UC DAVIS WILDLIFE HEALTH CENTER
DEPARTMENT OF FISH AND GAME RESOURCE ASSESSMENT PROGRAM

FINAL REPORT

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May 31, 2007

1) **PROJECT TITLE:** California Swainson's Hawk Inventory: 2005-2006

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3) **PROJECT START DATE:** March 1, 2005

4) **PROJECT COMPLETION DATE:** June 30, 2007

5) SUMMARY OF OBJECTIVES: (1/2 page)

The Swainson's hawk (*Buteo Swainsoni*) was listed as a threatened species in 1983 by the California Fish and Game Commission. This listing was due to the loss of habitat and reduction of numbers of Swainson's hawks in California. There continues to be rapid loss and modification of habitat for Swainson's hawks in the California Central Valley. Human population increases and projected urbanization in Swainson's hawk habitat in California, continues to place the Swainson's hawk at the heart of development controversies. In order to accommodate human population and development growth and maintain a sustaining Swainson's hawk population in the state, it is essential that more complete and accurate inventory information be available regarding available habitat, breeding pair numbers, and species distribution. To this end, DFG has initiated this study to inventory the state of California for Swainson's hawk breeding pairs and provide an up-to-date and accurate assessment of the Swainson's hawk population in California.

Swainson's Hawk Inventory Goals

1) To estimate Swainson's hawk breeding pair numbers in California.
2) To test and establish a survey protocol that will be appropriate for long-term trend analysis of Swainson's hawk breeding pair numbers and habitat changes.

To achieve this, the project objectives are:

1) develop a scientifically based sample design and protocol for estimating Swainson's hawk breeding pair numbers statewide,
2) develop a habitat type map to correspond with Swainson's hawk range,
3) develop a protocol for a long-term trend analysis of Swainson's hawk breeding pairs, distribution, and habitat changes,
4) conduct a pilot study and an inventory of Swainson's hawk breeding pairs,
5) describe the current Swainson's hawk abundance and distribution.

Questions to be addressed:

1) How many breeding pairs of Swainson's hawks are there in California?
2) What are the current abundance, distribution and condition of habitats?
3) How to determine the future trends in abundance, distribution and condition of habitats?

6) STUDY APPROACH AND METHODS: (1 page)

General description of study and sampling design

Swainson's hawk breeding pair densities vary throughout their range in California. These varying densities cannot easily be explained by land cover/habitat type. This study stratifies current range into one of three strata across the state by known breeding pair densities. Dense, moderately dense and sparse strata (e.g. Dense = average density is ≥ one breeding pair per 10 sq mi, Moderately Dense = average density is ≥ one breeding pair per 11 to 75 sq mi, and Sparse = average density is ≥one breeding pair per 76+ sq mi) will be delineated within current range. Random samples were selected within each of these strata. The sample strata were overlain with the Township, Range and section grid, that delineate cells approximately one mile on a side (one sq mi). The exact area of each section is known as is the estimated total area of Swainson's hawk range, so breeding pair detection is based on a per square mile metric. In 2005, individual sample units were selected at random within each stratum for a sample design with two hundred samples in dense strata, 100 samples in moderately dense strata, and 60 samples in sparse strata. In 2006, individual sample units were selected at random within the dense and moderately dense strata in the Central Valley of California for a sample design with three hundred samples in dense strata and 150 samples in Moderately dense strata. An observer conducted a census of each sample unit and visited each sample unit one or more times, until the observer was satisfied he or she knew how many, if any, breeding pairs of Swainson's hawks inhabited the sample unit. Sample units that were not completely inventoried were mapped to show the portion that was surveyed and that area was used in the "per square mile" analysis. For efficiency, observers were assigned sample units that coincided with the geographic location with which they had the most familiarity. Maps of the sample units, field forms, and instructions were provided to the observers. A data management system was established as well as a Quality Control process to ensure data was entered with few errors.

