The Definition and Location of Central California Sycamore Alluvial Woodland

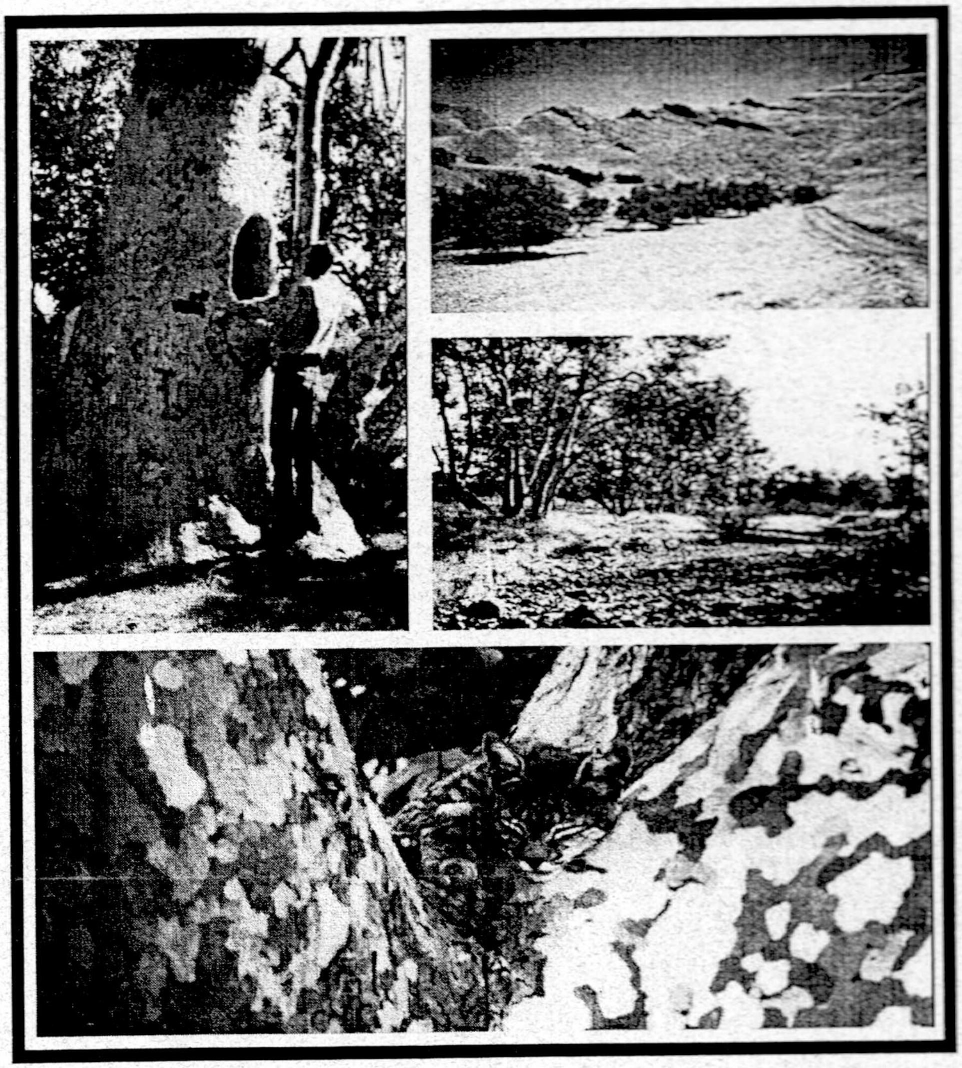

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TABLE OF CONTENTS

PAGE

Table of Contents i

List of Tables iii

List of Figures iv

Executive Summary 1

Introduction; Perspective on the Current Study 2

Methods of Study 4
- Mapping Methodology 4
- Sampling Methodology 8
- Data Analysis Methodology 9
- The Variation Within Stands and the Interpretation of the Classification 10

Aspects of the Natural History of Western Sycamore 11
- Sycamore Distribution 11
- Water Relations of Western Sycamore 13
- Asexual and Sexual Reproduction 14

Results and Description of Groupings 18
- The Results of the Classification and Ordination 18
  - Classification of the Samples 18
  - Ordination of the Samples 21
- Interpretation of the Classification in Terms of Mapping Decision Rules 36
- Description of the Four Main Sycamore Groups 36
  - The Foothill Group 36
  - The Interior Alluvial Group 37
  - The Mid-Coastal Alluvial Group 43
  - The Southern California Group 44

Stand Descriptions 46
- Los Banos Creek 49
- Pacheco Creek 52
- Orestimba Creek 54
- Nacimiento River 57
- Dry Creek 62

Arroyo Valle 65
Lower Mill Creek 69
Little Dry Creek 72
Lower Coyote Creek 75
South Fork Tule River 78
Upper Coyote Creek 80
Deer Creek 84
Arroyo Mocho 86
North San Ardo 92
South San Ardo 94
San Antonio Creek 94
Alameda Creek 99

Ranking of Stand Viability and Quality 101
Concluding Remarks 107
Literature Cited 109

Appendices

Appendix A. Individuals Contacted for Location of Sycamore Stands A-1

Appendix B. Plant Species Identified on the 86 Sycamore Vegetation Samples B-1

Appendix C. Code Numbers and Names for the 86 Sample Sites. C-1

Appendix D. Sycamore Age Data Taken from Each of the 86 Sample Plots. D-1

Appendix E. Full Explanation of the California Native Plant Society's Vegetation Sampling Protocol and an Example of the Sycamore Project Sampling Form. E-1

Appendix F. Environmental Variables Coded for Data Analysis. F-1

Appendix G. Key to the Major Groups of Sycamore Dominated Vegetation Defined in this Report G-1

Appendix H. TWINSPAN Table for Top 200 Constancy/Cover Species on All 86 Plots. H-1

LIST OF TABLES

Table 1. Example of Interim Sycamore Site Log Dated September 15, 1992 6

Table 2. The Four Groups Defined by TWINSPAN and the Stands of Sampling Areas Associated with Them 22

Table 3. List of Indicator Species for Each of the Four Groups Identified by TWINSPAN 23

Table 4. Constancy and Cover for Species of the Four Sycamore Groups Defined in this Study. 24

Table 5. Means and Standard Deviations of Environmental Variables for Samples from three Sycamore Groups. 39

Table 6. Acreages for Occurrences of Sycamore Alluvial Woodland 46

Table 7. Summary Table of Density and Age Data for Sycamores in Sycamore Alluvial Woodland Stands. 48

Table 8. Stand Viability Ranking for the 17 Stands of Sycamore Alluvial Woodland (ranking type a: stand size emphasis). 105

Table 9. Stand Quality Ranking for the 17 Stands of Sycamore Alluvial Woodland (ranking type b: stand fragmentation emphasis). . 106

LIST OF FIGURES

Figure 1.	Schematic Showing How Individual Sycamores are Aggregated into Stands.	7
Figure 2.	Distribution of Western Sycamore in California (Griffin and Critchfield 1976).	12
Figure 3.	A Sycamore Severely Affected by Anthracnose, Arroyo Mocho Stand.	15
Figure 4.	Sycamore Saplings in Streambed of North Fork Los Banos Creek, Typical Location Associated with Boulders	15
Figure 5.	Cattle Grazing is a Virtually Ubiquitous Impact on all Sycamore Alluvial Woodland Sites, Pacheco Creek.	17
Figure 6.	Sycamore Sprouting About Two Months After Fire at Coyote Creek Stand.	17
Figure 7.	Hollow, Recently Broken Sycamore Stem at Los Banos Creek Stand.	19
Figure 8.	Scatterplot of DCA Axis 1 and 2 Values for all Samples in the Four Groups	33
Figure 9.	Closer View of Same Ordination as Shown in Figure 8.	34
Figure 10.	Scatterplot of 79 Samples of Mid-Coastal, Foothill, and Interior Alluvial Groups.	35
Figure 11.	A View Looking East Across South Fork of Pacheco Creek Near Highway 152 Showing General Setting of Foothill Group.	38
Figure 12.	Interior View of Foothill Group, South Fork Pacheco Creek. Note Narrow Valley Bottom and Rocky, Bouldery Channel.	38
Figure 13.	A Southern California Alluvial Type at Starr Ranch Audubon Reserve, Orange County.	45

LIST OF FIGURES (Cont.)

Figure 14. Interior of a Southern California Narrow Canyon Type with Shrubs Typical of Southern California Chaparral in Understory, Indian Creek, San Gabriel Mountains, Los Angeles County. 45

Figure 15. The Distribution of Central California Sycamore Alluvial Woodland. 47

Figure 16. Los Banos Creek Sycamore Alluvial Woodland Stand 1 50

Figure 17. Open Understory at Los Banos Creek Transect #12 Showing Annual Grasses Dominated by *Festuca myuros*. 51

Figure 18. Pacheco Creek Sycamore Alluvial Woodland Stand 2. 53

Figure 19. Pacheco Creek Transect #2 with Coast Live Oak in Background as Part of the Stand and Mule Fat Along Active Channel to Left 55

Figure 20. Orestimba Creek Sycamore Alluvial Woodland Stand 3 56

Figure 21. Open Woodland at Orestimba Creek Transect #10. 58

Figure 22. Nacimiento River Sycamore Alluvial Woodland Stand 4 59

Figure 23. Open Annual Grass-dominated Understory with Large Over-arching Sycamores, Nacimiento River Transect #2 61

Figure 24. Dry Creek Sycamore Alluvial Woodland Stand 5 63

Figure 25. Dry Creek Stand at Transect #L1; Note Figure in Right Distance for Scale 64

Figure 26. Gravel Mining Within the Southern Portion of the Dry Creek Stand. 66

Figure 27. Arroyo Valle Sycamore Alluvial Woodland Stand 7 67

LIST OF FIGURES (Cont.)

Figure 28. Ground-level View of Transect #4 at Arroyo Valle Stand Showing Litter and Thick Annual Grass Understory. 68

Figure 29. Arroyo Valle Stand Showing Dead and Resprouting Sycamore Stems as a Result of Water Level Fluctuation Due to Releases from Upstream Del Valle Reservoir 70

Figure 30. Lower Mill Creek Sycamore Alluvial Woodland Stand 8. 71

Figure 31. Mill Creek Stand at Transect #2 Showing Heavily Grazed Understory with Valley Oak in Left Background. 73

Figure 32. Little Dry Creek Sycamore Alluvial Woodland Stand 9. 74

Figure 33. Little Dry Creek Stand Showing Main Channel of Little Dry Creek Along Linear Stand of Sycamore. Note Patch of Cattails in Channel, a Result of Seepage from Upstream Friant-Kern Canal. 76

Figure 34. Coyote Creek Sycamore Alluvial Woodland Stand 10. 77

Figure 35. Overview of Lower Coyote Creek from the Top of Anderson Reservoir Dam Looking Northwest up the Santa Clara Valley. Foreground is Dominated by Coast Live Oak, Background Right is Sycamore Stand. Note Numerous Surrounding Land Uses. 79

Figure 36. South Fork Tule River Sycamore Alluvial Woodland Stand 11. 81

Figure 37. South Fork Tule River Stand 82

Figure 38. Upper Coyote Creek Sycamore Alluvial Woodland Stand 12. 83

Figure 39. View Looking Northwest of western Portion of Upper Coyote Creek Stand Showing Surrounding Hills with Coast Live Oak and Blue Oak Woodland. 85

LIST OF FIGURES (Cont.)

Figure 40. Interior View of Upper Coyote Creek Stand with Typically Dense Canopy of Sycamores and Coast Live Oak with Patches of the Shrub, *Symphoricarpos rivularis,* in the Understory. 85

Figure 41. Deer Creek Sycamore Alluvial Woodland Stand 13. 87

Figure 42. Vegetation Sampling in the Understory in the Open Woodland of the Eastern Portion of the Deer Creek Stand 88

Figure 43. Arroyo Mocho Sycamore Alluvial Woodland Stand 14. 90

Figure 44. Arroyo Mocho Stand at One of its Widest Points (Transect #1) Showing the Small Stature of the Majority of Sycamores. 91

Figure 45. North San Ardo Sycamore Alluvial Woodland Stand 15. 93

Figure 46. South San Ardo Sycamore Alluvial Woodland Stand 16. 95

Figure 47. San Antonio Creek and Alameda Creek Sycamore Alluvial Woodland Stands 17 and 18. 96

Figure 48. San Antonio Creek Stand from the Top of Turner Dam. View Shows the Majority of the Stand, Which is Widest at its Closest (Upstream) End and Narrows to a Stringer as it Turns Behind the Left Hill in the Distance 97

Figure 49. Alameda Creek Stand from Center of Annual Grassland Patch on Alluvial Bench Between the Two Main Channels of the Creek. Note Buckeye in Left Center and Hills Dominated by Coast Live Oak. 100

EXECUTIVE SUMMARY

This report is an effort to quantitatively define what has become known as the Central California Sycamore Alluvial Woodland natural community. It has become important to know the extent and ecological characterization of this community, dominated by California sycamore, *Platanus racemosa*, due to the potential construction of a large off-stream storage reservoir at Los Banos Creek, Merced County. This reservoir would inundate the largest known site of this community. Herein, the definition of the Central California Sycamore Alluvial Woodland (CCSAW) community is refined based on a vegetation sampling and analysis regime and all the stands of the community are mapped.

A thorough search for all stands of CCSAW was made. This search yielded 118 potential sites for the community. All of these sites were field checked and 86 vegetation samples were taken within sycamore dominated vegetation throughout California. These samples were selected to represent all sites where Sycamore Alluvial Woodland was thought to occur, in addition to a number of other sites where similar vegetation existed. The intent of the broad sample was to collect sufficient information to produce a vegetation classification of sycamore dominated vegetation that would individuate the "true" alluvial woodland type from other related, but ecologically distinct sycamore vegetation.

Multivariate analysis substantiated the existence of four main groups of sycamore-dominated vegetation. Two of these groups, the mid-coastal alluvial and the interior alluvial, were ecologically similar enough to be considered together in the mapping of the CCSAW community. The other two, the foothill group and a disparate group consisting of southern coastal California samples were shown to be environmentally and floristically distinct from the previous two.

Mapping of the stands based on the criteria defined through the analysis yielded 17 occurrences of CCSAW for a total of 2,032 acres. The Los Banos Creek site is clearly the largest stand (426 acres, 21% of the total for the community) while all other stands are under 250 acres.

The four ecological groups are described and keys developed for their differentiation. Each of the 17 stands is described. The stands are then compared based on their size and existing environmental threats. The best example of this community is at Los Banos Creek at the site of the proposed reservoir.

The principal environmental conditions necessary for the perpetuation of this community are intermittent flooding over broad floodplains and a stable subterranean water table during the dry summer months.

INTRODUCTION

Perspective on the Current Study

The California Department of Fish and Game (DFG) Natural Diversity Data Base (NDDB) has been compiling an inventory of California's rare and endangered species and rare natural communities since 1979. The NDDB has identified what has previously been known as Sycamore Alluvial Woodland as a rare natural community based on individual records of occurrences sent to or obtained by NDDB. Prior to this study, the NDDB inventory included 7 sites of this community, representing a total of 2,582 acres.

Holland (1986) described the Sycamore Alluvial Woodland as an open to moderately-closed, winter-deciduous broad leafed riparian woodland overwhelmingly dominated by California sycamore *Platanus racemosa*. He indicates that California buckeye *Aesculus californica*, and blue elderberry *Sambucus mexicana* are common as small trees and mule fat *Baccharis viminea* and introduced grasses are common in the understory. According to Holland, these woodlands are found on braided, depositional channels of intermittent streams, usually with cobbly or bouldery substrates. Holland lists distribution of this community as the south Coast Ranges from Alameda to Santa Barbara Counties.

Before this study, five of the locations for this community occurred in the area predicted by Holland's description, whereas one example was known from the southern Sierra Nevada foothills. One inventoried site was on the Santa Ana River in San Bernardino County. The largest stand of Sycamore Alluvial Woodland inventoried by NDDB was on Los Banos Creek, Merced County.

In addition to Sycamore Alluvial Woodland, the NDDB also identified another community characterized by high cover of California sycamore. This Sycamore-Alder Riparian Forest has been mapped as an extensive community in the south coastal region of California with over 200 occurrences inventoried.

Although Holland's description of Sycamore Alluvial Woodland addresses some specific details about the community, it is a qualitative description, not based on data collected on its environment and the vegetation. The need for a quantitative description of Sycamore Alluvial Woodland arises as a result of proposed changes in land use in areas where this community is known to occur.

Assembly Bill 3792, in 1984, authorized the California Department of Water Resources (DWR) to build Los Banos Grandes Reservoir for an off-stream storage facility, as part of the State Water Resources Development System (Water Code Section 12931). This proposed reservoir would inundate the largest known stand of Sycamore Alluvial Woodland (SAW).

The Department of Water Resources initiated much of the recent work on the SAW community as part of the planning process for the Los Banos Grandes project (Department of Fish and Game 1990, DWR 1986, DWR 1990, DWR 1990a, Little 1990, U.S. Fish and Wildlife Service 1990, Witzman 1989). These reports have attempted to describe the impacts of the proposed project on the biota of the site, including the Sycamore Alluvial Woodland, to assess the significance of these impacts, and to propose mitigation measures for these impacts.

Acreage figures of SAW which would experience impacts from the proposed Los Banos Grandes facilities differ between these reports. In addition, the total acreage of the Sycamore Alluvial Woodland and, therefore, the significance of project impacts to the community as a whole, has been questioned. The variation in the acreage figures is a result of several factors including: different mapping standards, different purposes for mapping, and different definitions of SAW.

The differences in the acreage figures alerted DWR to the need for a more comprehensive study of sycamore-dominated riparian plant communities. This would enable development of a clearer understanding of the variation within sycamore-dominated plant communities and the total distribution of the type represented at the proposed Los Banos Grandes Reservoir site. DWR contracted the Bay-Delta and the Natural Heritage Divisions of DFG to study the variation in sycamore-dominated types, to determine whether or not the Sycamore Alluvial Woodland as described by Holland is a quantitatively different type than other sycamore-dominated riparian communities, and, if so, to determine the total extent of the community, and to define the SAW community so that its boundaries, its relationships to other riparian forests and woodlands, and its environmental requirements are better understood.

The purposes of this study are, therefore, to collect and analyze quantitative information to determine the relationship of the Sycamore Alluvial Woodland to other sycamore-dominated riparian woodlands in the state, to determine the total acreage of the Sycamore Alluvial Woodland, to map and describe all known stands of Sycamore Alluvial Woodland.

METHODS OF STUDY

Mapping Methodology

As one of the primary purposes of this study is to accurately depict the occurrences and extent of Central California Sycamore Alluvial Woodland (CCSAW), a detailed methodology was devised. This included the following steps:

1. Review existing mapping data in NDDB GIS
2. Contact knowledgeable sources for information on additional locations
3. Geographic scoping based on above information
4. Aerial reconnaissance of scoping areas
5. Ground-truthing of identified areas
6. Mapping from aerial photographs
7. Rectifying maps using orthophoto quadrangles
8. Aggregation of polygons
9. GIS digitizing
10. Acreage calculation
11. Refinement based on vegetation sampling
12. Re-digitizing and final map production

The existing NDDB data was derived from various sources and was mapped at various levels of accuracy. At the time of initiation of this study there were six occurrences mapped. A seventh, had been mapped in southern California, but was deleted from the NDDB a year previously because a field visit showed it to be an occurrence of southern sycamore-alder riparian forest community. The minimum mapping unit selected by the NDDB for Sycamore Alluvial Woodland was 50 acres. Given the need for accuracy and the likelihood of locating additional small, but significant stands of sycamores, the minimum mapping unit was reduced to 10 acres for this study. Stands smaller than 10 acres were thought to be of insufficient size to represent stable, functioning ecosystems. The NDDB criteria of assigning all occurrences within 1/4 mile to a single occurrence (stand) was retained for this study.

A list of people or agencies knowledgeable in the distribution of sycamores in California was developed and all were contacted by either Bay-Delta Division or NDDB staff (see Appendix A). Based on these contacts, a set of additional potential sycamore stands was developed. Geographically, these potential stands centered in the foothills of the Southern Sierra Nevada and the inner and middle South Coast Ranges. In July, August and September of 1992 several reconnaissance missions were flown. These included two in the southern Sierra Nevada and three in the South Coast Ranges.

The potential sites were first located on USGS 7.5 minute topographic maps and were coded into the airplane's LORAN geographic locator system. Flights were planned so that they would not only reconnoiter the potential identified sites, but would also fly the terrain likely to contain unknown stands, not identified by the sources.

The result of the flights yielded 11 additional stands that from the air appeared to be viable. They also indicated some necessary modifications to the previous delineations of the existing stands.

Following aerial reconnaissance, the new sites were field checked. This process evaluated stands for overall species composition and accessibility. Several stands identified from the air were later dismissed because they did not have sycamore as the dominant tree and the streambed type was dominated by boulders with no perceptible terraces. However, several were retained as sampling sites (to be explained in sampling selection section). An example of an interim list of evaluated sites is provided in Table 1. Sites were considered candidates for mapping if they met minimum size criteria, were dominated by sycamore (estimated >50% relative canopy cover), and they occurred along alluvial reaches of streams or rivers. Narrow 'v' shaped canyons, less than 50 m across the bottom, with steep adjacent slopes, and bouldery or bedrock substrate were not considered because of obvious environmental and compositional differences.

Mapping was based on several sources. Most of the new and known stands were represented on true color aerial photographs taken in 1990 and 1991 for the Farmland Mapping Project of the Department of Conservation. These photos were generally on a 1:60,000 scale although a few were only available at 1:120,000 scale. Aerial photos for several of the stands were available from DWR at a larger scale (1:24,000 or 1:12,000) These were cross-checked and rectified with the Farmland Mapping Project photos. The boundaries of the stands were traced as accurately as possible, in all cases detail was strived for, which in many cases (e.g., in open woodland) meant that individual trees were depicted.

Aggregation of the smaller polygons took place when the tracings were enlarged or standardized to match with 1:24,000 scale USGS 7.5 minute orthophoto quadrangles. Also at this time, rectification of the optically distorted edges of air photo-derived polygons to the optically corrected orthophoto quadrangles was done.

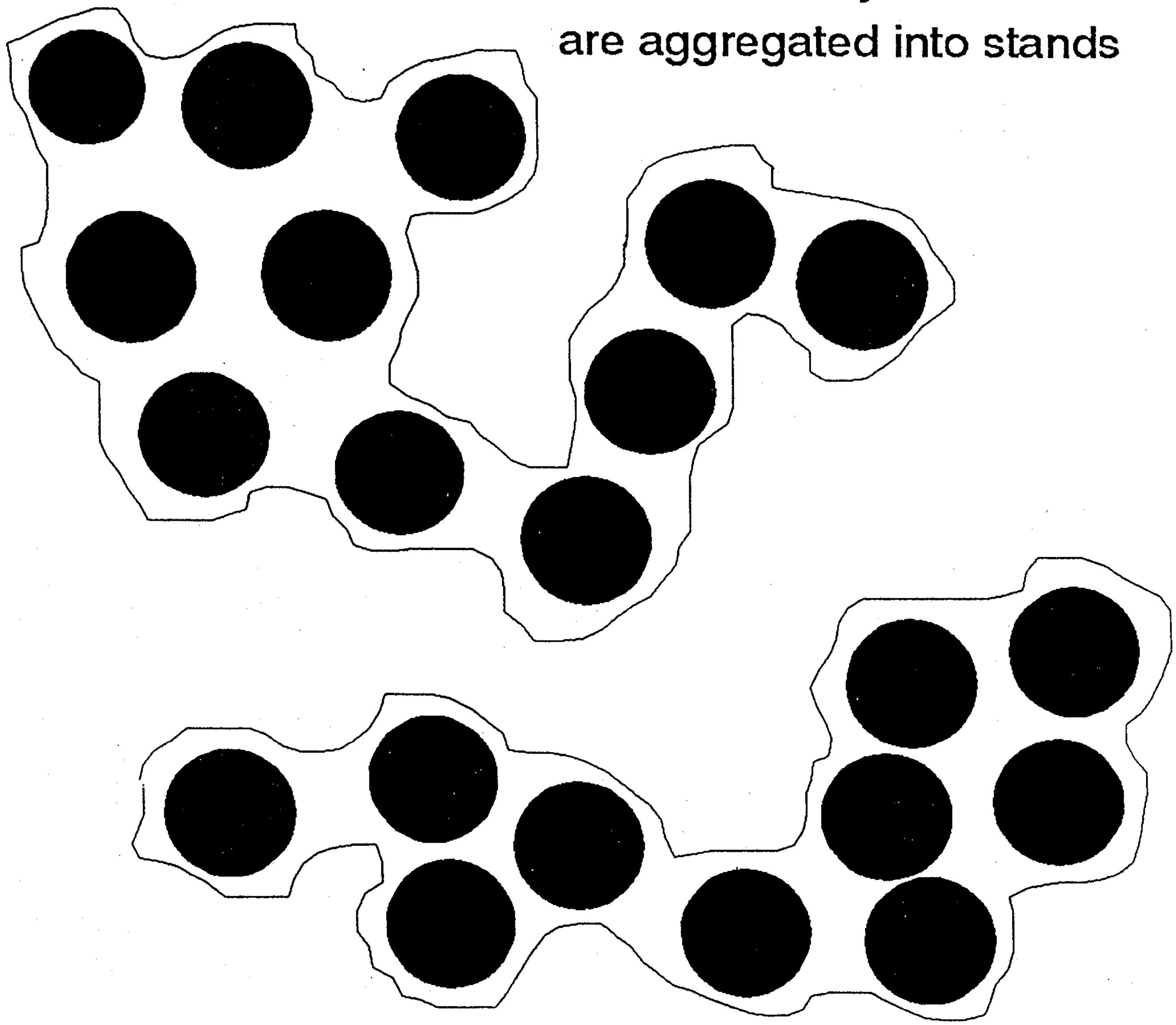
An aggregation rule was developed to group small polygons less than 80 m (true distance) apart into one. This allowed for isolation of non-sycamore vegetation within larger stands as small as 80 m minimum diameter, and afforded a standardized set of criteria to be developed for the depiction of each stand. The minimum accuracy scale for USGS 1:24,000 scale is 80 m. By using these criteria, transfer of hand-drawn maps to digitized GIS maps is also not compromised (any finer scale would tend to be misrepresented due to limits of digitizing puck accuracy). A schematic diagram showing a hypothetical sycamore stand and the way polygons are drawn is shown in Figure 1.

No quantitative analysis of the relationship of canopy cover to polygon selection was done. However, cover estimates were conservative. Final polygon boundaries are considered to be based on the visible delineation of the border of the stand modified by the 80 m rule mentioned above. Compared to other mapping efforts done by NDDB, the minimum cover of trees was somewhat lower than normal. This decision was made because open sycamore

Table 1. Example of Interim Sycamore Site Log Dated September 15, 1992.

Site	Extent	Date(s) Observed	Vegetation Type	Level of Work Required	Work Progress
Los Banos Creek	Undisputably largest occurrence so far, over 600 acres	7/8/92, 8/17/92, various 9/92	Sycamore Alluvial Woodland	Gridded sampling (12 plots, detailed mapping)	first approximation mapping 7/92; sampling initiated 8/17/92; gridded sampling completed 9/12
Orestimba Creek	Large and varied occurrence; may be somewhat larger than originally mapped	9/18/91, 9/1/92, etc.	Sycamore Alluvial Woodland	Gridded sampling, detailed mapping	first approximation mapping 7/92; gridded sampling initiated 9/1
Dry Creek	Largest Sierra occurrence, although somewhat smaller than originally mapped	7/22/92	Sycamore Alluvial Woodland	Gridded sampling, detailed mapping	first approximation mapping 8/17/92; sampling to begin 9/16
Pacheco Creek	Substantially smaller and more patchy than originally mapped	8/14/92	Sycamore Alluvial Woodland	Individual site sampling, detailed mapping	first approximation mapping 9/11
Upper Nacimiento River	Substantially smaller and more patchy than originally mapped	8/5/92, 9/11/92	Sycamore Alluvial Woodland	Gridded sampling , detailed mapping	Air recon and videoed 9/11, first approximation mapping 9/11
Arroyo Valle	Extensive site of over 200 acres; number of large trees estimated 150	8/14/92	Sycamore Alluvial Woodland	Gridded sampling, detailed mapping	air recon and videoed 8/14, first approximation mapping 9/15
Coyote Creek	Best site above reservoir	8/14/92	Sycamore dominated but may not be alluvial	Individual site sampling, detailed mapping	air recon and videoed 7/27/92
Little Dry Creek	Narrow stringer for 1 mile	7/27/92, 7/28/92	Sycamore Alluvial Woodland	Individual site sampling, detailed mapping	air recon and videoed 7/27/92
Mill Creek	Broken into several stands; may total over 50 acres	7/27/92, 7/28/92	Sycamore Alluvial Woodland	Individual site sampling, detailed mapping	air recon and videoed 7/27/92, 7/28/92
South Fork Kaweah River	A few 5-10 acre dense canopy stands	7/28/92	Sycamore dominated, may not be same community	Individual site sampling, detailed mapping	air recon and videoed 7/28/92
Yokohl Creek	Open woodland over 20+ acres at bend in creek	7/28/92	Sycamore Alluvial Woodland	Individual site sampling, detailed mapping	air recon and videoed 7/28/92
S. Fork Tule River	A few stands of several acres interspersed with valley oak woodland	7/28/92	Sycamore Alluvial Woodland	Individual site sampling, detailed mapping	air recon and videoed 7/28/92
Wunpost	An open stand covering 15-20 acres	8/5/92	Sycamore Alluvial Woodland	Individual site sampling, detailed mapping	air recon, videoed 8/5/92
San Ardo	An open stand covering ca 20 acres	8/5/92	Sycamore Alluvial Woodland	Individual site sampling, detailed mapping	air recon, videoed 8/5/92
Arroyo Mocho	equally mixed sycamores and valley oaks over 50 acres	8/14/92	mixed sycamore and valley oak	Individual site sampling	air recon 8/14/92
Alameda Creek	20-30 trees below San Antonio Res.	8/14/92	Sycamore Alluvial Woodland	Individual site sampling, detailed mapping	air recon 8/14/92
San Lorenzo River	Mixed stand near Henry Cowell S.P.	8/14/92	Sycamore - Alder - Redwood	Individual site sampling	air recon 8/14/92
Big Sur River	mixed stands along 2 miles of river below Hwy 1 crossing	8/5/92, additional visits in 1989 by DPR	Sycamore Cottonwood-Redwood	Individual site sampling	air recon 8/5/92
Big Dry Creek	mixed stands along several miles	7/27/92	Sycamore - Alder - Cottonwood	Individual site sampling	air recon 8/5/92

Figure 1: Schematic showing how individual sycamores are aggregated into stands



stands are normal and yet inhabit quantitatively different sites than adjacent grassland and other communities.

These hand drawn maps were then digitized by the Natural Heritage Division GIS staff. Digitizing was quality controlled by the original mappers to ensure accurate depiction. Acreage calculation algorithms built into the GENAMAP GIS system were used to determine acreages of the sites.

Following field sampling of the larger stands or ground-truthing of some of the unsampled stands, additional corrections were made on the digitized maps. The sampling and subsequent classification of certain stands resulted in some areas containing more than one sycamore association type. Stands that are predominantly Central California Sycamore Alluvial Woodland were treated as one type and mapped as such. In stands with predictable and easily discerned distributions of sycamore associations only the true CCSAW type was depicted. The classification and keys developed to associated sycamore vegetation (see Appendix G) can be used to differentiate stands on the ground.

Those stands in which acreage may be over- or under-estimated will be discussed in the stand description section. Final maps are represented as 1:24,000 scale distributions over a topographic map background (see stand description section).

Sampling Methodology

The basis for sampling sycamore vegetation was to develop an accurate description of CCSAW and to differentiate it from other sycamore-dominated vegetation in the state. To accomplish this all stands preliminarily identified as CCSAW in the above manner were sampled at a level of effort relative to their size. Approximately one sample per 40 acres was initially determined as an appropriate intensity. Following initial mapping of the largest stands including Los Banos Creek, Orestimba Creek, and Dry Creek in Tulare County these stands were divided by UTM Grid coordinates into 100 x 100 m grids. Using a stratified random sampling design (Gauch 1982), they were further divided into upper, middle, and lower segments and an appropriate number of transects were selected from each segment to ensure relatively equal representation of samples throughout the stands. Random numbers were generated based on the intersection of northing and easting coordinates and transect midpoints corresponded with the grid coordinates. These were located with a Trimble Pathfinder Basic Global Positioning System. A random compass direction was selected following the midpoint location.

For smaller stands, the grid selection system was found to be inefficient and a sample selection was made based on the extent of the stands and the location of a sample within a homogeneous patch of sycamore dominated vegetation. As in the largest stands, randomization was accomplished where possible by taking a random compass bearing. However, linear stands too narrow to include randomly chosen transect directions were selected parallel to the stream channel from the endpoint of the transect and a coin flip determined which direction the transect would run. Elongated stands were divided into upper and lower reaches based on stand size so that samples were relatively evenly distributed.

The sampling protocol was based on the 50 m line intercept technique developed by the California Native Plant Society (see Appendix F for complete description of the methodology). Additional variables were developed for this study pertaining directly to the riparian nature of the site and particular information useful for determining environmental correlates. A complete sampling form is provided in Appendix F together with description of the variables (Appendix G).

Because the objective of this study was to differentiate various types of sycamore vegetation from the principal type in question, we selected a variety of sites, some with markedly different species composition and environment for the core stands such as Los Banos Creek and Orestimba Creek. The principal criteria was that sycamore had to comprise 50% or more relative cover of the tree layer.

Several of the stands detected from aerial surveys were included in the sampling process even though ground-truthing determined that they were not ecologically equivalent to the alluvial types. Similarly, a field trip to southern California was undertaken in Late September and early October 1992 to collect sample data from a variety of sycamore-dominated stands in the Transverse and Peninsular Ranges of Los Angeles, Ventura, and Orange Counties.

Data Analysis Methodology

Following vegetation sampling, the sampling data was coded into a standardized format used by multivariate programs in the Cornell Ecology Programs statistical software programs for microcomputers (Gauch 1987). Sampling data was broken into species data and environmental variables.

The analytical approach taken in this study has been used for many studies of plant communities (Muller-Dombois and Ellenberg 1974, Gauch 1982, Barbour et al. 1989, Ter Braach 1991). It involves developing a classification of sites based on a sorting of species and samples so that character species that separate groups are identified. The polythetic divisive program TWINSPAN (Hill 1979) was used to make these divisions.

Following the division of species into related samples, the environmental variables collected for each sample were analyzed by the program DECORANA (Hill 1979). A modified version of DECORANA developed by Ter Braak (1991) was used to isolate the important environmental correlates to the species clustering in TWINSPAN.

The philosophy adhered to in this study was to capture enough information on the principal stands in northern and central California to ascertain if they were indeed ecologically similar enough to call one community type. Additional stands dominated by western sycamore were also sampled to afford some analytical comparison to the main stands sampled. Thus, this study is only an incomplete classification and ordination of sycamore vegetation in California and is not meant to be a definitive, state-wide analysis of all types of sycamore vegetation.

The Variation Within Stands and the Interpretation of the Classification

Sycamore stands, as with most other riparian vegetation vary spatially and temporally. Stands occurring along a stream may be seen from a distance to be continuous and dominated by sycamores. However, at closer view, for example if one looks at understory species and substrate, may be composed of more than one mixture of plants. These individual mixtures, despite their spatial patchiness, are replicated in other stands, so that the same association of plants are coupled with the same environmental conditions in many places. Thus, these are not unique mixtures that change randomly. The consistent component of these mixtures that can be observed repeatedly in different geographically isolated stands is what in plant ecology, is considered a plant association.

Typically for sycamores in central California, large interior valley stands such as those at Los Banos Creek, Dry Creek and Orestimba Creek are all composed of the same association. However, as one moves upstream in these stands into the foothills, or in stands in the middle or outer Central Coast Ranges, composition of the sycamore stands begins to change. The change is not usually manifested by a transformation in the entire stand. Instead it begins as patchy changes within one stand. For example, a portion of a continuous stand of sycamores may have a dense understory of snowberry and poison oak with an admixture of coast live oak and valley oak in the tree overstory, while an adjacent area may have an understory dominated by annual grasses and an insignificant amount of oaks. These patchy units within stands reflect variation in the local stand environments. These patches may occur in sizes of only a few meters to hundreds of meters in length.

In this study we have chosen to map continuous stands of sycamores reflecting the attributes of Sycamore Alluvial Woodland. We made certain logistical decisions because of the considerations of viability of stands and the difficulty of interpreting from aerial photographs the differences between some sycamore-dominated associations. First, we determined not to map isolated stands smaller than 10 acres (4.1 ha) in size (note: our reconnaissance uncovered very few small isolated stands). Second, we determined that stands with some variation in the association types of sycamore-dominated vegetation would be mapped if the majority of the stand (estimated by ground-truthing) could be classified as the CCSAW type.

The effect of these two decisions is to allow for other minor inclusions of associations within a stand, and to ignore occurrences smaller than 10 acres. In essence, it means that in stands dominated by CCSAW, but containing other sycamore associations, we are mapping at the level of vegetation series (e.g., all sycamore-dominated vegetation), while at the "pure" stands of Central California Sycamore Alluvial Woodland, we are mapping at the plant association level.

In some cases we have come across stands with components that exemplify traits of SAW that are either surrounded by other associations, or are too small to meet the mapping criteria. In some cases we have sampled these stands and analysis shows that these clearly fall into the CCSAW category. By using the dichotomous key (Appendix H), one can determine if the particular plant association one is standing in is CCSAW regardless of whether the stand it occurs in is large enough to be mapped for the purposes of this report.

ASPECTS OF THE NATURAL HISTORY OF WESTERN SYCAMORE

Sycamore Distribution

The western sycamore (*Platanus racemosa*), is the only member of the family Platanaceae in California. According to Hickman (1993) there are approximately eight species in the family world-wide. The Platanaceae has a north-temperate distribution with members in North America and Eurasia. All members of the small family are trees in the genus *Platanus*.

The closest relative to the western sycamore is the Arizona sycamore (*Platanus wrightii*). It occurs throughout southern Arizona from Southern Mojave County south and east to New Mexico, West Texas, and Northern Arizona (Kerney and Peebles 1960). Its distribution stops about 200 miles east of the easternmost stands of western sycamore, the two species being separated by the Mojave and the Colorado Deserts. According to Hickman some individuals of *P. racemosa* in the Peninsular Ranges of southern California are very close genetically to the Arizona trees, suggesting relatively recent isolation. Robichaux (1977) has shown that, in the Miocene and Pliocene, close, now-extinct relatives of western sycamore occurred in northwestern, northeastern, and east-central California on into eastern Oregon and Nevada.

Despite the rarity of certain natural communities dominated by sycamores in California, the tree itself has never been considered rare. Griffin and Critchfield (1976) show it to range widely from Shasta County southward into Baja California (Figure 2). The main body of sycamore distribution in California is centered in the Central and southern Coast Ranges, the southern Sierra foothills, and along the streams emanating from the Transverse and the Peninsular Ranges of southwestern California. In many areas western sycamore is only an occasional member of other riparian forests or woodlands. This is true, for example, along the entire length of the Sacramento River. In many areas where sycamore might be expected to occur, such as along the streams of the Inner North Coast Ranges, and the northern Sierra Nevada foothills, it does not. Conversely, sycamores may be found in virtually every drainage in portions of the outer South Coast Range, the western Transverse Ranges, and the outer Peninsular Ranges. In these areas they are frequently common and often

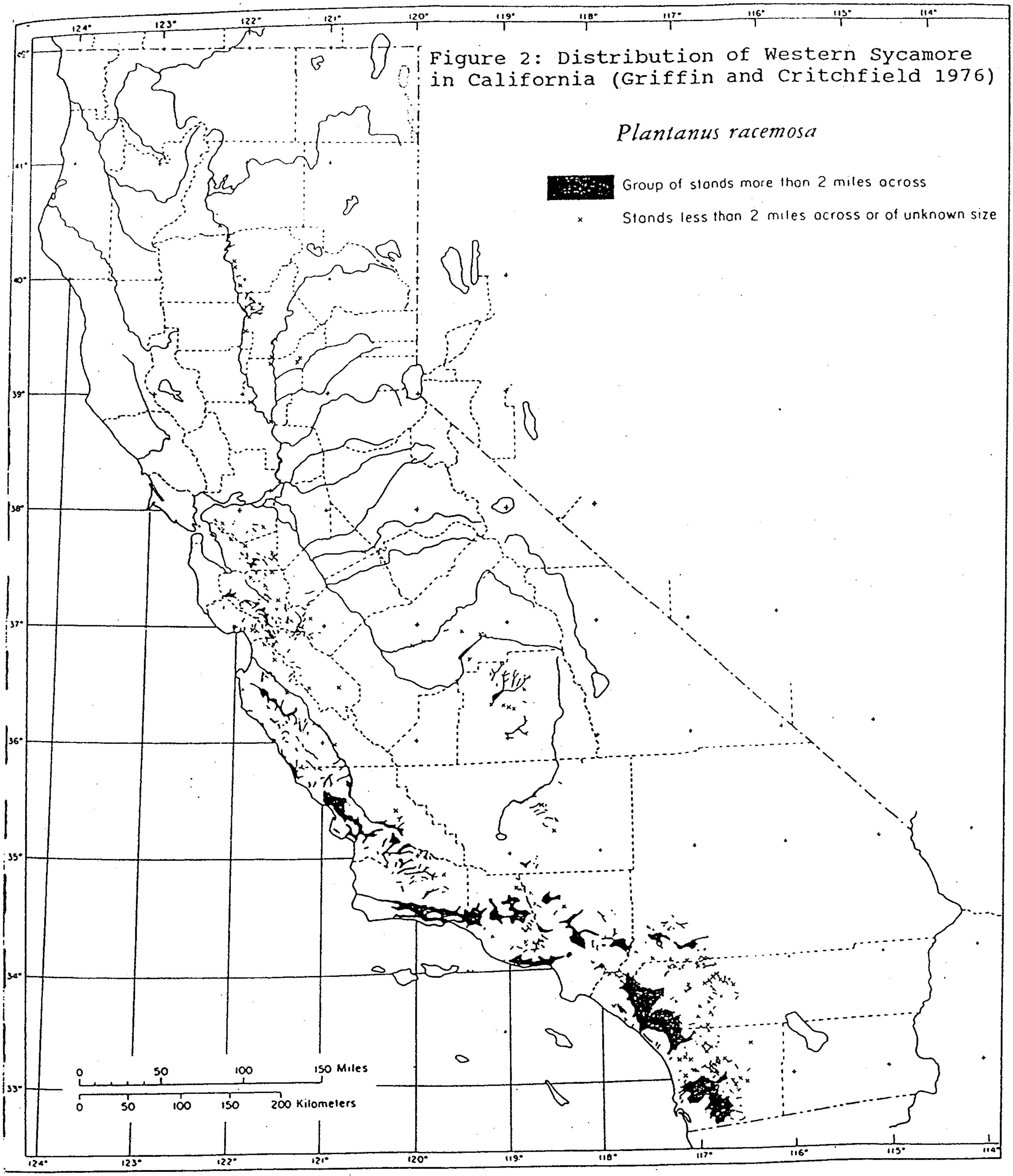


Figure 2: Distribution of Western Sycamore in California (Griffin and Critchfield 1976)
Plantanus racemosa
Group of stands more than 2 miles across
Stands less than 2 miles across or of unknown size
0 50 100 150 Miles
0 50 100 150 200 Kilometers

dominate the riparian vegetation.

Water Relations of Western Sycamore

Although western sycamore is typically associated with well-watered habitats, it is not found in the humid north coastal strip, where the highest precipitation in the state occurs. It only grows with north-coastal riparian trees such as coast redwood (*Sequoia sempervirens*) and red alder (*Alnus oregona*) in the central Coast Ranges, near the southern limits of the northern coastal coniferous forests. Western sycamore tends to associate with streams in parts of the state where California's mediterranean, summer hot-dry climate is most characteristic. Many of these streams are completely dry at the surface for the majority of the year. Surface flow may only occur for brief periods following winter rains, and beds may be completely dry during years of below normal precipitation.

This tolerance of relatively dry riparian conditions is mirrored on a small scale within drainages. Finn (1991) and Brothers (1985) have both shown that the species is often found away from the most active stream channels, either on terraces immediately above the stream or on slopes above creek beds. Sycamores also occasionally occur around springs and vernal seeps on slopes separated from streams by hundreds of meters.

The water requirements of western sycamore as they relate to the CCSAW community have been best studied by Matheny (1989). She investigated the die-back and reduced vigor of the Arroyo Valle stand in Sycamore Grove Park, Alameda County. She studied the history of the site with regard to the construction of the Del Valle Reservoir in 1966, the drought years of 1976-77, the age and growth rates of sycamores, and records from well-borings and well logs.

Matheny concluded that sycamores are a type-two phreatophyte. That is, they require high soil moisture during the initial growth annual cycle. However, they also require a significant reduction in the water table through the later part of the growing season. This latter requirement relates to the intolerance of sycamores to long-term exposure to water-logged, un-aerated soils. The documented poor health of the sycamores at Arroyo Valle was largely due to the unnaturally high summer discharge of water from the dam followed by several years of no water release.

Matheney reported little tolerance by sycamores of fluctuating water levels - raise the perched water table a few feet during the summer and the roots are injured due to poor aeration; eliminate water flow too early in the year and the soil-water reservoir available to the injured root system is depleted before the growing season ends. Matheny suggests that the optimum water regime for sycamore at this site is annual groundwater recharge in the winter and spring with gradual draw-down into the summer.

Clearly, once established, western sycamore can tolerate relatively dry conditions.

However, in nature, the successful establishment of individuals by seed appears to be a rare event.

Asexual and Sexual Reproduction

Western sycamore is a monoecious plant producing separate male and female flowers in spherical heads in early spring (typically February to April). The female flowers mature and form achenes densely packed into the spherical fruits by late summer. These fruits generally remain on the trees through winter and break apart by late winter; the persistent hairs surrounding the individual achenes afford lift during wind dispersal.

Sexual regeneration of *P. racemosa* and the related *P. wrightii* have been shown to be rare (Glinski 1977, Rucks 1984, Strahan 1984, Brady et al. 1985, Brothers, 1985, Finn 1991). No sycamore seedlings or saplings were located in over 50 miles of riparian habitat along the middle Sacramento river (K. Buer, pers. comm., 1991). Likewise, no *P. wrightii* saplings or seedlings were found along 14 miles of Sonoita Creek (Glinski 1977). The absence of sycamore seed regeneration has been attributed to changes in stream characteristics, falling water tables, reduction in overbank flooding, and downcutting of channels (Brothers 1985, Glinski 1977). Despite poor sexual regeneration in nature, experimental germination and growth of *P. racemosa* seedlings has been successful (DWR Sycamore pilot study pers. comm. D. Bishop, 1994).

Sycamore anthracnose (*Apiognomonia veneta*), a fungal disease affecting the tree throughout California, may, in part, be responsible for poor seed production in some years (Shanfield 1984). The disease is particularly virulent in wet springs when the new leaves, young fruit, and new shoots may be killed and a second growth of shoots, fruit, and leaves takes place later in the spring. In some years with late spring rains (such as 1995) sycamores may be leafless and without fruit into early summer. Sycamore anthracnose was found to be virtually ubiquitous in all stands sampled in this study (Figure 3).

