

Conceptual Approaches for the Development of Terrestrial Ecosystem Restoration Targets

Introduction

The most important first step in the development of ecosystem restoration targets is the development of a "Tangible Vision" for the Estuary. This vision shares a common theme with the term "Overarching Goal" but contains two additional concepts; that our goal is slightly beyond our reach but vivid enough so it can almost be grasped. Development of this tangible vision will help us craft relevant objectives and specific targets and motivate and invigorate us all to work aggressively toward our goal.

The following input takes two forms. First, are targets for terrestrial resources. Second, are specific prescriptions for selected special status species.

Terrestrial Targets

From the terrestrial species point of view, particularly those species that are closely linked to different types of wetland habitat, a potential approach to setting targets is to select "target" or "keystone" species. The following are a suite of 22 species that we would recommend using. Benefits to other species from achieving the targets for these keystone species will be substantial for other fish and wildlife in the Estuary. Benefits, however, may not be uniform without fine tuning the management of the restored habitats. Follow-up monitoring should be used to make the needed adjustments.

The focus should be on developing targets based on habitat, however, two other types of targets could be used such as increases in nesting territories and body condition indices.

Waterfowl:

puddle ducks:

northern pintail
mallard (wintering and nesting)

diving ducks:

canvasback
redhead

geese and swans:

white-fronted geese
tundra swan

Special status animals:

Swainson's hawk
greater sandhill crane
black rail
California clapper rail
bank swallow
Suisun song sparrow
yellow-billed cuckoo
riparian brush rabbit
salt marsh harvest mouse
western pond turtle
giant garter snake

Special status plants:

Rose mallow
Mason's lilaeopsis
Delta tule pea
Suisun aster
bird's beak

In developing targets the existing acreage of the Estuary's plant communities and historical data on key communities associated with the various land elevations found in the Estuary were considered. Based on this information, the Bay-Delta was divided into three zones (Figure 1); San Francisco Bay, Suisun Bay and Marsh, and Delta. A fourth zone was included to represent areas upstream of the Bay-Delta.

Ecosystem Restoration Targets. Targets for Habitat Restoration, Acreages of New Habitat.

Habitat Type	Delta Zone A ¹	Delta Zone B ²	Delta Zone C ³	Delta Zone D ⁴	San Francisco Bay	Suisun Marsh and Bay	Upstream Rivers and Floodplains
Tidally Influenced and Waterside Habitats							
Tidal Mudflats	300	200	400	1,000	2,000	1,000	
Tidal Marshes	2,000	1,000	3,000	25,000	2,000	5,000	
Shallow Shoal	1,000	1,000	1,500	6,000	1,000	2,000	
SRA	300	500	600	1,000		200	1,000
Other Wetlands							
Seasonal Wetlands - Farmed Wetlands managed for wintering wildlife	100,000	75,000	125,000				5,000
- Other Seasonal Wetlands	25,000	25,000	35,000	10,000	1,000		15,000
Emergent Wetland	1,000	1,000	1,000	2,000			
Riparian Forests	2,000	1,500	4,000	3,000			5,000
Scrub-shrub	500	300	500				500
Uplands/Agriculture							
Annual Grassland	1,000	1,000	5,000	500	500		2,000
Perennial Grassland	2,000	2,000	4,000	500	500		5,000
Irrigated Pasture	2,000	2,000	4,000				1,000
¹ Sacramento River/North Delta	² Cosumnes River-Mokelumne River						
³ San Joaquin River/South Delta	⁴ Central Delta						

