

Putah Creek Terrestrial Wildlife Monitoring Program



**Comprehensive Report
1997-2009**

**Museum of Wildlife and Fish Biology
University of California, Davis
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EXECUTIVE SUMMARY

California's varied topography and climate have given rise to a remarkable diversity of habitats and a correspondingly diverse array of plant and animal species. Riparian zones are an exceptionally productive area for wildlife. In California, over 225 species of amphibians, reptiles, mammals and birds depend on riparian habitats for their survival (RHJV 2004). However, the majority of California's riparian habitats have been lost. Those that remain are seriously degraded. Lower Putah Creek, for example, has lost more than 90% of its historic acreage (approximately 8900 hectares) since the arrival of the Europeans.

This report represents the culmination of Phase I of the MWFB's Terrestrial Wildlife Monitoring and Assessment Program. For this phase, our goals were to establish spatial and temporal baseline conditions for biological resources along Lower Putah Creek, as well as portions of the Yolo Bypass and Cosumnes River Preserve. The objectives of Phase I were to:

- Compile lists of species and formulate spatially-explicit estimates of relative abundance for selected riparian species.*
- Evaluate the importance of Putah Creek's riparian habitats to the maintenance of biodiversity at local and regional scales.*
- Meet the information needs of managers and landowners and provide recommendations for habitat restoration and enhancement.*

To meet these objectives, we conducted repeated, site-based surveys to quantify the distribution and relative abundance of Putah Creek's plants, butterflies, amphibians, reptiles, mammals, and birds over a 13-year period.

PLANTS. *Surveys conducted in 2005 and 2006 returned approximately 205 plant species (about half of which were native) across the Putah Creek study sites. Sites differed greatly in vegetative composition and structure. An additional 15 species were recorded for the Yolo/Sutter Bypass sites. (Data on vegetative cover for the Cosumnes River Preserve will be published separately.) In this report, we present site-specific estimates of relative percent cover for each plant species, as well as a table summarizing wildlife habitat values for selected plant species.*

BUTTERFLIES. *We recorded 31 butterfly species on Putah Creek, representing 56% of all species expected to occur in the Central Valley. An additional two species were found at the Yolo Bypass sites.*

Butterfly abundance is currently depressed due to sharp regional declines over the past decade. These declines are likely due to a combination of factors: habitat loss and degradation, parasites, pathogens, and climate change.

AMPHIBIANS. *We observed only four species of amphibians, representing 6% of the total number of species known to occur in California and 44% of the species known to occur in Yolo County (most of which reside in mountainous regions). However, these four species represented fully 80% of the total number of species known to inhabit the Sacramento Valley, representative of the limited herpetofauna known to inhabit this region (Stebbins 2004).*

REPTILES. *Ten species of reptiles were observed along Putah Creek, representing 11% of the total number of species found in California, 67% of all species recorded in the Sacramento Valley, and 71% of all species known to occur in Yolo County. The Western Pond Turtle, a California Species of Concern, is widespread along the creek. This species requires upland nesting sites with suitable substrates for burrowing. Restoration of upland breeding sites would likely improve habitat conditions for this species. A nonnative species of turtle, the Red-eared Slider is also widespread along the length of the lower creek. Its potential impact on the native pond turtle is unknown.*

MAMMALS. *We recorded 34 species of mammals, 15% of all species known to occur in California, 65% of all species recorded for the Central Valley, and 75% of all species known to occur in Yolo County. Systematic surveys for bats, carnivores, and medium-sized mammals are still needed. Black Rats are widespread and abundant along the creek. Control of this adaptable predator, if possible, would greatly improve conditions for nesting birds and other sensitive wildlife.*

BIRDS. *Documenting regional and local avian distribution and abundance was a particular focus of this study. Our surveys recorded 232 bird species for Putah Creek (71% of all avian species recorded for Yolo County). An additional 7 species were recorded at the Yolo-Sutter Bypass sites. Sixty-nine species were confirmed as breeding along Putah Creek; 45 species were confirmed breeding in the Yolo-Sutter Bypass sites. Almost all federal- and state-listed and riparian special-status species (RHJV 2004) have been documented along Putah Creek, elevating its conservation status far beyond previous expectations. However, many species occur in low numbers. Enhancing habitat value for these species is highly recommended.*

Phase II of the Putah Creek Riparian Habitat Assessment and Monitoring Program is currently awaiting contracting of awarded funding through the CALFED Bay-Delta Program. Phase II will consist of follow-up floral and faunal surveys, breeding bird surveys, investigations into the distribution and abundance of terrestrial arthropods, time series of biotic responses to restoration, and inquiries into the ecological mechanisms influencing riparian structure and function.

Some recommendations for future management and restoration of the lower Putah Creek ecosystem include:

- 1. Restore more natural hydrogeomorphology at key sites in the watershed*
- 2. Narrow the wetted channel in overwidened reaches*
- 3. Widen the vegetated corridor adjacent to the creek*
- 4. Restore upland habitats (especially oak woodlands and perennial grasslands)*
- 5. Create vegetated buffer zones between the riparian corridor and adjacent land uses*
- 6. Revegetate with native and wildlife-friendly species*
- 7. Eradicate invasive plants*
- 8. Protect environmental flows*
- 9. Reduce nonpoint source pollution*
- 10. Explore the feasibility of widening and enhancing the riparian corridor along extreme lower Putah Creek (Mace Blvd to the Putah Creek sinks).*
- 11. Conduct follow-up breeding bird atlas efforts*
- 12. Protect and conserve mature and senescing trees as wildlife habitat*
- 13. Expand the Putah Creek Nestbox Highway*
- 14. Implement terrestrial arthropod surveys*
- 15. Institute bat surveys*
- 16. Conduct remote camera monitoring for medium- to large-sized mammals.*
- 17. Investigate the status of California Red Fox along the creek*
- 18. Consider instituting Brown-headed Cowbird and Black Rat trapping programs*

1 PUTAH CREEK AS WILDLIFE HABITAT

California's varied topography and climate have given rise to a remarkable diversity of habitats and a correspondingly diverse array of plant and animal species (Bunn et al. 2007). Riparian corridors, zones of hydrophilic vegetation immediately adjacent to rivers and streams, are exceptionally productive habitats, supporting a high diversity of plant and wildlife species and serving as transition zones or "ecotones" between habitats. The high biodiversity characteristic of riparian habitats is a consequence not only of the availability of permanent water and abundant vegetation, it is also a result of high microsite variability caused by frequent disturbance such as flooding, windthrow, and other dynamic physical processes.

In California alone, over 225 species of amphibians, reptiles, mammals and birds depend on riparian habitats for their survival (RHJV 2004). Riparian habitats provide food, water, and shelter. Their dense cover provides protection from predators and unfavorable weather (Katibah 1984, Knopf et al. 1988, Dobkin 1994, Hehnke and Stone 1997, Faber 2003). They promote the integrity of instream environments by shading the water column, holding bank soils in place, delivering nutrients, and filtering pollutants from surface and subsurface runoff (Jensen et al. 1993, RHJV 2004).

Despite their biological importance, riparian habitats today comprise some of California's most degraded and threatened ecosystems, having lost 85-98% of their historic acreage over the past 150 years. Primary causes of riparian habitat loss and degradation are levee and reservoir construction, agricultural development, mining, livestock grazing, invasion by non-native species, and urbanization (Katibah 1984, Dawdy 1989, RHJV 2004). Riparian habitats in California's Central Valley have been particularly hard-hit (Katibah et al. 1984). Putah Creek's riparian habitats once stretched for miles on either side of the stream, covering approximately 22,000 acres (8,900 hectares). Today, these habitats have been reduced to less than a tenth of their original extent, only about 1,850 acres (750 hectares) (Katibah 1984). Putah Creek's remaining riparian corridors are extremely narrow, rarely extending more than 1,000 feet on either side of the stream (EDAW 2005).



Putah Creek from the air. Middle Reach. 1997.
Photo: M. Truan

Despite this habitat loss, Putah Creek still hosts a surprising number of species. Our surveys recorded 34 species of mammals (14% of all species found in California, 69% of all species known to occur in the Central Valley, and 81% of all species recorded for Yolo County), 10 species of reptiles (11% of all California species and 67% of all Sacramento Valley species), 4 species of amphibians (only 6% of all California species, but fully 80% of all Sacramento Valley species), 31 species of butterflies (56% of all species expected to occur in the Central Valley), and 232 species of birds (71% of all avian species known to occur in Yolo County). Other important groups, such as terrestrial arthropods, will be surveyed under Phase II of this project. The distribution and abundance of fishes (UC Davis and Thomas Paine & Associates) and aquatic macroinvertebrates (Ken Davis, Wildlife Survey and Photo Service) are also currently being monitored.

Thus, while its ecosystem structure and function have been highly altered by historical and recent development actions, Putah Creek still retains a significant amount of habitat for riparian species. Beavers still build their dams on the creek, river otters still cavort along its banks (eating mainly nonnative crayfish), and native fish still ply its waters (though they are forced to compete with widespread and abundant nonnative species). Thus, well-planned conservation and restoration projects aimed at specific target reaches offer strong potential for success.

1.1 MWFB Wildlife Monitoring on Putah Creek

Biological surveys of Putah Creek's terrestrial habitats were initiated in 1997, building on aquatic surveys conducted by Dr. Peter Moyle and his students. Following the Putah Creek Accord (SCWA 2000), the Museum of Wildlife and Fish Biology assumed management of the project, expanding the scope of biological assessments and increasing the number of study sites from nine to fourteen (Section 1.2 of this report).¹

The objectives of the MWFB Riparian Assessment and Monitoring Program were to:

- Compile lists of species and to formulate spatially-explicit estimates of relative abundance for selected riparian species.
- Evaluate the importance of Putah Creek's riparian habitats to the maintenance of biodiversity at local and regional scales.
- Meet the information needs of managers and landowners and to provide recommendations for habitat restoration and enhancement.

¹ Under contract with the California Department of Water Resources, we also surveyed selected sites in riparian habitats in the Yolo-Sutter Bypass system, providing comparative data between regions. We have also surveyed sites in the Cosumnes River Preserve, results to be published at a later date.

To achieve these goals, MWFB has developed a two-phased approach to assess biodiversity and habitat function, and to model the results of these assessments to provide recommendations for future habitat restoration and enhancement. This report represents the completion of Phase I.

This report consists of two parts, this narrative report and an associated Map Volume. Here, we summarize important findings from Phase I and discuss relevant patterns that have emerged from wildlife surveys over the past decade. Results from these surveys will be used to design follow-up surveys and to derive predictions and testable hypotheses under Phase II.

1.2 Survey Sites

Putah Creek arises as a spring on Cobb Mountain in California's Outer Coast Range, flowing southeast through rolling oak woodlands and chaparral through Lake Berryessa and Monticello Dam to the Sacramento Valley (Map Volume, Map Exhibit A). It is this lower stretch—from the Coast Range piedmont to the creek's debouchment into the Yolo Bypass—that is the focus of this study. Here, land cover adjacent to the creek ranges from oak woodlands and chaparral-covered slopes in the foothills, to orchards and ranchettes in the piedmont, to a long middle stretch of row crops and other agricultural uses, and finally to an agricultural-wetland complex of ponds and rice fields at the Yolo Bypass. The towns of Winters and Davis are also located in this region.

Study sites were selected on the basis of 1) location along the upstream-downstream continuum, 2) landowner cooperation and accessibility, 3) degree of similarity to historic riparian conditions, and 4) suitability for habitat enhancement and restoration. New sites are occasionally added as per this criteria.²

For purposes of this study, "length of the creek" refers to the entire lower stretch described above, the region between the Interdam site (CDFG Fishing Access #5) to the Putah Creek Sinks (near the Yolo Bypass). For some accounts, we will have occasion to refer to upper, middle and lower reaches of the creek. The upper reach encompasses all the study sites between Fishing Access #5 and the I-505 bridge: Interdam, Diversion Dam, Oxbow, Dry Creek Confluence, and Winters Putah Creek Park. The middle reach encompasses all sites between I-505 and Pedrick Road (County Road 98): Yolo Housing, Center for Land-based Learning, Russell Ranch, and Stevenson's Bridge. The lower reach contains all sites downstream of Pedrick Road to the juncture with the Yolo Bypass: Picnic Grounds, Old Davis Road, Mace Boulevard, Los Rios Farms, and Putah Creek Sinks. These reaches can be loosely grouped based on differences in flow regimes and aquatic communities. They also share some similarities in their adjacent terrestrial communities, those these are much less well-differentiated. At each of these survey sites, we

² We also present data from the Yolo-Sutter Bypass system to compare this wetland complex with Putah Creek's riparian habitats. Please note that some of the most-downstream Putah Creek sites (Map Exhibits B13 and B14) lie essentially within the Yolo Bypass ecosystem and may be similar to them in community composition and structure.

established permanent study plots and transects (Map Volume, Map Exhibits A and B; Appendix A of this report).

The **Interdam (INTDM)** site (Map Volume Exhibit B1) is situated in the foothills just prior to the piedmont, supporting a comparison of foothill flora and fauna with that of more downstream sites. Our records here date back to 1999.

The **Diversion Dam (DVDAM)** site (Map Volume B2) lies on private property just downstream of the Solano Diversion Dam and consists of mature mixed riparian woodland flanked by oak woodlands, orchards, and scattered exurban development. Flows emerge from the bottom of Lake Solano and are clear and relatively cold, supporting a variety of native fishes. Habitat restoration is ongoing at this site, consisting of weed eradication, floodplain restoration, and revegetation with native species. We have been surveying this site since 1997.

The **Oxbow (OXBOW)** site (Map Volume Exhibit B3) contains one of the widest corridors of mixed riparian woodland habitat along lower Putah Creek. Recent projects at this site include trail maintenance, floodplain restoration, weed eradication, and the construction of a large off-channel pond. More projects are slated for the future. Our surveys commenced here in 2004.

The **Dry Creek Confluence (DRYCK)** site (Map Volume Exhibit B4) lies at the confluence of Putah Creek and one of its major tributaries, Dry Creek. Undammed, Dry Creek brings cobbles and other coarse sediments to Putah Creek, an important source of salmon spawning gravels. This heterogeneous site contains a narrow corridor of mixed riparian woodland, dense groves of black walnut, orchards of cultivated walnuts, and a backwater wetland complex. The City of Winters flanks the site on the north. Recently, a major channel realignment and bank stabilization project was completed. Wildlife response to these actions will be compared against records dating back to 1999.

Winters Putah Creek Park (WINTR) (Map Volume Exhibit B5) has been surveyed continuously since 1997, enabling us to document wildlife activity through a series of changing management regimes. The site is currently undergoing a major restoration project, including the removal of a concrete percolation dam, extensive weed eradication, and floodplain restoration.

The **Yolo Housing (YOLOH)** site (Map Volume Exhibit B6), added to the monitoring rotation in the fall of 2005, underwent a dramatic transformation from a weedy, derelict dumping ground to a point of pride for this community. LPCCC-sponsored restoration actions have included weed eradication, floodplain restoration, instream habitat enhancement, and native plantings.

The **Center for Land-based Learning (CLBL)** site (Map Volume Exhibit B7), surveyed since 2004, is home to several innovative projects in sustainable and wildlife-friendly agriculture. This site consists of a wide, highly-incised channel, similar to other sites in the middle reach, but is flanked on the

south by organic and transitional-organic agriculture, tailwater ponds, wildlife plantings, and other innovative agricultural land uses.

Russell Ranch (RUSSR) (Map Volume Exhibit B8), a UCD Riparian Reserve site, has been undergoing riparian and upland habitat restoration over the past decade. This site currently serves as a mitigation site for development elsewhere on campus. We began surveying this site in 1997, just before restoration began. Russell Ranch hosts a variety of habitat types, including agriculture, emergent wetlands, riparian scrub, mixed riparian forest, remnant orchards, and a maturing oak savanna. Surrounding land use is predominantly agriculture with row crops with some exurban development.

The **Stevenson's Bridge (STVBR)** site (Map Volume Exhibit B9) is located on private property on the south bank, just downstream from Stevenson's Bridge Road. We began surveying this site in 2004. The downstream portion of the site has been landscaped with wildlife-friendly plants on the upper terrace. As a result, this site regularly hosts a wide array of birds and other wildlife. In addition, the riparian corridor has been carefully tended, with removal of nonnative plants and the creation of trails on the lower terrace. The creek here is fairly narrow, running clear and cool over a sandy bed shaded by an overarching canopy of *Eucalyptus* and native trees. Surrounding land uses are grazing lands on the north and agricultural uses with exurban development to the south.

The **UC Davis Picnic Grounds (PICNC)** site (Map Volume Exhibit B10) lies within the UC Davis Riparian Reserve. This site has been surveyed since 1997. The site is located in the old historic channel of Putah Creek and receives heavy human use as part of the UC Davis campus. The creek here is highly channelized, with steep slopes supporting oak woodland, eucalyptus groves, and annual grasslands. The upstream section flows swiftly through a shallow, braided channel flanked by emergent vegetation and stands of early-successional willows, while the downstream section flows sluggishly through a large pool. Adjacent land use consists of university-owned agricultural experimental stations on the north bank and row crops and limited exurban development on the south bank.

The next four sites are all located on the south fork of Putah Creek, excavated at the beginning of the 20th Century to divert floodwaters away from the city of Davis.

The **Old Davis Road-Restoria (OLDRR)** site (Map Volume Exhibit B11) as lies within the UC Davis Riparian Reserve. This site has an open aspect, consisting primarily of annual grasslands with scattered eucalyptus trees adjacent to a very narrow, intermittent fringe of riparian trees and early-successional willows. This site has a long legacy of disturbance, including off-road vehicle use but is currently being managed in a more ecologically-sensitive way. Surrounding land use consists of agricultural row crops, livestock facilities and other university agricultural uses. We began surveying this site in 1997.

The **Mace Boulevard (MACEB)** site (Map Volume Exhibit B12) is owned and operated by the City of Davis and straddles both sides of the creek. The site is also known as the South Fork Preserve. We have been surveying this site continuously since 1997. The north bank consists of a narrow fringe of riparian woodland backed by perennial grassland and native shrubs, planted in the late 1990's. The south bank consists of a younger restoration site (5-10 years old) of riparian trees, shrubs, sedges, and grasses, flanked by an even-younger upland oak woodland restoration site. Surrounding land use is agricultural row crop with one large home and a couple agriculture-related businesses nearby.

The **Los Rios Farms (LOS RF)** (Map Volume Exhibit B13) and **Putah Creek Sinks (PUTCS)** (Map Volume Exhibit B14) sites are located at the lower end of Putah Creek near its confluence with the Yolo Bypass. We began surveying these sites in 2004. These private parcels consist of very narrow linear riparian woodlands of cottonwood and tree willows, sandbar willow thickets, and wetlands surrounded by row crop agriculture. Due to their position at the lower terminus of Putah Creek, these sites flood frequently. Los Rios Farms also contains a small marshland habitat just west of the main survey transect. Surrounding land use is entirely agricultural row crops.

To place our results in a larger context, we also present data from biological assessments conducted between 2005 and 2008 at selected sites in the Yolo-Sutter Bypass system. While these sites clearly differ from Putah Creek in their hydrogeomorphology, a comparison of similarities and differences in biodiversity between the two systems may prove informative. We are also conducting similar riparian surveys at the Cosumnes River Preserve. The results of these surveys will be published separately.

The **Cache Creek Settling Basin (CCSB)** site (no Map Volume Exhibit) is located in a large, actively-managed overflow basin designed to retain sediment and floodwaters emerging from Cache Creek. The site is managed for flood conveyance and sediment transport and so supports mainly early-successional willows and hydrophytic vegetation interspersed with medium-aged trees. Due to late addition of the site into our sampling schedule, our records from this site are few and spatially-limited. Nevertheless, the site is known to attract a variety of riparian and wetland species and we plan to survey it more extensively in the future.

The **Sacramento Weir (SACWR)** site (Map Volume Exhibit B15) serves as an overflow corridor connecting the Sacramento River to the Yolo Bypass. It maintains a relatively constant trickle of water year-round, supporting a permanent wetland-marsh complex just east of the main survey transect. Riparian habitat at this site consists of a mature, but very narrow mixed riparian woodland fragment surrounded by a mixture of early-successional low grasses and forbs tolerant of frequent flooding and perennially saturated soils.

The **Fremont Weir (FREWR)** site (Map Volume Exhibit B16) is located on the south bank of the Sacramento River at the northern end of the Yolo Bypass. This area, a mixture of mature riparian and early-successional wetland/grassland habitats, floods frequently due to its position at the head of the Yolo Bypass flood conveyance system. Fremont Weir's vegetation is a mixture of mixed riparian woodland (65%), valley oak woodland (20%), and open grassland (15%). Typical understory plants include poison oak, blackberry, and sedge.

The **Sutter Bypass (SUTBY)** site (Map Volume Exhibit B17) consists of a narrow tract of mature riparian forest located at the confluence of the Sacramento and Feather Rivers, along the southeast edge of the Sutter Bypass. Dominant vegetation at this site consists of valley oak woodland with a sparse understory of poison oak, Himalayan blackberry, Santa Barbara sedge, and assorted grasses. A few large remnant cottonwoods and sycamores grow along the banks of the rivers. The riverbanks and forest gaps are vegetated with assorted sun-loving shrubs, forbs and grasses.

2 VEGETATION SURVEYS AND MAPPING

Plant surveys were conducted during the growing season at all survey sites except the Cache Creek Settling Basin, which was added after vegetation surveys had been completed (Map Volume, Map Exhibits B1-17). Species composition and percent cover was assessed using the Braun-Blanquet relevé method (Mueller-Dombois & Ellenberg 1974) on ten-meter-radius circular plots overlaid on avian point count stations. For each plot, percent cover was assessed by species and by vertical height class. While



Surveying vegetation on Putah Creek. Photo: Molly Farrell

herbaceous monocultures (such as stands of *Carex* or *Cynodon*) were identified to species, stands of mixed annual grasses were labeled simply as “annual grasses,” since separation into species would have been too time-consuming. Habitat assessments were made using California Natural Community Field Survey (CNDDDB) protocols. Tree height, tree diameter at breast height, and tree crown diameter were also recorded for all trees falling within sample plots. Summary metrics included mean percent cover, total percent cover, and importance percentage value (IPV). Importance percentage value provides an overall estimate of the influence or importance of a particular plant species to the community (Brower et al. 1990).

2.1 CWHR Land Cover Class Mapping

Maps of each study site (excepting the Cache Creek Settling Basin) are presented in the accompanying Map Volume (Exhibits B1-B17). Land cover classes (eg. Valley Riparian Woodland, Valley Oak Woodland, annual and perennial grasslands, various classes of agricultural land cover types, etc.), were drawn from the California Wildlife Habitat Relationships System (CWHR, Mayer and Laudenslayer 1988). Maps were created using 2005 National Agricultural Imagery Program (NAIP) aerial photographs as basemaps. Classification was done using ArcGIS 9.1 and the Spatial Analyst extension (ESRI Corp.). Image classification was carried out in a multi-stage process using both automated and manual techniques. Maps were classified on a per-site basis with analyses confined to a 500 meter buffer around study locations.

In this process, point shapefiles were created with points placed on locations in the image where clear class distinctions could be made. As much as practicable, points were created for all possible classes occurring within a study extent. These points were then given a numeric code corresponding to a given class type. Care was taken to ensure that points were scattered throughout the study extent, covering the visible variation within each class. Additionally, points were coded to account for image noise such as shadows. Image values for each point were then extracted and saved as a signature file using the “Create Signature” application in the Multivariate toolbox within Spatial Analyst Tools. The “Maximum Likelihood” classification application in the multivariate toolbox was then used with the signature file to classify the entire image.

The classified rasters were edited for errors due to noise in the image, and for misclassification resulting from the automated algorithm. Rasters were then converted to shapefiles and manually edited. Often, large homogeneous areas such as agricultural fields, roads, rivers and urban areas were simply drawn using the original image as a template. Misclassifications within these areas were then deleted. Resulting shapefiles were then merged and saved as a geodatabase. The final shapefile was then converted back to a raster so that both formats would be available for later analysis.

2.2 Results - Vegetative structure and composition

Our surveys recorded a total of 205 plant species across all Putah Creek study sites. Half of these species were native (Table 2.1). An additional 15 species not found at the Putah Creek sites were recorded at the Yolo/Sutter Bypass sites. Thirty-three percent of these were native. Data on plant species composition and percent cover by site and by vertical height class are presented in Tables 2.2.a-f. Table 2.3 presents information on the ecology of many of these species, as well as their importance to wildlife and pollinators.



Putah Creek at Stevenson's Bridge (left), California Grape (above) Jimson Weed (below). Photos: A. Engilis, Jr.



Sixteen plant species made up the canopy height class, the first eight of which were all native (Table 2.2.a). All canopy tree species found at the Yolo/Sutter Bypass sites also occurred along Putah Creek, though California Sycamore (*Platanus racemosa*) was much more abundant at the Yolo Bypass Fremont Weir site.

Of the understory tree species, those with the highest importance percentage values were: sandbar willow (*Salix exigua*), black walnut, box elder, and Fremont cottonwood (Table 2.2.b). Other common understory trees were red willow, Oregon ash, valley oak, and Goodding's black willow. Conspicuously absent at Diversion Dam and Oxbow, sites that might otherwise be expected to host this riparian species, was Oregon ash. Missing also at Oxbow were valley oak trees. It may be that oak recruitment is being

suppressed by the dense understory of false bamboo (*Arundo donax*) and other nonnative shrubs, like Himalayan blackberry (*Rubus armeniacus*), at the site, since source trees exist in neighboring upland areas. (This type of seedling suppression was also observed at the Cache Creek Nature Preserve (Truan 2002).)

Northern California black walnut (*Juglans californica* var. *hindsii*) is considered by some botanists to be truly native in only a few populations in Napa and Contra Costa Counties, elsewhere introduced by Europeans for use as a rootstock in walnut orchards and/or as street trees. Certain trees along Putah Creek, those that look like pure black walnut, may in fact be native walnuts, but their occurrence in this area may be the result of human dispersal (Dan Potter pers. comm.). At least some of the trees along Putah Creek are *Paradox* hybrids, trees intermediate between *J. hindsii* and the cultivated Persian (aka English) walnut (*Juglans regia*). *Paradox* is easy to distinguish from either parent species: the leaf morphology is intermediate, the bark is much lighter than the native species, and they are fast-growing and produce very few nuts. The latter two facts have made them attractive as street trees. *Paradox* has also been used extensively as a rootstock for *J. regia* in walnut orchards. A few *Paradox* trees appear to have arisen spontaneously along Putah Creek, but careful surveys have not been undertaken to confirm this. Some walnuts are known to be allelopathic, suppressing understory growth of other species, but this has not been confirmed for *J. hindsii*. We do note in our surveys that understory growth is sparse beneath Putah Creek's walnuts and that they tend to form monocultures. Wildlife diversity is also relatively low in and around walnut trees. For these reasons, we do not recommend revegetation using walnuts along Putah Creek. It may also be advantageous to remove trees that are clearly *Paradox* hybrids.

Himalayan blackberry was the most dominant shrub species across all study plots. Other dominant species included false bamboo, tamarisk (*Tamarix parviflora*), California rose (*Rosa californica*), buttonbush (*Cephalanthus occidentalis* var. *californicus*), blue elderberry (*Sambucus mexicana*), and poison oak (*Toxicodendron diversilobum*). Three native shrub species found at Mace Boulevard (*Baccharis salicifolia*, *Heteromeles arbutifolia*, and *Rhamnus californica*) were planted as part of a restoration project in the late 1990's. Small stands of native California blackberry (*Rubus ursinus*) were also present at several sites. Interdam hosts populations of native shrubs and vines that may be suitable as sources of propagules for future habitat restoration efforts elsewhere on the creek.

Among the herbs and forbs, nonnative Bermudagrass (*Cynodon dactylon*), black mustard (*Brassica nigra*) and white sweet clover (*Melilotus alba*) were most abundant, followed by native western goldenrod (*Euthamia occidentalis*). Goldenrod is an important nectar resource for pollinators in late summer and fall when relatively few other plants are in bloom. Other important native species included creeping wild rye (*Leymus triticoides*), a valuable wetland plant and ground cover; Douglas' mugwort (*Artemisia douglasiana*), a restoration asset and source of food and cover for birds; turkey tangle fogfruit

(*Phyla nodiflora*), an excellent ground cover and nectar source for insect pollinators; and the graceful naked or torrent sedge (*Carex nudata*), an important bank stabilizer and waterfowl food plant.

Of the native vines, California wild grape (*Vitis californica*), an important wildlife plant, was found at all but the three most-downstream sites. Dutchman's pipe (*Aristolochia californica*) was found at Interdam, Diversion Dam, Winters Putah Creek Park, and the Center for Land-based Learning. And the delicate yet hardy western white clematis (*Clematis ligusticifolia*) was found at Interdam and Winters Putah Creek Park.



Putah Creek at Picnic Grounds, UC Davis Riparian Reserve. Photo: M. Truan

TABLE 2.2.a. CANOPY TREE PERCENT COVER (native species underlined)

	Species Code	INTDM	DVDAM	OXBOW	DRYCK	WINTR	YOLOH	CLBL	RUSSR
<u>Populus fremontii</u>	<u>popfre</u>	25%	45%	33%		43%	35%	29%	38%
<u>Juglans californica</u> var. <u>hindsii</u>	<u>jugcab</u>	8%		15%	45%	40%	25%	19%	
<u>Salix laevigata</u>	<u>sallae</u>	12%		25%	35%		30%	15%	20%
<u>Quercus lobata</u>	<u>quelob</u>	12%	20%		20%	20%	19%	36%	
<u>Salix gooddingii</u>	<u>salgoo</u>		10%	35%			15%		
<u>Alnus rhombifolia</u>	<u>alnrho</u>	16%	25%	10%		29%		65%	
<u>Fraxinus latifolia</u>	<u>fralat</u>					13%	29%	70%	
<u>Acer negundo</u>	<u>aceneg</u>			10%	20%				
Eucalyptus globulus	eucglo								
Arundo donax	arudon		2%	30%	5%				
<u>Salix exigua</u>	<u>salexj</u>								
<u>Acer macrophyllum</u>	<u>acemac</u>						20%		
Catalpa sp.	catspe						20%		
<u>Salix lasiolepis</u>	<u>sallas</u>			13%					
<u>Platanus racemosa</u>	<u>plarac</u>								
<u>Quercus douglasii</u>	<u>quedou</u>	3%							
Total Canopy Trees		75%	102%	170%	125%	144%	193%	234%	58%

TABLE 2.2.a. CANOPY TREE PERCENT COVER (continued)

Species Code	STVR	PICNC	OLDR	MACEB	LOSRI	PUTCS	Mean % Cover	Total % Cover	IPV	SACWR	FREWR	SUTBY
<u>ponfre</u>	40%	65%		38%	36%	40%	39%	466%	19.10	34%	45%	42%
<u>jugcah</u>	41%		15%	29%	45%	52%	30%	334%	15.25			20%
<u>sallae</u>	25%			38%	30%	35%	27%	265%	12.93			
<u>quelob</u>	24%	47%		27%	15%		24%	238%	12.27	30%	30%	55%
<u>salgoo</u>			40%	38%	23%	30%	27%	190%	9.15	27%	48%	15%
<u>alnrho</u>			10%				26%	155%	7.65			
<u>fralat</u>	10%		19%				28%	140%	6.65	20%	50%	27%
<u>aceneg</u>			10%		35%		19%	75%	4.42		38%	
eucglo	38%	23%	5%				22%	66%	3.55			
arudon							12%	37%	2.85			
<u>salexi</u>					35%		35%	35%	1.50			
<u>acemac</u>							20%	20%	1.13			
catspe							20%	20%	1.13			
<u>sallas</u>							13%	13%	0.95			
<u>plarac</u>				5%			5%	5%	0.77		83%	
<u>quedou</u>							3%	3%	0.71			
	177%	135%	99%	175%	218%	157%	147%	2061%		111%	176%	159%

TABLE 2.2.b. UNDERSTORY TREE PERCENT COVER (native species underlined)

	Species Code	INTDM	DVDAM	OXBOW	DRYCK	WINTR	YOLOH	CLBL	RUSSR
<u>Salix exigua</u>	<u>salex</u>	4%	19%	17%	33%	21%	12%	10%	9%
<u>Juglans californica</u> var. <u>hindsii</u>	<u>jugcab</u>	7%	18%	6%	23%	9%	2%	12%	19%
<u>Acer negundo</u>	<u>aceneg</u>	18%	5%	11%	27%	6%	4%	2%	3%
<u>Populus fremontii</u>	<u>popfre</u>	3%	2%	4%	1%	4%	4%	10%	25%
<u>Salix laevigata</u>	<u>sallae</u>	5%	16%	9%	19%	7%	40%	13%	16%
<u>Fraxinus latifolia</u>	<u>fralat</u>	8%			12%	18%	12%	15%	2%
<u>Quercus lobata</u>	<u>quelob</u>	5%	7%		11%	10%	4%	9%	9%
<u>Salix gooddingii</u>	<u>salgoo</u>	9%	15%	14%	25%	15%	25%		30%
<u>Salix lasiolepis</u>	<u>sallas</u>	4%	20%	12%		9%		1%	4%
Eucalyptus globulus	eucglo				10%	5%	1%	2%	5%
<u>Alnus rhombifolia</u>	<u>alnrho</u>	10%		20%	3%	10%	1%		
Prunus amygdalus	pruamy				1%	8%	8%	6%	3%
<u>Platanus racemosa</u>	<u>plarac</u>					10%		5%	
Ailanthus altissima	ailalt			1%		9%	9%		
Ficus carica	ficcar		2%	4%	5%	1%			
<u>Cercis occidentalis</u>	<u>cerocc</u>	4%			1%				
Juglans regia	jugreg					100%		15%	20%
<u>Quercus wislizenii</u>	<u>quewis</u>	3%				1%		1%	
<u>Aesculus californica</u>	<u>aescal</u>							20%	
Catalpa sp.	catspe						10%	2%	
Prunus sp.	pruspe								3%
Morus alba	moralb			5%		2%			
Maclura pomifera	macpom		5%						
<u>Quercus douglasii</u>	<u>quedou</u>	1%							
Olea europaea	oleeur								15%
Ligustrum vulgare	ligvul								
<u>Pinus sabiniana</u>	<u>pinsab</u>	2%							
Albizia julibrissin	albjul						1%		
<u>Quercus agrifolia</u>	<u>queagr</u>							1%	
Robinia pseudoacacia	robpse								
Total Understory Trees		81%	108%	101%	170%	243%	131%	123%	162%

TABLE 2.2.b. UNDERSTORY TREE PERCENT COVER (continued)

Species Code	STVBR	PICNC	OLDRR	MACEB	LOSRF	PUTCS	Mean % Cover	Total % Cover	IPV	SACWR	FREWR	SUTBY
salexi	7%	5%	34%	39%	26%	16%	18%	252%	11.06	70%	16%	
jugcah	10%	7%	17%	13%	13%	18%	12%	175%	8.91	1%	6%	14%
aceneg	7%	11%	10%	17%	17%	5%	10%	142%	8.00	13%	23%	14%
popfre	3%	5%	1%	1%	5%	39%	8%	105%	6.98		12%	
sallae	8%	10%		9%		10%	13%	159%	7.90		20%	
fralat	6%	15%	6%	8%	20%	4%	10%	124%	6.92	15%	9%	33%
quelob	23%	15%	1%	13%	5%		9%	112%	6.58	1%	12%	11%
salgoo			1%	15%	28%	15%	17%	190%	8.46	20%	11%	4%
sallas	5%				35%	8%	11%	98%	5.33		14%	
eucglo	10%	23%	4%			15%	8%	75%	4.69			
alnrho	1%						7%	44%	2.97			
pruamy	2%						5%	28%	2.51			
plarac	10%			3%			7%	28%	1.94		10%	
ailalt	7%						6%	25%	1.84			
ficcar							3%	12%	1.48		14%	
cerocc		1%		1%			2%	7%	1.36			
jugreg							45%	135%	4.62			
quewis							2%	5%	1.00			
aescal				3%			12%	23%	1.22			
catspe							6%	12%	0.90			
pruspe		7%					5%	10%	0.86			
moralb							4%	7%	0.77			
macpom		1%					3%	6%	0.75		7%	5%
quedou			1%				1%	2%	0.63			
oleeur							15%	15%	0.71			
ligvul	3%						3%	3%	0.37			
pinsab							2%	2%	0.33			
albjul							1%	1%	0.32			
queagr							1%	1%	0.30			
robpse							0%	0%	0.00	1%		5%
	100%	101%	75%	122%	149%	130%	128%	1797%		121%	115%	86%

TABLE 2.2.c. TALL SHRUB PERCENT COVER (native species underlined)

	Species Code	INTDM	DVDAM	OXBOW	DRYCK	WINTR	YOLOH	CLBL	RUSSR
Rubus armeniacus	rubarm	3%	15%	17%		40%	15%	10%	
Arundo donax	arudon		23%	47%	5%		25%	25%	
Tamarix parviflora	tampar					10%		10%	11%
<u>Rosa californica</u>	<u>roscal</u>				10%	8%		25%	5%
<u>Cephalanthus occidentalis var. californicus</u>	<u>cepocc</u>	5%		12%	4%	27%	5%	15%	
Sambucus mexicana	sammex	20%				15%	5%	12%	5%
<u>Toxicodendron diversilobum</u>	<u>toxdiv</u>	6%			18%			14%	
<u>Baccharis pilularis</u>	<u>bacpil</u>	8%	3%				1%	13%	
<u>Rubus ursinus</u>	<u>ruburs</u>			38%	40%				
<u>Symphoricarpos albus</u>	<u>symalb</u>	21%						25%	
<u>Baccharis salicifolia</u>	<u>bacsal</u>		6%						
<u>Heteromeles arbutifolia</u>	<u>hetarb</u>	3%							
<u>Rhamnus californica</u>	<u>rhacal</u>								
<u>Cercis occidentalis</u>	<u>cerocc</u>	3%							
Nicotiana glauca	nicgla	3%							
<u>Cornus sericea</u>	<u>corser</u>	5%							
Total Tall Shrubs		76%	46%	114%	77%	100%	51%	148%	21%

TABLE 2.2.c. TALL SHRUB PERCENT COVER (continued)

Species Code	STVBR	PICNC	OLDRR	MACB	LOSFR	PUTCS	Mean % Cover	Total % Cover	IPV	SACWR	FREWR	SUTBY
rubarm	6%	10%				28%	16%	144%	14.65			
arudon				10%		7%	20%	142%	13.04			
tampar	10%	19%	10%		50%		17%	120%	11.87			
<u>roscal</u>	8%	10%				15%	11%	80%	9.64		17%	20%
<u>cepocc</u>		5%					10%	73%	9.25	20%	33%	
<u>sammex</u>		7%		5%			10%	69%	9.02		18%	12%
<u>toxdiv</u>	10%	3%		15%			11%	66%	8.11	10%	9%	28%
<u>bacpil</u>				11%			7%	36%	5.73		10%	5%
<u>ruburs</u>							39%	78%	5.82		18%	13%
<u>symalb</u>							23%	46%	4.05			
<u>bacsal</u>				18%			12%	24%	2.81			
<u>hetarb</u>				5%			4%	8%	1.93			
<u>rhacal</u>				15%			15%	15%	1.58			
<u>cerocc</u>							3%	3%	0.88			
nicgla							3%	3%	0.88			
<u>corser</u>							5%	5%	1.01			
	34%	54%	10%	79%	50%	50%	65%	910%		30%	69%	78%

TABLE 2.2.d. SHORT SHRUB PERCENT COVER (native species underlined)

	Species Code	INTDM	DVDAM	OXBOW	DRYCK	WINTR	YOLOH	CLBL	RUSSR
Rubus armeniacus	rubarm	20%	14%	21%	12%	32%	5%	18%	1%
<u>Rosa californica</u>	<u>roscal</u>	13%		3%	15%	10%		24%	11%
<u>Toxicodendron diversilobum</u>	<u>toxdiv</u>	6%	3%		10%	8%	3%	17%	
Arundo donax	arudon		5%	14%	7%		15%		
<u>Cephalanthus occidentalis var. californicus</u>	<u>cepocc</u>	3%	3%	13%	4%			3%	4%
<u>Rubus ursinus</u>	<u>ruburs</u>		9%	14%	1%			9%	
Tamarix parviflora	tampar					5%			7%
<u>Sambucus mexicana</u>	<u>sammex</u>	6%				15%		4%	17%
<u>Baccharis pilularis</u>	<u>bacpil</u>	4%	4%	1%					
<u>Symphoricarpos albus</u>	<u>symalb</u>	2%						50%	
<u>Baccharis salicifolia</u>	<u>bacsal</u>	3%	4%						
<u>Heteromeles arbutifolia</u>	<u>hetarb</u>	2%						1%	
Nicotiana glauca	nicgla	5%							
<u>Rhamnus californica</u>	<u>rhacal</u>							1%	
<u>Eriodictyon californica</u>	<u>erical</u>	11%							
<u>Atriplex lentiformis</u>	<u>atrlen</u>							3%	
<u>Diplacus aurantiacus</u>	<u>dipaur</u>	2%							
<u>Cercis occidentalis</u>	<u>cerocc</u>	1%							
Ligustrum vulgare	ligvul								1%
<u>Salix exigua</u>	<u>salex</u>	1%							
<u>Arctostaphylos manzanita</u>	<u>arcman</u>								
<u>Cercocarpus betuloides</u>	<u>cerbet</u>							1%	
<u>Cornus sericea</u>	<u>corser</u>	3%							
Total Short Shrubs		79%	41%	64%	50%	70%	23%	129%	39%

TABLE 2.2.d. SHORT SHRUB PERCENT COVER (continued)

Species Code	STVBR	PICNC	OLDRR	MACEB	LOSRF	PUTCS	Mean % Cover	Total % Cover	IPV	SACWR	FREWR	SUTBY
rubarm	13%	18%	13%	18%	24%	30%	17%	238%	21.93	14%	7%	11%
<u>roscal</u>	15%	3%	1%	1%		30%	11%	125%	13.54		9%	13%
<u>toxdiv</u>	34%	7%	5%	4%			10%	97%	11.29	13%	11%	34%
arudon			25%		45%		18%	110%	9.91			
<u>cepooc</u>				3%			5%	32%	5.74	9%	28%	
<u>ruburs</u>	12%	5%					8%	49%	6.24	20%	10%	24%
tampar	0%	13%	4%		6%		6%	34%	5.32			
<u>sammex</u>				1%			9%	43%	5.31		5%	15%
<u>bacpil</u>				2%			2%	10%	2.79		5%	3%
<u>symalb</u>				5%			19%	56%	5.03			
<u>bacsal</u>			1%				3%	8%	2.10			
<u>hetarb</u>				3%			2%	6%	1.98			
nicgla							5%	5%	1.40			
<u>rhacal</u>			3%				2%	3%	1.28			
<u>erical</u>							11%	11%	1.21			
<u>atrlen</u>							3%	3%	0.73			
<u>dipaur</u>							2%	2%	0.67			
<u>cerocc</u>							1%	1%	0.61			
ligvul							1%	1%	0.61			
<u>salexj</u>							1%	1%	0.61			
<u>arcman</u>			1%				1%	1%	0.58			
<u>cerbet</u>							1%	1%	0.58			
<u>corser</u>							3%	3%	0.72			
	74%	46%	51%	37%	74%	60%	60%	837%		56%	48%	100%

TABLE 2.2.e. HERB AND FORB PERCENT COVER (native species underlined)

