THE DISTRIBUTION, HABITAT, AND STATUS OF THE VALLEY ELDERBERRY LONGHORN BEETLE *DESMOCERUS CALIFORNICUS DIMORPHUS* FISHER (INSECTA: COLEOPTERA: CERAMBYCIDAE)

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Summary

The valley elderberry longhorn beetle (VELB), *Desmocerus californicus dimorphus* Fisher (Coleoptera: Cerambycidae), is patchily distributed throughout the Central Valley from Redding to the Bakersfield area. During this survey evidence of the VELB was found at about 28 percent of 230 sites with *Sambucus*, and in about 20 percent of 504 groups of elderberry at those sites. Of those with exit holes, recent (current year) holes were present at about 52 percent of 64 sites, and in about 45 percent of 103 groups of elderberry. Four adult beetles were collected at three sites in the eastern Central Valley. No evidence of the VELB was seen at several localities where it had been previously reported.

Elderberry shrubs/trees with VELB populations occur in a variety of habitats and plant communities, but most often in riparian or savanna areas. Two species of elderberry, *Sambucus mexicana* Presl. and *S. racemosa* L. var. *microbotrys* (Rydb.) Kearney & Peebles, serve as hosts for the beetle. The VELB inhabits elderberry of various sizes, ages, and growth forms. Those with many exit holes were most often large, mature plants; young stands were seldom infested. Emergence holes were most frequently found in healthy, unstressed plants.

An assortment of branch sizes are utilized for larval development and pupation. Fifty percent of those measured in this survey were 2-4 inches in diameter at the exit hole. However, some smaller than 1.5 inches in diameter were encountered infrequently, the smallest being 0.6 inches.

The valley elderberry longhorn beetle appears to be either a poor disperser or very host plant selective. The beetle was most likely to occur in situations where plants were not isolated from one another. In addition, it seems to be only locally common, i.e., found in population clusters which are not evenly distributed across available *Sambucus*. Frequently only particular trees or clumps in an area harbored the VELB, and other similar ones nearby were unaffected. The infested plants usually showed evidence of utilization over a period of several years, but sometimes only one or two exit holes were present. The reason for the selection of particular plants as hosts is not known.

Introduction

TAXONOMY

Desmocerus californicus was described by Horn in 1881 from a specimen collected in southern California, and is known only from California. The valley elderberry longhorn beetle (VELB) was first described as a separate species, *Desmocerus dimorphus* Fisher (1921), based on the distinctive coloration of the males; Sacramento was the type locality. Subsequently Linsley and Chemsak (1972) recognized the two as subspecies, and designated the latter as *D. californicus dimorphus* Fisher.

The subspecies are separated on the basis of distribution and the color pattern of the males. The male of *D. c. dimorphus* (Figure 1) is described as usually having the dark pattern of the elytra reduced to 4 oblong spots, and the basal segments of the antennae usually clothed with pale hairs. Conversely, the male of *D. c. californicus* has the dark pattern of elytra occupying most of the surface, and dark hairs on the basal segments of the antennae (Linsley and Chemsak 1972). The males of the latter subspecies are slightly larger on the average. Females of both have color patterns similar to the males of *D. c. californicus*, with dark elytra bordered in red or reddish orange (Figure 2), and are difficult or impossible to separate on the basis of morphology alone. A small percentage of male *D. c. dimorphus* also have an elytral pattern identical to that of the nominate subspecies.

Halstead (1990, 1991a) believes that *D. c. dimorphus* should be designated as a junior synonym of *D. californicus*. He claims that the two are merely color variants exhibiting the character extremes of a single species, and that "the characters used to distinguish the subspecies are not valid due to the great amount of variability, intergradation, and overlap." His work has not yet been published in a scientific journal, and prevailing opinion presently supports the current subspecific status of the VELB (Chemsak pers. comm.).

DISTRIBUTION

Linsley and Chemsak (1972) reported the range of *D. c. dimorphus* to be from the lower Sacramento Valley to the upper San Joaquin Valley (Figure 3). At that time nearly all records were from specimens

(Figure 3). At that time nearly all records were from specimens collected in the Sacramento and Davis areas. Since then the known range of the beetle, based on adult specimens, has been extended northward along the Sacramento River almost to Red Bluff in Tehama County (Jones and Stokes 1985, 1986, 1987b). The westernmost records are from Yolo County along Putah Creek just below Lake Berryessa (Schuster 1984). Halstead (1990) has taken adults as far southeast as the upper Kaweah River in Tulare County, and has examined specimens from the U. S. National Museum which were collected by H. K. Morrison, probably in 1880 (Shields 1990a), and labeled simply "Kern County." Adults have been collected at elevations ranging from 30 feet on the Central Valley floor to about 2200 feet in the Sierra Nevada (Halstead 1990).

In addition to adult records, the range has been further expanded by exit hole reports. Halstead (1990) found exit holes along the Sacramento River almost as far north as the Shasta/Tehama County line, and they were reported by Holland (1985) from along the Feather River in Yuba County. The most southeastern records were from along Caliente Creek in Kern County by Shields (1990b, 1990c).

The nominate subspecies, *D. c. californicus*, primarily inhabits the coast and Coast Ranges from Mendocino County southeast to Los Angeles and Riverside counties (Linsley and Chemsak 1972) (Figure 3), but there are a few isolated records from Trinity, San Diego, and eastern San Bernardino counties (Halstead 1990). Andrews et al. (1987) identified as this subspecies specimens from along Los Banos Creek (Merced County) in the eastern foothills of the Coast Range at an elevation of 400-440 feet.

It is not known if the ranges of the subspecies are parapatric, or adjoining; if so, hybrids or intergrades can be expected in the zone where this occurs.

LIFE HISTORY

Although there has been no detailed study of its life history and ecology, many independent observations have contributed to the current body of knowledge about *D. c. dimorphus*. The beetle has been found only in association with its host plant, elderberry (*Sambucus* spp.). Adults feed on the foliage and perhaps flowers, and are present from March through early June. The largest percentage of specimens have been collected in May. During this period the beetles mate, and the females lay eggs on living elderberry plants. The eggs are about 2.5-3.0 mm long, reddish brown, and are shaped like an elongate football with longitudinal ridges. The female places the eggs singly or in small groups in bark crevices or at the junctions of stem/trunk or leaf petiole/stem (Halstead 1991a). Upon eclosing, the first instar larva

undetermined amount of time, creating a characteristic gallery which is filled with frass and shredded wood (Figures 4, 5). The mature larva pupates in an enlarged pupal chamber within the tunnel. After transforming into an adult, it chews an exit hole and emerges from the elderberry (Chemsak pers. comm.). The life cycle of the VELB has been assumed to encompass two years, but recent information from rearing experiments suggests that a one year cycle is possible, if not probable (Halstead 1991a).

Valley elderberry longhorn beetle exit holes are circular or slightly oval and are usually 7-10 mm in diameter (Figures 6, 7, 13). Although there are many insects which burrow in wood for at least part of their life cycle, none other than the VELB are known to inhabit live elderberry wood and/or make exit holes of a similar size and shape in the Central Valley (Nagano 1989). The range of another species, *Desmocerus auripennis auripennis* Chevrolat, may overlap that of the VELB in the Sierra Nevada where it has been recorded from as low an elevation as 3500 feet. However, it is a much larger and more robust species and its exit holes would likewise be larger.

VELB emergence holes have been observed in shoots or branches with diameters as small as 0.5 inches (13 mm) (Halstead 1991a), to as large as 8 inches (Jones and Stokes 1985, 1986, 1987b). Jones and Stokes (1985, 1986, 1987b) also reported that more than 70 percent of the holes they found on the upper Sacramento River were located at 4 feet or less stem height.

HABITAT

Because of problems with the taxonomy of *Sambucus* (Caprifoliaceae) resulting from phenotypic variability, possible hybridization, and the need for a generic revision, the species serving as host(s) for the VELB has/have been in question. *Sambucus glauca* Nutt. was given as the host for both subspecies of *D. californicus* by Linsley and Chemsak (1972); both *S. mexicana* Presl. and *S. caerulea* Raf. have also been suggested as possible hosts (USFWS 1984).

Elderberry is a common component of the remaining riparian forests and adjacent grasslands of the Central Valley. It grows in association with various species of woody plants, depending on the locality, such as Fremont cottonwood (*Populus fremontii*), California sycamore (*Platanus racemosa*), willow (*Salix* spp.), oak (*Quercus* spp.), boxelder (*Acer negundo*), Oregon ash (*Fraxinus latifolia*), wild grape (*Vitis californica*), and poison oak (*Rhus diversiloba*) (USFWS 1984). *Sambucus mexicana* is the characteristic species of the Elderberry Savanna (Holland 1986) which borders riparian forests in some areas.

Almost 90 percent of the riparian habitat in California has been lost to agricultural and urban development during the last 150 years. It has been conservatively estimated that these forests formerly covered 922,000 acres in the Central Valley; an aerial survey in 1979 revealed that only about 102,000 acres remained at that time. Although little is known about the historical distribution and abundance of the VELB or its foodplant, extensive destruction of the riparian forests strongly suggests that the range of the beetle has been reduced and greatly fragmented (USFWS 1984). The earliest study of the distribution and status of *Desmoscerus c. dimorphus*, by Eya (1976) during 1975 and 1976, concluded that it was rare, localized, and in need of protection. That view has been shared by Dr. John Chemsak at University of California at Berkeley, an expert on the Cerambycidae (Federal Register 45:52803-52807)

FEDERAL PROTECTION

On August 10, 1978, the U. S. Fish and Wildlife Service (USFWS) proposed that *Desmocerus californicus dimorphus* Fisher be listed as threatened, with Critical Habitat (Federal Register 43:35636-35643); it was listed as such on August 10, 1980 (Federal Register 45:52803-52807). The two areas designated as Critical Habitat are both along the American River in the greater Sacramento metropolitan area.

A Recovery Plan published by the U. S. Fish and Wildlife Service in 1984 summarized the known aspects of the taxonomy, biology, distribution, and habitat/population decline of the beetle. Most importantly, the Plan detailed steps to protect the VELB and its habitat, and to gather additional information. Other than the Critical Habitat, two areas were designated as Essential Habitat: a portion of Putah Creek in Solano County, and the American River Parkway below Nimbus Dam in Sacramento County. An implementation schedule was included for the recovery process.

PREVIOUS STUDIES, 1984-1991

Since 1984 there have been several studies investigating the distribution, habitat, and life history of the VELB.

Under contract with the California Department of Fish and Game (CDFG), Arnold (1984) surveyed sites along the lower American River and several waterways in the lower Sacramento and upper San Joaquin valleys. Adult beetles were collected and/or observed along the American River.

Exit holes were found in Sacramento County along the Cosumnes River and Dry Creek; in San Joaquin County along Bear Creek, the Calaveras and Middle rivers; in Stanislaus County along the San Joaquin and Tuolumne rivers; and in Merced County along the Merced River. Working independently in 1985, Arnold reported adults from localities along the Sacramento River near its junction with the Feather River (Yolo County), Putah Creek (Solano County), and the Calaveras, Middle, Mokelumne (San Joaquin County), and Merced (Merced County) rivers. Unfortunately detailed reports and specific locality information are unavailable, and specimens collected have not yet been deposited at the University of California at Berkeley as Arnold (1985) stipulated.

Kellner found exit holes at a site on the Sacramento River in Broderick (Larry Seeman Associates 1985b) (also noted by Arnold 1986), and the American River at Sacramento Bar in Fair Oaks (Larry Seeman Associates 1985a). He also surveyed some areas along the San Joaquin River for a U. S. Army Corps of Engineers (COE) project (Environmental Science Associates 1985) but found no evidence of the VELB.

Nimbus Flat at Lake Natoma, part of Folsom Lake State Recreation Area, was surveyed for the valley elderberry longhorn beetle by the California Department of Parks and Recreation (CDPR); adults and exit holes were observed (Showers 1987, Singleton 1987).

Jones and Stokes (1987a) found exit holes, but no adults, during a survey of three tracts of land along the Cosumnes River southwest of Sloughhouse. Jones and Stokes also conducted a comprehensive three-year survey of 183 miles of the Sacramento River from its confluence with the American River in Sacramento, north to the Red Bluff Diversion Dam (Jones and Stokes 1985, 1986, 1987b). During this time 10 adults were collected from Knights Landing (Yolo County) to Proberta (Tehama County). Exit holes were found as far north as 3.5 river miles south of the Diversion Dam.

A stretch of Los Banos Creek (Merced County) from 400-800 feet in elevation, due to be impacted by Los Banos Grandes Reservoir, was inventoried by Andrews et al. (1987). Over a two month period only two adult specimens were collected, a male and a female. Although identified as the unprotected, nominate subspecies, *D. c. californicus*, it is possible that the single male could be the atypical dark form of *D. c. dimorphus*, a hybrid, or an intergrade. The beetles and numerous exit holes were found at an elevation of 400-440 feet.

In 1990, Shields conducted a field survey for the U. S. Fish and Wildlife Service in Kern County and reported finding exit holes at five sites along the Kern River, Poso Creek, and Caliente Creek (1990b, 1990c).

Halstead (1989, 1990, 1991a, 1991b, 1991c), working for the Kings River Conservation District, has been studying the VELB primarily from Merced County to Tulare County. He has taken adult specimens along the

Merced River, Kings River, West Fork Byrd Slough, Middle Fork Kaweah River, and in and near the town of Coarsegold (Madera County).

Reports from various other individuals and consultants, primarily to the California Department of Fish and Game (CDFG) Natural Diversity Data Base (NDDB), have supplied additional records. Of these, California Department of Transportation (CALTRANS) workers Ford and Villa (1987) were notable for reporting exit holes from Red Bluff, the most northern record at the time.

CURRENT STUDY

The primary goals of this status review have been: (1) to survey significant riparian vegetation in the Central Valley and foothills of the bordering mountains to determine the range of the valley elderberry longhorn beetle, and the maximum altitude at which it occurs; (2) to determine the habitat and ecological conditions preferred by the VELB by ascertaining the size, condition, and taxonomic identity of the elderberry host plants, and size and condition of riparian habitats utilized; (3) to record life history and behavioral information acquired from adults encountered, and from exit holes and infested wood examined; (4) to determine the amount of habitat that is currently protected in areas such as parks, refuges, and preserves; (5) to detail specific threats to the existence of the VELB, and to provide recommendations for its continued management and protection.

Materials and Methods

SURVEY AREA

A survey of the Central Valley and adjacent foothills was conducted during the period from 10 April to 31 July 1991; 45 total days were spent in the field. William S. Pence assisted from 4 June to 31 July 1991.

A total of 230 sites with *Sambucus* were examined, mostly in riparian habitats along the major rivers and streams from the Central Valley floor to the adjacent foothills of the Sierra Nevada and Coast Ranges (Figure 8). Elderberry shrubs/trees along most of the Sierran rivers were surveyed only up to the large reservoirs found usually from 700-1000 feet in elevation. However, in some areas plants were checked up to maximum elevations of 2000 feet, or until they or exit holes were no longer found. Special effort was directed to the areas around Redding at the northern end of the Central Valley, and Bakersfield at the southern end, to determine the north-south range of the beetle. Although some areas with previous records were surveyed, primary emphasis was placed on finding new populations. Due to the large scope of this project and the short time allocated, areas examined were mostly located adjacent to public roadways and in parks where rapid access was possible.

DOCUMENTATION

Detailed field notebooks were kept of all elderberry sites surveyed (consecutively numbered); areas where *Sambucus* was not found to be present were also noted. Complete locality information for the numbered sites (designated in this report as "#" followed by a numeral) is given in Appendix I. The two volume DeLorme *California Atlas and Gazetteer* (1986) was used in navigating during the field survey. Routes followed were highlighted in yellow, and color-coded dots were placed at VELB localities, including records from previous studies. Original field notes and atlases will be deposited at the Sacramento Field Office of the U. S. Fish and Wildlife Service.

Sites with present or past VELB populations examined during this survey have also been pin-pointed on 7.5 minute U.S.G.S. topographic

maps. Color-coded dots bear the site number, with red signifying adult records; blue, recent exit holes; and green, old exit holes. Due to space limitations on the maps, not all elderberry plants with holes or types of holes found at a site are represented by a dot: if recent holes were present, old holes are usually not indicated. Site elevations were determined from topographic maps, and the accuracy depended on the contour interval of the particular map. The overall range of the beetle as determined by this study and historic records is illustrated on 1:50,000 and 1:1,000,000 scale maps. All maps will be deposited at the Sacramento Field Office of the U. S. Fish and Wildlife Service.

A California Native Species Field Survey Form for each of the VELB sites has been prepared for the California Department of Fish and Game Natural Diversity Data Base (NDDB); copies will also be filed at the Sacramento Field Office of the U. S. Fish and Wildlife Service.

Numerous photographs were taken using 35 mm color slide film. These included pictures of elderberry plants that were VELB habitat, those with different physical characteristics, and close-up shots of adult beetles and exit holes. The slides will be deposited at the Sacramento Field Office of the U. S. Fish and Wildlife Service.

FIELD TECHNIQUES

ELDERBERRY

In accordance with Jones and Stokes (1986), "*potential* VELB habitat is defined by the presence of mature and immature elderberry shrubs (*Sambucus* spp.)."

In most stands of *Sambucus* it was difficult to separate individual plants from adjacent ones. A clump may be a single individual with many root shoots and multiple trunks, or may be several individuals growing in close proximity. Therefore, the amount of elderberry surveyed was designated according to type of *growth form*:

(1) tree - arborescent individual, usually with a single trunk (Figures 9, 10)
(2) clump - discrete bush-like group with multiple shoots/stems/trunks (Figure 11)
(3) grove - large discrete clump with more than 10 major trunks (Figure 12)

These types will be officially, collectively referred to as *groups* of elderberry. The terms *bushes* and *shrubs* may be used informally and loosely for an individual, and *stands* for an assemblage of individuals.

The ***maximum diameter*** of the largest trunk of a tree/clump/grove is indicative of its overall size and maturity. An English measure diameter tape, which converts circumference into diameter, was used to take measurements. Usually these were made at about breast height, i.e., 4.5 feet from the ground, but sometimes multiple trunks or masses of young shoots caused a small deviation from this. For descriptive convenience, the following arbitrary scale depicting age class was used:

(1) very young - <1 inch maximum diameter
(2) young - >1-<2 inches
(3) young mature - >2-<3 inches
(4) mature - >3 inches

The physical condition of an elderberry plant was noted in view of its general health and any damage present. ***Health*** was reported as:

(1) good - vigorous growth, green foliage
(2) fair - some sickly young shoots, foliage slightly droopy or yellowish
(3) poor - many dead/dying young shoots and/or branches, foliage droopy and yellowish

Those in the *poor* category could be considered "stressed." Three types of elderberry ***damage*** was observed, usually inflicted by man: cutting, fire, and herbicide.

The ***density*** of elderberry in the immediate vicinity of a surveyed site was subjectively determined as follows:

(1) isolated - one to a few lone trees/clumps, or a grove, with no others in sight
(2) scattered - several trees/clumps/groves spaced widely apart
(3) many - lots of trees/clumps often in groves, large clusters, or linear configurations along fencerows or levees

Thirty-six specimens of *Sambucus* foliage and flowers from 34 sites were prepared for identification by pressing and drying in a plant press. Most of these were taken from plants with VELB exit holes or where adults were found. All elderberry plants at a particular site are assumed to be the same species. The determinations are given in Appendix II. The specimens were identified by Lauramay Dempster of the Jepson Herbarium, University of California, Berkeley, and will be permanently deposited there as vouchers. Dempster is currently preparing the section on the genus *Sambucus* for the forthcoming *Jepson Manual* on the flora of California.

VALLEY ELDERBERRY LONGHORN BEETLE

In accordance with Jones and Stokes (1986), "*actual* VELB habitat is defined by the presence of VELB adults or elderberry shrubs with VELB emergence holes."

Elderberry plants were examined for evidence of the VELB by scanning the foliage, flowers, trunks, and branches for adult beetles, and the trunks and branches for exit holes. Binoculars were frequently used to examine the external canopy of large clumps; the inside of the canopy and trunks/branches were checked with the unaided eye.

When adult(s) were found, their substrate (leaf or branch/trunk), position (outside or inside canopy, right side up or upside down), and height above the ground were recorded. Specimens collected will be permanently deposited at the Natural History Museum of Los Angeles County (Entomology Section), Los Angeles. Subspecific identification was verified by Dr. John A. Chemsak, University of California, Berkeley, an authority on the longhorn beetles (Cerambycidae). In addition, all specimens of *Desmocerus californicus* housed in the California Academy of Sciences, Golden Gate Park, San Francisco, were borrowed on loan and also verified by Dr. Chemsak. These included specimens collected by Halstead outside the previously known range of the VELB in Merced, Madera, and Fresno counties.

All holes (with the proper characteristics, as explained below) found in elderberry in the Central Valley and the adjacent foothills of the Sierra Nevada and Coast Ranges were assumed to be VELB exit (=emergence) holes. If a small number of holes were present at a site, data were recorded for each; with large numbers, a series was selected which included any recent holes present. The relative age and condition of the individual exit holes were indicated thus:

(1) recent - current-year, clean-cut with fresh, light-colored wood inside
(2) old - not made this year, but clean-cut and undamaged, wood inside discolored (Figure 13)
(3) old poor - not clean-cut, eroded and/or enlarged by other insects, rot, or bird pecking (Figures 17, 18)
(4) partly healed - hole partially closed by growth (Figure 14)
(5) healed - hole completely occluded resembling an opening closed by a drawstring, cut-out circle usually still obvious in the bark (Figure 15)

A mini-flashlight was used to illuminate the dark interiors of the holes in order to determine whether or not they were recent. When it was

difficult to decide if a hole was new or not, it was entered as old. Only holes in good condition and of the proper size and shape (i.e., clean-cut, circular or slightly oval, and 7-10 mm in diameter) were recorded as VELB exit holes (Figures 6, 7, 13).

The condition of the branch or trunk(=stem) bearing exit hole(s), whether alive or dead, was noted. The longer wood has been dead, the more difficult it is to determine if the holes were originally caused by the VELB or by insects which bore in dead wood (Figures 17, 18). Pecking by birds, as well as the secondary invasion of such insects (Figure 16), can also obscure signs of VELB presence. All of the sites listed in this report, except three, are thought to have definite evidence of recent or previous VELB activity. The remaining three are reported as possibilities. Forty-two wood samples with possible exit holes were taken from 30 sites. Mostly dead wood, these were longitudinally sectioned with a bandsaw to confirm VELB habitation by the presence of larval galleries. The wood samples, tagged with locality and other data, will be permanently housed at the Natural History Museum of Los Angeles County (Entomology Section), Los Angeles.

Other exit hole data recorded were the diameter of the branch/trunk at the exit hole measured with an English diameter tape, and the vertical height of the hole above the ground taken with a standard English tape measure.

Results and Discussion

PREVIEW

During the field study evidence of the valley elderberry longhorn beetle was found at 64, or 27.8 percent, of the total 230 sites examined (Figure 8). Three additional areas are questionable possibilities. Four adult beetles were observed and collected from three different localities in the eastern Central Valley: Tulare County, Campbell-Moreland Ditch (tributary Tule River) just S of Porterville, elevation ~490 feet, 21 April 1991, one female; Tulare County, Lane Slough (tributary Kaweah River) ca. 5 miles N of Exeter, elevation 405 feet, 30 April 1991, one dead male with atypical dark coloration; San Joaquin County, Mokelumne River ca. 1 mile N of Clements, elevation ~135 feet, 15 May 1991, one male and one female. The remaining 61 sites are reported solely from exit hole evidence. Of the 504 groups of elderberry surveyed, 103, 20.4 percent, had been utilized by the VELB.

Historical data, from previous reports and studies, has also been included in mapping the range of the valley elderberry longhorn beetle (Figure 19). Nearly all of these records are from reliable sources, i.e., biologists having experience with the beetle. Nevertheless, holes in poor condition in dead wood are frequently impossible to identify with certainty, and some of these may have been erroneously reported in the past. It is also possible that non-entomologists, or biologists unfamiliar with its appearance, could mistake other black and red insects for the VELB, especially when in flight. Boxelder bugs (Hemiptera: Lygaeidae) are often very common in riparian woodlands and could be mistaken for the slightly larger male VELBs. Other insects of a similar size and color include largid bugs (Hemiptera: Largidae), wasps, and longhorn beetles such as *Crossidius* (Coleoptera: Cerambycidae). Most of the cited adult records are based on captured specimens, and the remainder were field observations by knowledgeable individuals.

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DISTRIBUTION

LIMITS OF THE RANGE

On the basis of exit holes records, the range of the VELB extends from Redding (Shasta Co.) at the northern end of the Central Valley to the Bakersfield area (Kern Co.) in the south. Adults have been taken northward almost to Red Bluff (Tehama Co.), and as far south as Porterville (Tulare Co.) and an unknown location in Kern County (museum specimen, not seen). North of Sacramento, adult VELBs have been observed only along the Sacramento River. In the foothills of the western Sierra Nevada, adults have been found up to 2220 ft. in elevation, and exit holes up to 2940 ft. Along the eastern edge of the Coast Ranges, adults have been found up to 500 ft., and holes up to 730 ft. in elevation. During this study, exit holes were recorded at a minimum elevation of 30-40 ft., and adults at 130 ft., in the Central Valley. Figure 19 illustrates the known range of the VELB based on current and historic records.

NORTH:

Several VELB exit holes, possibly recent, were found in Redding (Shasta Co.) at the Sacramento River, river mile (RM) 296E, elevation ~490 ft. Possibly recent exit holes were also found at two other sites along the Sacramento River in Shasta County at river miles 282W and 274W. The furthest north an adult has been taken was in Tehama County at the Sacramento River just E of Proberta, RM 235W, elevation 230 ft. (Jones and Stokes 1985).

SOUTH:

Emergence holes were found along Caliente Creek between Caliente and Loraine up to an elevation of ~2400 ft. All of these were old and most were in poor condition, but branch samples showed characteristic VELB tunneling. Shields (1990b, 1990c) also reported holes from this area. An adult VELB was collected at an unspecified date and location in Kern County, but it was not examined during this study (Halstead 1990).

EAST:

Emergence holes were discovered at the following localities at the eastern edge of the Central Valley or in the western Sierra Nevada foothills: Tehama County, Paynes Creek near Paynes Creek (town), elevation ~1875 ft. (old holes); Butte County, Big Chico Creek just NE of Chico, elevation 280 ft. (recent and old holes); Butte County, Feather River SW of Oroville, elevation 125 ft. (old holes); Placer

County, Miners Ravine (tributary Dry Creek) NNW of Folsom Lake, elevation ~490 ft. (recent and old holes); El Dorado County, Anderson Creek (tributary South Fork American River) NNE of Folsom Lake, elevation ~860 ft. (recent and old holes); Amador County, Sutter Creek just W of Ione, elevation ~265 ft. (recent and old holes).

An adult VELB was collected in 1974 at Mariposa in Mariposa County at an elevation of approximately 2000 ft. More recently, Halstead (1989) reported the collection of a beetle from Coarsegold in Madera County at 2220 ft., the highest recorded elevation, and observed numerous exit holes northeast of Oakhurst along a tributary of the Fresno River at the even higher elevation of 2540-2940 ft. He has also collected adults along the Kings River and West Fork Byrd Slough in the Centerville/Sanger area, Fresno County, at elevations of 350-400 ft.; recent exit holes were observed in that vicinity during this survey. In Tulare County, dead adults were found by Halstead and others (1990) in the Middle Fork Kaweah River near Sequoia National Park at 2200 ft. During this study recent exit holes were seen along the Tule River up to an elevation of 550 ft. just below Lake Success, in addition to an adult collected at ~490 ft. near Porterville.

WEST:

There are many fewer records to delimit the extent of the range of the valley elderberry longhorn beetle along the western margin of the Central Valley. In the Sacramento Valley exit holes were noted at two localities in Tehama County, Thomes Creek near Paskenta, elevation ~730 ft. (old holes), and Stony Creek just below Black Butte Reservoir, 380 ft. (recent and old holes); from many spots along Cache Creek up to an elevation of ~520 ft. NW of Woodland (Yolo County) (recent and old holes); and from Napa and Solano counties NW of Fairfield at a maximum of ~310 ft. elevation (recent and old holes). The only known adult specimens are from Solano and Yolo counties along Putah Creek west of Winters, the most western of which was collected at ~500 ft. from Cold Canyon just below Lake Berryessa.

No evidence of the VELB was found in the Sacramento-San Joaquin Delta (Delta) except for some emergence holes seen at the western margin near Dixon. Although Arnold (1984, 1985) reported observing an adult and exit holes along the Middle River southwest of Stockton (San Joaquin County), none were found during this survey.

Except for a couple along the San Joaquin River, there are no records of the VELB from the western side of the San Joaquin Valley. Due to the locality, there is a possibility that the two specimens collected in Merced County along Los Banos Creek at an elevation of 400-440 ft., and identified as the nominate subspecies (Andrews et al. 1987), may be *D. c. dimorphus* or intergrades. An occassional male VELB has most of the elytral surface dark as do male *D. c. californicus*, and unfortunately only one male beetle was collected. The near-absence of records from the western part of the San Joaquin Valley could be due to

the scarcity of habitat caused by agricultural conversion, and the ephemeral nature of the streams draining the inner Coast Ranges. However, particularly in the case of stream canyons where *Sambucus* may be present, the lack of survey effort may be a large factor.

THE SACRAMENTO VALLEY

Survey sites within drainage basins will be reviewed from lower to higher elevations, except for those along the Sacramento River which will be discussed from north to south.

SACRAMENTO RIVER:

Adult VELBs have been taken at six localities along the Sacramento River from RM 235W just E of Proberta (Tehama Co.) to RM 84.3W SE of Knights Landing (Yolo Co.) by Jones and Stokes (1985). During that study exit holes were found from RM 239.5W just S of the Red Bluff Diversion Dam (Tehama Co.) to RM 62.5W at Bryte (Yolo Co.). Before emergence holes were found in Redding (Shasta Co.), RM 296E, during this survey, the northernmost known exit holes were in Red Bluff (Ford and Villa 1987). The most southern exit hole records are from opposite the mouth of the American River in Broderick (Yolo Co.) (Larry Seeman Associates 1985b).

Because of the extensive study of the river between Red Bluff Diversion Dam (RM 243) and Sacramento (RM 60) by Jones and Stokes (1985, 1986, 1987b), the focus of this survey was primarily N of Red Bluff.

No elderberry was seen along I-5 or other roads N of Redding to near Lakeland N of Shasta Lake, elevation ~1200 ft. In the Whiskeytown-Shasta-Trinity National Recreation Area just below Shasta Lake and Dam (#54), elevation ~680 ft., several clumps of elderberry along the W bank were examined without success. A solitary plant at a tributary, Rock Creek (#55), also had no sign of the VELB.

The most northern exit holes were found in Redding at Turtle Bay East Fishing Access (City of Redding) (#56) just SE of the Hwy. 299 bridge, RM 296E, elevation ~490 ft. Recent and old exit holes were found in one grove of *S. mexicana*, four other clumps had none (Figure 20).

Recent and old exit holes were present in three groups of elderberry at Anderson River Park (City of Anderson) (#60), RM 282W, elevation ~395 ft. Natural vegetation had been removed from much of the area, giving it a "park-like" look, but there were some places where the riparian forest was dense (Figure 21). The elderberry shrubs were mostly young; only a few mature individuals were seen.

Excellent VELB habitat was found at 41 acre Reading Island Recreation Area (BLM)(#61), E of Cottonwood, between the river and Anderson Creek, RM 274W, elevation ~365 ft. Huge clumps *S. racemosa* var. *microbotrys* grew singly (Figure 9) or in clusters in an elderberry savanna (Figure 43) which bordered a narrow band of riparian forest with oak, ash, and grape. Numerous exit holes were present, a few of which were probably made this year. Extensive recent pruning and trimming of *Sambucus*, both live and dead wood, had been done near the campsites by the California Conservation Corps (Figure 37).

Halstead (1990) reported emergence holes from along Jellys Ferry Rd. near RM 271E. Seven groups of elderberry at two spots (#57) on the road were searched during this survey; only poor-condition old holes in dead wood were seen, none of which could be verified as having been caused by the VELB.

No elderberry was seen at Jellys Ferry Fishing Access (BLM) at Jellys Ferry Bridge near RM 267E, nor at Paynes Creek Recreation Area (BLM), RM 261E. A few scattered clumps of elderberry were examined at Bend Bridge Public Fishing Access (Tehama Co.) (#58), and in Bend (#59), RM 258-253E; no evidence of the VELB was noted.

Jones and Stokes (1985) collected the most northern adult VELB specimen E of Proberta at RM 235W, elevation 230 ft.

A section of the new Sacramento River National Wildlife Refuge (Flynn Tract) at RM 230-231W SE of Gerber was surveyed (#112). The 171 acre riparian area between the river and Elder Creek, elevation ~205 ft., had numerous *S. racemosa* var. *microbotrys* along the margin of riparian forest adjoining cultivated fields (Figure 22). Many clean-cut holes were found, at least one of which was recent.

Many large elderberry shrubs/trees were surveyed at Kopta Slough Preserve (The Nature Conservancy) (#113) between the river and Kopta Slough, RM 219W, elevation ~175 ft., E of Corning (Figure 23). This site is adjacent to Woodson Bridge State Recreation Area where exit holes have been previously reported (Jones and Stokes 1985). Dense riparian vegetation was present similar to that of the Flynn Tract. Exit holes, a couple of them recent, were abundant in *S. racemosa* var. *microbotrys*.

Huge groves of elderberry were seen, but not examined, between the Sacramento River and Rock Creek on Hwy. 32 W of Chico.

Jones and Stokes (1985, 1987b) took adult beetles downstream in Butte Co. E and SE of Bayliss at RM 177.7E and 179.4E, in Glenn Co. just NW of Butte City at RM 169.5W, in Colusa Co. SE of Colusa at RM 138.7W and N of Grimes at RM 126.5W, and in Yolo Co. SE of Knights Landing at RM 84.3W.

No adults or exit holes have been reported downstream from the Sacramento area. Areas surveyed are discussed under the sub-section called "The Sacramento-San Joaquin Delta."

SIERRA NEVADA DRAINAGES:

Cow Creek (Shasta Co.)

No elderberry was seen NE of Redding along Little Cow, Dry, Yank, Oak Run, Woodman, Stillwater, or Salmon creeks, all tributaries of Cow Creek. The area was surveyed up to an elevation of ~1500 ft., where the vegetation was mostly mixed chaparral-foothill woodland dominated by pine, manzanita, and yerba santa.

Battle Creek (Shasta, Tehama Co.)

Only the lower stretch to the end of Coleman Fish Hatchery Rd., about 8 mi. ENE of Cottonwood, was surveyed. No elderberry was found.

Paynes Creek (Tehama Co.)

Along Hwy. 36 elderberry occurred mostly in isolated clumps or groves. Four sites (#66-69) were examined from a few miles W of Dales, upstream to just E of the town of Paynes Creek; several old exit holes in living branches were found at two of these. The highest one (#67), elevation ~1875 ft., was an isolated clump in an open pasture (Figure 44); the other (#68), at 1040 ft., was a small grove of elderberry growing among buckeye and oak (Figure 24). Samples from both sites were identified as *Sambucus racemosa* var. *microbotrys*.

No elderberry was found at Paynes Creek Recreation Area (BLM) between Paynes Creek and the Sacramento River.

Deer Creek (Tehama Co.)

Elderberry occurrence was sporadic along roadside fencerows in open fields NE of Vina, and in riparian vegetation along Deer Creek. No exit holes were found at the three sites surveyed: Deer Creek (#109), Delaney Slough (#110), and China Slough (#111).

Big Chico Creek (Butte, Tehama Co.)

Bidwell Park (City of Chico) is a mostly undisturbed riparian corridor of 2250 acres surrounding Big Chico Creek from downtown Chico to several miles up Chico Canyon. *Sambucus mexicana* was very abundant

in the lower park at an elevation of ~280 ft. where three sites (#119-121) were inspected (Figure 25). Two of these had exit holes, but only one recent hole was located (#121). The six-mile Upper Park Road parallels the creek through open, dry grassland and pockets of riparian forest where the canyon is shallower. Three different groups of elderberry without holes were examined up to ~740 ft. in elevation (#122).