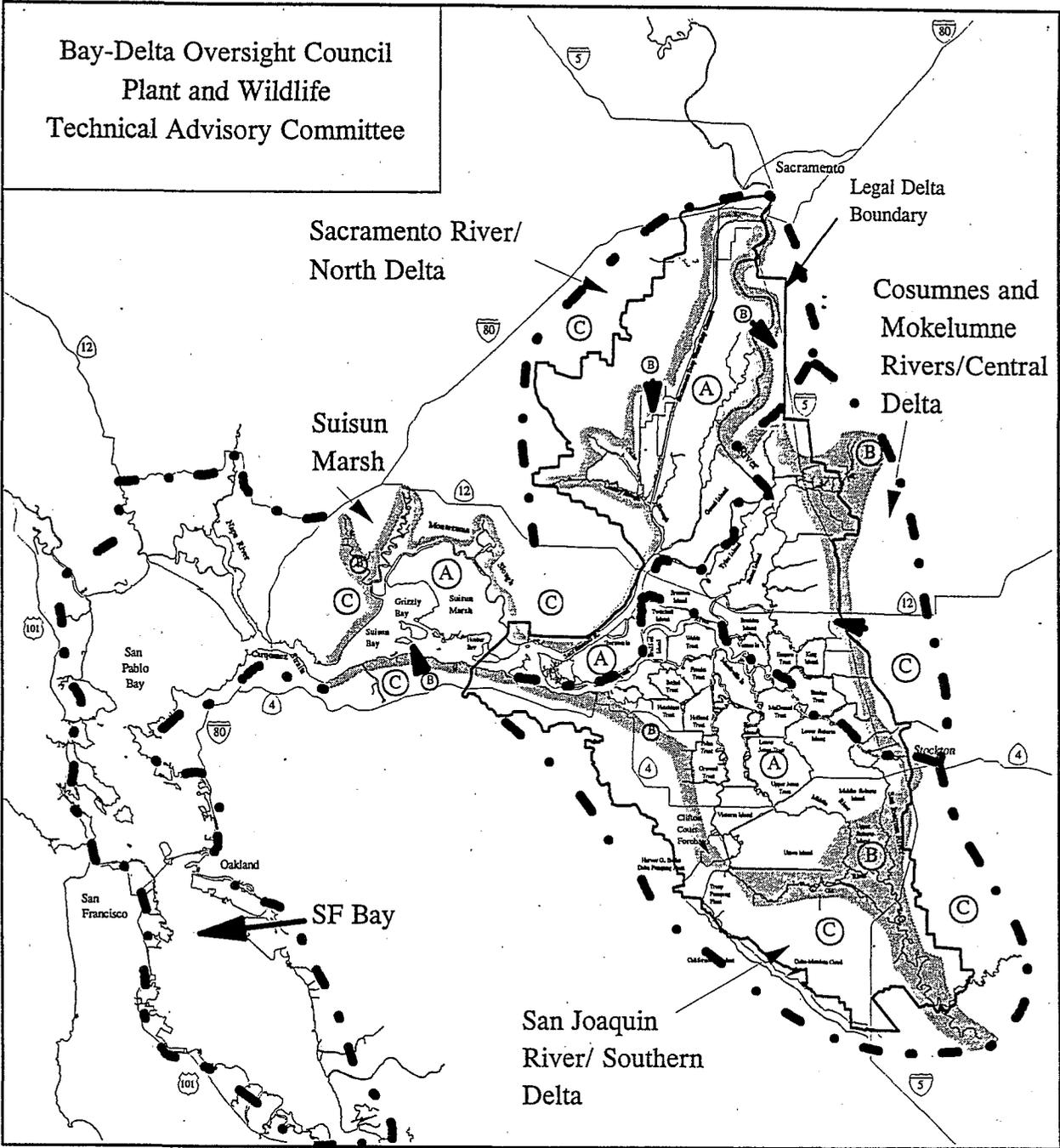


Figure 1
Conceptual Approaches for the Development
of Ecosystem Restoration Targets

July 1996

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The Delta was further segregated into four management zones; Sacramento River/North Delta; Cosumnes River-Mokelumne River; the Central Delta; and San Joaquin River/Southern Delta (Figure 2). Habitat acreage targets will be established for each of the four zones and for the four Delta management zones.

These zones can be further divided into zones of similar elevations and hydrological characteristics. These zones and subareas within the zones will be emphasized to take advantage of basic ecosystem management principals. Those principles rely, in part, on taking into account attributes such as; landscape resistance or the site's "ability" to support a particular habitat type without constant human intervention; geomorphology; hydrology; existing and predicted future hydraulic conditions, soils; and current fluvial characteristics. For instance, riparian restoration or reestablishment is located in an area which can be readily restored and, more importantly, maintained in perpetuity. Furthermore, there are areas in the central Delta, where subsidence has drastically lowered land elevations. Care must be taken when these areas are being considered for restoration as habitats such as riparian forest, upland, non-tidal seasonally managed wetland.

Restoring the balance of health in the system argues for selecting geographically and topographically specific targets. The zones, therefore, shown in figures 1 and 2 could be used to set those targets.

