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Priority Information Needs for Sandhill Cranes: A Funding Strategy

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Priority Information Needs for Sandhill Cranes

A FUNDING STRATEGY

Developed by the Association
of Fish and Wildlife Agencies'
Migratory Shore and Upland
Game Bird Support Task Force.

October 9, 2009



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Compiled and Edited by
David J. Case and Sarah J. Sanders
D.J. Case & Associates
October 9, 2009

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Sandhill crane illustration on page ii by USFWS

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Executive Summary

This Strategy contains recommendations for obtaining priority information needed to improve management decisions for migratory populations of sandhill cranes, focusing on initiating or enhancing monitoring efforts and estimating vital rates during the annual cycle of these birds. The Strategy is intended to increase financial support for management and research activities over the next 5 to 10 years with thoughtful and deliberate planning built on basic scientific principles.

The Migratory Shore and Upland Game Bird Support Task Force determined that convening a workshop of sandhill crane experts with knowledge about each of the six migratory populations would be the most efficient and effective process to develop the strategy. Experts from Flyways, universities, and from state and federal agencies in the United States and Canada were invited to the workshop. The workshop was held April 7–9, 2009 at the U.S. Fish and Wildlife Service Region 6 Office in Lakewood, Colorado.

The sandhill crane is an ancient North American species with fossil records dating back at least 2.5 million years. They are large, vocal, spectacular birds with unique breeding displays and have become symbols of international cooperation for bird conservation. Sandhill cranes are long-lived and have the lowest recruitment rates (5–15% immatures/total cranes) of any North American game bird. Generally, sandhill cranes do not breed until 3–5 years of age and lay two eggs each year. Less than twenty percent of pairs are successful in raising young each year, and most successful pairs fledge only one young.

North American sandhill cranes are divided into three non-migratory and three migratory subspecies. The non-migratory subspecies (Florida, Cuban, and Mississippi) are relatively small populations with restricted ranges, and specialized conservation programs already exist for their management.

The migratory subspecies (greater, Canadian, and lesser) are collectively the most abundant of the world's cranes and occupy a vast range that includes Russia (Siberia), Canada, the United States, and Mexico. For management purposes, the three migratory subspecies have been grouped into six populations: Central Valley Population, Eastern Population, Lower Colorado River Valley Population, Mid-Continent Population, Pacific Coast Population (also called the Pacific Flyway Population), and Rocky Mountain Population. The Mid-Continent Population is comprised of all three subspecies, whereas the other populations are comprised almost exclusively of either the greater or lesser subspecies.

These six populations occupy various habitats during their round-trip movements from nesting to wintering areas, and each of the six populations poses different management challenges. Because of their unique life history characteristics, the migratory sandhill crane populations were selected as a focus for development of an individual funding strategy for priority research and management needs, separate from the other hunted species of webless

Executive Summary

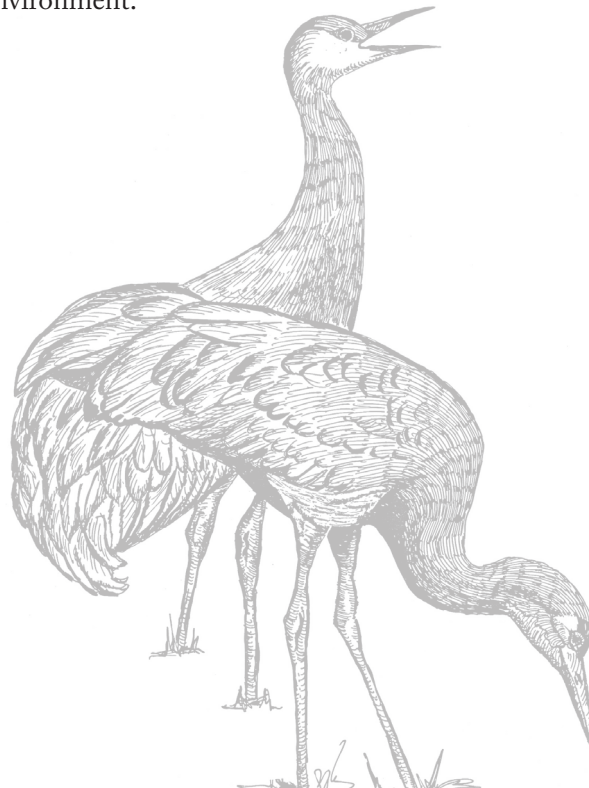
migratory birds. For the hunted populations, harvest strategies are dependent upon accurate information on abundance, recruitment, and mortality to accurately monitor population levels.

