Draft
Long-Range Plan for the Management of Sandhill Cranes in New Mexico

New Mexico Department of Game and Fish

Long-Range Plan for the Management of Sandhill Cranes in New Mexico

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About the Plan

New Mexico is a major migration route and winter range for three of the six recognized subspecies of sandhill cranes (*Grus canadensis*). The greater sandhill cranes (G. c. tabida) are from the Rocky Mountain population and winter mainly along the middle Rio Grande Valley (MRGV). Smaller numbers of greater sandhill cranes winter in the southwestern part of the state, the Pecos Valley and Las Vegas National Wildlife Refuge. The lesser sandhill crane (*G. c. canadensis*) and Canadian sandhill crane (*G. c. rowani*) are from the western subpopulation of the Mid-Continent Population. Lessers occur mainly in the playa lake region near the Texas border, the lower Pecos River Valley, and in the southwestern portion of the state. Lower numbers of lesser sandhill cranes occur along the middle Rio Grande Valley. The Canadian sandhill crane is not as common in the state and occurs throughout all the winter ranges. Genetic studies suggest the Canadian subspecies should be included with the greater subspecies.

The quality of winter habitat is important because sandhill cranes congregate in high densities and are dependent on limited resources. Sandhill crane numbers and distribution are dependent on the availability of food (primarily grain) and shallow roost sites with minimal disturbance. Sandhill cranes have a long life span and will continue returning to areas with suitable habitat. However, if any of these components decrease, this migratory species will search out areas with suitable habitat. Changing agricultural practices on private lands has reduced the available food supply and urban development is eliminating sandhill crane habitat.

Large numbers of sandhill cranes utilize private lands. The New Mexico Department of Game and Fish (Department) is precluded from expending state funds for habitat improvements to private lands under provisions of the Anti-Donation clause. This impacts the Department's contribution towards improving crane habitat on private lands.

Sandhill crane populations are closely monitored by the U.S. Fish and Wildlife Service (USFWS) and cooperating states that conduct annual population surveys. Both populations occurring in the state are currently at stable levels. The Rocky Mountain population numbers around 19,000 birds and the Mid-Continent population numbers near 500,000 birds. The Department conducts monthly aerial surveys during the fall and winter to estimate the number and distribution of cranes in the state. Additionally, Bosque del Apache National Wildlife Refuge personnel conduct weekly ground counts.

The USFWS has the primary responsibility in sandhill crane management. Low annual recruitment rates among sandhill cranes limits their ability to recover from population declines. Harvest regulation changes outside of federal frameworks must obtain approval through the Flyway Council System and the USFWS before the state can implement any changes.

Sandhill cranes are a highly visible species held in esteem by both wildlife viewers and the hunting public. At the same time sandhill cranes depredations are a major concern among agricultural growers. The Department's goal is to satisfy the recreational and ecological interests of the citizens of New Mexico and results in successful resolution of related issues. To accomplish this, the Department will focus efforts…

(1) Public involvement: Drafts of the plan will be made available to all interested parties. Following incorporation of public comments, suggestions, and concerns, the final version of the Long-Range Plan and the Operational plan will be presented to the State Game Commission for adoption during summer 2003.

(2) Public education and awareness: The Department will provide information to the public through printed media, presentations, and via the Internet to promote public awareness of sandhill crane issues. Public satisfaction with the Department's success in meeting recreational and ecological interests and resolving associated issues will be monitored with surveys.
(3) Maintain viable, widely distributed sandhill crane wintering populations: The Department will assess statewide habitats and populations, monitor harvest and success rate, identify potential threats to sandhill crane populations, minimize depredation costs to landowners, and establish productive working relationships with other publics, land management agencies, private landowners, and states and nations within the Central and Pacific Flyways.

Planning for the management of sandhill cranes in New Mexico is a multi-phase process. Phase I involved researching the biological and historical background, analyzing the current situation, establishing the management goal and objective, identifying issues which may impede goal attainment, and developing strategies to address those issues. Initial issues were developed using comments obtained developing management plans for the Pacific and Central Flyways Management Plan for the Rocky Mountain Population of Greater Sandhill Cranes, Management Guidelines for Mid-Continent Sandhill Cranes and A Plan for the Management for Waterfowl, Sandhill Cranes and other Migratory Birds in the Middle Rio Grande Valley of New Mexico. The draft Long-Range Plan will be made available for public review through March 14, 2003 to ensure all issues and strategies are identified. Comments need to be returned by March 14, 2003 so that they can be incorporated into the final Long-Range Plan.

The second phase is the Action Plan in which specific tasks to accomplish the Long-Range Plan's strategies are developed. The third phase is the Operational Plan in which tasks are scheduled for implementation and related costs are anticipated.

Acknowledgements – Bill Graves, Department Planner, provided valuable guidance and review in the development of the plan. Bill Dunn, Supervising Biologist for Predator and Gamebird Management went through numerous edits.

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Natural History

Physical Characteristics

Sandhill cranes (*Grus canadensis*) are among the oldest existing species of birds (2.5 million years) (Tacha et al. 1992, Tacha et al 1994). Sandhill cranes have heavy bodies and long necks and legs (Walkinshaw 1949, Tacha et al. 1992). Height extends to 1.2 m, wingspan to 2 m, and weight may reach 5.5 kg. The bill is elongate and strong. The feet have four toes with sharp hooked claws, the hallux small and elevated. Sexes are monochromatic gray and generally indistinguishable even with cloacal examination (Tacha and Lewis 1979). Juveniles have a feathered crown, brown nape feathers (Tacha and Vohs 1984) and buff-colored secondary wing coverts (Drewien et al. 1995). Adults have red, pappilos skin on the crown and gray nape feathers (Walkinshaw 1949, Tacha et al. 1992).

Six subspecies of sandhill cranes have been identified based upon size, head profile, and coloration (Lewis et al. 1977). Three of these subspecies occur in New Mexico. The lesser sandhill crane (*G. c. canadensis*) (lessers) is the smallest among all the subspecies. Female lessers weigh an average 2,955 g (6.5 lb) and males average 3,434 g (7.6 lb). Wing chord measurements (length from the wing tip to the first joint) average 448 mm for females and 473 mm for males. Posterior culmen measurements (length from back of nostril to bill tip) average 68.8 mm for females and 73.2 mm for males. The tarsus measurement (from the knee joint to the ankle joint) averages 176 mm for females and 186 mm for males.

Canadian sandhill cranes (*G. c. rowani*) (Canadians) are intermediate in size. Female Canadians weigh an average 4,701 g (10.4 lb) and males average 5,154 g (11.4 lb). Wing chord measurements average 496 mm for females and 510 mm for males. Posterior culmen measurements average 86.9 mm for females and 94.8 mm for males. The tarsus measurement averages 221 mm for females and 233 mm for males.

The greater sandhill crane (*G. c. tabida*) (greaters) is the largest among the subspecies. Female greaters weigh an average 4,928 g (10.9 lb) and males average 5,554 g (12.2 lb). Wing chord measurements for greaters average 514 mm for females and 538 mm for males. Posterior culmen measurements average 97.7 mm for females and 103.6 mm for males. The tarsus measurement averages 228 mm for females and 239 mm for males (Schmitt and Hale 1997).

Research on the Mid-Continent Population (MCP) suggests that the Canadian subspecies should be included with the greater subspecies (Tacha et al. 1985b). There appears to be a genetic difference between lessers and the larger subspecies, but not between the greater and Canadian subspecies (Rhymer et al. 2001, Gaines et al. 2002).

Distribution

New Mexico supports wintering migratory populations of lessers, Canadians and greater sandhill cranes (Schmitt and Hale 1997). Lessers and Canadians are from the Western subpopulation of the MCP (Tacha et al. 1984) (Fig. 1) and greaters are from the Rocky Mountain Population (RMP) (Drewien and Bizeau 1974) (Fig. 2).

Historically, RMP greater sandhill cranes nested in suitable habitat from northeastern Arizona, central Utah and western Colorado north through western Wyoming, Idaho, western Montana and probably Alberta. Much of their former nesting range has been reoccupied, except western Colorado and northwestern Arizona (Pacific and Central Flyway Management Plan 2001). Recent records also confirm breeding in extreme southwestern Alberta, which probably involve RMP pioneers following the Rocky Mountain Front northward from Montana (Semenchuk in Drewien et al. 2000).

During spring and fall migrations the San Luis Valley, Colorado (SLV) is the major migratory staging area for RMP greater sandhill cranes. Cranes departing the SLV in autumn follow the Rio Grande Valley south into New Mexico (Drewien and Bizeau 1974). The majority of RMP cranes migrate from Colorado to the Middle Rio Grande Valley (MRGV) (Fig. 3) the first three weeks of November, with 50% to 77% of the population leaving over a four-day period (Stahlecker 1992). Weather, wind speed and direction, and to a lesser extent, thermal activity (sunshine) affect the distance cranes travel. Sandhill cranes gain altitude by spiraling in thermals and proceed forward flapping and gliding. Sandhill cranes migrate at 23-83 km/hr (15-52 mi/hr) and usually discontinue migration before sunset (Melvin and Temple in Stahlecker 1992).

Stopover areas in New Mexico occur at the confluence of the Rio Chama and Rio Grande, on the upper portion of Cochiti Reservoir, the Santa Fe River delta, the upper portion of Jemez Reservoir, the Rio Grande between Cochiti Reservoir and Bernalillo and open mesas west of the Rio Grande. These areas are used as night roost sites when sandhill cranes are not able to complete the migration between Colorado and the MRGV before nightfall (Stahlecker 1992).

The principal winter range for RMP greater sandhill cranes is the MRGV in westcentral New Mexico, mainly from the Albuquerque-Los Lunas region in Bernalillo and Valencia counties south to the Bosque del Apache National Wildlife Refuge (NWR), Socorro County (Drewien et al. 2000) (Fig. 4). The valley has long been recognized as an important wintering area for cranes (Bailey 1928, Ligon 1961). The majority of the greater sandhill cranes winter at or in the vicinity of the Bosque del Apache NWR or an area 65-km north near Bernardo. Smaller groups are scattered throughout the valley north to Tome and Los Lunas areas in Valencia County (Drewien and Bizeau 1974). Flock counts and observations of marked cranes show that Bosque del Apache NWR is the single most important wintering location for greater sandhill cranes nesting in the Rocky Mountain region with over 50 percent of the entire population wintering here (Drewien and Bizeau 1974).

Smaller numbers of greater sandhill cranes winter in southwestern New Mexico, including the Hatch and Uvas valleys in Sierra and Dona Ana counties, the Deming-Columbus area in Luna County, and the upper Gila River, near Cliff in Grant County (Drewien et al. 1995). A small number of greaters also winter in the Pecos Valley, Las Vegas NWR and the Sulphur Springs Valley in Cochise County, Arizona. About 10 percent of the population winters in Chihuahua and Durango, Mexico (Drewien et al. 1996). Spring migration routes are the same as the fall migration (Drewien and Bizeau 1974).

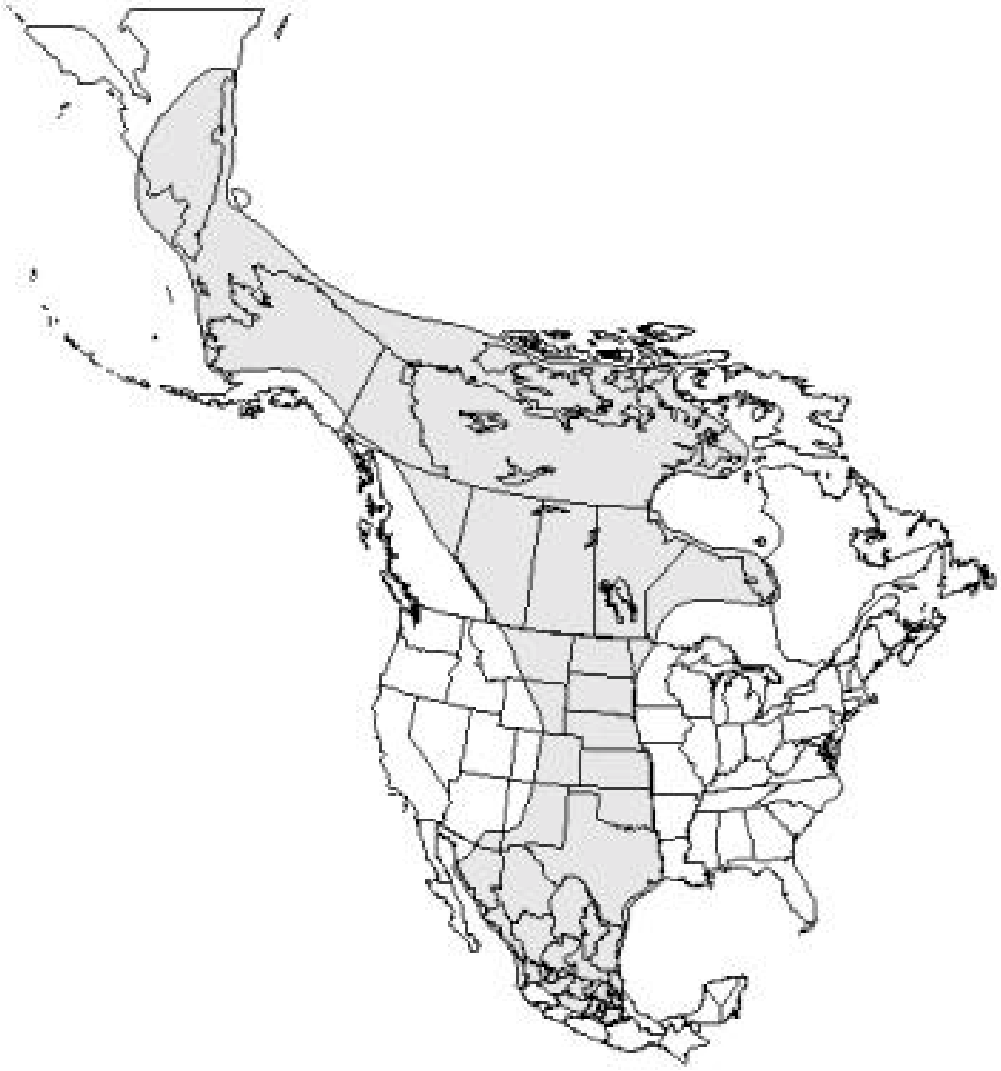

Figure 1. Approximate range of the Mid-Continent Population sandhill cranes (based Sharp and Dubovsky (2001), Tacha et al. (1994), and data from radio-telemetered birds provided by G. Krapu, Northern Prairie Wildlife Research Center, Jamestown, ND).

