The Distribution, Abundance, and Habitat Associations of the Swainson's Hawk *(Buteo swainsoni)* in the City of Elk Grove, California

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CITY OF ELK GROVE CALIFORNIA

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Executive Summary

The Swainson's Hawk (*Buteo swainsoni*) is a state-listed threatened species in California that occurs throughout much of the Central Valley. The City of Elk Grove (City) is within the region of the Central Valley – which includes Sacramento, Yolo, Solano, and San Joaquin Counties – that supports the largest concentration of nesting Swainson's Hawks in the state. Associated with large, open grassland and agricultural landscapes, the Swainson's Hawk is closely tied to an agricultural pattern in the Central Valley that provides high value foraging opportunities. This pattern, an agricultural landscape matrix of hay, grain, and row crops; irrigated pasture; and grazed annual grasslands is characteristic of this region.

The City has been actively developing a conservation strategy for the Swainson's Hawk in response to continuing urbanization and the resulting loss of high value agricultural habitats needed to sustain nesting populations – as well as the need for compliance with California Department of Fish and Game (DFG) habitat protection guidelines. The City instituted an ordinance in 2003 that requires mitigation for losses of Swainson's Hawk habitat due to urbanization. Conservation is achieved through selection of appropriate replacement lands and through management of suitable habitat values on those lands in perpetuity. With the assistance of DFG, the City has taken a landscape approach in their conservation strategy by using various habitat suitability and proximity criteria in the selection of potential conservation sites in an effort to provide meaningful conservation through consolidation of protected habitats and protection of landscape values that focus on sustainability of the breeding population.

In order to evaluate potential conservation lands in the context of a landscape approach to Swainson's Hawk population sustainability, the City recognized the need for a comprehensive baseline survey of the nesting population in South Sacramento County. In 2006, the baseline survey was conducted to provide the City with a more complete understanding of the distribution and abundance of the Swainson's Hawk in south Sacramento County and to further assist the City in establishing criteria for conservation site selection and approval. However, the study area for the baseline survey did not include lands within the city limits of Elk Grove.

As the City continues to implement its General Plan, information on Swainson's hawk distribution and abundance within the city limit boundary would be useful in assessing the effects on continued urbanization of remaining open space lands and exploring additional conservation opportunities. Thus, to provide additional information on Swainson's hawk nesting distribution and abundance within the city limit boundary, a survey was conducted in 2008, the results of which are presented in this report.

The study area for this survey and assessment was defined as all lands within the Elk Grove city limit boundary. A total of 14 active Swainson's Hawk breeding territories were documented within this 26,974-acre area, equating to a territory density of 0.33

breeding territories per square mile and 0.67 breeding territories per square mile of undeveloped land. Of these, 13 (92.9%) were confirmed to have nested, and of the active nests, 11 (84.6%) successfully reared young to fledging. One pair failed to produce young and the reproductive outcome of one pair was undetermined.

Approximately 88 percent of the study area was urbanized and approximately 22 percent remained open agricultural land or uncultivated grasslands, all of which was considered suitable Swainson's hawk foraging habitat. Agricultural lands consisted of annually rotated irrigated croplands, hayfields, and irrigated pastures. These types were combined into a single land use type – irrigated cropland/irrigated pastureland. Four land use types were defined within the study area, 1) high density urban, 2) low density urban, 3) irrigated cropland/irrigated pastureland, and 4) uncultivated grassland.

Twelve of the nest site locations (85.7%) were associated with the irrigated cropland/irrigated pastureland type and two (14.3%) were associated with uncultivated grasslands. This is consistent with other studies, including the South Sacramento County baseline survey and assessment. However, the size and configuration of remaining suitable habitat patches and the extent of fragmentation were probably greater influences on the distribution and abundance in the study area than the differing foraging values between irrigated lands and annual grasslands.

Due to the distribution of available habitat within the study area, all nesting sites were in close proximity to urban areas. All but one site was within 0.25 miles of urban areas, and many were immediately adjacent to urban areas, mostly newly developed residential neighborhoods. The majority of nest trees (42.9%) were along roadsides, either remnant mature valley oak trees retained for landscaping or eucalyptus trees planted for windbreaks or visual barriers. Others were associated with rural residences (14.3%), riparian habitat (14.3%), farmyards (7.1%), oak groves (7.1%), or isolated trees (7.1%). Eucalyptus was the most frequently used nest tree (42.9%) followed by valley oak (35.7%). The remaining nest trees included walnut, willow, and locust. A total of 15 fledged young were recorded equating to 1.36 young per successful nest, which is generally consistent with other past and ongoing studies of Swainson's hawk in the Central Valley.

While Swainson's hawks were distributed throughout most of the remaining open habitats in the study area, the majority (71.4%) were found within the largest remaining open space area between State Route 99 and Bruceville Road in the south-central portion of the study area. This area remains contiguous with open agricultural lands south of the city limit line and retains high value for Swainson's hawks due to the size, agricultural land use, availability of nesting habitat, and proximity to open agricultural landscapes to the south. Other suitable habitats within the study area are smaller, more fragmented, and subject to higher levels of human disturbances, and thus have less long-term conservation value.

1.0 Introduction

1.1 Historical Background

1.1.1 Statewide

The Swainson's hawk (*Buteo swainsoni*) (Plate 1-1) is a state-listed threatened species in California that occurs throughout much of the Central Valley. Reliant on certain types of agricultural land uses and remaining uncultivated grasslands, the largest remaining populations occur in the rapidly urbanizing region that includes Yolo, Solano, Sacramento, and San Joaquin Counties. Because of the inherent conflicts between urbanization, the preservation of agricultural and valley grassland habitats, and compliance with state laws and regulations, addressing land use-related impacts that affect the Swainson's hawk continues to be a key issue for land use decision-making in the Central Valley.

Plate 1-1. Adult Swainson's hawk

In 1994, the California Department of Fish and Game (DFG) took an initial step in addressing the issue of habitat conservation for Swainson's hawks by issuing guidelines for mitigating development-related impacts (California Department of Fish and Game 1994). Since then, the DFG Swainson's Hawk Mitigation Guidelines have been used by local agencies as a method to mitigate habitat impacts on individual development projects

pursuant to the California Environmental Quality Act (CEQA). In an attempt to standardize mitigation costs for impacts to Swainson's hawk habitat and consolidate conservation efforts, some local agencies including the City of Elk Grove, established local ordinances or similar programs that required payment of mitigation fees. The fees are applied to all development projects that would remove Swainson's hawk habitat and used to compensate for this loss through acquisition and management of offsite lands.

Concurrent with these activities, larger regional habitat conservation plans were also being considered or developed for lands within the range of the Swainson's hawk. Driven by the presence of federally listed species, habitat conservation plans (HCPs) are prepared pursuant to Section 10 of the federal Endangered Species Act under consultation with the U.S. Fish and Wildlife Service. State-listed species can be included as 'covered' species in HCPs under agreement and permit authorization of DFG (Section 2081 or 2080.1 of DFG Code). At the state level, Natural Community Conservation Plans (NCCPs) can also be prepared pursuant to Fish and Game Code (Sections 2800-2835) to provide a means of complying with the California endangered species act (CESA). An NCCP is similar to an HCP in that it is designed to protect and conserve intact natural landscapes and biological communities, biological diversity, and species listed under CESA while allowing appropriate development and economic growth. The HCP and NCCP processes can provide a more regional approach to addressing impacts and mitigation and potentially allowing for consolidation of conservation lands and a greater potential for conservation at a regional population level. Several multispecies HCPs have either been completed (e.g., Natomas Basin, San Joaquin County) or are in preparation (e.g., South Sacramento County) and several others are in progress that combine the HCP and NCCP processes (e.g., Yolo County, Solano County, Butte County) within the range of the Central Valley population of Swainson's hawk.

1.1.2 City of Elk Grove

With the incorporation of the City of Elk Grove in 2001, lands within the jurisdiction of the new city were no longer subject to the Sacramento County Swainson's Hawk ordinance. In 2003, the City of Elk Grove established their own City ordinance, began collecting mitigation fees, and began to formulate strategies to mitigate development-related impacts on Swainson's Hawk. While there is no conservation plan in place to direct or consolidate conservation efforts, the City took the preliminary steps to require developers to either pay fees or acquire mitigation lands within a specified area of the county. This mitigation 'receiving' area was designed to ensure compliance with provisions of CEQA that require a nexus between impacts and mitigation, and to begin to consolidate conservation lands in order to address issues of habitat connectivity and regional population stability.

To further support the City's efforts in the selection of appropriate conservation lands, a GIS-based model was developed that modeled Swainson's Hawk habitat suitability in south Sacramento County (Jones & Stokes 2005a). The model identified and ranked all areas of south Sacramento County with respect to their suitability for potential conservation based on several model variables. One element of the model was the

current nesting distribution of Swainson's Hawk within the study area. Because the model was sensitive to the locations of active nest sites, inaccuracies in the nesting distribution could result in some areas potentially devalued and thus not considered for conservation.

This, along with the interest on the part of the City, Sacramento County, and DFG to have an accurate baseline nesting distribution of Swainson's Hawks in south Sacramento County resulted in the City's funding of a 2006 baseline survey and habitat assessment for South Sacramento County (Estep 2007a). The City has also undertaken continued monitoring of this population by funding the monitoring of selected portions of the South Sacramento study area during the 2008 breeding season.

In 2008, the City also funded a Swainson's hawk nesting survey within the City of Elk Grove city limits, an area that was not previously included within the South Sacramento County study area. The results of that survey are the focus of this report.

1.2 Regulatory Background

The Swainson's hawk was listed as a state-threatened species by the California Fish and Game Commission in 1983 largely as a result of a statewide survey conducted in the late 1970s that estimated a population decline of greater than 90% (Bloom 1980). Species that are listed as threatened or endangered receive protection under the provisions of the California Endangered Species Act (CESA) (Section 2050 of the Fish and Game Code), and related Fish and Game Code Sections, including Section 2080 that prohibits the "take" of any threatened or endangered species. Take is defined in Section 86 as "hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill."

While not specifically defined in the definition of take, loss of essential habitat can result in the direct or indirect loss of breeding territories and reproductive potential leading to further population declines, and thus can potentially be included in the definition of take. However, most habitat-related impacts on the Swainson's hawk are addressed through CEQA.

CEQA defines the significance of an impact on a state-listed species based on the following:

- Appendix G of the State CEQA guidelines states that a biological resource impact is considered significant (before considering offsetting mitigation measures) if the lead agency determines that project implementation would result in "substantial adverse effects, either directly or through habitat modifications, on any species identified as being a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by CDFG or USFWS"; and

- CEQA Section 15065 (Mandatory Findings of Significance), a biological resource impact is considered significant if the project has the potential to "substantially

reduce the number or restrict the range of an endangered, rare or threatened species".

It has been pursuant to both the CESA and CEQA processes that mitigation and management, including the development of regional strategies, have been developed to address land use issues related to Swainson's hawk conservation.

1.3 Purpose

The purpose of this study is several-fold and includes:

- Determining the distribution and abundance of the Swainson's hawk in the City of Elk Grove.
- Determining nesting and foraging habitat associations of Swainson's hawk in the City of Elk Grove.
- Determining the reproductive performance of Swainson's hawks in the City of Elk Grove.
- Providing additional baseline information to assist the City of Elk Grove in the development of their Swainson's hawk conservation strategy.

2.0 Monitoring and Management of Swainson's Hawk Populations in the Central Valley

2.1 Monitoring of Populations

Data have been collected on the distribution and abundance of Swainson's hawk in the Central Valley since the late 1970s. Bloom (1980) conducted the initial statewide survey that described a 90% reduction in the historic population and led to the state-listing of the species. At this time, the statewide estimate of breeding pairs was 375. Beginning in the early 1980s, long-term monitoring of selected survey sites was conducted to assess population trends. In 1988, DFG conducted a second and more intensive statewide survey, which recalibrated the statewide estimate to 550 breeding pairs. Neither the initial Bloom (1980) or 1988 statewide surveys were conducted using a standardized survey protocol that would lend itself to statistical analysis sufficient to reliably estimate population size. Thus, it was acknowledged that these early statewide estimates were not necessarily an accurate estimate of the statewide population and were cautiously used to describe the status of the species. The survey efforts were, however, important in establishing the current distribution of the species in California.

