Energy Research and Development Division
FINAL PROJECT REPORT

GOLDEN EAGLE ABUNDANCE IN THE DESERT RENEWABLE ENERGY CONSERVATION PLAN AREA

Prepared for: California Energy Commission
Prepared by: Humboldt State University and Western EcoSystems Technology, Inc.

SEPTEMBER 2015
CEC-500-2015-077

PREPARED BY:

Primary Authors:
T. Luke George
Joel Thompson
Ryan Nielson

Humboldt State University
1 Harpst St.
Arcata, CA 95521
Phone: 707-499-4053 | Fax: 970-672-8545

Western EcoSystems Technology, Inc.
415 W. 17th Street, Suite 200
Cheyenne, WY 82001
http://www.west-inc.com/

Contract Number: 500-12-005

Prepared for:

California Energy Commission

Lillian Mirviss
Joe O'Hagan
Contract Managers

Aleecia Gutierrez
Office Manager
Energy Generation Research Office

Laurie ten Hope
Deputy Director
ENERGY RESEARCH AND DEVELOPMENT DIVISION

Robert P. Oglesby
Executive Director

DISCLAIMER

This report was prepared as the result of work sponsored by the California Energy Commission. It does not necessarily represent the views of the Energy Commission, its employees or the State of California. The Energy Commission, the State of California, its employees, contractors and subcontractors make no warranty, express or implied, and assume no legal liability for the information in this report; nor does any party represent that the uses of this information will not infringe upon privately owned rights. This report has not been approved or disapproved by the California Energy Commission nor has the California Energy Commission passed upon the accuracy or adequacy of the information in this report.

ACKNOWLEDGEMENTS

The authors would like to thank the California Energy Commission for support and funding. The authors also thank the pilots J. Greenhalgh and J. Romero (Owyhee Air), along with the observers and field support: W. Goldenberg, A. Gottesman, W. Lawton, J. Eckel, and T. Rintz. The National Park Service (NPS) allowed surveys to be conducted over all NPS lands within the study area and the Department of Defense allowed access to restricted airspace in many cases. B. Noll and L. McManus assisted with data management and statistical analyses.

PREFACE

The California Energy Commission Energy Research and Development Division supports public interest energy research and development that will help improve the quality of life in California by bringing environmentally safe, affordable, and reliable energy services and products to the marketplace.

The Energy Research and Development Division conducts public interest research, development, and demonstration (RD&D) projects to benefit California.

The Energy Research and Development Division strives to conduct the most promising public interest energy research by partnering with RD&D entities, including individuals, businesses, utilities, and public or private research institutions.

Energy Research and Development Division funding efforts are focused on the following RD&D program areas:

- Buildings End-Use Energy Efficiency
- Energy Innovations Small Grants
- Energy-Related Environmental Research
- Energy Systems Integration
- Environmentally Preferred Advanced Generation
- Industrial/Agricultural/Water End-Use Energy Efficiency
- Renewable Energy Technologies
- Transportation

Golden Eagle Abundance in the Desert Renewable Energy Conservation Plan Area is the final report for the Aerial Line Transect Surveys for Golden Eagles within the Desert Renewable Energy Conservation Plan Area project (contract number 500-12-005) conducted by Humboldt State University and WEST, Inc. The information from this project contributes to the Energy Research and Development Division's Energy-Related Environmental Research Program.

For more information about the Energy Research and Development Division, please visit the Energy Commission's website at www.energy.ca.gov/research/ or contact the Energy Commission at 916-327-1551.

ABSTRACT

Golden eagles (*Aquila chrysaetos*) are a Covered Species in the Draft Desert Renewable Energy Conservation Plan because of their low density and potential sensitivity to wind and solar energy development. However, planners lack precise estimates of their density and abundance in the region. This study examined the feasibility of estimating golden eagle density and abundance in the Desert Renewable Energy Conservation Plan Area using methods developed for the Western United States Golden Eagle Survey. The researchers flew aerial surveys between July 31-August 6 (post-fledging surveys) and December 9-15, 2013 (winter surveys) over Desert Renewable Energy Conservation Plan Area, which included National Park Service lands and Department of Defense lands. During the post-fledging surveys, two golden eagle groups were observed. Three golden eagle groups were observed during the winter surveys. Because of the low sample sizes, the researchers combined observations in the DRECP survey with observations from the Western-wide Golden Eagle Survey to estimate the probabilities of detecting golden eagles during the surveys. Therefore, based on the proportion of the area surveyed and estimates of the probability of detecting golden eagles in the sample areas, the researchers estimated there were 80 (90 percent confidence interval 31 to 191) and 135 (90 percent confidence interval 41 to 340) golden eagles in the Desert Renewable Energy Conservation Plan Area during the post-fledging and winter surveys, respectively. The Western United States Golden Eagle Survey methodology was used to estimate golden eagle abundance in the Desert Renewable Energy Conservation Area. It was determined that additional effort or a different survey design is needed to obtain a level of precision allowing detection of moderate changes in the eagle population over time. Changes to the survey design would require either conducting more than one pass over the area, increasing the density of transects or using information on golden eagle habitat associations to inform the placement of transect lines across the study area.

Keywords: golden eagle, aerial transects, density, abundance, Desert Renewable Energy Conservation Plan

Please use the following citation for this report:

George, T. L., J. Thompson, and R. Nielson. (Humboldt State University and WEST, Inc.). 2014. G***olden Eagle Abundance in the Desert Renewable Energy Conservation Plan Area.*** California Energy Commission. Publication number: CEC-500-2015-077.

TABLE OF CONTENTS

Acknowledgements i

PREFACE ii

ABSTRACT iii

TABLE OF CONTENTS iv

LIST OF TABLES v

EXECUTIVE SUMMARY 1

Introduction 1

Project Purpose 1

Project Results 2

Project Benefits 2

CHAPTER 1: Introduction 3

Chapter 2: Methods 4

2.1 Transects and Aerial Surveys 4

2.2 Statistical Analyses 9

CHAPTER 3: Results 10

CHAPTER 4: Discussion 12

Acronyms 14

REFERENCES 15

APPENDIX A: Location of Aerial Line Transects A-1

APPENDIX B: Research and Special Use Permits. B-1

LIST OF FIGURES

Figure 1: Golden Eagle observed from the air. 1

Figure 2: Location of Post-Fledging Golden Eagle Aerial Transects Within the Desert Renewable Energy Conservation Plan Area 5

Figure 3: Location of Winter Golden Eagle Aerial Transects Within the Desert Renewable Energy Conservation Plan Area 6

Figure 4: Golden Eagle Sighting During Survey 7

LIST OF TABLES

Table 1: Golden Eagle Groups Observed During the Desert Renewable Energy Conservation Plan Golden Eagle Surveys in 2013 10

Table 2: Estimated Average Probabilities of Detection for Four Categories of Observations During the Desert Renewable Energy Conservation Plan Golden Eagle Survey 10

Table 3: Estimated Density (no./km^2) and Abundance of Golden Eagles Within the Desert Renewable Energy Conservation Plan Study Area and 90 Percent Confidence Intervals (CI) 11

EXECUTIVE SUMMARY

Introduction

Concern about potential wind and solar development effects on golden eagles (*Aquila chrysaetos*), a protected species under the Bald and Golden Eagle Protection Act, may affect California's future renewable energy development. To understand the potential for such interactions, it is necessary to have a reasonable estimate of the number of Golden Eagles in the Mojave Desert. The Mojave Desert is one of the focused regions included in the Desert Renewable Energy Conservation Plan (DRECP). The DRECP is a comprehensive biological mitigation and conservation program providing effective protection and conservation of desert ecosystems while allowing for the appropriate development of renewable energy projects. The primary DRECP agencies include the Bureau of Land Management, U.S. Fish and Wildlife Service, California Energy Commission, and the California Department of Fish and Wildlife

Golden eagles, an iconic species, occur at low densities throughout their breeding range in the western United States and may be sensitive to wind and solar energy development. The golden eagle is also a Covered Species under the Draft DRECP. The United States Fish and Wildlife Service issued regulations under the Bald and Golden Eagle Protection Act that allow the take (defined as "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect") of golden eagles if the activity does not cause a net decrease in the number of breeding pairs within regional geographic management units. Information on the number of breeding and wintering golden eagles that currently occur within the DRECP area will provide a benchmark for assessing potential long-term changes in eagle abundance.

