



Management Plan: Lower Colorado River Valley Population of Greater Sandhill Cranes



Adopted August 2017

Cover Photograph: Greater Sandhill Crane © Dave Krueper.

This management plan is one of a series of cooperatively developed plans for managing various populations of migratory birds of the Pacific Flyway. Inquiries about this plan may be directed to member states of the Pacific Flyway Council or to the Pacific Flyway Representative, U.S. Fish and Wildlife Service, Division of Migratory Bird Management, 1211 SE Cardinal Court, Suite 100, Vancouver, Washington 98683-9684.

Suggested citation: Pacific Flyway Council. 2017. Pacific Flyway Management plan for the lower Colorado River Valley population of Sandhill Cranes. Pacific Flyway Council, care of the U.S. Fish and Wildlife Service's Pacific Flyway Representative, Vancouver, Washington. 26 pp.

MANAGEMENT PLAN
FOR THE
LOWER COLORADO RIVER VALLEY POPULATION OF
GREATER SANDHILL CRANES

Prepared for the

Pacific Flyway Council
U.S. Fish and Wildlife Service
Canadian Wildlife Service
Direccion General de Conservacion Ecologica de Recursos Naturales

by the

Lower Colorado River Valley Population of Greater Sandhill Cranes Subcommittee
of the
Pacific Flyway Study Committee

March 1983
Revised May 1989
Revised March 1995
Revised August 2017

Approved by:



Chairperson, Pacific Flyway Council

October 16, 2017

Date

ACKNOWLEDGEMENTS

Prepared by the Subcommittee of the Lower Colorado River Valley Population of Greater Sandhill Cranes, Pacific Flyway Study Committee:

Johnathan O'Dell, Arizona Game and Fish Department
Jeff Knetter, Idaho Department of Fish and Game
Blair Stringham, Utah Division of Wildlife Resources
Russell Woolstenhulme, Nevada Division of Wildlife
Todd Sanders, U.S. Fish and Wildlife Service, Headquarters
Steve Olson, U.S. Fish and Wildlife Service, Headquarters
Dan Collins, U.S. Fish and Wildlife Service, Region 2

TABLE OF CONTENTS

	<u>Page</u>
INTRODUCTION	1
GOAL AND OBJECTIVES	5
Objectives	5
STATUS	6
Distribution	6
Public Use	15
Management and Research	15
MANAGEMENT ISSUES	17
Overall.....	17
Habitat.....	17
Disease	17
MANAGEMENT ACTIONS	18
Habitat.....	18
Environmental Education.....	20
Inventories.....	20
Research.....	21
ANNUAL REVIEW	22
LITERATURE CITED	23
APPENDICES	25

LIST OF FIGURES

	<u>Page</u>
Figure 1. Traditional and new breeding distribution of the Lower Colorado River Valley Population of greater sandhill cranes.....	3
Figure 2. Areas of migratory importance and number of marked individuals who used them identified for the Lower Colorado River Valley Population of greater sandhill cranes through 2014–2015 migration events.	4
Figure 3. Population abundance estimate based on concurrent mid-winter waterfowl aerial and ground surveys of Lower Colorado River Valley Population of greater sandhill cranes 1961–2015.	6
Figure 4. Recruitment estimated based on ground surveys conducted at Cibola NWR and Sonny Bono Salton Sea NWR of Lower Colorado River Valley Population of greater sandhill cranes.....	7
Figure 5. Lower Colorado River Valley Population of Greater Sandhill Crane migration chronology.	14

LIST OF TABLES

	<u>Page</u>
Table 1. Historical observations of wintering populations of Lower Colorado River Valley greater sandhill cranes in southwestern Arizona, southeastern California, and Mexico 1961–1994.....	8
Table 2. Population abundance estimates for the Lower Colorado River Valley Population of greater sandhill cranes 1961–2016.	11
Table 3. Lower Colorado River Valley Population of greater sandhill crane recruitment rates, 1989–2015.....	12

LIST OF APPENDICES

	<u>Page</u>
APPENDIX A. Peak numbers of Lower Colorado River Valley Population of sandhill cranes observed at the Lund, Nevada spring stopover from 1976–1987 (Nevada Department of Wildlife records).....	26

PREFACE

The Pacific Flyway Council is an administrative body that forges cooperation among public wildlife agencies for the purpose of protecting and conserving migratory birds. Each Council is composed of the director or an appointee from the public wildlife agency in each state and province in the flyway from the United States, Canada, and Mexico. Migratory birds use four major migratory routes (Pacific, Central, Mississippi, and Atlantic flyways) in North America. Because of the unique biological characteristics and relative number of hunters in these regions, state and federal wildlife agencies adopted the flyway structure for administering migratory bird resources within the United States. Each flyway has its own Council.

Management plans are developed by Council technical committees and include biologists from state, federal, and provincial wildlife and land-management agencies, universities, and others. Management plans typically focus on populations, which are the primary unit of management, but may be species or subspecies specific. Management plans identify issues, goals, and actions for the cooperative management of migratory birds among state and federal agencies to protect and conserve these birds in North America. Management of some migratory birds requires coordinated action by more than one flyway. Plans identify common goals and objectives, establish priority of management actions and responsibility for them, coordinate collection and analysis of biological data, foster collaborative efforts across geo-political boundaries, document agreements on harvest strategies, and emphasize research needed to improve conservation and management. Population sustainability is the first consideration, followed by equitable recreational and subsistence harvest opportunities. Management plans generally have a 5-year planning horizon, with revisions as necessary to provide current guidance on coordinated management. Management strategies are recommendations and do not commit agencies to specific actions or schedules. Fiscal, legislative, and priority constraints influence the level and timing of management activities.

Management plans are not intended as an exhaustive compendium of information available, research needed, and management actions. Plans include summaries of historical data and information from recent surveys and research that help identify: 1) the current state of the resource (i.e., population), 2) desired future condition of the resource (i.e., population goals and objectives), 3) immediate management issues managers face, and 4) management actions necessary and assignment of responsibilities to achieve the desired future condition, including harvest strategies and monitoring to evaluate population status and management progress.

The first management plan for the Lower Colorado River Valley Population of greater sandhill cranes was adopted March 1983. This document is the third revision of that plan. It was developed by the Pacific Flyway Study Committee, Lower Colorado River Valley Population of Greater Sandhill Cranes Subcommittee.

ACRONYMS USED

AGFD	Arizona Game and Fish Department
AMI	Area of Migratory Importance
BLM	Bureau of Land Management
CDFW	California Department of Fish and Wildlife
CRIT	Colorado River Indian Tribes
CVP	Central Valley Population
DVIR	Duck Valley Indian Reservation
EP	Eastern Population
FWS	U.S. Fish and Wildlife Service, Department of the Interior
IDFG	Idaho Department of Fish and Game
LCRVP	Lower Colorado River Valley Population
NDOW	Nevada Department of Wildlife
NWR	National Wildlife Refuge
RMP	Rocky Mountain Population
UDWR	Utah Division of Wildlife Resources
WMA	Wildlife Management Area

**MANAGEMENT PLAN
FOR THE
LOWER COLORADO RIVER VALLEY POPULATION OF
GREATER SANDHILL CRANES**

INTRODUCTION

The greater sandhill crane (*Antigone canadensis tabida*; hereafter crane) is the largest race of the species, nesting from the Great Lakes region westward to the Pacific Northwest and British Columbia. The Lower Colorado River Valley Population (LCRVP) of cranes is the least numerous of the greater populations: Eastern Population (EP; 83,479), Rocky Mountain Population (RMP; 24,330), and Central Valley Population (CVP; ~ 11,000) (Drewien et al. 1976, Drewien and Lewis 1987, Dubovsky 2016). The 2016 Status and Harvest of Sandhill Cranes report a 3-year average population estimate of 2,768 (1998-2016) (Dubovsky 2016). In recent years, based on unpublished data (unpublished Pacific Flyway Office), the LCRVP has had one of the lowest recruitment rates (6.37%; 1998-2015) of any crane population in North America. In earlier literature (i.e., Braun et al. 1975, Lewis 1977), this population was called the “Colorado River Valley Population;” however, this subcommittee designated it the “Lower Colorado River Valley Population,” which describes their winter distribution.

