CACHE CREEK NATURE PRESERVE

RIPARIAN SURVEY & MONITORING PROJECT

VEGETATION AND AVIFAUNA

YEARS 1999 and 2001

Melanie Allen Truan
Department of Wildlife, Fish & Conservation Biology
University of California, Davis, One Shields Avenue, Davis, CA 95616

Final Draft
February 2002

SUMMARY OF FINDINGS

Vegetation

- In the study plots, overall plant species richness and percent cover increased 14.8% and 10.2%, respectively, following *Arundo* eradication measures. Species richness increased largely as a result of new species recruitment in the *Arundo* eradication patches (AEPs), while increases in overall percent cover could be attributed to increased herbaceous growth. S1 and S2 shrub cover declined 35.9% and 26.4%, respectively, largely the result of *Arundo* removal.

- Removal of *Arundo* from the AEPs resulted in a 150% increase in relative percent cover of native species in study plots, primarily due to nonnative biomass removal, but also due to recruitment of native seedlings released from competition.

- In AEPs, total species richness and percent cover declined 47% and 53%, respectively. Not surprisingly, species composition and percent cover was highly modified by treatment, especially in the shrub, bare ground, and *Arundo* litter strata.

- 43% of all recruits to AEPs were nonnative species. Many of these were early-successional colonizers, underscoring the need for follow-up treatment to control nonnative species in treatment areas.

Avifauna

- Avian species richness and abundance decreased 9% and 38%, respectively, in the year after treatment. Declines such as these are not uncommon following treatments of this type and magnitude. Avian diversity and abundance is expected to increase with time as the area recovers from disturbance.

- Declines in abundance were observed for all avian functional groups except winter residents, nectivores, pendant nesters, the prober foraging guild, and brood parasites. While overall declines in abundance were real and likely the result of treatment-related disturbance, individual functional group responses were likely spurious, with the exception of increases in Brown-headed Cowbird, a species that is known to invade newly-opened habitats. Increased cowbird parasitism is likely to have deleterious effects on nesting species, at least until dense vegetation can be reestablished to provide cover for nesting species.

- Declines in overall avian abundance differed between plots. No declines were observed for the control plot. Plots with intermediate levels of *Arundo* infestation experienced the greatest loss of avian abundance, possibly since these plots had more birds to begin with. Heavily invaded plots were already so depauperate of birds that disturbance had less effect on species diversity and abundance.

- Species dominance also shifted after treatment, with the Brown-headed Cowbird replacing the shrub-based California Towhee as the most dominant species (highest importance value).

BACKGROUND

In November 1999, a program to eradicate *Arundo donax*, a nonnative, invasive weed, was initiated on the Preserve. Vegetation was mulched by a hammer-flail mower mounted on a four-wheel-drive, New Holland articulated tractor. The tractor would lead the way into a thick stand of *Arundo*, mulching as much of the cane as possible using the flail mower. Care was taken to avoid native trees and shrubs. Where these were encountered, a ring of cane was left around sensitive plants for hand crews to cut and pile nearby for subsequent mulching by the mower.

By January of 2000, the majority of the standing *Arundo* vegetative matter had been removed and mulched. In March of 2000, herbicide (Roundup Pro) was applied to the *Arundo* resprouts. Applications were repeated every three weeks for the first few months, every four weeks over the next two month, with a final application five weeks later. This treatment resulted in suppression of approximately 90% of the *Arundo* in the treatment areas. In April 2001, half the area was again treated for re-sprouts, with the other half retreated in May 2001. One more application was made in September. In 2002, a wick application of herbicide will be applied to the remaining isolated plants. Virtual eradication of *Arundo* is anticipated in the treatment area by 2002.

During spring and summer 1999, I conducted detailed baseline surveys of plant cover and avian abundance in and around future treatment areas. These surveys were repeated in the spring and summer of 2001 to serve as the first phase of follow-up monitoring. Another follow-up survey will be performed in 2003. In 2001, large portions of the survey plots had been largely denuded of understory vegetation by the *Arundo* removal project, leaving areas in which the bare soil was overlain with finely-mulched *Arundo* fragments. These I termed *Arundo* Eradication Patches (AEPs).

MONITORING GOALS

- Monitor the response of plant and avian communities to ongoing habitat restoration and management efforts.
- Explore underlying ecological mechanisms affecting community dynamics and response to restoration.

METHODS

Site Description

Legal Description: A portion of the tract of land shown and designated as "Parcel 2" on Parcel Map No. 3179 filed in Book 6 of Parcel Maps at Page 90, Yolo County Records, located in the Gordon Grant, Yolo County, California.

The Cache Creek Nature Preserve (CCNP) lies west of County Road 94-B, south of County Road 20, and along the north side of Cache Creek and consists of 105 acres of natural and agricultural wildlife habitats. The quality of these habitats and their minimal degree of human disturbance support many wildlife species.

The Cache Creek Nature Preserve is one of the least disturbed areas along lower Cache Creek, and should support relatively high levels of biodiversity. One of its most significant features is the Cache Creek riparian corridor along the southern boundary of the Preserve. This corridor provides potential habitat for riverine and riparian wildlife, including special-status birds (Appendix D-2).

Vegetation in the study area consisted largely of the Fremont cottonwood series, with palustrine shrub-scrub wetland (Narrowleaf willow series) along the creek margin and Valley oak series in the adjacent uplands (Sawyer and Keeler-Wolf 1995). Direct impacts to the site included a former gravel extraction operation and invasion by exotic plants such as *Arundo donax* and *Tamarix sp*.

Plot Establishment

Six circular 50-meter-radius study plots (0.79 ha each) were established in a systematic random fashion along the riparian corridor. Plots were placed approximately 200 meters apart. An avian point count station was placed at the center of each plot, its geographic location recorded using a global positioning system (Appendix A Table 1). Plots were identified on the ground by colored flagging and aluminum plant identification tags.

Habitat physiognomy, plant percent cover and structure, and avian species composition and abundance were first quantified during the spring and summer of 1999. In 2000, an *Arundo donax* eradication project was initiated along the riparian corridor, presenting an opportunity to re-survey the study plots following treatment.

Denuded patches of varying size were left after treatment. Because study plots had been established before weed eradication, *Arundo* eradication patches (AEPs) did not coincide exactly with study plots. It was possible, however, to assign certain AEPs to study plots based on their adjacency. Two AEPs, 1E and 1W, were located in and adjacent to study plot 1. 2E and 2S were located in and adjacent to study plot 2. Study plots 3 and 5 each contained one AEP, and three AEPs (4, 4N, and 4E) occurred in and adjacent to study plot 4. AEPs were measured (Appendix A Table 2) and surveyed with respect to their plant percent cover, structure, and habitat physiognomy.

Values for plot 1 are presented but were not considered in analysis because this plot was composed mainly of oak woodland habitat and was not directly comparable to the riparian plots.

Survey Methodology

Vegetation

For each study plot, plant species composition, cover, and habitat physiognomy were surveyed using the Braun-Blanquet releve method (Mueller-Dombois and Ellenberg 1974). Vegetation physiognomy and structure was first assessed for the site as a whole. A species list was compiled, assigning to each species and height class a percent cover category. Species were subdivided into multiple height classes to quantify habitat physiognomy and to track community succession over time. Height classes consisted of a tree layer 5-10m in height (T2) and a tree layer >10m in height (T1), a shrub layer 2-5m in height (S1) and a shrub layer <2m in height (S2), an herbaceous layer (H), and categories for saplings and seedlings. For example, Fremont cottonwood (*Populus fremontii*-POFR) was classified into six different height classes to fully characterize the species' developmental level and physical stature within the community: POFR T1, POFR T2, POFR S1, POFR S2, POFR saplings, and POFR seedlings

Since the 1999 surveys were performed before AEPs had been established, no species composition or percent cover data existed specifically for them prior to the 2001 surveys. To estimate the pre-eradication species makeup and structure of the AEPs, I re-analyzed the 1999 plot data in areas that later fell within an AEP, checking these estimates against the species composition of extant Arundo clumps. This task was relatively straightforward since species diversity in *Arundo* clumps was and is quite low since *Arundo* tends to outcompete all other species.

Data were compiled using Microsoft EXCEL. Braun-Blanquet categories were converted to percent-cover values by assigning the median value for each category. The two rare species categories (+ and r) were assigned values 0.5 and 0.1, respectively. For each species growth form, frequency across plots was calculated and importance values (IV) were calculated using the formula: IV = (% Cover + Frequency) / 2.

1) The following tables were generated for the vegetation data:

    - Appendix B1: Plant Species List
    - Appendix B2: 1999 and 2001 Plant Species Height Class, % Cover, Frequency, and Importance Value (Plots pooled)
    - Appendix B3: Habitat Physiognomy by Year and Plot
    - Appendix C1: 1999 and 2001 AEP Physiognomy

- Appendix C2: 1999 and 2001 AEP % Cover, Frequency, and Importance Value

- Appendix C3: Species New to AEPs in 2001

- Appendix C4: AEP Native Species Richness and % Cover

Avifauna

Variable-radius point count surveys (Ralph *et al.* 1995, Bibby *et al.* 2000) were conducted April through June, 1999 and 2001. Surveys were begun within one half-hour of local sunrise and generally lasted approximately two hours. Each plot was surveyed for 10 minutes, in which abundance, distance from observer, detection method, and habitat type were recorded for each species. Birds were detected and identified by song, call, and/or visual observation. The habitat in which the bird was detected was identified, if possible. Habitat categories included: riparian woodland (RW), willow scrub (WS), oak woodland (OK), ruderal grassland (RG), open water (WA), shoreline (SL), marsh (MA), eucalyptus stand (EU), and agricultural area (AG).

Surveyors were trained in the methodology, assessed for their identification skills and ability to judge distance before each field season, and rotated among visits to minimize observer bias. Sampling effort consisted of three surveys per plot in 1999; four surveys per plot in 2001. Stations were surveyed in reverse order on alternate visits to minimize temporal bias. Observers approached the count stations cautiously and any flushed birds were included in the count.

Data were compiled using Microsoft EXCEL. For each bird species, an abundance index (AI) was calculated by dividing the total number of birds detected by the sampling effort. While all birds detected at all distances were included in the master species list (Appendix D-1), only birds detected within the 50 meter plots were included in the quantitative analysis. An importance value (IV) was calculated for each species using the following formula: IV = (AI + Frequency) / 2.

Birds are excellent indicators of habitat type and quality, especially when functional group or guild dynamics are considered. Functional groups included residence status, habitat preference, dietary guild, foraging guild, nest substrate, nest type, and disturbance tolerance (Appendix D4). Residence Status refers to the time of year that a species is generally encountered in the region. Habitat Preference governs whether a species is found across a wide array of habitat types (generalist), is restricted by its life history requirements to a specific habitat type (specialist), or occupies some middle ground between the two. Dietary Guild refers to the primary foodstuff consumed by a species. Some species consume more than one type of food (*i.e.* both seeds and herbaceous material, or both insects and fruit), and some species switch their diet at different times of year (*i.e.* insects during the breeding season and fruits during the winter). Thus, species were classified by the dietary item consumed most frequently or the foodstuff most often consumed during the breeding season. Foraging Guild refers to the mode by which a bird obtains its prey. Different species employ a wide variety of foraging strategies, which is one reason why they are such excellent indicators of habitat type and quality. Foraging guild categories were taken from Ehrlich *et al.* 1988. Nest Strata pertains to the substrate upon which a species builds its nest, and Type of Nest Built refers to the nest structure itself. The category Nest Parasite refers to a species, like the Brown-headed Cowbird, that lays its eggs in the nests of other birds. Disturbance Tolerance is a composite measure that we devised to reflect the overall sensitivity of a species to anthropogenic and/or natural disturbance in its environment. For example, species generally found in association with humans, such as the American Crow or the Northern Mockingbird, generally have a high tolerance for disturbance, while many forest interior species are extremely sensitive to abiotic and biotic disturbance.

1) The following analyses were generated for the avian data:

    - Appendix D1: Avian Species List with Functional Groups
    - Appendix D2: 1999 and 2001 Avian Abundance Indices and Importance Values (Plots pooled)
    - Appendix D3: Avian Abundance Indices by AEP Area
    - Appendix D4: Avian Abundance Index by Functional Group

RESULTS

Vegetation

For the study plots, overall plant species richness and percent cover following *Arundo* eradication measures increased 14.8% and 10.2%, respectively (Appendix B2). Species richness increased largely as a result of new species recruitment in the *Arundo* eradication patches (AEPs), while increases in overall percent cover could be attributed to increased herbaceous growth due to opening of the understory. Not surprisingly, S1 and S2 shrub cover declined 35.9% and 26.4%, respectively, as a result of *Arundo* removal.

Since so much biomass was removed from the AEPs, total species richness and percent cover declined 47% and 53%, respectively (Appendix B3). The biggest changes occurred in the shrub, bare ground, and *Arundo* litter strata (Appendix C-1). S1 percent cover composed mainly of *Arundo* shrubs decreased from 72% to 1%. Percent-cover for the S2 layer—which consisted mainly of shorter growth forms of *Arundo*—also decreased from 32% to 5%. Since most of the *Arundo* was chopped up and left as mulch, the *Arundo* litter layer increased from 6% to 84%. *Arundo* litter was clearly the dominant stratum in

2001. Bare ground—which had previously occurred mainly beneath the dense *Arundo* canopy and was now largely covered by *Arundo* litter—decreased from 35% to 2%.