Butte Creek (Sutter, Colusa, Glenn, Butte Co.)

No evidence of the VELB was found along Butte Creek. One site was examined at Gray Lodge Waterfowl Management Area (CDFG) (#215), and three others nearby (#214,216,217); the elderberry bushes were in isolated groups in this area. Little or no habitat was found upstream from the corner of Glenn and Butte counties to near Chico.

Sutter Basin (Sutter Co.)

No elderberry was seen at Sutter National Wildlife Refuge SW of Yuba City.

Feather River (Sutter, Yuba, Butte Co.)

At Bobelaine Audubon Sanctuary (#86) just downstream from the mouth of the Bear River, NW of Nicolaus, *Sambucus* was scattered in an elderberry savanna between Lake Crandell and Sand Spit Slough at an elevation of ~35 ft. Although only a few old holes in dead wood and poor condition were found, sectioning of wood specimens revealed tunnels that were probably made by the VELB. An exit hole had been previously reported from the sanctuary by Sorensen (1987).

Scattered elderberry shrubs were surveyed at eight sites (#165-172) along the east bank levee from just N of Marysville almost to the mouth of Honcut Creek (Figure 26), and at one site (#173) on lower Honcut Creek (Figure 42). Recent and partly healed VELB exit holes were noted in *S. racemosa* var. *microbotrys* at two of the sites (#172,173) at an elevation of 75 ft. Holland (1985a) reported finding exit holes in this area E of Live Oak in 1985. There was no sign of the VELB in elderberry at one site (#218) just SE of Honcut on North Honcut Creek.

Sambucus mexicana (#178) was scattered throughout Oroville Wildlife Area (CDFG) SW of Oroville. Several old exit holes were found in dead wood at the six sites (#174-179) examined at 115-125 ft. in elevation. No elderberry shrubs/trees were seen just below Lake Oroville on Oroville Dam Road.

Yuba River (Yuba, Nevada, Sierra Co.)

No evidence of VELB presence was found along the Yuba River, but access was poor along the lower section because of gold dredging operations. Isolated and scattered elderberry plants were surveyed at three sites NE of Marysville, near Hallwood (#180,181) and S of Browns Valley (#182). None were seen further up the Yuba River, or along Big Ravine or Slacks Ravine up to Penn Valley E of Smartville, elevation ~1440 ft.

Bear River (Sutter, Yuba, Placer, Nevada Co.)

There were many fire-scarred elderberry shrubs/trees, mainly in rows inside and at the base of the levees, near the Pleasant Grove Rd. bridge SW of Wheatland, elevation 60-65 ft. (#24,25). Although numerous plants were examined, recent VELB exit holes were noted in only two clumps of *S. racemosa* var. *microbotrys*.

No elderberry shrubs/trees were seen along Spenceville or Camp Far West roads up to Camp Far West Reservoir, where two isolated clumps without exit holes were found below the dam (#87), and another on the north shore of the lake (#88).

Only a few small elderberry clumps without exit holes were seen along Dry Creek, a tributary of the Bear River, in the Spenceville Wildlife Management Area (CDFG) E of Marysville.

Coon Creek (Sutter, Placer Co.); Dry Creek (Sacramento, Placer Co.)

Kavanaugh (1991) recently reported emergence holes from the Coon Creek drainage NW of Clipper Gap at an elevation of 1800-2000 ft.

During this study elderberry clumps were examined along two small tributaries of Dry Creek, which enters the Sacramento River just north of the mouth of the American River. Recent exit holes in *S. racemosa* var. *microbotrys* were found at two sites (#21,22) E of Rocklin along Miners Ravine (elevation 400-500 ft.), which parallels the northwest shore of Folsom Lake (Figure 48). Only old holes were seen along Secret Ravine NE of Rocklin near the Sierra College campus at an elevation of 300-320 ft. (#230).

American River (Sacramento, Placer, El Dorado Co.)

Adults and numerous exit holes have been previously reported from just above the mouth of the American River upstream to Lake Natoma. That stretch of river in the Sacramento area was not surveyed during this study, but exit holes were informally noted at Sacramento Bar and near the Business I-80 bridge.

A single isolated clump of elderberry was searched at Rattlesnake Bar, Folsom Lake State Recreation Area, near the North Fork arm of the lake (#23). There was no sign of the VELB.

Two sites were surveyed along Rattlesnake Bar Road, South Fork American River drainage. Many recent VELB exit holes were found in isolated elderberry shrubs just NE of Folsom Lake State Recreation Area Peninsula Campground (#99) in an oak woodland habitat, elevation ~600 ft. (Figure 46). Four large clumps of *S. mexicana* were growing in a wet roadside ditch, not a typical riparian situation. All exhibited evidence of cutting and pruning of major trunks. Just to the NE near Anderson Creek (#100), recent holes were seen in an isolated stand on a dry hillside at ~860 ft.

No emergence holes were seen at sites along the South Fork and tributaries upstream from Folsom Lake. In Coloma at Marshall Gold State Historical Park (#96), elevation ~760 ft., several clumps of *S. mexicana* were examined along the South Fork. Isolated groups of elderberry were checked on Salmon Falls Rd. S of Pilot Hill (#101), at Hastings Creek E of Pilot Hill (#98), at Granite Creek S of Lotus (#97), and on Hwy. 49 between Placerville and Coloma (#95). The elderberry at the Hastings Creek locality, elevation ~960 ft., was *S. racemosa* var. *microbotrys*. No *Sambucus* was seen at the Hwy. 193 crossing at Chili Bar, 966 ft.

Cosumnes River (Sacramento, El Dorado, Amador Co.)

The Cosumnes River was not surveyed during this study, but there are several previous records. Jones and Stokes (1987a) and Arnold (1984) found exit holes at four localities along the river from Twin Cities upstream to a few miles SW of Sloughhouse. An adult beetle was collected in 1964 between Deer Creek and the Cosumnes River just S of Sloughhouse, the most upstream record (Williams 1986).

Dry Creek (Sacramento, San Joaquin, Amador Co.)

Arnold (1984) reported finding exit holes just E of Galt. During this survey no sign of the VELB was found at two sites (#136,137) on the south bank about 7 mi. E of Galt.

Recent and old emergence holes in *S. mexicana* were examined at four sites at an elevation of ~265 ft. along Sutter Creek, a tributary of Dry Creek, in Amador County just W of Ione (#138-141).

Mokelumne River (Sacramento, San Joaquin, Amador, Calaveras Co.)

In 1985 Arnold reported seeing five adult VELBs along a 15-mile stretch of the Mokelumne River from its confluence with the Cosumnes River upstream to Lodi Lake. The lower portion near the mouth of the Cosumnes River may be considered part of the Sacramento-San Joaquin

Delta. During this study the river was surveyed at five localities from Woodbridge to the north shore of Camanche Reservoir.

Many huge, mature stands of *Sambucus* were seen at Woodbridge Regional Park (San Joaquin Co.) (#144) NW of Lodi. Although Arnold reported observing an adult nearby in 1985, no exit holes were found during this study.

One recent and several old exit holes were found in *S. mexicana* just NW of Lockeford at the Lockeford Plant Materials Center (USDA). The clumps were growing along the south bank levee with willow, cottonwood, oak, and blackberry at 60-65 ft. in elevation (#70).

Two adult VELBs (Figures 1, 66) were collected at a cemetery just N of Clements at an elevation of ~135 ft. The site (#72), 0.3 mi. SE of the Mokelumne River, was not a typical riparian habitat. Many large clumps of *S. mexicana* were growing along the enclosing fence, trunks often just outside on the margin of plowed agricultural fields (Figures 45, 65); plants were also scattered throughout the cemetery. Many exit holes, both recent and old, were present in several clumps. Some old, healed holes were also found in a line of mostly young elderberry shrubs along the roadside to the south (#71). Many *Sambucus* were seen from the road, but not examined, at Stillman Magee Regional Park (San Joaquin Co.) on the S bank of the river.

A lone elderberry with old, unrecognizable holes, was examined in a grassy field just below Camanche Reservoir Dam (#73), elevation ~115 ft. None were seen along the N shore of Camanche Reservoir.

No elderberry was found at a tributary, Bear Creek, SE of Lockeford and S of Clements, two localities where Arnold had reported finding exit holes in 1984.

COAST RANGE DRAINAGES:

Cottonwood Creek (Shasta, Tehama Co.)

Elderberry was not seen along Gas Point Rd. which parallels Cottonwood Creek up to the confluence of the North and Middle forks, nor on Foster Rd. along the Middle Fork. Four sites (#62-65) with isolated individuals, and a grove, were surveyed along the North Fork up to an elevation of ~650 ft. ca. 2 mi. NW of Gas Point. No evidence of VELB presence was found.

Thomes Creek (Tehama Co.)

Six sites were surveyed from just W of Richfield near I-5 to near Paskenta. *Sambucus* was very abundant at Rawson Rd. bridge W of

Richfield (#103,104), but the plants were in poor condition with droopy, yellowish foliage, perhaps due to drought stress. Although many mature trees and clumps were searched, no emergence holes or adults were found. Upstream the elderberry became scattered and appeared more sporadically. No exit holes were seen at three sites from just E of Henleyville to Flournoy (#105-107). Just NE of Paskenta (#108), elevation ~730 ft., one of several large clumps on the north bank of the creek had an old healed exit hole. Southwest of Paskenta the terrain became quite open, hilly, and dry, with little suitable habitat for *Sambucus*.

Stony Creek (Tehama, Glenn Co.)

Sambucus at five localities (#114-118) were examined along the north and west shores of Black Butte Lake up to an elevation of 490 ft. at North Fork Stony Creek. All were isolated individuals or clumps. One massive *S. racemosa* var. *microbotrys*, with 3 trunks of 10+ in. in diameter, bore several recent and old holes. It was located below a levee, just S of the Stony Creek outlet from the reservoir, at 380 ft. in elevation (#118) (Figure 27).

Colusa Basin (Glenn, Colusa Co.)

No elderberry shrubs/trees were seen in the Sacramento, Delevan, or Colusa National Wildlife refuges.

Cache Creek (Yolo, Lake Co.)

Many *Sambucus* with VELB exit holes were found along Cache Creek and Hwy. 16 from ca. 5 miles W of Woodland to ca. 3 mi. NW of Rumsey at an elevation of ~520 ft. Five of six sites (#74-79) surveyed had numerous old exit holes, and four of them had recent ones. From Woodland to about 350 ft. near Guinda, the road was virtually lined with elderberry; they became more scattered, then isolated, higher up the canyon. The 520 ft. site (#75) was an isolated grove growing in a mixed chaparral-foothill woodland habitat with digger pine, manzanita, toyon, redbud, and big-leaf maple (Figure 47). The species of elderberry occurring at both the lowest (#74) (100 ft.) and highest sites (#75) (~520 ft.) was *S. mexicana*.

Putah Creek (Yolo, Solano, Napa, Lake Co.)

Putah Creek from Lake Solano to Lake Berryessa historically has been considered to be important VELB habitat, and a section of the stream was termed Essential Habitat when the Recovery Plan was formulated in 1984. Adult specimens have been collected from Lake Solano up to Monticello Dam (elevation ~500 ft.) on Putah Creek, and from Stebbins Cold Canyon Reserve (Univ. of California Reserve System) to the south. That the VELB population is still extant in the area is evidenced by a recent

exit hole seen at Lake Solano Park (Solano Co.) (#222) in a *S. mexicana* trunk. Some of the elderberry had been damaged by cutting.

A couple of miles to the south of Lake Solano a recent exit hole was discovered along Pleasants Valley Creek (#221), a tributary of Putah Creek, at an elevation of ~200 ft. The host was determined to be *S. racemosa* var. *microbotrys*. Two other sites (#219,220) nearby had no sign of the VELB.

Several adult specimens collected from the Davis area in the 1920's and 1930's are housed in museum collections.

Ulatis Creek (Solano Co.); Alamo Creek (Solano Co.)

Arnold has reported finding VELB exit holes in Vacaville from Ulatis Creek (1990) and Alamo Creek (1991), tributaries of Cache Slough.

Suisun-Fairfield Basin (Solano, Napa Co.)

This is a small drainage basin in the eastern foothills of the Coast Range NW of Fairfield. It is composed of creeks which flow south into Grizzly and Suisun bays below the mouth of the Sacramento and San Joaquin rivers. Five sites on two different creek systems were surveyed.

An old exit hole in a dead branch was found in an isolated stand of *S. mexicana* on Gordon Valley Rd. at Suisun Creek or a tributary (#127). Elderberry was scattered along Wooden Valley Rd. which follows Wooden Valley Creek, a tributary of Suisun Creek. A recent hole was seen in a clump of *S. mexicana* at one site (#128) (Figure 28), but none at another site nearby (#129).

Two sites (#123,124) were surveyed along Ledgewood Creek on Clayton Rd. An old hole in dead wood was examined in an isolated stand at one of these (#123) (Figure 29). Old holes were also noted at two sites (#125,126) with many clumps elderberry along Gordon Valley Rd. at Gordon Valley Creek, a tributary of Ledgewood Creek (Figure 12).

Elderberry was not found along either Green Valley Rd. or Green Valley Creek.

THE SACRAMENTO-SAN JOAQUIN DELTA

The various sloughs and canals in this area are treated as tributaries of either the Sacramento or San Joaquin River.

Elderberry distribution in the Sacramento-San Joaquin Delta was spotty, and stands were often isolated from one another. Clumps that had been burned were frequently found along the levees. Although many areas were surveyed, evidence of VELB infestation was found at only one site at the edge of the Delta near Dixon.

SACRAMENTO RIVER:

Ten sites with elderberry were examined; VELB exit holes were seen at only one of them. The areas surveyed were as follows: (1) the Sacramento River on Hwy. 160 between Hood and Courtland (#27); (2) the levee immediately to the SSW of South Stone Lake between Hood-Franklin and Lambert roads (#26); (3) Elk and Sutter sloughs from Clarksburg S to confluence with Steamboat Slough SW of Vorden (#133), lots of elderberry; (4) Miners Slough SW of Paintersville and W of Vorden (#132); (5) Steamboat Slough from Hwy. 160 to the Sacramento River W of Vorden and Ryde, and N of Isleton (#28, 2 localities); (6) the Sacramento River just upriver from the mouth of Cache and Steamboat sloughs (#28); (7) Georgiana Slough E of Ryde and Isleton (#29); (8) Brannan Island State Recreation Area between the Sacramento River, Threemile Slough, and Sevenmile Slough SE of Rio Vista (#134), scattered elderberry; (9) The Big Ditch, tributary Lindsey Slough, NE of Birds Landing (#131); (10) Dudley Creek just E of Dixon (#130). At the last site on the edge of the Delta, 3 clean-cut old emergence holes were found in a large isolated clump of *S. mexicana*. The stand was in poor health and had burn scars.

SAN JOAQUIN RIVER:

Arnold (1984, 1985) reported finding adults and exit holes along the Middle River SW of Stockton and on the lower Mokelumne River near the mouth of the Cosumnes River, but there was no sign of the VELB at any of the nine sites that were examined during this study.

Areas surveyed were as follows: (1) Potato Slough and Venice Island SW of Terminous (#143); (2) Oak Grove Regional Park (San Joaquin Co.) at Bishop Cut NW of Stockton (#142); (3) Middle River (#135), Empire Cut, Whiskey Slough, and Trapper Slough bounding the Jones Tract; (4) Middle River along Wing Levee Rd. between Inland Drive and Undine Rd. ca. 5 mi. SW of Stockton (#80-85).

The latter area (#80-85) was the where Arnold found holes in 1984 and an adult VELB in 1985. Elderberry was very numerous to the east of the road along the outside of the levee, especially in an area 1.2 mi. N of Undine Rd., but many were in poor condition with droopy, yellowish foliage. Three aerial crop dusters were at work in the cultivated fields to the west of the road, which suggested the possibility of

pesticide effects. No sign of the VELB was found although many clumps were examined at six different sites.

No elderberry was observed at Franks Tract State Recreation Area NE of Antioch.

THE SAN JOAQUIN VALLEY

Survey sites within drainage basins are discussed from lower to higher elevations.

SAN JOAQUIN RIVER:

North-South Section

Areas were surveyed from Durham Ferry State Recreation Area just below the mouth of the Stanislaus River south to the mouth of the Merced River. No elderberry was seen at Durham Ferry, but three sites were examined E of Vernalis (#197) and SE of Grayson (#198,199).

One isolated young stand was found at the Merced National Wildlife Refuge SW of Merced (#155), but none were seen at Los Banos or Volta State Wildlife areas (CDFG), or San Luis Reservoir State Recreation Area SW of Santa Nella. Reportedly, there are also none at the San Luis National Wildlife Refuge.

No *Sambucus* was found along Fresno Slough in the Mendota Waterfowl Management Area (CDFG) SE of Mendota.

East-West Section

River access was poor from NW of Kerman upstream to Millerton Lake, and only three sites with elderberry were inspected. No evidence of the VELB was seen, but there are past records from NW of Kerman and in the Herndon area.

Many healthy stands of elderberry grew at the San Joaquin River (south bank) on Gravelly Ford Ranch property N off Ashlan Rd., NW of Kerman (#160). In 1985 VELB exit holes were seen north of the river, due north from the end of Yuba Avenue (Scammell-Tinling 1991).

An adult VELB was collected in Herndon in 1970, and Halstead (1990) reported emergence holes in 14 out of 20 trees inspected at Riverside Municipal Golf Course just NE of Herndon in 1989. An isolated group checked just W of Hwy. 99 and Herndon (#159) showed no sign of the VELB.

Halstead (1990) provided a second-hand report of a 1986 or 1987 adult sighting at Hwy. 41 N of Pinedale in Madera County.

Scattered clumps were checked at the Ball Ranch (#158) on Friant Rd. SW of Friant and Millerton Lake. No elderberry was seen at Lost Lake Recreation Area (Fresno Co.) just SW of Friant, nor at Millerton Lake State Recreation Area on the south shore.

SIERRA NEVADA DRAINAGES:

Calaveras River (San Joaquin, Calaveras Co.)

Twelve sites along the Calaveras River and tributaries were surveyed from N of Waterloo (elevation 60-65 ft.) to New Hogan Lake, as well as an area to the south and southeast of the lake up to an elevation of ~800 ft. Arnold reported seeing exit holes in 1984 and seven adults in 1985 in the area between Hwy. 88 and Waverly Rd.

A few old holes in poor condition, but probably caused by the VELB, were found at three sites N of Waterloo (#89-91). There were many scattered clumps of elderberry growing along the levees on both sides of the dry riverbed. Most large stems had been splintered or cut off near the ground on these *Sambucus*, and the living portion consisted mainly of young growth (Figure 39). A recent exit hole and numerous old ones were found in an isolated elderberry N of Linden (#93), elevation 110 ft. (Figure 30).

Six clumps of elderberry with several recent and old emergence holes were examined at a site between Bellota and the county line (#145) at an elevation of 150 ft. These plants were growing along the roadside some distance from the river.

No exit holes were seen in *Sambucus* along the Calaveras River NW of Linden (#92), Mormon Slough (technically a tributary of the San Joaquin River) near Bellota (#94), nor in an isolated clump in an open field near Indian Creek (#146).

Isolated stands of elderberry were examined at four sites (#147-150) along Hogan Dam Rd. S and SE of New Hogan Lake, mostly along tributaries Bear and Dry creeks. There was no sign of the VELB. At two of these localities the clumps were growing on dry hillsides with scattered oak trees, and appeared to be in poor condition with droopy, yellowish foliage.

Stanislaus River (San Joaquin, Stanislaus, Calaveras, Tuolumne Co.)

Twelve sites along the river were surveyed during this study from Caswell Memorial State Park SW of Ripon upstream to Tulloch Reservoir. The U. S. Army Corps of Engineers (COE) has 16 river parks from the mouth of the Stanislaus River to Goodwin Dam just below Tulloch Dam. Many of these were visited because of easy access, and in some cases, excellent riparian habitat.

Mature elderberry shrubs/trees were very abundant on the margins of the riparian forest at Caswell Memorial State Park (#196). Although many plants were examined, no emergence holes were found. Holes were reported from here in 1985 by Holland (1985b).

McHenry Avenue Recreation Area (COE) (#223) ca. 3 mi. SSW of Escalon, elevation ~70 ft., had a little-disturbed riparian forest of elderberry, boxelder, oak, blackberry, grape, etc. Numerous clumps of *Sambucus* were examined and nearly all had several exit holes, many of them recent. Some of the plants were in poor condition and some had been severely pruned and cut back (Figure 38). Singleton (1987) and Vouchilas (1989) reported finding exit holes at two areas southeast and southwest of the Rd. J6 (McHenry Ave.) bridge.

A few scattered *Sambucus* with old exit holes were seen on private property slated for development on the north bank just W of Jacob Meyers Recreation Area (COE) at the Rd. J7 bridge (#229). The area was an open grassy woodland with oak, boxelder, and elderberry.

At sites upstream the elderberry became fewer in number and more sporadic in occurrence, and none showed signs of VELB infestation. Oakdale Recreation Area (COE) (#224) ca. 1 mi. N of Oakdale, had riparian habitat with willow, cottonwood, oak, and ailanthus, but little elderberry. At Orange Blossom Recreation Area (COE) (#228) ca. 5 mi. NE Oakdale, a few scattered clumps grew with oak, willow, ailanthus, giant cane, and blackberry. Other sites having elderberry were: Valley Oak Recreation Area (COE) (#225) ca. 3 mi. NE of Oakdale, Horseshoe Road Recreation Area (COE) (#226) ca. 3.5 mi. WSW of Knights Ferry, and Knights Ferry Recreation Area (COE) (#227) at Knights Ferry.

Isolated clumps of elderberry growing on the dry, rocky canyon walls were examined at three sites (#152-154) along Tulloch Rd. below Tulloch Dam and Reservoir. The uppermost (#152), at an elevation of ~570 ft., was identified as *S. mexicana*.

Tuolumne River (Stanislaus, Tuolumne Co.)

Downstream from the areas surveyed in this study, Arnold (1984) reported finding exit holes along the Tuolumne River around Modesto and E of Empire. Nine sites with elderberry were examined upstream from N of Hughson to Turlock Lake, elevation ~200 ft.

Seven sites were in the area from N of Hughson to Waterford (#200-206), and of these, two had VELB exit holes. Recent and old holes were found at Site #203 in a *S. mexicana* growing at an elevation of ~65 ft. *Sambucus* was common at Site #206, elevation 80 ft., but it was in poor health and damaged by cutting; two old exit holes were seen. At Site #205 a clump without holes had been burned (Figure 41).

Several large elderberry clumps, fire-scarred and in poor condition, were present at Turlock Lake State Recreation Area (#207,208). No emergence holes were found. No *Sambucus* was seen along the south shore of Modesto Reservoir, nor along the southeast shore of Don Pedro Lake.

Merced River (Merced, Mariposa Co.)

Seven sites were surveyed from near the mouth of the Merced River upstream to Henderson Park (Merced Co.), which is about 5 mi. W of the Merced-Mariposa Co. line.

No sign of VELB presence was found at George J. Hatfield State Recreation Area (#194) near the mouth of the river. Only a few clumps of elderberry were seen in the park, some of which were in poor health, but just to the northeast there was a large healthy grove on private property (#195).

Exit holes were reported by CALTRANS (Walters 1986) at the Hwy. 99 bridge NW of Livingston, and Arnold (1984, 1985) reported observing two adult beetles and exit holes just upstream at McConnell State Recreation Area. No exit holes were found in the park (#193) during this study although numerous *Sambucus* clumps were inspected. Many were fire-scarred and appeared unhealthy.

The most upstream record of the VELB is a collection of two adults by Halstead (1990) at Rd. J7 just N of Cressey, elevation 110 ft. He also observed many emergence holes in the area.

Elderberry stands at five sites upstream were inspected without success. Many plants were growing at the Oakdale Rd. bridge N of Winton (#209,210), and isolated stands were seen near Hopeton (#211) (not at the river) and E of Henderson Park between Snelling and Merced Falls (#212,213). Those at Site #210 had been severely burned, and perhaps killed above the ground (Figure 40).

No elderberry was seen upriver to New Exchequer Dam below Lake McClure.

Chowchilla River (Merced, Madera, Mariposa Co.)

No evidence of VELB presence was seen along the river or the East Fork. Three sites (#190-192) with isolated or scattered *Sambucus* were examined along the lower river from Hwy. 99 NW of Chowchilla to White

Rock Rd. SW of Marguerite. Access upstream was poor. A few isolated clumps were searched at the East Fork Chowchilla River (#163) and a tributary (#164) near the Mariposa-Madera Co. line, elevation ~3000 ft.

Fresno River (Madera Co.)

Halstead has taken an adult VELB along Coarse Gold Creek at Kelshaw Corners, elevation ~1230 ft. (1991b), and reported the collection of another from Coarsegold, elevation ~2220 ft. (1989). He has also seen many exit holes along the Fresno River W of Oakhurst (1990), and along the Lewis Fork near Yosemite Forks NE of Oakhurst (1991c), elevation ~2540-2940 ft. During this study scattered clumps of elderberry were inspected at Coarsegold (#161) and Oakhurst (#162), but no holes were seen. A foliage/inflorescence sample from Oakhurst was identified as *S. mexicana*. The lower river was not surveyed.

Kings River (Kings, Fresno, Tulare Co.)

The Kings River, tributaries, and nearby canals were surveyed at 24 sites from Hwy. 41 up to Pine Flat Dam and Reservoir. The lower Kings River was dry and had very little riparian vegetation; when present, it consisted of a few willow and cottonwood trees, and an occasional elderberry.

In the area from Hwy. 41 upstream almost to Hwy. 43, 12 sites were examined on the South Fork (#37,38), North Fork (#183), three canals/tributaries (#39-41), and the main river channel (#184-189). A possible old emergence hole in dead wood was found ca. 2 mi. W of Hardwick near the river (#186) at an elevation of ~245 ft.; there were quite a few *Sambucus* at this locale (#186-188). The scattered pockets of elderberry along this section of river showed much evidence of abuse in the form of cutting and burning.

There were many clumps of elderberry growing at two sites (#156,157) between Hwys. 43 and 99 S of Kingsburg, but no exit holes were seen.

Old, enlarged holes which might have been VELB exit holes were found at sites S of Reedley at Rd. J40 (#42) and just W of Reedley (#43). Only one of these (#43) was reported as a possible locality record (Figure 31).

It appears that a relatively large VELB population exists along the river, tributary creeks, sloughs, and canals in the area around Sanger and Centerville. Halstead (1989, 1990) has observed and/or collected nine adults at three different localities, and has seen many emergence holes in two other areas. Both recent and old holes were present at two (#44,46) of the five sites (#44-46,48,49) surveyed during this study. The elevation in this general area ranges from about 330-400 ft.

Many clumps of elderberry, some huge, were inspected at five sites (#47,50-53) NE of Gravesboro along Piedra Rd. up to Pine Flat Dam (elevation 600 ft.). No evidence of VELB presence was found in this area.

Kaweah River (Tulare Co.)

Four sites (#30-33) in seven areas were examined along the river or tributaries from ca. 7 mi. E of Visalia to just above Lake Kaweah, elevation ~760 ft.; the *Sambucus* in this area occurred in isolated or scattered groups.

A dead adult was found in its exit tunnel near Lane Slough on Rd. J27 ca. 5 mi. N of Exeter (#32) at an elevation of 405 ft. (Figure 63). There were many recent and old exit holes in the three large *S. mexicana* inspected (Figure 64). None of the other *Sambucus* nearby along Deep Creek and Johnson Slough adjacent to Kaweah Oaks Preserve (The Nature Conservancy) (#30,31) had exit holes, nor were any seen at two spots along the south and east shores of Lake Kaweah (Figure 11), the river just above the lake, or the South Fork (#33).

Halstead (1990) and others have collected four dead adults over a four-year period in the Kaweah Power Station #3 hydroelectric flume (Middle Fork) at an elevation of 2200 ft. just SW of Sequoia National Park Ash Mountain Headquarters. Emergence holes were seen in elderberry shrubs/trees nearby. In 1937 a specimen, now in a museum, was collected from Kaweah on the North Fork.

Tule River (Kings, Tulare Co.)

The river downstream from Porterville has little, if any, riparian habitat left (Hanson pers. comm.). Apparently the Creighton Ranch Preserve (The Nature Conservancy) ca. 5 mi. SE of Corcoran used to have *Sambucus*, but they have been killed by the drought (Streeper pers. comm.). Elderberry was very numerous along the river from Porterville to Lake Success. Above the lake clumps became scattered and more sporadic in occurrence; none were seen in the Sequoia National Forest along the Middle Fork up to Coffee Canyon. Ten sites (#14-20,34-36) were surveyed from just S of Porterville to just E of Springville on Hwy. 190.

An adult female VELB (Figure 2) was captured along a railroad right-of-way near the Campbell-Moreland Ditch just to the S of Porterville (#15) at an elevation of ~490 ft. (Figure 62). Lots of exit holes were noted, many of them recent. The host plants, identified as *S. racemosa* var. *microbotrys*, were growing in a tangle of brush composed mostly of dead blackberry canes which appeared to have been treated with herbicide (Figure 32). There were open fields, some with scattered groups of elderberry, outside of the narrow railroad corridor. Several clumps

were examined at two nearby sites (#14,36), including Yaudanchi Ecological Reserve (CDFG) (#36), without finding evidence of the VELB.

Upstream at Rd. 284 not far below Success Dam, elderberry clumps with several recent and many old holes were examined on both the north and south banks (#20,34), elevation 520 ft. (Figure 33). A few massive old trees, one with a maximum diameter of 30 in. (Figure 10), were found to the north of the river along the Bartlett Park (Tulare Co.) fence just below the dam (#35) at an elevation of ~550 ft.; these had a few new and several old exit holes. They had been severely pruned and trimmed, with major trunks cut from one smaller individual (Figure 36). No sign of the VELB was found in vigorous, young and mature clumps growing at the Lake Success Park Headquarters (COE) just below the dam on the south side of the river (#19).

Two sites were examined just above Lake Success (#17,18), and one at the Middle Fork ca. 1.5 mi. E of Springville (#16), elevation ~1100 ft.

Deer Creek (Tulare Co.)

Just one site (#13) was examined on the north bank of Deer Creek ca. 4 mi. NE of Terra Bella at 550 ft. in elevation. One clean-cut old hole, probably made by a VELB, was found in a dead trunk.

Poso Creek (Kern Co.)

Just one solitary elderberry was seen on a route along Poso Creek through Coffee Canyon on Round Mountain Rd. The clump was near the junction of Granite and Round Mountain roads at an elevation of 645 ft. (#12); its main trunks had been cut out. Exit holes were reportedly seen in this area by Shields in 1990 (1990b, 1990c). No *Sambucus* was seen to the north and west in Granite or Corral canyons.

Kern River (Kern, Tulare Co.)

Only very sparse riparian vegetation consisting of willow, cottonwood, and baccharis was seen along the river W of Bakersfield from I-5 to Kern City, and at Goose Lake Slough (tributary of the Kern River) SE of Calders Corner. Elderberry grew abundantly in groves and scattered groups in riparian forest remnants from just NE of Bakersfield upstream at least to the upper end of the Kern River Park (Kern Co.). In the Kern Canyon the *Sambucus* occurred mostly in isolated clumps or small groups on the dry, rocky hillsides along with cottonwood and poison oak.

Riparian thickets, with elderberry a major component, were found along the river and canals below Panorama Park and along China Grade Loop in NE Bakersfield. Several large, healthy *Sambucus* were examined on Chevron Oil Corporation land E of Oildale at the China Grade Loop

(#11), elevation 445 ft. An old, enlarged hole was found in live wood, but its condition was too poor for it to be conclusive evidence of the VELB.

Two distinctly different areas were investigated in Kern River Park above Lake Ming at an elevation of ~520-560 ft. The first, along an access road north of the golf course (#2), was a mostly open, disturbed area. The site had been burned recently, and the six rather young clumps examined were in poor condition with the older branches dead. Shields reported finding emergence holes in this area in 1990 (1990b, 1990c); none were found in the current study. The second site (#1) was upstream at the Game Preserve, a narrow riparian corridor with many scattered *Sambucus* (*S. mexicana*) growing with willow, cottonwood, and baccharis. Some very old, eroded holes were found in dead wood, but it was not possible to determine if they were caused by the VELB.

Isolated clumps of elderberry were inspected at three different spots (#3) in the Kern River Canyon up to ~1300 ft. elevation, 3 mi. into the Sequoia National Forest. Since Shields (1990b, 1990c) had reported finding emergence holes in this area, an attempt was made to locate the same plants he had seen. No holes were found.

No elderberry or riparian vegetation of any kind was present at Cottonwood Creek on Breckenridge Rd. E of Bakersfield, a tributary of the Kern River. The streambed and area were very dry.

Caliente Creek (Kern Co.)

The elderberry along Caliente Creek were previously surveyed by Shields (1990b, 1990c) who noted old holes in poor condition from spots near Loraine to a few miles west of Loraine. During this study, four sites were examined from ca. 1.5 mi. NE of Caliente (#7) up to ca. 3 mi. W of Loraine (#8). Although many very old, unverifiable holes were found in dead wood at two sites, only one (#9), 3.2 rd. mi. W of Loraine at ~2400 ft. elevation, had a partly healed hole in live wood that could have been made by a VELB. Several *Sambucus* were present at a second site (#10) at ~2320 ft. A new hole in live wood was found, but at 0.5 in. (12 mm) diameter, it appeared to be too large to be caused by the VELB. Possibly the hole was made by *Desmoscerus a. auripennis* if the species occurs in the area.

A very isolated, small, young stand of *S. racemosa* var. *microbotrys* was encountered in the dry bed of a tributary of Caliente Creek along Bena Rd. near Ilmon, elevation ~1000 ft. (#4). Although the countryside was open and dry, the spot where the stand grew was surprisingly green with willow, grass, and nettle, probably because of a small spring seep. A partly healed hole was found in a live branch, and, when sectioned, there was a tunnel which appeared to have been made by the VELB.

Sambucus also grew in interesting terrain on another tributary of Caliente Creek along Caliente-Bodfish Rd. SW of Caliente (#6). A thick

grove was found at one spot in a deeply incised dry streambed surrounded by grassy, treeless, rolling hills (Figure 49). No sign of the VELB was found.

Buena Vista Lakebed (Kern Co.)

Virtually no riparian vegetation was seen to the south of Bakersfield, nor to the west at the western edge of the Central Valley. Areas that were searched included: Connecting Slough, and the New and Old River ditches S of Millux; Buena Vista Aquatic Recreation Area (Kern Co.); and W of I-5 to the West Side Canal near the Tule Elk State Reserve (CDPR).

ATYPICAL MALES

Males with dark elytra similar to those of *D. c. californicus* have been collected from the following localities:

Colusa Co., Sacramento River ca. 5 mi. SE of Colusa
Yolo Co., Sacramento River, Knights Landing
Yolo Co., Davis
Merced Co., Merced River
Fresno Co., Kings River
Tulare Co., Lane Slough (tributary Kaweah River)

Although it is possible that these individuals are hybrids or intergrades between the subspecies, none was from the eastern foothills of the Coast Range where a zone of hybridization or intergradation would be expected to occur. There is no apparent pattern to the distribution of these few specimens besides the fact that they were all collected below 410 ft. in the Central Valley.

HABITAT

SPECIES OF *SAMBUCUS* UTILIZED AS HOSTS

Samples of *Sambucus* foliage and flowers/fruit from 34 sites were identified by Lauramay Dempster at the Jepson Herbarium, University of California, Berkeley. Specimens from 19 sites were *S. mexicana* Presl.; those from the other 15 were *S. racemosa* L. var. *microbotrys* (Rydb.) Kearney & Peebles. *Sambucus racemosa* var. *microbotrys* is a new

combination: the species was formerly a synonym of *S. callicarpa* Greene, and the variety was treated as an independent species.