Of all of the 17 CCSAW stands mapped in this study, seedlings and saplings were only encountered at two; Nacmiento River and Orestimba Creek. Regeneration sites were limited to the active stream channels, associated with late lingering surface moisture (Figure 4). These sites would be likely to be altered by normal streamflow in the following rainy seasons. In contrast to the stands we mapped in central California Finn (1991) located seedlings and saplings at each of her eight study sites in south coastal California. The majority of these were found at the edge of tree canopies in filtered or partial sunlight. They were associated with seedlings of willow and alder suggesting requirements similar for establishment of these species. Finn found 78% of her seedlings within less than 1 m of the active water channel. There was a significant association between the seedling size classes and the presence of boulders. Most of Finn's sites had low to very low sycamore sapling-to-tree ratios (less that 1 sapling to two trees). Finn suggests that seedling and sapling mortality may have much to do with winter stream flows damaging or uprooting seedlings and desiccation during summer.

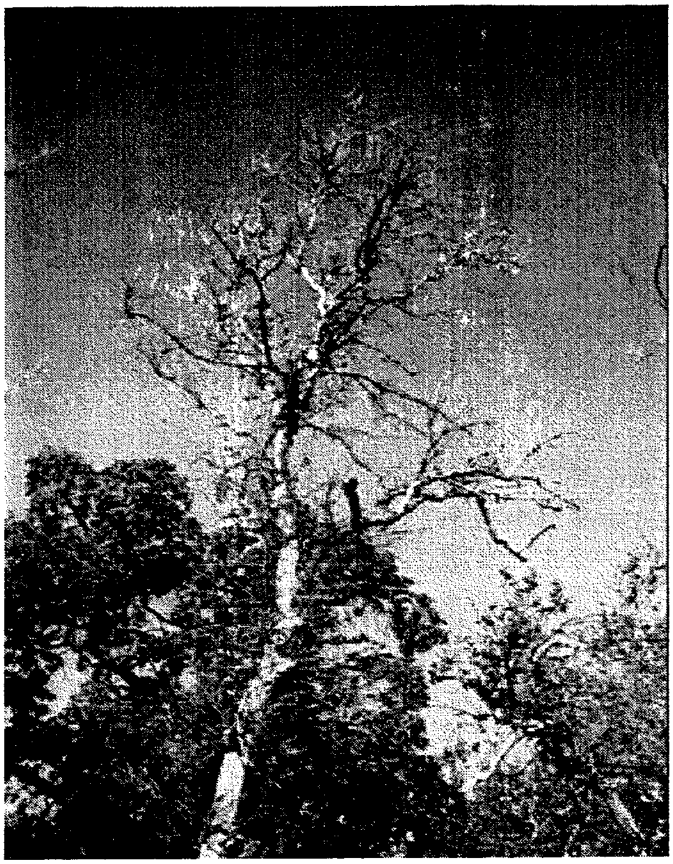


Figure 3. A Sycamore Severely Affected by Anthracnose, Arroyo Mocho Stand.

Figure 4. Sycamore Saplings in Streambed of North Fork Los Banos Creek
(a Non-CCSAW Site), Typical Location Associated with Boulders.

Boulders may serve to protect the established seedlings and saplings against flooding and channel scouring.

Some distinct differences in environmental conditions between Finn's study sites and those in this study suggest reasons why sexual reproduction is less significant in our study area than in Finn's. The general paucity of boulders at our main sites (see summary table) suggests a lack of suitable protection from scouring. Finn also found that seedlings occurred on wet soil sites in 92% of the cases examined. The majority of these sites were along perennial streams. Only 8% of seedlings were found at intermittent streams. All major stands inventoried in our study occurred along intermittent streams. Finn also found all seedlings and saplings associated with stream-beds and not terrace deposits. In contrast, all of our main sycamore stands were associated with terraces, often many meters from active stream channels.

Another difference between Finn's and our studies may involve the intensity of cattle grazing. Finn only found one area where cattle had browsed seedlings or sprouts. In contrast, browsing of sycamore was a factor on at least eight of the seventeen of our study sites (Figure 5). At these eight sites (Alameda Creek, Arroyo Mocho, San Antonio Creek, Los Banos Creek, Orestimba Creek, Dry Creek, Little Dry Creek, and Mill Creek), at least some adventitious sprouts were browsed back to their bases toward the end of the season (presumably after the reduction of more palatable forage). There is no reason to assume that sexually produced young growth would be treated any differently.

Although sexual reproduction is currently insignificant in the stands in our study, asexual reproduction in the form of adventitious sprouts was noted at every stand. Sycamores commonly produce a cluster of sprouts around the base of the parent trunk. When the original stem dies, the sprouts develop into mature stems which have the potential to produce their own sprouts. Sprouting is generally believed to be associated with various forms of disturbance such as flood, fire (Figure 6), age, insect, or other disease-related damage (Strahan 1984, Sharitz and Lee 1985).

Asexual sprouting is clearly advantageous to western sycamore, allowing the species to maintain its populations in habitats where germination and establishment by seed is rare. The large number of sprouts and the substantial diameter size of many of the sprouts indicate that asexual reproduction has been a major means of regeneration for some time. However, this form of vegetative sprouting does not have the potential to expand or colonize unpopulated areas. Asexual reproduction will only maintain the existing population of trees.

Based on this and other studies (Brothers 1985, Finn 1991) of western sycamore, disturbance by flooding is the most likely process to create conditions favorable for stand-expanding sexual reproduction. The presence of sycamore individuals in woodlands along terraces above the current level of the stream channels suggest that episodic flooding created these stands by opening up the substrate, depositing silt and sand, and providing sufficient

Figure 5. Cattle Grazing was Found to Have an Impact at Virtually all of the CCSAW Sites (Pacheco Creek).

Figure 6. Sycamore Sprouting About Two Months After Fire at Coyote Creek Stand.

moisture for a sufficient period to establish seedlings. Flooding also was a likely contributor to asexual regeneration in stands that became too isolated from the main stream channel to rely on regular moisture to support seedling growth. For example, a portion of the stand at Los Banos Creek has sprouts dating back to a flood event of 1956 (pers. comm., F. Wernette 1991).

The active downcutting of stream channels in some areas of our study (e.g., Salinas River, Deer Creek) and in other areas such as in the San Gabriel Mountains (Brothers 1985) has likely outstripped the capability of streams to rejuvenate terrace stands by even the most extreme flooding events. Thus, relict terrace sycamore stands may now rely on other forms of rejuvenation such as fire to perpetuate themselves.

Sycamore stems are brittle and loose large limbs and stems regularly from wind damage, or when spreading branches can no longer support the weight of stem and leaves (Figure 7). Most large stems have discoloration and rot of inner heart wood. Extrapolation of increment core data used to determine growth rates of the largest and an average sized sycamore stem in each sample plot indicates oldest stems are on the order of 550 years. This corresponds with core data taken by Little (1991) at Los Banos and Orestimba Creeks. The mean age of stems taken on older trees is likely to be less than the extrapolated age because most cores taken did not enter the centers of stems (these being mostly rotten in the larger individuals), where growth rings are typically substantially wider than the measured outer portions.

The typical life history of a western sycamore stand is thus initiated by a flood event immediately followed by a good seed year which produces a cohort of seedlings, some of which are in protected microsites. Sufficient moisture must remain to establish a small percentage of these seedlings. Following growth to maturity of the original stems, flooding or other disturbance initiates adventitious sprouting at the base of the stems. As the original stems succumb to disease and damage, the sprouts take over the role of the dominant biomass of the individual and this cycle of asexual replacement of an individual's stems continues for an undetermined length of time.

RESULTS AND DESCRIPTION OF GROUPINGS

The Results of the Classification and Ordination

Classification of the Samples

The 86 samples were first run through the TWINSPAN (Two-Way Indicator Species Analysis) program (Hill 1979). This program analyzes the species and samples, dividing up groupings and arranging them in a two-way species-by-sample sort. This classification technique is a computer assisted approximation of the intensive manual classification

Figure 7. Hollow, Recently Broken Sycamore Stem at Los Banos Creek Stand.

methodology used for over 70 years by plant ecologists to describe the vegetation of Europe and many other parts of the world (Muller-Dombois and Ellenberg 1974). Both of these techniques use indicator species to distinguish vegetation associations. Indicator species are not necessarily the dominant or most abundant species, but are the most characteristic of a certain vegetation type. Thus, by searching for these shared species in a set of data, the program groups like samples based on these characteristic species. TWINSPAN is the most widely used program currently available to classify vegetation samples and has a number of advantages over other computer assisted classification techniques (Gauch 1982, Jongman et al. 1987).

TWINSPAN classified the 86 samples into four main groups. The groups are based on the dichotomized splitting of the samples into first two, then four, and so on. Further subdivision was not appropriate based on the scale of the study and the variance within more finely divided groups (e.g., the finer subdivisions changed substantially when different rules were applied, see below). One of these groups was composed of only four samples representing southern coastal California sites. The remaining three groups were made up of 11, 32, and 39 samples each. To test the strength of this classification, multiple TWINSPAN runs were made on the data changing weighting of various parameters such as pseudospecies (see Hill 1979), cover values, rare species, and removing all herbaceous species from the analysis.

In general, despite these changes, the four groups remained static, with only a few plots shifting between one group and another. These varied depending on the parameters changed. These shifts occurred most frequently between what are termed the mid-coastal alluvial group and the interior alluvial group. These and the other two groups were named for their distinguishing geographic local, although they could also be named by their indicator species (see following pages). The most immutable (least susceptible to change based on modification of TWINSPAN runs) groups were the foothill group and the small southern California group.

Although samples were taken from spring through fall over a period of 10 months, the seasonal variance in vegetation expression was reduced through the botanical expertise of the sampling crew, who could reliably identify fragments of annual species throughout the sampling period. Although the winter of 1992 was somewhat drier than that of 1993, vegetation cover and species cover within the CCSAW is not expected to change substantially from year to year. Year to year re-sampling of the same plots on Central Coastal blue oak woodland, with a similar annual species dominance in the understory, showed that the same sites came out the same way in a TWINSPAN classification (Borchert et al. 1993).

The most clearly defined of these groups was the foothill group. Here, despite various alterations of the default values in the analysis, the 11 samples showed a very high fidelity to this group.

The smallest of the other groups consisted of five samples that equated to all but one of the stands sampled in south Coastal California. This group clearly has a great deal of heterogeneity (based on the species composition of the samples), but it does demonstrate that the southern California samples represented vegetation that was clearly different from the central California samples.

The remaining mid-coastal and interior alluvial groups contained the majority of samples. These groups showed some relationship to one another in that they exchanged some samples when subjected to changes in species ranking and pseudospecies values in the TWINSPAN analysis. The interior alluvial group included what was assumed prior to this study to be the core type of "Sycamore Alluvial Woodland". The mid-coastal group was somewhat heterogeneous as evidenced by the inclusion of samples from the foothill belt of the southern Sierra and one sample from southern California with the samples from Nacimiento River, Alameda Creek and other mid-coastal stands. However, the majority of these samples occur in alluvial stands in the Middle Coast Ranges and not the Inner Coast Ranges.

TWINSPAN assigns each plot to a group in the classification. The fidelity of plots within one TWINSPAN group to a particular stand of sycamores was generally high. That is, typically all or most of the sample plots taken in a certain stand of sycamores were classified as one type. For example, The majority of samples at lower Los Banos Creek, Orestimba Creek, Dry Creek, and lower Mill Creek all were classified within the Interior Alluvial Group. While all of the samples at Upper Orestimba Creek, Upper Mill Creek, Upper Pacheco Creek, and some samples at the South Fork and the North Fork of Los Banos Creek fell within the Foothill Group (Table 2).

Table 3 shows the list of indicator species for each of the three main groups sampled. Table 4 shows the constancy and cover values of the 200 most abundant species. Appendix H displays a TWINSPAN sorting of the 200 most common species among the 86 samples.

Ordination of the Samples

Following the classification by TWINSPAN the data were subjected to another multivariate computer program called Detrended Correspondence Analysis (DCA). This program (modified from Hill 1979 by Ter Braak 1991) is used in vegetation ecology to distinguish the environmental differences between sample stands of vegetation. This affords ecologists the ability to identify and graphically display the important environmental controls of the vegetation types sampled. Thus, they may substantiate that the differences seen in the vegetation groupings, as pointed out by programs such as TWINSPAN, are actually correlated with effects of the environment (such as temperature, moisture, soil type, etc.). The correlation of plant groups with certain environmental effects strengthen their validity as ecological units. DCA shows the relationship between the various groupings arrived at on two dimensional graphs by ordinating the plots along environmental axes.

Table 2. The Four Groups Defined by Twinspan and the Stands or Sampling Areas Associated with Them.

	No. of samples in group	No. of samples in stand	Percent of group in stand
Interior Sycamore Alluvial Group:			
Los Banos Creek	11	13	85
Orestimba Creek	10	12	83
Dry Creek	7	7	100
Lower Mill Creek	4	4	100
South Tule River	1	1	100
Little Dry Creek	1	1	100
Deer Creek	3	3	100
Arroyo Mocho	1	2	50
S. Fork Los Banos Creek	1	3	33
N. Fork Los Banos Creek	2	3	66
N. Fork Kaweah River	1	1	100
Foothill Group:			
Upper Pacheco Creek	2	2	100
N. Fork Los Banos Creek	1	3	33
S. Fork Los Banos Creek	2	3	66
Upper Orestimba Creek	3	3	100
Upper Mill Creek	3	3	100
Southern California Group:			
Santa Rosa Plateau	1	1	100
Malibu Creek	1	1	100
Big Sycamore Creek	1	1	100
Santa Ana Creek	1	1	100
Indian Canyon	1	1	100
Mid-Coastal Group:			
Lower Pacheco Creek	3	3	100
Nacimiento River	3	3	100
Arroyo Valle	4	4	100
Upper Coyote Creek	2	2	100
Lower Coyote Creek	2	2	100
Arroyo Mocho	1	2	50
Alameda Creek	3	3	100
San Antonio Creek	2	2	100
Starr Ranch (s. Calif.)	1	1	100
San Felipe Creek	1	1	100
South Fork Kaweah River	3	3	100
Los Banos Creek	2	13	15
Orestimba Creek	2	12	17

Table 3. List of Indicator Species for Each of the Four Groups Identified by TWINSPAN.

GROUP NAME	INDICATOR SPECIES
Foothill Group	*Baccharis viminea* (herb layer) Algal mat (mostly *Spirogyra* sp.) *Polypogon monspeliensis*
Interior Alluvial Group	*Bromus mollis* *Festuca myuros* *Hordeum leporinum*
Mid-coastal Group	*Avena barbata* \1
Southern California Group	*Quercus agrifolia* (tree) *Arundo donax* *Bromus carinatus*

\1. Determined to be an indicator the mid-coastal group because of a higher regular constancy within the group (8 samples have > 1% cover while only 2 samples have > 1% cover for the interior alluvial group).

Table 4. Constancy and Cover for Species of the Four Sycamore Groups Defined in this Study[1].

Species[2]	Foothill	Interior	Coast	S. Calif.
TREES:				
Fraxinus latifolia	0/0	0/0	3/1	0/0
Junglans californica	-	-	3/1	25/1
Platanus racemosa	91/5	95/5	100/5	100/4
Populus fremontii	9/1	5/1	-	-
Quercus agrifolia	18/1	-	16/2	75/4
Quercus lobata	9/1	5/1	16/2	-
Quercus douglasii	-	2/1	-	-
Quercus wislizenii	9/1	3/1	6/1	-
Salix laevigata	-	3/1	6/1	-
Toxicodendron diversiloba	-	-	-	25/1
Aesculus californica	-	3/1	-	-
Arundo donax (t)	18/1	-	13/1	75/3
Salix lasiolepis (t)	-	-	-	25/1
Umbellularia californica	9/1	-	16/1	-
SHRUBS:				
Cephlanthus occidentalis californicus (s)	18/1	3/1	-	-
Baccharis viminea (s)	9/1	18/1	19/1	25/1
Aesculus californicus (s)	-	-	9/1	-
Artemisia californica (s)	-	-	3/1	-
Brassica nigra (s)	-	-	6/1	-
Ceanothus crassifolius (s)	-	-	-	25/1
Eriodyction crassifolium (s)	-	-	-	25/1
Quercus dumosa (s)	-	-	-	25/1
Rhus trilobata	-	-	-	50/2
Rubus procerus (s)	-	-	-	25/1

Table 4. (cont.) Constancy and Cover for Species of the Four Sycamore Groups Defined in this Study[1].

Species[2]	Foothill	Interior	Coast	S. Calif.
Sambucus mexicanus (s)	-	-	-	25/1
Juglans californicus (s)	-	-	-	50/1
Calycanthus occidentalis (s)	-	-	3/1	-
Vitis californica (s)	-	-	3/1	-
Platanus racemosa (s)	-	-	13/1	-
Toxicodendron diversilobum (s)	18/1	-	16/1	25/1
HERBS AND GRAMINOIDS:				
Polygonum punctatum	18/1	2/1	6/1	-
Rumex obtusifolius agrestis	18/1	-	3/1	-
Toralis arvensis	27/1	-	3/1	-
Juncus patens	18/1	-	-	25/1
Scirpus americanus	36/1	-	-	25/1
Sonchus asper	18/1	-	3/1	-
Brickelia californica	36/1	3/1	3/1	-
Carex sp	55/1	3/1	-	25/1
Sonchus oleraceus	27/1	3/1	3/1	-
Baccharis viminea (h)	81/1	10/1	-	-
Boisduvalia densiflora	27/1	-	-	-
Centaurium sp.	18/1	3/1	-	-
Cynosurus echinatus	18/1	3/1	-	-
Datisca glomerata	27/1	5/1	-	-
Gnaphalium palustre	18/1	3/1	-	-
Gutierrezia bracteata	18/1	3/1	-	-
Lindernia anagallidea	27/1	5/1	-	-
Marsilea vestita	27/1	-	-	-
Paspalum distichum	36/1	10/1	-	-

Table 4. (cont.) Constancy and Cover for Species of the Four Sycamore Groups Defined in this Study[1].

Species[2]	Foothill	Interior	Coast	S. Calif.
Perideridia californica	45/1	5/1	-	-
Populus fremontii (h)	18/1	5/1	-	-
Salix laevigata (h)	27/1	5/1	-	-
Agrostis semiverticillata	27/1	-	-	-
Aira caryophyllea	27/1	-	-	-
Boisduvalia stricta	27/1	-	-	-
Cyperus niger capitatus	18/1	3/1	-	-
Eleocharis macrostachya	36/1	3/1	-	-
Eleocharis palustris	9/1	-	-	-
Equisetum hymale californicum	18/1	-	-	-
Galium murale	55/1	-	-	-
Mentha piperita	27/1	-	-	-
Stachys albens	36/1	-	-	-
Asclepias fascicularis	45/1	15/1	3/1	-
Blue-green algal mat	81/3	30/1	3/1	-
Gnaphalium leuto-album	64/1	15/1	3/1	-
Heleochloa schoenoides	45/1	10/1	-	-
Juncus balticus	36/1	8/1	-	-
Polypogon monspeliensis	90/1	33/1	3/1	-
Torilis heterophylla	27/1	8/1	-	-
Xanthium strumarium	73/1	21/1	3/1	-
Lythrum hyssopifolia	36/1	13/1	-	-
Mimulus pilosus	27/1	8/1	-	-
Conyza canadensis	9/1	3/1	3/1	-
Trifolium hirtum	9/1	3/1	3/1	-
Daucus pusillus	9/1	3/1	3/1	-

Table 4. (cont.) Constancy and Cover for Species of the Four Sycamore Groups Defined in this Study[1].

Species[2]	Foothill	Interior	Coast	S. Calif.
Barbarea sp.	18/1	3/1	3/1	25/1
Zauschneria californica	36/1	5/1	-	25/1
Ribes sp.	9/1	3/1	3/1	-
Melilotus indicus	45/1	18/1	/1	-
Paspalum dilatatum	9/1	5/1	-	25/1
Anagallis arvensis	27/1	8/1	3/1	-
Cyperus eragrostis	36/1	10/1	3/1	-
Lolium perenne	36/1	13/1	6/1	-
Rumex californicus	36/1	5/1	3/1	-
Rumex conglomeratus	27/1	15/1	6/1	-
Torilis nodosa	18/1	10/1	3/1	-
Amarinthus albus	36/1	18/1	-	-
Lactuca saligna	9/1	5/1	-	-
Quercus douglasii (h)	9/1	5/1	-	-
Cucurbita palmata	-	5/1	-	-
Eriogonum roseum	-	8/1	-	-
Euphorbia ocellata	-	31/1	-	-
Festuca dertonensis	-	26/1	3/1	-
Festuca megalura	-	13/1	-	-
Gilia sp.	-	13/1	-	-
Lasthenia chrysostoma gracilis	-	10/1	-	-
Medicago polymorpha	-	8/1	-	-
Sisymbrium orientale	-	10/1	-	-
Tillaea erecta	-	26/1	3/1	-
Bromus arenarius	-	26/1	-	-
Digitaria sanguinalis	-	8/1	-	-

Table 4. (cont.) Constancy and Cover for Species of the Four Sycamore Groups Defined in this Study[1].

Species[2]	Foothill	Interior	Coast	S. Calif.
Elymus caput-medusae	9/1	15/1	-	-
Heliotropum curassivicum occulatum	9/1	10/1	-	-
Heterotheca subaxillaris	-	8/1	-	-
Koelaria phleoides	-	8/1	-	-
Lactuca serriola	-	10/1	-	-
Marsilea ologospora	-	5/1	-	-
Piyrogramma triangularis	-	8/1	-	-
Spirogyra algae sp.	-	8/1	-	-
Stipa cernua	-	8/1	-	-
Centaurea melitensis	36/1	41/1	-	-
Trichostoma lanatum	36/1	33/1	3/1	-
Cynodon dactylon	100/3	92/2	6/1	-
Eleocharis sp.	9/1	18/1	-	25/1
Euphorbia supina	9/1	8/1	-	-
Filago gallica	9/1	8/1	-	-
Galium parisiense	27/1	13/1	-	-
Hordeum geniculatum	45/1	28/1	3/1	-
Juncus bufonius	55/1	28/1	-	-
Polypogon maritimus	45/1	41/1	-	-
Artemesia californica (h)	27/1	21/1	-	-
Bromus madritensis	45/1	28/1	6/1	-
Bromus rubens	45/1	80/2	28/1	25/1
Cyperus sp.	-	13/1	3/1	-
Distichlis spicata	18/1	41/1	6/1	-
Festuca myuros	27/1	85/1	19/1	-
Holocarpha virgata	9/1	13/1	3/1	-

Table 4. (cont.) Constancy and Cover for Species of the Four Sycamore Groups Defined in this Study\1.

Species\2	Foothill	Interior	Coast	S. Calif.
Lotus purshianus	45/1	36/1	6/1	-
Poa scabrella	-	8/1	3/1	-
Rumex crispus	18/1	23/1	9/1	-
Festuca pacifica	-	23/1	3/1	-
Hordium glaucum	-	31/1	3/1	-
Amsinckia sp.	18/1	41/1	16/1	-
Hypochoeris glabra	18/1	23/1	6/1	-
Plantago hookeriana californica	-	18/1	6/1	-
Hordeum leporinum	9/1	69/1	25/1	-
Lactuca serriola integrata	9/1	15/1	6/1	-
Chysopsis oregona rudis	-	18/1	9/1	-
Eriogonum gracile	-	5/1	-	25/1
Grindelia procera	-	5/1	3/1	-
Holocarpha obconica	-	8/1	3/1	-
Epilobium paniculatum	-	8/1	6/1	-
Lolium multiflorum	-	15/1	9/1	-
Montia perfoliata	-	13/1	6/1	-
Plagiobothrys tenellus	-	3/1	3/1	-
Sisimbrium officinale	9/1	15/1	9/1	-
Erodium cicutarium	9/1	10/1	6/1	-
Carduus tenuiflorus	18/1	15/1	9/1	-
Eremocarpus setigerus	82/1	67/1	25/1	-
Verbascum thapsus	18/1	8/1	3/1	-
Crypsus niliacea	9/1	5/1	6/1	-
Marribium vulgare	18/1	8/1	9/1	-
Medicago polymorpha	18/1	10/1	6/1	-

Table 4. (cont.) Constancy and Cover for Species of the Four Sycamore Groups Defined in this Study[1].

Species[2]	Foothill	Interior	Coast	S. Calif.
Brassica geniculata	27/1	44/1	47/1	-
Bromus mollis	36/1	92/1	66/1	25/1
Stellaria media	9/1	28/1	25/1	-
Agrostis sp.	9/1	3/1	6/1	-
Mentha sp.	-	5/1	6/1	-
Avena barbata	18/1	56/1	53/1	-
Bromus diandrus	64/1	95/3	100/4	75/3
Melilotus albus	27/1	-	9/1	-
Elymus glaucus	18/1	5/1	13/1	-
Foeniculum vulgare	9/1	-	9/1	-
Muhlenbergia rigens	-	3/1	3/1	25/1
Silybum marianum	9/1	5/1	16/1	25/1
Toxicodendron diversilobum (h)	9/1	5/1	16/1	25/1
Urtica holosericea	18/1	3/1	3/1	25/1
Avena fatua	18/1	10/1	22/1	-
Conium maculatum	9/1	3/1	3/1	-
Galium sp.	-	8/1	16/1	-
Oryzopsis miliacea	-	5/1	6/1	25/1
Senecio vulgaris	-	3/1	6/1	-
Centaurea solstitialis	-	5/1	9/1	-
Datura meteloides	-	5/1	16/1	-
Elymus triticoides	-	8/1	13/1	-
Eriogonum fasciculatum	-	3/1	6/1	-
Festuca sp.	-	8/1	16/1	-
Silene gallica	9/1	10/1	19/1	-
Urtica urens	-	3/1	6/1	-

Table 4. (cont.) Constancy and Cover for Species of the Four Sycamore Groups Defined in this Study\1.

Species\2	Foothill	Interior	Coast	S. Calif.
Geranium molle	18/1	-	6/1	-
Avena sp.	-	3/1	13/1	-
Lupinus bicolor	-	-	9/1	-
Quercus lobata (h)	-	-	9/1	-
Symphoricarpos rivularis	-	-	9/1	-
Quercus agrifolia (h)	-	-	9/1	-
Brassica nigra (h)	9/1	-	19/1	-
Carduus pycnocephalus	27/1	5/1	34/1	25/1
Euphorbia polycarpa	-	-	3/1	-
Platanus racemosa (h)	-	3/1	9/1	-
Stephanomeria virgata	-	3/1	9/1	-
Vitis californica (h)	-	-	9/1	-
Senecio douglasii (h)	-	-	6/1	25/1
Rubus ursinus	-	-	9/1	50/1
Elymus condensatus	-	-	3/1	25/1
Lemna sp.	-	-	6/1	25/1
Marah macrocarpus	-	-	3/1	50/1
Galium aparine	-	-	6/1	50/1
Bromus carinatus	-	-	-	50/1
Phacelia distans	-	-	-	25/1

\1. Constancy (percent of plots in which a species is found) is given first, followed by average cover class value of a species in a group (the cover classes and their equivalent percentages are: 1=0-1%, 2=2-4%, 3=5-9%, 4=10-19%, 5=20-100%).

\2. These species are listed in order of constancy within physiognomic categories; to determine the number of plots samples for each group, and the percentage of plots in which a species is found, see Appendix H.

The first run of DCA (Figure 8) shows the 86 plots arrayed along the first and second axis of the DCA gradients. The axes are defined by the program to pick up the greatest differences in the environmental gradients. Thus, the second axis summarizes the environmental variation between the plots in a way that is orthagonally related to the first axis. Therefore, the likelihood of the first and second axes emphasizing different aspects of the environmental data is high. The numbers on the scales are values that are given by DCA synthesizing the ecological distance along the gradient. They should not be equated to any value of a particular environmental variable. However, each of these axes is correlated with certain environmental variables collected at each sample (see Appendix 6 for list of all environmental variables coded).

In the first run, covering all 86 samples, the first axis gradient is most strongly correlated with elevation(r= 0.63) while the second axis is correlated with the percent cover of boulders(r=0.70) and the slope of the streambed (r=0.67). As can be seen in Figure 8, there are several plots, most notably those from southern California and two from the South Fork of the Kaweah River (indicated as the two most isolated plots in the mid-coastal group) that are outliers. The southern California plots in particular, are demonstratably different ecologically from the remaining plots. As evidenced by their dispersion, they are often as different from one another as they are from the remaining large cluster which includes all other plots. This suggests that if additional samples were taken in similar situations, further vegetation associations could be defined for southern California sycamore vegetation.

Figure 9 is a close-in view of the same ordination shown in Figure 8. At this view, the separation of the foothill, mid-coastal, and interior alluvial groups is becoming apparent. However, because the outlying plots may strongly distort the gradient in the DCA, we removed those seven plots and recalculated the DCA based just on the 79 samples and their assignments by TWINSPAN to the main groupings (Figure 10). In Figure 10, the mid-coastal group occupies the upper right of the scattergram, the interior alluvial group the lower left, and the foothill group the center-left of the graph. In this analysis axis 1 correlates most strongly with variables such as the number of sycamore stems per clump and the slope of the streambed, while axis 2 correlates with precipitation and the presence of annual grassland as the adjacent vegetation type.

The next step taken in this analysis was to individually subject each group defined by TWINSPAN to DCA. This allows further understanding of the environmental controls on the vegetation groupings. When this was done for the interior alluvial group the major correlates on the first axis included the percent cover of litter (r=0.53)[\1] , precipitation (r=0.50, and the presence or absence of interior live oak woodland as the adjacent vegetation(r=0.67). For the foothill group precipitation was also a good variable(r=0.64), as was the percent of silt in the substrate(r=0.57).

\1. Note: Sampling was conducted from spring through fall. Thus, litter based on freshly fallen leaves was a confounding factor in this analysis for some of the samples collected from Tule River, and Mill Creek. We suggest downplaying this variable.

Figure 8: Scatterplot of DCA axis 1 and 2 values for all samples in the four groups

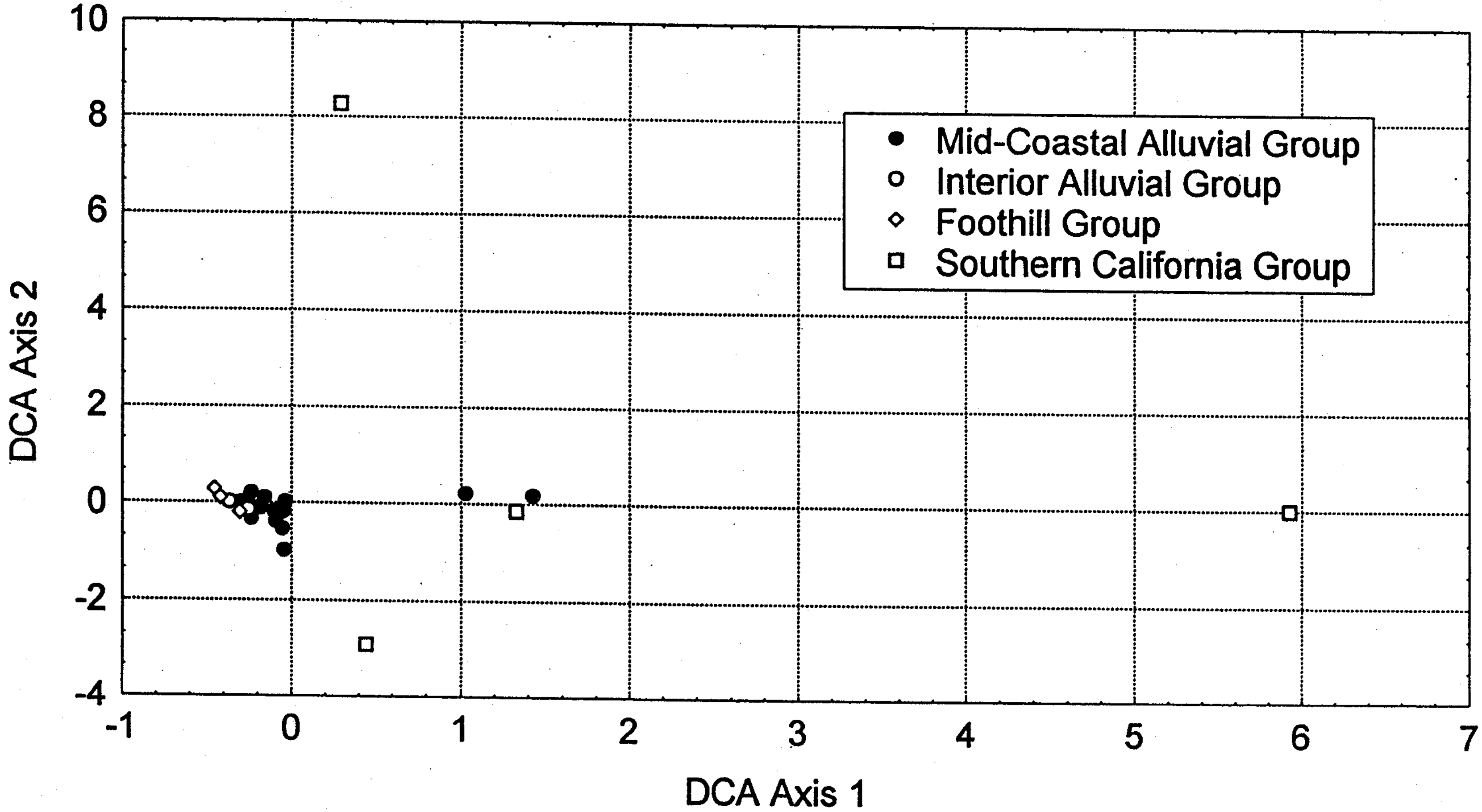


Figure 9: Closer view of same ordination as shown in Figure 8

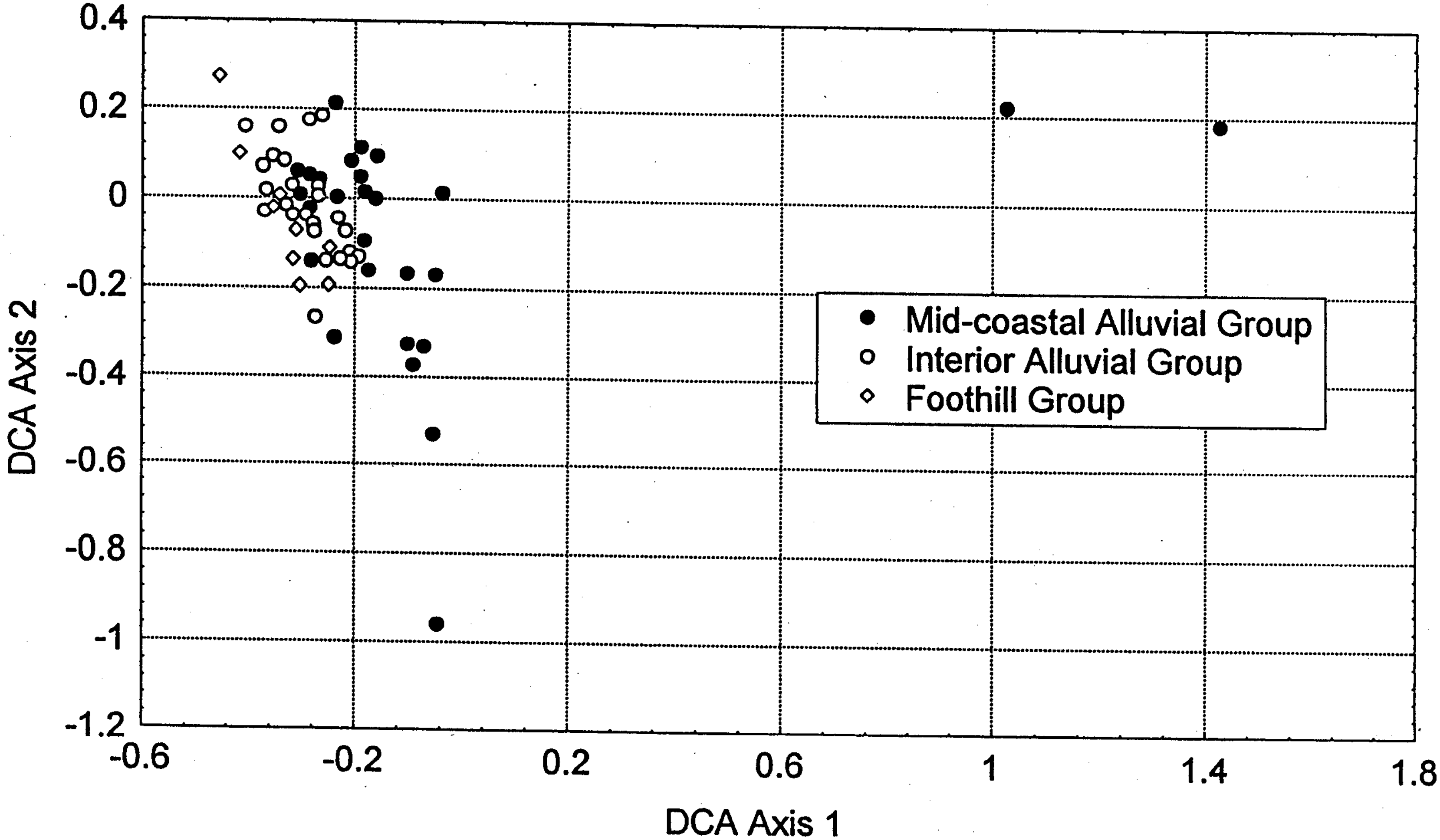
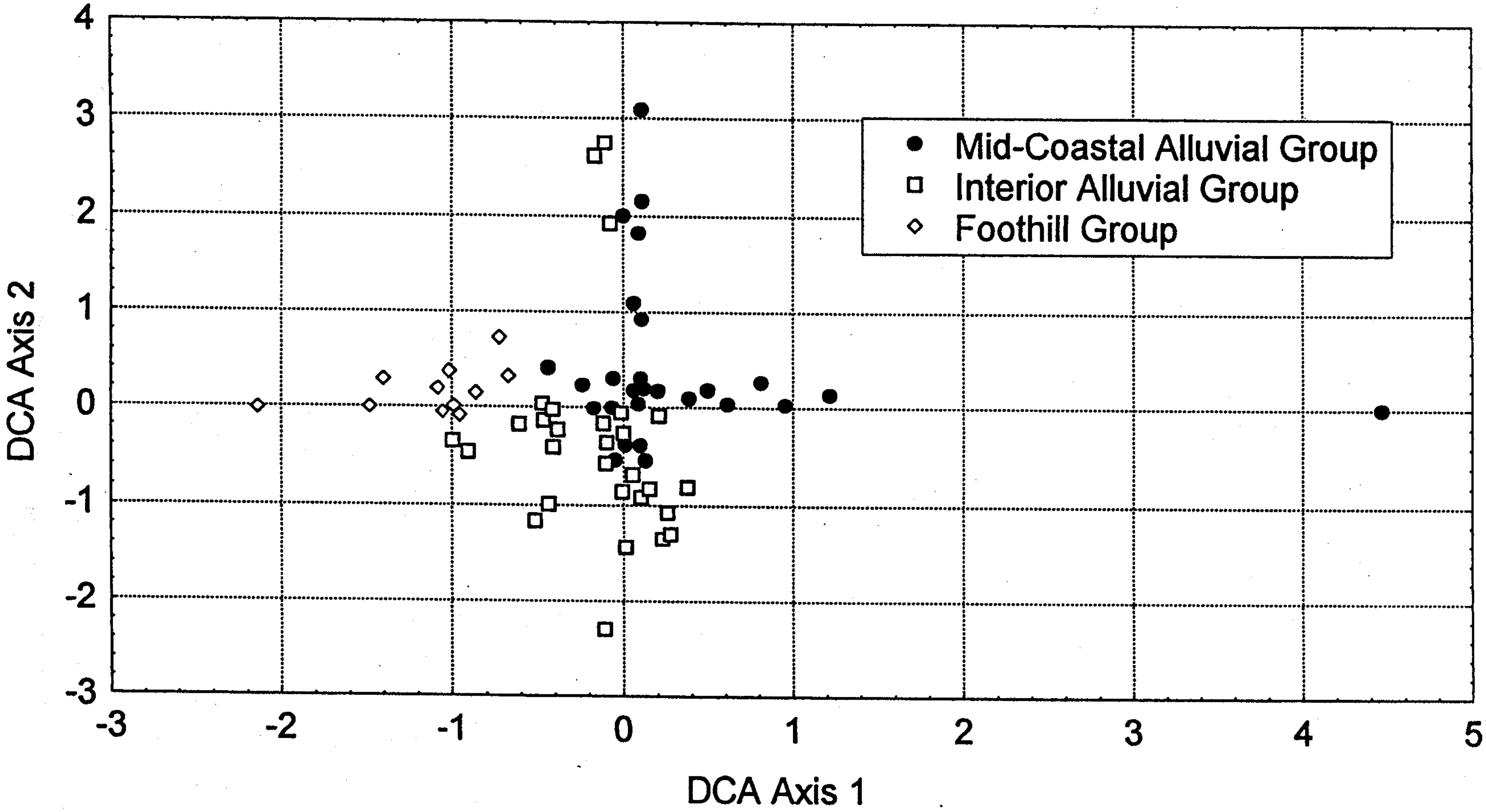


Figure 10: Scatterplot of 79 samples of Mid-Coastal, Foothill, and Interior Alluvial Groups



Although the variables single stream channel and multiple stream channel varied collinearly[2] and did not enter into the DCA analysis, there is a strong positive relationship between the foothill group and single stream channels (r=0.73).

The mid-coastal group shows correlations with elevation(r=0.57), percent boulder cover(r=0.47), and fire evidence (r=0.49). Based on the array of the 32 samples classified by TWINSPAN as members of the mid-coastal group, there is more variation in this grouping than in any other save the southern California group. The array of plots in ordination space (see Figure 10) also suggests that the relationships between the outlier coastal and southern California plots is closer than between foothill or interior alluvial plots and the southern California plots. With more sampling in the south coastal area and in southern California, these relationships could be elucidated.

Interpretation of Classification in Terms of Mapping Decision Rules

In this report we have decided to map the stands from the mid-coastal group together with the stands of the interior alluvial group as part of the main body of the community known as Central California Sycamore Alluvial Woodland. Thus, we have employed a conservative stance. We have assumed that: 1) because the mid-coastal stands occur on alluvial substrates, and 2) also share some other similar ecological variable values with the interior alluvial group, and 3) the samples that represent these two groups have a tendency to vacillate between the two depending on the types of statistical analyses used, that they should all be classified as "sycamore alluvial woodland". However, it is clear that there are some portions of the mid-coastal stands which are very different in species composition from the typical stands of the interior valleys.

In this study we are taking the position that the strong environmental differences between foothill and interior alluvial and between foothill and mid-coastal alluvial groups justifies excluding all foothill group stands from the mapping of this community type.

Description of the Four Main Sycamore Groups

The Foothill Group

Environmental Setting: This group occurs along the intermittent streams in the Inner South Coast Ranges and the southern Sierra Nevada. It exists in narrow valleys where slopes are adjacent to stream channels and where alluvial benches are narrow and poorly developed.

\2. This term refers to the trait or variables that react very similarly or in direct opposition to one another. Thus, suggesting that they are not independent of one another. In this case, because a stream could be either single- or multi-channel the relationship of one variable was inversely related to the other. Collinearity invalidates the statistical requirement of independence. However, a t-test shows the significant association of single channel streams with the foothill group (p>0.05).

(Figure 11). Elevations of the plots in this group range from 440 to 900 ft. Stream channels are almost always relatively narrow and single, rather than braided.

Typically, water lingers longer into the spring and summer in the shallow pools in these channels than at lower elevations in the broader valleys. The persistence of surface water into the early part of the dry season fosters certain wetland species and algal mats frequently grow on the isolated pools. Means and standard deviations of the principal environmental variables for the 11 plots in this type are shown in Table 5.

Most of the sites within this group showed evidence of recent flooding with flood debris caught in the lower forks of the trees up to 2 m above ground level. Stem size of the sycamores was relatively small and the stem damage index was moderate to high.

Substrate: The narrow valley stream channels typical of this group have a higher percent cover by larger substrate particles such as rocks and boulders than the lower stream reaches in the alluvial woodland zone (Figure 12). The average cover of rocks and boulders is 15 to 20 percent. Substrate type varies from soft marine sedimentary, to metamorphic sedimentary, and granitic.

Vegetative Characteristics: The vegetation in this group is typified by an open canopy (mean cover 38%) of sycamore over an herbaceous understory. The community forms narrow stringers along small to medium sized intermittent streams. Other trees are rare and include Fremont Cottonwood, willows, and interior live or blue oak. The shrub layer is poorly developed. In addition to the algal mats along the active streambeds, the presence of young mule fat (*Baccharis viminea*) and the grass *Polypogon monspeliensis* (Table 4), several other species have relatively high constancy and cover in this group. These include: *Scirpus americanus, Brickelia californica, Carex* sp., *Boisduvalia densiflora, Boisduvalia stricta, Galium murale, Paspalum distichum,* and *Perideridia californica*. Most of these species prefer moister sites than the species typical of the alluvial woodland group.

Vegetation adjacent to this group includes blue oak woodland, Interior live oak woodland, Diablan sage scrub, and annual grassland. This group may occur adjacent to the alluvial woodland group along the lower south and north forks of Los Banos Creek.

The Interior Alluvial Group

Environmental Setting: This group is found along the alluvial floodplains of low gradient streams and rivers emerging from the inner South Coast Ranges and the Southern Sierra Nevada foothills. It exists in relatively broad valleys where pronounced stream terraces formed from fine-grained alluvium have developed. In the best examples, these terraces are over 500 ft. wide and may be dissected by numerous inactive stream channels.

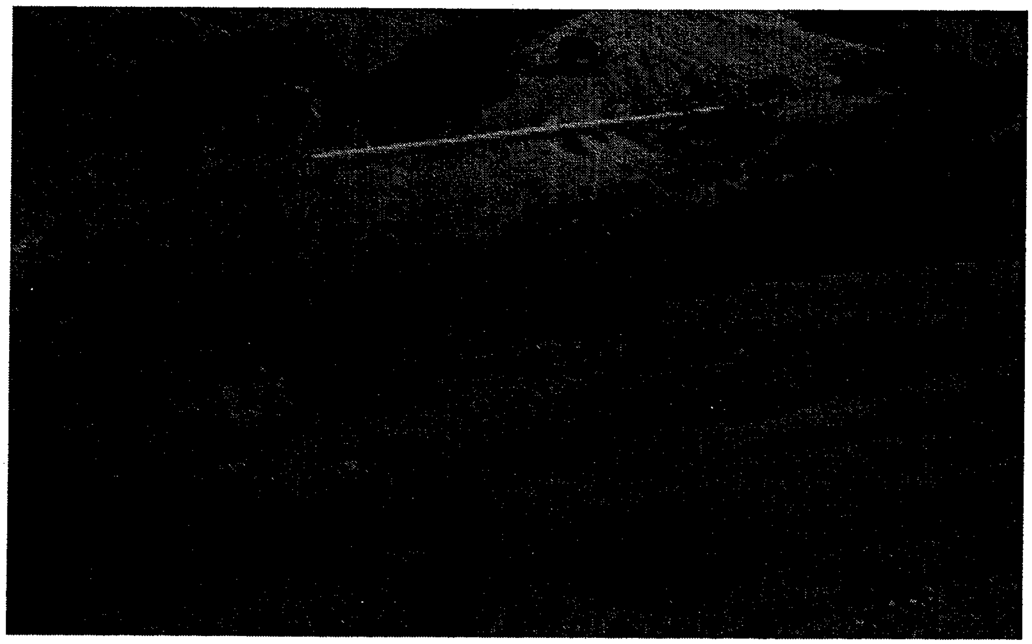


Figure 11. A View Looking East Across South Fork of Pacheco Creek Near Highway 152 Showing General Setting of Foothill Group.