Percent cover of native species increased 150%, not only through removal of Arundo biomass, but also because native seedlings that were suppressed by Arundo overgrowth were subsequently released from competition. However, 43% of recruits to AEPs were nonnative species. Many of these were early-successional colonizers, underscoring the need for follow-up treatment to control nonnative species in treatment areas. While total plant cover declined as a result of *Arundo* eradication, species height class diversity increased by 47% due to the appearance of 44 new species-height classes in 2001 (Appendix C-3). Species and/or species height classes that posted increases in 2001 included: *Cirsium arvense, Cyperus odoratus, Quercus lobata* seedlings, *Salix exigua* seedlings, *Populus fremontii* seedlings, *Juglans californica* var. *hindsii* seedlings, and *Salix laevigata* sprouts.

Avifauna

One-hundred and thirty bird species were detected across all distances during the 1999 and 2001 surveys (Appendix D-1). The most common species were year-round resident species that were also habitat generalists able to utilize a wide variety of habitat types and food resources. These species are also the most common regionally. With respect to functional group, the majority of species were insectivorous gleaners who nested in the tree layer in open cup or cavity nests. Most were moderately or highly tolerant of disturbance.

Within the 50-meter study plots, 42 avian species were detected in 1999 and 38 in 2001 (Appendix D-2). Accompanying this 9% decline in species richness was an overall 38% decrease in the abundance index. The only plot for which avian abundance did not decline was P6, the control plot where *Arundo* was not removed. Avian abundance did not decline linearly with treatment area, however. A possible reason for this will be discussed below.

Three species were common to all plots in 1999: California Towhee, Brown-headed Cowbird, and Mourning Dove. Of these, the California Towhee had the highest importance value. In 2001, six species were common to all six plots: Brown-headed Cowbird, Western Scrub Jay, Bewick's Wren, California Quail, Ash-throated Flycatcher, and Nuttall's Woodpecker. In 2001, Brown-headed Cowbirds had the highest importance value while California Towhees declined 67% in abundance. Several other species also showed changes in abundance index (Appendix D-2). While most species declined in abundance between the two surveys, some species did increase in abundance (Bushtit, Wilson's Warbler, American Goldfinch, and Blue Grosbeak). Notable declines included California Towhee (an endemic species), Mourning Dove, House Sparrow, and Warbling Vireo and Swainson's Thrush (both species of special concern in the Central Valley). Some species detected in 1999 were not detected at all in 2001: Black-headed Grosbeak, Mallard, Pacific-slope Flycatcher, Yellow-billed Magpie, Western Wood Pewee, and Yellow Warbler.

Functional group analysis (Appendix D-4) indicated that abundance decreased across functional groups. Only three groups—winter visitors, brood parasites, and those birds that construct pendant nests—increased in abundance between 1999 and 2001. The increase in winter visitors was likely a sampling artifact caused by the first visit occurring earlier in 2001 than in 1999. The increase in the brood parasite category was attributed to the increases in Brown-headed Cowbirds. The increase in pendant nesters was caused by an 88% increase in Bushtits, a species that constructs pendant nests. While Bushtit occurrence is often highly variable locally, sightings occurred across multiple sites and dates, suggesting that the Bushtits may have established multiple breeding groups in the area in 2001.

DISCUSSION

Vegetation

The *Arundo* eradication measures appeared to be effective at removing most of the *Arundo* biomass while retaining the tree and large shrub strata. Despite the fact that over 20% of the vegetative cover had been removed during *Arundo* eradication, species height class richness increased 13% (21 additional species height classes) between 1999 and 2001. This increase appeared to be due to release and recruitment of native seedlings and ruderal herbaceous species in the AEPs. In addition, many of the mature trees were sprouting new branches below the canopy where they had been previously suppressed by the *Arundo*. The *Arundo* mulch appeared to be fairly effective in suppressing weeds, since most of the ruderal species recruitment occurred in areas where the mulch was relatively thin. Weed suppression in the revegetating AEPs will be especially important since about half of all new species observed in 2001 were nonnative recruits.

A substantial amount of habitat heterogeneity was detected between study plots. This is consistent with the variable nature of riparian habitats, especially braided, aggrading streams like Cache Creek. Habitat heterogeneity along Central Valley streams has also resulted from a legacy of disturbance. While naturally heterogeneous habitats generally support a high degree of biodiversity, anthropogenically disturbed habitats do not. It will be important in the future to minimize anthropogenic sources of disturbance and to encourage natural floodplain disturbance processes.

Avifauna

In general, avian abundance declined as a result of *Arundo* removal. No declines in overall abundance were noted for control plot 6. The relationship between avian abundance and treatment area was not linear however since avian abundance for the two plots containing the greatest infestation area of Arundo (plots 4 and 5) did not decrease as much as for the two plots with intermediate levels of infestation (plots 2 and 3). This may be because plots 4 and 5 were already so highly invaded that avian richness was already compromised. Plots 4 and 5 did originally host fewer bird species and lower avian abundance than did plots 2 and 3. Put another way, changes wrought by weed eradication may have had a disproportionately greater effect on bird richness and abundance in plots 2 and 3 since there were more birds there to begin with and more native habitat was impacted by the treatment. Within these two groups, however, avian declines were greater in plots 5 and 3 which had higher levels of Arundo infestation than did plots 4 and 2.

California Towhee declines and concomitant increases in Brown-headed Cowbird abundance may have been the direct result of *Arundo* removal. Towhees, both California and Spotted, prefer dense shrub habitats. They are also some of the few species that we've observed nesting in *Arundo donax*. (Another species commonly found in *Arundo* thickets, the Song Sparrow, also declined in abundance between the two sampling periods.) Brown-headed Cowbirds prefer edges and open woodlands and generally do not venture far into densely wooded habitats. Thus, the removal of dense Arundo thickets could have created more opportunities for this species to invade riparian habitats. Since this brood parasite has been implicated in the decline of several species, it will be important to monitor its population dynamics and resulting impacts on local avifauna.

The increase in the shrub bird guild was largely a result of an increase in abundance of Golden-crowned Sparrows and Wilson's Warblers. While observed increases in winter resident sparrows was probably the result of sampling earlier in the season in 2001, increases in Wilson's Warblers may signal a preference by these shrub-nesting migrants for habitats with reduced *Arundo* understory. It is interesting that these birds were detected late into the breeding season in good numbers. More data is needed to ascertain whether any relationships exist.

The *Arundo* eradication process likely played a significant role in the observed variation in avian abundance between the two sampling periods, particularly in light of the amount of noise and disturbance that accompanied weed eradication and the profound changes wrought to the riparian community. Another follow-up survey is scheduled for 2003, the results of which will be instructive in documenting further changes to the riparian community, including recruitment of vegetation and response of avian communities following weed eradication.

LITERATURE CITED

Bibby, C.J., Burgess, N.D. and D.A. Hill. Bird Census Techniques. British Trust for Ornithology and the Royal Society for the Protection of Birds. Academic Press, Harcourt Brace & Company, London.

Ehrlich, P. R., D. S. Dobkin, and D. Wheye. 1988. The Birder's Handbook: A Field Guide to the Natural History of North American Birds. Simon & Schuster.

Mueller-Dombois, D. and H. Ellenberg. 1974. Aims and methods of vegetation science. Wiley, New York, NY.

Ralph, C.J., G.R. Geupel, P. Pyle, T.E. Martin, D.F. DeSante. 1993. Handbook of field methods for monitoring landbirds. Gen. Tech. Rep. PSW-GTR-144. Albany, CA: Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture; 41 p.

Sawyer, J.O. and Todd Keeler-Wolf. 1995. A Manual of California Vegetation. California Native Plant Society, Sacramento, CA.

Appendix A
Table 1

GEOGRAPHIC LOCATIONS OF SURVEY PLOTS/POINT COUNT STATIONS

Station	Latitude	Longitude
P1	38.689545315	-121.870643933
P2	38.689292750	-121.871745832
P3	38.688933280	-121.873819065
P4	38.688042024	-121.874793367
P5	38.686749124	-121.876766330
P6	38.686132611	-121.879107289

Table 2

AREAL EXTENT OF ARUNDO ERADICATION PATCHES

AEP	Perimeter (m)	Area (hectares)
P1 east	158.70	0.027
P1 west	66.00	0.015
P2 east	49.49	0.004
P2 south	171.70	0.058
P3	182.90	0.088
P4 main	251.20	0.107
P4 east	33.84	0.005
P4 north	21.85	0.003
P5	431.00	0.137

Appendix B1
PLANT SPECIES LIST

Species	Status	Species	Status
Ambrosia artemisiifolia	Exotic	Leymus triticoides	Native
Aquatic macrophytes		Lotus corniculatus	Exotic
Artemisia douglasiana	Native	Lythrum californicum	Native
Arundo donax	Exotic	Lythrum salicaria	Exotic
Anthriscus caucalis	Exotic	Malva neglecta	Exotic
Atriplex triangularis	Native	Marah fabaceus	Native
Avena sp.		Marrubium vulgare	Exotic
Baccharis pilularis	Native	Melilotus alba	Exotic
Baccharis salicifolia	Native	Mentha arvensis	Native
Bidens frondosa	Native	Muhlenbergia asperifolia	Native
Brassica nigra	Exotic	Nicotiana glauca	Exotic
Bromus diandrus	Exotic	Nicotiana sylvestris	Exotic
Bromus hordeaceus	Exotic	Oenothera glazioviana	Exotic
Carex nebrascensis	Native	Paspalum dilatatum	Exotic
Carex senta	Native	Plantago sp.	
Cephalanthus occidentalis	Native	Phorodendron macrophyllum	Native
Centaurea calcitrapa	Exotic	Phyla nodiflora	Native
Centaurea solstitialis	Exotic	Piptatherum miliaceum	Exotic
Chamaesyce serpyllifolia ssp. serpyllifolia	Native	Polygonum lapathifolium	Native
Chenopodium album	Exotic	Polygonum punctatum	Native
Chenopodium ambrosioides	Exotic	Polypogon maritimus	Exotic
Chenopodium berlandieri	Native	Polypogon monspeliensis	Exotic
Chenopodium botrys	Exotic	Populus fremontii	Native
Chenopodium californicum	Native	Prunus dulcis	Exotic
Cirsium arvense	Exotic	Quercus lobata	Native
Conium maculatum	Exotic	Quercus wislizenii	Native
Convolvulus arvensis	Exotic	Rhamnus californica	Native
Conyza bonariensis	Exotic	Rosa californica	Native
Crepis setosa	Exotic	Rubus discolor	Exotic
Cynodon dactylon	Exotic	Rubus ursinus	Native
Cyperus odoratus	Native	Rumex acetosella	Exotic
Digitaria sanguinalis	Exotic	Rumex crispus	Exotic
Dipsacus fullonum	Exotic	Rumex salicifolius var. transitorius	Native
Echinochloa crus-galli	Exotic	Rumex stenophyllus	Exotic
Elymus glaucus	Native	Saccharum ravennae	Exotic
Equisetum arvense	Native	Salix exigua	Native
Eremocarpus setigerus	Native	Salix laevigata	Native
Erodium cicutarium	Exotic	Salix lucida ssp. lasiandra	Native
Euthamia occidentalis	Native	Salix gooddingii	Native
Ficus carica	Exotic	Salsola tragus	Exotic
Galium aparine	Native	Sambucus mexicana	Native
Gnapthalium luteo-album	Exotic	Scirpus acutus	Native
Grindelia squarrosa	Exotic	Scirpus maritimus	Native
Gutierrezia sarothrae	Native	Scirpus pungens	Native
Helenium puberulum	Native	Senecio vulgaris	Exotic
Heliotropium curassavicum	Native	Silybum marianum	Exotic
Heteromeles arbutifolia	Native	Sonchus arvensis	Exotic
Heterotheca oregona	Native	Sorghum halepense	Exotic
Hordeum sp.		Stachys albens	Native
Juglans californica var. hindsii	Native	Tamarix parviflora	Exotic
Juncus balticus	Native	Taraxacum officinale	Exotic
Juncus xiphioides	Native	Toxicodendron diversilobum	Native
Kickxia elatine	Exotic	Typha spp. (latifolia dominant)	Native
Lactuca serriola	Exotic	Verbascum blattaria	Exotic
Lepidium latifolium	Exotic	Xanthium strumarium	Exotic

Appendix B2
PLANT SPECIES HEIGHT CLASS, % COVER, FREQUENCY, AND IMPORTANCE VALUE (IV) Plots Pooled