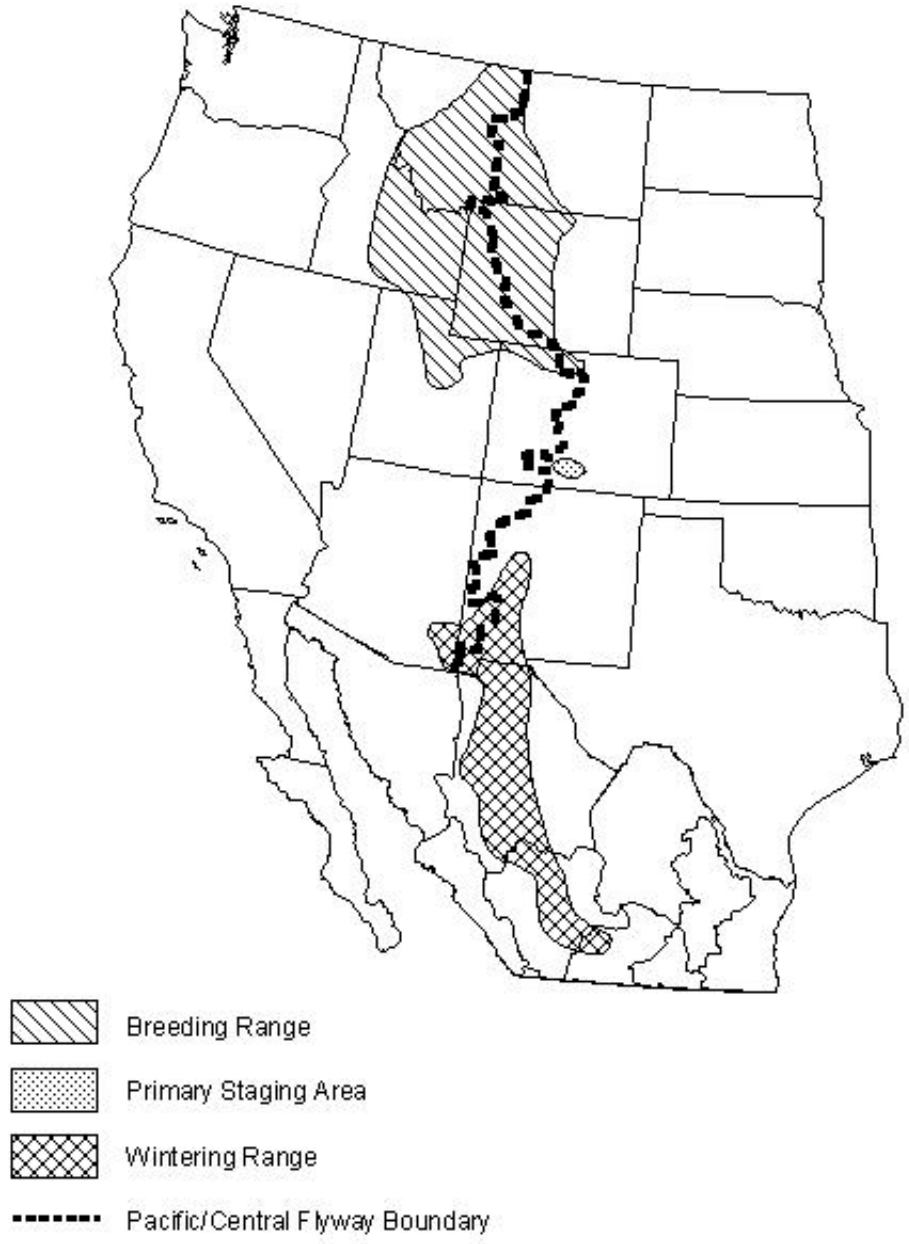

Figure 2. Approximate range of Rocky Mountain Population of Greater Sandhill Cranes (adapted from Sharp et al. 2001).

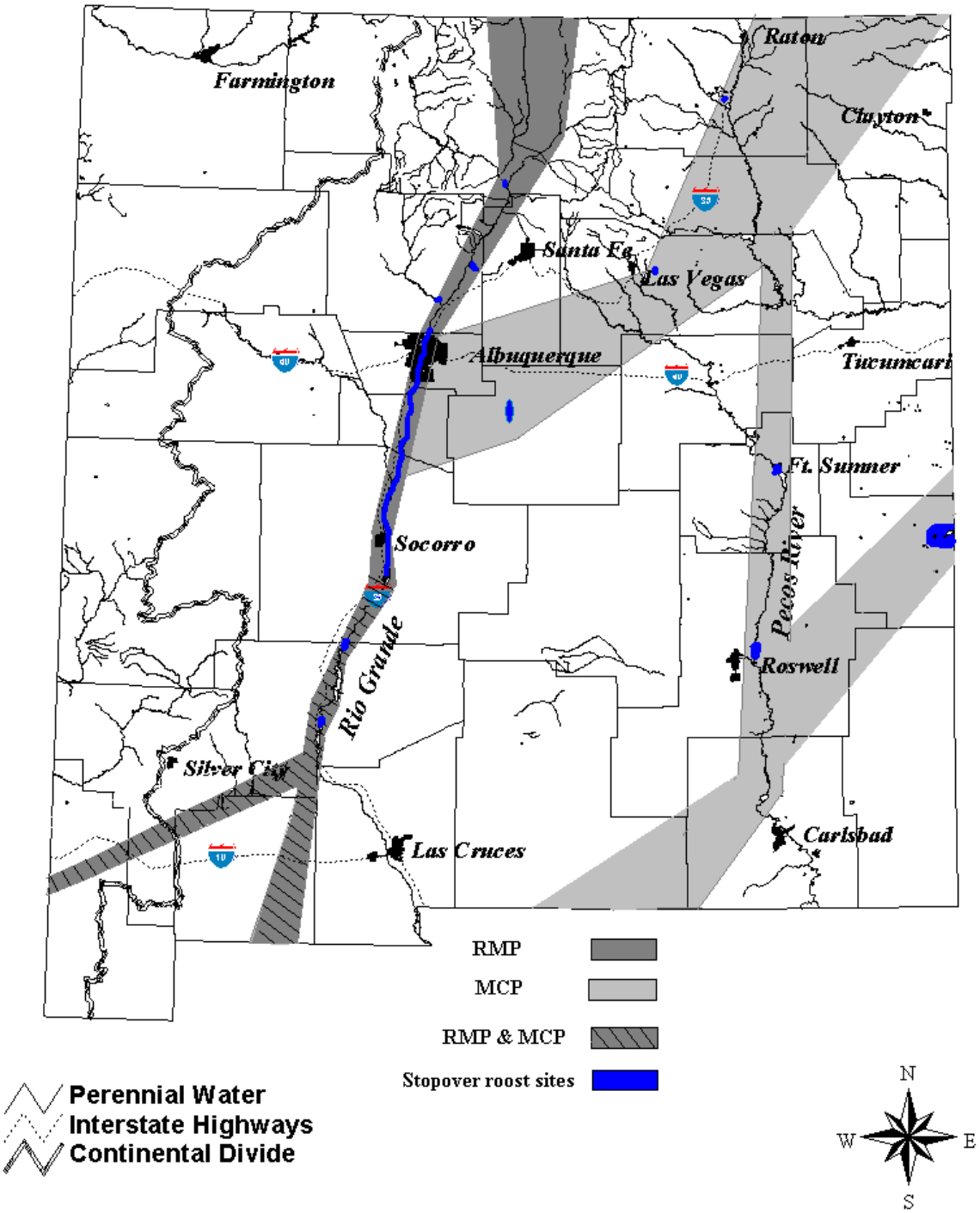

Figure 3. Approximate sandhill crane migration routes in New Mexico.

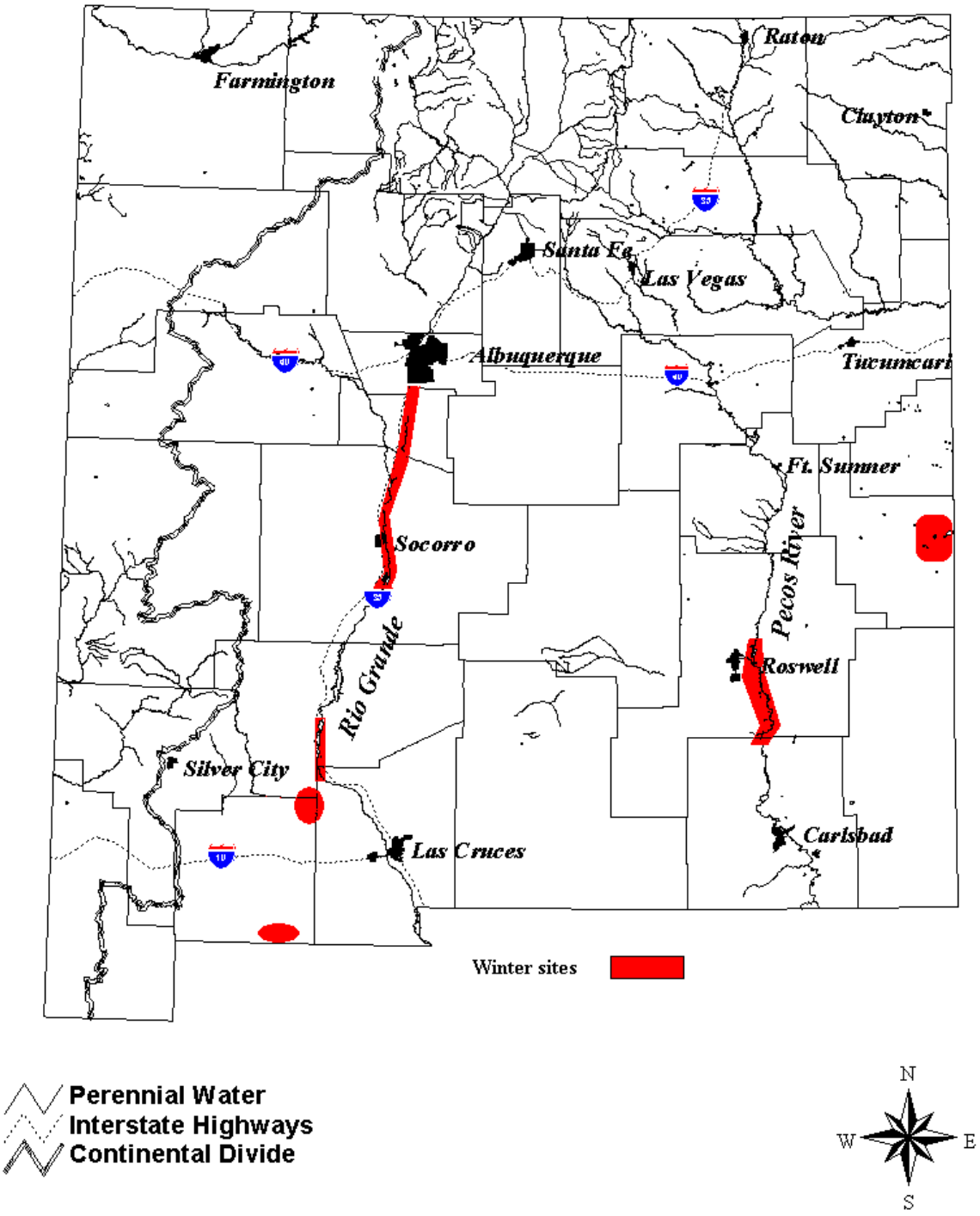

Figure 4. Approximate range of major sandhill crane wintering areas in New Mexico.

Lesser and Canadian sandhill cranes from the Western subpopulation of the MCP nest in western Canada, western and interior Alaska, and eastern Siberia. They migrate through central Alberta, southern Saskatchewan, western portions of North and South Dakota, Nebraska, Oklahoma, and eastern portions of Montana, Wyoming, and Colorado to wintering areas in western Texas, eastern and southern New Mexico, southeastern Arizona, and central and northern Mexico (Tacha et al. 1984, 1992). Southern Saskatchewan and western North Dakota are the primary fall staging areas. In spring, they stop in Nebraska along the more western portions of the Platte River and the North Platte River Valley (Tacha et. al 1992). In New Mexico, the principal wintering concentration for lessers is along the Pecos Valley (Fig. 4). The majority of these wintering sandhill cranes are on Bitter Lakes NWR (Walkinshaw 1949, Boeker et al. 1961, Montgomery 1997). Other sizable populations are scattered throughout the area near Portales and Grulla NWR in Roosevelt County (Boeker et al. 1961). Lessers and Canadians mix with greaters in the middle Rio Grande Valley. The percentage of lessers increase between Caballo Reservoir and the Hatch Valley in Sierra and Dona Ana counties, the adjacent Uvas Valley in Sierra and Dona Ana counties and near the Deming and Columbus area in Luna County (Schmitt and Hale 1997) (Fig. 4). Recently, sandhill crane use in the Estancia Valley has increased during the fall migration and winter. All three subspecies wintering in New Mexico were in the sample of cranes collected from this area in 2000 (Mitchusson 2001).

Habitat Requirements

The single most-important factor regulating sandhill crane populations is habitat availability (Tacha et al. 1992). Thus, maintenance of essential habitats is the primary need for sandhill cranes (Tacha et al. 1994). Sandhill cranes are primarily birds of open freshwater wetlands and shallow marshes, but use a broad range of habitat types from bogs, sedge meadows, and fens to open grasslands and cultivated lands (Tacha et al. 1992).

Breeding - RMP greater sandhill cranes nest in isolated, well-watered river valleys, marshes, and meadows at elevations above 1,500 m (Drewien 1973, Drewien and Bizeau 1974). Most nests are in wet meadow-shallow marsh zones along the marsh edge (Drewien and Bizeau 1974). After hatching, most broods tend to feed in moist areas along the water's edge or in adjacent meadows, using deeper water mainly for escape and occasional roosting (Drewien 1973). In Colorado, broods moved away from the willow drainage bottoms, upslope to the sagebrush ridges and the fringes of the aspen stands (Bieniasz 1978).

Non-breeding adults feed in wet meadows and grain fields adjacent to a roosting area. In August, cranes feed in alfalfa fields with large numbers of insects present. Use of grain fields increases during fall pre-migration staging where nearly all cranes observed are in grain fields (Rowland et al. 1988).

Prior to migration, greater sandhill cranes gather at staging areas nearest their summering site. The major attraction at staging areas is the availability of grain located in proximity to shallow lakes, marshes, and river bottoms that are used as roosting sites. In fall, RMP greaters feed in grainfields, primarily barley near adjacent wetlands (Drewien and Bizeau 1974).

During the breeding season, MCP sandhill cranes are found in a wide variety of northern wetlands (Tacha et al. 1992). Typical breeding territories in the Yukon-Kuskokwim Delta, Alaska were in wet marsh or sedge meadow areas. Broods spend the most time in taller *Elymus* vegetation along slough banks, heath tundra and short-grass meadows (Boise 1977). Sandhill cranes in northern Canada used similar habitats in tundra areas (Walkinshaw 1973). In central

Alberta cranes nested in open, wet, sedge marshes adjacent to wooded areas (Carlisle 1982). Lessers on Banks Island nest in extensive sand dune regions (Reed, 1988).

Migration - Habitats along migration routes tend to be large open palustrine and riparian wetlands near agricultural areas (Krapu et al. 1984). Sandhill cranes staging in southeastern Saskatchewan in fall roost in shallow, open wetlands and feed in small grain fields (Stephen 1967). Cranes in western North Dakota preferred to roost within large expanses of shallow saline water with a soft substrate, and far from bare shoreline (Soine 1982). Optimum habitat complexes for spring migrants staging in the North Platte River Valley included a river or shallow wetland roost site, an interspersion of 30-70% corn stubble, 5-40% pasture, 13% or greater alfalfa, and 1% or greater wetland within 4 km of the roost site (Iverson et al. 1987). Wet meadows and native lowland grassland habitats are important as they provide an important source of macroinvertebrates for cranes (Reinecke and Krapu 1986).