Since the mid-1980s, several survey and long-term monitoring efforts have been conducted in the Central Valley, particularly in Yolo, Solano, Sacramento, and San Joaquin Counties. These studies have provided additional information on distribution and abundance of the species, as well as providing additional life history data on the Central Valley population. Some of these efforts are listed below in Table 1.

As a result of these efforts and the increasing understanding of Swainson's hawk distribution and abundance in the Central Valley, but in the absence of any statistically-based analysis, the Swainson's Hawk Technical Advisory Committee (TAC) – an ad hoc group of researchers that conducts and facilitates research on the Swainson's hawk and advises DFG and local jurisdictions regarding Swainson's hawk ecology – provided a new estimated population range. In 2001 the TAC conservatively estimated that there were between 700 and 1,000 breeding pairs in the state with approximately 90% of these in the Central Valley.

In an effort to more conclusively estimate the population size, DFG and the TAC began a comprehensive, standardized, statistically-based statewide survey effort in 2005 (Anderson et al. 2007). Using a standardized sampling approach across the current range of the species in California, this two-year study estimates the current population at 2,081 breeding pairs (SE = 157.1 at 95% CI), 1,948 (94%) of which are estimated to occur in the Central Valley (Anderson et al. 2007). This is considered the most reliable estimate

to date and is thought to more accurately reflect the total number of breeding pairs in the Central Valley and throughout California.

Table 2-1. Survey and Monitoring Studies of Swainson's Hawks in the Central Valley.

Location	Date	Purpose	Reference
Statewide	1980	Statewide survey to estimate population	Bloom 1980
Yolo, Sacramento, and San Joaquin Counties	1984 - 1988	Selected survey blocks to examine population trends	DFG 1984, 1985, 1986, 1987, 1988
Yolo, Sacramento, and San Joaquin Counties	1987-89	Biology, movements, habitat relationships	Estep 1989
Yolo County	1986-2007	Long-term population monitoring	Estep *in preparation*
Statewide	1988	Statewide survey to estimate population	DFG 1988
San Joaquin County	1990	Development of county-wide conservation plan	Jones & Stokes 1990
Yolo County	1995	Home ranges and habitat associations/use	Babcock 1995
Yolo, Sacramento, and San Joaquin Counties	1995	Nest site selection and reproduction of urban nesting population	England et al. 1995
City of Stockton	1990s	Monitoring of urban nesting population	Holt unpublished reports
UC Davis campus – Putah Creek	1990s	Monitoring of local UC Davis population	England, Maurer unpublished data
Sacramento-San Joaquin Delta	2000s	Monitoring/impact avoidance associated with DWR projects.	Bradbury – unpublished agency reports
Natomas Basin, northern Sacramento and southern Sutter Counties	1999-2006	Compliance biological monitoring for Natomas Basin HCP	Swainson's Hawk TAC 1999, 2000, 2001, Estep 2002, 2003, Jones & Stokes 2004, 2005, 2006
Multi-county survey	2002 - 2003	Distribution/abundance surveys – estimate regional population	Gifford et al. 2004
Northeastern San Joaquin County	2002-2004	Habitat use study	Swolsgard 2004
Statewide	2005-06	Statewide survey to estimate population.	Anderson et al. 2007
South Sacramento County	2006	South Sacramento County baseline surveys	Estep 2007a, 2007b
Yolo County	2007	Yolo County baseline surveys	Estep 2008

The extent to which this revised statewide estimate reflects simply a more accurate estimation or whether it may represent an increasing population since the early 1980s is unclear. However, a long-term population study in Yolo County from 1986 to 2007 indicates that following an initial increase in population in the late-1980s – which could be attributed to refined survey technique and increased survey experience – this population remained relatively stable from the late 1980s to present (Estep *in preparation*), suggesting that the current higher statewide estimate may be primarily due to more reliable estimation techniques.

While the current estimate is higher than the original statewide estimate that led to the state listing of the species (Bloom 1980) and subsequent estimates through the 1980s and 1990s, it cannot be reliably used to measure trends. It does, however, continue to represent a substantial decline (50-90%) of the historic statewide breeding population in California (Bloom 1980).

2.2 Population Declines and Management Issues

Initial population declines of Swainson's hawk in California were attributed to loss of habitat from urbanization and conversion of native habitats to agriculture. Urbanization, agricultural conversion, channelization of watercourses and other factors have reduced the extent of nesting habitat (e.g., riparian forests, oak woodland) and foraging habitat, primarily native grasslands. As a result, the species is no longer found in southern California (with the exception of a few known nest sites in the Mojave Desert) or in coastal valleys. The species has persisted, however, in much of the Central Valley, particularly in the southern Sacramento and northern San Joaquin Valleys. While intensively farmed for over 100 years, much of this area retains a relative abundance of nesting habitat – narrow riparian corridors along rivers and streams, remnant oak groves and trees, roadside trees – and an agricultural pattern that is conducive to Swainson's hawk foraging. Thus, the species is relatively common in the central portion of the Central Valley and perhaps on a local basis - even more common than it was historically.

However, this area appears to support a disproportionate percentage of the Central Valley population. While the breeding range extends to the northern and southern extent of the Central Valley, the majority of the population resides between Stanislaus County on the south and Butte County on the north. Within this area, the largest number of breeding pairs and the highest breeding densities are found in Yolo, Sacramento, Solano, and San Joaquin Counties (Anderson et al. 2007).

Each of these counties has also been subject to the largest amount of urban growth relative to the rest of the Central Valley. This has clear implications related to conflicts between urban expansion and sustainability of the Swainson's hawk population.

Within this 'effective' range of the Swainson's hawk in the Central Valley, there are two primary issues that influence management and long-term sustainability of the species, 1) permanent loss of habitat from continuing urbanization; and 2) temporary, but long term loss of habitat from conversion to unsuitable crop patterns, such as vineyards. In addition, there are other issues that can influence management of this species, including:

- difficulty managing a species that occurs almost entirely on private lands;
- loss and lack of regeneration of valley oak and other native trees;
- loss of riparian vegetation from levee projects, agricultural practices, and local development along watercourses; and
- conflicts with management of other species with different habitat needs.

2.3 Current Management Strategies

2.3.1 Regional Conservation Plans

Because the Swainson's hawk occurs across large agricultural landscapes in the Central Valley, regional conservation planning designed to accommodate both urban growth and habitat conservation was initially explored as a concept that could be developed and implemented by local agencies (Estep and Teresa 1992). Until relatively recently, the state endangered species act relied on the preparation of management agreements and issuance of a 2081 permit, which authorizes take under the state endangered species act but does not necessarily address conservation issues at a landscape level. However, with several federally listed species also occurring within the range of the Swainson's hawk, local agencies also found a need for a federal incidental take permit through the development of HCPs pursuant to Section 10 of the federal endangered species act. Thus, in some cases (e.g,. Natomas Basin HCP) the HCP was the supporting document for both the Section 10(a)(1)(B) permit, authorizing take under the federal endangered species act, and the Section 2081 permit, authorizing take under the state endangered species permit. More recently, the state's NCCP process has also provided local agencies a means of addressing conservation of habitats and sensitive species at a landscape level. Several cities and counties have or are undergoing the development of multi-species HCPs and/or NCCPs with the intent of planning for both urban development and protection of resources, including Swainson's hawk habitat. Table 2 lists the HCPs and HCP/NCCPs that are permitted or in plan development within this geographic area.

Table 2-2. Local HCPs/NCCPs completed or in progress.

Plan	Geographic Area	Status
Natomas Basin HCP	Natomas Basin (portions of Sacramento and Sutter County)	10a(1)(B) permit re-issued in 2003
San Joaquin County HCP	San Joaquin County	10a(1)(B) permit issued in 2001
Yolo County HCP/NCCP (Yolo County Natural Heritage Program)	Yolo County	In Plan Development
South Sacramento County HCP	South Sacramento County, south of Highway 50, not including Delta	In Review
Solano County HCP/NCCP	Solano County	In Review
Contra Costa County HCP/NCCP	Contra Costa County (includes western edge of Central Valley and Swainson's hawk range)	10a(1)(B) permit issued in 2007
Butte County HCP/NCCP	Western Butte County	In Plan Development
Placer County HCP/NCCP (Placer County Conservation Plan)	Western Placer County	In Plan Development
Yuba/Sutter HCP/NCCP	Eastern Sutter County, western Yuba County	In Plan Development

2.3.2 DFG Guidelines

In 1994, DFG issued guidelines for assessing and mitigating impacts on Swainson's hawk for use by local agencies during CEQA review. These guidelines (California Department of Fish and Game 1994) have been referred to extensively throughout DFG's Region 2 as a means for local agencies to mitigate impacts on Swainson's hawk. The guidelines rely on a compensation ratio for loss of foraging habitat based on proximity to known nest sites. While not unreasonable in concept, application of the guidelines is problematic for two main reasons: 1) acquiring suitable compensation land with approval of DFG is uncertain due to escalating land values, the difficulties establishing conservation easements on agricultural lands, and responsibility for long-term management; and 2) the guidelines do not provide an approach to consolidation of compensation lands potentially reducing their value over the long term as neighboring land uses change.

2.3.3 Mitigation Banking

To some extent, mitigation banking has helped to resolve the two issues noted above pertaining to use of the DFG guidelines. Mitigation banks, usually owned and operated by private entities, have prior approval by DFG based on their suitability to provide high value Swainson's hawk habitat. Long term management is provided by the operator as dictated through conservation easements approved by DFG; and depending on their size they can consolidate compensation into larger blocks of suitable habitat. However, there are relatively few mitigation banks that provide credit for Swainson's hawk habitat. This is due in part to the escalating value of agricultural lands and the relatively low return on minimally improved agricultural lands compared with specific habitat types for other sensitive species (e.g., vernal pools and other wetlands).

2.3.4 Local Fees and Ordinances

Some local agencies have established programs to mitigate development-related impacts on Swainson's hawk habitat. This is usually done by requiring fees or compensation lands before grading permits are issued, and are often established through the local ordinance process. This process is often used in the absence of a regional plan or as a precursor to development of a more comprehensive conservation planning process. Fees are usually calculated based on a 1:1 replacement ratio. In some cases because of the difficulty and cost associated with land acquisition, applicants are required to find and acquire compensation land themselves. For example, the City of Elk Grove allows the applicant to pay a fee for compensation totaling less than 40 acres; but for compensation totaling more than 40 acres, the applicant is responsible for direct land preservation. Table 3 shows the existing local fee programs.

Table 2-3. Local Agency Fee Programs for Swainson's Hawk Habitat Conservation.

Local Agency	Instrument	Amount
Yolo County JPA	Interim Fee - agreement between Yolo HCP/NCCP Joint Powers Authority and DFG	$5,800 per acre
Sacramento County	Ordinance	$18,375 per acre ($16,000 land acquisition fee plus $2,375 land management fee)
City of Elk Grove	Ordinance	$18,325 per acre ($15,950 land acquisition fee plus $2,375 land management fee)
City of Rancho Cordova	Ordinance - pending	Undetermined

3.0 Description of Study Area

3.1 Location

The City of Elk Grove is located in the west-central portion of Sacramento County, a relatively large county located in the mid-section of the Central Valley, east of the Sacramento-San Joaquin River Delta (Figure 3-1). Within this primarily agricultural region, Sacramento County has undergone rapid urbanization in recent decades, primarily focused around the City of Sacramento metropolitan area. The City of Elk Grove is contiguous with the City of Sacramento along its northern border. Its southern and eastern borders currently define the southern and eastern limits of urbanization in the southwestern corner of the Sacramento metropolitan area (Figure 3-2).