1999						2001				
SPECIES	Ht Class	% Cover	Freq.	IV		SPECIES	Ht Class	% Cover	Freq.	IV
TREE LAYER (>10 m)	T1	25.76%	1.00	0.63		TREE LAYER (>10 m)	T1	25.76%	1.00	0.63
TREE LAYER (5-10 m)	T2	28.60%	1.00	0.64		TREE LAYER (5-10 m)	T2	28.60%	1.00	0.64
SHRUB LAYER (2-5 m)	S1	39.58%	1.00	0.70		SHRUB LAYER (2-5 m)	S1	25.76%	1.00	0.63
SHRUB LAYER (<2 m)	S2	35.80%	1.00	0.68		SHRUB LAYER (<2 m)	S2	26.33%	1.00	0.63
HERBACEOUS LAYER	H	62.50%	1.00	0.81		HERBACEOUS LAYER		62.50%	1.00	0.81
MARSH	M	5.30%	0.67	0.36		MARSH	M	5.30%	0.67	0.36
BARE GROUND	BG	32.58%	1.00	0.66		BARE GROUND	BG	19.51%	1.00	0.60
WOODY DEBRIS	WD	11.36%	1.00	0.56		WOODY DEBRIS	WD	11.36%	1.00	0.56
OPEN WATER	WA	9.47%	0.67	0.38		OPEN WATER	WA	9.47%	0.67	0.38
LEAF LITTER	LF	23.86%	1.00	0.62		LEAF LITTER	LF	21.97%	1.00	0.61
ARUNDO LITTER	AL	6.82%	1.00	0.53		ARUNDO LITTER	AL	14.77%	1.00	0.57
SNAG	T1	0.76%	0.33	0.17		SNAG	T1	0.76%	0.33	0.17
SNAG	T2	1.14%	0.33	0.17		SNAG	T2	1.14%	0.33	0.17
Arundo donax	S1	25.76%	1.00	0.63		Annual grasses (senesced)	H	45.83%	0.83	0.65
Populus fremontii	T1	19.51%	1.00	0.60		Cynodon dactylon	H	21.97%	1.00	0.61
Annual grasses (senesced)	H	34.85%	0.83	0.59		Populus fremontii	T1	19.51%	1.00	0.60
Cynodon dactylon	H	10.98%	1.00	0.55		Salix exigua	S1	13.45%	1.00	0.57
Arundo donax	S2	9.47%	1.00	0.55		Populus fremontii	T2	11.36%	1.00	0.56
Populus fremontii	T2	9.47%	1.00	0.55		Baccharis salicifolia	S2	10.98%	1.00	0.55
Baccharis salicifolia	S2	9.09%	1.00	0.55		Leymus triticoides (bottomland, green but drying)	H	9.09%	1.00	0.55
Leymus triticoides (bottomland)	H	9.09%	1.00	0.55		Salix exigua	S2	9.09%	1.00	0.55
Salix exigua	S1	9.09%	1.00	0.55		Toxicodendron diversilobum	S2	9.09%	1.00	0.55
Salix exigua	S2	7.58%	1.00	0.54		Tamarix parviflora	S2	7.58%	1.00	0.54
Tamarix parviflora	S2	7.58%	1.00	0.54		Arundo donax	Sprouts	6.44%	1.00	0.53
Toxicodendron diversilobum	S2	7.20%	1.00	0.54		Brassica nigra	H	5.30%	1.00	0.53
Brassica nigra	H	4.92%	1.00	0.52		Quercus lobata	Seedling	4.92%	1.00	0.52

Appendix B2
PLANT SPECIES HEIGHT CLASS, % COVER, FREQUENCY, AND IMPORTANCE VALUE (IV) Plots Pooled

1999						2001				
SPECIES	Ht Class	% Cover	Freq.	IV		SPECIES	Ht Class	% Cover	Freq.	IV
Quercus lobata	Seedling	4.92%	1.00	0.52		Cirsium arvense	H	14.39%	0.83	0.49
Cirsium arvense	H	12.50%	0.83	0.48		Arundo donax	S1	11.74%	0.83	0.48
Salix laevigata	T2	10.23%	0.83	0.47		Salix laevigata	T2	10.23%	0.83	0.47
Tamarix parviflora	S1	9.66%	0.83	0.46		Tamarix parviflora	S1	9.66%	0.83	0.46
Salix gooddingii	T2	8.52%	0.83	0.46		Salix gooddingii	T2	8.52%	0.83	0.46
Centaurea solstitialis	H	5.87%	0.83	0.45		Piptatherum miliaceum	H	8.14%	0.83	0.46
Piptatherum miliaceum	H	5.87%	0.83	0.45		Silybum marianum	H	8.14%	0.83	0.46
Arundo donax	Sprouts	4.73%	0.83	0.44		Baccharis salicifolia	S1	5.87%	0.83	0.45
Baccharis salicifolia	S1	3.98%	0.83	0.44		Euthamia occidentalis	H	4.36%	0.83	0.44
Euthamia occidentalis	H	3.98%	0.83	0.44		Polypogon monspeliensis	H	3.98%	0.83	0.44
Populus fremontii	Seedling	3.98%	0.83	0.44		Centaurea solstitialis	H	3.60%	0.83	0.43
Rumex crispus	H	3.22%	0.83	0.43		Toxicodendron diversilobum	Liana	3.60%	0.83	0.43
Lactuca serriola	H	2.84%	0.83	0.43		Rumex crispus	H	3.22%	0.83	0.43
Juglans californica var. hindsii	Seedling	2.46%	0.83	0.43		Lactuca serriola	H	2.84%	0.83	0.43
Arundo donax	T2	7.58%	0.67	0.37		Salix laevigata	Sprouts	2.84%	0.83	0.43
Silybum marianum	H	7.58%	0.67	0.37		Lepidium latifolium	H	7.58%	0.67	0.37
Lepidium latifolium	H	5.68%	0.67	0.36		Salix gooddingii	T1	5.30%	0.67	0.36
Salix gooddingii	T1	5.30%	0.67	0.36		Cyperus odoratus	H	3.41%	0.67	0.35
Salix laevigata	S2	3.03%	0.67	0.35		Populus fremontii	Seedling	3.41%	0.67	0.35
Toxicodendron diversilobum	Liana	3.03%	0.67	0.35		Artemisia douglasiana	H	3.03%	0.67	0.35
Artemisia douglasiana	H	2.65%	0.67	0.35		Populus fremontii	Sapling	3.03%	0.67	0.35
Marrubium vulgare	H	2.65%	0.67	0.35		Salix laevigata	S1	3.03%	0.67	0.35
Convolvulus arvensis	H	2.27%	0.67	0.34		Xanthium strumarium	H	3.03%	0.67	0.35
Quercus lobata	Sapling	2.27%	0.67	0.34		Marrubium vulgare	H	2.65%	0.67	0.35
Salix laevigata	T1	6.25%	0.50	0.28		Quercus lobata	Sapling	2.65%	0.67	0.35
Juglans californica var. hindsii	T2	5.87%	0.50	0.28		Chamaesyce serpyllifolia ssp. serpyllifolia	H	2.27%	0.67	0.34
Sambucus mexicana	S1	5.87%	0.50	0.28		Convolvulus arvensis	H	2.27%	0.67	0.34

Appendix B2
PLANT SPECIES HEIGHT CLASS, % COVER, FREQUENCY, AND IMPORTANCE VALUE (IV) Plots Pooled

1999						2001				
SPECIES	Ht Class	% Cover	Freq.	IV		SPECIES	Ht Class	% Cover	Freq.	IV
Rosa californica	S1	4.36%	0.50	0.27		Helenium puberulum	H	2.27%	0.67	0.34
Toxicodendron diversilobum	S1	4.36%	0.50	0.27		Juglans californica var. hindsii	Seedling	2.27%	0.67	0.34
Equisetum arvense	H	2.84%	0.50	0.26		Rumex salicifolius var. transitorius	H	2.27%	0.67	0.34
Melilotus alba	H	2.84%	0.50	0.26		Salix laevigata	T1	6.25%	0.50	0.28
Phyla nodiflora	H	2.84%	0.50	0.26		Juglans californica var. hindsii	T2	5.87%	0.50	0.28
Polypogon monspeliensis	H	2.84%	0.50	0.26		Sambucus mexicana	S1	5.87%	0.50	0.28
Xanthium strumarium	H	2.84%	0.50	0.26		Melilotus alba	H	4.73%	0.50	0.27
Ambrosia artemisiifolia	H	2.46%	0.50	0.26		Phyla nodiflora	H	4.73%	0.50	0.27
Juncus balticus	H	2.46%	0.50	0.26		Rosa californica	S1	4.36%	0.50	0.27
Salix laevigata	S1	2.46%	0.50	0.26		Toxicodendron diversilobum	S1	4.36%	0.50	0.27
Sambucus mexicana	S2	2.46%	0.50	0.26		Polypogon maritimus		3.98%	0.50	0.27
Carex nebrascensis	H	2.08%	0.50	0.26		Avena sp.	H	3.60%	0.50	0.27
Crepis setosa	H	2.08%	0.50	0.26		Equisetum arvense	H	2.84%	0.50	0.26
Salix exigua	Sapling	2.08%	0.50	0.26		Ambrosia artemisiifolia	H	2.46%	0.50	0.26
Scirpus acutus	H	2.08%	0.50	0.26		Juncus balticus	H	2.46%	0.50	0.26
Chamaesyce serpyllifolia ssp. serpyllifolia	H	1.70%	0.50	0.26		Sambucus mexicana	S2	2.46%	0.50	0.26
Helenium puberulum	H	1.70%	0.50	0.26		Carex nebrascensis	H	2.08%	0.50	0.26
Heliotropium curassavicum	H	1.70%	0.50	0.26		Crepis setosa	H	2.08%	0.50	0.26
Juglans californica var. hindsii	Sapling	1.70%	0.50	0.26		Juglans californica var. hindsii	Sapling	2.08%	0.50	0.26
Lotus corniculatus	H	1.70%	0.50	0.26		Lythrum californicum	H	2.08%	0.50	0.26
Marah fabaceus	Liana	1.70%	0.50	0.26		Scirpus acutus	H	2.08%	0.50	0.26
Rumex salicifolius var. transitorius	H	1.70%	0.50	0.26		Taraxacum officinale	H	2.08%	0.50	0.26
Heterotheca oregona	H	1.33%	0.50	0.26		Typha spp. (latifolia dominant)	H	2.08%	0.50	0.26
Chenopodium album	H	0.95%	0.50	0.25		Bromus hordeaceus	H	1.70%	0.50	0.26
Quercus lobata	T2	5.68%	0.33	0.20		Gnapthalium luteo-album	H	1.70%	0.50	0.26
Anthriscus caucalis	H	3.79%	0.33	0.19		Heliotropium curassavicum	H	1.70%	0.50	0.26
Bromus diandrus	H	1.89%	0.33	0.18		Kickxia elatine	H	1.70%	0.50	0.26

Appendix B2
PLANT SPECIES HEIGHT CLASS, % COVER, FREQUENCY, AND IMPORTANCE VALUE (IV) Plots Pooled

1999						2001				
SPECIES	**Ht Class**	**% Cover**	**Freq.**	**IV**		**SPECIES**	**Ht Class**	**% Cover**	**Freq.**	**IV**
Populus fremontii	Sapling	1.89%	0.33	0.18		Lotus corniculatus	H	1.70%	0.50	0.26
Salix laevigata	Sprouts	1.89%	0.33	0.18		Marah fabaceus	Liana	1.70%	0.50	0.26
Typha spp. (latifolia dominant)	H	1.89%	0.33	0.18		Chenopodium album	H	1.33%	0.50	0.26
Cyperus odoratus	H	1.52%	0.33	0.17		Heterotheca oregona	H	1.33%	0.50	0.26
Dipsacus fullonum	H	1.52%	0.33	0.17		Quercus lobata	T2	5.68%	0.33	0.20
Lythrum californicum	H	1.52%	0.33	0.17		Anthriscus caucalis	H	3.79%	0.33	0.19
Paspalum dilatatum	H	1.52%	0.33	0.17		Bromus diandrus	H	1.89%	0.33	0.18
Populus fremontii	S2	1.52%	0.33	0.17		Salix laevigata	S2	1.89%	0.33	0.18
Rosa californica	S2	1.52%	0.33	0.17		Aquatic macrophytes (floating: filamentous and feathered)	H	1.52%	0.33	0.17
Rubus discolor	S2	1.52%	0.33	0.17		Arundo donax	S2	1.52%	0.33	0.17
Saccharum ravennae	H	1.52%	0.33	0.17		Dipsacus fullonum	H	1.52%	0.33	0.17
Salix exigua	T2	1.52%	0.33	0.17		Paspalum dilatatum	H	1.52%	0.33	0.17
Salix gooddingii	S2	1.52%	0.33	0.17		Rosa californica	S2	1.52%	0.33	0.17
Salix gooddingii	Sapling	1.52%	0.33	0.17		Saccharum ravennae	H	1.52%	0.33	0.17
Salix lucida ssp. lasiandra	S1	1.52%	0.33	0.17		Salix exigua	T2	1.52%	0.33	0.17
Salix lucida ssp. lasiandra ?	T2	1.52%	0.33	0.17		Salix exigua	Seedling	1.52%	0.33	0.17
Scirpus maritimus	H	1.52%	0.33	0.17		Salix lucida ssp. lasiandra ?	T2	1.52%	0.33	0.17
Scirpus pungens	H	1.52%	0.33	0.17		Salix lucida ssp. lasiandra	S1	1.52%	0.33	0.17
Bromus hordeaceus	H	1.14%	0.33	0.17		Scirpus maritimus	H	1.52%	0.33	0.17
Chenopodium berlandieri	H	1.14%	0.33	0.17		Scirpus pungens	H	1.52%	0.33	0.17
Chenopodium botrys	H	1.14%	0.33	0.17		Chenopodium berlandieri	H	1.14%	0.33	0.17
Galium aparine	H	1.14%	0.33	0.17		Chenopodium botrys	H	1.14%	0.33	0.17
Gnapthalium luteo-album	H	1.14%	0.33	0.17		Conium maculatum	H	1.14%	0.33	0.17
Gutierrezia sarothrae	H	1.14%	0.33	0.17		Galium aparine	H	1.14%	0.33	0.17
Kickxia elatine	H	1.14%	0.33	0.17		Gutierrezia sarothrae	H	1.14%	0.33	0.17
Muhlenbergia asperifolia	H	1.14%	0.33	0.17		Phorodendron macrophyllum	Epiphyte	1.14%	0.33	0.17
Phorodendron macrophyllum	Epiphyte	1.14%	0.33	0.17		Rumex acetosella	H	1.14%	0.33	0.17