At the spring and fall staging sites in the San Luis Valley, roosting locations are ponds and sloughs where the birds use water up to 0.3 m deep. Loafing areas are wet meadows of baltic rush (*Juncus balticus*), sedges (*Carex spp.*), spikerush (*Eleocharis spp.*), greasewood (*Sarcobatus vermiculatus*) and a variety of grass species. These meadows do not have to be very wet to attract cranes; 2 to 4 cm of water is satisfactory. Cranes will sometimes use dry meadows as long as a ditch with water or a stream is nearby. Although some feeding activity occurs in meadows, they are primarily used for resting, preening and other social activities. The other major habitat used is grainfields during morning and evening. Barley is the primary crop so cranes use it most frequently, but will also utilize wheat, field peas, and potato fields. Primary feeding activity in potato fields is searching for insects and grubs (Kauffeld 1982).

Winter - The quality of winter habitat is important because cranes congregate in high densities and are dependent on limited resources. Cranes are vulnerable to disturbance and habitat alteration caused by changes in water and cropland management (Iverson et al. 1985b). Sandhill cranes wintering in the Rio Grande Valley roost in shallow river areas, lake areas, or artificial impoundments on state and federal refuges and spend most of the day in irrigated croplands and pastures. The riparian community is dominated by cottonwoods (*Populus fremonii*), Russian olive (*Elaeagnus angustifolia*), saltcedar (*Tamarix chinensis*), and willow (*Salix sp.*). State and federal refuges border the river and consist of riparian woodlands, cultivated fields, and artificial impoundments where water levels are manipulated for waterfowl and shorebirds. Impoundments having water throughout the year support plants such as hardstem bulrush (*Scirpus acutus*), spikerushes (*Eleocharis sp.*), rushes (*Juncus sp.*), and cattails (*Typha sp.*). Impoundments that are drawn down in spring support cockleburs (*Xanthium strumarium*) and other annuals after the water is removed. The remainder of the valley consists mostly of irrigated croplands. Cranes use the irrigated croplands for feeding and loafing. Common crops include alfalfa, chile, corn, cotton, and sorghum (Walker and Schemnitz 1987). In the Rio Grande Valley, the acreage of corn and small grains has decreased, causing cranes to concentrate on refuges and on dairy farms where grains are raised. Wetlands are scarce because of drainage projects carried out by the Bureau of Reclamation (Lewis et al. 1977).

A portion of the sandhill cranes migrating out of the MRGV winter south of Deming in Luna County. Luna County is part of a large closed-basin complex from which surface runoff drains into the playa region of northern Chihuahua, Mexico (Maker et al. in Walker and Schemnitz 1987). Cranes that roost in shallow desert lakes just south of the border in Chihuahua, Mexico cross the border daily to feed in the agricultural areas near Columbus

(Drewien and Bizeau 1974). The principal drainage, Mimbres River, is usually dry. The Deming-Columbus agricultural area is a broad to gentle sloping semi-desert plain between 1,219 and 1,524 m elevation. The Uvas Valley is an internally drained, gently sloping basin of approximately the same elevation (Neher and Buchanan in Walker and Schemnitz 1987). Dominant vegetation consists of creosote bush (*Larrea tridentata*), mesquite (*Prosopis glandulosa*), four-winged saltbush (*Atriplex canescens*), alkali sacaton (*Sporoblus airoides*), tobosa grass (*Hilaria mutica*), and other annuals. The area is used primarily for cattle grazing and irrigated farming of cotton, sorghum, corn, wheat, barley and alfalfa (Walker and Schemnitz 1987).

Sandhill crane winter habitat in the Pecos Valley consists of irrigated croplands near the communities of Fort Sumner, Roswell, Artesia, and Carlsbad. The principal crops are alfalfa, cotton, corn, chile peppers, wheat, barley, and sorghum (Hodson in Montgomery 1997). Intervening shortgrass prairie separates these areas from each other (Montgomery 1997). In Chaves County, the acreage of corn and sorghum has declined since 1970. Food provided by Bitter Lake NWR since 1991 has attracted the majority of cranes wintering in the Roswell area. The major roost sites are at Bitter Lake NWR and the Overflow Wetlands near Bottomless Lakes State Park (Montgomery 1997).

Crane winter habitat in west Texas consists of cotton and sorghum crops (Murfield et al. in Iverson et al. 1985). Pluvial lakes, deep linear basins depressed below the surrounding landscape, contain expansive areas of shallow water and mudflats. The semipermanent to permanent water in the basins is supplied by precipitation runoff and freshwater springs located along the basin perimeter (Iverson et al 1985). Lake water is alkaline due to sodium sulfate salts or gypsum (Reeves in Iverson et al. 1985). During dry periods, the exposed lake bottom provides broad expanses of crystallized salts (Iverson et al 1985). Pluvial lakes serve as night roosts, and most drinking water was obtained from freshwater springs bordering the lakes. Waste grain in harvested milo fields is the primary food (Iverson et al 1985b).

Additional playa lakes, ephemeral sheetwater wetlands, are created where shallow depressions fill following rainfall. Playa lakes vary in depth from 0.1 to 6 m. Surface areas varied from 0.1 to 200 ha, but 80% were less than 12 ha (Davoracek in Iverson et al. 1985). Water, when present is generally fresh compared to the highly alkaline water in pluvial basins (Rettman in Iverson et al. 1985). Southeastern New Mexico contains similar pluvial basins and playas adjacent to croplands. The Estancia Valley contains pluvial basins that are used as roosts adjacent to croplands.

Roosts used regularly by wintering birds generally are in shallow water several meters from shore. The physical features that characterize roosts are level terrain, shallow water bordered by a shoreline either lacking vegetation or only sparsely vegetated and an isolated location that reduces the chance of disturbance by humans. The ground slopes gradually into the water and a large area of 10 to 20 cm deep water is present several meters from the shore, providing standing room for a flock. The shallow water between the cranes and the shoreline, level terrain and sparse vegetation presumably permit a clear field of vision that provides some protection against predators. Optimal roost sites are located within 16 km (10 miles) of feeding areas (Lewis 1976). However, sandhill cranes in the Pecos Valley were observed flying 34.5 km (21 miles) from the roost site to a cornfield (Montgomery 1990). Sandhill cranes have been seen flying approximately 27 miles from Caballo Lake to cornfields in the Uvas Valley and returning to roost on Caballo Lake (personal observation).

Food Habits

Sandhill cranes have evolved an opportunistic foraging strategy that allows them to adapt to changes in food availability (Mullins and Bizeau 1978, Reinecke and Krapu 1986). The specific diet depends on food availability in different seasons and /or locations (Tacha et al. 1992). Sandhill cranes exploit foods by probing subsurfaces with bills and by gleaning seeds and other foods on the land surface or in shallow marshes (Walkinshaw 1949, Tacha et al. 1992). Cranes probe at a depth greater than 15 cm to obtain nut-grass tubers (Guthery 1975).

Food items eaten by marsh-nesting cranes include roots, browsed vegetation, snails (*Helisoma* spp.), crayfish (*Cambarus* spp.), small mammals, birds, frogs (*Hyla crucifer, Rana pipiens*), snakes, toads (*Bufo* spp.) and various insects (Walkinshaw 1973). Cranes will attempt to take any potential food item of the proper size, including waterfowl eggs, ducklings (Armbruster 1987), and lemmings (Reed 1988). Young cranes (colts) feed almost exclusively on animal food during the preflight period (Lewis 1977).

During migrations cultivated grains are major food items whenever and wherever they are available (Tacha et al. 1994). Cranes often feed in grain fields in the spring before nest sites thaw and again in late summer after the young reach flight stage (Armbruster 1987). Heavily used grains include barley (*Hordeum vulgare)* in Idaho (Drewien 1973) and Alaska (Mickelson 1987), wheat (*Triticum aestivum)* in Colorado (Bieniasz 1979) and Saskatchewan (Iverson et al. 1981) and corn (*Zea mays*) in Nebraska (Lewis 1979c, Reinecke and Krapu 1986). Cultivated grains provide the necessary fat stores required during migrations and are accessible with minimum energy expenditures (Tacha et al. 1987). At staging areas in Nebraska macroinvertebrates (e.g. earthworms, snails, beetles) provide essential proteins and calcium not obtained from other sources and are the foods in shortest supply (Reinecke and Krapu 1986).

During winter, waste corn is the primary food of cranes in the middle Rio Grande Valley and southwestern New Mexico. Other important foods eaten by cranes include chufa tubers (*Cyperus esculentus*), sorghum, alfalfa, grasshoppers and isopods (Walker and Schemnitz 1987). In the Pecos Valley cranes foraged mainly in corn, sorghum and alfalfa fields (Montgomery 1997). Sandhill cranes in the Roosevelt County area feed on harvested corn in addition to sorghum, wheat and peanuts left in the field (Windingstad et al. 1989).

Reproduction

Sandhill cranes are perennially monogamous with pair bonds maintained outside the breeding season (Tacha et al. 1992, Tacha et al. 1994). Sandhill cranes do not breed until they are 2 to 7 years old, depending on subspecies and population (Walkinshaw 1949; Tacha et al. 1992). In MCP sandhill cranes, pairs are formed as early as age 3 with 90-100% paired by age 7. MCP cranes may reproduce successfully as early as age 5, but over 75% are not successful until 8 years of age (Tacha et al. 1989, Tacha et al. 1994). Greaters have successfully nested in their third year (Lewis et al. 1977). However, the most productive RMP greater sandhill cranes were > 7-8 years old (Drewien et al. 2000). Pair bonds may form and dissolve before successful reproduction occurs (Nesbitt and Wenner 1987). Following successful reproduction, mate changes are rare unless a mate dies (Tacha 1988, Nesbitt 1989).

Lesser sandhill cranes usually arrive at Banks Island, Northwest Territories about 15 May (Walkinshaw 1965) while Alaskan cranes arrive on their breeding grounds between the last week of April and the middle of May (Boise 1979). RMP greater sandhill cranes arrive at Grays Lake, Idaho during late March or early April when the valley is still snow covered. In mid-April as weather moderates and snow levels decline, pairs disperse to breeding territories (Drewien 1973).

After arrival, most breeding pairs establish territories 2-4 weeks before nest building and egg laying starts (Drewien 1973). Pairs become aggressive toward their young of the previous year and proclaim their territory with loud, synchronized unison calls (Walkinshaw 1973). Pairs return to the same territory annually and both members assist in territorial defense. Pairs maintain mutually exclusive territories, and maximum aggressive behavior occurs during the prenesting period as adjacent pairs reestablish boundaries and drive off trespassing non-territorial cranes (Drewien 1973). The male is the most active in territory defense and females are less likely to retain the territory after loss of mates (Nesbitt and Tacha 1997).

Most daily requirements are found within territories, including nest, feed, roost sites, escape cover, and water. These components can be supplied by large marsh complexes (Drewien 1973); smaller, scattered marshes (Walkinshaw 1973; Armbruster 1987); bogs in northern boreal forests (Taylor 1976); intermittent streams in sagebrush parklands (Bieniasz 1979); and mountain meadows, beaver (*Castor canadensis*) ponds, and subirrigated wet meadows along riparian zones (Drewien and Bizeau 1974). Families use territories partially or entirely during prenesting, nesting, brood, and post-brood periods (Drewien 1973). Nesting lesser sandhill cranes on Banks Island have a mean territory size of 1.8 km^2 (Reed 1988). RMP greater sandhill cranes at Grays Lake, Idaho have the highest reported nesting density with a mean territory of 17 ha (Drewien 1973). Isolation from human activity appears to be an important criterion for selection and use of nesting territories by cranes. Sandhill cranes have the propensity to desert their nests or territories due to human disturbances (Walkinshaw 1973, Drewien 1973, Boise 1976).

Nests may be established on dry-land sites with almost no nest material but are more often in water on piles of emergent aquatic plants, sticks, grass, mud and sphagnum (Lewis et al. 1977). Nests on the Yukon-Kuskokwim Delta are typically located in low, wet areas not more than 50 m from open water. Although the nest site is usually very wet, the nest itself is placed on some raised portion and is therefore dry (Boise 1976). Nest size and complexity vary by location; those on dry sites are small and contained little material while those in water were larger and usually contain considerable nest material (Drewien 1973).

Mean date of nest initiation for lesser sandhill cranes on Banks Island is June 16 (Walkinshaw 1949). On the Yukon-Kuskokwim Delta nest initiation occurs late May to early June and hatching dates are from 16 June - 1 July (Boise 1976). At Grays Lake, greater sandhill cranes nest from late April through early July (Drewien 1973).

Clutches contain usually two, occasionally one, or rarely three eggs (Lewis et al. 1977). Average clutch size is 1.9 but is smaller in more northern-breeding birds (Nesbitt 1989, Tacha et al. 1994). Incubation begins after the first egg is laid (Lewis et al. 1977). Both sexes incubate; males and females share daylight incubation duties about equally, but the female is the primary nest attendant at night (Drewien 1973, Nesbitt 1989). Nest success varies among years and locations. It averages about 50% but has been as high as 78% (Tacha et al. 1992, Tacha et al. 1994, Drewien 1973). After 28-31 days of incubation, eggs hatch asynchronously (Lewis et al. 1977). Sandhill cranes raise a single brood per year but will renest following loss of eggs in

northern nesting populations or loss of eggs or young in southern populations (Tacha et al. 1994).

Hatching takes 24 to 36 hours. The precocial colt is dry in a few hours and is walking the next day. After the colt or colts hatch, the family moves to open uplands or meadows for feeding. The family returns to the marsh each night to roost, and it may return to the nest or the parents may build a platform for roosting (Lewis et al. 1977). Both parents feed the young, but females do most post-hatch brooding (Tacha et al. 1994). The colts' diet during the preflight period appears to be almost exclusively animal food, but young feed readily on agricultural grains in autumn (Lewis et al. 1977). RMP greaters fledge at 67-75 days (Drewien 1973). Post-fledging brood size averages 1.31 (range 1.21-1.35). In several populations, the percentage of post-fledged juveniles average 11.0% (range 6.6-18.3) (Tacha et al. 1992, Tacha et al. 1994). Young are usually separated from the parental care at about 10 months of age (Tacha 1988, Nesbitt 1992, Tacha et al. 1994).

Population Dynamics

The sandhill crane is the most abundant of the world's cranes (Meine and Archibald 1996). However, sandhill cranes have the lowest known recruitment (percent juvenile in fall) of any avian species hunted in North America (Drewien et al. 1995). For RMP greater sandhill cranes, nonbreeders comprise 31-39 percent of the total population annually (Drewien 1973).

Most sandhill cranes lay two eggs but usually raise only one young. Sibling aggression by the dominant colt increases when there is food stress. This enhances the survival of the dominant colt at the expense of its brood mate by dominating the food made available by the parents (Drewien 1973). The availability of food and water, weather and predation on the breeding grounds, not innate behavior, appear to primarily influence brood size (Drewien et al. 1995).