	Species Code	INTDM	DVDAM	OXBOW	DRYCK	WINTR	YOLOH	CLBL	RUSSR
Cynodon dactylon	cyndac	9.77%	3.88%	3.00%	4.88%	4.50%	24.50%	13.40%	13.20%
Brassica nigra	branig	11.08%	3.80%	3.30%	4.06%	6.01%	13.63%	0.88%	15.00%
Melilotus alba	melalb	5.17%	1.00%	1.27%	2.27%	2.08%	7.01%	7.29%	4.25%
<u>Euthamia occidentalis</u>	<u>eutocc</u>	1.50%	2.74%	1.75%	10.00%	2.00%	1.00%	3.00%	5.00%
Rumex crispus	rumcri	2.50%	0.23%	1.90%	2.75%	0.40%	1.32%	2.00%	1.76%
Lolium multiflorum	lolmul	34.00%	6.61%	4.17%	6.20%	9.25%	5.00%	3.75%	3.50%
<u>Leymus triticoides</u>	<u>leytri</u>	3.10%	17.33%		14.83%	7.52%	25.00%	6.56%	5.80%
<u>Xanthium strumarium</u>	<u>xanstr</u>	2.50%	9.68%	10.29%	6.85%	7.46%	6.71%	0.93%	2.33%
Lactuca serriola	lacser		0.82%	2.67%	1.56%	5.00%	4.29%	1.16%	4.26%
Bromus rigidus	brorig	22.13%	17.58%	3.00%	14.00%	24.40%	15.00%	20.83%	16.13%
<u>Artemisia douglasiana</u>	<u>artdou</u>	8.67%	12.96%	2.71%	5.00%	6.00%	1.50%	5.00%	3.00%
<u>Phyla nodiflora</u>	<u>phynod</u>			0.10%	1.30%	7.57%	2.50%	6.50%	1.50%
<u>Leersia oryzoides</u>	<u>leeory</u>		1.50%	1.73%	17.03%	3.83%	5.00%	2.03%	
<u>Carex nudata</u>	<u>carnud</u>	3.06%	2.00%	3.60%	7.42%	3.50%	3.78%	2.63%	2.05%
Convolvulus arvensis	conarv		0.23%	0.10%	0.53%	0.30%	2.17%		0.50%
Avena fatua	avefat	8.82%	2.75%		8.33%	15.57%	14.17%	10.50%	19.44%
Silybum marianum	silmar	9.10%				3.00%	15.17%	4.67%	8.67%
Centaurea solstitialis	censol	23.90%	1.43%	1.92%	1.76%	2.64%	1.68%	1.00%	
<u>Conyza canadensis</u>	<u>concan</u>	2.00%	1.10%	1.33%	0.94%	0.30%	2.00%	1.03%	2.00%
Marrubium vulgare	marvul	1.83%	0.50%	0.10%	0.63%	1.00%	0.10%	3.33%	1.05%
Lepidium latifolium	leplat		15.40%	21.33%	2.55%				24.75%
Taeniatherum caput-medusae	taecap	8.00%	3.00%			15.00%	4.67%	5.50%	17.00%
Annual grasses	anngra	45.00%			5.00%	13.00%	50.00%		61.92%
<u>Polygonum lapathifolium</u>	<u>pollap</u>		1.00%	1.62%	3.50%	0.83%	2.80%	0.30%	1.00%
Echinochloa crus-galli	echcru		1.64%	5.63%	2.70%	2.00%	1.83%	1.50%	2.00%
<u>Solanum americanum</u>	<u>solame</u>		1.23%	3.27%	2.78%	1.24%	5.13%	1.03%	0.50%
Chenopodium ambrosioides	cheamb	2.50%	0.87%	3.28%	0.87%	0.55%	1.50%	1.50%	0.30%
Carduus pycnocephalus	carpyc	6.33%	4.14%		2.00%	7.02%	12.50%	8.69%	7.87%
Anthriscus caucalis	antcau	18.00%	0.78%		0.10%		0.10%		4.35%
Polypogon monspeliensis	polmon	10.67%	5.61%	7.88%	3.83%	1.00%	1.00%		1.25%
<u>Chenopodium berlandieri</u>	<u>cheber</u>	0.50%		13.00%	6.00%	3.67%	4.39%	0.55%	
Kickxia spuria	kicspu		0.96%	1.03%	3.15%	0.90%	3.71%	3.00%	8.00%
Paspalum dilatatum	pasdil	2.50%		1.00%	15.00%	0.55%	1.38%	1.00%	
<u>Bidens frondosa</u>	<u>bidfro</u>		0.10%			0.10%	2.02%		
Piptatherum miliaceum	pipmil	9.79%	13.60%	4.60%	5.14%	1.50%			
<u>Eremocarpus setigerus</u>	<u>ereset</u>	18.75%	0.50%	0.10%	0.10%	0.77%	0.50%		
Crypsis schoenoides	crysch		5.67%	5.50%	10.45%	3.44%	5.80%	2.63%	
<u>Ambrosia psilostachya</u>	<u>ambpsi</u>	11.75%				1.00%	2.00%		

TABLE 2.2.e. HERB AND FORB PERCENT COVER (continued)

Species Code	STVBR	PICNC	OLDRR	MACEB	LOS RF	PUTCS	Mean % Cover	Total % Cover	IPV	SACWR	FREWR	SUTBY
cyndac	25.89%	16.29%	15.27%	7.23%	27.29%	17.40%	13.32%	186.49%	314.65%	27.38%	11.08%	29.00%
branig	0.75%	10.00%	9.56%	14.77%	11.10%	13.43%	8.38%	117.36%	232.65%	3.25%	8.39%	5.50%
melalb	5.33%	6.50%	3.10%	0.50%	0.50%	0.50%	3.34%	46.77%	148.93%	2.00%	1.05%	2.00%
eutocc	4.00%	1.50%	1.29%	3.00%	3.32%	1.50%	2.97%	41.60%	142.80%	3.50%	4.00%	13.50%
rumcri	1.17%	1.00%	3.37%	5.11%	3.25%	0.50%	1.95%	27.26%	125.79%	2.69%	8.14%	1.17%
lolmul	5.00%	15.63%	31.85%	15.25%		1.00%	10.86%	141.20%	254.25%	1.00%		
levtri	7.13%	14.71%	3.38%	12.18%	18.00%	4.25%	10.75%	139.78%	252.57%	1.90%	15.26%	19.09%
xanstr	3.56%	2.30%	2.54%	2.61%	2.43%		4.63%	60.20%	158.18%	17.25%	13.39%	2.00%
lacser	3.70%	3.33%	0.96%	2.38%	1.10%	1.12%	2.49%	32.34%	125.14%	3.06%	1.97%	1.50%
brorig	51.00%	18.00%	8.50%	8.25%			18.24%	218.83%	339.65%	3.38%		6.00%
artdou		25.00%	0.50%	2.00%	2.00%		6.20%	74.35%	168.29%	5.14%	11.44%	13.00%
phynod	6.50%	5.00%	14.11%	15.00%	1.50%	10.00%	5.96%	71.58%	165.00%	8.44%	4.55%	
leory	1.75%	10.33%	4.00%	2.33%	4.33%	1.00%	4.57%	54.87%	145.19%	1.00%	2.25%	
carnud	3.00%	4.00%	2.86%		5.00%		3.57%	42.89%	130.98%			
conarv	2.00%	3.00%	3.75%	3.25%	4.00%	4.28%	2.01%	24.11%	108.70%	6.57%	11.40%	
avefat	37.50%	36.67%	20.91%	30.07%			18.61%	204.73%	316.26%	4.06%		5.00%
silmar	8.00%	10.64%	3.00%	18.86%	0.75%	2.00%	7.62%	83.84%	172.88%	3.67%	7.55%	
censol		7.33%	10.29%	2.50%	7.00%		5.59%	61.45%	146.31%	12.17%	0.89%	
concan		0.10%		1.00%		1.00%	1.16%	12.80%	88.61%		6.75%	
marvul	2.00%		0.50%		1.00%		1.10%	12.05%	87.72%			
leplat	2.00%	0.75%	8.70%	9.67%	30.33%	17.50%	13.30%	132.98%	224.48%	4.70%	26.61%	18.83%
taecap	25.00%	20.00%	2.50%	5.63%			10.63%	106.29%	192.83%			
anngra		37.00%	63.14%	61.85%	15.00%		39.10%	351.92%	477.48%	31.25%	30.83%	
pollap	0.10%		2.00%		12.90%		2.60%	26.05%	97.65%	4.00%	1.95%	
echcru		2.00%			5.50%	1.00%	2.58%	25.80%	97.36%	2.00%	2.21%	
solame	0.87%	0.55%		4.00%			2.06%	20.59%	91.18%	3.00%	3.84%	1.33%
cheamb	1.83%		2.00%				1.52%	15.20%	84.78%	0.50%	2.84%	
carpyc		8.51%	10.00%				7.45%	67.05%	139.61%	1.50%	6.29%	
antcau	3.00%	3.93%	10.00%	11.67%			5.77%	51.92%	121.66%	2.67%	10.82%	5.00%
polmon		3.50%			10.00%		4.97%	44.74%	113.14%		2.58%	
cheber	1.40%	1.50%		2.83%			3.76%	33.84%	100.22%	2.33%	0.87%	1.17%
kicspu	1.20%	1.75%					2.63%	23.70%	88.18%	1.00%	1.02%	
pasdil			10.00%		2.00%		4.18%	33.43%	93.05%	0.10%	2.00%	
bidfro	0.30%	0.50%	0.50%	0.50%	2.00%		0.75%	6.02%	60.54%	1.75%	0.79%	0.92%
pipmil	10.00%	1.00%					6.52%	45.63%	100.86%	10.00%		
ereset		20.00%					5.82%	40.72%	95.02%			
crysch		2.00%					5.07%	35.49%	88.82%	3.00%	1.88%	
ambpsi	5.50%	5.25%	6.78%		0.50%		4.68%	32.78%	85.61%	12.16%	2.00%	

TABLE 2.2.e. HERB AND FORB PERCENT COVER (native species underlined)

	Species Code	INTDM	DVDAM	OXBOW	DRYCK	WINTR	YOLOH	CLBL	RUSSR
<u>Phoradendron macrophyllum</u>	<u>phomac</u>	1.00%	2.00%			6.75%		2.00%	3.38%
<u>Amaranthus retroflexus</u>	<u>amaret</u>		0.50%	2.00%	1.00%	2.67%	4.72%	0.10%	
Aster sp.	astspe	2.00%		2.00%					
Cyperus eragrostis	cypera		0.70%	0.92%	0.50%	1.80%			
<u>Amaranthus blitoides</u>	<u>amabli</u>			0.10%	0.50%	0.30%	1.00%		2.00%
<u>Galium aparine</u>	<u>galapa</u>	6.40%	1.00%			6.70%			22.18%
<u>Atriplex triangularis</u>	<u>atrtri</u>						2.00%	1.55%	
<u>Glycyrrhiza lepidota</u>	<u>glylep</u>	3.75%							4.33%
Conium maculatum	conmac		6.00%	5.20%					5.78%
Cuscuta sp.	cusspe				1.00%	2.00%	2.67%	8.33%	
<u>Malvella leprosa</u>	<u>mallep</u>						2.00%		
Lotus sp.	lotspe	2.00%					2.00%		1.00%
Cyperus esculentus	cypesc	2.00%					2.00%	1.62%	
<u>Equisetum sp.</u>	<u>equspe</u>	9.57%	0.30%	2.00%		2.00%			1.50%
Euphorbia prostrata	euppro			0.62%	0.23%	0.30%	1.25%	0.50%	
<u>Mentha arvensis</u>	<u>menarv</u>				6.00%	0.55%	1.37%	0.55%	
<u>Elymus glaucus</u>	<u>elygla</u>		16.25%			7.25%	11.50%	18.40%	
Sorghum halepense	sorhal			8.00%	4.67%	0.53%	5.67%		
Nicotiana glauca	nicgla		2.00%	3.50%	1.00%		1.15%		
<u>Plantago major</u>	<u>plamaj</u>	5.00%		0.55%		0.30%	2.00%	0.70%	
Cichorium intybus	cicint	2.00%					1.00%		
<u>Urtica dioica</u>	<u>urtdio</u>	2.50%	1.05%	2.08%			0.40%		
<u>Epilobium ciliatum</u>	<u>epicil</u>		0.30%	0.18%	0.10%		5.00%	1.00%	
<u>Panicum capillare</u>	<u>pancap</u>		1.00%	3.00%	0.50%		1.33%		0.50%
Datura meteloides	datmet		0.50%	1.17%	0.75%		0.10%		
<u>Digitaria sanguinalis</u>	<u>digsan</u>		0.30%	2.33%	0.50%		1.67%	1.00%	
Gnaphalium luteo-album	gnalut			0.30%	1.00%	2.00%	0.10%	0.55%	
<u>Datura stramonium</u>	<u>datstr</u>		1.00%	0.50%	5.00%				
<u>Apocynum androsaemilfolium</u>	<u>apoand</u>								8.50%
Raphanus sativus	rapsat								1.00%
Polygonum aviculare	polavi			1.00%		0.37%	7.50%		
<u>Juncus sp.</u>	<u>junspe</u>					2.00%		2.75%	
Lotus purshianus	lotpur					1.43%	1.00%		
<u>Heliotropium curassavicum</u>	<u>helcur</u>			0.10%		1.00%			7.75%
<u>Epilobium brachycarpum</u>	<u>epibra</u>			0.10%	1.00%	5.05%	3.13%		
Polygonum arenastrum	polare		0.55%		1.00%				
Verbascum blattaria	verbla						0.50%		0.53%
Vicia sp.	vicspe	13.00%				7.50%			

TABLE 2.2.e. HERB AND FORB PERCENT COVER (continued)

Species Code	STVBR	PICNC	OLDRR	MACEB	LOS RF	PUTCS	Mean % Cover	Total % Cover	IPV	SACWR	FREWR	SUTBY
<u>phomac</u>			1.00%	1.00%			2.45%	17.13%	67.04%	3.50%	7.75%	6.50%
<u>amaret</u>	3.00%						2.00%	13.99%	63.32%	5.00%	1.45%	
astspe		2.00%	0.88%	1.50%	2.55%	0.50%	1.63%	11.43%	60.28%	7.00%	9.65%	
cypera		1.00%	3.00%	1.79%			1.39%	9.71%	58.24%	2.00%	2.77%	
<u>amabli</u>		5.00%		0.75%			1.38%	9.65%	58.17%			
<u>galapa</u>	15.00%	15.00%					11.05%	66.28%	118.67%	3.86%	24.37%	39.75%
<u>atrtri</u>	0.70%	4.00%	1.17%		37.55%		7.83%	46.97%	95.76%	0.50%		
<u>glylep</u>	8.75%		10.90%	9.14%	4.21%		6.85%	41.09%	88.79%	9.00%		
conmac				1.00%	6.09%	13.17%	6.21%	37.23%	84.21%		25.00%	
cusspe	3.00%		12.50%				4.92%	29.50%	75.04%	70.00%		
<u>mallep</u>	2.00%		10.50%	3.25%	2.00%	2.50%	3.71%	22.25%	66.44%	13.50%	3.50%	
lotspe		10.52%		0.50%		3.75%	3.29%	19.77%	63.50%			
cypesc	0.75%	3.62%			8.33%		3.05%	18.32%	61.79%	4.75%	4.65%	
<u>equspe</u>	2.00%						2.90%	17.37%	60.66%	0.50%	1.00%	3.00%
euppro	10.00%						2.15%	12.90%	55.35%		8.10%	
<u>menarv</u>		2.00%			0.10%		1.76%	10.57%	52.59%		1.03%	
<u>elygla</u>				30.00%			16.68%	83.40%	132.30%		11.26%	2.00%
sorhal				5.00%			4.77%	23.87%	61.69%	9.07%		
nicgla	2.00%						1.93%	9.65%	44.82%		1.50%	
<u>plamaj</u>							1.71%	8.55%	43.52%	0.75%		
cicint	1.25%		2.11%	0.75%			1.42%	7.11%	41.81%	5.25%	0.10%	
<u>urtdio</u>			1.00%				1.41%	7.03%	41.72%		5.38%	
<u>epicil</u>							1.32%	6.58%	41.18%			
<u>pancap</u>							1.27%	6.33%	40.89%	1.00%	5.14%	
datmet		3.50%					1.20%	6.02%	40.51%			1.50%
<u>digsan</u>							1.16%	5.80%	40.26%		1.17%	
gnalut							0.79%	3.95%	38.06%		0.78%	
<u>datstr</u>				50.00%			14.13%	56.50%	93.72%	0.50%	1.00%	
<u>apoand</u>	2.33%		10.00%	1.50%			5.58%	22.33%	53.19%	6.00%	0.75%	
rapsat			0.50%	12.07%	2.00%		3.89%	15.57%	45.17%	0.30%	1.25%	20.00%
polavi						5.00%	3.47%	13.87%	43.15%	1.25%		
<u>junspe</u>			2.00%		5.00%		2.94%	11.75%	40.64%		8.67%	2.20%
lotpur			6.50%	0.83%			2.44%	9.76%	38.28%		26.86%	1.00%
<u>helcur</u>			0.50%				2.34%	9.35%	37.79%		0.50%	
<u>epibra</u>							2.32%	9.28%	37.70%			
polare			1.00%	1.00%			0.89%	3.55%	30.91%			
verbla			1.17%	1.00%			0.80%	3.20%	30.50%			
vicspe			15.33%				11.94%	35.83%	62.53%	20.00%	16.00%	

TABLE 2.2.e. HERB AND FORB PERCENT COVER (native species underlined)

	Species Code	INTDM	DVDAM	OXBOW	DRYCK	WINTR	YOLOH	CLBL	RUSSR
<u>Datura innoxia</u>	<u>datinn</u>					1.25%	6.33%		3.67%
<u>Asclepias fascicularis</u>	<u>ascfas</u>	2.50%							
Asparagus officinalis	aspoff				2.00%				
<u>Epilobium minutum</u>	<u>epimin</u>								1.80%
Polygonum persicaria	polper				0.50%	2.00%	1.50%		
<u>Eclipta prostrata</u>	<u>eclpro</u>			1.00%			2.25%	0.50%	
Sonchus oleraceus	sonole			2.00%		0.82%			
Sonchus arvensis	sonarv			1.03%			1.00%		
Foeniculum vulgare	foevul	2.00%	0.50%	0.10%					
Cotula coronopifolia	cotcor						1.00%	1.00%	0.50%
Portulaca oleracea	porole		0.10%		0.50%	1.00%			
<u>Trichostema lanceolatum</u>	<u>trilan</u>				0.30%	0.30%	1.00%		
Amaranthus albus	amaalb			0.75%	0.50%	1.10%			
<u>Nicotiana bigelovii</u>	<u>nicbig</u>		0.10%	0.54%	0.08%				
<u>Carex barbarae</u>	<u>carbar</u>							50.00%	
Medicago hispida	medhis	5.00%							
<u>Paspalum distichum</u>	<u>pasdis</u>				0.50%				
Cirsium vulgare	cirvul	15.00%							
<u>Nasella pulchra</u>	<u>naspul</u>								
Bromus mollis	bromol	27.50%					2.50%		
<u>Marah fabaceus</u>	<u>marfab</u>	3.00%						16.00%	
<u>Typha latifolia</u>	<u>typlat</u>	13.00%			5.00%				
Torilis arvensis	torarv	10.78%				4.00%			
<u>Epilobium angustifolium</u>	<u>epiang</u>								
<u>Setaria gracilis</u>	<u>setgra</u>				5.00%		0.50%		
Malva neglecta	malneg							2.00%	
Polygonum sp.	polspe						0.10%		
Ludwigia peploides	ludpep								
<u>Moss sp.</u>	<u>mosspe</u>					0.50%			
<u>Equisetum arvense</u>	<u>equarv</u>		1.00%	1.00%					
Ibicilla lutea	ibilut				1.00%	1.00%			
Plantago lanceolata	plalan								
Solanum sp.	solspe		1.00%				0.10%		
Physalis sp.	physpe			0.10%			0.50%		
Bromus sp.	bromsp		0.10%	0.10%					
Mentha sp.	menspe		0.10%	0.10%					
Rubus armeniacus	rubarm	75.00%							
Aegilops cylindrica	aegcyl								

TABLE 2.2.e. HERB AND FORB PERCENT COVER (continued)

Species Code	STVBR	PICNC	OLDRR	MACEB	LOS RF	PUTCS	Mean % Cover	Total % Cover	IPV	SACWR	FREWR	SUTBY
<u>datinn</u>							3.75%	11.25%	33.37%			
<u>ascfas</u>	3.00%		3.50%				3.00%	9.00%	30.70%			
aspoff					4.00%	3.00%	3.00%	9.00%	30.70%	1.25%		
<u>epimin</u>		0.85%				2.75%	1.80%	5.40%	26.43%		2.00%	
polper							1.33%	4.00%	24.77%	1.00%		
<u>ecipro</u>							1.25%	3.75%	24.47%	3.00%	4.50%	1.00%
sonole						0.50%	1.11%	3.32%	23.96%	0.55%	1.00%	
sonarv				1.00%			1.01%	3.03%	23.61%	0.67%		
foevul							0.87%	2.60%	23.11%			
cotcor							0.83%	2.50%	22.99%			
porole							0.53%	1.60%	21.92%			
<u>trilan</u>							0.53%	1.60%	21.92%			
amaalb							0.78%	2.35%	21.63%			
<u>nicbig</u>							0.24%	0.72%	20.87%		1.43%	
<u>carbar</u>				30.00%			40.00%	80.00%	108.24%	5.70%	36.39%	37.32%
medhis			50.67%				27.83%	55.67%	79.38%			
<u>pasdis</u>					45.00%		22.75%	45.50%	67.32%			
cirvul		20.00%					17.50%	35.00%	54.86%	0.10%	1.00%	
<u>naspul</u>			5.00%	30.00%			17.50%	35.00%	54.86%			
bromol							15.00%	30.00%	48.93%			
<u>marfab</u>							9.50%	19.00%	35.89%			
<u>typlat</u>							9.00%	18.00%	34.70%			
torarv							7.39%	14.78%	30.88%			
<u>epiang</u>					5.00%	1.00%	3.00%	6.00%	20.47%		1.00%	
<u>setgra</u>							2.75%	5.50%	19.87%			
malneg						2.17%	2.08%	4.17%	18.29%			
polspe		3.70%					1.90%	3.80%	17.86%			
ludpep			2.00%		1.50%		1.75%	3.50%	17.50%	15.00%	30.00%	
<u>mosspe</u>	2.00%						1.25%	2.50%	16.32%			
<u>equarv</u>							1.00%	2.00%	15.72%			
ibilut							1.00%	2.00%	15.72%			
plalan			1.00%	0.50%			0.75%	1.50%	15.13%			
solspe							0.55%	1.10%	14.66%			
physpe							0.30%	0.60%	14.06%			
bromsp							0.10%	0.20%	13.59%			
menspe							0.10%	0.20%	13.59%			2.00%
rubarm							75.00%	75.00%	95.63%			
aegcyl			20.00%				20.00%	20.00%	30.40%			

TABLE 2.2.e. HERB AND FORB PERCENT COVER (native species underlined)

	Species Code	INTDM	DVDAM	AXBOW	DRYCK	WINTR	YOLOH	CLBL	RUSSR
Keckiella sp.	kecspe							20.00%	
Erodium sp.	erospe	17.50%							
<u>Lemna minor</u>	<u>lemmin</u>	16.50%							
<u>Carex sp.</u>	<u>carspe</u>	15.00%							
Mentha pulegium	menpul								
Cirsium marianum	cirmar								
Cyperus sp.	cypspe			10.00%					
<u>Equisetum laevigatum</u>	<u>equlae</u>				10.00%				
Phalaris minor	phamin		10.00%						
Hordeum sp.	horspe	8.00%							
Salsola tragus	saltra								
Chenopodium album	chealb		7.01%						
Pennisetum clandestinum	pencla				5.67%				
<u>Muhlenbergia rigens</u>	<u>muhrig</u>								
<u>Helianthus annuus</u>	<u>helann</u>						4.00%		
Solanum elaeagnifolium	solela						4.00%		
<u>Asclepias incarnata</u>	<u>ascinc</u>								
Lotus corniculatus	lotcor								
<u>Epilobium canum</u>	<u>epican</u>	2.75%							
Clover sp.	clospe	2.50%							
Bromus diandrus	brodia								
Bromus tectorum	brotec	2.00%							
<u>Eleocharis palustris</u>	<u>elepala</u>	2.00%							
Iris sp.	irispe					2.00%			
Phalaris minor	phymin								2.00%
<u>Polygonum punctatum</u>	<u>polpun</u>				2.00%				
Triticum durum	tridur						1.50%		
<u>Agave sp.</u>	<u>agaspe</u>					1.00%			
Amaranthus sp.	amaspe								
Chenopodium murale	chemur		1.00%						
<u>Elymus elymoides</u>	<u>elyely</u>								
Epilobium sp.	epispe								1.00%
<u>Grindelia camporum</u>	<u>gricam</u>								
<u>Grindelia squarrosa</u>	<u>grisqu</u>								
Picris echioides	picech		1.00%						
Ricinus communis	riccom						1.00%		
<u>Scirpus acutus</u>	<u>sciacu</u>								
<u>Senecio riddellii</u>	<u>senrid</u>	1.00%							

TABLE 2.2.e. HERB AND FORB PERCENT COVER (continued)

Species Code	STVBR	PICNC	OLDRR	MACEB	LOS RF	PUTCS	Mean % Cover	Total % Cover	IPV	SACWR	FREWR	SUTBY
kecspe							20.00%	20.00%	30.40%			
erospe							17.50%	17.50%	27.43%			
lemmin							16.50%	16.50%	26.25%			
carspe							15.00%	15.00%	24.47%			
menpul		15.00%					15.00%	15.00%	24.47%		8.75%	
cirmar		11.50%					11.50%	11.50%	20.32%			
cypspe							10.00%	10.00%	18.54%			
egulae							10.00%	10.00%	18.54%			
phamin							10.00%	10.00%	18.54%			
horspe							8.00%	8.00%	16.16%			
saltra		0.50%		1.00%			0.75%	1.50%	15.28%		0.50%	
chealb							7.01%	7.01%	14.99%			
pencla							5.67%	5.67%	13.40%			
muhrig				5.13%			5.13%	5.13%	12.75%			
helann							4.00%	4.00%	11.42%	27.63%	5.50%	
solela							4.00%	4.00%	11.42%			
ascinc					3.00%		3.00%	3.00%	10.23%			
lotcor	3.00%						3.00%	3.00%	10.23%			
epican							2.75%	2.75%	9.94%			
clospe							2.50%	2.50%	9.64%			
brodia				2.00%			2.00%	2.00%	9.05%			
brotec							2.00%	2.00%	9.05%			
elepal							2.00%	2.00%	9.05%			
irispe							2.00%	2.00%	9.05%			
phymin							2.00%	2.00%	9.05%			
polpun							2.00%	2.00%	9.05%		2.00%	
tridur							1.50%	1.50%	8.45%			
agaspe							1.00%	1.00%	7.86%			
amaspe		1.00%					1.00%	1.00%	7.86%			
chemur							1.00%	1.00%	7.86%			
elyely	1.00%						1.00%	1.00%	7.86%			
epispe							1.00%	1.00%	7.86%		0.10%	
gricam			1.00%				1.00%	1.00%	7.86%			
grisau			1.00%				1.00%	1.00%	7.86%		0.50%	
picech							1.00%	1.00%	7.86%			
riccom							1.00%	1.00%	7.86%			
sciacu					1.00%		1.00%	1.00%	7.86%			
senrid							1.00%	1.00%	7.86%			

TABLE 2.2.e. HERB AND FORB PERCENT COVER (native species underlined)

	Species Code	INTDM	DVDAM	OXBOW	DRYCK	WINTR	YOLOH	CLBL	RUSSR
Sonchus asper	sonasp								
Tribulus terrestris	triter								
<u>Typha sp.</u>	<u>typspe</u>								
Abutilon sp.	abuspe								
<u>Adiantum jordanii</u>	<u>adijor</u>	0.50%							
Amaranthus palmeri	amapal								
Chenopodium sp.	chespe								0.50%
<u>Eschscholzia californica</u>	<u>esccal</u>	0.50%							
Lupinus sp.	lupspe	0.50%							
Aster chilensis	astchi				0.10%				
<u>Aster occidentalis</u>	<u>astocc</u>							0.10%	
Conyza bonariensis	conbon		0.10%						
Erodium moshatum	eromos								
<u>Mimulus cardinalis</u>	<u>mimcar</u>			0.10%					
Taraxacum officinale	taroff						0.10%		
<u>Veronica americana</u>	<u>verame</u>			0.10%					
Abutilon theophrasti	abuthe								
Daucus carota	daucar								
<u>Elymus trachycaulus</u>	<u>elytra</u>								
Eragrostis cilianensis	eracil								
Geranium mollis	germol								
<u>Lotus scoparius</u>	<u>lotsco</u>								
<u>Lycopersicon esculentum</u>	<u>lycesc</u>								
<u>Oenothera elata ssp. Hookeri</u>	<u>oenelh</u>								
<u>Phyla lanceolata</u>	<u>phylan</u>								
Plantago sp.	plaspe								
Rorippa curvisiliqua	rorcur								
Thinopyrum ponticum	thipon								
<u>Toxicodendron diversilobum</u>	<u>toxdiv</u>								
<u>Urtica sp.</u>	<u>urtspe</u>								
Verbena bonariensis	verbon								
Verbascum thapsus	vertha								
Total Herbs and Forbs		554.67%	196.11%	163.72%	231.39%	229.36%	339.27%	250.83%	306.31%

TABLE 2.2.e. HERB AND FORB PERCENT COVER (continued)

Species Code	STVBR	PICNC	OLDRR	MACEB	LOSRF	PUTCS	Mean % Cover	Total % Cover	IPV	SACWR	FREWR	SUTBY
sonasp				1.00%			1.00%	1.00%	7.86%	2.00%	3.00%	
triter				1.00%			1.00%	1.00%	7.86%			
typspe		1.00%					1.00%	1.00%	7.86%			
abuspe						0.67%	0.67%	0.67%	7.47%			
adijor							0.50%	0.50%	7.27%			
amapal					0.50%		0.50%	0.50%	7.27%	6.00%	5.67%	
chespe							0.50%	0.50%	7.27%			
esccal							0.50%	0.50%	7.27%			
lupspe							0.50%	0.50%	7.27%			
astchi							0.10%	0.10%	6.79%			
astocc							0.10%	0.10%	6.79%		3.00%	
conbon							0.10%	0.10%	6.79%			
eromos					0.10%		0.10%	0.10%	6.79%			
mimcar							0.10%	0.10%	6.79%			
taroff							0.10%	0.10%	6.79%			
verame							0.10%	0.10%	6.79%			
abuthe							0.00%	0.00%	0.00%	1.00%		7.19%
daucar							0.00%	0.00%	0.00%		6.41%	
elytra							0.00%	0.00%	0.00%		16.38%	
eracil							0.00%	0.00%	0.00%		15.00%	
germol							0.00%	0.00%	0.00%	1.00%		
lotsco							0.00%	0.00%	0.00%	4.13%	5.50%	
lycesc							0.00%	0.00%	0.00%		1.00%	3.00%
oenelh							0.00%	0.00%	0.00%	2.00%	1.50%	
phylan							0.00%	0.00%	0.00%			0.55%
plaspe							0.00%	0.00%	0.00%	2.00%		
rorcur							0.00%	0.00%	0.00%		1.00%	
thipon							0.00%	0.00%	0.00%		16.00%	
toxdiv							0.00%	0.00%	0.00%			60.00%
urtspe							0.00%	0.00%	0.00%	15.00%		
verbon							0.00%	0.00%	0.00%	3.00%		4.00%
vertha							0.00%	0.00%	0.00%		0.50%	
	279%	400%	420%	435%	299%	111%	301%	4216%		441%	547%	316%

TABLE 2.2.f. VINE PERCENT COVER (native species underlined)

	Species Code	INTDM	DVDAM	OXBOW	DRYCK	WINTR	YOLOH	CLBL	RUSSR
<u>Vitis californica</u>	<u>vitcal</u>	19%	17%	23%	17%	15%	20%	27%	9%
<u>Aristolochia californica</u>	<u>arical</u>	3%	2%			2%		9%	
Vitis vinifera	vitvin	7%	0%						
<u>Marah fabaceus</u>	<u>marfab</u>				4%		10%		
Parthenocissus vitacea	parvit				9%				
<u>Clematis ligusticifolia</u>	<u>clelig</u>	2%				1%			
Hedera helix variant?	hedspe		1%						
	Total Vines	31%	20%	23%	30%	18%	30%	36%	9%

Native species underlined. Percent cover values can exceed 100% since this index incorporates multiple height classes that overlap each other. IPV (Importance percentage value) calculated as mean relative cover and relative frequency * 100. Species names and classification follow The Jepson Manual: Higher Plants of California (Hickman 1993).

TABLE 2.2.f. VINE PERCENT COVER (continued)

Species Code	STVBR	PICNC	OLDRR	MACEB	LOS RF	PUTCS	Mean % Cover	Total % Cover	IPV	SACWR	FREWR	SUTBY
<u>vitcal</u>	2%	5%	7%				15%	161%	62.50	25%	13%	25%
<u>arical</u>							4%	16%	12.55			
vitvin		1%					3%	8%	8.34			
<u>marfab</u>							7%	14%	7.58			
parvit							9%	9%	4.33			
<u>clelig</u>							1%	3%	5.09		5%	
hedspe							1%	1%	2.41			
	2%	6%	7%	0%	0%	0%	15%	211%		25%	18%	25%

2.3 Plant Value to Wildlife and Pollinators

Plants serve as the base of the food chain and are the immediate or ultimate source of all food, and most of the shelter, used by wildlife (Martin et al. 1961). Most animal species are closely-associated with a particular suite of plants and/or a specific habitat type. Within these broad habitat types, localized variation in physical and biotic conditions favor certain animal species over others. For example, densely-wooded understory favors thicket-loving species like wrens and thrushes. Sparrows use these areas too, particularly if adjacent foraging areas are rich in grass seeds and other grains. Other wooded habitats with a more open and parklike aspect better suit the needs of aerial insectivores and/or species that hunt from exposed perches.

Pollinators are keystone species in most terrestrial ecosystems, providing essential ecosystem services. Insect pollinators are responsible for the reproduction of nearly 70 percent of the world's flowering plants, including more than two-thirds of our crop species. Fruits and seeds derived from insect pollination are a major part of the diet of approximately 25 percent of all birds, and of mammals ranging from red-backed voles to grizzly bears. In many places, pollinators are declining, at risk from habitat loss, pesticide use, and introduced diseases. Because they are subject to widespread natural and anthropogenic disturbances, riparian zones support many weedy or early-successional plant species, many of which provide resources for pollinators.

The availability of plant resources for wildlife and pollinators varies from year to year, season to season, and even day to day. Plant resources during late winter, a time of hardship for most wildlife, are crucial. Plants that bear their seeds or fruit high enough off the ground so as not to be buried or washed away by heavy rains are particularly valuable sources of food in riparian habitats. Variation in weather-related crop yields greatly influences survival of certain species. For example, crabgrass responds to early spring warming by producing an early crop of seeds that can mean the difference between life and death for small birds coming off the deprivations of winter.

In general, the lower life forms are of limited direct value to wildlife (Martin et al. 1961). This is not to say they are inconsequential since they participate in nitrogen fixation, decomposition, and other important nutrient cycling processes. Lichens and mosses are almost negligible in their food value, but lichens are often used in the nests of hummingbirds, pewees, and gnatcatchers. Ferns, and their relatives, the clubmosses and horsetails, are often used as food by woodland animals—deer, rabbits, woodrats, and turkeys—that feed on green vegetation. Ferns are especially valuable during fall and winter as they remain green after most other vegetation has been frost-killed.

Fruit, seeds, leaves, twigs, bark, stems, and roots of seed plants are by far the most important to wildlife. Fruits are rich in carbohydrates and vitamins. While fruit is most often available in summer and fall, the most valuable fruits persist into winter. Nuts are used extensively since they are unusually rich in

fats and proteins, and are available over long periods. Of all the nuts, acorns are the most widely available and most commonly eaten. While cultivated walnuts are consumed by a wide variety of animals, black walnuts, because of their especially thick, hard shells, are of importance only to squirrels and their kin. Like nuts, seeds are a major food source for many birds and small mammals. While weeds are generally unwelcome, they produce enormous amounts of seed. The most important weed seeds to wildlife are those from common, widespread species such as pigweed (*Amaranthus*), ragweed (*Ambrosia*), crabgrass (*Digitaria*), bristlegass (*Setaria*), goosefoot (*Chenopodium*), doveweed (*Croton*), filaree (*Erodium*), smartweed and knotweed (*Polygonum*), dock (*Rumex*), and deervetch (*Aeschynomene*). Thus, from a wildlife standpoint, the complete eradication of all weeds (if indeed this could be accomplished) is not advised.

Browsing and grazing mammals, some rodents, and a few gamebirds consume the vegetative parts of plants, favoring the aerial parts of grasses and the flowering or seed-producing parts of forbs. Leaves of clover and other nitrogen-fixing plants are high in protein and highly sought. Leaves, stems, tubers, and seeds of aquatic plants are consumed by waterfowl, muskrat, beaver, and occasionally deer. Besides twigs taken by browsers, inner bark or wood is important only for a few mammals: beaver, porcupine, rabbit, and certain mice. The underground parts of plants—rootstocks, bulbs, tubers, and roots—are eaten by muskrat, gopher, mole, duck, goose, turkey, and others. Tree sap and cambium are used by sapsuckers, hummingbirds consume nectar from flowers, and bushtits and other birds consume plant galls, as does the gray squirrel.

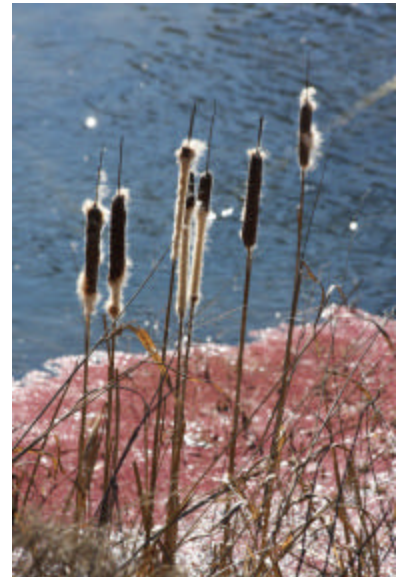
Often, the same plants that serve as food also provide cover (Martin et al. 1961). Cover needs vary according to the nesting, roosting, sleeping, escape, and protection needs of different species and according to daily and seasonal activities. Proximity to cover while feeding is especially important to birds in spring and summer. Thus, openings in forests or forest edges—clearings, thinnings, or even roadway openings—are often better for wildlife than an unbroken, dense cover of trees (Martin et al. 1961). That said, too many openings in too little forest can expose the ecosystem and its residents to outside forces, changing the essential nature of the ecosystem.

In restoration programs, plants that offer both shelter and food provide double benefit. Pines are good dual-purpose trees for many birds. Rose is a good multi-purpose plant, furnishing both food and cover. Grasses and other legumes are often used in restoration for ground cover and erosion control while providing food and cover for wildlife. Hedgerows provide food and cover as well serve as an extension of the forest border into and within the cultivated landscape. Aquatic and moist soil plants offer combined cover and food, as well as soil-holding capacities. Once hydrologic conditions are right for them, these plants will maintain permanent cover and a good food supply for marsh wildlife. Marsh habitats on Putah Creek are few and far-between, but support high biodiversity and an abundance of riparian focal species.

Plants like pondweed (*Potamogeton*), duckweed (*Lemna*), bulrush (*Scirpus*, *Cyperus*), spikerush (*Eleocharis*) and similar erect, densely-growing plants provide cover for fish, nesting cover for birds, and a good supply of fall and winter seeds. In all restoration programs, knowledge of the ecology and natural history of the organisms involved is essential to sound management. In all cases, restorationists must move deliberately and within the natural current of the ecosystem.

The best gauge of wildlife and pollinator preference for certain plant species is the extent to which a particular plant is used in relation to its abundance. Based on the plant species recorded in our vegetation surveys, we have compiled a table of local plant importance to wildlife and pollinators (Table 2.3). The star-user rating of plants is a numerical ratio which provides a semi-quantitative index of the value of the plant as a wildlife food (Martin et al 1961). For example, the rating for oaks (64*/37 users) indicates that 37 different kinds of animals use oaks in a frequency equivalent to an aggregate of 64 “stars”. Star rankings are calculated as the percentage to which a particular plant is used for food by all consumers. We report Pacific Coast region ratings wherever possible; nationwide rankings are provided in the absence of regional rankings. Nationwide rankings will always be higher than regional rankings since they incorporate a

greater variety of species endemic to a wider array of regions. Xerces Rankings (see Table 2.3) were derived from the Xerces Society for Invertebrate Conservation (<http://www.xerces.org/>) and indicate the degree to which plants are attractive to native bees that visit crops in the Central Valley (1 being most attractive and 27 is least attractive). Other notations indicate whether a particular plant species is “beneficial” or “attractive” to pollinators (bees, butterflies, hummingbirds, bats, etc.).



Cattails (*Typha* sp.) supply food and fiber for wildlife. Photo: A. Engilis Jr.

TABLE 2.3. ECOLOGY AND WILDLIFE VALUE OF SELECTED PLANT SPECIES

Scientific name	Common Name	Status	Wildlife Star Rating *	Xerces Ranking †	Restoration Implications and Importance to Wildlife
<i>Acer macrophyllum</i>	Bigleaf Maple	Native			PIF/RHJV key species for birds. Used as browse by black-tailed deer, mule deer, and horses during the sapling stage
<i>Acer negundo</i>	Box Elder	Native	61*/33 users (US)		PIF/RHJV key species for birds. Tolerant of poor conditions; good for naturalizing disturbed sites; seeds are important winter food for birds and small mammals, deer browse young plants. Buds and flowers also provide food for many kinds of birds and other animals. Birds use leaves and seed stalks in nest building.
<i>Adiantum jordanii</i>	California Maidenhair Fern	Native			Native to much of California, growing in shaded woods under oaks and pines. Found in shaded, moist winter spots that go dry in summer (where the plant will go dormant and look dead). Found often on north slopes and rock outcroppings. As a fern, it provides forage when other plants have been frost-killed.
<i>Aegilops cylindrica</i>	Jointed Goatgrass	Noxious			A widespread weed in North America, particularly troublesome in winter wheat. Usually grows in disturbed sites such as roadsides, fields, and along railroad tracks. It is native to the Mediterranean region and central Asia, and is adventive in other temperate countries. Hybrids with <i>Triticum aestivum</i> have been found in various parts of North America. Being sterile annuals, they do not persist.
<i>Aesculus californica</i>	California Buckeye or California Horse-chestnut	Native			A soil binder, preventing erosion in hilly regions. Local native American tribes used the poisonous nuts to stupefy schools of fish in small streams. Native groups occasionally used the nuts as food when the acorn supply was sparse; after boiling and leaching the toxin out of the nut meats for several days, they could be ground into a meal similar to that made from acorns. The nectar of the flowers is toxic, and it can kill honeybees and other insects. When the shoots are small and leaves are new they are lower in toxins and are grazed by livestock and wildlife.
<i>Ailanthus altissima</i>	Tree of Heaven	Introduced			Opportunistic, thriving in full sun and disturbed areas. Spreads aggressively both by seeds and vegetatively by root sprouts which re-sprout rapidly after cutting. Uses a "gap-obligate" strategy to reach the forest canopy, but rarely lives more than 50 years. Among the most pollution- and drought-tolerant of trees. Concentrates sulfur dioxide and mercury in its tissues. Allelopathic, and a threat to biodiversity. In North America, the host plant for the ailanthus webworm (<i>Atteva punctella</i>). In its native range, associated with at least 32 species of arthropods, including a silk moth, and 13 species of fungi.
<i>Albizia julibrissin</i>	Persian Silk Tree	Introduced		Attractive	Attractive to bees, butterflies and hummingbirds. The bark or cortex is used to cure bruises and as a vermicide. The seeds are used as a food for livestock and wildlife, and the sweetly-scented flowers are a good nectar source for honeybees. Can be invasive.

TABLE 2.3. ECOLOGY AND WILDLIFE VALUE OF SELECTED PLANT SPECIES

Scientific name	Common Name	Status	Wildlife Star Rating *	Xerces Ranking †	Restoration Implications and Importance to Wildlife
Alnus rhombifolia	White Alder	Native	7*/5 users (Pacific Region)		Nitrogen-fixing riparian pioneer species. A better indicator of water than either cottonwoods or willows. Typically colonizes fine-textured soils of sandbars or other fresh alluvium exposed by receding flood waters. Layering of mature trees does not occur after terrace buildup. Seeds are important to Siskins and Goldfinches. Other parts eaten by gamebirds and browsers. Dense copses provide effective wildlife cover. PIF/RHJV key species for birds.
Amaranthus albus	Prostrate Pigweed	Invasive	44*/27 users (Pacific Region)		Despite their weedy status, pigweeds are some of the most important foods of many of our best-loved songbirds, producing abundant seeds that persist well into winter (and possibly the following spring) when other foods are scarce. Also of considerable value for upland game birds and other wildlife species.
Amaranthus blitoides	Mat Amaranth	Invasive	44*/27 users (Pacific Region)		Despite their weedy status, pigweeds are some of the most important foods of many of our best-loved songbirds, producing abundant seeds that persist well into winter (and possibly the following spring) when other foods are scarce. Also of considerable value for upland game birds and other wildlife species.
Amaranthus palmeri	Palmer Amaranth, Carelessweed	Native; can be invasive	44*/27 users (Pacific Region)		Despite their weedy status, pigweeds are some of the most important foods of many of our best-loved songbirds, producing abundant seeds that persist well into winter (and possibly the following spring) when other foods are scarce. Also of considerable value for upland game birds and other wildlife species.
Amaranthus retroflexus	Redroot Pigweed	Native	44*/27 users (Pacific Region)		Despite their weedy status, pigweeds are some of the most important foods of many of our best-loved songbirds, producing abundant seeds that persist well into winter (and possibly the following spring) when other foods are scarce. Also of considerable value for upland game birds and other wildlife species.
Ambrosia psilostachya	Western Ragweed	Native	14*/11 users (Pacific Region)		One of the most valuable winter foods for all ground-feeding birds. Oil-rich, abundant seeds are very important for gamebirds and songbirds. Seeds persist well into winter.
Annual grasses					Value mixed: produce seeds that are consumed by rodents and granivorous birds, but also displace native plants and alter soil moisture relationships.
Anthriscus caucalis	Bur Chervil	Introduced			Widespread in waste places
Apocynum androsaemifolium	Spreading Dogbane	Native			Sunny, open slopes; rocky, gravelly
Arctostaphylos manzanita	Common or Whiteleaf Manzanita	Native	18*/14 users (Pacific Region)	25	Great wildlife plants. Provide nectar for butterflies, hummingbirds and native insects. Many of the manzanitas regulate their nectar to attract different insects, butterflies and hummingbirds during the day. Edible fruits. Excellent cover.

