

CALIFORNIA DEPARTMENT OF  
FISH AND GAME  
WILDLIFE MANAGEMENT  
DIVISION  
NONGAME BIRD AND MAMMAL  
PROGRAM  
1416 Ninth Street  
Sacramento, California 95814  
(916) 654-4262

5 - Year Status Review:  
GREATER SANDHILL CRANE (*Grus canadensis tabida*)  
Reported to:

California Fish and Game Commission

1994

## FIVE-YEAR STATUS REPORT

I. COMMON NAME: Greater Sandhill Crane  
SCIENTIFIC NAME: *Grus canadensis tabida*  
CURRENT CLASSIFICATION: Threatened

II. RECOMMENDED ACTION:

Retain threatened classification

III. SUMMARY OF REASONS FOR RECOMMENDED ACTION:

In California, greater sandhill cranes presently winter in the Central Valley and nest in six northeastern counties. These birds are part of the Central Valley population of greater sandhill cranes estimated at about 5,000 to 6,000 individuals (Pogson and Lindstedt 1988) and are featured in a Pacific Flyway Management Plan (Schlorff et al. 1983). Of the 276 nesting pairs located during a Department of Fish and Game study in northeastern California in 1988, 185 (67.0 percent) were on private land and 91 (33.0 percent) were recorded on State and Federal lands (Littlefield 1989). The current population is estimated to be within ten percent to our 1988 figure based on information obtained over the past five years. This entire population as well as approximately 25,000 lesser sandhill cranes (*G.c. canadensis*) share the California wintering ground extending from the Butte Sink area in Butte County in the north, southward to the Kern National Wildlife Refuge (NWR), Kern County, and the Carrizo Plain in eastern San Luis Obispo County. Although there have been no comprehensive breeding population studies since 1988, recent observations indicate that the population level is stable (data from Modoc NWR and four state WA files). Of nests recorded on public lands in 1988, 40 were on NWRs, 36 on State wildlife areas (WA), and 15 on U.S. Forest Service (USFS) lands. The relatively high percentage of crane pairs nesting on private lands makes them susceptible to the threat of land use changes. If private landowners convert meadow and marsh habitat to cereal grain and/or alfalfa crops and engage in other activities that adversely impact crane habitats and populations, there may be a further decline in the population. Recent studies, observations, and project reviews undertaken by the Department indicate that land conversions, combined with high predation rates on both eggs and young in some regions, power line collisions, disease, drought, timber harvesting near nest sites, early meadow haying, livestock grazing, and lowering water tables continue to threaten breeding and wintering greater sandhill cranes in California and neighboring states. Within certain portions of the range there has been an apparent trend toward increase in the numbers of pairs of cranes discovered in California for at least the past four decades (Walkinshaw 1973, Littlefield 1982, 1989). However, the number of nesting pairs has decreased since 1981 in other localized areas (Littlefield et al. in prep.). This shifting of population distribution within the overall range is primarily due to changes in available habitats required by cranes for nest sites. In addition, it is difficult to relate earlier numbers prior to forty years ago that were primarily based on cursory survey efforts with our more recent (since 1971) intensive investigations. Based on continuing land use threats and low population numbers, the Department recommends retaining the current threatened status for the greater sandhill crane.

#### IV. NATURE AND DEGREE OF THREAT:

Nesting greater sandhill cranes typically inhabit healthy undisturbed wetland ecosystems and consequently are vulnerable to any potentially detrimental changes that occur in these habitats. Agricultural technology is currently capable of converting large areas of wetland habitat to crops of various types in a relatively short period of time. This has occurred in California in recent years [U.S. Fish and Wildlife Service (USFWS) 1978], and this trend may continue. Existing and future market values of agricultural crops such as alfalfa could provide the incentive for landowners to increase drainage activities and land conversions which could lead to loss of nesting habitats for cranes and other wetland dependent wildlife species. While it appears that certain agricultural practices are detrimental to cranes on the breeding ground, agricultural crops (post-harvest fields of corn and rice) support the vast majority of foraging cranes on the wintering ground.