Annual fall recruitment in RMP greaters is 8.1% and the mean brood size is 1.25. About 20% of RMP recruitment comes from extra young in broods with 2 or rarely 3 young. Recruitment in MCP lessers average 11.2% and mean brood size is 1.14 (Drewien et al. 1995).

Adult cranes are long lived, but mortality can be high for eggs and young. Crows (*Corvus brachyrrhynchos*) and striped skunks (*Mephitis mephitis*) are primarily egg predators while ravens (*Corvus corax*), raccoons (*Procyon lotor*), and coyotes (*Canis latrans*) prey on eggs and young (USFWS Biological report 1987). Golden eagles (*Aquila chrysaetos*) may be a significant mortality factor as attacks have been observed on sandhill cranes (Armbruster 1987, Drewien et al. 2000, personal observation).

Estimated annual survival rates for RMP cranes from 1972-1985 was 95% (Drewien et al. 1995). With expanded hunting throughout the RMP range, current annual RMP crane adult survival is estimated at 89%. Most (>70%) mortality is due to human causes. Legal and illegal shooting accounts for 58.3% with hunting (53.9%) the single most important mortality factor. Other mortality factors are by unknown causes (24.4%), power line and fence collisions or entanglements (10.0%), and other factors (7.3%). The proportion of cranes lost to shooting increases with age, whereas non-shooting mortality declines with age, suggesting older cranes learn to avoid many forms of non-shooting mortality (Drewien et al. 2000).

Avian botulism (*Clostridium botulinum*), avian cholera (*Pasteurella spp.*), and mycotoxins (*Fusarium spp.*) on waste peanuts are leading causes of non-hunting mortality (Windingstad 1988, Tacha et al. 1994). Avian tuberculosis (*Mycobacterium avium*),

aspergillosis (*Aspergillus spp.*) and lead poisoning are other causes of mortality (Tacha et al. 1992, Tacha et al. 1994). Hail storms and lightning are notable environmental causes of crane mortality (Windingstad 1988).

Since the 1980's, incidences of avian cholera and avian tuberculosis in cranes have increased in the MRGV, and have been associated with increases in winter populations of snow geese (*Chen caerulescens*) and Ross' geese (*Chen rossii*) (Snyder et al. 1987, Taylor and Kirby 1990, Drewien et al. 2000). Outbreaks of avian cholera in cranes at the Bosque Refuge have occurred in 9 winters during 1984-1999 including a peak of 110 cranes in 1993-1994 (Drewien et al. 2000).

Maximum known age of a wild bird is 19 years from the MCP (Tacha et al. 1994), and 31 years from the RMP (Drewien et al. 2000). A sandhill crane at Malheur NWR, Oregon was banded as an adult in April 1969, recaptured and remarked in 1985 and reported still occupying it breeding territory in 2000. This crane was ≥ 34 years old (Drewien et al. 2000).

Historical Perspective

Habitat Trends

The New Mexico Department of Game and Fish (Department) has not performed a detailed inventory of sandhill crane habitat in New Mexico. However, qualitative changes in habitat have been observed. Increasing urbanization, changes in agricultural crops and water management impact sandhill crane habitat.

Urban development in portions of the Rio Grande Valley from Los Lunas to San Antonio is eliminating some winter sites and more will be lost in the near future. As habitat is lost and wintering cranes and waterfowl are restricted to fewer areas, food supply and overcrowding are becoming priority concerns for population maintenance (Tessman 1997). Houses built on the MRGV floodplain now prevent the large flows necessary during spring to scour the riverbed to maintain suitable unvegetated roost sites. As lands are converted from agricultural uses to urban areas more hazards for sandhill cranes in the form of power lines and fences will be created. Currently, urbanization doesn't pose as large threat to the other wintering areas, but there is the potential conflict as agricultural lands and water supplies are diverted from agricultural practices to urban uses.

Agricultural practices have both benefited and had adverse impacts on sandhill crane winter habitat. Initially, drainage of riparian habitats reduced the amount wetland habitat and naturally occurring moist soil foods. However, it also increased the available food supply in the form of waste grains. Recently, conversion on private lands from grain crops to non-grain crops has reduced the available food supply for wintering cranes.

Corn crop acreage on private lands in the MRGV dropped from 5370 acres in 1981 to 1450 acres in 1997. Approximately 3.1 million pounds of corn are produced annually on Department Wildlife Management Areas (WMA) and Bosque del Apache NWR. During cold periods, this provides a sufficient food source for the average number of wintering sandhill cranes and waterfowl in the MRGV. However it also concentrates birds into fewer areas and increases the chances for disease outbreaks. Moist soil vegetation produced on the WMAs, Bosque del Apache NWR, poorly drained alfalfa fields and occasionally on the Rio Grande floodway and reservoirs provide sandhill cranes a food source during mild weather periods

when energy demands are lower (Taylor, 1999). The amount of this food supply varies dependent on available water.

The expanding dairy industry in the Pecos Valley area resulted in the conversion from grain crops to alfalfa. Sorghum production declined from 5,666 ha to 405 ha during 1970 to 1988. Simultaneously, alfalfa production increased from 15,378 ha to over 20,000 ha during 1969 to 1980. Corn production has changed little since 1969; however, 99% is cut while green for ensilage leaving little as waste grain. Declining sandhill crane counts have correlated with declining sorghum production in the Pecos Valley. From peak counts of 66,000 cranes in 1969 and 70,000 in 1977 the peak count in 1988 was 6,000 birds (Montgomery, 1997). Grain crops are produced on Department WMAs in the Artesia area. However, these areas have received little crane use. This may be due to insufficient roost sites near these WMAs.

Similar crop conversions have occurred in the Clovis/Portales area from the expanding dairy industry. In the Deming/Columbus area conversion from grain crops to chile and cotton has reduced the value of this area to wintering sandhill cranes.

Federal and state water management significantly impacts sandhill crane winter habitat. Flood control and irrigation reservoirs can either provide roost sites such as Jemez Dam Reservoir, irrigation water for feed production, or prevent high flows that scour encroaching vegetation on river roost sites. Increasing water conflicts between urban, agricultural, interstate stream compacts and endangered species management, such as the silvery minnow; especially during drought periods, will most likely adversely impact sandhill crane habitats. Without the occasional high river flows to scour river vegetation, roost sites become overgrown concentrating birds into fewer open areas. The degradation of Rio Grande River roost sites may have already occurred. The past several years sandhill cranes have been seen flying west from the state prison farm area to roost sites several miles away toward the Rio Puerco River (personal observation). Apparently, cranes prefer to fly the extra distance to favorable roost sites than roost on the nearby Rio Grande River.

Sandhill cranes in Roosevelt and Curry counties are dependent on playas as roost sites. Since the 1980's few cranes have utilized this area compared to the 1960's. This decline is likely due to the lack of dependable roost sites along with reduced small grain production. Agricultural practices that maintain playa basin integrity would benefit sandhill crane roost sites when there is sufficient precipitation to fill the basins.

Lack of dependable irrigation supplies can result in reduced grain production to feed migrating and wintering sandhill cranes. The anticipated lack of irrigation water during the 2002 summer resulted in the Department not planting corn on the MRGV WMAs. Lack of water also prevented the Department from planting alfalfa into scheduled fields to maintain field productivity or fill roost site impoundments until late October. The Department purchased and spread corn on the MRGV WMAs this year to make up for the insufficient grain production, but this isn't the most desirable option. Water well development on Department WMAs would prevent such incidences in the future and guarantee food production and roost sites for sandhill cranes and waterfowl.

The state water law doesn't consider water used to benefit wildlife, such as moist soil development or crane roost sites, as a beneficial use of water rights. This may limit the amount of crane habitat that may be created. New Mexico also doesn't have a state in-stream flow law that would ensure crane roost sites during migration and winter periods. These last conflicts are issues that the Department has little influence and must deal with in the best way possible.

Population Trends

In the early 1800's, the migratory subspecies of sandhill cranes nested over much of eastern Siberia, Alaska, Canada, and the northern United States as far south as northern Arizona. Cranes disappeared from many nesting areas as a consequence of shooting for food, drainage of wetlands, settlement and general disturbance by man. The decline in their populations was most rapid between 1870 and 1915 (Walkinshaw 1949, Lewis et al. 1977). Crane hunting was outlawed in the United States and Canada by the Migratory Bird Treaty Act in 1916 and between the United States and Mexico in 1937. Sandhill crane populations increased as a result of protecting the birds and their habitats (Lewis et al. 1977).

In 1944, Walkinshaw (1949) estimated only 188-250 breeding pairs of greater sandhill cranes remained in the Rocky Mountain area. In 1966, the greater subspecies was listed as "rare" (U.S. Department of the Interior 1966). This was primarily due to the lack of knowledge concerning greater sandhill crane populations. After research concluded a population range of 10,000-15,000 greater sandhill cranes in the RMP, the greater subspecies was removed from the rare and endangered list in 1973 (Drewien and Bizeau 1974). RMP cranes increased to an estimated 20,832 in 1985 (Benning et al. 1997). The population recovery was attributed to protection from unregulated hunting, expansion of small grain agriculture, and establishment of refuges and management areas throughout most of the RMP range. Much of their former nesting range has been reoccupied, except western Colorado, northwestern Arizona and Alberta (Tessman 1997).

Important breeding areas in the Intermountain West have recently experienced extremely dry conditions and indices for recruitment rates (immatures/adults) are below average (Sharp and Dubovsky 2001). Fall recruitment surveys of RMP cranes in the SLV have been conducted annually since 1972. During 2002, the proportion of juvenile RMP cranes was 5.2%, which was 38.1% below the past 5-year mean ($x = 8.4\%$) and 33.3% below the 31-year mean ($x = 7.8\%$). The severe drought throughout the RMP breeding range contributes to poor production. Three years of below average recruitment combined with record harvests during the past two years could have contributed towards the decline since 2000 (Drewien 2000). The 2002 pre-migration survey estimate for the RMP was 18,803 birds (Drewien et al. 2002).

In 1944, Walkinshaw (1949) noted that lesser sandhill cranes have maintained their numbers better than any other species of North American crane with flocks of 100,000 still reported. The Mid-continent population included at least 510,000 sandhill cranes in March 1982, the last extensive survey involving high-altitude vertical photography of major spring migration staging concentrations. The MCP Cooperative Flyway Management Plan has established an objective to maintain a stable population between 343,000 – 465,000 cranes (Central and Pacific Flyway Councils 1993). The MCP has generally stabilized at comparatively high levels, since the increases in the 1970-80s. The March 2001 index for the MCP without the correction for visibility bias was about 396,000 cranes (Sharp et al. 2001).

In New Mexico, wintering sandhill cranes were abundant during 1846 (Emory and Albert in Bailey 1928) and McCall (quoted in Walkinshaw 1949) noted in 1852 that the area between Albuquerque and Socorro appeared to be covered with them. Bailey (1928) stated that many flocks were observed during 1876 at Belen, Valencia County, but declined afterwards. At Bosque del Apache NWR, sandhill crane population records have been maintained annually since 1940. The peak winter count in 1940 was 17 birds (Drewien and Bizeau 1974). The MRGV crane population gradually increased from 3,180 to 12,000 during 1962 to 1982 (Walker

and Schemnitz 1987). The highest peak count of 17,200 cranes was during 1989. The 2001 Bosque del Apache peak count is 13,200 (USFWS, Bosque del Apache NWR, 2002).

Department annual Rio Grande corridor aerial surveys reflect a similar increase in peak counts from 5,300 birds in 1967 to 30,654 birds in 1999 (NMDGF 1968-2000) (Fig.5). The 2000-01 counts are lower primarily due to training new survey observer.

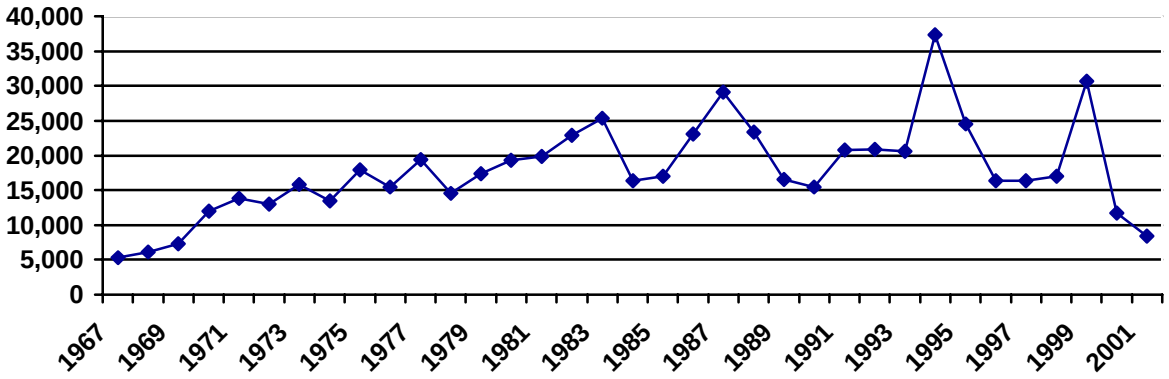

Figure 5. Annual peak Department MRGV aerial sandhill crane counts.

Using weekly ground surveys, the 2001 peak MRGV sandhill crane count was 32,156 birds with an average wintering population between the first week in November to the last week in February of 23,510 cranes (USFWS, Bosque del Apache NWR, 2002) (Fig. 6).

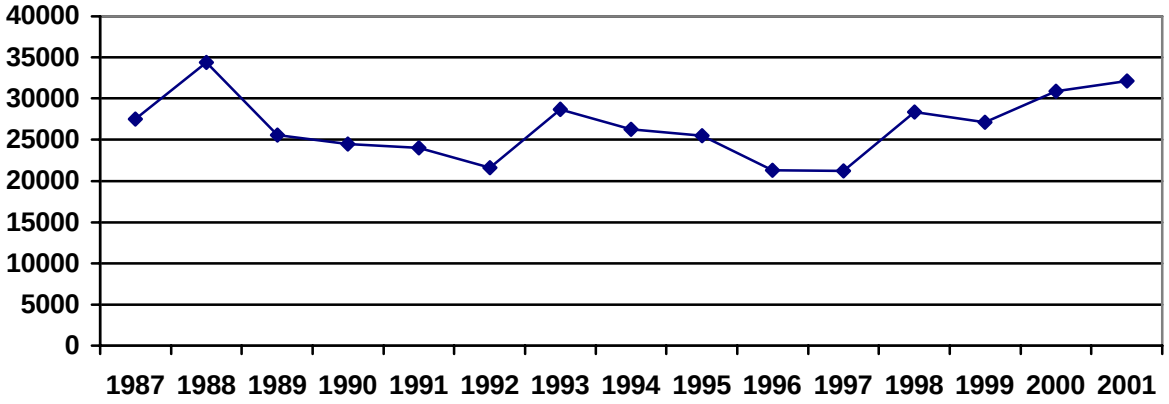

Figure 6. Annual peak MRGV sandhill crane ground counts conducted by USFWS personnel.

