Vegetation Sampling at Chino Hills State Park

I. Introduction

Vegetation sampling was conducted in 2001 at Chino Hills State Park as part of the California Department of Parks and Recreation Inventory, Monitoring and Assessment Program (IMAP) pilot program. The primary objective of this vegetation sampling was to objectively describe the diversity of plant associations within the park to provide a framework for selection of long-term monitoring sites at Chino Hills State Park. The secondary objective was to provide ground-truthing data to revise and fine-tune the existing vegetation map, which was created for revision of the park General Plan (DPR 1999) using 1993 aerial photographs. Sampling locations were dispersed throughout the then 12,422-acre park including Coal and Sonome Canyons, which are not contiguous with the main body of the park. Vegetation sampling began in April and continued through December 2001. The sampling period started later than anticipated and was prolonged beyond the original estimate because of inclement weather and other unforeseen factors associated with sampling (*i.e.*, navigating to sampling sites through dense vegetation and rugged terrain). The fieldwork was conducted by Kim Marsden, Associate State Park Resource Ecologist, and Melanie Howe, Environmental Services Intern, both from the Southern Service Center and both formally trained in botanical science and especially familiar with the southern California flora. Kim Marsden performed the data analysis with assistance from Darren Smith, Assistant State Parks Resource Ecologist, also from the Southern Service Center. A previous vegetation study was conducted in 1993 to characterize the composition and extent of the coastal sage scrub vegetation community within the park. This sampling effort did not focus on a particular vegetation community type but sought to characterize all natural vegetation types within the park.

II. Methods

A). Sampling Design – Stratification of the Study Area

The selection of sampling points for Chino Hills State Park was based on the gradient-directed transect ("gradsect") sampling approach that is used extensively by the National Park Service (2001) and in conservation site selection in Australia (Austin and Heyliger 1989, 1991). The gradsect approach seeks to identify the predicted environmental gradients that operate on the distribution of vegetation to obtain a representative sample of the floristic variation using characteristics of the study area (Austin and Heyliger 1989). The gradsect approach is a random-stratified approach that takes into account the selected environmental variables. This approach was used because sampling along environmental gradients captures more information about the vegetation attributes than would transects placed randomly in the landscape. It allows investigators to randomly pick unique combinations of slope, aspect, substrate, etc., to sample and/or monitor (Austin and Heyliger 1998). After the sampling points were selected, sampling was conducted using the relevé, or sample stand, technique (Mueller-Dubois and Ellenberg 1974). The relevé technique is a semi-quantitative technique that uses ocular estimates of vegetation cover for each taxon present in areas that are homogeneous with respect to composition and structure and provides for a classification of vegetation types. At each of the sampled locations a relevé was completed. Each relevé plot measured $400m^2$, which is the recommended size for grassland and shrubland vegetation types (CNPS 2001; Mueller-Dombois and Ellenberg 1974); we also found the $400m^2$ plot size sufficient to characterize the walnut and oak woodland-savannah areas, which are prevalent at Chino Hills State Park. Environmental variables (*e.g.*, slope, aspect, soil type, and disturbance history) were also recorded at each site in an attempt to elucidate their relationship to any environmental gradient that might be observed in subsequent data analyses. A field form was developed for relevé sampling at Chino Hills State Park (Appendix I) based on the California Native Plant Society's standardized relevé sampling form (CNPS 2002).

B). <u>Site Selection</u>

The framework for vegetation sampling followed National Park Service (2001) recommendations by placing a digital "base grid" over the entire park that was extended beyond the park boundaries. The grid was 20,000-meters x 13,600-meters and consisted of 1,000 m^2 cells (100-meter x 100-meter). To generate the universe of sampling points, a centroid was placed in each of the one thousand grid cells. The universe of sampling sites were reduced to those that occurred within an eighth of a mile from a travelable road or trail and to slopes of 25 degrees or less to optimize the time in the field and ensure accessibility to sampling locations. The universe of sampling points was further constrained by specifically excluding non-native annual grassland areas using the existing vegetation map, which reduced the number of sampling points to 325. Given that the District's plan for the Natural Resources Inventorying and Monitoring Program (1996) indicated that long-term monitoring would likely be done in communities other than grasslands and because the non-native annual grassland community is relatively homogeneous, typically of low-diversity, and composed largely of non-native species, it was not considered a key component of the vegetation sampling at Chino Hills State Park. Additionally, because the non-native grassland community encompasses large areas of the park, excluding it from sampling optimized the time and cost of relevé sampling in areas of unknown or lesser known diversity within the park.