Local weather and regional climatic conditions can profoundly influence productivity of greater sandhill cranes. During the above normal precipitation years of the early 1980's, crane production was significantly better than during drier periods of time. However, some losses from flooding were recorded, particularly in Jess Valley, Modoc County (W. Flourney, pers. comm.). At the other extreme are the recent conditions when drought conditions persisted through much of the winter, spring, and summer. Many California crane territories never received water and in some locations (e.g., Surprise Valley, Lassen National Forest, Siskiyou County), typically, only about half of the breeding population of cranes even attempted to nest. Those that did nest usually failed in their attempt to raise young birds to fledging age. Prolonged drought conditions can certainly have a detrimental influence on crane productivity. In addition, predation rates have increased during these dry periods. In 1988, during the Department's intensive study, in Ash Valley, Lassen County, of eight nests located in a marsh with limited water, seven were destroyed by predators (six by coyotes (*Canis latrans*), and one by a common raven (*Corvus corax*), and one was abandoned (Littlefield 1989). Similarly, most pairs which successfully nested in Siskiyou County had lost their chicks by the end of July. These were taken by coyotes which had little difficulty in reaching chicks as they fed in the drying meadows (R. Johnstone, pers. comm.). Recent studies at the Ash Creek WA indicate that predation is still a significant mortality factor that may be made worse by a lack of water and cover in critical areas (Nagendran 1993). In 1993, only about nine percent (two young from 22 nesting territories) of young birds managed to escape predation and successfully fledge.

Common ravens have increased dramatically in northeast California since 1981 (Littlefield, pers. obs.), and several crane nests examined in 1988 were lost to this predator. On Malheur NWR, Harney County, Oregon, high predation rates have resulted in a 25 percent reduction in crane pairs (236 to 181 pairs) since the mid-1970's (Littlefield, unpubl. data). Similar losses can be expected in California if predator populations continue to increase, particularly in years with below normal precipitation. Recent reports from NWRs and State WAs indicate that predation by a variety of species continues to be a significant cause of young crane mortality on the breeding grounds in California. In 1993, half of about 22 nests were destroyed by several mammalian predators at the Ash Creek WA. Recruitment of young cranes into the breeding population at the Modoc NWR has ranged from eight to 26 percent during the past five years. This low level of recruitment has occurred even though the refuge

had relatively large numbers of breeding pairs (range from 20 to 36 territories). Recruitment is being suppressed primarily by predators at this Federal refuge where crane nesting habitat appears optimal. At the Ash Creek WA, a study involving radio-tracking the movements of young cranes indicated that the current level of predation on cranes could be reduced with the application of certain management actions. Nagendran (1993) recommended establishing large permanent wetlands, maintaining water throughout the brooding season, delaying haying operations, and encouraging greater habitat diversity in order to improve crane recruitment and reduce predation.

Power line collisions are presently believed to be the primary mortality factor for all age classes of post-fledged cranes. The majority of mortalities occur on wintering areas; however, five adult cranes were lost from power line collisions in Modoc County in 1988 (C. Bloom, T. Melanson, pers. comm.). The first nest located in 1988 was unsuccessful after one pair member died from colliding with a power line near Alturas, Modoc County (Littlefield 1989). In the past five years, power line markers (orange plastic globes) at certain key areas have been successful in eliminating collisions and mortality at Modoc NWR (C. Bloom, pers. comm.).

During the 1988 crane survey, as in past surveys, no crane pairs were observed to initiate nesting activity in wetlands that were being grazed by cattle (Littlefield 1989). In Surprise Valley, one pair deserted their nest the same day cattle were introduced into their nesting marsh. It is possible that some nesting might occur during years with above normal precipitation; however, if water is limited, spring and summer livestock grazing can be extremely detrimental to breeding cranes. Even on winter grazed wetlands, nesting can be negatively impacted. On Malheur NWR, Oregon, areas which were winter grazed had 21 percent lower nesting success than similar areas which had not been grazed (Littlefield, unpubl. data). Since most studies conducted during the past five years have concentrated on State WAs and Federal refuges, the extent of livestock impact on nesting cranes has been difficult to assess on private and other public lands where livestock grazing occurs. Clearly, further study of the issue is needed, and it should be examined in the next intensive crane nesting study planned for 1995 or 1996. Because there is a great potential to increase crane production on public grazing lands, it is an issue which warrants further evaluation.

On private land, and to some extent on Federal lands, wetlands which are not spring and summer grazed are generally used for hay production. Mowing activity usually occurs in July, depending on the amount of annual precipitation received. In years with below normal precipitation, mowing usually begins in June. When threatened, very young crane chicks tend to hide in tall vegetation and remain hidden where they may be killed by a mower. It may be relatively difficult to completely eliminate pre-August mowing on private land; however, on public lands, wetland mowing should be avoided until after August 10 each year. The Department has recommended this haying timing standard for use on certain public lands that support nesting populations of cranes with limited success.