Appendix B2
PLANT SPECIES HEIGHT CLASS, % COVER, FREQUENCY, AND IMPORTANCE VALUE (IV) Plots Pooled

1999						2001				
SPECIES	**Ht Class**	**% Cover**	**Freq.**	**IV**		**SPECIES**	**Ht Class**	**% Cover**	**Freq.**	**IV**
Rumex acetosella	H	1.14%	0.33	0.17		Salix gooddingii	S2	1.14%	0.33	0.17
Taraxacum officinale	H	1.14%	0.33	0.17		Atriplex triangularis?	H	0.76%	0.33	0.17
Atriplex triangularis?	H	0.76%	0.33	0.17		Bidens frondosa	H	0.76%	0.33	0.17
Conium maculatum	H	0.76%	0.33	0.17		Grindelia squarrosa	H	0.76%	0.33	0.17
Ficus carica	Sapling	0.76%	0.33	0.17		Muhlenbergia asperifolia	H	0.76%	0.33	0.17
Grindelia squarrosa	H	0.76%	0.33	0.17		Rubus ursinus	S2	0.76%	0.33	0.17
Rubus ursinus	S2	0.76%	0.33	0.17		Arundo donax	T2	2.84%	0.17	0.10
Quercus lobata	T1	2.84%	0.17	0.10		Quercus lobata	T1	2.84%	0.17	0.10
Ficus carica	S1	0.57%	0.17	0.09		Grasses and sedges	H	0.95%	0.17	0.09
Avena sp.	H	0.95%	0.17	0.09		Quercus lobata planted	Seedling	0.95%	0.17	0.09
Grasses and sedges	H	0.95%	0.17	0.09		Rubus discolor	S2	0.95%	0.17	0.09
Nicotiana glauca	S2	0.95%	0.17	0.09		Salix exigua	Sprouts	0.95%	0.17	0.09
Chenopodium ambrosioides	H	0.57%	0.17	0.09		Salix lucida ssp. lasiandra	Seedling	0.95%	0.17	0.09
Chenopodium californicum	H	0.57%	0.17	0.09		Salix gooddingii	Seedling	0.95%	0.17	0.09
Digitaria sanguinalis	H	0.57%	0.17	0.09		Chenopodium ambrosioides	H	0.57%	0.17	0.09
Erodium cicutarium	H	0.57%	0.17	0.09		Chenopodium californicum	H	0.57%	0.17	0.09
Ficus carica	S1	0.57%	0.17	0.09		Conyza bonariensis	H	0.57%	0.17	0.09
Ficus carica	T2	0.57%	0.17	0.09		Digitaria sanguinalis	H	0.57%	0.17	0.09
Juglans californica var. hindsii	S1	0.57%	0.17	0.09		Elymus glaucus	H	0.57%	0.17	0.09
Juglans californica var. hindsii	S2	0.57%	0.17	0.09		Erodium cicutarium	H	0.57%	0.17	0.09
Juncus xiphioides	H	0.57%	0.17	0.09		Ficus carica	T2	0.57%	0.17	0.09
Leymus triticoides (upland)	H	0.57%	0.17	0.09		Ficus carica	S1	0.57%	0.17	0.09
Lythrum salicaria	S2	0.57%	0.17	0.09		Ficus carica	Seedling	0.57%	0.17	0.09
Malva neglecta	H	0.57%	0.17	0.09		Heteromeles arbutifolia	Seedling	0.57%	0.17	0.09
Mentha arvensis	H	0.57%	0.17	0.09		Hordeum sp.	H	0.57%	0.17	0.09
Nicotiana glauca	S1	0.57%	0.17	0.09		Juglans californica var. hindsii	S1	0.57%	0.17	0.09
Nicotiana glauca	T2	0.57%	0.17	0.09		Juglans californica var. hindsii	S2	0.57%	0.17	0.09

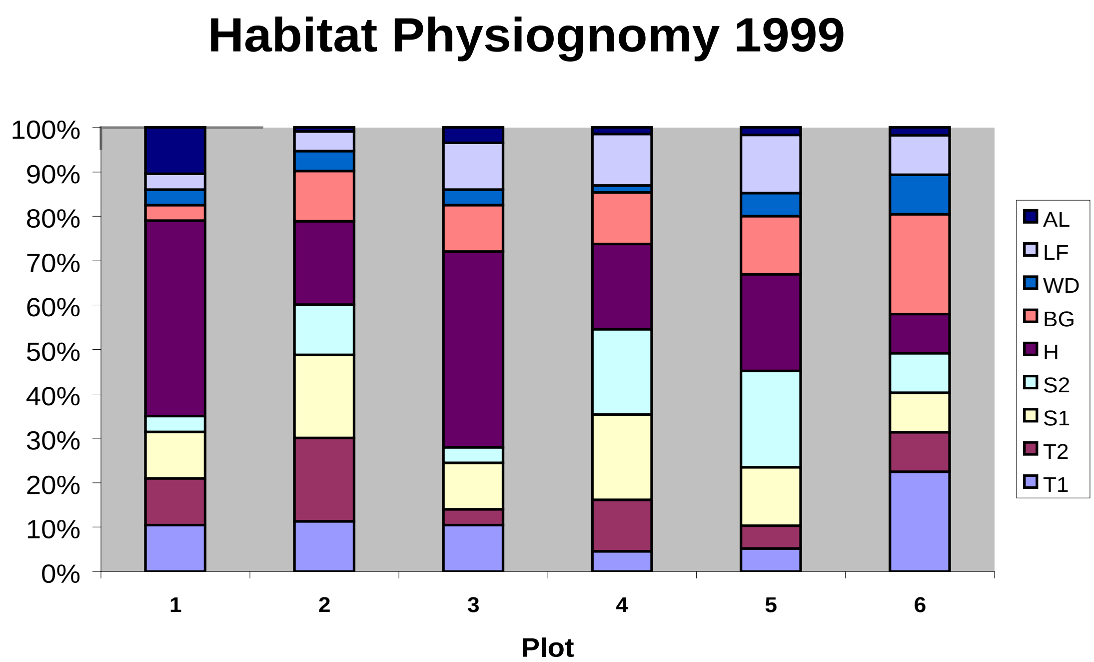
Appendix B2
PLANT SPECIES HEIGHT CLASS, % COVER, FREQUENCY, AND IMPORTANCE VALUE (IV) Plots Pooled

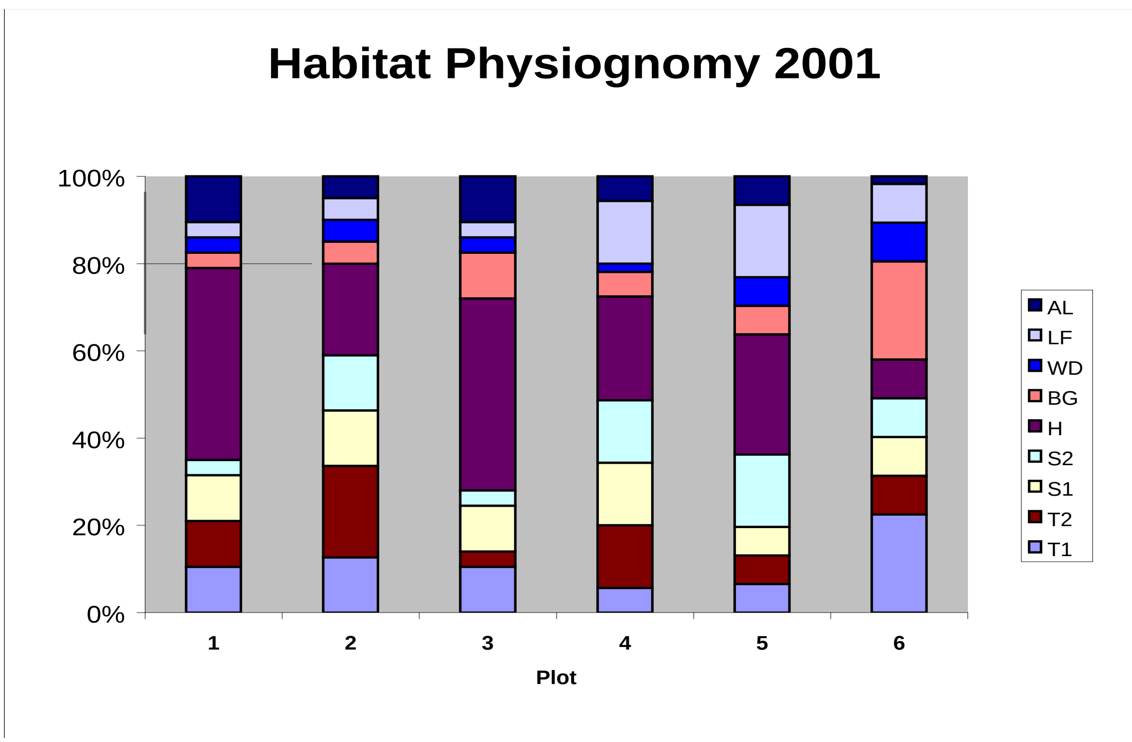
1999						2001				
SPECIES	Ht Class	% Cover	Freq.	IV		SPECIES	Ht Class	% Cover	Freq.	IV
Plantago sp.	H	0.57%	0.17	0.09		Juncus xiphioides	H	0.57%	0.17	0.09
Polygonum lapathifolium	H	0.57%	0.17	0.09		Leymus triticoides (upland, senescing)	H	0.57%	0.17	0.09
Polygonum punctatum	H	0.57%	0.17	0.09		Lythrum salicaria	S2	0.57%	0.17	0.09
Polypogon maritimus	H	0.57%	0.17	0.09		Malva neglecta	H	0.57%	0.17	0.09
Salix exigua	Seedling	0.57%	0.17	0.09		Mentha arvensis	H	0.57%	0.17	0.09
Salix gooddingii	Seedling	0.57%	0.17	0.09		Nicotiana glauca	T2	0.57%	0.17	0.09
Salix lucida ssp. lasiandra	S2	0.57%	0.17	0.09		Nicotiana glauca	S1	0.57%	0.17	0.09
Salix lucida ssp. lasiandra ?	Sapling	0.57%	0.17	0.09		Nicotiana glauca	S2	0.57%	0.17	0.09
Stachys albens	S2	0.57%	0.17	0.09		Nicotiana sylvestris	H	0.57%	0.17	0.09
Artemisia douglasiana	S2	0.19%	0.17	0.08		Oenothera glazioviana	H	0.57%	0.17	0.09
Baccharis pilularis	S1	0.19%	0.17	0.08		Plantago sp.	H	0.57%	0.17	0.09
Carex senta	S2	0.19%	0.17	0.08		Polygonum lapathifolium	H	0.57%	0.17	0.09
Centaurea calcitrapa	H	0.19%	0.17	0.08		Polygonum punctatum	H	0.57%	0.17	0.09
Cephalanthus occidentalis	S2	0.19%	0.17	0.08		Populus fremontii	S2	0.57%	0.17	0.09
Echinochloa crus-galli	H	0.19%	0.17	0.08		Populus fremontii (beaver-felled)	Sprouts	0.57%	0.17	0.09
Lythrum salicaria	S1	0.19%	0.17	0.08		Rhamnus californica	Seedling	0.57%	0.17	0.09
Prunus dulcis	T2	0.19%	0.17	0.08		Rubus discolor	Sprouts	0.57%	0.17	0.09
Rumex stenophyllus	H	0.19%	0.17	0.08		Salix lucida ssp. lasiandra	S2	0.57%	0.17	0.09
Senecio vulgaris	H	0.19%	0.17	0.08		Salix lucida ssp. lasiandra ?	Sapling	0.57%	0.17	0.09
Sorghum halepense	H	0.19%	0.17	0.08		Salix gooddingii	Sapling	0.57%	0.17	0.09
Verbascum blattaria	H	0.19%	0.17	0.08		Salsola tragus et al. (on dirt pile)	H	0.57%	0.17	0.09
Aquatic macrophytes	H	0.00%	0.00	0.00		Senecio vulgaris	H	0.57%	0.17	0.09
Conyza bonariensis	H	0.00%	0.00	0.00		Sonchus arvensis	H	0.57%	0.17	0.09
Elymus glaucus	H	0.00%	0.00	0.00		Stachys albens	S2	0.57%	0.17	0.09
Eremocarpus setigerus	H	0.00%	0.00	0.00		Verbascum blattaria	H	0.57%	0.17	0.09
Ficus carica	Seedling	0.00%	0.00	0.00		Artemisia douglasiana	S2	0.19%	0.17	0.08
Heteromeles arbutifolia	Seedling	0.00%	0.00	0.00		Baccharis pilularis	S1	0.19%	0.17	0.08

Appendix B2
PLANT SPECIES HEIGHT CLASS, % COVER, FREQUENCY, AND IMPORTANCE VALUE (IV) Plots Pooled

