Lower Colorado River Valley Sandhill Crane (*Grus canadensis*) Breeding and Wintering Ecology

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BACKGROUND/JUSTIFICATION

The Lower Colorado River Valley Population of sandhill cranes (LCRVP) is the smallest of the migratory populations of sandhill cranes. An identified management challenge with the LCRVP is uncertainty of its breeding origins due to intermingling and close proximity to other western sandhill crane populations (Rocky Mountain Population (RMP) and Central Valley Population (CVP)). Current coordinated winter aerial cruise surveys and ground counts conducted over 4 major wintering areas (Cibola National Wildlife Refuge (NWR), the Colorado River Indian Tribes wetland areas, Sonny Bono Salton Sea NWR, and Gila River) encompass ≥90% of this population. Approximately 30% of the cranes wintering in the LCRV have been located in the Nevada breeding range during the summer, leaving the remainder of the population unaccounted for during the breeding season. The primary LCRVP breeding areas are thought to be in northeast Nevada, specifically Elko and White Pines Counties. Because only 30% of the breeding population is currently accounted for on the wintering grounds there has been speculation that breeding occurs in other areas. Speculation regarding where LCRV cranes breed include: 1) western Utah, 2) south-central Owyhee County, Idaho (Mullins 1974), 3) southwestern Idaho (Drewien et al. 1976), and 4) Malheur County, Oregon. However, cranes in these areas belong to either the LCRVP or CVP (Littlefield and Thompson 1979). August (2011) suggested that federal and state lands in Nevada thought to encompass the breeding population may only contribute in a minor fashion to the overall population dynamics because suitable habitat may occur elsewhere, and there is little state and federal lands in the area favorable to breeding cranes. August (2011) found lower nest success rates on private lands (0.32 ± 0.08) in northeastern Nevada than either the Central Valley (0.72 ± 0.04, Ivey and Dugger 2008) or Rocky Mountain (0.41 ± 0.03, Austin et al. 2007; 0.65 ± 0.10, McWethy and Austin 2009) populations. This low nest success is inconsistent with recent estimates of recruitment on wintering LCRV cranes (Drewien and Rabe, personnel communications).

Current Pacific Flyway population management of the LCRVP is driven by abundance. Abundance is estimated throughout its wintering range along the Lower Colorado River and Gila Rivers in Arizona, the Imperial Valley in California, and Baja California Norte and Sonora in Mexico. Major concentrations are present on Cibola NWR and Colorado River Indian Reservation in La Paz County, Arizona (Pacific Flyway Council 1995). Current abundance indices and the low numbers of known nesting areas of the LCRVP resulted in the identification of priority information needs for this population of sandhill cranes by the Migratory Shore and Upland Game Bird Support Task Force. This information included the delineation of their current breeding range. Identification of these areas will provide valuable information on the extent to which the LCRVP intermixes on the breeding grounds with the CVP and RMP of cranes. Additional information that can be collected is seasonal movement and habitat selection data. Delineating breeding and wintering range is critical information for this population in order to be managed effectively. Knowledge of breeding and wintering habitats can be used to identify habitat needs, schedule appropriate monitoring strategies to assess population size, estimate recruitment and survival, and evaluate site fidelity for breeding and wintering cranes. All this information, basic to most managed bird populations, are relatively unknown for this species (USFWS 2009).

OBJECTIVES

The primary purpose of this study is to determine the breeding and wintering distribution of Lower Colorado River Valley sandhill cranes. Our goals are to identify the geographic area to prescript conservation measures. The following are specific objectives to be addressed in the study:

(1) Delineate and identify use areas outside of northeast Nevada by breeding and non-breeding individuals
(2) Describe winter movements and habitat needs
(3) Assess habitat selection and use during spring migration
(4) Assess the extent to which the LCRVP intermixes on the breeding grounds with CVP and RMP cranes
(5) Identify future wintering habitat needs, given climate change. This information is necessary to establish the geographic area within which conservation measures can be undertaken to protect and enhance this population of cranes.