The workshop resulted in the identification of five priority information needs for sandhill cranes (in priority order):

1. Improving Sandhill Crane Harvest-Management Decision Structures.
2. Improving the Eastern Population Sandhill Crane Survey.
3. Information Needs for Sandhill Crane Populations in the West.
4. Assessing Effects of Habitat Changes on the Rocky Mountain Population of Sandhill Cranes.
5. Improving Population Abundance Estimates for the Mid-Continent Population of Sandhill Cranes.

Workshop participants also identified overarching guidelines that should be considered in further development of each of the priority information needs; i.e., (1) recognize that multiple countries share sandhill crane management, (2) recognize the relative importance of critical habitats and their impacts on crane abundances and distributions, (3) recognize that modern agricultural practices influence crane populations and management decisions, (4) recognize the importance of private landowners to conserving habitats, and (5) recognize the substantial economic benefits to society provided by sandhill cranes.

Ultimately, these priorities help build on the foundation of current efforts in a way that ensures the long-term conservation and informed harvest management of these critically important birds in the face of a changing environment.



Introduction

In 2006, the Migratory Shore and Upland Game Bird Working Group (Working Group) established a Migratory Shore and Upland Game Bird Support Task Force (Task Force). The Task Force is composed of nine representatives of state, federal and non-governmental organizations. The Task Force was directed to update the research and management needs of the 16 species of migratory shore and upland game birds (MSUGB) and to develop a strategy for funding priority research and management needs for these species. The sandhill crane (*Grus canadensis*) is one of the webless game bird species that was targeted for development of a funding strategy.

STRATEGY PURPOSE

This Strategy contains recommendations for obtaining priority information needed to improve management decisions for migratory populations of sandhill cranes, focusing on initiating or enhancing monitoring efforts and estimating vital rates during the annual cycle of these birds. The Strategy is intended to increase financial support for management and research activities over the next 5–10 years with thoughtful and deliberate planning built on basic scientific principles. Resulting priorities will be used to guide the acquisition and expenditure of funds, as well as provide the means to attract additional funds from partners interested in migratory shore and upland game birds. Separate from the Strategy, an Action Plan will be developed to encourage partners to collaborate and support these information needs, to use or redirect current funding, and to secure new funding. Finally, the Action Plan will ensure the development of a consistent message when pursuing funding.

STRATEGY DEVELOPMENT PROCESS

The Task Force determined that convening a workshop of sandhill crane experts with knowledge about each of the six migratory populations would be the most efficient and effective process to develop the strategy. Experts from Flyways, universities, non-governmental organizations, and from state and federal agencies in the United States and Canada were invited to the workshop. The workshop was held April 7–9, 2009 at the U.S. Fish and Wildlife Service Region 6 Office in Lakewood, Colorado. A list of workshop participants is included in Appendix A. The Task Force retained D.J. Case & Associates to facilitate the workshop and to compile and finalize the Strategy.