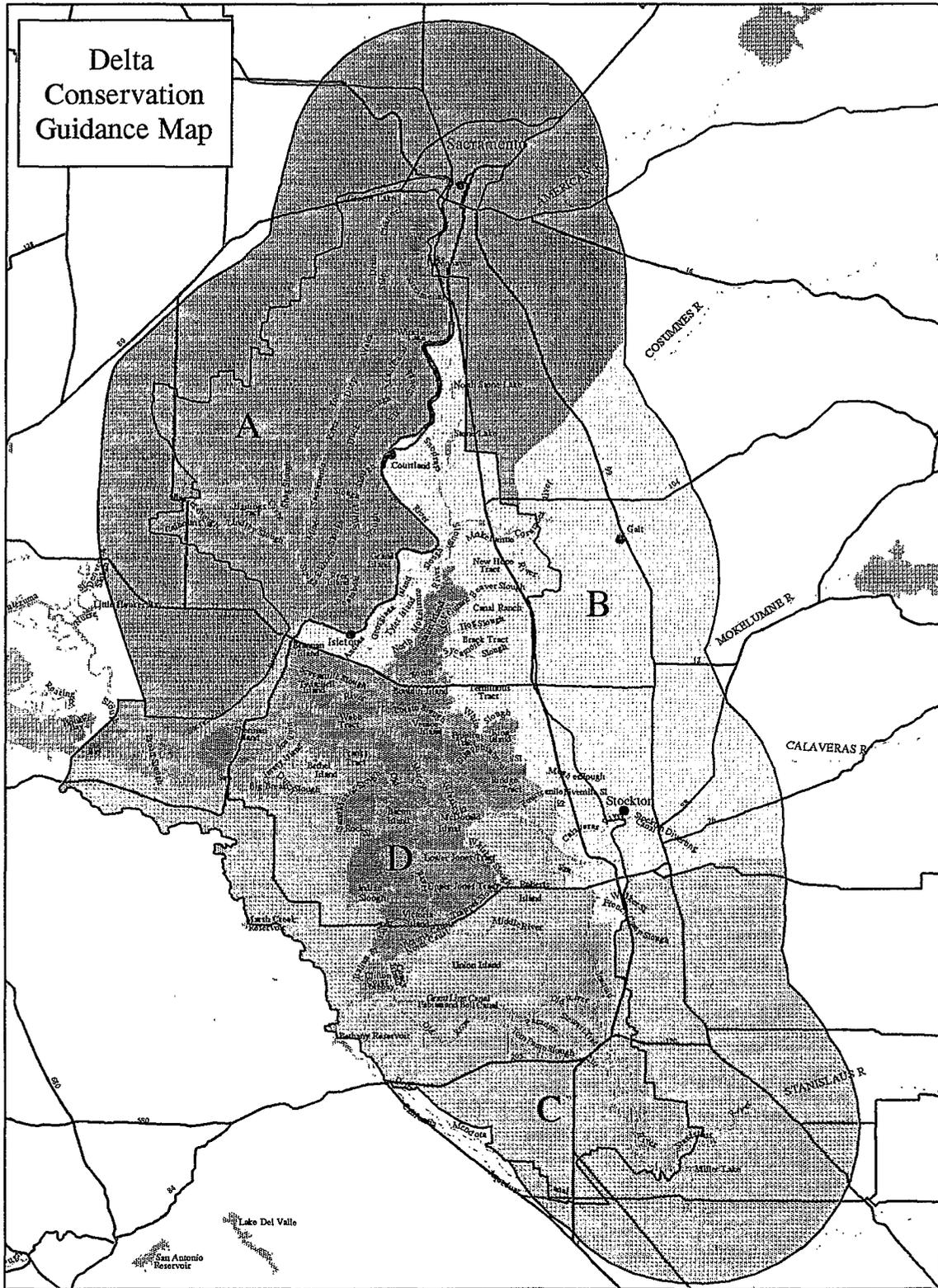
Species Specific Habitat Targets

Wintering Waterfowl:

Puddle ducks, geese and swans:

Specific habitat development strategies are available to address the habitat requirements for northern pintail, mallard, white-fronted geese, and tundra swan concurrently. Assuming those strategies are employed the following targets would apply:

Delta Mitigation Issue Team



- Zone Boundaries**
- Zone A - Sacramento R. North Delta
 - Zone B - Cosumnes/Mokelumne Rivers East Delta
 - Zone D - Central Delta
 - Zone C - San Joaquin R.