The study area is defined by the city limit boundary of the City of Elk Grove (Figure 3-2). This 26,974-acre area is generally bordered by Interstate 5 on the west, Kammerer Road on the south, Calvine Road on the north, and Grant Line Road and a portion of the Deer Creek watershed on the east. State Route 99 extends through the center of the study area northwest to southeast.

3.2 Land Use

Approximately 78 percent of the study area is urbanized. Most of this area (approximately 60 percent) is considered high density urbanization, most of which is relatively recent. The remaining (approximately 18 percent) is considered low-density urbanization, mostly small ranchette developments in the northeastern corner of the study area (Figure 3-2).

Other than parks, golf courses, and small undeveloped infill parcels, approximately 22 percent of the study area remains as open space. Most of these lands continue to be used as dryland or irrigated pastureland or irrigated croplands and are considered suitable as Swainson's hawk foraging habitat (Plates 3-1 to 3-6). The largest remaining open space area is in the south-central portion of the study area generally bordered by State Route 99 on the east, Kammerer Road on the south, Bruceville Road on the west, and Elk Grove Boulevard on the north. Smaller remaining open spaces include a portion of the Laguna Creek corridor; undeveloped parcels west of Franklin Boulevard, north of Grant Line Road, and east of Bradshaw Road; and open grasslands along and adjacent to the transmission line corridor extending north-south through the study area east of Waterman Road.

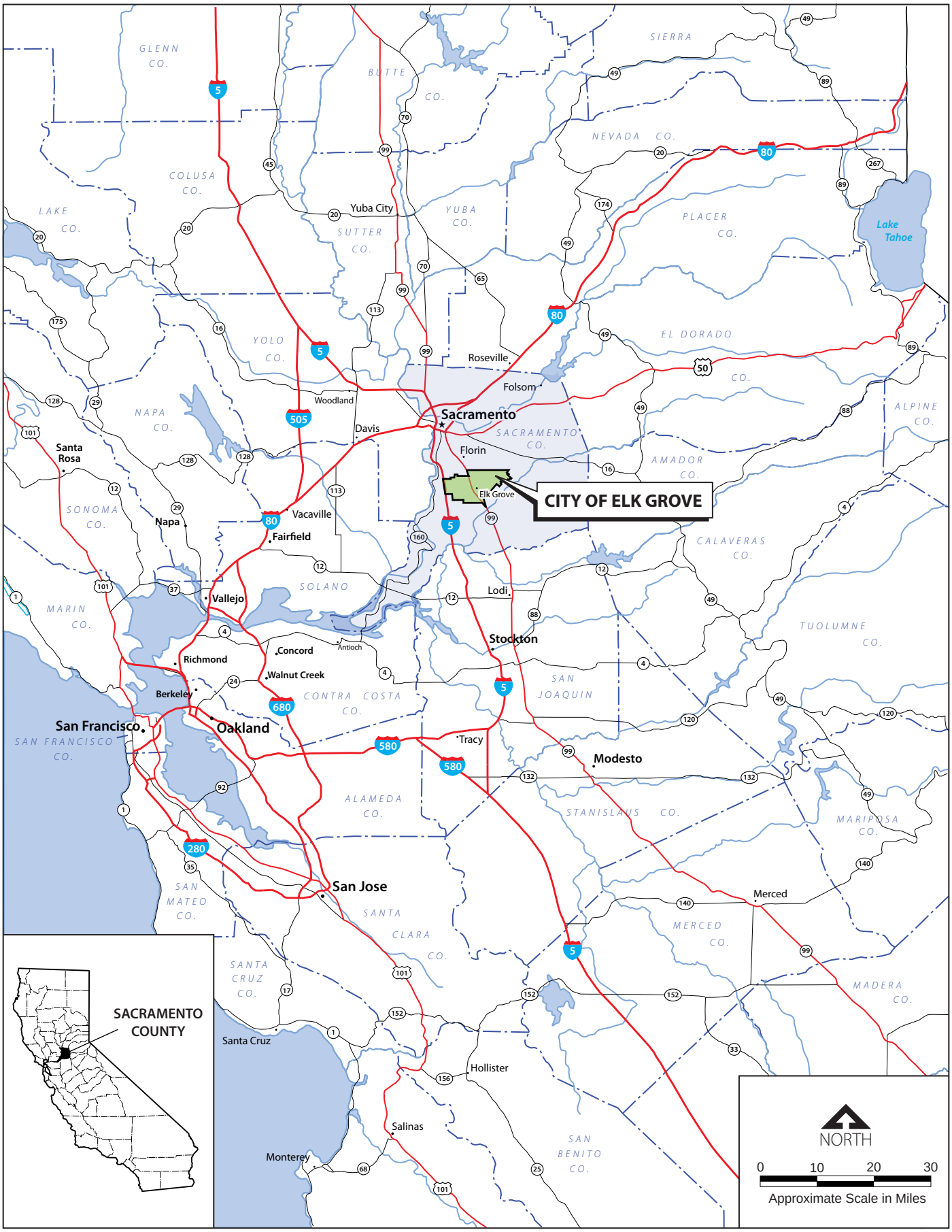

Figure 3-1
City of Elk Grove Regional Location

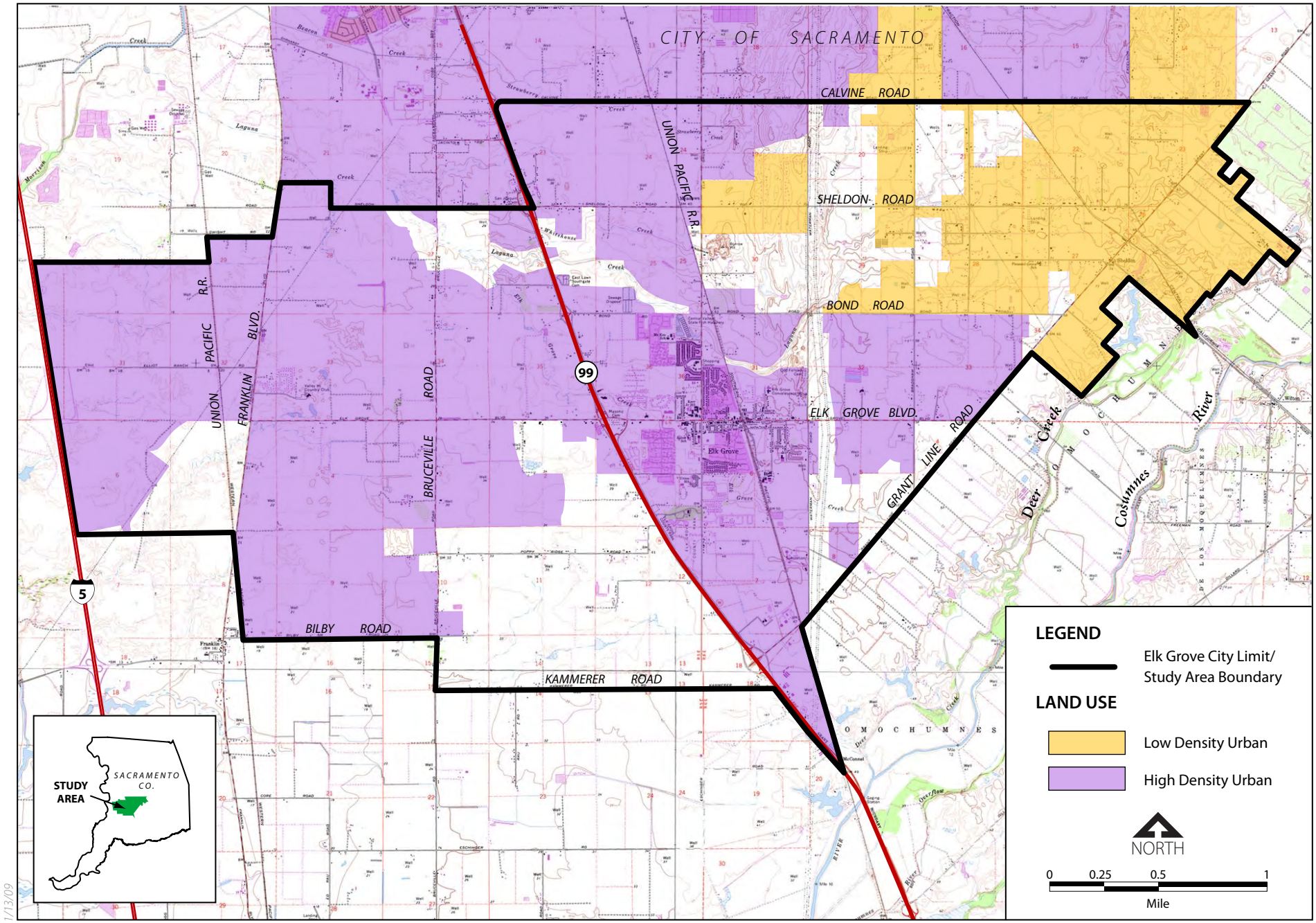

Figure 3-2
City of Elk Grove Study Area

Plate 3-1. Grassland south of Elk Grove Boulevard, west of State Route 99.

Plate 3-2. Irrigated pasture south of Poppy Ridge Road, west of State Route 99.

Plate 3-3. Farmland north of Poppy Ridge Road, east of Bruceville Road.

Plate 3-4. Irrigated pasture north of Kammerer Road, west of State Route 99.

Plate 3-5. Patch of remaining farmland and eucalyptus grove north of Grant Line Road, east of Waterman Road. New residential development in background.

Plate 3-6. Grasslands north of Sheldon Road and east of Waterman Road.

3.3 Climate and Physiography

3.3.1 Climate

Sacramento County's climate is characterized as Mediterranean with hot dry summers and temperate wet winters. During the summer months, a marine influence from the Sacramento-San Joaquin River Delta (Delta winds) moderates the hot summer temperatures. The average annual air temperature is from 60-62 degrees Fahrenheit. The average winter temperature in Elk Grove is 42 degrees Fahrenheit and the average summer temperature is 80 degrees Fahrenheit. Average rainfall in the City of Elk Grove is 21.66 inches falling mostly between October and April.

3.3.2 Physiography

The study area can be generally characterized as flat farmland or urban areas with no distinguishing topographical or geologic features. One major drainage, Laguna Creek, extends generally east-west through the northern portion of the study area. No other major drainages or other water bodies are present in the study area. The northeast corner of the study area extends southeast across Grant Line Road where it is adjacent to the Deer Creek/Cosumnes River corridor (Figure 3-2).

The study area is composed primarily of sediments from the Sierra Nevada deposited primarily by the Cosumnes River, Deer Creek, and Laguna Creek. Soil associations are primarily associated with alluvial fans or basins, which have created reasonably high value agricultural lands, some of which is used for irrigated crops and pasturelands or uncultivated grazing lands.

The elevation within the study area ranges from approximately 15 feet above sea level near the western edge of the study area to approximately 85 feet above sea level along the eastern edge of the study area. Sloping imperceptibly from east to west toward the Sacramento River, the majority of the study area is between 25 and 55 feet above sea level.

4.0 Description of the Species

4.1 Distinguishing Characteristics (Plumage and Morphology)

Swainson's hawk is a medium-sized buteo with an overall body size similar to the red-tailed hawk (*Buteo jamaicensis*), the species for which it is most often confused in the Central Valley. However, with its more streamlined body shape and longer wings, the Swainson's hawk is designed for soaring and is most often observed in flight, compared with the more robust red-tailed hawk, which is often observed perching.

As with most raptors, males are smaller than females. Using data from the Central Valley population, mean weight in males is 701.7g (range = 600 to 860g, N = 55), and mean wing length is 123.1 cm (range = 111.0 to 128.0, N=47); female mean weight is 954.9g (range = 820 to 1,130g, N=49), and mean wing length is 132.6 cm (range=126.0 to 139.7 cm, N=43) (Anderson and Estep unpublished data). While somewhat smaller than range-wide estimates, size difference between sexes is generally consistent with other parts of the species range (England et al 1997).