Status of Sandhill Cranes

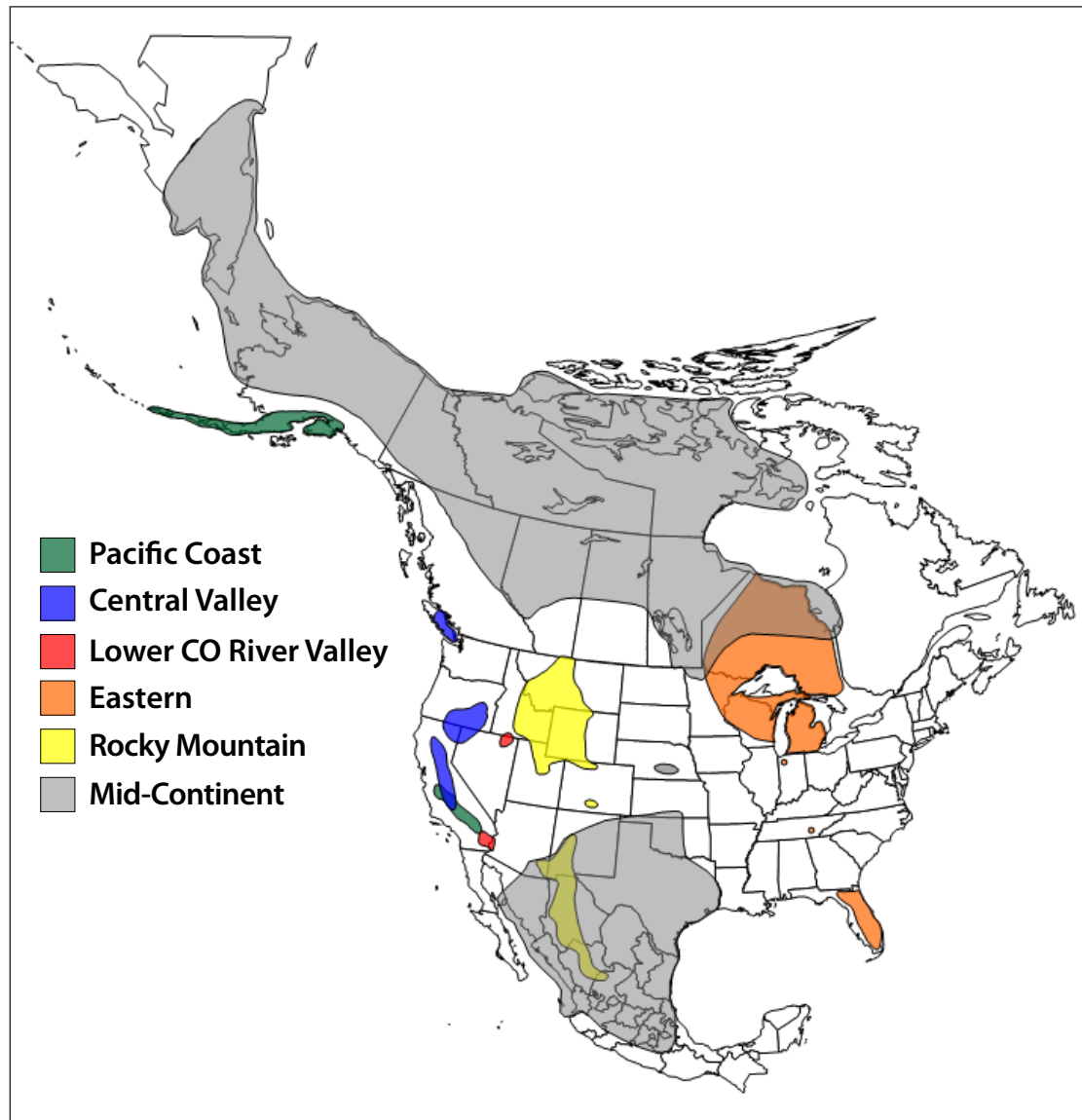
The sandhill crane is one of the most ancient species of birds that inhabits North America (fossil records date back at least 2.5 million years). They are large, vocal, spectacular birds with unique breeding displays and have become symbols of international cooperation for bird conservation and management. They are long-lived and have the lowest recruitment rates (5–15% immatures/total cranes) of any game bird in North America. Generally, sandhill cranes do not breed until 3–5 years of age and lay two eggs each year. Less than twenty percent of pairs are successful in raising young each year, and most successful pairs fledge only one young per year.

North American sandhill cranes are divided into three non-migratory and three migratory subspecies. The non-migratory subspecies (Florida [*G. c. pratensis*], Cuban [*G. c. nesiotis*], and Mississippi [*G. c. pulla*]) are small populations with restricted ranges and have specialized conservation programs developed for their recovery and management.

The migratory subspecies (greater [*G. c. tabida*], Canadian [*G. c. rowani*], and lesser [*G. c. canadensis*]) are collectively the most abundant of the world's cranes and occupy a vast range that includes Russia (Siberia), Canada, the United States, and Mexico. For management purposes, the three migratory subspecies have been grouped into six populations: Central Valley Population, Eastern Population, Lower Colorado River Valley Population, Mid-Continent Population, Pacific Coast Population (also called the Pacific Flyway Population), and Rocky Mountain Population (Figure 1). The Mid-Continent Population is comprised of all three subspecies, whereas the other populations are comprised almost exclusively of either the greater or lesser subspecies.

These six populations occupy multiple habitats during the course of their round-trip movements from nesting to wintering areas, and each of the six populations poses different management challenges. Because of their unique life history characteristics, the migratory sandhill crane populations were selected as a focus for development of an individual funding strategy for priority research and management needs, separate from the other hunted species of webless migratory birds. For the hunted populations, harvest strategies are dependent upon accurate information on abundance, recruitment, and mortality to accurately monitor population levels.