TABLE 2.3. ECOLOGY AND WILDLIFE VALUE OF SELECTED PLANT SPECIES

Scientific name	Common Name	Status	Wildlife Star Rating *	Xerces Ranking †	Restoration Implications and Importance to Wildlife
<i>Aristolochia californica</i>	California Pipevine or California Dutchman's- pipe	Endemic		Pipevine Swallowtail larval food plant	Common in moist woods and along streams in northern and central California. Flowers have an unpleasant odor which attracts tiny carrion-feeding insects. The insects crawl into the convoluted flowers and often become stuck and disoriented for some time, picking up pollen as they wander. Most eventually escape; the plant is not insectivorous as was once thought. The larva of the Pipevine Swallowtail butterfly (<i>Battus philenor</i>) relies on California pipevine as its only food source. The red-spotted black caterpillars consume the leaves of the plants and then use the flowers as a secure, enclosed place to undergo metamorphosis. The plant contains a toxin which when ingested by the caterpillars makes them unpalatable to predators.
<i>Artemisia douglasiana</i>	Douglas Mugwort	Native			Found on sandy, gravelly soils. Good cover plant. PIF/RHJV key species for birds. Birds eat seeds. Reportedly an antidote for poison oak
<i>Arundo donax</i>	Giant Reed	Invasive			Rapid growth. Dense stands displace native species. High water use. Low wildlife value. Fire-adapted and a hazard.
<i>Asclepias fascicularis</i>	Narrowleaf Milkweed; Mexican Whorled Milkweed	Native; can be weedy		Monarch larval food plant	Tolerant of drought and heavy clay soils. Larval food plant for the Monarch butterfly. The alkaloids associated with this plant give the butterflies protection from predators. However, alkaloids from the wrong milkweed (South American, Mexican, etc.) can expose butterflies to predation.
<i>Asclepias incarnata</i>	Swamp Milkweed	Native		Beneficial	Butterfly nectar source; moderately -important larval food for Monarch butterflies
<i>Aster chilensis</i>	California Aster	Native	1*/12 users (US)	Beneficial	Late-summer/fall bloomer; a favorite nectar source for native moths and butterflies.
<i>Aster occidentalis</i>	Western Mountain Aster	Native	1*/12 users (US)		Slight value to wildlife
<i>Atriplex lentiformis</i>	Quailbush, Big Saltbush	Native	29*/22 users (US)		Very alkali tolerant. A plant for wind breaks, borders, and range management. Will survive on 5-10 inches of rainfall in full sun and poor soil (C4 metabolism). All of the plant is edible, young shoots suitable for greens; Indians used for salty taste. Fair importance to wildlife: seeds used by several kinds of birds and small mammals. Twigs and scurfy foliage eaten by rabbits and other browsers. Quail and other birds use seeds for food, foliage for habitat.
<i>Atriplex triangularis</i>	Spearscale, Triangle Orache	Native	29*/22 users (US)		Fair importance to western wildlife

TABLE 2.3. ECOLOGY AND WILDLIFE VALUE OF SELECTED PLANT SPECIES

Scientific name	Common Name	Status	Wildlife Star Rating *	Xerces Ranking †	Restoration Implications and Importance to Wildlife
<i>Avena fatua</i>	Wild Oat	Introduced	98*/55 users (Pacific Region)		Seeds used freely by wildlife. CAL-IPC species of moderate threat to wildlands.
Baccharis pilularis	Coyotebrush	Native		26	Secondary pioneer species in chaparral and coastal sage scrub. Nectar source for most of our predatory wasps, native small butterflies, bees, and native flies. On Xerces list of plants beneficial to pollinators.
Baccharis salicifolia	Mulefat; Seepwillow; Water-wally	Native		13	Good habitat plant. Attracts butterflies. Good source of nectar/pollen for bees. Edible fruits. On Xerces list of plants beneficial to pollinators.
Bidens frondosa	Beggartick, Sticktight	Native	1*/7 users (US)		Minor value to wildlife.
<i>Brassica nigra</i>	Black Mustard	Introduced	6*/10 users (US)		Oily seeds relished by gamebirds and songbirds. CAL-IPC moderate threat; historic cultivar; medicinal uses
<i>Bromus diandrus</i>	Ripgut Brome	Invasive	21*/22 users (Pacific Region)		Relatively-large seeds are eaten by a number of birds and rodents. CAL-IPC invasive species of moderate threat. Found in waste places. Shade intolerant. Seedheads a hazard to animals as can easily become lodged in flesh
<i>Bromus mollis</i>	Soft Brome; Soft Chess	Introduced	21*/22 users (Pacific Region)		
<i>Bromus tectorum</i>	Cheatgrass	Invasive	21*/22 users (Pacific Region)		Seeds, a famine food, Indians cooked into a gruel during food shortages.
<i>Carduus pycnocephalus</i>	Italian Plumeless Thistle	Noxious weed			CAL-IPC moderate threat
Carex barbarae	Santa Barbara Sedge	Native	18*/25 users (Pacific Region)		Very high food and cover value to wildlife. Fire-resistant.

TABLE 2.3. ECOLOGY AND WILDLIFE VALUE OF SELECTED PLANT SPECIES

Scientific name	Common Name	Status	Wildlife Star Rating *	Xerces Ranking †	Restoration Implications and Importance to Wildlife
Carex nudata	Black or Naked Sedge	Native	18*/25 users (Pacific Region)		High food and cover value for wildlife; channel stabilization
<i>Centaurea solstitialis</i>	Yellow Star- thistle	Noxious invasive	20*/18 users (Pacific Region)		Highly competitive invasive with high growth plasticity. Lacks natural controls on populations. Pest in field crops, unpalatable to grazers (except when very young). A physical barrier to wild animal movement; toxic to horses. Hard, bristle-topped seeds are popular with birds, including mourning dove and California quail, and are especially important for western goldfinches.
Cephalanthus occidentalis var. californicus	California Buttonwillow	Native	3*/11 users (US)	9	Waterfowl are primary users of seeds. Nectar is used by bees to make honey; important to wood ducks for brood rearing and hiding; medicinal uses; does not grow well along manmade waterways.
Cercis occidentalis	Western Redbud	Native		14	Twigs used for basketry. Tolerates alkaline soil and clay. Attractive to birds. Good source of pollen/nectar for bees.
Cercocarpus betuloides	Mountain Mahogany	Native	6*/4 users (Pacific Region)		Tolerates drought, clay soils, and wind. A red dye can be obtained from the bark and roots. Deer browse. Nitrogen fixing. Wildlife value primarily to hoofed browsers.
<i>Chenopodium album</i>	White Goosefoot; Lamb's Quarters	Introduced	10*/12 users (Pacific Region)		Extremely abundant seeds, persisting well into winter, are relished by wildlife and many kinds of songbirds. Vulnerable to leaf miners, so a useful trap crop and companion plant. A host plant for the beet leafhopper, an insect which transmits curly top virus to beet crops. Prolific seeds are high in protein, vitamin A, calcium, phosphorus, and potassium. Quinoa is a closely related species which is grown specifically for its seeds.
<i>Chenopodium ambrosioides</i>	Mexican Tea	Introduced	10*/12 users (Pacific Region)		The extremely abundant seeds, persisting well into winter, are relished by many kinds of songbirds and wildlife
Chenopodium berlandieri	Southern Huauzontle, Netseed Lambsquarters, Pit-seed Goosefoot	Native	10*/12 users (Pacific Region)		The extremely abundant seeds, persisting well into winter, are relished by many kinds of songbirds and wildlife. Plant is medicinal, edible.

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Scientific name	Common Name	Status	Wildlife Star Rating *	Xerces Ranking †	Restoration Implications and Importance to Wildlife
<i>Chenopodium murale</i>	Nettleleaf Goosefoot	Introduced	10*/12 users (Pacific Region)		The extremely abundant seeds, which persist well into the winter, are relished by many kinds of songbirds and wildlife
<i>Cichorium intybus</i>	Chicory	Naturalized			Roadside weed; edible, medicinal
<i>Cirsium vulgare</i>	Bull Thistle	Introduced			CAL-IPC moderate threat
<i>Clematis ligusticifolia</i>	Western White Clematis; Virgin's Bower	Native			Native American medicinal and toiletry item
<i>Conium maculatum</i>	Poison Hemlock	Introduced			CAL-IPC moderate threat
<i>Convolvulus arvensis</i>	Field Bindweed	Noxious weed			Apparently little value for wildlife
<i>Conyza canadensis</i>	Canadian Horseweed	Native			But can be invasive
<i>Cornus sericea</i>	Western Dogwood	Native	11*/18 users (Pacific Region)	23	PIF/RHJV key species for birds. Fleshy fruits very valuable to wildlife, especially in fall and winter. One of the very best plants to beautify the landscape and attract birds. Good source of pollen/nectar for bees.
<i>Cotula coronopifolia</i>	Brass Buttons	Introduced			Occupy a specialized ecological niche, preferring muddy, anoxic wetlands and brackish water. Very salt-tolerant.
<i>Cuscuta</i> sp.	Dodder				Parasitic on many plants
<i>Cynodon dactylon</i>	Bermudagrass	Introduced	3*/5 users (US)		Minor value to wildlife. Some forage value for deer, geese and ducks in open, sunny areas
<i>Cyperus eragrostis</i>	Nutsedge; Umbrella Sedge	Native, but can be weedy	23*/23 users (US)		Grows in seasonal creeks, wet areas commonly with <i>Salix lasiolepis</i> , <i>Ambrosia</i> sp., <i>Quercus agrifolia</i> and <i>Populus</i> . Prefers wet soil, clay or gravel. Thrives in a disturbed plant community, rhizomatous, stems triangular. Nutritious tubers and seeds sought by waterfowl, upland gamebirds, songbirds, and rodents.
<i>Cyperus esculentus</i>	Chufa sedge; Yellow Nutsedge; Tigernut Sedge	Introduced	23*/23 users (US)		One of the oldest cultivated plants in Ancient Egypt. Nutritious tubers and seeds sought by waterfowl, upland gamebirds, songbirds, and rodents. Wildlife value probably much greater than all other species of <i>Cyperus</i> combined.
<i>Datura innoxia</i>	Pricklyburr	Introduced			All parts contain dangerous levels of poison and may be fatal if ingested by humans and other animals, including livestock and pets.

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Scientific name	Common Name	Status	Wildlife Star Rating *	Xerces Ranking †	Restoration Implications and Importance to Wildlife
<i>Datura stramonium</i>	Jimsonweed	Introduced			The seed is thought to be carried by birds and spread in their droppings. It can lie dormant underground for years and germinate when the soil is disturbed. Legendary but dangerous hallucinogenic properties.
Daucus carota	American Wild Carrot, Rattlesnake Weed	Native	1*/5 users (US)		Very slight value to wildlife.
Digitaria sanguinalis	Hairy Crabgrass	Native	58*/22 users (US)		Abundant seeds are outstanding in usefulness to songbirds and upland gamebirds who obtain a considerable part of the their diet from it. Produces seed very early during warm springs.
<i>Echinochloa crus -galli</i>	Barnyardgrass	Introduced	12*/14 users (Pacific Region)		Smooth, moderately-large seeds are important food for ducks and other birds. Often seeded onto moist mud flats over which water can be brought in the fall.
Eclipta prostrata	False Daisy	Native			Used in Chinese medicine where it has been found to function as an antidote to the venom of rattlesnakes.
Eleocharis palustris	Common Spikerush	Native	10*/13 users (Pacific Region)		Ducks regularly eat the underground tubers. Rhizomatous; good soil stabilizer
Elymus elymoides	Squirreltail	Native			Good winter forage when small and green.
Elymus glaucus	Blue Wildrye	Native		Beneficial	Grows well in both disturbed and undisturbed areas. Good competitor. Tolerates wide variations in soil and weather conditions. Prefers moisture but tolerates drought, some types are sun-adapted.
Epilobium angustifolium	Fireweed	Native but can be invasive	6*/5 users (US)		Most abundant of the fireweeds. Valuable honey plant, lepidopteran larval and nectar resource. Probably used by western hoofed browsers to a greater extent than reported. First to grow back after fire.
Epilobium brachycarpum	Tall Annual Willowherb	Native	6*/5 users (US)	Nectar/pollen source for bees	Valuable nectar and pollen sources for bees
Epilobium canum	California Fuschia	Native	6*/5 users (US)	27	Important hummingbird plant.
Epilobium ciliatum	Fringed Willowherb	Native	6*/5 users (US)	Nectar/pollen source for bees	Valuable nectar and pollen sources for bees

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Scientific name	Common Name	Status	Wildlife Star Rating *	Xerces Ranking †	Restoration Implications and Importance to Wildlife
<i>Epilobium minutum</i>	Minute Willowherb	Native	6*/5 users (US)		Found in dry, open, disturbed areas, often after fire
<i>Equisetum arvense</i>	Horsetail	Native	6*/3 users (Pacific Region)		Does not produce seeds but may still provide cover for small aquatics and forage for herbivores
<i>Equisetum laevigatum</i>	Smooth Scouring Rush; Smooth Horsetail	Native	6*/3 users (Pacific Region)		Does not produce seeds but may still provide cover for small aquatics and forage for herbivores
<i>Eremocarpus setigerus</i>	Turkey Mullein	Native	29*/19 users (Pacific Region)	Beneficial	An important wildlife food plant; medium-large oily seeds relished by gamebirds, songbirds, and rodents. Leaves were formerly crushed and thrown into streams by CA Indians to stupefy fish.
<i>Eriodictyon californica</i>	California Yerba Santa	Native		18	Unpalatable to most animals. Good source of pollen/nectar for bees. Used for revegetating damaged or disturbed lands, such as overgrazed rangeland. Strongly fire-adapted, sprouting from rhizomes after wildfire and developing a waxy film of flammable resins on its foliage.
<i>Erodium moschatum</i>	Storksbill		61*/45 users (Pacific Region)		Awl-shaped hard seeds are of major importance for western wildlife. Foliage relished by various browsers.
<i>Eschscholzia californica</i>	California Poppy	Native	2*/4 users (US)	3	Despite its beauty and status as state flower, wildlife value is very limited--principal user being the Mourning Dove. Good source of pollen or nectar for bees.
<i>Eucalyptus globulus</i>	Blue Gum	Introduced			Grows quickly. Allelopathic properties preclude recruitment by other species. Fire-adapted and a hazard.
<i>Euphorbia prostrata</i>	Spotted Spurge	Invasive	14*/15 users (US)		Seeds eaten by upland game birds and pipits.
<i>Euthamia occidentalis</i>	Western Goldenrod	Native	6*/20 users (US)	Nectar source	Wildlife utility of these fall-blooming weeds very low in proportion to their abundance and availability. However, an important nectar source for bees, butterflies, and other insects in late summer through fall; drought tolerant.
<i>Ficus carica</i>	Edible Fig	Introduced	13*/15 users (Pacific Region)		Fruit (figs) likely to be consumed by a wide variety of frugivores, though little data exists. CAL-IPC moderate threat; spreads rapidly; abiotic impacts unknown

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Scientific name	Common Name	Status	Wildlife Star Rating *	Xerces Ranking †	Restoration Implications and Importance to Wildlife
<i>Foeniculum vulgare</i>	Fennel	Introduced		Butterfly larval food plant	Used as a food plant by the larvae of some Lepidoptera species including the Mouse Moth and the Anise Swallowtail.
Fraxinus latifolia	Oregon Ash	Native	12*/20 users (US)		PIF/RHJV key species for birds. Moderate value to wildlife. Samaras and seeds eaten by a number of birds and mammals.
Galium aparine	Bedstraw, Stickywilly	Native			Produces edible seeds.
<i>Geranium molle</i>	Crane'sbill Geranium, Dovefoot Geranium	Introduced	4*/9 users (US)		Seeds eaten by birds and rodents.
Glycyrrhiza lepidota	American Licorice	Native		Beneficial	Sweet, edible root.
Grindelia camporum	Great Valley Gumweed	Native		5	Flowers all summer. Drought tolerant. Very valuable to a variety of pollinators: bees, butterflies, lady bugs, lacewings, and wasps, to name a few.
Grindelia squarrosa	Curlycup Gumweed	Native			Presumed similar to <i>G. camporum</i>
Helianthus annuus	Common Sunflower	Native cultivar	11*/16 users (Pacific Region)	19	Of outstanding value to western wildlife. Large, nutritious seeds eaten by gamebirds, songbirds, and rodents. Good source of nectar/pollen for bees. Provides structure and cover.
Heliotropium curassavicum	Salt Heliotrope	Native		Beneficial	Seeds consumed by mourning doves.
Heteromeles arbutifolia	Toyon	Native		1	An outstanding wildlife plant. Fruit consumed by birds, including mockingbirds, American Robins, Cedar Waxwings, as well as mammals including coyote and bear. The seeds are dispersed by such wildlife. Good source of nectar/pollen for bees. Many Native American uses.
<i>Ibicella lutea</i>	Devil's Claw	Introduced		Attractive to bees	Species from S. America naturalized in the Central Valley. Several species of bees frequent the fragrant blossoms of the native CA desert species, which have bright yellow nectar guide lines.
Juglans californica var. hindsii	Northern California Black Walnut	Native/Translocated? (see report text)	7*/6 users (US)		Native Northern California variety is endangered. Putah Creek walnuts may or may not be native (see discussion). May be useful to wildlife, but only eastern black walnut has recognized importance.
<i>Juglans regia</i>	Common or Persian Walnut	Introduced	4*/4 users (US)		Nuts highly nutritive for humans. Strong-billed birds (crow,jay, woodpecker, flicker, titmouse) are principal users.
<i>Juncus</i> spp.	Rushes	Native			Excellent cover plant and for use in stabilizing streambanks and canals. <i>J. patens</i> and <i>J. balticus</i> are good natives for use in Central Valley.

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Scientific name	Common Name	Status	Wildlife Star Rating *	Xerces Ranking †	Restoration Implications and Importance to Wildlife
<i>Lactuca serriola</i>	Prickly Lettuce	Introduced	0*/5 users (US)		Seeds occasionally eaten by wildlife. Foliage toxic to mammals
<i>Leersia oryzoides</i>	Rice Cutgrass	Native	17*/14 users (US)		Seeds eaten by ducks, swamp, and tree sparrows, and by the Sora Rail. Ducks also pull up the rootstocks and eat them in quantity.
<i>Lemna minor</i>	Common or Lesser Duckweed	Native	30*/16 users (US)		This salad-like fare, in addition to the many minute animal organisms associated with it, are an important food resource for many fish and birds (notably ducks); it is rich in protein and fats. Birds are also important in dispersing the species to new sites; the root is sticky, enabling the plant to adhere to the plumage or feet while the bird flies from one pond to another.
<i>Lepidium latifolium</i>	Perennial Pepperweed	Invasive	4*/7 users (US)		Wildlife use slight. Forms monocultures. Displaces other plants, many of which are themselves endangered or important as wildlife habitat.
<i>Leymus triticoides</i>	Creeping Wildrye	Native			Used for soil stabilization on channel, stream and river slopes, for restoration of roadside, riparian and rangeland areas, for forage or cover on wet or wet-saline-alkaline soils. Flood tolerant, lays flat during high water flow periods, thus allowing full water flow while still protecting the streambank. High quality waterfowl and upland game nesting habitat. Tolerant of burning.
<i>Ligustrum vulgare</i>	Privet	Introduced			Not uncommon to see the berries on the shrubs well into winter, untouched by birds. Yet, some reports that berries are readily eaten by thrushes, which disperse the seeds in their droppings.
<i>Lolium multiflorum</i>	Italian Ryegrass	Introduced	6*/9 users (US)		Important in California where seeds are eaten several kinds of birds and by the pocket mouse. Planted near impoundments in some regions for the use of geese.
<i>Lotus corniculatus</i>	Bird's-foot Trefoil	Introduced	18*/11 users (Pacific Region)	Butterfly larval food plant	As with the clovers, both seeds and foliage relished by wildlife. An important nectar source for many insects and is also used as a larval food plant by many species of Lepidoptera such as Six-spot Burnet. Contains cyanogenic glycosides and is thus poisonous to humans.
<i>Lotus purshianus</i>	Spanish Clover	Native	18*/11 users (Pacific Region)	Pollen/nectar source for bees	Found in dry, disturbed sites; nitrogen-fixer; larval food plant for Mournful Duskywing and Acmon Blue butterflies. Good source of pollen/nectar for bees. Seeds and foliage relished by wildlife.
<i>Lotus scoparius</i>	California Broom; Deerweed	Native	18*/11 users (Pacific Region)	11	Pioneer; N fixer. Like other other species of lotus and clover, seeds and foliage relished by wildlife. Good source of pollen/nectar for bees.

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Scientific name	Common Name	Status	Wildlife Star Rating *	Xerces Ranking †	Restoration Implications and Importance to Wildlife
Ludwigia peploides	Creeping Water-primrose, Floating Primrose-willow, Water-primrose	Some native; some infrataxa introduced		Butterfly nectar source	Flowers are a nectar source for butterflies. Invasive at the Cosumnes Nature Preserve.
Lycopersicon esculentum	Tomato	Native cultivar			A variety of invertebrate pests, but value to wildlife unclear
Maclura pomifera	Osage Orange	Native of Texas and Oklahoma	0*/3 users (US)		Largely -inedible fruit is sometimes torn apart by squirrels to get at the seeds, but few other native animals use it. This is unusual, as most large fleshy fruit takes advantage of seed dispersal through consumption by large animals. One recent hypothesis is that the Osage-orange fruit was eaten by a giant ground sloth that became extinct shortly after the first human settlement of North America. Other extinct Pleistocene megafauna, such as the mammoth, mastodon and gomphothere, may have fed on the fruit and aided in seed dispersal. An equine species that went extinct at the same time also has been suggested as the plant's original dispersal agent because modern horses and other livestock will sometimes eat the fruit.
Marah fabaceus	California Manroot	Native			Tubers were crushed and thrown into surface waters by the Kumeyaay to immobilize fish. All parts of the plant have a bitter taste. Despite this, the leaves have been used as a vegetable. The large tuber can be processed for a soap-like extract.
Marrubium vulgare	Horehound	Introduced			Many medicinal qualities, especially for lung troubles and coughs. Companion plant for tomatoes. Used as a natural grasshopper repellent. Occupies disturbed or overgrazed ground; highly unpalatable to livestock. Can be invasive.
Medicago hispida	Bur Clover	Introduced	9*/8 users (Pacific Region)		Of major value to some kinds of wildlife on the Pacific Coast. Herbage used extensively by CA Quail during late winter and spring.
Melilotus alba	White Sweetclover, Yellow Sweetclover	Introduced	7*/14 users (US)		Seeds of moderate value to some upland gamebirds
Mentha arvensis	Wild Mint	Native			
Mentha pulegium	Pennyroyal	Introduced			
Mimulus cardinalis	Cardinal Monkey Flower	Native			Attracts hummingbirds.
Morus alba	White Mulberry	Introduced			Fruits relished by birds. Silkworms raised on foliage. A major cause of seasonal allergies.

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Scientific name	Common Name	Status	Wildlife Star Rating *	Xerces Ranking †	Restoration Implications and Importance to Wildlife
Muhlenbergia rigens	Deergrass	Native		Beneficial	Grows on banks of seasonal creeks. Fast grower; excellent for revegetation and hedgrows/borders. Basketry plant.
Nasella pulchra	Purple Needlegrass	Native		Beneficial	Once a dominant species in California grasslands before invasive European grasses became dominant. The seeds were an important food source for many California Indian tribes. Today, it is the state grass of California and plays an important role in native grassland restoration and erosion control.
Nicotiana bigelovii	Indian Tobacco	Native			
Nicotiana glauca	Tree Tobacco	Introduced			
Oenothera elata ssp. Hookeri	Hooker's Evening Primrose	Native		Beneficial	Beneficial to pollinators. Seeds relished by finches and other seed-eating songbirds.
Olea europaea	Olive	Introduced			Can be very long lived. In South Australia, seeds are spread by the introduced red fox and by many bird species, including the European starling. Eventually form a dense canopy that prevents regeneration of native trees. Oil rich feral trees increase the fire hazard of native woodlands.
Panicum capillare	Witchgrass	Native	108*/67 users (US)		Due to its abundance and widespread distribution, are one of the country's most important sources of food for ground-feeding songbirds and gamebirds.
Parthenocissus vitacea	Woodbine	Native	26*/30 users (US)		Fruits are important fall and winter food, many fruits clinging to vines late into the season. Principal users: mockingbird, robin, thrashers, and bluebirds and other thrushes.
Paspalum dilatatum	Dallis Grass	Introduced			Seeds are of moderate importance to wildlife. Seeds eaten by upland gamebirds and other birds.
Paspalum distichum	Knotgrass	Native			Seeds are of moderate importance to wildlife. Seeds eaten by upland gamebirds and other birds.
Pennisetum clandestinum	Kikuyu Grass	Introduced			Allelopathic. May kill small trees and can choke ponds and waterways. Is resistant to mowing and grazing due to its strong network of roots, which easily send up new shoots. Easily introduced to new areas on plowing and digging machinery, which may transfer bits of the rhizome in soil clumps. Also dispersed via seed.
Phalaris minor	Dwarf Canary Grass	Introduced			Moderate food value for wildlife. Used as a fodder or forage for livestock and birdseed, but poisonous to some mammals and a potential contaminant of seed crops.

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Scientific name	Common Name	Status	Wildlife Star Rating *	Xerces Ranking †	Restoration Implications and Importance to Wildlife
Phoradendron macrophyllum	Big Leaf Mistletoe	Native	6*/11 users (Pacific Region)		Occurs on many riparian hardwoods, but not oak. Provides essential food, cover, and nesting sites for many creatures, some of which could not survive without it. Source of family wealth for Western Bluebirds. Berries and leaves provide high-protein fodder for many birds and mammals, especially in autumn and winter when other foods are scarce.
Phyla lanceolata	Lanceleaf Fogfruit	Native		Beneficial	Butterfly nectar source.
Phyla nodiflora	Turkey Tangle Fogfruit	Native		Beneficial	Butterfly nectar source.
Picris echioides	Bristly Oxtongue	Introduced		Attractive	Attractive to butterflies and bees
Pinus sabiniana	Gray Pine	Native	72*/39 users (Pacific Region)		Very high value to wildlife: nutritious oily seeds; pine needles consumed by grouse and browsers. Porcupines and small rodents use bark and wood as food. Also provides valuable cover, roosting and nesting sites.
Piptatherum miliaceum	Smilgrass	Introduced			A tufted perennial grass that thrives in dry or moist sites in disturbed areas, along roadsides and ditches. It can be found scattered along California's coast and central valley and appears to be increasing in riparian areas and canyons, especially in southern California. Produces seeds that were roasted and ground by the Paiute.
Plantago lanceolata	Narrowleaf Plantain	Introduced	17*/19 users (US)		Seeds eaten to a slight extent by many birds, especially the cardinal and grasshopper sparrow. Leaves are a favorite food of rabbits, and rodents eat seeds freely.
Plantago major	Common Plantain	Introduced	17*/19 users (US)		Seeds eaten to a slight extent by many birds, especially the cardinal and grasshopper sparrow. Leaves are a favorite food of rabbits, and rodents eat seeds freely.
Platanus racemosa	California Sycamore	Native	2*/4 users (US)		Water-loving tree. Apparently little appreciable value to wildlife beyond its structural value. Pendant seed balls are used by Purple Finches.
Polygonum arenastrum	Oval Leaf Knotweed	Introduced	27*/33 users (Pacific Region)		These upland knotweeds produce seeds that are important food for gamebirds and songbirds, depending on seed size. True knotweeds are important to ground-feeding songbirds.; large seeds of black bindweeds and false buckwheats benefit upland gamebirds.
Polygonum aviculare	Prostrate Knotweed	Introduced	27*/33 users (Pacific Region)		These upland knotweeds produce seeds that are important food for gamebirds and songbirds, depending on seed size. True knotweeds are important to ground-feeding songbirds.; large seeds of black bindweeds and false buckwheats benefit upland gamebirds.

TABLE 2.3. ECOLOGY AND WILDLIFE VALUE OF SELECTED PLANT SPECIES

Scientific name	Common Name	Status	Wildlife Star Rating *	Xerces Ranking †	Restoration Implications and Importance to Wildlife
Polygonum lapathifolium	Nodding Smartweed	Native	12*/22 users (Pacific Region)		Aquatic areas bordered by these amphibious smartweeds are popular with ducks. Produce a harvest of seeds in areas where water recedes leaving exposed mud flats for these plants to thrive on. Also highly valuable to many of our most common and best-loved songbirds.
Polygonum persicaria	Ladysthumb	Introduced; can be invasive	12*/22 users (Pacific Region)		Aquatic areas bordered by these amphibious smartweeds are popular with ducks. Produce a harvest of seeds in areas where water recedes leaving exposed mud flats for these plants to thrive on. Also highly valuable to many of our most common and best-loved songbirds.
Polygonum punctatum	Dotted Smartweed	Native	12*/22 users (Pacific Region)		Aquatic areas bordered by these amphibious smartweeds are popular with ducks. Produce a harvest of seeds in areas where water recedes leaving exposed mud flats for these plants to thrive on. Also highly valuable to many of our most common and best-loved songbirds.
Polypogon monspeliensis	Annual Rabbitsfoot Grass	Introduced	12*/22 users (Pacific Region)		Produces many seeds that are eaten by birds.
Populus fremontii	Fremont Cottonwood	Native	46*/28 users (US)		PIF/RHJV key species for birds. Catkins and bugs associated with this tree are valuable winter and spring food for wildlife, especially gamebirds. Tender bark, twigs, and foliage eaten by herbivores; wood and bark relished by beavers. Used by cavity nesters since cavities are easily excavated in soft bark.
Portulaca oleracea			18*/13 users (US)		Small seeds are relished by birds and rodents. Though plants are small, their seed production is tremendous.
Prunus amygdalus	Almond	Introduced	2*/1 user (US)		Almonds are a choice food item for woodpeckers. While data is sparse, gophers, ground squirrels, crows, jays, blackbirds, house finches, sapsuckers, and magpies are said to feed on fruits, buds, or roots.
Quercus agrifolia	Coast Live Oak		64*/37 users (Pacific Region)		A live oak so produces foliage year round. Otherwise, see Q. lobata
Quercus douglasii	Black Oak		64*/37 users (Pacific Region)		see Q. lobata

TABLE 2.3. ECOLOGY AND WILDLIFE VALUE OF SELECTED PLANT SPECIES

Scientific name	Common Name	Status	Wildlife Star Rating *	Xerces Ranking †	Restoration Implications and Importance to Wildlife
Quercus lobata	Valley Oak	Native	64*/37 users (Pacific Region)		Oaks are the most important group of broad-leaf timber trees in the country and a very important wildlife plant. Oaks are ecosystems unto themselves that provide niches for a wide variety of organisms. Acorns rate at the top of the wildlife food list, particularly for deer, turkeys, quail, woodpeckers, jays, and squirrels, and especially in winter when other foods are scarce. Oaks provide useful cover; leaves are used by many birds as nesting material. PIF/RHJV key species for birds.
Quercus wislizenii	Interior Live Oak		64*/37 users (Pacific Region)		A live oak so produces foliage year round. Otherwise, see Q. lobata
Rhamnus californica	California Buckthorn	Native	17*/20 users (Pacific Region)	24	Small black fleshy fruits ripen in fall are attractive to wildlife. Important food for mockingbird, catbird, phainopepla, thrushes, and others. Several mammals eat fruits to a limited extent. Deer browse.
Ricinus communis	Castorbean	Introduced			The host plant of the Common Castor butterfly (<i>Ariadne merione</i>), the Eri silkmoth (<i>Samia cynthia ricini</i>), and the Castor Semi-Looper moth (<i>Achaea janata</i>). It is also used as a food plant by the larvae of some other species of Lepidoptera, including <i>Hypercompe hambletoni</i> and the Nutmeg (<i>Discestra trifolii</i>). Seeds and leaves considered poisonous to vertebrates.
Robinia pseudoacacia	Black Locust	Native	1*/4 users (US)	Attractive; honey	Flowers attract hummingbirds and honeybees who produce good honey from its fragrant white blossoms. Low value to wildlife: seeds consumed to a limited extent by quail, other gamebirds, and squirrels.
Rorippa curvisiliqua	Curvepod Yellowcress	Native			No wildlife information readily available.
Rosa californica	California Rose	Native	15*/24 users (US)	7	PIF/RHJV key species for birds. Wildlife consume the fleshy rosehips and seeds inside. Hips provide food in winter. Thorny thickets provide good cover. A good border/hedgerow plant. A good source of pollen/nectar for bees.
Rubus armeniacus	Himalayan Blackberry	Introduced	24*/34 users (Pacific Region)		A strong competitor that rapidly displaces native species. Colonizes disturbed areas and can dominate range and pasture lands. Long-lived seeds are readily dispersed by gravity and by many species of birds and mammals. All types of blackberries rank at the very top of summer foods for wildlife, especially birds: Yellow-breasted Chat, American Robin, orioles and tanagers, thrashers, thrushes, and towhees. Fruits also popular with raccoons, squirrels. Leaves and stems eaten extensively by deer and rabbits. The thorny brambles also serve as effective cover, but can hinder movements of medium-sized to large mammals. A considerable fire hazard. (ANR website).

TABLE 2.3. ECOLOGY AND WILDLIFE VALUE OF SELECTED PLANT SPECIES

Scientific name	Common Name	Status	Wildlife Star Rating *	Xerces Ranking †	Restoration Implications and Importance to Wildlife
Rubus ursinus	California Blackberry	Native	24*/34 users (Pacific Region)		Very high wildlife value, like <i>R. armeniacus</i> , but without the nonnative downside. PIF/RHJV key species for birds.
<i>Rumex crispus</i>	Curly Dock	Introduced	21*/35 users (mainly <i>R. acetosella</i>) (US)		Food plants for larvae of a number of lepidopterans. Antidote for stinging nettles. <i>R. acetosella</i> the most important member of this group to wildlife.
Salix exigua	Coyote Willow; Narrowleaf Willow; Sandbar Willow	Native	8*/5 users (Pacific Region)	20	Drought resistant. Bank stabilizer. Important component of riparian community. PIF/RHJV key species for birds. Leaves, twigs, and buds have high browse value. A good source of nectar/pollen for bees.
Salix gooddingii	Goodding's Willow; San Joaquin Willow	Native	8*/5 users (Pacific Region)	20	Large-statured tree. Besides value of buds and catkins, enhances habitat structure at both large and small scales (bark is furrowed, creating microniches for invertebrates). A good source of nectar/pollen for bees.
Salix laevigata	Red Willow	Native	8*/5 users (Pacific Region)	20	Large-statured tree. Besides value of buds and catkins, enhances habitat structure at both large and small scales (bark is furrowed, creating microniches for invertebrates). A good source of nectar/pollen for bees.
Salix lasiolepis	Arroyo Willow	Native	8*/5 users (Pacific Region)	20	A pioneer species on wet sites. Essential for wildlife habitat within its range.
<i>Salsola tragus</i> (iberica)	Prickly Russian Thistle	Noxious weed	8*/10 users (Pacific Region)		Seeds are of good size and so provide moderate forage for birds and rodents. Hoofed browsers also feed on the young plants.
Sambucus mexicana	Blue Elderberry	Native	29*/38 users (Pacific Region)		Host plant for the federally threatened Valley Elderberry Longhorn Beetle. PIF/RHJV key species for birds. Fruit provides summer food for many kinds of songbirds, as well as gamebirds, squirrels, rodents, and several species of browsers. Also attractive to insects such as hoverflies, wasps, and lacewings. A good border/hedgerow plant.
Scirpus acutus	Hardstem Bullrush	Native	42*/31 users (Pacific Region)		Hard-coated seeds are one of the more important and most used foods of ducks and certain marshbirds and shorebirds. Stems and underground parts eaten by muskrats and geese. Important nesting cover for waterfowl and marsh wrens and blackbirds and cover for muskrats, otters, raccoons, and others. Muskrats use stems for building houses. Good soil stabilizer. Tolerant of burning. <i>S. americanus</i> good for use in Central Valley.

TABLE 2.3. ECOLOGY AND WILDLIFE VALUE OF SELECTED PLANT SPECIES

Scientific name	Common Name	Status	Wildlife Star Rating *	Xerces Ranking †	Restoration Implications and Importance to Wildlife
Senecio riddellii	Riddell's Ragwort	Native			Poisonous to livestock so usually eradicated. As a member of the Asteraceae, may be attractive to insect pollinators.
Setaria gracilis	Bristly Foxtail	Native			Due to abundance and wide distribution, as well as the large size of their many seeds, top all other weeds in the country in food value to wildlife.
Silybum marianum	Blessed Milk Thistle	Introduced			Extract used medicinally; seeds eaten by birds
Solanum americanum	American Nightshade	Native	12*/22 users (Pacific Region)		A wide variety of wildlife appreciate fruits, related as they are to tomatoes and eggplant. A complete listing of all nightshade users would be a long one.
Solanum elaeagnifolium	Silverleaf Nightshade	Native	12*/22 users (Pacific Region)		One of the more common and useful of the nightshades in the West.
Sonchus arvensis	Field Sowthistle	Noxious weed			Seeds consumed by goldfinches
Sonchus asper	Spiny Sowthistle	Introduced			Seeds consumed by goldfinches
Sonchus oleraceus	Common Sowthistle	Introduced			Seeds consumed by goldfinches. Minor food value for large mammals
Sorghum halepense	Johnsongrass	Introduced	70*/34 users (US)		Small, corn-like kernels are attractive to certain species of wildlife
Symphoricarpos albus	Common Snowberry	Native	32*/27 users (US)		Attractive to songbirds, gamebirds, small mammals and browsers who use this plant for food, cover, and nesting sites. A larval host and/or nectar source for Vashti sphinx moth (<i>Sphinx vashti</i>)
Taeniatherum caput-medusae	Medusahead	Invasive			The grazing capacity of land infested with medusahead can be reduced by up to 80%. Wildlife habitat and biodiversity also suffer, and the weed can eventually lead to alterations in ecosystem functions. Can exacerbate the decline of sage-grouse as it replaces plant communities that provide critical habitat for the bird. Other species, such as mule deer and chukar partridges, tend to avoid areas overrun with medusahead because it is not a good food source.

TABLE 2.3. ECOLOGY AND WILDLIFE VALUE OF SELECTED PLANT SPECIES

Scientific name	Common Name	Status	Wildlife Star Rating *	Xerces Ranking †	Restoration Implications and Importance to Wildlife
<i>Tamarix parviflora</i>	Saltcedar	Introduced			Fire-adapted species with long tap roots that allow them to intercept deep water tables and interfere with natural aquatic systems. Disrupts the structure and stability of native plant communities and degrades native wildlife habitat by outcompeting and replacing native plant species, monopolizing limited sources of moisture, and increasing the frequency, intensity and effect of fires and floods. Although it provides some shelter, foliage and flowers provide little food value for native wildlife species that depend on nutrient-rich native plant resources.
<i>Taraxacum officinale</i>	Common Dandelion	Introduced	23*/33 users (US)	Attractive	Used as food plants by the larvae of some species of Lepidoptera (butterflies and moths). Important plants for bees. Not only is their flowering used as an indicator that the honey bee season is starting, but they are also an important source of nectar and pollen early in the season.
<i>Torilis arvensis</i>	Field Hedge Parsley	Introduced			Like other members of the Carrot family, the small white flowers attract various insects, including small bees, flies, wasps, and beetles. In Illinois, the caterpillars of the Black Swallowtail butterfly (<i>Papilio polyxenes asterias</i>) feed on the foliage. The bur-like covering of the seeds clings readily to fur, feathers, and clothing, helping to distribute the seeds far and wide. The foliage is not known to be toxic, and may be eaten occasionally by mammalian herbivores.
Toxicodendron diversilobum	Pacific Poison Oak	Native	29*/29 users (Pacific Region)		Cottonwood/poison-oak woodlands contribute to high bird diversity and density. PIF/RHJV key species for birds. Fruits highly valuable to birds, especially in winter when other fruits are scarce. Popular with flickers and other woodpeckers, also used by the federally-endangered Least Bell's Vireo for nest sites in oak woodlands. One cottonwood/poison-oak woodland along Sacramento River is known to support ringtails, a species rare in the Central Valley.
<i>Tribulus terrestris</i>	Puncturevine	Noxious			Many medicinal qualities. Currently being marketed as a supplement for men's conditions and sports performance. Seed heads a frequent cause of bicycle flat tires.
Trichostema lanceolatum	Vinegarweed			2	Good source of pollen/nectar for bees.
<i>Triticum durum</i>	Cultivated Wheat	Introduced	74*/42 users (Pacific Region)		One of the most valuable wildlife plants in the country. Wheatfields also serve as an important nursery for ragweed, a valuable wildlife crop.
Typha latifolia	Cattail	Native	17*/17 users (US)		Tiny, wind-carried seeds too small and hairy to be attractive to birds. Rootstocks much more valuable as food for wildlife than seeds. Geese and muskrats use the starchy underground stems heavily. Also provide shelter and cover.

TABLE 2.3. ECOLOGY AND WILDLIFE VALUE OF SELECTED PLANT SPECIES

Scientific name	Common Name	Status	Wildlife Star Rating *	Xerces Ranking †	Restoration Implications and Importance to Wildlife
Urtica dioica	Stinging Nettle	Native			Significant medicinal properties. The growth of stinging nettle is an indicator that an area has high fertility (especially phosphorus) and has been disturbed. Leaves contain 40% protein, which is high for a leafy green vegetable. the exclusive larval food plant for several species of butterfly and are also eaten by the larvae of some moths. The roots are sometimes eaten by the larva of the Ghost Moth (<i>Hepialus humuli</i>).
Verbascum blattaria	Moth Mullein	Introduced			The pollen of the flowers is collected by bumblebees and Halictid bees. Syrphid flies feed on the pollen, but they are probably not effective at pollination. Little information appears to be available about this species' relationships to birds and mammals.
Verbascum thapsus	Common Mullein	Introduced			Megachilidae bees of the genus Anthidium use the hair (amongst that of various woolly plants) in making their nests. The seeds are generally too small for birds to feed on, although the American Goldfinch has been reported to consume them. Other bird species have been reported to consume the leaves (Hawaiian Goose) or flowers (Palila) or to use the plant as a source when foraging for insects (White-headed Woodpecker).
Verbena bonariensis	Purpletop Verbena	Introduced	4*/10 users (US)	Attractive	
Veronica americana	American Speewell	Native			Edible and nutritious with a flavor similar to watercress.
Vitis californica	Wild Grape	Native	94*/75 users (US)		PIF/RHJV key species for birds. Fruit is a favorite of gamebirds, many songbirds, and some fur bearers. Dried fruit clusters consumed in winter. In summer, dense foliage provides good escape and shelter cover as well as nesting sites for songbirds; bark is used in nest building.
Xanthium strumarium	Rough Cocklebur	Native			Cocklebur seeds were the most commonly recorded food of the extinct Carolina Parakeet, the only parrot native to eastern North America. Also the inspiration for velcro.