STUDY AREA / CAPTURE LOCATIONS

Cibola NWR
    Cibola NWR encompasses 6,988 ha of land in La Paz County, Arizona and Imperial County, California. The refuge was established in 1964 to mitigate the loss of fish and wildlife habitat due to water salvage and channelization projects along the Colorado River by the U.S. Bureau of Reclamation. Cibola NWR consists of 5 integrated Management Units and is the only refuge on the Lower Colorado River where cranes are found (Figure 1).

Sonny Bono Salton Sea NWR
    Sonny Bono Salton Sea NWR encompasses 13,259 ha in Imperial County, California. The refuge was established in 1930 as sanctuary for wintering, migrating, and breeding birds. The refuge consists of two managed units with courses of the New and Alamo Rivers running through the refuge (Figure 2).

Wheat Granary – South of Brawley, CA
    The wheat granary is located approximately 4 miles south of Brawley, CA surrounded by alfalfa and cereal grain fields. Also in close proximity, D&K duck club acts as a roosting site throughout the overwintering period (Figure 3).

EXPERIMENTAL DESIGN

    We captured sandhill cranes using rocket-nets (Wheeler and Lewis 1972, Urbanek et al. 1991) and noose snares (Hereford et al. 2001) at Cibola NWR in La Paz County, AZ and Sonny Bono Salton Sea NWR in Imperial County, CA during January and February 2014. We identified adult breeding cranes using adult plumage characteristics. We attached one solar-powered GPS satellite transmitter (hereafter PTT) (Ivey et al. 2005) to the left leg of each adult crane using a 2-piece leg band. One half of the leg band displayed a unique engraved alpha-numeric code for future identification purposes. We mounted the PTT on the tibia above the tibio-tarsus with the

antenna pointing down. We banded each crane with a standard size 9 U.S. Geological Survey Bird Banding Laboratory band on the right tibia above the tibio-tarsus (Krapu et al. 2011).

We programmed the PTTs to record 4 GPS locations per day in order to describe wintering, breeding, and migration movements and habitats. In addition, the PTTs were programmed to transmit Doppler locations and diagnostics data every 72 hours for 8-hour periods as secondary location data. We will use doppler locations to obtain reliable locations and subsequently used to determine locations of marked cranes throughout the annual cycle along with the GPS location data. We download data on a weekly basis directly from Service Argos, each with an Argos Location Class associated with it. See Fancy et al. (1988) and Harris et al. (1990) for a thorough description of the Argos system.

Identify Use Areas Outside of Northeast Nevada by Breeding and Non-Breeding Individuals

We identified new breeding ground distribution and staging areas using KML files, Google Earth, and ArcGIS. Breeding areas were categorized once individual crane movements became concentrated. It is difficult to determine a staging area solely on time spent there because available food, space, and energy also play key roles when choosing staging areas (Alerstam and Lindstrom 1990). However, we used the criteria in Warnock (2010) to assess if an area was a staging area or stopover area. According to Warnock (2010), stopover sites were typically occupied for hours-days (i.e. more than one hour up to 6 days). If a crane remained in an area for two consecutive location recordings (~6 hrs), but less than a week, that area was considered a stopover area. If more than one crane remained in an area for that length of time, the area was labeled as a "critical" stop over area. If any of the cranes used an area for more than one week, we classified that area as a staging area (Warnock 2010). Areas were labeled as a "critical" staging area if more than one crane used a particular area for longer than a week. For staging and stopover areas, we assessed the length of time in days and hours (e.g. 5 days 14 hours) that a crane stayed in an area before continuing their migration north.

Habitat Selection and Use

We will evaluate habitat selection using a Type III approach (Manly et al. 2002), where use and availability are identified at the animal level. Estimates derived from Type III assessments can be used to estimate parameters (and estimate variability) for the population of interest (Manly et al. 2002). We will classify the measured resource units as available (random) or used and use a generalized mixed linear model with a binomial error distribution (PROC GLIMMIX) to assess habitat selection for both refuges and other priority areas. Expected date for conducting this analysis is Summer 2015.