1999						2001				
SPECIES	**Ht Class**	**% Cover**	**Freq.**	**IV**		**SPECIES**	**Ht Class**	**% Cover**	**Freq.**	**IV**
Hordeum sp.	H	0.00%	0.00	0.00		Carex senta	S2	0.19%	0.17	0.08
Nicotiana glauca	Seedling	0.00%	0.00	0.00		Cephalanthus occidentalis	S2	0.19%	0.17	0.08
Nicotiana sylvestris	H	0.00%	0.00	0.00		Centaurea calcitrapa	H	0.19%	0.17	0.08
Oenothera glazioviana	H	0.00%	0.00	0.00		Echinochloa crus-galli	H	0.19%	0.17	0.08
Populus fremontii (beaver-felled)	Sprouts	0.00%	0.00	0.00		Ficus carica	Sapling	0.19%	0.17	0.08
Quercus lobata (planted)	Seedling	0.00%	0.00	0.00		Lythrum salicaria	S1	0.19%	0.17	0.08
Quercus wislizenii (planted)	Seedling	0.00%	0.00	0.00		Nicotiana glauca	Seedling	0.19%	0.17	0.08
Rhamnus californica	Seedling	0.00%	0.00	0.00		Prunus dulcis	T2	0.19%	0.17	0.08
Rosa californica	Seedling	0.00%	0.00	0.00		Quercus wislizenii (planted)	Seedling	0.19%	0.17	0.08
Rubus discolor	Sprouts	0.00%	0.00	0.00		Rosa californica	Seedling	0.19%	0.17	0.08
Rubus sp. (too young to id)	S2	0.00%	0.00	0.00		Rubus sp. (too young to discern, prob. Discolor)	S2	0.19%	0.17	0.08
Salix exigua	Sprouts	0.00%	0.00	0.00		Rumex stenophyllus	H	0.19%	0.17	0.08
Salix lucida ssp. lasiandra	Seedling	0.00%	0.00	0.00		Salix exigua	Sapling	0.19%	0.17	0.08
Salsola tragus et al. (on dirt pile)		0.00%	0.00	0.00		Sorghum halepense	H	0.19%	0.17	0.08
Sonchus arvensis	H	0.00%	0.00	0.00		Eremocarpus setigerus	H	0.00%	0.00	0.00
Number of species >>>>	142	441%		34.21		Number of species >>>>	163	486%		37.10

Appendix B3





LEGEND
AL=Arundo Litter
LF=Leaf Litter
WD=Woody Debris
BG=Bare Ground

H=Herbaceous Vegetation
S2=Woody Vegetation (0.3-2m tall)
S1=Woody Vegetation (2-5m tall)
T2=Woody Vegetation (5-8m tall)
T1=Woody Vegetation (>8m tall)

Appendix C1

ARUNDO ERADICATION PATCH PHYSIOGNOMY

1999

SPECIES		1E	1W	2E	2S	3	4	4N	4E	5			Avg % Cover	Freq	IV
TREE LAYER (>10 m)	T1	1	63	0	15	38	15	0	0	15			0.19	0.67	0.43
TREE LAYER (5-10 m)	T2	3	0	0	3	5	15	0	0	5			0.04	0.56	0.30
SHRUB LAYER (2-5 m)	**S1**	**88**	**63**	**38**	**38**	**63**	**63**	**88**	**63**	**63**			**0.72**	**1.00**	**0.86**
SHRUB LAYER (<2 m)	**S2**	**15**	**15**	**15**	**38**	**38**	**38**	**15**	**38**	**38**			**0.32**	**1.00**	**0.66**
HERBACEOUS LAYER	H	15	15	5	15	5	3	3	1	15			0.10	1.00	0.55
BARE GROUND	**BG**	**63**	**15**	**38**	**15**	**15**	**15**	**63**	**38**	**15**			**0.35**	**1.00**	**0.67**
WOODY DEBRIS	WD	3	5	3	5	5	5	0	0	5			0.04	0.78	0.41
LEAF LITTER	LF	5	5	5	5	5	5	5	3	5			0.05	1.00	0.53
ARUNDO LITTER	**AL**	**3**	**3**	**3**	**3**	**15**	**5**	**5**	**3**	**5**			**0.06**	**1.00**	**0.53**
SPECIES		**1E**	**1W**	**2E**	**2S**	**3**	**4**	**4N**	**4E**	**5**					
TREE LAYER (>10 m)	T1	1	63	0	15	38	15	0	0	15			0.19	0.67	0.43
TREE LAYER (5-10 m)	T2	3	0	0	3	5	15	0	0	5			0.04	0.56	0.30
SHRUB LAYER (2-5 m)	**S1**	**0**	**0**	**0**	**3**	**0**	**3**	**0**	**0**	**3**			**0.01**	**0.33**	**0.17**
SHRUB LAYER (<2 m)	**S2**	**3**	**3**	**3**	**5**	**0**	**3**	**5**	**15**	**3**			**0.05**	**0.89**	**0.47**
HERBACEOUS LAYER	H	15	15	5	15	5	3	0	1	5			0.08	0.89	0.48
BARE GROUND	**BG**	**3**	**0**	**0**	**3**	**3**	**3**	**0**	**0**	**3**			**0.02**	**0.56**	**0.29**
WOODY DEBRIS	WD	3	5	3	5	5	3	0	0	5			0.04	0.78	0.41
LEAF LITTER	LF	0	0	0	0	0	0	0	0	0			0.00	0.00	0.00
ARUNDO LITTER	**AL**	**63**	**88**	**88**	**63**	**63**	**63**	**88**	**88**	**63**			**0.84**	**1.00**	**0.92**

Figure C1a.
Arundo Plot Physiognomy 1999

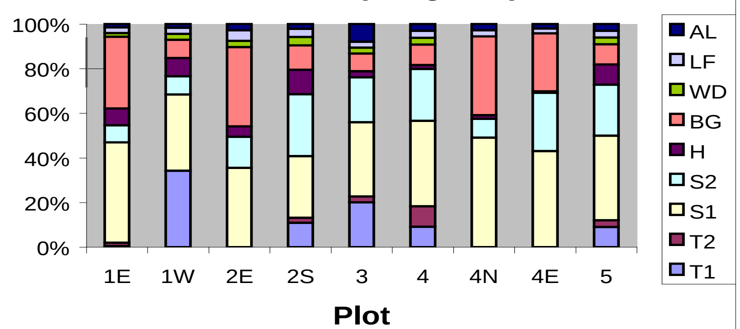
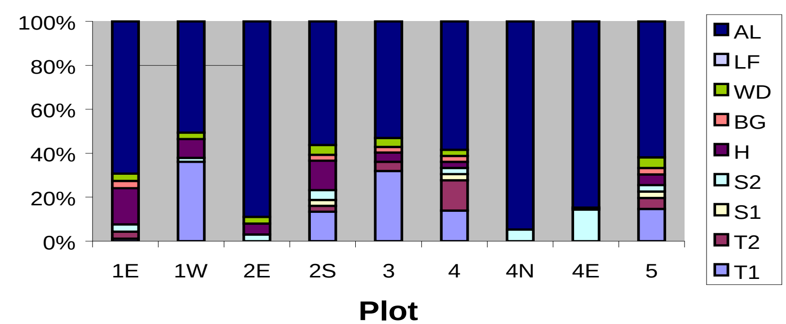


Figure C1b.
Arundo Plot Physiognomy 2001



Appendix C2

ARUNDO ERADICATION PATCH % COVER, FREQUENCY AND IMPORTANCE VALUE

1999							2001					
Species	**Strata**	**Status**	**% Cover**	**Freq.**	**IV**		**Species**	**Strata**	**Status**	**% Cover**	**Freq.**	**IV**
Arundo donax	**S1**	**E**	**74.75%**	**1.00**	**0.87**		**Arundo donax**	**Sprouts**	**E**	**9.22%**	**1.00**	**0.55**
Arundo donax	**S2**	**E**	**31.57%**	**1.00**	**0.66**		Bromus hordeaceus	H	E	2.15%	0.56	0.29
Arundo donax	**Sprouts**	**E**	**3.41%**	**1.00**	**0.52**		**Cirsium arvense**	**H**	**E**	**2.15%**	**0.56**	**0.29**
Populus fremontii	T1	N	4.04%	0.44	0.24		**Quercus lobata**	**Seedling**	**N**	**1.64%**	**0.56**	**0.29**
Salix gooddingii	T2	N	3.28%	0.44	0.24		Populus fremontii	T1	N	4.04%	0.44	0.24
Toxicodendron diversilobum	S2	N	1.77%	0.44	0.23		Toxicodendron diversilobum	S2	N	1.77%	0.44	0.23
Leymus triticoides (bottomland)	H	N	1.14%	0.33	0.17		Leymus triticoides (bottomland, green but drying)	H	N	1.52%	0.44	0.23
Tamarix parviflora	S2	E	1.14%	0.33	0.17		Euthamia occidentalis	H	N	1.01%	0.44	0.23
Salix gooddingii	S2	N	0.88%	0.33	0.17		Salix gooddingii	T2	N	2.90%	0.33	0.18
Salix gooddingii	Seedling	N	0.88%	0.33	0.17		Taraxacum officinale	H	E	1.64%	0.33	0.17
Populus fremontii	T2	N	2.27%	0.22	0.12		Bromus diandrus	H	E	1.39%	0.33	0.17
Salix laevigata	T1	N	2.02%	0.22	0.12		Polypogon monspeliensis	H	E	1.39%	0.33	0.17
Salix exigua	**Sapling**	**N**	**1.01%**	**0.22**	**0.12**		Brassica nigra	H	E	1.14%	0.33	0.17
Baccharis salicifolia	S2	N	0.76%	0.22	0.11		Rumex salicifolius var. transitorius	H	N	1.14%	0.33	0.17
Quercus lobata	**Seedling**	**N**	**0.76%**	**0.22**	**0.11**		Silybum marianum	H	E	1.14%	0.33	0.17
Salix exigua	S2	N	0.76%	0.22	0.11		Tamarix parviflora	S2	E	1.14%	0.33	0.17
Tamarix parviflora	S1	E	0.76%	0.22	0.11		Avena sp.	H		0.88%	0.33	0.17
Salix exigua	**Seedling**	**N**	**0.51%**	**0.22**	**0.11**		Xanthium strumarium	H	E	0.63%	0.33	0.17
Salix laevigata	T2	N	0.51%	0.22	0.11		Populus fremontii	T2	N	2.27%	0.22	0.12
Salix gooddingii	T1	N	1.89%	0.11	0.07		Salix laevigata	T1	N	2.02%	0.22	0.12
Salix exigua	S1	N	0.63%	0.11	0.06		Salix exigua	S2	N	1.26%	0.22	0.12
Atriplex triangularis?	H	N	0.38%	0.11	0.06		Crepis setosa	H	E	1.01%	0.22	0.12
Baccharis salicifolia	S1	N	0.38%	0.11	0.06		Cynodon dactylon	H	E	1.01%	0.22	0.12
Bromus diandrus	H	E	0.38%	0.11	0.06		**Salix exigua**	**Seedling**	**N**	**1.01%**	**0.22**	**0.12**
Bromus hordeaceus	H	E	0.38%	0.11	0.06		Baccharis salicifolia	S2	N	0.76%	0.22	0.11
Centaurea solstitialis	H	E	0.38%	0.11	0.06		Chamaesyce serpyllifolia ssp. serpyllifolia	H	N	0.76%	0.22	0.11
Cirsium arvense	H	E	0.38%	0.11	0.06		Polypogon maritimus		E	0.76%	0.22	0.11
Cynodon dactylon	H	E	0.38%	0.11	0.06		**Populus fremontii**	**Seedling**	**N**	**0.76%**	**0.22**	**0.11**
Ficus carica	S1	E	0.38%	0.11	0.06		Tamarix parviflora	S1	E	0.76%	0.22	0.11
Ficus carica	Sapling	E	0.38%	0.11	0.06		Lactuca serriola	H	E	0.51%	0.22	0.11
Helenium puberulum	H	N	0.38%	0.11	0.06		Salix laevigata	T2	N	0.51%	0.22	0.11