After constraining the number of potential sampling points to 325, existing Geographic Information System (GIS) layers were used to compile environmental information for each of the sampling points. Aspect information for the park was analyzed within four classes: north, east, south, and west; and the qualitative soil categories were converted to 8 classes by combining soil types to represent groups with similar textures (*i.e.*, clays, loams, sands, etc.). Aspect and soil types were converted into one file and clipped to the sampling location file in order to assess the soil type and aspect of each of the sampling points. The soil type and aspect information was then converted into numerical fields and merged into one field which represented the combination of soil type and aspect for the sampling sites within the park (*e.g.*, numerical code 12 would indicate a loam soil (1), and east-facing aspect (2)). The frequency of each combination type was determined to ensure that sampling was adequately spread across each type within the park. The coordinates of each site were transferred to the Trimble GeoExplorer® 3 Geographic Positioning System (GPS) unit for navigational purposes, and a map of the sampling sites was generated for use in the field (see Appendix II for a list of equipment used in the field). Finally, a target number of 240 relevé plots completed within a 60-day period was selected based on the estimate outlined in the original sampling plan (Appendix III). Because the target number of relevés was smaller than the potential number of sampling points, an effort was made to sample the slope/aspect combinations proportionate to their frequency and also to disperse the sampling sites throughout the park. Table 1 lists the sampling locations and the corresponding soil and aspect information for each location.

C). Data Analysis

The 2001 relevé vegetation data from Chino Hills State Park was analyzed using the multivariate statistical software package PC-ORD (McCune and Mefford 1999). Multivariate statistical methods are appropriate when analyzing ecological community data because they reduce the dimensionality of the data set from many, often highly correlated variables, into a few "supervariables" that are not directly measured but interpretable (Tabachnick, et al. 1989). The data were entered into a Microsoft Excel spreadsheet then transferred to the PC-ORD program. The resulting samples-by-species data matrix consisted of 182 species and 109 relevé plots. A second samples-by-environmental variables data matrix was also constructed for subsequent analyses; it consisted of three environmental variables and 109 relevé plots. Cluster (classification) and ordination methods were used to analyze this data. Classification was performed using TWINSPAN (Two-Way Indicator Species Analysis) and an indirect gradient analysis was performed using the Detrended Correspondence Analysis (DCA: DECORANA) ordination method.

TWINSPAN is a cluster analysis program that uses reciprocal averaging to classify data into similar groupings based on species abundance and composition. The result is a two-way ordered table of species and plots that provides a visual representation of vegetation groupings (see Table 2 for an example of the two-way table output; the full TWINSPAN output of the vegetation data analysis is provided in Appendix IV). DECORANA is an eigenanalysis ordination technique that is based on reciprocal averaging (Hill 1973).

III. Findings

A). Study Site and Plot Locations

The sampling locations were located in vegetation throughout the park using the map-derived soil/aspect environmental gradients (Figure 1). Sampling sites were located in the field by navigating to each site using the navigation function in the GPS unit. At each site a 400m^2 (*e.g.*, 20m x 20m, 40m x 10m) relevé was performed. Of the 325 randomly-selected sampling sites, relevés were completed at 109 sites during the sampling period from April 2001 to December 2001; the field data sheets are included in Appendix V. The discrepancy between the estimated number relevés (240) and the actual number completed (109) is primarily a result of basing the estimation on previous experience

Table 1. Sampling plot locations, and computer-generated plot codes, aspects, and soil textures.