Historically, northeast Nevada was thought to be the primary breeding area for this population of cranes. However, new or previously unknown breeding areas have been identified in Idaho (Figure 1; Conring 2016). Cranes now breeding from southwestern Idaho (e.g., Duck Valley Indian Reservation [DVIR]) north to Cascade and Bear Valley-Stanley area, Idaho have been confirmed to be affiliated with this population (Collins et al. 2015). Cranes nesting at Fish Springs National Wildlife Refuge (NWR) in Juab County, Utah are not affiliated with a distinct population, because of potential intermixing and small numbers from RMP and the LCRVP.

In fall, cranes congregate in the Ruby and Lamoille Valleys, Elko County, Nevada as well as the Payette River Valley, Idaho. Migration from summer areas begins during mid-August and peaks in mid-September, passing through Lund, White Pine County, Nevada, and follows the White River south to wintering areas along the Colorado River and in the Imperial Valley in southeastern California. Lower Colorado River Valley Population of cranes initiate spring migration as early as the first week of February, with a peak in mid-March, flying north through Lund, Nevada, which serves as a spring migration stopover area and one of the southernmost breeding areas. Cranes spend anywhere from a few days to a few weeks at the stopover; numbers generally peak in late February and early March. Recent data indicates that cranes use several publically-owned areas on both fall and spring migration that have been identified as areas of migratory importance (AMI) (Conring 2016; Figure 2).

Typically, this population of cranes winters in the lower Colorado River Valley of Arizona and Imperial Valley of California. Historically, wintering areas extended south along the Colorado River to its delta within the Gulf of California. However, a reduction of suitable wintering habitat has constricted the current wintering distribution to Cibola NWR and adjacent lands owned by the Colorado River Indian Tribes (CRIT) in southwestern Arizona, as well as Sonny

Bono Salton Sea NWR and the adjacent Brawley area in southeastern California. A small number of cranes also winter along the Gila River in Arizona near Gila Bend, Arizona. Collectively, these areas are believed to winter in excess of 90% of the total cranes in the LCRVP (Kruse and Dubovsky 2015).

This plan is a revision of the March 1995 LCRVP sandhill crane management plan, and its purpose is to establish guidelines for management of LCRVP sandhill cranes based upon current information.

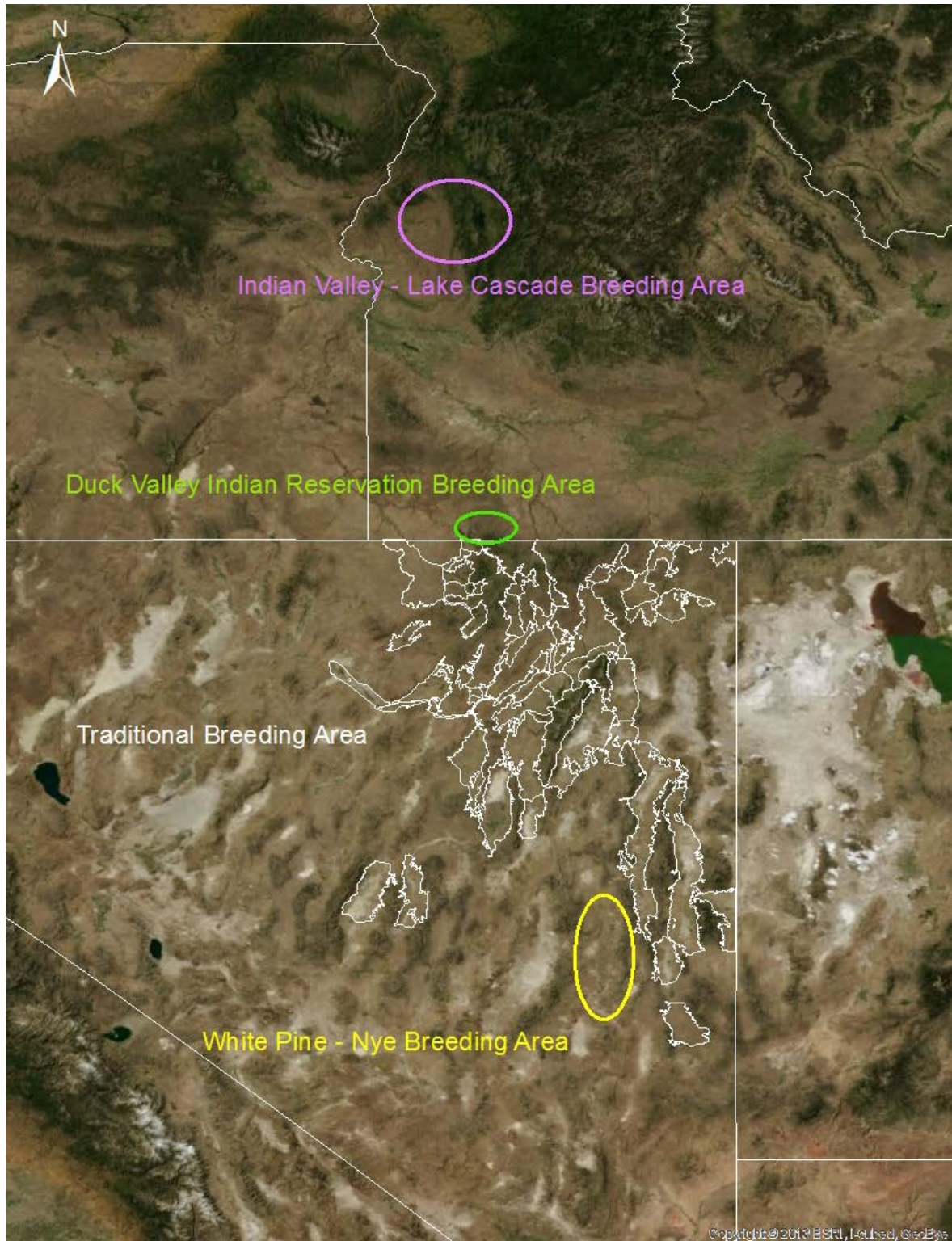


Figure 1. Traditional and new breeding distribution of the Lower Colorado River Valley Population of greater sandhill cranes.