Crane wintering populations in the Uvas Valley and Columbus area depend on available roost sites, the amount of grain planted nearby and the severity of the winter weather in the middle Rio Grande Valley. In the late 1980's, an average of approximately 2,500 cranes wintered in these areas. Recently, few cranes are counted in these areas as the majority

continues southward to more favorable habitat in Mexico. However, with suitable habitat conditions, the Game Department's December 1999 aerial survey counted 12,860 cranes using these two areas (Mitchusson 2000).

The Pecos Valley has been recognized as a migration route and wintering area for sandhill cranes since the 1940's. In March 1943, eleven thousand cranes were estimated using Bitter Lake Refuge (Walkinshaw 1949). In December 1960, 18,206 cranes were counted in Chaves County (Boeker et al. 1961). Peak numbers at Bitter Lake NWR averaged 38,583 during the 1970's and 13,842 during the 1980's, indicating a population decline had occurred in the Pecos Valley. From a peak count of 70,000 cranes in 1977 the peak count in 1988 was 6,000 birds (Montgomery 1997). During the 1990's the average peak count was 8,789 cranes indicating a further decline in the population. The last five year's average peak counts are 9,719 birds that may indicate a stabilized population, but it is far below the historic peak counts (J. B. Montgomery personal communication) (Fig. 7).

A similar decline has occurred in Curry and Roosevelt Counties. In 1960, Boeker et al. (1961) counted 21,537 cranes roosting at Salt Lake (Grulla NWR) and Lewiston Lake. From 1981 through 1986 peak counts at Grulla NWR and nearby Little Salt Lake averaged 18,617 cranes with a range of 1,799 – 35,000. From 1987 to 2002 sandhill crane counts have averaged only a few hundred birds each winter with the exception of 8,000 birds counted in 1991 (D. Clapp, Muleshoe NWR, personal communication). In 1960 Boeker et al. (1961) counted 1,500 cranes using the area around Fort Sumner. Recent New Mexico Dept. of Game and Fish Pecos River aerial surveys record few cranes utilizing this area, with most years not recording any crane use in the Fort Sumner area (Mitchusson 2002).

The declining crane population in southeastern New Mexico occurred while the MCP steadily increased to a population around 500,000 birds. This suggests that the population decline was the result of a shift from wintering areas in southeastern New Mexico to areas with more favorable habitat. A similar shift was noted in the wintering population in 1960. After one week of crane hunting and throughout the remainder of the season the population dropped from 35,073 in southeastern New Mexico to 1,500 birds due to moving out of the area and into west Texas (Boeker et al. 1961).

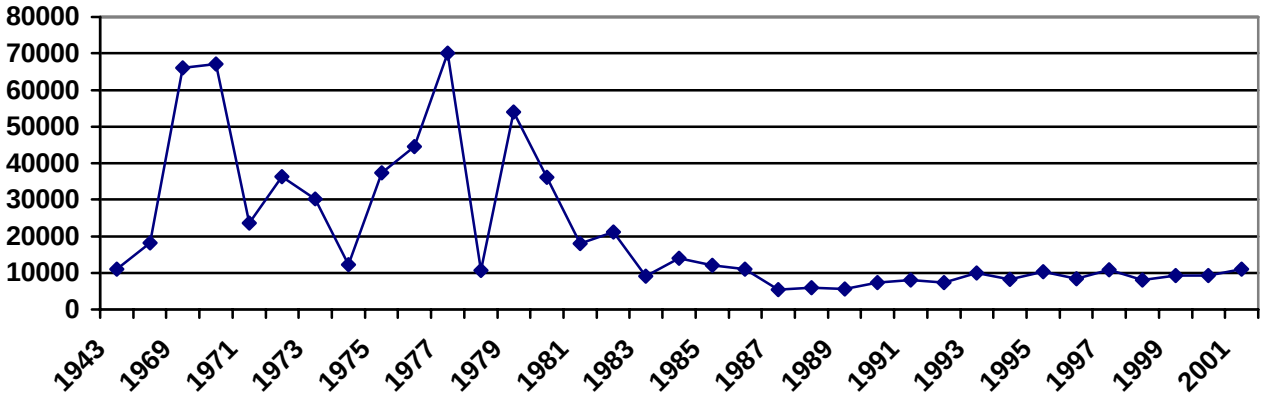

Figure 7. Annual peak counts of sandhill cranes in the Pecos Valley, New Mexico (adapted from Montgomery 1997 and J. B. Montgomery personal communication).

Use and Demand Trends

Hunting - Due to their large size and palatability sandhill cranes have long been hunted for food. Crane remains were found in ancient kitchen middens at Wupatki Pueblo, Arizona. Subsistence hunting by pioneer settlers across the U.S. played a large part in declining crane populations. Sandhill cranes were sold on the California markets into the twentieth century. In 1916, sandhill crane hunting was outlawed. However, a few were shot for food and eggs collected by natives in Alaska and northern Canada (Walkinshaw 1949). Subsistence hunters on the Yukon-Kuskokwim Delta, Alaska, annually take an average of 3,362 sandhill cranes and 547 eggs. Efforts are being made to gather additional information on subsistence harvests for the remainder of Alaska, Siberia and Canada (Sharp and Dubovsky 2001).

Beginning January 1, 1961, a 30-day season was authorized on MCP lesser sandhill cranes in eastern New Mexico (Sharp and Vogel 1992). Areas open to hunting were gradually expanded. Operational hunting seasons are conducted annually in Canada, Mexico, Alaska, Arizona, and all the Central Flyway, states except Nebraska (Sharp and Dubovsky 2001). Hunters gradually improved their knowledge of sandhill cranes. Together with improvements in equipment (decoys, calls, clothing, blinds, etc.) and a shift from pass-shooting and hunting on roosts to decoy-hunting in fields, hunter success continued to increase to current levels (Sharp and Vogel 1992).

Since 1975, dependent on each state's requirements, a special Federal Sandhill Crane Hunting Permits or HIP (Harvest Information Program) certification has been required for all crane hunters participating in seasons in the Central Flyway. A sample of these permittees are mailed questionnaires soon after the completion of each hunting season. The resulting responses enable estimation of hunting activities and success in each geographic area or state (Martin 2001, Sharp and Dubovsky 2001).

During the 2000-01 seasons in the Central Flyway, 61,311 hunters were either HIP certified or obtained crane hunting permits that were not limited in number. Estimates of active hunters indicated 7,497 hunted ≥ 1 time. The number of days afield per hunter fluctuates around an average of 3.0 days. The seasonal bag per hunter since the mid- 1980's has stabilized at about 2.5 cranes. During 1975-99, Central Flyway harvests steadily increased to 20,628 in 1995 (Sharp and Dubovsky 2001) (Fig. 8).

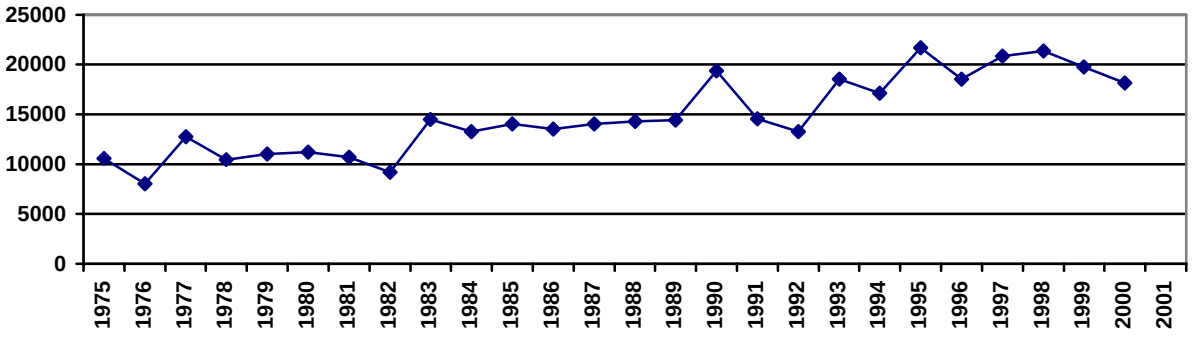

Figure 8. Estimated national Mid-Continent Population sandhill harvest (adapted from Sharp and Dubovsky 2001).

The 2000-01 preliminary estimated retrieved and unretrieved mortality associated with the sport harvest in the U.S is 18,110. The 2000 Canadian sport harvest was 9,450 and is nearly twice the long-term average. Much of this increase is due to fall conditions that have allowed cranes to remain on Saskatchewan staging areas until November in recent years. There are no annual harvest surveys in Mexico; but in any year MCP harvests probably are <10% of the retrieved harvest in the U.S. and Canada. The 2000-01 estimated sandhill crane harvest in Mexico was 2,756. The 2000-01 MCP preliminary estimated retrieved and unretrieved mortality associated with the sport harvest 34,576 cranes (Sharp and Dubovsky 2001).

New Mexico requires the federal sandhill crane permit for those hunting the Regular Sandhill Crane Season in eastern New Mexico (Quay, Curry, Roosevelt, De Baca, Chaves, Eddy and Lea counties) (Fig. 9). During the 2000-01 crane season, 493 sandhill crane permits were issued and hunters spent 521 hunter days afield harvesting 292 cranes. Sixty-seven percent (224) of the harvest occurred in Chaves County (Martin 2001). From 1975-2001, the annual number of permits issued (Fig. 10) and estimated harvests for New Mexico's Regular Crane Season have declined (Fig. 11).

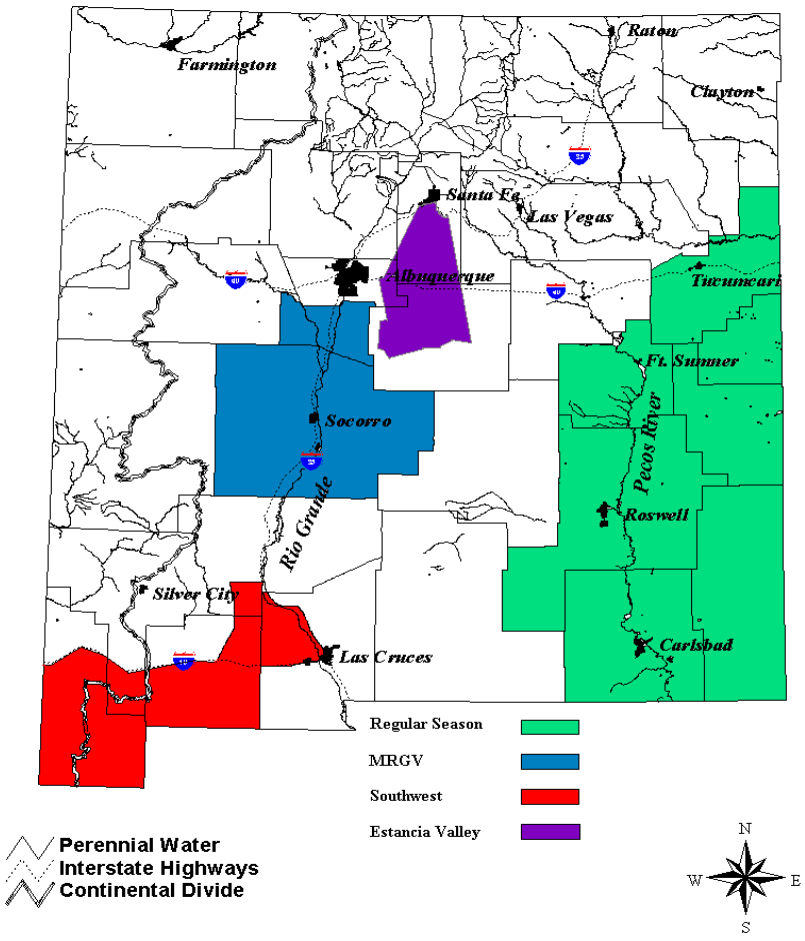

Figure 9. Sandhill crane hunt areas in New Mexico.

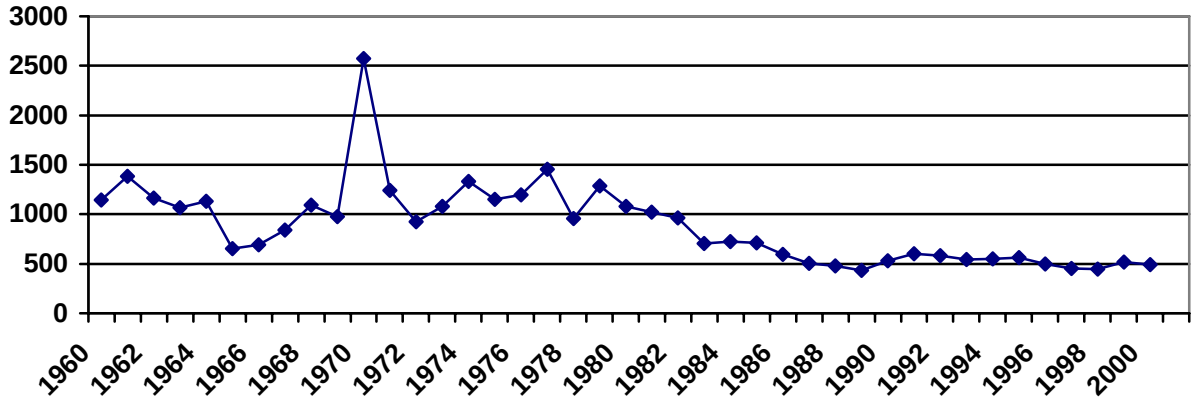

Figure 10. Regular season Federal Sandhill Crane Permits issued in New Mexico (adapted from Sharp and Dubovsky 2001).

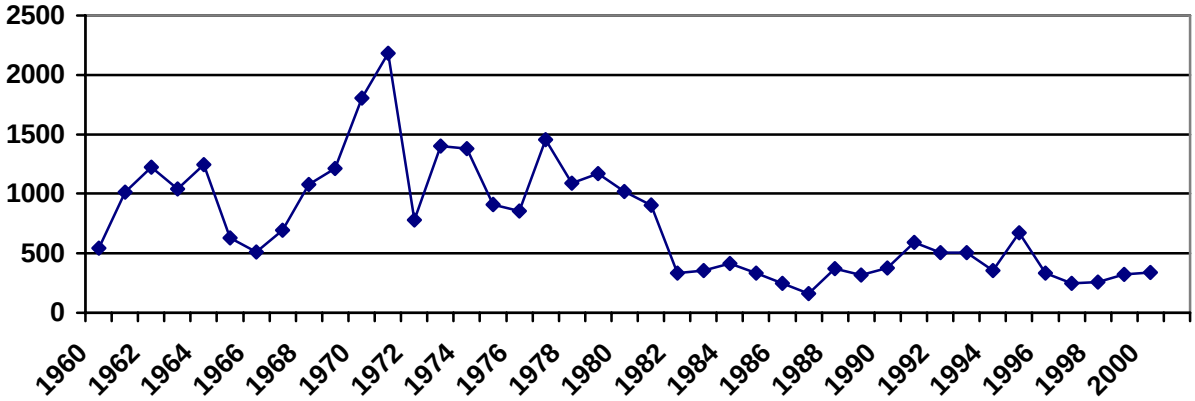

Figure 11. Harvest of sandhill cranes from the Mid-Continental Population in New Mexico (adapted from Sharp and Dubovsky 2001).