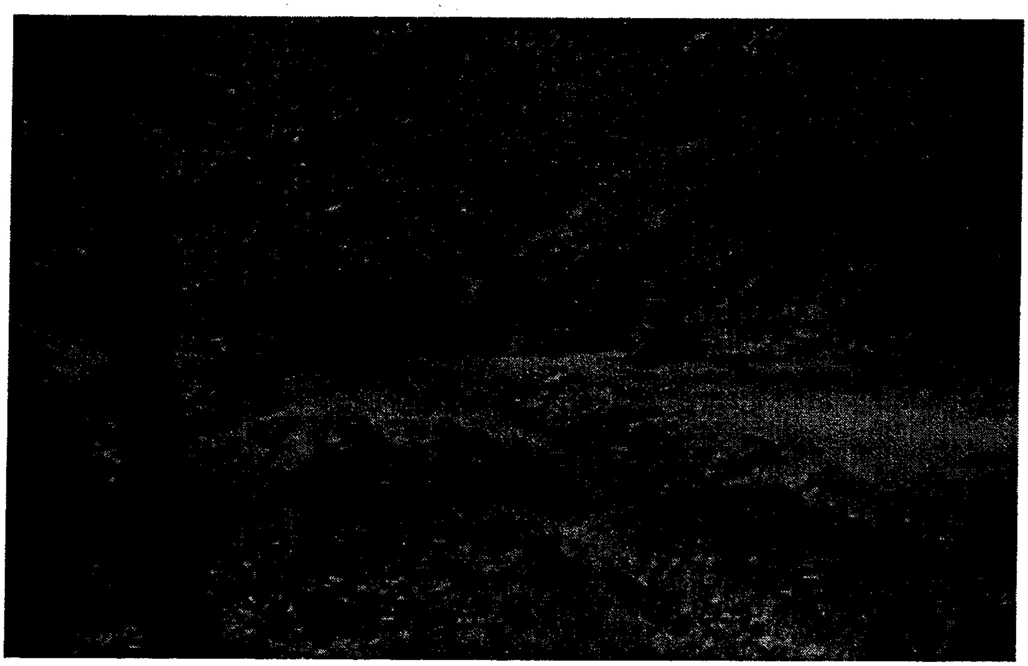


Figure 12. Interior View of Foothill Group, South Fork Pacheco Creek. Note Narrow Valley Bottom and Rocky, Bouldery Channel.

Table 5. Means and Standard Deviations of Environmental Variables for Samples from Three Sycamore Groups

Variable Number	Variable	FOOTHILL		INTERIOR ALLUVIAL		MID-COASTAL ALLUVIAL	
		Mean	Stand. Dev.	Mean	Stand. Dev.	Mean	Stand. Dev.
1	Elevation (ft)	736.8	200.0	533.2	201.3	601.5	369.9
2	Slope of Stream (°)	3.3	1.8	1.6	0.9	1.3	0.7
3	Aspect of sample (°)	226.9	71.1	190.5	92.6	127.8	82.2
4	Slope of sample (°)	2.0	2.1	2.7	4.5	2.0	3.0
5	Drainage basin size (mi^2) \1	87.4	39.6	90.3	39.4	91.5	51.8
6	Precipitation (inches)	18.1	2.5	13.5	2.9	19.3	4.5
7	% samples adjacent to Blue Oak Woodland	48.4	50.0	25.8	43.7	6.1	23.9
8	% samples adjacent to Annual Grassland	-	-	56.9	49.5	31.7	46.5
9	% samples adjacent to Interior Live Oak Woodland	28.2	45.0	6.9	25.4	12.6	33.2
10	% samples adjacent to agricultural land	-	-	7.8	26.8	8.3	27.6
11	% samples adjacent to Valley Oak Woodland	-	-	2.6	16.0	-	-
12	% samples adjacent to Mixed Coast Live Oak and Blue Oak Woodland	-	-	-	-	13.3	34.0
13	% samples adjacent to Mixed Valley Oak and Blue Oak Woodland	-	-	-	-	-	-
14	% samples adjacent to Coast Live Oak Woodland	-	-	-	-	14.6	35.3
15	% samples adjacent to Southern Coastal Sage Scrub	23.4	42.3	-	-	5.2	22.2
16	% samples adjacent to Ceanothus Chaparral	-	-	-	-	8.3	27.5
17	% samples adjacent to Mixed Chaparral	-	-	-	-	-	-
18	Stream channel width (ft) \2	64.0	91.1	76.7	102.8	58.3	35.9

Table 5 (con't). Means and Standard Deviations of Environmental Variables for Samples from Three Sycamore Groups

Variable Number	Variable	FOOTHILL Mean	FOOTHILL Stand. Dev.	INTERIOR ALLUVIAL Mean	INTERIOR ALLUVIAL Stand. Dev.	MID-COASTAL ALLUVIAL Mean	MID-COASTAL ALLUVIAL Stand. Dev.
19	% of substrate particles composed of silt	16.7	16.2	27.8	21.8	46.3	31.5
20	% of substrate particles composed of sand	17.3	19.9	37.5	27.9	38.4	26.8
21	% of substrate particles composed of gravel	8.2	4.2	11.9	9.5	6.5	10.6
22	% of substrate particles composed of rock	10.9	8.8	8.9	8.7	4.8	10.8
23	% of substrate particles composed of large rock	14.7	9.0	7.2	8.8	1.2	4.1
24	% of substrate particles composed of small boulders	14.1	7.6	5.2	11.4	0.4	1.1
25	% of substrate particles composed of boulders	18.1	14.4	1.5	2.6	0.6	1.6
26	% of plots occurring in a single channeled Streambed [13]	80.1	-	34.2	-	38.8	-
27	% of plots occurring in a multiple channeled streambed [13]	19.9	-	65.8	-	61.2	-
28	Depth of adjacent channel (ft) [12]	4.0	1.6	4.0	2.4	5.2	2.8
29	x growth rate of largest sycamore stems in the samples (rings/cm)	5.5	1.6	4.7	1.4	3.6	1.2
30	x growth rate of mid-sized sycamore stems in the samples (rings/cm)	4.7	1.2	4.3	1.6	3.6	1.4
31	Level of anthracnose infestation [14]	2	1	2	1	2	1
32	Level of insect damage [14]	1	0	2	1	1	1
33	Level of gravel mining [14]	-	-	1	1	1	1
34	Level of recent flooding [14]	2	0	1	1	1	1

Table 5 (con't). Means and Standard Deviations of Environmental Variables for Samples from Three Sycamore Groups

		FOOTHILL		INTERIOR ALLUVIAL		MID-COASTAL ALLUVIAL	
Variable Number	**Variable**	**Mean**	**Stand. Dev.**	**Mean**	**Stand. Dev.**	**Mean**	**Stand. Dev.**
35	Level of fire evidence \4	-	-	-	-	1	0
36	Level of grazing at the site \4	2	1	2	1	2	1
37	Number of stems per sample > 1 cm in diameter \5	10	4	7	5	19	10
38	Average DBH of stems > 1 cm	25.4	12.2	49.4	31.9	30.6	15.3
39	Number of seedlings per sample	0	0	0	0	0	0
40	Number of saplings per sample	0	1	0	0	0	0
41	Number of sprouts per sample < 1 cm in diameter	40	28	17	24	33	32
42	Index of stem damage	2	1	2	1	2	1
43	% cover of bare ground	8.7	6.6	7.1	6.5	4.4	4.5
44	% cover of rock	34.3	12.1	6.1	7.1	4.3	8.0
45	% cover of litter	18.4	13.9	44.5	15.4	40.5	17.7
46	% cover of moss	0.1	.3	.5	1.4	0.1	0.5
47	Width of valley bottom (ft)	525.1	394.5	848.1	365.1	851.2	326.6

\1. Represents the portion of the watershed above and including the sycamore stand.
\2. Ordinal variable; means are calculated from the midpoint (See Appendix F)
\3. Values represent total percentages, not means.
\4. Level 1=low, level 2=moderate, level 3=high.
\5. Although sycamore stems are frequently clumped, it was not always possible to safely ascertain the number of stems per clump, thus such a variable was not developed.

The streambeds in this group are almost always multi-channeled and are typically lined with gravel and small rocks rather than boulders and larger cobbles as with the foothill group (Table 5). Elevations of the plots ranged from 200 to approximately 800 ft.

Flooding of the stands in this group is a not a regular event. Although the trees lining the active channels may be more regularly affected, the largest proportion of stands are only affected during 25 to 50-year events. In some stands such as Deer Creek, the downcutting of the active channels has isolated the alluvial stands sufficiently to require a major (100 year+) flood event for their inundation. In most stands water flows only along the main channels for short periods in the winter months and by late spring even active channels have ceased flowing.

<u>Substrate</u>: Sand and silt are the predominant substrate particle size in this group. No sample had over 5% cover of large rock to boulder size particles. Rock type varies from soft sedimentary to metamorphic sedimentary and granitic.

<u>Vegetative Characteristics</u>: The vegetation of this group includes very open to moderately dense (mean canopy cover 41%, range 0-92%) stands of sycamores over a largely herbaceous understory dominated by annual grasses. In some stands such as Mill Creek and Dry Creek, valley oak, *Quercus lobata* and interior live oak may be a noticeable member of the canopy. Fremont cottonwood, red willow, and Gooding willow, *Salix gooddingii*, may occur occasionally. The shrub layer is intermittent and may include small trees of buckeye, Mexican elderberry, and mule fat in addition to shrubs such as coffeeberry, *Rhamnus californicus* and buttonwillow, *Cephlanthus occidentalis*. Shrubs usually cover less than 2% of the ground.

The herb layer is usually a dense cover of annual grasses and other non-native forbs. The most distinctive indicator species are the three non-native grasses listed in (Table 3). However, several other herbs are characteristic of this group. These include *Bromus arenarius, Festuca dertonensis, Tillaea erecta, Euphorbia ocellata, Lasthenia chrysostoma* ssp. *gracilis, Gilia* sp., and *Eriogonum roseum*. The latter five native herbs are characteristic of open sandy ground with relatively low grass cover.

Vegetation adjacent to this group includes primarily annual grassland, but also blue oak woodland and interior live oak woodland. In some cases, particularly along the lower north and south forks of Los Banos Creek (for a mile or so immediately above the main alluvial woodland stand), isolated alluvial benches carry the sycamore alluvial woodland vegetation separated by stretches of single channel stream lined by the foothill group sycamore vegetation.

The Mid-Coastal Alluvial Group

<u>Environmental Setting</u>: This group occurs along alluvial benches of multi-channel stream

courses much as does the interior alluvial group. The principal difference between the coastal and alluvial woodland group is climate. Temperatures are cooler during the growing season due to the locality of these sites within or near the summer fog belt. While alluvial woodland stands are baking in hot sun through the summer, coastal group stands are shielded by fog in some cases or at least experience temperatures several degrees Fahrenheit cooler during the average summer day. Average annual precipitation is also about 6 inches greater than the average for alluvial woodland sites. The result of the climatic difference is that a number of species more typical of coastal California such as coast live oak, *Quercus agrifolia*, California bay, *Umbellularia californica*, poison oak, *Toxicodendron diversilobum*, and creekside snowberry, *Symphoricarpos rivularis*, are important components of the vegetation. Streams are typically multi-channel with alluvial benches up to 500 ft wide (Table 5).

Substrate: The mid-coastal alluvial group has similar substrate conditions to the interior alluvial group. Silt and sand are the predominant particle sizes and parent material is typically sedimentary marine with some metamorphic rocks derived from marine sediments. Sand percentages are equal, but silt percentages vary significantly. Coastal sites differ from interior sites by having more silt, while interior sites have more gravel, rock, large rock, small boulders, and large boulders. This may be due to the presence of dams on Arroyo Valle, Creek, Alameda Creek, Pacheco Creek and Coyote Creek watersheds.

Vegetative Characteristics: Probably as a result of the cooler summer climate and the higher average precipitation, this group averages significantly higher cover in the tree canopy than the interior alluvial group. (mean tree cover 57%, t-test for dependent samples $p<0.05$). However, the cover does vary from open woodland to dense forest (range in cover 10-99%).

The climatic differences also notably influence the presence of certain tree species in this group. Although only one indicator species is shown in the TWINSPAN analysis (slender wild oat, *Avena barbata*), species such as California bay and coast live oak are regularly found in the mid-coastal stands and are absent from the interior alluvial stands. Shrubs such as creekside snowberry and poison oak occur in most mid-coastal stands and are not found in the interior alluvial stands. Additional species characteristic of the herb layer and not typically found in the interior alluvial group include the non-natives *Carduus pycnocephalus, Galium aparine,* and *Brassica nigra.*

A number of species are shared with the interior alluvial group. These include occasional trees of valley oak and small trees of Mexican elderberry, California buckeye and red willow. The high cover of *Bromus diandrus* and B. mollis are similar in both groups as is the presence of *Stellaria media,* and *Brassica geniculata.*

The Southern California Group

Environmental Setting: This is a poorly defined group represented by few samples. The environmental settings vary from sample to sample and include broad coastal valleys on alluvial benches (Figure 13) as well as narrow rocky stream channels in the foothills and mountains (Figure 14).

Substrate: Variable, from silt and sand on alluvial benches to large rocks and boulders in the narrow valleys and canyons. Rock type varies from sedimentary to metamorphic and granitic.

Vegetative Characteristics: The most distinctive trait of this group is its very different species composition. A number of southern California species and adjacent communities do not occur in or near any of the more northerly sycamore vegetation types. These include trees such as southern California black walnut, *Juglans californica*, and shrubs such as *Ceanothus crassifolius*, *Lepidospartum squamatum*, *Opuntia littoralis*, and *Eriodictyon crassifolium*. Communities such as Diegan sage scrub, *Ceanothus crassifolius* chaparral, and southern coast live oak riparian forest are also unique to this area.

It is important to note that the samples taken for southern California were all selected by using NDDB records of the community "Southern Sycamore Alder Riparian Forest". The results of this study shows that this "community" is substantially different from the Sycamore Alluvial Woodland community as it is defined by Holland (1986). It also strongly suggests that the Southern Sycamore Alder Riparian Forest is poorly defined and could be subdivided into more coherent ecological units with additional sampling. It appears that from the limited data collected that the division of sycamore groups into alluvial bench and foothill (narrow valley) types may be appropriate in southern California as well. However, there may well be several different subdivisions (associations) within each of the broader categories.

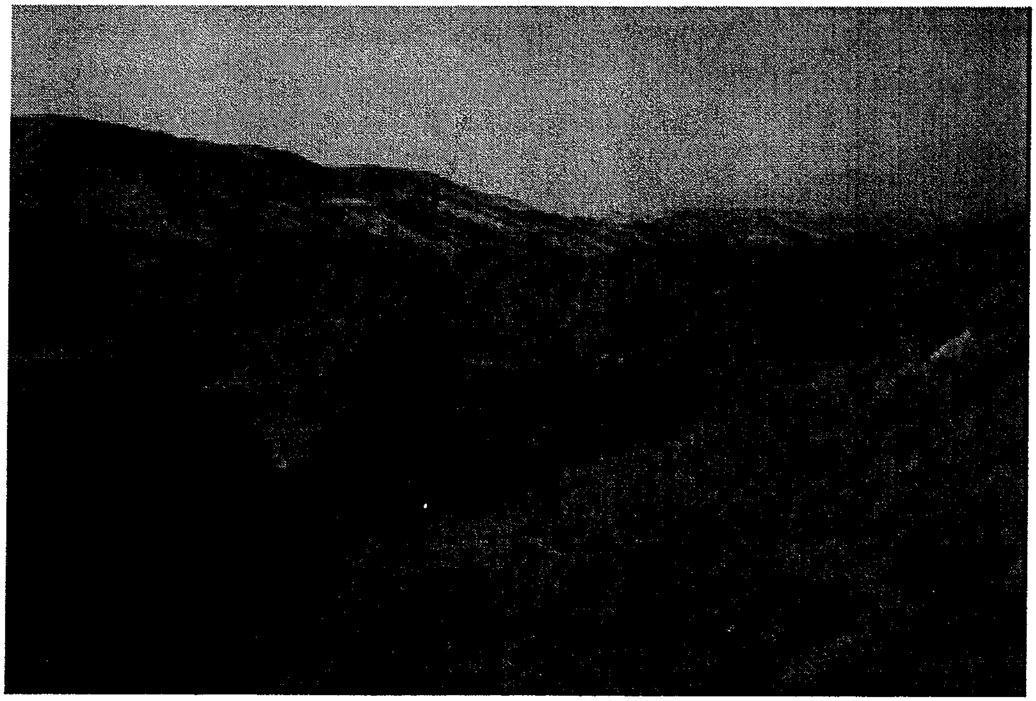


Figure 13. A Southern California Alluvial Type at Starr Ranch Audubon Reserve, Orange County.

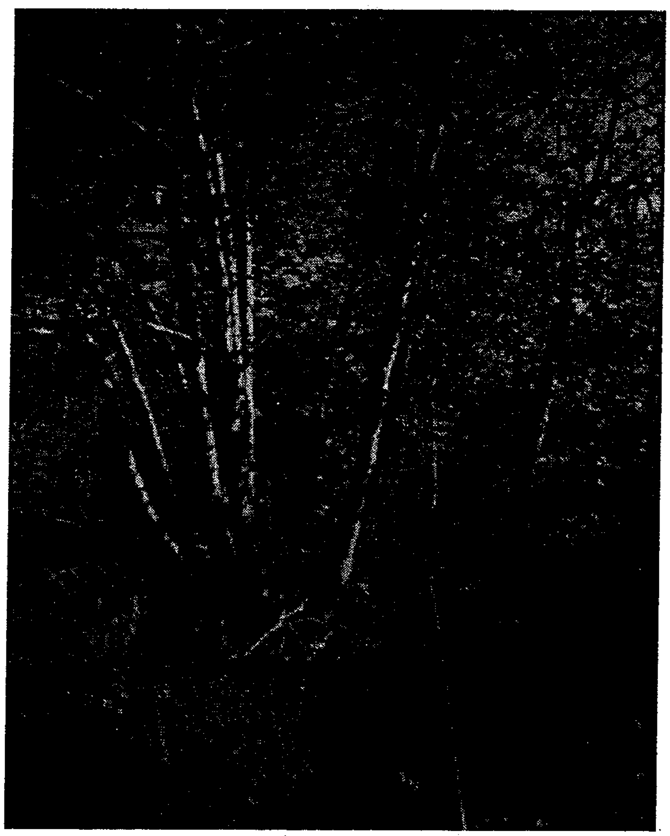


Figure 14. Interior of a Southern California Narrow Canyon Type with Shrubs Typical of Southern California Chaparral in Understory, Indian Creek, San Gabriel Mountains, Los Angeles County.

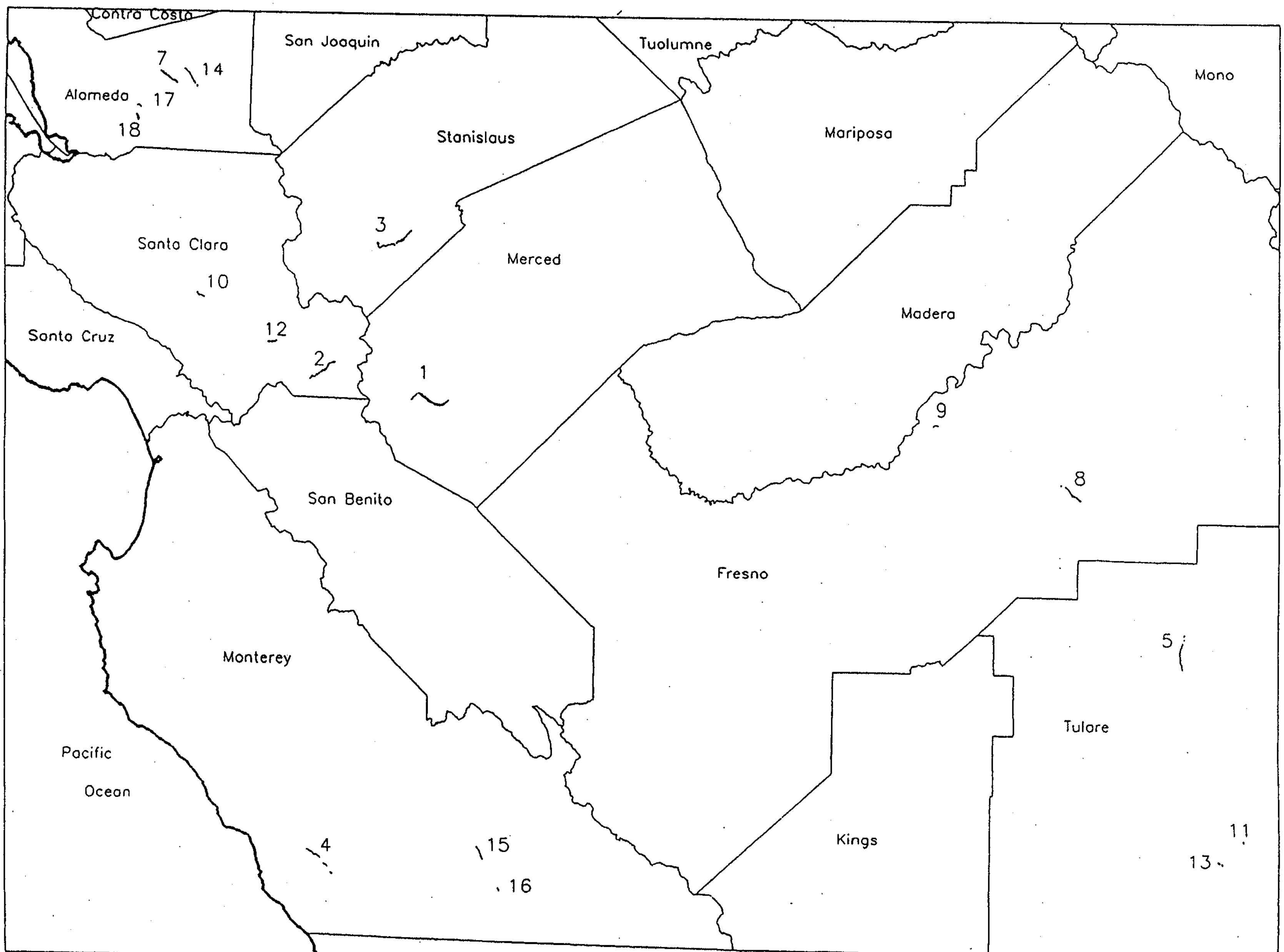
STAND DESCRIPTIONS

The following descriptions cover all 17 stands located and defined in this study. Each is accompanied with a map displaying the extent of the stand as it has been digitized into the NHD GIS system. Acreage totals are listed in Table 6. The stand numbers beside each heading in this section are the same numbers as they are assigned in the NDDB inventory (see also Figure 15). Note there is no occurrence 6. Several sample sites discussed in previous chapters (see table 2) are not included here. This is because they did not meet the quantitative criteria for inclusion as Central California Sycamore Alluvial Woodland or their size was below the minimum mapping unit of 10 acres. A summary of the quantitative sycamore density and age data discussed in the stand descriptions may be found in Table 7.

Table 6. Acreages for Occurrences of Central California Sycamore Alluvial Woodland

Occurrence	Drainage	Acres	N\1	Access Status\2
1	Los Banos Creek	425.9	13	+
2	Pacheco Creek	135.4	4	0
3	Orestimba Creek	249.0	12	0
4	Nacimiento River	101.3	3	+
5	Dry Creek	211.1	7	0
7	Arroyo Valle	211.2	4	+
8	Lower Mill Creek	229.0	4	+
9	Little Dry Creek	28.6	1	+
10	Coyote Creek	40.1	2	+
11	South Fork Tule River	15.9	1	+
12	Upper Coyote Creek	49.2	2	+
13	Deer Creek	45.2	2	+
14	Arroyo Mocho	87.4	2	+
15	North San Ardo	62.2	0	--
16	South San Ardo	11.4	0	--
17	San Antonio Creek	23.8	2	+
18	Alameda Creek	105.2	3	+
	Total	*2,031.9*		

\1. N represents the number of samples taken within each occurrence
\2. Access status key: '+' = no problems (access with landowner permission to all points selected), '0' = some problems (certain access points unavailable), '--' = access denied (no samples taken)



County Lines
California Coast
1 = Los Banos Creek
2 = Pacheco Creek
3 = Orestimba Creek
4 = Nacimiento River
5 = Dry Creek
7 = Arroyo Valle
8 = Lower Mill Creek
9 = Little Dry Creek
10 = Lower Coyote Cr.
11 = South Fork Tule River
12 = Upper Coyote Ck
13 = Deer Creek
14 = Arroyo Mocho
15 = N. San Ardo
16 = S. San Ardo
17 = San Antonio Creek
18 = Alameda Creek

Figure 15. The Distribution of Central California Sycamore Alluvial Woodland

Table 7. Summary Table of Density and Age Data for Sycamores in Central California Sycamore Alluvial Woodland Stands.

Site	Number of samples within each stand	Number of stems > 1 cm diameter[\1]	Number of stems per clump	Average stem diameter in cm	Range of stem diameters in cm	Estimated growth rate - average trees in rings/cm	Estimated growth rate-large trees in rings/cm	Estimated number of sucker sprouts in stand[\2]	Estimated number of sucker sprouts (<1 cm diameter) in stand	Average number of sucker sprouts per clump	Number of saplings
Los Banos Creek	13	49,807	4	43.8	1.4 - 168.3	4.5	5.0	168,576	12	0	0
Pacheco Creek	4	41,648	8	28.5	1.1 - 92.3	5.0	5.4	286,056	52	0	0
Orestimba Creek	12	36,960	6	37.7	1.1 - 197.9	3.4	4.1	69,888	12	0	1
Nacimiento River	3	31, 980	6	25.3	1.0 - 88.1	2.5	3.5	45, 920	8	0	0
Dry Creek	7	48,840	5	38.3	1.2 - 122.1	3.9	3.5	33,744	4	0	0
Arroyo Valle	4	53, 010	7	31.2	1.3 - 109.2	4.5	4.5	162,450	21	0	0
Lower Mill Creek	4	60,255	6	18.5	1.6 - 58.2	3.0	5.3	63,963	6	0	0
Little Dry Creek	1	186	4	77.0	2.9-81.1	2.3	3.0	8,816	19	0	0
Coyote Creek	2	7,452	3	41.0	2.1-86.8	4.4	3.2	11,664	3	0	0
South Fork Tule River	1	3,328	4	32.6	2.6 - 81.1	3.8	5.3	11,264	14	0	0
Upper Coyote Creek	2	8,358	5	35.1	2.0 - 84.6	4.2	4.5	62,884	40	0	0
Deer Creek	2	3,294	5	37.3	1.3 - 98.2	2.3	2.6	1,830	3	0	0
Arroyo Mocho	2	16,284	4	35.5	1.3 - 137.0	4.4	4.2	100,536	24	0	0
North San Ardo	0	no data	-	-	-	-	-	-	-	-	-
South San Ardo	0	no data	-	-	-	-	-	-	-	-	-
San Antonio Creek	2	15,855	8	32.0	1.3-118.4	3.4	4.8	23,975	12	0	0
Alameda Creek	3	15,372	4	57.4	9.7-115.0	4.2	4.2	56,876	16	0	0

\1. Calculated by taking the total number of stems per 250 m^2 sample and multiplying by the size of each stand.
\2. Tallied per 250 m^2 sample and multiplied by the size of each stand.

Stand 1; Los Banos Creek, Merced County

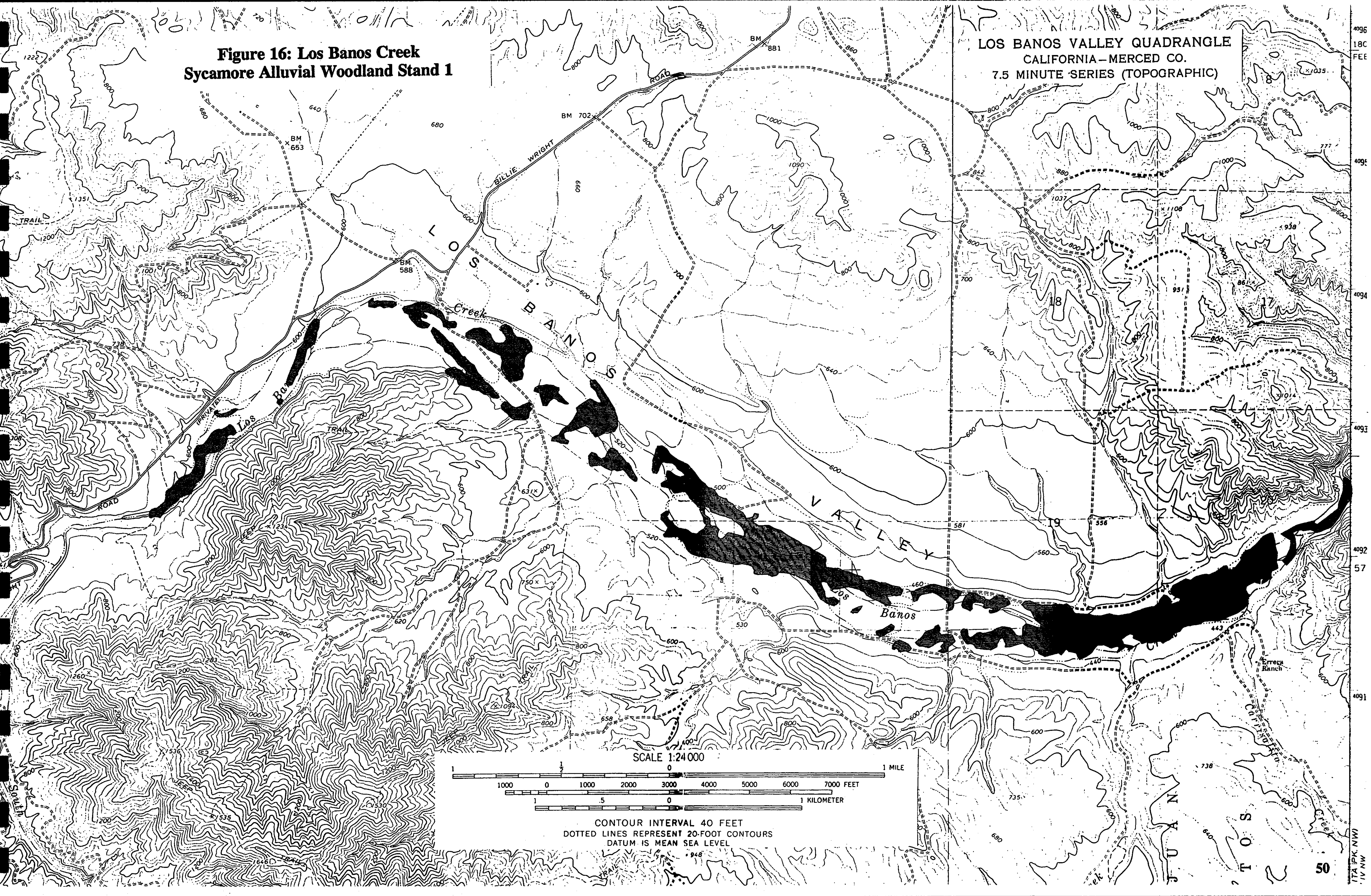
1. Stand Size, Distribution, and Surrounding Environment: The Los Banos Creek stand covers approximately 426 acres (173 ha) along six miles of Los Banos Creek extending from the junction of the north and south forks, downstream to the southwest corner of the Los Banos Creek State Recreation Area (Figure 16). The upper extent of the stand is somewhat patchy with intervening stretches of annual grassland and patches of blue oak woodland. About 1.25 mile downstream of a southward bend in Los Banos Creek, the stand widens and becomes nearly continuous, save for a stretch of non-native annual grassland, which dissects about a 1.5 mile long portion of this wide area. The eastern extent of the stand lies at the upstream mouth of the narrow canyon that contains "The Baths." The streambed then flows through this canyon and meets Los Banos Reservoir approximately 1.5 miles below the sycamore stand.

2. Adjacent Vegetation, Topography: The Los Banos Creek stand is surrounded by annual grassland interspersed with blue oak and interior live oak woodland at its upstream end. The stand grows on terraces within the braided multi-channeled streambed. These terraces range from 50 to over 500 feet. in width and rise anywhere from 1 to 6 feet above adjacent channels. The banks of the main channel range from gradually sloping to cut, with a depth range of 1 to 10 feet. The substrate here is sedimentary, and the soil is silty. Cobbles and large rocks compose up to 90% of the surface material in the upper reaches of this stand, while in the lower reaches, silt composes up to 90% of surface material.

3. Estimated Density and Numbers of Sycamore Stems, Age of Stems, Reproduction: Based on 11 samples, we estimate that 49,807 sycamore stems over one cm in diameter exist in this stand, with an average of almost four stems per clump. The average stem diameter for trees exceeding 1 cm diameter is 43.8 cm and the range of stem diameters is from 1.4 cm to 168.3 cm. The estimated growth rate of average sized trees in this stand is 4.5 rings/cm, while the estimated growth rate of the largest trees in the stand is 5.0 rings/cm. We estimate the number of sucker sprouts (those less than 1 cm diameter) in this stand to be 168,576, with 11.5 sprouts per clump, on the average. No seedlings or saplings were observed in this stand.

4. Variation in Cover and Association Type: Sycamore cover at this stand ranged from under 20% to over 80%. However, the majority of the samples had moderately open cover of sycamores over a relatively dense understory of annual grass including *Bromus diandrus, B. rubens, Festuca myuros,* and *Hordeum leporinum* (Figure 17). The introduced sod-former, Bermuda grass, (*Cynodon dactylon*) was a constant at most samples. The native herb *Euphorbia oscellata* and grass *Festuca dertonensis* are widespread, but low in cover value. Shrubs were uncommon with the exception of mule fat (*Baccharis viminea*) which occurred in less than 5% cover on many of the plots. Although not well represented in the samples, shrubs and small trees of California buckeye and Mexican elderberry are scattered throughout the understory, and occasional Fremont cottonwoods and red willows (*Salix laevigata*) occur in the canopy.

Figure 16: Los Banos Creek Sycamore Alluvial Woodland Stand 1



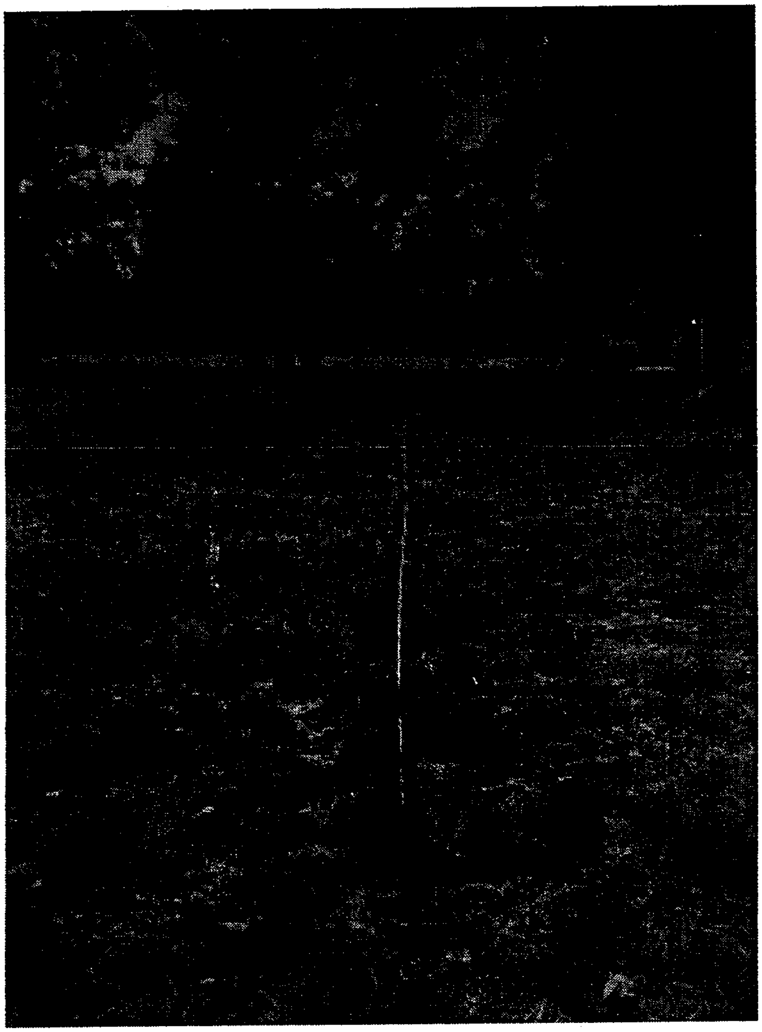


Figure 17. Open Understory at Los Banos Creek Transect # 12 Showing Annual Grasses Dominated by *Festuca myuros*.

TWINSPAN classified all but two of the Los Banos Creek samples as part of the interior alluvial group. Further division by TWINSPAN indicated that the majority of the Los Banos Creek plots were closely related to most of the Orestimba Creek and the Dry Creek samples and to one of the Arroyo Mocho samples.

Upstream from the main stand, particularly on the North Fork of Los Banos Creek, isolated individual copses of the interior alluvial woodland group are interspersed with the foothill group. These small islands were not included in the mapping effort because they are typically under 2 acres and there is difficulty distinguishing them in aerial photographs from some foothill group stands. On the ground they may be distinguished from the foothill group by the fine-grained alluvial substrate and their less hydrophilic understory vegetation.

5. Current Impacts to, and Condition of Stand: The sycamore trees in this stand are affected to varying degrees by anthracnose, and lacebug infestation. Evidence of light to heavy grazing manifests itself through bank erosion, soil compaction, the presence of manure and the cropping of sycamore sprouts to a height of 2-3 inches. Other impacts include bulldozing for the purpose of levee creation, and flooding as is evidenced by debris, bare roots, and wounds left by broken limbs. Eight of the 11 plots sampled showed moderate to heavy impacts due to grazing.

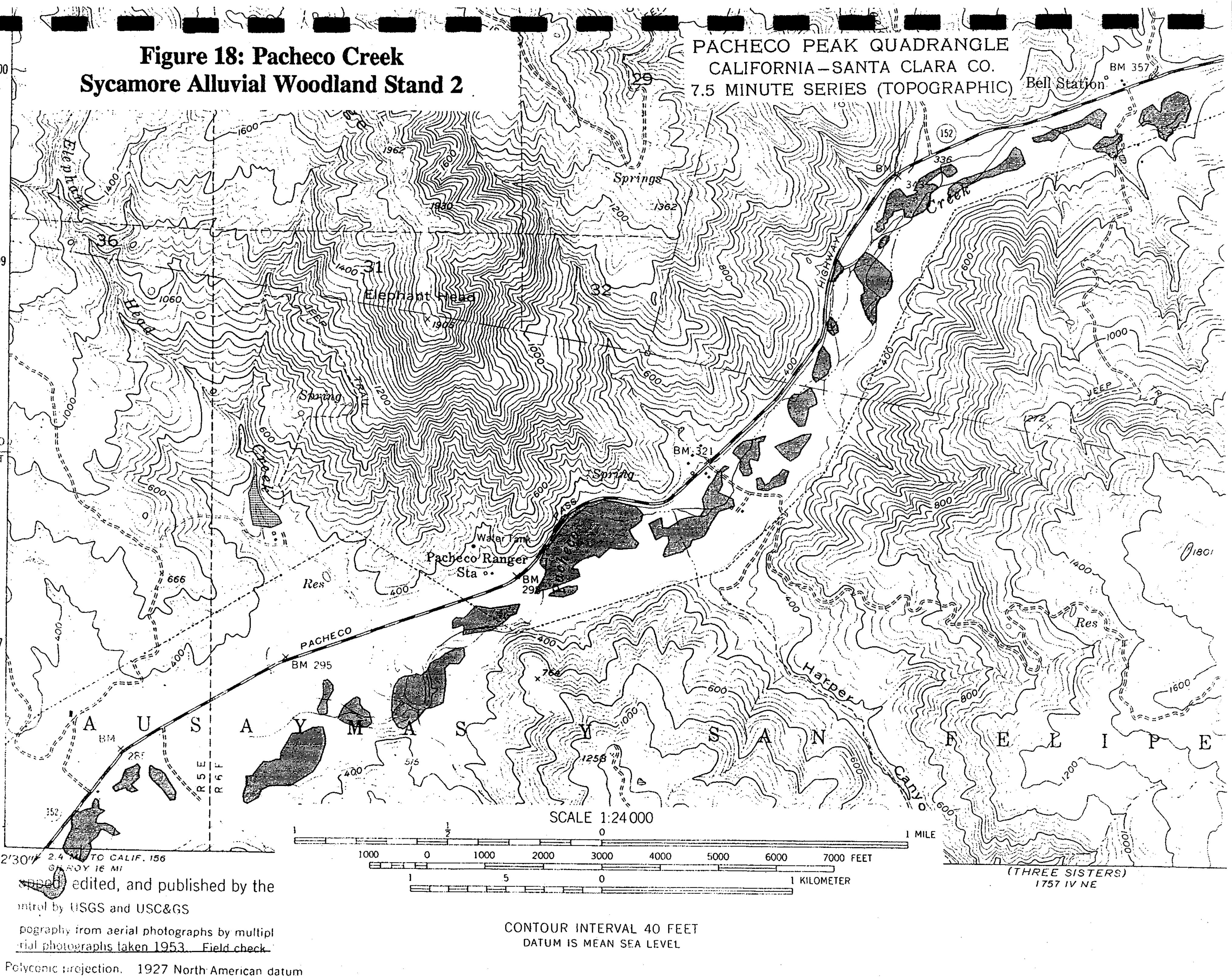
Stand 2; Pacheco Creek, Santa Clara County

1. Stand Size, Distribution, and Surrounding Environment: The Pacheco Creek stand covers approximately 135.4 acres (54.8 ha) of Pacheco Creek extending from Bell Station for about 5 miles to the vicinity of the Hollister Plain (Figure 18). This stand is patchy, and reaches a maximum width of 1/4 mile. Pacheco Creek meets Tequisquita Slough about 9 miles below this stand. Above the upper extent of the stand Pacheco Creek branches to the north and south. Water from the North Fork and Middle Forks flows from Pacheco Lake about 2.6 miles above the stand. The South Fork is undammed.

2. Adjacent Vegetation, Topography: The surrounding hills support coast live oak woodland on north slopes with mixtures of blue oak woodland, annual grassland, and sage scrub occurring on south facing exposures. Adjacent areas of the floodplain are dominated by annual grassland with some coast live oak riparian forest. The Pacheco Creek stand grows mostly on terraces within a braided, multi-channeled reach of Pacheco Creek. Some parts of the creek occupy only a single channel with inactive adjacent channels. Terraces vary in width from 200 to 700 ft and rise from 1 to 6 ft above adjacent channels. The substrate is sedimentary. The surface composition varies at each transect with sand, silt, gravel, and rock each comprising a majority of the surface material in different areas.

3. Estimated Density and Numbers of Sycamore Stems, Age of Stems, Reproduction: Based upon four samples, we estimate that 41,648 sycamore stems over 1 cm in diameter exist in this stand, with an average of approximately 8 stems per clump. The average stem diameter for

Figure 18: Pacheco Creek Sycamore Alluvial Woodland Stand 2



trees exceeding 1 cm diameter is 28.5 cm, and the range of stem diameters is 1.1 cm to 92.3 cm. The estimated growth rate of average sized trees in this stand is 5.0 rings/cm and the estimated growth rate of the largest trees in the stand is 5.4 rings/cm. We estimate the number is sucker sprouts (those less than 1 cm diameter) in this stand to be 286,056 with 52.2 sprouts per clump, on the average. No seedlings or saplings were observed in this stand.

4. Variation in Cover and Association Type: The Pacheco Creek stand has scattered coast live oak and California bay in the overstory with sycamores (Figure 19). The understory is typically dominated by annual introduced grasses with scattered mulefat, however one sample had a small percent cover by the native sod-former, *Elymus triticoides*.

All samples taken within the main stand were classified by TWINSPAN as part of the mid-coastal group. Two other samples taken above the main stand were classified within the foothill group.

5. Current Impacts to, and Condition of Stand: The sycamore trees in this stand are affected to varying degrees by anthracnose, moderately by lacebug infestation, and lightly by leaf mining insects. Damage to stems varied as did damage caused by grazing. CALTRANS has planted of *Platanus racemosa* and *Sambucus mexicana* in some areas as mitigation for Highway 152 construction impacts to the sycamore woodland adjacent to the highway.

Gravel mining in the lower third of the stand has resulted in some deep excavations adjacent to fragmented copses of sycamores. The dam on the north fork about 2 miles above the stand impedes the natural flooding regime on this stream.

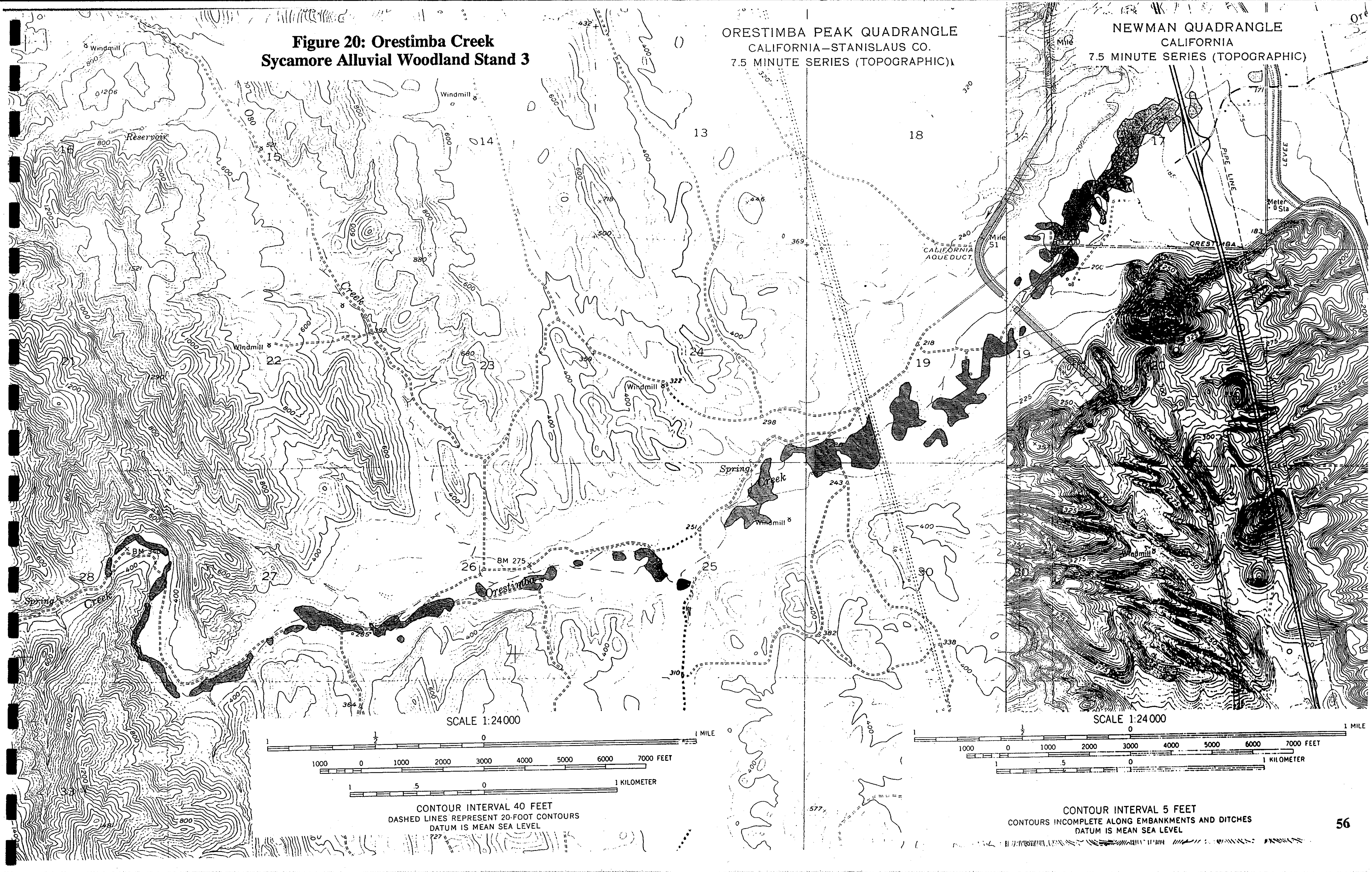
Stand 3; Orestimba Creek, Stanislaus County

1. Stand Size, Distribution, and Surrounding Environment: The Orestimba Creek stand covers approximately 249 (100.8 ha) acres extending for about 5 miles from a prominent bend at the upper end of the creek, downstream to the area just east of Interstate 5 (Figure 20). The stand is fairly narrow towards its upstream end and widens to a maximum width of 1/4 mile. Orestimba Creek meets the San Joaquin River about 9 miles below this stand.