Climate Change Forecasting

We will use a geographic information system to extrapolate the most supported habitat covariates from the study to develop a predictive habitat selection model for cranes in the Lower Colorado River Valley. We will follow the methodologies in Grisham et al. (2013) by extrapolating the predictive values from the equation produced in interpolated relationship between the dependent variable (selection) and independent (covariates from habitat selection assessment) variables. We will then project all data in GIS to assist in identification of broad-

scale environmental patterns to predict crane habitat selection in the Lower Colorado River Valley, given climate change forecasts. These data can be used as an index to identify areas of high conservation priority for cranes in the LCRV.

RESULTS

We captured sandhill cranes using rocket nets and noose snares 7 January– 20 February 2014 at three different trapping locations. We captured 40 sandhill cranes (Table 1) and attached one ARGOS Satellite Transmitter to a subset of identified adult cranes at each trapping location. Presently, we deployed 10 PTTs at Cibola NWR, five in Imperial County south of Brawley, and one at Sonny Bono Salton Sea NWR (Imperial Valley birds). We have four remaining PTTs and they will be deployed 28 July– 1 August 2014 in Idaho, northeast of Boise.

We have received 7, 317 usable GPS locations with an accuracy within 100 m. The average locations recorded per bird captured on Cibola and the Imperial Valley are 553 and 468, respectively. Of the 16 PTTs, two have malfunctioned and are not included in the previously stated location estimates and will not be used in the study. One from each study area malfunctioned leaving nine birds tagged at Cibola and five birds tagged in the Imperial Valley.

The PTTed cranes left their wintering grounds in early February through the middle of March. We categorized seven areas as stopovers, five of which qualified as critical stop-over areas. Eight cranes stopped over on Wayne E. Kirch WMA in Nye County, Nevada and five cranes stopped over on Pahranagat NWR in Lincoln County, Nevada, making these areas the two most used critical stopover locations. The remaining critical areas were Mojave National Preserve in San Bernardino County, California, Nesbitt Lake in Lincoln County, Nevada, and private land ~12 miles south of Boulder City, Nevada, in Clark County. Each of these areas were only used by two PTTed cranes each (different birds). Other stopover areas included: private land north of Alamo, Nevada, and the Ruby Valley/Humboldt-Toiyabe National Forest area (Figure 4).

We identified two staging areas, one of which met our criteria to be considered critical. The Ruby Valley-Humboldt-Toiyabe National Forest was used by five cranes that are currently breeding in Idaho (Figure 5). The other staging area was Duck Valley Indian Reservation in Owyhee County, Idaho; however this particular crane is now breeding on the Nevada side of the reservation (~10 miles from where it staged), so the individual may have been searching for nesting habitat instead of staging.

As of 15 July 2014, six cranes are in Elko County, NV and three cranes are in White Pine County, NV, which lie in the known breeding range of the LCRVP cranes in northeast Nevada. Four of the Elko County cranes are in the Ruby Valley/Humboldt-Toiyabe National Forest and the other two are in the Duck Valley Indian Reservation/Humboldt-Toiyabe National Forest. Two of the three cranes located in White Pine County are suspected to be a pair due to heavy location overlap. This pair is currently located northwest of Lund, Nevada. The third crane is in the Bassett/Garden Creek area just east of the Schell Creek Mountains. Four cranes are located in Owyhee County in southwest Idaho, also part of the known breeding range. These four cranes are located on the Duck Valley Indian Reservation and on adjacent private lands. One crane (CIB 001) has established its breeding territory in an undocumented LCRVP breeding area north of Lake Cascade in Valley County, Idaho (Figure 6). Due to lack of information of sandhill crane distribution in this area, we have chosen this area as the location to capture and tag cranes with the four remaining PTTs.