The lowering of the ground water table often results in stream down cutting and subsequent drying and degradation of wetland habitat. Round Valley, in Modoc County, supported two crane pairs in 1971, but by 1988 the area had been abandoned. No sightings have been reported from that site in the past five years. During the intervening years, streams

have been severely eroded and resultant lowered water tables have likely contributed to the early drying of meadows. Other wetlands in northeast California and eastern Oregon show similar symptoms of degradation, primarily from over grazing, channelization, and ground water pumping (Littlefield, pers. obs).

The incidence of disease caused mortality appears to be increasing in the Central Valley population of greater sandhill cranes. Until recently, on the Central Valley wintering ground, water can become somewhat limited in February forcing large numbers of birds to concentrate in the relatively few scattered ponds available. It is during this time that disease outbreaks have been noted (T. Pogson, S. Lindstedt, pers. comm.). The most prevalent is avian cholera (*Pasteurella multocida*), but recently one crane was found which eventually died from tuberculosis (*Mycobacterium tuberculosis*) (R. Schlorff, pers. obs.). Botulism (*Clostridium botulinum*), salmonellosis (*Salmonella spp.*), avian pox (*Poxvirus avium*), and herpesvirus have been reported from sandhill cranes elsewhere, but their importance in the Central Valley population has not been ascertained. The actions of agencies and private conservation groups have improved late winter water availability, thus the threat of large-scale disease outbreak has abated. The acquisition of key habitats for establishment of ecological reserves, State WAs, private preserves, and other managed lands has ensured the availability of sufficient acreage of roosting sites in important areas of the wintering ground. These roosts provide security from disturbance and predation and are also large and widely scattered enough to remove the threat of disease outbreaks due to over-crowded conditions.

Numerous parasite species have been recorded from sandhill cranes, but generally these do not result in mortality unless the bird is in a weakened condition due to injury or disease. However, on Malheur NWR, Oregon, several dead chicks have been found which apparently died from gape worm (*Syngamus sp.*) infestations (Littlefield, unpubl. data). Whether or not these parasites are prevalent in California nesting populations has not been the focus of specific research. However, the situation is not thought to be significant in otherwise healthy populations with adequate habitat.

## V. HISTORIC AND CURRENT DISTRIBUTION:

### Historic

Historically, greater sandhill cranes were known to nest in eastern Siskiyou County, northeastern Shasta County, and south to Honey Lake, Lassen County. Definite breeding records were from near Ft. Crook, Shasta County (in 1860), Eagleville, Modoc County, and near Alturas (Grinnell and Miller 1944). Walkinshaw (1949) estimated that three to four pairs had territories in California in 1944. Nothing remotely close to a rangewide search for active territories was conducted during these early times, however. Observations were primarily casual rather than systematic and organized surveys. Because of this, it is often difficult to develop population trend data from past to present times. Recent investigations have been more intensive than historic surveys. Recent baseline population levels were developed from data collected in the 1970's and 1980's when the first comprehensive rangewide surveys were initiated.

## Current

Results of intensive surveys in 1971, 1981, 1988, and subsequent observations, provide an accurate delineation of range and estimate of extant populations in California today. Funding limitations have prevented an intensive survey of breeding populations of greater sandhill cranes during the past five years. However, smaller investigations at State WAs, Federal refuges, and information from our project review and timber harvest review activities have provided an update of the status of the greater sandhill crane in California. Cranes are now breeding in Lassen, Modoc, Plumas, Shasta, Sierra, and Siskiyou counties. During the last intensive study in 1988, the greatest numbers of breeding cranes were in Modoc County (165 pairs-59.8 percent), while Lassen County had 75 pairs (27.2 percent), Siskiyou County 27 pairs (9.8 percent), Plumas County 7 pairs (2.5 percent), Shasta County one pair (0.4 percent), and Sierra County one pair (0.4 percent). Four pairs near McArthur, Shasta County, occasionally fed in Shasta County, but their nesting territories were east of the county line in Modoc County. Surprise Valley had the largest number of pairs with 53, followed by Big Valley, Modoc, and Lassen counties, with 36, Modoc NWR, Modoc County, with 30; and Ash Valley, with 17. Observations made by Department biologists in recent years tend to confirm that this distribution and abundance has not been significantly changed in the past five years (Department files).