2. Adjacent Vegetation, Topography: Vegetation adjacent to the Orestimba Creek stand includes Blue Oak Savanna, Southern Coastal Sage Scrub, and Annual Grassland at the upper end. Annual Grassland predominates as the adjacent vegetation type downstream. The Orestimba Creek stand grows on terraces on either side of a single channel at the upstream end, and on terraces within a braided multi-channel in the middle reaches. Nearing the downstream end, the creek occupies an entrenched single channel before finally branching out to a braided multi-channel. Terraces vary in width from 200 to 1000 ft and rise from 1 to 10 ft above adjacent channels. The substrate at the Orestimba Creek stand is sedimentary, and the surface composition varies at each transect. Silt comprises a majority of the surface material at the upstream end; sand, gravel, and rock comprise a majority at the central

Figure 19. Pacheco Creek Transect #2 With Coast Live Oak in Background as Part of the Stand and Mule Fat Along Active Channel to Left.

Figure 20: Orestimba Creek Sycamore Alluvial Woodland Stand 3



part of the stand; and silt and sand comprise the majority of the surface material at the downstream part of the stand.

3. Estimated Density and Numbers of Sycamore Stems, Age of Stems, Reproduction: Based upon 12 samples, we estimate that 36,960 sycamore stems over 1 cm in diameter exist in this stand, with an average of approximately 6 stems per clump. The average stem diameter for trees exceeding 1 cm diameter is 37.7 cm, and the range of stem diameters is 1.1 to 197.9 cm. The estimated growth rate of average sized trees in the stand is 3.4 rings/cm, and the estimated growth rate of the largest trees in the stand is 4.1 rings/cm. We estimate the number of sucker sprouts (those less than 1 cm diameter) in this stand to be 69,888 with 11.6 sprouts per clump, on the average. While no seedlings were observed in the sampling areas, one sapling was observed. Outside of where sampling was conducted, numerous sycamore seedlings were found growing beneath a clump of mulefat in a channel that remained moist into mid-summer.

4. Variation in Cover and Association Type: All but two samples along the main stand were classified by TWINSPAN as part of the interior alluvial group. Samples upstream from the main stand (above the bend) were classified in the foothill group. The vegetation of the stand is generally similar to the Los Banos Creek stand. However, much of the sycamore canopy is open to very open, with fewer large relatively closed copses of trees than at Los Banos Creek (Figure 21).

5. Current Impacts to and Condition of Stand: The sycamore trees in this stand are affected to varying degrees by anthracnose, lacebug infestation, and stem damage. Grazing and soil compaction varied over the stand from light to heavy. Other factors affecting this stand include rapid flood flows, road construction, gravel mining and bulldozing. The most concentrated impacts occur towards the downstream part of the stand where high voltage power lines, the California Aqueduct, and Interstate Highway 5 cross the stand all within a two mile stretch.

Stand 4; Nacimiento River, Monterey County

1. Stand Size, Distribution, and Surrounding Environment: The Nacimiento River stand covers 101.3 acres (41 hectares). It extends from the confluence of the Nacimiento River with Slickrock Creek for almost 6 miles downstream to an area 1.2 miles east-northeast of Sycamore Spring (Figure 22). The stand is fairly narrow, rarely exceeding a width of 0.12 mile. It is nearly continuous at the upper end for a little over 2 miles. Downstream from this point, two 1-mile breaks occur, interrupted by almost 0.8 of a mile

2. Adjacent Vegetation, Topography: Vegetation adjacent to the Nacimiento River stand includes coast live oak and blue oak mixed woodland, coast live oak and valley oak mixed woodland, valley oak woodland, and annual grassland. The Nacimiento River stand grows on terraces within a braided multi-channel. The terraces vary in width from 200 to 1800 ft and

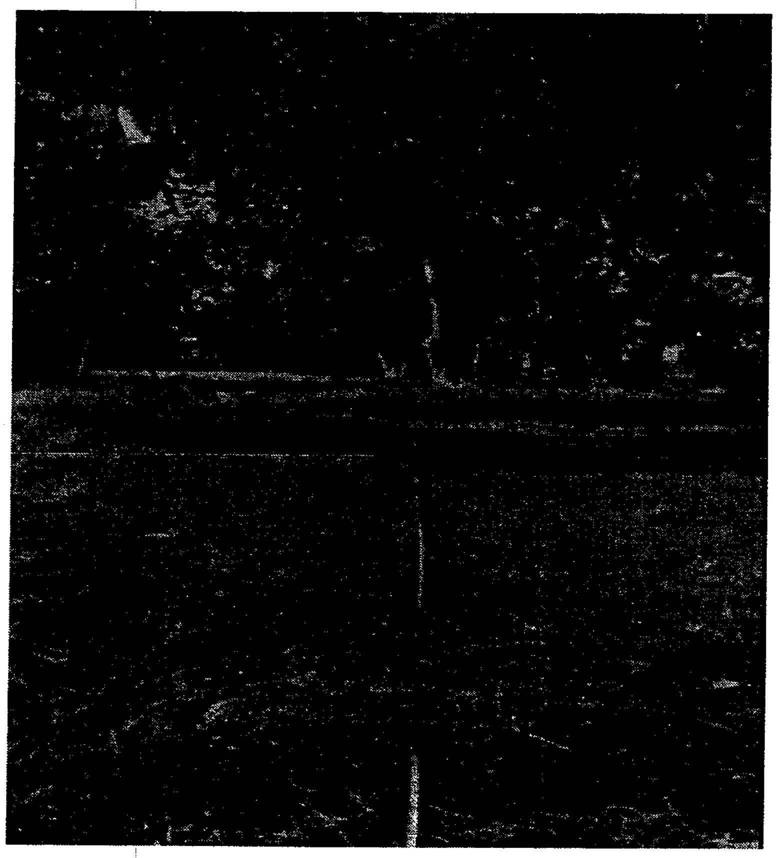


Figure 21. Open Woodland at Orestimba Creek Transect #10

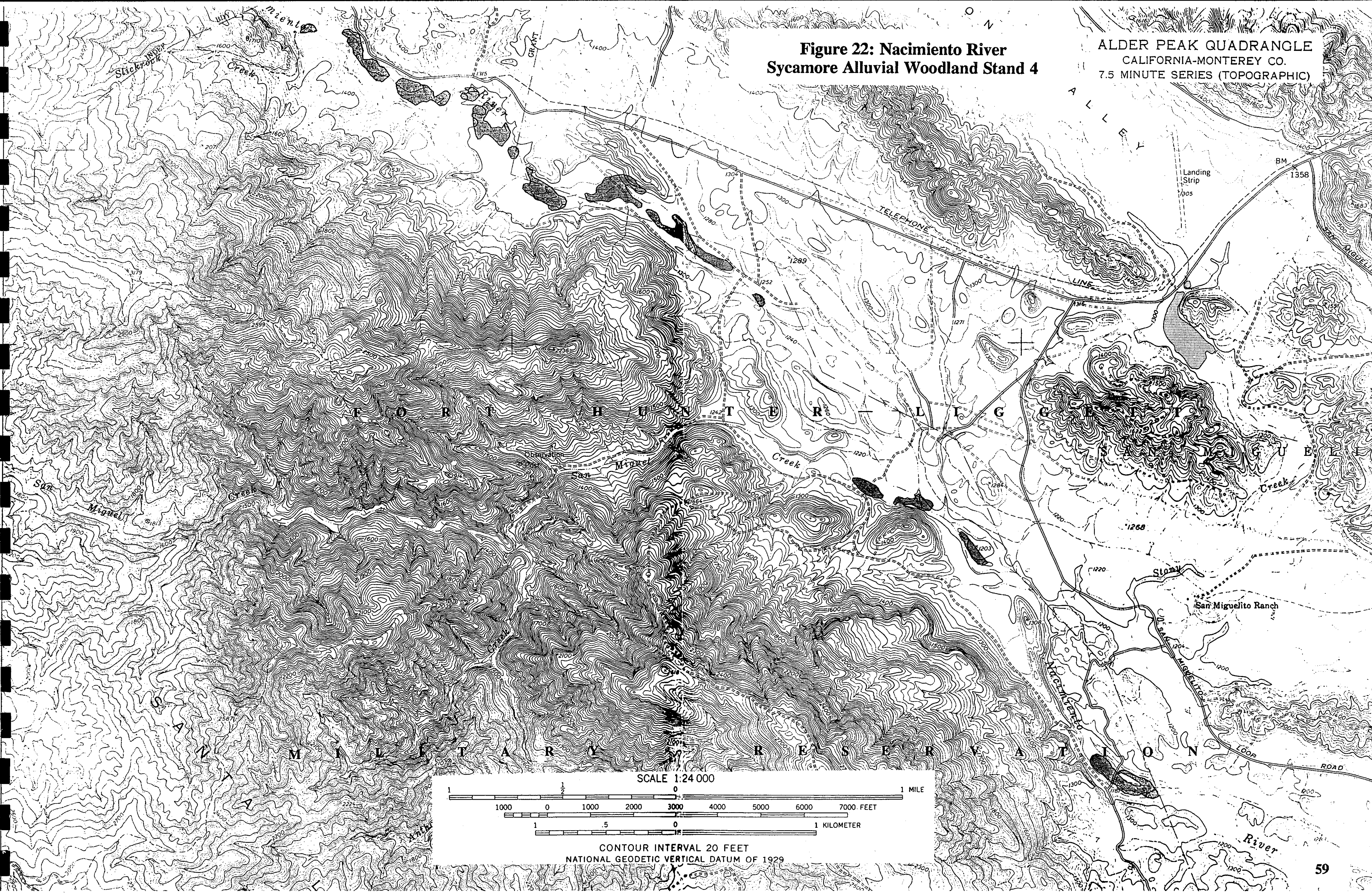


Figure 22: Nacimiento River Sycamore Alluvial Woodland Stand 4

rise 5 to 7 ft above adjacent channels. The underlying rock at the Nacimiento River stand is sedimentary. The majority of the surface substrate is comprised of sand, with gravel and rock comprising the remainder.

In the riparian zone upstream from the main stand the river narrows into a single channel where coast live oak and, to a lesser extent, canyon oak and ponderosa pine occur on the small terraces. In this area sycamore is more restricted to the active channel boundaries along with white alder. Downstream from the main stand the River flows through narrow canyons such as near The Pallisades. Here white alder predominates along the areas where water persists through most of the year and sycamore dominates along highly flood-scoured stretches over an actively worked large rock- and cobble-dominated substrate. The sycamore-dominated vegetation here is similar to the foothill group.

3. Estimated Density and Numbers of Sycamore Stems, Age of Stems, Reproduction: Based upon two samples, we estimate that 31,980 sycamore stems over 1 cm in diameter exist in this stand, with an average of approximately 6 stems per clump. The average stem diameter for trees exceeding 1 cm in diameter is 25.3, and the range of stem diameters is 1 to 88.1 cm. The estimated growth rate of average sized trees in the stand is 2.5 rings/cm, and the estimated growth rate of the largest trees in the stand is 3.5 rings/cm. We estimate the number of sucker sprouts to be 45,920 with 8 sprouts per clump, on the average. No seedlings or saplings were observed in this stand. However, a few hundred yards downstream of the main stand, an area of adjacent riparian vegetation co-dominated by white alder and sycamore supported numerous seedlings in the moist gravelly streambed adjacent to a drying pool.

4. Variation in Cover and Association Type: The Nacimiento River stand had scattered valley oak, coast live oak, Fremont Cottonwood, and gray pine (*Pinus sabiniana*) in the tree canopy. Some of the tallest individuals of sycamores noted in the study occurred in this stand (up to 100 ft.) Occasional California buckeye and Mexican elderberry occur as shrubs along with snowberry, and squaw bush, *Rhus trilobata*. In general, the main stand was largely devoid of shrubs with the ever-present annual ripgut brome and soft chess dominating the herb layer (Figure 23). Deer grass, *Muhlenbergia rigens*, pine bluegrass, *Poa scabrella*, and nodding needlegrass, *Stipa cernua,* are three native species that were noted occasionally in the understory. Herb cover was variable depending on recent flood activity, military equipment, and fire.

Both samples within the main stand were classified by TWINSPAN in the mid-coastal group.

5. Current Impacts to, and Condition of Stand: The sycamore trees in this stand are affected to varying degrees by anthracnose and leafhoppers, and vehicle tracks exist through parts of the stand. The stand has undergone substantial recent flooding, and resprouting indicates the occurrence of floods and fire within the past 5 years. A portion of the stand was recently

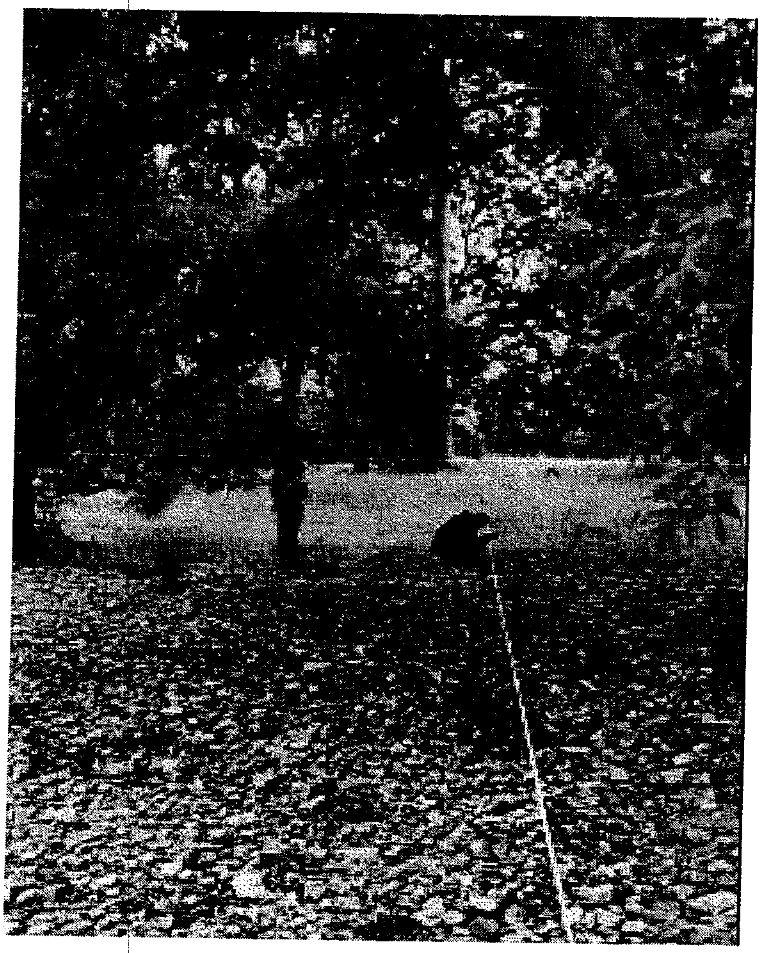


Figure 23. Open Annual Grass-dominated Understory with Large Over-arching Sycamores, Nacimiento River Transect #2.

burned, initiating many resprouts at the bases of surviving stems. The fire was caused by military maneuvers within Fort Hunter Leggett.

Stand 5; Dry Creek, Tulare County

1. Stand Size, Distribution, and Surrounding Environment: The Dry Creek stand covers approximately 211.1 acres (85.5 ha) along over 5 miles of Dry Creek. It extends from the vicinity of Hog Spring Canyon, south and downstream to an area 0.4 mile upstream from the confluence of Dry Creek with the Kaweah River (Figure 24). Approximately 1.4 miles downstream from its sparse and narrow upstream end, the stand becomes continuous, reaching a maximum width of 0.25 mile.

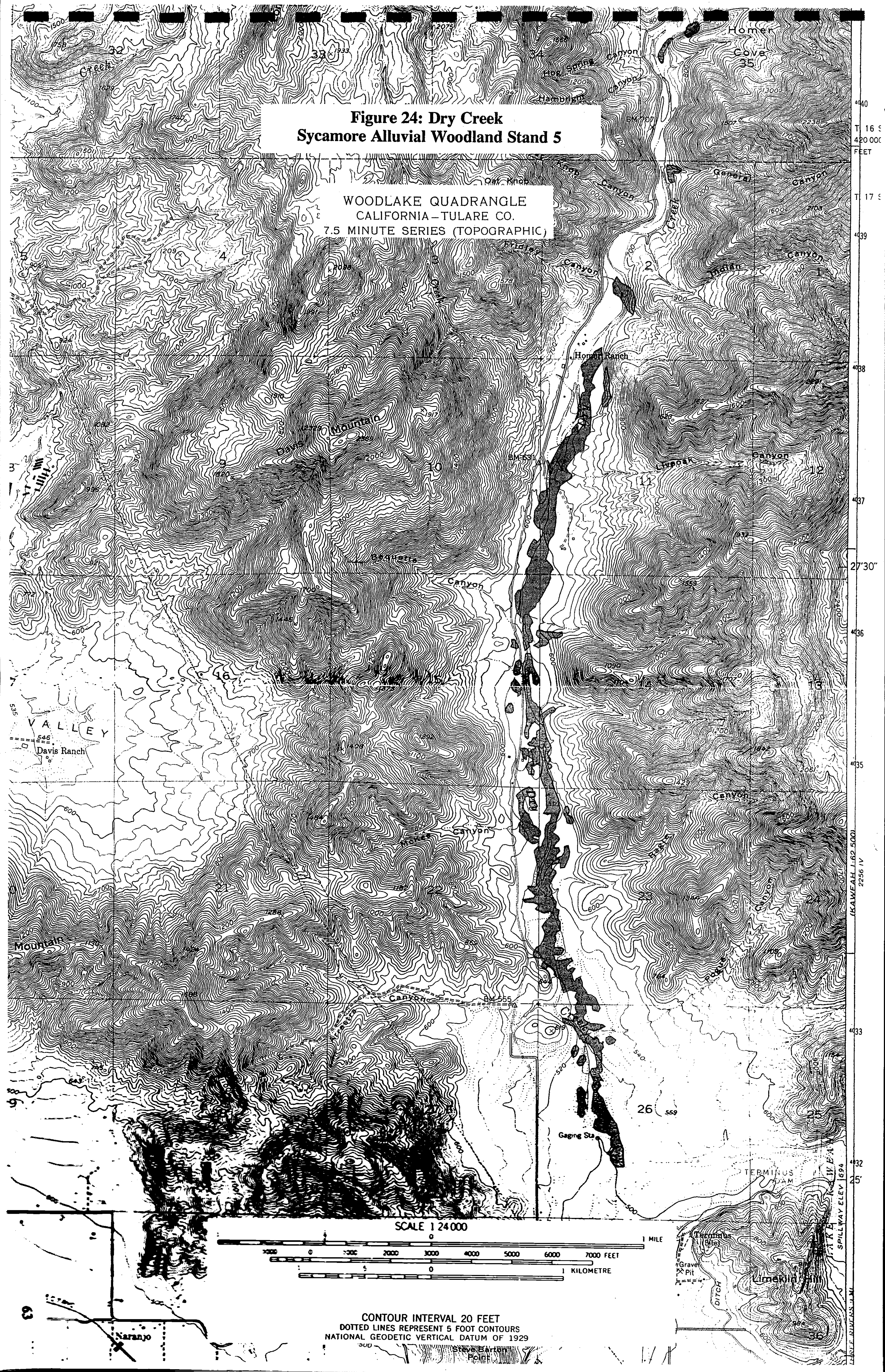
2. Adjacent Vegetation, Topography: Vegetation adjacent to the Dry Creek stand consists largely of annual grassland and blue oak woodland. At the downstream end of the stand, nearby land is also used for growing hay and alfalfa. The sycamores in this stand grow on terraces along single and multi-channeled reaches of Dry Creek. Terraces vary in width from less than 200 ft to almost 1000 ft and rise from 1 to 10 ft above adjacent channels. Most of the stand has a substrate derived from mixed metasedimentary and metavolcanic rocks. Surface composition varies slightly with each transect. Sand comprises the majority of the surface material over most of the lower part of the stand, with rocks comprising more of the surface towards the upper end.

3. Estimated Density and Numbers of Sycamore Stems, Age of Stems, Reproduction: Based upon 7 samples, we estimate that 48,840 sycamore stems over 1 cm in diameter exist in this stand with an average of approximately 5 stems per clump. The average stem diameter for trees exceeding 1 cm in diameter is 38.3 cm and the range of stem diameters is 1.2 to 122.1. The estimated growth rate of average sized trees in the stand is 3.9 rings/cm, and the estimated growth rate of the largest trees in the stand is 3.5 rings/cm. We estimate the number of sucker sprouts to be 33,744 with 3.5 sprouts/clump, on the average. No seedlings or saplings were observed in this stand.

4. Variation in Cover and Association type: All samples within The Dry creek stand were classified by TWINSPAN as part of the interior group with close affiliation to many of the Los Banos, Orestimba, Little Dry, and Mill creeks stands (Figure 25). As with the Mill Creek stand, valley oak was a relatively constant member of the tree layer. Oregon ash, *Fraxinus latifolia*, and red willow also occurred occasionally as small trees. The sycamore-dominated vegetation transcends upstream to the foothill group and downstream, quite abruptly, to Fremont cottonwood-dominated stands associated with permanent surface water near long-established gravel mining operations.

5. Current Impacts to and Condition of Stand: The sycamore trees in this stand are affected to varying degrees by anthracnose and only lightly by lacebugs. Evidence of grazing was apparent at five of the seven transects, and the effects of irrigation overflow were observed at

Figure 24: Dry Creek Sycamore Alluvial Woodland Stand 5



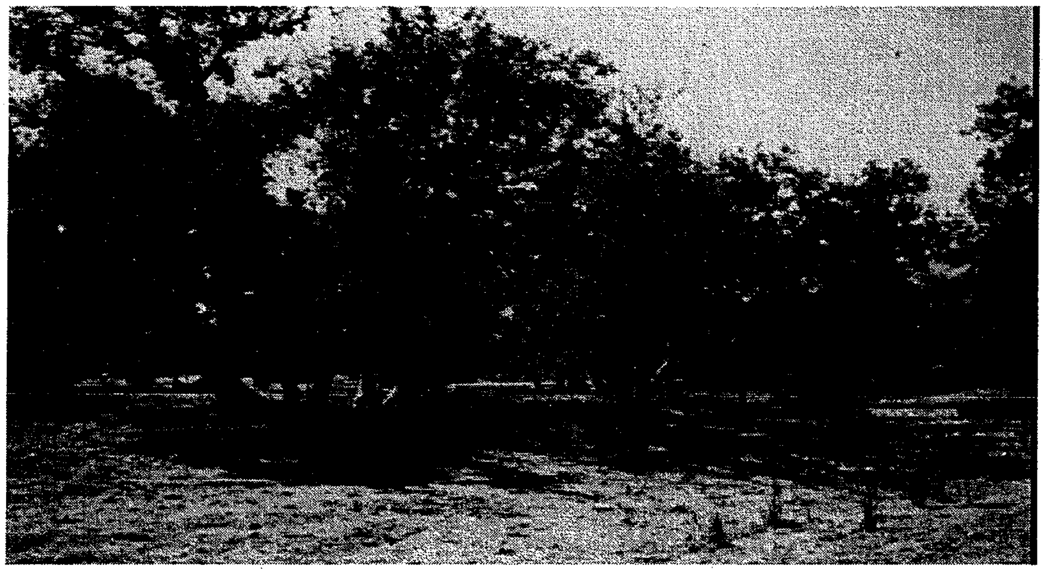


Figure 25. Dry Creek Stand at Transect #L1; Note Figure in Right Distance for Scale.

the downstream end of the stand. Gravel mining was observed to occur within the southern third of the stand. In the past several years gravel mining has increased substantially in the lower portion of the stand. The recent activity has included bulldozing and uprooting many sycamores from an area of approximately 70 acres (Figure 26). Future plans for this area including digging several deep pits up to 90 ft. (G. Presley, pers. comm. 1994, Carol Court pers comm. 1995). These activities likely will affect the upstream portion of the stand through alteration of the water table. Jacobs (1993) discusses how extensive degradation from gravel mining may affect riparian vegetation and water supply wells by inducing a decline in the alluvial water table as the stream banks are effectively drained to a lowered level.

Stand 7; Arroyo Valle, Alameda County

1. Stand Size, Distribution, and Surrounding Environment: The Arroyo Valle stand covers approximately 211.2 acres (85.5 ha) along 3 miles of Arroyo Valle (Figure 27). It extends from Arroyo Road near the Veteran's Administration Hospital downstream to the intersection of Alden Lane and Isabel Avenue. The stand is nearly continuous, with some small open breaks toward the downstream end. Much of the stand is wide, truncating abruptly at both its upstream and downstream ends. The stand ranges from 200 to 1400 ft. in width.

2. Adjacent Vegetation, Topography: Vegetation adjacent to the Arroyo Valle stand consists largely of annual grassland with scattered valley and coast live oak woodland in some areas, and vineyards. The sycamores in this stand grow on terraces along the braided multi-channel of Arroyo Valle. Terraces reach widths of up to 800 ft and rise from 3 to 10 ft above adjacent stream channels. The substrate is derived from non-marine sedimentary alluvium, playa, lake, and terrace deposits. Silt and sand comprise a majority of the surface material, with silt usually contributing a higher percentage. Gravel and rock comprise the remainder.

3. Estimated Density and Numbers of Sycamore Stems, Age of Stems, Reproduction: Based upon four samples, we estimate that 53,010 sycamore stems over 1 cm in diameter exist in this stand with an average of approximately 7 stems per clump. The average stem diameter for trees exceeding 1 cm in diameter is 31.2 cm dbh, and the range of stem diameters is 1.3 to 109.2 cm. The estimated growth rate of average sized trees in the stand is 4.5 rings/cm and the estimated growth rate of the largest trees in the stand is also 4.5 rings/cm. We estimate the number of sucker sprouts in this stand to be 162,450, with 21.1 sprouts per clump on the average. No seedlings or saplings were observed in this stand.

4. Variation in Cover and Association Type: The four samples in the Arroyo Valle stand are classified by TWINSPAN as part of the mid-coastal group (Figure 28). The scattered occurrence of coast live oak in the canopy of particularly the upper portion of the stand, and the scattered occurrence of shrubs such as creek snowberry and poison oak also substantiate the coastal influence in this stand.

Figure 26. Gravel Mining Within the Southern Portion of the Dry Creek Stand.

Figure 27: Arroyo Valle Sycamore Alluvial Woodland Stand 7

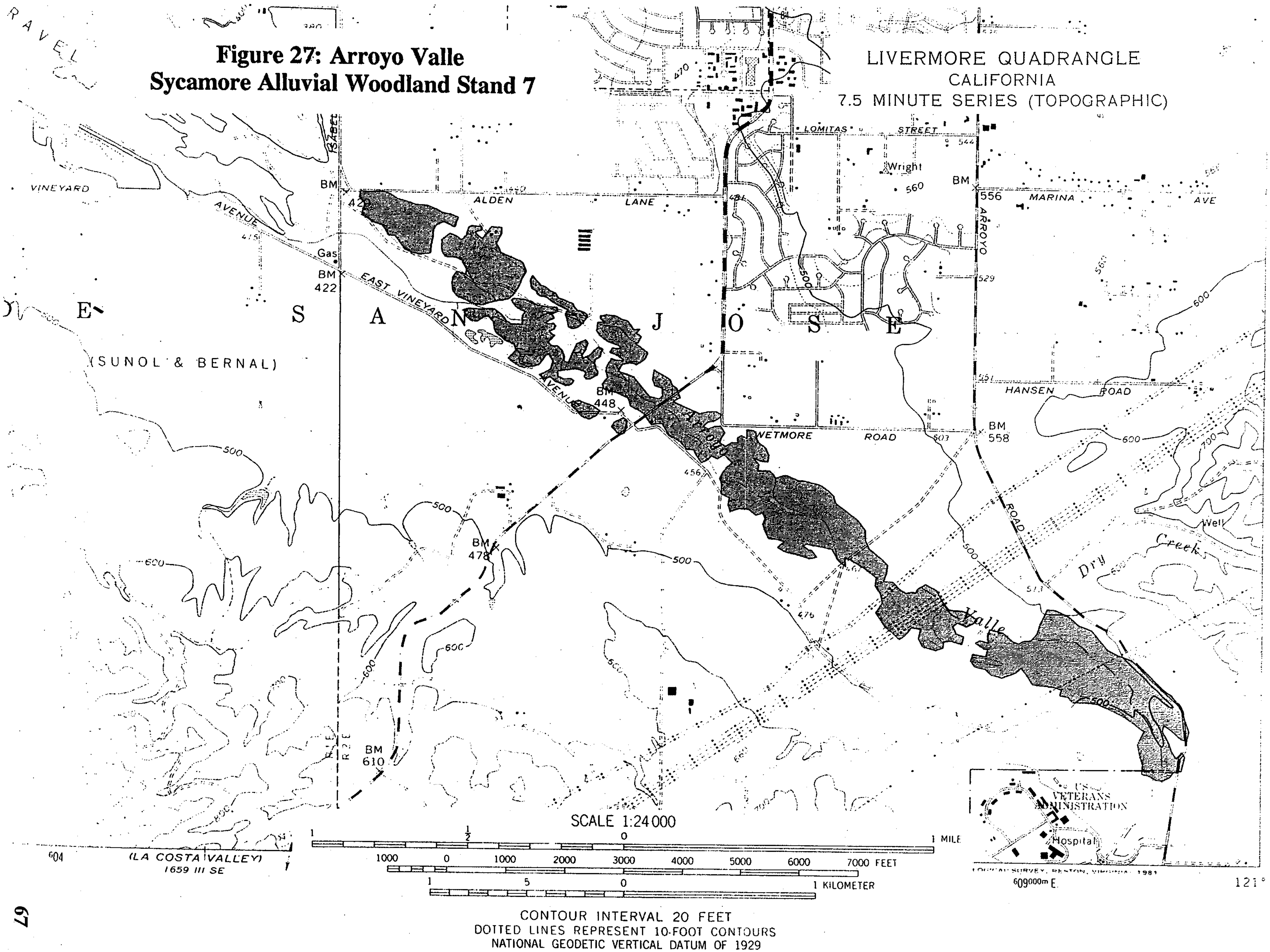


Figure 28. Ground-level View of Transect #4 at Arroyo Valle Stand Showing Litter and Thick Annual Grass Understory.

5. Current Impacts to, and Condition of Stand: The stand is now included almost completely within the Livermore Area Recreation and Park District's Sycamore Grove Park. The sycamore trees in this stand are affected to varying degrees by anthracnose and lightly by lacebugs. Stem dieback also varies between different areas of the stand from light to heavy. Trees associated with riverwash soils are more prone to poor health than those on Livermore Stony Loam (on the higher terraces away from the main creek channels). Trees near pathways and parking areas appear to be in poor health, or dead, and tree canopies throughout the stand appear damaged (Figure 29). Resprouting occurs both at stems and at the bases of trees. Scouring of the streambed and cutting of the streambank also occurred.

A principal documented negative affect in the past has been an artificially increased summer discharge from the upstream reservoir (Lake Del Valle) followed in successive years by an abrupt cut-off of this flow. This resulted in massive die-back of sycamore stems (Matheny 1989). Extensive and long-established gravel mining operations exist downstream. According to Livermore Area Recreation and Park District Ranger Bruce Weidman, the original extent of this stand stretched over 0.5 mile further downstream. Currently only scattered sycamores occur between largely denuded gravel excavation pits and gravel piles.

Stand 8; Lower Mill Creek, Fresno County

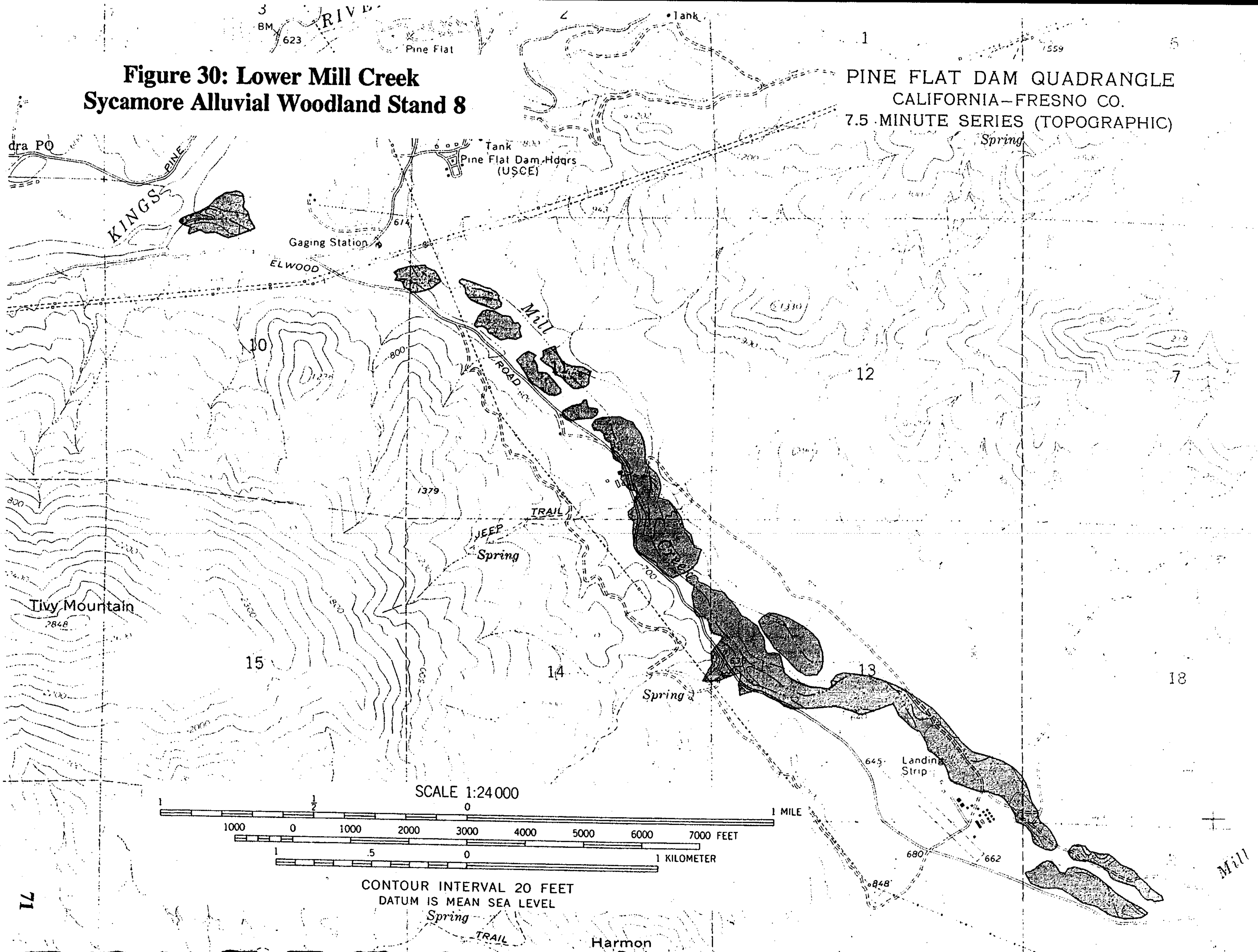
1. Stand Size, Distribution, and Surrounding Environment: The Lower Mill Creek stand covers approximately 229 acres (92.7 ha) along 4 miles of Mill Creek (Figure 30). The stand occupies the broad alluvial bottomland of the creek and is surrounded by foothills vegetated with interior live oak, blue oak and non-native grassland. It extends from the confluence of Tretten Creek and Mill Creek downstream to Mill Creek's confluence with the Kings River. The stand is nearly continuous except for a 0.5 mile break towards the downstream end of the stand.

2. Adjacent Vegetation, Topography: Vegetation adjacent to the Lower Mill Creek stand is primarily blue oak woodland. A mixture of blue oak and interior live oak woodlands appears adjacent to the upper end of the stand. The sycamores in this stand grow on terraces along the braided multi-channeled stream. The terraces vary in width from 200 to 900 ft and rise from 1 to over 10 ft above adjacent channels. The substrate is derived from plutonic rocks consisting of Mesozoic granite, quartz monzonite, granodiorite, and quartz diorite. The surface composition varies only slightly with each transect. Sand comprises a large majority of the surface over the stand.

3. Estimated Density and Numbers of Sycamore Stems, Age of Stems, Reproduction: Based on four samples, we estimate that 60,255 sycamore stems over 1 cm in diameter exist within this stand, with an average of approximately 6 stems per clump. The average stem diameter for trees exceeding 1 cm in diameter is 18.5 cm dbh and the range of diameters is 1.6 to 58.2 cm. The estimated growth rate of average sized trees in this stand is 3.0 rings/cm and the estimated growth rate of the largest sized trees in the stand is 5.3 rings/cm. We estimate the

Figure 29. Arroyo Valle Stand Showing Dead and Resprouting Sycamore Stems as a Result of Water Level Fluctuation Due to Releases from Upstream Del Valle Reservoir.

Figure 30: Lower Mill Creek Sycamore Alluvial Woodland Stand 8



number of sucker sprouts in this stand to be 63,963, with 6.3 sprouts per clump, on the average. No seedlings or saplings were observed in this stand.

4. Variation in Cover and Association Type: All samples in this stand had valley oak present (Figure 31). Interior live oak was also present in one sample. In a few areas valley oak co-dominates with sycamore and occasionally does dominate. Thus, portions of the stand are better classified as part of the Valley oak series and actual acreage of SAW is somewhat lower than the listed figure. The mingling of interior live oak in the periphery of the stands is reminiscent of the upper Los Banos Creek samples. When sampled, the understory was found to be relatively heavily impacted by grazing and cover values for herbs were understandably low. However, understory species diversity ranged from 17 to 35 species. *Bromus mollis* and *B. diandrus* were the most consistent species in the understory.

In the TWINSPAN analysis three of the four Mill Creek plots formed a consistent unit most closely related to individual plots at Dry, Deer, Orestimba, and Los Banos creeks.

5. Current Impacts to and Condition of Stand: The sycamores in this stand are affected to varying degrees by anthracnose, and only slightly by lacebugs. The impact of grazing was observed at all transect locations, though its intensity varied. Bridle paths traverse parts of the woodland, and road and levee construction is ongoing in some areas. Some of the trees in this stand suffered from axe wounds. Much of the upper and central portion of the stand is within a subdivision. Recent roads have been constructed onto the alluvial terraces and several homes have been built along the periphery of the stand. A dude ranch is located along the upper reaches of the stand.

Stand 9; Little Dry Creek, Fresno County

1. Stand Size, Distribution, and Surrounding Environment: The little Dry Creek stand covers approximately 29 acres (11.6 ha) in a narrow swath approximately 1 mile long (Figure 32). The stand occurs as a continuous stretch without any significant breaks. It lies at the beginning of the Little Dry Creek flood plain where the stream debauches onto the upper valley floor following a long course through a relatively narrow valley in the Southern Sierra Foothills. The lower extent of the stand correlates with a broadening of the valley bottom and a grove of planted Eucalyptus adjacent to a ranch house. Widely scattered individual sycamores occur downstream from the stand for over 0.25 mile.

2. Adjacent Vegetation, Topography: The area is surrounded by annual grassland with open blue oak woodland across Auberry Road to the south. The stand is adjacent to the multi-channeled Little Dry Creek, which currently has permanent moisture due to the seepage from the Friant Kern Canal crossing upstream about one quarter from the upper end of the stand. As a result of the moisture there, wetland plants such as cattail and tule grow in parts of the main channel through much of the stand.

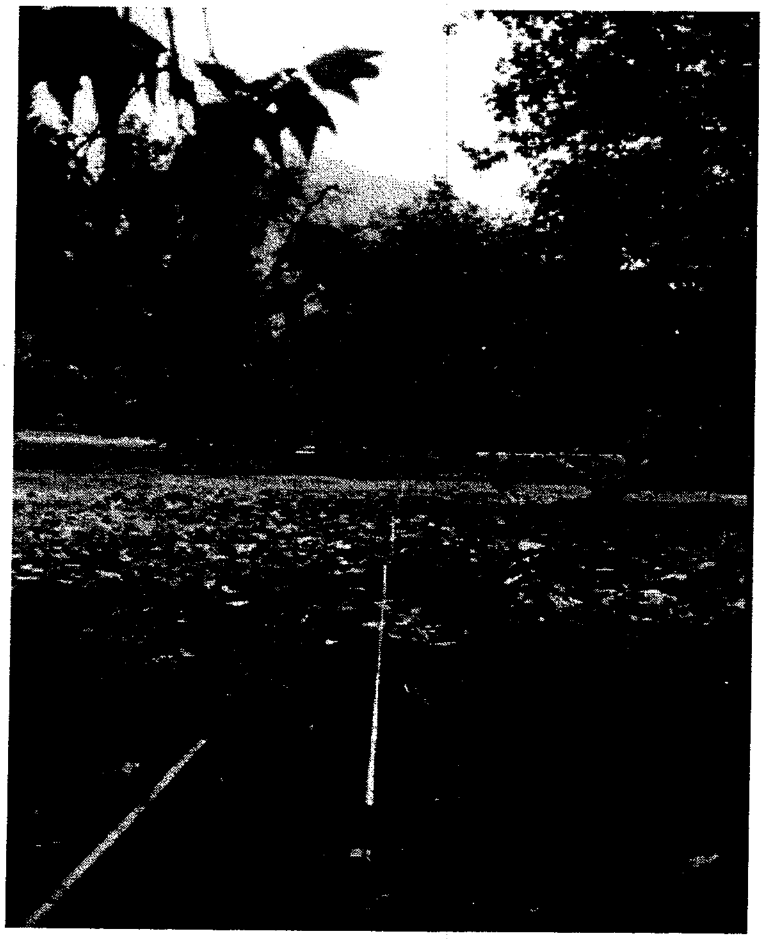
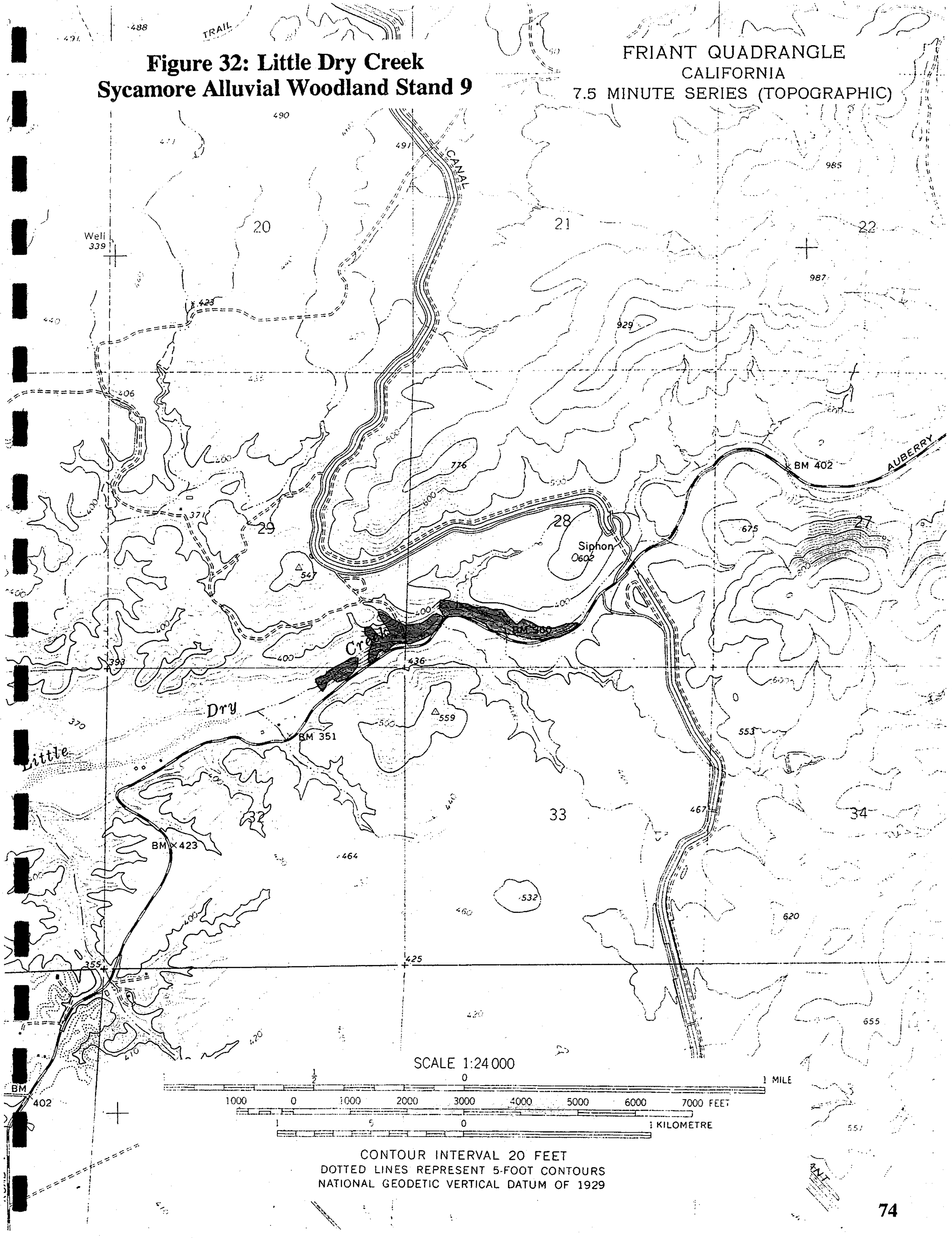


Figure 31. Mill Creek Stand at Transect #2 Showing Heavily Grazed Understory with Valley Oak in Left Background.