A unique feature of this effort is the collaborative participation of several established experts on Swainson's hawk from other agencies or non-government entities in California. Through an interagency agreement with the University of California, the Department of Fish and Game has been able to secure and support the expertise needed to conduct these surveys that are of relatively short duration but time-consuming during the survey period. Such constraints in the appropriate timing of surveys for a particular wildlife species, and existing staff duties independent of this project, make it difficult to put together an internal team to conduct a statewide survey. The Department and members of the Swainson's Hawk Tehnical Advisory Committee (SWHTAC) worked to identify and recruit experts to participate in this project.

7) RESULTS and INTERPRETATION OF MAJOR FINDINGS: (2 pages)

Results

Approximately 95% of California Swainsons' hawks (SWHA) exist in the Central Valley. The 2005 inventory estimate for California SWHA pairs was 1912 (range 1471-2353 (95%)). The 2006

inventory estimate for California SWHA pairs was 2251 (range 1811-2690 (95%)). The combined 2005-2006 inventory results for California SWHA pairs is 2081 (range 1770-2393 (95%)). The combined 2005-2006 estimate for California Central Valley (CV) pairs is 1948. In 2005 the *Dense* areas had 0.51 nests per sq mi, *Moderate* areas had 0.07 nests per sq mi., and *Sparse* areas had 0.0 nests per sq. mi. because we didn't have any hits in the *Sparse* samples. Certainly there are pairs in the *Sparse* areas but they are in such low numbers they are difficult to sample. In 2006 the *Dense* areas had 0.39 nests per sq mi, *Moderate* areas had 0.18 nests per sq mi., and *Sparse* areas were not sampled. Figure 1 shows historic SWHA range and is overlain with a recent updating of SWHA range that includes the dense, moderately dense and sparse potions of the range. These areas do not have sharp boundaries but are generally accurate. Figure 2 displays sites sampled in 2005 and 2006 and whether SWHA pairs were detected.

Table 1 and 2 lists the results of the inventories and shows the 95 percent confidence intervals for the combined estimates. Figure 3 and 4 lists the mean height of the nests and nest trees, and the more common tree species used for nesting documented during the 2005 and 2006 inventories. Valley oaks were used for 36 percent of the nest trees, Cottonwood and willows were tied with 17 percent each and seven additional tree species together made up the remaining 30 percent. Figure 2 displays the results of the 2005 inventory. It shows where the samples were located and which sample sites had one or more Swainson's hawk pairs.

Table 3 documents the variety of tree species SWHAs use for nesting, with some of the more popular tree species being valley oak, cottonwood, eucalyptus, and willow. Table 4 documents the height of the nest trees and the nest heights. Table 5 compares the results of four SWHA inventories (including this one) conducted over the last three decades. We are not certain whether inventory methods are improving, SWHAs are increasing in numbers or both.