Sources: *Martin et al. 1961. Xerces Society: The Most Important Plants for Native Bees that Visit Crops in the Central Valley of California and California Plants for Bees (<http://www.xerces.org/>). John Anderson, Hedgerow Farms. (<http://www.hedgerowfarms.com/aboutng.html>). USDA -NRCS Plants Database (<http://plants.usda.gov>). Las Pilitas Nursery (<http://www.laspilitas.com/nature-of-california/plants/>). California Partners in Flight key riparian plants for birds (http://www.prbo.org/cms/docs/edu/rip_handoutfinal.pdf). Purdue University Center for New Crops and Plants Products (<http://www.hort.purdue.edu/newcrop/>). Lady Bird Johnson Wildflower Center at U of Texas, Austin (<http://www.wildflower.org/plants/>). Wildflowers of Illinois website (<http://www.illinoiswildflowers.info/weeds/plants/>). Wikipedia.

3 BEE SURVEYS

A report on the distribution and abundance of native bees can be found in Lindgren et al. 2006.

4 BUTTERFLY SURVEYS



Pipevine Swallowtail (*Battus philenor*) nectaring on wild radish, Stevenson's Bridge, Putah Creek, CA. Photo: A. Engilis, Jr.

Butterflies are excellent indicators of environmental conditions. Their short life cycles, multiple life stages, strict dietary preferences, and sensitivity to environmental change make them well-suited to monitoring programs (Nelson and Andersen 1994; Sparrow *et al.* 1994; Blair 1999). Different species vary in their habitat preferences (Nelson and Andersen 1994). Some species thrive in open or highly disturbed habitats such as floodplains, roadsides, and agricultural systems, while other

species prefer more stable environments such as forests and deserts (Pollard and Yates 1993). While adult butterflies generally visit a wide variety of flowers to obtain nectar, their larvae are typically less catholic in their diets. For example, the larvae of the Pipevine Swallowtail feed only on Dutchman's pipe (*Aristolochia californica*). For this reason, monitoring and assessment protocols built upon differences in butterfly species composition can help provide fine-scale resolution of plant community composition, ecosystem structure and function, and community responses to environmental conditions and management actions (Blair 1999).

In 2005 and 2006, we surveyed butterflies monthly during the spring and summer using Pollard's transect walking technique (Pollard and Yates 1993). Butterflies were surveyed along 500m transects used to survey birds. Trained observers walked each transect at a predetermined pace, recording all butterfly species encountered within an imaginary 5m x 5m x 5m box centered on the observer. Information was used to derive broad-scale information on species diversity, distribution, and relative abundance at each study site.

The results presented below were derived from two years of limited surveys dependent upon availability of survey personnel. (Butterfly surveys were not originally included in our survey protocols, but were added to utilize staff expertise in this area.) Results should thus be considered a snapshot of species composition at different sites under varying sampling intensities. However, by pooling records

across sites and years, we have compiled a preliminary species list (Table 4.1), enabling us to make some general inferences about species presence-absence at the various survey sites on Putah Creek and in the Yolo Bypass.

Thirty-one species of butterflies were detected on Putah Creek, representing 56% of all the species expected to occur in the Central Valley. An additional two species were found in the Yolo Bypass sites, the Roadside Skipper (*Amblyscirtes vialis*) and the Rural Skipper (*Ochlodes agricola*). Though widely distributed across the US, the Roadside Skipper is uncommon in California, occasionally found in the Northern Coast Ranges and along the west slope of the Sierra. The Rural Skipper is a montane species, often found in meadows, forest openings and forest edges.



Mylitta Crescent (*Phyciodes mylitta*). Photo: A. Engilis Jr.

The Cabbage White (*Pieris rapae*) butterfly was by far the most abundant species encountered along Putah Creek. This species was accidentally introduced into North America and has since spread to all parts of the country. It is one of the principal pests of cabbage and other cole crops; the mustard oils in these plants make the larvae distasteful to avian predators (Scott 1986). Common Buckeye (*Junonia coenia*), Orange Sulfur (*Colias eurytheme*), and Common Checkered Skipper (*Pyrgus communis*) were also relatively abundant along the creek. Buckeyes are common across California, usually found in old neglected fields and weedy pastures. Orange Sulfurs are major pests of cultivated alfalfa, resembling as it does their native Fabaceous host plants (Garth and Tilden 1986). Common Checkered Skippers are found during all warm months of the year in backyards, vacant lots, city parks, fields, cultivated lands, and along roadsides, their larvae feeding on many members of the mallow family. Other species included the Eastern Tailed Blue (*Everes comyntas*), a widely-distributed but often-overlooked species. Eastern Tailed Blues were found at Russell Ranch, Stevenson's Bridge, Old Davis Road, and in the Yolo Bypass at the Sacramento Weir.

We present a list of species formerly or currently extant in the Central Valley (Table 4.2) along with information on their dietary, habitat, and conservation needs. Many Central Valley butterfly species have fallen into sharp decline in the last decade or so (<http://butterfly.ucdavis.edu/>). Causative factors are largely unknown, though a combination of factors such as habitat loss, habitat decline, parasites and pathogens, and/or climate change may be to blame. In many cases, researchers have noted shifts in species distribution or changes in behavior. A recent report of findings from 35 years of studies in the region (Forister *et al.*) has found that butterfly diversity has fallen for all sites near sea level, in the



Western Tiger-Swallowtail (*Papilio rutulus*). Photo: A. Engilis Jr.

Central Valley, and in the foothills. Conversely, sites near tree line show an increase in butterfly diversity as lower-elevation species react to warming climate by moving upslope to higher, cooler elevations. However, among high-elevation butterflies, the number of species is declining, possibly because temperatures are becoming uncomfortably warm for them. Another disturbing pattern is that the changes in seasonality noted for several Central Valley species as a prelude to extinction have been recorded for other species elsewhere.

We found Purplish Copper (*Lycaena helloides*), a dock and knotweed feeder that has been in steep decline across its range, at Old Davis Road as well as at the northern sites of Fremont Weir (both north and south transects) and the Sutter Bypass survey site. Lorquin's Admiral (*Limenitis lorquini*), a formerly common riparian willow feeder that is now rare and unpredictable, was found at Interdam, Diversion Dam, and Los Rios Farms. The familiar and iconic Mourning Cloak (*Nymphalis antiopa*), again formerly common but declining, was found at Diversion Dam and Los Rios Farms. The Common Sootywing (*Pholisora catullus*), once considered a "junk" species because it was found only in disturbed habitats, is now regionally rare. Sootywings were found at Yolo Housing, the UCD Picnic Grounds, and Mace Boulevard. One individual of Satyr Anglewing (*Polygonia satyrus*), a riparian feeder of native nettles that was never very common in the Valley to begin with, was found at the Center for Land-based Learning. Of all the sensitive species found, only the Pipevine Swallowtail (*Battus philenor*) was found in relatively good numbers, mainly in the upper reaches near the Coast Range foothills, suggesting that its obligate host plant, the Dutchman's pipe, grows there in sufficient abundance to support the species. We found Pipevine Swallowtail at 9 of the 14 study sites. We did not find them at any of the Yolo/Sutter Bypass sites. Eleven individuals of the second-most abundant sensitive species, the Pygmy Blue (*Brephidium exile*), depressed in recent years, were found mainly in the lower reaches, at the Center for Land-based Learning, the UCD Picnic Grounds, Old Davis Road, Mace Boulevard, and at the Fremont Weir and Sutter Bypass sites.



Acmon Blue (*Plebejus acmon*). Photo: A. Engilis, Jr.

TABLE 4.1. BUTTERFLY SPECIES FOUND AT PUTAH CREEK (AND SELECTED YOLO BYPASS SITES) IN 2005 AND 2006

	PUTAH CREEK														YOLO BYPASS			TOTAL OBSERVED
	INTDM	DVDAM	OXBOW	DRYCK	WINTR	YOLOH	CLBL	RUSSR	STVBR	PICNC	OLDDR	MACEB	LOSRF	PUTCS	SACWR	FREWR	SUTBY	
HESPERIIDAE																		
Roadside Skipper															1			1
Field Skipper		1									1		1		1	1		5
Mournful Duskywing												1				1		2
Fiery Skipper		1	2	2	2	2	1				2							12
Rural Skipper															1			1
Woodland Skipper				1	1	1	1						1					5
Common Sooty-Wing						1				2		1						4
Common Checkered Skipper		1		2	1	1	5	2		3	4	1	6	2				28
LYCAENIDAE																		
Pygmy Blue							1			1	4	1				3	1	11
Eastern Tailed Blue								1	1		3				1			6
Golden Hairstreak									1		1							2
Purplish Copper											4					2	1	7
Acmon Blue	1			1	2		2	1		5	4					1	1	18
California Hairstreak										1								1
Gray Hairstreak		2					3			1	3		1			1		11
NYMPHALIDAE																		
California Sister	2	2			1	1												6
Northern Checkerspot					1			1			1				1			4
California Ringlet	1	1								1								3
Monarch	3										2	1	1	2	1			10
Variable Checkerspot			1															1
Common Buckeye	4	3	1	3	2	2	5	4	3	4	6	3	2			7	3	52
Lorquin's Admiral	1	1											1					3
Mourning Cloak		2											1					3
Mylitta Crescent											3	1				1		5
Satyr Anglewing							1											1
West Coast Lady										1					1	1		3

TABLE 4.1. BUTTERFLY SPECIES FOUND AT PUTAH CREEK (AND SELECTED YOLO BYPASS SITES) IN 2005 AND 2006

	PUTAH CREEK														YOLO BYPASS			TOTAL OBSERVED
	INTDM	DVDAM	OXBOW	DRYCK	WINTR	YOLOH	CLBL	RUSSR	STVBR	PICNC	OLDDR	MACEB	LOSRF	PUTCS	SACWR	FREWR	SUTBY	
Painted Lady		1					1	1					2	1			2	8
American Painted Lady							1											1
PAPILIONIDAE																		
Pipevine Swallowtail	4	1		1		1	5	1	3	2	1							19
Western Tiger Swallowtail			1						1			1						3
PIERIDAE																		
Orange Sulfur	3	2	1	2	3	2	8	3	1	6	6	2	4	1	2	4	2	52
Cabbage Butterfly	4	5	5	5	3	3	6	5	5	7	6	7	13	3	3	14	4	98
Checkered White										1								1
TOTAL OBSERVED	23	23	11	17	16	14	40	19	15	35	51	19	33	9	12	36	14	387

See Table JJ for species names and natural history information by species code. Sensitive or declining species shaded. Sites: INTDM=Interdam, DVDAM=Solano Diversion Dam, OXBOW=Oxbow, DRYCK=Dry Creek Confluence, WINTR=Winters Putah Creek Park, YOLOH=Yolo Housing Complex, CLBL=Center for Land-based Learning, RUSSR=Russell Ranch (UCD), STVBR=Stevenson's Bridge, PICNC=Picnic Grounds (UCD), OLDDR=Old Davis Rd/Restoria (UCD), MACEB=Mace Boulevard (City of Davis South Fork Preserve), LOSRF=Los Rios Farms, PUTCS=Putah Creek Sinks, SACWR=Sacramento Weir, FREWR=Fremont Weir, SUTBY=Sutter Bypass.

TABLE 4.2 ECOLOGY OF SOME CENTRAL VALLEY BUTTERFLIES						
Common Name	Scientific name	Flight Season	Food Plant(s)	Nectar Plant(s)	Habitat Association	Conservation Status
HESPERIIDAE						
<u>Roadside Skipper</u>	<i>Amblyscirtes vialis</i>	Univoltine: Apr-Jul	Purportedly feeds on native grasses, but no precise identifications in this area.	Small woodland flowers: Vetch, Mint, Dogbane	Roadsides and streamsides in dappled light and shade in moist habitats; very local.	Local and generally uncommon; inconspicuous
<u>Field Skipper</u>	<i>Atalopedes campestris</i>	Multivoltine: Mar-Nov	Feeds on many kinds of grasses; <i>Cynodon</i> , <i>Paspalum</i> , and others.	An eager flower visitor: Tall Blue Verbena, Goldenrod, Rabbitbrush, Coyotebrush, Alfalfa, Thistles, Dogbane	Open country species, grasslands, aglands, mowed lawns, gardens, forest roadsides.	Expanding its range apparently due to global warming; has recently jumped the Sierra and invaded the w. Great Basin. Emerging nearly a month earlier than 30 yrs ago.
Proterpius Duskywing	<i>Erynnis proterpius</i>	Mainly univoltine: Feb-Jul	Feeds on deciduous and evergreen oaks.	Many flowers: Vetch, Blue Dicks, <i>Phacelia</i> , Fiddleneck, Yerba Santa, CA Buckeye, Dogbane, Milkweed	Woodlands and forests	Nearly gone in the Valley. Males are hilltoppers and avid puddlers.
<u>Mournful Duskywing</u>	<i>Erynnis tristis</i>	Multivoltine: Mar-Oct	Oviposits on young, tender growth of Quercus (<i>Q. lobata</i> , summer-watered <i>Q. suber</i>).	Tall blue <i>Verbena</i> , Yerba Santa, CA Buckeye and a variety of garden flowers, esp. <i>Buddleia</i>	Oak woodlands, forest clearings, roadside oaks, parks and yards.	Common in No CA inner valleys. Hilltopper; marginal puddler.
<u>Fiery Skipper</u>	<i>Hylephila phyleus</i>	Multivoltine: heavy winter kill, maximum abundance Sep-Oct	<i>Cynodon</i> and other turf grasses. Also <i>Distichlis</i> .	Garden flowers: <i>Lantana</i> , <i>Verbena</i> , <i>Zinnia</i> , Marigolds, <i>Buddleia</i> , <i>Centaurea solstitialis</i>	Our most urban butterfly; common on mowed lawns.	Widespread and common. Belongs to a large genus which is otherwise Andean; North American range may be recent.

TABLE 4.2 ECOLOGY OF SOME CENTRAL VALLEY BUTTERFLIES

Common Name	Scientific name	Flight Season	Food Plant(s)	Nectar Plant(s)	Habitat Association	Conservation Status
<u>Rural Skipper</u>	<i>Ochlodes agricola</i>	Univoltine: late Apr-early Jul	Presumably native perennial grasses	Ardent visitors of CA Buckeye flowers; flight period exactly matches blooming time.	Rocky foothill canyons	Intolerant of civilization
<u>Woodland Skipper</u>	<i>Ochlodes sylvanoides</i>	Apparently multivoltine at low elevations: late Jun-Oct	Feeds on largely undetermined perennial grasses	An avid flower visitor: <i>Centaurea</i> , <i>Aster</i> , Dogbane, Rabbitbrush, Goldenrod, Coyotebrush	Vast array of habitats, incl. chaparral, riparian, woodland, montane, coniferous forest, and shrub-steppe.	Only slightly less intolerant of civilization than <i>O. agricola</i>
<u>Common Sooty-Wing</u>	<i>Pholisora catullus</i>	Multivoltine: Mar-Oct	<i>Chenopodium</i> , <i>Amaranthus</i> , <i>Ambrosia</i>	<i>Lippia</i> , <i>Heliotrope</i> , lawns, clovers, small yellow - flowered <i>Oxalis</i>	Vegetable gardens, vacant lots	Formerly a "junk" species, now teetering on the edge of regional extinction, reason unknown
Umber Skipper	<i>Poanes melane</i>	Multivoltine: Apr-Oct	Presumably native riparian grasses, but not identified. Breeds on <i>Cynodon</i> in Bay Area, but apparently not in Central Valley.	Yerba Santa, Dogbane, Milkweed, Thistles, Yellow Star Thistle, CA Buckeye, Coyote Brush	Facultative riparian. Perches in dappled light and shade along streambanks, generally well off the ground.	Generally uncommon, or even rare. Extinct below Lake Solano; declining regionally.
Sandhill Skipper	<i>Polites sabuleti sabuleti</i>	Multivoltine: Mar-Nov	Mainly <i>Distichlis</i> , some <i>Cynodon</i> , lawn grasses	Prefers low flowers: <i>Heliotrope</i> , <i>Lippia</i> , <i>Aster</i> , Rabbitbrush on the Sierra slope	Urban, rabbitbrush	Seasonally-polyphenic, low altitudes
<u>Common Checkered Skipper</u>	<i>Pyrgus communis</i>	Multivoltine: Mar-Nov	Malvaceae	A great many flowers	Lowland variety: Weedy lots, ag, roadsides, parks; Montane variety: coniferous forest w/ <i>Sidalcea</i>	Widely distributed, apparently stable

TABLE 4.2 ECOLOGY OF SOME CENTRAL VALLEY BUTTERFLIES						
Common Name	Scientific name	Flight Season	Food Plant(s)	Nectar Plant(s)	Habitat Association	Conservation Status
Least Checkered Skipper	<i>Pyrgus scriptura</i>	Multivoltine: Mar-Oct	<i>Malvella leprosa</i>	Flowers with short corolla-tubes growing near the ground: esp. <i>Lippia</i> and <i>Heliotrope</i>	Compacted clay alkaline soils	Local and sometimes common with its host plant in the CV and Delta. Not a good colonizer but may have been introduced from SoCal or desert SW during the 20th Century
LYCAENIDAE						
Great Purple Hairstreak	<i>Atlides halesus</i>	Multivoltine: Mar-Oct	On mistletoe: <i>Phoradendron flavescens villosum</i> , <i>P. macrophyllum</i> , <i>P. juniperinum</i>	Garden flowers: <i>Lantana</i> , <i>Zinnias</i> . Riparian: Dogbane, Milkweed, Goldenrod, CA Buckeye, Apiaceae, <i>Lepidium latifolia</i>	Riparian forest, foothill woodland, and older urban neighborhoods with a well-developed canopy.	
<u>Pygmy Blue</u>	<i>Brephidium exile</i>	Feb-Oct, multivolt	Tumbleweed (<i>Salsola tragus</i>); occas. <i>Atriplex patula</i> , <i>A. hastata</i> , Pickleweed, and introduced <i>A. semibaccata</i>	Flowers with shallow corollas, mostly near the ground; Coyotebrush in autumn, as well as Asters and Goldenrods	Salt marshes, alkali flats, shadscale, weed patches	Exhibits classic source-sink dynamics; larvae are ant-tended; population growth can be explosive but numbers low in recent years, perhaps related to abundance of <i>Salsola</i>
<u>Eastern Tailed Blue</u>	<i>Everes comyntas</i>	Multivoltine: Mar-Oct	Observed a "seasonal succession" of hosts: <i>Vicia</i> , <i>Lathyrus</i> , <i>Lotus purshianus</i> , <i>L. corniculatus</i> , <i>Melilotus</i> , <i>Trifolium</i>	Avid flower visitors: <i>Lippia</i> , <i>Heliotrope</i> , Clovers	Disturbed habitats, annual grassland, riparian, tule marsh	
Silvery Blue	<i>Glaucopsyche lygdamus</i>	Univoltine: late Jan-Feb to July	Some adapted to naturalized annual vetches; native host <i>Lathyrus jepsonii</i> and var. <i>californicus</i>	Several flowers, esp. Fiddleneck	Highway embankments, riparian, foothill, montane	

TABLE 4.2 ECOLOGY OF SOME CENTRAL VALLEY BUTTERFLIES

Common Name	Scientific name	Flight Season	Food Plant(s)	Nectar Plant(s)	Habitat Association	Conservation Status
<u>Golden</u> (Boisduval's) <u>Hairstreak</u>	<i>Habrodais grunus</i>	Univoltine: late spr-early summer	<i>Quercus</i> , espec. <i>Q. chrysolepis</i> and its hybrids	Not known to visit flowers or any thing else resembling a food source	Oak woodlands	A strange species: often common to abundant (occasionally rare)
<u>Purplish Copper</u>	<i>Lycaena helloides</i>	Formerly Multivoltine: Mar-late fall	<i>Polygonum aviculare</i> , <i>Rumex</i> incl. <i>R. crispus</i>	<i>Lippia</i> , <i>Heliotrope</i> , Alfalfa, <i>Aster</i> , <i>Baccharis</i> , and many others	Marshes and damp grasslands	Once weedy, now scarce. Now rarely seen before June and only locally common in Sep-Oct. <i>Potentilla</i> -feeding Suisun race apparently extinct.
Great Copper	<i>Lycaena xanthoides</i>	Univoltine: May-Jul	<i>Rumex crispus</i>	Avid flower visitor: <i>Grindelia</i> , <i>Marrubium vulgare</i> , <i>Apocynum cannabinum</i> , <i>Heliotrope</i> , wh-fl umbels of Apiaceae, <i>Lepidium latifolium</i>	Bottomlands, tule marsh in Valley	Intensely local; Pops holding regionally. Suisun population in decline, apparently extinct in W. Sacramento.
<u>Acmon Blue</u>	<i>Plebejus acmon</i>	Multivoltine: Feb-Nov	<i>Lotus scoparius</i> , wild buckwheats, esp. <i>Eriogonum nudum</i> , <i>L. purshianus</i> , <i>Polygonum aviculare</i>	Coyotebrush	Roadsides with scattered weeds and a fair bit of bare soil; breeders gen. shun shaded locations, but has been found breeding on <i>L. oblongifolius</i> in riparian mesic-montane conditions.	Widespread and adaptable. Weedy and highly dispersive.
Boisduval Blue	<i>Plebejus icariodes</i>	Univoltine: Apr-Jun	Many spp of perennial lupines	Visits a great variety of flowers: Pink Pussy Paws, wild Buckwheats, Composites, etc.	Variable; avid puddlers, segregating by species in puddles	Still present, but not as widespread and abundant as previously

TABLE 4.2 ECOLOGY OF SOME CENTRAL VALLEY BUTTERFLIES						
Common Name	Scientific name	Flight Season	Food Plant(s)	Nectar Plant(s)	Habitat Association	Conservation Status
<u>California Hairstreak</u>	<i>Satyrium californica</i>	Univoltine: late Apr-late Jun	<i>Quercus lobata</i>	<i>Marrubium</i> , <i>Apocynum cannabinum</i> , CA Buckeye	Open woodland, riparian, forest edges, chaparral	Nearly extinct in Sac Vly.
Sepia Hairstreak	<i>Satyrium saepium</i>	Univoltine: late in season	<i>Ceanothus</i> spp., espec. <i>C. cuneatus</i>	Wild buckwheat, Rabbitbrush	Chaparral and forest edges	
Willow Hairstreak	<i>Satyrium sylvinus</i>	May-Jul, univolt	Different populations "specialize" on different willow species. Even in the Sacramento Valley, some feed on glabrous, green-leaved willows and others on the gray-pubescent Sandbar Willow .	Dogbane, Milkweed, <i>Eriogonums</i> of the <i>nudum</i> group, Yarrow, members of the Apiaceae, etc.		Prior to the 1980s, common to see several hundred at once on <i>Apocynum cannabinum</i> in the riparian zone in West or North Sacramento. Today, they are gone completely except for a handful of presumed strays at Rancho Cordova, though willows are superabundant in the jumbled post-dredging gravel landscapes.
<u>Gray Hairstreak</u>	<i>Strymon melinus</i>	Multivoltine: Feb-Nov	One of most polyphagous butterflies known: mallows, legumes, trefoil, clover, alfalfa, mullein	Visit immense variety of flowers both wild and cultivated, espec. <i>Heliotrope</i> and white flowered Apiaceae.	Common in weedy and disturbed habitats at low elev, but could be found anywhere.	
NYPHALIDAE						
<u>California Sister</u>	<i>Adelpha bredowii californica</i>	Multivoltine: Mar-Nov	<i>Quercus agrifolia</i> , <i>wislizenii</i> , and <i>chrysolepis</i>	CA Buckeye, Yerba Santa, Dogbane, Giant Hyssop, Goldenrod, Coyotebrush	Oak woodlands, streambeds and roads	Uncommon or rare, and irregular in Valley, but occas. seen in cities and suburbs .

TABLE 4.2 ECOLOGY OF SOME CENTRAL VALLEY BUTTERFLIES

Common Name	Scientific name	Flight Season	Food Plant(s)	Nectar Plant(s)	Habitat Association	Conservation Status
<u>Northern Checkerspot</u>	<i>Chlosyne palla</i>	Univoltine: Mar-Jul	<i>Aster radulinus</i> , occas. <i>Solidago</i>	Buckeye, Yerba Santa, Milkweed, Dogbane, Thistles, yellow composites	Canyons, meadows, forest openings	Common in foothills, but rare stray in Valley
<u>California Ringlet</u>	<i>Coenonympha tullia californica</i>	Multivoltine: Mar-Jun	Perennial grasses	Unenthusiastic flower visitors	Foothill woodland, grassland	Still abundant in woodland, but extinct in N. Sac and on the edge in Rancho Cordova.
<u>Monarch</u>	<i>Danaus plexippus</i>	Multivoltine	<i>Asclepias</i>	A great variety of long corolla flowers		Population numbers vary greatly, prob due to disease.
<u>Variable Checkerspot</u>	<i>Euphydryas chalcedona</i>	Univoltine: Apr-Jul	Scrophulariaceae	CA Buckeye, Squaw bush, Yerba Santa, thistles	Chaparral, canyon riparian, gullies and streambeds in grassland or shrub-steppe.	Absent in the Valley and Suisun, but common in Coast Range and Sierra foothills.
<u>Common Buckeye</u>	<i>Junonia coenia</i>	Spr-Fall; 2 or more broods	<i>Plantago</i> , esp. <i>P. lanceolata</i> , various Scrophulariaceae, esp. <i>Fluellin</i> , <i>Kickxia</i> , <i>Lippia</i> .	A great many flowers: <i>Heliotrope</i> , <i>Lippia</i> , Buckeye, Rabbitbrush, Coyotebrush in the fall.	Open country, entering woods only along roads or streams.	Common in CA
<u>Lorquin's Admiral</u>	<i>Limenitis lorquini</i>	Multivoltine: Apr-Oct	<i>Salix</i> : the glabrous, green-leaved ones	Buckeye, Buttonbush, Yerba Santa, and many others	Obligate riparian. Along Valley willow streams	Precipitous and unexplained decline in CV since late 90's, but has become more common in Sierra Vly.

TABLE 4.2 ECOLOGY OF SOME CENTRAL VALLEY BUTTERFLIES						
Common Name	Scientific name	Flight Season	Food Plant(s)	Nectar Plant(s)	Habitat Association	Conservation Status
<u>Mourning Cloak</u>	<i>Nymphalis antiopa</i>	Univoltine: spring, but conspicuous activity in late winter	<i>Salix, Ulmus, Celtis</i>	More likely to visit sap, injured fruit, dung, or mud than flowers, though spring individuals often nectar at willow catkins and autumn individuals feed on Rabbitbrush.	Obligate riparian. Seen on willow catkins in early spring.	Populations have crashed regionally in recent years. Some improvement in 2005 and hibernators up in 2006.
California Tortoiseshell	<i>Nymphalis californica</i>		Various species of <i>Ceanothus</i>	Flowers of many kinds, aphid and scale honeydew, damaged fruit, sap, and mud.	Foothill canyons. Valley records are migrants, usually May-Jun or Sep-Oct	
Field Crescent	<i>Phyciodes campestris campestris</i>	Multivoltine: Mar-Oct	<i>Aster chilensis</i> complex	<i>Aster</i> , native <i>Lythrum</i> , Dogbane, thistles, star thistle	Floodplain, tule marsh	Large colony north of Davis now apparently extinct; currently known from W. Sac only.
<u>Mylitta Crescent</u>	<i>Phyciodes mylitta</i>	Multivoltine: Feb-Nov	<i>Cirsium, Silybum</i>	Thistles, Yerba Santa, <i>Heliotrope</i>	All kinds of disturbed (incl urban) habitats	Abundant and weedy, though may not be a permanent resident
<u>Satyr Anglewing</u>	<i>Polygonia satyrus neomarsyas</i>	Multivoltine: late spr-early summer and Aug-Sep	<i>Urtica holosericea</i>	Rarely seen at flowers, prefers sap, fruit, etc.	Riparian, tule marsh	Scarce to rare, in retreat from civilization. Sporadic east of Winters
<u>West Coast Lady</u>	<i>Vanessa annabella</i>	Multivoltine: all year	Malvaceae, <i>Urtica</i>	Generalist flower visitor: Rosemary, <i>Escallonia</i> , <i>Salpichroa</i>	Common at all sites. Territorial sites typically open to the SW or W in very late afternoon, with a defining vertical backdrop (trees, a wall).	Common at low elev in CA

TABLE 4.2 ECOLOGY OF SOME CENTRAL VALLEY BUTTERFLIES

Common Name	Scientific name	Flight Season	Food Plant(s)	Nectar Plant(s)	Habitat Association	Conservation Status
Red Admiral	<i>Vanessa atalanta</i>	Multivoltine	<i>Urtica holosericea</i> and other nettles		Also territorial in late afternoon in sites open to the SW or W (i.e. lowering sun).	One of the most frequently seen in midwinter
<u>Painted Lady</u>	<i>Vanessa cardui</i>	Multivoltine: Most of year	Malvaceae, Boraginaceae, Asteraceae; in outbreak yrs seen on Fabaceae, Verbenaceae, Plantaginaceae, etc.	Visits all flowers eagerly: incl Thistles, Borages, Composites	Vacant lots, yards	Most widely distributed butterfly in world
<u>American Painted Lady</u>	<i>Vanessa virginiensis</i>	Multivoltine:	<i>Gnaphalium</i> , <i>Anaphalis</i> and other composites; exotic bedding plant <i>Gazania</i>		Riparian, tule marsh	Our least common Lady; seasonal life history poorly known
PAPILIONIDAE						
<u>Pipevine Swallowtail</u>	<i>Battus philenor</i>	Multivoltine: Feb-Nov	<i>Aristolochia californica</i>	Eager visitors to many flowers: Wild Radish, CA Buckeye, Blue Dicks, Ithuriel's Spear, Yerba Santa; Yellow Star Thistle in summer when no natives in bloom.	Obligate riparian	Declining regionally
Pale Swallowtail	<i>Papilio eurymedon</i>	Univoltine: Apr-Aug	<i>Rhamnus</i> ; <i>Ceanothus</i>	Avid flower visitors: Vetch, Yerba Santa, Blue Dicks, Ithuriel's Spear, CA Buckeye; Western Wallflower, native lilies.	Common from lower foothills to treeline; not usu seen in CV	

TABLE 4.2 ECOLOGY OF SOME CENTRAL VALLEY BUTTERFLIES

Common Name	Scientific name	Flight Season	Food Plant(s)	Nectar Plant(s)	Habitat Association	Conservation Status
<u>Western Tiger Swallowtail</u>	<i>Papilio rutulus</i>	Multivoltine at lower elevations: Mar-Sep	Low -elevation hosts include Populus, Platanus), Fraxinus, Cherry and other stone fruits (Prunus), Salix, Privet (Ligustrum), Lilac (Syringa) and (in Sacramento County) Sweet Gum (Liquidambar).	Yerba Santa, Buckeye, Milkweed, Dogband, Lilies, Coyotemint; in gardens on <i>Lilac</i> and <i>Buddleia</i>	Facultative Riparian	Widely distributed. Basically a species of riparian forest, gliding majestically along the watercourse. Has expanded into older urban neighborhoods where several of its host genera are grown as shade trees, and behaves as if the street were a watercourse
Anise Swallowtail	<i>Papilio zelicaon</i>	Feb-Oct; multivolt	<i>Foeniculum vulgare</i> , <i>Conium maculatum</i>	A vast array of flowers: Yerba Santa, Coyotemint, Blue Dicks, Ithuriel's Spear, CA Buckeye, Thistles, Buttonbush	Vacant lots, roadsides, hills, fields	A complex set of ecotypes, whose seasonality has been adjusted by natural selection to match that of their host plants.
PIERIDAE						
<u>Orange Sulphur</u>	<i>Colias eurytheme</i>	Multivoltine; flies all year at low elevations	Many Fabaceae			One of our commonest butterflies, ubiquitous except in closed-canopy forest; major pest on alfalfa.
Large Marble	<i>Euchloe ausonides</i>	Formerly 2 broods/yr. The second brood disappeared first.	Had transitioned to naturalized annual species of <i>Brassica</i> and <i>Raphanus</i>	Brassicaceous flowers	Grass, fields, streamsides	Formerly common in CV. Has suffered an unexplained crash and is teetering on the brink of regional extinction.

TABLE 4.2 ECOLOGY OF SOME CENTRAL VALLEY BUTTERFLIES						
Common Name	Scientific name	Flight Season	Food Plant(s)	Nectar Plant(s)	Habitat Association	Conservation Status
<u>Cabbage Butterfly</u>	<i>Pieris rapae</i>	Multivoltine: flies 44 wks/yr in Davis	<i>Brassica</i> , <i>Raphanus</i> ; contract down to cultivated Crucifers and Nasturtiums, as well as perennial <i>Hirschfeldia</i> <i>incana</i> and <i>Lepidium</i> <i>latifolium</i>	A great variety of flowers: one of two species that can extract nectar from flimsy f lowers of <i>Epilobium</i> <i>brachycarpum</i> (Woodland Skipper is the other) by hanging upside-down.	Towns and valley bottoms	Introduced; major pest of Brassica. Introducing into new areas via <i>L. latifolium</i> . Mustard oils make larvae distasteful to birds.
<u>Checkered White</u>	<i>Pontia protodice</i>	Multivoltine: Jan-Sep/Oct	Various Brassicas: <i>Lepidium</i> (<i>L. latifolium</i> unpreferred), <i>Sisymbrium altissimum</i> , <i>Herschfeldia incana</i>	Mustards, Composites, Legumes, alfalfa	Grasslands and steppe; in wooded areas only along roadsides .	Once abundant at low elevations. Since has become much rarer.
Species found along Putah Creek underlined. Sources: Garth & Tilden 1986. Scott 1986. Art Shapiro's Butterfly Site (http://butterfly.ucdavis.edu/).						

5 AMPHIBIANS AND REPTILES



Pacific Rattlesnake at Interdam. Photo: M. Truan

All herpetological records were gathered via incidental observations (Table 5). (More systematic surveys for focal species may occur in the future.) Four species of amphibians were observed along Putah Creek, representing only 6% of the total number of amphibian species known to occur in California and 44% of the amphibian species known to occur in Yolo County (most of which occur in the mountainous regions of the county). However, these four species represent fully 80% of the total number of species recorded for the Sacramento Valley, representative of the limited herpetofauna known to inhabit this region (Stebbins 2004).

Ten species of reptiles were observed, representing 11% of the total number of California reptile species, 67% of the total species recorded in the Sacramento Valley, and 71% of the species known to occur in Yolo County (Zeiner et al. 1988). The most abundant native amphibian along the creek was the Pacific Treefrog (*Pseudacris sierra*) and the most ubiquitous reptile was the Western Fence Lizard (*Sceloporus occidentalis*). Pacific Rattlesnakes (*Crotalus viridis*) were largely restricted to the upper reaches of the creek and were most frequently encountered in spring, during their time of emergence from hibernation.

The California Slender Salamander (*Batrachoseps attenuatus*) was recorded twice, a single observation in 1999 at Diversion Dam (under a downed oak limb) and a single animal on the UC Davis Campus reserve near Pedrick Road in 2000. We have not undertaken a comprehensive survey of this secretive and small salamander along the creek, but these two records indicate it may be widely distributed, at



Sierran Chorus Frog (*Pseudacris sierra*) in a mist netting pole. Photo: R. Melcer Jr.

least along the upper and middle reaches of the creek. Most extant records from Yolo and Solano counties are from the Berryessa foothills (<http://www.californiaherps.com>, last queried on 12 May 2010).

Western Pond Turtles (*Actinemys marmorata*) appear to be relatively widespread along the creek. This species occurs in both permanent and intermittent waters, preferring habitats with emergent logs or boulders for basking. Turtles also bask on top of aquatic vegetation or position themselves just below the surface where water temperatures are elevated. Western Pond Turtles are extremely wary and will rapidly dive off basking sites when approached by humans, even at distances of over 50m.



Western Pond Turtle (*Emys marmorata*) at Dry Creek Confluence back-water. Photo: A. Engilis, Jr.

Consequently, this species is often overlooked in the wild. Western pond turtles seek refuge in deep water, under submerged logs and rock, in beaver burrows and lodges, and by "swimming" into deep silt. Turtles are omnivorous with most of their animal diet consisting of insects, crayfish and other aquatic invertebrates. Fishes, tadpoles, and frogs are eaten occasionally and carrion is eaten when available. Plant foods include filamentous algae, lily pads, tule and cattail roots. Western Pond Turtles require upland habitats in which to nest. They may travel some distance from water for egg-laying, moving as much as 0.8 km (1/2 mile) from and up to 90 m (300 ft) above the nearest source of water. Most nests are within 90 m (300 ft) of water. The female usually leaves the water in the evening and may wander quite far before selecting a nest site, often in an open area of sand or hardpan with a southern aspect. Females produce 5-13 eggs per clutch, once or twice a year. The nest is flask-shaped with an opening of about 5 cm (2 in). Females spend considerable time covering up the nest with soil and adjacent low vegetation, making nests difficult to find. Winter rains may be necessary to loosen the hardpan soil where nests are deposited. Young appear in the spring. Individuals grow slowly in the wild, and age of their first reproduction may be 10 to 12 years in the northern part of the range. Adult turtles may survive more than 30 years in the wild.

The Red-eared Slider (*Trachemys scripta*) has become established along the entire length of Lower Putah Creek. This species is not native to California and may be competitively displacing Western Pond Turtle. Current range maps of its distribution in California do not indicate this species as being widespread in the rivers and streams of Yolo and Sacramento Counties.

TABLE 5. AMPHIBIANS AND REPTILES OBSERVED ON LOWER PUTAH CREEK

Common Name	Scientific Name	Upper Reach	Middle Reach	Lower Reach
California Slender Salamander	<i>Batrachoseps attenuatus</i>	X	X	
Western Toad	<i>Bufo boreas</i>	X	X	X
Sierran Chorus Frog	<i>Pseudacris sierra</i>	X	X	X
Bullfrog	<i>Rana catesbeiana</i>	X	X	X
Western Pond Turtle	<i>Actinemys marmorata</i>	X	X	X
Red-eared Slider	<i>Trachemys scripta</i>	X	X	X
Western Fence Lizard	<i>Sceloporus occidentalis</i>	X	X	X
Gilbert's Skink	<i>Eumeces gilberti</i>	X		
Southern Alligator Lizard	<i>Elgaria multicarinata</i>	X	X	
Western Yellow-bellied Racer	<i>Coluber constrictor</i>	X		X
Gopher Snake	<i>Pituophis catenifer</i>	X	X	X
California Kingsnake	<i>Lampropeltis getula</i>	X	X	X
Aquatic Garter Snake	<i>Thamnophis atratus</i>	X	X	
Pacific Rattlesnake	<i>Crotalus viridis</i>	X		

6 MAMMALS

We documented 34 species of mammals on Lower Putah Creek (Table 6), 15% of the total number of mammals known to occur in California, 65% of species recorded for the Central Valley and 75% of species recorded for Yolo County (Zeiner et al 1990). Data were gathered using a variety of methods: visual observations, scat and track identification, track plates, and live trapping via Sherman traps.

No comprehensive survey of the bat species of the creek has been done to date. A colony of Mexican Free-tailed Bats (*Tadarida brasiliensis*) lives under the I-80 overpass above Putah Creek on the UC Davis Campus Reserve. Other species are known to roost in riparian trees. Exploratory bat surveys are being planned for Putah Creek under the auspices of the UC Davis student chapter of The Wildlife Society and mammalogist Dr. Douglas Kelt. This will be a worthwhile undertaking since we lack good baseline data on these important members of the riparian community. Like birds and butterflies, bats serve as sensitive indicators of ecosystem structure, function, and environmental change. Hibernating bats in the northeastern United States are dying in record numbers in association with a fungal disease known as



River Otter on Putah Creek. Photo: J. Dunn, Avian Images

white-nose syndrome (WNS) (Blehert et al. 2009). WNS has rapidly spread to multiple sites. While the disease may be confined to cold and humid caves and mines in the eastern United States, it will be important to monitor western species to document any changes to their health or population abundance.

Western Gray Squirrel (*Sciurus griseus*) was found throughout the full length of Putah Creek, from the foothills to the sinks. In a matter of a decade this species has become widespread along the creek, and we are now encountering family groups, indicating active breeding. They have readily taken to Wood Duck nest boxes placed along the creek as part of an ongoing research and conservation project by Dr. John Eadie (UC Davis). This species may be using the creek as a corridor to travel between the Berryessa Hills and downstream riparian forests.



Western Gray Squirrel (*Sciurus griseus*) near Oxbow. Photo: A.Engilis, Jr.

In July 2004, a single Eastern Gray Squirrel (*Sciurus carolinensis*) was observed for the first time along the creek on transect at the Center for Landbased Learning (photo right). The non-native Eastern Fox Squirrel (*Sciurus niger*) has also been increasing along the creek and is plentiful along the reach adjacent to the UCD Campus. Since the beginning of the project, we have also observed fox squirrels as far upstream as Diversion Dam. The burgeoning populations of Fox Squirrels on the UC Davis campus has prompted an investigation of the efficacy of immunocontraception in this species

(<http://www.news10.net/news/local/story.aspx?storyid=49897>).

All live-trapping efforts on Putah Creek to date (1998-99 (Truan), 2002 (Engilis), 2004 (Kelt)) have captured large numbers of non-native rodents, primarily Black Rat (*Rattus rattus*) and House Mouse (*Mus musculus*). Black rats breed throughout the year; producing 3-6 litters/year of up to 20 young per litter. They nest in or under vegetation, and in trees, often forming social groups of up to 60 animals. Numerous studies document that Black Rats have directly caused or contributed to the extinction of many wildlife species, including birds, small



Eastern Gray Squirrel at Center for Land-based Learning. Photo: A. Engilis Jr.

mammals, reptiles, and invertebrates, especially on islands. Rats also prey on the eggs and young of forest birds and ground-nesting birds. While studies in riparian habitats are few, an investigation at the Cosumnes River Preserve in 2004-2005 revealed Black Rats to be significant predators on cup-nesting songbirds, eggs, and chicks, and were the primary reason for low fledgling success rates (Hammond 2008, Whisson et al 2007).

We conducted surveys for aquatic mammals, but mapping beaver dams and potential dens has proven to be difficult due to high flows and the ephemeral nature of these structures. Mink (*Neovison vison*) have been seen repeatedly, especially in the middle and upper reaches of the creek. These are important sightings since this species was once believed to have been extirpated from the area (Sean Barry, UC Davis, pers. comm.). Muskrats (*Ondatra zibethica*) were observed less frequently than expected. We know they occur in the marshes of the Yolo Basin Wildlife Area and in Lake Solano, but limited emergent vegetation in Putah Creek may limit this species' dispersal along its length.

A Black Bear (*Ursus americanus*) was sighted in the vicinity of Pedrick Road in 1998 (Melanie Truan, UC Davis, pers. comm.). Additionally, Black Bear scat was found near Russell Ranch in 2004 (Lynn Kimsey, UC Davis, pers. comm.). Mountain Lion (*Puma concolor*) sightings occur occasionally along the creek, usually in the upper reaches near the Coast Ranges and at the Dry Creek Confluence. Mountain Lion records also exist for the western edge of the UC Davis campus, at the former Experimental Ecosystem site, during the period that deer were housed there (Ronald E. Cole, UC Davis, pers. comm.). Mountain



Black bear track at Pedrick Road. Photo: M. Truan

Lions are also regularly sighted in the Yolo Wildlife Area (Dave Feliz pers. comm.) and one was recently reported at the City of Davis South Fork Preserve (Mace Boulevard) (John McNerney pers. comm.)

Of special interest has been the recent discovery that Red Fox (*Vulpes vulpes*) residing in the Sacramento Valley are not introduced populations, but instead represent the endemic Sierra Nevada Red Fox (*V. v. necator*) (Perrine et al. 2007). It was not that long ago that the California Department of Fish and Game called for control of these animals in areas outside the Sierra Nevada and Siskiyou, thinking they were non-native escapees from fur farms (Lewis et al 1993, CDFG 1999). Through 2002, populations along Putah Creek were controlled by land owners and even agencies managing their lands. The finding in 2007 that these animals represented a native species has refocused management policies.

We have recorded “California” Red Fox along the creek through 2008. They have been recorded in all three reaches, with active dens found in at least two localities. The first animals were sighted numerous times at Diversion Dam in 2001 and 2002. The den could not be located, but multiple animals seen on multiple occasions indicated that there was an active den at that time. We have not observed Red Fox at that site since 2002. In 2004, at Winters Putah Creek Park, two animals were observed yelping and protecting a territory on 24 July. An active den was located near avian Point Count 2 by A. Engilis, Jr. This den was abandoned in 2005. The final observations were of animals on the Putah Creek Campus Reserve and UCD Campus in 2000 and 2002 (an active den at the Experimental Ecosystem near Pedrick Road) and in 2008 in the UC Davis Arboretum. We have not instituted formal monitoring for Red Fox, but the use of remote sensing camera stations could be employed as part of an expanded effort in the near future.

