

Appendix K

Addendum to the Biological Technical
Memorandum, prepared by CH2MHill,
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Technical Memorandum

Addendum
**Natomas Basin Habitat
Conservation Plan EIR/EIS**

April 2003

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SECTION 1

Introduction

A Biological Resources Technical Memorandum (CH2M HILL, 2002) was prepared to determine the adequacy of the conservation strategy of the Natomas Basin Habitat Conservation Plan (NBHCP), and to provide a basis for the analysis of impacts in the NBHCP and its Environmental Impact Report/Environmental Impact Statement (EIR/EIS). This Addendum to the Technical Memorandum has been prepared to clarify the original analysis and to support responses to public comments on the Draft NBHCP and Draft EIR/EIS.

This Addendum provides additional information to clarify the baseline habitat conditions for the Swainson's hawk, specifically the quality and availability of foraging opportunities. It also presents clarifying information to refine further the analysis of the effects of the NBHCP on foraging opportunities and the consequent potential effects to the Swainson's hawk population in the Natomas Basin. In addition, it updates the analysis of potential effects of removal of nest trees on the Swainson's hawk population in the Natomas Basin in consideration of implementation of conservation measures to date (CH2M HILL, 2002). The additional information in this Addendum comprises minor revisions to the original analysis conducted for the Draft EIR/EIS and it does not alter the original findings that a less-than-significant impact to Swainson's hawk is anticipated to result from implementing the conservation strategy of the NBHCP. No new or substantially more severe environmental impacts have been identified in the analysis.

The Addendum is organized in the following way:

- Section 1, Introduction
- Section 2, Assumptions and Approach
- Section 3, Additional Information Clarifying Baseline Conditions
- Section 4, Additional Information Clarifying the Effects of Implementing the NBHCP
- Section 5, Conclusions
- Section 6, References

Assumptions and Approach

This section presents the approach and the assumptions used to develop additional information on baseline conditions and the effects of implementing the NBHCP on foraging habitat. Additional baseline information was developed by: (1) quantifying foraging habitat by habitat value and (2) quantifying the temporal availability of foraging opportunities during the months when Swainson's hawks are in the Natomas Basin (April through September). Information that further refines the 2002 Biological Resources Technical Memorandum's determination of the impacts of changes in foraging habitat on Swainson's hawk was developed by evaluating changes in the value and temporal availability of foraging habitat under a range of possible implementation scenarios on the Mitigation Lands (i.e., lands managed by The Natomas Basin Conservancy [TNBC] pursuant to the NBHCP).

2.1 Value of Foraging Habitat

The 2002 Biological Resources Technical Memorandum and Draft EIR/EIS rely on a habitat database to present quantitative information on the acreage of potential Swainson's hawk foraging habitat available in the Natomas Basin (see Tables 4-12 and 4-13 of the Draft EIR/EIS). The habitat database is based on the California Department of Water Resources (DWR) land cover database, which includes information on specific cover types (including crop types) during 1993 for Sacramento County and 1998 for Sutter County. Cover types considered to provide potential foraging habitat for Swainson's hawk are: non-rice crops, pasture, idle, ruderal, grassland, and alfalfa. While the Draft EIR/EIS acknowledges that different cover types offer different value as foraging habitat for Swainson's hawk, differences in estimated habitat values are not quantitatively described. In this manner, the Draft EIR/EIS assumes that all potential foraging habitat provides the same value—a conservative approach because foraging habitat value would not be underestimated.

This Addendum clarifies the prior analysis by classifying foraging habitat from the database (CH2M HILL 2002) as Low, Moderate, or High value using a class system developed by Estep and Teresa (1992). The habitat value classes of Estep and Teresa (1992) reflect differences in prey abundance and accessibility and are derived from a study (Estep 1989) of Swainson's hawk in the Central Valley. Based on the habitat preferences of 12 Swainson's hawks in the Central Valley, agricultural land uses are ranked according to their relative value as foraging habitat from most valuable to least valuable as follows:

- | | |
|---------------------|----------------------|
| 1. Alfalfa | 6. Tomatoes |
| 2. Discd field | 7. Irrigated pasture |
| 3. Fallow | 8. Grains |
| 4. Dry-land pasture | 9. Other row crops |
| 5. Beets | 10. Other |

This ranking reflects differences in prey abundance and accessibility among the cover types. The habitat value rating collapses this ranking into three categories: Low, Moderate, and High.

Table 1 shows the specific crop and pasture types mapped in the Natomas Basin and the corresponding habitat value designation.

TABLE 1

Foraging Habitat Value of Crops, Pasture and Other Cover Types for Swainson's Hawk in the Natomas Basin

Habitat value is based on Estep and Teresa (1992)

Cover Type	Habitat Value		Comment
Non-rice crops			
Sugar beet	Moderate	None	
Tomato	Moderate	None	
Corn	Low	None	
Safflower	Low	None	
Onions and garlic	Low		Assigned Low value because a majority of the row and field crops (6 out of 11) listed by Estep and Teresa (1992) are considered Low foraging habitat value. Tall plant structure would impede access to prey.
Melons, squash and cucumber	Moderate		Assigned Moderate value based on similar structure to tomatoes
Beans	Moderate	None	
Unspecified row and field crops	Low		Assigned Low value because a majority of the row and field crops (6 out of 11) listed by Estep and Teresa (1992) are assigned Low value.
Wheat	Moderate	None	
Pasture			
Alfalfa	High	None	
Clover	Moderate		Irrigated pasture in Estep and Teresa (1992)
Unspecified or mixed	Moderate		Irrigated pasture In Estep and Teresa (1992)
Grassland	Moderate		Grassland is assumed to provide Moderate habitat value (Rineck, pers. comm)
Idle	High		Idle fields are considered to be fallow fields under Estep and Teresa's (1992) habitat valuation approach. The Idle classification includes lands not cropped in the current or previous season but cropped in past 3 years. These fields are considered to be "High" value because stubble left after harvest provides forage for rodents and access for hawks. They would not have been idled long enough to allow development of vegetation sufficient to block access to prey by hawks.
Ruderal	Moderate		Ruderal lands are considered similar to fallow fields. Estep and Teresa (1992) show fallow fields as "High" or "Moderate" and note that the value of fallow fields as foraging habitat for Swainson's hawks depends on the height and density of vegetation. Ruderal was used for areas designated as "barren" in the DWR habitat classification. These areas, while not likely to have much vegetation cover, also would not be expected to support abundant prey because of limited vegetation. Therefore, the ruderal designation is considered to be "Moderate" rather than "High."

2.2 Temporal Availability of Foraging Opportunities

Bechard (1982) and Estep (1989) suggest that while some crop types support high prey abundance, the dense cover of vegetation in cultivated fields makes prey inaccessible to Swainson's hawk during much of the spring and summer. Prey are accessible during harvest and Swainson's hawks often are observed foraging in close association with harvesting equipment. Some crops (e.g. alfalfa) provide accessible prey throughout the hawk's residency period because frequent harvest and irrigation expose or concentrate prey, making them vulnerable to predation by hawks.