Location	Code	Aspect	Soil Texture		Location	Code	Aspect	Soil Texture
Rolling M Ranch	RMR-1	North	Clay loam		Lower Aliso Cyn	LAC-7	North	Rock
Bane Cyn	DS-52	West	Sandy loam		Lower Aliso Cyn	LAC-8	South	Sandy loam
Bane Cyn	DM-32	Flat	Sandy loam		Lower Aliso Cyn	LAC-9	West	Rock
Bane Cyn	DO-33	South	Sandy loam		Sonome Cyn	Z-68	South	Clay loam
Bane Cyn	DO-34	West	Sandy loam		Sonome Cyn	Z-67	North	Clay loam
Bane Cyn	DW-46	South	Sandy loam		Sonome Cyn	AB-67	East	Sandy loam
Lower Aliso Cyn	DV-56	East	Sandy loam		Sonome Cyn	SNM-1	East	Sandy loam
Upper Aliso Cyn	DM-46	East	Sandy loam		Sonome Cyn	T-66	North	Sandy loam
Lower Aliso Cyn	DV-58	North	Sandy loam		Sonome Cyn	P-66	South	Sandy loam
North Ridge Trail	Z-85	East	Clay		Bane Cyn	DN-34	East	Rock
North Ridge Trail	V-87	South	Clay		Bane Cyn	BC-1	South	Rock
Telegraph Cyn	AV-84	South	Sandy loam		Water Cyn	DQ-61	West	Clay loam
Lower Aliso Cyn	DW-62	South	Clay loam		North Ridge Trail	NRT-1	East	Clay loam
Lower Aliso Cyn	EZ-65	Flat	Sandy loam		North Ridge Trail	NRT-2	East	Clay loam
Bobcat Ridge	DF-73	South	Clay loam		North Ridge Trail	NRT-3	West	Sandy loam
Bobcat Ridge	DR-66	South	Clay loam		North Ridge Trail	NRT-4	North	Loam
Bobcat Ridge Trail	DT-65	South	Clay loam		North Ridge Trail	NRT-5	West	Loam
Lower Aliso Cyn	LAC-1	West	Sandy loam		Lower Aliso Cyn	LAC-HA1	North	Riverwash
Lower Aliso Cyn	LAC-2	West	Rock		Lower Aliso Cyn	LAC-HA2	South	Sandy loam
Lower Aliso Cyn	LAC-3	West	Rock		Sycamore Trail	SYC-1	North	Clay loam
Lower Aliso Cyn	LAC-4	West	Rock		Sycamore Trail	SYC-2	East	Sandy loam
South Ridge Trail	SRT-1	East	Cobbly/gravelly		Sycamore Trail	SYC-3	South	Sandy loam
South Ridge Trail	CO-73	West	Clay loam		Sycamore Trail	SYC-4	East	Sandy loam
South Ridge Trail	SRT-2	West	Loam		Telegraph Cyn	TC-1C	South	Clay loam
South Ridge Trail	SRT-3	West	Loam		Telegraph Cyn	TC-2C	West	Clay loam
South Ridge Trail	SRT-4	North	Clay loam		Scully Hill	SH-1	East	Cobbly/gravelly
South Ridge Trail	SRT-5	North	Loam		Scully Hill	SH-2	North	Cobbly/gravelly
South Ridge Trail	SRT-6	North	Clay		South Ridge Trail	SRT-HA1	North	Clay loam
South Ridge Trail	SRT-7	North	Loam		South Ridge Trail	SRT-VR1	North	Clay loam
South Ridge Trail	SRT-8	North	Clay loam		South Ridge Trail	SRT-11	North	Clay loam
South Ridge Trail	SRT-9	North	Clay loam		San Juan Hill Road	SJH-1	East	Rock
South Ridge Trail	SRT-10	North	Clay loam		San Juan Hill Road	SJH-2	West	Cobbly/gravelly
Diemer Trail	DMR-1	North	Clay loam		San Juan Hill Road	SJH-3	West	Cobbly/gravelly
Telegraph Cyn	TLG-1	South	Clay		McDermont Trail	MD-1	East	Clay loam
Coal Cyn	CC-1	East	Cobbly/gravelly		McDermont Trail	MD-2	East	Clay loam
Coal Cyn	CC-2	West	Rock		McDermont Trail	MD-3	West	Rock
Coal Cyn	FE-113	North	Cobbly/gravelly		McDermont Trail	MD-4	West	Rock
Coal Cyn	CC-3	East	Cobbly/gravelly		McDermont Spring	MDS-1	East	Clay loam
Coal Cyn	CC-4	West	Rock		Coal Cyn	FD-112	North	Cobbly/gravelly
Scully Ridge Trail	SR-1	East	Rock		Coal Cyn	FD-111	West	Cobbly/gravelly
Telegraph Cyn	TC-1	South	Clay		Coal Cyn	FC-109	West	Rock
Telegraph Cyn	TC-2	East	Clay		Coal Cyn	FA-107	North	Cobbly/gravelly
Telegraph Cyn	TC-3	South	Clay loam		Coal Cyn	FA-106	West	Cobbly/gravelly
Telegraph Cyn	TC-4	East	Clay loam		Coal Cyn	CCWRT-1	West	Rock
Telegraph Cyn	TC-5	East	Clay		Coal Cyn	FA-116	West	Rock
Telegraph Cyn	TC-1A	East	Sandy loam		Coal Cyn	EV-103	East	Rock
Telegraph Cyn	TC-2A	East	Clay loam		Coal Cyn	EX-103	East	Cobbly/gravelly
Telegraph Cyn	TC-3A	West	Sandy loam		Coal Cyn	EY-104	West	Rock
Telegraph Cyn	TC-4A	East	Clay		Coal Cyn	EY-102	North	Sandy loam
Telegraph Cyn	TC-5A	West	Clay loam		Santa Ana River	SAR-1	Flat	Riverwash
Telegraph Cyn	TC-6A	East	Clay loam		Santa Ana River	SAR-2	Flat	Riverwash
Bane Cyn	DX-47	West	Clay loam		Santa Ana River	FU-79	Flat	Sandy loam
Lower Aliso Cyn	LAC-5	South	Clay loam		Santa Ana River	FX-78	Flat	Riverwash
Lower Aliso Cyn	LAC-6	East	Clay loam		Santa Ana River	SAR-3	Flat	Riverwash
Lower Aliso Cyn	EH-76	East	Rock					

Figure 1. Chino Hills State Park IMAP Vegetation Sampling Point

conducting relevé sampling in desert vegetation that is relatively open and easy to access**.** The estimate did not take into account the unforeseen problems encountered in the field at Chino Hills State Park trying to navigate to each of the sampling locations using the GPS unit, which sometimes involved avoiding hazards such as poison oak and stinging nettle, traversing rugged terrain and dense vegetation, and often involved waiting for the GPS unit to pick up the minimum number of satellites to allow for navigation. The estimate also did not take into account the time needed to travel between sampling locations, or that needed to set up and collect data within plots located in dense vegetation.