Project Purpose

There has been no systematic survey conducted to estimate eagle (all references to eagles in this document refer to golden eagles) densities across the DRECP region so the California Energy Commission (a lead DRECP agency) funded an aerial survey of golden eagles across the Plan Area using methods developed for the Western-wide Golden Eagle Survey. The researchers surveyed 2,518 km and 2,358 km of transects (sample areas) during the post-fledging and winter surveys, respectively, recording the sex, age, group size, and distance of golden eagles observed within 1 km of the transects.

Figure 1: Golden Eagle observed from the air.

Project Results

Researchers spotted two golden eagle groups along two transects during the post-fledging survey and three golden eagle groups along two transects during the winter survey. Because of the low sample sizes, the researchers combined observations in the DRECP survey with observations from the Western-wide Golden Eagle Survey to estimate the probabilities of detecting golden eagles during the surveys. Based on the proportion of the area surveyed, the number of birds observed, and the detection probability of golden eagles on the transects, the researchers estimated there were 80 (90 percent confidence interval 31 to 191) and 135 (90 percent confidence interval 41 to 340) golden eagles in the DRECP area during the post-fledging and winter surveys, respectively.

It is possible that prey densities and eagle numbers were depressed across the DRECP plan area in 2013 because of the severe drought relative to what might be expected during periods with more normal precipitation. Additional surveys would be necessary to better capture differences in population size as they relate to annual and/or multi-year variations in weather patterns.

Increasing the precision of estimates of eagle abundance using future aerial line transect surveys in the DRECP area will likely require changes to the survey design. Changes to the survey design would require either conducting more than one pass over the area, increasing the density of transects or using information on golden eagle habitat associations to inform the placement of transect lines across the study area.

The United States Fish and Wildlife Service allows take of golden eagles if an activity does not cause a net decrease in the number of breeding pairs within regional geographic management units (74 FR 46877, Sept. 11, 2009, as amended at 79 FR 73725, Dec. 9, 2013). The aerial surveys and the observations from the Western-wide Golden Eagle survey provided initial estimates of golden eagle density and abundance, but they are too uncertain to establish take limits for golden eagles in the DRECP. The information from the surveys can be used, however, to specify the effort that would be needed to achieve explicit targets for confidence intervals or detection of population trends.

Project Benefits

The pilot study demonstrated the feasibility of estimating golden eagle abundance within the DRECP area using aerial line transect surveys. The researchers obtained estimates of golden eagle density and abundance in the DRECP area that are comparable with estimates from the Western-wide Golden Eagle Survey, which has been conducted throughout most of the western United States annually since 2006. The golden eagle observations provide pilot data to design future aerial surveys with specific goals for the precision of density estimates or trend analysis.

The primary purpose of the DRECP is to conserve the species and natural communities covered under the DRECP, while streamlining environmental review and permitting processes for renewable energy projects in the Mojave and Colorado Desert regions within California. Estimates of golden eagle numbers in the DRECP area provide regulatory agencies with important baseline data for making decisions regarding permitting renewable energy projects in the region. Greater certainty about the number of golden eagles in the region also provides a basis to estimate the potential impacts of energy development on golden eagles.

CHAPTER 1: Introduction

In 2011, California passed SB X1-2 (Simitian, Chapter 1, Statutes of 2011) requiring the state to meet 33 percent of its energy needs with renewable energy by 2020. A key region for developing renewable energy is the Mojave and Sonoran Deserts because of their abundant wind and solar energy potential and proximity to large population centers and transmission lines. To streamline the permitting of large renewable energy projects while conserving the plants and wildlife in the California deserts, state and federal agencies have been working together to develop the Desert Renewable Energy Conservation Plan (DRECP). One of the goals of the DRECP is to ensure the conservation of important lands that meet the regulatory requirements of the California Natural Community Conservation Planning Act, Federal Endangered Species Act, and the Federal Land Policy and Management Act.

Golden eagles (*Aquila chrysaetos*) occur at low densities throughout their breeding range in the western United States (Nielson et al. 2014) and may be sensitive to wind and solar energy development. Wind energy projects may disturb nesting sites and cause mortality from collisions with wind turbines (Smallwood and Thelander 2008). Large solar projects may cause disturbance to breeding sites and reduce prey availability (Holroyd et al. 2010). In addition, infrastructure, particularly power transmission lines, associated with both wind and solar energy projects can cause significant mortality to golden eagles through collision or electrocution (Lehman et al. 2010). Because of their protection under the Bald and Golden Eagle Protection Act, iconic status, low densities, and potential sensitivity to wind and solar energy development, golden eagles were included for conservation consideration in the DRECP (2014). In 2009, the United States Fish and Wildlife Service issued regulations under the Bald and Golden Eagle Protection Act (16 United States Code 668–668d) that allow take of golden eagles if the activity does not cause a net decrease in the number of breeding pairs within regional geographic management units. Information on the number of breeding and wintering golden eagles that currently occur within the DRECP area will provide a benchmark for assessing potential long-term changes in eagle abundance.

Golden eagles breed and winter in the DRECP area; however, there has been no systematic survey to estimate eagle (all references to eagles in this document refer to golden eagles) densities across the region. As a result of this data gap, the Energy Commission (a lead DRECP agency) funded that an aerial survey of golden eagles be conducted across the DRECP area using methods developed for the Western-wide Golden Eagle Survey (WGES) (Nielson et al. 2014). This report summarizes the results of aerial surveys conducted in the DRECP area in July to August (post-fledging) and December (winter) 2013 and includes estimates of the density and abundance of golden eagles within the study area during the two periods.

Chapter 2: Methods

2.1 Transects and Aerial Surveys

Systematic aerial line transect surveys for golden eagles had never been conducted in the DRECP region and no specific goals regarding precision of density estimates were identified prior to the survey. As a result, this study should be considered a pilot project that could provide information for developing sampling targets for future surveys.

The researchers operated under several constraints during the establishment of the transect locations. Because the DRECP area was relatively small and narrow along the east-west axis, the researchers used a transect length of 50 km. In addition, a minimum spacing between transects of 50 km east-west and 25 km north-south was established to maximize the survey effort given the available resources and minimize the possibility of double counting eagles on adjacent transects. Most of the habitat in the DRECP area was low elevation desert with lower prey availability than other golden eagle habitat; therefore, it was assumed that eagle density would be lower than the densities observed during surveys conducted across much of western North America (Nielson et al. 2014). Based on this assumption, the maximum density of transects was established given the pre-existing budgetary and logistical constraints.

Using ArcGIS (ESRI 2011), the researchers selected a random starting point and generated a systematic sample of transect locations across the region. Like the WGES, large water bodies (>30,000 ha) and urban areas (no-fly zones) were excluded. During the post-fledging surveys, 69 transects or transect segments were established across the region, totaling 2,649 km (Figure 2). Transect segments were 50 km transects that were shortened to adhere to the DRECP area boundaries or no-fly zones. The researchers used the same transect lines from the post-fledging surveys for the winter surveys, except that a portion of transect 53 that overlapped urban/suburban development was dropped and transect 53 was split into two transects (Transects 53 and 70, Figure 3) (T. Rintz, personal communication). Thus, for the winter surveys, 70 transects or transect segments were established across the region, totaling 2,618 km (Figure 3).