- Legend**
- Major Roads
 - Interstate Hwy
 - State Hwy
 - US Hwy
 - Delta Boundary and Buffer



Delta acreage target-95,000 acres of optimally managed seasonal wetland and 300,000 acres of agriculture managed in a manner that is beneficial to wildlife.

min patch size- 3,000 A with 25 to 40 % closed to hunting

Diving ducks:

New areas of permanent and tidal wetland should be managed optimally for canvasbacks and redheads. Permanent wetlands should be managed to include large areas (60 to 70 %) as open water 3 to 6 feet deep that supports high quality submergent vegetation. Tidal wetlands should be restored in a manner that supports similar conditions.

Delta acreage target-5,000 acres of permanent wetland

Suisun Bay/Marsh acreage target-3,000 acres of tidal wetland

San Francisco Bay acreage target-2,000 acres of tidal wetland

min patch size- 500 A

Nesting Waterfowl:

Mallard:

Manage new areas as suitable habitat for mallard nesting with 5 to 10 % of that acreage as reverse cycle brood ponds.

Delta acreage target-2,000 acres of nesting habitat with 200 acres of suitable brood ponds within or immediately adjacent to that nesting habitat.

Special status animals:

Swainson's hawk:

Delta target-100 acres of riparian forest widely scattered throughout the Delta

min patch size- none but habitat patches need to be buffered by low disturbance land uses such as agriculture for a one-half mile radius around habitat patch. Ideally adjacent habitat would be managed as optimal Swainson's hawk foraging habitat.

Greater sandhill crane:

Foraging habitat targets can be addressed with the targets for wintering puddle ducks. There is a specific desire to increase the acreage of roosting habitat since it is currently limited to small, fragmented areas in the northeastern Delta.

Delta target- 5,000 acres with the majority of that area in Zone B and D.

min patch size- 500 A with one-half mile buffer area adjacent to the roost area.

Black rail:

Existing suitable black rail habitat in the Delta is highly fragmented and very limited. Separate targets should be set for each zone in the Delta, the Suisun Bay area, and San Francisco Bay.

Delta target-1,000 A comprised of 20 to 30 miles of linear

emergent tidal wetland meeting the criteria in Appendix A along with adjacent suitable refugia.

Suisun Bay target-400 A represented by 10 miles of linear emergent tidal wetland habitat along with adjacent suitable refugia.

San Francisco Bay target-500 A of tidal wetland adjacent to suitable refugia.

min patch sizes-Delta, 1,000 linear feet; Suisun Bay, 1,000 linear feet; San Francisco Bay, 50 A.

California clapper rail:

San Francisco Bay target-2,000 A of suitable tidal wetland along with 400 acres of suitable high water refugia.

min patch size-100 acres with adjacent refugia. Habitat connections with areas containing introduced land predators should be avoided.

Bank swallow:

Upstream of Delta target-50 miles of new erodible banks associated with meander belts.

In-Delta target-5 miles of new erodible bank.

min patch size-2,000 linear feet.

Suisun song sparrow:

Target for black rail in the Suisun Bay area will also apply to the Suisun song sparrow.

Yellow-billed cuckoo:

Delta target-20 miles of mature riparian forest corridors
> 90 m in width.

min patch size-corridor should be continuous in the Delta and follow the larger rivers into the Delta, north along both forks of the Mokelumne to the Sacramento River, and then north of Sacramento. Appendix A details other habitat specifications.

Upstream targets include interconnected corridors between blocks of restored riparian forest and existing habitat.

Riparian brush rabbit:

Delta target-1,000 A of dense riparian meeting the criteria described in Appendix A.

Salt marsh harvest mouse:

San Francisco Bay target-2,000 A of upper intertidal wetland with adjacent refugia.

Suisun Bay target-5,000 A of managed wetland with a high percentage of dense pickleweed and adjacent refugia. Also, 1,000 A of tidal wetland and adjacent refugia.

min patch size-100 A; suitably vegetated corridors at least 30 m wide between patches.

Western pond turtle:

Delta target- 500 acres of ponds with suitable adjacent upland nesting habitat.

min patch size-25 A.

Giant garter snake:

Delta target- 1,000 acres of permanent managed emergent wetland along with suitable adjacent upland as described in Appendix A.