The Swainson's hawk is characterized by its long, narrow, and tapered wings held in flight in a slight dihedral shape (Plate 4-1). The body size is somewhat smaller, thinner, and less robust than other buteos, although the wings are at least as long as other buteos. This body and wing shape allows for efficient soaring flight and aerial maneuverability, important for foraging, which Swainson's hawks do primarily from the wing, and during courtship and inter-specific territorial interactions.

Plate 4-1. Swainson's Hawk in Flight.

There are three definitive plumage morphs: light, rufous, and dark (Plates 4-2 through 4-4). However, there are numerous intermediate variations between these plumage morphs. The two most distinguishing plumage characteristics are a dark breast band and the contrasting darker flight feathers and lighter wing lings on the underwings giving most individuals a distinctive bicolored underwing pattern. These characteristics are most pronounced in lighter morph birds and become less so as the plumage darkens, and can be indistinguishable in the definitive dark morph, which is completely melanistic. All three definitive plumage morphs are present in the Central Valley with a relatively large proportion of the population categorized as intermediate morph, with varying amounts of streaking or coloration in the belly and wing linings (Plate 4-5).

Plate 4-2. Light Morph Adult Swainson's Hawk

Plate 4-3. Rufous Morph Adult Swainson's Hawk.

Plate 4-4. Dark Morph Adult Swainson's Hawk

Plate 4-5. Intermediate Morph Adult Swainson's Hawk

4.2 Life History

4.2.1 Range and Populations

Swainson's hawk inhabits grassland plains and agricultural regions of western North America during the breeding season and winters in grassland and agricultural regions from Central Mexico to southern South America (England et al. 1997; Bradbury et al. *in preparation*). Early accounts described Swainson's hawk as one of the most common raptors in the state, occurring throughout much of lowland California (Sharp 1902). Since the mid-1800s, the native habitats that supported the species have undergone a gradual conversion to agricultural uses. Today, native grassland habitats are virtually nonexistent in the state, and only remnants of the once vast riparian forests and oak woodlands still exist (Katibah 1983). This habitat loss has caused a substantial reduction in the breeding range and in the size of the breeding population in California (Bloom 1980; England et al. 1997) (Figure 4-1). Swainson's hawks are also sensitive to habitat fragmentation. Foraging use declines as suitable foraging patch size decreases even though suitable prey conditions may exist (Estep and Teresa 1992). However, Swainson's hawks are also known to re-inhabit dense urban areas to nest if suitable nesting trees are present and suitable foraging habitat exists within 3.2 kilometers (2 miles) of the nest (England et al. 1995). The most recent statewide population estimate is 2,081 breeding pairs (Anderson et al. 2007). While this estimate is higher than the original statewide estimate that led to the state listing of the species (Bloom 1980) and subsequent estimates through the 1980s and 1990s, it represents a substantial decline (50-90%) of the statewide breeding population in California (Bloom 1980).

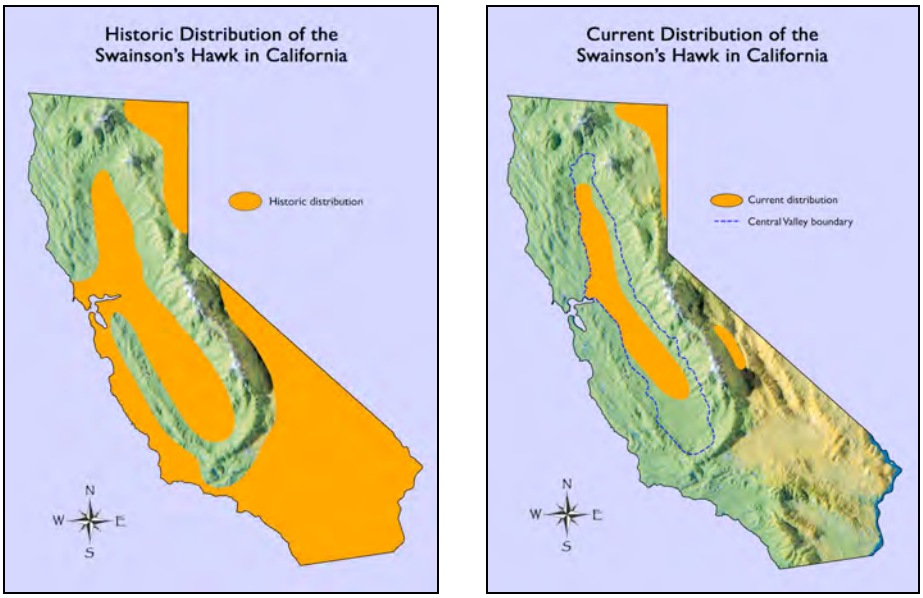

Figure 4-1. Historic and current distribution of the Swainson's hawk in California.

The Central Valley population (currently estimated at 1,948 breeding pairs) extends from Tehama County south to Tulare and Kings Counties. The optimum foraging and nesting habitat conditions in portions of Yolo, Solano, Sacramento, and San Joaquin Counties support the bulk of this Central Valley population (Estep 1989, Anderson et al. 2007) (Figure 4-2). The Central Valley is surrounded by mountains—the Sierra Nevada on the east and the Cascade Range on the north—that geographically isolate it from the rest of the species' range. Extensive banding (Anderson, Bloom, Estep, Woodbridge unpublished data) suggests that no movement occurs between the Central Valley breeding population and other populations. Results of satellite radio telemetry studies of migratory patterns further indicate minimal interaction between the Central Valley population and other populations of Swainson's hawks (Bradbury et al. *in preparation*).

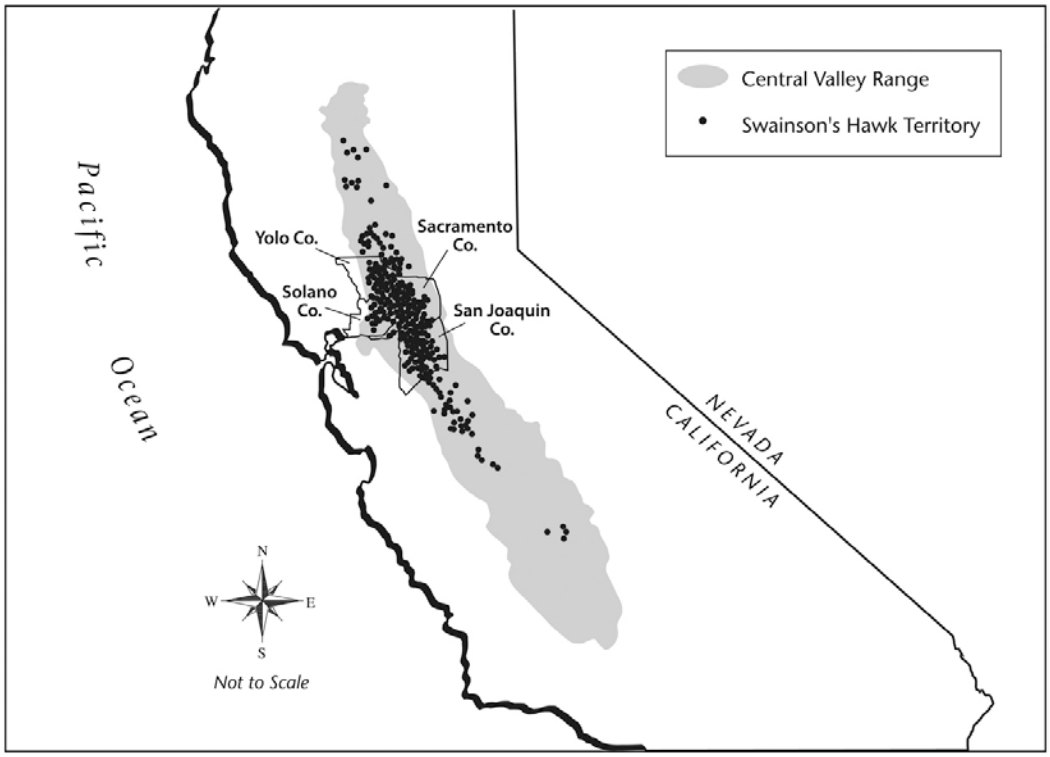

Figure 4-2. Distribution of the Swainson's hawk in the Central Valley of California

Despite the loss of native habitats in the Central Valley, Swainson's hawks appear to have adapted relatively well to certain types of agricultural patterns in areas where suitable nesting habitat remains (Plate 4-6). However, nesting habitat for Swainson's hawks continues to decline in the Central Valley because of flood control projects, agricultural practices, and urban expansion.

Plate 4-6. Typical Swainson's hawk riparian nesting and agricultural foraging habitat in the Central Valley.

4.2.2 Habitats and Habitat Use

Nesting

Swainson's hawks usually nest in large native trees such as valley oak (*Quercus lobata*), cottonwood (*Populus fremontia*), walnut (*Juglans californica*), and willow (*Salix* spp.), and occasionally in nonnative trees, such as eucalyptus (*Eucalyptus* spp.) (Plates 4-7 through 4-10). Nests occur in riparian woodlands, roadside trees, trees along field borders, isolated trees, small groves, and on the edges of remnant oak woodlands. Stringers of remnant riparian forest along drainages contain the majority of known nests in the Central Valley (Estep 1984; Schlorff and Bloom 1984; England et al. 1997). However, this is a function of nest tree availability rather than dependence on riparian forest. Nests are usually constructed as high as possible in the tree, providing protection to the nest as well as visibility from it (Plate 4-11).

Nesting pairs are highly traditional in their use of nesting territories and nesting trees. Many nesting territories in the Central Valley have been occupied annually since at least the 1970s and banding studies conducted since 1986 confirm a high degree of nest and mate fidelity (Estep *in preparation*).

Plate 4-7. Valley Oak Riparian Nesting Habitat

Plate 4-8. Valley Oak Nest Tree

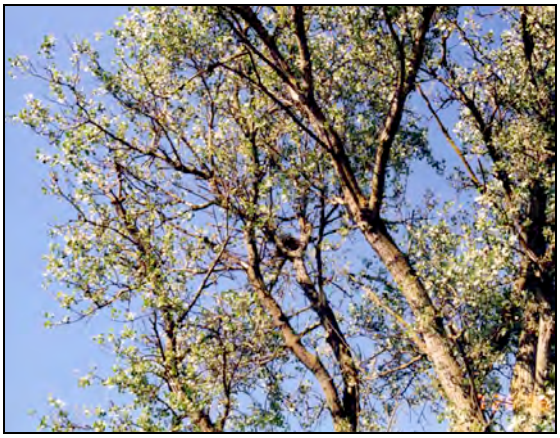

Plate 4-9. Nest in Cottonwood Tree

Plate 4-10. Nest in Eucalyptus Tree

Plate 4-11. Typical Swainson's Hawk Nest

Foraging

In the Central Valley, Swainson's hawks feed primarily on small rodents, usually in large fields that support low vegetative cover (to provide access to the ground) and high densities of prey (Bechard 1982; Estep 1989). These habitats include hay fields, grain crops, certain row crops, and lightly grazed pasturelands. Fields lacking adequate prey populations (e.g., flooded rice fields) or those that are inaccessible to foraging birds (e.g., vineyards and orchards) are rarely used (Estep 1989; Babcock 1995, Swolsgard 2004). Urban expansion and conversion to unsuitable crop types (e.g., vineyards and orchards) are responsible for a continuing reduction of available Swainson's hawk foraging habitat in the Central Valley.

Meadow vole (*Microtus californicus*) is the principal prey item taken by Swainson's hawks in the Central Valley. Pocket gopher (*Thomomys bottae*) is also an important prey item. Other small rodents, including deer mouse (*Peromyscus californicus*) and house mouse (*Mus musculus*) are also taken, along with a variety of small birds, reptiles, and insects (Estep 1989).