Figure 32: Little Dry Creek Sycamore Alluvial Woodland Stand 9



The sycamore stand grows on relatively narrow 50 to 100 ft- wide terraces adjacent to the main narrow channel with several smaller "extinct" channels coursing through the terrace deposits. The main channel has gradually sloping banks, and is about 4 to 6 ft. below the terrace level. Soils are fine-grained and sandy, derived from granite.

3. Estimated Density and Numbers of Sycamore Stems, Age of Stems, Reproduction: Based on a single sample, we estimate there are about 186 sycamore stems over 1 cm in diameter in this stand, with an average of 4 stems per clump. There are about 93 mature stems, with an average diameter of about 77 cm. Growth rates of two sampled mature stems were relatively rapid, averaging 2.3 and 2.9 rings per cm.

No seedlings were seen in the stand in 1992, but there were a number of sucker sprouts at the base of the clumps (an estimated 19 per clump and 8816 for the entire stand).

4. Variation in Cover and Association Type: The understory is a mixture of annual introduced grasses, with Bermuda grass forming a turf in the moister areas adjacent to the main channel and ripgut brome dominating in other areas (Figure 33). In intermediate areas, these two species average about equal cover (total herb layer cover about 95%). Shrubs are absent from the main stand, although tall herbs such as stinging nettle may occur as scattered individuals. There is very little shrub cover in the main stand. A few Fremont cottonwoods, including some recently dead, are scattered in the stand.

The Little Dry Creek stand is clearly part of the interior alluvial group. In the TWINSPAN analysis of samples Little Dry Creek is closely related to Deer, Dry, and Mill creeks samples, and to many of the Los Banos Creek and Orestimba Creek samples.

5. Current Impacts to, and Condition of Stand: The health of the stand is generally good, with light anthracnose and lacebug infestations. Grazing pressure is relatively light, although it has been long-persisting. The moisture and disturbance regimes have been altered by the effects of seepage below the canal. The lower extent of the stand appears more unhealthy, with only a few scattered large sycamores. Grazing pressure was greater at the lower extreme of the stand than elsewhere in 1992.

Stand 10; Lower Coyote Creek, Santa Clara County

1. Stand Size Distribution and Surrounding Environment: The Coyote Creek stand covers approximately 40.1 acres (16.2 ha) along over 2 miles of Coyote Creek in Santa Clara County (Figure 34). The stand is located approximately 2 miles southwest of Anderson Lake and extends from 0.4 mile west of Burnett Avenue downstream to the area just upstream of some gravel pits. The stand is fairly narrow and continuous except for 0.12 mile gap towards the upstream end.

2. Adjacent Vegetation, Topography: Vegetation adjacent to the Coyote Creek stand consists

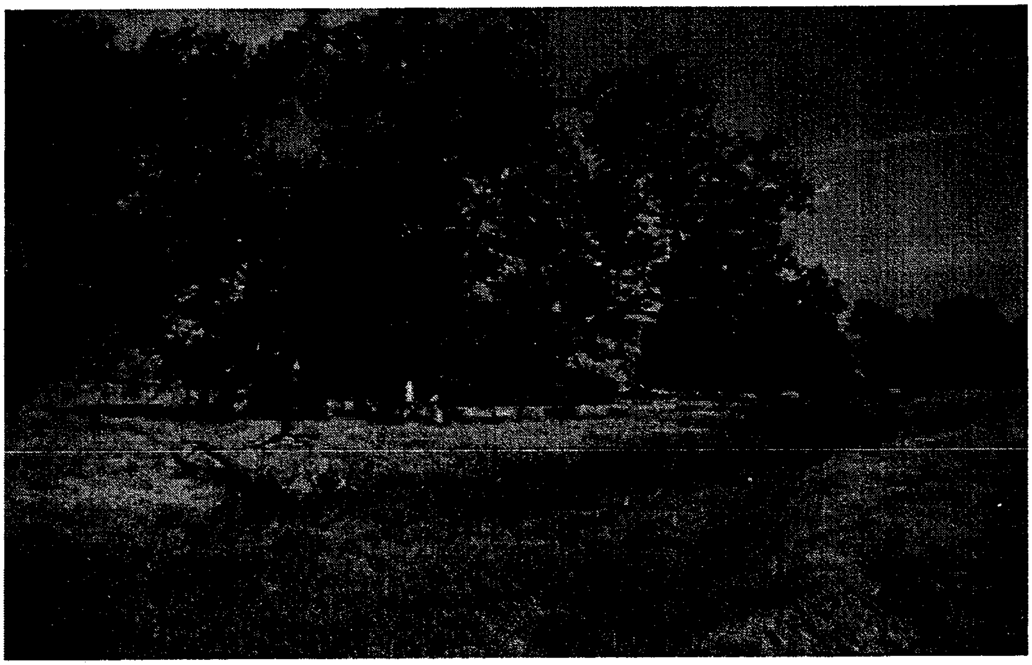
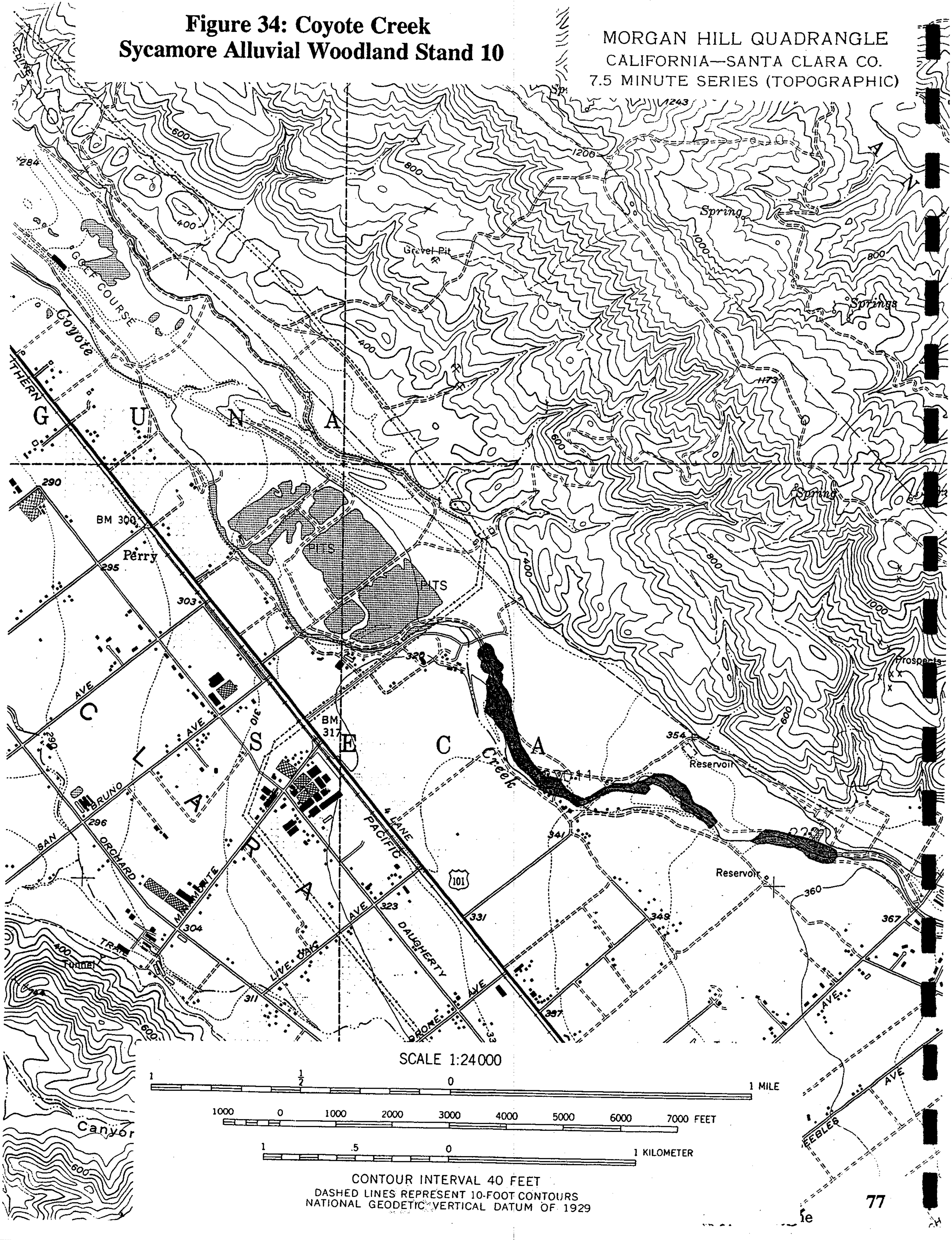


Figure 33. Little Dry Creek Stand Showing Main Channel of Little Dry Creek Along Linear Stand of Sycamore. Note Patch of Cattails in Channel, a Result of Seepage From Upstream Friant-Kern Canal.

Figure 34: Coyote Creek Sycamore Alluvial Woodland Stand 10



of agriculture, primarily orchards and fallow fields. Upstream from the site sycamores become less important, with coast live oak, valley oak, red willow, and California bay increasing in cover (Figure 35). The sycamores in this stand grow on terraces along a single channel at the upstream end of the stand, and on terraces along a braided multichannel at the downstream end of the stand. Terraces supporting this stand are less than 200 ft in width and rise from 1 to 6 ft above adjacent channels. The substrate is derived from sedimentary rock.

Towards the upper end of the stand, the surface is silty, with a few large and medium rocks. Towards the downstream end, sand and gravel comprise a majority of the surface material.

3. Estimated Density and Numbers of Sycamore Stems, Age of Stems, Reproduction: Based upon two samples, we estimate that 7,452 sycamore stems over 1 cm in diameter exist in this stand, with an average of approximately 3 stems per clump. The average stem diameter for trees exceeding 1 cm in diameter is 41.0 cm; the range of stem diameters is 2.1 to 86.8 cm. The estimated growth rate of average sized trees in the stand is 4.4 rings/cm and the estimated growth rate of the largest trees in the stand is 3.2 rings/cm. We estimate the number of sucker sprouts in this stand to be 11,664, with 2.6 sprouts per clump, on the average. No seedlings or saplings were observed in this stand.

4. Variation in Cover and Association Type: Both samples taken in the Lower Coyote Creek stand are classified by TWINSPAN as part of the mid-coastal group, with close affiliation to Arroyo Valle, Pacheco, Alameda, and San Antonio creeks stands. The presence of California bay and coast live oak scattered in the canopy are indicative of this mid-coastal affiliation. Additional occasional trees include red willow, bigleaf maple, *Acer macrophyllum*, valley oak, California black walnut, and gray pine. The understory is variable, but is characterized by a higher shrub cover than many stands. Shrubs include *Symphoricarpos rivularis, Rosa californica, Baccharis pilularis* var. *consanguinea,* and poison oak. Giant reed, *Arundo donax,* is a problem invader in parts of the stand.

5. Current Impacts to, and Condition of Stand: The sycamore trees in this stand are affected severely by anthracnose and some trees in the stand exhibit stem cavities. It appears from the looseness of the soil, the smoothness of grade, and the amount of trash, that the lower portion of this area was previously used as a landfill or gravel pit, and that the area has been refilled and graded. Anderson Reservoir (about 1 mile upstream from the stand) regulates the flow of water to this area of Coyote Creek. In the summer of 1992, the lower portion of this stand was burned. By fall, sprouts of sycamores were already over 18 inches high. A double freeway overcrossing (Hwy 101) traverses the lower portion of the stand and a paved bicycle path borders its entire length.

Stand 11; South Fork Tule River, Tulare County

1. Stand Size, Distribution, and Surrounding Environment: The South Fork Tule River stand

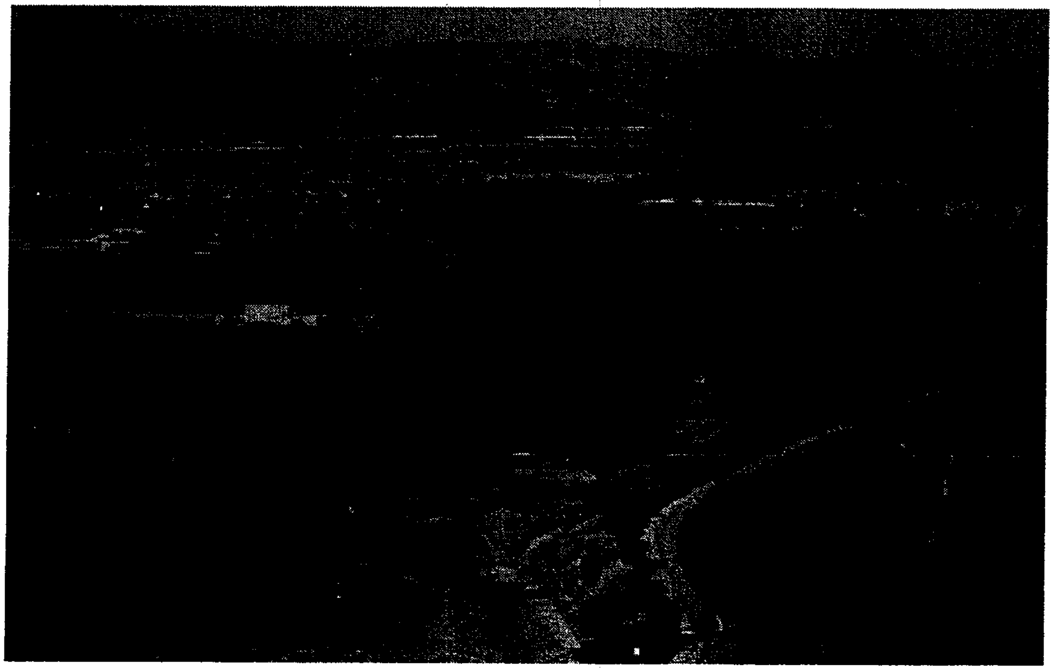


Figure 35. Overview of Lower Coyote Creek Stand from the Top of Anderson Reservoir Dam Looking Northwest up the Santa Clara Valley. Foreground is Dominated by Coast Live Oak, Background Right is Sycamore Stand. Note Numerous Surrounding Land Uses

covers approximately 15.9 acres (6.4 ha), making it the second smallest stand inventoried in this study. It occurs along less than 0.5 mile of the South Fork of the Tule River about 2 miles west of the Tule River Indian Reservation boundary (Figure 36). The stand is continuous and is about 0.12 mile wide at its widest point.

2. Adjacent Vegetation, Topography: Vegetation adjacent to the South Fork Tule River stand consists of annual grassland and valley oak woodland. Riparian vegetation immediately upstream and downstream is dominated by either white alder or Fremont cottonwood (Figure 37). The sycamores in this stand grow on terraces along a braided multi-channeled stretch of the river. Flow along this stretch is intermittent with some late summer pools persisting (these are bordered by young willows and white alders, and in one case by *Typha*). Terraces are 400-ft wide or less and rise from 1 to 6 ft, above adjacent stream channels. The substrate is mostly granitic alluvium derived from the Sierra Nevada Batholith. A large majority of the surface material is sand, with the remainder comprised of rock.

3. Estimated Density and Numbers of Sycamore Stems, Age of Stems, Reproduction: Based upon one sample, we estimate that 3328 sycamore stems over 1 cm in diameter exist in this stand, with an average of approximately 4 stems per clump. The average stem diameter for trees exceeding 1 cm is 32.6 cm and the range of stem diameters is 2.6 to 81.1 cm. The estimated growth rate of average sized trees in the stand is 3.8 rings/cm and the estimated growth rate of the largest trees in the stand is 5.3 ring/cm. We estimate the number of sucker sprouts in this stand to be 11,264, with 14.7 sprouts per clump, on the average. No seedlings or saplings were observed in the stand.

4. Variation in Cover and Association Type: This stand occurs adjacent to intermittently flowing stretches of the South Fork Tule River . *Bromus diandrus* and *Cynodon dactylon* are the most important herbaceous understory species. Buttonwillow is an important shrub in the understory. Sycamores are the only tree present in the sample; however, valley oak is present adjacent to the sample.

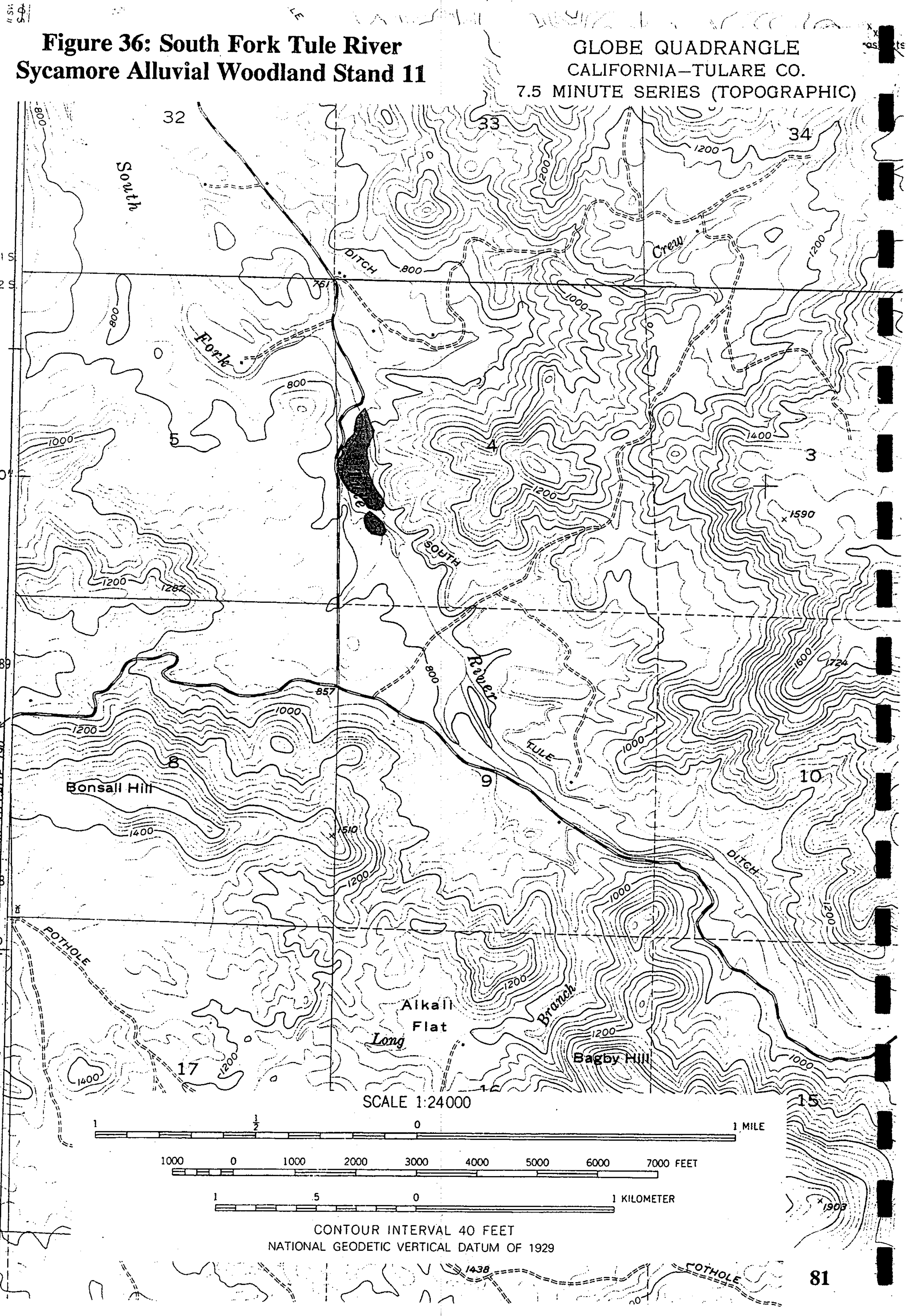
This stand is part of the interior alluvial group. TWINSPAN classifies this stand as a distinct subunit of the sycamore alluvial woodland along with the one of the North Fork Los Banos Creek stands and two of the Dry Creek (Tulare County) stands.

5. Current Impacts to, and Condition of Stand: The sycamore trees in this stand are heavily affected by anthracnose. Although it appears no grazing occurred in 1992, past evidence of grazing is apparent. About 0.25 mile downstream of this stand, the valley is subdivided into ranchettes.

Stand 12; Upper Coyote Creek, Santa Clara County

1. Stand Size, Distribution, and Surrounding Environment: The Upper Coyote Creek stand covers approximately 49.2 acres (19.9 ha) extending for about 1.5 miles upstream from the confluence of Coyote Creek with Bear Creek (Figure 38). Hills rise steeply on the north side

Figure 36: South Fork Tule River Sycamore Alluvial Woodland Stand 11



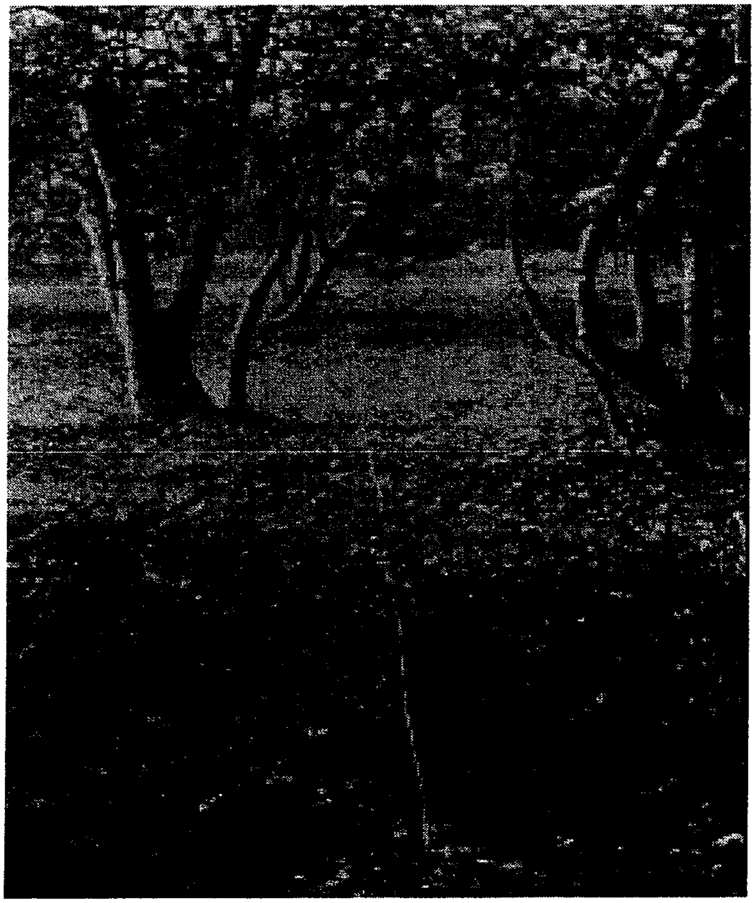
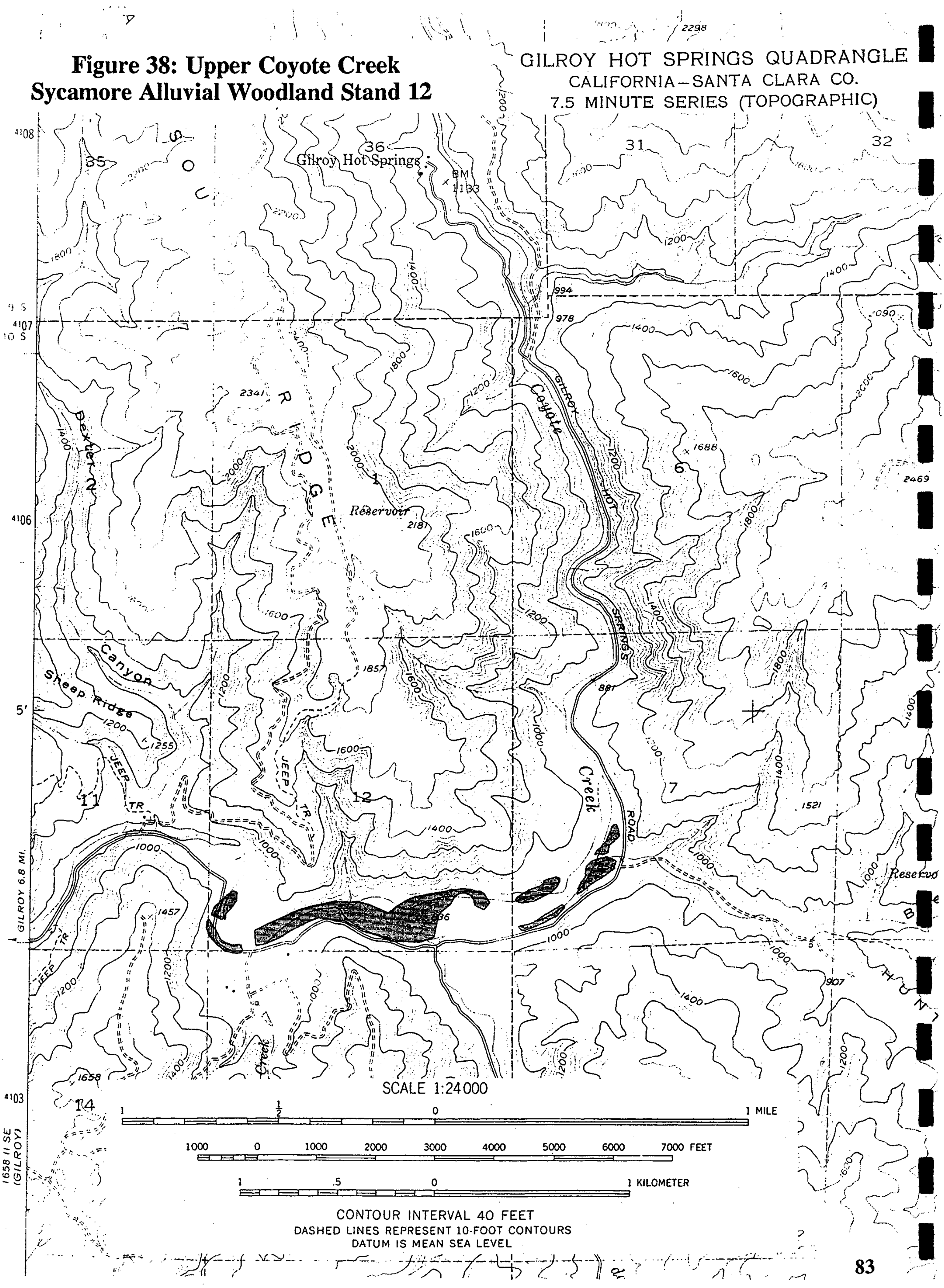


Figure 37. South Fork Tule River Stand.

Figure 38: Upper Coyote Creek Sycamore Alluvial Woodland Stand 12



of the valley bottom stand and are covered with a mixture of coast live oak , blue oak, and gray pine woodland, with patches of Diablan sage scrub (Figure 39). While the downstream end of this stand is fairly continuous, the upstream end is patchy, with some 0.12 mile breaks between patches of sycamore dominance.

2. Adjacent Vegetation, Topography: Vegetation adjacent to the upper Coyote Creek stand consists of coast live oak woodland with small patches of non-native grassland. The sycamores in this stand grow on terraces along this multi-channeled stretch of Upper Coyote Creek. Terraces vary in size, reaching maximum widths of 600 ft and rise from 3 to 10 ft above existing channels. The substrate is derived from Franciscan Formation sedimentary and metasedimentary rocks, including sandstone and shales. Surface composition varies slightly for each transect, with sand comprising the large majority of the surface and silt comprising the remainder.

3. Estimated Density and Numbers of Sycamore Stems, Age of Stems, Reproduction: Based upon two samples, we estimate that 8,358 sycamore stems over 1 cm in diameter exist in the stand, with an average of approximately 5 stems per clump. The average stem diameter for trees exceeding 1 cm is 35.1 cm; the range of stem diameters is 2.0 to 84.6 cm. The estimated growth rate of average sized trees in the stand is 4.2 rings/cm and the estimated growth rate of the largest trees in the stand is 4.5 rings/cm. We estimate the number of sucker sprouts in this stand to be 62,884, with 39.5 sprouts per clump, on the average. No seedlings or saplings were observed in this stand.

4. Variation in Cover and Association Type: Both samples had at least small amounts of coast live oak and one had California bay, in addition. Understory cover was predominantly annual grasses, including *Bromus diandrus* and *B. mollis*, however, each had some woody understory species (Figure 40). One sample had *Symphoricarpos rivularis, Aesculus californica, Ceanothus cuneatus,* and a sapling of Digger pine while another had *Ribes* sp. and *Brickelia californica*.

TWINSPAN classified each sample somewhat differently within the mid-coastal group. The sample with the highest coast live oak cover sorts with Alameda Creek and Lower Coyote Creek stands while the other shows greater affinity for certain Los Banos Creek, Orestimba Creek, Pacheco Creek and Kaweah River stands.

5. Current Impacts to, and Condition of Stand: The sycamore trees in this stand are severely affected by anthracnose and impacts due to grazing range from moderate to heavy. Recent high stream flows resulted in scouring of stream channels and exposure of sycamore root systems.

Stand 13; Deer Creek, Tulare County

1. Stand Size, Distribution, and Surrounding Environment: The Deer Creek stand covers

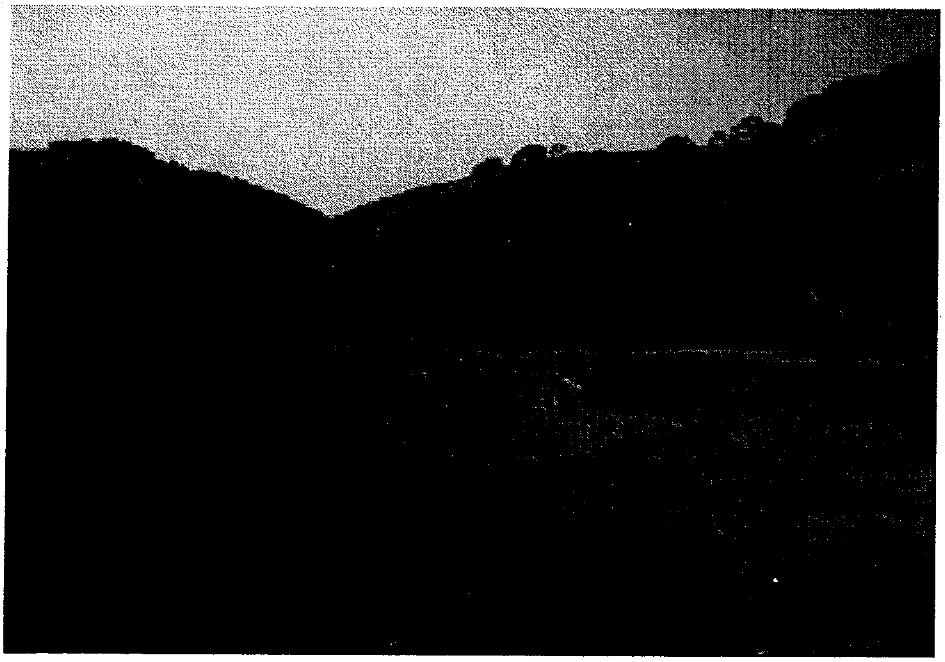


Figure 39. View Looking Northwest of Western Portion of Upper Coyote Creek Stand Showing Surrounding Hills with Coast Live Oak and Blue Oak Woodland.

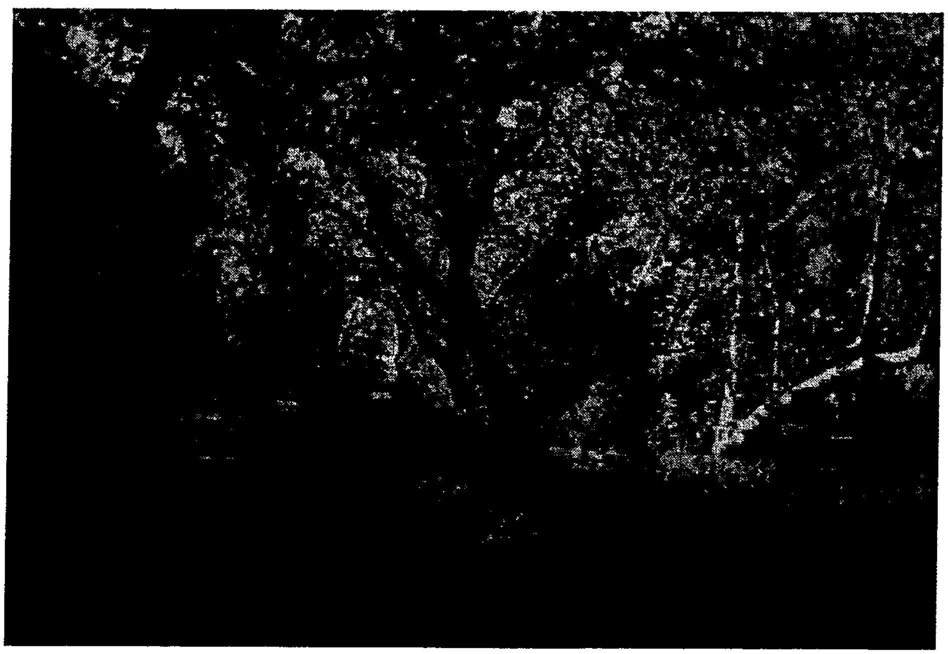


Figure 40. Interior View of Upper Coyote Creek Stand with Typically Dense Canopy of Sycamores and Coast Live Oak with Patches of the Shrub *Symphoricarpos rivularis* in the Understory.

approximately 45.2 acres (18.3 ha) scattered along about 1 mile of Deer Creek east of Road 298 in Tulare County (Figure 41). This stand consists of two patches on high terraces on opposite sides of the stream channel, separated by about 0.33 mile of annual grassland and sparse willow and cottonwood riparian along the active channel. The stand occupies a portion of a broad valley just below where Deer Creek debauches from a narrower valley in the southern Sierra foothills.

2. Adjacent Vegetation, Topography: Vegetation adjacent to the Deer Creek stand consists of blue oak woodland and annual grassland. Low foothills covered with non-native grassland and open blue oak woodland occur several hundred yards away from the stand. The sycamore trees in this stand grow on terraces along single and multi-channeled Deer Creek. Terraces are from 400 to over 1000 ft wide and rise from 3 to 20 ft above adjacent stream channels. The substrate is largely granitic alluvium derived from the Sierra Nevada Batholith. The surface material consists mostly of sand, with the remainder comprised of silt, gravel, and rock.

3. Estimated Density and Numbers of Sycamore Stems, Age of Stems, Reproduction: Based upon two samples, we estimate that 33,294 sycamore stems over 1 cm in diameter exist in this stand with an average of approximately 5 stems per clump. The average stem diameter for trees exceeding 1 cm is 37.3 cm and the range of diameters is 1.3 to 98.2. The estimated growth rate of average sized trees in the stand is 2.3 rings/cm and the estimated growth rate of the largest trees in the stand is 2.6 rings/cm. We estimate the number of sucker sprouts to be 1,830, with 2.5 sprouts per clump. No seedlings or saplings were observed in this stand.

4. Variation in Cover and Association Type: TWINSPAN classifies both samples as closely related to one another in the same division as Little Dry Creek, and the majority of the Pacheco Creek sites and half of the Arroyo Valle sites. Species diversity at both sites is low with only 5 and 13 understory species tallied (Figure 42). One site had a relatively high percentage of red willow in the tree layer. Dominant understory species were annual grasses.

5. Current Impacts to, and Condition of Stand: Anthracnose affects the sycamore trees in this stand only slightly and in some cases not at all. The sycamores are affected lightly to moderately by lacebugs. Grazing impact varies from light to heavy, with plant species in the area indicating a history of heavy, grazing. Access roads to corrals and ranch outbuildings were present adjacent to the stands.

The height of the terraces, particularly on the north side of the creek, suggests that downcutting of Deer Creek has been substantial over the past several decades. Although no dam exists upstream, probability of natural flooding regimes initiating sycamore regeneration cycles in the Deer Creek stand is slight.

Stand 14; Arroyo Mocho, Alameda County

1. Stand Size, Distribution, and Surrounding Environment: The Arroyo Mocho stand covers

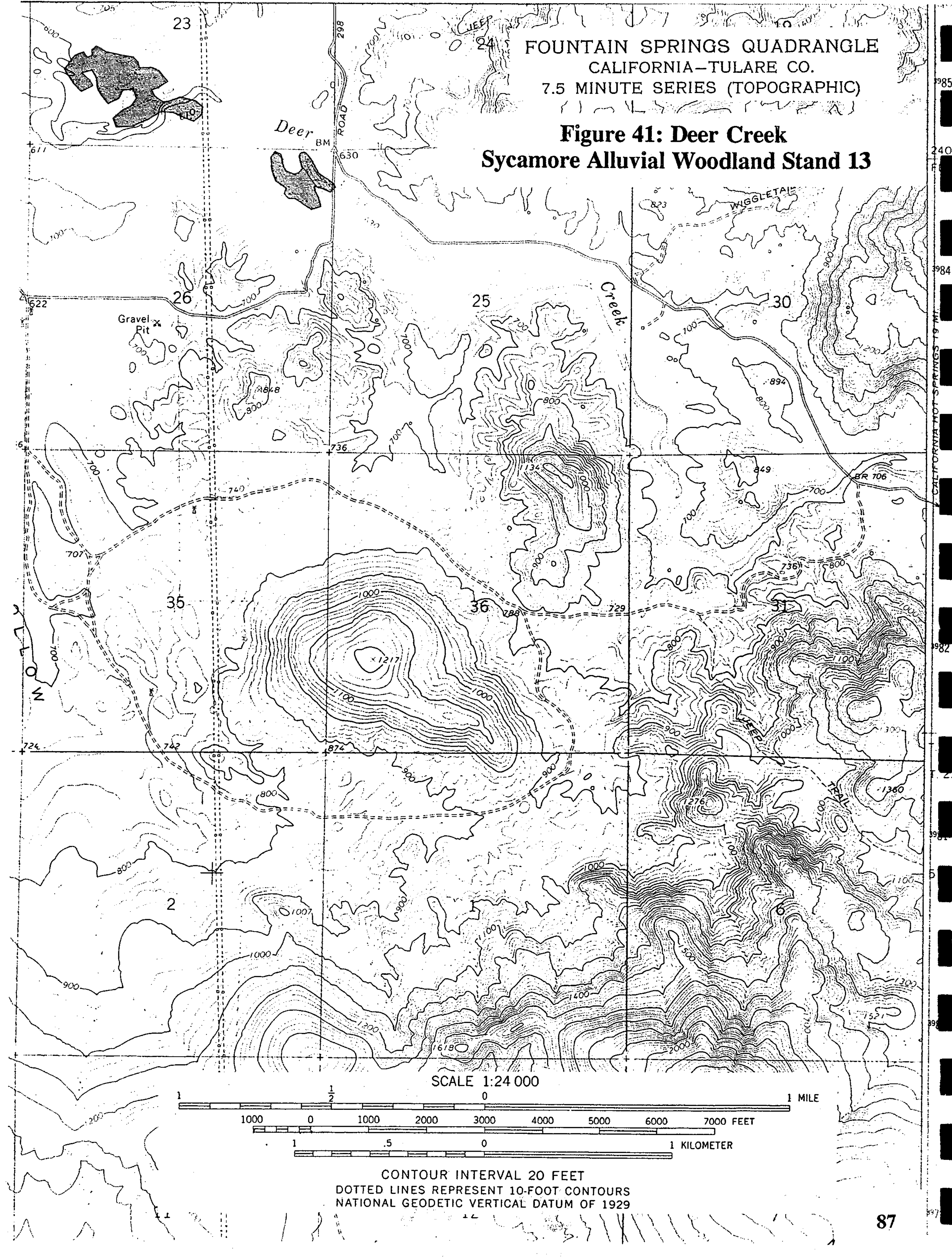


Figure 41: Deer Creek Sycamore Alluvial Woodland Stand 13

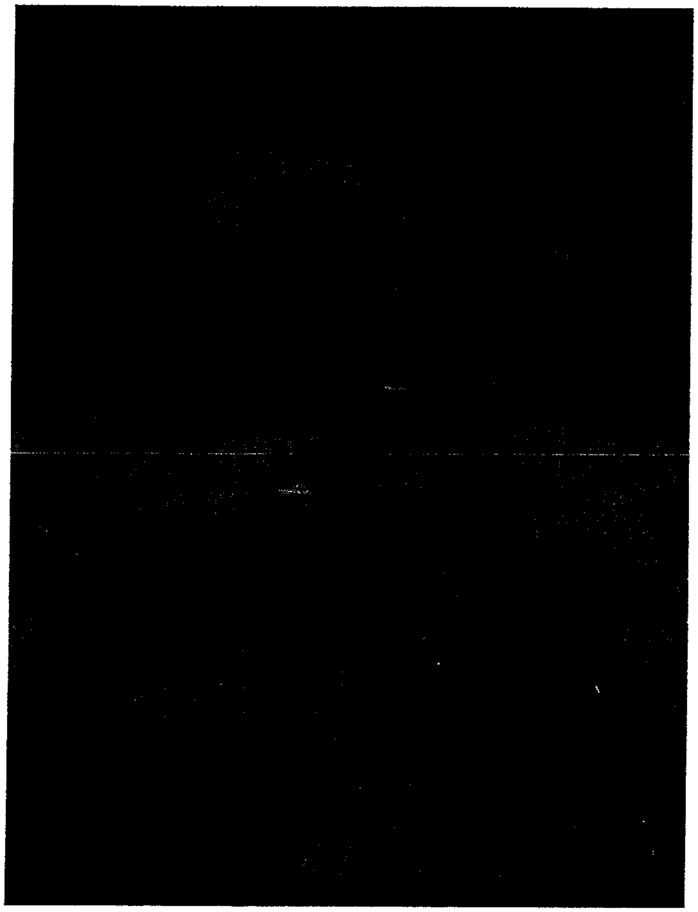


Figure 42. Vegetation Sampling in the Understory in the Open Woodland of the Eastern Portion of the Deer Creek Stand.

approximately 87.4 acres (35.4 ha) along 3.5 miles of Arroyo Mocho (Figure 43). The upper- and mid- portions of the stand are surrounded by low hills of the Diablo Range with blue oak woodland, annual grassland and Diablan sage scrub vegetation. The lower part of the stand occurs in the Livermore Valley and is surrounded by vineyards, other agricultural land, and homes. The stand is located approximately 2 air miles south-southwest of Lawrence Livermore Laboratory in Alameda County and is nearly continuous, save for a 0.5 mile break towards the upstream end. The stand is fairly narrow reaching a maximum width of about 500 ft., but averaging less than 200.

2. Adjacent Vegetation and Topography: Vegetation adjacent to the Arroyo Mocho stand consists of non-native grassland, blue oak woodland, and agriculture (including vineyards and livestock pastures). Several private ranchettes exist nearby. The sycamores in this stand grow along single and multichannel reaches of Arroyo Mocho. Terraces are fairly narrow reaching widths of 300 ft or less and rise from 3 to 10 ft above adjacent stream channels. The substrate is derived from sedimentary alluvium, lake, playa, and terrace deposits. Silt comprises a majority of the surface material in the sampled areas, with sand and gravel comprising the remainder.

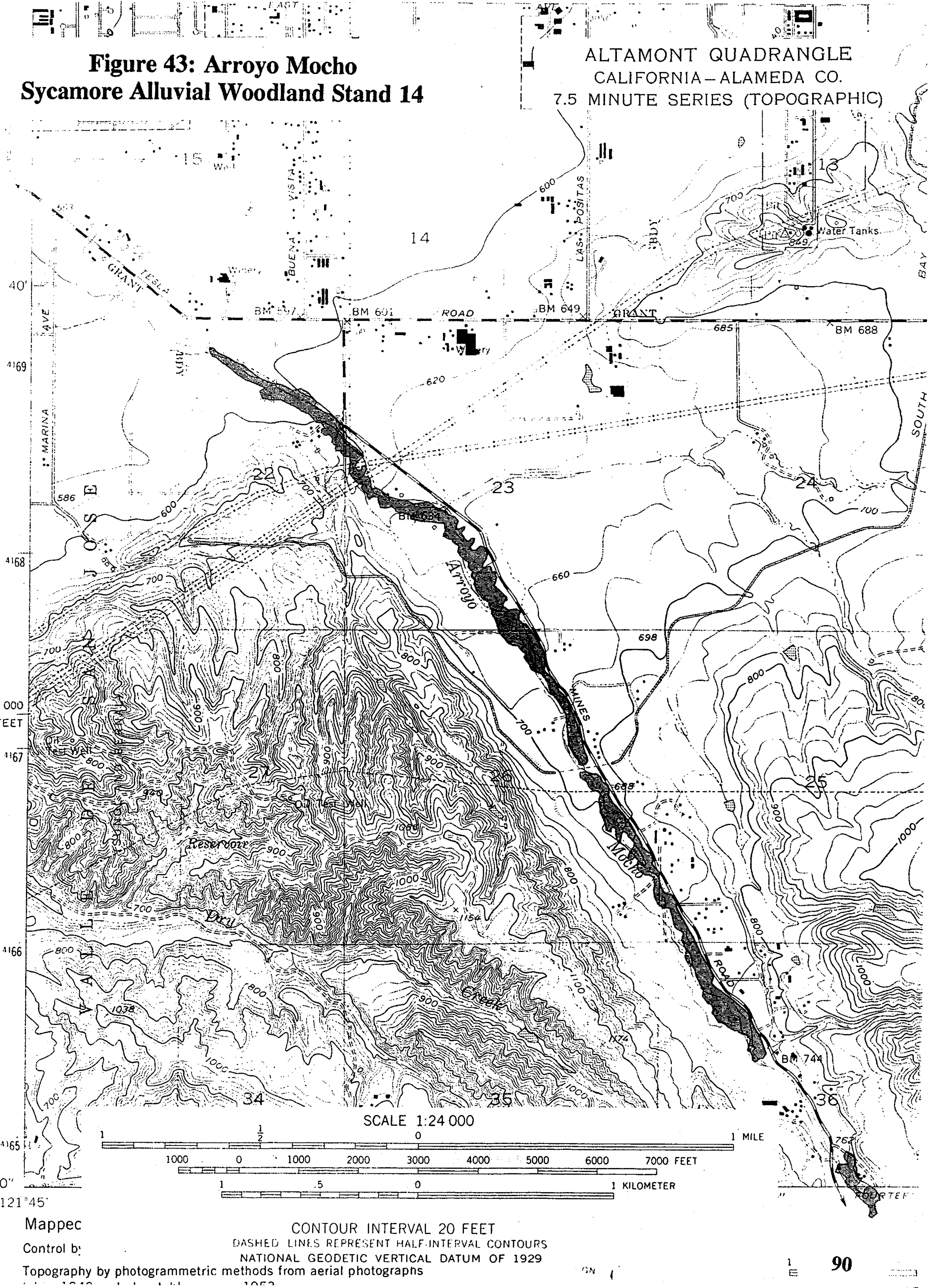
3. Estimated Density and Numbers of Sycamore Stems, Age of Stems, Reproduction: Based upon two samples, we estimate that 16,284 sycamore stems over 1 cm in diameter exist in this stand, with an average of approximately 44 stem per clump. The average stem diameter for trees exceeding 1 cm in diameter is 35.5 cm and the range of stem diameters is from 1.3 to 137.0 cm. The estimated growth rate of the largest trees in the stand is 4.2 rings/cm. We estimate the number of sucker sprouts in this stand to be 10,536, with 23.7 sprouts per clump, on the average. No seedlings or saplings were observed in this stand.