## VI. HISTORIC AND CURRENT ABUNDANCE:

Historic populations for this species are difficult to estimate due to the lower intensity of earlier survey efforts relative to recent studies. The current population is estimated to be the same as that estimated in 1988, about 276 breeding pairs in six northern counties. A current population estimate of greater accuracy is possible only with a study equal in intensity to that conducted in 1988 which covered six counties.

## VII. SPECIES DESCRIPTION AND BIOLOGY:

Greater sandhill cranes are the largest of the six subspecies of sandhill cranes. The average weight of adult males is 5,385 gms, range = 4,762-5,895 (168 oz, range = 149-184), while the average weight for adult females is 4,308 gms, range = 3,628-4,988 (135 oz, range = 113-156). Chicks that are 70 days old have an average weight of 3,268 gms (102 oz) (Johnsgard 1983). Average wing cord measurements for adult males is 561.5 mm, range = 526-598 (22.1 inches, range = 20.7-23.5) and females 546.0 mm, range = 510-575 (21.5 inches, range = 20.1-22.6). Tarsus, exposed culmen, and bare tibia average 244.5 mm, range = 226-264 (9.6 inches, range = 8.9-10.4), 137.1mm, range = 122-144 (5.4 inches, range = 4.8-5.7), and 111.2 mm, range = 88-125 (4.4 inches, range = 3.5-4.9), respectively for adult males. Adult female measurements average: tarsus 230.5 mm, range = 222-239 (9.1 inches, range = 8.7-9.4); exposed culmen 125.0 mm, range = 113-134 (4.9 inches, range = 4.4-5.3); and bare tibia 112.7 mm, range = 108-117 (4.4 inches, range = 4.3-4.6) (Walkinshaw 1965). Except for size differences, sexes are similar. General coloration is pale gray, with dark primaries. Cheeks, ear coverts, and chin are usually white, and all but juveniles have bare reddish foreheads. Fledged juveniles are usually similar to adults in body size, but are rust-brown in coloration, particularly on the wings and nape. The juvenile forehead does not become bare and reddish until late autumn; however, juveniles can still be distinguished from

adults well into February by the rust-brown on the nape. Frequently, adult cranes have bright rusty orange on their body feathers as a result of ferric oxide deposition (Taverner 1929). Sandhill cranes place mud on their feathers with their beaks, and if this occurs on soils which contain ferric oxide (rust) the orange coloration results.

Greater sandhill cranes have an omnivorous diet consisting primarily of vegetable matter such as small grains; however, they will consume almost any available food. Toads, frogs, eggs, young birds, small rodents, invertebrates, roots, and tubers are all included in their diet. However, animal matter, except for certain invertebrates, is taken primarily opportunistically and should not be considered a major component of the diet of cranes. Immediately before egg deposition, females increase their consumption of invertebrates and through the fledging period young are fed almost exclusively invertebrates, particularly earthworms.

Cranes usually mate for life (cf. Littlefield 1981), but will take a new mate if one member of the pair is lost. They return to the same breeding territory annually, but will not nest if nesting conditions are unfavorable (Littlefield, unpubl. data). The clutch usually consists of two eggs, occasionally one, and rarely three. In Modoc County, 1988, of 41 nests where complete clutches were present, five contained a single egg, 35 two, and one three eggs (Modoc NWR files, Littlefield, unpubl. data). Both members of a pair participate in the 30-day incubation period. Shortly after the second egg hatches, adults lead the young from the nest and begin feeding them. Generally, each parent feeds one chick. The chicks are aggressive toward each other and shortly after hatching one becomes dominant. Gradually the dominant chick becomes more aggressive, pushing the other chick away from the adults, often causing it to starve or be consumed by a predator. Consequently, usually only one chick fledges. A recent study at the Ash Creek WA investigated the movements and mortality of crane chicks and found that although most clutches contain two eggs, usually only one chick survives to fledging age. After the first three weeks, young grow rapidly and fledge when 60 to 70 days old. The Ash Creek study found that predation was so severe that only two young successfully fledged from a total of 22 breeding pairs (Nagendran 1993). Family groups leave their territories once young fledge, and usually move to nearby grain fields. Here they remain until late September to early November when they migrate southwest to the wintering ground in the Central Valley (Littlefield 1986).