Figure 1. Approximate Nesting, Winter, and Primary Migration Staging Areas of the Six Migratory Sandhill Crane Populations (compiled from information in Lewis 1977, Drewien and Lewis 1987, Sharp et al. 2000, Tacha et al. 1994, and data from radio-telemetered birds provided by G. Krapu, Northern Prairie Wildlife Research Center, Jamestown, ND).



SOCIO-ECONOMIC VALUE

Each year, sandhill cranes attract thousands of people to witness the migration spectacles at traditional spring- and fall-staging areas. Some of the most well-known festivals occur near San Antonio, New Mexico; Alamosa, Colorado; Othello, Washington; Lodi, California; Fairbanks, Alaska; Bellevue, Michigan; and Kearney, Nebraska. Probably the best-known area for crane viewing occurs along the Platte River in central Nebraska during late March. Over 90,000 visitors travel to the Platte River Valley each spring and add about \$30 million to the local economy.

Sandhill cranes also are important game birds for both North American subsistence hunters and sport hunters and the economic impact of sandhill crane hunting is considerable. In the United States during the 2008 hunting seasons, almost 140,000 sandhill crane hunting permits were issued and about 11,000 active sport hunters harvested nearly 27,500 sandhill cranes. An additional 16,000 cranes were harvested by hunters in Canada and Mexico. According to the National Survey of Fishing, Hunting, and Wildlife Associated Recreation, the estimated average per capita expenditures for migratory bird hunters was \$588 in 2006.

POPULATION STATUS AND TRENDS OF MIGRATORY POPULATIONS

Cooperative Flyway Management Plans have been developed and implemented for all six of the migratory populations; however, the plan for the Eastern Population is still in the draft stage of development. In total, about 650,000 sandhill cranes occur in the six migratory populations and all are currently near population objective levels set in those plans (Table 1). Harvest strategies have been developed for the Mid-Continent and Rocky Mountain Populations and annual sport hunting seasons for these populations occur in Canada, Mexico and the United States. A low level of harvest occurs in southern Alaska for the Pacific Coast Population. An experimental hunting season has been approved for the Lower Colorado River Valley Population, but has not been implemented. The Mississippi Flyway has been developing a harvest strategy for the Eastern Population, but to date no hunting season has been proposed. The Central Valley Population is not hunted.

About 4,000 sandhill cranes and their eggs are harvested annually during subsistence hunts in Alaska, Canada, and possibly Siberia during the nesting season. Most of this harvest occurs on the Mid-Continent Population; however, some harvest of the Eastern Population also may occur.

Table 1. Abundance, Trends, and Harvest Statistics for Migratory Sandhill Crane Populations

Migratory Population	Approximate Hunter Harvest	Approximate Population Size	Recent Population Trend
Central Valley	N/A	7,000	Increasing
Eastern	N/A	35,000	Increasing
Lower Colorado River Valley	N/A	2,500	Stable
Mid-Continent	35,000	560,000	Stable
Pacific Coast	250	25,000	Assumed stable
Rocky Mountain	800	20,000	Stable

Priority Information Needs

The workshop resulted in the identification of five priority information needs for sandhill cranes (in priority order):

1. Improving Sandhill Crane Harvest-Management Decision Structures.
2. Improving the Eastern Population Sandhill Crane Survey.
3. Information Needs for Sandhill Crane Populations in the West.
4. Assessing Effects of Habitat Changes on the Rocky Mountain Population of Sandhill Cranes.
5. Improving Population Abundance Estimates for the Mid-Continent Population of Sandhill Cranes.

Rationale, descriptions, timetables and costs for each of the priorities are provided in the following pages.

GUIDELINES

Workshop participants identified five overarching guidelines that should be considered in further development of each of the five priority information needs.

1. Increase involvement of Canada, Mexico and Russia. These three countries support significant portions of North American crane populations yet are not fully integrated into the management decisions that affect these birds.
2. Consider the effects of climate or system change on crane habitats and ultimately on the abundance and distribution of cranes.
3. Recognize that agricultural practices at both the landscape scale and locally have a fundamental influence on all sandhill crane populations and that sandhill crane populations can have a negative impact on agriculture through crop depredation. Large-scale changes in agriculture due to development, climate change or other factors can affect sandhill crane populations quickly and significantly.
4. Sandhill crane populations are sustained in large part by the collective habitat conservation efforts of a variety of conservation partners. Landowners must be substantial partners in their conservation.
5. Sandhill cranes have significant economic effects on local economies. Recreational hunting, wildlife festivals, and wildlife watchers bring money to local communities and support their conservation. Keeping these partners engaged is critical to sustaining sandhill crane populations.