The temporal availability of foraging opportunities is discussed in the Draft EIR/EIS. In this Addendum, additional information is presented on the temporal availability of foraging opportunities based on time of harvest in the Natomas Basin. For example, alfalfa is harvested and irrigated monthly beginning in April and continuing through September, thus providing foraging opportunities in every month during which hawks are in the Basin. In contrast, corn is harvested only in September. This Addendum assumes that prey are accessible in corn only during September, and the 924 acres of corn in the Basin are considered to provide potential foraging habitat only during that month. The months in which each cover type is considered to provide foraging opportunities for Swainson's hawks are shown in Table 2. For crops harvested during a 2-month period (e.g. sugar beets), half of the acreage is assumed to be harvested in each month.

TABLE 2
Months in which Each Cover Type Provides Foraging Opportunities for Swainson's Hawk

Cover Type	Months	Comment
Non-rice crop		
Sugar beet	September – October ^a	None
Tomato	July – August	None
Corn	September	None
Safflower	August	None
Onions and garlic	August	None
Melons, squash and cucumber	October ^a	Pumpkins
Beans	October ^a	None
Unspecified row and field crops	July – August	Conservatively assumed to be the same as tomatoes
Wheat	June	None
Pasture		
Alfalfa	April – September	None
Clover	April – September	None
Unspecified or mixed	April – September	None
Grassland	April – September	Grassland were assumed to be consistently usable as foraging habitat.

TABLE 2
Months in which Each Cover Type Provides Foraging Opportunities for Swainson's Hawk

Cover Type	Months	Comment
Idle	April – September	Idle fields were assumed to be consistently usable as foraging habitat.
Ruderal	April – September	Ruderal lands were assumed to be consistently usable as foraging habitat.

^a Swainson's hawks have migrated out of the Natomas Basin by October and if these crops were harvested in October they would not provide any foraging habitat for Swainson's hawks.

Sources: J. Williams, University of California, Davis Agricultural Extension Program, pers. comm.
J. Dickey, CH2M HILL, pers. comm.
Smallwood (1995)

2.3 Assumptions for Mitigation Lands Implementation Scenarios

The additional information on habitat value and the temporal availability of foraging habitat allows further refinement on the potential effects of the NBHCP on Swainson's hawk. One component of the NBHCP is the acquisition and management of lands by TNBC to provide habitat for Covered Species. The NBHCP specifies the total acreage of land to be acquired and the habitat composition to be provided in the reserves. To meet the reserve requirements, the NBHCP allows TNBC to acquire lands that currently provide habitat for Covered Species and manage and protect those lands in perpetuity. Alternatively, TNBC can acquire lands that do not provide habitat for Covered Species and implement actions to create habitat. As a result of this flexibility, there is a range of possible future habitat conditions in the Natomas Basin depending on how much of the reserve acreage consists of existing habitat. To clarify further the potential effects of the NBHCP on Swainson's hawks, three implementation scenarios are considered in this Addendum to capture the range of possible habitat conditions that could occur under the NBHCP. The following text describes the acreage and habitat composition requirements specified in the NBHCP, the assumptions on the value and temporal availability of foraging opportunities of habitats on the reserve, and the assumptions for the range of implementation scenarios used to refine the effects on the NBHCP on Swainson's hawk in this document.

2.3.1 Summary of NBHCP Requirements and Assumptions for Mitigation Lands

The NBHCP requires that 8,750 acres be acquired and maintained in a habitat reserve system (i.e., the Mitigation Lands) as mitigation for Authorized Development (i.e., the 17,500 acres of development authorized under the NBHCP). Of this 8,750 acres, 4,375 acres would be in rice, 2,187.5 acres would be managed marsh, and 2,187.5 acres would be upland habitat¹. Foraging opportunities for Swainson's hawk occur in the upland habitat, as well as portions of the rice and managed marsh, as discussed below. The assumptions used in this Addendum for this habitat are presented below:

- The 2,187.5 acres of upland habitat would be primarily managed to provide foraging habitat for Swainson's hawk. This habitat is assumed to be of High value and to provide consistently accessible prey through the hawk's residency period in the Natomas Basin.

¹ The NBHCP stipulates that the acreage of managed marsh can be increased up to 6,562.5 acres under certain conditions.

- The NBHCP requires fallowing of 10 percent of the rice each year and implementation of management practices to increase foraging habitat value for Swainson's hawk (Section V.4.b). The 437.5 acres of fallowed rice under the NBHCP is assumed to provide consistently accessible prey throughout the hawk's residency period, but is classified as Moderate-value habitat because prey likely would not be able to achieve high abundance in the short period during which the rice is fallowed.
- The managed marsh includes an upland component comprising 20 to 30 percent of the acreage. This upland habitat would consist mainly of annual and perennial grassland similar to native foraging habitat for Swainson's hawk. This habitat is assumed to provide consistently accessible prey for Swainson's hawk but to be of Moderate habitat value because of low to moderate prey abundance (Rinek, Personal Communication). Managed marsh is assumed to provide 546.9 acres (25 percent of 2,187.5 acres) of potential foraging habitat for Swainson's hawk.

2.3.2 Implementation Scenarios

The NBHCP does not identify specific lands to be acquired as Mitigation Lands to meet these requirements, and allows acquisition of lands that currently provide habitat to meet the acreage requirements. With this implementation flexibility, a range of possible outcomes exists for future habitat conditions in the Natomas Basin for Swainson's hawk. This Addendum considers three possible scenarios to encompass the possible range of future habitat conditions in the Natomas Basin depending on habitat value and temporal availability of foraging opportunities provided by lands incorporated into the reserve system. The three possible scenarios are summarized in Table 3 at the end of this section.

Under Scenario 1, it is assumed that all of 2,187.5 acres of upland habitat in the reserves consist of TNBC acquiring lands that currently do not provide foraging opportunities for Swainson's hawk and converting those lands to suitable foraging habitat. Similarly, the 546.9 acres of upland habitat associated with managed marsh is assumed to be created from lands that currently do not provide foraging opportunities for Swainson's hawk. The 10 percent of fallowed rice also is assumed to be derived for lands that do not currently provide foraging habitat for Swainson's hawk because it is assumed that in the absence of the NBHCP's fallowing requirement these lands would be flooded to produce rice. Thus, under Scenario 1, all potential foraging habitat for Swainson's hawk is considered to be newly created and, therefore, additive to other foraging habitat remaining in the Basin.