Foraging habitat value is a function of patch size (i.e., Swainson's hawk is sensitive to fragmented landscapes; use will decline as suitable patch size decreases), prey accessibility (i.e., the ability of hawks to access prey depending on the vegetative structure), and prey availability (i.e., the abundance of prey populations in a field). In the Central Valley, agricultural land use or specific crop type determine the foraging value of a field at any given time. Cover types were evaluated by Estep (1989) and ranked based on these factors. However, suitability ranking is based on a variety of site-specific issues and at a landscape level should be characterized only on a general basis. On a site-specific level – important for land management purposes to maximize foraging value – individual cover types can be assessed based on site-specific and management conditions.

A relative ranking of agricultural foraging habitat suitability was developed during a Swainson's hawk habitat use study in the Central Valley in the late 1980s (Estep 1989) (Table 4). This ranking was based on recorded foraging use and availability of these cover types during the two-year telemetry study.

Table 4-1. Relative Ranking of Foraging Cover Types based on Use and Availability (Estep 1989)

Ranking	Cover Type
1	Alfalfa
2	Disced/harvested Field
3	Fallow
4	Dryland Pasture
5	Beets
6	Tomatoes
7	Irrigated Pasture
8	Grains (e.g., wheat)
9	Other row crops
10	Other

These rankings suggest that higher value foraging habitat conditions occur with fields that have low vegetative cover to facilitate accessibility to prey.

Hay crops, particularly alfalfa, provide the highest value because of the low vegetation structure (high prey accessibility), relatively large prey populations (high prey availability), and because farming operations (e.g., weekly irrigation and monthly mowing during the growing season) enhances prey accessibility.

Dryland pastures are grazed annual grasslands (referred to in this report as uncultivated grasslands). Unlike cultivated fields, they maintain a fairly consistent prey base and vegetation structure throughout the breeding season and are important foraging habitats for Swainson's hawks that nest in areas where this habitat persists and where Swainson's hawks nest in low densities, such as the eastern and western foothills of the Central Valley. However, dryland pastures generally do not support the abundance of prey as do many cultivated habitats (Estep 1989).

Most row and grain crops are planted in winter or spring and have foraging value while the vegetation remains low, but become less suitable as vegetative cover and density increases. During harvest, vegetation cover is eliminated while prey populations are highest, significantly enhancing their suitability during this period. Thus, for most row and grain crops value is also a function of the timing of planting and harvesting.

Some crop types, such as rice, orchards, and vineyards, provide little to no value because of reduced accessibility and relatively low prey populations.

Foraging Ranges

Foraging range sizes are highly variable depending on cover type, and fluctuate seasonally and annually with changes in vegetation structure (e.g., growth, harvest) (Estep 1989). Foraging ranges of Central Valley Swainson's hawks range from 830 to 21,543 acres (336 to 8,718 ha) (Estep 1989, Babcock 1995). Swainson's hawks regularly forage across a very large landscape compared with most raptor species. Data from Estep (1989) and England et al. (1995) indicate that it remains energetically feasible for Swainson's hawks to successfully reproduce when food resources are limited around the nest and large foraging ranges are required.

4.2.3 Breeding Season Phenology

Swainson's hawks arrive at the breeding grounds from early March to early April. Breeding pairs immediately begin constructing new nests or repairing old ones. Eggs are usually laid in April, and incubation continues until mid-May when young begin to hatch. The brooding period typically continues through early to mid-July when young begin to fledge (England et al. 1997). Studies conducted in the Sacramento Valley indicate that one or two—and occasionally three—young typically fledge from successful nests, with an average of 1.4–1.8 young per successful nest (Estep *in preparation*) (Plates 4-12 through 4-15). After fledging, young remain near the nest and are dependent on the

adults for about 4 weeks, after which they permanently leave the breeding territory (Anderson et al. *in progress*). By mid-August, breeding territories are no longer defended and Swainson's hawks begin to form communal groups. These groups begin their fall migration from late August to mid-September.

Plate 4-12. Swainson's Hawk Nest with Eggs

Plate 4-13. Nestling Swainson's Hawks

Plate 4-14. Five-Week-Old Nestlings

Plate 4-15. Nearly Fledged Swainson's Hawks

Central Valley Swainson's hawks winter primarily in Central Mexico and, to a lesser extent, throughout portions of Central and South America (Bradbury et al. *in preparation*). This differs from what is known about the migratory pattern and wintering grounds of Swainson's hawk populations outside of the Central Valley, most of which take a different migratory route and winter entirely in southern South America, with the largest wintering populations known to occur in northern Argentina (England et al 1997).

5.0 Methods

5.1 Assessment of Populations

The goal of the nesting raptor survey was to record all active nests within the study area to the extent feasible. While the survey focused primarily on nesting Swainson's hawks, activity and nesting data were also collected on several other species that compete for nesting and/or foraging habitat resources and may influence the distribution and abundance of Swainson's hawk, including red-tailed hawk, red-shouldered hawk (*Buteo lineatus*), white-tailed kite (*Elanus leucurus*), and great-horned owl (*Bubo virginianus*). The intent was to generally indicate how these species were distributed across the landscape and to compare particularly the differences in distribution, abundance, and habitat characteristics between Swainson's hawk and red-tailed hawk.

The survey was designed as a complete census. All potential nesting areas within the study area were surveyed equally according to the protocol described below regardless of past survey effort or existing data on Swainson's hawk nests.

Surveys were conducted by systematically driving all available roads within the study area. Where roads were not available to drive or where there were no roads to access potential nest trees, the survey was conducted on foot unless access to private property was not granted. All potential nest trees were searched for nests and adult Swainson's Hawks using binoculars and/or a spotting scope. Photographs were taken of each active nest site and surrounding land use.

Surveys were conducted in three phases. Phase one surveys were conducted early in the breeding season (late March to mid-April) to detect Swainson's Hawk activity in the vicinity of all suitable nesting habitat. All suitable nesting habitats were checked for the presence of adult Swainson's Hawks and to note all nesting activity and behavior (e.g., nest construction, courtship flights, defensive behavior). Nest site, habitat, and activity data were recorded on a standardized field form and field maps; locations of active nests were documented on 7.5 minute USGS quadrangle maps and a hand-held GPS unit was used to record latitude-longitude locations of each nest.

Phase two surveys were conducted in mid-May through June to determine if breeding pairs detected during phase one surveys were actively nesting, to detect nest failures, and to resurvey all previously unoccupied potential nesting habitat for active nests. All active nest sites were mapped and characterized with respect to reproductive status and all relevant activities noted.

Phase three surveys were conducted from July through mid-August to determine nesting success. Each active nest was revisited to determine activity and reproductive status and to record the number of fledged young per nest.

Most nesting territories were visited on multiple occasions over the course of each survey phase in order to collect the necessary data.

Activity data were recorded based on the following definitions:

- An *active nesting territory* is defined as a nesting area that was occupied by a breeding pair of Swainson's hawks throughout all or a significant portion of the breeding season. The location of the nesting territory was based on the location of the nest or if the nest was not located based on the primary area of observed activity within potential nesting habitat.

- An *active nesting territory with confirmed nesting status* includes all active nesting territories for which reproductive outcome (i.e., successful or unsuccessful) was confirmed.

- An *active nesting territory with unconfirmed nesting status* includes all active nesting territories for which reproductive outcome (i.e., successful or unsuccessful) of the nest was not confirmed. This includes active nesting territories where access was not sufficient to determine nesting activity or repeat visits were inconclusive to determine success or failure of the nest.

- A *non-nesting territory* is defined as an active territory for which subsequent surveys confirmed the absence of an active nest.

- A *successful nest* is defined as an active nesting territory with confirmed nesting status that produced fledged young.

- An *unsuccessful nest* is defined as an active nesting territory with confirmed nesting status that did not produce fledged young.

Each active territory was characterized with respect to overall habitat conditions and availability, land use patterns, and potential threats. Each active nest site was characterized with respect to nesting habitat type and condition, tree species, and estimated tree and nest height.

5.2 Distribution of Nesting and Foraging Habitats

The distribution and characterization of land uses and habitat types throughout the study area were mapped from aerial photographs and updated through ground-truthing conducted during the survey.

For purposes of this study, foraging habitat associations were assessed on the basis of broad land use categories rather than the specific cover types. The agricultural crop

pattern mosaic is dynamic in portions of the study area and throughout the Sacramento Valley and is subject to change annually and seasonally. Therefore, specific agricultural crop types were grouped into broad categories that represent long-term land use patterns in the study area and that were used to characterize relative habitat suitability at the landscape level (Estep 1989, Babcock 1995, Jones & Stokes 2005). As a result, land use/cover type categories in the study area include the following:

- Irrigated Cropland (includes hay [including alfalfa], grain, and row crops)/Irrigated Pastureland
- Uncultivated Grassland
- Low Density Urban
- High Density Urban

Land use acreages were estimated to provide a relative abundance of the four land uses and the distribution and abundance of Swainson's Hawk and other raptor species was analyzed with respect to these broad habitat associations. The data collected during this survey and assessment were not subjected to statistical analysis for purposes of analyzing habitat use preferences or differences between data sets. The data were used solely to report and describe the nesting distribution and habitat associations of Swainson's Hawk and other raptors within the City of Elk Grove.

6.0 Results

6.1 Distribution, Abundance, and Habitat Associations of Swainson's Hawk

6.1.1 Distribution and Abundance

Figure 6-1 illustrates the distribution of Swainson's hawk territories in the study area in 2008. Appendix A (Table A-1) provides the location, activity, habitat association, and reproductive data for each nesting territory. Table 6-1 summarizes activity data.

Table 6-1. Activity Data for Swainson's Hawk Territories in the City of Elk Grove, 2008.

	Number	Percent of Total Active Territories	Percent of Total Active Nests
Active Territories	14		
Not Nesting (NN)	1	7.1	
Active Nests (S, U, UO)	13	92.9	
Successful Nests (S)	11		84.6
Unsuccessful Nests (U)	1		7.7
Unknown Outcome (UO)	1		7.7
Total		100	100

A total of 14 active nesting territories were located during the survey. Of these, 13 (92.9%) actively nested and one (7.1%) occupied the territory during most of the breeding season but did not nest. Of the 13 active nests, 11 (84.6%) successfully reared young to fledging; one nest (7.7%) failed; and reproductive outcome at one nest (7.7%) was undetermined.

Swainson's hawk nests were distributed in the study area based on the distribution of remaining suitable open farmland/pastureland habitat (Figure 6-1). All nest sites occurred on or immediately adjacent to open farmland, irrigated pastureland, or uncultivated grasslands. Ten of the nest sites were in the largest remaining open space area in the south-central portion of the study area between State Route 99 on the east and Bruceville Road on the west (Figure 6-1). Two sites were in remaining open space patches along Grant Line Road and adjacent to open farmland/pastureland south of Grant Line Road. The remaining two were in open grassland patches associated with the Laguna Creek watershed, one south of Calvine Road and east of Waterman Road, and the other south of Sheldon Road and west of State Route 99.