Figure 2: Location of Post-Fledging Golden Eagle Aerial Transects Within the Desert Renewable Energy Conservation Plan Area

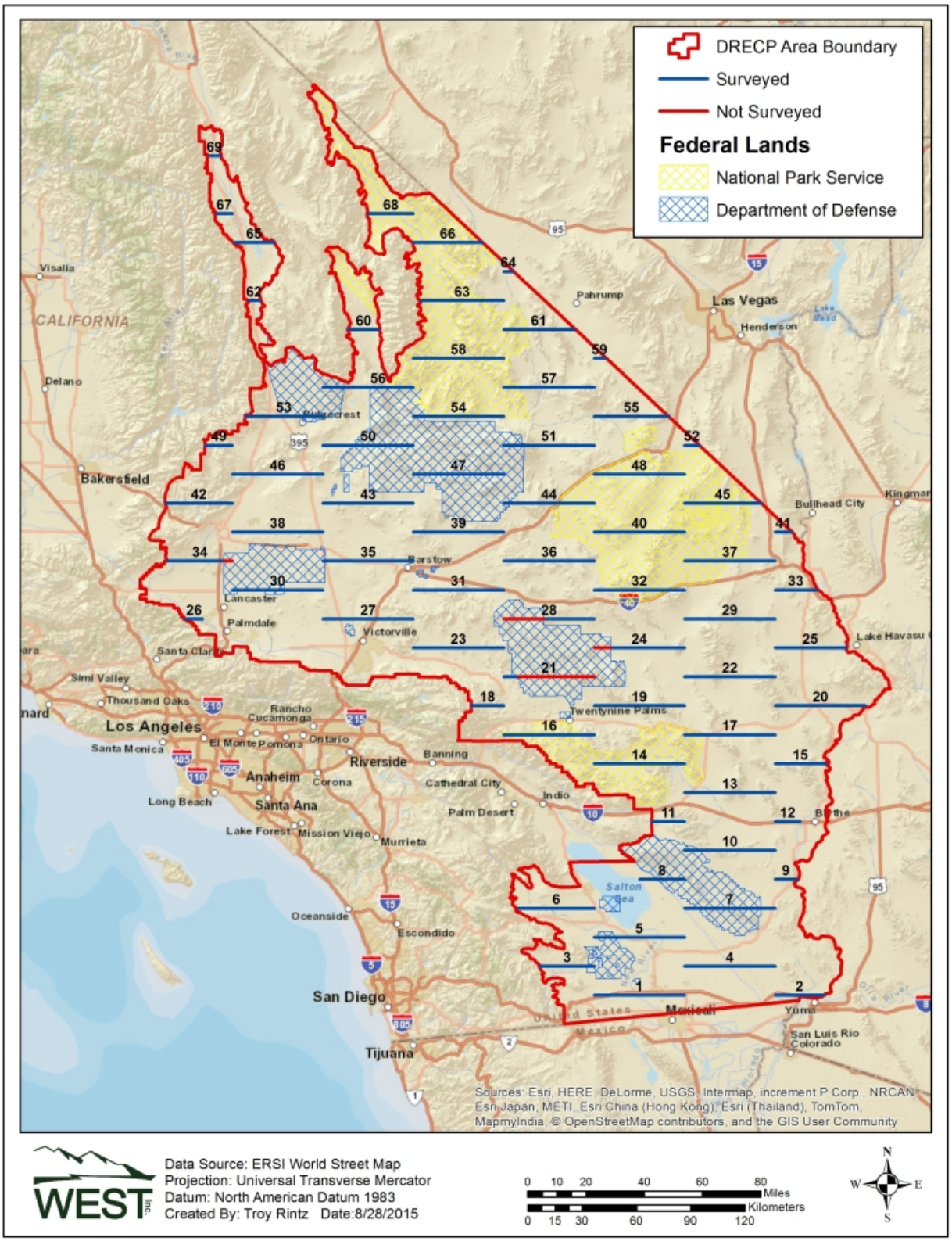
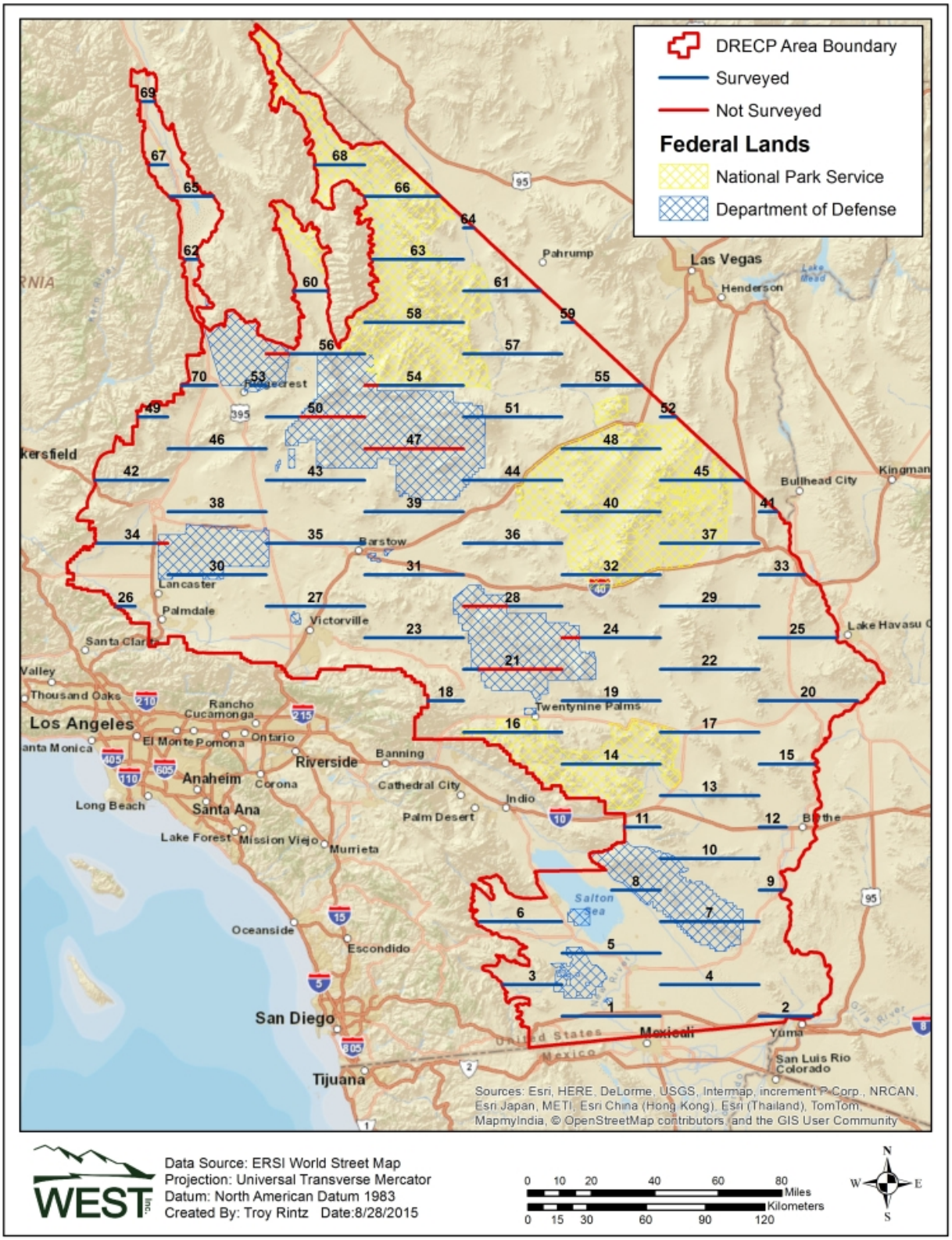


Figure 3: Location of Winter Golden Eagle Aerial Transects Within the Desert Renewable Energy Conservation Plan Area



Many of the transects overlapped Department of Defense (DOD) or National Park Service (NPS) lands, requiring clearance or permits for those areas before surveys could be conducted. After the transect locations were generated, Research Permits or Special Use Permits were obtained to fly over all of the NPS lands within the survey area (Appendix B). Permission was requested to fly over the portions of transects 21, 24, and 28 that overlapped the Marine Air Ground Task Force Training Command area near Twenty-nine Palms, CA (also known as the 29 Palms Marine Base) but our requests were denied both during the post-fledging and winter surveys. The researchers also requested but were denied permission to fly over a small (1.8 km) segment of transect 34 (Edwards Air Force Base) during the post-fledging surveys. During the winter surveys the researchers were denied permission to fly over portions of transects 47 and 54 over Fort Irwin National Training Center and all of transects 50 and 56 over China Lake Naval Air Weapons Station. The researchers also did not survey a portion of transect 53 during the winter surveys because it had subsequently been determined that a portion of the transect overlapped urban/suburban areas.

Each aerial transect was flown once between July 31 and August 6, 2013 (post-fledging surveys) and between December 9 and 15, 2013 (winter surveys) in a Cessna 206 aircraft operated by Owyhee Air Research (Nampa, ID). Following the protocol in the WGES survey, for safety reasons, transects over flat terrain were flown at 107 m above ground level (AGL) and those over rugged terrain were flown at 150 m AGL. Flights started within 15 minutes of local sunrise and continued until 11:00 am to 1:00 pm local time. Observations of golden eagles were collected following the WGES methodology (Nielson et al. 2013) which involved standard line transect methods that account for a decrease in detection probability with distance from the transect line (Buckland et al. 2001) combined with a mark-recapture component on the right side of the aircraft (Borchers et al. 2006). One observer was in the back-left seat and two observers were on the right side (front and rear seats) of the aircraft during most surveys.