Our records indicate that Black-tailed Deer (*Odocoileus hemionus*) may exhibit a disjunct distribution, anchored in two locations along the creek. They are fairly common upstream from Yolo Housing to Interdam and are also notable in the Putah Creek Sinks (we have observed them at several locales in the Yolo Bypass). However, deer appear to be absent or scarce in the middle reaches and most of the lower reach of the creek.



Opossum (*Didelphis virginiana*) is widespread along Putah Creek. Photo: A. Engilis, Jr.

TABLE 6. MAMMALS OBSERVED ALONG PUTAH CREEK															
Common Name	Scientific Name	INTDM	DVDAM	OXBOW	DRYCK	WINTR	YOLOH	CLBL	RUSSR	STVBR	PICNC	OLDRR	MACEB	LOS RF	PUTCS
DIDELPHIDAE															
Opossum	<i>Didelphis virginiana</i>								X	X	X				
SORICIDAE															
Ornate Shrew	<i>Sorex ornatus</i>		X						X		X				
TALPIDAE															
Broad-footed Mole	<i>Scapanus latimanus</i>		X	X	X	X				X	X				
VESPERTILLIONIDAE															
Yuma Myotis	<i>Myotis yumanensis</i>										X	X			
Hoary Bat	<i>Lasiurus cinereus</i>								X		X				
MOLOSSIDAE															
Mexican Freetail Bat	<i>Tadarida brasiliensis</i>								X	X	X	X			
CANIDAE															
Coyote	<i>Canis latrans</i>		X						X	X	X		X		
Gray Fox	<i>Urocyon cinereoargenteus</i>					X									
California Red Fox	<i>Vulpes vulpes necator</i>	X	X	X	X	X					X				
URSIDAE															
Black Bear	<i>Ursus americanus</i>					X			X		X ¹				
PROCYONIDAE															
Raccoon	<i>Procyon lotor</i>			X	X	X	X	X	X	X	X	X	X		X
MUSTELIDAE															
River Otter	<i>Lutra canadensis</i>		X	X	X	X	X	X	X	X	X		X	X	

TABLE 6. MAMMALS OBSERVED ALONG PUTAH CREEK

Common Name	Scientific Name	INTDM	DVDAM	OXBOW	DRYCK	WINTR	YOLOH	CLBL	RUSSR	STVBR	PICNC	OLDRR	MACEB	LOS RF	PUTCS
Mink	<i>Neovison vison</i>					X			X	X	X	X	X	X	
MEPHITIDAE															
Striped Skunk	<i>Mephitis mephitis</i>	X	X	X	X	X	X	X	X	X	X	X	X	X	
FELIDAE															
Mountain Lion	<i>Panthera concolor</i>			X	X					X	X		X		X
Bobcat	<i>Lynx rufus</i>	X		X					X						
House Cat (FERAL)	<i>Felis domesticus</i>			X	X	X	X	X	X	X		X	X		
CERVIDAE															
Black-tailed Deer	<i>Odocoileus hemionus</i>	X	X	X	X	X	X							X	
ERETHIZONTIDAE															
Porcupine	<i>Erethizon dorsatum</i>										X				
SCIURIDAE															
Beechey's Ground Squirrel	<i>Spermophilus beecheyi</i>		X		X		X	X	X		X	X			
Western Gray Squirrel	<i>Sciurus griseus</i>	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Eastern Gray Squirrel	<i>Sciurus carolinensis</i>							X							
Fox Squirrel	<i>Sciurus niger</i>		X	X				X		X	X	X			
CASTORIDAE															
Beaver	<i>Castor canadensis</i>	X	X	X	X	X			X		X	X	X	X	X
GEOMYIDAE															
Botta's Pocket Gopher	<i>Thomomys bottae</i>								X		X		X		
CRICITIDAE															

TABLE 6. MAMMALS OBSERVED ALONG PUTAH CREEK

Common Name	Scientific Name	INTDM	DVDAM	OXBOW	DRYCK	WINTR	YOLOH	CLBL	RUSSR	STVBR	PICNC	OLDRR	MACEB	LOS RF	PUTCS
Western Harvest Mouse	<i>Reithrodontomys megalotis</i>	X	X		X	X			X		X	X	X		
Deer Mouse	<i>Peromyscus maniculatus</i>	X							X		X	X			
California Vole	<i>Microtus californicus</i>	X	X		X	X			X		X	X	X		X
Muskrat	<i>Ondatra zibethica</i>	X	X			X					X				
MURIDAE															
Black Rat	<i>Rattus rattus</i>	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Norway Rat	<i>Rattus norvegicus</i>								X		X	X			
House Mouse	<i>Mus musculus</i>	X	X		X	X			X		X	X	X		
LEPORIDAE															
Black-tailed Jackrabbit	<i>Lepus californicus</i>			X				X	X	X	X	X	X		
Audubon's Cottontail	<i>Sylvilagus audubonii</i>	X		X						X	X	X	X	X	
Nomenclature follows Wilson and Reeder 2005. ¹ Animal observed on creek bank west of Pedrick Road.															

7 BIRDS

We surveyed birds using strip transects (spring, fall, and winter) (Bibby et al 2000, Lindgren et al. 2006) and/or variable-radius point count surveys (three times in spring) (Ralph et al. 1997, Lindgren 2006). These surveys enabled us to determine both species presence-absence and to estimate species relative abundance based on the number of detections, corrected for effort. Relative abundance measures were supplemented by a two-year Breeding Bird Atlas effort conducted



Male Yellow-rumped Warbler, one of the most abundant wintering birds on Putah Creek. Photo: A. Engilis, Jr.

in 2004 and 2005 (BBA protocols, Cornell Lab of Ornithology). The Breeding Bird Atlas assessed breeding status based on behavioral cues and direct observations (Lindgren et al. 2006; MWFB 2008). Breeding Bird Atlas observations were made using the grid system used in the Putah Creek Watershed Management Action Plan (EDAW 2005) which divided the creek into one-mile-long blocks. In 2005 and 2006, we conducted a Monitoring Avian and Productivity (MAPS) constant-effort mist-netting project (Nott et al. 2003, DeSante et al. 2005) to obtain data on avian demographics, body condition, and reproductive status of birds along Putah Creek and in the Yolo-Sutter Bypass system (Lindgren et al. 2006; MWFB 2008). In addition to these systematic surveys, birds observed during casual visits to sites or outside designated survey periods were recorded as incidental sightings.

Since birds are highly-mobile and prone to vagrancy, new species are being added each year. We continue to add species to the list of known breeding or wintering avifauna, and also to the list of geographic vagrants that visit the creek from time to time. We include Yolo-Sutter Bypass records for comparison. (Note, however, that we completed fewer surveys for the Yolo-Sutter Bypass sites, so estimates, especially those for presence-absence—which are highly correlated with the number of visits to a site—cannot be directly compared with values for Putah Creek.) In previous reports, we discuss patterns of relative abundance, status of foraging guilds, and temporal patterns of change along Putah Creek (Truan et al 2005, Lindgren et al. 2006). We will be updating these analyses in 2011.

Following is a discussion of most species recorded to date. Treated in more detail are focal species designated by the California Partners in Flight Riparian Habitat Joint Venture (RHJV 2004) and the CALFED Multispecies Conservation Strategy (CALFED MSCS 2000), California endemic bird species, and Local Focal Species (those chosen by the UC Davis Museum of Wildlife and Fish Biology

based on local conservation concern (Table 7.1)). Seasonal distribution maps for all focal species are included in the associated Map Volume (Exhibits C1-C36). Partners in Flight Riparian Habitat Joint Venture (RHJV 2004) species are those that: 1) use riparian vegetation as their primary breeding habitat in most bioregions of California, 2) are common enough to allow adequate sample sizes for statistical comparisons and to assess responses to changes in management (such as restoration), 3) have breeding requirements that represent the full range of successional stages of riparian ecosystems (and so enable the assessment of success of restoration efforts), and 4) have experienced a reduction in their historical breeding range and so warrant special management status.

To comply with Endangered Species Act (ESA), California Endangered Species Act (CESA), and Natural Community Conservation Planning (NCCP) requirements, the CALFED Multi-species Conservation Strategy has identified a list of special-status species to be evaluated under proposed management actions: 1) those listed as threatened or endangered under ESA or CESA, 2) candidates for listing, 3) Essential Fish Habitat (EFH) designated by NOAA Fisheries, 4) plants listed as rare under the California Native Plant Protection Act, 5) fully-protected species or specified birds under various sections of the California Fish and Game Code, 6) California species of special concern (CSC), 7) plants included on California Native Plant Society (CNPS) List 1A, 1B, 2, or 3, and/or 8) other native species of concern to the CALFED program.

The majority of endemic species—species that occur exclusively within a specific geographic area and nowhere else—are found on islands, due to their geographic isolation from mainland populations. California, due to its large spatial area, varied topography and climate and its relative isolation from the rest of the mainland United States by intervening mountains and deserts, also hosts many endemic species, especially plants (Cain 1944, Bunn et al. 2007). In addition, California's historical lack of continental glaciation has provided a longer time span for speciation to occur. Endemic species are particularly prone to extinction due to their restricted distributions, generally small population sizes, and limited genetic diversity. Furthermore, endemic populations don't have the luxury of being rescued by immigration from other populations. If a population of an endemic species becomes regionally extinct, the species becomes globally extinct as well. Because of this inherent vulnerability, we have chosen to include endemic species within our suite of focal species of conservation concern in California.

Museum of Wildlife and Conservation Biology (MWFB) Local Focal Species are those that do not fall under any of the preceding categories, but which we feel warrant special conservation attention. Some of these species are special because they have modified their distribution or seasonality to encompass Central Valley habitats, some are important members of the overwintering bird community, and others were chosen because they stand to benefit from conservation measures enacted locally or regionally.

Spatiotemporal distribution maps were prepared for the 36 avian focal species considered in this report (Map Volume Exhibit C1-36). For each focal species, relative abundance by site and for a specific range of dates (adjusted for effort) was indicated. Results from these analyses indicated that the majority of species (Swainson's Hawk, Black-chinned Hummingbird, Anna's Hummingbird, Nuttall's Woodpecker, Yellow-billed Magpie, Tree Swallow, Swainson's Thrush, Hermit Thrush, Common Yellowthroat, California Towhee, Song Sparrow, Black-headed Grosbeak, and Blue Grosbeak) displayed relatively uniform spatial distributions across the entire lower watershed, with differences mainly due to differences in relative abundance between sites. For other species, presence and/or relative abundance were generally greater either in the upper reaches (i.e. closer to the Coast Range foothills) or in the lower reaches (i.e. closer to the Yolo Bypass). Species with distributions centered more in the upper reaches included Black-chinned Hummingbird, Oak Titmouse, Western Bluebird, and Black-headed Grosbeak. Species with distributions centered more in the lower reaches included Swainson's Hawk and Blue Grosbeak. Song Sparrow displayed a bimodal distribution, with peaks in both the upper and lower reaches, but fewer sightings in the middle reach. For some species, detections were relatively sporadic and scattered across the lower watershed. Sightings for these species were few and far-between for a variety of reasons. Valley riparian woodland habitats are generally not considered to be prime habitats for certain focal species such as Sandhill Crane, Spotted Sandpiper, Long-eared Owl, Wrentit, and Tricolored Blackbird, though they do occur in small numbers here from time to time. Other species that *would* be expected to occur along the creek—and which, in many cases, did historically occur but have been greatly reduced in recent years—include Yellow-billed Cuckoo, Bell's Vireo, and Bank Swallow. Finally, a small number of focal species were found to occur less often because they generally frequent the creek during the winter (Winter Wren) or because they are currently in the process of expanding their distribution inland (Allen's Hummingbird).

For an additional ten focal species that are known to have bred historically in the area, but for whom the current extent and frequency of breeding is reduced and is therefore, uncertain, we divided observations into 3 temporal periods based on the season at which individuals were observed. A green symbol indicates that individuals were detected during the spring and were probably spring migrants passing through the area. A blue symbol indicates individuals detected during the usual period of fall migration. A red symbol, however, indicates individuals detected outside the usual season of occurrence (Yolo Audubon Society Checklist Committee 2004). Thus, these individuals may be remaining in and possibly attempting to breed in the area. If they are attempting to breed, the outcome of these attempts are important to determine since they represent the potential for recovery of the species and indicative of the types of threats that they may be facing. Combining anomalous summer records with

follow-up Breeding Bird Atlas surveys will help to confirm the status of these individuals and their reproductive success.

Our combined 1997-2008 surveys resulted in 52,014 records for a total of 232 bird species for Putah Creek. Seven additional species were recorded only at the Yolo-Sutter Bypass sites (Table 7.2): Greater Scaup (*Aythya marila*), Lesser Scaup (*A. affinis*), Rough-legged Hawk (*Buteo lagopus*), Long-billed Dowitcher (*Limnodromus scolopaceus*), Black Swift (*Cypsiloides niger*), Mountain Bluebird (*Sialia currucoides*), and Chestnut-sided Warbler (*Dendroica pennsylvanica*). In addition, a few vagrants have been recorded along Putah Creek over the years. These include: Baltimore Oriole (*Icterus galbula*) (22 Sept 2007, Pedrick Road area), Taiga Flycatcher (*Ficedula albicilla*) (25 Oct 2006, Interdam reach – first continental record for North America), and Red-throated Loon (25 Mar 2003, Lake Solano). During the Breeding Bird Atlas period (2003–2005), we confirmed 59 species as nesting along lower Putah Creek. Since then we have confirmed an additional nine species, bringing the total confirmed number of breeding species to 69. In addition, we rated 17 species as probable breeders and six species as possible breeders, bringing the number of either confirmed or suspected breeders to 92 species (Table 7.2). That most species have been elevated to probable or confirmed reflects the many hours we have spent on the creek assessing breeding status. Several summer visiting species (including Neotropical migrants) which are known to breed here are also of special status in the state of California. To further confirm the breeding status of many of these species on the creek, we hope to repeat the creek-wide Breeding Bird Atlas in spring of 2011–2012.



Left: Anna's Hummingbird (*Calypte anna*) a Near Endemic species.

Right: Black-chinned Hummingbird (*Archilochus alexandri*), a Local Focal species.

Both are common



Great Blue Heron, Winters Putah Creek Park. Photo: A. Engilis Jr.

TABLE 7.1 FOCAL SPECIES CONSIDERED IN THIS REPORT

SPECIES	STATUS	SEASONALITY	CONSERVATION IMPLICATIONS	MAP
Swainson's Hawk	RHJV, MSCS	Summer Breeder	Threatened by habitat loss; Agriculture contributes to its conservation in the Central Valley	C1
Sandhill Crane	MSCS	Winter Visitor	Threatened by loss of wetlands	C2
Spotted Sandpiper	RHJV	Summer Visitor		C3
Western Yellow-billed Cuckoo	RHJV, MSCS	Summer Visitor; Former Breeder	Threatened by loss of mature riparian forests	C4
Long-eared Owl	Local Focal	Uncommon Winter Visitor	Dependent on riparian woodlands and thickets with small densely canopied trees for roosting and nesting	C5
Black-chinned Hummingbird	Local Focal	Summer Breeder	Dependent on riparian forests	C6
Anna's Hummingbird	CA near Endemic	Newly Resident	Endemicity	C7
Allen's Hummingbird	CA Endemic	Migrant; Range expansion to CV?	Endemicity	C8
Nuttall's Woodpecker	CA Endemic	Resident	Threatened by loss of cavity trees	C9
Western Wood Pewee	Local Focal	Summer Breeder	Breeding Range Expansion to Central Valley	C10
Pacific-slope Flycatcher	Local Focal	Migrant; Former Breeder?	May have bred more commonly in early 20th Century followed by decline; a very local breeder since 1995	C11
Willow Flycatcher	RHJV, MSCS	Migrant; Former Breeder	Threatened by habitat loss and cowbird brood parasitism	C12
Bell's Vireo	RHJV, MSCS	Migrant; Former Breeder	Brown-headed cowbird host.	C13

TABLE 7.1 FOCAL SPECIES CONSIDERED IN THIS REPORT

SPECIES	STATUS	SEASONALITY	CONSERVATION IMPLICATIONS	MAP
Warbling Vireo	RHJV	Migrant; Former Breeder	Threatened by habitat loss and cowbird brood parasitism	C14
Yellow-billed Magpie	CA Endemic	Resident	Endemicity; Susceptible to West Nile Virus	C15
Tree Swallow	RHJV	Summer Breeder	Nest site limitation	C16
Bank Swallow	RHJV, MSCS	Summer Breeder	Dependent on cutbanks	C17
Oak Titmouse	CA Endemic	Resident	Dependent on oak trees; Susceptible to West Nile Virus	C18
Winter Wren	Local Focal	Migrant and Winter Visitor	Rare to uncommon; Found in areas with most complete canopy cover and densest understory	C19
Western Bluebird	Local Focal	Resident	Nest site limitation	C20
Hermit Thrush	Local Focal	Common Migrant and Winter Visitor	Common in wooded habitats with some understory, near water	C21
Swainson's Thrush	RHJV	Uncommon Spring Migrant, rare Summer Breeder, rare Fall Migrant	Declining in CA	C22
Wrentit	CA near Endemic	Resident	Endemicity. Putah Creek is one of a few drainages where species occurs on Valley floor	C23
Orange-crowned Warbler	Local Focal	Abundant Migrant, Winter Visitor, Casual Summer Breeder	Wooded and especially brushy habitats and their edges, espec. near water	C24
Yellow Warbler	RHJV, MSCS	Common spring and fall migrant, rare breeder	Breeders nearly extirpated due to habitat loss, cowbird parasitism, and possibly black rat predation	C25
Common Yellowthroat	RHJV	Common migrant, uncommon and somewhat local winter visitor, uncommon summer breeder (historically common)	Loss of tall, emergent wetland vegetation; Brown-headed cowbird host.	C26

TABLE 7.1 FOCAL SPECIES CONSIDERED IN THIS REPORT

SPECIES	STATUS	SEASONALITY	CONSERVATION IMPLICATIONS	MAP
Wilson's Warbler	RHJV	Common spring migrant	Loss of dense, shaded plant cover near streams, with low temps and high humidity	C27
Yellow-breasted Chat	RHJV	Uncommon migrant. Breeding reported in N. Sac Valley	Breeding range reported to have declined throughout CV. Brown-headed cowbird host.	C28
Fox Sparrow	Local Focal	Regional migrant and winter visitor	Commonly found in brushy riparian habitat and, less commonly, in woodlands with dense understory	C29
Oregon Junco	Local Focal	Summer Breeder	May be consolidating breeding/summering in lowlands	C30
Song Sparrow	RHJV	Polytypic resident and intra-temperate zone migrant	Threatened by habitat loss. Brown-headed cowbird host.	C31
Western Tanager	Local Focal	Fairly common migrant and rare winter visitor	Favors woodlands of diverse floristics	C32
Black-headed Grosbeak	RHJV	Common Summer Breeder	Choice woodlands, esp. cottonwood/willow, generally have greater plant diversity and richer vertical structure than average	C33
Blue Grosbeak	RHJV	Summer Breeder	Formerly common, now declining, especially in the southern CV. Appear to nest in safflower fields	C34
Tricolored Blackbird	RHJV, CA Endemic	Summer Breeder	Dependent on Valley wetlands though some breeding colonies still form in agricultural fields	C35
California Towhee	Local Focal	CA near Endemic	Endemicity. Putah Creek is one of a few drainages where species occurs on Valley floor	

7.1 An historical account of the regional avifauna of the Central Valley

Many species of conservation concern have suffered long-term population declines or extirpations for shared historical reasons. Based on major summaries of the regional avifauna compiled by Belding 1890, Grinnell 1915, Grinnell and Miller 1944, and Gaines 1974, we present a brief sketch of that history.

In the Sacramento Valley of the late 19th and early 20th centuries, Californians engaged in wholesale removal of the Central Valley's riparian vegetation to make way for agricultural production. As a result, by the early 1980's, only 11% of this habitat type remained in the Central Valley (41,300 ha from 373,000 ha) (Katibah 1984). Of that, at least half is currently in a disturbed and/or degraded state due to the effects of development,



Western Bell's Vireo (*Vireo bellii*) one of two birds found in the Putah Creek Sinks in April 2010. This was the fourth record of this once-extirpated species along Putah Creek in the past 6 years. Photo: E. Harper.

water diversions and dams, levee construction, livestock grazing, and ground water pumping. Putah Creek's historic riparian habitat has been estimated at approximately 8,900 ha (22,000 ac), with a riparian corridor 1.5 miles wide in places (WMA 2005). Today, Putah Creek's riparian habitat covers about 750 ha (1,850 ac), with a riparian corridor varying from 100 to 1,000 feet in width.

Not surprisingly, widespread loss of these riparian habitats has resulted in equally widespread losses of the nesting birds that depend on them. Populations of Yellow-billed Cuckoo (*Coccyzus americanus*), Willow Flycatcher (*Empidonax traillii*), Bell's Vireo (*Vireo bellii*), Warbling Vireo (*V. gilvus*), Bank Swallow (*Riparia riparia*), Yellow Warbler (*Dendroica petechia*), Black-headed Grosbeak (*Pheucticus melanocephalus*), and Blue Grosbeak (*Passerina caerulea*) have been decimated, and in some cases, all but extirpated. These species are now considered Species of Special Concern, with conservation and restoration efforts currently underway to improve habitat conditions for them.

From published sources, it appears that other species of special concern bred either locally (*i.e.*, Swainson's Thrush (*Catharus swainsoni*) and Yellow-breasted Chat (*Icteria virens*)) or primarily in wetlands of the Central Valley (*i.e.*, Common Yellowthroat (*Geothlypis trichas*), Song Sparrow (*Melospiza melodia*), and Tricolored Blackbird (*Agelaius tricolor*). Swainson's Hawk (*Buteo swainsoni*), another species of special concern and a flagship species for the Central Valley, ranged in numbers that are elusive in the published record, further clouded by the fact that some observers reported them widely

in winter. Bank Swallow (*Riparia riparia*) was known to nest only in a few places in the Valley, and its total numbers were thought lowest of all regionally-breeding swallows.

Habitat loss is not the only threat to California's breeding birds. In the 1920s, Brown-headed Cowbirds (*Molothrus ater*) colonized California from the south. In the early 20th Century, cowbirds were common in California only along the lower Colorado River. They later moved into the Imperial Valley with the advent of irrigated agriculture and settlement, then on into coastal southern California. Once on the coastal versant, they spread north both along the coast and up the Central Valley, and have been an entrenched part of the regional avifauna ever since. Adult cowbirds routinely feed in the vicinity of large ungulates, like cattle, which are widespread across the Central Valley. Since the daily commute distance of a cowbird may be as great as twenty miles, there are no Central Valley or lower foothill riparian woodlands that are beyond their range.

Brown-headed Cowbirds are brood parasites. Females lay their eggs in the nests of other songbird species, leaving them to rear both their own and the cowbird young. Species that have co-evolved with cowbirds generally have a greater ability to discriminate against cowbird eggs, either ejecting them from the nest or building a new nest elsewhere. Central Valley species, even those whose eastern populations discriminate against cowbirds, are often completely defenseless against these brood parasites. The interesting, exasperating biology of the Brown-headed Cowbird, including the long list of species it parasitizes, has supported the publication of numerous books and articles on the subject (Bendire 1895, Friedmann et al. 1977, Ortega 1998, Davies and Quinn 2000, De Groot and Smith 2001, Rivers et al. 2010).

The Brown-headed Cowbird is not the only exotic bird to have had deleterious effects on native species in the Central Valley. The European Starling (*Sturnus vulgaris*) was introduced to New York in 1890 by a group of well-meaning, but ecologically-challenged devotees of Shakespeare who determined to introduce to the New World all the birds ever mentioned in the bard's works. In the 1950s, the first starlings made it to California, completing the initial phase of their expansion across the continent, consolidating their presence in the state over the next decade. European Starlings are obligate secondary cavity nesters, aggressively taking possession of every cavity sought, even to the point of ejecting the very same pair of woodpeckers that just constructed it. Starlings invariably out-compete all small songbirds for these cavities.

Another lesser-known, but equally devastating, invader is the Black Rat. Recent studies at the Cosumnes River Preserve (Hammond 2008, Whisson 2007) demonstrated a high abundance of rats in riparian forest habitats and a heavy predation on open-cup nests of birds. Black Rats are equally at home on the ground or in the trees. Their arboreal habits protect them against flooding events that sweep out other terrestrial small mammals. The potential for Black Rats to negatively impact bird populations in the

Central Valley is great, but studies are generally lacking to document the full impact of this introduced predator.

7.2 Annotated Species List of the birds of Lower Putah Creek³

ANATIDAE: Waterfowl use portions of Putah Creek at all seasons. In conditions of high water in the Yolo Bypass, lower Putah Creek (part of the Putah Creek Sinks) backs up, becoming a haven for geese, swans and ducks in very great numbers. These conditions also tend to prohibit access by surveyors. Thus, the value of Putah Creek Sink's habitat for waterfowl has very likely been underestimated in our studies. **Greater White-fronted Goose, Snow Goose, Ross's Goose, Canada Goose, and Cackling Goose** were all regular in the vicinity of the Yolo Bypass during late fall and winter. Most of these waterfowl observations were of birds flying overhead. **Canada Goose** was noted regularly and was a confirmed breeder at many sites from Mace Boulevard to Interdam. Exceptional was an **Emperor Goose** flying over Putah Creek Sinks on 12 February 2008. This species is of casual occurrence in both the Sacramento Valley and along the coast of Northern California. We noted **Tundra Swan** five times, generally in the lower reach. **Wood Duck** and **Mallard** were resident and widely-proven breeders. **Gadwall** was a probable nester at Los Rios Farms. We detected **American Wigeon, Cinnamon Teal, Northern Shoveler** and **Northern Pintail**, all very common species locally, between one and five times. The *Aythya* (diving ducks) were represented by single observations of **Lesser Scaup, Greater Scaup,** and **Canvasback**, the latter was on the creek below the Solano Diversion Dam. Along the creek, particularly in the upper and Interdam reach, **Ring-necked Duck, Bufflehead, Common Goldeneye, Barrow's Goldeneye, Hooded Merganser** and **Common Merganser** were fairly regular in migration and winter. Hooded Merganser was also confirmed as breeding between Picnic and Old Davis Road-Restoria. **Common Merganser** was rated a probable breeder at Dry Creek Confluence. There is a report of **Red-breasted Merganser** in June from the Picnic Grounds. This is certainly unseasonal, but not unprecedented. The several species enumerated above hint at the variety present annually in fall, winter and spring.

PHASIANIDAE: Four nonnative species live along the creek. **Red Junglefowl** lives in close association with humans, detectable when the roosters are crowing in spring and early summer. **Ring-necked Pheasant** dwells mostly in grassland and shrub settings and in the agricultural fields of the lower reaches and Sink when not flooded. They also use woodland edges sparingly. Again, crowing cocks in season are most commonly detected. **Common Peafowl** occupies similar open habitats and edges, at present usually near dwellings where supplementary feeding is provided. There is a long-standing

³ Scientific names are omitted for clarity of presentation

population that breeds in the Interdam Reach, however, and a female on nest was found at Russell Ranch in 2004. Otherwise, birds are regularly detected in spring and summer. **Wild Turkey** is at home both in woodland and open weedy habitats, requiring trees for nocturnal roosts. They were noted breeding the length of the creek.

ODONTOPHORIDAE: This family's lone representative locally is our state bird, the **California Quail**. This is a resident bird of brush and woodland edges. Winter records are fewer, however. California Quail is a widespread, fairly common breeder along Putah Creek.

PODICIPEDIDAE: The only grebe detected during the study was **Pied-billed Grebe**. An infrequently-noted species, this taxon is present all year and breeds locally on bodies of water with emergent vegetation. Nearly half of our 18 observations came from the Dry Creek Confluence, where it probably breeds.

PELECANIDAE: **American White Pelican** was detected only four times, as flyovers above the intersection of the creek with the Yolo Bypass between 9 January and 23 March.

PHALACROCORACIDAE: **Double-crested Cormorant** was detected at all sites save Yolo Housing, on dates that spanned the entire year, including the breeding season. There are no known Central Valley breeding sites north of Stone Lakes National Wildlife Refuge, but the sizes of the recent colonies there and at Valensin Ranch on the Nature Conservancy's Cosumnes River Preserve, are slowly increasing, with breeders settling amongst Ardeids at established heronries.

ARDEIDAE: Of herons and their allies, we detected seven species. **American Bittern** was an unexpected find once each at Picnic Grounds, Stevenson's Bridge and Diversion Dam, between mid-May and mid-June. **Great Blue Heron** and **Great Egret** were noted over the length of the creek. In the case of the former, there was a fairly even distribution of encounters across sites, except for increased numbers at the Dry Creek Confluence. More than three quarters of Great Egret encounters occurred across the five most-downstream survey sites. Found throughout the year, there was a slight peak for both species during the breeding season, suggesting the existence of a heronry in some isolated woodland block. Eighty-one of 92 encounters with **Snowy Egret** occurred in the most-downstream seven of the fourteen survey sites. Snowy Egret sightings also increased during the breeding season. We made but three winter observations. Even more restricted in distribution along the creek, **Cattle Egret** detections were entirely limited to the lower half of the survey sites, and like Snowy Egret, were centered at Old Davis Road-

Restoria, where 33 of 41 encounters took place. This site is fairly close to an established Cattle Egret rookery on the UC Davis campus. Dates spanned 20 April to 29 August. **Green Heron** and **Black-crowned Night-Heron** were both distributed over the entire length of the creek, but detections were more common in the downstream sites, especially so for the night-heron. Though **Green Heron** was not a proven breeder, it was rated a probable nesting species at Oxbow and a possible at Picnic Grounds and near the Center for Land-based Learning. Of our 95 encounters, 93 occurred between 19 April and 26 September, and one each occurred in December and January. **Black-crowned Night-Heron** was found nesting at Los Rios Farms and Old Davis Road-Restoria. While it is resident in the lower Sacramento Valley, we found it along the creek only between 11 April and 24 August.

THRESKIORNITHIDAE: **White-faced Ibis** was detected rather infrequently and almost exclusively at the four sites in closest proximity to the Yolo Bypass. The only exceptions were two encounters of birds flying overhead at Yolo Housing,. Dates of occurrence span 17 April to 28 September. In recent years, very large numbers of ibis have settled in the breeding season at National Wildlife Refuges in the middle Sacramento Valley and in the northern San Joaquin Valley. They usually remain scarce between those locations until they are finished breeding, after which they disperse more widely. In the 2008 and 2009 breeding season, however, there was a large nesting colony in the Yolo Bypass just north of Putah Creek Sinks.

CATHARTIDAE: **Turkey Vultures** were detected at all survey sites, most regularly in the upper survey areas. They were detected throughout the year in proportion to survey effort. We observed no evidence of breeding, though nests can be very hard to find. At the Cosumnes River Preserve, nests are almost always situated in dense Himalayan blackberry tangles, and nestlings remain silent until one is nearly atop them. (The aforementioned tangles are mostly avoided on our survey routes.)

ACCIPITRIDAE: Eighteen of the thirty-three encounters of **Osprey** occurred at Interdam or Diversion Dam. Osprey were found across all seasons, but we found no evidence of breeding. They have been recorded nesting at Solano Lake and Lake Berryessa. In addition, Osprey is a rare migrant in spring and fall. **White-tailed Kite** was widely-distributed along the creek, but 88 of 121 contacts occurred at either Old Davis Road-Restoria or at Picnic Grounds. Breeding was proven at Picnic Grounds, and rated probable or possible across all other sites. A very similar pattern emerged for **Northern Harrier**. Though scarcer upstream than White-tailed Kite, it too was found far more often at Old Davis Road-Restoria and at Picnic Grounds (84 of 113 detections). Breeding was confirmed at the former site, and it was rated probable at most of the rest of the lower survey locations. Both Northern Harrier and White-tailed Kite

were found across all seasons, with few winter observations. **Sharp-shinned Hawk** is a widespread migrant and winter visitor to the Central Valley and surrounding foothills. Our sighting dates run from 18 October to 9 May. It hunts in a variety of habitats, mostly wooded settings. It was detected at virtually every survey site, though infrequently. While **Cooper's Hawks** were detected about twice as often as the "Sharpies," they were also considered to be uncommon along the creek, though present at all seasons. Cooper's Hawk met the criteria as a possible breeder at Dry Creek Confluence. We had one incidental encounter with **Northern Goshawk**. This immature bird was found 5 February 2002 near Picnic Grounds. **Red-shouldered Hawk** was found on more than 550 surveys, across all seasons. It was confirmed breeding at six sites and rated a probable or possible breeder almost everywhere else. The **Red-tailed Hawk**, detected on 203 surveys, is also a resident and breeding species, but routinely forages in more open settings than the Red-shouldered Hawk, a bird of wooded habitats. Red-tailed Hawk was confirmed nesting at nine sites. We observed **Golden Eagle** twice over Interdam in April and June 2003. Incidental sightings of this species have been reported, generally in winter, along the lower reaches of Putah Creek as well.

Swainson's Hawk *Buteo swainsoni*

Map Volume Exhibit C1

PIF/RHJV and CALFED MSCS focal species

Management Status: Threatened Species, CDFG

Swainson's Hawk is a strongly-migratory species with a large breeding range across western North America. Its range runs from southern British Columbia (and disjunctly in a small part of northwestern British Columbia), central Alberta and Saskatchewan, and southwestern Manitoba through eastern Washington and Oregon, the Modoc Plateau in northeastern California, the Great Basin, the Great Plains, much of the Southwest (where mostly rare), to south-central Texas, northern Sonora, Chihuahua, northeastern Durango, Coahuila, northern Nuevo Leon and extreme northern Tamaulipas. They also breed in California's Central Valley and Owens Valley. They have been extirpated from the coastal plain of southern California. Nonbreeders over-summer in small numbers on the Great Plains east of the known breeding limits. Excepting the Central Valley population (and possibly the Owens Valley population), all birds migrate south to the grasslands of northern and central Argentina, and adjacent Uruguay, for the boreal winter. Recent satellite tracking studies have revealed that Central Valley Swainson's Hawks winter at scattered sites from central-western Mexico to northern South America, with occasional birds also wintering in Argentina. Small numbers (perhaps on the order of 100 individuals in total) winter regularly in the United States in three places: the Sacramento-San Joaquin Delta, South Texas and south Florida.

Where these individuals breed is unknown. Their diet during the breeding season is typical for the *Buteo* genus, with emphasis on rodents and lagomorphs. However, the species undergoes a dramatic dietary shift during the non-breeding seasons, switching almost completely to insects.

Swainson's Hawks have been found the length of Putah Creek, but only 55 of 606 notations were made upstream of Russell Ranch. Dates of encounter during the study span 7 February to 30 Nov, typical for any given year in the Central Valley. Nesting was confirmed at twelve sites from Putah Creek Sinks to Diversion Dam. Almost all surveys detected one or two birds only. Our only flock totaled six hawks, this in spring migration.

FALCONIDAE: Of the four species of Falconidae detected, only **American Kestrel**, as expected, was widespread across sites and seasons. Just over two-thirds of the 125 detections were made between Old Davis Road-Restoria and Russell Ranch. Breeding was proven at four sites from Old Davis Road-Restoria to Russell Ranch. American Kestrel was denoted a probable or possible breeder at most other locations. **Merlin** was detected seven times on dates that spanned 1 November to 12 April. The lower reach appears to be preferred by Merlin, but the small sample size fails to inspire great confidence in this. In a similar vein, **Peregrine Falcon** was found once at Interdam and four times at the two most-downstream sites; all were winter and spring sightings. **Prairie Falcon** was reported three times, once at Russell Ranch, Winters County Park, and in winter and once at Interdam in spring.

RALLIDAE: **Virginia Rail** was noted incidentally at Los Rios Farms and once at Mace Boulevard, both in spring. **Common Moorhen** was found regularly nowhere. Common Moorhen was observed four times at Dry Creek Confluence, once at Los Rios Farms, where it was a proven breeder, and once at Picnic Grounds, where it was considered a possible breeder. Two ponds adjacent to the Picnic Grounds transect support several pairs of nesting moorhens annually. **American Coot** was found nine times, between Los Rios Farms and Dry Creek Confluence. It met the criteria for probable breeding at Los Rios Farms. Except for a winter observation at Dry Creek Confluence, all sightings occurred during the breeding season.

GRUIDAE: Fall and winter birds of wetlands and open agricultural lands, Sandhill Cranes were detected only five times during the study, all as flyovers in small flocks at the three most-downstream survey sites between 24 November and 28 February..

Greater Sandhill Crane *Grus canadensis tabida*

Map Volume Exhibit C2

CALFED MSCS focal species

Greater Sandhill Crane breeds in scattered wetland localities in southern Canada and the northern tier of states from the Great Lakes region west to British Columbia, then south through eastern Washington and Oregon to the Modoc Plateau and Sierra Valley in northeastern California. In winter, birds of this race are likewise scattered over the southern tier of states from the Texas coastal plains west to California. A very large portion of the western breeding Greater Sandhill Crane population winters in the north part of the Sacramento-San Joaquin Delta, but generally east of the Sacramento River. The northernmost extent of regular winter occupation by this assemblage of *Grus canadensis tabida* is known to be Stone Lakes National Wildlife Refuge in Sacramento County. The far-more-numerous nominate subspecies (*Grus c. canadensis*) also winters in this same region, making close observation necessary to racially identify individual birds. The several observations we have made during the study were made to species level only. At this time it does not appear that lower Putah Creek has important habitat for Greater Sandhill Crane.

CHARADRIIDAE: **Black-bellied Plover** was found twice, as a flyover at Los Rios Farms and at Mace Boulevard; both observations were made on spring passage. **Pacific Golden-Plover** was detected flying over Mace Boulevard on 1 January 2006 (R. Melcer Jr.). **Semipalmated Plover** was noted once as a spring flyover at Putah Creek Sinks. **Killdeer** was found commonly throughout the year and evenly over the length of the creek on more than 350 surveys, the great majority of these as flyovers too. But where surveys enabled observation of suitable agricultural fields, some birds were noted on the ground. Killdeer was a confirmed breeder at Mace Boulevard and near Picnic Grounds, and a probable or possible breeder on nine other Breeding Bird Atlas blocks.

RECURVIROSTRIDAE: **Black-necked Stilt** was found four times at Los Rios Farms, Old Davis Road-Restoria and Picnic Grounds as flyovers during spring migration. **American Avocet** was found just once, an incidental observation 24 March 2005 at Los Rios Farms.

SCOLOPACIDAE: As with the plovers and recurves in the two previous families, most species of sandpipers and relatives were detected in migration. **Greater Yellowlegs** were found on 13 occasions, half as flyovers and half at winter and spring puddles, virtually across the entire length of the creek. **Lesser Yellowlegs** were noted once at Putah Creek Sinks. **Whimbrel** was noted incidentally on four mid-April dates, right in the middle of its spring migration through the Central Valley. This is the only season when one can expect Whimbrel regionally. A Whimbrel was also reported on 1 July 2004 at Mace

Boulevard. Fall detections are much rarer in the Central Valley. **Long-billed Curlew** was detected rarely at nearly every study site from Dry Creek Confluence down to the Yolo Bypass. The observations of one to five birds passing overhead span the seasons. **Western Sandpiper** was detected but once, a trio of spring migrants at Putah Creek Sinks. However, if wetland water conditions are right, spring passage may bring thousands of Western Sandpipers concurrently to the junction of the creek and the Yolo Bypass, and only slightly fewer in the fall. The same may be said of **Least Sandpiper**, a species we detected only once, not in the expected downstream part of the drainage, but at Russell Ranch on 11 July 2006. **Long-billed Dowitcher** is another shorebird staple of the Central Valley. This species went entirely undetected on our surveys. **Wilson's Snipe** was noted incidentally at Putah Creek Sinks, our only observation.

Spotted Sandpiper *Actitis macularia*

Map Volume Exhibit C3

PIF/RHJV focal species

Management Status: None

Spotted Sandpiper is the most widely-distributed North American breeding shorebird, nesting from the southern margin of the Arctic to the northern margin of the southern tier of the United States, and from coast to coast. In winter, some birds remain along the Pacific Coast from British Columbia south, in California's Central Valley, and in the southernmost parts of the Southwest and Gulf Coast states. Most, however, retreat to Mexico, Central America, and the northern three-quarters of South America. While the Birds of North America account (Oring *et al.* 1997) does not clearly map the species as breeding on the periphery of its range here in the Central Valley, Spotted Sandpipers are known to breed along several Sacramento River tributaries where suitable gravel bars are present. There are also rare, scattered nest records for Valley areas with muddy substrates, such as once at the Cosumnes River Preserve.

Spotted Sandpiper is a recent addition to the Partners in Flight Riparian Habitat Joint Venture (PIF/RHJV) list of species of special concern. Geographically marginal as it is, Putah Creek is of minimal significance to this species. There were but three observations of Spotted Sandpiper during the project, twice at Interdam on 5 May 2000 and 26 April 2001 and once at Center for Land-based Learning 18 September, 2009. In general, the creek lacks rock or stone shorelines suitable to support nesting Spotted Sandpipers.

LARIDAE: As a group, gulls occur mainly during the non-breeding seasons locally, and at our survey sites as flyovers in small numbers. Many were not identified to species. The proximity of the lower

creek sites to places of gull congregation in eastern Yolo County would make them likely places for observation. However, this did not turn out to be the case. *In toto*, gull observations were about equally distributed up and down the creek. **Bonaparte's Gull**, **Ring-billed Gull**, **California Gull**, and **Herring Gull** are the four most common species of gull regionally. **Bonaparte's Gull** was encountered twice, at Mace Boulevard and Dry Creek Confluence, both in early April. **Ring-billed Gull** was noted at Los Rios Farms, at Picnic Grounds, thrice at Old Davis Road-Restoria (which is close to the campus water treatment facilities where gulls sometimes flock), and at Diversion Dam. **California Gull** was the most widely-detected larid species, noted 16 times from Old Davis Road-Restoria to Interdam. A 20 August sighting was the only one outside the winter-spring period. **Herring Gull** was seen only twice, with flyovers noted at Picnic Grounds in midwinter and at Winters Putah Creek Park in midsummer, one of only a handful of Yolo County records for that season. **Thayer's** and **Glaucous-winged gulls** were documented on 24 January 2009 (UCD winter bird survey) flying over the creek at Picnic Grounds (en route to the nearby UC Davis landfill). Also in this family, in a different subfamily, are the terns. These too were detected rarely. **Caspian Tern** was incidentally noted as a pair flying by in midsummer at Putah Creek Sinks, an autumn bird at Old Davis Road-Restoria and as spring birds at Mace Boulevard and Interdam. These are the times when this species is most expected, and though they are not known to breed regionally, summer birds often include volant, begging juveniles. **Forster's Tern** was detected on four occasions as flyovers in June; individuals were found once at Putah Creek Sinks, twice at Mace Boulevard, and once at Old Davis Road-Restoria.

COLUMBIDAE: **Rock Pigeon** was detected at twelve of fourteen sites along Putah Creek. Of 178 encounters, 130 were at Mace Boulevard and Old Davis Road-Restoria. The great majority were observed in flocks passing overhead during the breeding season. Winter records were few. **Eurasian Collared-Dove** was noted twice, one individual at Dry Creek Confluence in June 2006 and two birds at Putah Creek Sinks in April 2007. However, since 2008 it has nested in the town of Winters and is now recorded along the creek at Winters Park and Yolo Housing. This Old World species, after colonizing the Caribbean islands in the 1980s, is rapidly expanding and consolidating its range across the United States. It will certainly become a fixture in our region. **Mourning Dove** was noted commonly at all study sites. We found it at all seasons, though rarely in winter. It was confirmed breeding at Los Rios Farms, Mace Boulevard, Old Davis Road-Restoria, Stevenson's Bridge, Russell Ranch and Dry Creek Confluence. This species can be considered a common breeding resident of the Putah Creek drainage.

CUCULIDAE: The one local species in this family is the Western Yellow-billed Cuckoo.

Western Yellow-billed Cuckoo *Coccyzus americanus occidentalis*

Map Volume Exhibit C4

PIF/RHJV and CALFED MSCS focal species

Management Status: Endangered Species, CDFG, Region 1 Sensitive Species USFWS

This species was once common along the Pacific Coast north into British Columbia, in the Southwest east to the Trans-Pecos region of Texas, and in northwestern Mexico. Excepting vagrants to Oregon in recent years, cuckoos are now restricted as summer visitors to the Pacific states only to California. In the Southwest, abundance has also diminished, but much less dramatically. Numbers in California, estimated to have been in the hundreds of thousands before destruction of riparian habitats statewide, are now thought to be fewer than 50 pairs. The California portion of the Colorado River recently had a stable, modest population, but a 1983 flood event destroyed almost all of what remained of cuckoo habitat in that part of the state. This was a grave loss, since it is thought that those cuckoos served as a source population for most of the birds in California. Habitat still exists on the Arizona side in the Bill Williams River delta, but it will be years before habitat restoration projects underway along the Colorado itself bear fruit in terms of regional population recovery. Currently, regularly-occupied habitat in California occurs only along the South Fork of the Kern River, and along the Sacramento River from Red Bluff to Colusa. For reasons that remain unclear, California yellow-billed cuckoos require substantially larger breeding territories than Southwest populations. Key floristic components of habitat for Western Yellow-billed Cuckoo include a mix of early- and later-successional stages of mixed cottonwood-willow riparian woodlands.