Under Scenario 2, upland habitat associated with managed marsh and fallowed rice come from lands that currently do not provide foraging opportunities for Swainson's hawk as assumed for Scenario 1. The 2,187.5 acres of upland habitat, however, is assumed to be derived from a row crop that can be used by Swainson's hawk for foraging. Row crops can provide Low or Moderate value as foraging habitat. For Scenario 2, the lands acquired for the reserve is used to consist of row crops that provide Low value. It was assumed that TNBC converted the row crops to a High-value cover type for Swainson's hawk foraging. To analyze the future temporal availability of foraging opportunities under Scenario 2, it is assumed that the row crops incorporated into the reserve consist of a crop harvested in September and, therefore, provide foraging opportunities in this month only. It is assumed that TNBC converted the crop to a cover type that provides foraging opportunities continually during April through September.

Scenario 3 constitutes the worst case for Swainson's hawk foraging habitat because it assumes that much of the upland habitat in the reserves consists of lands that currently provide High-value foraging habitat for hawks. For the habitat value analysis, all of the High-value habitat remaining outside of development areas (1,102 acres) is incorporated into the reserves. The remaining 1,085 acres of upland habitat required in the reserves are assumed to consist of lands that currently provide Moderate-value habitat. It is assumed that TNBC converts or manages these lands such that they provide High-value habitat. For the temporal availability analysis, all of the habitats remaining outside of development areas that provide foraging opportunities during April through September (1,102 acres) are assumed to be incorporated into the reserves with the balance of the required acreage assumed to come from a crop that is harvested in June. It was assumed that TNBC converted the crop to a cover type that provides foraging opportunities continually during April through September. Upland habitat associated with managed marsh and fallowed rice is assumed to come from lands that currently do not provide foraging opportunities for Swainson's hawk as assumed for Scenario 1.

Future habitat conditions identified in this Addendum, the 2002 Technical Memorandum, and the EIR/EIS are determined by first assuming that habitat in areas of Authorized Development were lost. Habitat conditions outside of Authorized Development areas are assumed not to change, based on the assumptions described above for each of the implementation scenarios. Future habitat conditions in the Natomas Basin are predicted in consideration of the implementation of the NBHCP. For Scenario 1, the acreage of upland habitat to be provided in the reserves is added to the foraging habitat projected to remain outside of development areas. For Scenario 2, the acreage of foraging habitat provided by fallowed rice and the upland component of managed marsh is added to the habitat projected to remain outside of development areas. To determine habitat value, the 2,187.5 acres of upland habitat in the reserves is accounted for by moving acres from the Low value class to the High value class. To determine temporal availability, the upland habitat in the reserves is assumed to provide additional foraging opportunities during April through August but not to provide any additional foraging opportunities in September. For Scenario 3, the 1,102 acres of High-value habitat is assumed to be incorporated into the reserves. To account for the remaining 1,085 acres, in this habitat value analysis this acreage is moved from the "Moderate" value class to the "High" value class. To determine temporal availability, the upland habitat in the reserves is assumed to provide additional foraging opportunities during April, May, July, August, and September, but not to provide any additional foraging opportunities in June.

TABLE 3

Summary of Assumptions for the Implementation Scenarios used to Evaluate the Range of Potential Effects to Foraging Habitat for Swainson's Hawk from Implementing the NBHCP.

Scenario	Description
Scenario 1	<p>The 2,187.5 acres of upland habitat in the reserve is derived from cover types that currently do not provide foraging opportunities for Swainson's hawk. The upland habitat would be managed as High-value habitat and would provide consistently accessible prey throughout the hawk's residency period of April through September.</p> <p>Fallowed rice provides 437.5 acres of potential foraging habitat and is derived from non-habitat (i.e., formerly flooded rice fields). Fallowed rice is assumed to provide consistently accessible prey throughout the hawk's residency period but to be of Moderate value because of moderate prey abundance.</p> <p>The upland component of managed marsh would provide 546.9 acres of potential foraging habitat and is derived from lands that are not currently classified as foraging habitat. Upland habitat in managed marsh is assumed to provide consistently accessible prey throughout the hawk's residency period, but to be of Moderate value because of moderate prey abundance.</p>
Scenario 2	<p>For assessing future habitat value, the 2,187.5 acres of upland habitat in the reserve is derived from a crop providing Low-value habitat. For the analysis of temporal availability of foraging opportunities, the 2,187.5 acres of upland habitat in the reserve is derived from a crop that provides foraging opportunities in September when it is harvested. The upland habitat in the reserve is assumed to be managed as High-value habitat and would provide consistently accessible prey throughout the hawk's residency period of April through September.</p> <p>Fallowed rice and the upland component of managed marsh provide foraging opportunities as under Scenario 1.</p>
Scenario 3	<p>For the 2,187.5 acres of upland habitat, 1,102 acres of High-value habitat remaining after Authorized Development is incorporated in the reserves. The remaining (1,085 acres) of upland habitat is derived from a crop providing Moderate-value habitat and harvested in June. The created upland habitat is of High value and provides consistently accessible prey throughout the hawk's residency period of April through September.</p> <p>Fallowed rice and the upland component of managed marsh provide foraging opportunities as under Scenario 1.</p>

Additional Information Clarifying Baseline Conditions

Using the assumptions presented in Section 2 of this Addendum, this section presents the refined analysis to clarify the 2002 Biological Resources Technical Memorandum.

3.1 Value of Foraging Habitat

On the basis of the habitat value ratings in Table 1 combined with DWR land cover data, the habitat database developed for the Draft EIR/EIS indicates that most of the potential foraging habitat in the Natomas Basin is of Moderate value (Table 4). Less than 10 percent of the potential foraging habitat in the Natomas Basin is classified as High value. High-value potential foraging habitat generally occurs in scattered patches throughout the Natomas Basin (Figure 1). Given the small amount of High-value habitat in the Basin, hawks might need to forage over large distances to find a sufficient amount of suitable prey.

TABLE 4
Baseline Conditions and Changes in Potential Swainson's Hawk Foraging Habitat by Habitat Value (acres)

Habitat Value Class	Baseline	City of Sacramento	Metro Air Park	Sutter County	Total Change	Remaining Foraging Habitat ^a
High	1,835	(675)	(50)	(8)	(733)	1,102
Moderate	15,666	(5,098)	(349)	(1,852)	(7,299)	8,367
Low	4,550	(1,152)	(4)	0	(1,156)	3,394