4. Variation in Cover and Association Type: Species diversity ranged from 10 to 26 in the understory with sycamore being the only tree in either sample. Red willows and Fremont cottonwoods are occasional at the upper reaches of the stand and a Fremont cottonwood-dominated stretch is responsible for the break in the stand at the upper end. The most common understory species are annual grasses such as *Bromus diandrus* and *Avena barbata.* Total ground cover is between 60 and 70%. Many of the sycamores in this stand are relatively small-statured (Figure 44).

TWINSPAN classifies each sample differently, regularly putting one into the mid-coastal alluvial group and the other into the interior alluvial group. Thus, this stand is a clear indication of the transitional nature of these two plant associations and supports our conservative lumping of the two groups into the broader category of Sycamore Alluvial Woodland.

5. Current Impacts to, and Condition of Stand: The sycamore trees in this stand are affected by a heavy anthracnose infestation resulting in die-off of branches and crown deformities. The trees exhibit wounds and large basal cavities. Damage due to grazing appears to be light and

Figure 43: Arroyo Mocho Sycamore Alluvial Woodland Stand 14



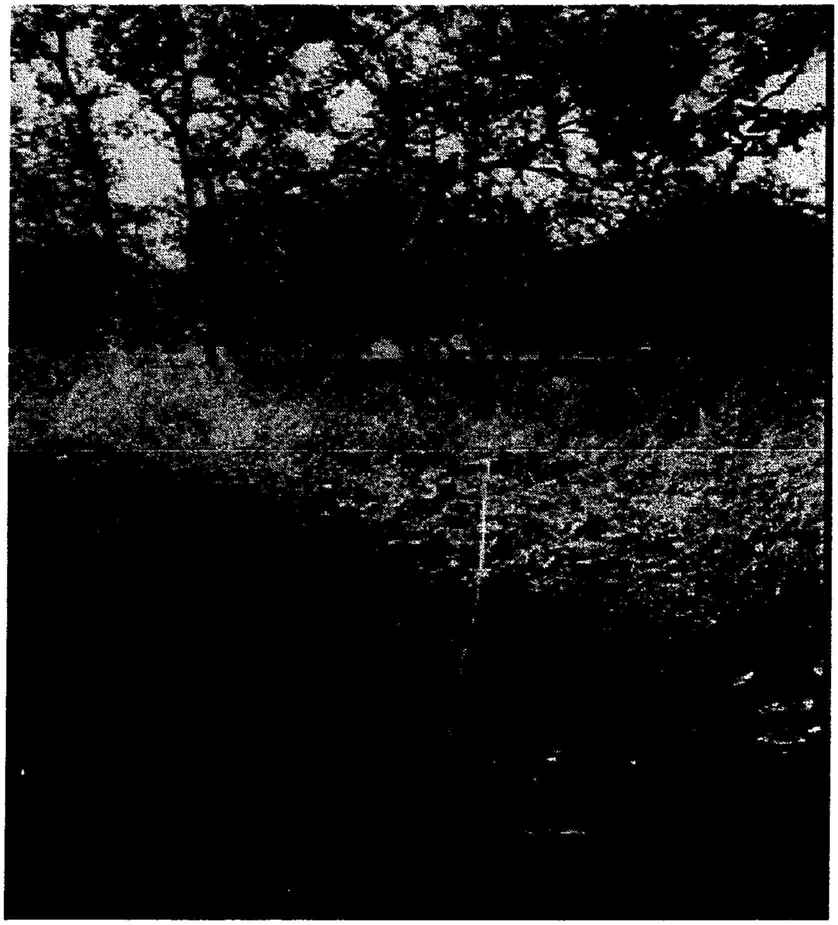


Figure 44. Arroyo Mocho Stand at One of its Widest Points (Transect #1) Showing the Small Stature of the Majority of Sycamores.

evidence of flooding appears in and adjacent to the streambed in the form of flood debris, bank erosion, and root exposure. Suburban development also exists adjacent to portions of the stand. The lower end of the stand has been reduced and truncated, a result of vineyards and access roads constructed up to the edge of the single creek channel. A series of high voltage power lines and the Hetch Hetchy aqueduct cross the stand at approximately the midpoint. Several dirt roads and bridges also traverse the stand.

Stand 15; North San Ardo, Monterey County

1. Stand Size, Distribution, and Surrounding Environment: The North San Ardo Stand covers approximately 62 acres (25.2 ha) along about 2 miles of the upper Salinas River along the upper alluvial terraces of the river beginning immediately north of the San Ardo Oil Field (Figure 45). The stand is patchy, broken into nine polygons separated by intervening annual grassland. The largest continuous portion of the stand is about 0.33 mile x 0.20 mile.

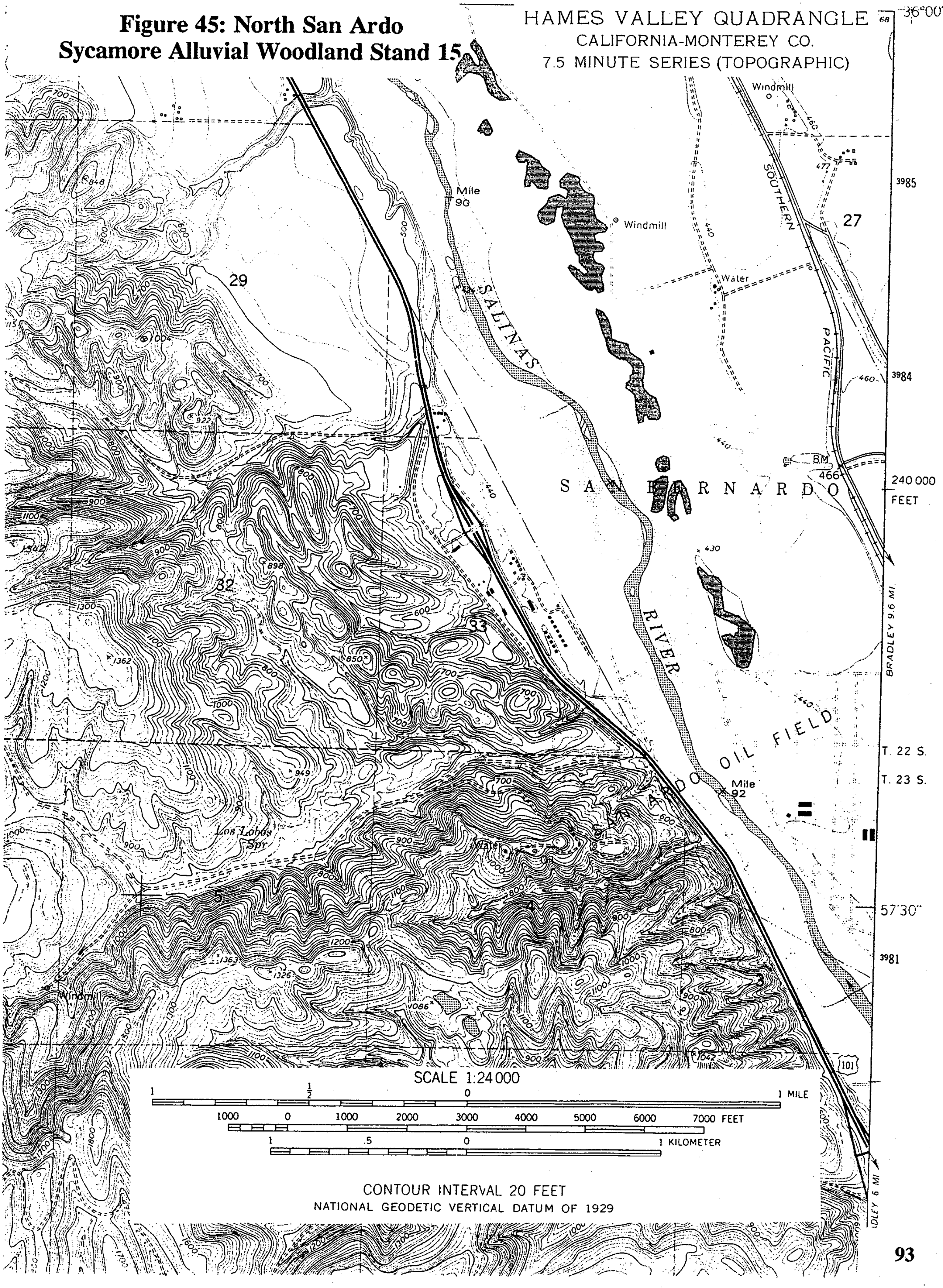
2. Adjacent Vegetation, Topography: The North San Ardo stand is surrounded by agriculture and annual grassland, with remnant stands of coast live oak and blue oak savanna. It occurs on the upper flood plain of the Salinas River in some cases between 0.25 and 0.50 mile away from the active channel. This terrace is over 1 mile in width and is largely taken over by agriculture and pasture land. This terrace at the point of the stand is over 20 ft above the active channel, separated by a steep bank. The channel is sandy and is dominated by narrow-leaf willow, *Salix hindsiana,* and Fremont cottonwood.

3. Estimated Density, Number of Sycamore Stems, Age of Stems, and Reproduction: Access to this stand was denied by the land owners. No quantitative sampling was conducted.

4. Variation in Cover and Association type: A binocular survey of two portions of the stand was made from a frontage road adjacent to Highway 101. The observers noted a sycamore-dominated woodland approximately 40-80 ft tall averaging about 50% cover. Within the stand, scattered Fremont cottonwood and red willow comprised less than 5% of the cover and there was about 1% cover by coast live oak. The herb layer was dense and dominated by annual introduced species. Trees in some polygons were openly spaced and in others relatively dense. In one dense area, sycamores formed a relatively narrow stringer with trees up to 90 ft tall, and coyote brush, *Baccharis pilularis,* formed an intermittent shrub layer over a dense layer of annual grasses.

5. Current Impacts to, and Condition of Stand: The North San Ardo Stand is currently unlikely to receive any flood disturbance as a result of dam control of the Salinas River and its major tributaries. Agriculture and grazing are significant surrounding impacts. Reproduction, unless initiated by human activities such as stem cutting is unlikely to occur under current conditions.

Figure 45: North San Ardo Sycamore Alluvial Woodland Stand 15



Stand 16; South San Ardo, Monterey County

1. Stand Size, Distribution, and Surrounding Environment: At 11.4 acres (4.6 ha), this is the smallest stand mapped in the project. It occurs approximately 3 miles south of the San Ardo Oil Field, about 5 miles south of the North San Ardo Salinas River stand, and about 4 miles north of the town of Bradley (Figure 46). It occupies the west bank of the Salinas River in a narrow band, broken into two patches.

2. Adjacent Vegetation, Topography: This stand is adjacent to fallow agricultural fields, annual grassland, open blue oak savanna, and Diablan sage scrub. The narrow band of sycamore woodland corresponds to the edge of an abandoned channel of the river, now elevated several feet above the active channels. The terrace it occupies is over 600 ft. wide.

3. Estimated Density and Numbers of Sycamore Stems, Age of Stems, Reproduction: Access to this stand was denied by the land owners. No quantitative sampling was conducted.

4. Variation in Cover and Association Type: The binocular survey of this site indicated a woodland of sycamores 45 to 70 ft tall with variable diameters (estimated mean maximum 80-90 cm). There was no evidence of basal clonal sprouts and most of the trees were single-stemmed. Mean cover was estimated at 25%. In addition to the dominant sycamore, red willow was estimated to cover 2% of the stand. A scattered shrubby understory of four-wing saltbush, *Atriplex lentiformis,* overlaid a dense herb layer dominated by annual grasses.

5. Current Impacts to, and Condition of Stand: As is the case with the North San Ardo Stand, this stand is currently unlikely to receive any flood disturbance as a result of dam control of the Salinas River and its major tributaries. The active channel is at least 10 ft below the upper terraces with sycamores. Agriculture and grazing are significant surrounding impacts. Reproduction, unless initiated by human activities such as stem cutting or anthropogenic fires, is unlikely to occur under current conditions.

Stand 17; San Antonio Creek, Alameda County

1. Stand Size, Distribution and Surrounding Environment: This stand covers 24 acres (10 ha) along about 0.66 mile of San Antonio Creek beginning only about 200 yd downstream from the base of the James H. Turner Dam and extending to approximately the crossing of Calaveras Road over San Antonio Creek (Figure 47). The stand is broken in the middle by a small intervening stand of coast live oak and valley oak riparian forest. The widest portion is near its upstream limits. It becomes a narrow riparian corridor for the lower half of its length (Figure 48). The lower reaches of the stand is only about 0.50 mile from the confluence of San Antonio Creek and Alameda Creek, which is in turn only about 1 mile north of the

**Figure 46: South San Ar
Sycamore Alluvial Woodland S**

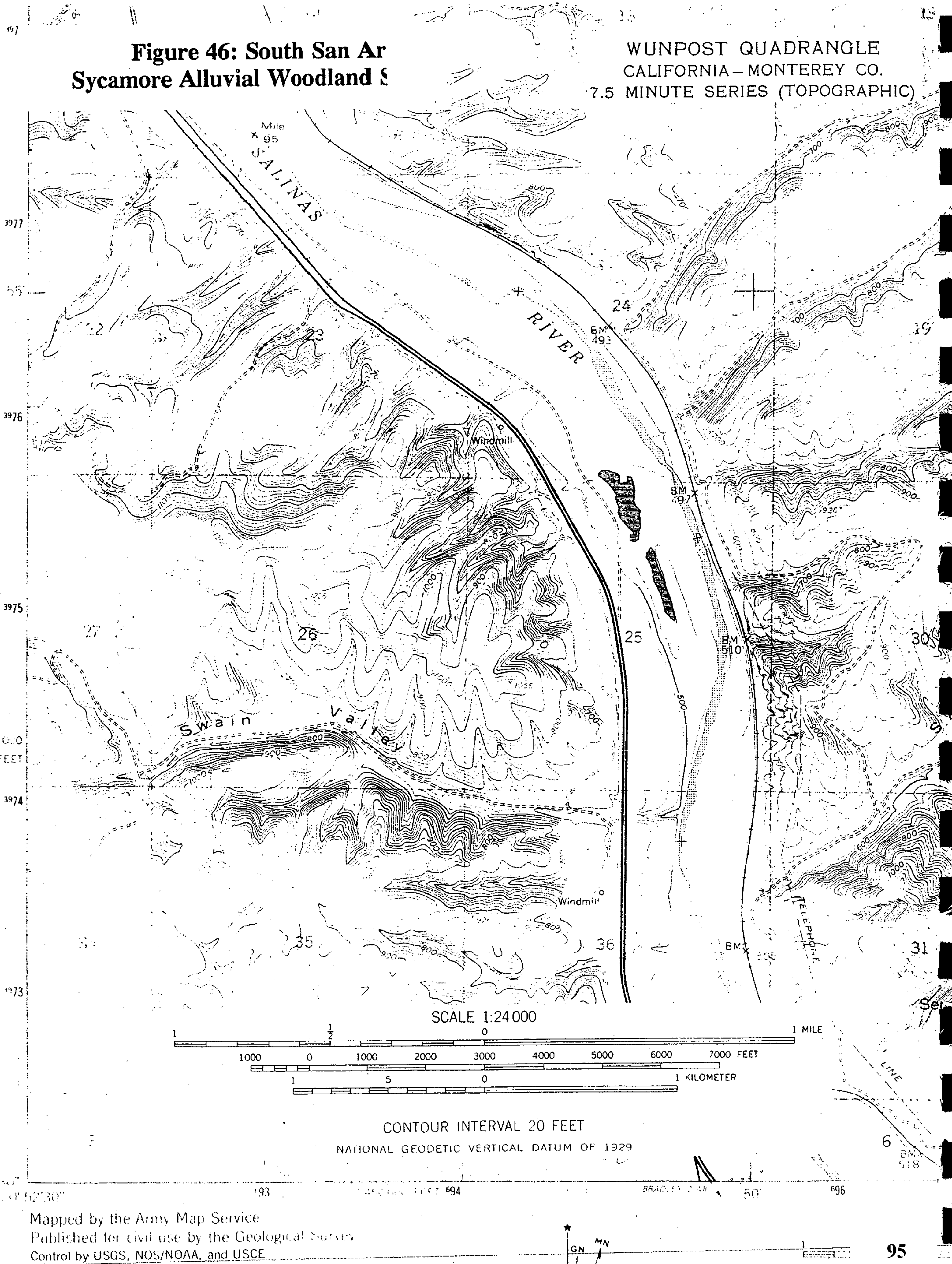
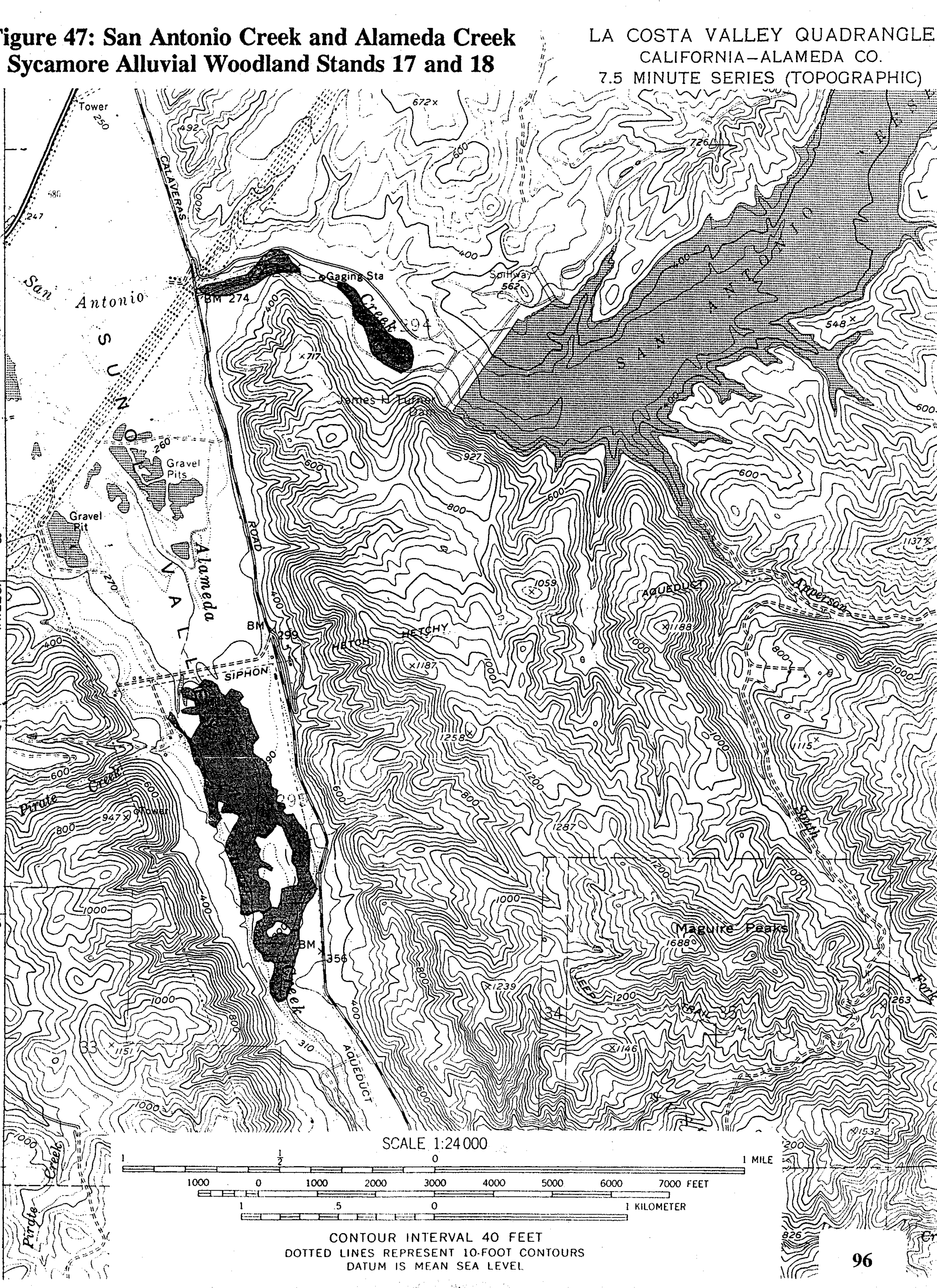


Figure 47: San Antonio Creek and Alameda Creek Sycamore Alluvial Woodland Stands 17 and 18



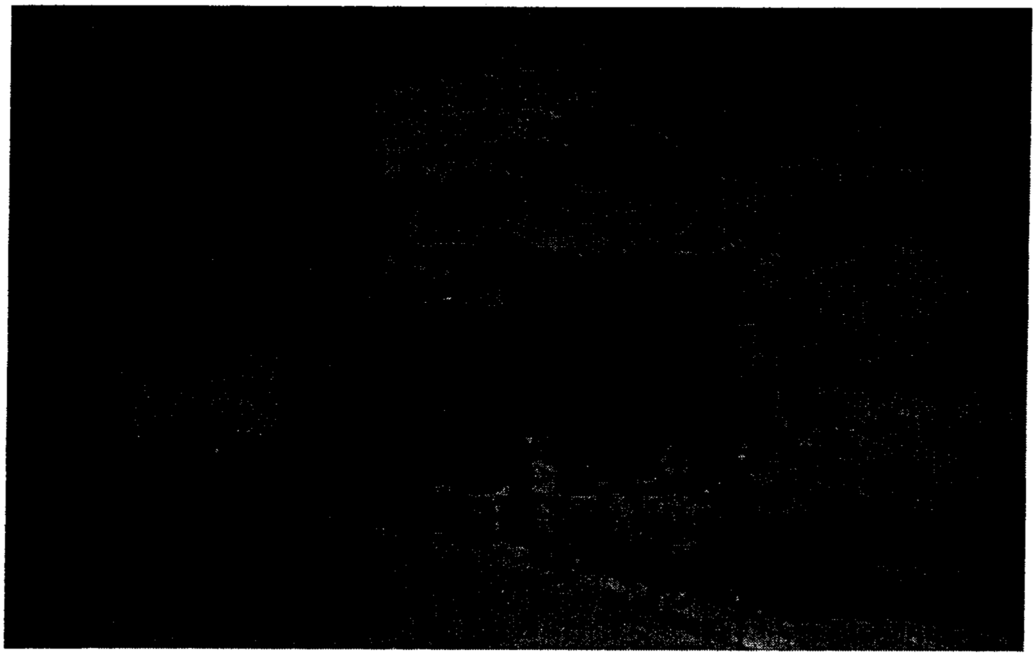


Figure 48. San Antonio Creek Stand from the Top of Turner Dam. View Shows the Majority of the Stand, Which is Widest at its Closest (Upstream) End and Narrows to a Stringer as it Turns Behind the Left Hill in the Distance.

northern-most extent of the Alameda Creek stand\1.

2. Adjacent Vegetation, Topography: This stand is bordered on the north primarily by annual grassland and open valley oak savanna and on the south by coast live oak woodland. Due to seepage under the dam, portions of the creekside within the stand are dominated by willows and herbaceous wetland species.

The stand occurs along the alluvial terraces of San Antonio Creek and is best developed on the southern terrace, which is several feet lower than the northern terrace, (and dominated by valley oak, not sycamore). Terrace deposits are up to 300 ft wide, ranging down to under 50 ft at the lower portions. The upper end of the stand shows evidence of multi-channel streambed. However, at the lower end the streambed is entrenched several feet from the surrounding terraces and is clearly a single channel.

The banks of the lower main channel are 3 to 6 ft high and are moderately steep. The banks of the upper channel are 1 to 3 ft high. In many areas of the upper part of the stand the northern bank is a steep cutbank while the southern bank is low and gradual. Silt predominates over sand in the substrate with no significant proportion of larger particles present. Parent material is derived from Pliocene-Pleistocene marine sedimentary rocks.

3. Estimated Density and Numbers of Sycamore Stems, Age of Stems, Reproduction: Based on two samples, we estimate that 15,855 sycamore stems over 1 cm in diameter exist in this stand, with an average of 8 stems per clump. The average stem diameter for trees over 1 cm dbh is 32.0 cm and the range of diameters is from 1.3 to 118.4 cm. The estimated growth rate of the average sized sycamores in this stand is 3.4 rings/cm, while the estimated growth rate of the largest trees in the stand is 4.8 rings/cm. We estimate the number of sucker sprouts in this stand to be 23,975, with 12 sprouts per clump, on the average. No seedlings or saplings were observed in this stand.

4. Variation in Cover and Association Type: The vegetation of this stand varies from essentially pure open sycamore-dominant canopy to a mixture of sycamore, valley oak, coast live oak, and California bay. This gradient runs westward along the creek with the highest tree mixtures occurring toward the downstream end of the stand (16% bay and 10% valley oak, with 69% sycamore cover). TWINSPAN classifies both samples at this site within the

\1. In a recent communication with Eric Gillies, a graduate student in biology at California State University Hayward, we learned of two small stands of Central California Sycamore Alluvial Woodland above San Antonio Reservoir approximately 2-3 miles upstream from this stand. These stands occur along the main forks of San Antonio Creek and Indian Creek, both in La Costa Valley. Portions of both of these stands are privately owned and we have not been able to access them. The former stand may be up to a mile in length, but is narrow and is probably similar in size to the lower San Antonio Creek stand. The Indian Creek stand is smaller and similarly narrow. Mr. Gillies is familiar with the classification differences between foothill and alluvial sycamore groups, and states that both of these stands are alluvial types. Further information about these stands is lacking at present.

mid-coastal group. Further divisions of TWINSPAN show the two samples hanging together under most applied permutations. Standard TWINSPAN runs place these samples along with samples at Pacheco and upper and lower Coyote creeks.

The shrub *Symphoricarpos rivularis* is present, averaging about 9% cover along with scattered shrubs of poison oak. The understory is dominated by the non-natives *Bromus diandrus* and *Carduus pycnocephalus*.

5. Current Impacts to, and Condition of Stand: This stand is subjected to moderately heavy grazing over much of the year. Cattle wallows in the flowing portions of the creek and streambank breakdown indicate long-term usage. The dam less than 0.25 mile upstream from the stand effectively prevents regular flooding events and also perpetuates a higher than normal moisture level in the creek through the dry season. Insect damage is light and anthracnose damage is moderately high on the sycamores throughout the stand. Access roads border the stand on both north and south banks of the creek. The lower end of the stand is truncated by the overcrossing of Calaveras Road and the right of way for PG&E power lines.

Stand 18; Alameda Creek, Alameda County

1. Stand Size, Distribution, and Surrounding Environment: The Alameda Creek stand covers 105 acres (42.7 ha) along 1.2 miles of Alameda Creek (see Figure 47). The stand occupies the broad alluvial bottomland of the creek and is surrounded by hills vegetated with coast live oak, California bay, and annual grassland. It extends from a point approximately 300 yds downstream from the crossing of the San Francisco Water Authority's filter plant road to approximately 0.25 mile above the gravel plant near Highway 680. The stand is nearly continuous with some inclusions of annual grassland (Figure 49). At the upper end, the sycamore-dominated vegetation gradually transcends into a mixed riparian terrace forest co-dominated by coast live oak, valley oak, California bay, and sycamore[\1].

2. Adjacent Vegetation, Topography: Annual grassland is the primary vegetation type associated with the three samples. The main sycamore stand grades upstream into coast live oak riparian woodland with a significant California bay and valley oak component. Two active channels dominated by mule fat bound the main body of the stand on the west and the east sides of the valley bottom. Terraces occur primarily on the inward sides of these two channels. The central width of the stand varies between 300 and 1200 ft. Terraces rise from 1 to 6 ft. above adjacent channels. The substrate is derived from Franciscan Formation sedimentary and metasedimentary rocks. The surface composition of the stand is

\1. Eric Gillies (pers. comm 1995) has also recently identified two additional small stands of alluvial sycamore stands along the mid and upper portions of Alameda Creek within and adjacent to the Sunol Regional Wilderness. These stands have not been visited yet, but from his description may be smaller than the 10 acre minimum size for inclusion in this study. The stands are approximately one mile upstream and three miles downstream from Camp Ohlone.

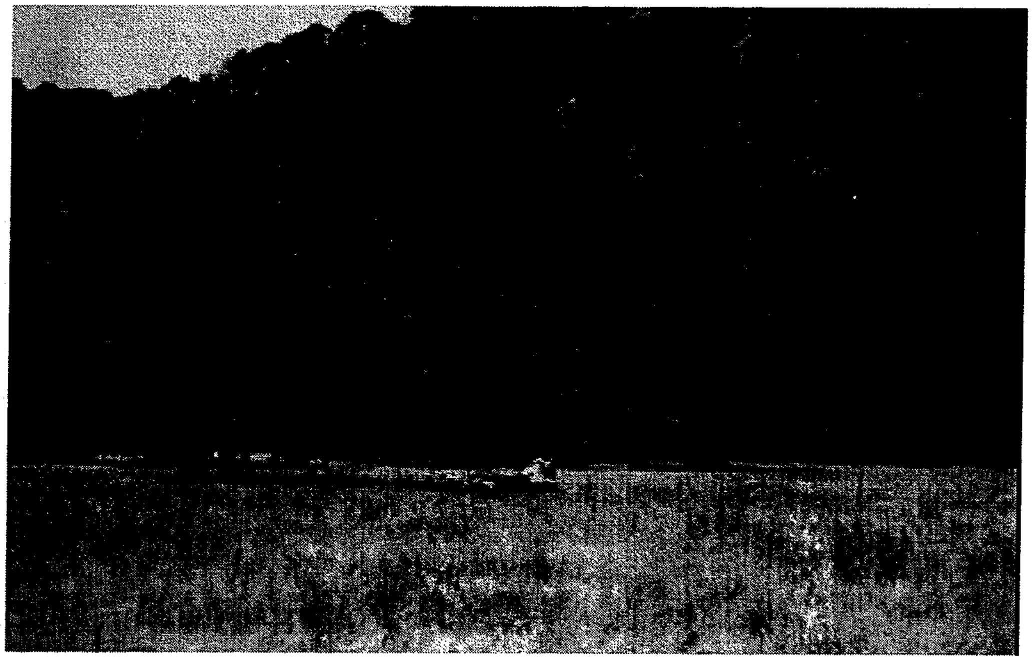


Figure 49. Alameda Creek Stand from Center of Annual Grassland Patch on Alluvial Bench Between the Two Main Channels of the Creek. Note Buckeye in Left Center and Hills Dominated by Coast Live Oak.

predominantly silt with some sand and small amounts of gravel and rock.

3. Estimated Density and Numbers of Sycamore Stems, Age of Stems, Reproduction: Based on three samples we estimate that there are 15,372 stems greater than 1 cm in diameter in the stand. The number of stems per clump averaged about four. The average stem diameter was 57.4 cm (range 9.7 to 115.0 cm). The estimated growth rate for average trees in rings per cm is 4.2 and the growth rate of the largest stems sampled is also 4.2 rings/cm. We estimate the number of sucker sprouts in the stand to be 56,876, with 16 sprouts per clump, on the average. No seedlings or saplings were noted in the stand.

4. Variation in Cover and Association Type: Coast live oak and valley oak are occasional members of the stand, sparingly distributed through the lower portion. California bay is a rare member of the main stand, but becomes more common along with the two oak species in the upper portion of the stand. Small trees of California buckeye and Mexican elderberry are widespread in the main stand and may form a distinct sub-canopy in some areas. Shrubs are uncommon and include *Symphoricarpos rivularis, Ribes* sp., and *Rhamnus crocea*, over a dense herb layer of the typical annual grass species.

TWINSPAN classifies all three samples as within the mid-coastal group, with close relations to Arroyo Valle, San Antonio, and Upper Coyote creeks stands.

5. Current Impacts and Condition of Stand: The sycamores in this stand are affected moderately to heavily by anthracnose and only lightly by lacebugs and other insects. Grazing impacts were observed to be moderate to heavy at all three samples with recent sucker sprouts having been browsed at one site. Cattle were present throughout much of the late summer of 1993. Adjacent to the entire eastern side of the stand are large commercial tree nurseries. At least one of which has modified the bottomland valley zone in the northeastern portion of the stand by clearing understory vegetation and replacing it with dirt roads and potted trees. Gravel mining operations occur approximately 0.25 mile downstream from the stand and a dam impeding about half of the natural drainage into the site occurs about 2 miles upstream.

RANKING OF STAND VIABILITY AND QUALITY

The 17 CCSAW sites mapped and described in this report exhibit a range of quality based on several criteria commonly used to judge ecological reserves. This section is an attempt to evaluate the sites of this community.

Because of the varied natural ecosystem values of the Central California Sycamore Alluvial Woodland vegetation, it is important to represent the range of values in any stand quality assessment. For example, species that use the sycamore stands for nesting and shelter, may view the larger stands as most important, yet species that require edges of riparian habitat and value the juxtaposition of divergent vegetation types may value the more broken, fragmented stands most highly. Thus, we have attempted to establish two weighting systems for evaluating both the viability and the quality of the 17 stands. Both systems rely upon the same basic criteria. However, the first ranking is based on the classic ideas of preserve design; that "bigger is better" in terms of the size of the stands and their effect on the interdependent species of plants and animals associated with them. In this case the largest sized stands were weighted (by using a multiplier) more heavily than the smaller stands.

The second ranking relies upon an unweighted view of stand size and simply assigns a given value of 1 through five to a stand based on size. The second ranking also views fragmentation and shape differently. Instead of giving the lowest values to the most highly fragmented, narrow stands, it evaluates the stands on their perimeter length and on their number of individual polygons. Thus, the stands with the greatest amount of "edge" and those most highly fragmented, are given higher value (see below for further explanation).

The following criteria were used to judge the site viability and quality of all stands. Please note the differences between ranking type a and type b for criteria 1 and 2:

1. Size
Logic for ranking a: The size of a site is an important aspect in ecological preserve design. The greater the area of a preserve, the higher the capacity to buffer external threats and the more likely it is to operate as a unified ecosystem. A size multiplier was incorporated to account for the area of SAW at each stand as follows: <50 acres x 1, 50-100 acres x 2, 100-200 acres x 3, 200-300 acres x 4, and >300 acres x 5.

Logic for ranking b: Size may be an indication of the integrity of a habitat for some species, but is not necessarily the most important criteria, and may not warrant a weighting factor. Because the entire extent of the Central California Sycamore Alluvial Woodland community is small, it is clear that the largest sites afford the best mitigation for possible losses at other sites. Thus, large sized stands are ranked more highly than small in the following way: <50 acres=1 point, 50-100 acres=2 points, 100-200 acres=3 points, 200-300 acres=4 points, and >300 acres=5 points.

2. Fragmentation and shape of a stand
Logic for ranking a: Fragmentation is a function of size and shape. The more a stand is broken up into isolated clumps, the more likely it is to receive external threats due to a greater proportion of its edge exposed to adjacent habitat. These threats could include such things as grazing, insect damage, weed invasion, exposure of hidden prey to predators, and cowbird nest parasitism. The more distant these clumps are from each other, the less likely the stand will contain features of a unified ecosystem. Long, narrow stands also expose larger circumference-to-area ratios than circular stands. Any area with a greater proportion of edge to mass will be subjected to negative "edge effects" as listed above.

Fragmentation and shape were synthesized into four categories (with corresponding points given for each) based on the estimated circumference/area ratio of each stand as follows: 1 point) highly fragmented - few to many well-isolated polygons composing majority of stand with no polygons >200 m in diameter, 2 points) fragmented, but with some polygons >200 m in diameter and less space between, 3 points) majority of stand composed of polygons >200 m in diameter.

Logic for ranking b: Although fragmentation and narrow stands may be detrimental for species that require large contiguous groves of sycamores, there are numerous species that also require large edge-to-area ratios. Moreover, riparian and alluvial stands of sycamores are not typically broad and are often naturally fragmented. To reflect the value for edge species or species requiring juxtaposition of several habitats (e.g., other riparian and herbaceous communities which may occur adjacent to sycamore stands) we have based a ranking on the perimeter values and the total number of polygons for each of the 17 stands. Perimeters were calculated using algorithms in the ARC-INFO GIS analysis and are the sum of all polygon perimeters in each stand. The following ratings were given: <5 km=1 point, 5-10 km=2 points, 10-20 km=3 points, 20-30 km=4 points, >30 km=5 points. Stands with <5 polygons were given a score of 1 point, 5-10=2 points, 10-15=3 points, 15-25=4 points, and >25=5 points. The perimeter and polygon number classes were added to make the combined score for the fragmentation/edge value in ranking criteria b.

3. Interruption of Natural Hydrologic Regime

This factor, caused primarily by dams upstream from the site, is considered the single most important factor in arresting the natural processes that perpetuate and enlarge stands of SAW. It includes removal of regular large-scale flooding necessary for clearing sites for initiation of sexual reproduction, and disturbance and injury promoting asexual regeneration. It also can cause either seasonally unnaturally elevated or reduced moisture content of the substrate. High soil moisture in summer (due to seepage or water release from dams) encourages other more hydrophilic riparian species such as willows to dominate and thus, contributes to type-conversion. Reduced moisture during winter and spring (due to impoundment) may cause insufficient ground water recharge, resulting in unnaturally low water tables, and reduced vigor or death of sycamores.

There are numerous additional extenuating factors which, if identified, could modify this ranking criteria. For example, dams which export water may have a greater detrimental effect to down-stream sycamore stands than those that are just used for flood control. Also, fine-tuning of the amount of up-stream drainage area controlled by dams could lend a more realistic view of the relative effects of dams on a given sycamore stand. However, due to lack of this detailed information we have assigned the following default rankings based on damming: A score of 4 points was given to every site that did not have a dam upstream. A score of 2 points was given to sites that had a dam upstream on a tributary, but also had major undammed tributaries upstream. A score of 1 point was given to stands that had major dams pimmediately upstream from them with the majority of natural through-flow impeded.

4. Gravel Mining

This activity, depending on its intensity, can strongly affect the water table within stands as well as actively destroy trees and remove understory vegetation. Even gravel mining as much as a half-mile downstream from sites can cause water table drops and rapidly increase headwall erosion (e.g., undercutting of stream channel escarpment created by gravel excavation) into the stands. A score of 3 points was given to sites without appreciable gravel mining, 2 points were given to sites with moderate gravel mining impacts, and 1 point was given to sites with intensive gravel mining.

5. Grazing

Persistent livestock grazing and browsing has a negative impact on asexual and sexual reproduction. It also reduces herbaceous cover of native species and increases cover of weedy, unpalatable non-native understory herbs, reducing the quality of the natural ecosystem. A score of 3 points was given to sites with light grazing impacts, 2 points for moderate impacts, and 1 point for heavy grazing.

6. Other Human Impacts

This category includes the effects of roads and highways, aqueducts, high voltage power lines, agriculture, and buildings and other structures adjacent to, or intruding into or across stands. The result of all of these impacts is to reduce the site's effectiveness as a naturally functioning ecosystem by reducing wildlife value, natural emigration and immigration of component species, and connectivity to other natural areas. Sites were given a score of 3 points for low impacts of this type, 2 points for moderate impacts, and 1 point for heavy impacts.

Table 8 summarizes the ranking and the weighting factors for all sites by the six aforementioned categories using ranking system a. Scores are arrived at by adding the points given to criteria 2 through 6 as discussed above, and multiplying the sum by the size factor (criteria 1).

This analysis indicates that Los Banos Creek has a much higher score than any other stand. It is the only site that consistently ranks high in all six categories. Orestimba Creek ranks second and the Dry Creek and Arroyo Valle stands are tied for third, followed by the Nacimiento River and Mill Creek stands.

Table 9 summarizes the results of the ranking option b. Scores were arrived at by summing the total of the six criteria across the rows. Again, Los Banos Creek is the highest scoring followed by Orestimba Creek. Tied for third place are the Dry Creek and Nacimiento River stands, and tied for fourth place are the Pacheco Creek and Mill Creek stands.

Table 8. Stand Viability Ranking for the 17 Stands of Sycamore Alluvial Woodland (ranking type a: stand size emphasis).

STAND	*Individual Disturbance*				*Disturbance Total*	Fragmentation and Shape	Size	*Stand Total*
	Dams	Gravel mines	Grazing	Other				
Los Banos Creek	4	3	2	3	12	3	x5	75
Orestimba Creek	4	2	2	2	10	3	x4	52
Dry Creek	4	1\2	2	2\3	9	2\1	x4	44
Arroyo Valle	1	2	3	2	8	3	x4	44
Nacimiento River	4	3	3	3	13	1	x3	42
Mill Creek	4	2	1	1	8	2	x4	40
Alameda Creek	2\4	2	2	2	8	2	x3	30
Pacheco Creek	2	1	2	2	7	2	x3	27
Arroyo Mocho	4	3	2	1	10	1	x2	22
North San Ardo	2	3	2	2	9	1	x2	20
Deer Creek	4	3	1\5	3	11	3	x1	14
Upper Coyote Creek	4	3	2	2	11	2	x1	13
South Tule River	4	3	2	2	11	1	x1	12
Little Dry Creek	4	3	2	1	10	1	x1	11
South San Ardo	2	3	2	2	9	1	x1	10
San Antonio Creek	1	3	2	2	8	1	x1	9
Coyote Creek	1	2	3	1	7	1	1	8

\1. Most polygons at Dry Creek are <200 m across.
\2. Dry Creek has the most intensive gravel mining of any stand.
\3. Dry Creek has roads and agriculture in and adjacent to stand.
\4. Upstream from the Alameda Creek stand, its major tributary, Arroyo Hondo, is dammed at Calaveras Reservoir.
\5. The Deer Creek stand is adjacent to a livestock gathering area and series of corrals, which heavily impact portions of the stand.

Table 9. Stand Quality Ranking for the 17 Stands of Sycamore Alluvial Woodland (ranking type b: stand fragmentation emphasis).

STAND	*Individual Disturbance*				*Disturbance Total*	Perimeter + Total Polygon Number per Stand	Size	*Stand Total*
	Dams	Gravel Mines	Grazing	Other				
Los Banos Creek	4	3	2	3	12	5+4	5	26
Orestimba Creek	4	2	2	2	10	5+5	4	24
Nacimiento River	4	3	3	3	13	3+3	3	22
Dry Creek	4	1	2	2	9	5+4	4	22
Mill Creek	4	2	1	1	8	4+3	4	19
Pacheco Creek	2	1	2	2	7	4+5	3	19
Arroyo Valle	1	2	3	2	8	4+2	4	18
Arroyo Mocho	4	3	2	1	10	3+1	2	16
North San Ardo	2	3	2	2	9	3+2	2	16
Upper Coyote Creek	4	3	2	2	11	2+2	1	16
Deer Creek	4	3	1	3	11	2+1	1	15
S. Tule River	4	3	2	2	11	1+1	1	14
Alameda Creek	2	2	2	2	8	2+1	3	14
Little Dry Creek	4	3	2	1	10	1+1	1	13
South San Ardo	2	3	2	2	9	1+1	1	12
San Antonio Creek	1	3	2	2	8	1+1	1	11
Coyote Creek	1	2	3	1	7	2+1	1	11

The similar ranking of the Los Banos Creek, Orestimba Creek, Dry Creek, Nacimiento River, and Mill Creek stands, using either criteria a or b, suggests that these sites are of greatest value for species requiring large extents of sycamore woodland habitat as well as those requiring the largest proportion of fragmentation and edge-effects. The fact that the Los Banos Creek stand exceeds all other stands in either analysis also points to its singular value as the best remaining stand of this vegetation type.

CONCLUDING REMARKS

This study indicates that Central California Sycamore Alluvial Woodland is indeed a rare natural community, restricted to just 17 sites with a total area of slightly over 2,000 acres. Unknown to us before, it actually consists of two closely related plant associations, the mid-coastal and the interior alluvial groups. These associations share many of the same environmental characteristics (e.g., fine-grained alluvium, low stream gradients, numerous shared plant species), but differ principally by climate (primarily by summer temperature regime), and minor species composition (e.g., coastal stands have some coast live oak and California bay). This study also shows that western sycamore vegetation in California is diverse, with types distinguished in the foothill stream-side areas (the foothill group) and several, as yet undifferentiated groups in the south-coastal area of the state.

The standard scientific criteria used to distinguish between different plant communities are met in this study. Analysis of the samples has shown that there are distinct ecological groupings of sycamore-dominated samples that are associated with certain environmental variables. Although western sycamore is a common tree it may form very rare and distinct communities based on certain combinations of ecological situations. This fact underscores the basis of ecological communities - that they are combinations of species and abiotic factors, which sort out along environmental gradients.

The specific geographic location of a given CCSAW stand is a result of numerous interacting environmental factors, both natural and human-mediated. Central California Sycamore Alluvial Woodland is not found at upstream sites because it transcends into the foothill group after the loss of substantial alluvial benches. It also does not occur downstream below where the intermittent streams debauch onto the broad San Joaquin or other valley floors.

Some of the downstream limitation has to do with loss of habitat due to human alteration. Typically the intermittent streams in these areas are heavily disturbed by agriculture, gravel mining, and development. These intermittent streams, in many cases, join with larger permanent streams which support riparian forests of more hydrophilic trees such as cottonwoods and willows. Isolated stands along the Salinas river and isolated individual sycamores along several of the lower reaches of southern Sierra streams suggest that CCSAW once grew more extensively in these sites.

In some cases hydrophilic riparian communities may line a stream and the less-hydrophilic CCSAW may have occurred at the outer edges of the stream's floodplain (e.g., the outer edge of the 100 year floodplain). In these cases such as along the Salinas River at the two San Ardo stands, the communities have typically been altered and reduced by agriculture. However, in more cases there does seem to be a distinct zone of preference along a linear extent of stream.

It is probably not coincidental that the zone of highest likelihood of CCSAW is the area where floods are first able to outwash out onto broad flood plains, where the full force of floods emerging from the mountains and the foothills is available to disturb and lay the bed for the regeneration of large stands of sycamores, and where moisture from these streams quickly percolates into the deep alluvial deposits that surround the troughs of the large structural valleys of the state. Yet, only with additional sampling and analysis of all adjacent and ecologically related riparian forests will a full understanding of the environmental setting of CCSAW be gained.

Much discussion has taken place over the possibility of creating more Sycamore Alluvial Woodland by mimicking the conditions necessary for the community. In addition to the alluvial, intermittent stream bench location, periodic broad-scale floods, rare high moisture conditions in the spring growing season (fostering seedling establishment), low browsing pressure, and reduction of the anthracnose levels that plague successful fruiting of seeds are among some of the factors needed for persistence and spread of this community. However, given the current understanding, the complexity of conditions necessary in order for SAW to persist, expand, or be restored is prohibitive.

Historical accounts of the extent of sycamores in the Coast Ranges of California suggest that natural limitation is a strong factor in the current distribution of CCSAW. Reports of the last century (e.g., W.H. Brewer in Farquhar 1966 and see discussion in Griffin and Critchfield) suggest that sycamores were locally distributed and many of the areas that lack stands of them today, lacked them then. It is likely that due to the exacting requirements of this community, CCSAW is naturally limited to a few sites. Now many of these sites are severely impacted by human effects and have a greatly diminished capacity for carrying on the processes of a natural ecosystem.

The quality of the 17 stands of CCSAW varies based on the criteria used to assess them in this report. The Los Banos Creek stand includes slightly over 21% of the entire acreage of this community and is the best quality site.