Priority 1. Improving Sandhill Crane Harvest-Management Decision Structures

RATIONALE

Harvest management of sandhill cranes currently uses simplistic threshold approaches based on population objectives. For the Rocky Mountain and Mid-Continent Populations, harvest-regulation changes are considered if the most recent three-year average of each population's index falls above or below a specified range. Recent work has shown that equating a decision threshold (when to make changes in regulations) with an objective threshold (acceptable population index/number), such as those used for the Rocky Mountain and Mid-Continent Populations, may not be the best method of achieving management objectives. Sandhill crane life history (i.e., long-lived, delayed maturity, age-related recruitment) makes it difficult to adjust management actions sufficiently once the index falls outside the target range of values. This is especially true since, due to inherent imprecision of surveys, a minimum three-year lag is required to take action. The population trajectories for these cranes could have a considerable amount of "inertia" before a problem is recognized and corrective actions are implemented. In addition, because non-hunting mortality of cranes is thought to be no more than 10%, hunting could have an impact on crane populations at a lower harvest rate than for most other hunted bird species.

Given these uncertainties and risks, an analytical review of crane life history and population dynamics in the context of harvest management is warranted. This analysis would develop stage-based models of the Rocky Mountain and Mid-Continent Populations to address two issues. First and foremost, what are the risks to these populations, in light of management objectives, of continuing the current decision rules for harvest decisions? If the risks are unacceptable, should the decision rules be altered, and is additional monitoring information needed to better inform decisions? In addition, for any specified level of monitoring effort, what can be expected in terms of performance measures identified in management objectives (e.g., crane harvest and crane numbers)? Second, given the limitations of our knowledge of crane populations and the best-case scenario with respect to the monitoring effort that could be devoted to cranes, what are the potential advantages and limitations for using models to directly inform management decisions? As part of this effort, hypotheses about other important and measurable limiting factors on a population or subpopulation can be evaluated (e.g., the effect of climatic variables on recruitment).

Results from an initial modeling effort using existing data will provide an assessment of these issues, as well as tools to build a decision-making framework that would be applicable to all hunted sandhill crane populations, and ultimately would improve harvest management decisions that sustain sandhill cranes at identified abundance levels and distributions. Such sandhill crane models also could be informative for non-hunted populations of cranes, and could be further adapted to address their management needs.

DESCRIPTION

An initial modeling effort would be used to review current decision rules and their implications for sustaining sandhill cranes at objective levels, and would identify whether gaps exist in current monitoring efforts relative to attaining management objectives. Currently, several operational monitoring programs are available to assess abundance, harvest, and in some cases recruitment. Because a larger number of reliable data streams exist for the Rocky

Mountain Population (i.e., operational abundance, harvest, and recruitment surveys, and estimates of survival from historical data) than for other populations, it is logical to build a stage-based model for this population first, followed by one developed for the Mid-Continent Population. The richness of the data associated with the Rocky Mountain Population will allow us to evaluate the value of each source of data in developing management decisions and assessing performance.

TIMETABLE AND COST

The timetable is four years, beginning immediately, at \$50,000 annually. This could be funded as a graduate student project over four years, or a postdoctoral research project over two years.

Priority 2. Improving the Eastern Population Sandhill Crane Survey

RATIONALE

The Eastern Population is rapidly expanding in size and geographic range. Although the population is not currently hunted, the Mississippi and Atlantic Flyway Councils are developing a management plan for Eastern Population cranes that includes provisions for establishing hunting seasons in states within these flyways. Managers anticipate that some states will immediately request approval for hunting seasons once the plan is completed, which further heightens the need for reliable population estimates. An operational survey for Eastern Population cranes will provide data necessary for responsible management of this population, which includes considerations for consumptive and non-consumptive uses as well as other interactions with humans (e.g., crop depredation, plane collisions).

Although the U.S. Fish and Wildlife Service has coordinated a survey for the Eastern Population since 1979, it is ad hoc in nature. The survey occurs during the last week of October and is conducted by volunteers as well as personnel from the federal and state agencies. During the survey, numbers of cranes at historic migratory staging areas are recorded, and the sum of these area-specific counts provides a fall index of the population.