#### VIII. HABITAT REQUIREMENTS:

Five isolated populations of greater sandhill cranes occupy favorable wetland ecosystems from the Great Lake states westward to the Pacific states. In California and Oregon, the Central Valley population of greater sandhill cranes establishes nesting territories in wet meadows, often interspersed with marsh land habitat. At Malheur NWR, Oregon, nesting regularly occurs in stands of giant burreed (*Sparganium eurycarpum*), hardstem bulrush (*Scirpus acutus*), and common cattail (*Typha latifolia*) (Littlefield and Ryder 1968). This tendency to nest in dense emergent marsh vegetation appears unique and apparently evolved due to the heavy predation pressure that ground nesters face (Littlefield, pers. obs.). In other regions of the Central Valley population's nesting range, a large percentage of nests are established in relatively open habitats such as rushes (*Juncus spp.*), spikerush (*Eleocharis spp.*), grasses, and/or sedges (*Carex spp.*). California pairs generally nest in open habitats;

however, exceptions do occur, particularly in Surprise Valley (east of Easleyville) and on the Lakeshore Ranch near the south shore of Goose Lake, Modoc County. Here, some nesting occurs in bulrush and burreed (Littlefield, pers. obs.).

Results of the intensive study in 1988 provided some details on the nesting habitat of cranes. Nests are usually constructed over water; and in California, 1988, water depths averaged 6.6cm (2.3 inches) (N = 50). On Malheur NWR, Oregon, water depths were deeper, averaging 16.8 cm (6.6 inches) (N = 93) (Littlefield 1968). The shallower water depths in California likely reflect the habitat type in which the majority of pairs nested and the dry conditions which persisted throughout the 1988 nesting season. Seven nests were located on moist soil, while the greatest water depth was 33.5 cm (13.2 inches). Nagendran (1993) stated that "sufficient and appropriate" habitat could substantially improve recruitment of cranes into the Ash Creek WA population. With substantial wet areas and cover, protection from predators could become established. Recruitment is suppressed by predation at most breeding areas within the range of the population. At Ash Creek, there were more breeding cranes in 1993 than could be successfully accommodated by the available suitable habitat. There appears to be considerable potential for managing more areas as crane habitat since these areas already have crane territories established, but insufficient resources to allow for successful breeding (Nagendran 1993).

Breeding territory sizes vary depending on the quality of available habitat. In Idaho, five territories averaged 17 ha (42 acres) in size (Drewien 1973), on Malheur NWR, Oregon, eight territories averaged 25 ha (61.8 acres) (Littlefield and Ryder 1968), and in Michigan 76 territories averaged 53 ha (131 acres) (Walkinshaw 1973). In California, no territory sizes have been estimated for pairs on private land. However, at Modoc NWR, territories appeared somewhat smaller than those reported elsewhere. In high quality habitat on Malheur NWR, territory sizes are about seven ha (17.3 acres) (Littlefield, unpubl. data), and these appear similar to those at Modoc NWR. Nagendran (1993) stated that crane territories could be as large as 259 ha (640 acres). Within the nesting territory water and a feeding area are the two main habitat components essential for success. Young cranes feed primarily in moist meadows where invertebrates are abundant. In some years when meadows dry prematurely, adults move their young to upland sites where the chicks feed primarily on grasshoppers and other insects.

After young fledge, cranes concentrate on grain fields near favorable roost sites. They confine most of their activities within these habitats until migration time in the fall. Food consists of a variety of cereal grains, including barley, rye, wheat, and oats. Fields used consistently by cranes are usually within six km (3.7 mi) of a shallow water body that serves as a communal roost site (Littlefield 1986). Once cranes leave pre-migratory staging areas, they fly southwest to wintering grounds in the Central Valley from near Chico, Butte County, south to Delano, Kern County (Littlefield and Thompson 1979, Pogson and Lindstedt 1988). Favorable roost sites and an abundance of cereal grain crops characterize winter concentration areas. Rice is the primary food source for cranes near Gray Lodge WA, Butte County, and corn is the most important food at the majority of other concentration areas in the Central Valley particularly in the Sacramento - San Joaquin delta. Irrigated pastures are used extensively as loafing sites in some wintering areas (Pogson and Lindstedt 1988, Littlefield, pers. obs.).