Although it was not included in the analyses, one of the two malfunctioning PTTs (CIB 009) recorded locations through the end of April 2014. Based on the information available, it stopped over at Wayne E. Kirch WMA, private land south of Pahranagat NWR, private land south of the Ruby Valley area in White Pine County, Nevada, Ruby Valley/Humboldt-Toiyabe National Forest, Duck Valley Indian Reservation, and along the Payette River in Payette and Gem Counties in Idaho. This crane was the only PTTed crane to use private land south of Pahranagat NWR, private land south of the Ruby Valley area in White Pine County, Nevada, and land along the Payette River in Payette and Gem Counties in Idaho. It did not stage at any point throughout its migration. CIB 009 seemed to establish itself on the Washington-Adams County line before we lost contact with it in late April.

We have developed the preliminary statistical code for Objective 2 and plan to analyze data for this objective when we have data from 2014-2015 wintering months (March 2015). We will assess home range size for each individual crane using the Brownian Bridges movement model (BBMM; Jennrich and Turner 1969, Worton 1995, Horne et al. 2007) and Arc GIS 10.2 (hereafter GIS). Brownian bridge models estimate an animal movement path using location data collected at comparatively short time interludes (Nielson et al. 2013). This method is more applicable than other common methods (e.g. Kernel density estimate) for our assessment because the assumption of independent locations is relaxed in BBMM. This method is more robust because cranes are highly social and locations are dependent on where other cranes are present (Horne et al. 2007). Home range juxtaposition to resources (ie. Crops, water, etc.) will also be assessed using similar methods.

MANAGEMENT IMPLICATIONS

The results of our study are critical to providing basic information needed to manage the smallest population of migratory cranes in North America. The information gained from this study will enable agencies and land managers to target breeding and wintering landscapes for conservation of LCRVP sandhill cranes. Any habitat maps and GIS layers produced will be used as a tool for interested parties (e.g. USFWS, AGFD, NGO's, and private landowners) to incorporate into wildlife management plans.

TIME TABLE

Time	Activity
November 2013 –August 2014	Begin identifying trap sites and trapping
January 2014 – December 2016	Collect and analyze ARGOS data as well as produce initial maps
January – March 2016	Develop and submit draft report for review
May 2016	Submit final report

PARTNERSHIPS

ACKNOWLEDGEMENTS

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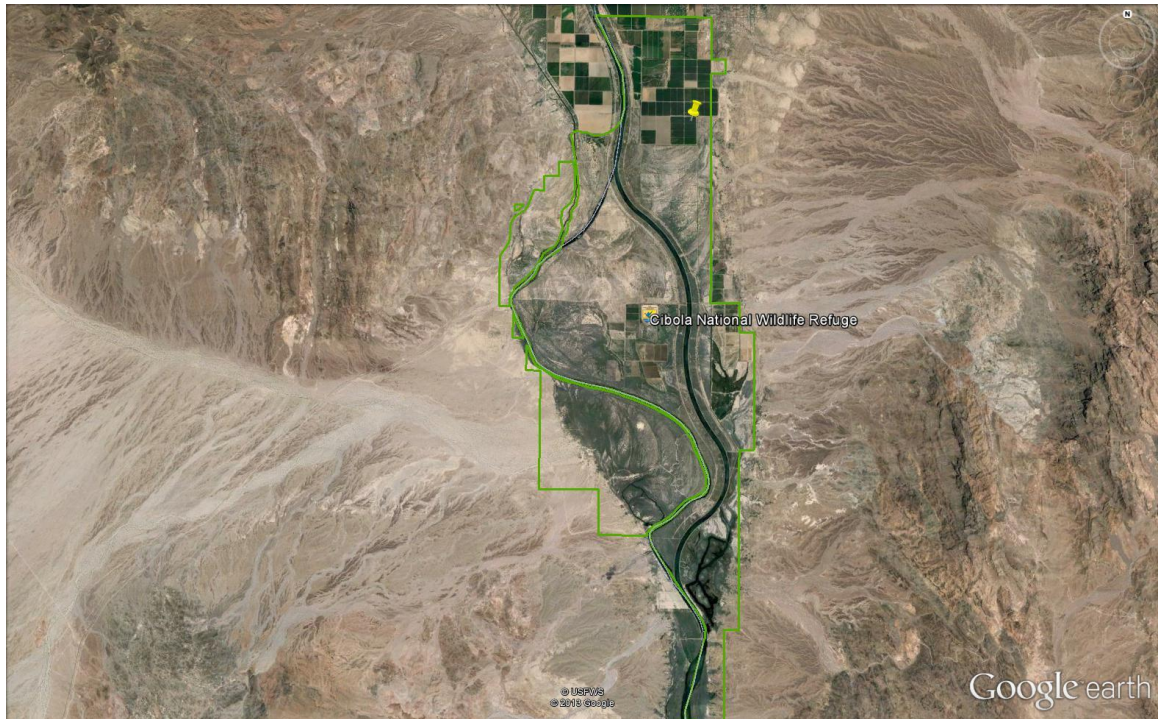
Figure 1. Cibola NWR and capture location.