According to Dempster, the two species are fairly easy to separate. *Sambucus mexicana* has a flat-topped inflorescence formed by an abruptly shortened terminal flower stem and longer laterals; the fruits are black with a whitish coating which causes them to appear blue. In contrast, *S. racemosa* var. *microbotrys* has an inflorescence which is pyramidal in shape due to a long, dominant terminal flower stem; the fruits are red.

The two species do not appear to have obviously different habitat preferences. Both occurred in similar plant communities and environmental conditions, ranging from lowland riparian forest to foothill oak woodlands. The elevational range for the *S. mexicana* specimens was 60-2260 feet; *S. racemosa* var. *microbotrys* ranged from 60-1875 feet.

Samples of elderberry were taken from 43.8 percent (28) of the 64 sites where there was evidence of a VELB population. At 53.6 percent (15) of these sites the host plant was *S. mexicana*, at 46.4 percent (13) it was *S. racemosa* var. *microbotrys*. Three of the four adult beetles collected were from *S. mexicana* (two VELB at one site). Identifications of these *Sambucus* samples are given in Appendix II. Although the sample size is too small to definitively determine whether or not the VELB exhibits host preference at the species level, it appears that the beetle inhabits whichever *Sambucus* spp. that is available. Of six specimens taken from sites where the VELB seemed not to be present, four were *S. mexicana*, and two were *S. racemosa* var. *microbotrys*.

SAMBUCUS PHYSICAL CHARACTERISTICS AND CONDITION

GROWTH FORM AND PHENOLOGY:

Sambucus may be arborescent, tree-like, with one to a few trunks (Figures 9, 10), or may form bushy, many-stemmed clumps (Figures 11, 12). It appears that very old individuals, those growing beneath mature overstory canopies, and especially those that have been systematically pruned, are more likely to be arborescent. The VELB did not seem to prefer plants with any particular growth form.

Many dead branches and shoots were commonly associated with healthy, vigorously growing plants; this seemed to be a normal occurrence not necessarily indicating poor condition (Figures 20, 33).

The time of flowering varied widely between different localities and even between plants within a single locality. Groups in pre-bloom and those in full bloom were often seen at the same site. Some were still blooming in September over a month after the field survey had ended.

Flowers and fruit were rarely present simultaneously on the same individual. All three of the adult VELBs collected during the study were on plants in flower.

SIZE:

Due to time constraints, it was not possible to do exhaustive stem measurements and counts on the elderberry plants examined. Instead, the maximum diameter of the largest branch or trunk in a group (tree/clump/grove) was used as an indicator of overall size and maturity.

The majority of elderberry groups (63.8 percent), both with and without exit holes, had maximum diameters >3-9 inches. The diameters of groups in the overall measured population ranged from 1.0-30.0 inches, with a mean of 7.5 inches (n=250). See Figure 34.

That of groups with exit holes ranged from 2.5-30.0 inches, with a mean of 8.1 inches (n=80 holes). For groups with recent exit holes the range was the same, but the average diameter was an inch larger, 9.2 inches (n=38). The reason for this is not known. Because of growth subsequent to the creation of a hole, the diameters of *Sambucus* with recent exit holes were more reliable indicators of size than those with just old holes.

In their Sacramento River study, Jones and Stokes (1987b) found that the basal diameter of the largest stem in 285 clumps with exit holes was 2-6 inches more than 60 percent of the time, and 26 percent were larger than 6 inches. In contrast, only about 41 percent of elderberry groups with holes in this study had maximum diameters of 2-6 inches, and almost 59 percent had diameters larger than 6 inches. Eya (1976) reported that the VELB prefers elderberry shrubs/trees with basal diameters of 15-65 cm (6-26 inches).

During the course of the study no exit holes were found in exclusively young stands. In fact, they were not seen in any *Sambucus* with maximum diameters of less than 2.5 inches. This supports the Jones and Stokes (1987a) conclusions that the VELB may have a limited ability to colonize young stands. Conversely, another Jones and Stokes study (1987b) reported that 10 percent of clumps with VELB were less than 2 inches in basal diameter. Arnold (1986) stated that his observations indicated that the majority of adults and larvae infest younger elderberry plants with trunk diameters of no more than a few inches.

HEALTHY AND STRESSED:

The great majority, 81.7 percent, of the *Sambucus* surveyed were healthy, with bright green foliage, vigorous new growth, and abundant inflorescences; only 14.5 percent were considered to be in poor condition (n=504) (Figure 35). A definite seasonal trend was noted, with only an occasional unhealthy plant seen during the spring, but many in July. If seasonality is a factor, the data will be biased because the study was conducted from April through July. As the weather became hotter and the soil drier, an increasing number of plants with yellow, droopy foliage and dying young shoots were encountered. This may be a normal annual phenomenon resulting from typical climatic conditions, or it may be exacerbated by the cumulative effects of five years of drought. Munz (1959) noted that *S. mexicana* is "often quite deciduous in the dry season." Riparian and other plants growing near good water sources seldom appeared to be in poor health.

When considering *Sambucus* health in relation to VELB presence, a strong parallel was found with the health of the overall surveyed elderberry population (Figure 35). This indicates that VELB presence is not a factor in producing unhealthy plants, and also the converse, that unhealthy plants are not a factor in VELB presence. In groups of elderberry with the VELB, 82.5 percent were healthy, 4.9 percent were fair, and 12.6 percent were unhealthy (n=103). All three of the living adults collected were from healthy clumps. If a seasonal health trend is normal, then the VELB emergence period would occur before the elderberry plants are greatly impacted by the dry season. The long-term, non-seasonal health of the plants may change with time, therefore it is not possible to know their condition over the entire period of infestation.

There has been much discussion about whether the VELB is attracted to "stressed" *Sambucus*. These are plants with smaller, yellow-green leaves that are deciduous earlier than normal (Environmental Science Associates 1986). Arnold (1984) hypothesized that stressed plants aid in VELB mate location by functioning as congregation sites. He intentionally stressed elderberry shrubs at four localities by slashing and girdling, and subsequently observed adults on the damaged plants at three of them. A larger sample size and more observations would be needed to ascertain that they were attracted specifically to those plants: the beetles also may have emerged from them (there was no mention of exit holes), or have been present by chance. Arnold (1986) and Kellner (Environmental Science Associates 1986) also reported that the majority of adults they have sighted were in association with stressed or young elderberry plants. Both Jones and Stokes (1987b) and Halstead (1991a) have observed that VELB adults emerge from both healthy and stressed *Sambucus*; Jones and Stokes believed that there was an equal likelihood for either situation. The adults collected during this study were taken from healthy, undamaged clumps of elderberry. Plants that had been recently injured were seldom encountered.

DAMAGE DUE TO HUMAN ACTIVITIES:

Damage to *Sambucus* caused by people was primarily from cutting and burning. Some type of injury was evident at 16.7 percent (38) of the sites surveyed, and 39.5 percent (15) of these had VELB populations. Herbicide damage was suspected, but unverified, at a couple of sites.

Elderberry shrubs/trees at 20 sites were affected by pruning, trimming, and/or cutting (Figures 36-39). These plants were primarily growing in parks; adjacent to paths, roadways, and parking lots; and along fences, levees, and cultivated fields or orchards. Some had only been pruned of branches and trunks that interfered with human activities, but others had major trunks or the entire plant removed at some time in the past. In the latter case, young shoots often came up around the old stump and eventually disguised it as they grew (Figure 39). One orchard owner stated that the elderberry shrubs on her property kept coming back up despite being cut down every couple of years. Although the damage at most sites was several years old, some was recent.

Soot and burns were seen on *Sambucus* at 18 sites (Figures 40, 41). Most of the stands that had fire scars grew along levees which are periodically burned to control brush. Some of these plants looked unhealthy with sparse foliation, but most did not seem to be seriously harmed.

The effect of herbicides on the elderberry at three sites was unknown or speculative. At one (#15) herbicides had been used to kill brush consisting mainly of blackberry brambles, but the *Sambucus* and other trees appeared to be unharmed (Figure 32). At the other two sites (#84,85) where roadside plants were adjacent to large cultivated fields, many had twisted, yellowish foliage. Others nearby, but not bordering the fields, looked healthy. Jones and Stokes (1987a) cited elderberry deaths from herbicides at the Cosumnes River, as well as damage from frequent cutting.

SAMBUCUS HABITAT AND PLANT COMMUNITIES

Sambucus was found growing in several types of situations, and was not necessarily restricted to riparian areas. It occurred as both an understory and overstory plant. Although an analysis of habitats and plant communities was not attempted, some general observations were made in the course of the study.

The largest concentrations of elderberry were encountered in remnants of the Great Valley Mixed Riparian Forest and Great Valley Oak Riparian Forest (Holland 1986) along the rivers and larger streams of the Central Valley (Figure 42). In these areas the bushes do not grow

immediately adjacent to the watercourses, but in upland areas, on natural levees and terraces, or on the slopes or at the bases of artificial levees. They also were frequently scattered in Elderberry Savannas (Holland 1986) adjacent to riparian forests (Figure 43), in pastures (Figure 44), and along fencerows (Figure 45). Common woody plant associates included *Populus* sp. (cottonwood), *Salix* sp. (willow), *Fraxinus* sp. (ash), *Quercus* spp. (oak), *Juglans* sp. (walnut), *Acer negundo* (boxelder), *Ailanthus altissima* (tree of heaven), *Rubus* sp. (blackberry), *Rhus diversiloba* (poison oak), *Vitis californica* (grape), and *Rosa* sp. (rose), as well as *Baccharis* sp. in the southern part of the Central Valley.

Adjacent to the Central Valley in the foothills of the Sierra Nevada and Coast Range, elderberry occurred in both oak woodlands (Figure 46) and mixed chaparral-woodland communities (Figure 47), sometimes growing right on the banks of smaller streams. Occasionally plants were found in areas that were not considered riparian. Unlikely appearing places were dry hillsides (Figure 48) and rocky canyon walls, and open fields some distance from surface water. In these situations the bushes were often tucked in low areas, even roadside ditches and culverts, that would periodically collect water. A few times in the arid southern San Joaquin Valley, elderberry and other plants were seen in isolated patches along dry streambeds in areas where ground water was available near the surface (Figure 49).

Sambucus was observed most frequently in mixed plant communities. However, it often occurs nearly alone in altered and artificial situations such as along levees, roadside ditches, and in maintained yards and pastures, and is the characteristic woody plant of the Elderberry Savanna (Holland 1986).

The VELB was present in all of the communities in which elderberry grew, but it was more common in riparian woodlands and savannas. This was perhaps due to the greater concentrations of host plants in these areas. Inhabited *Sambucus* grew as either an understory or overstory plant.

SAMBUCUS DENSITY

The density of elderberry at a particular site was subjectively determined as detailed in the Materials and Methods section. These data reflect the situation only in the areas surveyed, not that of the overall elderberry population.

At all 230 sites, isolated groups were encountered 42.2 percent of the time, and scattered groups, 41.3 percent. At the 64 sites where the VELB was present, elderberry groups were isolated at 18.8 percent, scattered at 56.3 percent, and many at 20.3 percent. Figure 50 contrasts elderberry density at all sites with those utilized by the

beetle. Although isolated and scattered plants were encountered almost equally overall, three times as many sites with scattered plants hosted the VELB. The percentage of all sites with many groups was almost a third lower than the percentage of sites with such groups selected by the VELB. These figures support the assumption that the VELB prefers areas where elderberry groups are not isolated from each other.

EXIT HOLES

FIELD OBSERVATIONS

Only clean-cut holes of the proper size and shape were considered to be evidence of VELB habitation (Figures 6, 7, 13-15). Eroded and weathered holes, or those enlarged by birds or other insects, were frequently encountered but were usually unverifiable (Figures 17, 18). Old, dead branches and trunks are often invaded by insects that live and feed in dead wood, such as termites (Isoptera) (Figures 16, 61), bostrichid beetles (Coleoptera: Bostrichidae) (Figure 60), and ants (Hymenoptera: Formicidae) (Figures 56, 58, 59). Their galleries and holes do not resemble those of the VELB, but their invasion secondarily can damage or obliterate evidence of prior VELB presence (Figures 56, 57).

The distribution of survey sites, with VELB presence or absence indicated, is illustrated in Figure 8. A total of 186 exit holes were recorded during the survey. Exit holes were found at 27.8 percent (64) of the 230 sites examined (3 sites with unverifiable holes were excluded), and in 20.4 percent (103) of the total counted elderberry groups (n=504).

Thirty-three, or 51.6 percent, of the sites had recent VELB holes in addition to old holes from previous years. At some of the remaining 31 sites where only old holes (including healed holes) were seen, early season sampling before adult emergence may have been a factor. Of the elderberry groups with exit holes, 44.7 percent (46) had recent holes.

Exit holes were numerically sorted by age/condition, and by whether they occurred in living or dead stems (n=186) (Figure 51). The largest group was recent holes in live wood with 40.9 percent, followed by old and old poor holes in dead wood with 24.2 percent. The occurrence of healed and partly healed holes (Figures 14, 15) has not been previously reported by other observers or researchers. These were noted in live wood 16.1 percent of the time, and in dead wood, 1.1 percent. It appears that in healthy, actively growing stems, the hole is eventually closed by new growth. This would be advantageous for the plant since exit holes offer easy entry for secondarily invading insects and

diseases. Holes also could be difficult to detect if they had been packed with frass by other insects such as termites (Figure 16).

Jones and Stokes (1988) sectioned 17 stems from three different clumps and found that many vacant galleries were apparently unaccompanied by exit holes, or that the holes were not visible externally. They concluded that this may have been due to larval VELB mortality. Observations from the current study suggest that, in the latter case, it is also possible that some of the holes healed over and were no longer very obvious externally.

BRANCH OR TRUNK DIAMETER AT EXIT HOLE:

Recent, current-year emergence holes are the most reliable for determining the preferred branch size at time of pupation. Unless the stem died shortly after the adult emerged, it would have continued to grow during the intervening time interval. Recent exit holes (n=70) were found in branches and trunks ranging from 1.0-8.4 inches in diameter, with a mean of 3.5 inches. The diameters of all of those with holes (n=138) ranged from 0.6-10.0 inches, with a 3.3 inch mean; the largest number was in branches of >2-4 inches. Figure 52 compares these frequencies.

Jones and Stokes (1987b) estimated the stem diameters at 49 current-year exit holes along the Sacramento River. They similarly ranged from 1-8 inches, but 66 percent were in stems of less than 3 inches, and the majority, 40 percent, in the 2-2.5 inch size class. In this survey only 41.5 percent were 3 inches or smaller, and 50 percent were in branches >2-4 inches. Jones and Stokes (1988) reported a mean of 3.21 inches and a range of 1.38-6.60 inches for diameters of stems with galleries in a study of *Sambucus* inhabited by the VELB at the Cosumnes River. Andrews et al. (1987) found that for *D. c. californicus* holes, the frequency of utilization of stems for VELB development paralleled the frequency of occurrence of stem sizes on the study site.

Exit holes in very small diameter stems were not frequently encountered in this study, and in all but one instance they were growing from larger branches or trunks. Most of these stems were collected and later split longitudinally to verify former VELB activity and examine the gallery. Small diameter stems had a proportionally very large pith diameter comparable in size to that of much larger stems, and the VELB tunnel occupied most of it. There were eight measurements of young stems one inch or smaller in diameter with exit holes (Figures 53, 54), and 22 of stems 1.5 inches or smaller. This contradicts Jones and Stokes' (1988) conclusion that the VELB does not appear to use stems less than about 1.5 inches in diameter. Actually, small stems may be under-represented because of insufficient time for larval development and pupation. Most of the very small (<1 inch) diameter stems with holes were dead, raising the possibility that they were killed by the

VELB. It is likely that stems of this size grew from new shoots within the postulated two year period of VELB occupation (Jones and Stokes 1987b).

VERTICAL HEIGHT OF EXIT HOLE:

The heights of emergence holes varied widely from near the ground to nine feet high. The vast majority were within an easily examined height. The data are probably biased due to the difficulty of spotting the often cryptic holes in higher trunks and branches. Although trees were climbed when feasible, it was not usually possible to conduct a thorough search.

For all exit holes surveyed (n=122), as well as recent ones (n=68), the heights ranged from 6-108 inches (0.5-9.0 feet) (Figure 55). The overall mean was 38.8 inches (3.2 feet), and the mean for recent holes was 41.5 inches (3.5 feet). Almost 71 percent of all holes were 48 inches (4 feet) or less in height; nearly 56 percent were 36 inches (3 feet) or less. These results parallel those of Eya (1976), Jones and Stokes (1987b), and Andrews et al. (1987). Jones and Stokes estimated stem heights at 627 exit holes and found that nearly 70 percent were at or below 4 feet, and only about 10 percent were higher than 6 feet. Andrews et al. found *Desmocerus californicus* holes from ground level up to 7 feet high. Of 133 measurements, 65 percent were less than 3 feet high, and 35 percent were between 1-2 feet. Eya reported holes from 10 cm to 3 m (0.3-10 feet) from the ground, and Halstead (1991a) has found emergence holes up to 25 feet high.

SAMBUCUS WOOD SAMPLES

In most cases, it was possible to confirm past VELB larval activity in branches with potential exit holes by examining longitudinally cut sections (Figures 4, 5, 53, 54). A few times the wood had been dead for too long, and secondary invasion by other insects had obscured or obliterated whatever galleries may have existed (Figures 56-58). Other insects that were found boring in the wood were termites (Isoptera), carpenter ants (Hymenoptera: Formicidae), and bostrichid beetles (Coleoptera: Bostrichidae); none of these made galleries and exit holes with the characteristics of those made by the VELB (Figures 59-61). Other arthropods that inhabited the tunnels included spiders, earwigs (Dermaptera), ants, and perhaps bees.

ADULT BEETLES

FIELD OBSERVATIONS

All of the adults observed during the study were captured. Each of the four beetles was found in different positions on the host plant. Female #1 (Figure 2) was on a 4.8 inch diameter trunk near the center of a clump, 60 inches above the ground (Figure 62). Male #1 (Figure 63) was dead in an exit hole, his head nearly flush with the bark; he had been dead for at least several days, and the cause was not apparent. The hole was in a 2 inch diameter stem near the center of a clump, 52 inches from the ground (Figure 64). Female #2 and Male #2 (Figures 1, 66) were taken at the same site, but on widely separated clumps of elderberry (Figures 45, 65). Female #2 was positioned about 84 inches above ground on the underside of foliage growing on the outer margin of the elderberry crown. Male #2 was on the upper side of a leaf inside the canopy and near the center of the clump, about 72 inches above ground.

On each of the occasions the weather was warm and sunny, and the time was 4:00-5:30 pm. None of the beetles were seen flying, nor the females, ovipositing. Three of the host plants were growing in open areas, and one was growing amidst other trees and brush. None were understory plants or in completely shaded situations.

SCARCITY OF ADULT COLLECTIONS

Adult valley elderberry longhorn beetles can be surprisingly cryptic in the dense foliage or shady interior of the elderberry crown during the brief period in which they are extant. One of the reasons for the overall small number of adults observed or collected historically, as well as in the current study, is that no efficient means of locating them has been discovered. Chance and luck apparently play a large part in finding them.

The large geographic scope of this project coupled with the small number of investigators also probably contributed to the low number of adults seen and captured. In order to determine the range of the VELB, it was necessary to spend time in areas from which it had not been recorded. Sites were not visited more than once, even those with many exit holes. At some of the sites investigated in the early part of the field study, it was probable that this year's emergence had not begun yet.

The strategy of returning periodically during the emergence period to those sites with exit holes may have resulted in more collections. This method was used successfully by both Jones and Stokes (1985, 1986, 1987b) and Arnold (1984, 1985), who surveyed for exit holes during one season or year, then returned to likely spots during the emergence period. Even then, only 10 adults were collected on the Sacramento River by Jones and Stokes during three years of field work by teams of up to seven people; one year, none were collected. Andrews et al. (1987) inhabited the field study site on Los Banos Creek for almost three months, but collected only two possible specimens of *D. c. californicus* even though 17 fresh exit holes were discovered.

LABORATORY OBSERVATIONS

The three valley elderberry longhorn beetles captured alive were maintained until they died, presumably of natural causes. They fed on a diet of fresh elderberry leaves and did not appear to eat flowers. The male lived 17 days in captivity, and each of the females lived 25 days.

The male and female captured at the same site were placed together and began mating within a day (Figure 66). Eggs were observed within three days. Mating continued off and on for at least five days. Eighty or more eggs were produced, and about half of these hatched. Female #1 (Figure 2) laid 110 eggs in captivity. Most of the eggs were attached to the leaves and stems of the foliage offered as food. Leaf petiole-stem junctions, leaf veins, and other spots with crevices and depressions were favored for oviposition. The eggs were firmly attached with an adhesive.

Halstead (1991a) noted that females oviposit in a variety of locations, and may even place several eggs close to each other. This was true of the captive females in this study, but they also had very limited choices. Andrews et al. (1987) thought that the selection of oviposition sites in natural situations is independent of branch size and is possibly random.

POPULATION STATUS

Even though this study was not aimed at determining the population status of the valley elderberry longhorn beetle, some related information can be reported. Of 103 groups of *Sambucus* with VELB exit holes, 44.7 percent (n=47) had recent (current year) holes; at the 64 sites with exit holes, 51.6 percent (n=33) had recent holes. These figures are likely an underestimate of the active populations because,

at some elderberry surveyed early in the season, adult emergence may not have occurred yet.

No sign of a VELB population was found at several localities where exit holes and/or adults had been previously reported:

(1) Sacramento River near RM 271E, Tehama Co. southeast of Cottonwood (Site #57; Halstead 1990, exit holes)
(2) Mokelumne River at Woodbridge Regional Park (Site #144; Arnold 1985, adult)
(3) Middle River southwest of Stockton (Sites #80-85,135; Arnold 1984, 1985, adult and exit holes)
(4) Stanislaus River at Caswell Memorial State Park (Site #196; Holland 1985b, exit holes)
(5) Merced River at McConnell State Recreation Area (Site #193; Arnold 1984, 1985, adults and exit holes)
(6) Poso Creek northeast of Bakersfield (Site #12; Shields 1990b, 1990c, exit holes)
(7) Kern River at Kern River Park just northeast of Bakersfield (Sites #1,2; Shields 1990b, 1990c, exit holes)
(8) Kern River in the Kern River Canyon (Site #3; Shields 1990b, 1990c, exit holes)

Failure to find evidence of VELB populations at these sites does not necessarily mean that they are no longer extant. Because exit holes are present in only a small number of *Sambucus* at many sites, they could have been missed. This clustered aspect of distribution is discussed in the Conclusions.

At two sites on Bear Creek, a tributary of the Mokelumne River, where Arnold reported exit holes in 1984, no *Sambucus* was found.

OWNERSHIP OF HABITAT

In order to determine where VELB populations occur in potentially protected locations, extra effort was directed at parks and wildlife areas. Table 1 lists the acreages of such areas, both surveyed and not surveyed, and indicates the current and historic presence/absence of elderberry and VELB populations; Table 2 summarizes the information contained in Table 1..

Fifty-three sites, 23 percent of the total, were surveyed in 40 parks or wildlife areas. Of these, 39.6 percent of the sites and 37.5 percent of the parks/wildlife areas had *Sambucus* with VELB emergence holes. Two of these were private reserves (Audubon, The Nature Conservancy).

Elderberry residing in such areas was not necessarily protected from intentional injury. There were several in which plants had been quite severely pruned and trimmed, even those with exit holes (Figures 36-38). Fire-scarred *Sambucus* were found in one state park, but that damage was probably accidental.

Conclusions

PROJECT SUMMARY

OVERVIEW

Desmocerus californicus dimorphus is patchily distributed throughout much of the Central Valley from Redding to the Bakersfield area (Figures 8, 19).. During the survey, evidence of the beetle was found at about 28 percent of the 230 sites with *Sambucus*, and in about 20 percent of the 504 groups of elderberry examined at those sites. Of those with exit holes, recent holes were present at about 52 percent of 64 sites, and in about 45 percent of 103 groups of elderberry. Where only old or healed holes were seen, early season sampling before adult emergence may have been a factor. Four adult beetles were collected at three sites in the eastern Central Valley. No evidence of the VELB was seen at several localities where it had been previously reported.

The valley elderberry longhorn beetle inhabits *Sambucus* of various sizes, ages, and growth forms, and utilizes an assortment of branch sizes for larval development. Two species, *S. mexicana* and *S. racemosa* var. *microbotrys*, serve as hosts. Elderberry shrubs/trees with VELB populations occur in a variety of habitats and plant communities, most commonly along the margin of riparian forest and in adjacent grassy savannas.

The beetle appears to be only locally common, i.e., found in population clusters which are not evenly distributed across available *Sambucus*. Frequently only particular clumps or trees in an area harbored the VELB, and other similar ones were unaffected. The infested plants usually showed evidence of utilization over a period of several years, but sometimes only one or two exit holes were present. Similar observations on the clustered distribution of exit holes were made by Jones and Stokes (1987a) and Halstead (1991d, pers. comm.). In the current study it was noted that elderberry shrubs/trees with many exit holes were most often large, mature plants; young stands were seldom infested.

The criteria for the selection of particular plants as hosts are not known. Perhaps the VELB continues to use the same host clumps/trees that were suitable habitat in the past in lieu of dispersal, i.e., they may be poor dispersers. In addition, some of the VELB populations inhabiting isolated groups of elderberry appeared to not have nearby

hosts to which to disperse. It is also possible that the beetle is very selective for *Sambucus* with special, as yet unknown, qualities.

SAMBUCUS WITH VALLEY ELDERBERRY LONGHORN BEETLE POPULATIONS

The valley elderberry longhorn beetle utilizes both *Sambucus mexicana* Presl. and *Sambucus racemosa* L. var. *microbotrys* (Rydb.) Kearney & Peebles (Appendix II). The limited data indicate that one species is not preferred over the other, and that the VELB uses whichever is available.

The VELB does not seem to favor any particular growth form of elderberry, but occurs in both arborescent plants, and bushy clumps and groves.

Most of the *Sambucus* observed were healthy, including those with VELB exit holes (Figure 35). A parallel was found between the health of the overall elderberry population, and those with previous or current VELB populations. This indicates that VELB presence is not a factor in producing unhealthy plants, and conversely, that unhealthy plants are not a factor in VELB presence. Clumps in poor health were more common later in the season as the weather became hotter and drier.

Exit holes were found in *Sambucus* with maximum diameters of 2.5-30 inches; about 64 percent (n=51) were in elderberry plants >3-9 inches in diameter (Figure 34). In general, the sizes of elderberry utilized roughly paralleled those in the overall population. An exception was those with maximum diameters of 3 inches or smaller which were inhabited only about half as much; no holes were found in those less than 2.5 inches in diameter. It appears that the either the VELB avoids elderberry plants which are very young or small, or that insufficient time had elapsed for a complete life cycle. Jones and Stokes (1987b), however, reported 10 percent of infested clumps in their study to be less than 2 inches in diameter.

Recent exit holes were always found in live wood; partly healed and healed holes were mainly in live wood; old holes were found more frequently in dead than live wood (Figure 51). Healthy, actively growing stems often heal, or close up, old emergence holes.

The density distribution of *Sambucus* groups (Figure 50) appears to have an affect on the presence or absence of the VELB: the beetle seems to prefer situations where groups are not isolated from each other. Sites with isolated or scattered plants were encountered almost equally, while three times as many sites with scattered elderberry had VELB populations. At sites where elderberry was abundant (i.e., many scattered and many), those with evidence of the VELB exceeded the overall percentage of these categories by about a third.

Sambucus serving as hosts for the VELB occurred in several plant communities: riparian forest, savanna or grassland, oak woodland, and mixed chaparral-foothill woodland. The VELB was more frequently encountered in riparian forest margin and elderberry savanna than other situations. Host plants grew in the open, without overstory, and also as understory plants.

VALLEY ELDERBERRY LONGHORN BEETLE

The three live adult beetles were captured in various orientations and positions on the elderberry plants: on foliage and on bark, inside the canopy (shaded, concealed) and outside (in sun, exposed), oriented horizontally and vertically, and oriented right-side-up and upside-down. One beetle was found dead in an exit tunnel. Flight was not observed.

The three beetles captured alive were maintained in the laboratory on a diet of fresh *Sambucus* leaves; the male lived for 17 days and the females for 25 days. A male and female placed together after capture mated off and on for at least five days. The females produced 80-110 eggs each, most of which were attached in crevices, depressions, and at petiole-stem junctions on the food plant.

Based on the presence of exit holes, the VELB seems to prefer stems for larval development and pupation which are larger than an inch or two in diameter. The largest number of recent exit holes, 50 percent (n=35), were in branches or trunks >2-4 inches in diameter (Figure 52). Only 10 percent occurred in branches 1.5 inches or smaller. Small stems may be under-represented because of insufficient time for larval development, pupation, and adult emergence. Branch/trunk diameters ranged from 0.6-10.0 inches for all holes, and 1.0-8.4 inches for recent holes.

The vertical heights of exit holes above the ground (Figure 55) ranged from 6-108 inches. About 70 percent (n=86) were 48 inches (4 feet) or lower, and 56 percent (n=68) were 36 inches (3 feet) or lower. These results may be biased by the greater ease at which lower elderberry trunks and branches are examined.

FACTORS AFFECTING THE VALLEY ELDERBERRY LONGHORN BEETLE

THE PRESENT OR THREATENED DESTRUCTION, MODIFICATION, OR CURTAILMENT OF ITS HABITAT OR RANGE:

Riparian fragmentation and destruction caused by agricultural conversion, waterway maintenance, and urbanization will continue to be a threat in the future. VELB populations inhabiting *Sambucus* that is isolated or widely scattered are especially vulnerable to being extirpated in some parts of the range. Despite legal protection of the beetle, host plants are still frequently injured through cutting and burning, and sometimes by herbicides.

Insecticide drift from cultivated fields and orchards adjacent to elderberry stands could have a deleterious effect on VELB populations if this occurs when adults are present. Evidence of insecticide residue on elderberry was noted by Jones and Stokes along the Sacramento River, and was cited as a possible factor in their failure to locate adults in 1986. At one of the localities in this study (#80-85), next to fields being sprayed, no evidence of the VELB could be found where an adult and exit holes had been seen six years ago (Arnold 1984, 1985).

OVER-UTILIZATION FOR COMMERCIAL, RECREATIONAL, SCIENTIFIC, OR EDUCATIONAL PURPOSES:

No evidence of over-utilization was noted during this survey, but since longhorn beetles (Cerambycidae) are very popular with collectors, it is possible that, if unprotected, the VELB could be adversely impacted due to its rarity and notoriety.

DISEASES OR PREDATION:

No direct evidence of either disease or predation was observed during this study. Disease or deformity may have caused the death of an adult VELB found undamaged and still in its exit hole. Jones and Stokes (1988) proposed that empty galleries without either larvae or emergence holes could have resulted from larval mortality.

It is possible that bird predation is a minor factor in regulating VELB populations, but it is also possible that aposematic coloration affords protection for the adults. A large number of bird nests were noted in elderberry shrubs/trees, probably due to their dense, brushy

nature. Although no predation was seen, many exit holes had been enlarged from the outside in a manner consistent with bird pecking. Jones and Stokes (1987b) discussed in depth the role of birds, probably woodpeckers, in enlarging exit holes and creating new holes in elderberry stems.

It has been reported that cattle readily forage on *Sambucus* (USFWS 1984, Halstead 1991a). Damage to the plants by large herbivores such as cattle or deer was not seen or recognized during the study, but such activity would be destructive to the eggs, larvae, and pupae of the VELB.

Arnold (USFWS 1984) suggested that the VELB itself weakens the elderberry host and makes it more susceptible to invasion by fungus diseases and other insects.

THE INADEQUACY OF EXISTING REGULATORY MECHANISMS:

This is not a currently problem since *Desmocerus californicus dimorphus* Fisher is listed on the Endangered Species Act of 1973, as amended. However, this is the only protection afforded the beetle since it and other insects are not safeguarded under the California Endangered Species Act, nor is it covered under any other special statutes.

RECOVERY

The Step-Down Outline and Implementation Schedule of the Recovery Plan (USFWS 1984) have only been minimally pursued. Until this year little has been accomplished besides Priority 1 tasks and surveys of the Sacramento River and part of the Cosumnes River.

This project was aimed at completing several of the remaining tasks dealing with the distribution and range, life history, and environmental requirements of the valley elderberry longhorn beetle. Some of these goals have been achieved, if only partially, but detailed life history and ecology information is still lacking. Specifically, Priority 2 tasks which remain incomplete are:

(1) Conduct field studies on autecology of VELB at known colonies, and at any newly discovered sites.
(2) Conduct laboratory studies to determine VELB life history.
(3) Determine synecology of riparian forest vegetation at these sites.

(4) Investigate autecology of *Sambucus* spp.
(5) Investigate the effects of grazing, disturbance and successional processes on *Sambucus* and VELB.
(6) Determine VELB population status and success of management actions.

The importance of these tasks should be considered when addressing whether or not *Desmocerus californicus dimorphus* should be removed from the Federal list of endangered and threatened wildlife.

RECOMMENDATIONS

I. Additional field study and collections of adult beetles are needed especially from the northern and southern ends of the range in the Redding and Bakersfield areas, the eastern edge of the Sacramento Valley, and the eastern foothills of the Coast Range. Although the VELB appears to be distributed throughout much of the Central Valley, it is known only from exit holes in a large portion of the range. Furthermore, except for those reported in this study and those of Halstead, most of the adult and exit hole records are older than five years. Some of those populations may no longer be extant.

II. Although prevailing scientific opinion presently supports the current status of the VELB, problems with male variability and the inability to identify some individuals except by collection locality has raised questions about the appropriateness of subspecific designations (Halstead 1990, 1991a). A major problem has been the lack of specimens throughout the range with which to study variation in the overall population. In order to determine the nature of the contact zone between the subspecies, observations and collections of adults are especially needed from the possible area of parapatry in the eastern foothills of the Coast Range. Important questions include:

(1) whether or not the subspecies are parapatric, i.e., have adjoining ranges
(2) if parapatric, whether a zone of intergradation or hybridization exists
(3) the presence or absence of clinal variation

III. Almost nothing is known about the dynamics of VELB population ecology. An in-depth, multiple-year study in a particular area is needed to answer questions about:

(1) the size and distribution of population groups
(2) the amount of habitat necessary to sustain a healthy population
(3) larval and adult mortality rates and causes
(4) continuous or synchronous emergence of adults
(5) dispersal/colonizing ability

IV. Study encompassing more than one life cycle is needed to address important, undocumented aspects of the life history of the VELB, such as:

(1) duration of life cycle
(2) the internal and/or external controlling factors influencing adult maturation and emergence
(3) daily activity period of adults
(4) adult feeding habits
(5) mate location
(6) presence/absence of pheromones

V. The ecological interactions between the VELB and its host plant should be more thoroughly investigated. It is not known how and why particular *Sambucus* individuals are selected as hosts, information which could be important in habitat preservation, restoration, and mitigation.

VI. A study should be undertaken to test the feasibility of inoculating elderberry shrubs with VELB eggs. Such a technique could prove to be a valuable tool in restoration of extirpated populations. In addition, controlled experiments would provide life history information that may be difficult or impossible to obtain in the field. The captive females in this project were easy to maintain and produced many viable eggs.

VII. There is a definite need for education aimed at landowners and personnel of agencies in charge of public lands in order to minimize damage to the VELB's host, *Sambucus*.

VIII. The VELB should not be removed from the Federal list of endangered and threatened wildlife unless permanent protection is insured for disjunct populations in different parts of the Central Valley. In that event, a system of federally designated VELB refuges, where the beetle and its host plant could be protected, studied, and closely monitored, is strongly recommended. Some excellent habitat (i.e., mostly undisturbed, with numerous healthy *Sambucus*) with valley elderberry

longhorn beetle populations is present on lands that are already set aside for public use as parks, recreation areas, and wildlife refuges. These are noted in Table 1. These lands, or portions thereof, are not presently managed specifically for the VELB.