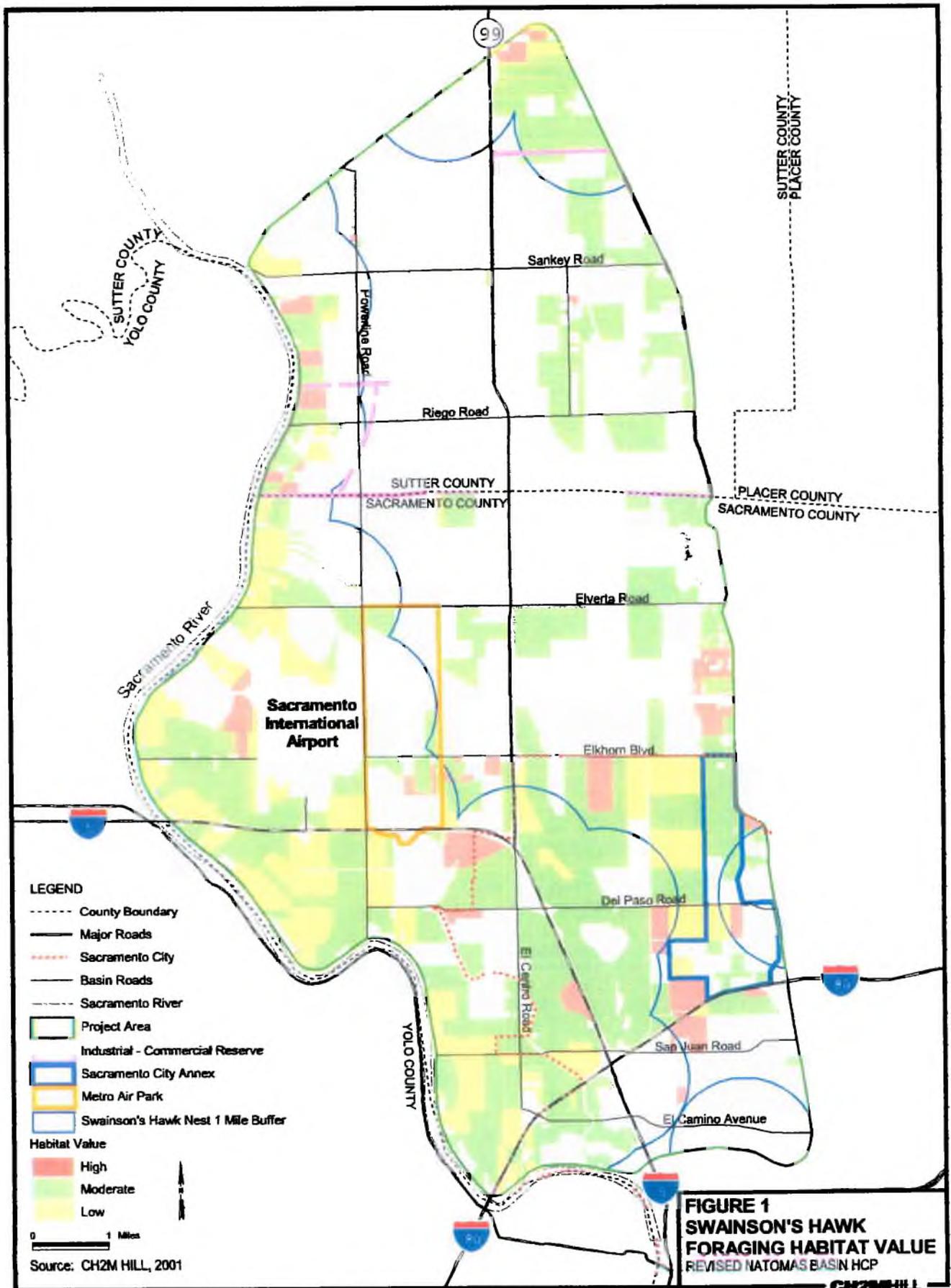
(#) Decrease in acreage

^a Remaining Foraging Habitat represents habitat assumed to remain outside of areas of Authorized Development. It does not include habitat created and maintained under the NBHCP.

Source: Habitat and Land Use Assessment Database prepared for NBHCP Draft EIR/EIS and Biological Resources Technical Memo (CH2M HILL 2002)

3.2 Temporal Availability of Foraging Opportunities

Swainson's hawks forage opportunistically and are reported to travel large distances (up to 18 kilometers [km]) to forage. Foraging patterns appear to reflect the temporal and spatial accessibility of prey. Estep (1989) reports that hawks with a large amount of alfalfa or pastureland in their territories tend to have smaller and more stable foraging ranges throughout the spring and summer than do hawks nesting in areas dominated by row crops. The smaller, more stable home range is attributed to alfalfa and pastureland providing consistently accessible prey such that the hawks did not need to travel long distances to forage.



For one hawk nesting in an area dominated by row and grain crops, Estep (1989) reports a marked increase in foraging range during June and July and attributed this increase to reduced accessibility of prey in row crops because of dense vegetation coverage. This hawk's foraging range constricted in the late summer (August) when crops were being harvested near its nest.

In Washington, Bechard (1982) reports that Swainson's hawk home ranges increase as the acreage of cultivated land consisting of wheat, peas or mustard increases and the acreage of uncultivated land (i.e., pasture and "eyebrows"²) decreases. As does Estep (1989), Bechard (1982) reports that cultivated fields have high prey abundance, but are not to be used by Swainson's hawk until harvest activities make prey accessible. Where habitats such as alfalfa, which provides consistently accessible prey, predominate near nest sites, home ranges of Swainson's hawk are small (Woodbridge, 1991, cited in England et al., 1997; Estep, 1989; Bechard, 1982).

Considering the seasonality of foraging opportunities of each cover type, the acreage of usable foraging habitat available in the Natomas Basin varies considerably during the period when Swainson's hawks are in the Basin (Figure 2). Most of the potential foraging habitat in the Basin consists of row and field crops that predominantly provide foraging opportunities only late in the summer and early fall when the crops are being harvested. The least amount of potential foraging habitat is available during April, May, and July.

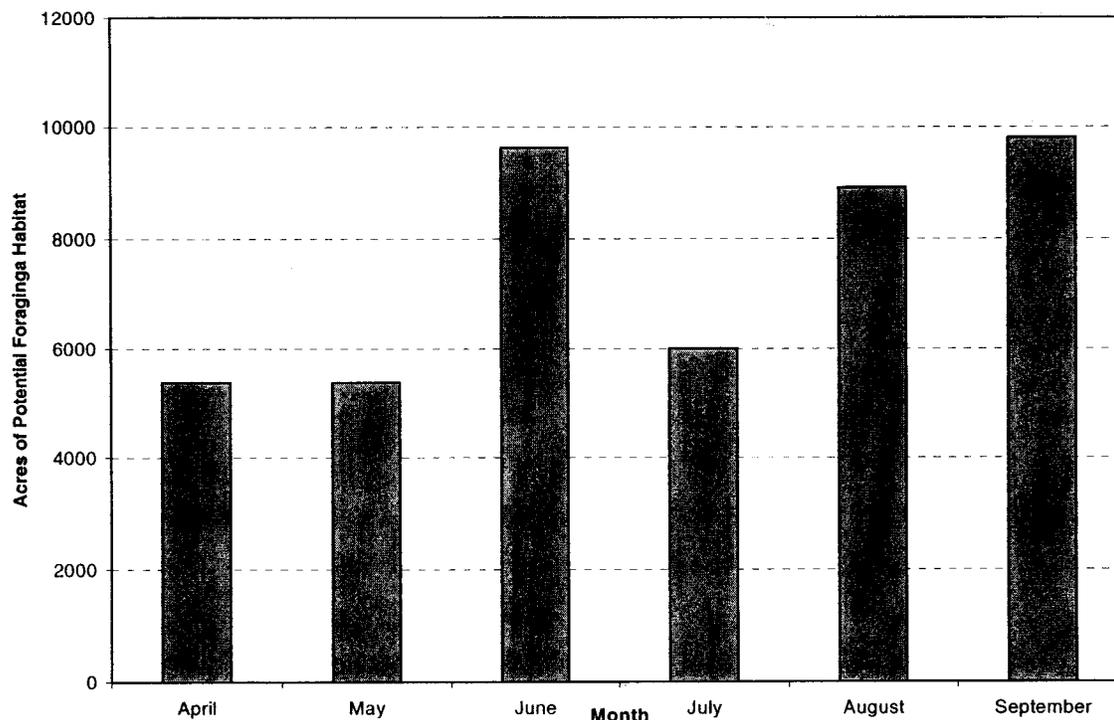


FIGURE 2
Monthly Availability of Potential Foraging Habitat for Swainson's Hawk under Baseline Condition.