Figure 4: Golden Eagle Sighting During Survey

Two students from Humboldt State University (HSU) and one experienced WEST, Inc. employee were observers on all transects during the post-fledging survey. One field ecologist was hired to fill in during a portion of the winter survey when one of the HSU students was not available. Prior to the post-fledging survey, the two HSU students attended ground training on July 29 and flew training flights on July 30. One of the students that conducted the post-fledging surveys also participated in the winter surveys. Ground training, but no flight training, was conducted prior to the winter survey and therefore one HSU student and one field ecologist conducted the surveys without prior flight training. Three observers were present for all flights except on December 12 when one observer was sick (back right).

Observers followed the WGES methods when flying surveys (Nielson et al. 2014). When flying transects, observers looked for perched and flying eagles (Figure 1 and Figure 4) on the side of the aircraft where they were sitting. Binoculars were not used because focusing on distances further from the transect line violates assumptions of standard distance sampling protocol (Buckland et al. 2001). When an observer saw what they thought was a golden eagle, the identity was verified by flying off transect to obtain a closer view. Perched birds were circled at low altitudes (50 m AGL) to confirm species identification, to age the individual, and to obtain Global Positioning System (GPS) locations that were later used to measure distances of observations from the transect line. For birds observed flying, the perpendicular distance from the transect line to the bird's original location (i.e., where it was first observed) was visually estimated by the observers. This visual estimate was verified by flying to the point on the surface below where the eagle was first detected and recording the location with real time GPS. A notebook computer equipped with real time GPS tracking was used to record the actual flight path of the airplane. The start and end points of each transect and changes in topography (smooth vs rugged) associated with changes in flight altitude were also recorded on the notebook computer. The group size, age, sex, location (perched or flying) of each eagle observation was recorded on a field data form. Golden eagles spotted while flying off-transect were noted, but were not used to estimate population densities.

Based upon visible plumage characteristics, eagles were classified into one of six age classes: 1) adult, 2) unknown adult (adult or older immature), 3) older immature (sub-adult), 4) juvenile, 5) unknown immature (juvenile or older immature), and 6) unknown (Clark 2001, Clark and Wheeler 2001, Bloom and Clark 2002).

During the post-fledging surveys, most of the flights originated from Lake Havasu City, Arizona; on the last day of the survey, the researchers flew from Inyokern, California. Temperatures were high during the survey period (average high: 43° C, average low: 30° C) but were close to the long-term averages for high and low temperatures in Lake Havasu City, Arizona in August (42° C and 26° C, respectively). Winter survey flights all originated from Needles, California. Daytime high temperatures were cool and nighttime lows were warm for the region during the winter survey period (average high: 15.0^{o} C, average low: 5.2^{o} C) compared to the long-term averages for high and low temperatures in Needles, California in December (23.3^{o} C and -1.7^{o} C, respectively). Visibility was not obstructed by weather, smoke, or smog during the surveys.

2.2 Statistical Analyses

Due to low sample sizes (few observed golden eagles), the DRECP observations were combined with observations from the WGES conducted during late-summer of 2006 to 2013 (Nielson et al. 2013) to estimate probabilities of detection. The researchers used Akaike's Information Criterion as a guide to model selection (Nielson et al. 2014: step [2]) based on the mark-recapture data (whether one or both observers detected an eagle group) collected on the right-side of the aircraft. Mark-recapture trials were used to estimate probability of detection at the distance from the transect line where probability of detection was highest (Borchers et al. 2006). At the distance where detection rates were greatest, it was assumed that the kernel distance function should equal the mark recapture detection probability, and the detection function was scaled so that the maximum height of the function was equal to the mark recapture probability at the distance where the maximum occurred (Nielson et al. 2014). The scaled detection function was then used to estimate the average detection probability for observations of flying golden eagle groups and perched groups when surveying from 107 m AGL.

Density was estimated using the standard line transect (distance) formula (Nielson et al. 2014: formula [4]),

$$\hat{D} = \frac{\sum_{i=1}^{n} s_i}{2(W_2 - W_1)L\overline{P}},$$

where n was the number of observed golden eagle groups; s_i was the size of the ith group; W_1 and W_2 were the minimum and maximum sighting distances, respectively; L was the total length of transects flown (thus, $2[W_2–W_1]L$ was the total area searched); and $\bar{P}$ was the estimated average probability of detection within the area searched. Density was estimated separately for perched and flying golden eagles in each season and total density was estimated as the sum of both types of observations. Abundance ($\hat{N}$) was estimated by multiplying density by the DRECP study area (A; 91,723 km^2 [22,665,200 ac]),

$$\hat{N} = \hat{D} * A.$$

Individual transects were bootstrapped to calculate 90 percent confidence intervals for golden eagle density and abundance within the DRECP study area. The WGES and DRECP observations were included in bootstrap process to account for variability in the estimates of probabilities of detection ($\bar{P}$). All analyses were performed in R (v3.1.0, R Core Team 2014).

CHAPTER 3: Results

The researchers surveyed 2,518 km and 2,358 km of transects during the post-fledging and winter surveys, respectively. Two golden eagle groups were observed during post-fledging survey along two transects and three golden eagle groups were observed along two transects during winter survey (Table 1). All five groups consisted of single individuals, and all individuals were within 1,000 m of the transect line (W_2 = 1,000 m; Nielson et al. 2014). No golden eagles were classified as juveniles; however, a single flying golden eagle was classified as an unknown immature (either juvenile or sub-adult) during post-fledging surveys (Table 1) using the decision matrix described in Nielson et al. (2014: Figure 4).

Estimated average probabilities of detection for flying and perched eagles from the right and left side of the airplane ranged from 0.385 to 0.590 (Table 2). The researchers estimated there were a total of 80 golden eagles (90 percent confidence interval 31 to 191) within the DRECP area during the post-fledging survey, and a total of 135 golden eagles (90 percent confidence interval 41 to 340) within the area during the winter survey (Table 3).

Table 1: Golden Eagle Groups Observed During the Desert Renewable Energy Conservation Plan Golden Eagle Surveys in 2013

Survey	Transect	Observation ID	Age class	Golden eagle activity
Post-fledging	22	2013-22-1-PF-1	Unknown immature	Flying
	34	2013-34-1-PF-1	Adult	Perched
Winter	69	2013-69-1-W-1	Unknown adult	Perched
	42	2013-42-1-W-1	Adult	Flying
	42	2013-42-1-W-2	Adult	Flying

Table 2: Estimated Average Probabilities of Detection for Four Categories of Observations During the Desert Renewable Energy Conservation Plan Golden Eagle Survey

Observer position(s)	Golden eagle activity	Aircraft AGL	Average probability of detection
Back-left seat only	Perched	107 m	0.467
Both right-side seats	Perched	107 m	0.590
Back-left seat only	Flying	–	0.385
Both right-side seats	Flying	–	0.476

Table 3: Estimated Density (no./km^2) and Abundance of Golden Eagles Within the Desert Renewable Energy Conservation Plan Study Area and 90 Percent Confidence Intervals (CI)

Season	Density (90 percent CI)	Abundance (90 percent CI)
Post-fledging	0.0009 (0.0003–0.0021)	80 (31–191)
Winter	0.0015 (0.0004–0.0038)	135 (41–340)

CHAPTER 4: Discussion

The estimate of the density of golden eagles in the DRECP area during the post-fledging surveys (0.0009 eagles/km^2; 90 percent CI 0.0003–0.0021) was lower than the average density estimate for the larger Sonoran and Mojave Desert Bird Conservation Region (also known as BCR 33), which from 1967 to 2010 was 0.0027 eagles/km^2 (Millsap et al. 2013). The density estimate in Millsap et al. (2013) is based on an integrated analysis of WGES and Breeding Bird Survey data and therefore is not independent of the estimate obtained in this study. In addition, though BCR 33 and the DRECP area overlap, the DRECP area occupies approximately 42 percent of the extreme western portion of the BCR, which is substantially drier and has lower primary productivity than the eastern portion of the BCR (Thomey et al. 2014). Therefore, it is likely that prey availability for golden eagles is also lower in the DRECP area and as a result may support lower eagle densities than the eastern portion of BCR 33.