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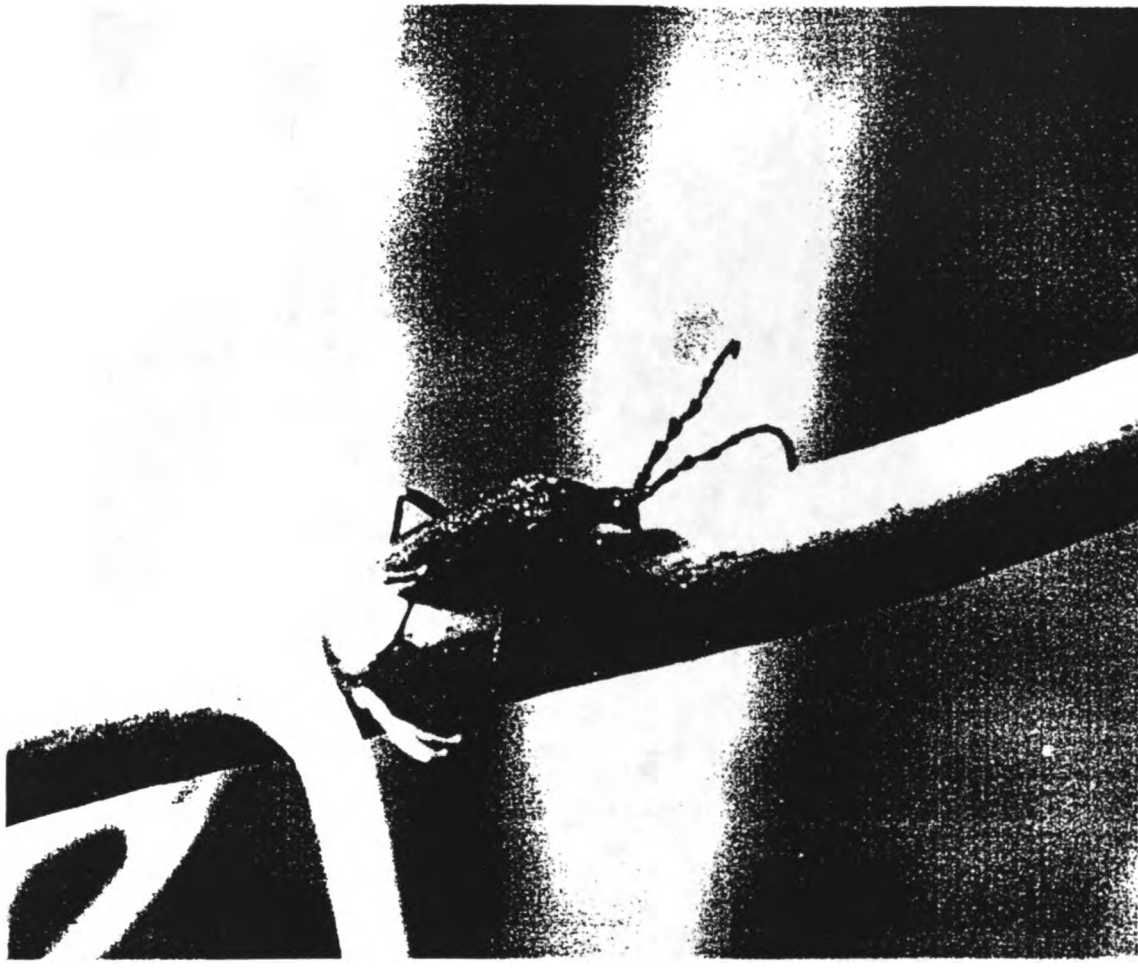

Figure 1. Male *Desmocerus californicus dimorphus* collected near the Mokelumne River north of Clements, San Joaquin Co., 15 May 1991 (Site #72).

Figure 2. Female *Desmocerus californicus dimorphus* collected at the Campbell-Moreland Ditch just southeast of Porterville, Tulare Co., 21 April 1991 (Site #15).

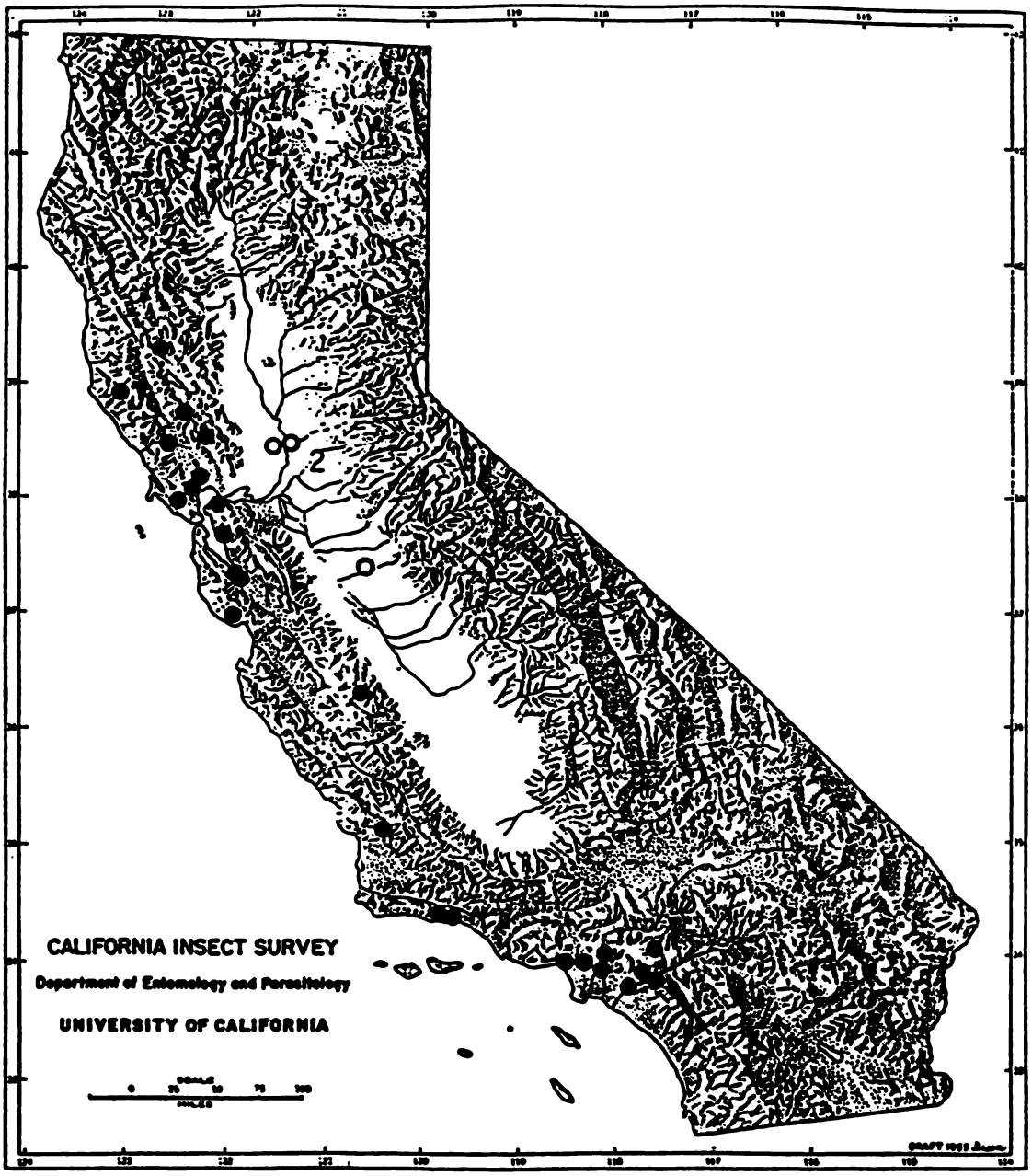

Figure 3. Known geographic ranges of: 1, *Desmocerus californicus californicus* Horn (closed circles); 2, *D. californicus dimorphus* Fisher (open circles). (From Linsley & Chemsak 1974)

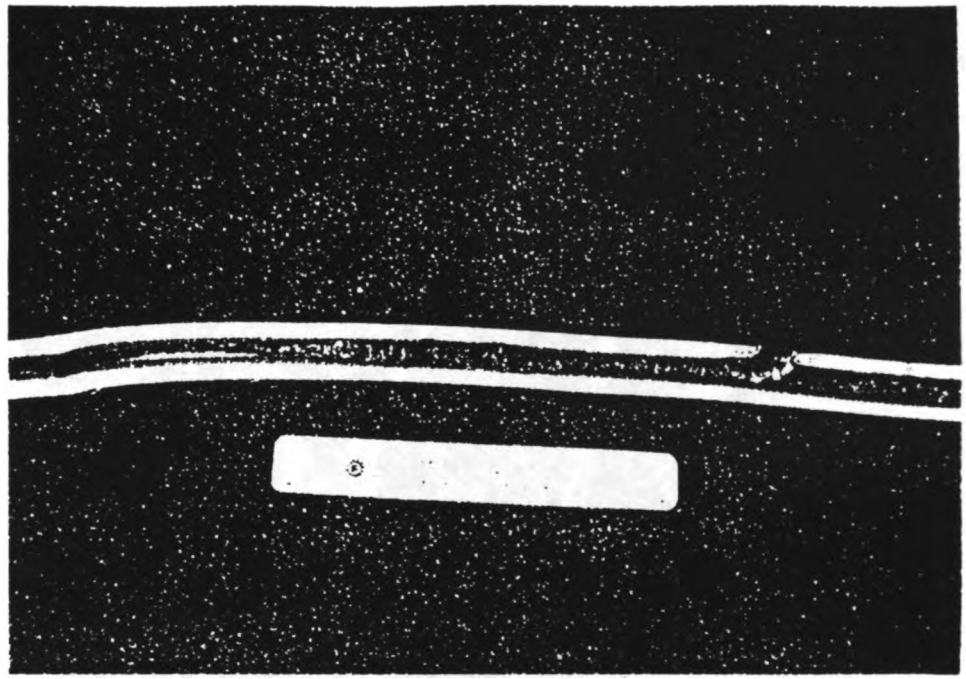

Figure 4. *Sambucus* stem sectioned longitudinally to expose VELB gallery; note frass and shredded wood (Site #32).

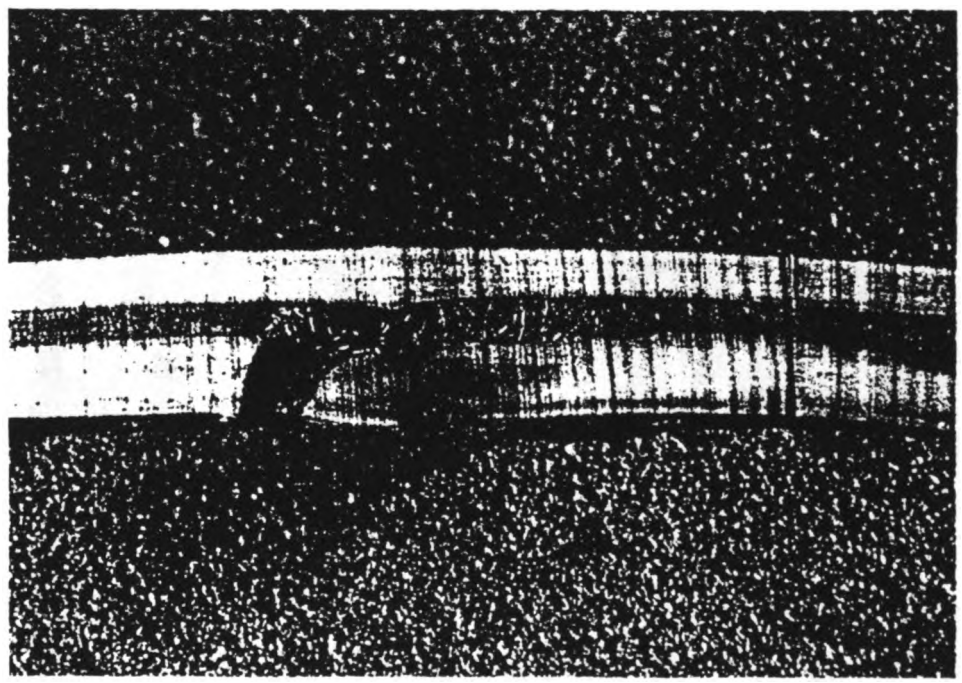

Figure 5. *Sambucus* stem sectioned longitudinally to expose VELB gallery; note frass and shredded wood (Site #32).

Figure 6. Recent VELB exit hole (Site #141).

Figure 7. Recent VELB exit hole (Site #24).

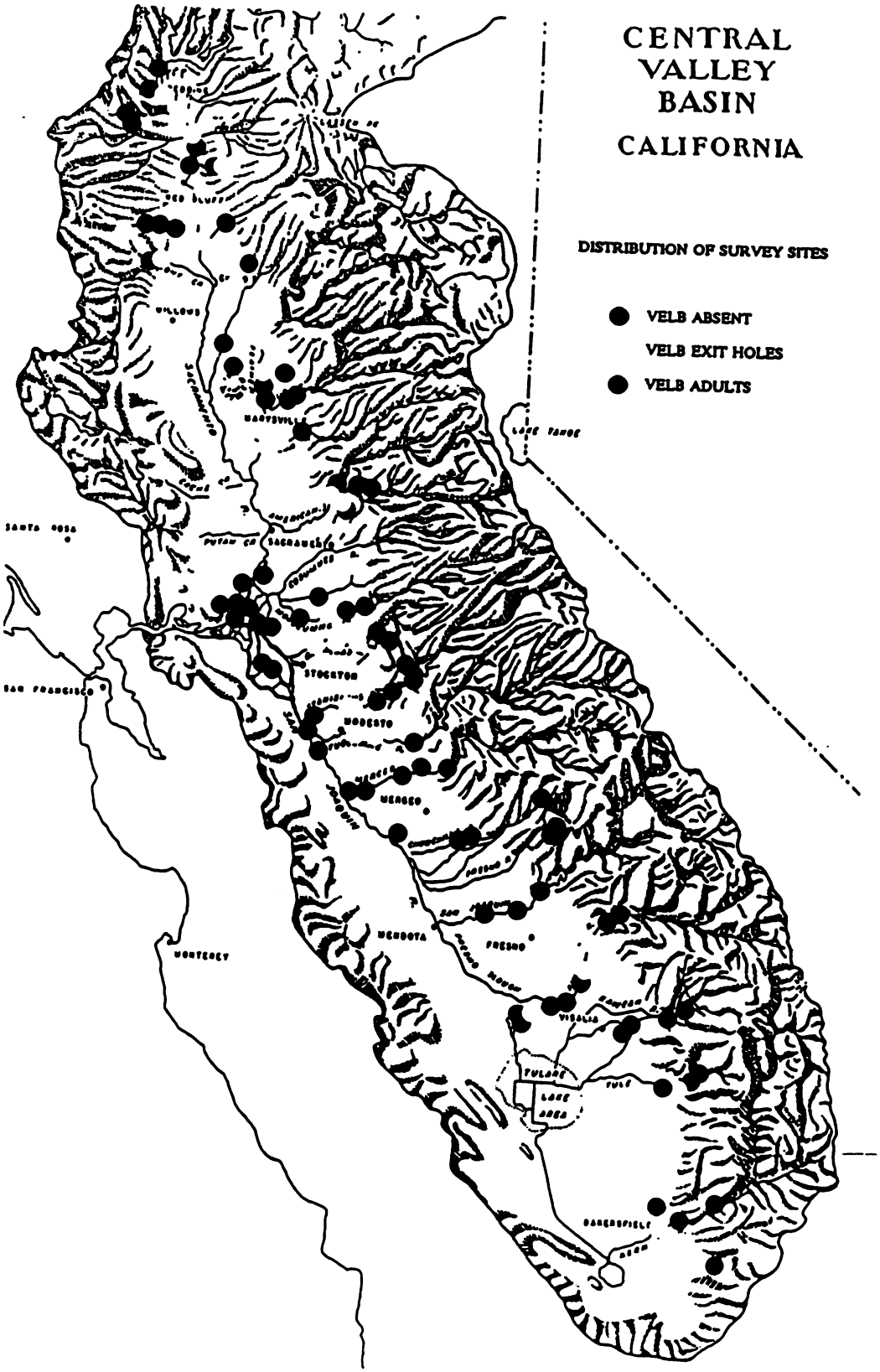

Figure 8. Distribution of survey sites with *Desmocerus californicus dimorphus* and /or *Sambucus* present.

Figure 9. Lanky arborescent *Sambucus racemosa* var. *microbotrys* at Reading Island Recreation Area (BLM) campsite on the Sacramento River, Shasta Co. (Site #61); note the pruning scars and absence of bark on much of the trunk.

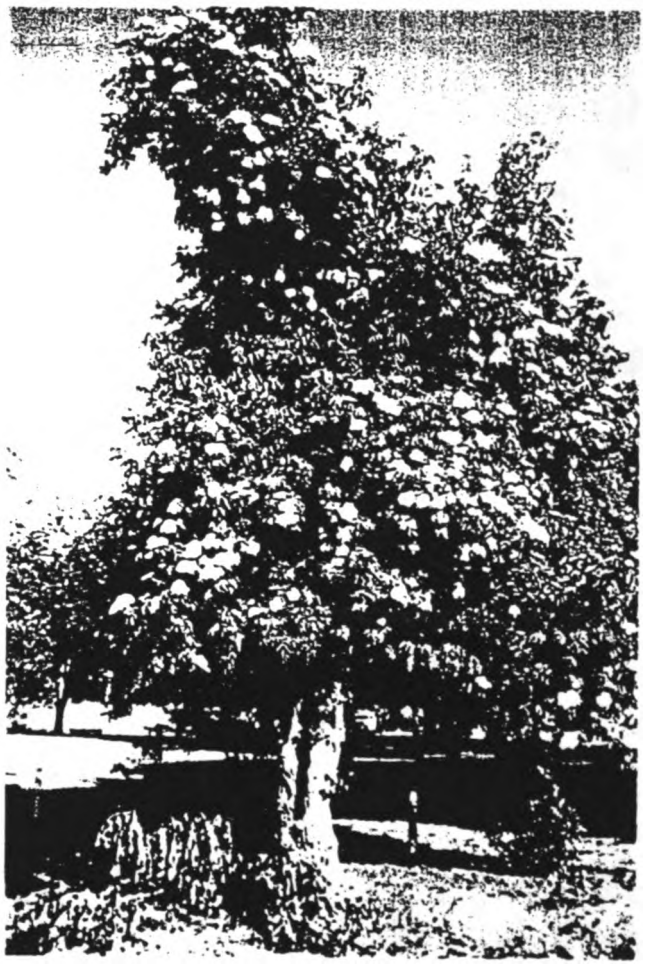

Figure 10. Massive arborescent *Sambucus*, with a maximum trunk diameter of 30 inches, adjacent to Bartlett Park (Co.) on the Tule River east of Porterville, Tulare Co. (Site #35); the tree had been pruned.

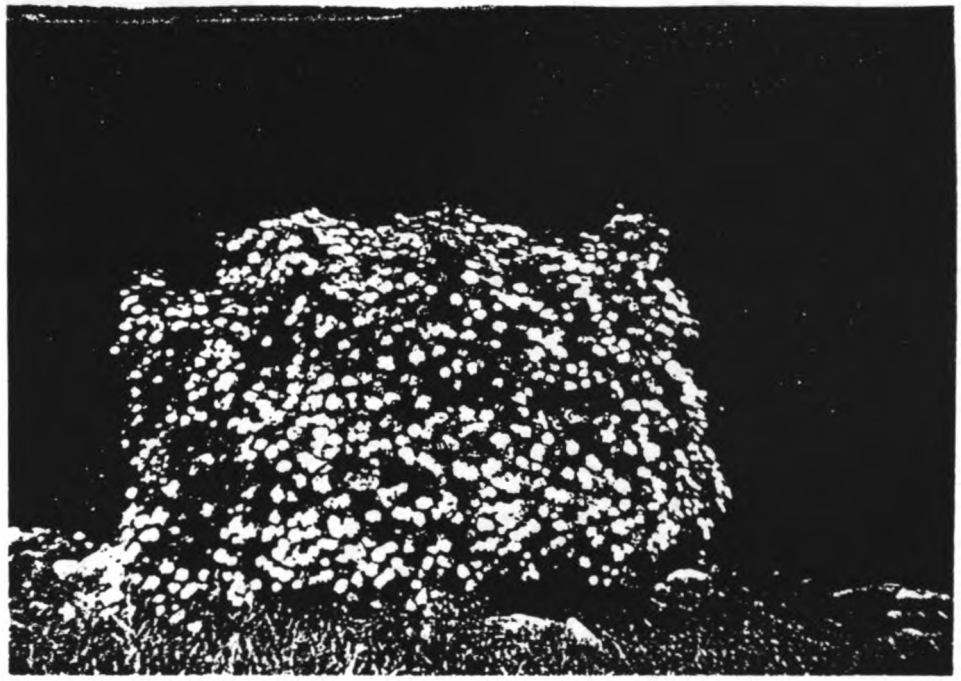

Figure 11. *Sambucus* in full bloom above Lake Kaweah (COE), Hwy. 198, Tulare Co. (Site #33).

Figure 12. Dense *Sambucus* grove along Gordon Valley Creek about 4 mi. northwest of Fairfield, Solano Co. (Site #125).

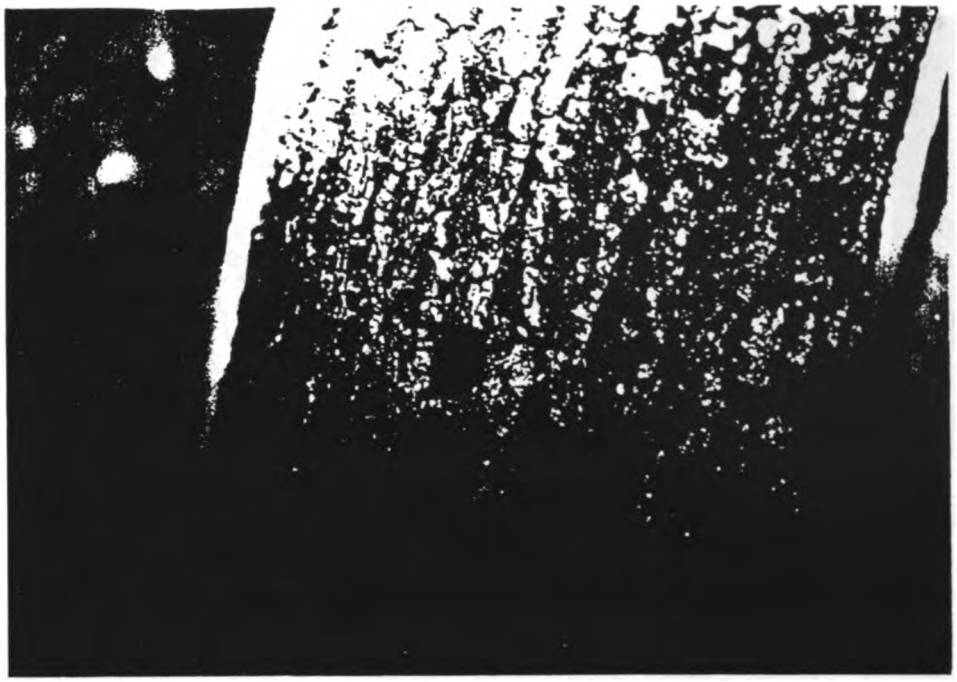

Figure 13. Clean-cut, typical VELB exit hole (Site #56).

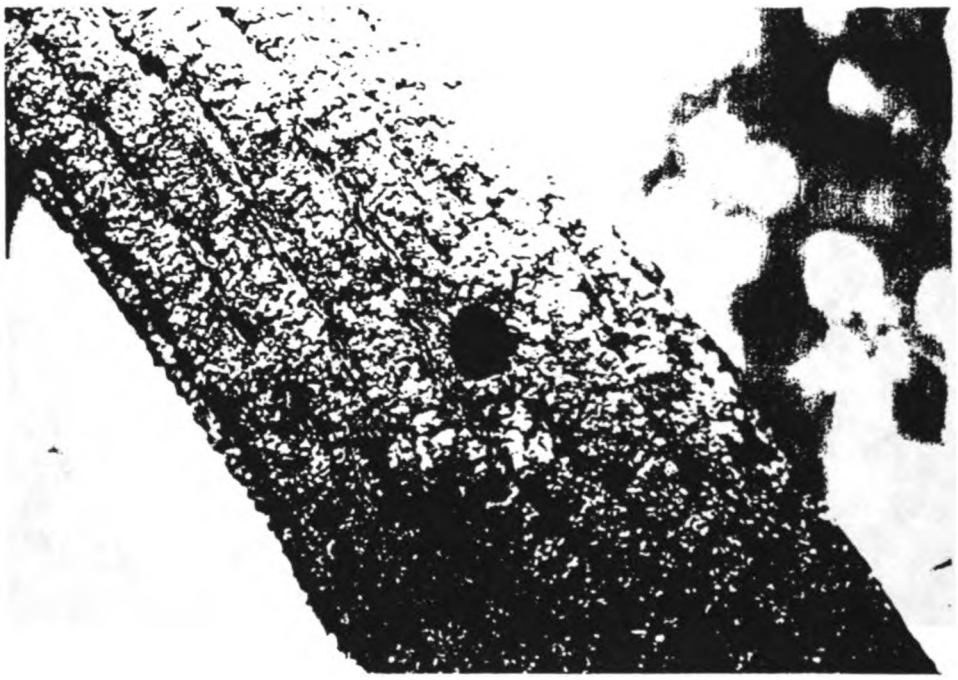

Figure 14. Partly healed VELB exit hole (Site #61).

Figure 15. Healed VELB exit hole (Site #32).

Figure 16. Possible VELB exit holes plugged with sawdust/frass from secondary insect infestation, perhaps by termites (Site #32).

Figure 17. Enlarged holes with extruded sawdust/frass from recent non-VELB insect activity (Site #20).

Figure 18. Enlarged hole with extruded sawdust/frass from recent non-VELB insect activity (Site #20).

Figure 19. Known range of *Desmocerus californicus dimorphus* Fisher from current and historic adult /exit hole records.

Figure 20. *Sambucus mexicana* grove with VELB exit holes at Turtle Bay East Fishing Access (city) on the Sacramento River, Redding, Shasta Co. (Site #56).

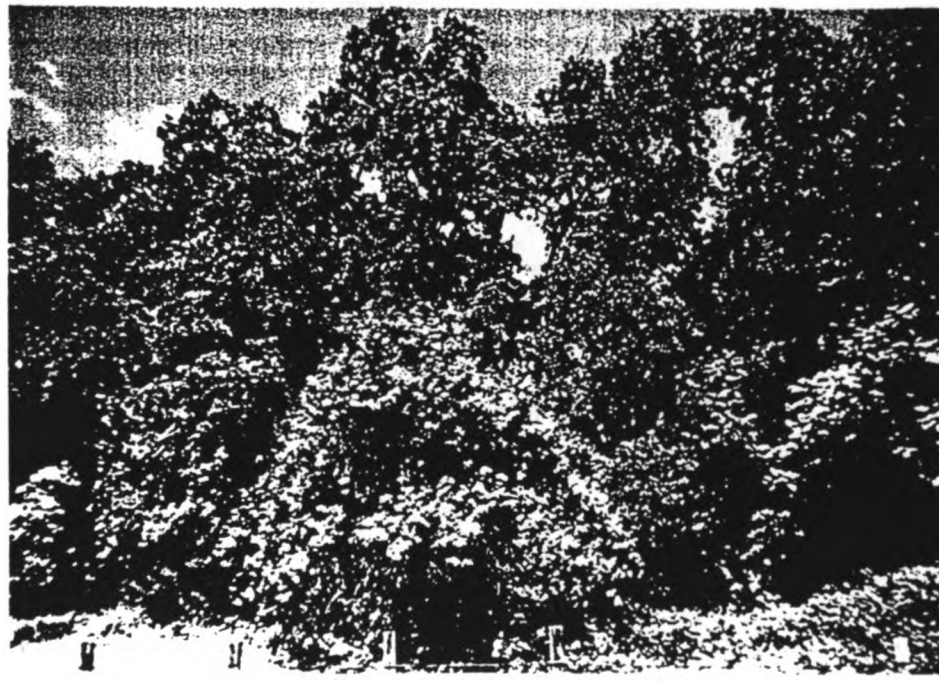

Figure 21. *Sambucus* clump with VELB exit holes at Anderson River Park (city) on the Sacramento River, Shasta Co. (Site #60).

Figure 22. *Sambucus racemosa* var. *microbotrys* grove with VELB exit holes at the margin of riparian forest along the Sacramento River, Sacramento River NWR (Flynn Tract) southeast of Gerber, Tehama Co. (Site #112).

Figure 23. Large *Sambucus racemosa* var. *microbotrys* clump with VELB exit holes at the margin of a dense riparian corridor along the Sacramento River, Kopta Slough Preserve (The Nature Conservancy) east of Corning, Tehama Co. (Site #113).

Figure 24. Grove of buckeye, oak, and *Sambucus racemosa* var. *microbotrys* with VELB exit holes above Paynes Creek, Tehama Co. (Site #68).

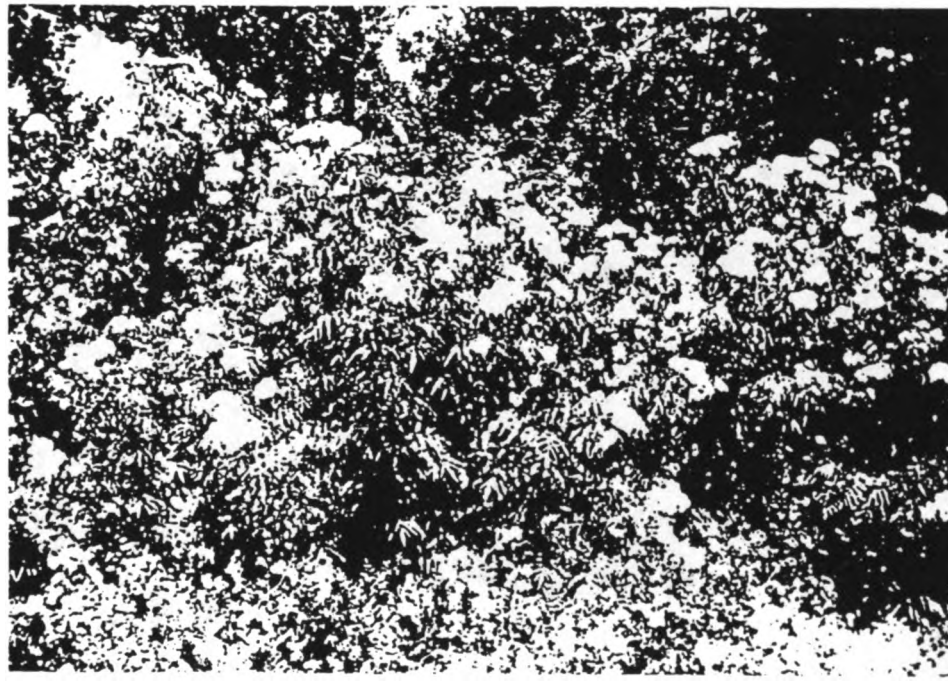

Figure 25. Riparian *Sambucus mexicana* with VELB exit holes along Big Chico Creek in Bidwell Park (city), Chico, Butte Co. (Site #119).

Figure 26. *Sambucus racemosa* var. *microbotrys* with VELB exit holes along the Feather River levee east of Live Oak, Yuba Co. (Site #172).

Figure 27. Huge, isolated *Sambucus racemosa* var. *microbotrys* with VELB exit holes below Black Butte Lake Dam, Tehama Co. (Site #118).

Figure 28. Recent exit hole in *Sambucus mexicana* branch, Wooden Valley Creek northwest of Fairfield, Napa Co. (Site #128).

Figure 29. Dense stand of *Sambucus* in bloom along a tributary of Ledgewood Creek northwest of Fairfield, Solano Co. (Site #123).

Figure 30. **Large clump of *Sambucus* with numerous VELB exit holes along the Calaveras River north of Linden, San Joaquin Co. (Site #93).**

Figure 31. **Massive old *Sambucus* with possible VELB exit holes above the Kings River west of Reedley, Fresno Co. (Site #43).**

Figure 32. *Sambucus racemosa* var. *microbotrys* with numerous VELB exit holes; Campbell-Moreland Ditch (tributary Tule River) just southeast of Porterville, Tulare Co. (Site #15).

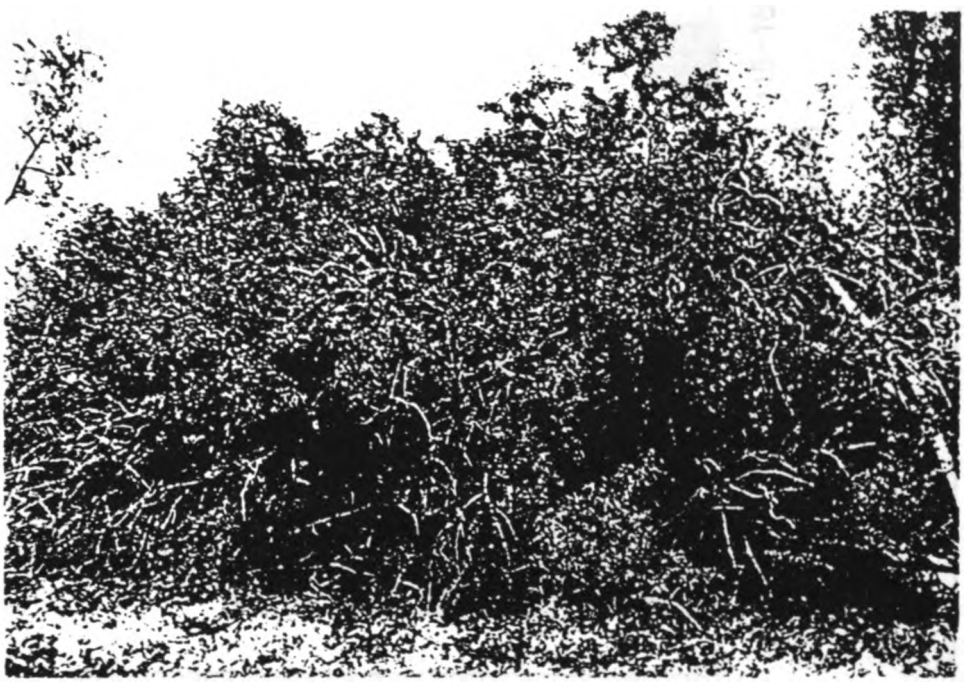

Figure 33. **Large clump of *Sambucus* with VELB exit holes at the margin of the riparian corridor along the Tule River east of Porterville, Tulare Co. (Site #20).**

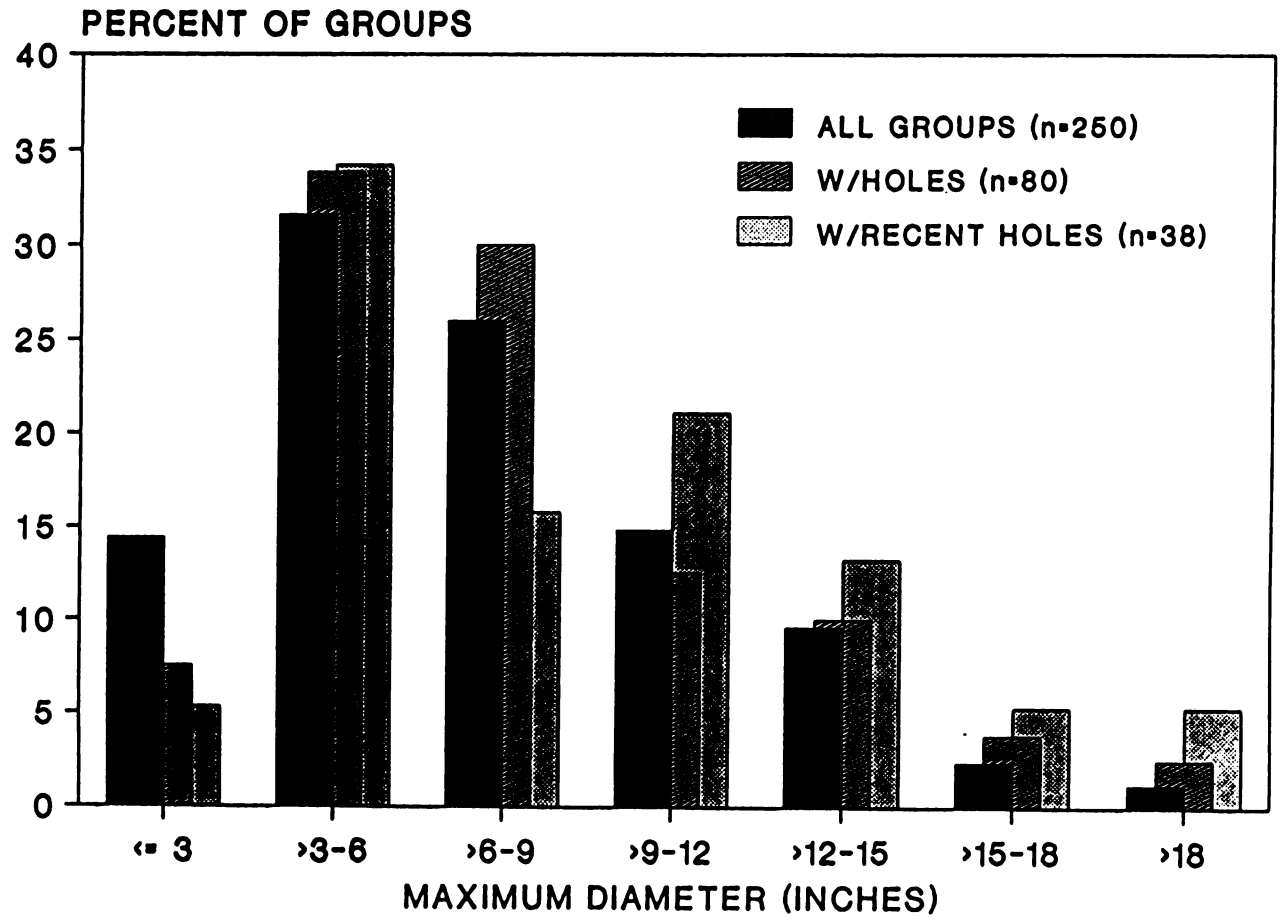

Figure 34. The size distribution of maximum diameters of all *Sambucus* groups compared to those with VELB exit holes.