² "Eyebrows" is a local term for narrow patches of unplowed land on steep hillsides.

Swainson's hawk lay eggs in April and young fledge in July (Estep 1989). Thus, much of the potential foraging habitat in the Natomas Basin does not provide accessible prey during the nesting period.

3.3 Habitat Conditions Close to Nest Sites

Swainson's hawk can forage over large areas (up to about 18 miles [Estep, 1989]), thus all of the Natomas Basin is accessible to Swainson's hawks nesting along the Sacramento River and elsewhere in the Basin. Reproductive success, however, declines as distance to foraging habitat from the nest increases (Woodbridge, 1991, cited in England et al., 1997). England et al. (1995) reports lower reproductive success for birds nesting in urban areas (Davis and Stockton, California) as compared to birds nesting in rural areas. Based on findings by Babcock (1995) that hawks typically did not return to the nest with prey caught far from a nest and the absence of nesting birds in nearby urban areas that are surrounded by habitats unsuitable for foraging (e.g., Lodi), he attributes this difference to urban nesting birds traveling farther to forage.

The availability and quality of habitat near nests has the potential to influence reproductive success, thus changes in foraging habitat within 1 mile of nest sites under the NBHCP also were evaluated in the 2002 Biological Resources Technical Memorandum and are further refined in this Addendum. The acreage of potential foraging habitat within 1 mile of nest sites identified through 2001 is shown in Table 5. Most of this acreage consists of Moderate-value habitat; only 899 acres of habitat designated as High value occurs within 1 mile (Table 6). Much of the Moderate-value habitat consists of row crops that predominantly provide foraging opportunities late in the summer and early fall during harvest, and therefore does not contribute to foraging habitat during the nesting season. Based on this information, it appears that hawks nesting in the Natomas Basin have little foraging habitat available near nest sites under existing conditions during the nesting season.

TABLE 5
Baseline Conditions and Change in Potential Foraging Habitat within 1 Mile of Swainson's Hawk Nest Sites (acres)

Habitat Class	Baseline	City of Sacramento	Metro Air Park	Sutter County	Total Change	Remaining Foraging Habitat ^a
Alfalfa	280	0	0	0	0	280
Grassland	51	(21)	0	0	(21)	30
Idle	619	(264)	(47)	0	(311)	308
Non-rice Crops	9,698	(2,523)	(232)	(159)	(2,915)	6,784
Pasture	353	(3)	(20)	0	(23)	330
Ruderal	1,444	(868)	(6)	(5)	(879)	565
Total	12,446	(3,679)	(305)	(165)	(4,149)	8,297

(#) Decrease in acreage

^a Remaining Foraging Habitat represents habitat assumed to remain outside of areas of Authorized Development. It does not include habitat created and maintained under the NBHCP.

Source: Habitat and Land Use Assessment Database prepared for NBHCP Draft EIR/EIS and Biological Resources Technical Memo (CH2M HILL, 2002)

TABLE 6
Baseline Conditions and Change in Potential Foraging Habitat by Habitat Value within 1 Mile of Swainson's Hawk Nest Sites (acres)

Habitat Value Class	Baseline	City of Sacramento	Metro Air Park	Sutter County	Total Change	Remaining Foraging Habitat^a
High	899	(264)	(47)	0	(311)	588
Moderate	8,532	(3,079)	(252)	(164)	(3,498)	5,035
Low	3,014	(336)	(4)	0	(339)	2,674
Total	12,445	(3,679)	(305)	(164)	(4,148)	(8,297)

(#) Decrease in acreage

a Remaining Foraging Habitat represents habitat assumed to remain outside of areas of Authorized Development. It does not include habitat created and maintained under the NBHCP.

Source: Habitat and Land Use Assessment Database prepared for NBHCP Draft EIR/EIS and Biological Resources Technical Memo (CH2M HILL, 2002)

Additional Information Clarifying Effects of Implementing the NBHCP

4.1 Changes in Foraging Habitat from Authorized Development

With implementation of the NBHCP, Authorized Development would occur in the City of Sacramento, Sutter County, and Metro Air Park (Draft NBHCP EIR/EIS, 2002). As discussed in the Draft EIR/EIS (see Table 4-12 of the Draft EIR/EIS), this level of development would result in the loss of about 9,188 acres of potential foraging habitat in the Basin. Most (7,299 acres) of the habitat that would be affected would comprise a variety of row and field crops with Moderate habitat value (Table 4). Somewhat more than 10 percent (733 acres) would be High-value habitat. As noted in Section 1, above, the impact to Swainson's hawk from a reduction in foraging habitat was evaluated in the 2002 Biological Resources Technical memorandum. This Addendum provides additional information clarifying the less-than-significant impact determination made in the Draft EIR/EIS (see Section 4.4.5.2.11 of the Draft EIR/EIS).

The primary effect of urban development on foraging habitat for Swainson's hawk would be a reduction of the acreage of usable foraging habitat late in the summer (primarily August and September). Young have fledged by this time, the reduction in row and field crops would not be expected to affect immediate reproductive success. For hawks still on the breeding grounds and preparing to migrate in August and September, it is unlikely that foraging opportunities would be limiting. Of the crop and cover types investigated by Estep (1989), tomatoes and beets had the highest relative abundance of prey species. Prey species were two to three times greater in tomatoes and sugar beets than alfalfa and dryland pasture. These prey become available all at once during harvest in late July through September resulting in an abundance of accessible prey during these months.

Of the 9,188 acres lost, urban development would affect 733 acres of High-value potential foraging habitat. None of the 371 acres of alfalfa would be impacted. Most of the reduction would consist of idle lands that while designated as High habitat value in this analysis, probably encompass a wide range of habitat value for Swainson's hawk. Of this 733 acres, only 311 acres of foraging habitat classified as High value and within 1 mile of a known nest site would be affected by Authorized Development.