B). Statistical Analysis

To objectively determine the nature and variety of the vegetation at Chino Hills State Park, a TWINSPAN classification was performed using the program default settings. The first TWINSPAN division split the 109 sample units into two groups. The first group consisted of 66 plots and represented the group of species with dry or upland affinities (generally coastal sage scrub species). The second group consisted of 43 plots and represented the group of species with more moist affinities (generally north-facing slope, riparian, and wetland species) (see Appendix IV, page 2). Indicator species were identified at each successive division of the data. Indicator species serve to aid in the interpretation of the classification dichotomies (*i.e.*, the first division identified two indicator species: Artcal (*Artemisia californica*) and Salmel (*Salvia mellifera*) which defined the coastal sage scrub species group). Successive divisions ultimately split the data set into four major groups (A, B, C, and D). These groups were subsequently compared with the groups identified in the DECORANA analysis.

The next step in the analysis was to perform a direct gradient analysis using the DECORANA program in PC-ORD. Again, the default settings were used in the analysis. The resulting ordination diagram provided a visual summary of the species composition data from the sample plots; the diagram was inspected and compared to the TWINSPAN groups. The TWINSPAN groups were drawn in by hand on the ordination diagram (Figure 2). The vegetation groupings delineated by TWINSPAN were mostly reflected in the ordination diagram with little overlap of plots and a clear wet to dry gradient was apparent along the first ordination axis (Figure 2). General group affinities are as follows: group A consists of riparian species, group B consists of mesic woodlands, group C consists of species typical of coastal sage scrub communities, and group D consists of species typical of chaparral communities.

Successive DECORANA analyses were performed on two subsets of the original TWINSPAN groups; groups A and B together, and group C, in an attempt to further elucidate meaningful vegetation patterns within each subset. The DECORANA analysis of groups A and B separated these two groups clearly into riparian woodland (group A) and oak/walnut woodland (group B) as indicated on the ordination diagram (Figure 3). The DECORANA analysis of TWINSPAN group C was of particular interest because this group comprised the majority of the species that are characteristic of coastal sage scrub communities, which are widespread within the park. This analysis was performed

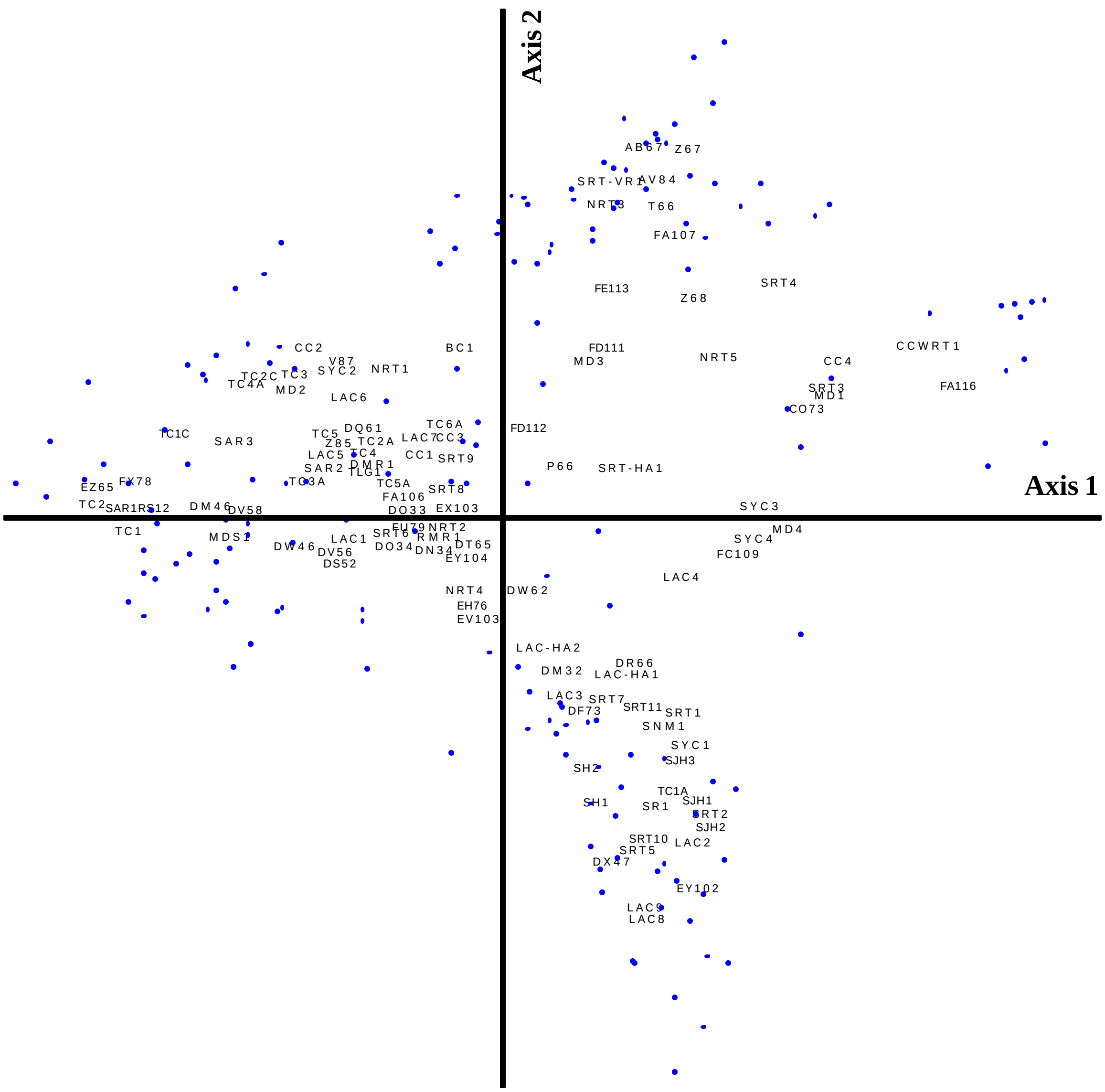

Figure 2. DECORANA ordination diagram of plots (labeled) and species (dots) from the original data set with TWINSPAN groups A - D delineated.