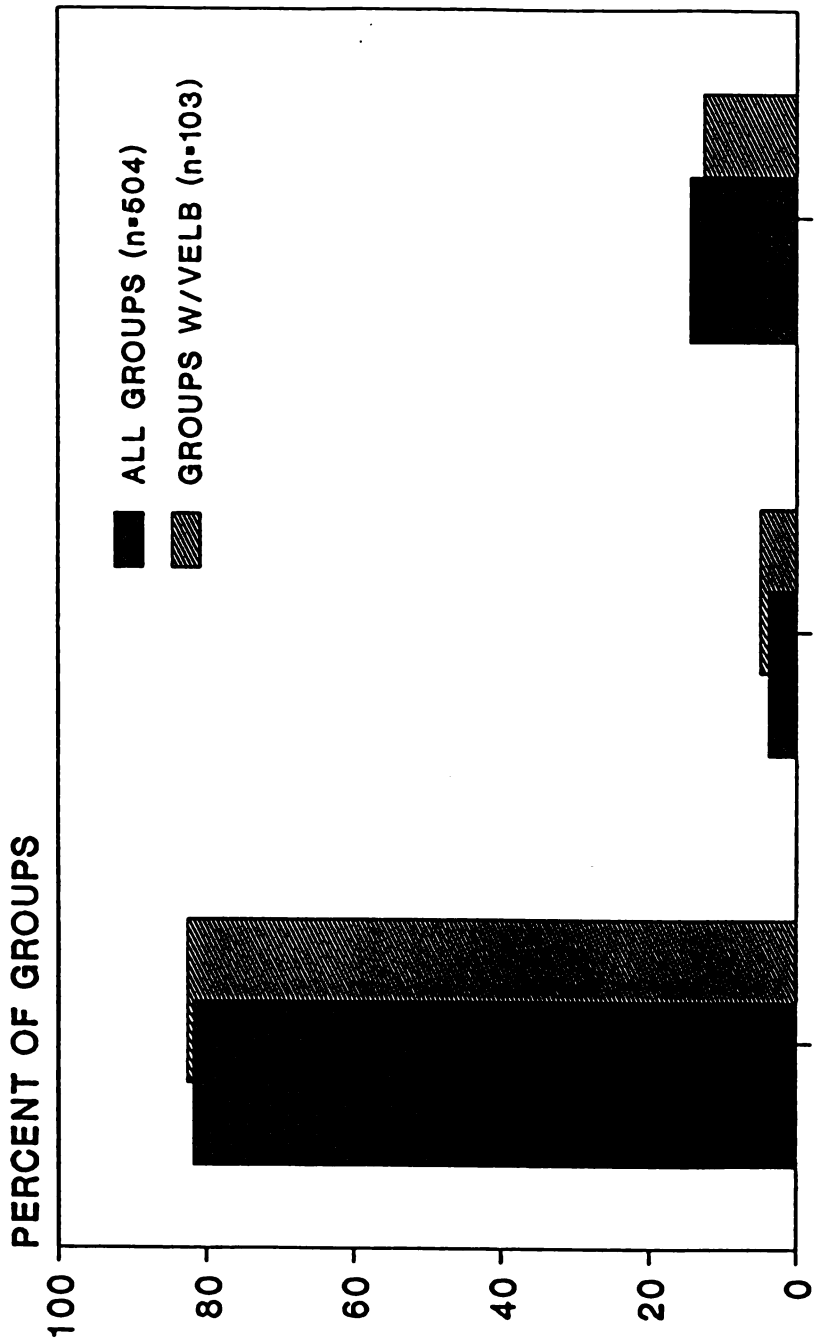

Figure 35. The health of all *Sambucus* groups compared to those with VELB exit holes.

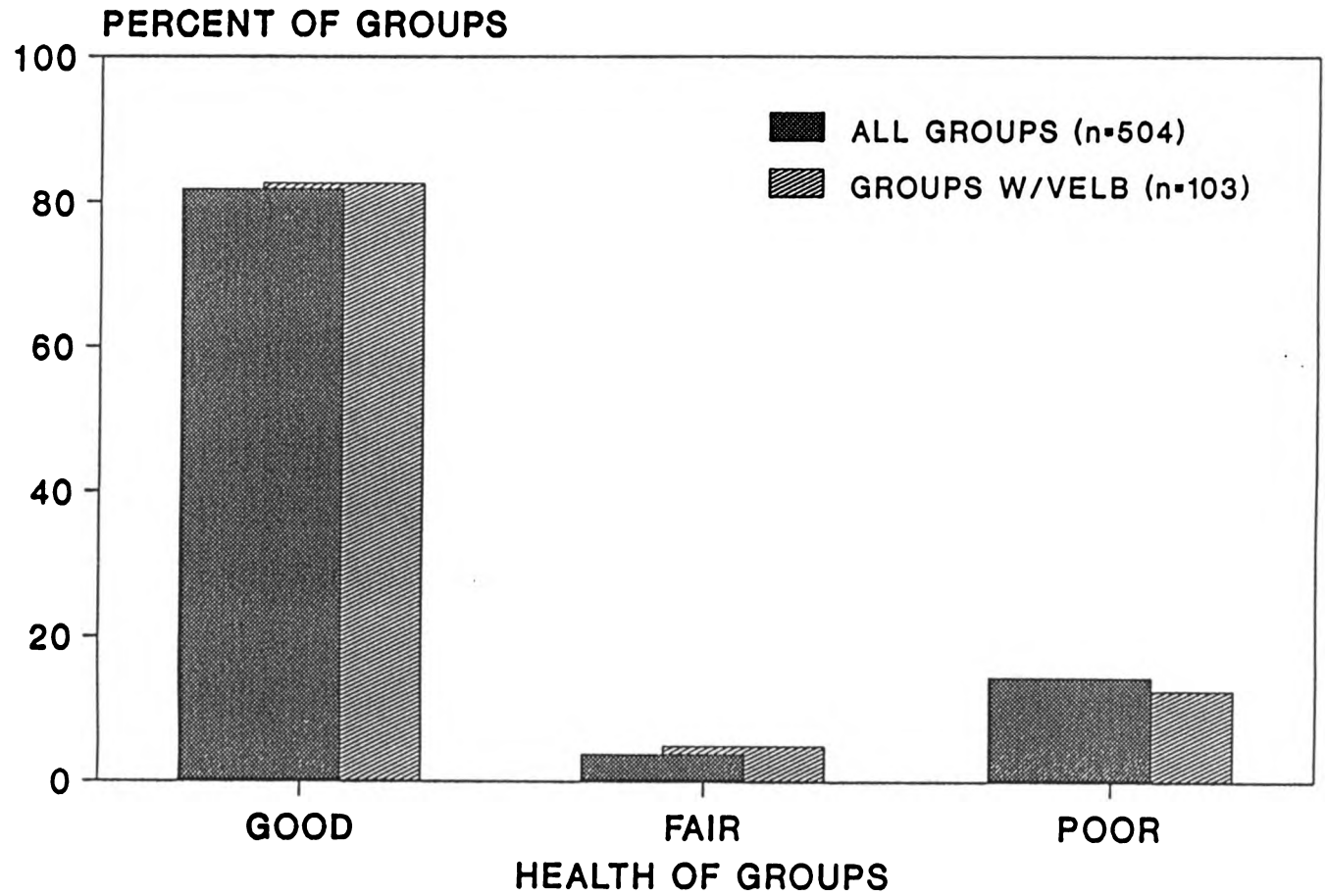

Figure 35. The health of all *Sambucus* groups compared to those with VELB exit holes.

Figure 36. Recently pruned *Sambucus* adjacent to Bartlett Park (Co.) on the Tule River, Tulare Co. (Site #35); VELB exit holes were present.

Figure 37. Recently cut *Sambucus* logs at Reading Island Recreation Area (BLM) campsite on the Sacramento River, Shasta Co. (Site #61); VELB exit holes were present.

Figure 38. Cutting damage to *Sambucus* at McHenry Avenue Park (COE) picnic area on the Stanislaus River, San Joaquin Co. (Site #223); VELB exit holes were present.

Figure 39. Old, splintered *Sambucus* stems and trunks surrounded by young shoots (Site #89).

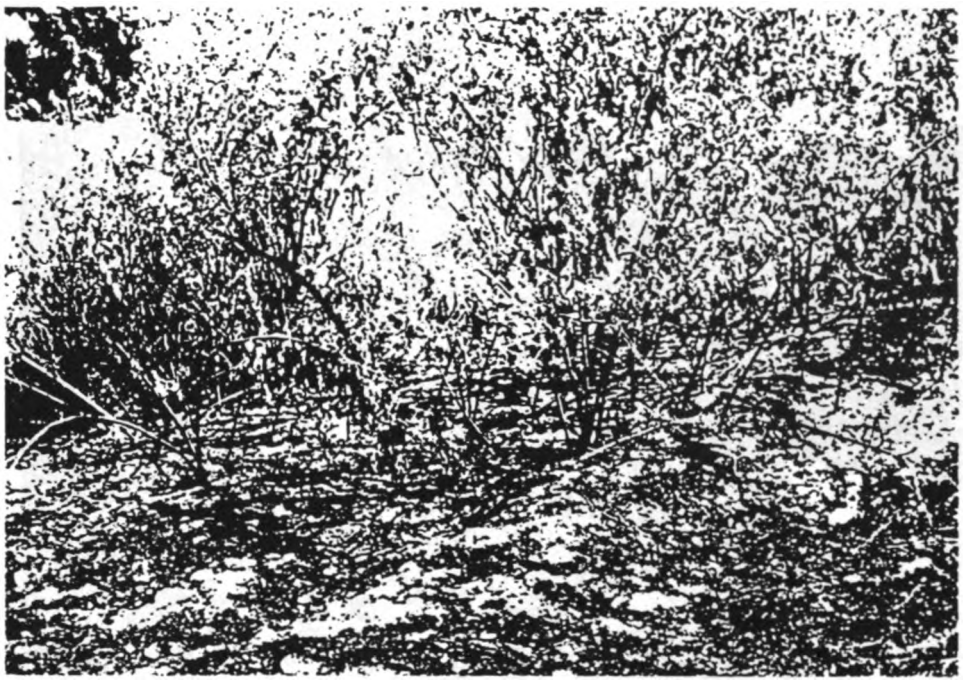

Figure 40. Burned *Sambucus* grove (Site #210).

Figure 41. Burn scars on *Sambucus* trunk (Site #205).

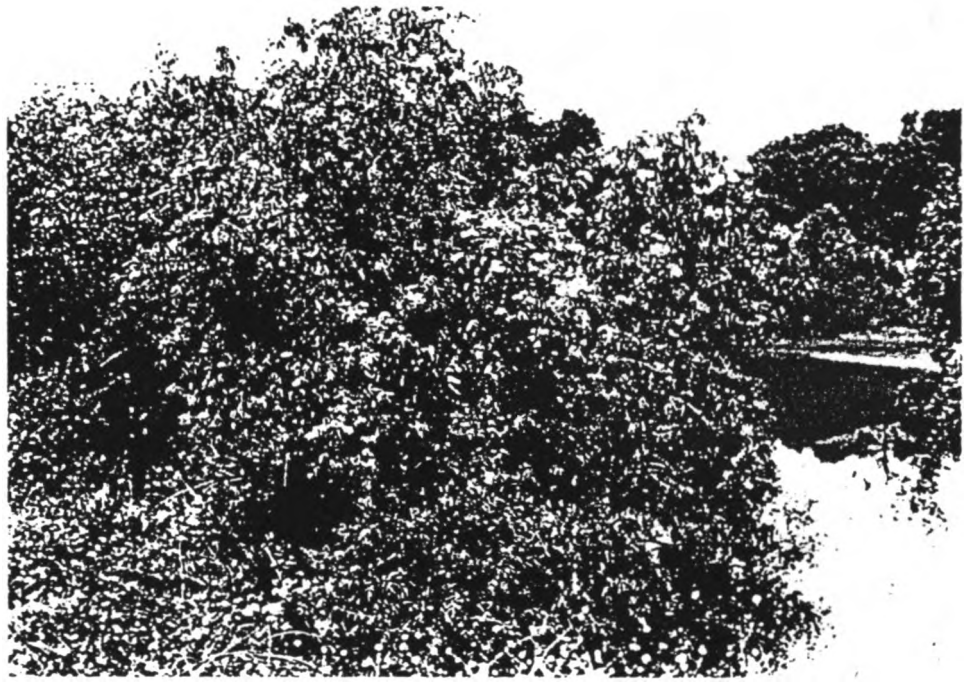

Figure 42. Riparian *Sambucus racemosa* var. *microbotrys* stand, elevation ~85 ft., at Honcut Creek northeast of Live Oak, Yuba Co. (Site #173).

Figure 43. Elderberry savanna with huge *Sambucus racemosa* var. *microbotrys*, elevation ~365 ft., at Reading Island Recreation Area (BLM) on the Sacramento River, Shasta Co. (Site #61).

Figure 44. Isolated *Sambucus racemosa* var. *microbotrys* clump in a pasture bordering Paynes Creek, elevation ~1875 ft., Tehama Co. (Site #67).

Figure 45. Fencerow *Sambucus mexicana* with cemetery on the left and plowed field on the right, elevation ~135 ft., near the Mokelumne River north of Clements, San Joaquin Co. (Site #72); a female VELB was captured on this clump on 15 May 1991.

Figure 46. *Sambucus mexicana* in an oak-woodland habitat, elevation ~780 ft.; the plants were growing in a damp roadside ditch at the Peninsula Campground entrance, Folsom Lake State Recreation Area, El Dorado Co. (Site #99).

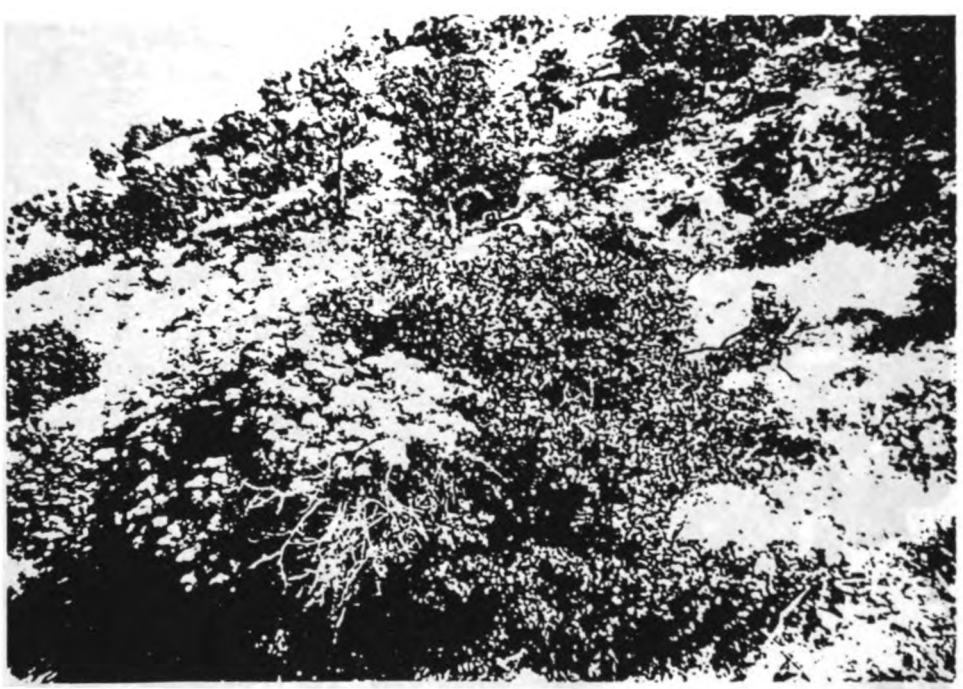

Figure 47. *Sambucus mexicana* in a mixed chaparral-foothill woodland habitat, elevation ~520 ft., Cache Creek Canyon, Yolo Co. (Site #75); plant associates included toyon, manzanita, redbud, digger pine, and big-leaf maple.

Figure 48. *Sambucus racemosa* var. *microbotrys* growing amid boulders on a rocky hill, elevation ~410 ft., near Miners Ravine west of Folsom Lake, Placer Co. (Site #21).

Figure 49. Dense *Sambucus* grove in a dry, incised streambed southwest of Caliente, Kern Co., elevation ~1360 ft. (Site #6).

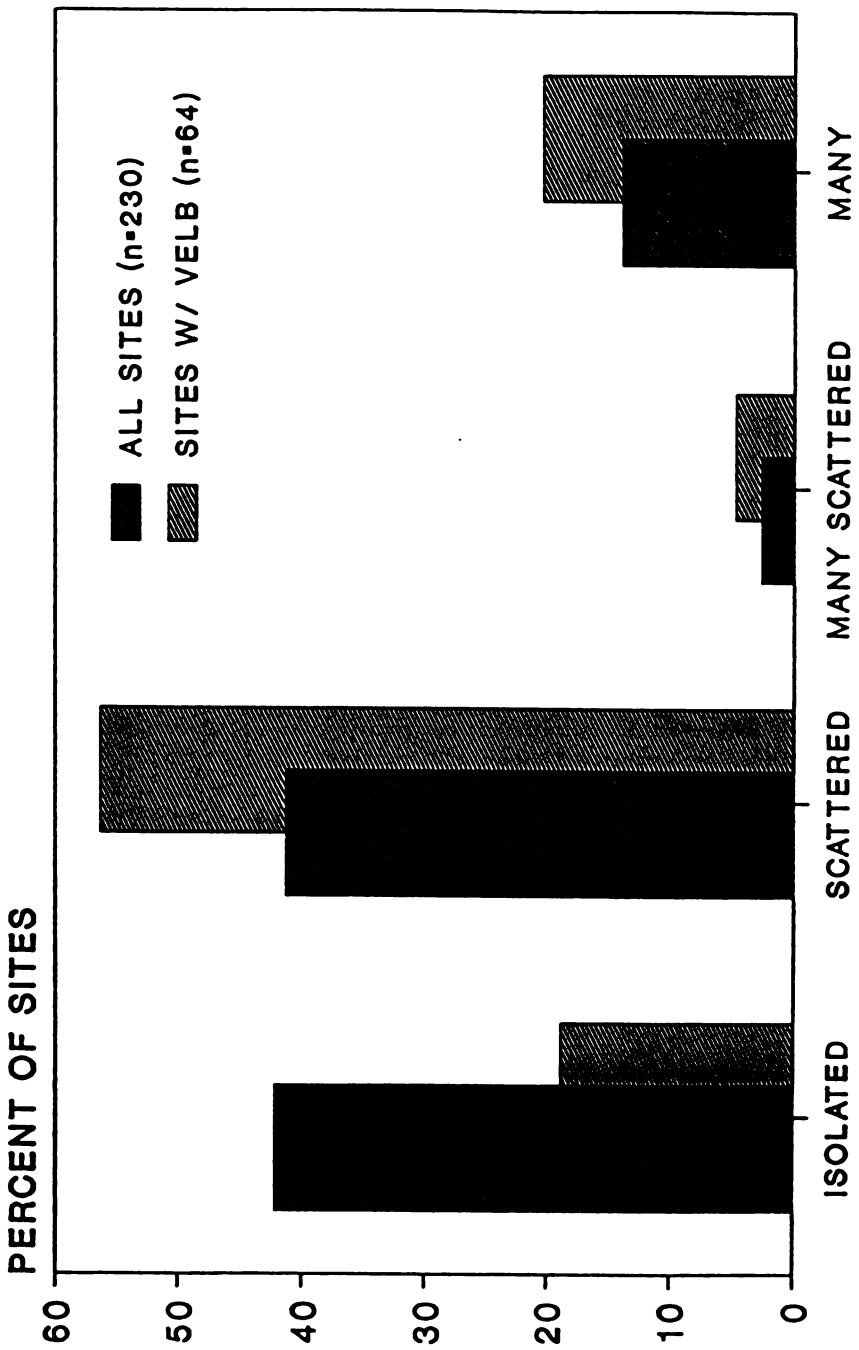

Figure 50. Elderberry density at all sites compared to those with VELB exit holes.

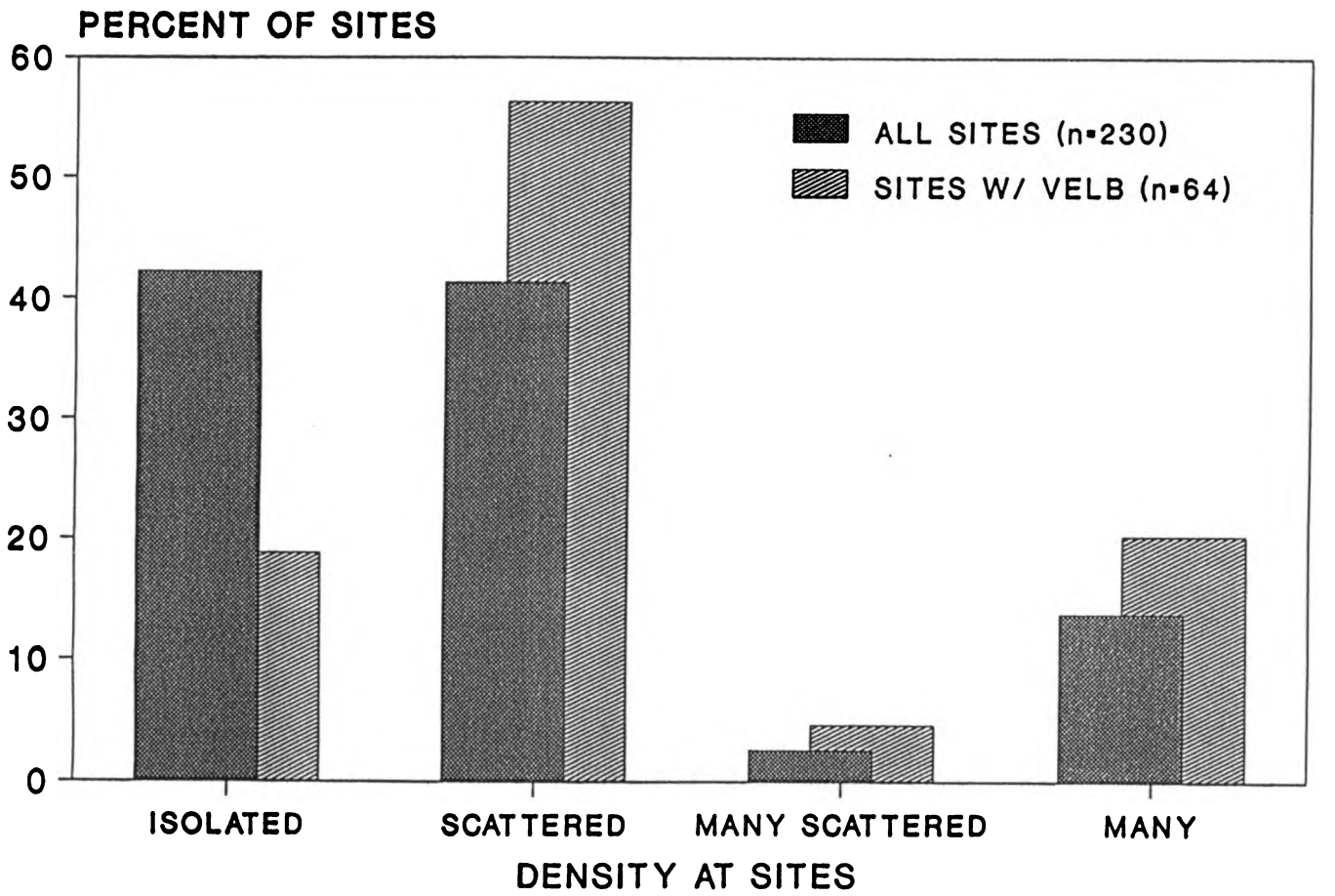

Figure 50. Elderberry density at all sites compared to those with VELB exit holes.

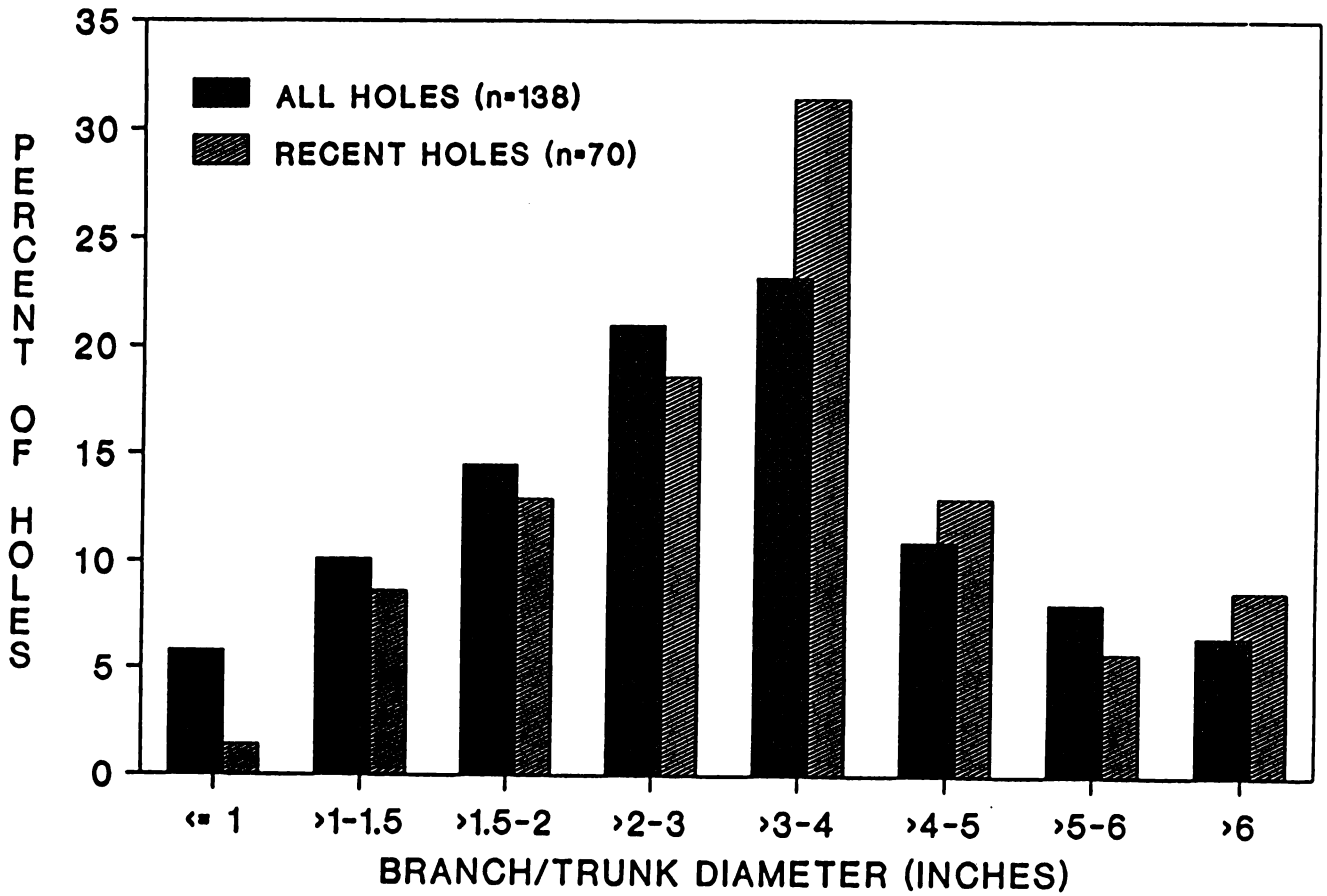

Figure 52. The size distribution of branch/trunk diameters at VELB exit holes.

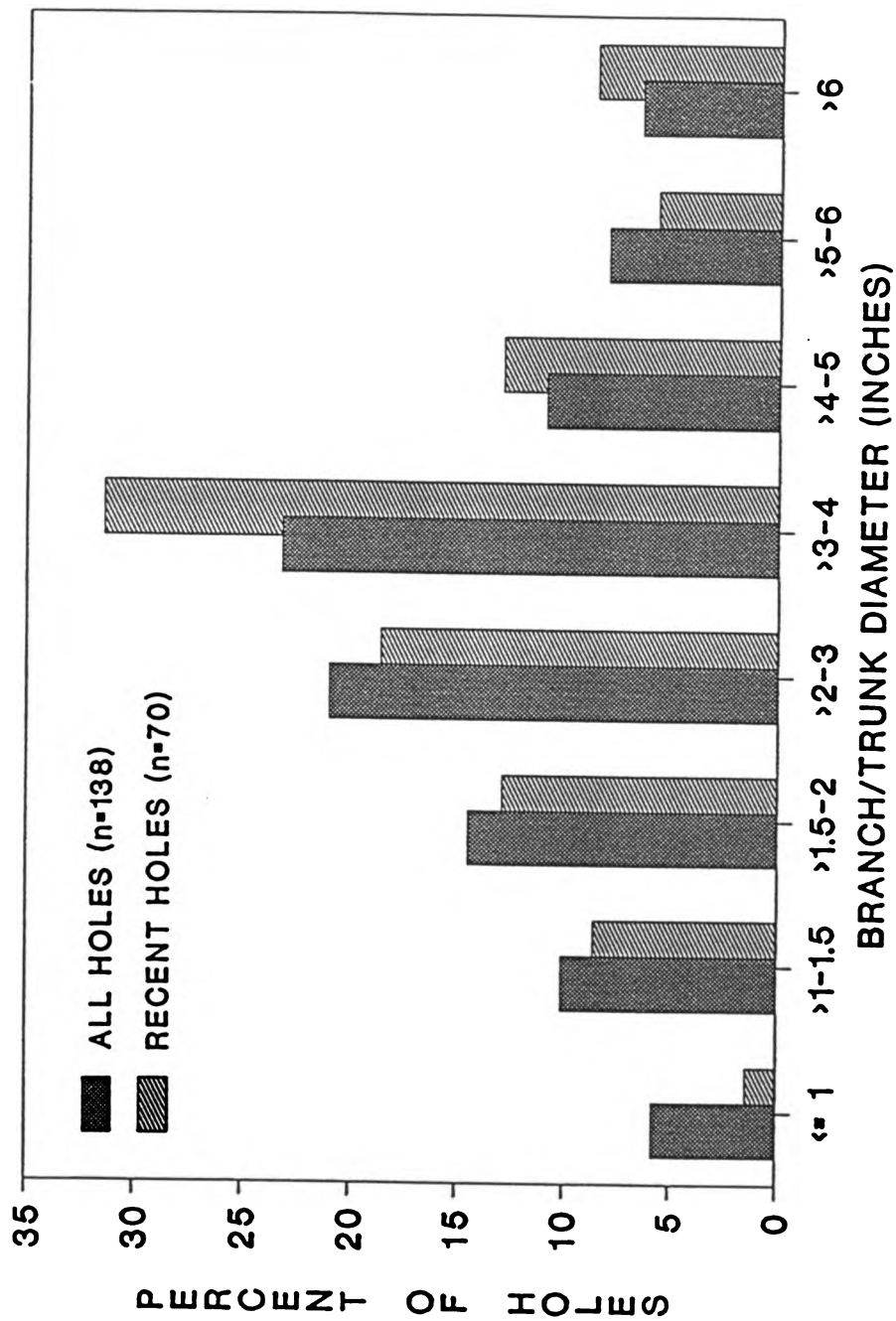

Figure 52. The size distribution of branch/trunk diameters at VELB exit holes.

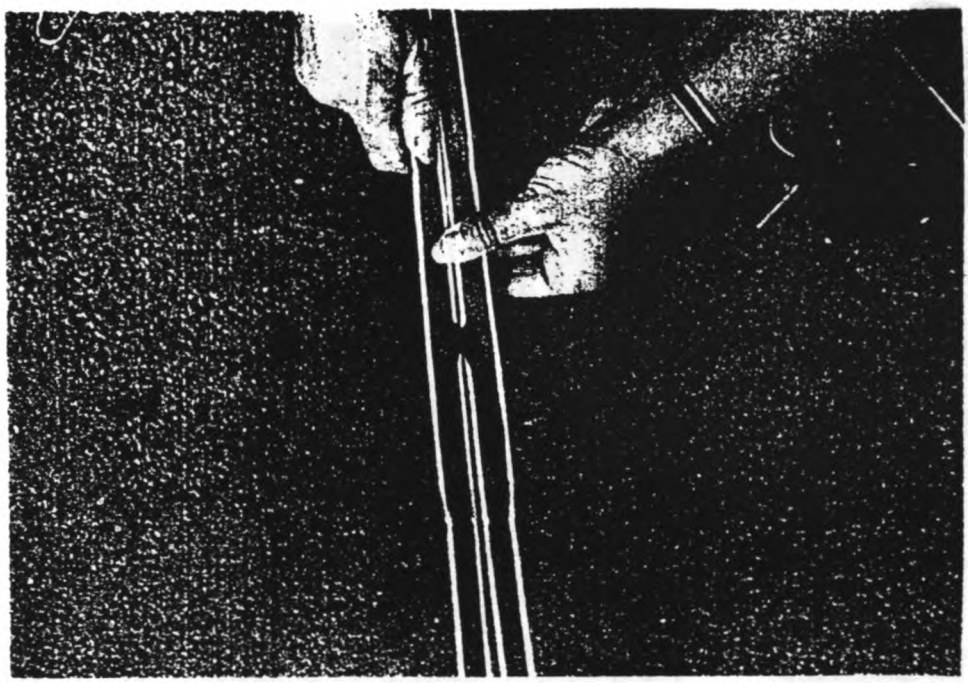

Figure 53. VELB gallery and exit hole in a 0.7 inch diameter dead branch (Site #78); note the large percentage of pith.