Reproductive success of Swainson's hawk appears to fluctuate in response to prey availability (Bechard, 1983; Houston and Schmutz, 1995). Houston and Schmutz (1995) report that the number of young per successful nest appeared stable between for three decades up until 1987 but declined thereafter with the six years of 1988 through 1993 showing the lowest number of young per successful nest. They noted that the decline in reproductive success corresponded with a decline in the hawk's primary prey of ground squirrel. Nesting density also was higher during years of high prey availability as compared to years characterized as normal prey availability. During a 4 year study, Bechard (1983) monitored reproductive success and nestling weight at hawk nests in cultivated areas and uncultivated but grazed

areas. He found lower reproductive success and lower nestling weights at nests in cultivated areas. Interpreting nestling weight as an index of food availability, he suggested that Swainson's hawks adjust brood size in response to prey availability.

Without the implementation of any habitat conservation measures, the loss of 733 acres of High-value habitat could adversely affect the reproductive success of Swainson's hawks in the Natomas Basin and/or the size of the nesting population. High-value foraging habitat for Swainson's hawk provides moderate to high abundance of prey that is consistently accessible. The loss of High-value areas has greater potential to adversely affect the size of the nesting population of Swainson's hawk in the Natomas Basin and its reproductive success than does the loss of Moderate or Low-value habitat because most of the Moderate and Low-value habitat consists of row and field crops that predominantly provide foraging opportunities when the crops are harvested after the nesting season.

4.2 Effects of NBHCP Conservation Measures on Foraging Habitat

4.2.1 General Discussion of Effects

Under the NBHCP, Mitigation Lands would be established outside of the area of Authorized Development. Mitigation Lands would be maintained in perpetuity and specifically managed to provide habitat for the Covered Species. The reserves would not be the only foraging habitat available to Swainson's hawks nesting in the Natomas Basin. Agricultural lands outside the Authorized Development areas in the Natomas Basin also would continue to provide foraging opportunities. In addition, foraging habitat is available in Yolo County on the west side of the Sacramento River. Yolo County supports more than 200,000 acres of non-rice agricultural crops with about 40,000 acres of alfalfa (California Agricultural Commissioners, 2003). While only a portion of this habitat would be within the foraging distance of hawks nesting on the Sacramento River, lands in Yolo County nonetheless contribute to the foraging habitat base for the Swainson's hawk population in the Natomas Basin.

Under the NBHCP, 2,187.5 acres of the Mitigation Lands would be upland habitat managed specifically to provide foraging habitat for Swainson's hawk. Upland habitat in the reserves would be managed to provide consistently available and abundant prey for Swainson's hawk. A specific habitat or crop type that would comprise the upland habitat is not specified in the NBHCP, thereby allowing TNBC to select the most effective and appropriate cover type for a particular property for providing foraging opportunities for Swainson's hawks. Effective cover types could include alfalfa where feasible, native grasses or other mixes of legumes, grasses and herbs. TNBC currently is working with agricultural experts from the University of California Davis Cooperative Extension Program to identify plant mixes that support abundant prey and allow management in a manner that makes prey regularly available to Swainson's hawk throughout their residency period (e.g., regular irrigations, harvest and/or mowing).

In addition to the 2,187.5 acres of upland habitat, foraging opportunities for Swainson's hawk also would be available in portions of the reserve system managed for the giant garter snake. The Mitigation Lands will include 4,375 acres of rice. Ten percent of the rice will be fallowed each year, providing 437.5 acres of foraging habitat for Swainson's hawk. Managed marsh created for giant garter snake would contain 20 to 30 percent upland habitat. These upland

areas predominantly would consist of grassland habitat comparable to native grassland habitat formerly present in the Natomas Basin. Managed marsh and rice fields of the reserves would provide 978.4 total acres of potential foraging habitat for Swainson's hawk.

4.2.2 Effects Considering the Value of Foraging Habitat

As discussed in the 2002 Biological Resources Technical Memorandum, future habitat conditions with implementation of the NBHCP cannot be predicted precisely because the foraging habitat value on Mitigation Lands yet to be acquired remains to be determined. The range of future conditions under the NBHCP is identified through consideration of the three implementation scenarios described above (Table 3).

Scenario 1 represents the best possible future condition for Swainson's hawk because all foraging habitat in the reserves would be derived from lands that currently do not provide foraging opportunities for Swainson's hawk, representing the largest increase in foraging habitat. Under this scenario, the Natomas Basin would support about 16,035 acres of potential foraging habitat, about 6,016 acres less than under the baseline condition (Table 7 and Figure 3). With the NBHCP, however, the amount of High-value habitat would nearly double relative to baseline conditions, with the reduction in habitat primarily affecting Moderate and Low-value habitats.

Scenarios 2 and 3 would result in about 13,847 acres of potential foraging, which is a reduction of about 8,204 acres relative to baseline conditions (Table 7). As in Scenario 1, the amount of High-value habitat would nearly double under Scenario 2. The acreage of Moderate and Low-value habitat would decrease under Scenario 2 with the acreage of Low-value habitat decreasing to a greater extent than under Scenario 1.

Scenario 3 would result in the least amount of High-value habitat and would result in only a small increase (about 350 acres) in High-value habitat over baseline conditions. Moderate- and Low-value habitat would decrease under Scenario 3 as under Scenario 1. The smaller increase in High-value habitat under Scenario 3 develops from the assumption of this scenario that all remaining High-value habitat is incorporated into the reserves.

TABLE 7
Change in Potential Foraging Habitat by Habitat Value With Implementation of the NBHCP (acres)

Habitat Value Class	Baseline	Acres Affected by Development	Remaining Foraging Habitat ^a	Scenario 1 ^b	Scenario 2 ^b	Scenario 3 ^b
High	1,835	733	1,102	3,290	3,290	2,188
Moderate	15,666	7,299	8,367	9,351	9,351	8,265
Low	4,550	1,156	3,394	3,394	1,207	3,394
Total	22,051	9,188	12,863	16,035	13,847	13,8475

(#) Decrease in acreage

^a Remaining Foraging Habitat represents habitat assumed to remain outside of areas of Authorized Development. It does not include habitat created and maintained under the NBHCP.