Though the estimate of golden eagle density was higher during the winter surveys than the post-fledging surveys, the 90 percent confidence intervals of the two estimates substantially overlapped; therefore, the researchers found no support for a change in density between the two survey periods. Some golden eagles that breed in the western United States stay through the winter but others migrate, generally moving south in the winter (Kochert et al. 2002). In addition, golden eagles that breed in Alaska generally winter in the southwestern United States (McIntyre et al. 2008). Therefore, it is possible that some golden eagles that breed farther north move into the DRECP area during the winter. During the period December 1992 to November 1993, golden eagles were only observed in November and December during weekly raptor surveys along highways in the central portion of the DRECP area (Knight et al. 1999). Thus, there is some evidence from other studies suggesting that golden eagle densities may increase during the winter in the Mojave Desert, but the researchers were unable to detect a statistically significant change (alpha = 0.10) in golden eagle density between the post-fledging and winter periods in this study.

The density and population size estimates were largely based on detection probabilities from the WGES surveys. Because the researchers did not obtain enough observations to estimate detection probabilities of golden eagles within the DRECP study area, the researchers combined the five observations with over 1,000 observations from the WEGS surveys conducted during late-summer 2006 to 2013. Therefore, the estimates of golden eagle density and abundance obtained in this study are based on the assumption that detection probabilities in the DRECP area were similar to those on the WGES survey. It is likely that detection probabilities in the DRECP surveys are similar to those on the WGES surveys because: 1) the researchers used the same protocol as the WGES, 2) one experienced observer from the WGES survey was present on all flights and trained the other observers on the DRECP surveys, 3) the researchers used a flight contractor (Owyhee Air Research, Inc.) that had flown for the WGES, 4) the terrain was similar to areas in the Great Basin and Southern Rockies/Colorado Plateau Bird Conservation Regions that were included in the WGES, 5) the statistical analyses were conducted by the individuals

that had developed the analytical approach or had extensive experience with analysis of WGES data, and 6) detection probabilities on the WGES surveys have been relatively stable across years.

The general topography of the DRECP area, characterized by steep rugged mountains surrounded by extensive areas of desert scrub, is generally considered to be favorable habitat for golden eagles (Kochert et al. 2002), and therefore densities might be expected to be higher than the researchers found. The Mojave Desert, however, is one of the least productive ecosystems in the United States (Bamberg et al. 1976) and therefore densities may be limited by low prey densities as has been suggested for other eagle populations (Hunt et al. 1995). In addition, winter densities of golden eagles in southern Idaho have been found to correlate strongly with changes in prey abundance (Kochert 1980, Craig et al. 1984). It is possible that prey densities and subsequently, eagle numbers were depressed across the DRECP Plan Area in 2013 because of the severe drought relative to what might be expected during periods with more normal precipitation. Additional surveys are necessary to better capture differences in population size as they relate to annual and/or multi-year variations in weather patterns.

Increasing the precision of estimates of eagle abundance using future aerial line transect surveys in the DRECP area will likely require changes to the survey design. Transect lines were placed as closely as possible (25 km) north to south and 50 km east to west given budgetary constraints for a single pass survey without potentially violating the assumption that eagle observations are independent on adjacent transects. Therefore, changes to the survey design would require either conducting more than one pass over the area, increasing the density of transects (provided more resources are available), or using information on eagle habitat associations to inform the placement of transect lines across the study area (i.e., a stratified systematic sample with random starts).

The United States Fish and Wildlife Service allows take of golden eagles if an activity causes no net decrease in the number of breeding pairs within regional geographic management units. The aerial surveys and the observations from the Western-wide Golden Eagle Survey provided initial estimates of golden eagle density and abundance, but they are too uncertain to establish take limits for golden eagles in the DRECP. The information from the surveys can be used, however, to specify the effort that would be needed to achieve explicit targets for confidence intervals or detection of population trends.

ACRONYMS

Term	Definition
AGL	Above Ground Level
BCR	Bird Conservation Region
CI	Confidence Interval
DOD	Department of Defense
DRECP	Desert Renewable Energy Conservation Plan
HSU	Humboldt State University
NPS	National Park Service
WEST, Inc.	Western EcoSystems Technologies, Inc.
WGES	Western United States Golden Eagle Survey

REFERENCES

Bamberg S. A., A. T. Vollmer, G. E. Klienkopf, and T. L. Ackerman. 1976. A comparison of seasonal primary production of Mojave Desert shrubs during wet and dry years. American Midland Naturalist 95:398-405.

Bloom, P. H., and W. S. Clark. 2002. Molt sequence of plumages of golden eagles and a technique for in-hand ageing. North American Bird Bander 26:97–116.

Borchers, D. L., J. L. Laake, C. Southwell, and C. G. M. Paxton. 2006. Accommodating unmodeled heterogeneity in double-observer distance sampling surveys. Biometrics 62:372–378.

Buckland, S. T., D. R. Anderson, K. P. Burnham, J. L. Laake, D. L. Borchers, and L. Thomas. 2001. Introduction to Distance Sampling: Estimating Abundance of Biological Populations. Oxford University Press, Oxford, England.

Clark, W. S. 2001. Aging eagles at hawk watches: what is possible and what is not. Pages 143–148 in K. L. Bildstein and D. Klem, editors. Hawkwatching in the Americas. Hawk Migration Association of North America, North Wales, Pennsylvania, USA.

Clark, W. S., and B. K. Wheeler. 2001. A field guide to hawks of North America. Second edition. Houghton Mifflin Company, New York, New York, USA.

Craig, T. H., E. H. Craig, and L. R. Powers. 1984. Recent changes in eagle and Buteo abundance in southeastern Idaho. Murrelet 65:91-93.

Desert Renewable Energy Conservation Plan (DRECP). 2014. Desert Renewable Energy Conservation Plan (DRECP) and Environmental Impact Report/Environmental Impact Statement. September. http://drecp.org/draftdrecp/.

ESRI 2011; ArcGIS Desktop: Release 10. Redlands, CA: Environmental Systems Research Institute.

George, T. L., J. Thompson, and R. Nielson. 2014. Summary of winter golden eagle aerial transect surveys in the Desert Renewable Energy Conservation Plan Area 2013. California Energy Commission, Interim report.

Holroyd, G., R. Knight, S. Lewis, R. Murphy, J. Pagel, K. Steenhof, and D. Whittington. 2010. A collaborative critique of the golden eagle's uncertain future in North America, in Minutes and notes of the North American golden eagle science meeting, 21 Sept. 2010, USGS Science Center , Fort Collins , Colorado, U.S. Fish and Wildlife Service, p. 1–28.

Hunt, W. G., R. E. Jackman, T. L. Brown, J. G. Gilardi, D. E. Driscoll, and L. Culp. 1995. A pilot Golden Eagle population study in the Altamont Pass Wind Resource Area, California.Predatory Bird Res. Group, Univ. of California, Santa Cruz.

Kochert, M. N. 1980. Golden Eagle reproduction and population changes in relation to jackrabbit cycles: Implications to eagle electrocutions. Pages 71-86 in A workshop on raptors and energy developments. (Howard, R. P. and J. F. Gore, Eds.) U.S. Fish and Wildlife Service and Idaho Chapter of the Wildlife Society Boise, ID.

Kochert, M. N., K. Steenhof, C. L. Mcintyre, and E. H. Craig. 2002. Golden Eagle (*Aquila chrysaetos*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.bnaproxy.birds.cornell.edu/bna/species/684doi:10.2173/bna.684

Knight, R. L., R. J. Camp, W. I. Boarman, and H. A. L. Knight. Predatory bird populations in the east Mojave Desert, California. 1999. Great Basin Naturalist 59:331-338.

Lehman, R. N., J. A. Savidge, P. L. Kennedy, and R. E. Harness. 2010. Raptor electrocution rates for a utility in the Intermountain Western United States. Journal of Wildlife Management 74:459–470.

McIntyre, C. L., D. C. Douglas, and M. W. Collopy. 2008. Movements of Golden Eagles (*Aquila chrysaetos*) from interior Alaska during their first year of independence. Auk 125:214–224.