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Appendix A

Individuals Contacted for Location Information of Sycamore Stands

Appendix A

Individuals Contacted for Location Information of Sycamore Stands

Dr. John Stebbins, Professor of Biology, Fresno State University (additional sites in S.Sierra)

Tom Griggs, The Nature Conservancy (additional sites in S. Cal. and S. Sierra)

Wayne Ferren, University of California, Santa Barbara Herbarium (additional sites in S. Cal. and related sycamore vegetation)

Brad Olson, Oakland Port Authority, California Native Plant Society East Bay Chapter (status and location of Diablo Range sites)

Dr. John Little, Sycamore Associates, Sacramento (status of S. coast Range sites)

Monica Finn, Ecologist, California Department of Transportation Los Angeles (location and ecology of s. Cal. sycamore sites)

Eric Gillies, Graduate Student in Biology, California State University, Hayward. (distribution of sycamore woodlands in the Diablo Range)

Deborah Hillyard, Plant Ecologist, DFG, Region 3 (relationship and location of outer coastal sycamore stands Santa Cruz and Monterey Counties)

Dr. Mark Borchert, Zone Ecologist, Los Padres National Forest (location and ecological relationships of S. coastal sycamore stands)

Peter DeSimone, Reserve Manager Starr Ranch Audubon Reserve, Orange County (location of S. Cal. sycamore stands)

James Dice, Plant Ecologist, DFG, Region 5 (location of sycamore stands in S. Cal)

Donald Mullally, Los Angeles County Parks Department (location of S. California sycamore stands)

Appendix B

Plant Species Identified on the 86 Sycamore Vegetation Samples

Appendix B

Plant Species Identified on the 86 Sycamore Vegetation Samples

Although the new Jepson Manual (Hickman 1993) was published during the writing of this report, it was not available before most of the identifications of specimens from the samples were made. Because nomenclature of many of these species have changed since the new Jepson treatment (including collapsing and splitting of taxa), we have opted for consistency of identification in this report. Therefore, herein the taxonomy follows the previous authority on California plants, Munz (1968). Because the sampling protocol required identification of individual species by structural layer we have coded tree, shrub, and herb-size individuals of the same species differently (for example see *Aesculus californica*). Thus, although 462 entities have been identified, the actual total number of taxa is somewhat less. Taxa are arranged alphabetically.

Species number	Species name	Species code
3	*Aesculus californica* herb	AECA 2H
2	*Aesculus californica* shrub	AECA 2S
1	*Aesculus californica* tree	AECA 2T
4	*Agoseris* sp.	AGO-1
351	*Agrostis semiverticillata*	AGSE
5	*Agrostis* sp.	AGR-2
352	*Aira caryophyllea*	AICA
6	*Aira elegans*	AIEL
7	*Alchemilla occidentalis*	ALOC-1
354	*Alnus rhombifolia* herb	ALRHH
353	*Alnus rhombifolia* shrub	ALRHS
8	*Amaranthus albus*	AMAL
9	*Amaranthus blitoides*	AMBL
355	*Amaranthus californicus*	AMCA-1

Appendix B (cont.) Plant Species Identified on 86 Sycamore Vegetation Samples.

Species number	Species name	Species code
10	*Amaranthus palmeri*	AMPA-1
356	*Amaranthus retroflexus*	AMRE
11	*Ambrosia acanthocarpa*	AMAC
12	*Amsinckia* sp.	AMS-1
13	*Anagallis arvensis*	ANAR-2
357	*Anthemis cotula*	ANCO-2
14	*Arabidopsis thaliana*	ARTH
358	*Arctium lappa*	ARLA-1
15	*Arenaria* sp.	ARE-3
16	*Artemisia californica* herb	ARCA-7H
17	*Artemisia californica* shrub	ARCA-7S
18	*Artemisia douglasiana*	ARDO-3
19	*Artemisia dracunculus*	ARDR-1
20	*Arundo donax* herb	ARDO-1H
21	*Arundo donax* tree	ARDO-1T
22	*Asclepias fascicularis*	ASFA
359	*Astragalus* sp.	AST83
360	*Atriplex* sp.	ATR81
23	*Avena barbata*	AVBA
24	*Avena fatua*	AVFA
25	*Avena* sp.	AVE
26	*Azolla* sp.	AZO
27	*Baccharis pilularis*	BAPI
28	*Baccharis pilularis consanguinea* shrub	BAPIC

Appendix B (cont.) Plant Species Identified on 86 Sycamore Vegetation Samples.

Species number	Species name	Species code
29	*Baccharis viminea* herb	BAVIH
30	*Baccharis viminea* shrub	BAVIS
31	*Barbarea* sp.	BAR-3
32	*Benitoa occidentalis*	BEOC-1
33	*Bloomeria crocea*	BLCR
34	Blue-green algae mat	ALGA
35	*Boisduvalia densiflora*	BODE
361	*Boisduvalia* sp.	BOI
362	*Boisduvalia stricta*	BOST-1
36	*Boraginaceae* sp.	BORAGI
37	*Brassica geniculata*	BRGE
38	*Brassica nigra* herb	BRNIH
39	*Brassica nigra* shrub	BRNIS
40	*Brickellia californica*	BRCA-5
363	*Brodiaea pulchella*	BRPU
41	*Bromus arenarius*	BRAR-1
42	*Bromus carinatus*	BRCA-1
43	*Bromus diandrus*	BRDI-2
44	*Bromus madritensis*	BRMA-2
45	*Bromus marginatus*	BRMA-3
46	*Bromus mollis*	BRMO-2
47	*Bromus rigidus*	BRRI-2
48	*Bromus rubens*	BRRU
49	*Bromus tectorum*	BRTE

Appendix B (cont.) Plant Species Identified on 86 Sycamore Vegetation Samples.

Species number	Species name	Species code
50	*Bromus willdenovii*	BRWI
51	*Calandrinia* sp.	CAL-2
349	*Calycanthus occidentalis* herb	CAOC-2H
52	*Calycanthus occidentalis* shrub	CAOC-2
53	*Calystegia macrostegia* ssp.	CAMA-8
54	*Camissonia* sp.	CAM-8
55	*Carduus pycnocephalus*	CAPY-2
56	*Carduus tenuiflorus*	CATE-4
57	*Carex* sp.	CAR-1
58	*Carex (stoloniferous)*	CASPST
59	*Castilleja* sp.	CAS-3
60	*Castilleja stenantha*	CAST-4
61	*Ceanothus crassifolius* shrub	CECR
62	*Ceanothus cuneatus*	CECU-2
63	*Ceanothus sorediatus*	CES0-3
64	*Centaurea melitensis*	CEME-1
65	*Centaurea solstitialis*	CESO-1
364	*Centaurium muhlenbergii*	CEMU-2
66	*Centaurium* sp.	CEN-5
67	*Cephalanthus occidentalis californicus* shrub	CEOCC
365	*Cerastium* sp.	CER-3
68	*Cerastium viscosum*	CEVI
69	*Chaenactes glabriscula*	CHGL1
458	*Chenopodium album*	CHAL-3

Appendix B (cont.) Plant Species Identified on 86 Sycamore Vegetation Samples.

Species number	Species name	Species code
366	*Chenopodium ambrosiodes*	CHAM
462	*Chenopodium berlanderi sinuatum*	CHBES
70	*Chenopodium californicum*	CHCA-2
71	*Chenopodium murale*	CHMU-2
367	*Chlorogalum pomeridianum*	CHPO-1
72	*Chorizanthe* sp.	CHO-2
73	*Chrysopsis oregona* var *rudis*	CHORR
74	*Cichorieae* sp.	CISP
75	*Cirsium vulgare*	CIVU
76	*Clarkia purpurea*	CLPU
368	*Collinsia* sp.	COL-4
77	*Conium maculatum*	COMA
78	*Conyza canadensis*	COCA-2
79	*Corethrogyne filaginifolia* var. *bernardina*	COFIB1
80	*Corethrogyne filaginifolia* var. *peirsonii*	COFIP1
81	*Crypsus niliacea*	CRNI
82	*Cryptantha flaccida*	CRFL-1
83	*Cucurbita palmata*	CUPA
84	*Cynodon dactylon*	CYDA
85	*Cynosurus echinatus*	CYEC
87	*Cyperus eragrostis*	CYER-1
369	*Cyperus niger* var. *capitatus*	CYNIC
370	*Cyperus niger rivularis*	CYNIR
86	*Cyperus* sp.	CYP-3

Appendix B (cont.) Plant Species Identified on 86 Sycamore Vegetation Samples.

Species number	Species name	Species code
88	*Datisca glomerata*	DAGL-2
90	*Datura meteloides*	DAME
89	*Datura* sp.	DAT-4
371	*Daucus pusillus*	DAPU
91	*Digitaria sanguinalis*	DISA
92	*Dipsacus sativus*	DISA-2
93	*Distichlis spicata*	DISP
94	*Echinochloa crusgallii*	ECCR
372	*Eleocharis macrostachya*	ELMA-2
373	*Eleocharis palustris*	ELPA-3
95	*Eleocharis* sp.	ELE-4
97	*Elymus caput-medusae*	ELCA-2
98	*Elymus condensatus*	ELCO
99	*Elymus glaucus*	ELGL
100	*Elymus tritichoides*	ELTR
101	*Encelia californica*	ENCA
102	*Epilobium adenocualon* ssp. *holosericeum*	EPADH
103	*Epilobium adenoculon* ssp. *parishii*	EPADP
374	*Epilobium ciliatum*	EPCI
104	*Epilobium paniculatum*	EPPA
375	*Equisetum hyemale* var. *californicum*	EQHYC
105	*Equisetum laevigatum*	EQLA
376	*Eragrostis hypnoides*	ERHY
106	*Eremocarpus setigerus*	ERSE

Appendix B (cont.) Plant Species Identified on 86 Sycamore Vegetation Samples.

Species number	Species name	Species code
107	*Erigeron foliosus*	ERFO
108	*Eriodyction crassifolium*	ERCR-2
109	*Eriogonum cinereum*	ERCI
110	*Eriogonum fasciculatum*	ERFA
111	*Eriogonum fasciculatum* var. *polifolium*	ERFAP
112	*Eriogonum gracile*	ERGR-3
113	*Eriogonum gracile* var. *citharaeforme*	ERGRC
114	*Eriogonum roseum*	ERRO-2
115	*Eriophyllum confertiflorum*	ERCO-7
116	*Erodium botrys*	ERBO
117	*Erodium cicutarium*	ERCI-2
118	*Erodium moschatum*	ERMO-4
119	*Eschscholzia californica*	ESCA-2
120	*Euphorbia ocellata*	EUOC-2
121	*Euphorbia polycarpa*	EUPO-1
377	*Euphorbia serpyllifolia*	EUSE-1
457	*Euphorbia serpyllifolia* var *serpyllifolia*	EUSES
378	*Euphorbia serpyllifolia* var. *hirtula*	EUSEH
122	*Euphorbia supina*	EUSU
379	*Festuca confusa*	FECO
124	*Festuca dertonensis*	FEDE
125	*Festuca megalura*	FEME
126	*Festuca myuros*	FEMY
127	*Festuca pacifica*	FEPA

Appendix B (cont.) Plant Species Identified on 86 Sycamore Vegetation Samples.

Species number	Species name	Species code
128	*Festuca reflexa*	FERE
123	*Festuca* sp.	FES-3
380	*Filago californica*	FICA-2
129	*Filago gallica*	FIGA
130	*Foeniculum vulgare*	FOVU
346	*Fraxinus latifolia* herb	FRLA-2H
131	*Fraxinus latifolia* tree	FRLA-2T
132	*Galium angustifolium*	GAAN-2
133	*Galium aparine*	GAAP
381	*Galium murale*	GAMU-1
134	*Galium parisiense*	GAPA-2
135	*Galium* sp.	GAL-4
382	*Gastridium ventricosum*	GAVE-1
383	*Geranium dissectum*	GEDI
384	*Geranium molle*	GEMO
137	*Gilia capitata*	GICA-4
136	*Gilia* sp.	GIL-1
139	*Gilia tricolor*	GITR-2
385	*Glycyrrhiza lepidota*	GLLE-3
140	*Gnaphaleum californicum*	GNCA
141	*Gnaphaleum leuto-album*	GNLU
386	*Gnaphalium beneolens*	GNBE
142	*Gnaphalium microcephalum*	GNMI
143	*Gnaphalium palustre*	GNPA

Appendix B (cont.) Plant Species Identified on 86 Sycamore Vegetation Samples.

Species number	Species name	Species code
387	*Grindelia camporum*	GRCA
144	*Grindelia procera*	GRPR
145	*Gutierrezia bracteata*	GUBR
146	*Haplopappus pinifolius*	HAPI
388	*Heleanthus bolanderi*	HEBO-1
147	*Helenium puberulum*	HEPU-1
148	*Heleochloa schoenoides*	HESC-1
149	*Helianthus annuus lenticularis*	HEANL
150	*Heliotropium curassavicum oculatum*	HECUO
389	*Hemicarpha micrantha*	HEMI-1
390	*Herniaria cinerea*	HECI-2
151	*Heterotheca subaxillaris*	HESU-1
152	*Holocarpha obconica*	HOOB
153	*Holocarpha virgata*	HOVI
154	*Holozonia filipes*	HOFI
455	*Hordeum californicum*	HOCA-1
155	*Hordeum geniculatum*	HOGE
156	*Hordeum glaucum*	HOGL
157	*Hordeum leporinum*	HOLE
158	*Hypochoeris glabra*	HYGL
159	*Juglans californica*	JUCA-4
160	*Juglans californica* shrub	JUCA-4S
161	*Juncus balticus*	JUBA
162	*Juncus bufonius*	JUBU

Appendix B (cont.) Plant Species Identified on 86 Sycamore Vegetation Samples.

Species number	Species name	Species code
459	*Juncus oxymeris*	JUOX
163	*Juncus patens*	JUPA-2
391	*Juncus phaeocephalis* var *paniculatus*	JUPHP
392	*Juncus xiphioides*	JUXI
164	*Keckiella breviflora*	KEBR
165	*Keckiella cordifolia*	KECO-1
393	*Kickxia elatine*	KIEL
166	*Kickxia spuria*	KISP
167	*Koeleria phleoides*	KOPH
394	*Koeleria phleoides*	KOPH
168	*Kyllingia brevifolia*	KYBR
169	*Lactuca saligna*	LASA
170	*Lactuca serriola*	LASE-1
171	*Lactuca serriola integrata*	LASEI
395	*Lactuca virosa*	LAVI-1
172	*Lagophylla ramosissima*	LARA
173	*Lamium* sp.	LAM
174	*Lasthenia chrysostoma gracilis*	LACH-3
175	*Layia* sp.	LAY
176	*Lemna* sp.	LEM
178	*Lepidium nitidum*	LENI
177	*Lepidium* sp.	LEP-4
179	*Lepidospartum squamatum*	LESQ
180	*Lessingia gemanorum glandulifera*	LEGEG

Appendix B (cont.) Plant Species Identified on 86 Sycamore Vegetation Samples.

Species number	Species name	Species code
181	*Linanthus liniflorus*	LILI
397	*Linanthus* sp.	LIN80
398	*Linariacanadensis* var. *texana*	LICAT
182	*Lindernia anagallidea*	LIAN-2
183	*Lippia incisa*	LIIN
184	*Lolium multiflorum*	LOMU
185	*Lolium perenne*	LOPE-1
186	*Lotus purshianus*	LOPU-2
187	*Lotus scoparius*	LOSC
399	*Lotus* sp.	LOT-3
400	*Ludwigia palustris*	LUPA-4
401	*Ludwigia peploides*	LUPE-3
188	*Lupinus bicolor*	LUBI
189	*Lupinus densiflorus*	LUDE
190	*Lythrum hyssopifolia*	LYHY
402	*Lythrum* sp.	LYT81
403	*Madia* sp.	MAD-3
191	*Malacothamnus fasciculatus laxiflorus*	MAFAL
192	*Malacothamnus marruboides*	MAMA-4
193	*Malosma laurina* shrub	MALA-2
404	*Marah fabaceus*	MAFA-1
194	*Marah macrocarpus*	MAMA-2
195	*Marrubium vulgare*	MAVU
196	*Marsilea ologospora*	MAOL

Appendix B (cont.) Plant Species Identified on 86 Sycamore Vegetation Samples.

Species number	Species name	Species code
197	*Marsilea vestita*	MAVE
405	*Matricaria matricarioides*	MAMA-3
406	*Medicago hispida*	MEHI
198	*Medicago polymorpha*	MEPO
199	*Medicago polymorpha brevispina*	MEPOB
201	*Melica imperfecta*	MEIM
200	*Melica* sp.	MEL-1
407	*Melica subulata*	MESU
202	*Melilotus albus*	MEAL-1
203	*Melilotus indicus*	MEIN-1
408	*Mentha arvensis*	MEAR-3
205	*Mentha pulegium*	MEPU-1
204	*Mentha* sp.	MEN-1
206	*Mentha spicata*	MESP-2
409	*Mentha x piperita*	MEPI
410	*Microsteris gracilis*	MIGR
207	*Mimulus cardinalis*	MICA-3
411	*Mimulus guttatus*	MIGU
412	*Mimulus nasutus*	MINA-2
208	*Mimulus pilosus*	MIPI-2
209	*Mollugo verticillata*	MOVE-1
210	*Montia perfoliata*	MOPE-2
211	*Morus alba*	MOAL
212	*Muhlenbergia rigens*	MURI-2

Appendix B (cont.) Plant Species Identified on 86 Sycamore Vegetation Samples.

Species number	Species name	Species code
215	*Nasturtium officinale*	NAOF
413	*Nemophila* sp.	NEM-3
213	*Nicotiana glauca*	NIGL
214	*Nicotiana glauca* shrub	NIGLS
216	*Oenothera* sp.	OEN-4
217	*Opuntia littoralis* ssp. shrub	OPLI
218	*Oryzopsis miliacea*	ORMI-2
219	*Osmorhiza brachypoda*	OSBR
414	*Panicum capillare*	PACA-4
415	*Panicum* sp.	PAN-3
220	*Paspalum dilatatum*	PADI-2
222	*Paspalum distichum*	PADI-3
416	*Pectocarya penicillata*	PEPE-1
223	*Pellaea andromaedifolia*	PEAN-1
224	*Perideridia californica*	PECA-3
225	*Phacelia distans*	PHDI-1
226	*Phacelia imbricata*	PHIM
227	*Phalaris aquatica*	PHAQ
417	*Phleum pratense*	PHPR-1
228	*Pholistoma auritum*	PHAU-2
229	*Pholistoma membranaceum*	PHME
230	*Phoradendron flavescens macrophyllum*	PHFLM
231	*Picris echioides*	PIEC
232	*Pinus sabiniana*	PISA-2

Appendix B (cont.) Plant Species Identified on 86 Sycamore Vegetation Samples.

Species number	Species name	Species code
350	*Pinus sabiniana* shrub	PISA-2S
233	*Pityrogramma triangularis*	PITR
418	*Plagiobothrys* sp.	PLA-3
234	*Plagiobothrys tenellus*	PLTE-1
235	*Plantago heterophylla*	PLHE
236	*Plantago hookeriana*	PLHOC
237	*Plantago hookeriana* var *californica*	PLHOCA
419	*Plantago major*	PLMA-1
240	*Platanus racemosa* herb	PLRAH
239	*Platanus racemosa* shrub	PLRAS
238	*Platanus racemosa* tree	PLRAT
420	*Plectritus macrocera*	PLMA-2
242	*Poa annua*	POAN-1
421	*Poa bolanderi howellii*	POBOH
243	*Poa scabrella*	POSC-3
241	*Poa* sp.	POA-3
422	*Polygonum hydropiperoides asperifolium*	POHYA
244	*Polygonum persicaria*	POPE-2
245	*Polygonum punctatum*	POPU-2
423	*Polypogon elongatus*	POEL
246	*Polypogon maritimus*	POMA
247	*Polypogon monspeliensis*	POMO-1
248	*Populus fremontii* herb	POFR-3H
249	*Populus fremontii* tree	POFR-3T

Appendix B (cont.) Plant Species Identified on 86 Sycamore Vegetation Samples.

Species number	Species name	Species code
424	*Potentilla glandulosa*	POGL-2
250	*Prunus amygdalus*	PRAM
425	*Psoralea macrostachya*	PSMA-1
251	*Pterostegia drymarioides*	PTDR
426	*Quercus agrifolia* herb	QUAGH
252	*Quercus agrifolia* shrub	QUAGS
253	*Quercus agrifolia* tree	QUAGT
254	*Quercus dumosa* shrub	QUDU-2
255	*Quercus douglasii* herb	QUDOH
427	*Quercus douglasii* shrub	QUDOS
256	*Quercus douglasii* tree	QUDOT
258	*Quercus lobata* herb	QULOH
428	*Quercus lobata* shrub	QULO
257	*Quercus lobata* tree	QULOT
259	*Quercus wislizenii* herb	QUWIH
347	*Quercus wislizenii* shrub	QUWIS
260	*Quercus wislizenii* tree	QUWIT
429	*Ranunculus californicus*	RACA-2
261	*Rhamnus californica*	RHCA-2
262	*Rhamnus californica* ssp. *tomentella*	RHCAT
263	*Rhamnus crocea*	RHCR
264	*Rhamnus crocea ilicifolia*	RHCRI
265	*Rhus trilobata*	RHTR
267	*Ribes indecorum*	RIIN-1

Appendix B (cont.) Plant Species Identified on 86 Sycamore Vegetation Samples.

Species number	Species name	Species code
268	*Ribes malvaceum*	RIMA-1
430	*Ribes menziesii*	RIME
266	*Ribes* sp.	RIB
269	*Ribes speciosum*	RISP
270	*Ricinus communis*	RICO
431	*Rorippa nasturtium-aquaticum*	RONA
271	*Rosa californica* herb	ROCA-1H
272	*Rosa californica* shrub	ROCA-1S
273	*Rubus procerus* herb	RUPRH
274	*Rubus procerus* shrub	RUPRS
432	*Rubus* sp.	RUB80
275	*Rubus ursinus*	RUUR
276	*Rumex californicus*	RUCA-2
277	*Rumex conglomeratus*	RUCO
278	*Rumex crispus*	RUCR-2
433	*Rumex obtusifolius agrestis*	RUOBA
434	*Rumex salicifolius*	RUSA
279	*Sagina* sp.	SAG-3
280	*Salix gooddingii*	SAGO
282	*Salix laevigata* herb	SALA-4H
281	*Salix laevigata* tree	SALA-4T
283	*Salix lasiolepis* tree	SALA-3
284	*Salvia columbariae*	SACO-1
285	*Salvia mellifera*	SAME-4

Appendix B (cont.) Plant Species Identified on 86 Sycamore Vegetation Samples.

Species number	Species name	Species code
435	*Sambucus mexicana* tree	SAME-7
286	*Sambucus mexicana* shrub	SAME-6
436	*Sanicula bipinnata*	SABI-2
437	*Sanicula crassicaulis*	SACR-2
287	*Scirpus americanus*	SCAM
288	*Scrophularia californica* herb	SCCA-2H
289	*Scrophularia californica* shrub	SCCA-2S
290	*Scutellaria austinae*	SCAU
291	*Senecio douglasii*	SEDO-2
348	*Senecio douglasii* shrub	SEDO-2S
438	*Senecio* sp.	SEN81
292	*Senecio vulgaris*	SEVU
439	*Silene antirrhina*	SIAN
293	*Silene gallica*	SIGA
294	*Silybum marianum*	SIMA-2
295	*Sisymbrium officinale*	SIOF
296	*Sisymbrium orientale*	SIOR-3
297	*Solanum nodiflorum*	SONO
298	*Solidago californica*	SOCA-2
440	*Solidago canadensis elongata*	SOCAE
299	*Solidago occidentalis*	SOOC
300	*Sonchus asper*	SOAS
441	*Sonchus asper*	SOAS
301	*Sonchus oleraceus*	SOOL

Appendix B (cont.) Plant Species Identified on 86 Sycamore Vegetation Samples.

Species number	Species name	Species code
302	*Sorghum halepense*	SOHA
442	*Spergularia bocconii*	SPBO
303	*Spirogyra algae*	SPIRO
443	*Stachys ajugoides*	STAJ
444	*Stachys albens*	STAL
445	*Stachys* sp.	STA-3
304	*Stellaria media*	STME
305	*Stephanomeria virgata*	STVI-2
306	*Stipa cernua*	STCE
307	*Stipa lepida*	STLE
308	*Stylocline* sp.	STY-1
310	*Symphoricarpos rivularis* herb	SYRIH
309	*Symphoricarpos rivularis* shrub	SYRIS
312	*Tamarix* sp. herb	TAM-1H
311	*Tamarix* sp. shrub	TAM-1S
447	*Taraxacum officinale*	TAOF
448	*Thelypodium* sp.	THE81
313	*Tillaea erecta*	TIER
449	*Torilis arvensis*	TOAR
314	*Torilis heterophylla*	TOHE
315	*Torilis nodosa*	TONO
318	*Toxicodendron diversilobum* herb	TODIH
316	*Toxicodendron diversilobum* shrub	TODIS
317	*Toxicodendron diversilobum* tree	TODIT

Appendix B (cont.) Plant Species Identified on 86 Sycamore Vegetation Samples.

Species number	Species name	Species code
319	*Trianthema portulacastrum*	TRPO-2
320	*Trichostema laceolatum*	TRLA-1
321	*Trichostema lanatum*	TRLA-4
322	*Trifolium fucatum*	TRFU
323	*Trifolium hirtum*	TRHI
324	*Trifolium microcephalum*	TRMI-2
325	*Trifolium obtusiflorum*	TROB-2
326	*Trifolium repens*	TRRE
450	*Triteleia laxa*	TRLA-5
327	*Typha* sp.	TYP
328	*Umbellularia californica*	UMCA-1
329	*Urtica holosericea*	URHO
330	*Urtica urens*	URUR
331	*Phalaris* sp.	PHA-3
332	*Venegasia carpesioides*	VECA-2
333	*Verbascum thapsus*	VETH
452	*Verbena lasiostachys*	VELA
456	*Verbena lasiostachys scabrida*	VELAS
335	*Verbena litoralis*	VELI
453	*Verbena robusta*	VERO
454	*Veronica anagallis-aquatica*	VEAN
460	*Veronica chamaedrys*	VECH
336	*Vicia americana*	VIAM
337	*Vicia dasycarpa*	VIDA

Appendix B (cont.) Plant Species Identified on 86 Sycamore Vegetation Samples.

Species number	Species name	Species code
338	*Vinca major*	VIMA-1
340	*Vitis californica* herb	VICA-3H
339	*Vitis californica* shrub	VICA-3S
341	*Vitis vinifera*	VIVI-2
342	*Woodwardia fimbriata*	WOFI
343	*Xanthium strumarium*	XAST
344	*Yucca whippelei*	YUWH
345	*Zauschneria californica*	ZACA-1

Appendix C

Code Numbers and Names For the 86 Sample Sites

Appendix C

Code Numbers and Names
For the 86 Sample Sites

Sample number	Code Name	Full Name
1	LBG1	LOS BANOS CREEK 1
2	LBG2	LOS BANOS CREEK 2
3	LBG4	LOS BANOS CREEK 4
4	LBG5	LOS BANOS CREEK 5
5	LBG10	LOS BANOS CREEK 10
6	LBG11	LOS BANOS CREEK 11
7	LBG12	LOS BANOS CREEK 12
8	LBG13	LOS BANOS CREEK 13
9	LBG16	LOS BANOS CREEK 16
10	LBG17	LOS BANOS CREEK 17
11	LBG18	LOS BANOS CREEK 18
12	LBGN1	NORTH FORK LOS BANOS CREEK 1
13	LBGN2	NORTH FORK LOS BANOS CREEK 2
14	ORE1	ORESTIMBA CREEK 1
15	ORE2	ORESTIMBA CREEK 2
16	ORE3	ORESTIMBA CREEK 3
17	ORE4	ORESTIMBA CREEK 4
18	ORE5	ORESTIMBA CREEK 5
19	ORE6	ORESTIMBA CREEK 6
20	ORE7	ORESTIMBA CREEK 7
21	ORE8	ORESTIMBA CREEK 8
22	ORE9	ORESTIMBA CREEK 9

Appendix C (cont.) Code Numbers and Names For the 86 Sample Sites.

23	ORE10	ORESTIMBA CREEK 10
24	ORE11	ORESTIMBA CREEK 11
25	ORE12	ORESTIMBA CREEK 12
26	DRYLA1	DRY CREEK (TULARE) LA1
27	DRYL1	DRY CREEK (TULARE) L1
28	DRYL3	DRY CREEK (TULARE) L3
29	DRYC2	DRY CREEK (TULARE) C2
30	DRYCA1	DRY CREEK (TULARE) CA1
31	DRYC3	DRY CREEK (TULARE) C3
32	DRYC4	DRY CREEK (TULARE) C4
33	LDRY	LITTLE DRY CREEK (1 ONLY)
34	NKW	NORTH FORK KAWEAH RIVER (1 ONLY)
35	SKW1	SOUTH FORK KAWEAH RIVER 1
36	SKW2	SOUTH FORK KAWEAH RIVER 2
37	SKW3	SOUTH FORK KAWEAH RIVER 3
38	DEER1	DEER CREEK 1
39	DEER2	DEER CREEK 2
40	PACH1	PACHECO CREEK 1
41	PACH2	PACHECO CREEK 2
42	PACH3	PACHECO CREEK 3
43	PACH4	PACHECO CREEK 4
44	ARMO1	ARROYO MOCHO 1
45	ARMO2	ARROYO MOCHO 2
46	MILL1	MILL CREEK 1
47	MILL2	MILL CREEK 2

Appendix C (cont.) Code Numbers and Names For the 86 Sample Sites.

48	MILL3	MILL CREEK 3
49	MILL4	MILL CREEK 4
50	STUL	SOUTH FORK OF TULE RIVER (1 ONLY)
51	NAC1	NACIMIENTO RIVER 1
52	NAC2	NACIMIENTO RIVER 2
53	NAC3	NACIMIENTO RIVER 3
54	AVAL1	ARROYO VALLE 1
55	AVAL2	ARROYO VALLE 2
56	AVAL3	ARROYO VALLE 3
57	AVAL4	ARROYO VALLE 4
58	COYL1	COYOTE CREEK LOWER 1
59	COYL2	COYOTE CREEK LOWER 2
60	COYU1	COYOTE CREEK UPPER 1
61	COYU2	COYOTE CREEK UPPER 2
62	SRP	SANTA ROSA PLATEAU (ADOBE CR.)
63	STARR	STARR RANCH
64	MAL	MALIBU CREEK
65	BSC	BIG SYCAMORE CREEK (PT MUGU SP)
66	SANT	SANTA ANA CREEK (VENTURA CO.)
67	IND	INDIAN CANYON (SAN GABRIEL MTS)
68	SFEL	SAN FELEPE CREEK
69	PACH5	PACHECO CREEK 5
70	ALA1	ALAMEDA CREEK 1
71	ALA2	ALAMEDA CREEK 2
72	ALA3	ALAMEDA CREEK 3

Appendix C (cont.) Code Numbers and Names For the 86 Sample Sites.

73	NLBGA	NORTH FORK LOS BANOS CREEK A
74	NLBGB	NORTH FORK LOS BANOS CREEK B
75	NLBGC	NORTH FORK LOS BANOS CREEK C
76	SLBG1	SOUTH FORK LOS BANOS CREEK 1
77	SLBG2	SOUTH FORK LOS BANOS CREEK 2
78	SLBG3	SOUTH FORK LOS BANOS CREEK 3
79	UORE1	UPPER ORESTIMBA CREEK 1
80	UORE2	UPPER ORESTIMBA CREEK 2
81	UORE3	UPPER ORESTIMBA CREEK 3
82	SANT1	SAN ANTONIO CREEK 1
83	SANT2	SAN ANTONIO CREEK 2
84	UMILL1	UPPER MILL CREEK 1
85	UMILL2	UPPER MILL CREEK 2
86	UMILL3	UPPER MILL CREEK 3

Appendix D

Sycamore Age Data Taken From Each of the 86 Sample Plots

Appendix D

Sycamore Age Data Taken From Each of the 86 Sample Plots

At each sample site, an attempt was made to core the largest and a mid-sized trunk of sycamore. The cores were taken with a 16 inch increment borer and were treated with a solution of HCL and Phlorogluconol, then fixed in 90% ethanol to make the typically indistinct annual rings more apparent. The dashes in the table represent missing data, largely due to the unreadability of the cores resulting from rot or poor stainability.

Estimates of age were based on extrapolation of the average growth rates taken in the core. As all trees over approximately 80 cm dbh could not be cored to the center, estimates of the largest tree's ages are inacurate to an unknown degree. Many of the smaller diameter trees also could not be completely sampled as a result of rotten cores. Thus, many ages listed should only be considered a rough estimate. In general, we would expect the actual ages to be somewhat less than the estimates because of the tendency for young trees to put on greater average annual increments than older trees.

Plot #	LARGE TREES			AVERAGE TREES		
	DBH	Growth Rate	Estimated Age	DBH	Growth Rate	Estimated Age
1	132.0	3.9	257.4	-	-	-
2	94.0	6.3	296.1	42.3 51.7	7.1 3.4	150.5 88.1
3	168.3	3.7	311.5	-	-	-
4	111.7	5.1	285.1	62.3	5.4	168.5
5	70.8	6.3	223.0	34.0	5.4	91.8
6	112.7	3.8	214.3	19.2	2.6	25.0
7	59.1	4.3	127.3	41.6	4.9	101.9
8	117.8	4.8	282.7	68.1	4.1	139.8
9	84.2	4.1	172.6	43.0	3.2	68.8
10	102.0	6.1	311.1	47.3	4.2	112.1

Appendix D (cont.) Sycamore Age Data Taken From Each of the 86 Sample Plots.

Plot #	LARGE TREES			AVERAGE TREES		
	DBH	Growth Rate	Estimated Age	DBH	Growth Rate	Estimated Age
11	48.9	5.4	132.3	33.2	8.4	139.4
12	56.6	5.1	144.3	39.6	4.6	91.1
13	58.5	4.4	128.9	45.9	6.0	138.0
14	57.5	3.7	106.6	-	-	-
15	48.8	4.1	100.0	-	-	-
16	197.9	5.7	564.3	89.9	1.9	85.5
17	41.2	5.3	109.2	30.9	6.1	94.6
18	165.5	4.3	356.0	-	-	-
19	34.5	3.1	53.6	15.3	2.1	16.2
20	105.2	4.5	236.7	34.7	3.6	62.6
21	117.8	3.2	188.5	70.5	4.0	141.2
22	60.7	5.3	161.1	52.8	4.0	105.6
23	86.6	3.1	134.2	65.0	6.7	217.8
24	112.8	3.8	214.3	37.7	4.5	85.1
25	103.6	3.4	176.1	64.0	4.2	134.4
26	88.6	4.0	177.2	69.5	4.4	153.1
27	122.1	3.6	220.0	61.0	8.3	253.2
28	91.3	4.2	191.9	24.5	2.4	29.5
29	93.0	2.7	125.6	17.1	2.3	19.8
30	100.0	4.4	220.0	34.2	2.3	39.3
31	102.5	3.0	153.9	-	-	-
32	76.8	3.1	119.0	-	-	-
33	81.1	3.0	121.8	75.2	2.3	86.5

Appendix D (cont.) Sycamore Age Data Taken From Each of the 86 Sample Plots.

Plot #	LARGE TREES			AVERAGE TREES		
	DBH	Growth Rate	Estimated Age	DBH	Growth Rate	Estimated Age
34	82.1	3.8	156.2	35.4	2.5	44.3
35	56.7	2.6	73.8	32.4	4.8	77.8
36	81.6	2.5	102.0	67.8	3.7	125.4
37	137.9	2.5	171.1	117.9	3.7	218.3
38	96.8	2.8	135.5	45.1	2.6	58.8
39	98.2	2.5	122.8	55.5	2.0	55.6
40	92.3	5.3	244.9	40.3	3.5	70.7
41	79.9	5.5	220.0	55.5	6.5	180.7
42	71.4	7.4	264.2	51.7	3.4	88.1
43	83.1	4.5	187.2	79.2	4.6	182.2
44	137.0	4.9	335.7	56.9	4.1	116.9
45	54.0	3.5	94.5	46.0	4.7	108.1
46	43.4	7.2	156.2	34.7	4.7	52.2
47	52.3	4.8	125.8	31.4	2.3	36.1
48	50.1	6.5	163.2	27.3	3.6	49.3
49	58.2	2.8	81.5	47.7	3.1	74.1
50	41.8	5.3	110.8	17.0	3.8	32.3
51	35.1	1.3	22.9	26.5	1.1	14.6
52	88.1	3.3	145.5	67.0	1.5	70.3
53	52.0	3.7	96.2	45.2	3.5	79.1
54	43.8	6.0	131.4	34.8	5.5	95.7
55	57.8	4.8	138.7	27.2	4.2	57.1
56	109.2	4.1	223.9	44.5	4.6	102.6
57	78.2	3.0	117.3	34.7	3.9	67.9

Appendix D (cont.) Sycamore Age Data Taken From Each of the 86 Sample Plots.

Plot #	LARGE TREES			AVERAGE TREES		
	DBH	Growth Rate	Estimated Age	DBH	Growth Rate	Estimated Age
58	86.8	2.2	95.5	42.7	2.9	62.1
59	66.6	4.2	139.9	59.7	5.9	176.4
60	84.6	4.3	181.9	31.0	5.0	77.5
61	61.6	4.8	147.8	50.2	3.4	85.3
62	33.8	2.0	33.8	21.5	-	-
63	30.0	2.2	33.0	19.0	1.5	14.3
64	80.4	2.1	84.4	9.0	1.3	5.9
65	101.3	-	-	-	-	-
66	46.7	-	-	35.0	-	-
67	27.0	-	-	22.1	-	-
68	75.8	37.9	-	-	-	-
69	49.5	5.0	123.8	41.2	6.5	2.4.8
70	95.5	4.3	205.3	63.0	2.8	88.2
71	115	-	-	84.8	4.0	169.6
72	85.4	4.0	170.8	63.0	5.8	181.4
73	76.8	8.6	330.2	52.6	4.1	107.8
74	67.3	7.8	262.5	42.3	6.0	126.9
75	48.8	5.6	136.6	48.8	6.2	151.3
76	23.3	5.7	66.4	18.5	2.7	25.0
77	42.6	6.9	147.0	24.2	4.5	54.5
78	62.6	7.3	228.5	35.1	7.0	122.9
79	33.0	3.5	57.8	30.5	4.2	64.1
80	50.6	4.7	118.9	30.8	5.1	78.5
81	63.2	3.6	113.8	55.2	3.9	107.6

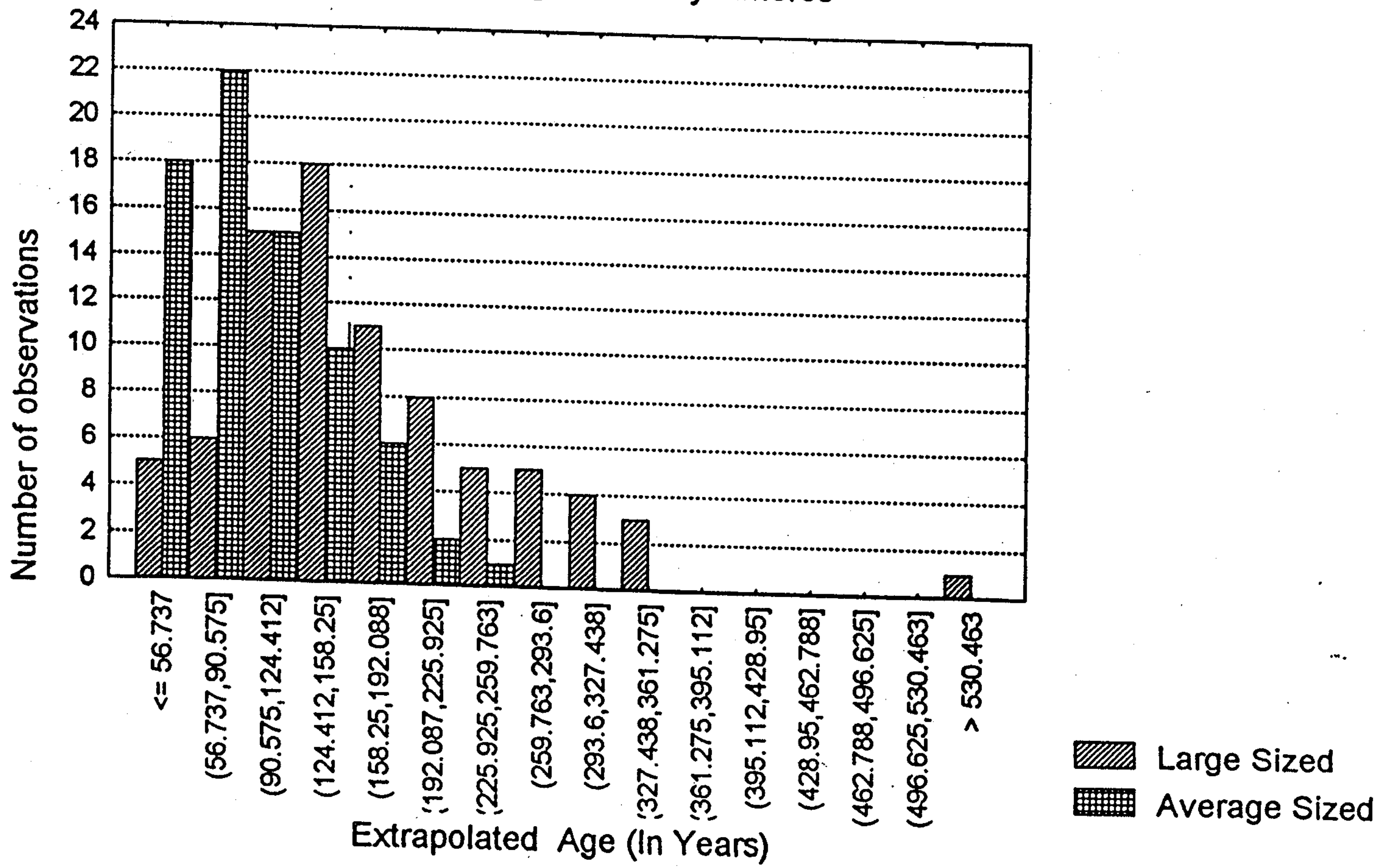
Appendix D (cont.) Sycamore Age Data Taken From Each of the 86 Sample Plots.

Plot #	LARGE TREES			AVERAGE TREES		
	DBH	Growth Rate	Estimated Age	DBH	Growth Rate	Estimated Age
82	110.0	5.7	313.5	41.0	3.5	110.3
83	148.0	3.8	281.2	59.5	3.3	98.2
84	44.7	3.7	82.7	38.8	3.7	71.8
85	92.5	5.3	245.1	37.3	4.1	76.5
86	43.3	3.3	52.8	31.8	4.6	73.1

Summary Table of Extrapolated Ages for Samples Sycamore Trees:

Tree Size	**N**	**Mean**	**Minimum**	**Maximum**	**Std. Dev.**
Large	81	171.5	22.9	564.3	89.3
Medium	74	93.8	85.9	253.2	52.9

Appendix D: Histogram of Estimated Ages for Large and Average Sized Sycamores



Appendix E

Full Explanation of the California Native Plant Society's Vegetation Sampling Protocol and An Example of the Sycamore Project Sampling Form

VEGETATION SAMPLING RATIONALE

California Native Plant Society
Rare Plant Communities of California
Rev. 92/9/15

INTRODUCTION

As an integral part of the effort to protect rare plant communities in California, the California Native Plant Society (CNPS) has initiated a program to systematically collect information to be used to identify and define selected rare or threatened communities. Working from the assumption that the first step in effective protection is identification, the vegetation sampling program will provide information on the species abundance and composition of those rare communities for which such quantitative data do not yet exist. This will allow CNPS ecologists to generate an objective description of each community, and place it in the context of a larger classification of the vegetation of California. With the help and expertise of the CNPS membership, it is hoped that those communities most in need of protection will be defined in the near future. The following provides a brief introduction to the sampling and classification of vegetation in general, and the rationale behind the sampling method designed specifically for this effort. A detailed protocol for field sampling using this method is included in a separate document.

THE NATURE OF SAMPLING

Ecologists choose to sample vegetation, as opposed to characterizing entire stands, because sampling is more efficient. It is often unfeasible, given time constraints, to survey an entire stand of vegetation, much less assign objective abundance values to each species. A species list generated by a sampling procedure is also less subject to error, and will quickly pick up the most abundant species in a stand. Sampling, then, allows for the efficient comparison of the composition of many stands of vegetation.

VEGETATION CLASSIFICATION

Traditionally, vegetation is classified into types, or communities, based upon similarities in floristic composition among patches. A homogeneous patch of vegetation is chosen and plots are placed within its boundaries to obtain a representative sample of the species occurring there. Plots and species are then grouped according to floristic similarity using multivariate classification techniques. After such an analysis, one may find that what appeared to be one type in the field actually consists of several distinct subtypes, or that seemingly different stands are more similar to one another. Sampling and classification thus become joined in an iterative process, as the investigator returns to the field with new insight and is able to reappraise the vegetation. Stands of similar vegetation from different areas can also be compared this way, and the range of variation within a type documented.

Although vegetation can be classified using the simple presence and absence of species, it is preferable to include some measure of abundance for each species. The measure most often used by plant ecologists is *percent canopy cover*, or the vertical projection of the canopy of plants onto the ground, within a fixed area. The fraction of the fixed area covered by the canopies of each species is their percent cover. Canopy cover provides an efficient and simple estimate of biomass, and can be used to quantify the importance of a species on a plot.

THE CNPS VEGETATION SAMPLING METHOD

Considerations. Unfortunately, there is no one best way to sample vegetation. The best sampling method for one community type may be totally inappropriate for another, depending on the needs of the investigation and the structure and scale of the vegetation. Sampling methods are best designed by taking into account the objectives of the study, the nature of the vegetation of interest, the abilities of the individuals carrying out the work, and time and equipment constraints.

The objective of the CNPS sampling effort is to collect floristic composition and abundance data for the classification and identification of rare plant communities in California. These communities represent a broad spectrum of physiognomic types, including grasslands, scrub, woodlands, and forests. CNPS volunteers who conduct the survey have a wide variety of backgrounds and experience, including familiarity with a local flora, but little formal background in vegetation ecology. Lastly, the time and equipment required to carry out the field sampling must be kept to a minimum, allowing for the efficient collection of a larger number of samples.

Methodology. The sampling method is based on a 50 m long point-transect centered in a 50 m x 5 m plot which is randomly located in a subjectively chosen homogeneous patch of vegetation. At each 0.5 m interval along the transect, a point is projected vertically down into the vegetation or up into the canopy. Each species intercepted by a point is recorded, providing a tally of hits for each species within designated canopy layers. Boundaries of each layer are determined in the field by assessing the maximum height of the herb and shrub layers, and the minimum height of the tree layer(s). Percent cover for each species according to vegetation layer (herb, shrub, and tree) can be calculated from these data. Finally, a list of all additional species within the 250 m^2 plot is made.

FEEDBACK

As with vegetation description in general, the CNPS vegetation sampling effort will be an iterative process, with adjustments made along the way as we gain experience. Thus, feedback from field volunteers is an essential part of the process. It is hoped that the methods and techniques which the CNPS develops will have broad applicability in the effort to describe and preserve rare plant communities.

The data sheets are to be collected by a designated member of each chapter. The sheets will ultimately be forwarded to a central location in Sacramento for storage and analysis.