^b See Table 3 for description of each scenario

Source: Habitat and Land Use Assessment Database (CH2M HILL, 2002)

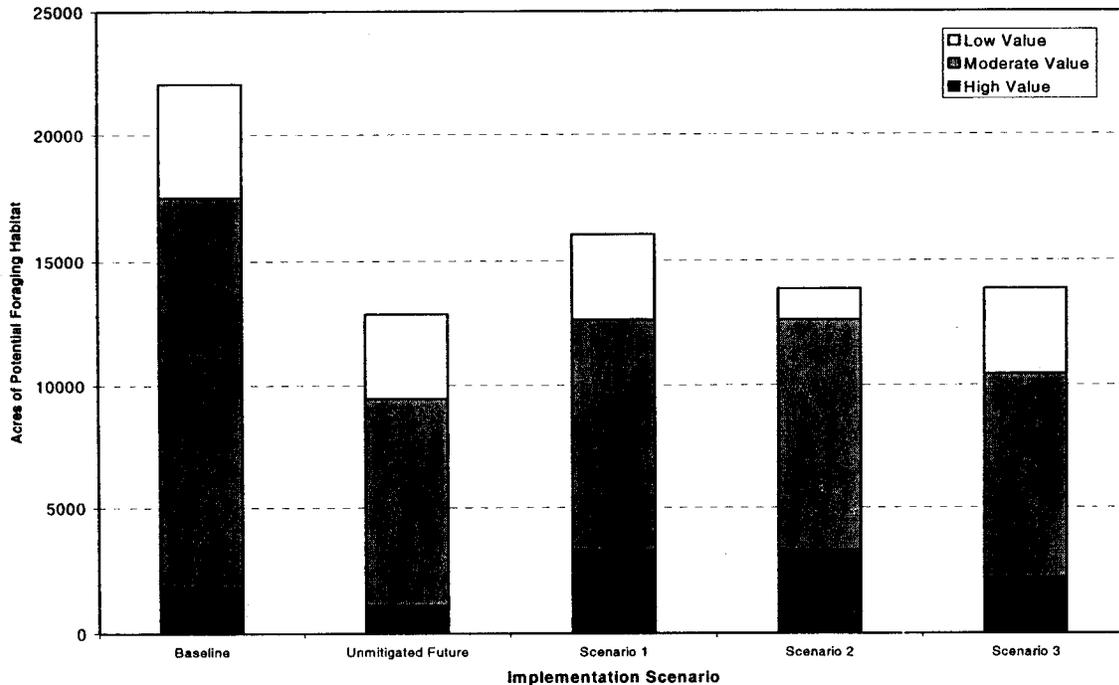


FIGURE 3
Acres of Potential Foraging Habitat for Swainson's Hawk by Habitat Value under Existing Conditions and with Implementation of the NBHCP.

4.2.3 Effects Considering the Temporal Availability of Foraging Opportunities

The upland habitat on the reserves will be managed to provide consistently accessible and abundant prey for Swainson's hawk throughout their residency. Table 8 and Figure 4 show the monthly distribution of foraging habitat availability under the three scenarios considered and assuming continuation of baseline cropping patterns in areas outside of Authorized Development and the NBHCP reserves.

TABLE 8
Change in acres providing foraging opportunities each month with implementation of the NBHCP

Month	Baseline	Acres Affected by Development	Remaining Foraging Habitat ^a	Scenario 1 ^b	Scenario 2 ^b	Scenario 3 ^b
April	5,365	2,671	2,694	5,866	5,866	4,765
May	5,365	2,671	2,694	5,866	5,866	4,765
June	9,625	4,667	4,958	8,130	8,130	5,942
July	6,002	2,851	3,151	6,323	6,323	5,222
August	8,923	3,451	5,471	8,643	8,643	7,542
September	9,806	4,539	5,268	8,470 ^b	6,282	7,369

(#) Decrease in acreage

^a Remaining Foraging Habitat represents habitat assumed to remain outside of areas of Authorized Development. It does not include habitat created and maintained under the NBHCP.

^b See Table 3 for description of each scenario

Source: Habitat and Land Use Assessment Database (CH2M HILL, 2002)

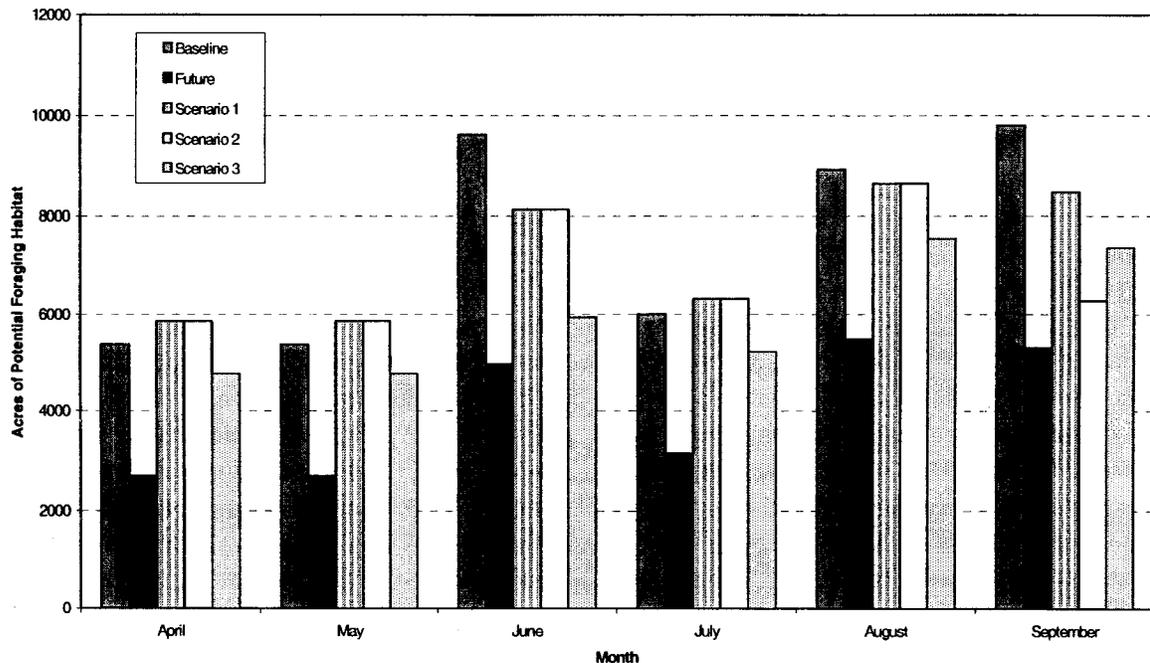


FIGURE 4
Monthly Availability of Potential Foraging Habitat for Swainson's Hawk
under Baseline Conditions and With Implementation of the NBHCP

Scenarios 1 and 2 would increase the availability of foraging habitat relative to baseline conditions during April, May and July, the nesting period for Swainson's hawk. Prey availability during these months can influence nesting density (Houston and Schmutz, 1995) and reproductive success. In June, foraging habitat availability under Scenarios 1 and 2 would be slightly less than baseline conditions. Although the acreage of foraging habitat in June could be less than baseline conditions, it would be greater than that available during the other months of the breeding season (April, May, and July). Because the amount of habitat available during April, May, and July under the baseline condition is sufficient to support the current nesting population, providing at least that level of habitat during June is anticipated to be sufficient to continue to support this population level. With similar or improved habitat availability during the nesting season under Scenarios 1 and 2, no significant adverse effects to the nesting population or reproductive success would be expected from changes in foraging habitat.

The amount of foraging habitat available during August and September under Scenarios 1 and 2 would be less than that under baseline conditions. Accessible prey is anticipated to be abundant in these months because of the high abundance of prey that becomes available during the short harvest season and, therefore, foraging habitat is not anticipated to be limiting.