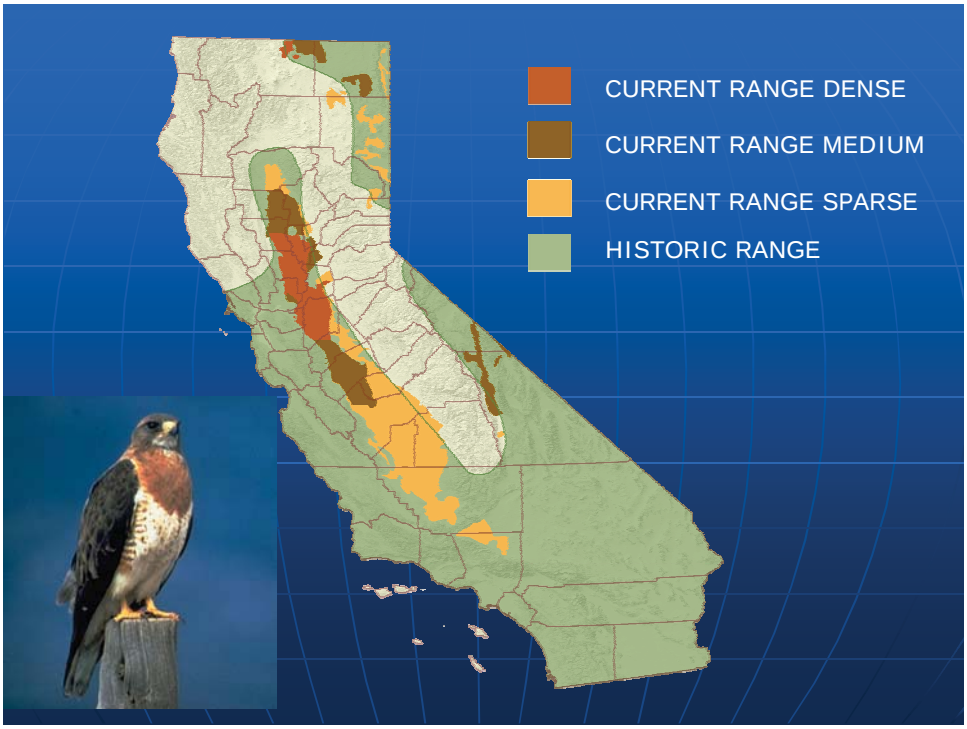


Figure 1: Swainson's hawk range in 2006 and historic range.