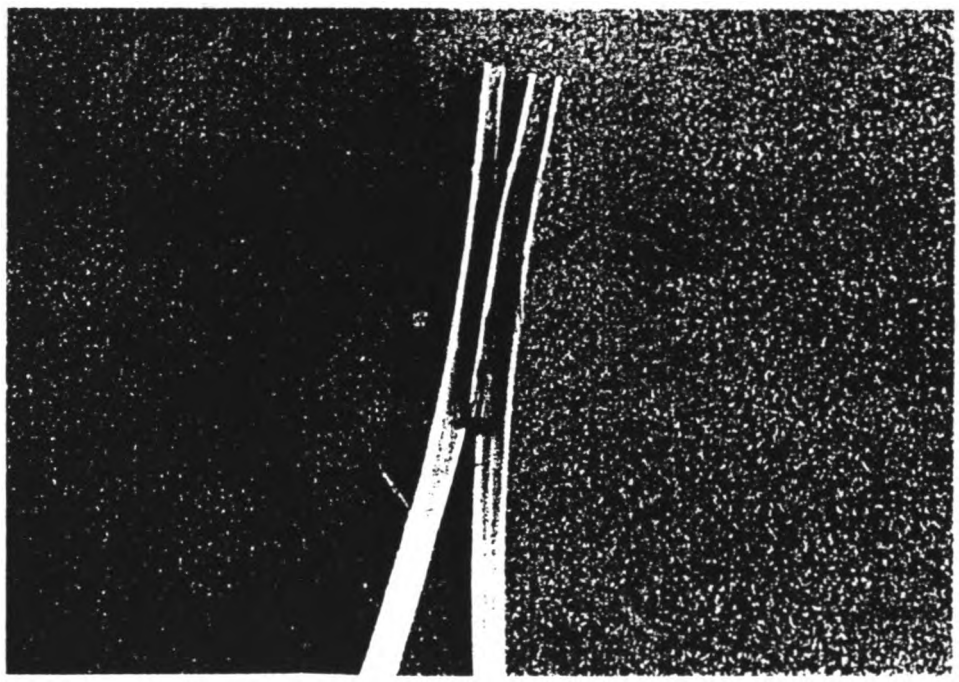

Figure 54. VELB gallery in a 0.6 inch diameter dead branch (Site #75); note the large percentage of pith.

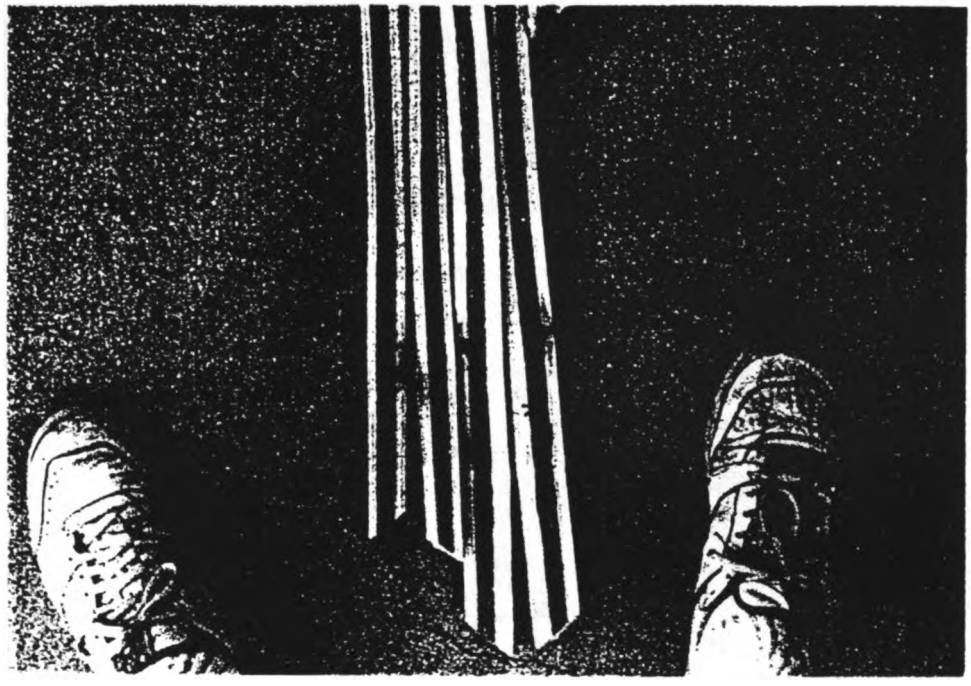

Figure 56. Sectioned branch with probable VELB gallery damaged by a secondary invasion of other insects, possibly ants (Site #60).

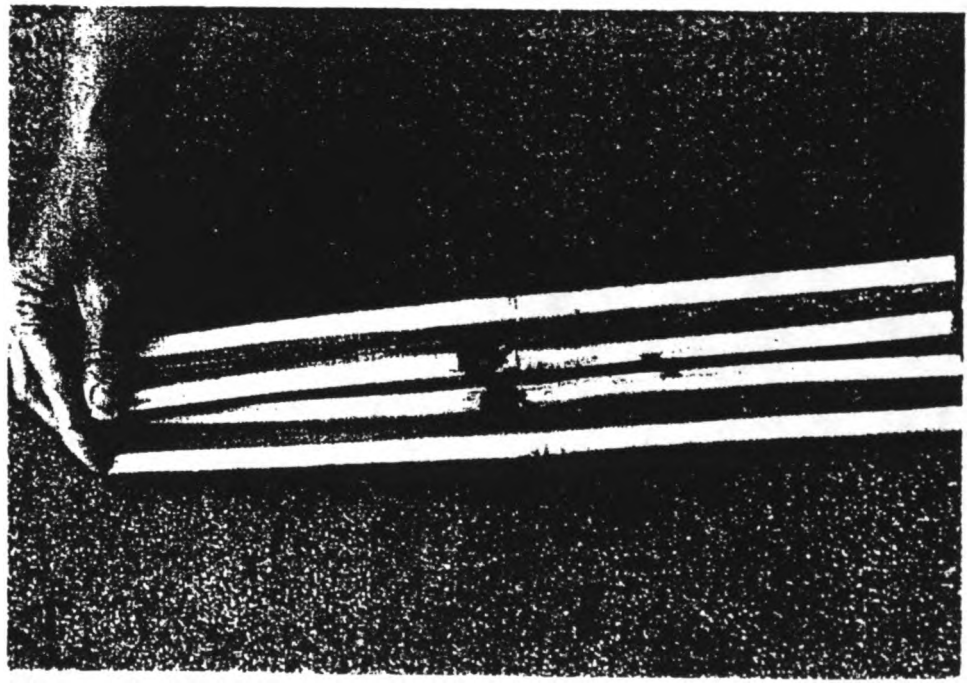

Figure 57. Sectioned branch with probable VELB gallery nearly obliterated by a secondary invasion of other insects (Site #145).

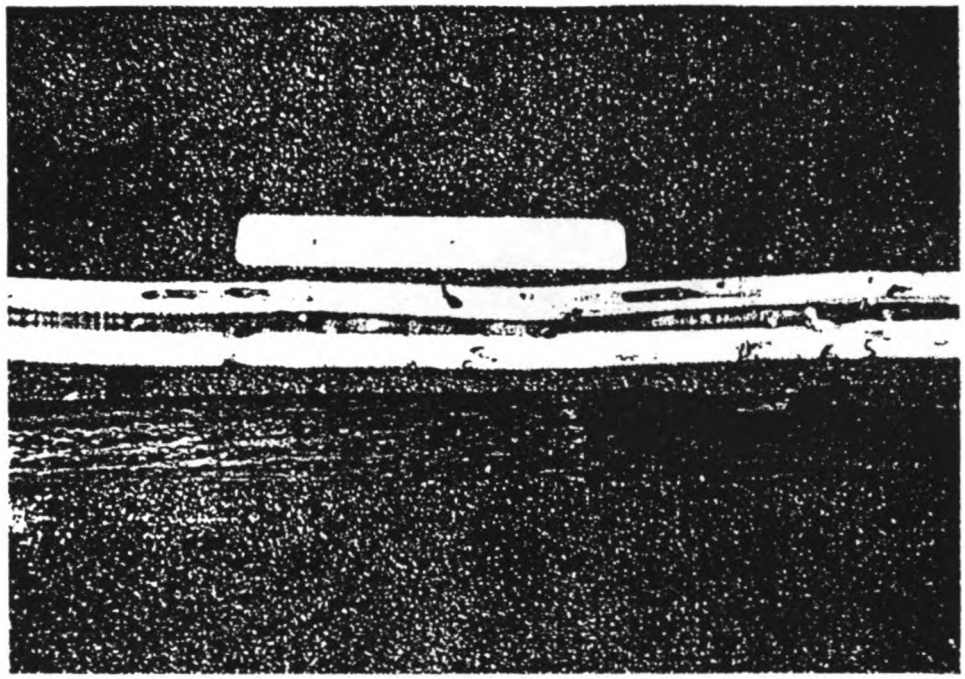

Figure 60. Sectioned branch with galleries and exit holes of bostrichid beetles and termites (Site #6).

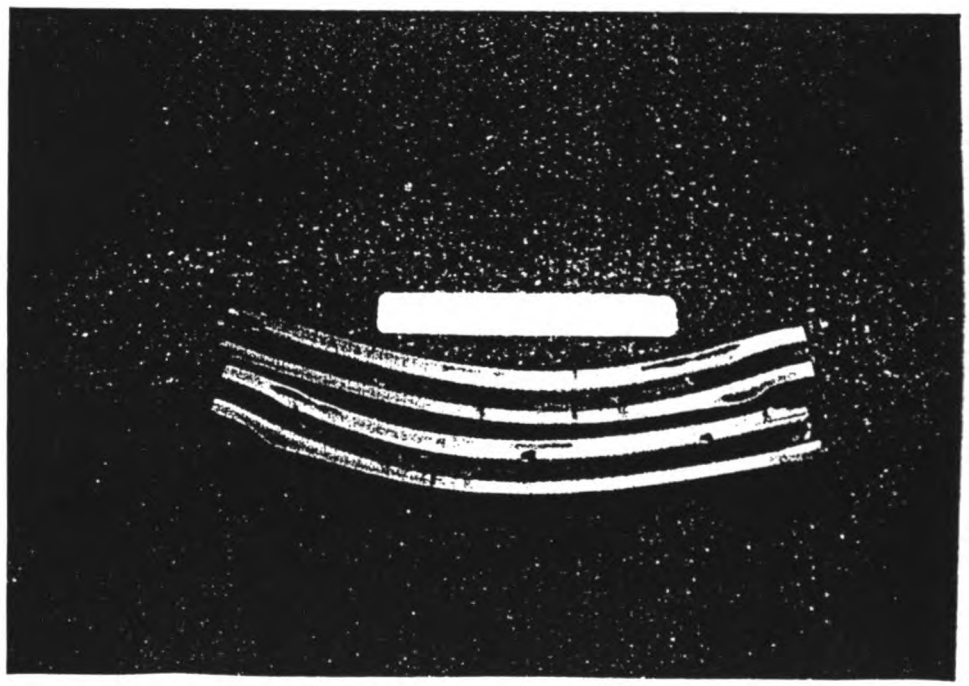

Figure 61. Sectioned branch with galleries and exit holes of termites (Site #12).

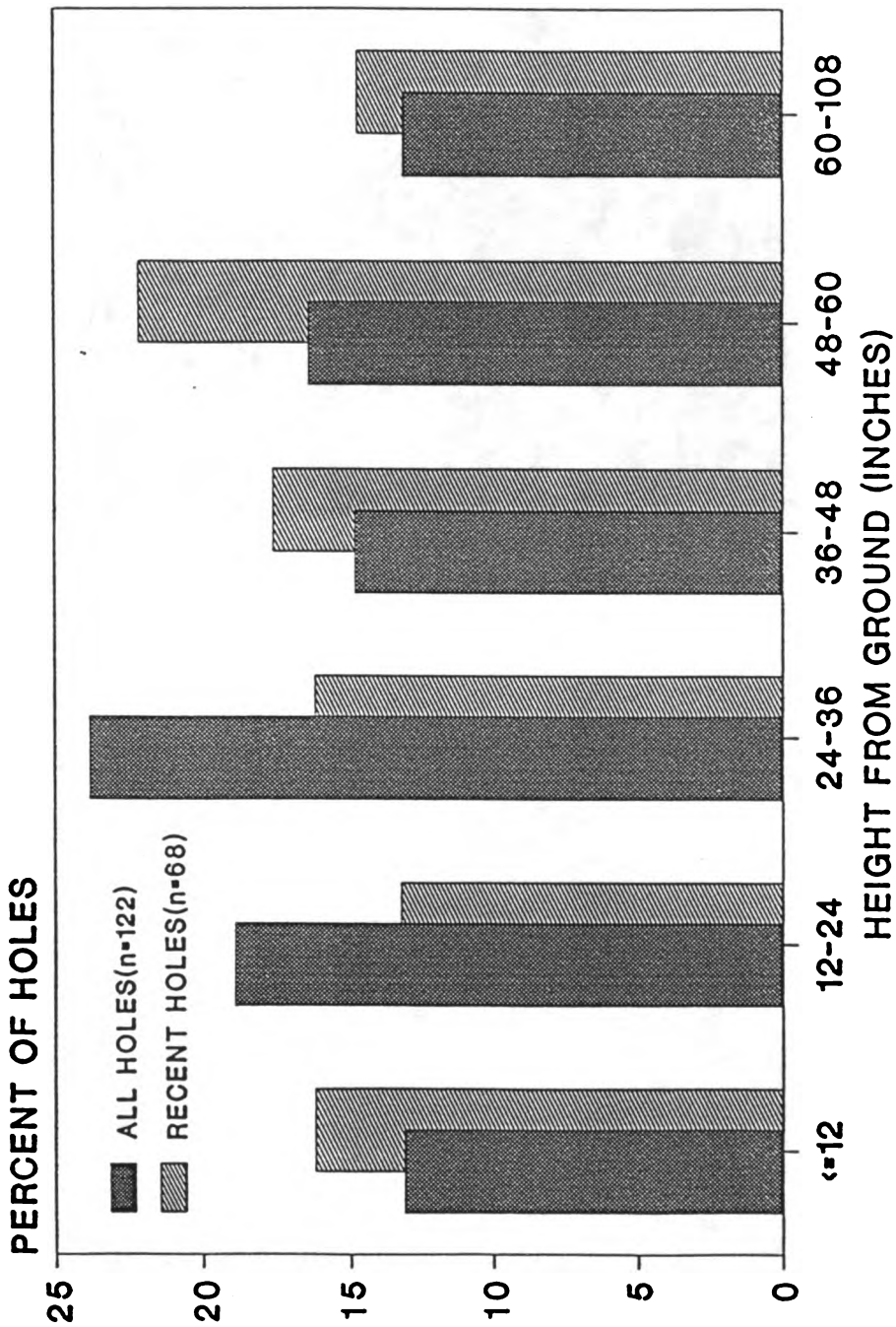

Figure 55. Distribution of the heights of VELB exit holes above the ground.

Figure 63. Dead adult male VELB in exit tunnel, 30 April 1991, near Lane Slough (tributary Kaweah River) north of Exeter, Tulare Co. (Site #32).

Figure 64. Clump of *Sambucus mexicana* with dead male VELB and numerous exit holes, near Lane Slough (tributary Kaweah River) north of Exeter, Tulare Co. (Site #32).

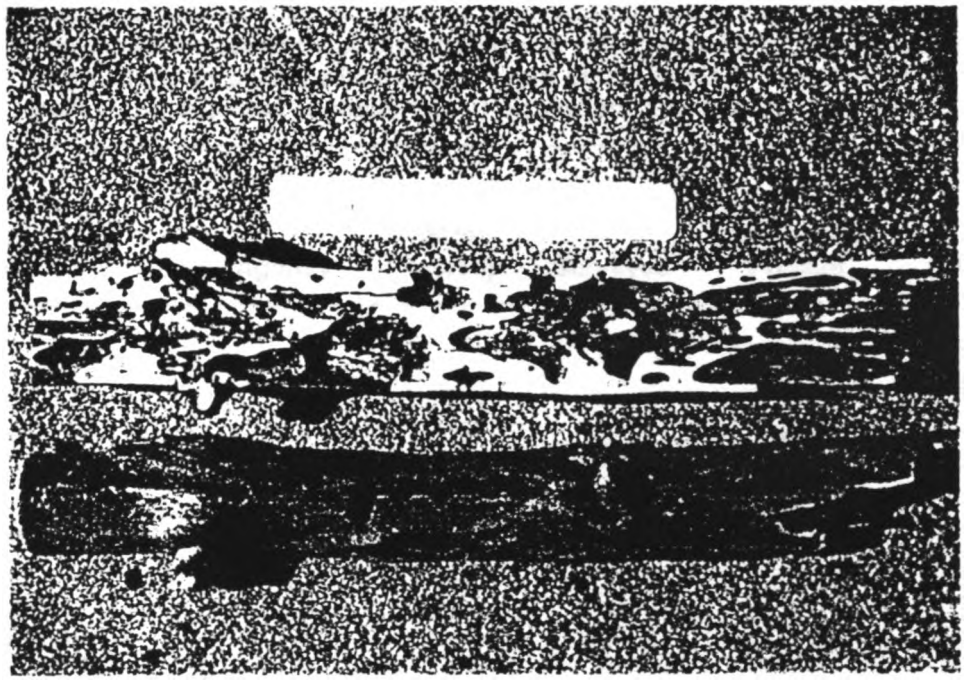

Figure 58. Sectioned old branch with external holes resembling those of the VELB, but without a recognizable VELB gallery; the dead wood was probably mined by carpenter ants (Site #9/10).

Figure 59. Cut stump with tunnels probably created by carpenter ants (Site #15).

Table 1. The presence/absence of elderberry and valley elderberry longhorn beetle populations in parks, wildlife areas, and public lands in the Central Valley and adjacent foothills based on current and historic records.

Area	Agency	Size (acres)	Surveyed	*Sambucus* Present	VELB Present
Federal:					
Butte Sink NWR	FWS	733	no	unknown	unknown
Colusa NWR	FWS	4,040	yes	no	no
Delevan NWR	FWS	5,583	yes	no	no
Kern NWR	FWS	10,618	no	unknown	unknown
Kesterson NWR	FWS	5,900	no	unknown	unknown
Merced NWR	FWS	3,198	yes	yes	no
Pixley NWR	FWS	5,992	no	unknown	unknown
Sacramento NWR	FWS	10,776	yes	no	no
* Sacramento River NWR	FWS	10,821	yes	yes	yes
San Joaquin River NWR	FWS	700	no	unknown	unknown
San Luis NWR	FWS	7,430	no	no	no
Sutter NWR	FWS	2,591	yes	no	no
Whiskeytown-Shasta-Trinity NRA, Shasta Unit	NPS	105,000	yes	yes	no
Sequoia NF, Greenhorn RD	NFS	125,000	yes	yes	historic
Jellys Ferry FA	BLM	79	yes	no	no
Paynes Creek RA	BLM	4,676	yes	no	no
* Reading Island RA	BLM	46	yes	yes	yes
Cosumnes FWSA	BLM	3,000	no	unknown	unknown
Merced River FWSA	BLM	50,000	no	unknown	unknown
Sacramento River FWSA	BLM	5,000	no	unknown	unknown
Black Butte Lake RA	COE	8,918	yes	yes	yes
Eastman Lake RA	COE	1,672	no	unknown	unknown
Englebright Lake RA	COE	2,514	no	unknown	unknown
Hensley Lake RA	COE	1,620	no	unknown	unknown
Lake Kaweah (Terminus) RA	COE	1,126	yes	yes	no
Lake Success RA	COE	1,766	yes	yes	no
New Hogan Lake RA	COE	1,932	yes	yes	no
Pine Flat Lake RA	COE	7,314	no	unknown	unknown
Stanislaus River Parks:	COE	882			
Buttonbush RA	COE	17	no	unknown	unknown
Goodwin Dam RA	COE	30	no	unknown	unknown
Honolulu Bar RA	COE	93	yes	no	no
Horseshoe Road RA	COE	79	yes	yes	no
Jacob Meyers RA	COE	90	adj	adjacent	adjacent
Knights Ferry RA	COE	174	yes	yes	no
Lover's Leap RA	COE	29	no	unknown	unknown
* McHenry Avenue RA	COE	73	yes	yes	yes
Mohler Road RA	COE	27	no	unknown	unknown
Oakdale RA	COE	71	yes	yes	no
Orange Blossom RA	COE	18	yes	yes	no
Ripon RA	COE	36	no	unknown	unknown
Riverbank RA	COE	9	no	unknown	unknown
River's End RA	COE	20	no	unknown	unknown
Two-Mile Bar RA	COE	84	no	unknown	unknown
Valley Oak RA	COE	26	yes	yes	no
Lockeford Plant Materials Center	USDA	81	yes	yes	yes

Figure 62. An adult female VELB was captured on 21 April 1991 on this *Sambucus racemosa* var. *microbotrys* at the Campbell-Moreland Ditch (tributary Tule River) near Porterville, Tulare Co. (Site #15).

Figure 65. An adult male VELB was captured on 15 May 1991 on this *Sambucus mexicana* near the Mokelumne River north of Clements, San Joaquin Co. (Site #72).

Figure 66. Mating pair of *Desmocerus californicus dimorphus* captured separately near the Mokelumne River north of Clements, San Joaquin Co., 15 May 1991 (Site #72); they began mating in captivity after being placed together.

Table 1. Continued.

Area	Agency	Size (acres)	Surveyed	*Sambucus* Present	VELB Present
State:					
Auburn SRA	CDPR	42,000	no	unknown	unknown
Bethany Reservoir SRA	CDPR	300	no	unknown	unknown
Bidwell-Sacramento R. SP	CDPR	180	no	yes	historic
Brannan Island SRA	CDPR	336	yes	yes	no
* Caswell Memorial SP	CDPR	258	yes	yes	historic
Clay Pit SVRA	CDPR	220	no	unknown	unknown
Colonel Allensworth SHP	CDPR	240	no	unknown	unknown
Colusa-Sacramento River SRA	CDPR	67	no	yes	historic
Columbia SHP	CDPR	273	no	unknown	unknown
Delta Meadows River Park	CDPR	134	no	unknown	unknown
Durham Ferry SRA	CDPR	183	yes	no	no
Empire Mine SHP	CDPR	780	no	unknown	unknown
* Folsom Lake SRA	CDPR	17,718	yes	yes	yes
Franks Tract SRA	CDPR	3,515	yes	no	no
Fremont Ford SRA	CDPR	114	no	unknown	unknown
George J. Hatfield SRA	CDPR	47	yes	yes	no
Indian Grinding Rock SHP	CDPR	136	no	unknown	unknown
Lake Oroville SRA	CDPR	16,100	no	unknown	unknown
Malakoff Diggins SHP	CDPR	3,000	no	unknown	unknown
Marshall Gold Discovery SHP	CDPR	280	yes	yes	no
McConnell SRA	CDPR	74	yes	yes	historic
Millerton Lake SRA	CDPR	6,553	yes	no	no
San Luis Reservoir SRA	CDPR	26,026	yes	no	no
Shasta SHP	CDPR	13	no	unknown	unknown
Tule Elk SR	CDPR	946	yes	no	no
Turlock Lake SRA	CDPR	228	yes	yes	no
Wassama Round House SHP	CDPR	10	no	unknown	unknown
* Woodson Bridge SRA	CDPR	428	adj	yes	historic
Battle Creek WA	CDFG	252	no	unknown	unknown
Cottonwood Creek WA	CDFG	6,316	no	unknown	unknown
Feather River WA	CDFG	2,291	no	unknown	unknown
Fremont Weir WA	CDFG	214	no	unknown	unknown
Gray Lodge WA	CDFG	8,340	yes	yes	no
Little Panoche Reservoir WA	CDFG	780	no	unknown	unknown
Los Banos WA	CDFG	5,586	yes	no	no
Lower Sherman Island WA	CDFG	3,115	no	unknown	unknown
Mendota WA	CDFG	11,802	yes	no	no
Merrill's Landing WA	CDFG	296	no	unknown	unknown
Miner Slough WA	CDFG	37	yes	no	no
Mouth of Cottonwood Cr. WA	CDFG	316	no	unknown	unknown
O'Neill Forebay WA	CDFG	700	adj	no	no
* Oroville WA	CDFG	11,870	yes	yes	yes
Sacramento River WA	CDFG	1,814	no	unknown	unknown
San Luis Reservoir WA	CDFG	868	adj	no	no
Spenceville WA	CDFG	11,421	yes	yes	no
Sutter Bypass WA	CDFG	5,239	adj	unknown	unknown
Tehama WA	CDFG	48,988	no	unknown	unknown
Volta WA	CDFG	3,003	yes	no	no
White Slough WA	CDFG	880	adj	unknown	unknown
Yaudanchi ER	CDFG	162	yes	yes	no

Table 1. Continued.

Area	Agency	Size (acres)	Surveyed	*Sambucus* Present	VELB Present
County:					
* Kern River Park	KRN	370	yes	yes	historic
Lost Lake Recreation Area	FRE	266	yes	no	no
Henderson Park	MER	32	yes	no	no
* American River Parkway	SAC	4,681	no	yes	historic
Oak Grove Regional Park	SJQ	180	yes	yes	no
* Stillman Magee Regional Park	SJQ	20	adj	yes	adjacent
Woodbridge Regional Park	SJQ	17	yes	yes	no
* Lake Solano Park	SOL	165	yes	yes	yes
Fox Grove Regional Park	STA	54	yes	yes	no
Modesto Reservoir Regional Park	STA	3,200	yes	no	no
Bend Bridge Fishing Access	TEH	6	yes	yes	no
Bartlett Park	TUL		adj	adjacent	adjacent
Municipal:					
Anderson River Park	Anderson	425	yes	yes	yes
* Bidwell Park	Chico	2,250	yes	yes	yes
Turtle Bay Fishing Access	Redding	140	no	unknown	unknown
Turtle Bay E Fishing Access	Redding	86	yes	yes	yes
Other:					
Cosumnes River Preserve	TNC	1,100	no	yes	unknown
Creighton Ranch Preserve	TNC	3,280	no	no?	no?
Gray Davis Dye Creek Preserve	TNC	37,500	no	unknown	unknown
Jepson Prairie Preserve	TNC/UCNRS	1,566	no	no	no
Kaweah Oaks Preserve	TNC	324	adj	yes	unknown
* Kopta Slough Preserve	TNC	700	yes	yes	yes
Paine Wildflower Preserve	TNC	600	no	no	no
Parrott Ranch Preserve	TNC	2,000	no	yes	historic
Pixley Vernal Pools Preserve	TNC	40	no	no	no
Princeton Ferry Preserve	TNC	100	no	unknown	unknown
Stony Creek Preserve	TNC	500	no	yes	unknown
Vina Plains Preserve	TNC	1,950	no	no	no
Bobelaine Sanctuary	Audubon	436	yes	yes	yes
Stebbins Cold Canyon Reserve	UCNRS	579	no	yes	historic
Sierra College Nature Trail		240	yes	yes	yes
Lake McClure & McSwain RAs	MER ID		yes	no	no

Table 1. Continued.

KEY TO ABBREVIATIONS

Area:

ER = Ecological Reserve
FA = Fishing Access
FWSA = Fish & Wildlife Special Area
NF = National Forest
NRA = National Recreation Area
NWR = National Wildlife Refuge
RA = Recreation Area
RD = Ranger District
SHP = State Historic Park
SP = State Park
SR = State Reserve
SRA = State Recreation Area
SVRA = State Vehicular Recreation Area
WA = Wildlife Area

Agency:

BLM = Bureau of Land Management
CDFG = California Dept. of Fish & Game
CDPR = California Dept. of Parks & Recreation
COE = U.S. Army Corps of Engineers
FWS = U.S. Fish & Wildlife Service
MER ID = Merced Irrigation District
NFS = National Forest Service
NPS = National Park Service
TNC = The Nature Conservancy
UCNRS = Univ. of California Natural Reserve System
USDA = U.S. Dept. of Agriculture

adj = adjacent

* known excellent habitat with VELB population(s)

Table 2. Total acreage of parks, wildlife areas, and public lands in the Central Valley and adjacent foothills with known current and historic populations of the valley elderberry longhorn beetle and/or elderberry (summation of Table 1). [1]

Ownership	*Sambucus* Present	VELB Present
Federal	258,329	144,939
State	51,409	30,595
County	5,493	5,216
Municipal	2,761	2,761
Other	5,879	3,955
GRAND TOTAL	323,871	187,466

[1] Totals are based on presence/absence within an area and do not indicate amount of actual habitat present

Appendix I

SURVEY SITES

The following sites with *Sambucus* were examined during this survey. Those with evidence of previous or current VELB populations are indicated by an asterisk (*) preceding the entry. Distance from towns or cities is straight line mileage unless otherwise noted.

#1 Kern County, Kern River (S bank) upstream from Lake Ming, Kern River Park (Co.) Game Preserve just E golf course, ca. 6 mi. NE Bakersfield; elev. ~520 ft. 19 April 1991. Cheryl B. Barr.

#2 Kern County, Kern River (S bank) upstream from Lake Ming, Kern River Park (Co.) just N golf course, ca. 6 mi. NE Bakersfield. 19 April 1991. Cheryl B. Barr.

#3 Kern County, Sequoia NF, Kern River Canyon along Hwy. 178; 1.8, 2.1, & 3.0 rd. mi. NE NF boundary. 19 April 1991. Cheryl B. Barr.

#4 * Kern County, trib. Caliente Creek, Bena Rd. 3.6 rd. mi. N jct. Hwy. 58, ca. 5 mi. W Caliente; elev. ~1000 ft. 19 April 1991. Cheryl B. Barr.

#5 Kern County, Tehachapi Creek, Bealville Rd. just S jct. Caliente-Bodfish Rd., just S Caliente; elev. ~1315 ft. 19 April 1991. Cheryl B. Barr.

#6 Kern County, Caliente Creek drainage, Caliente-Bodfish Rd. 1.5 rd. mi. NE jct. Bena Rd., 3.2 rd. mi. SW jct. Bealville Rd., ca. 3 mi. SW Caliente. 19 April 1991. Cheryl B. Barr.

#7 Kern County, Caliente Creek, Caliente-Bodfish Rd. 1.6 rd. mi. NE Caliente. 20 April 1991. Cheryl B. Barr.

#8 Kern County, Caliente Creek, Caliente Creek Rd. 2.9 rd. mi. W Loraine (jct. Indian Creek Rd.), 10.9 rd. mi. NE Caliente. 20 April 1991. Cheryl B. Barr.

#9 * Kern County, Caliente Creek, Caliente Creek Rd. 3.2 rd. mi. W Loraine (jct. Indian Creek Rd.), 10.6 rd. mi. NE Caliente; elev. ~2400 ft. 20 April 1991. Cheryl B. Barr.

#10 * Kern County, Caliente Creek, Caliente Creek Rd. 4.1 rd. mi. W Loraine (jct. Indian Creek Rd.), 9.7 rd. mi. NE Caliente; elev. ~2320 ft. 20 April 1991. Cheryl B. Barr.

#11 * Kern County, Kern River (N bank) at China Grade Loop, just N Bakersfield & E Oildale; elev. 440-450 ft. 21 April 1991. Cheryl B. Barr.

#12 Kern County, Poso Creek, Granite Rd./Bakersfield-Glennville Rd. just W jct. Round Mountain Rd., ca. 14 mi. SW Woody; elev. 645 ft. 21 April 1991. Cheryl B. Barr.

#13 * Tulare County, Deer Creek, Avenue 120 ca. 5 mi. SE Porterville; elev. 540-560 ft. 21 April 1991. Cheryl B. Barr.

#14 Tulare County, Tule River drainage, Road 265/Blue Heron Pkwy. betw. Worth Ave. & Hwy. 190, just SE Porterville. 21 April 1991. Cheryl B. Barr.

#15 * Tulare County, Campbell-Moreland Ditch (trib. Tule River) at AT&SF Railroad right-of-way betw. Worth Ave. & Hwy. 190, just E Martin Hill & SE Porterville; elev. ~490 ft. 21 April 1991. Cheryl B. Barr.

#16 Tulare County, Tule River, Hwy. 190 1.4 rd. mi. E Springville. 22 April 1991. Cheryl B. Barr.

#17 Tulare County, Tule River (S bank), Pleasant Oak Dr. 0.5 rd. mi. SE jct. Hwy. 190, ca. 3 mi. SW Springville. 22 April 1991. Cheryl B. Barr.

#18 Tulare County, Tule River (N bank), River Island Dr. just S of Hwy. 190, 0.4 rd. mi. E Tule R. bridge, ca. 3 mi. SW Springville. 22 April 1991. Cheryl B. Barr.

#19 Tulare County, Tule River (S bank) just below Lake Success Dam, Lake Success Park Hdqts. (COE) just N of Hwy. 190. 22 April 1991. Cheryl B. Barr.

#20 * Tulare County, Tule River (S bank) at Road 284 just N jct. Hwy. 190, ca. 2 mi. E Porterville; elev. 520 ft. 22 April 1991. Cheryl B. Barr.

#21 * Placer County, Miners Ravine (trib. Dry Creek), Auburn-Folsom Rd. 0.2 rd. mi. N Moss Ln., just N Hidden Valley & ca. 5 mi. E Rocklin; elev. 400-420 ft. 25 April 1991. Cheryl B. Barr.

#22 * Placer County, Miners Ravine bridge (trib. Dry Creek) at Auburn-Folsom Rd. 1.1 rd. mi. S jct. Horseshoe Bar Rd., ca. 6 mi. E Rocklin; elev. 480-500 ft. 25 April 1991. Cheryl B. Barr.

#23 Placer County, Folsom Lake (NW shore), Folsom Lake SRA (CDPR), Rattlesnake Bar, ca. 5 mi. S Auburn. 25 April 1991. Cheryl B. Barr.

#24 * Sutter County, Bear River (N bank) at Pleasant Grove Rd., ca. 4.5 mi. SW Wheatland; elev. 60 ft. 25 April 1991. Cheryl B. Barr.

#25 * Sutter County, Bear River (S bank) at Pleasant Grove Rd., ca. 4.5 mi. SW Wheatland; elev. 65 ft. 25 April 1991. Cheryl B. Barr.

#26 Sacramento County, just SSW South Stone Lake, levee road betw. Hood-Franklin Rd. & Lambert Rd., ca. 4 mi. E Courtland. 26 April 1991. Cheryl B. Barr.

#27 Sacramento County, Sacramento River (RM 37E), Hwy. 160 1 rd. mi. NE jct. Lambert Rd., 2.8 rd. mi. NE Courtland. 26 April 1991. Cheryl B. Barr.

#28 Sacramento County, Steamboat Slough & Sacramento River (RM 16W), Grand Island Rd. 2.2-7.3 rd. mi. N jct. Hwy. 160 nr. Isleton (4 localities). 26 April 1991. Cheryl B. Barr.

#29 Sacramento County, Georgiana Slough, Tyler Island Rd. 2.3 rd. mi. NE jct. Tyler Island Bridge Rd., ca. 3 mi. NE Isleton. 26 April 1991. Cheryl B. Barr.

#30 Tulare County, Deep Creek & Johnson Slough (tribs. Kaweah R.), Road 182 0.5-0.8 rd. mi. N jct. Hwy. 198, adjacent to Kaweah Oaks Preserve (TNC) ca. 3 mi. NW Exeter; elev. 380 ft. 29 April 1991. Cheryl B. Barr.

#31 Tulare County, Deep Creek & Johnson Slough (tribs. Kaweah R.), Avenue 304 0.4 rd. mi. E jct. Road 182, ca. 3 mi. NW Exeter. 29 April 1991. Cheryl B. Barr.

#32 * Tulare County, Lane Slough (trib. Kaweah R.), Road 196/J27 2.9 rd. mi. N jct. Hwy. 198, ca. 5 mi. N Exeter & 9 mi. E Visalia; elev. 405 ft. 30 April 1991. Cheryl B. Barr.

#33 Tulare County, Kaweah River & Lake Kaweah (S shore)(COE), Hwy. 198 1.3-6.9 rd. mi. SW Three Rivers (4 localities). 30 April 1991. Cheryl B. Barr.

#34 * Tulare County, Tule River (N bank) at Road 284 just N jct. Hwy. 190, ca. 2 mi. E Porterville; elev. 520 ft. 30 April 1991. Cheryl B. Barr.