Yellow-billed Cuckoos continue to be detected at intervals in Yolo County. A few individuals (a relict population?) were present along Elkhorn Slough in Yolo County—just a bit south of the Interstate 5 bridge over the Sacramento River—in the early 1980s. We noted a single bird at Los Rios Farms on 22 June 2005. Another singleton was found on 23 July that year in the Cache Creek Settling Basin. In 2006, a singing bird was noted at Fremont Weir on 16 June and again on 31 July. Several cuckoos thought to be migrants were found in the lower Sacramento Valley in June 2007, including one at Dry Creek Confluence on 11 June. These birds were not detected subsequently.

Perhaps the two greatest limitations on successful colonization by Yellow-billed Cuckoos in the Central Valley are insufficient habitat and the lack of an adequate source population from which to recruit new birds (Laymon and Halterman 1989, Laymon 1998). Given habitat constraints, the southwestern population of cuckoos (Arizona and New Mexico) may serve as a more suitable source

population for California recruitment since California-based populations appear to have larger space requirements. The two lowermost Putah Creek sites, Putah Creek Sinks and Los Rios Farms, may be large enough to support breeding cuckoos of the southwestern subpopulation (Arizona and New Mexico). Habitat restoration projects that increase the area of suitable habitat for cuckoos and other sensitive species in target areas should be undertaken.

TYTONIDAE: Barn Owl was detected only eighteen times, all but three of these in spring and summer. This species is more strictly nocturnal than other typical owls and was doubtless found disproportionately less-frequently to its actual abundance, particularly compared to the more crepuscular Great Horned Owl. Barn Owl was confirmed as a breeding species at Stevenson's Bridge.

STRIGIDAE: Western Screech-Owl was found just four times, from Picnic Grounds to Dry Creek Confluence. As with Barn Owl, intensive nocturnal surveys are required to accurately characterize its distribution and abundance. It was rated a proven nester at Picnic Grounds and Stevenson's Bridge, and a possible nester at Winters Putah Creek Park. **Great Horned Owls** are occasionally vocal during daylight hours, in a way that Barn Owls and Western Screech-Owls are not. Thus, this species was noted on 114 surveys, covering all seasons and nearly all locations. Nesting was confirmed on ten Breeding Bird Atlas survey blocks. Still, this taxon is doubtless much more common than our surveys indicate. **Northern Pygmy-Owl** was found once each at Diversion Dam on 29 September 2004 and at Interdam on 15 April 2008. Since these sites lie near the lower elevational limit for these montane and foothill residents, our observations were probably individuals straying out of more suitable habitat. This species is resident, or nearly so, in the Stebbins Cold Canyon Reserve. **Long-eared Owl (Local Focal Species; Map Volume Exhibit C5)** was noted on four occasions, once at Los Rios Farms, once at Dry Creek Confluence, and twice at Diversion Dam, all during the first four months of the calendar year.

CAPRIMULGIDAE: Common Poorwill was detected only once, at Putah Creek Sinks on 2 May, 2004.

APODIDAE: Vaux's Swifts are regular passage migrants regionally both spring and fall. We have two spring records (both from April) and two fall records (both in September) All sightings are from the Middle and Upper reaches. **White-throated Swift** detections were distributed in space such that the middle reach of the creek had scarcely any sightings. Twenty-one of 34 observations (25 January-31 August) occurred at Picnic Grounds and Old Davis Road-Restoria, where it was confirmed nesting in 2007 (under the Old Davis Road Bridge over Putah Creek). White-throated Swift is locally a resident and

partial migrant. Our observations reflect the occurrence of breeding populations from the overpass bridges near UC Davis (Davis Road Restoria, Picnic) and also on Monticello Dam (Interdam and Diversion Dam).

TROCHILIDAE: Black-chinned Hummingbird (Local Focal Species; Map Volume Exhibit C6) is a Neotropical migrant that comes north from its southwestern Mexican wintering grounds to breed over much of northern Mexico, the western U.S., and into southern British Columbia. It exploits a variety of habitats across its range. In the Central Valley of late, Black-chinned Hummingbird has been found breeding in well-vegetated suburbs. But its core habitat here continues to be riparian forests. The 128 records for this species came from all survey sites and spanned 10 April to 20 September. Black-chinned Hummingbird was a proven breeder at Winters Putah Creek Park, and it was rated a probable or possible breeder at almost all other sites between Mace Boulevard and Diversion Dam. **Anna's Hummingbird (CA near Endemic Species; Map Volume Exhibit C7)**, once limited to the coastal versant from San Francisco Bay to northern Baja California, now breeds in a broad band that stretches down the Pacific Coast from southern British Columbia to Baja California and across southern Arizona (Russell 1996). This range expansion is believed to be the result of the birds' exploitation of lush suburban plantings and feeders. Anna's Hummingbird is now resident the length of the Sacramento Valley; we obtained 419 observations, from all seasons and all survey sites. A proven nester at Stevenson's Bridge, Winters Putah Creek Park, and Dry Creek Confluence, the species was judged a probable or possible breeder at almost all other sites between Mace Boulevard and Diversion Dam. Whether local birds shift about within the region or join in the migrations to the southeastern U.S. or Mexico is unknown. Of **Calliope Hummingbird** we had no firm report, but a competent birder found one at Mace Boulevard on 23 April 2006 and the landowner at Stevenson's Bridge recorded it on 4 May 2007 and 25 April 2008 (this latter bird was photographed by A. Engilis Jr.). **Rufous Hummingbird** was twice netted at Los Rios Farms on 3 May 2005 and on 26 May 2006; it was recorded also at Mace Boulevard, Stevenson's Bridge, Russell Ranch, Yolo Housing, Center for Land-based Learning, Dry Creek and Diversion Dam. In spring, this species migrates more commonly to the west of the Central Valley, whereas, in autumn, Rufous migrates more often to the east along the Sierra Nevada and other mountain ranges. It is a scarce migrant at both seasons on the Valley floor. Our spring dates run from 1 March to 26 May; our lone fall encounter was 16 August. The very similar **Allen's Hummingbird (CA Endemic Species; Map Volume Exhibit C8)** was reported four times, once each from Mace Boulevard, Center for Land-based Learning, Dry Creek Confluence and Diversion Dam. In our area it is known strictly as a migrant, with our dates ranging from 25 April to 3 June. However, this species has bred at least three times in the last seven years at the Cosumnes River Preserve. Formerly it was known to nest almost entirely within 20 miles of the Pacific

Ocean. The bird found on 26 June 2005 was reported to be an adult male. The other three records don't specifically identify the criteria for identification. Other plumages are not field-identifiable. Many other reports are identified only to genus, as is expected with the Rufous/Allen's species pair.

ALCEDINIDAE: Belted Kingfisher, with more than 500 survey entries, was found in all seasons and at all survey sites. It was a confirmed breeder at Dry Creek Confluence and Oxbow, and judged a probable nesting species at almost every other site from Putah Creek Sinks to Diversion Dam. Kingfishers require steep cutbanks in which to construct their nest burrows, so management that encourages the formation of these erosional features is desirable for kingfishers, as well as for the State Threatened Bank Swallow (see below).

PICIDAE: Lewis's Woodpecker is an irregular migrant in our area, some years fairly common, other years rare or even absent. It is more likely to occur along the hilly margins of the Central Valley than in the core flatlands. It has been noted only four times between mid-September and early December, at Yolo Housing, Center for Land-based Learning, Dry Creek Confluence and Oxbow. **Acorn Woodpecker** is a species of open oak woodlands. It is common in lower montane and foothill settings, but uncommon in the seemingly-suitable extensive habitat of the Central Valley floor. As might be expected then, 78 of our 107 encounters were at Interdam. However, our records indicate probable breeding by Acorn Woodpeckers between Mace Boulevard and Los Rios Farms and Oxbow, so pockets of habitat suitable for breeding may occur along lower Putah Creek as well. Local birder Darell Slotton found an adult male **Yellow-bellied Sapsucker**—a very rare species for this region—about half a mile east of Picnic Grounds on 7 January 2007. **Red-breasted Sapsucker**, a retiring migrant and wintering species, was detected infrequently but across a wide array of sites. Dates of occurrence along the creek ran from 27 September to 17 March. **Nuttall's Woodpecker (CA Endemic Species; Map Volume Exhibit D9)**, virtually endemic to California, is the commonest woodpecker in oaks in the Central Valley. We amassed 2459 records from all survey areas at all seasons. This species was a proven or probable breeder at every study site. **Downy Woodpecker**, not so strongly tied to oaks, occurred about one quarter as often, with 610 survey entries spanning all seasons and survey locations. It was a resident that was confirmed breeding at four sites and determined a probable breeder at seven others. **Hairy Woodpecker** is a rare bird in the Central Valley, except locally on the Valley's margins. A fall bird at Los Rios Farms, then, would be an exceptional record except for the apparent use of Putah Creek as a corridor to pierce the valley. We have noted Hairy Woodpecker on 26 other occasions. More than half of these have been from the two most-upstream survey sites, where the species is most expected. But seven records have come from Russell Ranch, well-removed from the Coast Range foothills. Moreover, Hairy Woodpecker

was rated a probable breeder at Russell Ranch, based on multiple observations of a pair at an active cavity and male drumming. The pair was first found by M. Truan on 23 May 2002. They were observed nearly continuously through 24 June of that year (Trochet et al., in prep), but failed to maintain their nesting effort. Twenty-one of the 27 reports are from Russell Ranch. It is unclear why Russell Ranch seems to be more attractive to Hairy Woodpeckers; perhaps it has to do with the mix of trees at the site. On more than one occasion, Hairy Woodpecker sightings were associated with a fringe of tall, yet senescing, *Eucalyptus* trees that contained many cavities and bare limbs suitable for drumming. These trees have been girdled as a result of weed eradication efforts and so are expected to decline as a resource for woodpeckers over time. **Northern Flicker** is the third most common woodpecker in the Central Valley, with much greater variation in abundance across the seasons than the other Picidae. We compiled 612 survey encounters. Despite survey effort that was biased toward the breeding season, most observations were made at other times of the year, consistent with its status elsewhere in the region. Despite the relative paucity of breeding season sightings, this species was proven to breed at Russell Ranch and found to be a probable breeder at seven other sites. A distinctive, rare bird from a northeastern population, the **Yellow-shafted Flicker**, was found at Putah Creek Sinks on 22 January 2004. Like Downy Woodpecker, Northern Flicker is not dependent on oak woodlands. **Pileated Woodpecker** seems to be a species expanding its range in central western California. Of interest to us is its recent residence along Putah Creek where the creek debouches from the foothills. Our four detections have all been at Interdam in summer and autumn.

TYRANNIDAE: Excepting the phoebes, all our flycatchers are Neotropical migrants. **Olive-sided Flycatcher** is a scarce migrant both spring and fall. We had but eight detections in 12 years. These were mostly from Mace Boulevard to Russell Ranch, the exception being an observation made at Diversion Dam. Seven of the sightings were in the window of 3-20 May; the other observation was 15 June. **Eastern Wood-Pewee** is the eastern North American sister species to, appropriately enough, the Western Wood-Pewee. The two are not reliably distinguished in the field except by voice. One Eastern Wood-Pewee was found in full song 26 June 2004 at Dry Creek Confluence. **Western Wood-Pewee (Local Focal Species; Map Volume Exhibit C10)** was noted on surveys 93 times from late April to late September. This flycatcher, a generalist of wooded habitats, probably nested at Putah Creek Sinks and was rated a possible breeder at Picnic Grounds and Russell Ranch. We also documented breeding at the wooded Yolo-Sutter Bypass sites. Western Wood-Pewee was unknown as a breeder in the Central Valley as recently as the 1920s, however, by the 1960s, it had colonized the northern Sacramento Valley in large numbers, breeding in very small numbers in the southern Sacramento Valley. Its status appeared largely unchanged in the southern part of the Valley until quite recently. Within the last ten years, this species

has gone from quite local as a breeder here to much more widespread. Why this range consolidation should have occurred is not known. A **Least Flycatcher**, a member of the *Empidonax* group of primarily eastern North American distribution, was found at Russell Ranch on 31 August 2004. **Hammond's Flycatcher** is an uncommon spring and fall migrant in this region *en route* to and from closed canopy mixed coniferous forest breeding sites. We have but six observations, all between Old Davis Road-Restoria and Russell Ranch and all during spring migration. **Gray Flycatcher** is a common breeding species east of the Sierra-Cascade crest. In the middle Central Valley, it is a rare spring migrant only. Our two sightings are from late April and early May at Old Davis Road-Restoria and Putah Creek Sinks, respectively. Two other recent sightings were made at the end of April at Mace Boulevard by competent local birders that are not part of our field crew. **Dusky Flycatcher** is only slightly commoner regionally, strictly as a passage migrant regionally, both on north-bound and south-bound migrations. We have but six records, all in spring, spanning nearly the entire length of our survey sites. **Pacific-slope Flycatcher (Local Focal Species; Map Volume Exhibit C12)** is one of the *Empidonax* flycatchers with a sister species, the **Cordilleran Flycatcher**, so similar in appearance that it is only reliably identified in the field by voice. Silent birds are commonly referred to as **Western Flycatchers**. Roughly one fifth of the encounters, a larger percentage in migration, were so-called. Since the Cordilleran Flycatcher is almost unknown west of the Sierra crest, the so-called Western Flycatchers will be treated herein as the Pacific-slope species. The Pacific-slope Flycatcher is a common migrant that seems in the early 20th Century to have bred in the Sacramento Valley, but how widely is unclear. Surveys in the 1970s failed to find it nesting. Since 1995 it has been known to be a very local breeding species in the southern Sacramento Valley. This taxon was noted on 346 occasions from 5 April to 2 October at all study sites. It was rated a confirmed nesting species at Dry Creek Confluence where adults were seen carrying food (the nest could not be found) and a possible nesting species at six other sites from Putah Creek Sinks to Diversion Dam. Observations between 15 June and 2 August are very few and may well represent completed or failed nesting birds from surrounding uplands. **Black Phoebe** is the one resident tyrant flycatcher in the lower Sacramento Valley. It was noted on 1346 surveys throughout the year and throughout the survey areas. It was proven to breed at 13 sites along the Creek from Putah Creek Sinks to Diversion Dam. **Eastern Phoebe** is a vagrant from eastern and central North America to California during the nonbreeding seasons. Two of our Eastern Phoebe observations, two years apart, were at Dry Creek Confluence. These are unlikely to represent the same bird returning to winter locally in three consecutive years since we failed to find it in the middle year. A third bird was found at Mace Boulevard between December 8-11, 2005. As this represented the intervening year, perhaps all three records were of the same bird moving about the riparian corridor. This conclusion is further supported by another Eastern Phoebe that wintered three consecutive winters in the West Davis Ponds (Yolo Audubon Society Checklist Committee 2004).

Say's Phoebe breeds north and east of our area, with small numbers of birds migrating and wintering on the Sacramento Valley floor. They are much commoner at these seasons in open lower foothill locations. Say's Phoebe was found on ten surveys covering the entire surveyed length of the creek, on dates between 18 October and 23 February. **Ash-throated Flycatcher** is a common cavity-nesting woodland flycatcher that was recorded 2147 times over all locations from 9 April to 31 August. Nesting was confirmed at almost all BBS stations along Putah Creek, and where not confirmed, was rated probable. Ash-throated Flycatchers also nest in the artificial nestboxes of the Putah Creek Nestbox Highway, producing 673 chicks from 2000 to 2009. **Western Kingbird** is a common Neotropical migrant species that hawks insects in open country, one that usually requires woody support for its nest. This may be a shrub, a tree or some man-made structure. We made note of it 693 times from 4 April to 29 August, at all survey locales, and we confirmed it nesting the entire length of the creek.

Willow Flycatcher *Empidonax traillii*

Map Volume Exhibit C11

PIF/RHJV and CALFED MSCS focal species

Management Status: Threatened Species CDFG, Region 1 Sensitive Species USFWS

Willow Flycatcher is a polytypic Neotropical migrant, with all three western North American races breeding in California. All these subspecies have some conservation designation. These western birds winter in Pacific Coastal tropical dry scrub from Nayarit, Mexico south to northern Central America, sparingly to Costa Rica and Panama. As the nesting season approaches, these birds come north late in the spring and seek shrubby, often wet habitats from southern Alberta and British Columbia south through the Pacific Northwest, Idaho, western Montana, southwestern Wyoming, and northeastern and southern Nevada and Utah, and from western Colorado through southeastern Arizona and southwestern New Mexico. Two other races that breed in eastern North America winter on the Atlantic versant of Central America south into South America. The breeding range of California Willow Flycatchers has contracted severely in the 20th Century, owing primarily to habitat loss and cowbird brood parasitism. The two races of historically-limited distribution in the state are *adastus*, which breeds on the Modoc Plateau and perhaps in the Mono Basin, and the federally-endangered *extimus*, which breeds at widely separated oases in the California deserts, along selected small coastal streams in San Diego, Ventura and Santa Barbara Counties, and, most numerous, along the South Fork of the Kern River. On the testament of competent 19th and early 20th Century ornithologists, Willow Flycatcher certainly nested regularly in the Central Valley a century ago. This would have been the race *brewsteri*, which bred over most of the state from the valleys to the mountains west of the Sierra-Cascade axis. Cattlegrazing has destroyed many suitable mountain

meadows in recent decades. Compared to the historical record, the number of currently-active montane breeding stations indicates that, even at locations that are hydrologically and floristically intact, this species is disappearing. Migrants are able to persist since they are able to use a wider variety of vegetated habitats. Relative abundance for this species was highest at Oxbow, Orr Shred (Cosumnes River Preserve), and Yolo Housing, suggesting that habitat conditions at these sites are sufficient to support at least migrant flycatchers. Excepting Orr Shred, the Putah Creek sites had relatively more Willow Flycatchers than did the Yolo-Sutter Bypass and Cosumnes River Preserve sites (Table 7.1).

Absent intensive cowbird control, there is no prospect of restoring Willow Flycatcher to the regular breeding avifauna of the Central Valley, because no Valley site is greater than the daily commuting radius of female brown-headed cowbirds to a livestock feed lot, where they routinely forage. That being the case, Willow Flycatchers detected during this study and for the foreseeable future will most certainly be migrants. Our 57 encounters were nearly evenly divided in spring (21 May to 15 June) and during south-bound migration (6 August to 27 September). There was also a 23 June date that is probably a detection of a very late spring migrant.

LANIIDAE: Loggerhead Shrike is another species in long-term decline throughout its range, especially in eastern North America. A species of open country, our surveys were not designed to capture the true local status of this resident species. We had only nine encounters, the great majority in the lowest reach of the creek. By BBS criteria, Loggerhead Shrike was rated a possible breeder at Putah Creek Sinks. The few records span the seasons.

VIREONIDAE: Plumbeous Vireo was first found at the Picnic Grounds (Point Count Station 4) on 22 April 2005 by A. Engilis, Jr.. It was observed the following day by others. A second bird was found at Mace Boulevard North on 31 August 2008 by a reputable observer not affiliated with the MWFB.

Cassin's Vireo is a migrant both spring and fall through the region. It was found 36 times over the entire array of survey sites, more commonly in spring. Dates of north-bound passage range from 12 April to 25 May; fall dates span 12 August to 9 September. An 8 July date is anomalous. **Hutton's Vireo**, a near-endemic to California, nests commonly in oak woodland in foothills both east and west of the Valley. On the Valley floor itself, it is a very local resident and breeder (e.g., in only some of the wooded parcels of the Cosumnes River Preserve). In this study we detected this vireo 24 times over the entire length of the creek. We failed to encounter it in June or July, but did so every other month. During the BBS portion of the study, Hutton's Vireo was rated a possible breeder at Picnic Grounds and Dry Creek Confluence.

PIF/RHJV and CALFED MSCS focal species

Management Status: Endangered CDFG, Endangered USFWS

Bell's Vireo is a polytypic species. Birds of the greener-plumaged eastern subspecies group are rare vagrants to California. Of the grayer group, both races occur in California. The race *arizonae* summers along the Colorado River, breeding in remnant patches of habitat. Least Bell's Vireo, of the race *pusillus*, formerly summered and bred in dense riparian thickets over much of the state's lowlands: coastal southern California and adjacent Baja California Norte, on the east slope of southern California mountain ranges along watercourses, the Owens Valley and scattered desert oases, stream courses in the southern Coast Range Mountains, and the length and breadth of the Central Valley. The species winters in the Cape region of Baja California Sur and on the Pacific slope of Mexico and Central America from southern Sonora to northwestern Nicaragua. It is unknown if Least Bell's Vireo is restricted to some subset of this winter distribution.

In their 1944 magnum opus, Grinnell and Miller already noted a severe decline in the Central Valley population due to cowbird brood parasitism, to which Least Bell's Vireo is particularly sensitive. The last of the Sacramento Valley nesting Bell's Vireos disappeared in the 1950s. Least Bell's Vireo made its last stand in California on the Pacific slope of southern California. This subspecies was on the verge of disappearing entirely when cowbird trapping was instituted locally in San Diego County in the early 1980s and nearly region-wide on the coastal slope north to Santa Barbara County by the late 1980s. This resulted in dramatic recovery of these populations. Following this rebound, Least Bell's Vireo made some limited returns to more far-flung parts of its historic range, nesting in the Carmel River Valley in Monterey County in the 1990s and breeding in the northern San Joaquin Valley in 2005. Individual wanderers thought to be of this subspecies have been noted in the lower Sacramento Valley and on its perimeter within the last 15 years, but no breeding attempt here has been documented. As with Willow Flycatcher and others, re-establishment of robust local breeding populations in the absence of cowbird control must await the evolution of cowbird egg discrimination by western Bell's Vireos.

Putah Creek is certainly part of the historic breeding range of this species. One of the last Northern California specimens was a breeding male taken by Professor Tracy Storer on 17 June 1925 along Putah Creek some three miles southwest of the town of Winters (an area now under water behind the Solano Diversion Dam). During our study, Bell's Vireo was detected three times: Old

Davis Road-Restoria on 11 May 2004, Stevenson's Bridge on 29 September 2005, and Diversion Dam on 24 June 2005⁴. We found no evidence of breeding.

Warbling Vireo *Vireo gilvus*

Map Volume Exhibit C14

PIF/RHJV focal species

Management Status: None

Warbling Vireo is a polytypic Neotropical migrant songbird, breeding from southeastern Alaska, southern Yukon and southwestern Nunavut, east across southernmost Canada, south in the west to southwestern California, the Sierra San Pedro Martir in Baja California Norte, southern Nevada, southeastern Arizona and southwestern New Mexico, the mountain islands of Trans Pecos Texas, south into Mexico in the Sierra Madre Occidental to Guerrero and Oaxaca; and south in the east to northern New Jersey, central Maryland, the Appalachians south to the Smoky Mountains, southern Ohio, western Kentucky and Tennessee to extreme northeastern Louisiana and southern Oklahoma. Warbling Vireo winters in a geographic area much smaller than that in which it breeds: in the Cape region of Baja California Sur, and, narrowly, near the west coast in central Mexico, more broadly in southern Mexico and more narrowly again in western Central America to northwestern Nicaragua. These eastern and western breeding areas delimit the major subspecies groups that are sometimes considered separate species. The breeding race in California and most of western North America is *V. g. swainsoni*.

The preferred breeding habitats for this species feature mature deciduous trees with semi-open canopies, commonly near streams and lakes. Tree floristics are modestly important, but presence or absence of a shrub layer appears to play no importance at all. Characteristically, migrants have rather more catholic tastes in trees and shrubs. Like Willow Flycatcher, this species formerly bred widely over the state, but no longer breeds in the Central Valley due to habitat loss and cowbird brood parasitism. Unlike Willow Flycatcher, however, Warbling Vireo is still common at most breeding stations at moderate and moderately high elevations. We encountered Warbling Vireos most often at the Yolo-Sutter Bypass and Cosumnes River Preserve sites (Table 7.1).

We found one singing Warbling Vireo, possibly attempting to breed. The individual defended a territory below Solano Diversion Dam continuously from late May to late June 2005. Efforts to find a second bird were unsuccessful. Two adults were confirmed nesting at Stevenson's Bridge,

⁴ Two Bell's Vireos, both apparently singing males, were found in the Putah Creek Sinks on 17 April 2010. They were observed more or less continuously by many observers, including several MWFB team members through at least 18 May 2010.

foraging together, then both carrying food, on 5 June, 2009 (M. Kusch pers. comm.). Despite following these birds, he was unable to locate the nest. Otherwise, Warbling Vireos detected during the study were strictly birds of passage. As such, they were a common component of migrations both spring and fall. They were encountered on 181 occasions and at every study site. Spring dates spanned from 19 April to 14 June; autumn dates from 5 July to 14 September. The early July dates might seem suggestive of summering on a wider scale. In addition, south-bound migrants consistently appear widely on the Valley floor as early as July in most years.

CORVIDAE: Steller's Jay is a common resident species of western North American coniferous forests. Infrequently some of these birds move out of their usual haunts to valleys and deserts in autumn and winter. We have two such solid records in twelve years: one bird found at Putah Creek Sinks on 30 September 2005, the other at Russell Ranch on 5 October 2004. **Western Scrub-Jay** is a common resident of oak-dominated habitats at low and middle elevations. We had 3419 detections at all study locations and seasons. The species was confirmed nesting at 10 stations virtually the entire length of the creek. **Yellow-billed Magpie (CA Endemic Species; Map Volume Exhibit C15)** is the one truly endemic California bird species in that has never been recorded outside the state's political boundaries. In many areas, this and the following members of the Corvidae have been hard hit by West Nile Virus. Yellow-billed Magpie was encountered on 1310 surveys across all seasons and study sites, with nearly three-quarters of the encounters concentrated in the short distance between Mace Boulevard and Picnic Grounds. It was a proven breeder at Los Rios Farms, Picnic Grounds, and Center for Land-based Learning and a probable breeder at five other sites. **American Crow** was found 1700 times, spanning the entire temporal and geographic ranges of the study. As with Western Scrub Jay, there was a concentration of encounters, in this case 60%, between Mace Boulevard and Picnic Grounds. American Crow was confirmed nesting at seven sites from Los Rios Farms to Dry Creek Confluence and probably nested at three other survey locations. **Common Raven** encounters are increasing in the region. It was a rare bird along Putah Creek 25 years ago and only a decade ago was nearly unknown on the southern Sacramento Valley floor. We have met with ravens on 34 occasions, at all seasons, with 20 of those between Dry Creek Confluence and Interdam. The species now nests sparingly in the region. We found evidence of probable breeding at Dry Creek Confluence.

ALAUDIDAE: Horned Lark, a grassland- open country species, was not a target of our survey protocol. Nonetheless, with wooded plots adjacent to grasslands and agricultural fields, this species was detected several times, almost all as flyovers. Of 22 detections, most in the lowest reach of the creek, 21 occurred within the date span of 18 October to 24 March. Somewhat surprising was a bird found 24 May

at Los Rios Farms, a date that suggests local breeding. Horned Larks are known to breed in the southern Yolo Bypass some years.

HIRUNDINIDAE: Purple Martin is a rarity in the Central Valley away from urban Sacramento, where it is uncommon and local, nesting under highway overpasses. We found it only once, at Diversion Dam on 3 March 2004. **Violet-green Swallow** is mainly a rare to uncommon migrant on the Central Valley Floor, with occasional large concentrations detected. It is more common on the margins of the Valley, and breeds at middle elevations both east and west. We detected this swallow 14 times in 12 years, the majority of encounters having taken place along the upper reaches of the creek in spring. We had but one autumn sighting. Surprisingly, Violet-green Swallow was rated a probable breeder at Dry Creek Confluence one year. **Rough-winged Swallow** is an uncommon breeding species regionally. However, we detected it 314 times between 17 March and 31 August. Though all sites had detections, observations were far more frequent between Mace Boulevard and Picnic Grounds, and at Winters Putah Creek Park, Dry Creek Confluence, and Interdam than at any of the other eight survey sites. Nesting was proven at Mace Boulevard, Old Davis Road-Restoria, and near Winters. Breeding was deemed probable at six other sites. **Cliff Swallow** is a locally common species regionally, exploiting as colonial nesting sites freeway overpasses, bridges, large culverts and buildings. Based on 443 encounters at all study sites, this Neotropical migrant was present from 24 March to 4 September, with an additional very late record of 24 November. Almost half the detections were recorded at Old Davis Road-Restoria and Winters Putah Creek Park; large colonies are known to occur under nearby bridges. Nesting was noted at six sites between Old Davis Road-Restoria and Diversion Dam, and at six other sites breeding was rated probable or possible. **Barn Swallow** is a locally common spring migrant, a widespread nesting species, and an abundant autumn migrant. Solitary nests are usually placed under eaves or over the doorways of buildings. Our 341 encounters between 19 March and 18 October consisted of birds numbering in the single digits. At suitable regional wetland roosts, counts of hundreds or thousands may have been made that same October day. This species has bred at Picnic Grounds, Stevenson's Bridge, Russell Ranch and Winters Putah Creek Park. It was rated a possible or probable breeder at eight other sites.

Tree Swallow *Tachycineta bicolor*

Map Volume Exhibit C16

PIF/RHJV focal species

Management Status: None

Tree Swallows breed across northern North America from the limit of trees (or even farther north locally where nest boxes are provided) south to the Delmarva Peninsula, southeast in the

mountains to northern Georgia, west to northeastern Oklahoma, north to northeastern South Dakota, west to the Black Hills, then south again in the mountains to northern New Mexico, west to eastern Nevada, north again to central Idaho, then west to the Cascade Mountains of central Oregon, and then south again to all of California from the Cascade-Sierra axis west, so excluding coastal southern California and the California deserts. The main wintering range for central and eastern breeders is near the Atlantic coast from Cape Hatteras south to all of peninsular Florida, Cuba, and the Gulf Coast south to Costa Rica. In recent years, Tree Swallow flocks have been noted along the coast of northeastern South America. It is thought that western birds winter from southern California and all of Baja California south on the Pacific slope of Mexico to Colima. Birds of uncertain breeding locality winter in a band across central Mexico. Tree Swallows are wintering with increasing regularity in the Sacramento Valley region from Glenn County south.

Tree Swallows are aerial insectivores that forage usually over or near water. Their hunting range is usually below 100 feet, and their usual prey is in the 3-5 mm size range. They are model study organisms. Because they readily use nest boxes, measures of physical characteristics of the nest and environment, daily activity patterns at the nest, rates of food provision to chicks and nestling growth, and other life history parameters are easy to monitor. Much of the data gathering can be automated, at least for the comparatively wealthy investigator! The time is fast approaching when transmitter miniaturization will make possible the use of satellite technology to follow the migratory movements of this species. Tree Swallow biology is poised, perhaps, to become the best known of any wild bird.

In contrast with other avian riparian obligates, large, solid blocks of riparian woodland are inferior breeding habitat for Tree Swallows, compared with narrow strips of habitat composed of large trees or snags. Thus the removal of forest trees from large contiguous areas across the Sacramento Valley has been a boon for Tree Swallows. However, the range expansion of European Starlings has not. This recent arrival claims most of the suitable cavities in an area for itself. Luckily, Tree Swallows are a bit smaller than starlings so certain holes made by Nuttall's and Downy woodpeckers are just the right size to admit swallows, but not starlings. Nest boxes, with small holes designed either for Western Bluebirds or for the swallows themselves, have been placed in some areas. The rapidity with which these boxes are claimed strongly suggests that the regional Tree Swallow population is limited by the availability of suitable nest cavities and not by prey availability.

Tree Swallow remains a common nesting species the length of the Sacramento Valley, one of its strongholds in the state. They are now conspicuously fewer in many places in California, but it is unclear how numbers differ regionally from those of the past. During our Putah Creek surveys, we

made note of Tree Swallow on 3200 occasions at all sites. Tree Swallows are the most common resident of the Putah Creek Nestbox Highway, having produced 1,936 fledglings between 2000 and 2009. We confirmed breeding everywhere except Oxbow, where nesting was rated probable. Nearly all dates fell between 22 February and 28 October. We had but a handful of mid-winter records, corresponding both to the nadir of swallow numbers and that of investigative effort.

Bank Swallow *Riparia riparia*

Map Volume Exhibit C17

PIF/RHJV and CALFED MSCS focal species

Management Status: Threatened Species, CDFG

Bank Swallow is one of the most nearly cosmopolitan of passerine birds. It breeds widely in the Holarctic and winters mostly in the Southern Hemisphere. In North America it breeds from Central Alaska east to the southern Hudson Bay region and to northern Quebec and southern Newfoundland, south across an east-west belt across the central United States, with threads of breeding distribution extending farther south along some major rivers: the Sacramento south to Yolo County, the Rio Grande south to southern New Mexico, the Pecos south to southeastern New Mexico, and the Mississippi down to northeastern Louisiana. There is a disjunct area of breeding from about Del Rio, Texas southeast mostly along the Rio Grande to the Gulf of Mexico. The major wintering area for these birds is South America, excepting the southern half of the Southern Cone. Subsidiary wintering areas include southern Pacific coastal Mexico, eastern Panama, and Puerto Rico.

Bank Swallow nests colonially in friable soils of vertical or near-vertical river banks and bluffs (*i.e.* cutbanks) where pairs excavate their own nesting tunnels. In some places, quarries may be found suitable. Colony size varies from about ten to over 2000 pairs. As these river banks are regularly subject to erosion, colony sites often move. The historical record makes clear that Bank Swallows had colonies in the Sacramento Valley from the time of the earliest naturalists' visits. Unclear is how many colonies there were and how many bank swallows were nesting. Not only are numbers infrequent in the historical record, but some observers had difficulty telling Bank and Northern Rough-winged Swallows apart. It was evident, at least to some observers, that this species was always less abundant than the Rough-wing. The most recent complete survey of the Sacramento River was in 1986, where 70-80% of the state's summering Bank Swallows were estimated to breed (Garrison *et al.* 1987). Sixty colonies with an estimated 16,000 pairs were found between Shasta Dam and the Sacramento-San Joaquin Delta, mostly between Red Bluff and the Feather River confluence. The lower Feather River, which is also known to have had some recent colonies, was

not surveyed. A partial survey from Red Bluff to Colusa, the reach of the river having some 13,000 pairs in 1986, had only 8,000 pairs in 2007.

Bank Swallow was detected only nine times during this study, but across almost the entire length of the creek. Bank Swallow was noted during the period 8 May to 26 June. We found no suggestion of breeding along Putah Creek. The closest known breeding colony is 15 miles north at Fremont Weir at the north end of the Yolo Bypass.

PARIDAE: In our area, **Chestnut-backed Chickadee** is a rare visitor to riparian lower foothill settings, with occurrences usually bunched in “flight years” that punctuate greater or lesser periods of total absence regionally. Of the 20 encounters logged on our surveys, 60% were from the upper reach of the creek, in keeping with its typically montane and foothill distribution, and none were from the lowest survey sites. Our dates range from 15 September to 25 February. Very much out of season was a chickadee at Yolo Housing 24 June 2006. However, in summer 2009, we encountered a family group in the vicinity of some artificial nestboxes. These observations coincide with increasing observations of Chestnut-backed Chickadees on the creek during the winter months. **Oak Titmouse (CA Endemic Species; Map Volume Exhibit C18)** is another near-endemic California bird. It is a regionally-common species of woodlands dominated by its eponymous trees. Numbers now seem to be rebounding, following a dramatic decrease, likely due to West Nile Virus. We noted Oak Titmouse 495 times during our work, at all seasons and at almost all survey locations. More than two-thirds of the contacts were from the upper reach of the creek. We confirmed breeding at Winters Putah Creek Park, Dry Creek Confluence, and Diversion Dam. Oak Titmouse was rated a probable or possible breeder at seven other survey sites along the creek.

AEGITHALIDAE: **Bushtit** is a common species in all woodland settings in this region. Common on every part of the creek, Bushtit was found at every study site throughout the year for a total of 1235 observations. It bred with certainty at almost every survey site.

SITTIDAE: **Red-breasted Nuthatch** is a coniferous forest denizen during the breeding season and most remain to winter in such places most years. But this species is known to move irruptively in autumn and winter to valleys and deserts, sometimes lingering into spring, should food supplies collapse in evergreen forests. We have about ten records, mostly from 26 September to 23 May, but also from mid-July and mid-August. While this species rarely moves in summer out of the mountains to the valley, there have been several such records in the last 20 years. Our summer records fit that pattern. **White-breasted Nuthatch** is a fairly common resident of oak woodlands regionally, and to a much lesser extent in woodlands of other tree species. We noted this species on 402 occasions, at all seasons and at all study

sites. This is one of few species that was most commonly encountered along the middle reach of the creek. Nesting was proven at five sites from Los Rios Farms to Interdam. The field team found this species probably nesting at six other sites.

CERTHIDAE: Brown Creeper is known regionally as a scarce fall, winter and spring visitant to native woodlands and exotic conifer plantings. Two of our five records, at Stevenson's Bridge and Interdam, conform to this pattern. Exceptionally, a bird was recorded at Diversion Dam in June 2007, followed by a sighting of a pair in mid-April 2008. The next month, breeding was confirmed. This is the first regional breeding record for Brown Creeper, details of which will be published in the literature.

TROGLODYTIDAE: Bewick's Wren, a fairly common woodland and chaparral resident regionally, returned 1477 detections at all locations throughout the year. Breeding was proven or rated probable at 12 sites extending the entire length of the creek. **House Wren** is locally an abundant and conspicuous breeder and an uncommon and less conspicuous winter resident in woodlands with dense understory vegetation. Its regularity in winter is a phenomenon of the past 30 years only. We tallied 1202 encounters at all seasons and at all locations surveyed, the vast majority of these being breeding season detections. Breeding was proven at 12 locations up and down the creek, with an additional four sites having probable breeders. House Wren has been implicated in declines of Bewick's Wren in the eastern United States (Kennedy and White 1996). House Wrens nest commonly in the artificial nestboxes of the Putah Creek Nestbox Highway, producing 922 fledglings from 2000 to 2009. **Winter Wren (Map Volume Exhibit C19)** is a rare to uncommon migrant and winter visitor to the lower Sacramento Valley, lingering only in the woodland blocks with the most complete canopy cover and densest understory. We noted it on Putah Creek on only seven surveys. A 27 May observation at Picnic was extraordinarily late. The species was much more abundant at the Cosumnes River Preserve, especially at the Shaw Forest and Orr Forest sites (Table 7.1). **Marsh Wren** is a common lower Sacramento Valley resident of cattail and bulrush wetlands. In migration and winter they are also rare inhabitants of grassy/shrubby fields. In neither habitat did we spend any significant time, so Marsh Wren was found only six times, with half noted at Los Rios Farms, with dates from 28 September to 24 May.

CINCLIDAE: American Dipper is a rare fall and winter visitor to Putah Creek. Most observations from below Monticello Dam are upstream of our survey area. We did have one observation at Interdam on 23 November 2004.

REGULIDAE: Golden-crowned Kinglet is a migrant and wintering species on the floor of the Central Valley, found most commonly in mature oaks, among native trees, or in exotic conifers. They are generally uncommon here. They were noted 13 times between 28 October and 7 February from nearly the length of the creek. Detections were less frequent on the upper reach. There are two additional late May reports that are difficult to credit. By contrast, **Ruby-crowned Kinglet** is a common migrant and winter visitor to wooded and brushy habitats of almost all descriptions. It was found at all study sites, noted 309 times between 15 September and 8 May. One unseasonal bird on 7 July 2005 near Winters was likely an unusually early south-bound transient.

SYLVIIDAE: Blue-gray Gnatcatcher is currently an uncommon migrant and winter visitor to the lower Sacramento Valley, mostly to thickets of shrubs or sapling trees. It formerly nested locally in the northern part of the Valley, but breeding below the foothill chaparral in this region is currently unknown. We detected it at every field site save Yolo Housing. We found it on 45 occasions between 6 August and 2 June. One third of these detections were at Mace Boulevard and Old Davis Road-Restoria. Breeding was rated possible at Old Davis Road-Restoria.

TURDIDAE: Western Bluebird (Map Volume Exhibit C20) was once a fairly common resident of oak savannas in the lower Sacramento Valley, commoner in adjacent foothills. A wider variety of habitats is exploited outside of breeding season. We found this species 289 times across all seasons, detected everywhere except Putah Creek Sinks. Detections have increased significantly over time as Western Bluebirds have taken up residence in the artificial nest boxes of the Putah Creek Nestbox Highway, producing 634 fledglings between 2000 and 2009 (Truan et al. 2006). As a result, we have confirmed breeding in nine Breeding Bird Atlas grids from Old Davis Road-Restoria to the upstream limit of our surveys. Regionally, **Hermit Thrush (Map Volume Exhibit C22)** is a common migrant and winter visitor in wooded habitats with some understory development, especially near water. It is less common in brushy habitats at those same times of year. We found it at every study site; dates for 181 of our 183 detections range from 12 September to 29 May. The two atypical findings were 20 June 2003 at Interdam and 13 July 2004 at Center for Land-based Learning. **American Robin** is a fairly common resident of wooded tracts in this region. Numbers often increase or decrease in autumn and winter, depending on fruit availability. We encountered 810 robins throughout the year, across all sites. American Robin was confirmed breeding at Los Rios Farms, Center for Land-based Learning, Winters Putah Creek Park, and Dry Creek Confluence, possibly or probably nesting at every other site from Mace Boulevard upstream. **Varied Thrush** breeds in the temperate rainforests of coastal Alaska south to far northwestern California. We see it as a regular fall migrant and sometime winter visitor and spring

migrant, mostly to our best blocks of forest habitat. That said, Varied Thrush numbers were substantially higher at the Cosumnes River Preserve Tall Forest and Shaw Forest sites (Table 7.1), suggesting that, of all the sites we surveyed, these held the best blocks of forest habitat. Numbers in the valley vary considerably among years. We had 13 detections. These span the length of the creek and from 15 December to 11 April.

Swainson's Thrush *Catharus ustulatus*

Map Volume Exhibit C21

PIF/RHJV focal species

Management Status: None

Swainson's Thrush is a polytypic Neotropical migrant songbird that breeds widely across North America. The "russet-backed" race breeds from southeastern Alaska to San Diego County; the nominate race breeds from the northern limit of the species to Humboldt County; and *oedicus* breeds from Siskiyou, Lake and Nevada Counties south, west of the Sierra crest and on the Pacific slope of southern California. Breeding habitat is dense alder and/or willow thickets. One of the "olive-backed" races, *almae*, breeds—but possibly no longer—in the Warner Mountains and on the east slope of the Sierra Nevada, in areas of dense conifers. The russet-backed birds winter in southern Mexico and Middle America. The olive-backed races winter in South America. Though still common over much of its range, Swainson's Thrush seems to be in decline in many places. This is particularly true in California. Though the trend is clear, the reasons are not. Grinnell and Miller mapped this species as breeding in the Central Valley, possibly a rare mistake on their part. North-bound migrants are still routinely found at these latitudes to 10 June, exceptionally to 22 June. Belding's assertion of breeding at Marysville in 1878 may well be true, but unique so far as is known for the Valley as a whole. One pair summered at the Cosumnes River Preserve in 2002. Nesting was strongly suspected but never proven. In the lower Sacramento Valley, Swainson's Thrush is a uncommon spring migrant and rare fall transient, favoring mesic, well- wooded sites.

During the Putah Creek study, Swainson's Thrush was among the most common of migrant species in spring, when we had 284 survey detections. The dates ranged from 2 May to 19 June; June dates were distinctly uncommon. We have three fall dates between 31 August and 28 September. Winter records are extremely rare in our region, however. Of local interest are two specimens from the lower Putah Creek/Yolo Bypass. The first was a bird collected near the west UC Davis aviaries (less than ½ mile from Picnic Grounds Transect) on 11 January 1969 by A. C. Rissey (WFB 6161z). The second was a bird found dead at Green Lake, Yolo Bypass (just north of the Putah Creek Sinks) on 26 December 1976 by A. Engilis, Jr. (WFB-5425).

