ungrazed	1.0	0.122
Vasco Caves	sheep	3.8	
Vasco Caves	unknown	2.0	

Figure 1: 2004-2006 percent of plots with grassland bird guild presence (Grasshopper Sparrow, Horned Lark, Savannah Sparrow, Western Meadowlark), 2004 significant at p-value = 0.03; data restricted to only ≤100m

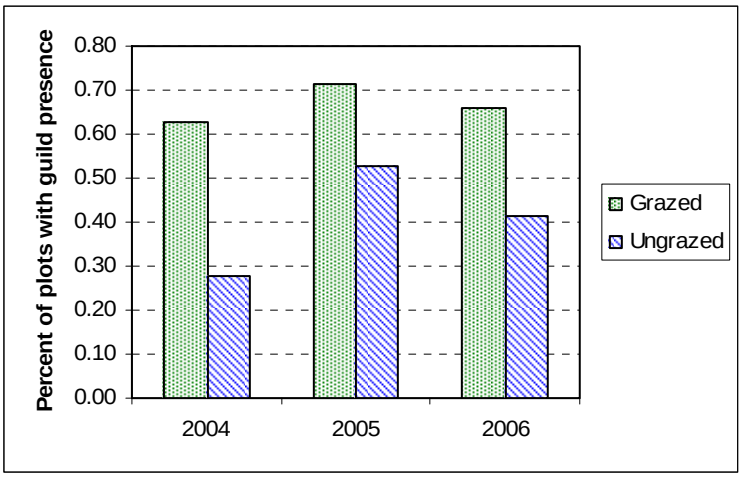

Table 3: 2004-2006 summary statistics by park comparison; Morgan Territory added 4 plots in 2005; Sunol-Ohlone added 9 plots in 2005; data restricted to only ≤100m

		2004		2005		2006	
Location	**Plots**	**Species richness**	**Detections**	**Species richness**	**Detections**	**Species richness**	**Detections**
Brushy Peak	6	15	114	10	54	17	99
Chabot Ridge	5	17	119	19	105	23	136
Morgan Territory	6,10,10	13	39	19	68	20	92
Pleasanton Ridge	6	9	42	10	73	23	79
Sunol-Ohlone	9	NA	NA	22	83	36	193
Sycamore Valley	6	15	200	15	137	21	108
Vasco Caves	10	7	105	5	71	8	74
Grand Total	*52*		*619*		*591*		*781*
Cumulative Species Richness		*43*		*46*		*63*	

Figure 2: 2005-2006 park-level ground squirrel point count summary; total numbers of squirrels (detections) based on highest number surveys per year; data restricted to ≤100m of plot center