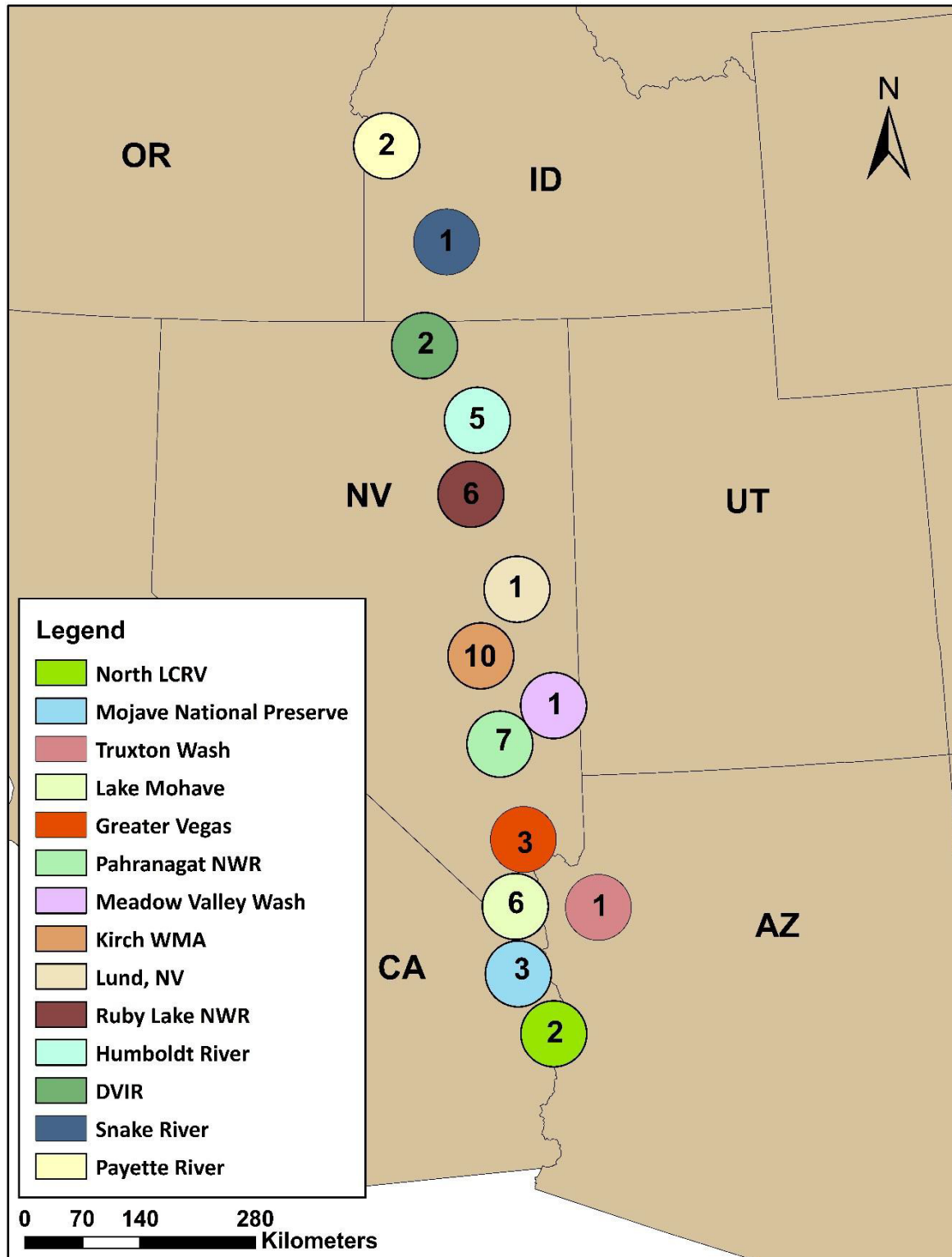


Figure 2. Areas of migratory importance and number of marked individuals who used them identified for the Lower Colorado River Valley Population of greater sandhill cranes through 2014–2015 migration events.

GOAL AND OBJECTIVES

The goal is to maintain the LCRVP of greater sandhill cranes to ensure long-term conservation, meet needs for consumptive and non-consumptive uses, and provide for its increase and expansion within its current range.

Objectives

1. Maintain the population at a minimum 2,500 cranes as measured by the 3-year average index of total cranes from the winter survey. There currently is thought to be sufficient habitat to support the population objective.

Most LCRVP cranes overwinter in specific locations throughout the wintering range during late October to early March, but migration chronology can vary between years. The overwintering timeframe provides the best opportunity to survey this population. The population objective of this plan will be based on winter surveys.

2. Maintain and protect suitable habitat in sufficient quantity and quality to support the population objective and recent past spatial distribution and expansion.

Sufficient breeding, wintering, and migration habitat is required to maintain a stable population. Some areas of historic range suitable for nesting pairs are currently not occupied, and some staging and wintering areas are potentially overcrowded. Breeding birds pioneering into unoccupied areas should be encouraged to expand, and migrating and wintering birds may be encouraged to use alternate areas through various management practices (e.g., creation of food plots, new roost sites, or protected areas). Cooperative management between state management areas and federal refuges could significantly improve spatial distribution and habitat for cranes.

Increasing human impacts on crane habitats will likely result in short and long-term habitat loss. As habitat is lost due to changing agricultural practices, cranes are restricted to fewer areas. Food supply, roost sites, and overcrowding are becoming priority concerns for population maintenance, especially on winter areas.

3. Provide for recreational uses of LCRVP cranes.

Watching and photographing Sandhill Cranes is a popular activity. Expenditures by U.S. birders were nearly \$41 billion in 2011, and 60% of birders reported observing waterbirds (U.S. Fish and Wildlife Service 2011). Crane festivals attract birders from across the country and other nations to view and photograph wildlife, and participate in other wildlife-related events, contributing to the local economies (Case and Sanders 2009). Hunting may be considered when the population exceeds the 3-year average of 2,500.

STATUS

Distribution

Abundance.—Historic information on population trends indicate an increase in the number of cranes wintering in the lower Colorado River Valley in Arizona and Imperial Valley of California over the last 50 years (Figure 3). However, until recently the timing of surveys was conducted differently which may explain the consistent increase in abundance in the time series. For example counts took place from 1949 to 1994 and ranged from a low of 39 observed in 1980 to a high of 1,100 in 1994 in the lower Colorado River Valley and ranged from a low of two in 1970 to a high of 290 in 1989 in the Imperial Valley of California (Figure 3; Table 1). Efforts to capture a better estimate began in 1998 where four core areas (Cibola NWR, Colorado River Indian Reservation, Imperial Valley, California, and the Gila River between Buckeye and Gila Bend, Arizona) were identified. These areas are thought to summarize what is thought to be ~90% of the population. The population has ranged from a low of 1,215 to a high of 3,876. Currently, the 3-year average (2014-2016) is 2,768 and long-term average (1998-2016) is 2,464 (Table 2.). Only 30%+ of the LCRVP wintering population has been located on Nevada summer range. This discrepancy suggests several possibilities, including: a) the summer range of the LCRVP includes a larger area than previously believed; b) the summer ranges of the LCRVP, RMP and CVP or RMP and LCRVP are not mutually exclusive; c) there is only one population of western Greater Sandhill Cranes, subpopulations of which utilize distinct wintering areas; and/or d) summer ranges are distinct and at least some mixing of populations occurs during migration and on winter ranges.

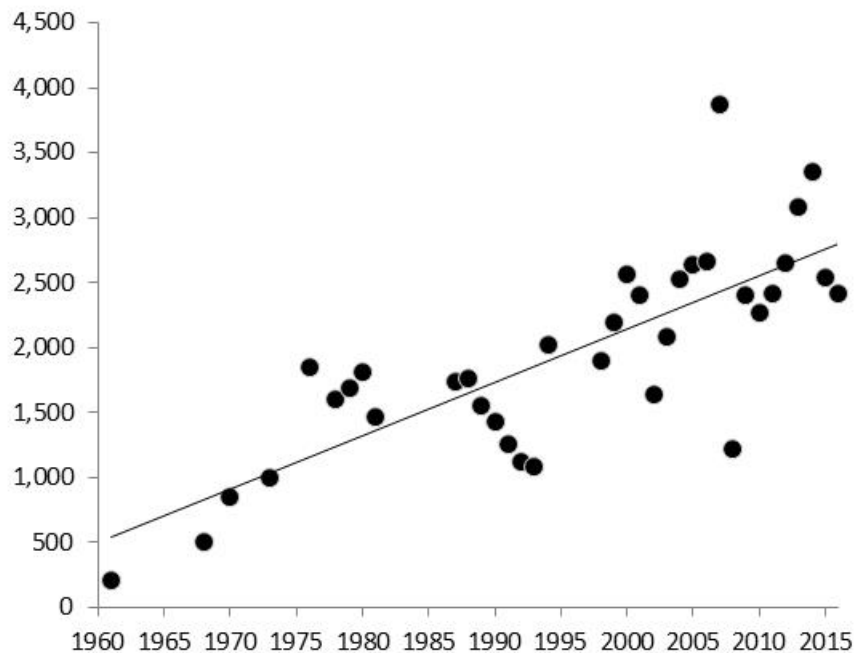


Figure 3. Population abundance estimate based on concurrent mid-winter waterfowl aerial and ground surveys of Lower Colorado River Valley Population of greater sandhill cranes 1961–2015.