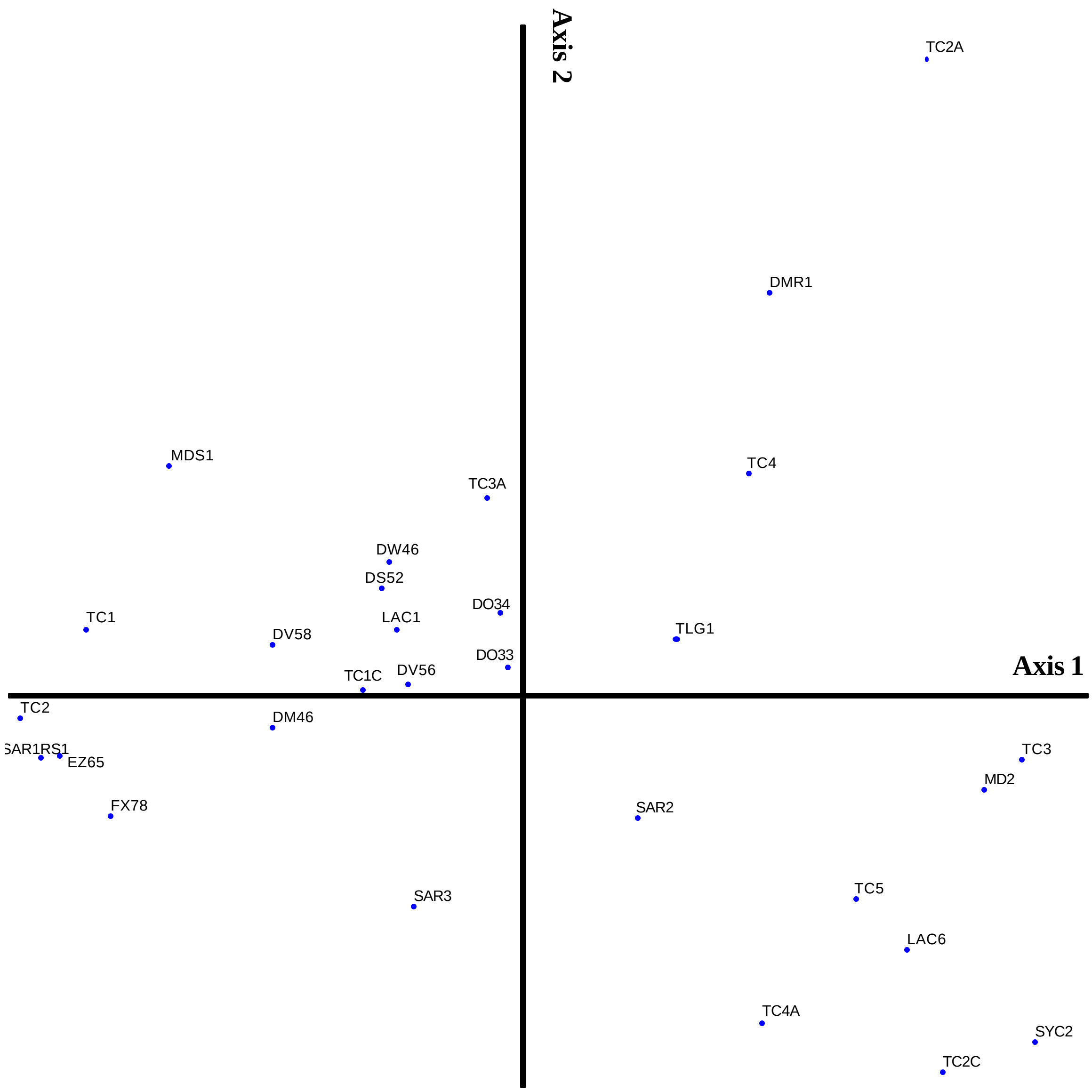

Figure 3. DECORANA ordination diagram of relevé plots from TWINSPAN groups A and B. See Table 1 for plot location codes.