Arizona initiated the first-modern day RMP sandhill crane season in 1981. Since 1982, hunting programs have been guided by a cooperative management plan, including a harvest strategy that has been periodically updated and endorsed by the Central and Pacific Flyways. All states within the RMP greater sandhill crane's range, except Colorado, conduct special limited hunting seasons (Sharp and Dubovsky 2001). From 1981 to 2001, harvest increased from 20 to 810 (Fig. 12)

The 2001-02 total RMP sport harvest in the six participating states was 810, 23% higher than the 2000-01 harvest and a record-high harvest for the population (Fig. 12). Based on RMP population and recruitment indices, management guidelines allowed a maximum take of 1,175 during the 2001-02 hunting seasons (Sharp and Dubovsky 2001).

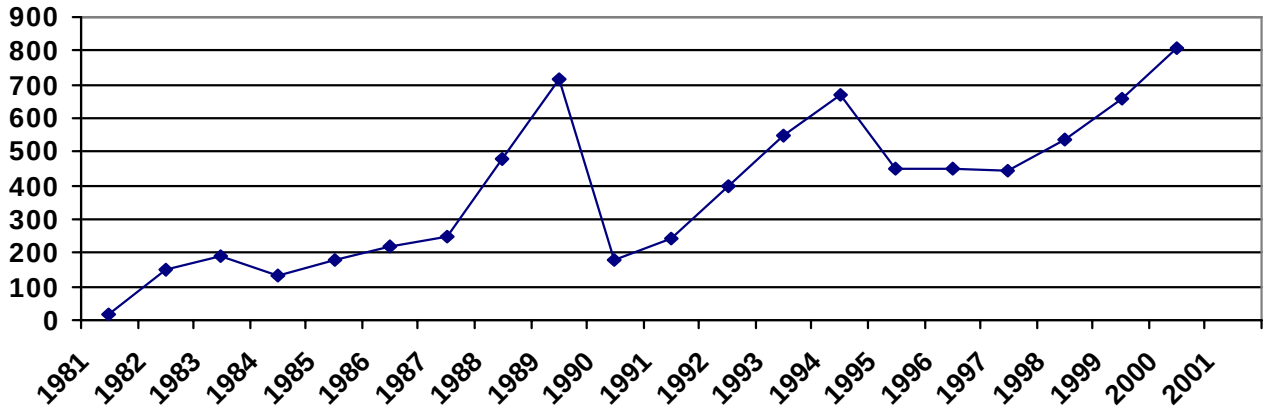

Figure 12. Harvest of sandhill cranes from the Rocky Mountain population from all states (adapted from Sharp and Dubovsky 2001).

Limited permit hunting seasons for RMP cranes were initiated in southwestern New Mexico (SW) in 1982 and in the MRGV in 1986 (Schmitt and Hale 1997). An experimental limited permit season in the Estancia Valley (EV) was initiated in 2001.

Sandhill crane hunters participating in the MRGV, Estancia Valley (EV) and Southwest (SW) hunts (Fig. 9) must apply for a special crane permit issued through a random draw. These hunt areas are within the RMP greater sandhill crane winter range. Guidelines and procedures outlined in the 1997 Management Plan of the Pacific and Central Flyways for the Rocky Mountain population of greater sandhill cranes are followed. New Mexico's average annual RMP harvest is 233 (range 47-483) (Fig. 13).

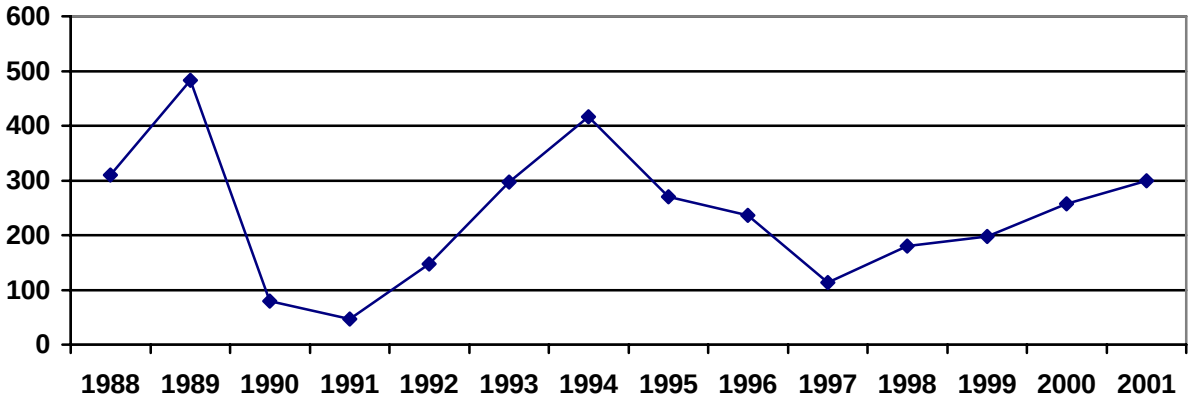

Figure 13. Harvest of sandhill cranes from the Rocky Mountain population in New Mexico.

During 2001-02, 240 permits were issued for the MRGV seasons, 60 for each of 4 hunts. Of those that received a permit, 82% hunted. The 2001-02 MRGV sandhill crane harvest estimate of all subspecies combined is 338 (Fig. 14).

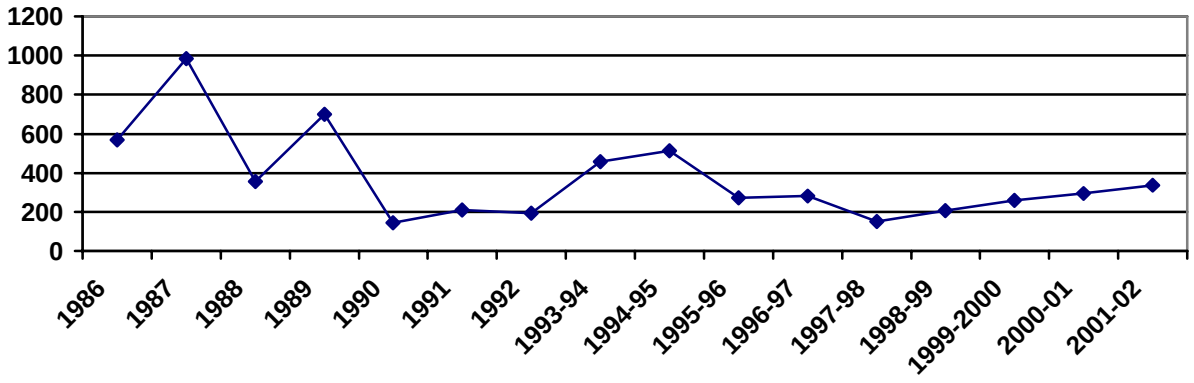

Figure 14. Harvest of sandhill cranes in the Middle Rio Grande Valley, New Mexico.

Sixty permits were available for the SW sandhill crane seasons and 53 permits were issued. SW hunters could hunt both the November and January hunt periods. For the SW season, it was projected that 78% of those receiving a permit hunted. During the November hunt 51% participated, and 66% participated during the January hunt. Eight hunters participated only during the November hunt period, 19 during both hunt periods, and 16 hunted only during the January hunt period for a total of 43 participants. An estimated 61 sandhill cranes were bagged during the 2001-02 SW hunts (Fig. 15).

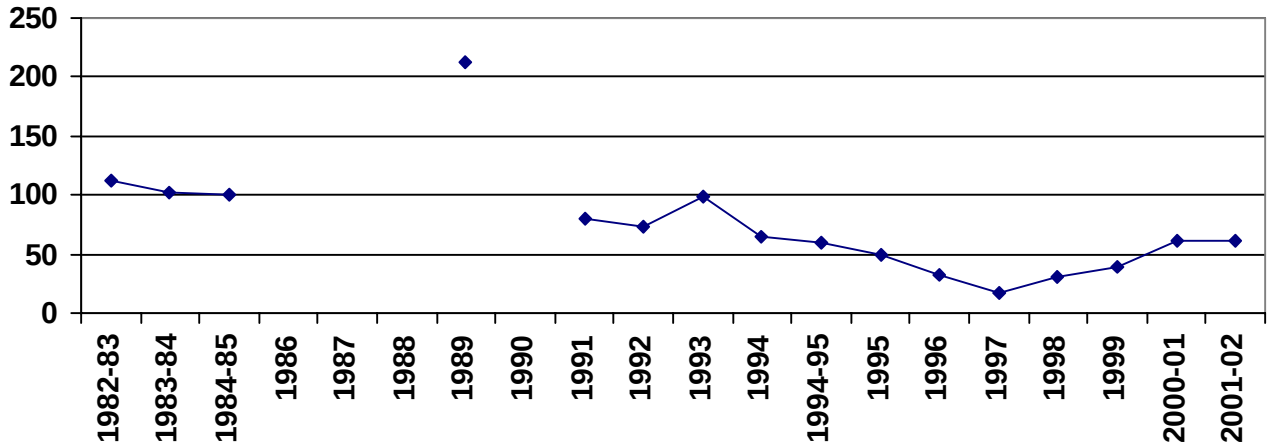

Figure 15. Harvest of sandhill cranes in southwestern New Mexico. No hunts were held from 1986-88 and in 1990.

Forty permits were available for the Estancia Valley season. Seventeen permits were issued and 53% participated. An estimated 6 sandhill cranes were bagged during the 2001-02 EV hunt. An overall participation rate of 80% was projected for the combined special season permit hunts (Mitchusson 2002).

Wildlife Viewing - Interest in watching and photographing sandhill cranes is a popular winter activity. General wildlife watching and other non-consumptive uses account for approximately 74% of all wildlife associated recreation by New Mexico residents (U.S. Department of the Interior 1996). In 2001, 92,853 visitor days were recorded at Bosque del Apache NWR during the October – February timeframe when cranes are common at the refuge. Each November, the Festival of the Cranes is held at Bosque del Apache NWR and the Socorro area. This festival attracts birders from across the country and other nations to view and photograph wildlife, and participate in other wildlife related events. Large numbers of sandhill cranes and snow geese within easy viewing distance are the main attraction. This festival began in 1988 with 3000 visitors recorded during the 1-day event. In 2002, Bosque del Apache NWR recorded 5214 visitor days during the 6-day festival (J. Shannon, Bosque del Apache NWR, personal communication).

In the MRGV, large numbers of sandhill cranes are available for viewing on Department WMAs. Programs to enhance or improve these viewing opportunities could be developed on the WMAs as long as they don't interfere with other Department objectives. Similar programs could be developed along the Pecos Valley and Portales areas if wintering cranes recovered to historic numbers.

Management to Date

Mid-Continent Population - The MCP is comprised of the Western and Gulf Coast subpopulations. MCP sandhill cranes migrating and wintering in New Mexico are from the Western subpopulation. Accurate population estimates for the Western subpopulation cannot be obtained as the MCP is managed as one population during the March survey on the Platte River. The Western subpopulation comprises approximately 95% of the MCP (Tacha et al. 1994).

The MCP annual survey is conducted along Nebraska's Central-Platte River Valley. During late March over 95% of MCP sandhill cranes are generally found in this area. Since 1982, an intensive survey is conducted on the Platte River Valley and visual assessments from other spring staging areas are used to monitor the annual status and trends for this population. This survey produces a highly variable index of the MCP size, so a 3-year average is used to smooth index trends. The population trend has been relatively stable since 1982. The index for 1998-2000 is 435,283 cranes, within the management thresholds (343,000-465,000). Sharp and Dubovsky 2001).

Hunting was not allowed in the U.S. between 1916-60 due to the prevailing idea that the species could not withstand a harvest. A lack of knowledge of the migrations and winter distributions of the different subspecies led to concern that legalizing hunting in any area where these birds occurred might endanger the rarer populations.

However, recurring depredations of cranes on small grain crops both in Canada and the U.S. as well as the increasing feeling among sportsmen and game managers that certain populations of this migratory game bird could withstand harvest under proper management. By 1960 the Bureau of Sport Fisheries and Wildlife and the New Mexico Department of Game and Fish amassed sufficient evidence to show that neither the whooping crane nor the greater sandhill crane would be endangered by a hunting season limited to certain counties of eastern New Mexico and western Texas where the greatest concentration of the lesser sandhill crane occurred (Boeker et al. 1961).

The first sandhill crane hunting season was limited to a six-county area in New Mexico (Fig. 9). The bag/possession limit was 2 birds (Boeker et al. 1961). Areas open to MCP sandhill crane hunting were gradually expanded with hunting seasons now conducted annually in portions of Colorado, Kansas, Montana, Oklahoma, South Dakota, Wyoming, Texas and seven counties in New Mexico. Cranes from the MCP are also harvested in Alaska, Arizona, Canada and Mexico. Federal frameworks (season length, bag limit and earliest opening and closing season dates) for hunting sandhill cranes vary depending on state or locality. In eastern New Mexico, a daily bag/possession limit of 3/6, season dates between September 1 – February 28 and a 93-day season is allowed (USFWS Federal register 2002).

MCP harvests have been increasing at a higher rate than the trend in population growth (Sharp and Dubovsky 2001). Sandhill cranes have low recruitment rates that limit the ability of populations to recover from declines. Careful and reasonably accurate harvest management is required to maintain populations subject to hunting (Tacha et al. 1994). The Central and Pacific Flyway's MCP sandhill crane management plan, upon which population, distribution, harvest and research strategies are based, is scheduled for revision in 2003.

New Mexico harvest estimates are obtained by surveying a sample from hunters that request the Federal Sandhill Crane Hunting Permit. New Mexico's harvest indicates a declining population and harvest trend (Fig. 11).

Rocky Mountain Population - The objective of the Pacific and Central Flyway's Management Plan for the Rocky Mountain Population of Greater Sandhill Cranes is maintain a stable population index of 17,000-21,000 determined by an average of the 3 most recent reliable pre-migration surveys. During 1984-96, the RMP was surveyed at the spring stopover sites in the San Luis Valley, Colorado. However, cranes from the MCP also began to use this area. In 1996, a fall pre-migration (September) survey in Idaho, Utah, Wyoming, Montana and northwestern Colorado replaced the spring count (Tessman 1997, Sharp and Dubovsky 2001). Several years of experience will be required with this September survey to determine variability in estimates and to refine survey methodologies. The September pre-migration survey approach for the RMP appears to be a good alternative to either a spring or fall survey in the San Luis Valley, as no other known crane population co-mingles with them on summer areas in September (Sharp and Dubovsky 2001). The 1995-2002 pre-migration surveys have ranged from 16,028 to 19,990 RMP cranes (Sharp and Dubovsky 2001, Drewien et al. 2002) (Fig. 16).