Millsap, B. A., G. S. Zimmerman, J. R. Sauer, R. M. Nielson, M. Otto, E. Bjerre, and R. Murphy. 2013. Golden eagle population trends in the western United States: 1968-2010. Journal of Wildlife Management 77:1436–1448.

Nielson, R. M., L. McManus, T. Rintz, and L. L. McDonald. 2013. A survey of golden eagles (*Aquila chrysaetos*) in the western U.S.: 2013 Annual Report. A report for the U.S. Fish & Wildlife Service. WEST, Inc., Cheyenne, Wyoming.

Nielson, R. M., L. McManus, T. Rintz, L. L. McDonald, R. K. Murphy, W. H. Howe, and R. E. Good. 2014. Monitoring abundance of golden eagles in the western United States. Journal of Wildlife Management 78:721–730.

Smallwood, K. S., and Thelander, C. 2008. Bird mortality in the Altamont Pass Wind Resource Area, California. Journal of Wildlife Management 72:215–223.

Thomey, M. L., P. L. Ford, M. C. Reeves, D. M. Finch, M. E. Litvak, and S. L. Collins. 2014. Review of climate change impacts on future carbon stores and management of warm deserts of the United States. Gen. Tech. Rep. RMRS-GTR-316. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 26 p.

APPENDIX A:
Location of Aerial Line Transects

Location of aerial line transects flown during post-fledging (PF) and winter (W) surveys for golden eagles in the Desert Renewable Energy Conservation Plan Area. Transects that completely overlapped restricted airspace where permission to fly could not be obtained are not included.

Season	Transect	Point	Start/Stop	Habitat[1]	Latitude	Longitude	Length (km)
PF	1	1	start	DS	32.7631	-115.9254	49.9
PF	1	2	stop	DS	32.7561	-115.3917	0.0
PF	2	1	start	DS	32.7498	-114.8588	27.1
PF	2	2	stop	DS	32.7420	-114.5689	0.0
PF	3	1	start	DS	32.9056	-116.2455	30.0
PF	3	2	stop	DS	32.9060	-115.9243	0.0
PF	4	1	start	DS	32.8879	-114.8576	50.5
PF	4	2	stop	DS	32.9002	-115.3986	0.0
PF	5	1	start	DS	33.0466	-115.3869	49.9
PF	5	2	stop	DS	33.0509	-115.9226	0.0
PF	6	1	start	DS	33.1940	-115.9204	42.1
PF	6	2	stop	DS	33.1982	-116.3732	0.0
PF	7	1	start	DS	33.1882	-115.3854	11.6
PF	7	2	NA	R	33.1850	-115.2604	28.8
PF	7	3	NA	DS	33.1825	-114.9513	9.5
PF	7	4	stop	DS	33.1809	-114.8495	0.0
PF	8	1	start	DS	33.3300	-115.3817	24.8
PF	8	2	stop	DS	33.3358	-115.6482	0.0
PF	9	1	start	DS	33.3229	-114.7163	3.0
PF	9	2	NA	R	33.3216	-114.7486	9.0
PF	9	3	stop	R	33.3234	-114.8455	0.0
PF	10	1	start	R	33.4679	-114.8409	3.7
PF	10	2	NA	DS	33.4697	-114.8806	26.5
PF	10	3	NA	R	33.4752	-115.1663	9.5
PF	10	4	NA	DS	33.4749	-115.2689	10.3
PF	10	5	stop	DS	33.4772	-115.3802	0.0
PF	11	1	start	R	33.6210	-115.3745	9.9
PF	11	2	NA	DS	33.6202	-115.4810	5.4
PF	11	3	NA	R	33.6233	-115.5393	3.0
PF	11	4	stop	R	33.6235	-115.5721	0.0
PF	12	1	start	DS	33.6137	-114.8370	27.9

Season	Transect	Point	Start/Stop	Habitat[1]	Latitude	Longitude	Length (km)
PF	12	2	stop	DS	33.6079	-114.5354	0.0
PF	13	1	start	DS	33.7654	-115.3739	20.1
PF	13	2	NA	R	33.7611	-115.1564	13.5
PF	13	3	NA	DS	33.7600	-115.0105	8.0
PF	13	4	NA	R	33.7563	-114.9243	6.0
PF	13	5	NA	DS	33.7576	-114.8596	2.5
PF	13	6	stop	DS	33.7567	-114.8328	0.0
PF	14	1	start	DS	33.9101	-115.3716	5.7
PF	14	2	NA	R	33.9111	-115.4330	10.4
PF	14	3	NA	DS	33.9126	-115.5455	7.9
PF	14	4	NA	R	33.9137	-115.6310	3.0
PF	14	5	NA	DS	33.9136	-115.6637	23.0
PF	14	6	stop	DS	33.9149	-115.9128	0.0
PF	15	1	start	DS	33.8962	-114.5272	7.0
PF	15	2	NA	R	33.8979	-114.6025	7.6
PF	15	3	NA	DS	33.8994	-114.6853	13.5
PF	15	4	stop	DS	33.9013	-114.8315	0.0
PF	16	1	start	R	34.0609	-115.9081	8.9
PF	16	2	NA	DS	34.0633	-116.0042	3.5
PF	16	3	NA	R	34.0622	-116.0423	11.9
PF	16	4	NA	DS	34.0632	-116.1715	6.8
PF	16	5	NA	R	34.0638	-116.2455	18.8
PF	16	6	stop	R	34.0652	-116.4497	0.0
PF	17	1	start	DS	34.0465	-114.8256	32.4
PF	17	2	NA	R	34.0517	-115.1774	1.0
PF	17	3	NA	DS	34.0523	-115.1880	16.5
PF	17	4	stop	DS	34.0536	-115.3674	0.0
PF	18	1	start	CR	34.2070	-116.6461	10.3
PF	18	2	NA	DS	34.2059	-116.5338	8.1
PF	18	3	stop	DS	34.2068	-116.4456	0.0
PF	19	1	start	DS	34.2008	-115.9072	19.4
PF	19	2	NA	R	34.2047	-115.6961	5.3
PF	19	3	NA	DS	34.2020	-115.6390	10.8
PF	19	4	NA	R	34.2017	-115.5217	6.0
PF	19	5	NA	DS	34.1996	-115.4566	9.0
PF	19	6	stop	DS	34.1979	-115.3586	0.0
PF	20	1	start	R	34.1882	-114.8235	5.0
PF	20	2	NA	DS	34.1880	-114.7693	45.2
PF	20	3	stop	DS	34.1795	-114.2780	0.0
PF	21	1	start	DS	34.3522	-116.3776	6.7
PF	21	2	stop	DS	34.3547	-116.4507	0.0

Season	Transect	Point	Start/Stop	Habitat[1]	Latitude	Longitude	Length (km)
PF	22	1	start	DS	34.3424	-115.3632	3.5
PF	22	2	NA	R	34.3407	-115.3253	3.4
PF	22	3	NA	DS	34.3410	-115.2884	7.5
PF	22	4	NA	R	34.3405	-115.2064	6.5
PF	22	5	NA	DS	34.3379	-115.1360	18.9
PF	22	6	NA	R	34.3352	-114.9299	10.2
PF	22	7	stop	R	34.3326	-114.8183	0.0
PF	23	1	start	DS	34.4965	-116.9944	23.8
PF	23	2	NA	R	34.4970	-116.7344	3.3
PF	23	3	NA	DS	34.4975	-116.6982	22.9
PF	23	4	stop	DS	34.4934	-116.4488	0.0
PF	24	1	start	R	34.4872	-115.3630	5.8
PF	24	2	NA	DS	34.4891	-115.4266	29.1
PF	24	3	stop	DS	34.4925	-115.7439	0.0
PF	25	1	start	DS	34.4757	-114.4021	37.9
PF	25	2	stop	DS	34.4784	-114.8161	0.0
PF	26	1	start	CR	34.6328	-118.3686	9.6
PF	26	2	stop	CR	34.6372	-118.2642	0.0
PF	27	1	start	DS	34.6410	-116.9933	49.9
PF	27	2	stop	DS	34.6411	-117.5395	0.0
PF	28	1	start	DS	34.6383	-115.9020	8.3
PF	28	2	stop	DS	34.6384	-115.9923	0.0
PF	29	1	start	DS	34.6234	-114.8109	50.0
PF	29	2	stop	DS	34.6296	-115.3578	0.0
PF	30	1	start	DS	34.7841	-118.0872	49.9
PF	30	2	stop	DS	34.7852	-117.5406	0.0
PF	31	1	start	DS	34.7861	-116.4468	22.4
PF	31	2	NA	R	34.7873	-116.6917	12.6
PF	31	3	NA	DS	34.7868	-116.8296	15.0
PF	31	4	stop	DS	34.7865	-116.9944	0.0
PF	32	1	start	R	34.7748	-115.3527	2.8
PF	32	2	NA	DS	34.7764	-115.3832	26.4
PF	32	3	NA	R	34.7768	-115.6723	9.3
PF	32	4	NA	DS	34.7796	-115.7740	4.2
PF	32	5	NA	R	34.7812	-115.8204	4.3
PF	32	6	NA	DS	34.7809	-115.8679	3.1
PF	32	7	stop	DS	34.7820	-115.9014	0.0
PF	33	1	start	DS	34.7619	-114.5572	14.3
PF	33	2	NA	R	34.7652	-114.7135	6.0
PF	33	3	NA	DS	34.7664	-114.7797	2.6
PF	33	4	stop	DS	34.7673	-114.8083	0.0