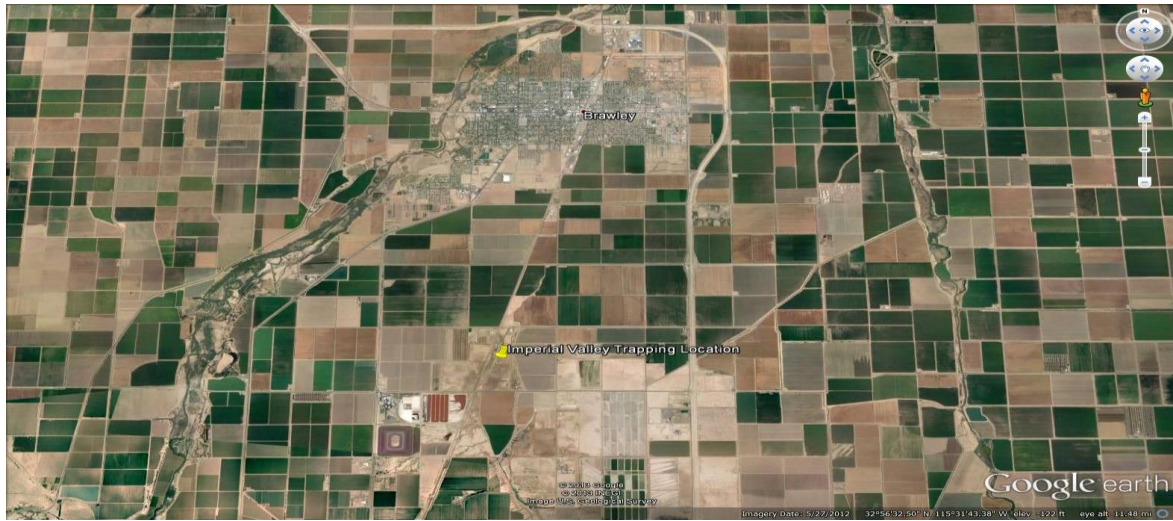Figure 2. Sono Bono Salton Sea NWR and capture location.