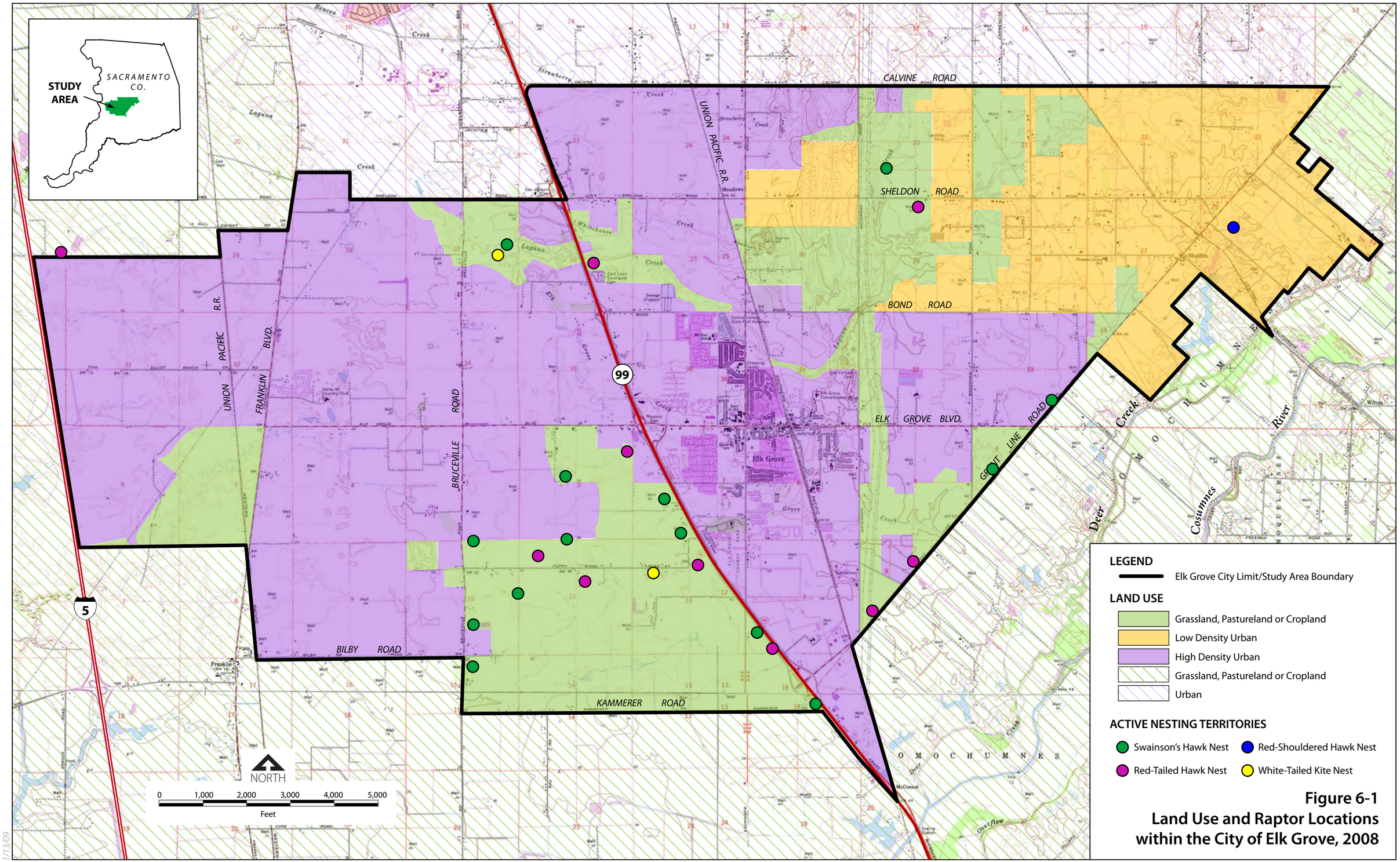

Figure 6-1
Land Use and Raptor Locations within the City of Elk Grove, 2008

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All of the nesting territories in the study area were also near urban areas and subject to substantial levels of human disturbance. All but one was within _ mile of urban areas (Figure 6-1) and seven were immediately adjacent to urban areas (Plate 6-1).

Plate 6-1. Swainson's hawk nest tree adjacent to a recently-developed residential area along Whitelock Parkway.

Nest site density was similar to that found in other areas of South Sacramento County (Estep 2007a). Using the entire study area, nest site density was 0.33 nest sites per square mile. However, using only the undeveloped portion of the study area, nest site density increased to 0.67 nest sites per square mile. While lower than in some other Central Valley locations, such as portions of Yolo County, this is a high density compared with other portions of the species' breeding range (Table 6-2). It indicates the value of the agricultural habitats within this region to Swainson's Hawks and the importance of the 'core' Central Valley population (Yolo, Solano, Sacramento, and San Joaquin Counties).

Table 6-2. Territory Density in the City of Elk Grove Study Area Relative to other Geographic Areas.

Location	Territory Density (Territories per sq mi [km])	Source
City of Elk Grove	0.33 (0.85)	This study
Yolo County	0.58 (1.50)	Estep (2008)
South Sacramento County	0.37 (0.96)	Estep (2007a)
Butte Valley	0.14 (0.37)	Woodbridge et al. 1995
Alberta, Canada	0.09 (0.23)	Schmutz 1987
New Mexico	0.07 (0.17)	Bednarz et al. 1990

6.1.2 Habitat Associations

Foraging Habitat

Figure 6-1 also illustrates the distribution of suitable Swainson's hawk foraging habitat throughout the study area. Within the study area, suitable foraging habitat includes irrigated croplands and pasturelands, and uncultivated grasslands. With the exception of parks, golf courses, and several smaller undeveloped in-fill parcels, these areas (approximately 22% of the study area) represent the only available foraging habitat for Swainson's hawks in the study area. While there are differences in the foraging quality of different irrigated crops, there are no unsuitable perennial crop types such as orchards or vineyards in the study area. Thus, all lands designated for purposes of this assessment as irrigated cropland/irrigated pastureland are considered suitable as foraging habitat. Each land use type is described below.

- Irrigated Cropland/Irrigated Pastureland. This type is defined as areas that are dominated by a mixture of irrigated croplands and irrigated pasture (Plates 6-2 and 6-3). Approximately 15% of the study area consists of this land use type (Table 6-3). The irrigated croplands are annually cultivated and seasonally or annually rotated. The pastures are often grazed and/or regularly cut for hay. Most of these lands occur in the south-central portion of the study area west of State Route 99 and along the north side of Grant Line Road east of State Route 99.

- Uncultivated Grasslands. This type is defined as uncultivated annual grassland habitat that is regularly or irregularly grazed by livestock and that has retained most topographical and other natural features (e.g., vernal pools and swales, native oak trees, etc.) (Plate 6-4). Approximately 7.4% of the study area consists of this land use type (Table 6-3). Uncultivated grasslands are found primarily along and adjacent to the broad transmission line corridor paralleling the east side of Waterman Road, west of Franklin Boulevard and south of Elk Grove Boulevard, and remaining open spaces associated with the Laguna Creek corridor (Figure 6-1).

- High Density Urban. This type consists of dense small-lot residential or commercial development. Open space areas consist mainly of community parks and golf courses. While it is possible that Swainson's hawks could nest in these areas if suitable trees existed and if they were within 1 to 2 miles of suitable foraging habitat (England et al. 1995), there are no foraging opportunities within this type. Approximately 60 percent of the study area is currently defined as high density urban (Table 6-3) and additional conversion to high density urban is planned within the study area.

- Low Density Urban. This type consists of large lot (1 to 10-acre) residential or ranchette development. In the study area, this type is found primarily in the northeastern corner between Deer Creek and Calvine Road (Figure 6-1). In

general, smaller lots are landscaped with lawns, ponds, and native or ornamental plantings, and larger lots retain small pastures for horses and other livestock. While it is possible (and a greater likelihood than in high density urban areas) that Swainson's hawks may nest in suitable trees in these areas as long as suitable foraging habitat remains nearby, there are very limited foraging opportunities within this type, and thus it is considered an unsuitable land use type for Swainson's hawk foraging habitat. Approximately 18 percent of the study area is currently defined as low density urban (Table 6-3).

Plate 6-2. Irrigated cropland north of Kammerer Road.

Plate 6-3. Irrigated pastureland north of Kammerer Road.

Plate 6-4. Uncultivated grassland north of Sheldon Road and east of Waterman Road.

Table 6-3. Relative Abundance of Estimated Land Cover Type Acreages in the City of Elk Grove, 2008.

Cover Type	Estimated Acres	Percent of Total
Irrigated Cropland/Pasture	4,000	14.8
Uncultivated Grassland	2,000	7.4
High Density Urban	16,000	59.3
Low Density Urban	5,000	18.5
Total	27,000	100

Unlike the South Sacramento County baseline survey and assessment (Estep 2007a) where habitat associations were based on a 0.5 mile radius around the nest, because of the constrained and fragmented open landscape in the study area, habitat associations for this assessment is based on the dominant land use (Irrigated cropland/irrigated pastureland or uncultivated grasslands) in the immediate vicinity of the nest.

Table 6-4 indicates that the majority of nest sites (85.7%) were associated with the remaining patches of irrigated cropland/pastureland in the study area and only two (14.3%) were associated with uncultivated grasslands. While this is consistent with other studies, including the 2006 South Sacramento County baseline survey and assessment (Estep 2007a), the size and configuration of remaining suitable habitat patches and the extent of fragmentation within the study area are likely more influential in determining the distribution and abundance of nesting sites than is the differing foraging values of these land uses. As noted above, all nests were in close proximity to urban areas; however, no nests were found within urban areas (Table 6-4).

Table 6-4. Land Use/Habitat Associations of Swainson's Hawk Nests in the City of Elk Grove, 2008.

Habitat Association	Number of Territories	Percent of Total
Irrigated cropland/pastureland	12	85.7
Uncultivated grassland	2	14.3
High density urban	0	
Low density urban	0	
Total	14	100

Figure 6-1 also illustrates the general land use type adjacent to the study area. Lands south, east, and west of the study area are primarily open agricultural lands, most of which are suitable for Swainson's hawk foraging. The northern boundary of the study area is contiguous with the City of Sacramento and is mostly urbanized with the exception of the Sacramento Regional County Sanitation District Bufferlands located north of the northern boundary and west of Franklin Road (Figure 6-1).

Nesting Habitat

Several different nesting habitat types occur in the study area and are defined as follows:

- *Riparian*. This includes valley oak, cottonwood, and willow-dominated riparian woodland along natural or channelized stream corridors. Laguna Creek represents the only significant riparian corridor in the study area. The majority of the creek within the study area is confined within a relatively narrow corridor surrounded by dense urbanization. Mature riparian woodland is discontinuous along the creek with some areas supporting mature trees and others areas lacking any overstory vegetation.

- *Isolated Trees*. Isolated trees are single trees that are not associated with roadsides, residences or other features. Many are large, mature valley oak trees in the middle of agricultural fields that are remnants of pre-agricultural oak woodlands. This type is limited in the study area and occurs primarily in the south-central portion of the study area west of State Route 99. Mature valley oak trees have also been retained in some locations within the urban areas.

- *Roadside Trees*. Roadside trees can be remnant native valley oak trees, naturally occurring 'volunteer' native or non-native trees, or ornamental trees planted for landscaping or as wind breaks or roadside barriers. This type is also distributed throughout most of the remaining open spaces in study area as well as in some urban areas (e.g., native valley oak trees along Bruceville Road).

- *Tree Row*. Tree row refers to planted rows of trees that are not associated with roadsides. These often occur along field borders or rural driveways and were usually planted as windbreaks or for landscaping purposes.

- *Rural Residential*. Rural residential refers to trees that are planted for windbreak cover, shade, or ornamentals around rural farmsteads. These trees are of a variety of species, including valley oak, walnut, eucalyptus, and pine.

- *Eucalyptus Groves*. Several small eucalyptus groves occur in the study area, planted as windbreaks or sound and visual barriers.

- *Farmyard Trees*. Farmyard trees refer to trees planted around agricultural farmyards used for equipment staging and shade. Farmyard trees are typically walnut, eucalyptus, or valley oak trees.

- *Urban Trees*. Urban trees are large remnant native or nonnative ornamental trees within urban areas. Swainson's hawks will occasionally occupy these sites if the tree is large and the nest can be visually protected from disturbance, and the site is within 1 to 2 miles from foraging habitat (England et al. 1995). Nest trees tend to be tall and dense to allow protection from direct disturbances and a panoramic view of the surrounding landscape. Most urban nest trees are ornamental pines or redwoods or remnant native valley oaks (England et al. 1995).

Within the study area, roadside trees were the most frequently used nest tree (Table 6-5). Of the six roadside tree nest sites, two were remnant valley oak trees that were retained during construction of Whitelock Road (Plate 6-1), and four were eucalyptus trees planted along roadsides (Plate 6-5).