Further, because the young have fledged by this time, hawks are not restricted to areas near nests and can seek more productive foraging opportunities if necessary in more distant areas. Therefore, no adverse effects to Swainson's hawk are expected from reduced foraging opportunities during August and September.

Under Scenario 3, foraging opportunities would be reduced in all months relative to baseline conditions. For the following reasons, however, Scenario 3 is not likely to occur, and is included to provide a worst-case, yet unlikely scenario. The assumption of Scenario 3 is that all existing High-value habitat is incorporated into the reserve system. Areas of High-value habitat occur in many small, isolated parcels throughout the Natomas Basin. In acquiring reserve lands, TNBC must establish reserves at least 400 acres in size of which at least one must be at least 2,500 acres. TNBC is currently seeking to build upon its existing reserves to create several large reserve centers. With this approach and the acreage restrictions, it is not considered likely that TNBC will incorporate all of the isolated parcels of High-value habitat and therefore would need to create a greater amount of upland habitat than assumed under Scenario 3. The difference in acreage between baseline and Scenario 3 during April and May is only 600 acres. If only half of the lands providing foraging opportunities during the nesting season (April through July) are incorporated into the reserve system with the remainder of the required upland acreage created, foraging opportunities under the NBHCP would be about the same as baseline in April, May and July. The acreage of foraging opportunities in June would be less under Scenario 3 than under baseline, but would exceed the baseline acreage in April, May, and July. As explained for Scenarios 1 and 2, because habitat availability in June under Scenario 3 would be greater than what currently is available during the other months of the nesting season (April, May, July), foraging opportunities in June under Scenario 3 are expected to remain sufficient to support population levels.

Proximity to Nest Trees

An additional benefit of the NBHCP for Swainson's hawk that is not easily quantified is that foraging habitat provided in the Mitigation Lands often will be located in close proximity to nesting habitat. This will be accomplished through establishing upland reserves near known nest sites (e.g., within the Swainson's Hawk Zone) and by planting trees on the reserves that will provide new nesting opportunities near foraging habitat. Under the NBHCP, TNBC seeks to acquire land for upland reserves close to known nest sites because of the energetic benefit and associated reproductive success improvement from the availability of nearby foraging habitat. To date, TNBC has been successful in acquiring lands near known nest sites (e.g., Sousa, Cummings, and Alleghany 50). Several of the lands acquired to fulfill requirements for rice and managed marsh also are close to known nest sites (e.g., Bennett South, Frazer North). The Sousa, Cummings and Alleghany 50 tracts encompass about 160 acres and currently support non-rice crops that provide Low- or Moderate-value foraging habitat for Swainson's hawk. These lands will be converted to High-value foraging habitat under the NBHCP.

Currently, only 899 acres of High-value foraging habitat occurs near (within 1 mile) of known nest sites. Of this amount, 311 acres would be lost because of Authorized Development (Table 6). With the NBHCP, much if not all of the 2,187.5 acres of High-value upland habitat is expected to be within 1 mile of a nest site, substantially increasing the amount of High-value habitat near nest sites where it is most valuable.

4.3 Changes in Nesting Habitat

The Draft EIR/EIS identifies territories in or immediately adjacent to Authorized Development areas that could be eliminated by removal of the nest tree or affected by loss of foraging habitat in the vicinity of the nest tree. Based on data from surveys conducted in 2001, the Draft EIR/EIS identifies seven territories as potentially affected: five within the City, one immediately adjacent to Metro Air Park, and one in Metro Air Park. In 2002, the two nest sites on and adjacent to Metro Air Park were removed. Of the five territories located in the City, two (NB-2 and NB-6) are in the right of way of Interstate 5 and would not be removed although, as described in the Draft EIR/EIS (Section 4.4.5.2.11), they could be abandoned as a result of loss of nearby foraging habitat and urban encroachment. The remaining three territories could be lost if the nest trees are removed.

The potential loss of five territories is not expected to adversely affect the nesting population of Swainson's hawk for several reasons. Surveys for Swainson's Hawk territories in the Natomas Basin conducted annually since 1999 have identified 70 territories in the Natomas Basin and along the Sacramento River. Not all territories are active each year. For example, in 2002, of the 70 territories, 43 were active (i.e., had at least one adult present on the nesting territory), leaving 27 unoccupied territories (Estep, 2002). Similarly, in 2001, only 46 territories were occupied (Estep, 2002). At most, 5 nest trees would be removed or potentially abandoned because of adjacent urban development. Given that only a portion of the known territories are occupied each year, sufficient alternate nest sites are available to accommodate birds displaced from these territories.

Second, the NBHCP includes a tree planting program to provide additional nesting opportunities when the trees mature. In 2001, 200 trees were planted on the Betts-Kismat-Silva reserve. In 2002, an additional 60 trees were planted at the Bennett South reserve, and in 2003, 83 trees were planted at Betts-Kismat-Silva reserve in 2003. Species planted that could be used for nesting by Swainson's hawk are valley oak and western sycamore. In the Central Valley, nest trees averaged 57.7 feet tall with a standard deviation of 9.8 feet (Estep, 1989). Valley oaks can grow about 3 feet per year (Redwood Barn Nursery, Davis California) and could reach 48 feet (the lower end of the range of tree heights found to be used) in about 16 years. Sycamores grow at a faster rate of 6 to 10 feet per year (Empire National Nursery, 2003) and could achieve this height in 5 to 8 years. Tree planted in 2001 could reach a suitable size to support nesting as early as 2006. Over the longer term, trees planted as part of the conservation strategy of the NBHCP would provide additional nesting opportunities. Based on this information, the potential short-term loss of nest trees because of urban development covered by the NBHCP is not expected to significantly impact Swainson's hawk.

SECTION 5

Conclusions

Additional information on the value of foraging habitat for Swainson's hawk in the Natomas Basin shows that Basin currently supports little High-value habitat. Most of the available habitat is row and field crops that provide Moderate- or Low-value habitat. Further, the row and field crops predominantly provide foraging opportunities in August and September when harvest makes prey accessible. Most of the habitat that would be affected by Authorized Development consists of row and field crops.

Foraging opportunities provided by upland habitat in the reserves created under the NBHCP would be High- or Moderate-value habitat that would provide consistently accessible prey for Swainson's hawk. Assuming that most of the lands incorporated into the reserves are row crops, upland habitat in the reserves would offset reductions in habitat availability from urban development during most of the nesting season (April, May, and July). Foraging habitat availability in June is expected remain sufficient to avoid adverse effects to reproductive success. The NBHCP foraging habitat availability during the nesting season would remain similar to baseline conditions, thus adverse effects on reproductive success or the adult nesting population are not expected. Although foraging opportunities would decline during August and September, foraging opportunities likely are not a limiting factor during these months because of the high abundance of prey that becomes available during the short harvest season. Therefore, effects to Swainson's hawk from changes in foraging habitat under the NBHCP are considered less than significant.

SECTION 6

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