Much of the survey is dependent on volunteer efforts, which may or may not be available in the future. The lack of a standardized protocol is a major deficiency of the survey. Furthermore, not all sites are surveyed each year and the extent to which this affects the reliability of population estimates is unknown. This study will explore the use of imputation techniques in population/trend estimation procedures to account for years when certain sites are not surveyed.

To date, managers believe the survey has done an adequate job of documenting, in a general sense, the rapid growth of this population. However, a rigorous analysis of historic data has not been conducted. Such analyses should be conducted immediately, especially considering the fact that proposals for new hunting seasons are likely forthcoming. A standardized protocol for existing survey sites also should be developed.

In the longer term, the survey needs to be refined to address the geographic expansion of the population and to provide a more statistically sound methodology for estimating crane abundance. Little is known about the geographic extent of breeding, migration, and wintering

ranges of the Eastern Population. Recently, tracking of birds via satellite telemetry has been successfully used for the Mid-Continent Population to better understand these critical life history aspects. A similar study is necessary for the Eastern Population not only to improve our understanding of migration ecology, but such information will be critical to adequately target the timing, locations, and sampling intensity for this population survey.

DESCRIPTION

This priority has two parts:

1. Conduct a critical review of the current survey to identify deficiencies, conduct a statistical analysis of historic data, and recommend methodological improvements to increase its reliability. This review also would include development of a standardized protocol for conducting the survey.
2. Document the geographic extent of breeding, migration, and wintering ranges of Eastern Population cranes and make appropriate changes to the spatial/temporal design of the population survey to reflect contemporary distributions and migration patterns. This project will be accomplished by placing solar-powered satellite transmitters on cranes at important migration stopover locations. The long life expectancy of such transmitters will allow documentation of wintering ranges and subsequent breeding locations of cranes. This information also will provide insight to the approximate boundary between the Eastern and Mid-Continent populations. In addition to tracking cranes via transmitters, an attempt will be made to capture and color-mark cranes on several breeding sites. Information from re-sightings of color-marked cranes during migration and winter will complement results obtained from satellite tracking of cranes. Information gained from the satellite telemetry project will then be used to conduct a review of the current population survey to identify deficiencies and make recommendations for improving the existing survey or recommending a new survey protocol.

TIMETABLE AND COST

1. Survey evaluation: A proposal for this project in the amount of \$50,000 will be developed in time for the FY10 request for proposals. A final report would be completed within 12–18 months once funding is secured.
2. Document geographic range: A multi-year proposal in the amount of \$425,000 will be developed in time for the FY10 request for proposals. We envision a total of 40 cranes being captured on at least two migration stopover sites and fitted with solar-powered transmitters. Bird locations would be monitored for at least two years to document the geographic extent of breeding, migration and wintering areas of Eastern Population cranes. Approximately 100 cranes would be captured and color-marked on various breeding sites in the United States and Canada. A final report would be completed within 12–18 months once funding is secured.

Priority 3. Information Needs for Sandhill Crane Populations in the West

RATIONALE

Sufficient information to inform harvest-management decisions is lacking for the three defined populations of sandhill cranes wintering along the Lower Colorado River and in the Central Valley of California. The Lower Colorado River Valley Population currently is defined by its winter range along the Lower Colorado River and Gila Rivers in Arizona, the Imperial Valley in California, and Baja California Norte and Sonora in Mexico. The primary breeding areas are thought to be in northeast Nevada. Winter ranges of the Central Valley Population, Pacific Coast Population, and the coastal-nesting Canadian sandhill cranes in southeast Alaska and British Columbia overlap in the Central Valley of California. This common winter range makes separation of those populations during winter counts difficult. The bulk of the Central Valley Population breeds in northeast California and southcentral Oregon. Survey efforts are confounded because these populations mix on wintering grounds and include three subspecies. Because of the close proximity of all three western populations of greater sandhill cranes and the uncertainty surrounding the breeding origins of the Lower Colorado River Valley Population, the populations may intermingle at various locations during their annual cycles.

A very conservative hunt has been approved for the Lower Colorado River Valley Population; however, better delineation of breeding areas would help in the future management of these birds. Recent changes in the status of wintering birds is inconsistent with demographic information from nesting areas thought to be primary source areas of the Lower Colorado River Valley Population. A better understanding of the source areas for this population would: (1) permit a better biological rationale for the harvest management plan for this population, and (2) provide valuable information on the extent to which the Lower Colorado River Valley Population intermixes on the breeding grounds with the Central Valley and Rocky Mountain Populations, providing insights into appropriate monitoring strategies for these populations.