Recruitment.—The Nevada Division of Wildlife (NDOW) conducted fall recruitment surveys from 1977 to 1983, to determine percent young in the population as an index of productivity. These counts were discontinued in 1984 because NDOW could not classify a statistically sufficient number of cranes (based on a sampling formula presented by Czaplewski et al. 1983). Nevada Division of Wildlife was classifying less than 41% of the required sample of cranes; therefore age ratio could not be correlated to population trend. Sonny Bono Salton Sea NWR, Cibola NWR, and the CRIT initiated efforts to determine age ratios of wintering cranes in December 1989. Recruitment surveys were conducted in late November in 1989, 1992, and 1993, and in late October in 1990 and 1991. Although young birds were more readily identified in October, there was a greater chance of biased results as pairs with young tended to remain apart from large aggregations. Pairs with young appeared to join larger congregations later in the winter. August (2011) suggested population growth is most susceptible to changes in recruitment rate of young into the breeding population, in the absence of harvest or additional sources of adult mortality. Because Sandhill Cranes exhibit low fecundity, with small clutch size (1.94 ± 0.02 ; Drewien 1973) and low incidence of reneating (1.5-10.5% of total nests; Austin et al. 2007), nest success may limit recruitment and therefore population growth. Based on unpublished data (Pacific Flyway Office), this population has had one of the lowest recruitment rates (6.37%; 1998-2015) of any crane population in North America (Figure 4; Table 3).

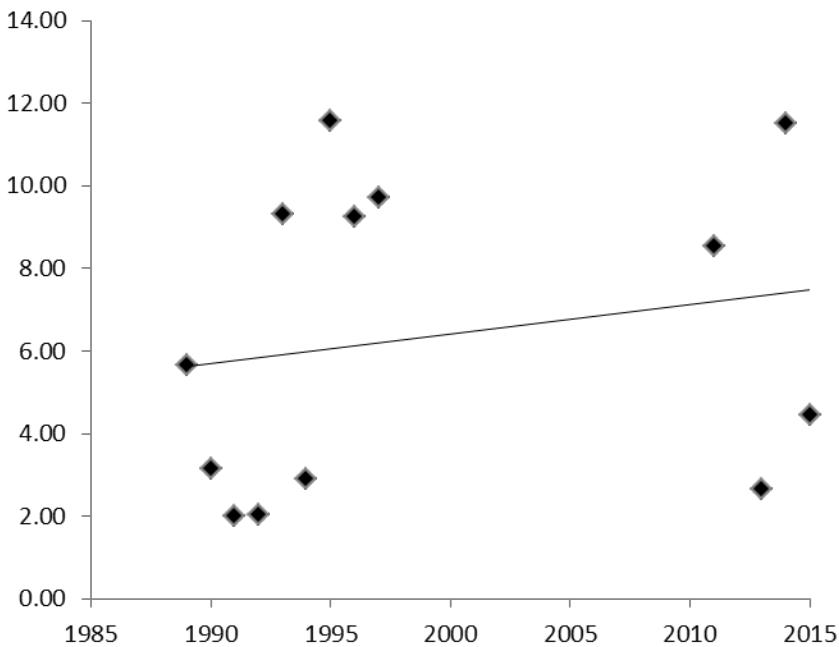


Figure 4. Recruitment estimated based on ground surveys conducted at Cibola NWR and Sonny Bono Salton Sea NWR of Lower Colorado River Valley Population of greater sandhill cranes.

Table 1. Historical observations of wintering populations of Lower Colorado River Valley greater sandhill cranes in southwestern Arizona, southeastern California, and Mexico 1961–1994.

Location	Number of cranes	Month	Day	Year	Source
Arizona					
Colorado River					
Indian Reservation	210	2	28	1961	L.D. Hatch (Phillips et al. 1964)
	500			1968	R. Kinghorn (Drewien et al. 1976)
	160	1	24	1970	C.D. Littlefield
	800			1970	C.D. Littlefield
	347	2	2	1971	C.D. Littlefield
	576	2	5	1972	C.D. Littlefield
	1,100			1973	R. Kinghorn (Drewien et al. 1976)
	571	1	31	1976	C.D. Littlefield
	1,500			1976	C.D. Littlefield
	1,079	12	29	1978	D.E. Brown, D.L. Perkins
	83	2	5	1979	D.L. Perkins
	1,349	1	9	1980	D.L. Perkins
	416	1	13	1986	M.S. Rawlings
Cibola NWR	61	12	8	1966	Cibola NWR Narrative Report
	150	12		1967	Cibola NWR Narrative Report
	20	1		1968	Cibola NWR Narrative Report
	42	11		1968	Cibola NWR Narrative Report
	121	11	10	1975	Cibola NWR Narrative Report
	120	12	10	1975	Cibola NWR Narrative Report
	40	12	13	1975	Cibola NWR Narrative Report
	250	11	26	1976	Cibola NWR Narrative Report
	350	12		1976	K.V. Rosenberg
	50	2		1977	K.V. Rosenberg
	258	12	28	1979	D.E. Brown, D.L. Perkins
	72	2	4	1979	D.L. Perkins
	39	1	10	1980	D.E. Brown, D.L. Perkins
	317	10	20	1980	Cibola NWR Narrative Report
	270	2	4	1981	Cibola NWR Narrative Report
	511	1	5	1983	W. Martin
	350	1	6	1986	W. Martin
	481	1	14	1986	M.S. Rawlings
	433	1	6	1987	W. Martin
	584	1	2	1988	W. Martin
	983	1	2	1988	W. Martin
	800	1	5	1993	W. Martin
	1,100	1	4	1994	W. Martin
Imperial NWR	15	12	18	1949	L.D. Yeager (Phillips et al. 1964)
	85	2	17	1950	V.H. Householder (Phillips et al. 1964)
	200	2	18	1952	V.H. Householder (Phillips et al. 1964)
	18	2	4	1956	V.H. Householder (Phillips et al. 1964)
	2	1	23	1970	C.D. Littlefield
	50			1970	C.D. Littlefield

Table 1. Continued.