FIELD SAMPLING PROTOCOL

California Native Plant Society
Rare Plant Communities of California
Rev. 93/2/9

INTRODUCTION

This document describes the procedures used for vegetation sampling by CNPS. The samples will provide information for the classification and description of selected plant communities in California. The sampling method is based on a 50 m long point-transect centered in a 50 m x 5 m *plot*. At each 0.5 m interval along the transect (beginning at the 50 cm mark and ending at 50.0 m), a point is projected vertically into the vegetation. Each species intercepted by a point is recorded, providing a tally of hits for each species in the herb, shrub, and tree canopies. In so far as it is possible, it is important to take care to stretch the tape taut, in order to maintain a consistent sampling area. Percent cover for each species according to vegetation layer (herb, shrub, and tree) can be calculated from these data. Finally, a list of all additional species within the 250 m^2 plot is made.

Often, the composition and abundance of the species within a type will vary with seasonality or in response to disturbance, such as fire. The optimal time to sample vegetation is determined by flowering dates such that as many species as possible can be identified. This becomes of greater concern in herbaceous vegetation types as opposed to those dominated by woody species.

PLOT LOCATION

Plots are located within subjectively chosen patches of homogeneous vegetation. Once such an area has been chosen and approximate boundaries defined, the transect is objectively located. The observer may walk to the center of the patch and then determine the center of the transect in an arbitrary manner (e.g. by tossing an object over the shoulder). The direction of the transect line from this center point is chosen randomly, using a wrist watch: the position of the second hand can refer to a compass direction, with noon equivalent to north.

For unusual cases such as narrow bands or small patches of vegetation which do not lend themselves to the placement of a straight 50 m long transect, the transect may be bent or curved. However, this should be avoided whenever possible in order to maintain consistency among the plots and to avoid observer bias in establishing the transects.

REPLICATION

Determining how many plots to establish in a given patch of vegetation involves an assessment of the size and floristic variability of the patch, the time available to the field team, and the proximity of additional patches of the same vegetation type. Here the volunteers must make a decision, which will be based on these considerations after spending enough time in the field to gain a familiarity with the type. In some patches, one plot will adequately capture the composition and structure of the vegetation type; in others, additional plots will be necessary. For example, if a team establishes a plot in a patch of forest vegetation, and it is evident to the members of the team that the floristic composition and structure of the plot does not adequately represent that of the patch, additional plots should be established. If there are a number of individual patches of the same type in an area, it may be preferable to spread the sampling among them, thus capturing the variability among adjacent stands. The CNPS ecologist may be able to assist with developing a strategy for sampling a given vegetation type.

GENERAL PLOT INFORMATION

The following items are included on each datasheet. As a rule, please avoid the use of abbreviations.

Temporary field plot number: Assigned in the field, using a unique number for each patch and for each replicate plot within a patch. Final plot numbers will be assigned by CNPS.

Date: Date of sampling.

Contact Person: Name, address and phone number of individual responsible for data collection on the plot.

Observers: Names of individuals assisting on the plot.

County: County plot is located in.

Topographic Quad: The name of the USGS map the plot is located on; note series (15' or 7½').

Township/Range/Section/Quarter section/Quarter section/Meridian name: Legal map location of site; this is useful for land ownership determination.

UTMN and UTME: Northing and easting coordinates using the Universal Transverse Mercator (UTM) grid as delineated on the USGS topographic map; to the nearest 0.01 of a km. See sample map for an example of determining coordinates.

Elevation: Recorded in feet.

Slope: Degrees, read from clinometer or compass or estimated; averaged over plot.

Aspect: Degrees from true north, read from a compass or estimated; averaged over plot.

Photographs: (optional). Describe view direction of color slides taken of the site.

Site Location: A careful description which makes revisiting the vegetation patch and plots possible; give landmarks and directions. Indicate location on a photocopy of a USGS topographic map (preferably 7.5') and attach to field survey form.

Site and Vegetation Description: A thorough narrative description of the patch being sampled, including the vegetation structure, physical setting of the site, adjacent vegetation types, and phenology. Information on soils and geology are included if available.

VEGETATION DATA

Point-intercept transect: A 50 m long tape is laid along the center of the plot and secured at both ends. The observer uses a 1 meter length of steel roundbar to sight along a vertical line at every 0.5 m interval from the 0.5 to the 100 meter mark.. Each species intercepted by the vertical line is tallied by vegetation layer. A total of 100 points along the transect are thus sampled.

Assessment of Layers. Estimates of the maximum height of the herb and shrub layers, and the minimum height of the tree layer, are recorded. These estimates are made after a quick assessment of the vegetation and its structure; these need not be overly precise, and will vary among vegetation types. Some types will have more than three layers (e.g. two tree layers of different maximum height); this should be indicated in the plot description. However, data are recorded for only three layers (herb, shrub and tree) whenever possible. The manner in which a species is recorded on the data sheet depends on the layer it occupies. The layer a species occupies will usually be determined by growth form, but exceptions will occur. For instance, a plot may contain a shrubby, multi-stemmed form of a tree species which occupies the shrub layer.

Because the species occupies the shrub layer, even though nominally a tree, it is treated as a shrub and recorded in the shrub layer on the data sheet. Similarly, a shrub occupying space in the tree canopy is recorded in the tree layer. Seedlings of woody plants, shorter than the maximum height of the herb layer, are recorded in the herb layer. An individual plant is recorded within only one layer, depending on the height of the tallest part of the individual. A species may, however, be represented in more than one layer on a plot depending on the height of each individual. For example, a single transect may contain seedlings of a tree species in the "herb", or lowest layer; saplings in the "shrub", or second layer; and mature trees in a third layer.

Determining Hits. It is important not to bias the location of the point to include a plant; this will result in overestimation of plant cover. This bias is most likely to be a problem with the herbaceous species. Take care to record hits along the same side of the tape within a plot; which side is unimportant, as long as one is consistent. The roundbar provides a line which can be projected into the vegetation layer; for the tree canopy, a canopy densiometer (a hand-held sighting device similar to a small periscope) may be used. Only hits which fall within the canopy outline (delineated by visually rounding out the canopy edges) of a tree, shrub, or herb, or which directly hit a grass, are valid (see Figure 1a). If two species within a single layer are intercepted by a point, both are recorded for that layer (see Figure 1b). If no vascular plant is hit by a point, a non-plant category (bare, rock, or litter in the herb layer; sky in the shrub or tree layers) is recorded as a hit for that layer. If the tree and shrub layers are both bare, *and* the herb layer is either bare or occupied by a non-vascular plant (rock, moss, lichen, litter) then the category BARE at the top of the page also receives a tally. Although this may seem redundant, recording non-hits in this manner allows for the calculation of absolute plant cover for the entire plot as well as for each separate layer. Plant names are recorded as Latin binomials (not common names) and should be consistent with Munz and Keck (Jepson after 1993).

It may be helpful to consider the above as a series of decision rules. In the herb layer: IF the point intercepts a grass, or the canopy outline of an herbaceous or woody species, record a hit for that plant. If more than one species is intercepted, record a hit for each within that layer. IF AND ONLY IF no vascular plant is intercepted in the herb layer, one and only one non-vascular plant category receives a hit: the options are bare, litter, rock or moss/lichen.

In the shrub and tree layers: IF the point intercepts the sphere of influence of a live individual, that species receives a hit for the layer which the highest point of the individual occurs within. Cover of dead plants is not recorded; however, if a site has a significant number of dead individuals this should be noted in the site description. An individual need not be rooted in the plot to be counted; intercepts of overhanging vegetation are included in the tally.

Data Sheets: In order to accommodate different styles of recording, two types of datasheet have been prepared. Many observers find it more convenient to use the long form, which provides a prompt for which point is being recorded. This form must then be summarized on the short form by summing the hits for each species and recording them by layer. After one is comfortable with the sampling method, the short form may be used directly; please take the time to sum the tallies as indicated on the sample data sheet.

Additional Species: All vascular plants not recorded for the transect are listed by layer after searching the entire 250 m^2 plot (2.5 m on each side of the 50 m transect). A careful and exhaustive search is required to be sure that no species are missed.

Unknown specimens: Plant specimens which cannot be determined to species in the field, or which need further verification, are collected and pressed according to standard procedure. Each specimen is assigned a field unknown number made up of the plot number and a sequential number unique to each unknown plant on the plot. For example, unknown number CNPS4-2-6 is the sixth unknown specimen collected on the second plot established in patch number 4. This number is recorded on the datasheet in lieu of a species name. When in doubt, it is preferable to record a species as unknown rather than guessing.

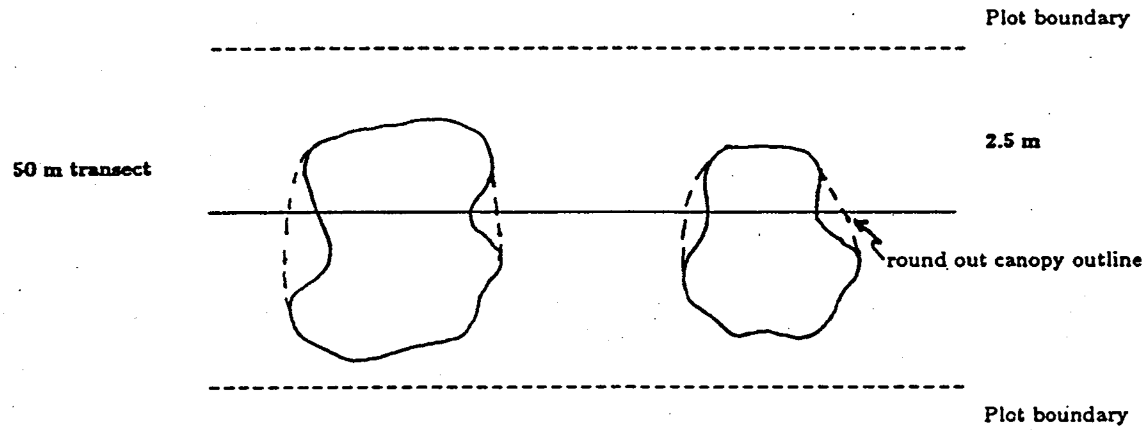
EQUIPMENT

50 m tape
steel roundbar
compass
clipboard/data sheets
topographic map
surveyor stakes (for marking corners)

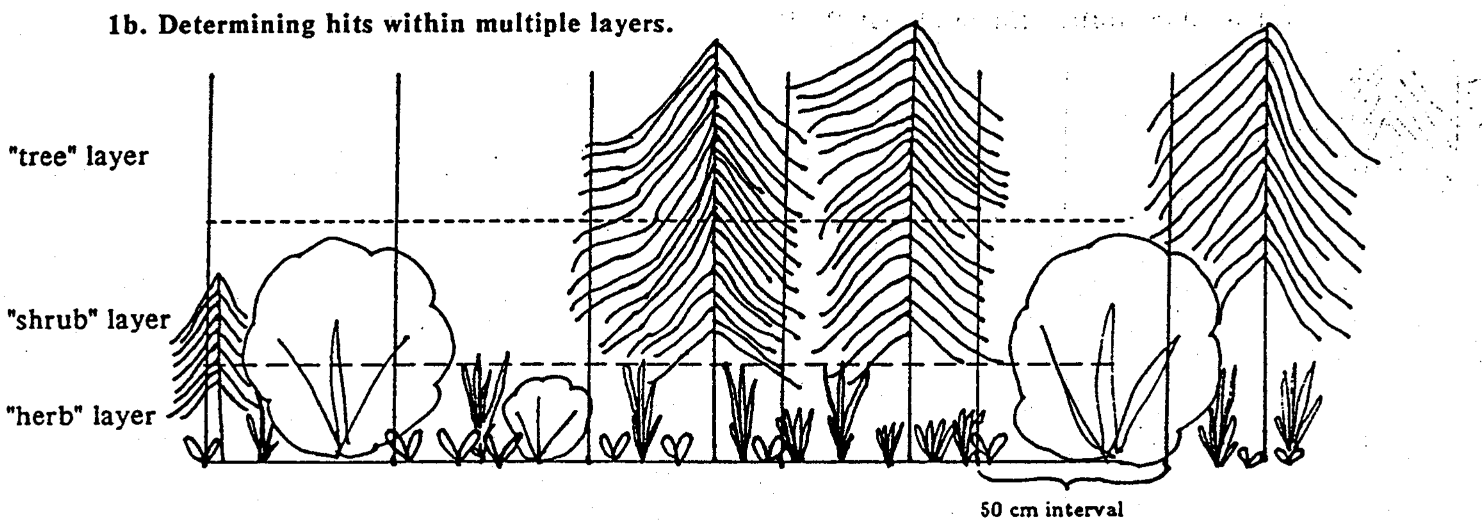
Optional
clinometer
watch with second hand
canopy densiometer

Figure 1. Determining hits along a transect

1a. Determining canopy outline (bird's eye view of plot).



1b. Determining hits within multiple layers.



species 1 ( ): 4 hits in herb layer

species 2 ( ): 2 hits in herb layer

species 3 ( ): 4 hits in tree layer, 1 hit in shrub layer

species 4 ( ): 2 hits in shrub layer, 1 hit in herb layer

CALIFORNIA NATIVE PLANT SOCIETY
CALIFORNIA PLANT COMMUNITIES FIELD DATA FORM
Rev. 92/11/10

Temporary field plot number: ______________________________

Date: ____________________

Contact Person: ______________________________

County: ____________________

Address: ______________________________

USGS Map: ____________________

______________________________ Phone: ____________________

CNPS Chapter: ____________________ Observers: ______________________________

Elevation (ft): ______________ Slope (°): ______________ Aspect (°): ______________

Township/Range/Sec/Q/Q-Q/Meridian name: ______________________________

UTMN/UTME: ______________________________

Photographs: ______________________________

Site Location

Site and Vegetation Description

Vegetation Type: ______________________________

Vegetation Structure: ______________________________

Canopy: open partially closed closed

Phenology: early peak late

Adjacent vegetation types: ______________________________

Adjacent land uses: ______________________________

Topography: ______________________________

Soil type: ______________________________ Geologic parent material: ____________________

Site history (disturbance, fire, etc.): ______________________________

Additional comments: ______________________________

Cover Estimation--Summary Form

BARE: (for each point failing to intercept a vascular plant in each of the layers, e.g. bare + sky + sky, place a tally here)

"Herb" Layer: ht. <______m

Bare:

Rock:

Litter:

Moss/Lichen:

Species	hits

"Shrub" Layer: ht. <______m

Sky (no shrub cover):

Species	hits

"Tree" Layer: ht.>______m

Sky (no tree cover):

Species	hits

Additional Species Found on Plot (5 X 50 m); list by layer

FIELD DATA FORM FOR SYCAMORE ALLUVIAL WOODLAND PROJECT
(VERSION 7/29/92)

Sample #: LBG 2 Recorder: M. PETERSON, J. RIPPERDA, P. ALLEN Date: 08-19-92
USGS Map: LOS BANOS VALLEY Quad Code: 3612181 T: 11S R: 8E Sec:
____1/4 of: ____1/4 Sec: ____ Elevation (ft.): 387 Slope of Streambed(°): 4% Aspect of Streambed (°): N87.5° Aspect at Sample Point(°) N89.5° Slope at Sample Point(°): 1%
UTMN: 4092150 UTME: 668790 Drainage Basin Size (sq. miles): ______ Mean Ann. Ppt.("): ____

Photographs (taken from both transect ends? note photo number, describe any additional photos for transect): #5 TAKEN FROM WEST END OF THE TRANSECT
#6 TAKEN FROM EAST END OF THE TRANSECT

Transect Location (Attach USGS Map with grids and show approx. location and orientation, include directions, landmarks for relocation): TRANSECT LOCATED ON THE SOUTH SIDE OF BILLIE WRIGHT ROAD, APPROX. 2 1/4 MILES WEST OF LOCKED SHRIMP/ME GATE. TRANSECT PT. IS AT BASE OF HILLSIDE SLOPING AWAY FROM THE ROADWAY. SAMPLE POINT IS ON THE NORTH BANK OF STREAM CHANNEL, 30 YDS WEST OF SALIX OCCURRENCE IN STREAM CHANNEL.

Brief Site Description (is this a sycamore- or other species-dominated site?, general estimate of cover by layers of dominant species, successional status, tree height and size): SYCAMORE DOMINATED SITE (20%). AVE HT 40'-60'. BLUE OAK (10%) AVE HT. 30'-70'.
TAMARISK (3%)
ANNUAL GRASSLAND (70%) / CLIMAX COMMUNITY

Adjacent Non-riparian Vegetation (list dominant species (if more than one community list separately)): (1) BLUE OAK WOODLAND (QUERCUS DOUGLASII), (2) ANNUAL GRASSLAND (BROMUS RUBENS), (3) TAMARISK SCRUB (TAMARIX SP.)

Stream Bottom Width (A; <20 ft, B; 20-50 ft., C; 50-100 ft., D; 100-200 ft., E; 200-500 ft, F; >500 ft.): B

Substrate type (%) (granitic, ultramafic, marine sedimentary, calcarious, non-calcarious metamorphic, extrusive volcanic, other igneous, or mixed (if mixed give approx % of each)): METAMORPHIC

Surface Characteristics: %Silt 50%, %Sand 2%, %Gravel (0.25-1") 5%, %Rock (1-5") 10%, %Large rock (5-10") 25%, %Small boulder (10-20") 5%, %Boulder(>20") 2%

Streambed Morphology (braided multi-channel, narrow channel, holes and riffles, high cutbanks, etc. describe): BRAIDED MULTI-CHANNEL

Moisture Conditions Sampled at Beginning, Mid and End of Transect (A; standing water (depth), B; saturated substrate at surface, C; moist substrate at surface, D; moisture 6" beneath surface, E; dry throughout): Beginning: E Mid-: E End: E

Adjacent Channel Depth (A; <1 ft., B; 1-3 ft., C; 3-6 ft. D; 6-10 ft., E; >10 ft.): N/A
Main Channel Depth (A; <1 ft., B; 1-3 ft., C; 3-6 ft. D; 6-10 ft., E; >10 ft.): B

Age of Largest and 1 Mid-sized Sycamore (total dbh at point of core and annual rings/length of core of each (if can't read core label and store)):
Largest: SAMPLE B DBH 94.0 CM
Mid-Size: SAMPLE A1 DBH 42.3 CM / SAMPLE A4 51.7 CM

Health of Stand (anthracnose, lacebug, mistletoe, other. List by light, moderate, or heavy): MODERATE TO HEAVY ANTHRACNOSE, LACEBUGS - POPULATION INCREASING FROM MODERATE TO HEAVY INFESTATION; MANY CAVITIES

Evidence of Disturbance (recent flooding, grazing, gravel mining, other): GRAZING

For 5X50m plot please provide:

Sycamore clump (Assign letter code)	clonal sprouts (per clump)	DBH of Each Stem (indicate inches or cm)	Stem Damage Index (A light; B moderate; C heavy)
A	4 21cm	A1 42.3	(4)
		A2 8.4	
		A3 43.6	
		A4 54.7	
B	1 21cm	B1 94.0	(4)

Sycamore seedlings:_____ Sycamore saplings:_____

TRANSECT DATA: No Hits in Any Layer:

Low (Herb) Layer: ht. <_____(c)m

Cover estimate: 15%

Bare: ~~||||~~ ~~||||~~ |||

Rock: ~~||||~~ ~~||||~~ |||

Litter: ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ |||

Moss/Lichen:

Species	Tally
BROMUS RUBENS	||
CYNODON DACTYLON	~~||||~~ ~~||||~~ |||
UNIDENTIFIED GRASS	|||
ELEOCHARIS SP.	|||
ALGAL MAT (SPIROGYRA?)	~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ |||

Mid (shrub) Layer: ht.____(c)m-____m

Cover estimate:

Absent: ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~

Species Tally

Tree Layer: ht.____m-____m

Cover estimate: 45%

Absent: ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~

Species	Tally
PLATANUS RACEMOSA	~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~

Additional Species on Plot (5x50m)

BRASSICA GENICULATA
EREMOCARPUS SETIGERUS
FESTUCA MYUROS
CARDUUS SP.
BROMUS MOLLIS
HORDEUM LEPORINUM
POLYPOGON MONSPELIENSIS
POLYPOGON MARITIMUS
HORDEUM GENICULATUM
JUNCUS BUFONIUS
CRYPSIS NILIACA
POA ANNUA
RUMEX CRISPUS
BROMUS MADRITENSIS
LOLIUM MULTIFLORUM
AMARANTHUS ALBUS

HERBS continued:

BROMUS DIANDRUS
AVENA FATUA
PLAGIOBOTHRYS SP.
TILLAEA ERECTA

Appendix F

Environmental Variables Coded For Data Analysis

Appendix F

Environmental Variables Coded For Data Analysis

The following environmental variables were used for the analysis of the vegetation ordination. They are reflected on the previous field data sheet with a few exceptions. Those exceptions include data taken in a non-uniform way or data which was obviously not useful for the analysis (e.g., aspect of streambed, substrate type, moisture conditions, and adjacent channel depth).

Variable #1 elevation: read directly from attached topo map

Variable #2 slope of stream bed: a continuous variable from 0-90 degrees

Variable #3 aspect at sample point: a continuous variable from 0-360 degrees

Variable #4 slope of sample point: a continuous varible from 0-90 degrees

Variable #5 drainage basin size: continuous from 0 to many square miles

Variable #6 mean annual precipitation: a continuous variable taken from Rantz (1972) take the midpoint between two isohyets (in inches)

Variables #7 through #17 are adjacent non riparian vegetation coded as the predominant vegetation immediately adjacent to sampled stand of sycamore vegetation:

Variable #7 blue oak woodland
Variable #8 annual grassland
Variable #9 interior live oak woodland
Variable #10 agricultural land
Variable #11 valley oak woodland
Variable #12 mixed coast live oak and blue oak woodland
Variable #13 mixed valley oak and blue oak woodland
Variable #14 coast live oak woodland
Variable #15 coastal sage scrub
Variable #16 ceanothus chaparral
Variable #17 mixed chaparral

Variable #18 Stream bottom width: coded as six ordinal varibles with midpoint values used for data analysis. Midpoints are as follows: 10 ft, 35 ft, 75 ft, 150 ft, 350 ft, and500 ft.

Variable #19 percent silt: in 1 % increments (0-100)

Variable #20 percent sand: as above
Variable #21 percent gravel: as above
Variable #22 percent rock: as above
Variable #23 percent large rock: as above
Variable #24 percent small boulder: as above
Variable #25 percent boulder: as above
Variable #26 single streambed: coded as 0 or 1 (y or n)
Variable #27 multiple (braided) streambed: coded as 0 or 1 (y or n)
Variable #28 adjacent channel depth: a five point scale using midpoints as the points to be tallied (0.5 ft, 2 ft, 4.5 ft, 8 ft, 12 ft)

Variable #29 growth rate of largest sycamore: ratio of growth rings/cm
Variable #30 growth rate of mid-size sycamore: ratio of growth rings/cm

Variable #31 anthracnose level: (1=light, 2=moderate 3=heavy)
Variable #32 lacebug infestation: (light, moderate, heavy)
Variable #33 gravel mining: (light, moderate, heavy)
Variable #34 recent flooding: (light, moderate, heavy)
Variable #35 fire evidence: (light, moderate, heavy)
Variable #36 grazing: (light, moderate, heavy)
Variable #37 number of clonal sprouts >1 cm DBH
Variable #38 average stem diameter breast height (DBH in cm)
Variable #39 total number of seedlings in sample area
Variable #40 total number of saplings in sample area
Variable #41 number of clonal sprouts < 1 cm DBH
Variable #42 average stem damage index: (1=light, 2= moderate, 3= heavy)
Variable #43 percent cover of bare ground (0-100)
Variable #44 percent cover of rock
Variable #45 percent cover of litter
Variable #46 percent cover of moss or lichen
Variable #47 width of valley bottom, mid-points of ordinal scale (100 ft, 300 ft, 500 ft, 700 ft, 900 ft, 1200 ft)

Appendix G

Key to the Major Groups of Sycamore Dominated Vegetation Defined in this Report

Appendix G

Key to the Major Groups of Sycamore Dominated Vegetation Defined in this Report

General Instructions:
Read the key from the beginning and follow through the couplet dichotomies until you reach the desciption of the situation that fits the site you are attempting to identify. When making a determination, position yourself in a stand of vegetation with a uniform composition and in a uniform environment. For example, not at a noticeable break in cover or dominance of principal species, and not at the edge of an obvious topographic or substrate discontinuity (such as from a flat to a slope or a moist or wet river bed to a dry alluvial terrace). Remember that the samples used to develop this classification were 50-m long and 5-m wide and that looking at vegetation on a much smaller or much larger scale than this (e.g., at a sample only 1 m x 10 m or as large as 200 m x 2000 m) may suggest different results. It is also important to recall that the seasonality of this habitat (e.g., winter-deciduous dominant trees and spring-annual dominant understory plants) affords best determinations in the spring and summer.

1 Sycamore > 50% relative cover\1 in the tree layer.........**California Sycamore Series (2)**

1' Sycamore < 50% relative cover in the tree layer..........**Other riparian tree series (not included in key)**

2 Sycamore stands growing on alluvial benches or in narrow valleys adjacent to intermittent or permanent streams north of the California southwest coast ecoregion\2................. 3

2' Sycamore stands growing along streambeds in the valleys, foothills or mountains of the southwest coast ecoregion .... **Southern California Group (undifferentiated)**

\1. Relative cover is the percent of ground covered by the crown and stem of one species, in this case sycamore, divided by the percent cover of all other species in the vegetation layer (in this case, all tree species).
\2. This ecoregion includes the Transverse Ranges from Point Conception eastward to San Gorgonio Pass and the Peninsular Ranges from said pass south to the Sierra San Pedro Martyr in Northern Baja, California, and all points west to the Pacific Ocean (a map is available in the front of the Jepson Manual (Hickman 1993).

3 Sycamore stands growing along single-bed, rocky or bouldery stream channels in narrow valleys and canyons of foothill regions of the central and southern Coast Ranges and the southern Sierra Nevada..**Foothill Group**

3' Sycamore stands growing on fine-grained alluvium, typically on benches bordering multi-channel (braided) intermittent streams..**4**

4 Sycamore stands with at least a small percentage of coast live oak and/or California bay in the tree layer and within the influence of summer maritime air masses.........**Mid-coastal Alluvial Group**

4' Sycamore stands without California bay and coast live oak in summer-hot interior valleys bordering the San Joaquin Valley....................................**Interior Alluvial Group**

Appendix H

TWINSPAN Species/Sample Table for the 200 Most Frequently Occurring Species on all 86 Samples

[redacted]PENDIX H:T[redacted]SPAN[redacted]table for[redacted]200[redacted]frequently[redacted]occurring species on all 86 samples. Sample numbers (see Appendix 3) are listed across the top, species code numbers and names (see Appendix 2) are along left margin, binary codes for division cuts for species are on far right, binary codes for division cuts for samples are at bottom of table, vertical lines separate the four main groups, and species cover-abundance ranks are as in Table 4.

		Foothill Group	Interior Alluvial Group	Mid-coastal Group	S.Cal Group	
		88878877746	1177 11 1111112227 2224233524 333444	6673556 22344455555667746883533	6666	
		45690146729	233545601345678902481278946230177018689	74242308935503514569380111239867	2567	
245	POPU 2	1-1--------	--------------------------1------------	1------------------------------1	----	00000
433	RUOB A	11---------	---------------------------------------	--------------------------1-----	----	00000
449	TOAR	111--------	---------------------------------------	---------------------------1----	----	00000
163	JUPA 2	---------11	---------------------------------------	--------------------------------	1---	00001
287	SCAM	----2-111--	---------------------------------------	--------------------------------	2---	00001
300	SOAS	---------11	---------------------------------------	-------------------------------1	----	00001
40	BRCA 5	---1121----	1--------------------------------------	-------------------------1------	----	000100
57	CAR 1	11-311----1	1-------------------------1------------	--------------------------------	1---	000100
301	SOOL	----1----11	-------------------------1-------------	---------------------------1----	----	000100
29	BAVI H	1-1211111-1	-------1-------11-1--------------------	--------------------------------	----	000101
35	BODE	--------111	---------------------------------------	--------------------------------	----	000101
66	CEN 5	-------1-1-	------------------------1--------------	--------------------------------	----	000101
67	CEOC C	33---------	-----------------------------1---------	--------------------------------	----	000101
85	CYEC	-1--------1	------------------------1--------------	--------------------------------	----	000101
88	DAGL 2	----113----	---1-------------------1---------------	--------------------------------	----	000101
143	GNPA	------1---1	------------------------1--------------	--------------------------------	----	000101
145	GUBR	-----1-1---	------------------1--------------------	--------------------------------	----	000101
182	LIAN 2	111--------	-----------------------11--------------	--------------------------------	----	000101
197	MAVE	111--------	---------------------------------------	--------------------------------	----	000101
222	PADI 3	------321-1	---1--------------1----1-1-------------	--------------------------------	----	000101
224	PECA 3	------11111	--11-----------------------------------	--------------------------------	----	000101
248	POFR 3H	---12------	--1----1-------------------------------	--------------------------------	----	000101
282	SALA 4H	------11--1	--1---------------1--------------------	--------------------------------	----	000101
351	AGSE	------1-1-1	---------------------------------------	--------------------------------	----	000101
352	AICA	---111-----	---------------------------------------	--------------------------------	----	000101
362	BOST -1	----1-11---	---------------------------------------	--------------------------------	----	000101
369	CYNI C	------11---	---1-----------------------------------	--------------------------------	----	000101
372	ELMA -2	---3--241--	---2-----------------------------------	--------------------------------	----	000101
373	ELPA -3	----------4	---------------------------------------	--------------------------------	----	000101
375	EQHY C	---12------	---------------------------------------	--------------------------------	----	000101
381	GAMU -1	11111--1---	---------------------------------------	--------------------------------	----	000101
409	MEPI	111--------	---------------------------------------	--------------------------------	----	000101
444	STAL	-11-1--1---	---------------------------------------	--------------------------------	----	000101
22	ASFA	------11111	1-1-------1--1--1-1--------------------	-------------------------1------	----	000110

Appendix H: Twinspan Table for top 200 constancy/cover species on all 86 plots

APPENDIX H: (Continued)

No.	Species	Foothill Group	Interior Alluvial Group	Mid-coastal Group	S.Cal Group	
		88878877746	1177 11 1111112227 2224233524 33344	5673556 22344455555667746883533	6666	
		45690146729	233545601345678902481278946230177018689	74242308935503514569380111239867	2567	
34	ALGA	--435431443	1-213-1---2-22-------1-31-3------------	--2-----------------------------	----	000110
141	GNLU	111---111-1	--11---1----------11----1--------------	1-------------------------------	----	000110
148	HESC 1	-1-1--111--	-------1----1--1--------1--------------	--------------------------------	----	000110
161	JUBA	---1---1-11	--11---1-------------------------------	--------------------------------	----	000110
247	POMO 1	11111-12111	--111-1-1-1--1-1----111-11-------------	--1----------------------------1	----	000110
314	TOHE	------1--11	1-11-----------------------------------	--------------------------------	----	000110
343	XAST	11--111111-	---1---1-----------11--11-1--1---------	1-------------------------------	----	000110
190	LYHY	------111-1	-------1-------1--1-----1----1---------	--------------------------------	----	000111
208	MIPI 2	------111--	-------1------------1---1--------------	--------------------------------	----	000111
78	COCA 2	-------1---	--------------------------1------------	-------------------------------1	----	001000
323	TRHI	----------1	------------------------1--------------	------------------1-------------	----	001000
371	DAPU	----------1	---1-----------------------------------	---------------------1----------	----	001000
31	BAR 3	------1---1	---1-----------------------------------	-----------------------------1--	--1-	001001
345	ZACA 1	-----1-1--2	--11-----------------------------------	--------------------------------	---2	001001
266	RIB	----------1	1-1------------------------------------	------1-------------------------	----	00101
203	MEIN 1	------11111	-------------11----11---11--1----------	----1-------------------------1-	----	001100
220	PADI 2	---------1-	--------------------------1--1---------	--------------------------------	1---	001100
13	ANAR 2	------11--1	--11---1-------------------------------	---------------------1----------	----	001101
87	CYER 1	1-------111	-----------------------11-1--1---------	1-------------------------------	----	001101
185	LOPE 1	------11-21	1--1-1-1-----------1----2--------------	-------------1---1--------------	----	001101
276	RUCA 2	------1-111	--1-----------------1------------------	----------------------1---------	----	001101
277	RUCO	--------111	1-------------------1--1-11--1---------	1----------------------------1--	----	001101
315	TONO	---------11	1-11----1------------------------------	--1-----------------------------	----	001101
8	AMAL	------111-1	------11------------111------1-----1---	--------------------------------	----	00111
169	LASA	----------1	1------1-------------------------------	--------------------------------	----	00111
255	QUDO H	----------1	--1---------------------1--------------	--------------------------------	----	00111
83	CUPA	-----------	--------------------------2--------1---	--------------------------------	----	010000
114	ERRO 2	-----------	------1-1-----------------------1------	--------------------------------	----	010000
120	EUOC 2	-----------	--11--1-1----1-1-------11----1-1-1--1--	--------------------------------	----	010000
124	FEDE	-----------	1--3----42-11----1-----2--1-------5----	---------1----------------------	----	010000
125	FEME	-----------	-----1--4--------------1-------2--2----	--------------------------------	----	010000
136	GIL 1	-----------	-1------1--------------1--------1-2----	--------------------------------	----	010000
174	LACH 3	-----------	--------1-----------1-------1---1------	--------------------------------	----	010000
199	MEPO B	-----------	-------------1----------1--------1-----	--------------------------------	----	010000
296	SIOR 3	-----------	----------------111-----------1--------	--------------------------------	----	010000
313	TIER	-----------	--------1----------1-112-----11-11--1--	------1-------------------------	----	010000
1	AECA 2T	-----------	3--------------------------------------	--------------------------------	----	010001
41	BRAR 1	-----------	11111----11------1-1-----1-------------	--------------------------------	----	010001
91	DISA	-----------	---------------1--------1-1------------	--------------------------------	----	010001

Appendix H: Twinspan Table for top 200 constancy/cover species on all 86 plots

APPENDIX H: (Continued)

		Foothill Group	Interior Alluvial Group	Mid-coastal Group	S.Cal Group	
		88878877746	1177 11 1111112227 2224233524 333444	5673556 22344455555667746883533	6666	
		45690146729	233545601345678902481278946230177018689	74242308935503514569380111239867	2567	
97	ELCA 2	-------1---	-111---1-1---------1-------------------	--------------------------------	----	010001
150	HECU O	--------1--	-------1-------122---------------------	--------------------------------	----	010001
151	HESU 1	-----------	------------------------1-11-----------	--------------------------------	----	010001
167	KOPH	-----------	-----------11------1-------------------	--------------------------------	----	010001
196	MAOL	-----------	----------------------13---------------	--------------------------------	----	010001
233	PITR	-----------	11-1-----------------------------------	--------------------------------	----	010001
249	POFR 3T	----1------	-----------4---1-----------------------	--------------------------------	----	010001
256	QUDO T	-----------	----------4----------------------------	--------------------------------	----	010001
303	SPIR O	-----------	--------------------25-----------------	--------------------------------	----	010001
306	STCE	-----------	--11----------------1------------------	--------------------------------	----	010001
64	CEME 1	------11-11	--111-11111-111-11111------------------	--------------------------------	----	010010
320	TRLA 1	----1--111-	---1---11111-11-11111------------------	---------1----------------------	----	010010
84	CYDA	23222145345	1-241314113132312-31141132525411-121111	-------1-------------------1----	----	010011
95	ELE 4	---------2-	-----1-11-1-1--------2-------2---------	--------------------------------	1---	010011
122	EUSU	---------1-	-------1--1-------------1--------------	--------------------------------	----	010011
129	FIGA	---------1-	-11----------------------------1-------	--------------------------------	----	010011
134	GAPA 2	------1--11	-------1--1---------1-1-2--------------	--------------------------------	----	010011
155	HOGE	------11111	----21121----31-----111-1---------2----	-------------------------1------	----	010011
162	JUBU	--1---11111	--111-1-1----1-----1111-1--------------	--------------------------------	----	010011
246	POMA	------12111	1--11-111-1--1-1--1-11113----1---------	--------------------------------	----	010011
16	ARCA 7H	-----11----	1-111--1---------1--1----1-------------	1-------------------------------	----	010100
44	BRMA 2	1----111--1	21-32--1----1-----1-11--1--------------	-----------------1-------------1	----	010100
48	BRRU	-----11112-	-2121-2114213313414432131---1-32111--21	4--11--11-----1-2--2-----------1	---2	010100
86	CYP 3	-----------	-------1-------1------111--------------	-------------------------------1	----	010100
93	DISP	------11---	1-11----1-211----12-1-----1-2-11--1-1--	-------2-1----------------------	----	010101
126	FEMY	--1---1---1	-113-11133111121133311131-1--231215-211	--2-1---11-----3-3--------------	----	010101
153	HOVI	-------1---	----1--111---------1-------------------	-------------------------1------	----	010101
186	LOPU 2	------11111	1-11--1---1-111-1-11----21------------1	---1-1--------------------------	----	010101
243	POSC 3	-----------	--12----1------------------------------	-----1--------------------------	----	010101
278	RUCR 2	---------11	1-11----------------11-1-11--1---------	1------------------1---------1--	----	010101
127	FEPA	-----------	---1----1----------1---1------1111--1--	---1----------------------------	----	010110
156	HOGL	-----------	-----1-1-------1-11--2-1-1-----2--11-1-	----------------------------2---	----	010110
12	AMS 1	---------11	--------1-------1--11-12--11111--113-21	---------1--2-1------1------1---	----	010111
158	HYGL	---------11	--------1-1--1---------32--------11--11	----21--------------------------	----	010111
237	PLHO CA	-----------	-111-------------------2-------2----11-	---1--1-------------------------	----	010111
260	QUWI T	--2--------	3-----------------------------------55-	---1-------3--------------------	----	010111
157	HOLE	----------1	--1-21122311-111-11-11-1-1111-1-11241--	-------31-1------1---112-------1	----	01100
170	LASE 1	---------1-	------1--1---1-------1------1-1--------	------------1------------------1	----	01100
73	CHOR R	-----------	-------------11-11-11----------1-------	---------------1-1-------1------	----	01101

Appendix H: Twinspan Table for top 200 constancy/cover species on all 86 plots

APPENDIX H: (Continued)

		Foothill Group	Interior Alluvial Group	Mid-coastal Group	S.Cal Group	
		888788877746	1177 11 1111112227 2224233524 333444	5673556 22344455555667746883533	6666	
		45690146729	233545601345678902481278946230177018689	74242308935503514569380111239867	2567	
112	ERGR 3	-----------	----1--------------1-------------------	--------------------------------	---1	01101
144	GRPR	-----------	-----------------11--------------------	------------------------1-------	----	01101
152	HOOB	-----------	-1-1--------------------1--------------	----------1---------------------	----	01101
30	BAVI S	---------1-	------------------4-3-3441------------1	213--------------2-------1-1----	---1	011100
104	EPPA	-----------	11---------------------------1---------	-----------------1-1------------	----	011100
184	LOMU	-----------	----1---------------111-1----1---------	--1-2----------------------1----	----	011100
210	MOPE 2	-----------	11-----1--------------11---------------	----1----------------2----------	----	011100
234	PLTE 1	-----------	--2------------------------------------	-----1--------------------------	----	011100
295	SIOF	----------1	11--------------------11--11-----------	----------1----1---------------1	----	011100
117	ERCI 2	-------1---	---------1--1-1-1----------------------	---1------1---------------------	----	011101
56	CATE 4	------11---	111-1--11------------------------------	----------1--------1---------1--	----	011110
106	ERSE	-11--111111	1-21-1111111-11111-111-12-12---1111----	-12----11---------13-31---------	----	011110
333	VETH	1-1--------	----------------------1-11-------------	1------------------------------1	----	011110
81	CRNI	--1--------	----1----------------1-----------------	--1------------------------1----	----	011111
195	MAVU	-------1--1	------------1-----1-1------------------	-1-----------1------------1-----	----	011111
198	MEPO	-------1--1	--------------1----1----11-------------	----1--------------------------1	----	011111
37	BRGE	-------112-	----1-11-1-11111121111---2----1--------	1-----1--11-11111111----21---1--	----	1000
238	PLRA T	5555555-555	555555555554-44555555555555555555-55455	55555554555155454555555555555555	5155	10010
46	BRMO 2	------11-11	115411212221113-123411122111-222112-121	1--14424311--311514-52221------1	--2-	10011
304	STME	----------1	111-1--1--------------11--11-----11----	----1-1--111--1------3---------1	----	10011
5	AGR 2	-------1---	-------------------1-------------------	--1----------------------------1	----	10100
204	MEN 1	-----------	------------------------1----1---------	--1------------------------1----	----	10101
23	AVBA	-------1--1	11111--1-11-113111112--114---1-1-------	---12113----3-2-41121212-1----1-	----	10110
43	BRDI 2	-121-1-11-2	314-51232211-44113513135545455212352133	553551312155351554555514552352	-552	10111
202	MEAL 1	111--------	---------------------------------------	--1-11--------------------------	----	110001
99	ELGL	---------11	1-1------------------------------------	1--------------1---------11-----	----	11001
130	FOVU	---------2-	---------------------------------------	1-----------------------1--1----	----	11001
212	MURI 2	-----------	----------1----------------------------	-----1--------------------------	---1	11010
294	SIMA 2	---------1-	-------2--------------------------1----	11---------------1-1-----------1	-5--	11010
318	TODI H	---------1-	1-1------------------------------------	1---------------1----1--------11	--4-	11010
329	URHO	1---------1	--1------------------------------------	-------------------------------1	3---	11010
24	AVFA	-----1---1-	--1-----------------11------------1----	-----1--1--1-------1------11-2--	----	110110
77	COMA	----------1	-------1-------------------------------	-4------------------------------	----	110110
135	GAL 4	-----------	-1-1---------------------1-------------	2-----1------------------1----11	----	110110
218	ORMI 2	-----------	------------------1------1-------------	21-----------------------1------	-1-	110110
292	SEVU	-----------	-----------------------1---------------	-----------------1-------------1	----	110110
65	CESO 1	-----------	-------11------------------------------	----2------------------11-------	----	110111
90	DAME	-----------	--------------------------1--------1---	-1-1-------1--------1---------1-	----	110111
100	ELTR	-----------	---1-1-------------------------------1-	----1------2--1-----------------	----	110111
110	ERFA	-----------	----1----------------------------------	---------------1----1-----------	----	110111

Appendix H: Twinspan Table for top 200 constancy/cover species on all 86 plots

		Foothill Group	Interior Alluvial Group	Mid-coastal Group	S.Cal Group	
		88878877746	1177 11 1111112227 2224233524 333444	5673556 22344455555667746883533	6666	
		45690146729	233545601345678902481278946230177018689	74242308935503514569380111239867	2567	
123	FES 3	-----------	-------------------------------2-12----	----1-125-----------------------	----	110111
257	QULO T	--3--------	------------------------------------5-1	---541-------3------------4-----	----	110111
293	SIGA	1----------	-----------------------11------------11	---1111--------1-----1----------	----	110111
330	URUR	-----------	------------------------------1--------	---------11---------------------	----	110111
384	GEMO	1-1--------	---------------------------------------	---------------------3-----1----	----	110111
2	AECA 2S	-----------	---------------------------------------	------1--------------------1-1--	----	111000
17	ARCA 7S	-----------	---------------------------------------	--------------------3-----------	----	111000
25	AVE	-----------	------1--------------------------------	-2---4--------------1--------1--	----	111000
39	BRNI S	-----------	---------------------------------------	--------------------4------1----	----	111000
131	FRLA 2T	-----------	---------------------------------------	---3----------------------------	----	111000
188	LUBI	-----------	---------------------------------------	----11---------------1----------	----	111000
258	QULO H	-----------	---------------------------------------	--11-------------------------1--	----	111000
281	SALA 4T	-----------	---1-----------------------------------	----------------------------52--	----	111000
309	SYRI S	-----------	---------------------------------------	------1-------------------33----	----	111000
328	UMCA 1	----------1	---------------------------------------	--1----------------------141-1--	----	111000
426	QUAG H	-----------	---------------------------------------	--1------------------1----1-----	----	111000
38	BRNI H	--1--------	---------------------------------------	-31-------------1----121--------	----	111001
55	CAPY 2	--1------11	------------------------11-------------	21-----21--------11--222--21----	--2-	111001
121	EUPO 1	-----------	---------------------------------------	-3------------------------------	----	111001
159	JUCA 4	-----------	---------------------------------------	-3------------------------------	-1--	111001
239	PLRA S	-----------	---------------------------------------	24------------------2---------1-	----	111001
240	PLRA H	-----------	---------------1-----------------------	32----------------1-------------	----	111001
305	STVI 2	-----------	-------------------1-------------------	-1--11--------------------------	----	111001
340	VICA 3H	-----------	---------------------------------------	-----------3------------------45	----	111001
291	SEDO 2	-----------	---------------------------------------	---------------1-1--------------	---2	111010
316	TODI S	--------1-1	---------------------------------------	-----------------------13-12-1--	4---	111011
52	CAOC 2	-----------	---------------------------------------	------------------------------4-	----	111100
275	RUUR	-----------	---------------------------------------	-----------------------------224	2-1-	111100
339	VICA 3S	-----------	---------------------------------------	------------------------------4-	----	111100
98	ELCO	-----------	---------------------------------------	-2------------------------------	---1	111101
176	LEM	-----------	---------------------------------------	1--------------------------1----	1---	111101
194	MAMA 2	-----------	---------------------------------------	-2------------------------------	-11-	111101
253	QUAG T	----1-----2	---------------------------------------	-55--52----------------------1--	515-	111101
133	GAAP	-----------	---------------------------------------	----1----------------1----------	-21-	111110
18	ARDO 3	-----1-1---	---------------------------------------	-2-1--------------------------43	-244	111111
42	BRCA 1	-----------	---------------------------------------	--------------------------------	-2-1	111111
47	BRRI 2	-----------	---------------------------------------	--------------------------------	-4-	111111
61	CECR	-----------	---------------------------------------	--------------------------------	---3	111111
108	ERCR 2	-----------	---------------------------------------	--------------------------------	---4	111111

Appendix H: Twinspan Table for top 200 constancy/cover species on all 86 plots

APPENDIX H : (Continued)

	Foothill Group	Interior Alluvial Group	Mid-coastal Group	S.Cal Group	
	88878877746	1177 11 1111112227 2224233524 33344	5673556 22344455555667746883533	6666	
	45690146729	233545601345678902481278946230177018689	74242308935503514569380111239867	2567	
160 JUCA 4S	-----------	---------------------------------------	--------------------------------	2-3-	111111
225 PHDI 1	-----------	---------------------------------------	--------------------------------	--4-	111111
254 QUDU -2	-----------	---------------------------------------	--------------------------------	---4	111111
265 RHTR	-----------	---------------------------------------	--------------------------------	--25	111111
274 RUPR S	-----------	---------------------------------------	--------------------------------	5---	111111
283 SALA 3	-----------	---------------------------------------	--------------------------------	3---	111111
286 SAME 6	-----------	---------------------------------------	--------------------------------	-5--	111111
317 TODI T	-----------	---------------------------------------	--------------------------------	3---	111111
	00000000000	000000000000000000000000000000000000000	11111111111111111111111111111111	1111	
	00000000000	111111111111111111111111111111111111111	00000000000000000000000000000000	1111	
	00011111111	000000000000000000000000000000011111111	00000000000000000000000000000011		
	0001111100	001111111111111111111111111100000011100	0111111111111111111111111111		
	00011	00000000000000001111111111000001	000000000000000000000111111		
		00000111111111111000000111100111	000011111111111111111000011		

Appendix H : Twinspan Table for top 200 constancy/cover species on all 86 plots