DESCRIPTION

To define the breeding range of the Lower Colorado River Valley Population, a project would be initiated to determine summer distribution and breeding origins of greater sandhill cranes which winter along the Lower Colorado River in Arizona and California. Marking cranes with satellite radios and tarsal bands at wintering locations and following their movements northward during spring and summer would help identify breeding areas. Coupled with this winter marking, cranes should also be marked with tarsal bands at known breeding locations in western Idaho, eastern Oregon, western Utah and eastern British Columbia. An ongoing project being conducted by Dr. Jim Sedinger of the University of Nevada, Reno will mark cranes on breeding areas in Nevada, and resulting data will complement what is proposed here. Observation of markers in the winter ranges along the Lower Colorado and Gila rivers in Arizona and the Salton Sea in California will be relatively easy and cost-effective because the cranes are concentrated in fairly restricted areas.

A survey should be designed to provide population estimates and trends for cranes wintering in the Central Valley and along the Lower Columbia River in Oregon and Washington. An experimental survey using stratified sampling along randomly selected transects was initiated in the Sacramento Delta by Oregon State University and U.S. Geological Survey biologists in 2007. These methods could be adapted to cover the entire winter range of these cranes. Aerial

surveys would provide total numbers of cranes at various winter sites, and those data would be adjusted using ground surveys to assess subspecies composition which will allow population estimates. Such surveys could be conducted annually or on a 3–5 year rotation and would provide an index to the populations.

TIMETABLE AND COST

The timetable is three years at \$160,000 total, which includes two years of field time and materials for 20 satellite transmitters (PTT) at \$130,000 and one-year for survey design at \$30,000.

Priority 4. Assessing Effects of Habitat Changes on the Rocky Mountain Population of Sandhill Cranes

RATIONALE

Winter habitat has been identified as the major bottleneck for the Rocky Mountain Population. Currently, approximately 80% of Rocky Mountain Population cranes winter in two New Mexico counties encompassing 34 river miles, 5,000 acres of managed wetlands, and a limited number of acres of suitable agriculture. Of those agriculture acres available, only about 600 acres are planted with high-energy foods such as corn, sudan, and milo.

The Middle Rio Grande Valley in New Mexico and the San Luis Valley in southern Colorado have experienced increasing impacts from human influences that are compromising the long-term capability of these areas to provide adequate forage and roosting habitats to sustain cranes at objective levels. The impacts of changing human activities on the landscape present immediate challenges to cranes, especially in New Mexico.

Changing practices on private lands (e.g., shifts from farming small grains to alfalfa and vegetables; selling of farmland tracts to real-estate developers) has reduced the availability of suitable winter food resources to those occurring on three state-owned waterfowl management areas and Bosque del Apache National Wildlife Refuge in New Mexico. Recently, two important properties were offered for sale; however, funds were not available for conservation easements or acquisition. These properties were particularly valuable because their spatial locations promoted crane distributions that would decrease the danger of disease outbreaks. Currently, agricultural land with pre-1907 water rights costs \$35,000–\$40,000/acre; other lands with lower priority water rights cost \$14,000/acre.

The San Luis Valley is large in geographic size but limited with respect to areas valuable to cranes. The Spring Creek corridor contains the Monte Vista and a portion of the Alamosa National Wildlife Refuges, whereas the Rio Grande corridor runs southward to the confluence of the Conejos River and to a lesser degree the Russell Creek area near the town of Saguache. All these areas currently are providing the energetic needs to all spring- and fall-migrating Rocky Mountain Population cranes as well as a growing number of Mid-Continent Population cranes. Changes in agricultural markets have greatly reduced the total acreage being planted in barley, which historically has been important to cranes. Agriculture crops, including wheat and barley, are capable of meeting cranes' energetic needs, but increasing use of fall tillage makes these resources less available. Increased numbers of people in rural landscapes are increasing human/crane conflicts and the type and occurrence of disturbance to cranes.

Due to limited wetlands and food resources in the Middle Rio Grande Valley, concentrations of light geese have experienced avian cholera outbreaks; these outbreaks have resulted in roosting sandhill cranes dying from the disease. Uncertainty in the future of water availability (physical and legal), increasing urban expansion, and loss of farming traditions will further reduce the future value of the Middle Rio Grande Valley to cranes. Reduced hydrological flows in the Rio Grande have resulted in limited suitable roost sites, requiring cranes to expend greater amounts of energy in search of available food resources.