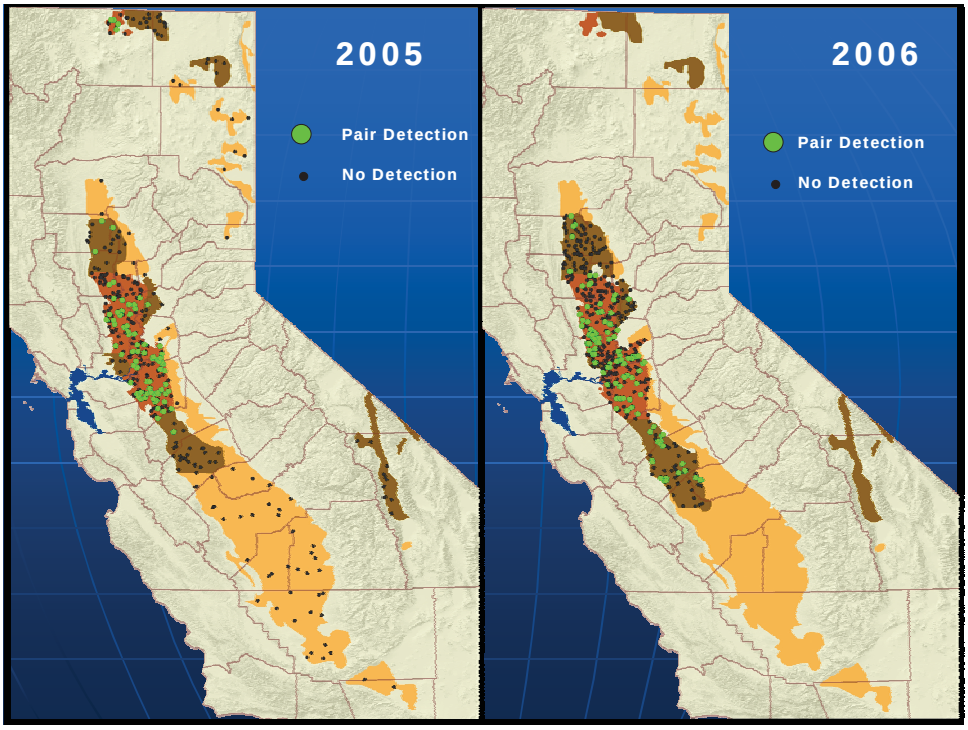


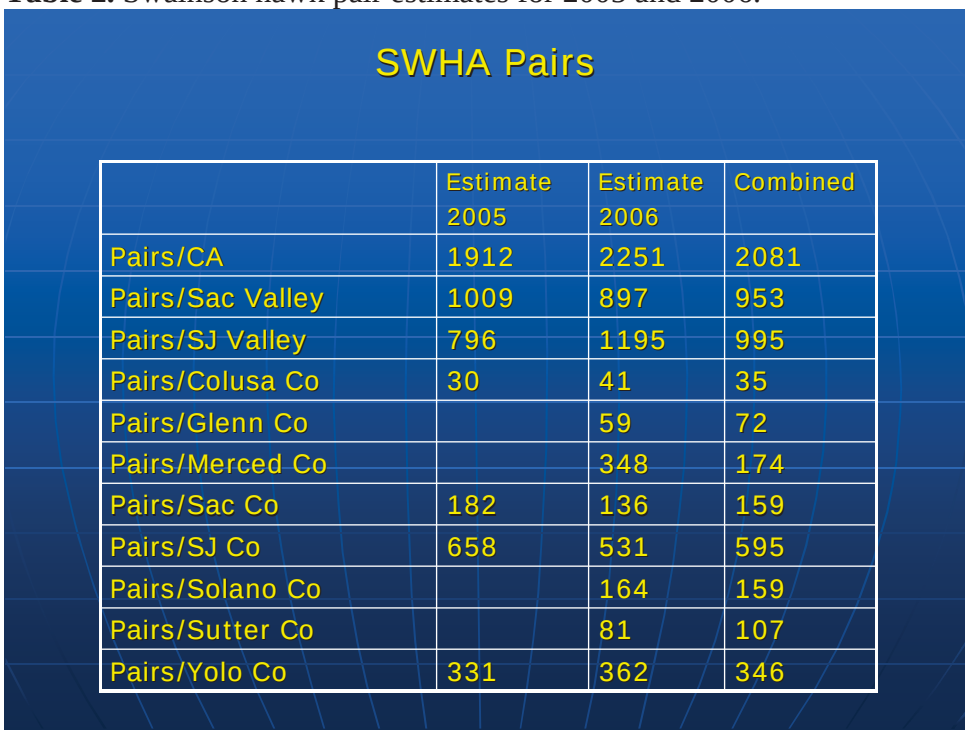
Figure 2. Sample locations and Swainson's hawk pair detections in 2005 and 2006.

Table 1. Results of 2005 and 2006 Swainson's hawk inventory.

SWHA Pairs 2005 & 2006 Combined

	Estimate	Lower 95%	Upper 95%
Pairs/CA	2081	1770	2393
Pairs/Sac Valley	953	772	1134
Pairs/SJ Valley	995	765	1226
Pairs/Colusa Co	35	6	65
Pairs/Glenn Co	72	7	136
Pairs/Merced Co	174	88	261
Pairs/Sac Co	159	105	213
Pairs/SJ Co	595	435	755
Pairs/Solano Co	159	93	226
Pairs/Sutter Co	107	39	175
Pairs/Yolo Co	346	239	453