to see if the observed differences in species composition of sage scrub communities at Chino Hills State Park would show up with this type of analysis. The first TWINSPAN division split the data from the original group C into two main groups, the alluvial scrub group (A), dominated by scalebroom (*Lepidospartum squamatum*), and the coastal sage scrub group (B), dominated by California sagebrush (*Artemisia californica*). Ultimately seven groupings were identified using the two-way table from the TWINSPAN analysis of group C (Table 2). These groups encompass disturbed alluvial scrub group (A1), undisturbed alluvial scrub (A2), wild rye (*Leymus condensatus*)/Mexican elderberry (*Sambucus mexicana*) (B1), purple needlegrass (*Nassella pulchra*) (B2), purple sage (*Salvia leucophylla*)/walnut (*Juglans californica*)(B3), black sage (*Salvia mellifera*)/California encelia (*Encelia californica*) (B4), and buckwheat (*Eriogonum fasciculatum*)/coast prickly pear (*Opuntia littoralis*) (B5). The groupings are depicted on the dendrogram derived from the analysis of TWINSPAN group C (Figure 4) and also on the ordination diagram (Figure 5) from the DECORANA analysis of TWINSPAN group C. These groupings represent the majority of the different associations within the coastal sage scrub community at Chino Hills State Park.

In summary, the ordination and classification techniques and the settings used here were sufficient to meet the objective of characterizing the variation of the vegetation in the park based on the relevé data collected. Although there are a multitude of ways that this data set could have been further explored using these multivariate statistical techniques (e.g., manipulating the data set and/or changing the program settings), to do so would be beyond the scope of this project. A further objective of conducting relevé sampling at Chino Hills State Park was to gather information to update the existing vegetation map for the park. The chosen sampling design of gradsect and relevé has proven useful in reflecting environmental gradients and providing quantitative information for the revision of the existing vegetation map. In addition to the quantitative information gathered, sampling throughout the park provided an opportunity for staff to gather visual ground-truthing data for the map revision. The vegetation mapping effort will be addressed in a separate report that will be included as part of the final IMAP product for the pilot program.

As originally anticipated, the results of this type of analysis can be used to direct the selection of long-term vegetation monitoring sites. In one case, areas in need of management may be identified from this type of analysis where monitoring would be implemented to evaluate the success of a management program. For instance, the analysis of this data indicated that the thistle, *Centarea melitensis*, is more prevalent in the black sage/encelia group than any other group; the monitoring of the success of a thistle eradication program could be implemented by District as part of the park resource management program. Another situation where this analysis would be useful in selecting monitoring sites is when the results indicate high variability within the vegetation type that has been targeted for monitoring (apparent on an ordination diagram as widely dispersed points within a TWINSPAN group, *i.e.*, see Figure 5, group B5). Effective monitoring of the selected vegetation type would necessitate the placement of sampling

TABLE 2. Two-way ordered table from the TWINSPAN analysis of Group C with groups delineated.

		1 133 312221311122 12233 223 2411333	
		2411972335433459660201787907868162045589	
6	Artcal	555555555-531131154524515222515-55511122	00000
94	Salapi	---3---2---11-5-----1-1--11----152----1-	00000
2	Adefas	----------------1-----------------------	000010
8	Asceri	11--------------------------------------	000010
13	Blocro	---------11---11------------------------	000010
16	CalochZ1	---------1---1--------------------------	000010
19	Carpyc	5-11-1--41-111-5--11-1------------------	000010
25	Checal	--------------1-------------------------	000010
27	Clabot	-----------1----------------------------	000010
28	Claper	1---------------------------------------	000010
29	Conmac	-----------1----------------------------	000010
30	Concan	-----------1----------------------------	000010
34	Cucfoe	----------1-----------------------------	000010
36	Datwri	----------------1-----------------------	000010
38	Dicaca	---1------1--11-------1-----------------	000010
45	Erielo	---1----1-------------------------------	000010
49	Erocic	----------------1-----------------------	000010
53	Galapa	1--------------1------------------------	000010
64	Jugcal	--1--------555-------------------2------	000010
65	Kecant	----------------1-----------------------	000010
69	Leycon	331---------1-1-----------11------------	000010
71	LupiZ1	--------------5-------------------------	000010
76	Melimp	--1-------------------------------------	000010
84	PhacZ1	-1--------------------------------------	000010
86	Queagr	----------------5-----------------------	000010
87	Quescrbo	----------------1-----------------------	000010
89	Rhuint	-------------3----1----1----------------	000010
91	Ribspe	--------------1-------------------------	000010
96	Salleu	------------521----1-----------2--------	000010
98	Sammex	-53-------------1--------11------1------	000010
101	Silmar	--------1---1-111-1---------------------	000010
102	Sisbel	---------1------------------------------	000010
105	Sonole	--------1----1--------------------------	000010
106	Stajri	-----1--3-------------------------------	000010
107	Stemed	-1--------------------------------------	000010
109	Toxdiv	-----------5----------------------------	000010
5	Ammein	---1----2--1-----1----------1-----------	000011
17	Calcat	----------1------1----------------------	000011
31	Corfil	--11-11-1111----11---------1-----11-----	000011
37	Daupus	--------21---------------1--------------	000011
42	Ereset	------1-1--1----------11----------------	000011
66	Lacser	---1-1-----1------------------1---------	000011
75	Marvul	111---1-2--111----------------11-1------	000011
81	Naspul	1-21--1-255--1---11-1111-21-1----1------	000011
85	Phrala	-----------1--111----1---21---3---------	000011
88	Rhaili	----------------1-----------------1-----	000011
103	SolanuZ1	------------1--------------------1------	000011
43	Erieri	-------11----------11----3--2-----------	000100
60	Hemfas	--1--------------1-11--1---------1------	000100
78	Melind	-----------1------1---------------------	000100
93	Saltra	-----------1--------1---1---------------	000100
104	Sonasp	-----------1------1-----1----1----------	000100
1	Acomic	-------------------------1--------------	000101
11	Bacpil	--------------------------2-------------	000101
26	Ciocca	--------------------------1-------------	000101
33	CrypZ1	------------------------111-------------	000101
35	CuscZ1	-----------------1--31-1----------------	000101
44	Erifol	-----------------1----------------------	000101
54	Gnabic	-------------------1--------------------	000101
59	Helgra	------------------------1---------------	000101
67	LepidiZ1	---------------------1------------------	000101
80	Mircal	-----------------1-111------------------	000101