Appendix C2

ARUNDO ERADICATION PATCH % COVER, FREQUENCY AND IMPORTANCE VALUE

1999							2001					
Species	**Strata**	**Status**	**% Cover**	**Freq.**	**IV**		**Species**	**Strata**	**Status**	**% Cover**	**Freq.**	**IV**
Juncus xiphioides	H	N	0.38%	0.11	0.06		Salix gooddingii	S2	N	0.51%	0.22	0.11
Lepidium latifolium	H	E	0.38%	0.11	0.06		**Juglans californica var. hindsii**	**Seedling**	**N**	**0.25%**	**0.22**	**0.11**
Lythrum californicum	H	N	0.38%	0.11	0.06		**Salix laevigata**	**Sprouts**	**N**	**0.25%**	**0.22**	**0.11**
Marah fabaceus	Liana	N	0.38%	0.11	0.06		Ambrosia artemisiifolia	H	E	0.63%	0.11	0.06
Muhlenbergia asperifolia	H	N	0.38%	0.11	0.06		**Cyperus odoratus**	**H**	**N**	**0.63%**	**0.11**	**0.06**
Nicotiana glauca	S2	E	0.38%	0.11	0.06		Piptatherum miliaceum	H	E	0.63%	0.11	0.06
Piptatherum miliaceum	H	E	0.38%	0.11	0.06		Salix exigua	S1	N	0.63%	0.11	0.06
Rubus discolor	S2	E	0.38%	0.11	0.06		Salix exigua	Sprouts	N	0.63%	0.11	0.06
Salix exigua	T2	N	0.38%	0.11	0.06		Artemisia douglasiana	H	N	0.38%	0.11	0.06
Toxicodendron diversilobum	Liana	N	0.38%	0.11	0.06		Annual grasses (senesced)	H		0.38%	0.11	0.06
Rubus ursinus	S2	N	0.13%	0.11	0.06		Atriplex triangularis?	H	N	0.38%	0.11	0.06
Saccharum ravennae	H	E	0.13%	0.11	0.06		Baccharis salicifolia	S1	N	0.38%	0.11	0.06
Salix lucida ssp. lasiandra ?	T2	N	0.13%	0.11	0.06		Centaurea solstitialis	H	E	0.38%	0.11	0.06
Number of species >>>>>	**44**	**27**	**142.68%**		**5.94**		Conyza bonariensis	H	E	0.38%	0.11	0.06
							Dipsacus fullonum	H	E	0.38%	0.11	0.06
								S1	E	0.38%	0.11	0.06
							Ficus carica	Seedling	E	0.38%	0.11	0.06
							Helenium puberulum	H	N	0.38%	0.11	0.06
							Hordeum sp.	H		0.38%	0.11	0.06
							Juncus xiphioides	H	N	0.38%	0.11	0.06
							Kickxia elatine	H	E	0.38%	0.11	0.06
							Lepidium latifolium	H	E	0.38%	0.11	0.06
							Lythrum californicum	H	N	0.38%	0.11	0.06
							Marah fabaceus	Liana	N	0.38%	0.11	0.06
							Melilotus alba	H	E	0.38%	0.11	0.06
							Muhlenbergia asperifolia	H	N	0.38%	0.11	0.06
							Nicotiana glauca	S2	E	0.38%	0.11	0.06
							Quercus lobata	Sapling	N	0.38%	0.11	0.06
							Rubus discolor	Sprouts	E	0.38%	0.11	0.06
							Rumex acetosella	H	E	0.38%	0.11	0.06
							Salix exigua	T2	N	0.38%	0.11	0.06
							Salix laevigata	S1	N	0.38%	0.11	0.06

Appendix C2

ARUNDO ERADICATION PATCH % COVER, FREQUENCY AND IMPORTANCE VALUE

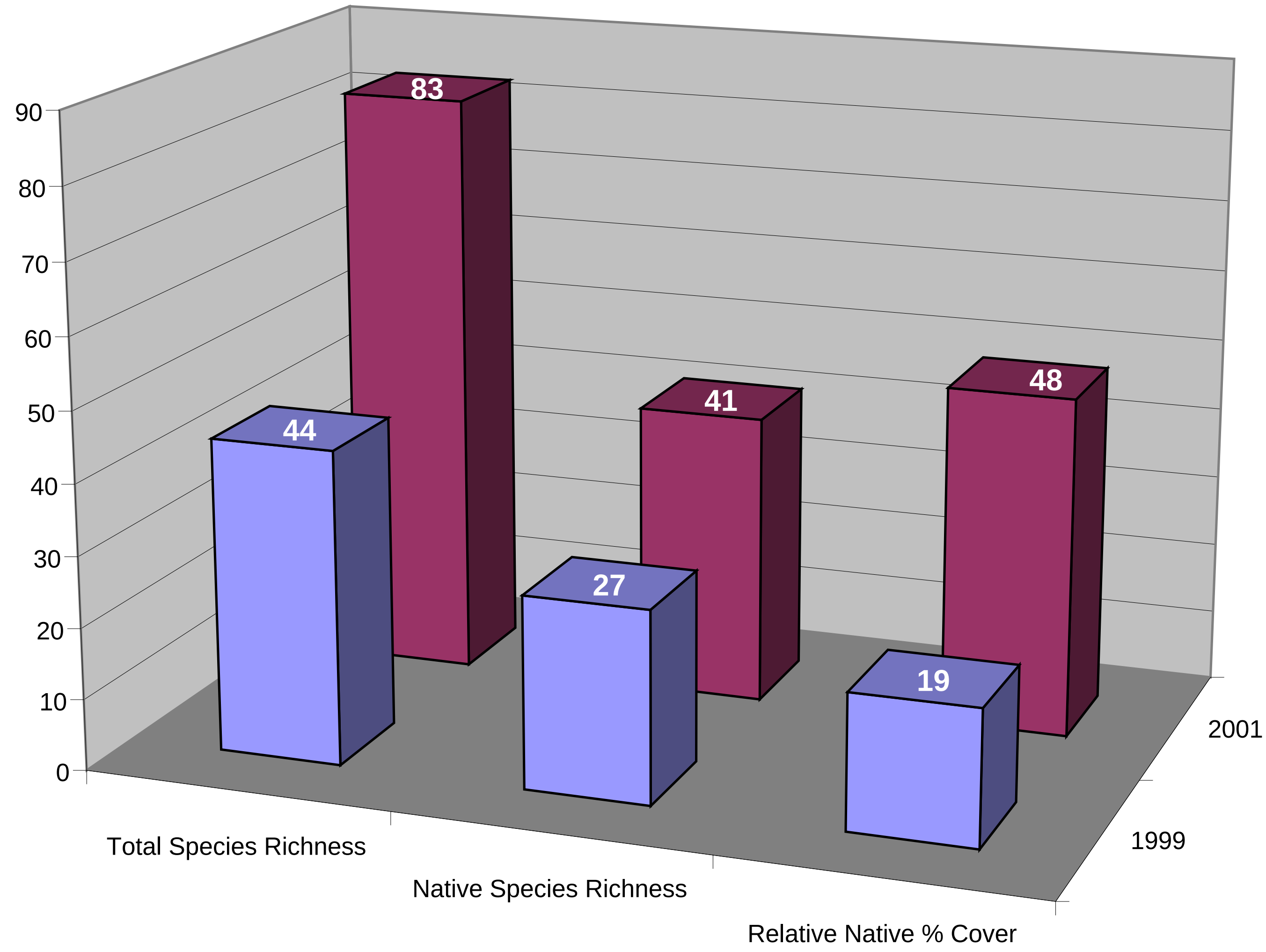
1999							2001					
Species	**Strata**	**Status**	**% Cover**	**Freq.**	**IV**		**Species**	**Strata**	**Status**	**% Cover**	**Freq.**	**IV**
							Salix gooddingii	Seedling	N	0.38%	0.11	0.06
							Salix gooddingii	Sapling	N	0.38%	0.11	0.06
							Sonchus arvensis	H	E	0.38%	0.11	0.06
							Toxicodendron diversilobum	Liana	N	0.38%	0.11	0.06
							Chenopodium album	H	E	0.13%	0.11	0.06
							Conium maculatum	H	E	0.13%	0.11	0.06
							Convolvulus arvensis	H	E	0.13%	0.11	0.06
							Eremocarpus setigerus	H	N	0.13%	0.11	0.06
							Heterotheca oregona	H	N	0.13%	0.11	0.06
							Nicotiana glauca	Seedling	E	0.13%	0.11	0.06
							Nicotiana sylvestris	H	E	0.13%	0.11	0.06
							Populus fremontii (beaver-felled)	Sprouts	N	0.13%	0.11	0.06
							Rubus ursinus	S2	N	0.13%	0.11	0.06
	1999	**2001**					Rubus sp. (too young to discern, prob. Discolor)	S2		0.13%	0.11	0.06
Total Species Richness	**44**	**83**					Rumex crispus	H	E	0.13%	0.11	0.06
Native Species Richness	**27**	**41**					Saccharum ravennae	H	E	0.13%	0.11	0.06
Relative Native % Cover	**19**	**48**					Salix exigua	Sapling	N	0.13%	0.11	0.06
							Salix lucida ssp. lasiandra ?	T2	N	0.13%	0.11	0.06
							Senecio vulgaris	H	E	0.13%	0.11	0.06
							Verbascum blattaria	H	E	0.13%	0.11	0.06
							Number of species >>>>>	**83**	**41**	**67.05%**		**8.72**

Appendix C3

SPECIES NEW TO ARUNDO ERADICATION PATCHES IN 2001

Species	Strata	Status	% Cover	Freq	IV
Ambrosia artemisiifolia	H	E	0.63%	0.11	0.06
Annual grasses (senesced)	H		0.38%	0.11	0.06
Artemisia douglasiana	H	N	0.38%	0.11	0.06
Brassica nigra	H	E	1.14%	0.33	0.17
Chamaesyce serpyllifolia ssp. serpyllifolia	H	N	0.76%	0.22	0.11
Chenopodium album	H	E	0.13%	0.11	0.06
Conium maculatum	H	E	0.13%	0.11	0.06
Convolvulus arvensis	H	E	0.13%	0.11	0.06
Conyza bonariensis	H	E	0.38%	0.11	0.06
Crepis setosa	H	E	1.01%	0.22	0.12
Cyperus odoratus	H	N	0.63%	0.11	0.06
Dipsacus fullonum	H	E	0.38%	0.11	0.06
Eremocarpus setigerus	H	N	0.13%	0.11	0.06
Euthamia occidentalis	H	N	1.01%	0.44	0.23
Ficus carica	Seedling	E	0.38%	0.11	0.06
Heterotheca oregona	H	N	0.13%	0.11	0.06
Hordeum sp.	H		0.38%	0.11	0.06
Juglans californica var. hindsii	Seedling	N	0.25%	0.22	0.11
Kickxia elatine	H	E	0.38%	0.11	0.06
Lactuca serriola	H	E	0.51%	0.22	0.11
Melilotus alba	H	E	0.38%	0.11	0.06
Muhlenbergia asperifolia	H	N	0.38%	0.11	0.06
Nicotiana glauca	Seedling	E	0.13%	0.11	0.06
Nicotiana sylvestris	H	E	0.13%	0.11	0.06
Polypogon maritimus		E	0.76%	0.22	0.11
Polypogon monspeliensis	H	E	1.39%	0.33	0.17
Populus fremontii	Seedling	N	0.76%	0.22	0.11
Populus fremontii (beaver-felled)	Sprouts	N	0.13%	0.11	0.06
Quercus lobata	Sapling	N	0.38%	0.11	0.06
Rubus discolor	Sprouts	E	0.38%	0.11	0.06
Rumex acetosella	H	E	0.38%	0.11	0.06
Rumex crispus	H	E	0.13%	0.11	0.06
Rumex salicifolius var. transitorius	H	N	1.14%	0.33	0.17
Salix exigua	Sprouts	N	0.63%	0.11	0.06
Salix gooddingii	Sapling	N	0.38%	0.11	0.06
Salix laevigata	S1	N	0.38%	0.11	0.06
Salix laevigata	Sprouts	N	0.25%	0.22	0.11
Senecio vulgaris	H	E	0.13%	0.11	0.06
Silybum marianum	H	E	1.14%	0.33	0.17
Sonchus arvensis	H	E	0.38%	0.11	0.06
Taraxacum officinale	H	E	1.64%	0.33	0.17
Toxicodendron diversilobum	Liana	N	0.38%	0.11	0.06
Verbascum blattaria	H	E	0.13%	0.11	0.06
Xanthium strumarium	H	E	0.63%	0.33	0.17
TOTALS >>>	**44**	**17**	**21.72%**		**3.78**

Appendix C4
AEP Native Species Richness and Percent Cover



Appendix D1									
AVIAN SPECIES LIST WITH FUNCTIONAL GROUPS									
	Species	**Residence Status**	**Habitat**	**Habitat Specificity***	**Dietary Guild**	**Foraging Guild**	**Nest Strata**	**Nest Type**	**Disturbance Tolerance****
Acorn Woodpecker	ACWO	Resident	Oak Woodland	4	Omnivore	Glean,Bark	Tree	Cavity	3
Allen's Hummingbird	ALHU	Migrant	Chaparral	3	Nectivore	Glean,Hover	Tree	Cup	4
American Avocet	AMAV	Resident	Open Water	2	Insectivore	Probe	Ground	Scrape	3
American Bittern	AMBI	Resident	Wetland	4	Piscivore	Stalk & Strike	Ground	Platform	1
American Coot	AMCO	Resident	Wetland	2	Omnivore	Surface Dips & Dives	Ground	Platform	3
American Crow	AMCR	Resident	Broad	1	Omnivore	Glean,Ground	Tree	Cup	5
American Goldfinch	AMGO	Resident	Broad	2	Granivore	Glean,Foliage	Shrub	Cup	4
American Kestrel	AMKE	Resident	Open Habitats	2	Insectivore	Aerial, Hover & Pounce	Tree	Cavity	4
American Robin	AMRO	Short-distance migrant	Broad	1	Insectivore	Glean,Ground	Tree	Cup	4
Anna's Hummingbird	ANHU	Resident	Wooded	1	Nectivore	Glean,Hover	Tree	Cup	5
Ash-throated Flycatcher	ATFL	Summer Resident	Broad, Riparian	2	Insectivore	Glean,Hover	Tree	Cavity	2
Bank Swallow	BANS	Summer Resident	Riparian	3	Insectivore	Aerial,Forager	Cliff/Bank	Burrow	3
Barn Owl	BAOW	Resident	Open Habitats	2	Carnivore	Aerial,Patrol	Tree	Cavity	4
Barn Swallow	BARS	Summer Resident	Open Habitats	2	Insectivore	Aerial,Forager	Building	Cup	4
Black-chinned Hummingbird	BCHU	Summer Resident	Open Woodlands	2	Nectivore	Glean,Hover	Shrub	Cup	4
Black-crowned Night Heron	BCNH	Resident	Wetland	2	Piscivore	Stalk & Strike	Tree	Platform	3
Belted Kingfisher	BEKI	Resident	Riparian	4	Piscivore	Aerial,Dives	Cliff/Bank	Burrow, cavity	1
Bewick's Wren	BEWR	Resident	Open Woodlands	3	Insectivore	Glean,Ground	Tree	Cavity	2
Blue-gray Gnatcatcher	BGGN	Passage Migrant?	Wooded	2	Insectivore	Glean,Foliage	Tree	Cup	3
Brown-headed Cowbird	BHCO	Unclear	Broad	2	Insectivore	Glean,Ground	Tree	Parasite	5
Black-headed Grosbeak	BHGR	Summer Resident	Riparian	3	Insectivore	Glean,Foliage	Tree	Cup	1
Blue Grosbeak	BLGR	Summer Resident	Scrub	2	Insectivore	Glean,Ground	Shrub	Cup	3
Black Phoebe	BLPH	Resident	Riparian	1	Insectivore	Aerial, Hover & Pounce	Cliff/Bank	Cup	3
Brewer's Blackbird	BRBL	Resident/Summer Resident	Broad	1	Insectivore	Glean,Ground	Tree	Cup	5
Black-throated Gray Warbler	BTGW	Migrant	Scrub	3	Insectivore	Glean,Foliage	Tree	Cup	2
Bullock's Oriole	BUOR	Summer Resident	Open Woodlands	2	Insectivore	Glean,Foliage	Tree	Pendant	3