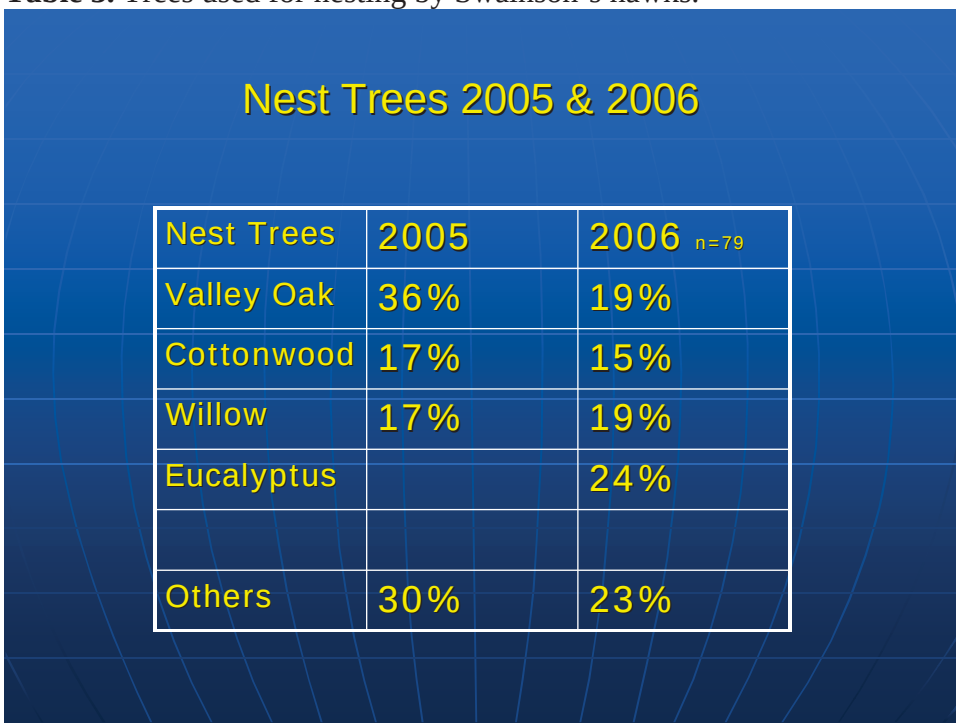
Table 2. Swainson hawk pair estimates for 2005 and 2006.



SWHA Pairs

	Estimate 2005	Estimate 2006	Combined
Pairs/CA	1912	2251	2081
Pairs/Sac Valley	1009	897	953
Pairs/SJ Valley	796	1195	995
Pairs/Colusa Co	30	41	35
Pairs/Glenn Co		59	72
Pairs/Merced Co		348	174
Pairs/Sac Co	182	136	159
Pairs/SJ Co	658	531	595
Pairs/Solano Co		164	159
Pairs/Sutter Co		81	107
Pairs/Yolo Co	331	362	346

Table 3. Trees used for nesting by Swainson's hawks.



Nest Trees 2005 & 2006

Nest Trees	2005	2006 n=79
Valley Oak	36%	19%
Cottonwood	17%	15%
Willow	17%	19%
Eucalyptus		24%
Others	30%	23%

Table 4. Nest tree height and nest height for Swainson's hawks.

Nest and Tree Height

	2005	2006
Mean Nest Tree Height	53.1 ft	48.6 ft
Mean Nest Height	43.4 ft	38.9 ft

Table 5. A comparison of Swainson's hawk inventories.

Statewide Swainson's Hawk Inventories

	1979 Bloom	1988 Estep	1994 CDFG	2006 CDFG/SWT AC/UCDWHC
SWHA Inventories	400 Statewide	800 Statewide	1000 Statewide	2081 Statewide

8) SIGNIFICANCE TO WILDLIFE RESOURCE ASSESSMENT: (1/2 page)

Some potential uses of the inventory results include:

- Recovery planning;
- Regional land use planning;
- Mitigation guidelines/strategy development;
- Updating current range and density information for SWHAs;
- Geographic information system uses such as habitat maps and natural resource databases; and
- Baseline for periodic inventories.

The preliminary results of the inventory are being used to assist in the drafting of a Departmental interim conservation strategy for the Swainson's hawk in California. A number of habitat conservation plans (HCP's) are being completed and implemented within California Central Valley Swainson's hawk range where development of essential habitats for the species is continuing at an accelerated pace. Results of this statewide inventory will be used to assist in those processes. The inventory results will be used to assess the species status. Additionally, geographical information systems (GIS) and other tools needed to assist in the design and implementation of recovery and conservation planning strategies can be developed from this inventory. Implementation of these conservation strategies, contained in the HCP's and other planning vehicles, will be needed in order to ensure the recovery of the Swainson's hawk and prevent its extirpation from California.

9) PUBLICATIONS: California Department of Fish and Game staff report.