DESCRIPTION

Hire a time-limited coordinator for 4–5 years to:

- Establish cooperative agreements with other land-management agencies to protect and improve crane habitat on public lands.
- Partner with sportsmen and environmental groups to support sandhill crane habitat-development projects on public and private lands.
- Evaluate, develop and promote outreach and grant projects to encourage and enable public and private landowners to protect and improve crane habitat.
- Promote conservation easements, leases, or acquiring agricultural lands suitable for cranes that might otherwise be converted to other uses.
- Participate in local government decision-making to encourage maintenance of lands in agricultural production.
- Employ information and education initiatives to impart public understanding of the importance of preserving agricultural lands for sandhill crane management.
- Seek opportunities for additional water rights to maintain habitats for wintering Rocky Mountain Population sandhill cranes.

TIMETABLE AND COST

The timetable is 4–5 years at \$100,000/year.

Priority 5. Improving Population Abundance Estimates for the Mid-Continent Population of Sandhill Cranes

RATIONALE

The Mid-Continent Population is the largest sandhill crane population in world. This population provides substantial recreational opportunity through hunting and viewing and generates significant economic benefits to many areas.

The current survey framework has been in place since 1982 and uses diurnal counts, photo-corrected for visibility bias, on a sub-sample of the 54 transects in the Central Platte River Valley of Nebraska to produce a spring index of abundance. This survey is supplemented, on a limited basis, by aerial and ground survey efforts by state agencies to estimate numbers of cranes outside the surveyed area. The Cooperative Flyway Management Plan for this population defines a reliable population index for the Mid-Continent Population as one in which $\geq 90\%$ of the population is estimated as being within the area where photo-corrected counts are conducted.

Measuring Success

Defined as above, the survey has produced unreliable indices only four out of 26 years during the period from 1982 through 2007. However, three of the four unreliable counts occurred during 1999 through 2007, raising concern that the estimates are becoming less reliable given habitat changes, especially in the Central Platte River Valley. The distribution of Mid-Continent Population cranes counted within the Central Platte River Valley survey area can be affected by the number of cranes “soaring” during the survey, severe local weather, dewatering of the Platte River and subsequent encroachment by vegetation, competition from increasing numbers of snow geese in the Central Platte River Valley, and changing agricultural practices that leave less food on the landscape. These changes, along with climate change, also may be affecting migration patterns.

A study is currently underway to investigate the standardized annual survey date for the cooperative spring survey. Investigators are using information from telemetered cranes to help identify areas that have sandhill cranes which may not have reached or possibly have already migrated past traditional stopover areas in the Central Platte River Valley at the time of the survey. If these areas hold large numbers of cranes on the date of the spring survey, then changes to the survey protocol may be necessary.

DESCRIPTION

Evaluations of other survey methods should include comparisons to results from the current survey methodology for abundance, variability, and reliability. Nocturnal infrared videography has shown promise for estimating abundance of the Mid-Continent Population in previous evaluations and eliminates some of the known sources of variation in the existing survey. This technique could be refined further to eliminate potential biases and improve data-processing efficiency. A meeting between remote sensing experts and survey biologists should be convened to identify technologies that have a high likelihood of successfully estimating abundance of the Mid-Continent Population (both within and outside of the Central Platte River Valley), or improve estimates provided by nocturnal infrared videography techniques that previously were evaluated.

TIMETABLE AND COST

A team of experts should be assembled as soon as possible to evaluate potential new technologies and methodologies to survey the Mid-Continent Population. Once a new methodology is tested and determined to be a viable annual survey, it should overlap the existing Central Platte River Valley survey data for several (at least five) years. The estimated cost to evaluate new survey technologies and methods is \$200,000. Upfront costs for remote sensing equipment to be used in operational surveys are estimated to be \$100,000.

Measuring Success

All of the priorities described in this strategy promote efforts to reduce uncertainty in current management practices or initiate studies on poorly monitored populations. Success in addressing these priority needs will increase our knowledge of the ecology and habitat requirements of migratory sandhill crane populations. The improved information will better enable managers to target site-specific and range-wide management and monitoring programs, increasing the cost-effectiveness of management.

Appendix A

2009 Workshop Participants

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