Location	Number of cranes	Month	Day	Year	Source	
Imperial NWR	12	11	21	1978	D.E. Brown, D.L. Perkins	
	51	12	2	1978	D.E. Brown	
	44	1	3	1979	D.E. Brown	
	54	1	25	1980	C.M. Copley	
	79	2	6	1981	D.L. Perkins	
	155	1	14	1986	M.S. Rawlings	
	120	1	4	1988	P. Smith	
	111	12	30	1988	P. Smith	
	115	1	2	1991	P. Smith	
	140	12	30	1991	P. Smith	
	132	12	31	1992	P. Smith	
	78	12	29	1993	P. Smith	
California						
Brawley Area	60	12		1951	Salton Sea NWR Narrative	
	12	10	22	1965	Salton Sea NWR Narrative	
	52	12	18	1969	C.D. Littlefield	
	40	1	24	1970	C.D. Littlefield	
	49	1	24	1971	C.D. Littlefield	
	35	11	24	1971	C.D. Littlefield	
	32	10	3	1975	Salton Sea NWR Narrative	
	82	12	4	1975	Salton Sea NWR Narrative	
	77	1	31	1976	C.D. Littlefield	
	128	2	3	1979	D.L. Perkins	
	205	1	5	1981	A. Metcalf	
	253	1	16	1986	M.S. Rawlings	
	290	12		1989	Salton Sea NWR Narrative	
	100	10	4	1991	Salton Sea NWR Narrative	
	252	11	15	1991	Salton Sea NWR Narrative	
	210	11	11	1992	Salton Sea NWR Narrative	
	229	11	23	1992	Salton Sea NWR Narrative	
	299	11	30	1992	Salton Sea NWR Narrative	
	295 (45 lessers)	12	9	1992	Salton Sea NWR Narrative	
	157	11	6	1993	Salton Sea NWR Narrative	
	83 (17 lessers)	11	21	1993	Salton Sea NWR Narrative	
	329	2	12	1994	Salton Sea NWR Narrative	
	4	2	26	1994	Salton Sea NWR Narrative	
	Salton Sea NWR	4	1	30	1946	Salton Sea NWR Narrative
		3	1	13	1950	Salton Sea NWR Narrative
		4	11	25	1950	Salton Sea NWR Narrative
		90	3		1951	Salton Sea NWR Narrative
4		4	10	1951	Salton Sea NWR Narrative	
4		12	25	1951	Salton Sea NWR Narrative	
5		12		1951	Salton Sea NWR Narrative	
5		2	13	1952	Salton Sea NWR Narrative	
14		3	14	1952	Salton Sea NWR Narrative	
5		12	18	1952	Salton Sea NWR Narrative	

Table 1. Continued.

Location	Number of cranes	Month	Day	Year	Source
Salton Sea NWR	9	1	27	1953	Salton Sea NWR Narrative
	20	2	3	1953	Salton Sea NWR Narrative
	3	4	2	1953	Salton Sea NWR Narrative
	4			1953	Salton Sea NWR Narrative
	3	10	12	1953	Salton Sea NWR Narrative
	3	1	9	1955	Salton Sea NWR Narrative
	2	2	18	1955	Salton Sea NWR Narrative
	5	3	19	1955	Salton Sea NWR Narrative
	13	10	21	1955	Salton Sea NWR Narrative
	27	10	22	1955	Salton Sea NWR Narrative
	19	11	1	1955	Salton Sea NWR Narrative
	5	12	1	1955	Salton Sea NWR Narrative
	1	11	28	1956	Salton Sea NWR Narrative
	4	12	10	1956	Salton Sea NWR Narrative
	7	1	20	1957	Salton Sea NWR Narrative
	1	3	1	1957	Salton Sea NWR Narrative
	7	10	22	1965	Salton Sea NWR Narrative
18	10	25	1965	Salton Sea NWR Narrative	
2	11	11	1965	Salton Sea NWR Narrative	
Mexico					
About 25 miles south of Yuma	135	12		1952	Salton Sea NWR Narrative
South of Mexicali	10	12		1953	Salton Sea NWR Narrative

Table 2. Population abundance estimates for the Lower Colorado River Valley Population of greater sandhill cranes 1961–2016.

Year	Cibola NWR	Colorado River Indian Tribe	Sonny Bono Salton Sea NWR	Gila River	Total
1961					210
1968					500
1970					850
1973					1,000
1976					1,850
1978					1,601
1979					1,681
1980					1,807
1981					1,459
1987					1,736
1988					1,764
1989					1,546
1990					1,433
1991					1,257
1992					1,123
1993					1,081
1994					2,024
1998	775	596	351	178	1,900
1999	1,200	511	325	163	2,199
2000	820	1,259	235	252	2,566
2001	961	952	350	134	2,397
2002	1,003	168	417	52	1,640
2003	1,200	455	430	0	2,085
2004	1,341	354	521	312	2,528
2005	1,513	457	476	191	2,637
2006	1,141	673	493	360	2,667
2007	2,322	809	295	450	3,876
2008	115	NS	687	413	1,215
2009	289	1,216	603	293	2,401
2010	266	729	904	365	2,264
2011	553	636	899	327	2,415
2012	1,097	474	924	151	2,646
2013	1,629	344	671	434	3,078
2014	1,981	591	641	140	3,353
2015	676	720	688	452	2,536
2016	631	631	862	292	2,416
3-year mean	1,096	647	730	295	2,768
Long-term mean	1,027	643	567	261	2,464

Table 3. Lower Colorado River Valley Population of greater sandhill crane recruitment rates, 1989–2015.

Year	Adults	Juveniles	Total	Recruitment
1989	1,255	71	1,326	5.66
1990	860	27	887	3.14
1991	550	11	561	2.00
1992	634	13	647	2.05
1993	354	33	387	9.32
1994	966	28	994	2.90
1995	328	38	366	11.59
1996	659	61	720	9.26
1997	402	39	441	9.70
2011	563	48	611	8.53
2013	453	12	465	2.65
2014	226	26	252	11.50
2015	314	14	328	4.46
3-year mean	331	17	348	6.20
Long-term mean	564	31	595	6.35

Breeding Areas.—Summer distribution is well documented in Nevada. Summer distribution in Utah was thought to be well documented; however, intermixing of the RMP and LCRVP has blurred which population affiliation summering cranes in Utah are associated with. The LCRVP has expanded their range into Idaho; however, the area(s) where LCRVP cranes summer do not overlap with RMP and potentially CVP cranes is still unknown (C. Littlefield and R. Drewien; pers. comm., Collins et al. 2015). Currently, nesting areas in public ownership in Nevada are Ruby Lake NWR, Elko County, lands administered by NDOW on the Bruneau River and Franklin Lake, and by the Bureau of Land Management (BLM) on the Mary’s River and Bruneau River, and North Spring Valley, White Pine County. In Utah, public lands historically suspected of summering LCRVP cranes are Lynn Reservoir, Fish Springs NWR, U.S. Forest Service lands, and Locomotive Springs Waterfowl Management Area. Currently known public areas in Idaho include the Boise and Payette National Forests and DVIR. Additional areas include Idaho Department of Fish and Game (IDFG) properties (i.e., Centennial Marsh Wildlife Management Area [WMA]), and state and federal lands in Owyhee County and along the Snake River around Mountain Home, Idaho.

Cranes continue to use the traditional breeding area in northeastern Nevada. Additionally, recent research (Conring 2016) also identified new breeding areas. Newly identified, the Indian Valley-Lake Cascade area is the farthest north new summer area and stretches across Valley, Adams, and Washington counties in western Idaho (Figure 1). Much of the Indian Valley-Lake Cascade Unit falls in the Indian Valley in Adams County, Idaho, and surrounding Lake Cascade in Valley County, Idaho. The second newly identified area was the DVIR and is more of an extension of the previously defined traditional breeding area in northeastern Nevada. This area is located on the Idaho-Nevada state border in Owyhee County, Idaho, and Elko County, Nevada. Cranes used the DVIR as well as the Humboldt National Forest and adjacent BLM lands east of the reservation (near Wildhorse Reservoir). The White Pine-Nye area was the southernmost unit and extended across White Pine and Nye counties in eastern Nevada. This area is west of the Steptoe and Lake valleys in White Pine County, Nevada, and cranes were located within 25 km of Lund, Nevada (Conring 2016).