Season	Transect	Point	Start/Stop	Habitat[1]	Latitude	Longitude	Length (km)
PF	34	1	start	DS	34.9214	-118.4823	33.7
PF	34	2	stop	DS	34.9240	-118.1122	0.0
PF	35	1	start	DS	34.9242	-117.5285	49.0
PF	35	2	stop	DS	34.9296	-116.9903	0.0
PF	36	1	start	DS	34.9252	-115.8986	13.2
PF	36	2	NA	R	34.9273	-116.0438	11.8
PF	36	3	NA	DS	34.9276	-116.1729	8.9
PF	36	4	NA	R	34.9283	-116.2705	4.9
PF	36	5	NA	DS	34.9289	-116.3247	5.5
PF	36	6	NA	R	34.9292	-116.3852	5.0
PF	36	7	NA	DS	34.9309	-116.4405	0.5
PF	36	8	stop	DS	34.9313	-116.4455	0.0
PF	37	1	start	DS	34.9105	-114.8030	50.1
PF	37	2	stop	DS	34.9199	-115.3522	0.0
PF	38	1	start	DS	35.0696	-118.0915	50.1
PF	38	2	stop	DS	35.0724	-117.5404	0.0
PF	39	1	start	DS	35.0763	-116.9937	30.6
PF	39	2	NA	R	35.0740	-116.6577	8.3
PF	39	3	NA	DS	35.0733	-116.5665	11.3
PF	39	4	stop	DS	35.0725	-116.4420	0.0
PF	40	1	start	DS	35.0711	-115.8973	4.7
PF	40	2	NA	R	35.0693	-115.8458	2.9
PF	40	3	NA	DS	35.0695	-115.8138	25.4
PF	40	4	NA	R	35.0664	-115.5350	7.4
PF	40	5	NA	DS	35.0651	-115.4532	6.5
PF	40	6	NA	R	35.0645	-115.3819	3.2
PF	40	7	stop	R	35.0629	-115.3468	0.0
PF	41	1	start	DS	35.0582	-114.8002	3.3
PF	41	2	NA	R	35.0584	-114.7636	4.6
PF	41	3	NA	DS	35.0534	-114.7133	1.2
PF	41	4	stop	DS	35.0519	-114.7006	0.0
PF	42	1	start	R	35.2156	-118.0915	7.5
PF	42	2	NA	CR	35.2130	-118.1741	29.5
PF	42	3	stop	CR	35.2105	-118.4991	0.0
PF	43	1	start	DS	35.2174	-116.9929	50.2
PF	43	2	stop	DS	35.2174	-117.5463	0.0
PF	44	1	start	DS	35.2185	-116.4464	8.4
PF	44	2	NA	R	35.2154	-116.3539	6.2
PF	44	3	NA	DS	35.2149	-116.2858	35.5
PF	44	4	stop	DS	35.2156	-115.8943	0.0
PF	45	1	start	DS	35.2136	-115.3443	29.2

Season	Transect	Point	Start/Stop	Habitat[1]	Latitude	Longitude	Length (km)
PF	45	2	NA	R	35.2010	-115.0232	2.8
PF	45	3	NA	DS	35.1974	-114.9931	9.9
PF	45	4	stop	DS	35.2007	-114.8841	0.0
PF	46	1	start	DS	35.3629	-117.5443	1.8
PF	46	2	NA	R	35.3615	-117.5641	3.4
PF	46	3	NA	DS	35.3629	-117.6021	44.5
PF	46	4	stop	DS	35.3581	-118.0929	0.0
PF	47	1	start	DS	35.3654	-116.7060	23.9
PF	47	2	stop	DS	35.3622	-116.4424	0.0
PF	48	1	start	DS	35.3574	-115.8942	50.0
PF	48	2	stop	DS	35.3524	-115.3423	0.0
PF	49	1	start	DS	35.5068	-118.0952	1.0
PF	49	2	NA	DS	35.5022	-118.1043	12.1
PF	49	3	NA	FR	35.5015	-118.2384	2.1
PF	49	4	stop	FR	35.5023	-118.2612	0.0
PF	50	1	start	DS	35.5075	-117.5409	49.7
PF	50	2	stop	DS	35.5071	-116.9919	0.0
PF	51	1	start	DS	35.5033	-115.8934	29.8
PF	51	2	NA	R	35.5058	-116.2227	20.1
PF	51	3	stop	R	35.5070	-116.4447	0.0
PF	52	1	start	DS	35.4956	-115.2496	8.3
PF	52	2	stop	DS	35.4959	-115.3409	0.0
PF	53	1	start	DS	35.6504	-117.5443	43.0
PF	53	2	stop	DS	35.6501	-118.0201	0.0
PF	54	1	start	DS	35.6679	-116.4495	49.5
PF	54	2	stop	DS	35.6523	-116.9979	0.0
PF	55	1	start	DS	35.6439	-115.4361	3.3
PF	55	2	NA	R	35.6424	-115.4728	8.0
PF	55	3	NA	DS	35.6442	-115.5617	4.6
PF	55	4	NA	R	35.6435	-115.6129	3.4
PF	55	5	NA	DS	35.6444	-115.6510	14.5
PF	55	6	NA	R	35.6462	-115.8110	2.8
PF	55	7	NA	DS	35.6464	-115.8420	4.3
PF	55	8	stop	DS	35.6460	-115.8898	0.0
PF	56	1	start	DS	35.7983	-116.9955	15.0
PF	56	2	NA	R	35.8005	-117.1620	9.5
PF	56	3	NA	DS	35.7971	-117.2671	8.7
PF	56	4	NA	R	35.7952	-117.3631	16.6
PF	56	5	stop	R	35.7952	-117.5474	0.0
PF	57	1	start	R	35.7917	-115.8857	8.4
PF	57	2	NA	DS	35.7924	-115.9784	16.9

Season	Transect	Point	Start/Stop	Habitat[1]	Latitude	Longitude	Length (km)
PF	57	3	NA	R	35.7928	-116.1663	24.0
PF	57	4	NA	DS	35.7930	-116.4323	0.7
PF	57	5	stop	DS	35.7940	-116.4394	0.0
PF	58	1	start	R	35.9381	-116.4384	2.8
PF	58	2	NA	DS	35.9385	-116.4695	4.1
PF	58	3	NA	R	35.9390	-116.5150	14.7
PF	58	4	NA	DS	35.9418	-116.6787	17.4
PF	58	5	NA	R	35.9399	-116.8725	5.6
PF	58	6	NA	DS	35.9410	-116.9347	5.2
PF	58	7	stop	DS	35.9388	-116.9929	0.0
PF	59	1	start	DS	35.9348	-115.8179	6.2
PF	59	2	stop	DS	35.9361	-115.8864	0.0
PF	60	1	start	DS	36.0947	-117.3850	16.3
PF	60	2	stop	DS	36.0839	-117.2036	0.0
PF	61	1	start	DS	36.0794	-116.0084	6.8
PF	61	2	NA	R	36.0791	-116.0839	6.5
PF	61	3	NA	DS	36.0832	-116.1565	5.0
PF	61	4	NA	R	36.0837	-116.2117	4.9
PF	61	5	NA	DS	36.0829	-116.2667	6.8
PF	61	6	NA	R	36.0825	-116.3419	7.6
PF	61	7	NA	DS	36.0833	-116.4267	1.1
PF	61	8	stop	DS	36.0830	-116.4390	0.0
PF	62	1	start	DS	36.2244	-118.0054	6.0
PF	62	2	stop	DS	36.2253	-117.9382	0.0
PF	63	1	start	DS	36.2320	-116.9492	15.4
PF	63	2	NA	R	36.2265	-116.7775	7.5
PF	63	3	NA	DS	36.2306	-116.6941	8.2
PF	63	4	NA	R	36.2322	-116.6023	4.2
PF	63	5	NA	DS	36.2280	-116.5554	10.8
PF	63	6	stop	DS	36.2284	-116.4346	0.0
PF	64	1	start	DS	36.3797	-116.3832	5.0
PF	64	2	stop	DS	36.3719	-116.4382	0.0
PF	65	1	start	DS	36.5169	-118.0986	21.8
PF	65	2	stop	DS	36.5111	-117.8546	0.0
PF	66	1	start	DS	36.5194	-116.5694	3.8
PF	66	2	NA	R	36.5129	-116.6111	18.6
PF	66	3	NA	DS	36.5160	-116.8191	15.6
PF	66	4	stop	DS	36.5169	-116.9941	0.0
PF	67	1	start	DS	36.6561	-118.2123	9.1
PF	67	2	stop	DS	36.6567	-118.1100	0.0
PF	68	1	start	DS	36.6566	-117.0023	24.1