TIMALIIDAE: Wrentit (Map Volume Exhibit D23) is a characteristic member of the California Biotic Province and the sole New World representative of the Babbler family. This taxon is most familiar as the “voice of the chaparral.” But it does occur on the Valley floor in riparian habitat in a few drainages. Lower Putah Creek is one such drainage. We noted this species 65 times. On eight occasions, all in the breeding season, we found it at Putah Creek Sinks where it was recently confirmed as a breeding species on 18 May 2010 (adults provisioning young). It is usually resident where found. Of the remaining encounters, 53 were in the upper reaches, 45 of these at Interdam, and a single record from Stevenson’s Bridge (in 2009). The upper sites are very near expanses of prime chaparral especially favored by Wrentit. Interdam was the only location where we often found it outside the breeding season. Breeding was also scored as possible at Diversion Dam.

MIMIDAE: Northern Mockingbird is far less common in native habitats than in suburbia. It occupies dense, usually fruiting, shrubbery adjacent to open habitats. It generally avoids forest interiors. It is a resident in this region, but fewer than 10% of our observations are from the winter season. We found this species 291 times at all survey sites, with 202 detections between Mace Boulevard and Picnic Grounds. Nesting was proven between Old Davis Road-Restoria and Picnic Grounds. At 12 other blocks, breeding was scored possible or probable from Oxbow downstream. **California Thrasher** is another indicator species of the California chaparral, with one well-known, perhaps unique residence in open canopy-dense understory riparian woodland on the Central Valley floor. This exceptional place is Caswell Memorial State Park in southern San Joaquin County. In certain years, California Thrasher is known to move in late autumn across seemingly inappropriate Valley habitats. During our Putah Creek surveys, we found it five times in spring and summer along the upper reach, five of these at Oxbow over four consecutive springs. All of the Oxbow detections were of a singing male and it was scored as a probable nesting species based on repeated detections of a singing male. **Sage Thrasher** was detected once at Old Davis Road Restoria in 2001, a bird that finally settled for the winter at the nearby UC Davis Raptor Center.

STURNIDAE: European Starling, as is obvious from the common name, is a nonnative member of the local avifauna. It is well established, however, having arrived in this area in the mid-to-late 1950s. It is an obligate secondary cavity nester, and regularly out-competes native species for old woodpecker holes and scarce natural cavities. Numbers of post-breeders frequently swell as great winter flocks swarm over the valley, often mixed with blackbirds. Our 1637 survey detections span all seasons and survey sites. European Starling was confirmed breeding at 11 sites along the creek.

MOTACILLIDAE: American Pipit is a common migrant and winter visitor to open habitats in the Central Valley, breeding on the alpine tundra of the mountains of western North America and probably eastern Siberia. We found this species, usually as flyovers, on 77 surveys, from 31 August to 22 April, at all survey sites except Dry Creek Confluence. Seventy percent of these detections occurred along the lower reach of the creek.

BOMBYCILLIDAE: Cedar Waxwing is a common migrant and winter visitor to the Central Valley, where it roams in flocks over all manner of habitats seeking fruits, its dietary mainstay. It was noted 302 times between 31 August and 2 June at all study sites. Two-hundred sixteen of these detections occurred at just five sites: Picnic Grounds, Winters Putah Creek Park, Dry Creek Confluence, Diversion Dam and Interdam. A 303rd observation at Diversion Dam on 21 June 1998 is definitely out of season.

PTILOGONATIDAE: Phainopepla is a fruit specialist, too, especially partial to mistletoe. This species is rather rare on the Valley floor, being much more common and resident in riparian and oak woodland foothill settings to the east and west. Consistent with its known distribution, 24 of 29 detections spanning all seasons were from the four most upstream survey stations, 5 occurred in the middle reach, and no birds were noted in the lower reach. Breeding was rated probable at Dry Creek Confluence and Interdam.

PARULIDAE: Tennessee Warbler is a vagrant to California from eastern North America. One was found at Stevenson's Bridge on 9 September 2008. Regionally, **Orange-crowned Warbler (Map Volume Exhibit C24)** is an abundant migrant (especially in the autumn when three races may pass through), a local and uncommon winter visitor, a fairly common breeder in the foothills, and a rare (casual?) breeder on the lower Sacramento Valley floor. In this region, it uses a variety of wooded and especially brushy habitats and their edges, especially near water. Orange-crowned Warbler was noted 314 times at all seasons and study locations. It was confirmed nesting at Dry Creek Confluence, and rated as probably nesting at Mace Boulevard, Old Davis Road-Restoria, Stevenson's Bridge and Russell Ranch. **Nashville Warbler** is an uncommon migrant in the area, using similar habitats as the Orange-crowned Warbler. We encountered it 28 times only. Spring and fall passage dates ranged from 11 April to 26 May and from 23 August to 11 September, respectively. The species was encountered everywhere save Oxbow. **Northern Parula** is another Neotropical migrant species that breeds east of the Rocky Mountains. Our one detection of this vagrant was at Mace Boulevard on 21 August 2004. **Yellow-rumped Warbler** is a polytypic species that is common on passage and as a winter visitor. Though the variety *auduboni* is commoner than *hooveri*, this summary applies to both racial groups. Yellow-rumps

use a variety of wooded and brushy habitats and edges. In their commutes from one patch to another, they are often detected overhead by voice to a degree that other warblers are not. Our surveys found this species 756 times between 31 August and 21 April at all study sites. Of these detections, most were not assigned to racial group. But 173 detections were ascribed to Audubon's Warbler and 51 to Myrtle Warbler. **Black-throated Gray Warbler**, an uncommon to fairly-common migrant and rare winter visitor to the area, was also found at all survey sites, totaling 61 encounters. Like other migrants, it may be found in woody vegetation of a variety of growth habits. We found no individuals in winter, and our observations of migrants in spring were somewhat more numerous than in the fall. Our spring sightings cluster in late April, but span from 6 April to 5 June. The two dozen autumn encounters span the dates 16 August to 3 October. **Black-throated Green Warbler** is a species that breeds in eastern North America, occurring in California as a vagrant. One of these lost birds was found singing at Old Davis Road-Restoria on 23 June 2006. **Townsend's Warbler**, our handsomest widespread western wood warbler, is still less common than the Black-throated Gray Warbler, yet a regular migrant and rare winter visitor in the region. It is perhaps less likely to be found in brush rather than trees compared to other regular migrant warblers. We had 46 observations. Spring migrants were detected from 12 April to 31 May; autumn birds from 12 August to 28 October. This species was noted the length of the creek, but the majority were found in the lower sites. Based on local experience elsewhere and in previous years, **Hermit Warbler** would ordinarily be thought of as less common than the preceding species, as a migrant in both spring and autumn, its habitat preferences mirroring those of Townsend's Warbler. However, we encountered this species 30 times over nearly the whole length of the creek, with an astonishing number found in June, most likely spring migrants. We found only two autumn migrants, on 31 July and 31 August. **Blackpoll Warbler** is another vagrant wood warbler, breeding in far-northern and eastern North America and wintering in South America. When it appears in California during migration, it does so far more commonly in fall than in spring. Consistent with this, one was netted at Los Rios Farms on 2 September 2005; another seen 1-2 October 2004 near Picnic Grounds; and a third near Interdam on 4 October 2008. **Black-and-white Warbler** is yet another wood warbler that breeds in eastern North America and regularly travels as a vagrant to California in spring and especially fall. In addition, there are several summer and many winter records. We had two sightings, one at Stevenson's Bridge 16 April 2008 and one at Picnic Grounds 24 May 2008. These may represent observations of the same bird. The status of **American Redstart** closely matches that of the preceding species. During this study, one was found incidentally on the creek across from the UC Davis Experimental Ecosystem (west of Road 98) on 25 April 2001. This observation is indicated on the table as having taken place at Picnic, the closest survey site. Yet another lost wood warbler found along Putah Creek was an **Ovenbird** (see photo). Like the preceding three species, this bird breeds east of the Rocky Mountains and its usual migration routes

carry it far from California. Nevertheless, this distinctive taxon was found at Mace Boulevard on 5 November 2005. It remained in this location until 9 April 2006. Very likely the same individual returned to winter the next year in the very same place, but it was not detected until 8 January 2007. It was last seen 25 February. Of **Northern Waterthrush**, we had one observation, a bird at Stevenson's Bridge on 27 November 2003.

MacGillivray's Warbler is a skulker of dense shrubs and saplings that is a regular but uncommon component of avian migrations through the region. We had only 36 survey sightings, more than a third of these at Los Rios Farms. Spring passage was noted from 22 April to 18 May, with a late bird on 11 June. In fall, we found this species between 9 August and 29 September. MacGillivray's Warbler detections were more frequent in autumn.



Ovenbird at Mace Blvd. Photo: J. Dunn, Avian Images

Yellow Warbler *Dendroica petechia*

PIF/RHJV and CALFED MSCS focal species

Management Status: Species of Special Concern, CDFG

Map Volume Exhibit C25

Yellow Warbler is a polytypic Neotropical migrant songbird of wide breeding distribution in North America. The breeding range covers most of the northern two-thirds of the continent, with still more southerly breeding taking place along the Pacific Coast into the northern half of Baja California Norte, in southern New Mexico and Arizona and adjacent Sonora, and on the central Mexican Plateau, as well as in mangroves of extreme southern Florida, the Caribbean and both coasts of Mexico. The mangrove birds are resident, as are those yellow warblers breeding on the Mexican Plateau. The rest are migratory, with western birds tending to winter in southern Baja California and southwestern Mexico down to Central America, while eastern birds are believed to winter in South America mostly east of the Andes Mountains south to northern Bolivia. There are three distinctive groups of subspecies. The Pacific and Caribbean host one each among the mangrove residents. The third group is the migratory set of subspecies, plus the central Mexican Plateau form, which is sedentary. These migratory races prefer moist or wet willow-dominated

habitats, with cottonwoods being an important part of the floristics in the southwestern quadrant of the breeding range. This species formerly nested in numbers up and down the Central Valley. But habitat loss, cowbird brood parasitism, and perhaps nest predation by black rats (*Rattus rattus*), have extirpated them from all but the far northern end of the Valley, where they have held on, perhaps by virtue of immigrants from nearby breeding sites. These sites occur in the low foothills, in areas possibly less affected by factors depressing breeding success on the Valley floor. In the last ten years, however, there have been some nesting efforts made in places that have not seen summering Yellow Warblers in decades: at San Joaquin NWR, along the lower Mokelumne River, and at the Cosumnes River Preserve. Some of these were successful breeding efforts, others not.

We found with certainty only migrant Yellow Warblers during this study. There were among the 341 survey encounters, with 251 of these on the lower seven survey sites, slightly more sightings in spring than in autumn. The span of dates in spring ran from 2 May to 10 June; in fall, from 30 July to 31 October. We had two rather late October dates (18 October being the other), which is unusual. Yellow Warbler fall migration is very heavy in August and early September, and is typically only a trickle the last week of September. In October this species is very hard to find. In the course of Breeding Bird Atlas surveys, Yellow Warbler met criteria for probable nesting at Diversion Dam and for possible breeding at Putah Creek Sinks, Winters Putah Creek Park, and Dry Creek Confluence. In May and June of 2008, a pair of Yellow Warblers was found at the west end of the Dry Creek Confluence survey route, again suggesting possible nesting.

Common Yellowthroat (*Geothlypis trichas*)

Map Volume Exhibit C26

PIF/RHJV focal species

Management Status: Species of Special Concern CDFG (*G. t. sinuosa*)

Common Yellowthroat is a polytypic Neotropical migrant songbird, with three races that breed in California. This is a very common species over much of its range, but some populations in California and Texas have become scarce. The species breeds from southeastern Alaska, Yukon, southwestern Nunavut and northern Saskatchewan east to the shores of James Bay, then east to eastern Quebec and Newfoundland south over the whole of the U.S. (see some exceptions below) to northern Baja California Norte, extreme northern Tamaulipas, over the central Mexican Plateau south to Jalisco, then east in the volcanic belt to extreme western Veracruz. Within this area, it is absent in the Cascades of Washington and Oregon, central and northern Idaho, extreme southern Florida including the Keys, and within the xeric southwestern portion of the U.S. it is very local. This species winters from about the Great Dismal Swamp south along the Atlantic Coast to the

entirety of Florida, and west across the Gulf states in eastern North America to South Texas, and in the West from northern California west of the Sierra-Cascade axis, the lower Colorado River from southern Nevada south, locally in southern Arizona and southwestern New Mexico south through the entirety of Mexico and Central America to northernmost South America. Everywhere, breeding takes place in wet settings with dense emergent vegetation. This vegetation is frequently herbaceous, but willow thickets are also commonly used and blackberry tangles occasionally employed. Of the three races breeding in California, *sinuosa*, of the San Francisco Bay Area from the Carquinez Straits west, is of conservation concern. The race breeding in the Central Valley (and well beyond those boundaries to the north) is *arizela*. Within the Central Valley, this species was thought abundant in the breeding season by early chroniclers of the region's birds. By the 1970s, Common Yellowthroats were difficult to find in riparian settings away from the far northern end of the Sacramento Valley. This species remains a common migrant through the lower Sacramento Valley and an uncommon and somewhat local winter visitor.

Common Yellowthroat was detected 95 times on surveys at all sites, but only twice between 16 December and 4 April. Breeding was rated probable at Los Rios Farms, Dry Creek Confluence and Diversion Dam, and possible at three sites in the lower reaches.

Wilson's Warbler *Wilsonia pusilla*

Map Volume Exhibit C27

PIF/RHJV focal species

Management Status: None

Wilson's Warbler is a polytypic Neotropical migrant songbird. this species is a very common bird over its western range. It breeds across the continent in boreal forest and taiga, then down the Pacific Coast to Santa Barbara County and in the Sierra Nevada south to the higher Tehachapi Mountains. It also breeds in the Wallowa and Blue Mountains of northeastern Oregon, in the northern Rocky Mountains from central Idaho and northwestern Wyoming north, and discontinuously south in the higher Rockies and Great Basin ranges to northern New Mexico. Formerly it bred south along the California coast into northern Baja California Norte. In winter, this species settles in southern Baja California Sur, southern Sonora, Guanajuato, southern Nuevo Leon and northern Tamaulipas south through Mexico and Central America to central Panama (Ammon and Gilbert 1999). It is also scarce but regular in winter in coastal southern California and along the coast of the Gulf of Mexico from Alabama to central Texas.

Breeding habitat is low, usually dense, shaded plant cover near streams, meadows, bogs or hillside seepages, where temperatures are relatively low and humidity high. In migration and winter,

habitat variety is very wide indeed. In the Tropics, it may be found from humid coastal forest edges to the *páramo* (a high elevation, sparsely-vegetated neotropical ecosystem). Most commonly, Wilson's Warbler is a bird of foothills and highlands in winter. Historically, there seems to be no evidence that the species summered in the Central Valley. It was and still is one of the most abundant migrant songbirds of central and western North American woods and brush.

Wilson's Warbler was noted on 747 surveys, at all field sites, with the great majority being in spring. Migration dates in spring were 4 April to 4 June; in autumn from 13 July to 2 October. The species, while widespread, was most abundant at the Putah Creek Sinks, the Center for Land-based Learning, and Yolo Housing sites (Table 7.1).

Yellow-breasted Chat *Icteria virens*

Map Volume Exhibit C28

PIF/RHJV focal species

Management Status: Species of Special Concern CDFG

Yellow-breasted Chat is an atypical wood warbler, but like most others, it is a polytypic Neotropical migrant. It is uncommon over much of its range, but common in some isolated ideal habitat patches (e.g., in the Southwest). Eastern birds of the nominate race breed from southwestern Iowa and southeastern Minnesota, east to southern Ontario and New York, south to central Texas, and east to northern Florida. Western birds of the race *auricollis* nest from southern British Columbia east to central Saskatchewan, south patchily and mostly in foothill riparian settings to central western California, and the Colorado River Delta east to the Rio Grande and Pecos Rivers of Texas downstream to about Laredo. In Mexico, the spotty breeding range includes locally in Baja California Norte, central Sonora to Nayarit, and on the Central Plateau to Michoacan and Morelos; it formerly bred in Tamaulipas. In winter, Chats migrate south to both coasts of central Mexico south to the Isthmus of Tehuantepec, and from there throughout Middle America to Panama. Very small numbers may winter in the southern U.S.

For western birds, typical breeding habitat is shaded riparian thickets of low, dense plants, most commonly willows, weed tangles, blackberries and grapes. The ground itself need not be wet or muddy. Historically, this species is said to have been a common breeding species the length of the Sacramento Valley, but citations of specific locations and breeding birds are few; almost all of these are from the northern part of the Valley. Currently, the species is still fairly common in the northern Sacramento Valley, more along tributary creeks than on the main stem. There is no known regular breeding location on the southern Valley floor. At this latitude, the species is found regularly in the foothills of the Sierra, irregularly in the foothills of the Coast Range (e.g., along Putah Creek), and in

the north Delta. It is mystifying that Chats are not part of the breeding avifauna of the Cosumnes River Preserve, as many parts of the Preserve appear not merely acceptable but truly ideal for the species. This species is known to be heavily parasitized by cowbirds.

We have found Yellow-breasted Chat eleven times thus far. It was rated as a possible nesting species at Dry Creek Confluence and Oxbow, with a singing male found on 26 June 2004 and 13 July 2005, respectively. . Harder to call was a bird found at Putah Creek Sinks in mid-June 2005. On the basis of that date, this species was rated a possible breeder. Dates of migrant sightings span 2 May to 13 May and 13 July to 28 August. Professor Tracy Storer collected a breeding male on 17 June 1925 along Putah Creek some three miles southwest of Winters (an area now under water behind the Solano Diversion Dam). This specimen provides the only evidence that this species historically nested along Putah Creek.

EMBERIZIDAE: Spotted Towhee is very common at all seasons in wooded and riparian settings with a dense shrub layer. It was regularly found at all study sites, rather infrequently at Yolo Housing and abundantly elsewhere. It was confirmed nesting at four sites on the lower reach of the creek and was a probable breeder at multiple sites along the middle and upper reaches. A near-endemic in the state, **California Towhee (Map Volume Exhibit C30)** is also a common resident bird in the same habitats, though a bit less common than its congener, the Spotted Towhee. California Towhee tends to seek out edges on higher ground, less susceptible to inundation by floods. A confirmed breeder at Diversion Dam and Winters Putah Creek Park, it was rated a probable breeder at nine other sites downstream. **Rufous-crowned Sparrow** is a widely distributed, rather inconspicuous denizen of rocky foothill grassland settings both east and west of the Central Valley, and elsewhere in the southwestern quadrant of the contiguous 48 states. Though it is resident in Cold Canyon just below Lake Berryessa, we did not detect it until 10 September 2009. On that date a single Rufous-crowned Sparrow was noted incidentally at Interdam. **Chipping Sparrow** is currently an infrequent migrant through the lower Sacramento Valley, much less regular than formerly. We had only eight sightings, one in spring and seven in autumn, distributed in all reaches of the creek. **Brewer's Sparrow** is a rare migrant to our area, usually found in brush or grass. It was detected 24 August 2007 at Picnic Grounds. **Lark Sparrow** is an uncommon resident regionally. Preferred habitats include open country with some brush and trees admixed. We found it 13 times, nine of these on the upper reach of Putah Creek. All seasons were represented in the dates of detection. Lark Sparrow was confirmed breeding at Dry Creek Confluence. **Savannah Sparrow** migrates and winters in this region in great numbers in appropriate habitat (open habitats that we did not visit). Accordingly, we had only 24 sightings, but these came from all reaches of the creek encompassing fall, winter and spring dates. **Grasshopper Sparrow** is regionally rare in grassland habitats at all

seasons. We detected it once each at Mace Boulevard on 23 April 2004 and at Old Davis Road-Restoria on 7 May 2007. **Fox Sparrow (Map Volume Exhibit C31)** is a polytypic species that migrates and winters regionally. It is uncommon to fairly-common in brushy riparian habitat and a bit less common in woodlands with dense understory. Sooty, slate-colored, red and large-billed racial groups may, in fact, be separate species. But these birds frequently afford less than adequate looks to assign to racial group, and all of our observations are of Fox Sparrow *sensu lato*. We had 93 survey observations, somehow missing this bird at Mace Boulevard, where it must be regular in season, but finding it about equally often at all other survey locations. The span of 92 dates from 15 September to 22 April is typical for the wider area, but a bird found 11 May 2004 at Interdam was very late. **Lincoln's Sparrow** is locally common in migration and winter in brushy habitats. We had 202 survey encounters, finding the species at all survey sites save Stevenson's Bridge on dates from 5 September to 17 May. **Swamp Sparrow** is a rare migrant and winter visitor to the southern Sacramento Valley. Our sole detection was at Los Rios Farms on 23 March 2004. More expected was **White-throated Sparrow**, which, like Swamp Sparrow, is a bird of eastern North American breeding distribution. We found this species seven times from Diversion Dam to Old Davis Road-Restoria on dates spanning 27 October to 17 April. **White-crowned Sparrow** is a polytypic species that haunts brushy edges in migration and during winter in the Central Valley. It almost always is found in flocks, all white-crowns or with other sparrows. Of the two local races, *gambelii* is orders of magnitude more common than *pugetensis*. We had 265 detections spanning the dates 15 September to 30 May, at all study sites. **Golden-crowned Sparrow** is another regionally-common taxon in migration and winter, preferring many of the same habitats as White-crowned Sparrow, plus occasionally woodland interiors. We had 339 survey detections at all locations. The dates ranged from 15 September to 8 May, plus two early June reports. **Dark-eyed Junco** is a polytypic songbird of open woodlands and woodland margins as a migrant and in winter. Several races are subsumed each in "Oregon" Junco (**Map Volume Exhibit C33**) and "Slate-colored" Junco. Individuals of the latter racial group are occasionally found locally, we have three sightings from the Upper Reach. In 2000, this species was discovered nesting in the Central Valley at the Cosumnes River Preserve (Trochet 2001). Suggesting a consolidation of regional lowland summering, Dark-eyed Juncoes bred over three consecutive years (2002–2004) at Dry Creek Confluence. We had 245 encounters, from 23 August to 17 April, excepting the nesting birds at Dry Creek Confluence. For these we had May and June dates as well.

Song Sparrow *Melospiza melodia*

Map Volume Exhibit C32

PIF/RHJV focal species

Management Status: Species of Special Concern CDFG (*M. m. mailliardi*)

Song Sparrow is a polytypic resident and intra-temperate-zone migrant songbird, common over much of its range. Twenty-four to 52 races are variously recognized, at least 11 in California alone. Pacific coastal birds tend to be resident and highly differentiated. Birds from the Rockies eastward are migratory, at least in part, and more homogeneous morphologically. The northern limit of breeding Song Sparrows runs from Attu in the Aleutian Islands east along the coast and gulf islands of Alaska through southern Yukon, southern Nunavut, northern Manitoba, and northern Ontario to eastern Quebec and Newfoundland. The southern margin of the breeding range is south to central Baja California, central and southern Arizona, northern parts of Sonora and Chihuahua, south in the mountains to northern New Mexico, mainly north of the Missouri River across the Great Plains, thence southeast to northern Georgia, then northeast on the coastal slope of the Appalachian Mountains to the coast of southern Virginia, and down the immediate coast and on the Outer Banks of North Carolina. There is a tropical disjunct resident population across the central volcanic belt from southeastern Jalisco to Puebla. This species winters from coastal Alaska, central British Columbia, southern Montana, southern Minnesota, central Michigan, southern Ontario, southernmost Quebec and southernmost Maine south to the head of the Sea of Cortez and across the northern tier of the states of Mexico. Within this range, some areas with insufficient suitable habitat in western desert regions of the U.S. lack breeding and wintering Song Sparrows, and none winter in far southeastern Florida. This species was historically common the length of the Central Valley. Three subspecies are involved: *fisherella* north of Colusa County, *heermanni* south of Stanislaus County, and *mailliardi* between these two. All three, like many Song Sparrows elsewhere, nest commonly in marshes of cattails and bulrushes. Only *mailliardi* also routinely nested in woody riparian habitats. A survey in the 1970s failed to find them breeding in this setting. The Point Reyes Bird Observatory resurveyed the southern Sacramento Valley from 1995- 1999 and likewise failed to find them breeding in riparian woodlands. They do breed in such settings at the Cosumnes River Preserve, but their rates of success there are quite low. The resident *mailliardi* birds are joined in winter by song sparrows of at least three other races.

Our surveys noted Song Sparrow 737 times, at all seasons and study sites. The species was confirmed nesting at three sites along the creek's lower reach and one site each in the middle and upper reaches. It was rated as probably or possibly nesting at all other sites. The specific habitats of these breeding birds cannot be identified since they may have also been nesting in cattail marshes and other wetland habitats in the general vicinity.

CARDINALIDAE: Western Tanager (Map Volume Exhibit C29) is fairly common in migration and rare in winter in the lower Sacramento Valley, favoring woodlands of diverse floristics. We did not find this species in winter, but as a migrant we enjoyed 357 encounters, evenly divided between spring and autumn, at all study sites. Tanagers were most often encountered at the Center for Land-based Learning, Sutter Bypass, and Fremont Weir South sites (Table 7.1). Spring dates spanned from 12 April to 4 June. Fall dates ranged from 10 July to 24 October. We also noted this species eight times between 13 June and 1 July. Breeding was considered unlikely, but at Oxbow, Western Tanager met criteria to confirm nesting (carrying food on 23 July 2004). Most, if not all, of these summer dates likely represented early departures from their normal montane breeding range following failed breeding attempts there. “Tanagers” breeding in the United States and Canada have recently been removed from the Thraupidae, the true tanagers, but as yet the common names have not been changed. **Rose-breasted Grosbeak** is the eastern North American sister taxon of Black-headed Grosbeak and a rare bird in California. A few to several are discovered each year in the state. There are two records from Putah Creek. The first was a male found at Picnic Grounds on 24 August 2007. The second was a male found at Russell Ranch on 29 June 2009. **Lazuli Bunting** is a fairly common migrant and summering species. It breeds in the Central Valley at edges of woodland blocks and riparian strips adjacent to expanses of forbs and grasses, and in other habitats outside the Valley. It was found at all sites except Interdam. Breeding was not confirmed, but rated probable in all three reaches. The 96 survey records run from 22 April to 28 September. **Indigo Bunting** is the Lazuli Bunting’s eastern North American counterpart. It expanded its range into the Southwest and into southeastern California in the 1930s to 1960s. It is a rare migrant and casual breeder in the lower Sacramento Valley. Habitat preference is as for Lazuli Bunting, with which it may hybridize. During the study we had a single observation, a singing male at Diversion Dam on 17 April 2007.

Black-headed Grosbeak *Pheucticus melanocephalus*

Map Volume Exhibit C34

PIF/RHJV focal species

Management Status: None

Black-headed Grosbeak is a polytypic Neotropical migrant songbird. Both races breed in California, *maculatus* nesting over most of the state and *melanocephalus* doing so in restricted areas east of the Sierra- Cascade crest. The breeding range for the species runs from southern British Columbia, southern Alberta, southwestern Saskatchewan, and central North Dakota south in the west to northwestern Baja California Norte along the coast, to Fresno County in the Central Valley, and throughout the mountains of California except the desert ranges, including also the lower slopes and

foothills of the Rockies and the Basin and Range mountains south to southern Nevada and southern Utah, the mountains of the Mogollon Rim in Arizona, then south through the Sierra Madre Occidental to the central volcanic belt, and south in the east through the midportions of the northern Plains states to southern Kansas and extreme western Oklahoma, then south again through New Mexico west of the eastern plains, the Trans-Pecos of Texas, and the Sierra Madre Oriental to the central volcanic belt. Black-headed Grosbeak is present at all seasons in that volcanic belt, the central plateau, and in the southern halves of both the major Sierras. In winter it also occurs in Baja California Sur, coastal western Mexico from southern Sonora to Michoacan, and coastal eastern Mexico from northern Tamaulipas to central Veracruz. It winters rarely in the southern U.S. and in Central America.

The Black-headed Grosbeak breeds in an amazing variety of settings. It is probably easier to say where it doesn't breed: grasslands, deserts away from riparian groves, chaparral and unbroken coniferous forest. Woodlands of choice frequently have greater plant diversity and vertical structure than is average in such woods. As such, we encountered Grosbeaks more often at Fremont Weir South, Cache Creek Settling Basin, and at the Center for Land-based Learning. Cottonwood-willow habitats appear especially favored. Historically this was a common breeding bird up and down the Sacramento Valley, and it remains so today. We encountered Black-headed Grosbeak 658 times on our surveys, at all sites, from an early date of 9 April to a late date of 31 August. Breeding was confirmed at five sites from Picnic Grounds to Oxbow. Breeding was rated possible or probable at all other sites.

Blue Grosbeak *Passerina caerulea*

Map Volume Exhibit C35

PIF/RHJV focal species

Management Status: None

Blue Grosbeak is a polytypic Neotropical migrant songbird. Three of seven described races occur in the United States, two of these in California. The breeding bird of the Central Valley, along southern coastal California to northwestern Baja California Norte and in the Owens Valley is the race *salicaria*. The other race in the state, *interfusa*, is restricted to the Colorado River margin and the Imperial Valley, as well as northwestern Mexico. Some authorities consider these birds to be *salicaria* as well. The northern margin of the breeding distribution for the species east of California ranges from southern Nevada, southern Utah, northern New Mexico north through eastern Colorado and southeastern Wyoming to southern North Dakota, south through eastern South Dakota and Nebraska to central Missouri, southern Illinois, Indiana, Ohio and West Virginia to central Maryland

and central New Jersey. The southern margin in the east is central peninsular Florida sparing the immediate coasts, west in the southern Gulf States, again sparing the immediate coasts to the Coastal Bend of Texas, south into Mexico to central Oaxaca, again sparing the coastal lowlands. In the west, the range runs south from southeastern Arizona in the Sierra Madre Occidental and its foothills to the central volcanic belt to central Oaxaca. The breeding range includes the intervening Mexican Plateau, where the species is resident. Southeast of the lowlands of the Isthmus of Tehuantepec, the breeding range resumes on the western half of Middle America from eastern Oaxaca to extreme western Panama. These Middle American birds are breeders and are likewise resident. In winter this species withdraws, with extremely rare exception, from all of the United States. Additional areas in Mexico used in winter include the Cape Region of Baja California Sur, the Pacific Coastal lowlands from southern Sonora south, and the Caribbean Coastal lowlands from central Tamaulipas to the Yucatan Peninsula. The species winters in all of Middle America southeast to central Panama.

Preferred habitats include floodplain stands of tall forbs or saplings, especially willow thickets commonly fairly close to tall riparian groves. Historically, this species was considered fairly common to common in the Central Valley by observers in the first half of the 20th Century. By the 1970s, it was considered uncommon at best. In the late 1990s, Point Reyes Bird Observatory surveyed widely for riparian obligate birds in the Sacramento Valley. Blue Grosbeak, according to their findings, was fairly common in the north end of the Valley but much scarcer in the southern portion (White 1998).

Excepting Winters Putah Creek Park, Blue Grosbeak was found at all survey sites over the course of this study. Of 144 survey encounters, 116 were from the lower reach of Putah Creek. The observations span the dates from 21 April to 27 September. Breeding was proven at Los Rios Farms and Putah Creek Sinks, and was rated probable in three other atlas blocks along the lower reach of the creek and at the Center for Land-based Learning.

ICTERIDAE: Red-winged Blackbird is polytypic species, a very common resident whose numbers are fantastically augmented during migration and winter by the influx of individuals of races breeding outside the Central Valley. As a breeder, Red-winged Blackbird favors wetlands, which can be quite small, as well as fields grown thickly with forbs and scattered small trees. In winter, it is found in these places and in agricultural fields (dairy feed lots, etc.). Winter roosts may comprise just a score of individuals or, in favored wetlands, may number in the hundreds of thousands. During this study, Red-winged Blackbirds were found in numbers, especially at the lower seven survey sites, across all seasons. For the resident race *mailliardorum*, sometimes called the Bicolored Blackbird, nesting was rated probable at multiple sites along the lower reach of the creek and at Russell Ranch, and rated possible at many other sites up to

Dry Creek Confluence. Although breeding was not proven during the BBA project, this species doubtless does breed along the creek. **Western Meadowlark** is a hallmark of grasslands over the western two-thirds of the country. It is resident in the Central Valley, with the local population supplemented in the non-breeding seasons with immigrants from populations breeding outside the Valley. Noted on 199 occasions spanning the year, it was missed only at Center for Land-based Learning. It possibly bred at Putah Creek Sinks and Los Rios Farms. **Yellow-headed Blackbird** is a rare to uncommon species at all seasons in the lower Sacramento Valley. For breeding, this species prefers wetlands with deeper water than do other blackbirds. Like other blackbirds, its habitat preferences broaden after breeding. We had only three detections, one each at Putah Creek Sinks, Los Rios Farms and Mace Boulevard. In this region, **Brewer's Blackbird** is common in all seasons. Breeding occurs in areas of grassland or mixed grassland and brush having taller brush or trees for singing and nest placement, altogether drier habitats than usually preferred by Red-winged Blackbird. In winter, it frequents the same areas as other blackbirds, and frequently forms mixed flocks with them. We noted this species 632 times, at all seasons and locations, with a preponderance of encounters at the lower seven survey sites. Breeding was proven at Putah Creek Sinks, Mace Boulevard, Winters Putah Creek Park, and Oxbow, and possibly at nine other sites. **Brown-headed Cowbird** is a common species at all seasons locally. It is easy to miss in winter, however, because it assembles into large mixed flocks that one may fail to encounter or to recognize. Owing to its breeding habitat preferences coinciding with our survey sites, we found this species on over 2000 surveys, between 17 March and 24 October, but just twice in winter. May and June surveys almost never failed to detect cowbirds. Brown-headed Cowbirds successfully bred at Los Rios Farms and Mace Boulevard, and probably did so at almost every other site. **Hooded Oriole** is a rare and local summering songbird that has expanded its range into northern California by exploiting nonnative palm trees planted in yards and along roadways. It was detected 13 times at four sites. The area hot spot is at Stevenson's Bridge where nine of those encounters took place, the birds nesting in ornamental palms at the residence adjacent to that survey site. Dates of encounters along the creek ran from 17 May to 4 September. **Bullock's Oriole** is an uncommon, but often conspicuous, migrant and summer visitor to the Central Valley. It breeds in the Valley in riparian woodland and oak woodland. On 368 different surveys, we found it at all sites on dates spanning 27 March to 31 August. Breeding was confirmed at Los Rios Farms, Stevenson's Bridge and Dry Creek Confluence. It probably bred at six other sites from Putah Creek Sinks to Winters Putah Creek Park.

Tricolored Blackbird *Agelaius tricolor*

PIF/RHJV focal species; CA Endemic

Management Status: Species of Special Concern CDFG

Map Volume Exhibit C36

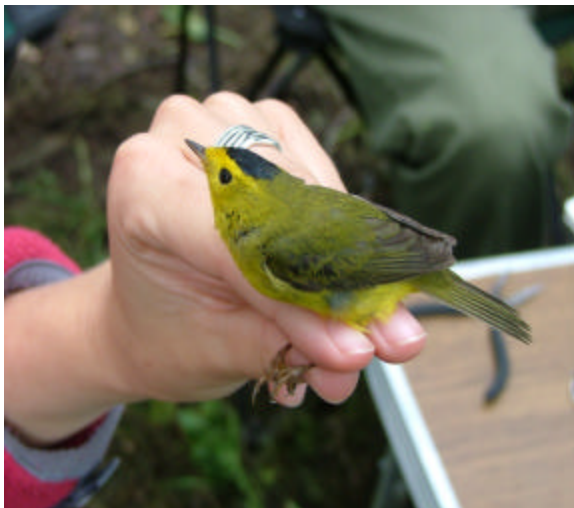
Tricolored Blackbird is another of the near-endemic birds of California, this one nearly endemic to the Central Valley itself, which has always been the core of its breeding range. The species has long been known to breed also in the Klamath Basin, around Honey Lake, in western Nevada, the coastal versant of southern California, and in northern Baja California Norte. In recent years it has bred in very small numbers at isolated colonies in central and eastern Oregon, and once in Washington State. In winter it withdraws from these sites of recent expansion and from the Klamath and Honey Lake basins, western Nevada and Baja California Norte to its core range. Even in the Central Valley, big numbers in winter only occur in the central portion. In contrast, winter numbers swell at favored sites along the coast from Marin to Monterey Counties and in the Sacramento-San Joaquin Delta. This species formerly bred in dense colonies in the hundreds of thousands of pairs in Valley wetlands, now largely gone. Modern Tricolored Blackbird colonies still nest in marshes, but they also use agricultural fields (especially dense grain fields) and large Himalayan blackberry tangles. Breeding areas must be within commute distance of a few miles to irrigated pastures, grain fields, or upland foraging areas. This species is notorious for changing colony site both within years (nesting again at second site) and between years.

Our riparian surveys were not designed to detect Tricolored Blackbirds in numbers. We had but eight sightings, these being at Los Rios Farms, Putah Creek Sinks, Mace Boulevard and Center for Land-based Learning. All but one was of fewer than 15 birds. Sightings were in spring and early summer, except for a single bird found 18 October at Putah Creek Sinks.

FRINGILLIDAE: Purple Finch is an uncommon migrant and winter visitor on the Valley floor. Some years it may be virtually absent. We had 24 observations over the length of the creek from 11 of 14 stations. Dates ranged from 28 September to 30 May. We found no evidence of nesting. **House Finch** is a very common bird, using a remarkably broad range of habitats. Our 1100-plus encounters came throughout the year and at all study sites. We confirmed nesting at Putah Creek Sinks, Mace Boulevard, Stevenson's Bridge, Winters Putah Creek Park, and Diversion Dam. Probable breeding was noted at 12 other sites up and down the creek. **Pine Siskin** is another coniferous forest breeder that moves in small numbers to the Central Valley floor almost annually, and that moves to valley and desert habitats in large numbers irruptively. Our 15 observations span 27 October to 10 May, and encompass the entire length of the creek. **Lesser Goldfinch** is a resident and breeding species in the southern Sacramento Valley. It is uncommon in summer and fairly common locally in winter. Like some of the species mentioned earlier, this taxon flocks either by itself, or with other finches in winter, where it can be missed due to its patchy distribution in space. We had 302 observations across all seasons. Lesser Goldfinch was found at all

sites. It was rated a possible or probable breeder at 12 sites the length of the creek, but nowhere proven to breed. **Lawrence's Goldfinch**, another California near-endemic, is a foothill species that rarely strays to the Central Valley floor. However, of our ten detections, eight came from the lower half of the creek. We had one mid-October date; the rest of our records spanned 20 April to 9 June. **American Goldfinch** is a very common resident locally, breeding in a variety of woodland settings. Our 722 encounters occurred at all sites and seasons. It bred at Los Rios Farms, Putah Creek Sinks and Dry Creek Confluence. American Goldfinch was rated a possible or probable breeder at 12 other Breeding Bird Atlas blocks over the length of the creek. One flight of four **Evening Grosbeaks** was observed at Winters Putah Creek Park on 30 October 2004.

PASSERIDAE: House Sparrow is a common species of urban and suburban environments and around farm and ranch buildings. It is generally scarce away from these settings, where it is almost always detected as a post-breeding wanderer. Our 112 detections span all but late fall dates. House Sparrow was proven to breed at seven sites from Mace Boulevard to Diversion Dam.



Mist netting on Putah Creek. 2005-2006.
Wilson's Warbler above, Western Tanager right.
Photos: R. Melcer Jr.