Special status plants:

Rose mallow
Mason's lilaeopsis
Delta tule pea
Suisun aster
bird's beak

Delta and Suisun Bay targets- Achieving the targets described for black rail, with minor adjustments to accommodate species specific habitat requirements, also can serve as a target for most of these plants. The targets set for salt marsh harvest mouse habitat in tidal areas can serve as the target for bird' beak as well.

Non-Habitat Targets

There are several examples of potential targets that are not measures of increased or improved habitat. For instance, detailed surveys have been conducted for the black rail and Suisun song sparrow. Both species have severely limited distributions. An aggressive but attainable target is to increase the number of nesting territories for both species by 300 % compared to baseline studies conducted prior to implementation. The target for greater sandhill cranes is to over winter 50 % more cranes than the previous 5 year average. Increasing the element occurrences of the special status species by 200 % is also an achievable target.

Wintering waterfowl body condition just prior to the spring migration is an accurate indicator of the suitability of the wintering habitat. A target of improving body fat indices in white-fronted geese by 25 % compared to the average index prior to implementation is also realistic.

APPENDIX A

**HABITAT
PRESCRIPTIONS FOR
SELECTED SPECIAL STATUS SPECIES**

Appendix A

Giant Garter Snake Thamnophis couchi gigas

The giant garter snake occupies marshlands, ditches and adjacent upland areas in the Central Valley (California Department of Fish and Game 1980). The giant garter snake forages in shallow open water and dense emergent vegetation. The snake requires dense emergent vegetation for cover, and adjacent herbaceous upland habitat for basking and hibernating (abundant rodent burrows are required for den sites). Optimal giant garter snake habitat has a series of parallel canals separated by upland herbaceous habitat (Brode pers. comm.). Giant garter snakes feed on small fish, amphibians, and small mammals (Brode pers. comm.). Young giant garter snakes are vulnerable to predation from non-native fish such as large-mouth bass, striped bass, green sunfish, and bluegill (Brode pers. comm.).

The following habitat characteristics should be included to create suitable habitat including movement corridors and foraging habitat:

- Create approximately 10 acres of non-tidal tule marsh habitat suitable for garter snakes.
- Provide two to three main channels approximately 20-30 feet across (inner bank to inner bank); the outer margins of the channels should be approximately 2 to 3 feet deep, which would allow tules and bulrushes to grow, the middle portion should be at least 4 feet deep, which would prevent too much emergent vegetation from growing and keep the center of the channel as open water.
- Provide at least five interconnecting channels with shallow open water.
- Introduce native fishes into the wetland as a food source for giant garter snakes, Sacramento blackfish, Sacramento perch, and hitch are considered suitable fish species (Brode pers. comm.).
- Create 10 acres of non-forest upland habitat adjacent to the wetlands to provide garter snake basking and hibernating areas.
- Buffer 75-100 feet of native or ruderal vegetation at least 30 feet from roads.

Western Pond Turtle Clemmys marmorata

The western pond turtle inhabits quiet water of lowland ponds, streams, sloughs,

marshes, and reservoirs. Pond turtles hibernate in upland herbaceous areas. They require rocks, logs, or banks for basking. The following should be included to create suitable habitat including basking sites:

- Create open water areas suitable for foraging (open water, ponds, and sloughs).
- Provide three to five basking sites (e.g., particularly submerged logs) in shallow portions of the open water for western pond turtles.
- Create adjacent non-forest upland areas and upland riparian areas for reproduction and hibernation.
- Sandy banks or open grassy fields in a strip 10 - 70 m wide adjacent to river or ponds

Yellow-billed Cuckoo
Coccyzus americanus occidentalis

- Width of riparian 15-30 meters- Fair
- Width of riparian 30-90 meters - Good
- Width of riparian 90+ meters- Excellent
- dense multi-story riparian
- predominately cottonwood/tree willows

California Black Rail
Laterallus jamaicensis coturniculus

- Tidal tules and cattails >20 meters in width
- Adjacent higher upland refugia or riparian scrub/shrub to hide in during floods and high tides.

Riparian Brush Rabbit
Sylvilagus bachmani riparius

- 90,000 A of habitat historically now only 5,000 A.