Appendix D1									
AVIAN SPECIES LIST WITH FUNCTIONAL GROUPS									
	Species	**Residence Status**	**Habitat**	**Habitat Specificity***	**Dietary Guild**	**Foraging Guild**	**Nest Strata**	**Nest Type**	**Disturbance Tolerance****
Bushtit	BUSH	Resident	Wooded	2	Insectivore	Glean,Foliage	Tree	Pendant	4
Cattle Egret	CAEG	Resident	Open Water	2	Insectivore	Glean,Ground	Tree	Platform	
Canada Goose	CAGO	Resident/winter Migrant	Wetland	3	Herbivore	Surface Dips & Dives	Ground	Scrape	4
California Gull	CAGU	Resident/Winter Resident	Broad	1	Insectivore	Aerial,Dives	Ground	Scrape	5
California Quail	CAQU	Resident	Riparian	3	Granivore	Glean,Ground	Ground	Scrape	2
California Towhee	CATO	Resident	Scrub	2	Granivore	Glean,Ground	Shrub	Cup	3
Cassin's Vireo	CAVI	Migrant	Wooded	3	Insectivore	Glean,Foliage	Tree	Cup	2
Cedar Waxwing	CEWA	Winter Resident	Broad	2	Frugivore	Glean,Foliage	Tree	Cup	3
Chipping Sparrow	CHSP	Summer Resident	Open Woodlands	2	Insectivore	Glean,Ground	Tree	Cup	3
Cliff Swallow	CLSW	Summer Resident	Open Habitats	2	Insectivore	Aerial,Forager	Building	Gourd	4
Cooper's Hawk	COHA	Winter Resident/Resident?	Wooded	2	Carnivore	Aerial,Pursuit	Tree	Platform	2
Common Merganser	COME	Resident/Winter Resident?	Wetland	4	Piscivore	Surface Dips & Dives	Tree	Cavity	3
Common Nighthawk	CONI	Summer Resident	Open Habitats	2	Insectivore	Aerial,Forager	Ground	None	2
Common Yellowthroat	COYE	Unclear	Broad	2	Insectivore	Glean,Foliage	Shrub	Cup	2
Double-crested Cormorant	DCCO	Winter Resident	Wetland	2	Piscivore	Surface Dips & Dives	Ground	Platform	3
Downy Woodpecker	DOWO	Resident	Wooded	2	Insectivore	Glean,Bark	Tree	Cavity	3
Dusky Flycatcher	DUFL	Migrant	Coniferous Forests	2	Insectivore	Aerial, Hover & Pounce	Shrub	Cup	2
European Starling	EUST	Resident	Broad	1	Insectivore	Glean,Ground	Tree	Cavity	5
Forster's Tern	FOTE	Summer Breeder	Wetland	2	Piscivore	Aerial,Dives	Ground	Platform	4
Great Blue Heron	GBHE	Resident	Wetland	2	Piscivore	Stalk & Strike	Tree	Platform	2
Golden-crowned Sparrow	GCSP	Winter Resident	Scrub	2	Insectivore	Glean,Ground	Ground	Cup	4
Great-horned Owl	GHOW	Resident	Broad	1	Carnivore	Aerial,Swoops	Tree	Abandoned nest	4
Great Egret	GREG	Resident	Wetland	2	Piscivore	Stalk & Strike	Tree	Platform	2
Green Heron	GRHE	Resident	Wetland	3	Piscivore	Stalk & Strike	Tree	Platform	1
Greater Yellowlegs	GRYE	Winter Resident	Wetland	2	Piscivore	Probe	Ground	Scrape	2
Greater White-fronted Goose	GWFG	Winter Resident	Open Water	2	Herbivore	Surface Dips & Dives	Ground	Scrape	4

Appendix D1

AVIAN SPECIES LIST WITH FUNCTIONAL GROUPS

	Species	Residence Status	Habitat	Habitat Specificity*	Dietary Guild	Foraging Guild	Nest Strata	Nest Type	Disturbance Tolerance**
Hammond's Flycatcher	HAFL	Migrant	Coniferous Forests	4	Insectivore	Aerial, Hover & Pounce	Tree	Cup	2
Hairy Woodpecker	HAWO	Resident	Wooded	2	Insectivore	Glean,Bark	Tree	Cavity	2
Hermit Thrush	HETH	Winter Resident	Coniferous Forests	3	Insectivore	Glean,Ground	Ground	Cup	2
Hermit Warbler	HEWA	Migrant	Coniferous Forests	4	Insectivore	Glean,Foliage	Tree	Cup	2
House Finch	HOFI	Resident	Broad	1	Granivore	Glean,Ground	Tree	Cup (cavity)	5
House Sparrow	HOSP	Resident	Broad	1	Granivore	Glean,Ground	Building	Cavity	5
House Wren	HOWR	Summer Breeder	Open Woodlands	2	Insectivore	Glean,Ground	Tree	Cavity	4
Hutton's Vireo	HUVI	Migrant	Oak Woodland	3	Insectivore	Glean,Foliage	Tree	Cup	2
Jungle Fowl	JUFO	Resident	Broad	1	Insectivore	Glean,Ground	Ground		5
Killdeer	KILL	Resident	Open Habitats	1	Insectivore	Glean,Ground	Ground	Scrape	2
Lark Sparrow	LASP	Migrant	Grasslands	2	Granivore	Glean,Ground	Ground	Cup	2
Long-billed Curlew	LBCU	Winter Resident	Wetland	2	Insectivore	Glean,Ground	Ground	Scrape	2
Lesser Goldfinch	LEGO	Resident	Open Habitats	2	Granivore	Glean,Foliage	Tree	Cup	3
Loggerhead Shrike	LOSH	Resident	Savanna	2	Insectivore	Aerial,Swoops	Tree	Cup	3
Mallard	MALL	Resident	Wetland	1	Granivore	Dabble	Ground	Scrape	4
Mourning Dove	MODO	Resident	Broad		Granivore	Glean,Ground	Tree	Saucer	3
Nashville Warbler	NAWA	Resident	Wooded	3	Insectivore	Glean,Foliage	Ground	Cup	2
Northern Flicker	NOFL	Resident	Broad	1	Insectivore	Glean,Ground	Tree	Cavity	3
Northern Harrier	NOHA	Resident	Grasslands	2	Carnivore	Glean,Ground	Ground	Platform	4
Northern Mockingbird	NOMO	Short-distance migrant	Broad	1	Insectivore	Aerial,Forager	Shrub	Cup	5
Northern Rough-winged Swallow	NRWS	Summer Resident	Riparian	3	Insectivore	Glean,Bark	Bank	Crevice	3
Nuttall's Woodpecker	NUWO	Resident	Wooded	2	Insectivore	Glean,Foliage	Tree	Cavity	3
Oak Titmouse	OATI	Resident	Oak Woodland	3	Insectivore	Glean,Foliage	Tree	Cavity	3
Orange-crowned Warbler	OCWA	Winter Resident, Migrant, poss. Summer Res.	Broad	2	Insectivore	Aerial, Hover & Pounce	Ground	Cup	1
Olive-sided Flycatcher	OSFL	Migrant	Forests	4	Insectivore	Aerial,Dives	Tree	Cup	1
Osprey	OSPR	Resident/Migrant?	Riparian	3	Piscivore	Surface Dips & Dives	Tree	Platform	3
Pied-billed Grebe	PBGR	Resident	Wetland	3	Carnivore		Reeds	Platform	3
Peacock	PEAC	Resident	Broad	2	Frugivore	Glean,Foliage	Ground		5
Phainopepla	PHAI	Summer Resident	Riparian	3	Frugivore	Aerial, Hover & Pounce	Tree	Cup	3

Appendix D1									
AVIAN SPECIES LIST WITH FUNCTIONAL GROUPS									
	Species	**Residence Status**	**Habitat**	**Habitat Specificity***	**Dietary Guild**	**Foraging Guild**	**Nest Strata**	**Nest Type**	**Disturbance Tolerance****
Pacific-slope Flycatcher	PSFL	Migrant	Wooded	3	Insectivore	Glean,Foliage	Tree	Cavity	2
Ring-billed Gull	RBGU	Winter Resident	Open Water	2	Omnivore	Glean,Ground	Ground	Saucer	4
Red-breasted Nuthatch	RBNU	Migrant	Coniferous Forests	4	Insectivore	Glean,Bark	Tree	Cavity	2
Ruby-crowned Kinglet	RCKI	Winter Resident	Wooded	3	Insectivore	Glean,Foliage	Tree	Pendant	3
Ring-necked Pheasant	RIPH	Resident	Open Habitats	1	Omnivore	Glean,Ground	Ground	Scrape	3
Rock Dove	RODO	Resident	Broad	1	Granivore	Glean,Ground	Building	Saucer	5
Red-shouldered Hawk	RSHA	Resident	Riparian	3	Carnivore	Aerial,Patrol	Tree	Platform	3
Red-tailed Hawk	RTHA	Resident, Winter Res.	Wooded	1	Carnivore	Aerial, Hover & Pounce	Tree	Platform	4
Rufous Hummingbird	RUHU	Migrant	Forests	4	Nectivore	Glean,Hover	Tree	Cup	4
Red-winged Blackbird	RWBL	Resident	Wetland	3	Insectivore	Glean,Ground	Reeds	Cup	3
Savannah Sparrow	SASP	Winter Resident	Grasslands	2	Insectivore	Glean,Ground	Ground	Cup	2
Snowy Egret	SNEG	Resident	Wetland	2	Piscivore	Stalk & Strike	Tree	Platform	2
Song Sparrow	SOSP	Resident	Riparian	3	Insectivore	Glean,Ground	Ground	Cup	3
Spotted Sandpiper	SPSA	Winter Resident	Broad	2	Insectivore	Glean,Ground	Ground	Scrape	2
Spotted Towhee	SPTO	Resident	Shrublands	2	Insectivore	Glean,Ground	Ground	Cup	1
Sharp-shinned Hawk	SSHA	Winter Resident	Wooded	3	Carnivore	Aerial,Pursuit	Tree	Platform	1
Swainson's Hawk	SWHA	Summer Resident	Savanna	1	Carnivore	Aerial,Patrol	Tree	Platform	3
Swainson's Thrush	SWTH	Migrant	Wooded	2	Insectivore	Glean,Foliage	Shrub	Cup	1
Townsend's Warbler	TOWA	Migrant	Coniferous Forests	3	Insectivore	Glean,Foliage	Tree	Cup	2
Tri-colored Blackbird	TCBL	Resident	Grasslands	2	Insectivore	Glean,Ground	Reeds	Cup	4
Tree Swallow	TRES	Resident, Summer Resident	Open Woodlands	2	Insectivore	Aerial,Forager	Tree	Cavity	3
Turkey Vulture	TUVU	Unclear	Open Habitats	1	Carnivore	Aerial,Patrol	Cliff/Bank	None	4
Vaux's Swift	VASW	Migrant	Coniferous Forests	3	Insectivore	Aerial,Forager	Tree	Saucer	3
Violet-green Swallow	VGSW	Summer Resident	Open Woodlands	3	Insectivore	Aerial,Forager	Tree	Cavity	3
Warbling Vireo	WAVI	Summer Resident	Open Woodlands	2	Insectivore	Glean,Foliage	Tree	Cup	2
White-breasted Nuthatch	WBNU	Resident	Coniferous Forests	3	Insectivore	Glean,Bark	Tree	Cavity	1
White-crowned Sparrow	WCSP	Winter Resident	Scrub	1	Insectivore	Glean,Ground	Shrub	Cup	4