TABLE 7.2 BIRD SPECIES DETECTED ALONG PUTAH CREEK AND SELECTED SITES IN THE YOLO-SUTTER BYPASS, 1997-2008																			
SPECIES NAME	Breeding Status	INTDM	DVDAM	OXBOW	DRYCK	WINTR	YOLOH	CLBL	RUSSR	STVBR	PICNC	OLDRR	MACEB	LOSRF	PUTCS	SACWR	FREWR	SUTBY	CCSB
ANATIDAE																			
Greater White-fronted Goose					X	X		X	X	X		X	X	X	X	X	X		X
Emperor Goose															X				
Snow Goose								X	X					X	X		X		
Ross's Goose															X				
Cackling Goose														X	X				
Canada Goose	CO	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X		
Tundra Swan								X	X		X			X			X		
Wood Duck	CO	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Gadwall	PR													X	X	X			
American Wigeon		X			X														
Mallard	CO	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Blue-winged Teal															X				
Cinnamon Teal	PR				X									X	X	X			X
Northern Shoveler														X					
Northern Pintail														X	X	X	X		
Canvasback			X																
Greater Scaup																	X		

TABLE 7.2 BIRD SPECIES DETECTED ALONG PUTAH CREEK AND SELECTED SITES IN THE YOLO-SUTTER BYPASS, 1997-2008																			
SPECIES NAME	Breeding Status	INTDM	DVDAM	OXBOW	DRYCK	WINTR	YOLOH	CLBL	RUSSR	STVBR	PICNC	OLDRR	MACEB	LOS RF	PUTCS	SACWR	FREWR	SUTBY	CCSB
Lesser Scaup																	X		
Ring-necked Duck			X										X						
Bufflehead		X	X		X								X						
Common Goldeneye		X	X																
Barrow's Goldeneye		X																	
Hooded Merganser	CO	X		X		X		X											
Common Merganser	PR	X	X	X	X		X								X				
Red-breasted Merganser											X								
PHASIANTIDAE																			
Red Junglefowl		X	X	X	X	X			X	X	X		X						
Ring-necked Pheasant (I)	PR	X	X		X			X	X	X	X	X	X	X	X	X	X	X	X
Common Peafowl (I)	CO	X	X			X			X		X		X				X	X	
Wild Turkey (I)	CO	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X	X
ODONTOPHORIDAE																			
California Quail		X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X
PODICIPEDIDAE																			
Pied-billed Grebe	PR	X		X	X	X		X	X				X			X	X	X	
PELECANIDAE																			

TABLE 7.2 BIRD SPECIES DETECTED ALONG PUTAH CREEK AND SELECTED SITES IN THE YOLO-SUTTER BYPASS, 1997-2008																			
SPECIES NAME	Breeding Status	INTDM	DVDAM	OXBOW	DRYCK	WINTR	YOLOH	CLBL	RUSSR	STVBR	PICNC	OLDRR	MACEB	LOSRF	PUTCS	SACWR	FREWR	SUTBY	CCSB
American White Pelican														X	X	X	X	X	
PHALACROCORACIDAE																			
Double-crested Cormorant		X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X
ARDEIDAE																			
American Bittern			X							X	X					X			
Great Blue Heron		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Great Egret		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Snowy Egret		X	X	X	X		X		X	X	X	X	X	X	X	X	X	X	X
Cattle Egret									X	X	X	X	X	X		X			
Green Heron	PR	X	X	X	X	X	X	X	X		X	X	X	X		X	X	X	X
Black-crowned Night-Heron	CO	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
THRESKIORNITHIDAE																			
White-faced Ibis							X					X	X	X	X	X	X		X
CATHARTIDAE																			
Turkey Vulture		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
ACCIPITRIDAE																			
Osprey		X	X	X	X				X	X	X		X					X	
White-tailed Kite	CO	X		X	X	X			X	X	X	X	X	X		X	X		X

TABLE 7.2 BIRD SPECIES DETECTED ALONG PUTAH CREEK AND SELECTED SITES IN THE YOLO-SUTTER BYPASS, 1997-2008																			
SPECIES NAME	Breeding Status	INTDM	DVDAM	OXBOW	DRYCK	WINTR	YOLOH	CLBL	RUSSR	STVBR	PICNC	OLDRR	MACEB	LOS RF	PUTCS	SACWR	FREWR	SUTBY	CCSB
Northern Harrier	CO	X	X						X		X	X	X	X	X	X	X		X
Sharp-shinned Hawk		X	X	X	X	X	X	X		X	X	X	X		X	X	X		
Cooper's Hawk	PO	X	X		X		X	X	X	X	X		X	X	X	X	X	X	X
Northern Goshawk											X								
Swainson's Hawk	CO	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Red-shouldered Hawk	CO	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Red-tailed Hawk	CO	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X
Rough-legged Hawk																	X		
Ferruginous Hawk											X								
Golden Eagle		X																	
FALCONIDAE																			
American Kestrel	CO	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Merlin		X	X		X		X				X		X		X		X	X	
Peregrine Falcon		X												X	X		X		
Prairie Falcon		X				X			X										X
RALLIDAE																			
Virginia Rail													X	X					

TABLE 7.2 BIRD SPECIES DETECTED ALONG PUTAH CREEK AND SELECTED SITES IN THE YOLO-SUTTER BYPASS, 1997-2008																			
SPECIES NAME	Breeding Status	INTDM	DVDAM	OXBOW	DRYCK	WINTR	YOLOH	CLBL	RUSSR	STVBR	PICNC	OLDRR	MACEB	LOSRF	PUTCS	SACWR	FREWR	SUTBY	CCSB
Common Moorhen	CO				X									X		X			X
American Coot					X	X			X				X			X			X
GRUIDAE																			
Sandhill Crane													X	X	X	X	X	X	
CHARADRIIDAE																			
Black-bellied Plover													X	X					X
Pacific Golden Plover													X						
Semipalmated Plover															X				
Killdeer	CO	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
RECURVIROSTRIDAE																			
Black-necked Stilt											X	X		X			X	X	X
American Avocet														X					X
SCOLOPACIDAE																			
Spotted Sandpiper		X						X										X	X
Greater Yellowlegs			X	X	X	X					X	X	X	X		X	X		X
Lesser Yellowlegs															X			X	
Whimbrel								X	X				X	X		X			
Long-billed Curlew			X		X	X		X	X		X	X	X	X	X	X	X	X	X

TABLE 7.2 BIRD SPECIES DETECTED ALONG PUTAH CREEK AND SELECTED SITES IN THE YOLO-SUTTER BYPASS, 1997-2008

SPECIES NAME	Breeding Status	INTDM	DVDAM	OXBOW	DRYCK	WINTR	YOLOH	CLBL	RUSSR	STVBR	PICNC	OLDRR	MACEB	LOS RF	PUTCS	SACWR	FREWR	SUTBY	CCSB
Western Sandpiper															X	X			
Long-billed Dowitcher																			X
Least Sandpiper									X										
Wilson's Snipe															X			X	
LARIDAE																			
Bonaparte's Gull					X						X	X	X						
Ring-billed Gull			X								X	X		X			X		
California Gull		X			X	X		X	X		X	X				X			
Herring Gull						X					X								X
Thayer's Gull											X								
Glaucous-winged Gull											X								
Caspian Tern		X										X	X		X	X			
Forster's Tern												X	X		X	X			
COLUMBIDAE																			
Rock Pigeon (I)			X		X	X	X	X	X	X	X	X	X	X	X		X	X	
Eurasian Collared-Dove (I)	PO				X	X	X								X				
Mourning Dove	CO	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

TABLE 7.2 BIRD SPECIES DETECTED ALONG PUTAH CREEK AND SELECTED SITES IN THE YOLO-SUTTER BYPASS, 1997-2008																			
SPECIES NAME	Breeding Status	INTDM	DVDAM	OXBOW	DRYCK	WINTR	YOLOH	CLBL	RUSSR	STVBR	PICNC	OLDRR	MACEB	LOS RF	PUTCS	SACWR	FREWR	SUTBY	CCSB
CUCULIDAE																			
Yellow-billed Cuckoo					X									X			X		
TYTONIDAE																			
Barn Owl	CO				X			X	X	X	X		X	X	X		X	X	
STRIGIDAE																			
Western Screech-Owl	CO				X	X				X	X								
Great Horned Owl	CO		X	X	X			X	X	X	X	X	X	X	X	X	X	X	X
Northern Pygmy-Owl		X	X																
Long-eared Owl			X		X									X					
CAPRIMULGIDAE																			
Common Poorwill															X				
APODIDAE																			
Black Swift																	X		
Vaux's Swift		X		X	X			X									X		
White-throated Swift	CO	X	X		X	X				X	X	X	X	X	X	X			
TROCHILIDAE																			
Black-chinned Hummingbird	CO	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Anna's Hummingbird	CO	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	

TABLE 7.2 BIRD SPECIES DETECTED ALONG PUTAH CREEK AND SELECTED SITES IN THE YOLO-SUTTER BYPASS, 1997-2008																			
SPECIES NAME	Breeding Status	INTDM	DVDAM	OXBOW	DRYCK	WINTR	YOLOH	CLBL	RUSSR	STVBR	PICNC	OLDRR	MACEB	LOSRF	PUTCS	SACWR	FREWR	SUTBY	CCSB
Calliope Hummingbird								X		X			X						
Rufous Hummingbird			X		X		X		X	X			X	X					
Allen's Hummingbird			X		X	X	X	X					X						
Selasphorus spp.		X	X		X	X				X	X	X	X	X					
ALCEDINIDAE																			
Belted Kingfisher	CO	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
PICIDAE																			
Lewis's Woodpecker				X	X		X	X											
Acorn Woodpecker	PR	X	X	X	X					X	X		X	X			X		
Yellow-bellied Sapsucker											X								
Red-breasted Sapsucker		X	X			X			X	X		X	X						
Nuttall's Woodpecker	CO	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Downy Woodpecker	CO	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Hairy Woodpecker	PR	X	X			X			X		X		X	X					
Northern Flicker	CO	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Northern Flicker (Red-shafted)		X	X	X	X	X		X	X	X	X	X	X		X				
Northern Flicker (Yellow-shafted)															X				

TABLE 7.2 BIRD SPECIES DETECTED ALONG PUTAH CREEK AND SELECTED SITES IN THE YOLO-SUTTER BYPASS, 1997-2008																			
SPECIES NAME	Breeding Status	INTDM	DVDAM	OXBOW	DRYCK	WINTR	YOLOH	CLBL	RUSSR	STVBR	PICNC	OLDRR	MACEB	LOSRF	PUTCS	SACWR	FREWR	SUTBY	CCSB
Pileated Woodpecker	PR	X																	
TYRANNIDAE																			
Olive-sided Flycatcher			X						X	X	X	X	X						
Eastern Wood-Pewee					X														
Western Wood-Pewee	PR	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Willow Flycatcher		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Least Flycatcher									X										
Hammond's Flycatcher									X	X	X	X							
Gray Flycatcher												X			X				
Dusky Flycatcher				X					X		X		X	X			X	X	
Pacific-slope Flycatcher	CO	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Black Phoebe	CO	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Eastern Phoebe					X								X						
Say's Phoebe		X	X					X		X			X	X	X			X	
Ash-throated Flycatcher	CO	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Western Kingbird	CO	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
LANIIDAE																			
Loggerhead Shrike	CO				X				X				X	X	X	X			

TABLE 7.2 BIRD SPECIES DETECTED ALONG PUTAH CREEK AND SELECTED SITES IN THE YOLO-SUTTER BYPASS, 1997-2008																			
SPECIES NAME	Breeding Status	INTDM	DVDAM	AXBOW	DRYCK	WINTR	YOLOH	CLBL	RUSSR	STVBR	PICNC	OLDRR	MACEB	LOSRF	PUTCS	SACWR	FREWR	SUTBY	CCSB
VIREONIDAE																			
Bell's Vireo	PO		X							X		X							
Plumbeous Vireo													X						
Cassin's Vireo		X	X		X	X		X	X	X	X	X	X	X	X		X	X	
Hutton's Vireo	PO	X	X	X	X	X			X	X	X	X			X		X		
Warbling Vireo	CO	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
CORVIDAE																			
Steller's Jay									X						X				
Western Scrub-Jay	CO	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Yellow-billed Magpie	CO	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
American Crow	CO	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Common Raven	PR	X	X	X	X	X	X	X	X	X		X		X	X	X	X		
ALAUDIDAE																			
Horned Lark					X			X			X	X	X	X	X	X	X	X	
HIRUNDINIDAE																			
Purple Martin			X													X			
Tree Swallow	CO	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Violet-green Swallow		X	X		X			X	X	X	X			X					

TABLE 7.2 BIRD SPECIES DETECTED ALONG PUTAH CREEK AND SELECTED SITES IN THE YOLO-SUTTER BYPASS, 1997-2008																			
SPECIES NAME	Breeding Status	INTDM	DVDAM	OXBOW	DRYCK	WINTR	YOLOH	CLBL	RUSSR	STVBR	PICNC	OLDRR	MACEB	LOSRF	PUTCS	SACWR	FREWR	SUTBY	CCSB
Northern Rough-winged Swallow	CO	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Bank Swallow		X	X		X	X						X		X			X	X	
Cliff Swallow	CO	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Barn Swallow	CO	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
PARIDAE																			
Chestnut-backed Chickadee	CO		X	X	X	X	X	X	X	X	X								
Oak Titmouse	CO	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X
AEGITHALIDAE																			
Bushtit	CO	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
SITTIDAE																			
Red-breasted Nuthatch			X			X		X	X		X		X		X	X	X		
White-breasted Nuthatch	CO	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
CERTHIIDAE																			
Brown Creeper	CO	X	X							X									
TROGLODYTIDAE																			
Bewick's Wren	CO	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
House Wren	CO	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

TABLE 7.2 BIRD SPECIES DETECTED ALONG PUTAH CREEK AND SELECTED SITES IN THE YOLO-SUTTER BYPASS, 1997-2008																			
SPECIES NAME	Breeding Status	INTDM	DVDAM	OXBOW	DRYCK	WINTR	YOLOH	CLBL	RUSSR	STVBR	PICNC	OLDRR	MACEB	LOS RF	PUTCS	SACWR	FREWR	SUTBY	CCSB
Winter Wren		X			X				X		X			X			X		
Marsh Wren	PR		X		X	X								X		X			X
REGULIDAE																			
American Dipper		X																	
REGULIDAE																			
Golden-crowned Kinglet			X		X			X	X		X		X	X	X	X	X	X	X
Ruby-crowned Kinglet		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
SYLVIIDAE																			
Blue-gray Gnatcatcher	PR	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	
TURDIDAE																			
Western Bluebird	CO	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	
Mountain Bluebird																		X	
Swainson's Thrush		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Hermit Thrush		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
American Robin	CO	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Varied Thrush		X	X		X	X	X		X	X	X				X		X	X	
TIMALIIDAE																			

TABLE 7.2 BIRD SPECIES DETECTED ALONG PUTAH CREEK AND SELECTED SITES IN THE YOLO-SUTTER BYPASS, 1997-2008																			
SPECIES NAME	Breeding Status	INTDM	DVDAM	OXBOW	DRYCK	WINTR	YOLOH	CLBL	RUSSR	STVBR	PICNC	OLDRR	MACEB	LOS RF	PUTCS	SACWR	FREWR	SUTBY	CCSB
Wrentit	CO	X	X	X		X			X	X	X				X				
MIMIDAE																			
Northern Mockingbird	CO	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			
Sage Thrasher												X							
California Thrasher	PR		X	X															
STURNIDAE																			
European Starling	CO	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
MOTACILLIDAE																			
American Pipit		X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
BOMBYCILLIDAE																			
Cedar Waxwing		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
PTILOGONATIDAE																			
Phainopepla	PR	X	X	X	X	X	X		X	X									
PARULIDAE																			
Tennessee Warbler										X									
Orange-crowned Warbler	CO	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Nashville Warbler		X	X		X	X	X	X	X	X	X	X	X	X	X		X	X	X

TABLE 7.2 BIRD SPECIES DETECTED ALONG PUTAH CREEK AND SELECTED SITES IN THE YOLO-SUTTER BYPASS, 1997-2008																			
SPECIES NAME	Breeding Status	INTDM	DVDAM	OXBOW	DRYCK	WINTR	YOLOH	CLBL	RUSSR	STVBR	PICNC	OLDRR	MACEB	LOS RF	PUTCS	SACWR	FREWR	SUTBY	CCSB
Northern Parula													X						
Yellow Warbler	PR	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Chestnut-sided Warbler																X			
Yellow -rumped Warbler		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Yellow -rumped Warbler (Audubon's)		X	X	X	X	X	X	X	X	X	X	X	X	X	X				
Yellow -rumped Warbler (Myrtle)		X		X	X	X	X	X	X	X	X	X	X	X					
Black-throated Gray Warbler		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Black-throated Green Warbler												X							
Townsend's Warbler		X		X	X	X			X	X	X	X	X	X	X	X	X		
Hermit Warbler		X			X			X	X		X	X	X	X		X	X		
Blackpoll Warbler		X									X			X					
Black-and-white Warbler										X	X								
American Redstart												X							
Ovenbird													X						
Northern Waterthrush										X									
MacGillivray's Warbler		X	X	X	X	X	X	X	X	X		X		X		X	X	X	X
Common Yellowthroat	CO	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

TABLE 7.2 BIRD SPECIES DETECTED ALONG PUTAH CREEK AND SELECTED SITES IN THE YOLO-SUTTER BYPASS, 1997-2008																			
SPECIES NAME	Breeding Status	INTDM	DVDAM	OXBOW	DRYCK	WINTR	YOLOH	CLBL	RUSSR	STVBR	PICNC	OLDRR	MACEB	LOS RF	PUTCS	SACWR	FREWR	SUTBY	CCSB
Wilson's Warbler		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Yellow-breasted Chat	PR	X		X	X		X		X	X		X			X				
EMBERIZIDAE																			
Spotted Towhee	CO	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
California Towhee	CO	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Rufous-crowned Sparrow		X																	
Chipping Sparrow				X	X			X						X	X				
Brewer's Sparrow												X							
Lark Sparrow	CO	X	X	X	X		X						X	X	X	X	X	X	
Savannah Sparrow		X	X		X		X	X	X		X	X	X	X	X	X	X	X	
Grasshopper Sparrow												X	X						
Fox Sparrow		X	X	X	X	X	X	X	X	X	X	X		X	X	X	X		X
Song Sparrow	CO	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Lincoln's Sparrow		X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X
Swamp Sparrow														X					
White-throated Sparrow			X		X	X		X	X			X							
White-crowned Sparrow		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X

TABLE 7.2 BIRD SPECIES DETECTED ALONG PUTAH CREEK AND SELECTED SITES IN THE YOLO-SUTTER BYPASS, 1997-2008																			
SPECIES NAME	Breeding Status	INTDM	DVDAM	OXBOW	DRYCK	WINTR	YOLOH	CLBL	RUSSR	STVBR	PICNC	OLDRR	MACEB	LOS RF	PUTCS	SACWR	FREWR	SUTBY	CCSB
Golden-crowned Sparrow		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X
Dark-eyed Junco	CO	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X
CARDINALIDAE																			
Western Tanager		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Rose-breasted Grosbeak									X		X								
Black-headed Grosbeak	CO	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Blue Grosbeak	CO	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X
Lazuli Bunting	PR		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Indigo Bunting			X														X		
ICTERIDAE																			
Red-winged Blackbird	CO	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Tricolored Blackbird								X					X	X	X	X		X	
Western Meadowlark	PR	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X
Yellow-headed Blackbird													X	X	X		X		
Brewer's Blackbird	CO	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Great-tailed Grackle															X	X			
Brown-headed Cowbird	CO	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

TABLE 7.2 BIRD SPECIES DETECTED ALONG PUTAH CREEK AND SELECTED SITES IN THE YOLO-SUTTER BYPASS, 1997-2008																			
SPECIES NAME	Breeding Status	INTDM	DVDAM	OXBOW	DRYCK	WINTR	YOLOH	CLBL	RUSSR	STVBR	PICNC	OLDRR	MACEB	LOS RF	PUTCS	SACWR	FREWR	SUTBY	CCSB
Hooded Oriole	CO			X	X					X	X								
Bullock's Oriole	CO	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
FRINGILLIDAE																			
Purple Finch		X	X	X	X	X	X		X	X	X	X			X		X		
House Finch	CO	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Pine Siskin		X	X		X			X	X	X					X		X		
Lesser Goldfinch	CO	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Lawrence's Goldfinch					X				X	X	X	X	X	X					
American Goldfinch	CO	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Evening Grosbeak						X													
PASSERIDAE																			
House Sparrow	CO	X	X			X	X	X	X	X	X	X	X				X		
Data from point counts, transects, banding, and incidental surveys, 1997-2009. I = Introduced species. See annotated species list for discussion.																			

8 IMPRESSIONS

Over the years, Putah Creek has never ceased to impress us with its diversity and abundance of species, despite the fact that it is a highly altered riparian system surrounded by a vastly modified agricultural landscape. All of the California Partners in Flight Riparian Habitat Joint Venture bird species have been found on the creek; many are regulars; many breed here. The creek's wooded margins support important nesting and roosting sites for Swainson's Hawks and other imperiled species. In 1998, Putah Creek and environs were classified as a Nationally Important Bird Area by the National Audubon Society and the American Bird Conservancy based on its population of the endemic Yellow-billed Magpie. Putah Creek has also treated local birders to some exciting finds over the years, including Taiga Flycatcher, Eastern Phoebe, Plumbeous Vireo, Tennessee Warbler, Black-throated Green Warbler, Blackpoll Warbler, Black-and-white Warbler, American Redstart, Ovenbird, Bobolink, Baltimore Oriole, and Brewer's Sparrow. Bell's Vireo, a federal and state endangered species, is being seen more and more frequently. Putah Creek's waterways also host significant numbers of the Western Pond Turtle, a California Species of Special Concern. Another California Species of Special Concern, fall-run Chinook salmon, have spawned here in recent years.

Wooded, well-watered habitats function as important habitat refuges and stopover habitats for migrating wildlife in agricultural landscapes. Putah Creek flows west to east, jutting out into the Central Valley Flyway, a major migration corridor for waterfowl and other migratory birds. As such, Putah Creek tends to intercept migratory wildlife, providing rest and refueling opportunities for species traveling north and south along the Central Valley Flyway.

With its feet in the Coast Range, Putah Creek also functions as a dispersal corridor for wildlife traveling between mountain and lowland habitats. Besides birds, deer, and other animals, mountain lions, and bears have been seen. Foothill species often irrupt into the upper reaches of the creek, and Western Bluebirds are recolonizing the creek from upstream, using the boxes of the Putah Creek Nestbox Highway as waystations.

Riparian habitat quality and suitability for wildlife is not uniform across the creek. Some sites provide better habitat conditions for wildlife than others due to differences in vegetative cover, instream conditions, and surrounding land uses. Ongoing restoration projects aim to improve habitat conditions by removing trash and exotic vegetation, planting native species, and restoring the stream channel to a more natural hydrogeomorphology. Equally important will be efforts to improve conditions in surrounding landscapes, or, at least, to buffer the riparian environment from their negative effects. Projects that serve to widen the riparian vegetated corridor will be extremely effective in creating additional riparian habitat and buffering interior habitats from outside disturbances.

Habitat restoration projects usually involve noticeable short-term disturbances, but appreciable long-term improvements for wildlife and their habitats. The use of heavy equipment needed to remove large stands of exotic vegetation and to recontour floodplains can create a temporarily-denuded landscape that takes some getting used to. However, riparian habitats are quick to recover and within just a few years will be much improved structurally and functionally. Most restoration permits require that actions be performed during a season that limits disturbance to wildlife and remaining wildlife is generally able to relocate temporarily until habitats again become suitable, and hopefully better, for them.

While detailed results for individual taxonomic groups are presented in their relevant chapters, we can make some general statements and recommendations for restoration of wildlife habitat to benefit resident and visiting species in the lower Putah Creek corridor.

1. Wherever possible, help return the channel to normal form and function. Strive for improved hydrologic function and increased local habitat heterogeneity. Narrow the wetted channel and create shaded riverine aquatic cover.
2. Widen the vegetated riparian corridor by restoring upland habitats and create vegetated buffer zones between the riparian corridor and adjacent land uses, especially where a lack of vegetated cover creates “pinch points” in the riparian corridor. When creating upland habitats, consider the nesting needs of the Western Pond Turtle.
3. Continue weed eradication efforts.
 - These efforts should be staged to ensure that sufficient habitat remains for wildlife during the eradication process. Retain snags and large woody debris wherever possible.
4. Revegetate with native plant species and wildlife-friendly plants (see Table 2.3).
5. Protect water quality by limiting fine sediment inputs and intercepting nonpoint source pollution.
6. Expand the Putah Creek Nestbox Highway to include new sites and support new species.
 - This project provides valuable nesting habitat for cavity nesting birds, producing over 7000 fledglings of seven different species since its inception in 2000. This project is also serving to bring back populations of the Western Bluebird, an iconic species that was largely extirpated from the Central Valley due to habitat loss and competition with nonnative cavity nesters. Our data indicate that more boxes are needed, at more sites, to accommodate the growing numbers of birds who are turned away due to a lack of nesting habitat. Nest boxes for other species (owls, kestrels, bats, etc.) could also be installed.
7. Consider instituting a Brown-headed Cowbird trapping program.

- These programs have been shown to be effective in reducing populations of this avian brood parasite to numbers that enable native host species to resume successful breeding (Solomon 1998). However, cowbird trapping should be carefully considered and conducted in conjunction with surveys that address clearly-defined criteria and should not be performed in lieu of measures that improve overall habitat quality and availability (Kus and Whitfield 2005).
8. Institute bat surveys.
 9. Conduct a follow-up Breeding Bird Atlas effort to update status and trends for breeding birds.
 10. Examine the feasibility of establishing remote camera stations to establish status and trends for carnivores such as mink, fox, bear, and mountain lion.

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APPENDIX A1 GEOGRAPHIC COORDINATES FOR VEGETATION PLOTS

APPENDIX A.1 GEOGRAPHIC COORDINATES FOR VEGETATION RELEVÉ PLOTS

SITE	PLOT	NORTHING	EASTING	SITE	PLOT	NORTHING	EASTING
INTDM	1A	583561.5760	4262389.2490	MACEB SOUTH	1A	614486.8590	4264146.4030
	1B	583583.5140	4262404.3350		1B	614473.2420	4264120.2040
	1D	583603.1590	4262340.0880		1C	614459.2110	4264096.6310
	1E	583517.4960	4262429.9920		1D	614528.6320	4264102.3830
	2A	583411.3150	4262510.2600		1E	614453.8180	4264182.7030
	2B	583432.8750	4262532.4260		2A	614319.6340	4264259.7940
	2C	583449.1000	4262565.3160		2B	614317.3620	4264229.0380
	2D	583472.4160	4262485.6920		2C	614310.0200	4264203.1870
	2E	583381.5320	4262563.6990		2D	614351.0150	4264250.0440
	3A	583233.1240	4262620.0360		2E	614265.8670	4264262.8610
	3B	583247.0380	4262646.3790		3A	614132.4510	4264200.9500
	3C	583276.9510	4262661.3850		3B	614136.3510	4264170.4560
	3D	583316.2070	4262616.4620		3C	614137.9460	4264140.3490
	3E	583200.8290	4262668.4240		3D	614184.1540	4264238.1860
DVDAM	1A	587313.5410	4261471.7840	LOS RF	3E	614074.7940	4264177.1100
	1B	587331.3920	4261447.4670		4A	613943.7900	4264189.0770
	1C	587351.4260	4261423.5050		4B	613939.6070	4264159.1590
	1D	587363.7000	4261508.4020		4C	613935.2330	4264135.4290
	1E	587275.4990	4261428.7070		4D	614002.4010	4264168.1950
	2A	587201.7670	4261361.1190		4E	613888.2250	4264224.1510
	2B	587215.6520	4261336.5800		1A	618637.5150	4264070.0120
	2C	587236.7340	4261313.7810		1B	618650.8940	4264096.2880
	2D	587257.2420	4261392.9950		1D	618682.0210	4264042.4650
	2E	587159.2660	4261331.1990		1E	618586.3000	4264081.0220
	3A	587050.7280	4261220.7950		2A	618440.6440	4264083.8700
	3B	587065.1910	4261192.0270		2B	618442.5600	4264114.0650
	3D	587087.0590	4261270.3390		2D	618510.3850	4264092.0630
	3E	587005.2270	4261201.8840		2E	618389.9810	4264063.5630
	4A	586973.5530	4261162.9490	PUTCS	3A	618261.0320	4264012.6360
OXBOW	4B	586995.6420	4261142.9000		3B	618242.4010	4264036.6700
	4D	587005.2270	4261201.8840		3D	618310.9900	4264039.0940
	4E	586933.7000	4261113.8370		3E	618210.4570	4263990.0270
	1A	588451.2290	4262265.2460		4A	618086.2100	4263907.8200
	1B	588476.6640	4262270.3780		4B	618067.0090	4263921.0650
	1D	588454.8560	4262324.1740		4D	618135.4640	4263946.6620
	1E	588426.9450	4262202.6700		4E	618058.6700	4263853.0170
	2A	588313.8370	4262124.3700		1A	619796.4200	4263099.0960
	2B	588323.3110	4262108.1110		1D	619852.6070	4263112.6880
	2C	588350.2750	4262094.5580		1E	619743.0350	4263088.8600
	2D	588349.5910	4262146.2970		2A	619620.5570	4263249.8750
	2E	588246.9410	4262095.6020		2D	619622.4740	4263193.1130
	3A	588116.8190	4262037.1510		2E	619620.9590	4263313.2070
	3B	588123.8920	4262008.1230		3A	619555.0570	4263435.8020
	3C	588138.5780	4261982.4100		3D	619601.2770	4263390.5850
	3D	588168.5190	4262064.8740		3E	619500.3580	4263450.3700

APPENDIX A.1 GEOGRAPHIC COORDINATES FOR VEGETATION RELEVÉ PLOTS

SITE	PLOT	NORTHING	EASTING	SITE	PLOT	NORTHING	EASTING
DRYCK	3E	588069.2460	4261983.1960	SACWR	4A	619359.5590	4263521.7650
	1A	589520.8910	4263448.1480		4D	619396.5970	4263466.9970
	1B	589513.2240	4263478.0550		4E	619358.3730	4263583.3060
	1C	589493.4140	4263500.9980		1A	623667.7680	4273525.3480
	1D	589572.6250	4263488.7890		1B	623659.7630	4273557.2600
	1E	589476.3350	4263409.2580		1C	623658.4180	4273585.3250
	2A	589389.8280	4263310.4460		1D	623729.9020	4273561.3030
	2B	589380.1860	4263340.9160		1E	623617.6170	4273511.7760
	2C	589376.6510	4263370.0910		1F	623689.7010	4273509.8380
	2D	589440.0350	4263347.1410		1G	623699.8870	4273484.5210
	2E	589339.0410	4263277.5100		2A	623481.7910	4273475.6350
	3A	589288.3700	4263186.5940		2B	623469.2700	4273502.9430
	3C	589234.6660	4263209.6410		2C	623454.0890	4273527.1130
	3D	589288.0830	4263250.3440		2D	623427.6440	4273454.7910
WINTR	3E	589285.6280	4263126.7940		2E	623536.2740	4273494.1820
	1A	590599.2750	4264334.1160	FREWR	2F	623489.7690	4273442.8190
	1D	590659.8020	4264352.5700		2G	623491.3810	4273407.1210
	1E	590545.5210	4264323.1790		3A	623300.1180	4273407.3790
	2A	590321.2140	4264304.3880		3B	623297.2260	4273436.7570
	2B	590334.6030	4264281.4320		3C	623280.0510	4273468.1730
	2C	590348.7090	4264254.2290		3D	623240.2650	4273389.2100
	2D	590358.0490	4264347.8460		3E	623360.2000	4273434.1660
	2E	590285.8780	4264251.3250		3F	623311.9270	4273377.0190
	3A	590129.4980	4264130.6830		3G	623310.5250	4273346.9320
	3B	590152.5080	4264107.8050		1A	616204.7670	4291387.4960
	3D	590184.4370	4264168.2720		1E	616255.4950	4291382.2100
	3E	590071.8620	4264110.2870		1N	616210.6690	4291440.2780
	4A	589993.8660	4264012.6050		1S	616195.3940	4291328.6530
	4B	590008.5510	4263987.7830		1W	616143.3250	4291377.7430
YOLOH	4C	590027.8820	4263968.7810		2A	616144.1190	4291547.1390
	4D	590032.4110	4264041.2250		2E	616197.8260	4291562.0180
	4E	589955.6390	4263964.1520		2N	616162.1790	4291603.7700
	1A	592290.6100	4265570.0960		2S	616159.9500	4291484.0420
	1B	592278.2770	4265597.0520		2W	616096.1060	4291553.2660
	1E	592236.5050	4265539.6360		3A	616333.8740	4291594.0220
	2A	592155.0860	4265416.8190		3E	616388.0320	4291582.4650
	2B	592133.7040	4265437.9180		3N	616341.4730	4291659.0250
	2D	592194.0000	4265469.3780		3S	616319.4280	4291539.6930
	2E	592128.7860	4265361.7810		3W	616275.8700	4291618.4540
	3A	592074.1940	4265224.4410		4A	616329.1660	4291940.9150
	3B	592048.0860	4265239.0450		4E	616366.9720	4291931.5650
	3C	592022.2740	4265254.0920		4N	616320.5000	4291991.5910
	3E	592057.3990	4265164.1410		4S	616294.2190	4291877.1370
CLBL	1A	594355.5650	4265122.5970		4W	616260.6850	4291939.4040
	1B	594364.6950	4265093.2850		5A	616321.4780	4291773.7640
	1D	594413.1610	4265136.5180		5E	616375.3790	4291763.0290
	1E	594297.9110	4265108.4670		5N	616332.0890	4291846.1710
	2A	594158.2270	4265102.8120		5S	616282.4000	4291730.8490

APPENDIX A.1 GEOGRAPHIC COORDINATES FOR VEGETATION RELEVÉ PLOTS

SITE	PLOT	NORTHING	EASTING	SITE	PLOT	NORTHING	EASTING
RUSSR	2B	594157.3830	4265071.7310	FREWR NORTH	5W	616258.4840	4291800.9890
	2D	594218.0730	4265101.5280		6A	616510.8600	4291756.2280
	2E	594098.3370	4265110.7780		6E	616570.9660	4291756.5530
	3A	593961.0890	4265107.2890		6N	616522.5860	4291818.4260
	3B	593954.9850	4265077.2640		6S	616493.9230	4291702.7010
	3D	594021.8920	4265108.0610		6W	616449.4420	4291761.3480
	3E	593901.5630	4265110.4700		1A	616039.1180	4291358.2710
	4A	593760.0500	4265114.2860		1B	616067.5280	4291348.5310
	4D	593818.7550	4265111.4420		1C	616097.6970	4291340.3330
	4E	593702.9940	4265117.5560		1D	616070.9250	4291413.6470
	1A	599062.7090	4266177.5150		1E	616025.1010	4291298.9490
	1B	599056.6290	4266209.0250	FREWR SOUTH	2A	616095.7030	4291552.0880
	1C	599054.9330	4266236.2740		2B	616126.2440	4291552.2040
	1D	599107.4760	4266168.6170		2C	616152.5310	4291539.8760
	1E	599009.1930	4266158.2590		2D	616112.7070	4291609.0010
	2A	598795.1990	4266057.2410		2E	616083.5810	4291490.6990
	2B	598794.8700	4266086.1710		3A	616123.8470	4291747.8110
	2C	598795.6130	4266113.0680		3B	616151.5400	4291737.4120
	2D	598845.4760	4266063.3790		3C	616180.0440	4291727.3820
	2E	598734.8000	4266067.7810		3D	616126.6140	4291806.2030
	3A	598505.8830	4266141.4550		3E	616122.5240	4291686.3540
PICNC	3B	598506.8030	4266172.2510		4A	616163.7360	4291941.3970
	3C	598505.1120	4266202.5070		4B	616188.3280	4291923.5950
	3D	598557.3430	4266133.2240		4C	616212.4720	4291908.4340
	3E	598444.5860	4266165.0200		4D	616199.9090	4291983.8770
	4A	598316.5760	4266190.3860		4E	616141.5990	4291888.8820
	4B	598321.3250	4266212.5680	SUTBY	1A	616331.7490	4291185.1810
	4C	598324.8700	4266248.2720		1B	616322.8340	4291157.1820
	4D	598380.0260	4266183.8150		1C	616295.7960	4291139.8350
	4E	598253.6700	4266184.6930		1D	616378.0020	4291157.0520
	1A	605409.9560	4264784.2710		1E	616274.7870	4291164.7000
	1B	605420.7830	4264817.6390		2A	616430.2530	4291031.9620
	1C	605420.0830	4264846.0120		2B	616405.5460	4291017.8500
	1D	605462.0700	4264750.1830		2C	616371.1120	4291017.8910
	1E	605358.6310	4264819.8550		2D	616455.0930	4290969.2760
	2A	605166.1610	4264924.3080		2E	616405.8700	4291108.3630
	2B	605184.0990	4264948.6380		3A	616503.2490	4290777.6750
	2D	605219.5190	4264891.2480		3B	616464.1290	4290769.1210
	2E	605118.8220	4264960.9120		3C	616442.0230	4290768.6660
	3A	604872.9730	4265001.2260		3D	616524.3020	4290724.9350
	3B	604880.6330	4265030.5430		3E	616492.8940	4290842.4600
	3C	604891.3770	4265056.3280		1A	619505.4620	4293979.6860
	3D	604933.8410	4265002.3400		1D	619546.1920	4293929.0310
	3E	604818.2360	4265007.5360		1E	619462.4960	4294019.7730
	4A	604659.5490	4265029.2450		1F	619432.4060	4293965.3270
	4B	604656.9380	4265057.4400		1G	619404.2180	4293969.3650

APPENDIX A.1 GEOGRAPHIC COORDINATES FOR VEGETATION RELEVÉ PLOTS

SITE	PLOT	NORTHING	EASTING	SITE	PLOT	NORTHING	EASTING
OLDRR	4C	604654.1690	4265082.7880		2A	619375.6320	4294128.3940
	4D	604720.8540	4265022.9740		2B	619359.6930	4294101.6040
	4E	604596.4440	4265016.9980		2C	619331.5840	4294087.1480
	1A	608475.0750	4263950.7390		2D	619411.4350	4294079.7050
	1B	608479.2130	4263990.6850		2E	619337.4570	4294171.7510
	1C	608480.2130	4264020.4680		2F	619284.5900	4294098.1320
	1D	608537.5100	4263968.8490		2G	619255.7040	4294088.5400
	1E	608418.8970	4263954.1470		2H	619226.4290	4294079.4840
	2A	608173.0650	4263903.7920		3A	619255.6810	4294278.1020
	2B	608179.3160	4263925.9050		3B	619224.9440	4294278.4980
	2C	608186.4370	4263952.7940		3C	619191.8240	4294270.0880
	2D	608244.8050	4263891.0660		3D	619282.2330	4294230.0450
	2E	608116.1470	4263927.4350		3E	619214.1600	4294334.0650
	3A	607990.8220	4263994.2160		3F	619163.4810	4294281.6120
	3B	607979.7130	4264020.2630		3G	619132.4020	4294281.5050
	3C	607988.2140	4264048.9560		4A	619139.5450	4294437.2010
	3D	608038.9340	4263964.4990		4B	619107.3770	4294422.3200
	3E	607922.0410	4263995.6710		4C	619082.3590	4294409.1120
	4A	607693.2330	4263966.3980		4D	619169.3580	4294388.5790
	4B	607682.4080	4264006.1440		4E	619098.6610	4294490.1300
MACEB	4C	607678.2830	4264034.6670				
	4D	607760.3620	4263983.3760				
	4E	607626.4270	4263960.1430				
	5A	607374.8720	4263952.6030				
	5D	607454.9090	4263948.9120				
	5E	607312.5670	4263959.5100				
	1A	614553.0360	4264157.5660				
	1B	614554.9980	4264186.7340				
	1C	614560.7070	4264217.2800				
	1E	614507.1950	4264199.6910				
	2A	614408.8730	4264268.9960				
	2B	614420.4880	4264299.5320				
	2C	614425.9900	4264325.8460				
	2D	614456.3040	4264238.9690				
	2E	614354.1870	4264286.8390				
	3A	614253.1050	4264295.6030				
	3B	614251.2810	4264326.0050				
	3D	614311.1670	4264293.0910				
	3E	614205.4180	4264286.4370				
	4A	614097.4460	4264249.3760				
	4B	614090.1320	4264278.2630				
	4C	614090.5850	4264307.0550				
	4D	614144.1970	4264271.8020				
	4E	614032.6110	4264247.9350				
	5A	613793.1420	4264248.7510				
	5B	613785.2900	4264275.9780				
	5C	613786.8840	4264306.4440				
	5D	613852.1290	4264286.2770				

APPENDIX A2 GEOGRAPHIC COORDINATES FOR BIRD TRANSECTS

APPENDIX A.2 GEOGRAPHIC COORDINATES FOR BIRD TRANSECTS

SITE	SEGMENT	NORTHING	EASTING	SITE	SEGMENT	NORTHING	EASTING
INTDM	T0	583332.0000	4262629.0000	OLDDR	T0	607962.0777	4263997.2943
	T100	583235.0000	4262629.0000		T100	607850.8331	4264004.5494
	T200	583173.0000	4262697.0000		T200	607744.0000	4263993.0000
	T300	583106.0000	4262778.0000		T300	607641.0000	4263977.9999
	T400	583049.0000	4262848.0000		T400	607544.0000	4263967.0000
	T500	582978.0000	4262918.0000		T500	607454.0000	4263966.0000
DVDAM	T0	587386.0000	4261469.0000	MACEB	T0	614553.0000	4264161.9999
	T100	587324.0000	4261392.0000		T100	614501.0000	4264216.9999
	T200	587233.0000	4261350.0000		T200	614412.0000	4264281.9999
	T300	587144.0000	4261305.0000		T300	614306.0000	4264303.9999
	T400	587089.0000	4261220.0000		T400	614202.0000	4264298.9999
	T500	586987.0000	4261186.0000		T500	614111.7329	4264278.0367
OXBOW	T0	588529.0000	4262336.0000	LOS RF	T0	618635.0000	4264082.0000
	T45	588489.0000	4262337.0000		T100	618537.0000	4264099.0000
	T100	588451.0000	4262281.0000		T200	618441.0000	4264080.0000
	T200	588447.0000	4262153.0000		T300	618345.0000	4264057.0000
	T300	588403.0000	4262057.0000		T400	618251.0000	4264026.0000
	T400	588340.0000	4261981.0000		T500	618170.0000	4263972.0000
T500		588274.0000	4261906.0000	PUTCS	T0	619626.0000	4263195.0000
	T0	589525.0000	4263454.0000		T100	619626.0000	4263285.0000
	T100	589480.0000	4263393.0000		T200	619615.0000	4263380.0000
	T200	589443.0000	4263340.0000		T300	619546.0000	4263444.0000
	T300	589373.0000	4263313.0000		T400	619455.0000	4263462.0000
	T400	589313.0000	4263254.0000		T500	619367.0000	4263495.0000
T500		589288.0000	4263181.0000	SACWR	T0	623676.0000	4273540.0000
	T0	590607.8796	4264334.9306		T100	623579.0000	4273513.0000
	T100	590513.0000	4264300.0000		T200	623486.0000	4273480.0000
	T200	590415.1181	4264329.3433		T300	623391.0000	4273445.0000
	T300	590327.1183	4264277.6609		T400	623298.0000	4273410.0000
	T400	590237.7217	4264188.2643		T500	623202.0000	4273375.0000
T500		590123.1823	4264108.6454	FREWR NORTH	T0	616075.0000	4291418.0000
	T0	592283.0000	4265579.0000		T100	616086.0000	4291523.0000
	T100	592202.0000	4265523.0000		T200	616113.5748	4291626.8217
	T200	592160.0000	4265432.0000		T300	616131.0000	4291724.0000
	T300	592119.0000	4265340.0000		T400	616194.0000	4291807.0000
	T400	592075.0000	4265250.0000		T500	616233.0000	4291889.0000
T500		592055.0000	4265151.0000	FREWR SOUTH	T0	616297.0000	4291134.0000
	T0	594272.0000	4265074.0000		T100	616341.0000	4291043.0000
	T100	594166.0000	4265106.0000		T200	616419.0000	4290978.0000
	T200	594071.0000	4265109.0000		T300	616466.0000	4290887.0000
	T300	593961.0000	4265090.0000		T400	616477.0000	4290776.0000
	T400	593864.0000	4265098.0000		T500	616498.0000	4290676.0000
T500		593779.0000	4265107.0000	SUTBY	T0	619530.0000	4293971.0000
	T0	598849.0000	4266110.0000		T100	619441.0000	4294020.0000

APPENDIX A.2 GEOGRAPHIC COORDINATES FOR BIRD TRANSECTS

SITE	SEGMENT	NORTHING	EASTING	SITE	SEGMENT	NORTHING	EASTING
STVBE	T100	598767.0000	4266111.0000	CCSB SOUTH	T200	619389.0000	4294109.0000
	T200	598658.0000	4266116.0000		T300	619324.0000	4294187.0000
	T300	598571.0000	4266142.0000		T400	619214.0000	4294237.0000
	T400	598472.0739	4266152.8926		T500	619166.0000	4294318.0000
	T472	598403.6997	4266183.2811		T0	611627.0000	4283824.0000
	T500	598324.0000	4266194.0000		T100	611634.0000	4283923.0000
	T0	601604.0000	4265326.0000		T200	611639.0000	4284024.0000
	T100	601516.0000	4265381.0000		T300	611642.0000	4284122.0000
	T200	601427.0000	4265429.0000		T400	611638.0000	4284222.0000
	T300	601336.0000	4265471.0000		T500	611641.0000	4284319.0000
PICNC	T400	601273.0000	4265554.0000	CCSB NORTH	T0	611648.0000	4284581.0000
	T500	601170.0000	4265598.0000		T100	611667.0000	4284679.0000
	T0	604970.0000	4265036.0000		T200	611659.0000	4284778.0000
	T100	604873.9285	4265048.0072		T300	611671.0000	4284879.0000
	T200	604788.0000	4265062.0000		T400	611662.0000	4284977.0000
	T300	604689.0000	4265058.0000		T500	611666.0000	4285076.0000
	T400	604585.0000	4265039.0000				
	T500	604486.0000	4265027.0000				

APPENDIX A3 GEOGRAPHIC COORDINATES AVIAN POINT COUNT STATIONS

APPENDIX A.3 GEOGRAPHIC COORDINATES FOR AVIAN POINT COUNT STATIONS

SITE	POINT COUNT STATION	NORTHING	EASTING	SITE	POINT COUNT STATION	NORTHING	EASTING
INTDM	1	583561.5760	4262389.2490	MACEB	1	614556.8894	4264159.1538
	2	583411.3150	4262510.2600		2	614413.5023	4264274.9970
	3	583247.0380	4262646.3790		3	614204.1841	4264291.0657
	4	583166.4373	4262714.7963		4	614029.4354	4264244.5188
	5	582946.5106	4262943.8364		5	613793.6203	4264248.9095
DVDAM	1	587313.5410	4261471.7840	LOS RF	1	618635.8964	4264064.2505
	2	587159.2660	4261331.1990		2	618442.7880	4264089.9757
	3	587005.2270	4261201.8840		3	618255.7980	4264018.1485
	4	586973.5530	4261162.9490		4	618084.3309	4263908.4470
OXBOW	1	588451.2290	4262265.2460	PUTCS	1	619794.0578	4263099.0294
	2	588313.8370	4262124.3700		2	619620.0784	4263251.8364
	3	588116.8190	4262037.1510		3	619553.1956	4263438.9913
	4	588274.0000	4261916.0000		4	619356.8708	4263522.4027
DRYCK	1	589520.8910	4263448.1480	SACWR	1	623689.7010	4273509.8380
	2	589389.8280	4263310.4460		2	623484.0000	4273474.0000
	3	589288.3700	4263186.5940		3	623287.0000	4273406.0000
WINTR	1	590611.4292	4264311.4458		4	623044.0835	4273315.2427
	2	590358.0490	4264347.8460	FREWR	1	616197.0000	4291389.0000
	3	590184.4370	4264168.2720		2	616145.0000	4291551.0000
	4	590032.4110	4264041.2250		3	616331.0000	4291600.0000
YOLOH	1	592290.6100	4265570.0960		4	616316.0000	4291784.0000
	2	592155.0860	4265416.8190	FRWTN	5	616316.0000	4291940.0000
	3	592074.1940	4265224.4410		6	616509.0000	4291760.0000
CLBL	1	594355.5650	4265122.5970		1	616039.1180	4291358.2710
	2	594158.2270	4265102.8120		2	616095.7030	4291552.0880
	3	593961.0890	4265107.2890		3	616123.8470	4291747.8110
	4	593760.0500	4265114.2860		4	616163.7360	4291941.3970
RUSSR	1	599062.7090	4266177.5150	SUTBY	1	619432.0000	4293965.0000
	2	598795.1990	4266057.2410		2	619278.0000	4294085.0000
	3	598505.8830	4266141.4550		3	619190.0000	4294277.0000
	4	598316.5760	4266190.3860		4	619118.0000	4294438.0000
STVBR	1	601603.7010	4265334.9150	CCSB	1	611627.0000	4283824.0000
	2	601429.3290	4265438.7850		2	611639.0000	4284024.0000
	3	601269.3600	4265547.2290		3	611638.0000	4284222.0000
	4	601092.5898	4265641.3158		4	611648.0000	4284581.0000
PICNC	1	605405.4014	4264786.7981		5	611659.0000	4284778.0000
	2	605172.5435	4264924.8452		6	611662.0000	4284977.0000
	3	604884.0000	4265035.0000				
	4	604659.1105	4265019.8455				
OLDDR	1	608475.0750	4263950.7392				
	2	608173.0649	4263903.7918				
	3	607990.8218	4263994.2159				
	4	607693.2326	4263966.3983				
	5	607374.8722	4263952.6033				