Two sites were associated with rural residences (Plate 6-6), two in riparian, and one each in isolated tree, tree row, oak grove, and farmyard types (Table 6-5).

Table 6-5. Nesting Habitat Associations of Swainson's Hawk Territories in the City of Elk Grove, 2008.

Nesting Habitat Type	Number of Territories	Percent of Total
Roadside Tree	6	42.9
Rural Residence	2	14.3
Riparian	2	14.3
Isolated Tree	1	7.1
Tree Row	1	7.1
Oak Grove	1	7.1
Farmyard	1	7.1
Total	14	100

Plate 6-5. Swainson's hawk nest site in roadside eucalyptus tree along Grant Line Road.

Plate 6-6. Swainson's hawk nest site in row of walnut trees at rural residence near Bilby Road and Bruceville Road.

Table 6-6 indicates the tree species used by nesting Swainson's Hawks within the study area. Eucalyptus was the most frequently used nest tree (42.9%), following by valley oak (35.7%). While not quantified for this study, these also appear to be the tree species that occur in the greatest frequency in the study area. Other tree species used were walnut, willow, and locust (Table 6-6) (Plates 6-7 through 6-9).

Table 6-6. Nest Tree Species used by Nesting Swainson's Hawks in the City of Elk Grove, 2008.

Tree Species	Number of Active Nest Sites	Percent of Total
Eucalyptus	6	42.9
Valley Oak	5	35.7
Walnut	1	7.1
Willow	1	7.1
Locust	1	7.1
Total	14	100

Plate 6-7. Swainson's hawk nest site in valley oak tree along Whitelock Parkway.

Plate 6-8. Swainson's hawk nest site in eucalyptus tree along Grant Line Road.

Plate 6-9. Swainson's hawk nest site in locust tree west of State Route 99 and north of Poppy Ridge Road.

6.1.3 Reproduction

Reproductive performance is calculated on the basis of the number of fledged young. While data are collected on the number of nestlings at various ages, these data are inconsistent due to the inability to observe nests sufficiently to confirm the number of nestlings from all nests at various stages of the breeding cycle. Data on the number of eggs per nest are also not calculated because of the risk of nest abandonment during the sensitive incubation phase of the breeding cycle. Reproductive data are presented in Table 6-7.

Table 6-7. Reproductive Performance of Swainson's Hawks in the City of Elk Grove, 2008.

Active Nests (S, U, UO)	13	
Successful Nests (S)	11	
Unsuccessful Nests (U)	1	
Unknown Outcome (UO)	1	
Total Number of Young		15
Number of Young per Nesting Attempt (S+U)		1.25
Number of Young per Successful Nest		1.36

A total of 15 fledged young were recorded (Table 6-7). This equates to 1.36 young per successful nest, which is generally consistent with other past and ongoing studies of Swainson's Hawk in the Central Valley, but is low compared with reported success outside of the Central Valley (Table 6-8).

Table 6-8. Comparison of Reproductive Performance of Swainson's Hawk Populations in the Central Valley and other North American Populations.

Location	Years of Study	Young per Nesting Attempt	Young per Successful Nest	Source
Elk Grove	1	1.25	1.36	This study
Yolo County	1	1.24	1.45	Estep (2008)
South Sacramento County	1	0.76	1.46	Estep (2007a)
Yolo County	15	1.16	1.49	Estep (in prep)
Natomas Basin	7	1.21	1.65	Jones & Stokes (2006)
Rancho Cordova	1	1.20	1.33	Estep (2007b)
Central Valley	5	1.35	1.65	England et al. 1995
S.E. Washington	3	1.50	1.85	Fitzner 1978
N.E. Colorado	3	1.19	2.18	Olendorff 1978
S.E. Alberta	3	1.41	1.98	Schmutz et al. 1980
S.E. New Mexico	3	1.76	1.94	Bednarz 1988
S.E. Idaho	3	1.24	1.62	Hansen and Flake 1995

6.2 Distribution and Abundance of Other Surveyed Raptor Species

Several other species compete with Swainson's hawk for nesting and food resources that can affect distribution, abundance, and reproductive performance. Interspecific competition for nesting and food resources is a normal ecological process in raptor communities that influences local and regional population structure (Newton 1979, Rothfels and Lein 1983, Thurow and White 1983, Janes 1984, Hansen and Flake 1995). However, in an environment with depleting or uncertain resources, such as much of the southern Sacramento and northern San Joaquin Valleys, these interactions can have a greater negative affect on some raptor populations. This can be particularly important to Swainson's hawks because spring arrival onto breeding territories is later than other raptor species. Other raptor species, particularly red-tailed hawk, white-tailed kite, and great-horned owl sometimes occupy traditional Swainson's hawk nesting areas prior to the arrival of Swainson's hawks. This can result in aggressive territorial interactions with variable results depending on the species involved. For example, white-tailed kites are often displaced from traditional Swainson's hawk nesting areas by late-arriving Swainson's hawks leading to poor kite nesting success (Erichsen 1995). Conversely, red-tailed hawks and great-horned owls are rarely displaced resulting in the selection of alternative nesting sites by the returning Swainson's hawk pair or occasionally resulting in the temporary or permanent abandonment of Swainson's hawk nesting territories (Estep *in preparation*). However, other studies have shown that while nest sites were not relinquished, red-tailed hawks forfeited portions of their breeding territories to late-arriving Swainson's hawks, potentially affecting the reproductive success of the red-tailed hawk pair (Janes 1994, Hansen and Flake 1995). Over time, as nesting and food resources are reduced due to urbanization or other factors, local or regional Swainson's hawk and other raptor populations could be negatively affected as a result of both habitat loss and increased interspecific competition.

In addition, evaluation of the distribution and habitat relationships of other species – particularly red-tailed hawk – can reveal differences in habitat relationships and use at a landscape level that may be helpful in assessing different geographic areas with respect to their suitability for species conservation. In other words, certain areas may be more suitable for red-tailed hawk than for Swainson's hawk, and thus would not be considered high priority conservation areas for Swainson's hawk.

Figure 6-1 illustrates the distribution and abundance of other surveyed raptor species in the study area in 2008. Red-tailed hawk, the most abundant nesting buteo in the Central Valley, was distributed similarly as the Swainson's hawk occurred throughout the study area and sufficient information was gathered to make general comparisons with Swainson's hawks regarding distribution, activity, and reproduction (See below). Data were also collected for red-shouldered hawk, white-tailed kite, and great-horned owl, species that compete with Swainson's hawks for nesting or food resources and influence Swainson's hawk nesting distribution. Table A-2 provides the location, activity, habitat association, and reproductive data for other raptor species.

6.2.1 Red-shouldered Hawk

Red-shouldered hawks typically nest in wooded areas, often along riparian corridors. They forage primarily on small rodents, passerine birds, and some amphibians and reptiles (Crocoll 1994). In the Central Valley, the species can be locally common in mature riparian forests and other native woodland habitats, but is also found with increasing frequency in eucalyptus groves and occasionally in sites subject to substantial levels of human disturbance. Only one red-shouldered hawk nesting site was detected during the survey (Figure 6-1, Table A-2). The site is in a eucalyptus grove in the low-density urban area south of Grant Line Road, north of Sheldon. Because of the difficulty detecting nest sites in urban areas, this is likely an under-representation of the species' occurrence in the study area, particularly in the low-density urban area in the northeast corner of the study area. Red-shouldered hawk competes with Swainson's hawk for nesting sites and food resources.

6.2.2 White-tailed Kite

White-tailed kites nest in a variety of wooded habitats, including riparian woodlands, oak woodlands, and oak savannah. They can be found in narrow channelized riparian habitats and occasionally in roadside trees or tree rows. Two white-tailed kite nesting sites were located during the survey (Figure 6-1, Table A-2). One was associated with savannah-like habitat in the Laguna Creek corridor west of State Route 99 and one was associated with a roadside tree along Poppy Ridge Road. White-tailed kite competes with Swainson's hawk for nesting sites and food resources (Erichsen 1995). Like Swainson's hawk, California vole is the principal prey item for white-tailed kite (Warner and Rudd 1975, Dunk 1995). While the presence of white-tailed kite can influence the distribution and nesting activity of Swainson's hawk, there are data that suggest that the opposite scenario is more likely and that Swainson's hawk is relatively successful at dislodging white-tailed kite from nest sites and forcing them to renest elsewhere (Erichsen 1995).

6.2.3 Great-horned Owl

Great-horned owl was also included in the survey because it can have a more significant local influence on Swainson's hawk nesting distribution and success compared with red-shouldered hawk and white-tailed kite. Great-horned owls do not typically construct their own nest, but instead occupy the nests of other stick-nest-build raptors (Houston *et al*. 1998). Because they nest earlier in the season than most other raptors (often initiating nesting as early as January), their nesting cycle is well underway by the time Swainson's hawks arrive onto their breeding territories. Great-horned owls often occupy Swainson's hawk nests, and Swainson's hawks are usually unsuccessful at dislodging great-horned owls from their nest once they arrive onto the breeding territory (Estep *personal observation*). This can result in the Swainson's hawk pair not nesting or causes them to construct a nest in an alternative and potentially less desirable location. Great-horned owls also prey on Swainson's hawk young, so proximity to an owl nest can also influence

Swainson's hawk productivity. This species will nest in most woodland habitats, including riparian woodlands and oak woodlands. It will also nest in isolated trees, tree rows, and eucalyptus groves.

Two great-horned owl nests were found during the survey (Figure 6-1, Table A-2). One was in a valley oak tree along Laguna Creek west of State Route 99. This is also the location of a non-nesting Swainson's hawk territory (SWHA-8, Table A-1). The presence of the great-horned owl nest at this location may have been responsible for the lack of a nesting attempt by the Swainson's hawk pair reported from that location. The nest the owls used may have been constructed by the Swainson's hawk pair the previous year and occupied by the owls prior to the return of the Swainson's hawk pair. The second nest was in a valley oak tree south of Elk Grove Boulevard and east of Big Horn Boulevard (Figure 6-1).

6.2.4 Red-tailed Hawk

Among the species surveyed, red-tailed hawk may influence the distribution and abundance of Swainson's hawk more than any other species in the study area (Rothfels and Lein 1983, Janes 1984, Bechard et al. 1990, Janes 1995, Hansen and Flake 1995). Territorial competition influences red-tailed hawk and Swainson's hawk territory occupancy and reproductive performance depending on specific habitat elements (Janes 1984, 1994). Red-tailed hawk is similar size to the Swainson's hawk and uses similar nesting and foraging habitat. More of a generalist with respect to foraging habitat, prey species, and foraging behavior, the red-tailed hawk uses a variety of nesting and foraging habitats. A total of 10 red-tailed hawk nesting territories were recorded during surveys (Figure 6-1, Table A-2).

Overall, Swainson's hawk and red-tailed hawk were distributed similarly across the landscape (Figure 6-1). While similar, there are differences in habitat selection between the two species particularly with respect to the use of cultivated and uncultivated habitats and the type of prey found in each. Results of surveys conducted throughout South Sacramento County in 2006 (Estep 2007a), indicated that the red-tailed hawk was distributed more evenly across the landscape while the Swainson's hawk distribution suggested a greater preference for cultivated habitats.

With a more diverse diet and the ability to capture small rodent prey (e.g., *Microtus* and other mice) and larger prey, such as black-tailed jackrabbit (*Lepus californicus*) and California ground squirrel (*Spermophilus beechii*), the red-tailed hawk can more effectively utilize uncultivated grassland habitats where these species are more common. Bechard et al. (1990) showed that Swainson's hawk and red-tailed hawk in Washington State selected nesting areas based on specific habitat parameters (e.g., distance to water, distance to human disturbance, nest tree diameter, foraging habitat type) that resulted in a relatively clear partitioning of the available landscape. However, because the study area occurs in the largely agricultural interior of the Central Valley and supports only small patches of uncultivated habitats, resource partitioning between the two species is less clear. With a wider range of acceptable habitat parameters, the red-tailed hawk occurs

throughout the valley floor as well as in foothill and mountainous areas where the Swainson's hawk does not occur. This level of landscape partitioning is clear throughout the county as a whole. But within the study area, partitioning becomes more subtle and with the exception of some relatively minor differences (e.g., proximity to human disturbance, nest tree size), both species occupy and compete for the same nesting and foraging resources. Because of this – and because of their earlier nest initiation, red-tailed hawks occasionally occupy traditional Swainson's hawk nest sites, which in some cases have resulted in the permanent abandonment of Swainson's hawk nesting territories (Estep *in preparation*.).