- 261 A of occupied habitat at Caswell State Park is all that is left
- Dense brush understory
 - protected from flooding
 - grassy buffer around riparian
 - clumps of brush > 450 m² cover > 21 cm (8-10")
 - clumps contiguous or <350 m apart
 - no willows
 - wild rose
 - coyote brush
 - elderberries
 - wild grape
 - box elders
 - valley oaks - cottonwoods

Greater Sandhill Crane
Grus canadensis tabida

Two habitat components, feeding areas, and roost sites, must be present and in close proximity in an optimally managed wintering area for cranes. Data presented by Pogson (1990) indicate that roost sites should be less than 2.5 miles from feeding areas. These roost sites would ideally be adjacent to or intermingled with feeding areas (Littlefield pers comm.). The feeding areas would be characterized as flooded cropland and pastures or dry cropland, pastures, and uncultivated borders of agricultural fields. The roost sites would be shallowly flooded pasture or shallowly flooded wetlands. DFG guidelines for management of feeding areas for cranes on DFG wildlife areas provide for uplands to be specifically managed as upland foraging areas and as cereal grain plantings. The crane's diet consists primarily of waste grain followed by tubers and invertebrates. The following are key components of the sandhill crane's diet:

<u>Vegetative</u>	<u>Animal</u>
Corn	Worms
Milo	Grasshoppers
Wheat	Beetles
Barley	Caterpillars
Rice	Snails
Nutgrass tubers	
Alkali bulrush tubers	
Chufa tubers	

The specifics of how the feeding areas are managed for optimum crane foraging habitat include:

1. Manage cereal grain areas to leave large amounts of waste grain following harvest e.g. 500 pounds/A or more.
2. Mow or chop vegetation following harvest so that average vegetation height is less than 6" to 12" (Mowing or chopping unharvested grain crops should be completed after waterfowl season to avoid violations of baiting regulations).
3. Beginning October 1, a minimum of 50 percent of the area should be kept dry and the remainder flooded less than 6".
4. 25 percent of the non-flooded area should be gradually sub-irrigated beginning January 1, to provide a shallow feather edge interface between flooded and unflooded areas.
5. Use of pre-emergent and post-emergent herbicides will be restricted and the use of nematocides, insecticides, etc., will be excluded.
6. Greater than 250 acres in size.

Areas managed as roost sites have substantially different criteria:

1. 80 percent of the area flooded to an average depth of 6" with a range of 4-10"
2. Five percent of the flooded area would be gradually sloped at 6:1 so that narrow (10-20 ft. wide, 100-200 ft. long) linear islands surrounded by water could be provided as loafing sites in the roost areas.
3. Minimize human disturbance.
4. Provide visual, vegetative screen around roost sites to screen from county road or other human use areas.
5. Manage 10 percent of the cereal grain area as roosting/loafing habitat.
6. Roost sites would ideally be flooded pasture where the vegetation is kept very low, < 4" by mowing prior to flooding.

Swainson's Hawk

Buteo swainsoni

Swainson's hawks usually nest in large, mature trees. Native trees are almost always used, although nests have been found in eucalyptus (*Eucalyptus* sp) Trees and ornamental conifers. Tree species most commonly used in the Central Valley in decreasing order of frequency include valley oak (*Quercus lobata*), Fremont cottonwood (*Populus fremontii*), black walnut (*Juglans hindsii*), and willow (*Salix* sp). Nests are usually constructed high in the tree to provide the nesting pair a panoramic view of their territory. Nests are usually of flimsy construction and often blow out of the nest tree during high winds, particularly during winter.

The Swainson's hawk is adapted to foraging in large, open plains and grasslands. In the Central Valley, however, virtually all native foraging habitat has been converted to agricultural uses, restricting Swainson's hawks to areas that support cropping patterns compatible with their foraging requirements. Both the abundance of prey populations and the accessibility of prey to foraging birds determine the suitability and quality of agricultural foraging habitat for Swainson's hawks. The many crop types grown in the Central Valley differ widely with respect to their foraging habitat suitability.

Swainson's hawks hunt aerially almost exclusively in the Central Valley, soaring from 100 to 300 feet above the ground while scanning for prey (Estep 1989). Foraging birds select fields that are most compatible with this type of foraging behavior (i.e., fields that are large, support low cover to provide access to the ground, and provide the highest densities of accessible prey). These habitats include hay and grain crops, lightly grazed pasture lands, and certain row crops, such as tomatoes and sugar beets. Fields lacking adequate prey populations, such as flooded rice fields, or those that are inaccessible to foraging birds, such as vineyards and orchards, are avoided.

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