Wintering Areas.—Wintering areas have been reduced from the Colorado River into the delta region of the Gulf of California in Sonora and Baja California, Mexico, to primarily the lower Colorado River Valley in southwestern Arizona and Imperial Valley in southeastern California. Current monitoring indicates 90% of the population winters on five areas, Cibola NWR, CRIT lands, Sonny Bono Salton Sea NWR, private lands around Brawley, California, and a reach of the Gila River between Buckeye and Gila Bend, Arizona.

Migration Chronology.—A significant spring migration stopover was identified in Lund, Nevada in 1976 (Appendix A). This area is attractive to cranes because of the availability of wet meadows for loafing and feeding, and a playa for roosting and proximate grain fields for feeding. However, these habitats are not in public ownership and future protection and management of these areas are uncertain. Recent research (Collins et al. 2015) indicates cranes arrive on summering grounds as early as March and depart / begin arriving on wintering grounds in late September (Figure 5). Historically, the Lund, Nevada area was thought to be the main stopover area LCRVP cranes used before continuing on with migration (Appendix A). However, recent research also identified AMIs. Cranes marked and track with satellite GPS platform terminal

transmitters ($n = 18$) used 17 AMIs that were ranked based on use (i.e., number of marked cranes) and length of stay (i.e., days) (Conring 2016). The Mojave National Preserve, Pahranaagat NWR, and Wayne E. Kirch WMA were used by four or more marked cranes in each migration (spring 2014, $n = 14$; fall 2014 $n = 9$; spring 2015 $n = 9$). Other AMIs used by ≥ 4 Sandhill Cranes in the spring 2015 sample ($n = 9$) include the Greater Vegas Area, Joshua Tree Wilderness, and Ruby Lake NWR. Humboldt River also hosted ≥ 4 marked Sandhill Cranes during fall 2014 ($n = 9$). Areas of migratory importance used only during spring migration events were Joshua Tree Wilderness, Lund, Wildhorse Reservoir, Snake River, and the DVIR, while no AMIs were exclusive to the fall migration. Five AMIs were also summer terminuses for Sandhill Cranes in our study, including Ruby Lake NWR, Lund, Humboldt River, Wildhorse Reservoir, and DVIR, based on location data from the summer season (Conring 2016; Figure 2).

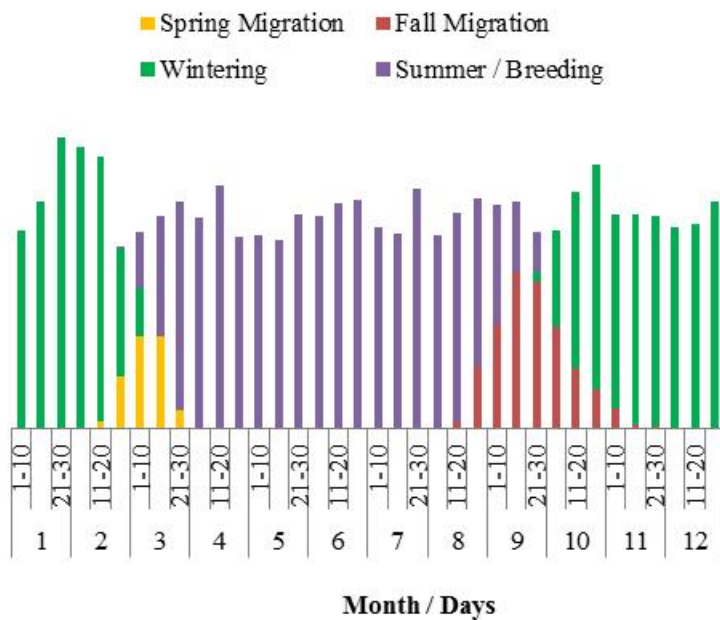


Figure 5. Lower Colorado River Valley Population of Greater Sandhill Crane migration chronology.

Habitat.—Deficiencies in roosting, loafing and feeding habitat on winter range have been previously identified. Roost locations are limited to river locations where sand bars have developed and river water is slowed, managed wetlands (e.g., NWR lands and private lands), and in some cases open dirt patches (e.g., Cibola NWR). Depending on the wintering location (i.e., Imperial Valley or Lower Colorado River Valley), grain crops fluctuate in availability and abundance. Cibola NWR and Sonny Bono Salton Sea NWR have the most consistent grain production of all winter sites used. Cranes prefer to loaf in alfalfa fields, irrigated pastures, and some plowed fields. The number of cranes wintering along the lower Gila River and southeast of Brawley has increased in recent years due to proximity of roost sites (e.g., private duck hunting club) to foraging locations.

A small persistent flock on the lower Gila River between Gila Bend and Buckeye, Arizona, continues to use this area, which has a decent matrix of foraging resources close to roost sites. However, because of frequent disturbance to the roosts, primarily by farmers and waterfowl hunters, roosting sites are limited to a few relatively remote stretches of the Gila River and could potentially lead to cranes abandoning the area.

Historically, summering / breeding grounds were thought to be primarily in northeastern Nevada where cranes typically utilized managed areas such as Ruby Lake NWR and private lands, wetland / agricultural complexes, and wet meadow complexes on federal and state lands such as the Humboldt National Forest. Recent research indicates that summer resource selection of marked cranes showed preference to four habitats: 1) crops and pastures; 2) open water, wetlands, and riparian areas; 3) grasslands, shrubs, scrub, and meadows; and 4) forests and woodlands. All four of these have wetland components nested within them or provide a foraging resource in close proximity (Kruse et al., in review)

Public Use

Viewing.—The principal “use” of LCRVP cranes is wildlife viewing/observation. This activity is presently unmeasured, but is thought to be significant and increasing, particularly at Lund and Ruby Lake NWR.

Hunting. —The LCRVP was not hunted after the signing of the Migratory Bird Treaty Act in 1918. In 2007, the Service completed an Environmental Assessment entitled “Proposed hunting regulations for the Lower Colorado River Valley Population of Greater Sandhill Cranes in the Pacific Flyway” (U.S.D.I. 2007). In 2008, the Service determined that a small allowable harvest (about 30) could be allowed on this population in years when the 3-year average of winter counts exceeded 2,500. The hunting season was to be experimental for 3 years. After the 3 years, the season would be reviewed and revised if necessary. A limited youth hunting season for this population was conducted during 2010 in Arizona, the only state that has hunted these cranes. No LCRVP cranes were harvested. The Pacific Flyway currently has no plans to conduct hunts in the near future. Any future hunting season would require completion of an updated Environmental Assessment (Dubovsky 2017).

Management and Research

Lower Colorado River Valley Population cranes are inventoried once annually during the winter and every five years in Nevada on their primary breeding grounds. The winter survey is conducted in conjunction with the Mid-winter Waterfowl Survey in January in the Imperial Valley, Cibola NWR, CRIT lands, and the Gila Bend area of Arizona. Counts are then combined to give one annual population estimate. The Nevada breeding population estimate is conducted in a variety of forms depending on terrain, access, and current workload per biologist (i.e., aerial, ground, other). Other than receiving statutory protection, this population is passively and actively managed depending on where in the annual cycle they occur. For example, on the wintering grounds, cereal crops are planted and manipulated to provide easy access to foraging resources; while on the breeding grounds, areas of importance are identified but no active management to improve or sustain habitat is occurring.