Table 2 continued.

```
  83  Opulit    -----------1-----553551-155-------------  000101
  95  Salcol    ---------------------1------------------  000101
  99  Sacyha    -----------------1----------------------  000101
  24  ChamZ1    ----------------------1-----1-----------  000110
  40  Dudpul    --------------------1-----------1-------  000110
  57  Gutcal    ------------------1--14-----21--3-------  000110
  10  Astrtr    -------------------------------1--------  000111
  20  CastZ1    --------------------------------1-------  000111
  32  Crocal    ---------------------------------1------  000111
  39  Disspi    -----------------------------1----------  000111
  41  Enccal    -------------1--2511-11-1-3--5-545------  000111
  50  Euchch    ---------------------------------1------  000111
  55  Gnacal    -----------1-------------1--2-3--1------  000111
  58  Hasqgr    -----------------1---------------11-----  000111
  90  Rhutri    ---------------------------------1------  000111
 100  Scrcal    ---------------------------------1------  000111
  14  Branig    21151-113312-5455113111354451222-1111215  001
  74  Marmac    -----------111--1-------11-----------1--  001
 111  NNG       5555-31-55155553533344555445542311155445  001
  46  Erifas    ---1-------------345555522-23---5-51121-  010
  63  Isomen    --1----------1-------11-1-21-1--11----11  010
 108  Stevir    -----------1--1-11-----1-1-1--1--1-1-1--  010
  18  Calmac    -----1-----------1--1---------------1---  0110
  22  Cenmel    ------------11-11-11115-2242552211-21114  0110
  61  Hetarb    ----------------------------1----2---1--  0110
  97  Salmel    ---------------------------1513131211211  0110
  52  Gaanan    --11---------1--11--1----1------1---11--  0111
  92  Romcou    ----------------1-------------------1---  1000
   3  Agrave    ------------------------------------5---  100100
   7  Artdou    -----------------------------------1111-  100100
   9  Astbra    ------------------------------------1---  100100
  12  Bacsal    -1----------------------2----------4313-  100100
  15  Brical    ------------------------------------121-  100100
  21  Ceameg    ------------------------------------1---  100100
  23  Cerbet    --------------------------------------1-  100100
  47  Ercoco    -----------------------------------1-1--  100100
  51  Foevul    -------------------------------------1--  100100
  56  Gnacan    ------------------------------------32--  100100
 110  Yucwhi    ------------------------------------111-  100100
  62  Hetgra    ---------------------------1-----1-11111  100101
  68  Lepsqu    ----------------1------------------55542  100101
  48  Erobot    -------------------------------------1-5  10011
  72  Malfas    ---------------------------------1--1-12  10011
  77  Melalb    ---------------------------------1---111  10011
  82  Nicgla    ------------------------------------1--2  10011
  79  Mimaur    --1-------------------1--1----------11--  101
   4  Ambpsi    ---------------------------------1-----1  11
  70  Lotsco    ----------------1------1---1----41111111  11
  73  Mallau    ----------------------------3------1111-  11