## IX. CURRENT AND RECOMMENDED MANAGEMENT:

The Central Valley population of greater sandhill cranes was placed on the USFWS, Region 1's sensitive species list in 1982. In 1983, the California Fish and Game Commission added the greater sandhill crane to the State list of threatened bird species. Since these actions, the subspecies has received significant management attention in California. This includes annual monitoring on the breeding and wintering grounds and land acquisitions in Big Valley (Ash Creek WA) and in the San Joaquin Valley (Woodbridge Ecological Reserve, south and north units). Wetland easements include the Soil Conservation Service's Water Bank Program, which has protected some crane territories temporarily in Modoc County. However, many areas within the California nesting and wintering ranges are still in need of protection. In northeast California, major nesting areas in Surprise Valley, Jess Valley, Pit River Valley and near Davis Creek in Modoc County, and Ash Valley and Willow Creek Valley in Lassen County continue to be threatened by potential drainage and conversion to agricultural crops. Since 1988, various development projects and disturbances, such as timber harvesting and mineral mining have occurred near nesting cranes (DFG files). In addition to nesting areas, portions of the wintering ground need protection. Winter roost sites are important; however, it is also critical that suitable foraging areas (usually fields of cereal grains) be available for crane use. The conversion from corn to vineyards, for example, could eliminate some of these areas as usable crane habitat. This would be a threat primarily in the Delta.

Power line marking devices have been used successfully on Modoc NWR to prevent collision mortality in cranes. Unfortunately, few of these devices have been used elsewhere within the California nesting and wintering ranges. Although these power line marking devices are important to prevent collision mortality in areas where nesting cranes occur, there appears to be an even greater need for their installation on lines near winter roosting and feeding sites in the Central Valley. As many as 22 cranes are known to have been killed in a single day as birds left a roost site on a foggy morning (T. Pogson, pers. comm.). This type of loss could be eliminated by the use of power line markers (particularly bright orange spheres). Power line mortalities have been virtually eliminated at some crane concentration areas in Oregon, Colorado, New Mexico, Wyoming, and the Modoc NWR, California with these marking devices (R. Drewien, D. Lockman, C. Bloom, pers. comm.). It is important that a marking program be initiated on certain power lines in the Central Valley crane wintering area as soon as possible. Cooperation from utility companies will be required before this source of mortality can be reduced. Unfortunately, utility companies have been reluctant to install marking devices on their power lines primarily because of the fear that markers may become attractive targets for shooters. Although efforts by the Department over the years to provide this protection have been met with resistance, the problem is being studied by the Avian Power Line Interaction Committee and a solution, hopefully, will be implemented prior to 1998 (C. D. Littlefield pers. comm.).

Spring and summer livestock grazing continues to negatively impact sandhill crane productivity on both private and public lands. Some habitat improvement has occurred on the Modoc National Forest; however, it is a matter of USFS policy that many wetlands and moist meadow habitats are still being grazed during the nesting and fledging period. Most crane nesting areas on the Lassen National Forest are grazed by cattle during summer months. No crane pairs successfully nested on the Lassen National Forest in 1988. In the mid 1980's the

Department attempted to convince the USFS to include the greater sandhill crane on their list of sensitive species without success. We have suggested alternatives ranging from exclusion of cattle from all or portions of a nesting area to changes in the timing of grazing. Information gathered in the past five years indicates no improvement in nesting success on USFS meadows primarily because many of our suggested management has not been implemented. On private lands, it appears that relatively little can be done to reduce grazing pressure except through establishment of conservation easements or the purchase of the impacted lands. However, establishing certain crane management actions within the present Private Lands Management Program may prove to be an effective strategy. However, efforts still need to be initiated or expanded on National Forest lands to remove cattle from wetland habitat where conflicts are known to cause reproductive failure in cranes. In aggregate all USFS lands represent the second or third most important nesting area for cranes in the State. Although nesting success has been poor, the potential for improvement is great if cattle grazing were controlled or eliminated from areas used by nesting cranes. This single action could result in a doubling of the available habitat supporting successfully breeding cranes. This would represent a significant step toward recovery of the greater sandhill crane in California.

Riparian habitat must be fenced and protected to avoid erosion and subsequent water table lowering in riparian-meadow areas on all public lands. Methods needed to enhance riparian-meadow habitat on private lands should be investigated and incentives provided to land owners for implementation of effective management. In some areas, crane habitat could actually be created simply by increasing water table levels, thus, promoting the growth of vegetation suitable as nesting habitat.