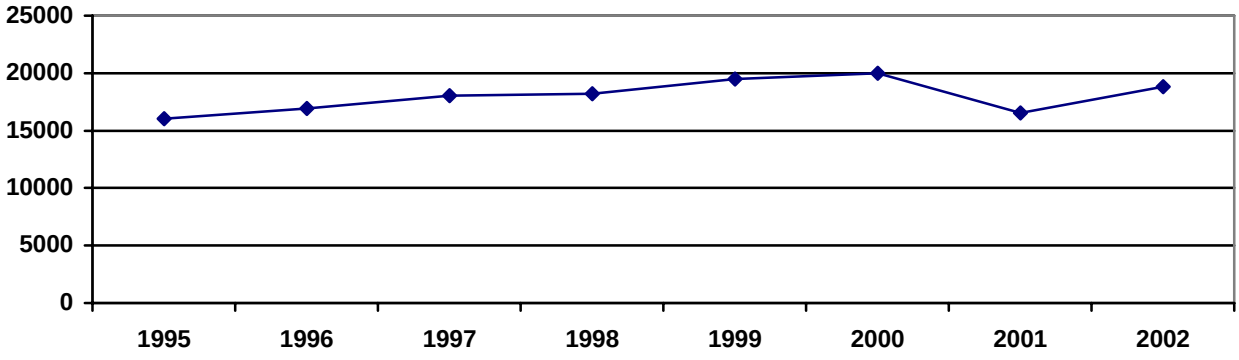

Figure 16. Fall estimates of the Rocky Mountain population of sandhill cranes in New Mexico (adapted from Drewien et al. 2002).

Special limited hunting seasons for RMP greater sandhill cranes are held in southeastern Arizona, western Wyoming, Utah, Idaho, Montana, and New Mexico. Hunting programs are guided by a cooperative management plan, including a harvest strategy, which has been periodically updated and endorsed by the Central and Pacific Flyways. Recreational hunting of the RMP is permitted when the fall population index exceeds 15,000. A conservative harvest allotment is prescribed when the fall population index is between 15,000 and 18,000 cranes to allow for population growth. A percentage of the total harvest allotment is then divided among participating states based on relative crane abundance by seasonal range. All sandhill crane hunters in the range of the RMP must obtain a state permit to hunt cranes. This provides the sampling frame for independent state harvest estimates and allows for assignment of harvest quotas by state. In many areas, harvest estimates are supplemented by mandatory check station reporting (Tessman 1997, Sharp and Dubovsky 2001).

Initially, the management plan's harvest allotment was directed towards the wintering states with New Mexico receiving the majority of the harvest allotment. New Mexico still receives the largest percentage of the harvest allotment. However, with the RMP management plan revision and all states within the RMP range establishing hunting seasons, except Colorado, the majority of the RMP harvest has been redirected towards the breeding ground states. Department personnel have not been attending the Pacific Flyway meetings when RMP sandhill crane harvest allotments are determined, and participate mainly by correspondence. The Central and Pacific Flyway's RMP sandhill crane management plan, upon which population, distribution, harvest and research strategies are based, is scheduled for revision in 2003.

In the MRGV, SW and EV, MCP cranes mix with RMP cranes making management at the subpopulation level difficult. The Department is required by the Pacific and Central Flyway's Management Plan for the Rocky Mountain Population of Greater Sandhill Cranes to conduct harvest check stations in these areas to determine the subspecies composition and the percentage of RMP cranes to ensure the harvest is below the state's RMP harvest allotment.

Accurate harvest estimates are required because 90-95% of the RMP cranes winter in the MRGV and this ensures the state's RMP harvest allotment isn't exceeded. During the SW hunts a check station is operated in the Hatch area. Hatch area hunters are requested to bring harvested cranes to the check station, as those hunting the Rio Grande Valley south of Caballo Dam and the Uvas Valley are most likely to harvest RMP cranes. Mandatory check stations are required the first three years of the EV hunt to determine the percentage of RMP cranes in the harvest.

There is a mandatory requirement that all hunters receiving special sandhill crane permits return a harvest questionnaire within 5 days from the end of their hunt. A second questionnaire is sent if the first hasn't arrived in the allotted time. Permit holders that don't return a harvest questionnaire are ineligible to receive a permit the following year. Questionnaires are designed to gather information from which to estimate the harvest of cranes, crippling losses, number of days hunted, hunter participation and related information.

All MRGV sandhill cranes were required to successfully complete an identification course designed to provide information on how to distinguish sandhill cranes from numerous other large-sized birds, particularly whooping cranes. This examination was not required for hunting sandhill cranes in southwestern New Mexico or the Estancia Valley because whooping cranes rarely occurred in these areas (Mitchusson 2002). The identification course will no

longer be required for MRGV sandhill crane hunters as there are no whooping cranes wintering in the state.

When it is likely the Department will exceed the state's RMP sandhill crane harvest allotment the Department will close hunts in the MRGV or SW hunt areas. This was necessary for the 1990 SW and the final two MRGV hunt segments in 1993-94. Hunters are notified of these closures by letter and on a toll-free telephone message (Schmitt and Hale 1997).

Middle Rio Grande Valley Management - MRGV sandhill crane management is guided by a cooperative agreement, *A Plan for the Management for Waterfowl, Sandhill Cranes, and other Migratory Birds* (MRGV Plan), between the New Mexico Department of Game and Fish, U.S. Fish and Wildlife Service, and the Animal Plant Health Inspection Service-Wildlife Services (APHIS-WS). The MRGV Plan goal is maintain a mean monthly population of 17,000- 22,000 sandhill cranes during November- February. This population level ensures viability within food supplies and depredation complaints that are not excessive. The objectives are maintain a refuge distribution of 60% of the wintering birds at Bosque del Apache NWR and 40% on Department WMAs, and minimize problems associated with sandhill crane crop depredations. Weekly ground surveys are conducted by the USFWS to monitor the population and a USFWS aerial survey is conducted in December to assess crop depredation potential on private lands (Taylor 1999). The 1999-2001 MRGV mean population was 21,879 wintering sandhill cranes. The 2001 average population was 23,510 cranes with a peak count of 32,156. The proportion of sandhill cranes wintering on the refuges during 1999-2001 averaged 50% on Bosque del Apache and 50% on Department WMAs (USFWS, Bosque del Apache, 2002). Flock distribution objectives have not been met since 1989 (Taylor 1999). Sandhill cranes are counted on the Department's monthly aerial waterfowl surveys providing the longest continuous record for sandhill crane populations within the state (Fig. 5).

Large numbers of sandhill cranes winter on private lands in the MRGV. Crane use on private lands has been tolerated by some landowners, while others, particularly in the Socorro area have been quite vocal and have filed complaints with APHIS-WS. In 1993, complaints reached an all time high prompting congressional response and informal hearings. As a result, APHIS-WS received funding specifically to provide more personnel to answer depredation complaints in the MRGV. APHIS-WS personnel use pyrotechnics to disperse flocks and assign sandhill crane hunters to private lands with depredation complaints. MRGV sandhill crane hunting seasons are scheduled to reduce depredation and provide recreational opportunity. These methods along with timed crop manipulations on the refuges are used to encourage sandhill cranes to the refuges and reduce agricultural damage (Taylor 1999). The proportion of sandhill cranes using private lands during 1989-2001 has ranged from 9% to 35% and averaged 23% (USFWS, Bosque del Apache, 2001).

While agricultural producers in the MRGV are satisfied with the depredation control work, a growing number of landowners do not support the program. These are generally small landowners who do not derive the majority of their income from agricultural production and enjoy the sights and sounds of cranes on their property. Balancing depredation control work, particularly when such properties are adjacent to one another can be a delicate task for field personnel (Taylor 1999). Increasing urbanization will likely exacerbate this conflict.

Whooping Crane Program - In 1975, RMP sandhill cranes known to winter in the MRGV were used experimentally as foster-parents in an attempt to establish a second free flying, migratory population of whooping cranes. From 1975-88, 289 eggs were transferred to sandhill crane nests, 210 hatched and 84 fledged. The RMP whooping crane population peaked at 33 in 1984-85. Additional efforts to introduce captive female whooping cranes or chicks into male territories were unsuccessful. Failure to produce any chicks or mated pairs and high mortality resulted in discontinuing the program in 1994 (USFWS 1994). In 1997, 4 whooping cranes along with 8 sandhills were part of an experiment to determine if using ultralight aircraft could teach cranes a migratory route. Two of these whooping cranes were lost to predators and two migrated north in the spring. The last RMP whooping crane was seen during the winter of 2002 in the Casa Colorada WMA area. Currently, there are no plans to introduce any more whooping cranes into the Rocky Mountain region (U.S. Department of Interior, USFWS, 2001).

The presence of whooping cranes required adjustments to the MRGV sandhill crane and light goose hunting programs and required passing a bird identification course to participate. These programs were successful, as hunting caused no RMP whooping crane mortality.

Habitat Assessment

The amount and distribution of current suitable sandhill crane habitat has not been quantified in New Mexico. Several tools are available to determine this information, such as Geographic Information Systems (GIS) and habitat suitability models. Flood control dams on the Rio Grande and Pecos Rivers have eliminated annual spring floods. Without high flows to scour river channels creating wide, open shallows, encroaching vegetation has eliminated suitable roost habitat, but to what extent is unknown. Increasing urbanization in agricultural areas along with the conversion in agricultural crops away from grains has further decreased available crane habitat. Increasing demands on the state's limited water supply will impact available crane habitat.

Over 2400 playas occur in Quay, Curry, Roosevelt and Lea Counties. Several playas have been noted in the past as important crane roost sites. These areas need to be evaluated to determine habitat changes that have resulted in less crane utilization. Most of these playas occur on private lands and landowner cooperation will be important.

Federal agricultural habitat improvement programs such as the Conservation Reserve Program (CRP), Wildlife Habitat Incentives Program (WHIP), Environmental Quality Incentive Program (EQIP), Grassland Reserve Program (GRP) and federal grants using the North American Wetlands Conservation Act (NAWCA), Landowner Incentive Program (LIP), Intermountain West Joint Venture (IWJV) and the Playa Lakes Joint Venture could be used for crane habitat improvements.

The State Constitution's Anti-donation Clause poses problems for the Department when it comes to improving wildlife habitat on private properties. Major grant programs require contributing matching funds from several cooperators to qualify. Innovative methods will be needed for the Department to contribute toward such private land habitat projects. A Private Lands Wildlife Habitat Improvement Initiative similar to surrounding states would greatly enhance New Mexico landowners' ability to compete for these habitat improvement grants and benefit the wildlife in the state.

Economic Impacts

Hunting - Hunters contribute to New Mexico's economy through the purchase of guns, ammunition, clothing, equipment, food, lodging and fuel. Small game and migratory bird hunters spent $25.4 million in New Mexico in 1996 (U.S. Dept. of Interior, 1996). Annual spending by migratory bird hunters averages $470 per hunter (U.S. Dept. of Interior, 2001). During 2000-01, 493 permits were issued for the Regular season sandhill crane hunt with 160 active hunters spending 540 days afield (Martin, 2001). Using an average of $22 spent per trip (U.S. Dept. of Interior, 2001), these hunters spent $11,880 during the 2000-01 season on trip related expenses. Hunter days were not obtained for the 2000-01 Special MRGV, SW and EV season crane hunts but the 249 active hunters would have contributed a minimum of $5,478 in trip related expenses. In 2000-01, active crane hunters contributed $192,230 directly to New Mexico's economy in hunting related expenses. Using the economic multiplier effect, these hunters potentially generated $576,690 worth of economic activity.

Outfitters and guides generally have not relied upon sandhill cranes as their main income due to the unpredictable availability of birds. However, when numbers of birds are adequate, outfitters and local residents could supplement their income by guiding hunters and charging trespass fees on private lands. Since a significant number of sandhill cranes utilize privately owned lands, a public hunting fee program similar to the Pleasant Hill, NM Volunteer Fire Department's pheasant hunt would benefit local economies. Hunters pay a fee for hunting pheasants on private properties that are arranged by the local fire department. Hunters receive a list of cooperating landowners and the proceeds benefit the volunteer fire department. The Junior Chamber of Commerce of Muleshoe, TX conducts a similar program for sandhill crane hunting. During three consecutive weekends, sandhill crane hunters generated $20,640 worth of economic activity (Leonard 1976).

Depredation - The Migratory Bird Treaty Act protects sandhill cranes and the USFWS has the jurisdictional responsibility for sandhill crane management. Sandhill crane depredation complaints received by the Department are forwarded to the USFWS. Generally, the USFWS then tasks APHIS-WS personnel to handle these complaints.

Sandhill cranes forage primarily in agricultural areas resulting in depredation complaints. The primary justification for the original sandhill crane hunting seasons was to address depredation issues. Crane depredation has included feeding on sorghum (the most widespread and serious), shocked grains, alfalfa, green barley, new wheat and oats; trampling freshly listed land; trampling and breaking up small irrigation ditches and lister ridges; pulling up young wheat and clipping the heads of mature wheat and taking mature corn (Boeker et al. 1961), but not recently as most grains are harvested by combines or cut for silage. Changing agricultural crops and practices have resulted in fewer complaints concerning grain crops. APHIS-WS records for the Pecos Valley, Curry and Roosevelt Counties over the most recent 5 years did not record any sandhill crane depredations. This does not mean sandhill crane depredations are not a problem in these areas, but that the landowners generally handle the problem themselves. Wheat planted in January is especially vulnerable. These landowners own or borrow propane canons to scare cranes or allow hunters to hunt on their property without charging trespass fees (A. May, APHIS-WS, personal communication).

Farmers in the Uvas Valley and Hatch areas of southwestern New Mexico have depredation damage on newly planted wheat fields while sandhill cranes are returning north

from Mexico. Generally, these landowners use propane canons to haze sandhill cranes from their fields (R. Aaltonen, NMDGF, personal communication). The January SW crane hunt is scheduled during this timeframe to address these depredation complaints.

The majority of sandhill crane depredation complaints in the MRGV are on newly planted alfalfa crops. Planting alfalfa in late summer with fall irrigation makes these fields vulnerable to crane depredation. Damage to newly planted fields may be serious if large numbers of sandhill cranes pull up and consume the young sprouts. Additional damage results from cranes trampling and probing in young alfalfa stands. After alfalfa becomes established, cranes will continue to use these fields but seldom eat the plants. Few cranes using established alfalfa fields actually eat alfalfa. Planting alfalfa in the spring after cranes have migrated would alleviate most complaints (Walker and Schemnitz 1987). Additional complaints in the MRGV concern damage to red chile, corn and silage used as cattle feed (A. May, APHIS-WS, personal communication).

Prior to 1993, annual agricultural damage caused by sandhill cranes in the MRGV was in excess of $100,000 per year. The current program incorporates APHIS-WS personnel to haze sandhill cranes from sensitive areas. APHIS-WS personnel also place MRGV sandhill crane hunters in these areas. These methods, in conjunction with the timing of crane hunts and refuge crop manipulations to attract cranes, have greatly reduced the monetary losses caused by sandhill cranes in the MRGV (Taylor 1999). The average annual confirmed depredation loss in the MRGV since 1993 is approximately $500. Confirmed sandhill crane damage in the MRGV during 2001-02 was corn-$300, chile-$500 and silage-$500 (A. May, APHIS-WS, personal communication). Further utilization of small grain lure crops could be used to attract sandhill cranes away from potential depredation areas.