                0000000000000000000000000000000000011111
                0000000000000000011111111111111111100001
                00000000000111111000000000001111111
                00011111111000011000000011110000111
                   00000011      0000011
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Figure 4.

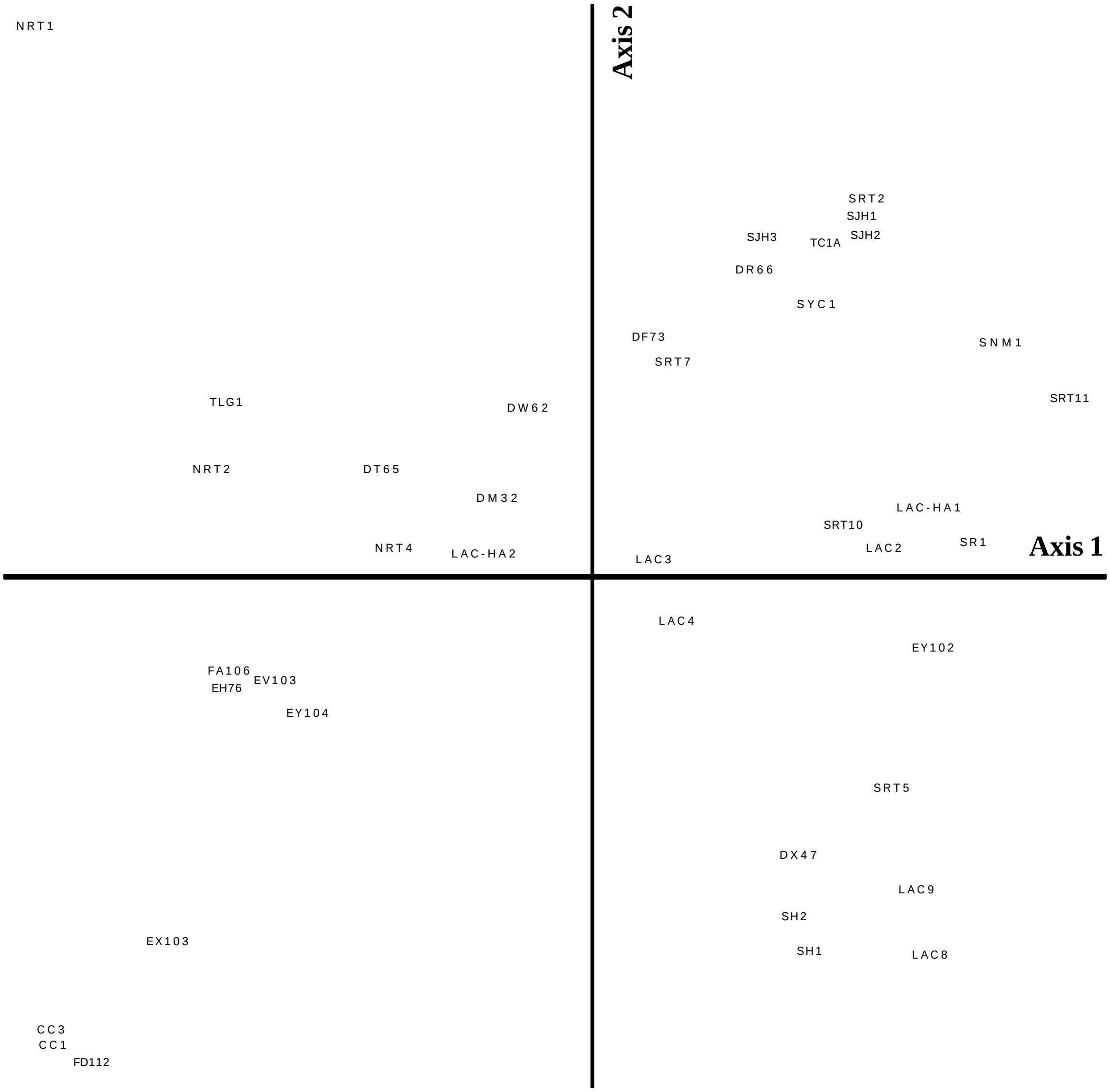

Figure 5. DECORANA ordination diagram of TWINSPAN group C with alluvial scrub and coastal sage scrub groups delineated.

units throughout the identified range of variability within the vegetation type in order to correctly characterize the property of the vegetation that is being monitored. A long-term monitoring plan has been developed for the annual grass/native grass/native herb community at Chino Hills State Park (Appendix VI). The exclusion of the annual grassland community from the 2001 vegetation sampling precluded using this data for the selection of the long-term monitoring sites. The rationale for selecting the grass/herb community for the initial long-term monitoring effort is discussed in Section V below. If in the future, the District elects to establish long-term vegetation monitoring within any of the vegetation types analyzed herein, this analysis may prove useful in selection of those monitoring sites.

IV. Data Management

Software packages used in the data analysis and production of this report include Microsoft (MS) Word 2000, MS Excel 2000, PC-ORD version 4, and ArcView GIS version 3.2. Digital versions of the report, graphics, GIS data (ArcView shape files), data files and data forms are included on a CD in a pocket following the appendices. See Appendix VII for the list of files included with this report.

V. Future Monitoring Plan

Chino Hills State Park has many native perennial purple needlegrass (*Nassella pulchra*) areas within the park; most of these areas are small, others are more extensive. They occur in a mosaic with the annual grassland community and are not delineated on the current vegetation map as areas of native grassland. Unfortunately, excluding annual grasslands from the 2001 vegetation sampling also resulted in excluding these native grassland areas, many of which were mapped during the rare plant surveys that were also conducted in 2001. During these surveys, it was also noted that the diversity of some of these native grassland areas was notably increased by the presence of native herbs. Because there is a strong interest in the native grass/native herb community within Chino Hills State Park these areas were chosen by the District ecologists to be the subject of the initial long-term monitoring program. The sampling design includes collecting frequency data along permanent transects in each of three separate macroplots. Pilot sampling will be implemented in May of 2002 in one of the macroplots to test the validity of the sampling design. The results of the pilot sampling will be evaluated in 2002 and recommended changes to the sampling design will be made. Subsequent sampling will be the responsibility of Inland Empire District ecologists.

VII. Contact Information

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