Appendix D1

AVIAN SPECIES LIST WITH FUNCTIONAL GROUPS

	Species	Residence Status	Habitat	Habitat Specificity*	Dietary Guild	Foraging Guild	Nest Strata	Nest Type	Disturbance Tolerance**
Western Bluebird	WEBL	Resident?	Open Woodlands	2	Insectivore	Aerial, Hover & Pounce	Tree	Cavity	3
Western Gull	WEGU	Resident	Open Water	1	Piscivore	Aerial,Patrol	Cliff/Bank	Scrape	5
Western Kingbird	WEKI	Summer Resident	Broad	2	Insectivore	Aerial, Hover & Pounce	Tree	Cup	4
Western Meadowlark	WEME	Resident	Grasslands	2	Insectivore	Glean,Ground	Ground	Cup	3
Western Scrub Jay	WESJ	Resident	Scrub	1	Omnivore	Glean,Ground	Tree	Cup	5
Western Tanager	WETA	Migrant	Wooded	3	Insectivore	Glean,Foliage	Tree	Cup	1
Western Wood Pewee	WEWP	Migrant	Coniferous Forests	2	Insectivore	Aerial, Hover & Pounce	Tree	Cup	1
Wild Turkey	WITU	Resident	Wooded	3	Omnivore	Glean,Ground	Ground	Scrape	2
Wilson's Warbler	WIWA	Summer Resident	Shrublands	3	Insectivore	Glean,Foliage	Ground	Cup	1
Wood Duck	WODU	Unclear	Riparian	4	Piscivore	Surface Dips & Dives	Tree	Cavity	1
Wrentit	WREN	Resident	Chaparral	2	Insectivore	Glean,Foliage	Shrub	Cup	1
White-tailed Kite	WTKI	Resident	Open Habitats	1	Carnivore	Aerial, Hover & Pounce	Tree	Platform	4
White-throated Swift	WTSW	Resident	Cliffs	4	Insectivore	Aerial,Forager	Cliff/Bank	Crevice	2
Yellow-billed Magpie	YBMA	Resident	Broad	1	Omnivore	Glean,Ground	Tree	Sphere	5
Yellow Warbler	YEWA	Summer Resident	Riparian	3	Insectivore	Glean,Foliage	Shrub	Cup	1
Yellow-rumped Warbler	YRWA	Winter Resident	Coniferous Forests	2	Insectivore	Glean,Foliage	Tree	Cup	4

*** Habitat Specificity: gradient between 1 and 4 where 1 indicates a species that occurs across a variety of habitats, and 4 indicates a habitat specialist**

**** Disturbance Tolerance: gradient between 1 and 5 where 1 indicates low tolerance to disturbance and 5 indicates high tolerance.**

Appendix D2

AVIAN ABUNDANCE INDEX, FREQUENCY, AND IMPORTANCE VALUE (Plots Pooled)

	1999				2001			
SPECIES	**Abund. Index**	**Freq.**	**IV**	**SPECIES**	**Abund. Index**	**Freq.**	**IV**	**IV Change**
Acorn Woodpecker	0.33	0.17	0.25					-0.25
American Crow	0.33	0.17	0.25					-0.25
American Goldfinch	0.33	0.17	0.25	American Goldfinch	1.75	0.17	0.96	0.71
				American Robin	0.5	0.17	0.33	0.33
				Anna's Hummingbird	0.5	0.33	0.42	0.42
Ash-throated Flycatcher	7	0.83	3.92	Ash-throated Flycatcher	3.75	1	2.38	-1.54
Belted Kingfisher	0.33	0.17	0.25					-0.25
Bewick's Wren	7.67	0.83	4.25	Bewick's Wren	5	1	3.00	-1.25
Black Phoebe	0.67	0.17	0.42	Black Phoebe	0.5	0.33	0.42	0.00
Black-headed Grosbeak	**3**	**0.67**	**1.83**					**-1.83**
				Blue Grosbeak	**1**	**0.5**	**0.75**	**0.75**
Brewer's Blackbird	0.67	0.17	0.42	Brewer's Blackbird	0.25	0.17	0.21	-0.21
Brown-headed Cowbird	6.67	1	3.83	Brown-headed Cowbird	8.5	1	4.75	0.92
Bullock's Oriole	2.33	0.17	1.25	Bullock's Oriole	0.5	0.33	0.42	-0.83
Bushtit	2	0.33	1.17	Bushtit	6.5	0.67	3.58	2.41
California Quail	**5**	**0.33**	**2.67**	**California Quail**	**4.5**	**1**	**2.75**	**0.08**
California Towhee	**11.33**	**1**	**6.17**	**California Towhee**	**3.25**	**0.83**	**2.04**	**-4.13**
Canada Goose	1.33	0.17	0.75	Canada Goose	1.25	0.17	0.71	-0.04
				Chipping Sparrow	0.75	0.17	0.46	0.46
				Empidonax Flycatcher	0.25	0.17	0.21	0.21
European Starling	5.33	0.5	2.92	European Starling	4.25	0.67	2.46	-0.46
				Golden-crowned Sparrow	0.25	0.17	0.21	0.21
				Greater Yellowlegs	0.5	0.17	0.33	0.33
Green Heron	0.33	0.17	0.25					-0.25
				House Finch	1.25	0.33	0.79	0.79
House Sparrow	2	0.17	1.08	House Sparrow	0.25	0.17	0.21	-0.87
				House Wren	0.25	0.17	0.21	0.21
Killdeer	5	0.67	2.83	Killdeer	2.5	0.67	1.58	-1.25
Mallard	1	0.33	0.67					-0.67
Mourning Dove	5	1	3	Mourning Dove	1.25	0.67	0.96	-2.04
Northern Mockingbird	0.33	0.17	0.25					-0.25
Nuttall's Woodpecker	**7.33**	**0.83**	**4.08**	**Nuttall's Woodpecker**	**3.75**	**1**	**2.38**	**-1.70**
Orange-crowned Warbler	0.33	0.17	0.25	Orange-crowned Warbler	0.75	0.5	0.63	0.38
Pacific-slope Flycatcher	1	0.33	0.67					-0.67
Pied-billed Grebe	0.33	0.17	0.25					-0.25
Red-tailed Hawk	0.67	0.33	0.5					-0.50
Red-winged Blackbird	7	0.33	3.67					-3.67
				Ring-necked Pheasant	0.25	0.17	0.21	0.21
Snowy Egret	1.33	0.33	0.83					-0.83
Song Sparrow	**1.33**	**0.5**	**0.92**	**Song Sparrow**	**0.5**	**0.33**	**0.42**	**-0.50**
Spotted Towhee	0.33	0.17	0.25	Spotted Towhee	0.25	0.17	0.21	-0.04
Swainson's Thrush	**1**	**0.33**	**0.67**	**Swainson's Thrush**	**0.25**	**0.17**	**0.21**	**-0.46**
Townsend's Warbler	0.33	0.17	0.25					-0.25
Tree Swallow	**5.33**	**0.67**	**3**	**Tree Swallow**	**1.5**	**0.5**	**1.00**	**-2.00**
Warbling Vireo	**1**	**0.17**	**0.58**	**Warbling Vireo**	**0.25**	**0.17**	**0.21**	**-0.37**
				Western Bluebird	0.25	0.17	0.21	0.21

Appendix D2

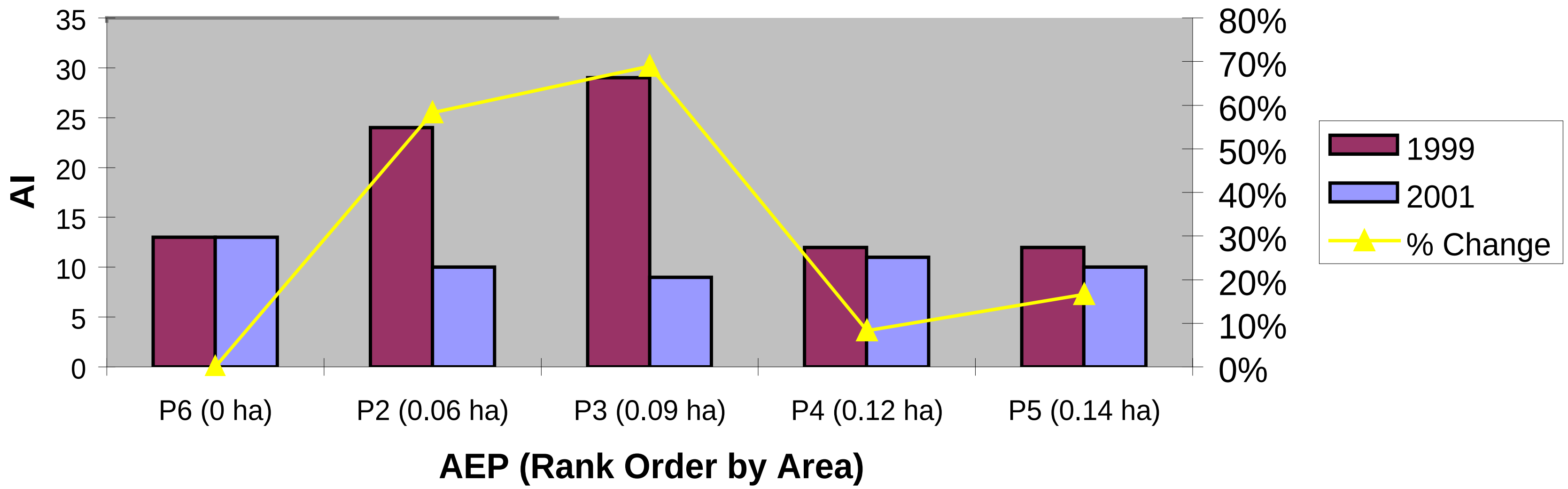
AVIAN ABUNDANCE INDEX, FREQUENCY, AND IMPORTANCE VALUE (Plots Pooled)

	1999				2001			
SPECIES	**Abund. Index**	**Freq.**	**IV**	**SPECIES**	**Abund. Index**	**Freq.**	**IV**	**IV Change**
				Western Kingbird	0.75	0.33	0.54	0.54
Western Meadowlark	0.33	0.17	0.25	Western Meadowlark	0.25	0.17	0.21	-0.04
Western Scrub Jay	6.67	0.83	3.75	Western Scrub Jay	6	1	3.50	-0.25
Western Wood Pewee	0.67	0.17	0.42					-0.42
Wild Turkey	0.67	0.17	0.42					-0.42
Wilson's Warbler	**1**	**0.33**	**0.67**	**Wilson's Warbler**	**1.75**	**0.83**	**1.29**	**0.62**
				Wood Duck	0.5	0.17	0.33	0.33
Yellow Warbler	**0.67**	**0.17**	**0.42**					**-0.42**
Yellow-billed Magpie	**1**	**0.17**	**0.58**					**-0.58**
42 species	**106.33**		**61.08**	**38 species**	**66.25**		**41.46**	

CAL-Partners in Flight Riparian Habitat Joint Venture, CALFED Multispecies Conservation Strategy, and California endemic species in BOLD

Appendix D3

Abundance Index by AEP Area



Appendix D4							
AVIAN ABUNDANCE INDEX BY FUNCTIONAL GROUP (Plots pooled)							
	1999	**2001**	**Δ**				
Year-round Residents	45.92	32.13	-30%				
Migrants	2	1.29	-36%				
Summer Residents	11.67	5.96	-49%				
Winter Residents	**1.5**	**1.88**	**25%**				
HABITAT PREFERENCE				**NEST STRATA**	**1999**	**2001**	**Δ**
Generalist	15.42	11.54	-25%	On structures	1.08	0.21	-81%
Moderate Generalist	34.17	25.96	-24%	Cavity nester	0.67	0.42	-37%
Moderate Specialist	6	0.71	-88%	Ground nester	13.58	8.54	-37%
Specialist	5.5	3.04	-45%	Shrub nester	55.83	39.08	-30%
				Tree nester	38	28.13	-26%
DIETARY GUILD				**NEST TYPE**			
Carnivore	0.5	0	-100%	Cavity	20.42	12.17	-40%
Frugivore	0	0	No change	**Pendant**	**2.42**	**4**	**65%**
Granivore	13.83	7.71	-44%	Gourd	0	0	No change
Herbivore	13.83	7.71	-44%	Sphere	0.58	0	-100%
Insectivore	39.42	28.04	-29%	Open Cup	24.67	14.75	-40%
Nectivore	**0**	**0.42**	**100%**	Platform	1.83	0	-100%
Omnivore	5.25	3.71	-29%	**Nest Parasite**	**3.83**	**4.75**	**24%**
				Scrape	7.33	5.58	-24%
FORAGING GUILD				**DISTURBANCE TOLERANCE**			
Aerial-Dive	0.25	0	-100%	Low	0	0	No change
Aerial-Forager	3	1	-67%	Moderately Low	6.08	4.08	-33%
Aerial-Hover & Pounce	2	1.17	-42%	Moderate	6.83	4.25	-38%
Aerial-Patrol	0	0	No change	Moderately High	30.25	19.71	-35%
Aerial-Pursuit	0	0	No change	High	17.92	13.21	-26%
Aerial-Swoops	0	0	No change				
Glean-Bark	4.33	2.38	-45%				
Glean-Foliage	7.33	7.29	-1%				
Glean-Ground	37.50	25.25	-33%				
Glean-Hover	3.92	2.79	-29%				
Prober	**0**	**0.33**	**100%**				
Surface Dips & Dives	1.67	1.04	-38%				
Stalk & Strike	1.08	0	-100%				