Predator populations [coyote, common raven, raccoon (*Procyon lotor*)] should be monitored closely and controlled if necessary. Common ravens have increased significantly throughout the nesting range of cranes in California since 1981 (Littlefield, pers. obs.), and coyotes were regularly seen in many crane nesting areas in 1988, particularly Ash Valley, Sierra Valley, Plumas and Sierra counties, and lower Klamath NWR, Siskiyou County. While it is assumed that predator control regularly occurs on most private lands, it also needs to be implemented on most public lands that support nesting crane populations. Recent programs to reduce predator mortality at Malheur NWR have resulted in significantly improved nesting success (pers. comm., Malheur NWR staff). Crane reproductive performance needs to be monitored periodically and, if it is found that persistently low recruitment rates occur in particular regions of the State, then more intensive nesting studies should be initiated. If it is determined that predators are responsible, then control measures should be taken.

It is recommended that the State continue to pursue an aggressive program of acquisition and other strategies to protect wetlands used by nesting cranes. Greater sandhill cranes are an indicator species of productive wetland ecosystems, and by protecting these lands other wetland species such as waterfowl and several species of native birds will also benefit. Higher commodity prices for agricultural crops such as alfalfa make the potential for extensive land conversions more likely. Such conversions have the potential to virtually eliminate breeding greater sandhill cranes from most private lands in California. In order to preserve the current small nesting population, it will become increasingly important to maximize crane production on public lands in California in the next decade.

Wintering sandhill cranes in the Central Valley currently are dependent on certain agricultural practices and cropping patterns. Cranes primarily concentrate on private lands and are vulnerable to land-use changes that alter their feeding, loafing, and roosting habitats. Aside from purchasing certain parcels of land to ensure that critical roosting and loafing sites are available and free from disturbance, there is relatively little habitat that can be placed under the protection of governmental agencies. Most feeding areas are on large-acreage private lands and the only means agencies have to ensure continued availability of these sites for crane-use may be through certain kinds of landowner cooperation programs and establishment of conservation easements and other incentives to reward private landowners for practicing good wildlife management. Thus, it appears that the private sector may ultimately hold the key to the future viability of crane populations on both the breeding and wintering ground.

In recent years, however, the Department has acquired lands that support large flocks of foraging cranes. Rogers (1990) reported that 90 percent of the Little Dry Creek Unit (LDCU) of the Upper Butte Basin WA was cultivated rice land. These rice crops were documented as important feeding areas for cranes (Pogson and Lindstadt 1988). Management actions to restore wetlands and to provide waterfowl habitat and hunting opportunity needs to be designed to avoid or at least minimize potential conflict directly with the needs of this threatened species. Research is underway to answer basic questions and derive solutions that restore certain foraging habitats for cranes that are not unduly disturbed by regulated public use including hunting and other activities at State WAs (Littlefield 1993). In a draft report of his findings, Littlefield (1993) reported that recent management of the LDCU to provide for lost food resources with plantings of corn has resulted in extensive foraging use of the area by cranes. Between October 1992 and February 1993, an estimated 156,006 feeding-use-days accrued on LDCU corn plots developed specifically for cranes. This was a dramatic increase in feeding use over the 1991-92 winter. Although available in 1991-92, the food plots were not discovered by cranes until shortly before their northward migration. While this improvement in feeding use of LDCU is significant, maintenance of feeding resources must continue as part of the overall management operation of the area. A biological opinion, prepared by the Department for management of its lands, ensures that cranes be provided mitigation for lost habitat and disturbance associated with users of these public lands. Littlefield (1993) also investigated the impact of human disturbance on cranes at LDCU and surrounding agricultural fields. The preliminary findings indicate that while it does occur, disturbance due to shooting, hunting, and other human activities is usually short-term and relatively insignificant at current levels. What disturbance that does occur can probably be reduced even further with the application of certain management actions including changes in the distribution of open and closed hunting areas and establishing certain kinds of vegetation to screen potentially disturbing activities from crane use areas. The challenge facing the Department is to provide a balance of habitats to meet the needs of greater sandhill cranes on private and certain public lands.

X. SOURCES OF INFORMATION:

Drewien, R. C. 1973. Ecology of Rocky Mountain Greater Sandhill Cranes. Ph. D. dissertation, Univ. of Idaho, Moscow, Idaho. 82 pp.