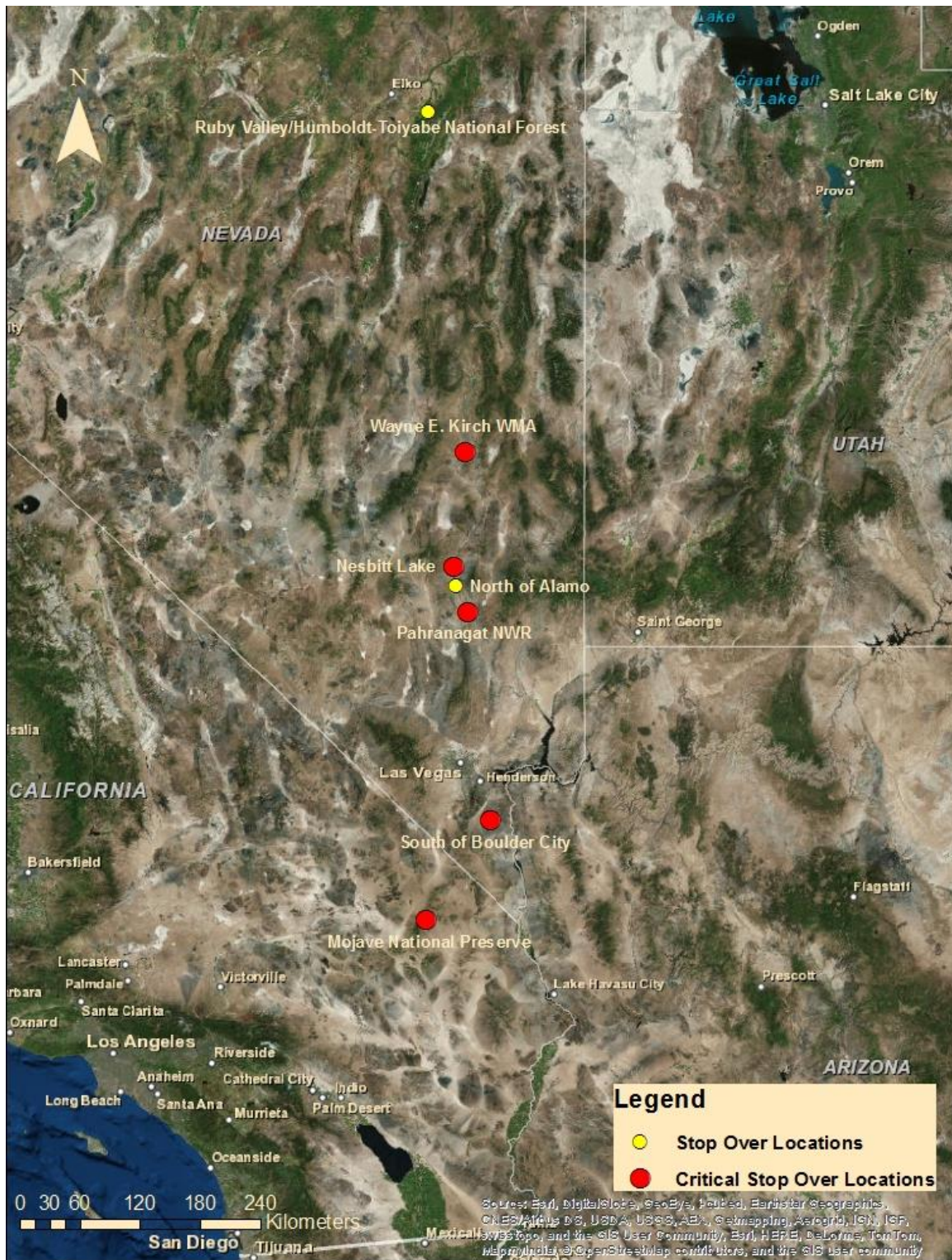Figure 3. Wheat granary capture location south of Brawley, CA.

Figure 4. LCRVP sandhill crane northerly (spring) migration stop over locations.

Figure 5. LCRVP sandhill crane northerly (spring) migration staging locations.

Figure 6. Breeding locations for each crane categorized into breeding areas.

Age	Cibola NWR	Imperial County	Salton Sea NWR	Grand Total
AHY	26	11	1	38
HY	0	0	0	0
SY	1	1	0	2
Total	27	12	1	40

Table 1. Lower Colorado River Valley sandhill crane banding summary by trapping locations, 2014.