Interestingly, Swainson's hawk has been and continues to be significantly more abundant in the interior of Sacramento County and surrounding Central Valley counties than the red-tailed hawk (Estep 2007a, 2008, *in preparation*). Information from Schmutz et al. (1980) and Cottrell (1981) suggest that valley floor may be a sub-optimal habitat for red-tailed hawks. Both studies indicate the red-tailed hawk productivity declines markedly where they are forced to nest in close proximity to cogeners, such as Swainson's hawk, independent of food supply. Note, however, that as noted below, red-tailed hawk productivity is higher in the study area than that of Swainson's hawk, which is consistent with findings from other related studies in the Central Valley (Estep 2007a, 2008, *in preparation*).

On a more speculative note, this could also be in part a function of the foraging behavior of each species. The Swainson's hawk is a highly active hunter, hunting almost entirely from the wing and known to travel long distances in search of prey (Estep 1989, Babcock 1995). Red-tailed hawks are less active hunters, hunting to large extent from a perch, and have very small foraging ranges compared with Swainson's hawk (Preston and Beane 1993). The foraging behavior of the Swainson's hawk allows it to adapt to the dynamic agricultural foraging landscape and adjust its foraging range as prey accessibility changes with the crop growth and harvesting regime. The red-tailed hawk may be less likely to adjust to this dynamic condition, which may restrict their abundance on the valley floor.

Activity and Reproduction

Table 6-9 compares activity data between Swainson's hawk and red-tailed hawk. While there were several more Swainson's hawk nesting territories (14) than red-tailed hawk nesting territories (10), successful nesting activity was confirmed for all ten red-tailed hawk sites compared with 11 of the 14 Swainson's hawk territories.

Table 6-10 compares reproductive performance data for Swainson's hawk and red-tailed hawk. Red-tailed hawks produced 19 fledged young from 10 successful nests, and perhaps in contrast with the findings of Schmutz et al. (1980) and Cottrell (1981) noted above, resulting in a greater reproductive performance (i.e., number of young per nesting attempt and number of young per successful nest) compared with Swainson's hawk.

Table 6-9. Comparison of Activity Data for Swainson's Hawk and Red-tailed Hawk in the City of Elk Grove, 2008.

	Swainson's Hawk			Red-tailed Hawk		
	No.	**Percent of Active Nesting Territories**	**Percent of Total Active Nests**	**No.**	**Percent of Active Nesting Territories**	**Percent of Total Active Nests**
Active Territories	14			10		
Not Nesting (NN)	1	7.1		0	0	
Active Nests (S, U, UO)	13	92.9		10	100	
Successful Nests (S)	11		84.6	10		100
Unsuccessful Nests (U)	1		7.7	0		0
Unknown Outcome(UO)	1		7.7	0		0
Total		100	100		100	100

Table 6-10. Comparison of Reproductive Performance Data for Swainson's Hawk and Red-tailed Hawk in the City of Elk Grove, 2008.

	Swainson's Hawk		Red-tailed Hawk	
Active Nests (S, U, UO)	13		10	
Successful Nests (S)	11		10	
Unsuccessful Nests (U)	1		0	
Unknown Outcome (UO)	1		0	
Total Number of Young		15		19
Number of Young/Nesting Attempt (S+U)		1.25		1.9
Number of Young/Successful Nest		1.36		1.9

Habitat Associations

Table 6-11 compares the habitat associations between Swainson's hawk and red-tailed hawk. Both species were similar in their selection of irrigated croplands/irrigated pastures over uncultivated grasslands. However, as noted above, within the study area this is likely a function of the size and fragmentation of suitable habitats rather than habitat value.

Table 6-11. Comparison of Land Use/Habitat Associations of Swainson's Hawk and Red-tailed Hawk Nests in the City of Elk Grove, 2008.

	Swainson's Hawk		Red-tailed Hawk	
Habitat Association	**Number of Territories**	**Percent of Total**	**Number of Territories**	**Percent of Total**
Irrigated cropland/pastureland	12	85.7	8	80.0
Uncultivated grassland	2	14.3	2	20.0
High density urban	0		0	
Low density urban	0		0	
Total	14	100	10	100

Table 6-12 compares nesting habitat type of Swainson's hawk and red-tailed hawk in the study area. While roadside trees were the predominant type used by Swainson's hawk hawk, both species used a variety of nesting habitat types.

Table 6-12. Comparison of Swainson's Hawk and Red-tailed Hawk Nesting Habitat in the City of Elk Grove, 2008.

	Swainson's Hawk		Red-tailed Hawk	
Nesting Habitat Type	**Number of Territories**	**Percent of Total**	**Number of Territories**	**Percent of Total**
Roadside Tree	6	42.9	2	20.0
Rural Residence	2	14.3	2	20.0
Riparian	2	14.3	1	10.0
Isolated Tree	1	7.1	3	30.0
Tree Row	1	7.1	2	20.0
Oak Grove	1	7.1	0	0
Farmyard	1	7.1	0	0
Total	14	100	10	100

Table 6-13 compares nest tree species used by Swainson's hawk and red-tailed hawk in the study area. Both species used eucalyptus and valley oak trees similarly and predominantly.

Table 13. Comparison of Nest Tree Species used by Swainson's Hawks and Red-tailed Hawks in the City of Elk Grove, 2008.

	Swainson's Hawk		Red-tailed Hawk	
Tree Species	**Number of Active Nest Sites**	**Percent of Total**	**Number of Active Nest Sites**	**Percent of Total**
Eucalyptus	6	42.9	5	50.0
Valley Oak	5	35.7	4	40.0
Walnut	1	7.1	0	0
Willow	1	7.1	1	10.0
Locust	1	7.1	0	0
Total	14	100	10	100

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Appendix A. Swainson's Hawk and Other Raptor Data

Table A-1. Swainson's Hawk Nesting Territories within the City of Elk Grove, 2008.

Territory Number	Quad Map	Location	Lat-long	Status	Nesting Habitat	Nest Tree Species	Land Use Association	Number of Young
SWHA-1	Florin	Whitelock Pkwy at Bruceville	38 23.670/121 24.930	S	Roadside Tree	Valley Oak	IP/IC/U	2
SWHA-2	Florin	Whitelock Pkwy at Big Horn Blvd.	38 23.672/121 23.946	F	Roadside Tree	Valley Oak	IP/IC/U	0
SWHA-3	Florin	W of Hwy 99, N of Whitelock Pkwy	38 23.951/121 23.097	S	Farmyard	Locust	IP/IC/U	1
SWHA-4	Florin	W of Hwy 99, N of Whilelock Pkwy	38 23.790/121 22.990	S	Isolated Tree	Valley Oak	IP/IC/U	1
SWHA-5	Florin	Bruceville Rd, N of Bilby	38 22.968/121 24.982	S	Rural Residence	Eucalyptus	IP/IC/U	1
SWHA-6	Florin	Bruceville Rd at Bilby Rd	38 22.707/121 24.943	S	Rural Residence	Walnut	IP/IC/U	1
SWHA-7	Galt	Hwy 99 at Kammerer Rd	38 22.390/121 21.614	S	Rural Residence	Eucalyptus	IP/IC/U	1
SWHA-8	Elk Grove	Sheldon at Waterman (Laguna Creek)	38 26.529/121 20.906	S	Riparian	Valley Oak	UG/U	2
SWHA-9	Elk Grove	Hwy 99, NW of Grant Line Rd	38 23.145/121 22.299	S	Roadside Tree	Eucalyptus	IP/IC/U	1
SWHA-10	Elk Grove	Grant Line Rd, E of Bradshaw	38 24.273/121 19.777	S	Roadside Tree	Eucalyptus	IP/IC/U	2
SWHA-11	Elk Grove	Grant Line Rd, N of Elk Grove Blvd.	38 24.788/121 19.244	S	Roadside Tree	Eucalyptus	IP/IC/U	2
SWHA-12	Florin	Lotz Pkwy at Big Horn Blvd.	38 24.112/121 24.114	S	Oak Grove	Valley Oak	IP/IC/U	1
SWHA-13	Florin	0.25m S Poppy Ridge, 0.5mi E of Bruceville	38 23.229/121 24.513	U	Tree Row	Eucalyptus	IP/IC/U	
SWHA-14	Florin	Laguna Cr between Hwy99 and Bruceville	38 25.901/121 24.774	NN	Riparian	Willow	UG/U	0

Key: IC = Irrigated Cropland; IP = Irrigated Pasture; UG = Uncultivated Grassland; U=Urban

Table A-2. Other Raptor Nesting Territories within the City of Elk Grove, 2008.

Territory Number	Quad Map	Location	Lat-long	Status	Nesting Habitat	Nest Tree Species	Land Use Association	Number of Young
RTHA-1	Florin	Laguna Grove Dr, auto mall	38 24.306/121 23.338	S	Isolated Tree	Valley Oak	UG/U	2
RTHA-2	Florin	Poppy Ridge at Hwy 99	38 23.455/121 22.754	S	Isolated Tree	Valley Oak	IP/IC/U	2
RTHA-3	Florin	South of Poppy Ridge, 1.1mi E of Bruceville	38 23.347/121 23.820	S	Tree Row	Valley Oak	IP/IC/U	2
RTHA-4	Florin	North of Poppy Ridge, 0.5mi E of Bruceville	38 23.493/121 24.338	S	Rural Residential	Valley Oak	IP/IC/U	1
RTHA-5	Florin	0.2mi E of I-5, 0.25mi N of Laguna Blvd.	38 25.851/121 29.085	S	Riparian	Willow	IP/IC/U	2
RTHA-6	Florin	0.1mi S of Laguna Cr, 0.1mi E of Hwy99	38 25.718/121 23.737	S	Tree Row	Eucalyptus	UG/U	2
RTHA-7	Elk Grove	0.1mi S of Sheldon Rd, 0.5mi W of Bradshaw	38 26.194/121 20.466	S	Isolated Tree	Eucalyptus	IP/IC/U	2
RTHA-8	Elk Grove	W side of Hwy99, 0.6mi N of Grant Line	38 23.030/121 22.213	S	Roadside Tree	Eucalyptus	IP/IC/U	2
RTHA-9	Elk Grove	N side of Grant Line, 0.3mi NE of Waterman	38 23.150/121 21.010	S	Roadside Tree	Eucalyptus	IP/IC/U	2
RTHA-10	Elk Grove	N side of Grant Line, 0.5mi NE of Mosher	38 23.449/121 20.701	S	Rural Residential	Eucalyptus	IP/IC/U	2
RSHA-1	Elk Grove	Moody Rd south of Grant Line	38 25.986/121 17.619	U	Roadside Tree row/Rural Res.	Eucalyptus	RR	
WTKI-1	Florin	Laguna Creek N of Big Horn, E of Bruceville	38 25.916/121 24.800	F	Riparian	Willow	UG/U	0
WTKI-2	Florin	South side Poppy Ridge, 0.7m W Hwy99	38 23.426/121 23.250	U	Roadside Tree		IC/IP	
GHOW	Florin	Laguna Creek, W of Hwy 99	38 25.919/121 24.673	U	Riparian	Valley Oak	UG/U	
GHOW	Florin	S of Elk Grove Blvd, E of Big Horn Blvd.	38 24.335/121 23.913	U	Isolated Tree	Valley Oak	UG/U	

Key: IC = Irrigated Cropland; IP = Irrigated Pasture; UG = Uncultivated Grassland; U=Urban