- Grinnell, J. and A. H. Miller. 1944. The distribution of the birds of California. Cooper Ornith. Club 27. 608 pp.
- Johnsgard, P. A. 1983. Cranes of the world. Indiana Univ. Press, Bloomington, Ind. 257 pp.
- Littlefield, C. D. 1968. Breeding biology of the Greater Sandhill Crane on Malheur National Wildlife Refuge, Oregon. M.S. Theses, Colorado State Univ., Ft. Collins, Colo. 78 pp.
- \_\_\_\_\_. 1981. Mate-swapping of sandhill cranes. Journ. Field Ornith. 52:244-245.
- \_\_\_\_\_. 1982. The status and distribution of Greater Sandhill Cranes in California, 1981, Calif. Dept. Fish and Game, Wildl. Branch Admin. Rep., 82-1. 27 pp.
- \_\_\_\_\_. 1986. Autumn sandhill crane habitat in southeast Oregon. Wilson Bull. 98:131-137.
- Littlefield, C. D. and R. A. Ryder. 1968. Breeding biology of the Greater Sandhill Crane on Malheur National Wildlife Refuge, Oregon. Trans. N.A. wildl. and Nat. Resources Conf. 33:444-454.
- Littlefield, C.D. and S. P. Thompson. 1979. Distribution and Status of the Central Valley Population of Greater Sandhill Cranes. Pp 113-120, In J.C. Lewis, ed. Proceed. 1978 Crane Workshop. Colorado State Univ. Print. Serv., Ft. Collins, Colo.
- \_\_\_\_\_. 1989. Status of Greater Sandhill Crane breeding populations in California, 1988., Calif. Dept. Fish and Game, Nongame Bird and Mammal Sec. Rep. 40 pp. Littlefield, C. D. 1989. Status of Greater Sandhill Crane breeding populations in California, 1988. Calif. Dept. Fish and Game, Nongame Bird and Mammal Sec. Rep. 40 pp.
- Littlefield, C. D. 1993. Annual assessment and monitoring report for Greater Sandhill Cranes and other Threatened and Endangered species on the Little Dry Creek Unit, California (October 1992 - February 1993). draft report. 29 pp + appendices.
- Nagendram, M. 1993. Study to determine nesting success; natality and causes of chick mortality of greater sandhill cranes breeding at Ash Creek Wildlife area, California. Department of Fish and Game, final report. 15 pp + appendices.
- Pogson, T. H. and S. M. Lindstadt. 1988. Abundance, distribution, and habitat of Central Valley Population Greater Sandhill Cranes during winter. Unpubl. ms. 52 pp.
- Rogers, R. D. 1990. Gray lodge Wildlife area Upper Butte sink unit management plan. California Department of Fish and Game. 154 pp.

Schlorff, R., G. Herron, G. Kaiser, C. Kebbe, G. Kramer, and C. D. Littlefield. 1983. Pacific flyway management plan for the Central Valley population of Greater Sandhill Cranes. U.S. Fish and Wildlife Service, Portland, OR. 28 pp.

Taverner, P. A. 1929. The red plumage coloration of the Little Brown and Sandhill Cranes. *Grus canadensis* and *Grus mexicanus*. Auk 46:228-230.

U.S. Fish and Wildlife Service. 1978. Guidelines for management of the Central Valley Population of Greater Sandhill Cranes. Portland, Oregon. 42 pp.

Walkinshaw, L. H. 1949. The sandhill crane. Cranbrook Instit. of Science, Bull. No. 29. 202 pp.

\_\_\_\_\_. 1965. A new sandhill crane from central Canada. The Canadian-Field Nat. 79:181-184.

\_\_\_\_\_. 1973. Cranes of the world. Winchester Press, New York. 370 pp.

XI. REPORT PREPARED BY:

Mr. Ronald W. Schlorff  
Nongame Bird and Mammal Program  
Wildlife Management Division  
California Department of Fish and Game  
February 8, 1994

XII. CONTACT FOR FURTHER INFORMATION:

Mr. Ronald W. Schlorff  
Nongame Bird and Mammal Program  
916-654-4262

XIII. DRAFT REPORT REVIEWED BY:

Mr. Carroll D. Littlefield  
HCR4 Box 212  
Muleshoe, Texas 79347

schlorff\5yr-sand.