Research topics identified for the LCRVP of greater sandhill cranes during the term of this plan are as follows:

1. Map the extent of summer, staging, and wintering habitat, and assess land ownership and land use that characterize the LCRVP landscape.
2. Develop spatially explicit range-wide models that predict landscape carrying capacity and anthropogenic changes (e.g., water use, crop conversion, and rural development) that are impacting habitat availability, abundance, and configuration as well as identify and examine broad-scale landscape stressors (e.g., drought and anthropogenic changes) influencing range-wide demographic patterns in LCRVP cranes.
3. Delineate breeding, migratory, and overwinter seasonal ranges of LCRVP and CVP in western Idaho and eastern Oregon.
4. Assess breeding season habitat selection at multiple spatial scales.
5. Assess productivity and recruitment of the LCRVP in comparison to the RMP.

MANAGEMENT ISSUES

Overall

1. Water scarcity and crop conversion in summering, staging, and wintering areas is a growing concern, specifically in Arizona, California, and Nevada.
2. Ability of responsible state and federal agencies to monitor the population.

Habitat

Summer Range

1. Preferred nesting habitats throughout the described breeding range are largely in private ownership. Summer livestock grazing and early harvest of meadow grasses are potential limiting factors on reproductive success.
2. Water management and agricultural practices that contribute to desiccation of meadows used for nesting. Large scale conversion of wet meadow/willow riparian to upland shrub/exotic forb/grasslands due to destabilization of the hydrology of the Humboldt River system by unsound agricultural practices continue to threaten long-term summer range health.
3. Conversion of native hay meadow/willow riparian habitats to gravel pits is increasing.

Winter Range

1. A shortage of suitable undisturbed roosting sites in close proximity to small grain crops to meet desired distribution on the winter range (i.e., the Colorado River including NWRs, the Lower Gila River, and Imperial Valley).
2. Roost site destruction through past and proposed dredging, channelization, and other activities by the Bureau of Reclamation and/or U.S. Army Corps of Engineers on the lower reaches of the Colorado River.
3. Conversion of lands currently in small grain production to non-food crops such as cotton and alfalfa.

Disease

There have been no documented mortalities caused by disease on LCRVP cranes on winter or summer habitats. Sandhill cranes are known to be susceptible to several diseases including botulism, tuberculosis, avian cholera, avian salmonellosis, inclusion body disease of cranes, aspergillosis, lead poisoning and Leucocytozoonosis. Because this population is not hunted, the incidence of disease-related mortality is difficult to monitor and would probably go undetected unless a significant die-off occurs. Preliminary analysis of blood samples taken by Utah Division of Wildlife Resources (UDWR) from sandhills captured for marking showed no evidence of Leucocytozoonosis.

MANAGEMENT ACTIONS

The following management strategies are recommended. Degree and timing of implementation by responsible agencies will be influenced by personnel, fiscal, and legislative constraints beyond the scope of this plan. Whenever possible, management procedures in this plan should be coordinated with and incorporated into plans for other species and populations of Pacific Flyway birds.

Habitat

General

1. Identify, classify, rank, and catalog habitats used now and historically by LCRVP cranes to facilitate acquisition of habitat and to protect areas through public awareness, cooperative agreements, conservation easements, special-use permits, and mitigation. Classification should include, but not be limited to, land status and use, vegetative composition, physiognomic characteristics, relative importance to cranes (current and potential) and threats to continued existence of that habitat. Priority for acquisition and possible manipulation of specific land should be identified. All interested agencies, groups, and individuals are encouraged to participate in this effort.

Priority: 2
Responsibility: AGFD, CDFW, IDFG, NDOW, UDWR, FWS, CRIT
Schedule: 2016–2020

Nesting

2. Protect areas used by nesting cranes. Suitable areas should be prioritized for acquisition through purchase, lease, or easement and managed for optimum production of Sandhill Cranes. Specific recommendations:
 - a. Encourage responsible agencies to discourage draining, diking, filling, and other destructive practices on nesting meadows.
 - b. Encourage public and private land managers to keep meadows wet through July. Rapid drying of meadows while young cranes are dependent on invertebrates can result in starvation.
 - c. Discourage construction of dams that would inundate or dewater crane nesting habitat.
 - d. Seek easements with private landowners to delay dewatering and hay mowing on nesting areas until at least August 1. Encourage land management agencies to delay hay mowing on public lands until August 1 to prevent the loss of young cranes. Hay stacks should be removed because “moldy” hay provides favorable conditions for aspergillosis which has been known to infect young cranes at Malheur NWR.
 - e. Encourage land management agencies to promote sound livestock grazing practices on public lands encompassing crane nesting/brooding habitat to levels that do not compromise crane production.
 - f. Encourage land management agencies to promote sound winter livestock grazing on public lands that support cranes and associated vegetation throughout their annual cycle.
 - g. The subcommittee should be notified by the responsible subcommittee representative and/or the FWS of proposed projects and/or actions which will use federal funds or require federal approval or permits that may have a significant adverse impact on summer

range habitats. Upon such notification, recommendations to the appropriate funding/permitting agency(s) should be prepared and presented.

Priority: 1 for items 2a through 2c; 2 for items 2d through 2g
Responsibility: Subcommittee, IDFG, NDOW, UDWR, FWS
Schedule: 2016–2020

Stopover

3. Investigate opportunities to preserve and develop stopover sites and AMIs (i.e., roost site enhancement/restoration). Special consideration should be given to the Kirch WMA at Sunnyside, White Pine County, Nevada as well as Pahrnagat NWR, Ruby Lake NWR, areas on the Snake River around Mountain Home, Idaho, and the Payette River Valley, Idaho. Possibilities for the retention, development, and management of key habitats at the stopover site near Lund should also be investigated.

Priority: 2
Responsibility: IDFG, NDOW, FWS
Schedule: 2016–2020

Winter Range

4. Protect roost sites. Those on public lands should be protected from degradation and disturbance. Attempts should be made to acquire, through fee acquisition or easement, important roost areas in private ownership and manage them for cranes. Specific recommendations:
 - a. Through direct acquisition, lease or easements, protect two important winter roost sites located southeast of Brawley, California, owned by the D & K Duck Club and Ostercamp Farms. If these roost sites are lost through a change in management, this wintering flock may be lost.
 - b. Vigorously oppose proposed projects and programs that will degrade riverine roost sites. Special consideration should be made to prevent dredging of shallow water sites and prevent vehicle access to shorelines. Cooperation from the U.S. Army Corps of Engineers and the Bureau of Reclamation is essential.
 - c. Roost sites on public lands (Cibola and Sonny Bono Salton Sea NWRs) should be managed for the benefit of cranes, including complete or temporary closures to prevent/minimize disturbance as well as maintaining open areas suitable for crane roosting and feeding.
 - d. The subcommittee should be notified by the responsible subcommittee representative and/or the FWS of proposed projects and/or actions which will use federal funds or require federal approval or permits that may have a significant adverse impact on the crane wintering habitats. Upon such notification, recommendations to the appropriate funding/permitting agency(s) should be prepared and presented.

Priority: 1
Responsibility: Subcommittee, AGFD, CDFW, FWS
Schedule: 2016–2020

Habitat Management on National Wildlife Refuges

5. Encourage all lower Colorado River NWRs, particularly Cibola NWR, to maintain practices to ensure adequate cereal grains (milo, wheat, barley, rice) are available for cranes during the winter (October-March). Manipulation of grain crops, such as bumping, chopping, or swathing should be practiced to increased food availability. Grain fields should be dispersed over farm units to reduce crowding. Roosts sites should be protected and enhanced and new ones developed as appropriate.