#35 * Tulare County, Tule River (N bank), Worth Dr. adjacent to Bartlett Park (Co.), ca. 3 mi. E Porterville; elev. 540-560 ft. 30 April 1991. Cheryl B. Barr.

#36 Tulare County, Tule River, Yaudanchi Ecological Reserve (CDFG), jct. Hwy. 190 & Road 265 just SE Porterville. 30 April 1991. Cheryl B. Barr.

#37 Kings County, South Fork Kings River (S bank), Hwy. 41 0.4 rd. mi. S jct. Fremont Ave., ca. 5 mi. N Lemoore. 1 May 1991. Cheryl B. Barr.

#38 Kings County, South Fork Kings River (N & S banks), Fremont Ave. E jct. Hwy. 41, ca. 5 mi. N Lemoore. 1 May 1991. Cheryl B. Barr.

#39 Fresno County, Kings River drainage, Hwy. 41 0.2-0.3 rd. mi. N jct. Mt. Whitney Rd., ca. 3.5 mi. E Riverdale. 1 May 1991. Cheryl B. Barr.

#40 Fresno County, irrigation ditch (trib. Kings River), Mt. Whitney Rd. 1.1 rd. mi. W Laton. 1 May 1991. Cheryl B. Barr.

#41 Fresno County, canal (trib. Kings River), DeWoody Ave. just E Laton. 1 May 1991. Cheryl B. Barr.

#42 Tulare County, Kings River (E bank) at Road J40, ca. 4 mi. SW Reedley. 1 May 1991. Cheryl B. Barr.

#43 * Fresno County, Kings River (W bank), Kings River Rd. ca. 1 mi. W Reedley; elev. ~340 ft. 1 May 1991. Cheryl B. Barr.

#44 * Fresno County, Collins Creek (trib. Kings River), Channel Rd. 1.6-1.9 rd. mi. S jct. Annadale Rd., ca. 2 mi. SE Sanger; elev. ~330 ft. 1 May 1991. Cheryl B. Barr.

#45 Fresno County, Centerville-Kingsburg Canal, Rainbow Rd. 0.7 rd. mi. NE jct. Annadale Rd., 2.0 rd. mi. SW jct. Hwy. 180, ca. 1.5 mi. NE Sanger. 1 May 1991. Cheryl B. Barr.

#46 * Fresno County, Kings River (E bank), Piedra Rd. 0.2 rd. mi. N jct. Hwy. 180, ca. 5.5 mi. NE Sanger; elev. ~395 ft. 1 May 1991. Cheryl B. Barr.

#47 Fresno County, Alta Main Canal, Piedra Rd., 5.7-5.8 rd. mi. NE jct. Hwy. 180, ca. 2 mi. SW Piedra. 1 May 1991. Cheryl B. Barr.

#48 Fresno County, Kings River drainage, Hwy. 180 betw. Oliver Rd. & Rainbow Rd. just E Centerville. 2 May 1991. Cheryl B. Barr.

#49 Fresno County, Kings River (W bank), Hwy. 180 just E Centerville. 2 May 1991. Cheryl B. Barr.

#50 Fresno County, Kings River (E bank) & Alta Main Canal, Piedra Rd., 6.2 rd. mi. NE jct. Hwy. 180, ca. 1 mi. SW Piedra. 2 May 1991. Cheryl B. Barr.

#51 Fresno County, Kings River (E bank) & Alta Main Canal, Piedra Rd., 7.3 rd. mi. NE jct. Hwy. 180 just SW Piedra. 2 May 1991. Cheryl B. Barr.

#52 Fresno County, Kings River (W bank) just below Pine Flat Reservoir, Pine Flat Dam Rd., 1.1 rd. mi. NE Piedra P.O. 2 May 1991. Cheryl B. Barr.

#53 Fresno County, Kings River (W bank) just below Pine Flat Reservoir, Pine Flat Dam Rd., 1.9 rd. mi. NE Piedra P.O. 2 May 1991. Cheryl B. Barr.

#54 Shasta County, Whiskeytown-Shasta-Trinity NRA (NPS), Sacramento River (W bank) just below Shasta Lake Dam, ca. 9 mi. NNW Redding. 7 May 1991. Cheryl B. Barr.

#55 Shasta County, Rock Creek (trib. Sacramento R.), Iron Mountain Rd. just S jct. Keswick Dam Rd., ca. 4 mi. NW Redding. 7 May 1991. Cheryl B. Barr.

#56 * Shasta County, Redding, Sacramento River (RM 296E), Turtle Bay East Fishing Access (city) just SE Hwy. 299 bridge; elev. ~490 ft. 7 May 1991. Cheryl B. Barr.

#57 Tehama County, Sacramento River (RM 271E), Jellys Ferry Rd. 10.9-11.0 rd. mi. S jct. Gover Rd., ca. 6 mi. SE Cottonwood. 7 May 1991. Cheryl B. Barr.

#58 Tehama County, Bend, Sacramento River (RM 257.5E), Bend Bridge Public Fishing Access (Co.), Bend Ferry Rd. ca. 5 mi. N Red Bluff. 7 May 1991. Cheryl B. Barr.

#59 Tehama County, Bend, Sacramento River (RM 253-258E), Bend Ferry Rd. 0.4 & 0.6 rd. mi. E bridge, ca. 5 mi. N Red Bluff. 7 May 1991. Cheryl B. Barr.

#60 * Shasta County, Sacramento River (RM 282W), Anderson River Park (city) ca. 2.5 mi. NE Anderson; elev. 390-400 ft. 8 May 1991. Cheryl B. Barr.

#61 * Shasta County, Sacramento River (RM 274W), Reading Island Recreation Area (BLM), Adobe Rd. ca. 4.5 mi. E Cottonwood; elev. 360-370 ft. 8 May 1991. Cheryl B. Barr.

#62 Shasta County, North Fork Cottonwood Creek at Lower Gas Point Rd. bridge, 1 rd. mi. NW jct. Gas Point Rd., ca. 12 mi. WSW Anderson. 8 May 1991. Cheryl B. Barr.

#63 Shasta County, North Fork Cottonwood Creek, Lower Gas Point Rd. 2.7 rd. mi. NW jct. Gas Point Rd., ca. 13 mi. W Anderson. 8 May 1991. Cheryl B. Barr.

#64 Shasta County, North Fork Cottonwood Creek, Lower Gas Point Rd. 2.9 rd. mi. NW jct. Gas Point Rd., ca. 13 mi. W Anderson. 8 May 1991. Cheryl B. Barr.

#65 Shasta County, North Fork Cottonwood Creek just S bridge, Lower Gas Point Rd. 3.2 rd. mi. NW jct. Gas Point Rd., ca. 13 mi. W Anderson. 8 May 1991. Cheryl B. Barr.

#66 Tehama County, Paynes Creek (town), Paynes Creek, Paynes Creek Loop nr. jct. Plum Creek Rd. 9 May 1991. Cheryl B. Barr.

#67 * Tehama County, Paynes Creek, Paynes Creek Loop 1.1 rd. mi. E jct. Hwy. 36, 0.7 rd. mi. E Paynes Creek (town); elev. 1870-1880 ft. 9 May 1991. Cheryl B. Barr.

#68 * Tehama County, Paynes Creek, Hwy. 36 4.4-4.5 rd. mi. E Dales (jct. Road A6/Manton Rd.); elev. 1040 ft. 9 May 1991. Cheryl B. Barr.

#69 Tehama County, Paynes Creek, Hwy. 36 0.8 rd. mi. SW Dales (jct. Road A6/ Manton Rd.). 9 May 1991. Cheryl B. Barr.

#70 * San Joaquin County, Mokelumne River (S bank), Lockeford Plant Materials Center (USDA), Elliott Rd. ca. 1.5 mi. NW Lockeford; elev. 60-65 ft. 15 May 1991. Cheryl B. Barr.

#71 * San Joaquin County, Mokelumne River (S bank), Mackville Rd. just N jct. Mehrten Rd., 0.6 rd. mi. SE bridge & 0.6 rd. mi. N Clements; elev. ~133 ft. 15 May 1991. Cheryl B. Barr.

#72 * San Joaquin County, Mokelumne River (S bank), Clements Glen View Cemetery, Mackville Rd. 0.3 rd. mi. SE bridge, 0.9 rd. mi. N Clements; elev. 130-140 ft. 15 May 1991. Cheryl B. Barr.

#73 San Joaquin County, Mokelumne River (N bank) just below Camanche Reservoir Dam, end Buena Vista Rd., ca. 4.5 mi. NE Clements. 15 May 1991. Cheryl B. Barr.

#74 * Yolo County, Cache Creek (S bank) at Road 94B N jct. Hwy. 16, ca. 5 mi. W Woodland; elev. ~100 ft. 16 May 1991. Cheryl B. Barr.

#75 * Yolo County, Cache Creek, Hwy. 16 2.7 rd. mi. NW Rumsey; elev. ~520 ft. 16 May 1991. Cheryl B. Barr.

#76 Yolo County, Cache Creek, Hwy. 16 1.6-1.7 rd. mi. NW Rumsey. 16 May 1991. Cheryl B. Barr.

#77 * Yolo County, Capay Valley, Cache Creek, jct. Hwy. 16 & Road 40A, 0.6 rd. mi. NW Rumsey; elev. ~440 ft. 16 May 1991. Cheryl B. Barr.

#78 * Yolo County, Capay Valley, Cache Creek, Hwy. 16 0.5 rd. mi. NW Guinda; elev. -360 ft. 16 May 1991. Cheryl B. Barr.

#79 * Yolo County, Capay Valley, Cache Creek, Hwy. 16 2.8 rd. mi. SE Guinda; elev. 320-340 ft. 16 May 1991. Cheryl B. Barr.

#80 San Joaquin County, Middle River, Wing Levee Rd. 2.6 rd. mi. N jct. Undine Rd., ca. 5 mi. SW Stockton. 4 June 1991. Cheryl B. Barr & William S. Pence.

#81 San Joaquin County, Middle River, Wing Levee Rd. 2.4 rd. mi. N jct. Undine Rd., ca. 5 mi. SW Stockton. 4 June 1991. Cheryl B. Barr & William S. Pence.

#82 San Joaquin County, Middle River, Wing Levee Rd. 1.7 rd. mi. N jct. Undine Rd., ca. 5 mi. SW Stockton. 4 June 1991. Cheryl B. Barr & William S. Pence.

#83 San Joaquin County, Middle River, Wing Levee Rd. 1.5 rd. mi. N jct. Undine Rd., ca. 5 mi. SW Stockton. 4 June 1991. Cheryl B. Barr & William S. Pence.

#84 San Joaquin County, Middle River, Wing Levee Rd. 1.3-1.4 rd. mi. N jct. Undine Rd., ca. 5 mi. SW Stockton. 4 June 1991. Cheryl B. Barr & William S. Pence.

#85 San Joaquin County, Middle River, Wing Levee Rd. 1.2 rd. mi. N jct. Undine Rd., ca. 5 mi. SW Stockton. 4 June 1991. Cheryl B. Barr & William S. Pence.

#86 * Sutter County, Feather River (W bank), Bobelaine Audubon Sanctuary, end Laurel Ave. E jct. Hwy. 99, ca. 2 mi. NW Nicolaus; elev. 30-40 ft. 6 June 1991. Cheryl B. Barr & William S. Pence.

#87 Sutter County, Bear River just below Camp Far West Reservoir Dam, McCourtney Rd.(?) SE bridge, ca. 6 mi. NE Wheatland. 6 June 1991. Cheryl B. Barr & William S. Pence.

#88 Sutter County, Camp Far West Reservoir (N shore), Camp Far West Rd. NW Wheatland. 6 June 1991. Cheryl B. Barr & William S. Pence.

#89 * San Joaquin County, Calaveras River (S bank), S levee road 0.8 rd. mi. E jct. Hwy. 88, ca. 1 mi. N Waterloo; elev. 60-65 ft. 7 June 1991. Cheryl B. Barr & William S. Pence.

#90 San Joaquin County, Calaveras River (N bank), S levee road 0.2 rd. mi. E jct. Hwy. 88, ca. 1 mi. N Waterloo. 7 June 1991. Cheryl B. Barr & William S. Pence.

#91 San Joaquin County, Calaveras River (N bank), N levee road ca. 0.6 rd. mi. NE jct. McFarland driveway, S of Eight Mile Rd., ca. 1 mi. N Waterloo. 7 June 1991. Cheryl B. Barr & William S. Pence.

#92 San Joaquin County, Calaveras River (S bank), Eight Mile Rd. 2.8 rd. mi. E jct. Jack Tone Rd., ca. 2.5 mi. NNW Linden. 7 June 1991. Cheryl B. Barr & William S. Pence.

#93 * San Joaquin County, Calaveras River (N bank), Clements Rd. bridge just N jct. Comstock Rd., ca. 2 mi. N Linden; elev. 110 ft. 7 June 1991. Cheryl B. Barr & William S. Pence.

#94 San Joaquin County, Mormon Slough, Shelton Rd. 0.4 rd. mi. E jct. Hwy. 26 & Road J6, just E Bellota. 7 June 1991. Cheryl B. Barr & William S. Pence.

#95 El Dorado County, South Fork American River drainage, Hwy. 49 0.1 rd. mi. E jct. Gold Hill Rd., ca. 3 mi. NW Placerville. 11 June 1991. Cheryl B. Barr & William S. Pence.

#96 El Dorado County, Coloma, South Fork American River (S bank), Marshall Gold Discovery SHP (CDPR); elev. ~760. 11 June 1991. Cheryl B. Barr & William S. Pence.

#97 El Dorado County, Granite Creek (trib. South Fork American R.), Lotus Rd. ca. 2 rd. mi. SW jct. Hwy. 49, ca. 1.5 mi. SW Coloma. 11 June 1991. Cheryl B. Barr & William S. Pence.

#98 El Dorado County, Hastings Creek (trib. South Fork American R.), jct. Hwy. 49 & Pedro Hill Rd. 1.4 rd. mi. SE Pilot Hill; elev. ~960. 11 June 1991. Cheryl B. Barr & William S. Pence.

#99 * El Dorado County, Folsom Lake (NE shore), Folsom Lake SRA (CDPR) 0.1-0.2 rd. mi. N Peninsula Campground entrance, Rattlesnake Bar Rd. 8.7-8.8 rd. mi. SW Pilot Hill (jct. Hwy. 49); elev. 760-800 ft. 11 June 1991. Cheryl B. Barr & William S. Pence.

#100 * El Dorado County, Anderson Creek (trib. North Fork American R.), Rattlesnake Bar Rd. ca. 8.4 rd. mi. SW Pilot Hill (jct. Hwy. 49); elev. 840-880 ft. 11 June 1991. Cheryl B. Barr & William S. Pence.

#101 El Dorado County, South Fork American River drainage, jct. Salmon Falls Rd. & Timeless Ln., ca. 3.4 rd. mi. S Pilot Hill (jct. Hwy. 49). 11 June 1991. Cheryl B. Barr & William S. Pence.

#102 El Dorado County, El Dorado Hills, El Dorado Hills Blvd., 11 June 1991. Cheryl B. Barr & William S. Pence.

#103 Tehama County, Thomes Creek, Rawson Rd. 0.3 rd. mi. S bridge, just SW Richfield. 12 June 1991. Cheryl B. Barr & William S. Pence.

#104 Tehama County, Thomes Creek just SW Rawson Rd. bridge, Cecil Wainscott Ranch, just SW Richfield. 12 June 1991. Cheryl B. Barr & William S. Pence.

#105 Tehama County, Thomes Creek, Simpson Rd. betw. Freeman School House Rd. & Apple Rd., just E Henleyville. 12 June 1991. Cheryl B. Barr & William S. Pence.

#106 Tehama County, Thomes Creek, Paskenta Rd. 1.7-1.8 rd. mi. SW Henleyville (jct. Simpson Rd.). 12 June 1991. Cheryl B. Barr & William S. Pence.

#107 Tehama County, Thomes Creek, Paskenta Rd. 0.2 rd. mi. E Flournoy (jct. Road A9). 12 June 1991. Cheryl B. Barr & William S. Pence.

#108 * Tehama County, Thomes Creek, Paskenta Rd. 0.4-0.5 rd. mi. NE Paskenta (jct. Round Valley Rd.); elev. 720-740 ft. 12 June 1991. Cheryl B. Barr & William S. Pence.

#109 Tehama County, Deer Creek, Leininger Rd. ca. 3.5 mi. NE Vina. 12 June 1991. Cheryl B. Barr & William S. Pence.

#110 Tehama County, Delaney Slough (Deer Creek drainage), Leininger Rd. ca. 3 mi. NE Vina. 12 June 1991. Cheryl B. Barr & William S. Pence.

#111 Tehama County, China Slough (Deer Creek drainage), Vina Rd. ca. 0.6 rd. mi. W jct. Leininger Rd., ca. 2 mi. NE Vina. 12 June 1991. Cheryl B. Barr & William S. Pence.

#112 * Tehama County, Sacramento River (RM 230-231W) & Elder Creek, Sacramento River NWR (Flynn Tract) (USFWS), ca. 2 mi. SE Gerber; elev. 200-210 ft. 13 June 1991. Cheryl B. Barr & William S. Pence.

#113 * Tehama County, Sacramento River (RM 219W) & Kopta Slough, Kopta Slough Preserve (The Nature Conservancy) ca. 4 mi. E Corning; elev. ~175 ft. 13 June 1991. Cheryl B. Barr & William S. Pence.

#114 Tehama County, Black Butte Reservoir (W shore), Morrison Bryant Rd. 0.6 rd. mi. E jct. Newville Rd., just W Burris Creek Rec. Area (COE), ca. 12 mi. NW Orland. 13 June 1991. Cheryl B. Barr & William S. Pence.

#115 Tehama County, North Fork Stony Creek at Newville Rd. bridge just above Black Butte Reservoir (W shore), ca. 12.5 mi. NW Orland. 13 June 1991. Cheryl B. Barr & William S. Pence.

#116 Tehama County, Black Butte Reservoir (N shore), Newville Rd. ca. 1.6 rd. mi. E jct. Black Butte Rd., ca. 10 mi. NW Orland. 13 June 1991. Cheryl B. Barr & William S. Pence.

#117 Tehama County, Black Butte Reservoir (N shore), Newville Rd. ca. 2.1 rd. mi. E jct. Black Butte Rd., ca. 10 mi. NW Orland. 13 June 1991. Cheryl B. Barr & William S. Pence.

#118 * Tehama County, below Black Butte Lake Dam (COE) (E shore), Newville Rd. betw. Stony Creek & South (Stony Creek Irrigation) Canal, ca. 8 mi. NW Orland; elev. 380 ft. 13 June 1991. Cheryl B. Barr & William S. Pence.

#119 * Butte County, Chico, Big Chico Creek, Bidwell Park (city), Centennial Ave. just SW jct. Manzanita Ave.; elev. 260-280 ft. 14 June 1991. Cheryl B. Barr & William S. Pence.

#120 Butte County, Big Chico Creek, Chico, upper Bidwell Park (city), Centennial Ave. 0.4 rd. mi. SW jct. Chico Canyon Rd. 14 June 1991. Cheryl B. Barr & William S. Pence.

#121 * Butte County, Big Chico Creek, Chico, upper Bidwell Park (city), Centennial Ave. 0.1 rd. mi. SW jct. Chico Canyon Rd.; elev. ~280 ft. 14 June 1991. Cheryl B. Barr & William S. Pence.

#122 Butte County, Big Chico Creek, upper Bidwell Park (city), Upper Park Rd. 2.0-5.3 rd. mi. E jct. Manzanita Ave. (3 localities); elev. 300-760 ft. 14 June 1991. Cheryl B. Barr & William S. Pence.

#123 * Solano County, trib. Ledgewood Creek, Clayton Rd. 0.5 rd. mi. NE jct. Gordon Valley Rd., ca. 3 mi. NW Fairfield; elev. 140 ft. 18 June 1991. William S. Pence.

#124 Solano County, Ledgewood Creek, Clayton Rd. 1.6 rd. mi. NE jct. Gordon Valley Rd., ca. 3 mi. NW Fairfield. 18 June 1991. William S. Pence.

#125 * Solano County, Gordon Valley Creek, Gordon Valley Rd. at Bridge #B174 1.1 rd. mi. N jct. Clayton Rd., ca. 4 mi. NW Fairfield; elev. 155 ft. 18 June 1991. William S. Pence.

#126 * Solano County, Gordon Valley Creek, Gordon Valley Rd. 1.2 rd. mi. N jct. Clayton Rd., ca. 4 mi. NW Fairfield; elev. 160-165 ft. 18 June 1991. William S. Pence.

#127 * Napa County, Suisun Creek just below Lake Curry, nr. jct. Gordon Valley Rd. & Chimney Creek Ln., ca. 7 mi. W Vacaville; elev. 300-320 ft. 18 June 1991. William S. Pence.

#128 * Napa County, Wooden Valley Creek, just NW jct. Wooden Valley Rd., Suisun Valley Rd. & Wooden Valley Cross Rd., ca. 6 mi. NW Fairfield; elev. 220 ft. 18 June 1991. William S. Pence.

#129 Napa County, Wooden Valley Creek, Wooden Valley Rd. 0.4 rd. mi. NW jct. Suisun Valley Rd. & Wooden Valley Cross Rd., ca. 6 mi. NW Fairfield. 18 June 1991. William S. Pence.

#130 * Solano County, Dudley Creek, Pedrick Rd. 0.1 rd. mi. N jct. Dixon Ave., just E Dixon; elev. 55 ft. 19 June 1991. William S. Pence.

#131 Solano County, The Big Ditch, Hwy. 113 2.2 rd. mi. S jct. Hwy. 12, ca. 6 mi. W Rio Vista. 19 June 1991. William S. Pence.

#132 Solano County, Miner Slough, jct. Hwy. 84 & Holland Rd., ca. 4 mi. SW Courtland. 19 June 1991. William S. Pence.

#133 Solano County (?), Sutter Slough, Holland Rd. ca. 2 mi. SW Courtland. 19 June 1991. William S. Pence.

#134 Sacramento County, Sacramento River (RM 9-10E) & Threemile Slough, Brannan Island SRA (CDPR) ca. 3 mi. SSE Rio Vista. 20 June 1991. William S. Pence.

#135 San Joaquin County, Middle River, Bacon Island Rd. 3.8 rd. mi. W jct. Hwy. 4, ca. 10 mi. WSW Stockton. 20 June 1991. William S. Pence.

#136 San Joaquin County, Dry Creek, levee road 0.3 rd. mi. W jct. Clay Station Rd., ca. 6.5 mi. E Galt. 21 June 1991. William S. Pence.

#137 San Joaquin County, Dry Creek, levee road 0.5 rd. mi. W jct. Clay Station Rd., ca. 6.5 mi. E Galt. 21 June 1991. William S. Pence.

#138 Amador County, Sutter Creek, Prouty Rd. 1 rd. mi. S Hwy. 104 via Fivemile Dr., ca. 1.5 mi. W Ione. 21 June 1991. William S. Pence.

#139 * Amador County, Sutter Creek, Prouty Rd. 1.2 rd. mi. S Hwy. 104 via Fivemile Dr., ca. 1.5 mi. W Ione; elev. 260-270 ft. 21 June 1991. William S. Pence.

#140 * Amador County, Sutter Creek, Prouty Rd. 1.3 rd. mi. S Hwy. 104 via Fivemile Dr., ca. 1.5 mi. W Ione; elev. 260-270 ft. 21 June 1991. William S. Pence.

#141 * Amador County, Sutter Creek, Prouty Rd. 1.4 rd. mi. S Hwy. 104 via Fivemile Dr., ca. 1.5 mi. W Ione; elev. 260-270 ft. 21 June 1991. William S. Pence.

#142 San Joaquin County, Bishop Cut, Oak Grove Regional Park (Co.), Eight Mile Rd. just W jct. I-5, ca. 5 mi. NW Stockton. 24 June 1991. William S. Pence.

#143 San Joaquin County, Potato Slough, Venice Island at W end of Eight Mile Rd., ca. 10 mi. NW Stockton. 24 June 1991. William S. Pence.

#144 San Joaquin County, Mokelumne River (S bank), Woodbridge, Woodbridge Regional Park (Co.). 24 June 1991. William S. Pence.

#145 * San Joaquin County, Calaveras River (S bank), Shelton Rd. 2.5 rd. mi. NE jct. Road J6/Escalon-Bellota Rd., 1.4 rd. mi. W jct Waverly Rd., ca. 2 mi. ENE Bellota; elev. 150 ft. 25 June 1991. Cheryl B. Barr & William S. Pence.

#146 Calaveras County, Indian Creek (trib. Calaveras R.), jct. Hwy. 26 & Road J4/Milton Rd., ca. 5.5 mi. SW Valley Springs. 25 June 1991. Cheryl B. Barr & William S. Pence.

#147 Calaveras County, New Hogan Lake (SW shore), Hogan Dam Rd. 2.1 rd. mi. SE Calaveras River bridge below New Hogan Dam, ca. 6 mi. SE Valley Springs. 25 June 1991. Cheryl B. Barr & William S. Pence.

#148 Calaveras County, New Hogan Lake (SW shore), Hogan Dam Rd. 2.6 rd. mi. SE Calaveras River bridge below New Hogan Dam, ca. 6 mi. SE Valley Springs. 25 June 1991. Cheryl B. Barr & William S. Pence.

#149 Calaveras County, New Hogan Lake (SW shore), Hogan Dam Rd. 3.0 rd. mi. SE Calaveras River bridge below New Hogan Dam, ca. 6 mi. SE Valley Springs. 25 June 1991. Cheryl B. Barr & William S. Pence.

#150 Calaveras County, Calaveras River drainage, Hogan Dam Rd. 3.2 rd. mi. NW jct. Hunt Rd., ca. 7 mi. NE Milton. 25 June 1991. Cheryl B. Barr & William S. Pence.

#151 Calaveras County, Littlejohns Creek (trib. San Joaquin R.) drainage, Hwy. 4 3.8 rd. mi. SW jct. Reeds Turnpike, ca. 4 mi. SW Copperopolis. 25 June 1991. Cheryl B. Barr & William S. Pence.

#152 Tuolumne County, Stanislaus River (S bank), Tulloch Rd. 0.2 rd. mi. SW Tulloch Reservoir Dam, ca. 5 mi. NE Knights Ferry; elev. 560-580 ft. 25 June 1991. Cheryl B. Barr & William S. Pence.

#153 Tuolumne County, Stanislaus River (S bank), Tulloch Rd. 1.3 rd. mi. SW Tulloch Reservoir Dam, ca. 4 mi. NE Knights Ferry. 25 June 1991. Cheryl B. Barr & William S. Pence.

#154 Tuolumne County, Stanislaus River (S bank), Tulloch Rd. 1.7 rd. mi. SW Tulloch Reservoir Dam, ca. 4 mi. NE Knights Ferry. 25 June 1991. Cheryl B. Barr & William S. Pence.

#155 Merced County, Mariposa Slough, Merced NWR (USFWS) ca. 11 mi. SW Merced. 26 June 1991. William S. Pence.

#156 Kings County, Kings River, 5 3/4 Rd. jct. 6th Ave., ca. 4 mi. W Traver. 27 June 1991. William S. Pence.

#157 Kings County, Kings River, 6th Ave. 0.1 rd. mi. N jct. 5 3/4 Rd., ca. 4 mi. W Traver. 27 June 1991. William S. Pence.

#158 Fresno County, San Joaquin River (S bank), Ball Ranch on Friant Rd., SW Friant. 27 June 1991. William S. Pence.

#159 Fresno County, San Joaquin River (S bank), Herndon Ave. just W jct. Hwy. 99, just W Herndon. 27 June 1991. William S. Pence.

#160 Fresno County, San Joaquin River (S bank), Gravelly Ford Ranch N of jct. Ashlan Ave. & Lake Ave., ca. 6 mi. NW Kerman. 27 June 1991. William S. Pence.

#161 Madera County, Coarsegold, Coarse Gold Creek (trib. Fresno R.) nr. jct. Hwy. 41 & Raymond Rd. 28 June 1991. William S. Pence.

#162 Madera County, Oakhurst, Fresno River at Hwy. 41; elev. 2240-2280 ft. 28 June 1991. William S. Pence.

#163 Mariposa County, East Fork Chowchilla River at Hwy. 49, ca. 3 mi. NW Nipinnawassee. 28 June 1991. William S. Pence.

#164 Mariposa County, Chowchilla River drainage, Hwy. 49 ca. 5 rd. mi. N Madera Co. line, ca. 4.5 mi. NW Nipinnawassee nr. Elliott Corner. 28 June 1991. William S. Pence.

#165 Yuba County, Feather River (E bank), W of Hwy. 70 on levee road betw. Silva Ave. & Walnut Ave., ca. 2 mi. NNW Marysville. 2 July 1991. William S. Pence.

#166 Yuba County, Feather River (E bank), W of Hwy. 70 on levee road betw. Silva Ave. & Walnut Ave., ca. 2 mi. NNW Marysville. 2 July 1991. William S. Pence.

#167 Yuba County, Feather River (E bank), W of Hwy. 70 at Noble Rd. jct. levee road, ca. 4.5 mi. NNW Marysville. 2 July 1991. William S. Pence.

#168 Yuba County, Feather River (E bank), W of Hwy. 70 on levee road betw. Noble Rd. & Woodruff Ln., ca. 4.5 mi. NNW Marysville. 2 July 1991. William S. Pence.

#169 Yuba County, Feather River (E bank), W of Hwy. 70 on levee road betw. Woodruff Ln. & Magnolia Rd., ca. 5 mi. NNW Marysville. 2 July 1991. William S. Pence.

#170 Yuba County, Feather River (E bank), W of Hwy. 70 on levee road betw. Magnolia Rd. & Ramirez Rd., ca. 3 mi. SE Live Oak. 2 July 1991. William S. Pence.

#171 Yuba County, Feather River (E bank), W of Hwy. 70 at Boyer Rd. jct. levee road, ca. 2.5 mi. SE Live Oak. 2 July 1991. William S. Pence.

#172 * Yuba County, Feather River (E bank), 0.9 rd. mi. W of Hwy. 70, on levee road 0.1 rd. mi. S jct. River Oak Ranch road, ca. 2.5 mi. E Live Oak; elev. -70 ft. 2 July 1991. William S. Pence.

#173 * Yuba County, Honcut Creek (S bank), W of Hwy. 70 on levee road 3.1 rd. mi. N jct. River Oak Ranch road, ca. 3 mi. NE Live Oak; elev. -85 ft. 2 July 1991. William S. Pence.

#174 * Butte County, Feather River (E bank), Oroville WA (CDFG) 3.5 rd. mi. NW Hwy. 70 S entrance, ca. 5 mi. NE Biggs; elev. 125 ft. 2 July 1991. William S. Pence.

#175 * Butte County, Feather River (E bank), Oroville WA (CDFG) 3.3 rd. mi. NW Hwy. 70 S entrance, ca. 5 mi. NE Biggs; elev. 125 ft. 2 July 1991. William S. Pence.

#176 * Butte County, Feather River (E bank), Oroville WA (CDFG) 3.2 rd. mi. NW Hwy. 70 S entrance, ca. 5 mi. NE Biggs; elev. 125 ft. 2 July 1991. William S. Pence.

#177 * Butte County, Feather River (E bank), Oroville WA (CDFG) 3 rd. mi. NW Hwy. 70 S entrance, ca. 5 mi. NE Biggs; elev. 125 ft. 2 July 1991. William S. Pence.

#178 * Butte County, Feather River (E bank), Oroville WA (CDFG) 2.7 rd. mi. NW Hwy. 70 S entrance, ca. 5 mi. NE Biggs; elev. 125 ft. 2 July 1991. William S. Pence.

#179 * Butte County, Feather River (E bank), Oroville WA (CDFG) 0.7 rd. mi. NW Hwy. 70 S entrance, ca. 5 mi. E Biggs; elev. 115 ft. 2 July 1991. William S. Pence.

#180 Yuba County, Yuba River (N bank), Sycamore Ranch Campground (pvt.) just S jct. Hwy. 20 & Browns Valley Rd., just S Browns Valley (town). 3 July 1991. William S. Pence.

#181 Yuba County, Yuba River drainage, jct. Hwy. 20 & Loma Rica Rd. ca 1 mi. N Hallwood. 3 July 1991. William S. Pence.

#182 Yuba County, Yuba River drainage, end Hallwood Blvd. ca. 1 rd. mi. S jct. Hwy. 20, ca. 1 mi. S Hallwood. 3 July 1991. William S. Pence.

#183 Kings County, Kings River (N bank), levee road E off 19th Ave. just SE jct. Hwy. 41 & Fresno Co. line, ca. 5 mi. SE Riverdale. 9 July 1991. William S. Pence.

#184 Kings County, Kings River (N bank), jct. 17th Ave. & Everett Rd., SE jct. Hwy. 41 & Fresno Co. line, ca. 2.5 mi. WSW Hardwick. 9 July 1991. William S. Pence.

#185 Kings County, Kings River (N bank), levee road 1 rd. mi. SW jct. 17th Ave. & Everett Rd., SE jct. Hwy. 41 & Fresno Co. line, ca. 3 mi. SW Hardwick. 9 July 1991. William S. Pence.

#186 * Fresno/Kings County, Kings River (N bank), jct. Maple Rd. & Excelsior Ave. ca. 4 mi. SW Laton; elev. -245 ft. 9 July 1991. William S. Pence.

#187 Fresno (?) County, Kings River (N bank ?), just N off Excelsior Ave. 0.1 rd. mi. E jct. Maple Rd., ca. 4 mi. SW Laton. 9 July 1991. William S. Pence.

#188 Kings County, Kings River (S bank), Excelsior Ave. 0.5 rd. mi. E jct. Maple Rd., ca. 4 mi. SW Laton. 9 July 1991. William S. Pence.

#189 Fresno County, Kings River (N bank), jct. Clovis Rd. & Hochderffer Rd., S off Mt. Whitney Rd. just W Laton. 9 July 1991. William S. Pence.

#190 Madera County, Chowchilla River (S bank) just W of Hwy. 99 nr. Avenue 27, ca. 2 mi. NW Chowchilla. 10 July 1991. William S. Pence.

#191 Madera County, Chowchilla River (S bank), 0.5 rd. mi. E of Hwy. 99, ca. 2 mi. N Chowchilla. 10 July 1991. William S. Pence.

#192 Madera County, Chowchilla River (S bank) at White Rock Rd., ca. 4 mi. NE Chowchilla. 10 July 1991. William S. Pence.

#193 Merced County, Merced River (N bank), McConnell SRA (CDPR) ca. 2 mi. N Livingston. 10 July 1991. William S. Pence.

#194 Merced County, Merced River (N bank), George J. Hatfield SRA (CDPR) ca. 4 mi. NE Newman. 10 July 1991. William S. Pence.

#195 Merced County, Merced River (N bank), jct. Turner Rd. & Mitchell Rd. ca. 6 mi. NE Newman. 10 July 1991. William S. Pence.

#196 San Joaquin County, Stanislaus River (N bank), Caswell Memorial SP (CDPR) ca. 3 mi. SW Ripon. 12 July 1991. William S. Pence.

#197 Stanislaus County, San Joaquin River (W bank), levee road 2.4 rd. mi. SE jct. Kasson Rd. (2.8 rd. mi. SE jct. Greenwood Rd. & Kasson Rd.), ca. 4 mi. E Vernalis. 16 July 1991. William S. Pence.

#198 Stanislaus County, San Joaquin River, (W bank) levee road 1.4 rd. mi. SE jct. Condit Rd. & Cox Rd., ca. 2 mi. SE Grayson. 16 July 1991. William S. Pence.

#199 Stanislaus County, San Joaquin River (W bank), levee road 1.1 rd. mi. SE jct. Condit Rd. & Cox Rd., ca. 2 mi. SE Grayson. 16 July 1991. William S. Pence.

#200 Stanislaus County, Tuolumne River (S bank), end Charles St. N jct. Hatch Rd., ca. 2 mi. N Hughson. 17 July 1991. William S. Pence.