Grasshoppers, other invertebrates, chufa and Johnson grass are often consumed by sandhill cranes foraging in established alfalfa fields. Sandhill cranes may contribute significantly in controlling these insects, undesirable plants and by aerating the soil while probing thereby providing an economic benefit to the farmer (Walker and Schemnitz 1987).

Wildlife Viewing - In 1996, the total monies spent on wildlife-watching activities (non-consumptive) in New Mexico were $429 million (U.S. Dept. of Interior, 1996). The proportion spent on sandhill crane activities is unknown. The average wildlife watcher annually spends $738 towards this recreation (U.S. Dept. of Interior, 2001). In 1996, the average trip-related expenditure for wildlife viewing was $400 per person (U.S. Dept. of Interior, 1996). Fifty percent of New Mexico's residents participate in viewing wildlife with 29% of the population taking trips for the purpose of viewing wildlife (U.S. Dept. of Interior, 2001).

In 2002, the Festival of the Cranes contributed $525,000 towards the economy of Socorro County (Tom Harper, Festival of the Cranes coordinator, personal communication). An additional 5214 visitor days were recorded at the Bosque del Apache NWR entrance during the six-day event (D. Perry, Bosque del Apache NWR, personal communication). The economic impact these day visitors contribute to the economy has not been determined.

In addition, 192,853 visitor days were recorded during the 2001-02 October-February time frame contributing $41,267.00 as entrance fees. Eighty percent of these funds are used towards Bosque del Apache's refuge management (D. Perry, Bosque del Apache NWR, personal communication).

During 1993-94, Bosque del Apache NWR visitors came from 39 states and 8 counties in New Mexico. Of these 54% were from out of state and 43.8% stayed more than one day in the area averaging visits of 1.8 days. On average they spent between $300 and $500 on these

trips, contributing between $28 and $48 million to the economy. The economic impact was estimated to be $3.3 million without economic multipliers (Kerlinger 1994).

Special Consideration

Being migratory, sandhill crane populations in New Mexico are not only affected by the state's habitat quality, quantity and hunting regulations, but also by the habitat quality and harvest regulations on their breeding grounds and migration routes. Factors that adversely impact sandhill crane survival and breeding success or survival during migration will impact New Mexico's wintering populations. Conversely, New Mexico's sandhill crane management will impact crane populations elsewhere. Sandhill cranes tend to return to the same areas annually. If sandhill crane wintering habitat quantity or quality declines, cranes move elsewhere, but the cost to crane survival is undetermined. If suitable habitat is created along migration routes and wintering areas, cranes will discover and utilize this habitat.

The USFWS has the primary responsibility in sandhill crane management. Low annual recruitment rates among sandhill cranes limits their ability to recover from population declines. Harvest regulation changes outside of federal frameworks must obtain approval through the Flyway Council System and the USFWS before the state can implement any changes.

Two sandhill crane subpopulations and three subspecies winter in New Mexico. The lesser sandhill cranes in southeastern New Mexico are entirely from the MCP and can be managed at the subpopulation level. However, sandhill cranes in the MRGV and southwest are intermingled with cranes from the MCP and RMP. Ninety to ninety-five percent of the entire RMP of greater sandhill cranes winter primarily in Valencia and Socorro counties. Whatever habitat changes and harvest management occurs in these two counties may significantly impact this population. Including what may be formally the MCP Canadian subspecies with the greater subspecies shouldn't severely impact MRGV sandhill crane management, as it is possible to separate out these cranes based on morphological measurements.

The Department is precluded from expending state funds for habitat improvements to private lands under provisions of the Anti-Donation clause. This impacts the Department's contribution towards improving crane habitat on private lands.

Summary and Conclusions

New Mexico supports two wintering subpopulations and three subspecies of sandhill cranes. The Mid-Continent Population (MCP) is comprised of mostly lesser sandhill cranes with some Canadian sandhill cranes. Major MCP wintering areas are Bitter Lakes NWR near Roswell, Grulla NWR near Portales, southwestern New Mexico near the Hatch and Deming areas and the middle Rio Grande Valley (MRGV). The Rocky Mountain Population (RMP) is comprised of greater sandhill cranes that winter primarily in the MRGV between the Albuquerque-Los Lunas region south to Bosque del Apache. Smaller numbers of greater sandhill cranes winter in the southwestern portion of the state.

The quality of winter habitat is important because sandhill cranes congregate in high densities and are dependent on limited resources. Sandhill cranes depend on open freshwater wetlands and shallow marshes, but use a broad range of habitats. During migrations and winter sandhill cranes feed mainly on cultivated grains. Department WMAs and USFWS refuges provide grain crops. However, agricultural changes on private lands away from grains have

reduced the available food supply. Urban development is eliminating some sandhill crane habitat and more will be lost in the future. Cranes are vulnerable to disturbance and habitat alteration caused by changes in water management.

Sandhill cranes are long lived. The maximum known age of a wild bird is 34 years. Sandhill cranes do not breed until they are 2 to 7 years old, and have the lowest known recruitment (percent juvenile in the fall) of any avian species hunted in North America. Most mortality is due to human causes with hunting the most important factor.

Sandhill cranes are a highly visible species occurring in large numbers available to public viewing. Interest in watching and photographing sandhill cranes is a popular winter activity providing a significant economic benefit to local economies. Programs to enhance or improve these viewing opportunities should be encouraged.

Large numbers of sandhill cranes winter on private lands. Some landowners tolerate cranes while others file depredation complaints. Depredation control methods similar to those used in the MRGV would minimize sandhill crane depredations.

Sandhill cranes are protected under the Migratory Bird Treaty Act. The USFWS has the jurisdictional responsibility for sandhill crane management. Sandhill crane depredation complaints are forwarded to USFWS or Animal Plant Health Inspection Service-Wildlife Services (APHIS-WS) personnel. The Department's sandhill crane harvest management must follow USFWS guidelines and frameworks. The Central and Pacific Flyways along with the USFWS must approve recommendations outside the federal frameworks before the Department may implement any changes.

Sandhill crane hunting provides recreational opportunities and is an important component in controlling depredations. Harvest management follows strict protocols to ensure viable populations. The Department conducts monthly aerial surveys and USFWS personnel conduct weekly ground surveys to monitor sandhill crane populations and distribution. Surveys should be modified and expanded to monitor all wintering sandhill crane populations. The USFWS monitors annual MCP harvest by surveying hunters that obtained the Federal Sandhill Crane Permit for hunting in southeastern New Mexico. The Department requires all sandhill crane hunters that receive the middle Rio Grande Valley, Southwestern or Estancia Valley special permit to return harvest questionnaires. These surveys along with sandhill crane harvest check stations allow the Department to monitor harvest and ensure the state's RMP sandhill crane harvest allotment is not exceeded.

The amount and distribution of current suitable and potential sandhill crane habitat has not been quantified in New Mexico. Geographic Information Systems (GIS) technology and habitat suitability models can be used to obtain this information. The Department will take a proactive management approach to address and resolve issues related to managing New Mexico's sandhill crane resource.

Management Strategy Section

Long Range Goal and Objective

Goal: That the Department's management of sandhill cranes satisfies the recreational and ecological interests of the citizens of New Mexico and results in successful resolution of related issues.

Objective: That by 2007, 70% of New Mexicans are satisfied with the Department's success in meeting sandhill crane related recreational and ecological interests and to resolve associated issues.

Issues and Strategies

Issue 1. Satisfaction of recreational and ecological interests and provisions of the Accountability in Government Act require establishment of shared expectations (meaningful performance measures), evaluation of progress, and adjustment of management strategies as necessary.

Strategy 1. Establish the following objective parameters as target outcomes expected to foster satisfaction of recreational and ecological interests and serve as measures of performance.

Target Objective Parameters- Middle Rio Grande Valley				
Year	Wintering Population	Distribution	Active Hunter Success	Habitat Extent/Quality *
2003	17,000-22,000	75% public lands	60%	16,000 acres
2004	17,000-22,000	75% public lands	60%	16,200 acres
2005	17,000-22,000	77% public lands	65%	16,500 acres
2006	17,000-22,000	77% public lands	65%	16,800 acres
2007	17,000-22,000	80% public lands	70%	17,000 acres

* Feeding and roost habitat acreage on NMDGF and USFWS managed areas.

Target Objective Parameters- Pecos Valley				
Year	Wintering Population	Distribution	Active Hunter Success	Habitat Extent/Quality *
2003	10,000	50% public lands	60%	2,900 acres
2004	11,000	50% public lands	60%	2,950 acres
2005	13,000	55% public lands	65%	3,000 acres
2006	14,000	55% public lands	65%	3,100 acres
2007	15,000	60% public lands	70%	3,170 acres

* Feeding and roost habitat acreage on NMDGF, State Parks, USFWS and BLM managed areas.

Target Objective Parameters- Portales Area			
Year	Peak Migration/Winter Population	Active Hunter Success	Habitat Extent/Quality
2003	500	60%	To be determined
2004	1,000	63%	To be determined
2005	1,500	65%	To be determined
2006	1,800	67%	To be determined
2007	2,000	70%	To be determined

* All food source habitats are privately owned and crane use tolerance has to be determined.

Target Objective Parameters- Southwestern			
Year	Peak Wintering Population	Active Hunter Success	Habitat Extent/Quality *
2003	300	60%	To be determined
2004	400	60%	To be determined
2005	500	65%	To be determined
2006	600	65%	To be determined
2007	800	70%	To be determined

* All food source habitats are privately owned and crane use tolerance has to be determined.

Target Objective Parameters- Estancia Valley			
Year	Peak Fall Migration Population	Active Hunter Success	Habitat Extent/Quality
2003	200	40%	To be determined
2004	250	45%	To be determined
2005	300	50%	To be determined
2006	400	55%	To be determined
2007	500	60%	To be determined

* All food source habitats are privately owned and crane use tolerance has to be determined.

Strategy 2. Maintain annual population surveys and expand to include agricultural and playa areas in Curry, Roosevelt and Torrance counties.

Strategy 3. Develop survey methods to obtain accurate population and distribution information.

Strategy 4. Monitor harvest and hunter success.

Strategy 5. Utilize Geographic Information Systems (GIS) to assess the extent and status of crane habitat and identify potential limitations and opportunities.

Strategy 6. Monitor public satisfaction with the Department's success in meeting recreational and ecological interests and in resolving associated issues.

Issue 2. Land use decisions on private and public properties are beyond the Department's authority and can significantly impact the ability to meet objective parameters for crane management.

Strategy 7. Establish cooperative agreements with other land management agencies to protect and improve crane habitat on public lands.

Strategy 8. Evaluate, develop and promote outreach and grant projects to encourage and enable public landowners to protect and improve crane habitat where needed.

Strategy 9. Employ public hunting and depredation control measures to minimize the disincentive effects of costs incurred by landowners from the use of private lands by sandhill cranes.

Strategy 10. Utilize Federally funded habitat improvement programs (Wildlife Habitat Improvement Program, Conservation Reserve Program, Landowner Incentive Program, Wetland Reserve Program, North American Wetland Conservation Act, Playa Lakes Joint Venture, Inter-mountain West Joint Venture) to encourage improvement and increase use of crane habitat on public and partnered private lands.

Strategy 11. Partner with private organizations, sportsmen and environmental groups to support sandhill crane habitat development projects on public and private lands.

Issue 3. Public support and acceptance of the Department's management of cranes and related issues depends upon knowledge and understanding of relevant issues, actions and outcomes.

Strategy 12. Provide public information regarding crane biology, the Department's, Central and Pacific Flyway's sandhill crane management plans, related issues and accomplishments.

Strategy 13. Provide public information and education opportunities regarding crane hunting methods, ethics and shooting skills.

Issue 4. The Department's ability to manage wintering sandhill cranes is compounded by the intermixing of two crane subpopulations and 3 subspecies. Managing a limited RMP sandhill crane subpopulation while overall sandhill crane numbers are stable affects the public's recreational and ecological expectations.

Strategy 14. Develop hunt management strategies to ensure the state's RMP sandhill crane harvest allotment is not exceeded.

Strategy 15. Maintain sandhill crane harvest check stations or develop other methods to determine subspecies harvest.

Strategy 16. Maximize harvest consistent with population and distribution objective parameters.

Issue 5. Sandhill cranes are migratory birds whose primary population and harvest management is under USFWS jurisdictional authority. USFWS management decisions do not always foster attainment of New Mexico's target objectives.

Strategy 17. Participate in Central and Pacific Flyway decision making to resolve issues impeding attainment of our target objective parameters.

Issue 6. Sandhill crane populations are dependent on habitats and management strategies outside of New Mexico, limiting the Department's ability to influence wintering populations and meet recreational and ecological expectations.

Strategy 18. Support planning and implementation of research, management and habitat grants that benefit sandhill cranes.

Issue 7. Mortality from a wide array of diseases and human caused factors can reduce crane wintering populations to levels inadequate to meet ecological and recreational expectations.

Strategy 19. Promote developing widely dispersed, high quality sandhill crane habitat to reduce the chance for disease and provide alternative areas in cases of disease outbreaks.

Strategy 20. Investigate all reports of cranes that appear to be unhealthy.

Strategy 21. Assist other agencies when disease outbreaks occur.

Strategy 22. Publish farming management techniques that reduce access to moldy peanuts that result in sandhill crane mortality.

Strategy 23. Assist companies managing power lines to identify threat areas and reduce sandhill crane power line strikes.

Issue 8. Department WMAs and USFWS refuges are not meeting the public's recreational and ecological expectations.

Strategy 24. Develop public viewing opportunities on Department's MRGV and Pecos Valley WMA's.

Strategy 25. Improve sandhill crane habitat on the Department's MRGV and Pecos Valley WMAs to increase sandhill crane use and improve recreational opportunities.

Issue 9. Use of existing refuges and WMAs for hunting, viewing and refuge purposes often conflict and impede attainment of recreational and crane population targets.

Strategy 26. Lease, acquire and develop habitat in sufficient quantity and distribution to separate conflicting uses.

Issue 10. Increasing urbanization is reducing sandhill crane habitat below the amount necessary to meet target population levels.

Strategy 27. Lease or acquire agricultural lands suitable for cranes that might otherwise be converted to other uses.

Strategy 28. Participate in local government decision making to encourage maintenance of lands in agricultural production.

Strategy 29. Employ information and education initiatives to impart public understanding of the importance of preserving agricultural lands for sandhill crane management.

Issue 11. Water conflicts with availability, and quantity affect the Department's ability to provide sufficient crane habitat to support target population objectives.

Strategy 30. Develop water well capabilities on Department WMAs to ensure adequate supplies for growing feed and providing roost sites.

Strategy 31. Participate in initiatives to recognize the Department's use of its water rights to provide sandhill habitat as a beneficial use under state water law.

Issue 12. The Plan for the Management of Waterfowl, Sandhill Cranes, and other Migratory Birds in the Middle Rio Grande Valley of New Mexico identifies inadequate public access as limiting the level of opportunity necessary to realize desired hunting and viewing expectations.

Strategy 32. Create access by employing public hunting as a means of managing depredation on private lands.

Strategy 33. Coordinate access to private lands for crane-related recreational purposes among landowners and the public.

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