All forms of disturbance in feeding and roosting areas should be minimized. Planned activities should be kept at a distance compatible with maintenance of cranes on refuge units. Operation of farm machinery does not generally disturb cranes as do some other activities; however, care should be taken to operate farm machinery in only one portion of a refuge farm unit at a time so cranes have secondary areas to retreat to. In refuge farm units where fog, rain, or other causes reduce visibility, overhead powerlines should either be removed, marked (e.g., yellow vibration dampers) or placed underground (Brown and Drewien 1995). Internal fences in areas managed for cranes should be removed or modified to a 3-strand design such as those successfully used at Grays Lake NWR, Idaho.

Priority: 1
Responsibility: FWS (NWRs)
Schedule: 2016–2020

Environmental Education

Interpretive Programs

1. Encourage and promote nonconsumptive use of greater sandhill cranes throughout their range. Nonconsumptive use and the need for a better understanding of these cranes is recognized as an integral part of this plan. Subcommittee member agencies should publish information on the life history of these cranes and the need for a cooperative management program. The development of interpretive programs by participating agencies, other groups and organizations that include cranes is encouraged.

Priority: 2
Responsibility: AGFD, CDFW, IDFG, NDOW, UDWR, FWS
Schedule: 2016–2020

Inventories

Population Count

1. The mid-winter aerial survey conducted the first full week of January will index the winter population, and document changes in distribution. To obtain the most accurate recruitment data, surveys should be conducted in October – early November; survey results should be reported to the Subcommittee at the annual meeting.

Priority: 1
Responsibility: AGFD, CDFW, FWS
Schedule: 2016–2020

Research

Delineation of Populations

1. Population affiliation of cranes known to nest in some areas in western Idaho, Oregon, and eastern Washington is currently unknown (R. Drewien, pers. comm.). Cranes from these locations should be banded and color marked to determine if all or a portion of cranes are LCRVP cranes.

Priority: 1
Responsibility: AGFD, CDFW, IDFG, NDOW, UDWR, FWS, CRIT
Schedule: 2016–2020

Annual Production Surveys

2. Annual recruitment surveys should be conducted on winter range during late-November or early-December to determine annual reproductive success.

Priority: 1
Responsibility: AGFD, CDFW, FWS
Schedule: 2016–2020

ANNUAL REVIEW

The Subcommittee shall meet annually or as needed to measure progress toward achieving the goal and objectives of this plan and to recommend revisions. For the Subcommittee to initiate effective management, representatives should inform the Subcommittee of local issues or problems which may pose a threat to the population or crucial habitats. The Subcommittee shall report on accomplishments and shortcomings of the cooperative management efforts to the Pacific Flyway Council (through the Pacific Flyway Study Committee), those state and federal agencies with management responsibilities, and those agencies and organizations either interested in or cooperating in crane management.

Priority: 1
Responsibility: Subcommittee
Schedule: Annual

LITERATURE CITED

- August, C. W. 2011. Demography of greater sandhill cranes in Northeast Nevada. M.S. Thesis, University of Nevada, Reno. 73 pp.
- Austin, J. E., A. R. Henry, and I. J. Ball. 2007. Sandhill crane abundance and nesting ecology at Grays Lake, Idaho. *Journal of Wildlife Management* 71:1067–1079.
- Braun, C. E., R. C. Drewien, C. D. Littlefield, and L. H. Walkinshaw. 1975. Conservation Committee on status of sandhill cranes. *Wilson Bulletin* 87(2):297–302.
- Brown, W. M., and R. C. Drewien. 1995. Evaluation of two power line markers to reduce crane and waterfowl collision mortality. *Wildlife Society Bulletin* 23:217–227.
- Case, D. J., and S. J. Sanders, editors. 2009. Priority information needs for sandhill cranes: a funding strategy. Developed for the Association of Fish and Wildlife Agencies by the Migratory Shore and Upland Game Bird Support Task Force.
- Collins, D. P., B. A. Grisham, C. M. Conring, J. M. Knetter, W. C. Conway, S. A. Carleton, and M. A. Boggie. 2015. New summer areas and mixing of two greater sandhill crane populations in the Intermountain West. *Journal of Fish and Wildlife Management* 7:141–152.
- Conring, C. M. 2016. Spatial ecology of the Lower Colorado River Valley Population of greater sandhill cranes (*Grus Canadensis tabida*). M.S. Thesis. Texas Tech University, Lubbock, TX. 175 pp.
- Czaplewski, R. L., C. M. Crowe, and L. L. McDonald. 1983. Sample sizes and confidence intervals for wildlife population ratios. *Wildlife Society Bulletin* 11:121–128.
- Drewien, R. C. 1973. Ecology of Rocky Mountain Greater Sandhill Cranes. Ph.D. Dissertation. University of Idaho, Moscow. 152 pp.
- Drewien, R. C., and J. C. Lewis. 1987. Status and distribution of cranes in North America. Pages 469–477 *in* Archibald and R. F. Pasquier, editors. Proceedings of the 1983 International Crane Workshop. International Crane Foundation, Baraboo, Wisconsin.
- Drewien, R. C., R. J. Oakleaf, and W. H. Mullins. 1976. The sandhill crane in Nevada. Pages 130–138 *in* J. C. Lewis, editor, Proceedings International Crane Workshop. Oklahoma State University Publishing Print, Stillwater.
- Dubovsky, J. A. 2016. Status and harvest of Sandhill Cranes: Mid-Continent, Rocky Mountain, Lower Colorado River Valley, and Eastern Populations. Administrative Report, U.S. Fish and Wildlife Service, Lakewood, Colorado. 15 pp.
- Dubovsky, J. A. 2017. Status and harvest of Sandhill Cranes: Mid-Continent, Rocky Mountain, Lower Colorado River Valley, and Eastern Populations. Administrative Report, U.S. Fish and Wildlife Service, Lakewood, Colorado. 44 pp.

- Kruse, K. L., and J. A. Dubovsky. 2015. Status and harvests of Sandhill Cranes: Mid-Continent, Rocky Mountain, Lower Colorado River Valley, and Eastern Populations. Administrative Report, U.S. Fish and Wildlife Service, Lakewood, Colorado. 14 pp.
- Kruse, K. L., D. P. Collins, C. M. Conring, B. A. Grisham, W. C. Conway, and J. M. Knetter. 2017. Summer resource selection of the Lower Colorado River Valley Population of greater sandhill cranes. *Journal of Fish and Wildlife Management*: *in review*.
- Lewis, J. C. 1977. Sandhill crane. Pages 5–43 in G. C. Sanderson, editor, Management of migratory shore and upland game birds in North America. International Association of Fish Wildlife Agencies.
- Phillips, A., J. Marshall, and G. Monson. 1964. The birds of Arizona. University of Arizona Press, Tucson.
- U.S. Department of the Interior, U.S. Fish and Wildlife Service, and U.S. Department of Commerce, U.S. Census Bureau. 2011 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation.
- U.S.D.I. 2007. Proposed hunting regulations for the Lower Colorado River Valley population of greater sandhill cranes in the Pacific Flyway. U.S. Department of the Interior, U.S. Fish and Wildlife Service, Portland, OR. 13pp.

APPENDICES

APPENDIX A. Peak numbers of Lower Colorado River Valley Population of sandhill cranes observed at the Lund, Nevada spring stopover from 1976–1987 (Nevada Department of Wildlife records).

Year	Number observed	Date	Number of count days
1976	497	February 27	3
1977	850	February 28	7
1978	485	February 28	2
1979	768	March 6	4
1980	1,028	March 6	6
1981	1,094	March 5	2
1982	324	March 2	1
1983	1,076	March 1	5
1984	1,459	February 28	4
1985	1,427	March 6	20
1986	340	February 20	24
1987	319	February 28	5
1993	376	March 11	1