#201 Stanislaus County, Tuolumne River (S bank), just N end Charles St., N jct. Hatch Rd., ca. 2 mi. N Hughson. 17 July 1991. William S. Pence.

#202 Stanislaus County, Tuolumne River (S bank), 0.5 rd. mi. N end Charles St., N jct. Hatch Rd., ca. 2 mi. N Hughson. 17 July 1991. William S. Pence.

#203 * Stanislaus County, Tuolumne River (S bank), Charles St. 0.8 rd. mi. S jct. Leedom St., N jct. Hatch Rd., ca. 2 mi. N Hughson; elev. -65 ft. 17 July 1991. William S. Pence.

#204 Stanislaus County, Tuolumne River (S bank), Fox Grove Regional Park (Co.) E off Road J14/Geer Rd., ca. 2 mi. NE Hughson. 17 July 1991. William S. Pence.

#205 Stanislaus County, Tuolumne River (N bank), 0.2 rd. mi. S off Jantzen Rd. betw. Weyer Rd. & Hopper Rd., ca. 3 mi. NE Hughson. 17 July 1991. William S. Pence.

#206 * Stanislaus County, Tuolumne River (N bank), River View Ranch S off Pellerin Rd. betw. McEwen Rd. & Blossom Rd., ca. 2 mi. SW Waterford; elev. 80 ft. 17 July 1991. William S. Pence.

#207 Stanislaus County, Tuolumne River (S bank) & Turlock Lake, Turlock Lake SRA (CDPR) Hdqts., Lake Side Rd. 17 July 1991. William S. Pence.

#208 Stanislaus County, Tuolumne River (S bank) & Turlock Lake, Turlock Lake SRA (CDPR), Lake Side Rd. 0.2 rd. mi. E Hdqts. 17 July 1991. William S. Pence.

#209 Merced County, Merced River (S bank) at Oakdale Rd. ca. 4 mi. NE Cressey. 18 July 1991. William S. Pence.

#210 Merced County, Merced River (S bank), Oakdale Rd. 0.1 rd. mi. S bridge, ca. 4 mi. NE Cressey. 18 July 1991. William S. Pence.

#211 Merced County, Dana Slough (trib. Merced River), Road J17/Turlock Rd. 1.4 rd. mi. W jct. Hwy. 59, nr. Hopeton. 18 July 1991. William S. Pence.

#212 Merced County, Merced River (N bank), Road J16/Merced Falls Rd. 1 rd. mi. E Henderson Park (Co.), ca. 2 mi. E Snelling. 18 July 1991. William S. Pence.

#213 Merced County, Merced River (N bank), Road J16/Merced Falls Rd. 1.5 rd. mi. E Henderson Park (Co.), ca. 2 mi. E Snelling. 18 July 1991. William S. Pence.

#214 Butte County, Butte Creek drainage, Gray Lodge WA (CDFG), Pennington Rd. 0.4 rd. mi. N jct. Reimer Rd., ca. 3 mi. N Pennington. 24 July 1991. William S. Pence.

#215 Butte County, Butte Creek drainage, Gray Lodge WA (CDFG) Hdqts. ca. 4 mi. NW Pennington. 24 July 1991. William S. Pence.

#216 Butte County, Butte Creek (E bank), W of Aguas Frias Rd. on levee road betw. Hwy. 162 & Afton Rd., ca. 7 mi. ESE Butte City. 24 July 1991. William S. Pence.

#217 Butte County, Butte Creek (E bank), W of Aguas Frias Rd. on levee road betw. Hwy. 162 & Afton Rd., ca. 7 mi. ESE Butte City. 24 July 1991. William S. Pence.

#218 Butte County, North Honcut Creek 0.2 rd. mi. S off Lower Honcut Rd., 1 rd. mi. W jct. LaPorte Rd., just SE Honcut. 25 July 1991. William S. Pence.

#219 Solano County, Pleasants Creek or trib., Pleasants Valley Rd. 8.4 rd. mi. N jct. Cherry Glen Rd., ca. 6 mi. W Allendale. 26 July 1991. William S. Pence.

#220 Solano County, trib. Pleasants Creek, Pleasants Valley Rd. 9.5 rd. mi. N jct. Cherry Glen Rd., ca. 6 mi. W Allendale. 26 July 1991. William S. Pence.

#221 * Solano County, Pleasants Creek, Pleasants Valley Rd. 10.4 rd. mi. N jct. Cherry Glen Rd., ca. 5 mi. WNW Allendale; elev. ~200 ft. 26 July 1991. William S. Pence.

#222 * Solano County, Putah Creek, Lake Solano Park (Co.) (S shore) ca. 3 mi. SW Winters; elev. -120 ft. 26 July 1991. William S. Pence.

#223 * San Joaquin County, Stanislaus River (N bank), McHenry Avenue Recreation Area (COE), S off River Rd. ca. 1 rd. mi. W jct. Road J6/McHenry Ave., ca. 3 mi. SSW Escalon; elev. 65-75 ft. 31 July 1991. Cheryl B. Barr & William S. Pence.

#224 San Joaquin County, Stanislaus River (N bank), Oakdale Recreation Area (COE) end Liberini Rd., S off River Rd. just W jct. Road J14/Albers Rd., ca. 1 mi. N Oakdale. 31 July 1991. Cheryl B. Barr & William S. Pence.

#225 San Joaquin County, Stanislaus River (N bank), Valley Oak Recreation Area (COE), S off Rodden Rd. just W jct. Arbini Rd., ca. 3 mi. NE Oakdale. 31 July 1991. Cheryl B. Barr & William S. Pence.

#226 San Joaquin County, Stanislaus River (N bank), Horseshoe Road Recreation Area (COE), S off Orange Blossom Rd. just E jct. Horseshoe Rd., ca. 3.5 mi. WSW Knights Ferry. 31 July 1991. Cheryl B. Barr & William S. Pence.

#227 San Joaquin County, Knights Ferry, Stanislaus River (N & S banks), Knights Ferry Recreation Area (COE), Sonora Rd. 31 July 1991. Cheryl B. Barr & William S. Pence.

#228 San Joaquin County, Stanislaus River (N bank), Orange Blossom Recreation Area (COE), S off Rodden Rd. just W jct. Orange Blossom Rd., ca. 5 mi. NE Oakdale. 16 April 1991. Cheryl B. Barr.

#229 * San Joaquin County, Stanislaus River (N bank), just W Jacob Meyers Recreation Area (COE) at Road J7, just NW Riverbank; elev. -90 ft. 16 April 1991. Cheryl B. Barr.

#230 * Placer County, Rocklin, Secret Ravine (trib. Dry Creek), Sierra College Nature Trail, E of I-80; elev. 300-320 ft. 10 April 1991. Cheryl B. Barr.

Appendix II

SAMBUCUS DETERMINATIONS

Foliage and flower/fruit specimens from the following sites were determined by Lauramay Dempster, Jepson Herbarium, University of California, Berkeley, and deposited as vouchers in the Jepson Herbarium.

SAMBUCUS MEXICANA PRESL.

CA: Amador Co., Sutter Creek, Prouty Rd. via Five Mile Dr. 1.4 mi. S jct. Hwy. 104, ca. 1.5 mi. W Ione; R9E T6W; elev. 260-270 ft. 21 June 1991. Coll. William S. Pence. (site #141) (recent exit hole)

CA: Butte Co., Chico, Bidwell Park, Big Chico Creek along Centennial Ave. just SW jct. Manzanita Ave.; R2E T22N S Sec. 18; elev. ca. 270 ft. 14 June 1991. Coll. Cheryl B. Barr & William S. Pence. (site #119) (old exit holes, live wood)

CA: Butte Co., Feather River (east bank), Oroville St. Wildlife Area, 2.7 mi. W off Hwy. 70, ca. 21 mi. N Marysville; R3E T18W Sec. 4?; elev. ca. 125 ft. 2 July 1991. Coll. William S. Pence. (site #178) (old exit holes, dead wood)

CA: El Dorado Co., Coloma, So. Fork American River at Marshall Gold Discovery St. Hist. Pk., Hwy. 49; R10E T11N SW Sec. 17; elev. ca. 760 ft. 11 June 1991. Coll. Cheryl B. Barr & William S. Pence. (site #96) (no exit holes)

CA: El Dorado Co., Folsom Lake St. Rec. Area 0.1-0.2 mi. N Peninsula Campground entrance; Rattlesnake Bar Rd. 8.7-8.8 mi. SW jct. Hwy. 49 (Pilot Hill); R8E T10N NE Sec. 4 or T11N SE Sec. 32; elev. ca. 760-800 ft. 11 June 1991. Coll. Cheryl B. Barr & William S. Pence. (site #99) (recent exit holes)

CA: Kern Co., Kern River at Kern River Co. Pk. Game Preserve just upstream from Lake Ming, ca. 6 mi. NE Bakersfield; R29E T29S, NW Sec. 3; elev. ca. 520 ft. 19 April 1991. Coll. Cheryl B. Barr. (site #1) (no exit holes)

CA: Madera Co., Fresno River, Oakhurst, Hwy. 41; T7S R21E SE Sec. 10; elev. 2240-2280 ft. 28 June 1991. Coll. William S. Pence. (site #162) (no exit holes)

CA: Napa Co., Suisun Creek, Gordon Valley Rd. at Chimney Creek Ln., 6.9 mi. N jct. Clayton Rd., ca. 7 mi. NW Fairfield; R2W T6N; elev. 300-320 ft. 18 June 1991. Coll. William S. Pence. (site #127) (old exit hole, dead wood)

CA: Napa Co., Wooden Valley Creek at jct. Wooden Valley Cross Rd. & Suisun Valley Rd., ca. 7 mi. NW Fairfield; R3W T6N; elev. 220 ft. 18 June 1991. Coll. William S. Pence. (site #128) (recent exit hole)

CA: San Joaquin Co., Clements Glen View Cemetery, Mackville Rd. 0.3 mi. SE Mokelumne River, 0.9 mi. N Clements; R8E T4N NW Sec. 15; elev. 130-140 ft. 15 May 1991. Coll. Cheryl B. Barr. (site #72) (adult male & female, recent exit holes)

CA: San Joaquin Co., Mokelumne River at Elliott Rd. ca. 1.5 mi. NW Lockeford; Lockeford Plant Materials Center (USDA); R7E T4N SW Sec. 24; elev. 60-65 ft. 15 May 1991. Coll. Cheryl B. Barr. (site #70) (recent? exit hole)

CA: Shasta Co., Redding, Sacramento River, Turtle Bay East Fishing Access Area just SE Hwy. 299 bridge, N & W off Bechelli Ln. (Sacto. R. mi. 296); R4W T32N SW? Sec. 31; elev. ca. 490 ft. 7 May 1991. Coll. Cheryl B. Barr. (site #56) (recent? exit holes)

CA: Solano Co., Dudley Creek, Pedrick Rd. 0.1 mi. N jct. Dixon Ave., ca. 1 mi. E Dixon; R2E T7W Sec. 18; elev. 55 ft. 19 June 1991. Coll. William S. Pence. (site #130) (old exit holes, dead wood)

CA: Solano Co., Lake Solano County Park, Putah Creek, ca. 9.5 mi. NNW Vacaville; R1W T8N; elev. ca. 120 ft. 26 July 1991. Coll. William S. Pence. (site #222) (recent? exit hole)

CA: Stanislaus Co., Tuolumne River, Charles St. ca. 1.5 mi. N jct. Hatch Rd., ca. 2.0 mi. N Hughson; R10E T3S SW Sec. 34; elev. ca. 65 ft. 17 July 1991. Coll. William S. Pence. (site #203) (recent exit hole)

CA: Tulare Co., Kaweah River - Lane Slough, Rd. 196/J27 2.9 mi. N off Hwy. 198, ca. 9 mi. E Visalia; R26E T18S NW Sec. 14; elev. 405 ft. 30 April 1991. Coll. Cheryl B. Barr. (site #32) (dead adult male, recent exit holes)

CA: Tuolumne Co., Stanislaus River, Tulloch Rd. 0.2 mi. SW Tulloch Dam & Reservoir; R12E T1S SW Sec. 1; elev. 560-580 ft. 25 June 1991. Coll. Cheryl B. Barr & William S. Pence. (site #152) (no exit holes)

CA: Yolo Co., Cache Creek at Rd. 94B, N off Hwy. 16 ca. 5 mi. W Woodland; R1E T10N; elev. ca. 100 ft. 16 May 1991. Coll. Cheryl B. Barr. (site #74) (recent exit holes)

CA: Yolo Co., Cache Creek, Hwy. 16 2.7 mi. NW Rumsey; R4W T12N SE Sec. 2; elev. ca. 520 ft. 16 May 1991. Coll. Cheryl B. Barr. (site #75) (recent exit holes)

SAMBUCUS RACEMOSA L. VAR. *MICROBOTRYS* (RYDB.) KEARNEY & PEEBLES

CA: El Dorado Co., Hastings Creek, Hwy. 49 at Pedro Hill Rd., 1.4 mi. SE jct. Salmon Falls Rd. (Pilot Hill); R9E T11N SW Sec. 5; elev. ca. 960 ft. 11 June 1991. Coll. Cheryl B. Barr & William S. Pence. (site #98) (no exit holes)

CA: Kern Co., tributary Caliente Creek, Bena Rd. 3.6 mi. N off Hwy. 58, ca. 5 mi. W Caliente; R31E T30S; elev. ca. 1000 ft. 19 April 1991. Coll. Cheryl B. Barr. (site # 4) (partly healed exit hole)

CA: Kern Co., Tehachapi Creek, Bealville Rd. just S jct. Caliente-Bodfish Rd. (just S Caliente); R31E T30S; elev. ca. 1315 ft. 19 April 1991. Coll. Cheryl B. Barr. (site #5) (no exit holes)

CA: Placer Co., Miners Ravine, Auburn-Folsom Rd. ca. 5 mi. E Rocklin; R7E T11N SE Sec. 26; elev. 400-420 ft. 25 April 1991. Coll. Cheryl B. Barr. (site #21) (recent? exit hole)

CA: Shasta Co., Sacramento River - Auderson Creek, Reading Island Rec. Area (BLM) E off Adobe Rd., ca. 4.5 mi. E Cottonwood (Sacto. R. mi. 274); R3W T29N SW Sec. 3?; elev. 360-370 ft. 8 May 1991. Coll. Cheryl B. Barr. (site #61) (recent? exit holes)

CA: Solano Co., Pleasants Creek, Pleasants Valley Rd. 10.4 mi. N jct. Cherry Glen Rd., ca. 9 mi. NNW Vacaville; R2W T7N Sec. 12; elev. ca. 200 ft. 26 July 1991. Coll. William S. Pence. (site #221) (recent? exit hole)

CA: Sutter Co., Bear River at Pleasant Grove Rd. SW Wheatland; R4E T13N SE Sec. 11; elev. 60 ft. 25 April 1991. Coll. Cheryl B. Barr. (site #24) (recent? exit holes)

CA: Tehama Co., Paynes Creek, Paynes Creek Loop 0.7 mi. E Paynes Creek (town); R1E T29N SE Sec. 30; elev. 1870-1880 ft. 9 May 1991. Coll. Cheryl B. Barr. (site #67) (old exit holes, live wood)

CA: Tehama Co., Paynes Creek, Hwy. 36 4.4 mi. E jct. Rd. A6/Manton Rd. (Dales); R1W T28N NE Sec. 5; elev. 1040 ft. 9 May 1991. Coll. Cheryl B. Barr. (site #68) (old exit holes, live wood)

CA: Tehama Co., Sacramento River - Elder Creek, Sacramento River Natl. Wildlife Refuge (Flynn Tract) ca. 2 mi. SE Gerber (Sacto. R. mi. 230-231); R2W T25N; elev. 200-210 ft. 13 June 1991. Coll. Cheryl B. Barr & William S. Pence. (site #112) (recent exit holes)

CA: Tehama Co., Sacramento River - Kopta Slough, Kopta Slough Preserve (TNC) ca. 4 mi. E Corning (Sacto. R. mi. 219); R2W T24N SE Sec. 21; elev. ca. 175 ft. 13 June 1991. Coll. Cheryl B. Barr & William S. Pence. (site # 113) (recent exit holes)

CA: Tehama Co., Newville Rd./Rd. 200 just SE Black Butte Reservoir Dam, between Stony Creek outlet & Stony Creek Irrigation Canal, ca. 8 mi. NW Orland; R4W T23N SW Sec. 28; elev. 380 ft. 13 June 1991. Coll. Cheryl B. Barr & William S. Pence. (site #118) (recent exit holes)

CA: Tulare Co., Campbell-Moreland Ditch (tributary Tule River) at RR right-of-way between Hwy. 190 & Worth Ave, just S Porterville & E Martin Hill; R28E T22S NW Sec 6; elev. ca. 490 ft. 21 April 1991. Coll. Cheryl B. Barr. (site #15) (adult female, recent exit holes)

CA: Yuba Co., Feather River (east bank) levee, 0.9 mi. W off Hwy. 70 on River Oak Ranch Rd..& 0.1 mi. S on levee, ca. 6 mi. N Marysville; T16N R3E; elev. 70 ft. 2 July 1991. Coll. William S. Pence. (site #172) (recent exit hole)

CA: Yuba Co., Honcut Creek, 0.9 mi. W off Hwy. 70 on River Oak Ranch Rd. & 4 mi. N on levee, ca. 8 mi. N Marysville; T16N R3E Sec. 6?; elev. 85 ft. 2 July 1991. Coll. William S. Pence. (site #173) (old exit hole, dead wood)

Department of Agriculture, Office of General Counsel in Portland, Oregon, specializing in NEPA litigtaion.

When: Wednesday-Thursday, June 10-11, 8:30 a.m.-4:30 p.m. / 2 meetings.
Where: University Club, Old Davis Road, UC Davis.
Credit: 1.3 CEUs. 13 MCLE hours.
Fee: $350. Includes course materials and one networking lunch. **Enroll in section 974U230.**

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Additional courses this spring

- **Effective Code Enforcement Programs: Development and Implementation,** April 24
- **Developing, Critiquing and Adopting Findings in Land Use Environment Decision-Making,** May 13
- **CEQA: An Update,** May 6
- **Successful CEQA Compliance: An Intensive Two-Day Seminar,** May 20-21
- **Protecting Cultural Resources Under the California Environmental Quality Act,** April 3
- **Water Resources Planning,** April 29
- **Natural Communities of Northern California: Vernal Pools, Wetlands and Aquatic Habitat,** April 14
- **Natural Communities of Northern California: Central Valley Riparian Habitat,** May 12
- **GIS for Resource Managers and Professionals,** March 31-April 1

The Land Use and Natural Resources program is the largest of its kind in the Western United States. We aim to meet the continuing education needs of planners, resource managers, government officials, consultants, designers, developers, attorneys and others involved in the planning process. For a complete catalog of classes and more information about courses or custom programs, please call (530) 757-8878.

Fire Ecology Program Series

University Extension is pleased to present a series of intensive workshops addressing the

Database Systems and Concepts

Database Design, Development and Management

Learn the principles and issues involved in managing databases on microcomputers. Topics include: database processing, data models, structure and design of relational databases, principles and methodology of designing normalized databases, overview of major database management functions, database administration, historical perspectives and future trends. The course includes some hands-on use of Microsoft Access. Prerequisite: *Computer Information Systems: Concepts and Careers* and a working knowledge of Microsoft Access. *Microsoft Access: Introduction* is recommended for students with little or no Access experience. ***Hands-on course.***

Instructor: *Margaret Messick*, M.A., is a database administration consultant in Davis. She has more than 10 years of experience in designing and administering databases and teaching users to manage databases.

Where: Sutter Square Galleria, 2901 K St., Sacramento.
Credit: 3 quarter units academic credit, X497.5.

Wednesdays in April, May & June
When: Wednesdays, April 1-June 3, 6-9 p.m. / 10 meetings.
Fee: $445. **Enroll in section 974N130**.

Fridays in April, May & June
When: Fridays, April 3-June 5, 1-4 p.m. / 10 meetings.
Fee: $445. **Enroll in section 974N131.**

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Relational Database Technology: Advanced Topics

This lecture course, a continuation of *Database Design, Management, and Administration*, introduces students to advanced concepts used in today's database management systems. Review the concepts of database design during the first part of the course, then proceed through a detailed examination of all the steps involved in the design and implementation of a major database project. The remainder of the course covers advanced topics and new developments in database systems, including advanced SQL topics, multi-user issues in databases including transaction processing and concurrency control, distributed database management systems, object-oriented databases, client/server information systems (including a discussion of the three-tier model), and data warehousing. Prerequisite: *Database Design, Development and Management* or consent of the instructor.

Instructor: *Lee Sauer* is owner of ACL Associates, a Sacramento-based consulting practice specializing in the development of custom database systems for private businesses. He is a member of the board of directors of the Sacramento FoxPro User's Group.

When: Tuesdays, March 31-June 9 (no class May 19), 6-9 p.m. / 10 meetings.
Where: Sutter Square Galleria, 2901 K St., Sacramento.
Credit: 3 quarter units academic credit, X498.33.
Fee: $420. Text sold at first class. **Enroll in section 974N132.**

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SQL: Concepts and Syntax

SQL is the most common language used by relational database management systems (including SQL Server, Oracle and Ingress). This course is a comprehensive look at SQL and how to program using the SQL language. You learn concepts of the language and the full syntax. Topics include relational database systems; tables, columns and rows; primary and foreign keys; entering, changing and deleting data in a table; and looking at data in one table and in many tables. Because the course covers the ANSI standard, you will be

able to write queries and update tables in any SQL-based database system by the end of the course. Prerequisites: *Computer Information Systems: Concepts and Careers* or equivalent knowledge. ***Hands-on course.***

Where: Sutter Square Galleria, 2901 K St., Sacramento.
Credit: 1.5 quarter units academic credit, X497.59. Passed/not passed grading.

Thursdays in April
Instructor: *Christos Kolonis*, M.S., is a senior systems engineer at Hughes Aircraft in Sacramento. A university instructor for eight years, he has also worked in design, configuration and systems integration of client-server architectures in PC- and Unix-based environments.
When: Thursdays, April 2-23, 5:30-9:30 p.m. / 4 meetings.
Fee: $435. **Enroll in section 974N133.**

Intensive format
One Monday, Tuesday & Wednesday in May

Instructor: *Bill Pennock* is principal of Square Tree Software. He has worked with Fox products since 1987 and has published articles in Database Advisor. He has written strategic applications for clients in Arizona and California.
When: Monday-Wednesday, May 18-20, 8 a.m.-1 p.m. / 3 meetings.
Fee: $535. **Enroll in section 974N134.**

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Database Design Tools

Relational database products make it easy to create tables and set up relationships but are not equipped to handle complex database designs. There are now a variety of database design tools on the market that allow you to create tables and relationships plus set up the many details of the structure needed for a functioning database (foreign keys, cardinality, mandatory/optional relationships, etc.). Set up a small database using different tools to see how they work and compare. Design tables, set up relationships, foreign keys, cardinality and print out E-R diagrams and data dictionaries. Use design tools to create databases for Access, Oracle, MS-SQL Server and other popular relational databases. Prerequisites: *Database Design, Development and Management* or equivalent experience designing databases and creating E-R diagrams and hands-on experience with at least one database management system such as Access or Oracle. ***Hands-on course.***

Instructor: *Margaret Messick*, M. A., is a database administration consultant in Davis. She has more than 10 years of experience in designing and administering databases and teaching users to manage databases.

When: Saturdays, April 18-May 2, 9 a.m.-3 p.m. / 2 meetings.
Where: Sutter Square Galleria, 2901 K St., Sacramento.
Credit: 1 quarter unit academic credit, X495.10. Passed/not passed grading.
Fee: $355. **Enroll in section 974N145.**

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User Interface Design ***

The design of the database user interface is critical for the success of a database. Learn to design the user interface. Today, there are two commonly encountered interfaces: terminals (or microcomputers behaving as terminals) used in conjunction with mainframes and display monitors connected to microcomputers. Determine which features can be used for effective user interface design, design and evaluate the human engineering in a user interface for a typical information system, apply appropriate user interface strategies to an information system, and use a state transition diagram to plan and coordinate a user interface for an information system. Learn how prototyping is used to design a user interface, and how to use display layout charts to format the user interface screens in a system. Prerequisite: *Database Design, Development and Management* or equivalent experience.

Instructor: *Nabil Fares* is an information systems analyst with the Department of Motor Vehicles in Sacramento. He has 12 years of experience teaching computer programming, systems analysis and systems design classes.

When: Wednesdays & Fridays, May 27-10, 5:30-9:30 p.m. / 5 meetings.
Where: Sutter Square Galleria, 2901 K St., Sacramento.
Credit: 2 quarter units academic credit, X495.11. Passed/not passed grading.
Fee: $400. **Enroll in section 974N146.**

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Database Administration

Learn the principles of administration and management of Relational Database Management Systems (RDBMS). Topics include backup and recovery, security, concurrency control, integrity enforcement, query optimization and performance tuning. An overview and comparison of the major RDBMS's (DB2, Oracle, SQL/Server, and others) is also presented. Prerequisite*: Database Design, Development and Management* or equivalent experience. ***Hands-on course.***

Instructor: *Raymond Carlson* is an Oracle database administrator, Unix system administrator, Visual Basic and C/C++ programmer with Lum-Carlson Consulting. He has been an Oracle DBA for the last three years and has worked with Oracle products for over four years.

When: Wednesdays, May 27-June 10, 5:30-9:30 p.m., & Saturday, June 6, 8 a.m.-5 p.m. / 4 meetings.
Where: Sutter Square Galleria, 2901 K St., Sacramento.
Credit: 2 quarter units academic credit, X495.5.
Fee: $450. **Enroll in section 974N147.**

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Microsoft Access: Introduction

Learn the basics of database theory and Microsoft Access in this course. Topics include: the definition of a database; creating table structures; entering, viewing and editing data; creating queries, reports and labels; and creating multi-file queries and complex reports. Learn to create a well-planned database structure and select and report data. The class is taught using Access 8 but the concepts and tasks are compatible with Access 2.0. Prerequisite: *Computer Information Systems: Concepts and Careers* or the equivalent experience. ***Hands-on course.***

Instructor: *Margaret Messick*, M.A., is a database administration consultant in Davis. She has more than 10 years of experience in designing and administering databases and teaching users to manage databases.

When: Mondays, April 6-20, 9 a.m.-5 p.m. / 3 meetings.
Where: Sutter Square Galleria, 2901 K St., Sacramento.
Credit: 2 quarter units academic credit, X497.46. Passed/not passed grading.
Fee: $450. **Enroll in section 974N135.**

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Oracle: An Introduction

Learn the Oracle Relational Database Management System (RDBMS) from two perspectives: relational theory and system design. On the conceptual side, gain a theoretical foundation of relational database theory, including data normalization and data modeling. Methods of deriving third normal form databases from problem descriptions and data modeling are discussed, as well as the conversion of flat file databases to third normal form. On the system design side, learn Oracle installation and set-up, as well as methods for establishing databases and database users. Discussions also include the overall structure of Oracle and the basics of the Oracle database concept. Recommended to those wanting a hands-on introduction to Oracle, lab sessions include employment of the actual Oracle 7 RDBMS. Prerequisites: *Database Design, Development and Management* or the equivalent experience and knowledge of SQL. ***Hands-on course.***

Instructor: *Christos Kolonis*, M.S., is a senior systems engineer at Hughes Aircraft in Sacramento. A university instructor for eight years, he has also worked in design, configuration and systems integration of client-server architectures in PC- and Unix-based environments.

When: Thursdays, May 7-June 18, 5:30-9 p.m., & Saturday, June 20, 9 a.m.-3:30 p.m. / 8 meetings.
Where: Sutter Square Galleria, 2901 K St., Sacramento.
Credit: 3 quarter units academic credit, X497.80.
Fee: $490. **Enroll in section 974N137.**

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Oracle: Database Administration

Develop a practical knowledge of Oracle 7 database administration activities using Personal Oracle 7. Learn about Oracle architecture and configuration, activity, backup and recovery techniques, resource management, monitoring and tuning. Related topics such as data warehousing, data mining and very large databases are also explored. The lab portion

of each class provides students with hands-on experience using SQLDBA and SQL scripts related to database administration. Additionally, students access various Web sites, newsgroups and FTP sites for Oracle-related information. Prerequisites: *SQL: Concepts and Syntax* and *Oracle: An Introduction* or equivalent experience. ***Hands-on course.***

Instructor: *Raymond Carlson* is an Oracle database administrator, Unix system administrator, Visual Basic and C/C++ programmer with Lum-Carlson Consulting. He has been an Oracle DBA for the last three years and has worked with Oracle products for over four years.

Intensive Format
When: Monday-Friday, May 18-22, 9 a.m.-4 p.m. / 5 meetings.
Where: Sutter Square Galleria, 2901 K St., Sacramento.
Credit: 3 quarter units academic credit, X498.39.
Fee: $695 includes course materials. **Enroll in section 974N136.**

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Internet

Internet Architecture and Services

Now more than ever, employers are requiring Internet experience in the workplace. This hands-on class not only teaches you how to use the Internet but also how to understand the interworkings of the Internet. This class introduces using email, newsgroups, World Wide Web, FTP, Unix and more. Understand how to diagnose common Internet problems with email attachments, DNS, TCP/IP, etc. Learn the difference between shell access verses SLIP/PPP. Also learn how to use compression and encoding tools such as PKZIP, UUENCODE, how to successfully download/upload files and programs to your computer, and how to install and configure new Internet/modem software. Learn how to select an Internet provider and easily access the Internet's vast resources. ***Hands-on course.***

Instructor: *Tom Henry.*
When: Fridays, April 3 & 17, 6-9 p.m., & Saturdays, April 4 & 18, 9 a.m.-5 p.m. / 4 meetings.
Where: Sutter Square Galleria, 2901 K St., Sacramento.
Credit: 2 quarter units academic credit, X499.1.
Fee: $450. **Enroll in section 974N120.**

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Web Page Creation and Authoring

Web pages are the door to the World Wide Web. Design and build your own professional-looking Web pages that allow the user to link to and explore relevant

professional-looking Web pages that allow the user to link to and explore relevant resources. Become proficient with HyperText Markup Language (HTML) and HTML editors. Learn to use not only the basic HTML tags to build your first pages (lists, menus, hyperlinks, images, etc.) but also some of the more powerful fundamental concepts of Web design today (JavaScript, Java, ActiveX, CGI scripting, frames, etc.). Learn what it takes to create dynamic Web pages and what current and future technologies can bring to your Web site. Prerequisite: *Internet Architecture and Services*. ***Hands-on course.***

Instructor: *Tim Silva* is with the software development unit of Play Inc. focusing on Internet development. He has more than 10 years of experience in computer programming and consulting and is a Microsoft Certified Professional product specialist.

When: Fridays, April 24-June 19 (no class May 22), 5:30-9:30 p.m. / 8 meetings.
Where: Sutter Square Galleria, 2901 K St., Sacramento.
Credit: 3 quarter units academic credit, X499.3.
Fee: $490. **Enroll in section 974N121.**

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Web Site Functional Design

Designing a functional Web site is more than just putting great graphics, exciting animation and state-of-the-art multimedia on a Web page. The questions you need to ask include: How do I get started? How do I find and evaluate a service provider? How do I win customers? How do I get people to respond to and inquire about my services? How do I build enough flexibility into my Web site to incorporate emergent technologies? Get the answers to all of these questions and more. ***Hands-on course.***

Instructor: *Pat Palozzola* has more than 20 years of experience in graphic art industry practices and techniques. She has a Bachelor of Fine Arts and holds teaching credentials in art, computer concepts and applications and printing and graphic occupations. As a partner in Desktop Solutions, she is currently teaching and consulting in graphic illustration and Web page design.

When: Thursdays, April 2-June 4, 9 a.m.-noon / 10 meetings.
Where: Sutter Square Galleria, 2901 K St., Sacramento.
Credit: 3 quarter units academic credit, X499.10.
Fee: $490. **Enroll in section 974N122.**

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Web Page Scripting

Simpler than Java or CGI, yet powerful enough to create complex applications, JavaScript generates linked, online programs that share objects and resources on both clients and servers. Learn JavaScript from the ground up including creative interactive forms, games, JavaScript events, cookies and the advanced JavaScript features of Netscape Navigator. This object-based scripting language offers a quick, easy way to embed interactive content into Web pages. Learn the ins and outs of validating data, manipulating form elements and creating new objects. Discover how JavaScript minimizes network traffic by allowing programs to be executed on the client instead of the server. Experience how JavaScript spices up HTML with the one-two punch of portability and speed. Prerequisite: *Web Page Creation and Authoring*. ***Hands-on course.***

Instructor: *Sundar Rajan* is a software consultant with Hewlett-Packard in Roseville. He has worked as project manager and team leader with electronic communications firms for 15 years. The president of the Sacramento Client/Server Users Group, he has published articles in several publications and has presented papers at international conferences.

When: Wednesdays, April 1-June 3, 6-9 p.m. / 10 meetings.
Where: Sutter Square Galleria, 2901 K St., Sacramento.
Credit: 3 quarter units academic credit, X498.37.
Fee: $490. **Enroll in section 974N123.**

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Web Database Application Design

More and more Web content is being stored in databases and generated dynamically. Searching for data in a relational database is not a casual endeavor. Learn what can be done to help end users find the proverbial "needle in the haystack." Discover the latest search technologies and techniques available to perform ad hoc searching and extraction of information from free-form information sources, such as database fields, Web pages or documents. Products such as West Wind Web Connection, Visual Basic Script and ActiveX controls are demonstrated. Participants create sample Web pages from databases using a variety of tools. ***Hands-on course.***

Instructor:

Instructor: *Miriam Liskin* is a database consultant and programmer. She writes a monthly column for the FoxPro Advisor magazine and has authored 16 books on databases.

When: Mondays, Wednesdays & Friday, April 20, 22, 24, 27 & 29, 9 a.m.-4 p.m. / 5 meetings.
Where: Sutter Square Galleria, 2901 K St., Sacramento.
Credit: 3 quarter units academic credit, X499.11.
Fee: $490. **Enroll in section 974N124.**

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Web Site Server Implementation Strategies

Installing and effectively administering Internet Web servers — from basic requirements to specific functionality, security and site maintenance — is the primary focus of this course. Students learn how to install and configure the server to meet individual needs for email, list services, company directories, forms, online catalogs and search engines. Monitoring and tuning the Web server for optimun performance is also emphasized.

Instructor: *Jim Brown* is a systems engineer with Sun Microsystems. He has held various staff and management positions in the computer processing development and design arena for over 20 years, specializing in Unix systems for the last 11 years. He is fluent in many programming languages and skilled in a number of computer environments.

When: Wednesdays, June 3-10, 6-9 p.m., & Saturdays, June 6-20, 9 a.m.-4 p.m. / 7 meetings.
Where: Sutter Square Galleria, 2901 K St., Sacramento.
Credit: 3 quarter units academic credit, X499.12.
Fee: $420. **Enroll in section 974N125.**

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Web Page Graphics

Create Web graphics that load fast and look good whether you are working with graphics for the first time or transferring print graphic skills to the Web. Learn to design graphics

that are appropriate in size and file format, and optimized for speed and presentation, use patterned backgrounds tiles and menu bars, great-looking text using drop shadows and other special effects, buttons, beveled icons and horizontal rules. Colorize grayscale photos and give graphics interesting edges. Create graphic links to other pages by using image maps. Save graphic files as Transparent and Interlaced GIFs and learn to use techniques such as anti-aliasing. This course is designed for students in the Web, Graphics or Multimedia certificate programs. Prerequisite: Mac OS Fundamentals or equivalent experience. ***Hands-on course.***

Instructor: *Pat Palozzola* has more than 20 years of experience in graphic art industry practices and techniques. She has a Bachelor of Fine Arts and holds teaching credentials in art, computer concepts and cpplications and printing and graphic occupations. As a partner in Desktop Solutions, she is currently teaching and consulting in graphic illustration and Web page design.

When: Wednesdays, April 15-June 17, 9 a.m.-noon / 10 meetings.
Where: Sutter Square Galleria, 2901 K St., Sacramento.
Credit: 3 quarter units academic credit, X499.20.
Fee: $490. **Enroll in section 974N127**.