Season	Transect	Point	Start/Stop	Habitat[1]	Latitude	Longitude	Length (km)
PF	68	2	stop	DS	36.6615	-117.2729	0.0
PF	69	1	start	DS	36.9430	-118.1930	6.1
PF	69	2	stop	DS	36.9431	-118.2620	0.0
W	1	1	start	DS	32.7545	-115.3939	49.8
W	1	2	stop	DS	32.7616	-115.9263	0.0
W	2	1	start	DS	32.7411	-114.5697	27.1
W	2	2	stop	DS	32.7489	-114.8597	0.0
W	3	1	start	DS	32.9022	-115.9233	29.9
W	3	2	stop	DS	32.9089	-116.2435	0.0
W	4	1	start	DS	32.8884	-114.8559	49.8
W	4	2	stop	DS	32.9007	-115.3893	0.0
W	5	1	start	DS	33.0470	-115.3865	49.5
W	5	2	stop	DS	33.0526	-115.9180	0.0
W	6	1	start	DS	33.1973	-116.3720	42.0
W	6	2	stop	DS	33.1934	-115.9199	0.0
W	7	1	start	DS	33.1791	-114.8471	50.1
W	7	2	stop	DS	33.1879	-115.3858	0.0
W	8	1	start	DS	33.3360	-115.6495	24.9
W	8	2	stop	DS	33.3329	-115.3808	0.0
W	9	1	start	DS	33.3219	-114.7166	4.8
W	9	2	NA	R	33.3226	-114.7683	5.0
W	9	3	NA	DS	33.3240	-114.8220	2.8
W	9	4	stop	DS	33.3255	-114.8523	0.0
W	10	1	start	DS	33.4757	-115.3768	49.8
W	10	2	stop	DS	33.4694	-114.8397	0.0
W	11	1	start	R	33.6184	-115.3760	7.0
W	11	2	NA	DS	33.6221	-115.4513	7.7
W	11	3	NA	R	33.6237	-115.5350	3.3
W	11	4	stop	R	33.6246	-115.5702	0.0
W	12	1	start	DS	33.6068	-114.6923	13.4
W	12	2	stop	DS	33.6132	-114.8364	0.0
W	13	1	start	DS	33.7538	-114.8349	2.8
W	13	2	NA	R	33.7583	-114.8652	5.4
W	13	3	NA	DS	33.7592	-114.9237	7.9
W	13	4	NA	R	33.7598	-115.0092	13.1
W	13	5	NA	DS	33.7634	-115.1510	20.5
W	13	6	stop	DS	33.7648	-115.3724	0.0
W	14	1	start	DS	33.9179	-115.9145	30.3
W	14	2	NA	R	33.9121	-115.5859	13.3
W	14	3	NA	DS	33.9105	-115.4416	6.5
W	14	4	stop	DS	33.9099	-115.3711	0.0

Season	Transect	Point	Start/Stop	Habitat[1]	Latitude	Longitude	Length (km)
W	15	1	start	DS	33.8952	-114.5267	8.3
W	15	2	NA	R	33.8991	-114.6170	6.2
W	15	3	NA	DS	33.8995	-114.6843	13.5
W	15	4	stop	DS	33.9017	-114.8307	0.0
W	16	1	start	R	34.0636	-116.4532	12.3
W	16	2	NA	DS	34.0634	-116.3195	13.1
W	16	3	NA	R	34.0616	-116.1777	22.4
W	16	4	NA	DS	34.0598	-115.9346	2.2
W	16	5	stop	DS	34.0597	-115.9105	0.0
W	17	1	start	DS	34.0551	-115.3681	49.9
W	17	2	stop	DS	34.0454	-114.8266	0.0
W	18	1	start	FR	34.2110	-116.6425	2.6
W	18	2	NA	DS	34.2089	-116.6142	15.2
W	18	3	stop	DS	34.2086	-116.4490	0.0
W	19	1	start	DS	34.2049	-115.9096	16.7
W	19	2	NA	R	34.2022	-115.7283	8.9
W	19	3	NA	DS	34.2015	-115.6318	9.4
W	19	4	NA	R	34.2000	-115.5292	6.5
W	19	5	NA	DS	34.1992	-115.4588	8.5
W	19	6	stop	DS	34.1983	-115.3659	0.0
W	20	1	start	DS	34.1775	-114.2805	45.4
W	20	2	NA	R	34.1887	-114.7736	5.1
W	20	3	stop	R	34.1911	-114.8289	0.0
W	21	1	start	DS	34.3536	-116.4500	6.8
W	21	2	stop	DS	34.3520	-116.3764	0.0
W	22	1	start	DS	34.3402	-115.3637	3.8
W	22	2	NA	R	34.3414	-115.3223	3.1
W	22	3	NA	DS	34.3408	-115.2884	6.7
W	22	4	NA	R	34.3411	-115.2149	7.1
W	22	5	NA	DS	34.3398	-115.1374	19.1
W	22	6	NA	R	34.3365	-114.9290	10.0
W	22	7	stop	R	34.3348	-114.8199	0.0
W	23	1	start	DS	34.4960	-116.9962	50.2
W	23	2	stop	DS	34.4960	-116.4482	0.0
W	24	1	start	R	34.4865	-115.3575	4.9
W	24	2	NA	DS	34.4880	-115.4110	32.2
W	24	3	stop	DS	34.4932	-115.7630	0.0
W	25	1	start	DS	34.4670	-114.3970	38.6
W	25	2	stop	DS	34.4799	-114.8177	0.0
W	26	1	start	CR	34.6314	-118.2636	9.4
W	26	2	stop	CR	34.6336	-118.3664	0.0

Season	Transect	Point	Start/Stop	Habitat[1]	Latitude	Longitude	Length (km)
W	27	1	start	DS	34.6450	-116.9924	4.8
W	27	2	NA	R	34.6409	-117.0446	3.4
W	27	3	NA	DS	34.6421	-117.0813	41.7
W	27	4	stop	DS	34.6405	-117.5369	0.0
W	28	1	start	DS	34.6369	-115.9016	8.4
W	28	2	stop	DS	34.6382	-115.9936	0.0
W	29	1	start	DS	34.6197	-114.8109	49.8
W	29	2	stop	DS	34.6310	-115.3558	0.0
W	30	1	start	DS	34.7855	-117.5384	50.1
W	30	2	stop	DS	34.7816	-118.0873	0.0
W	31	1	start	DS	34.7860	-116.4444	17.8
W	31	2	NA	R	34.7858	-116.6393	18.0
W	31	3	NA	DS	34.7872	-116.8362	14.2
W	31	4	stop	DS	34.7868	-116.9916	0.0
W	32	1	start	DS	34.7781	-115.3552	29.7
W	32	2	NA	R	34.7799	-115.6808	14.1
W	32	3	NA	DS	34.7819	-115.8358	5.8
W	32	4	stop	DS	34.7824	-115.8992	0.0
W	33	1	start	DS	34.7625	-114.5555	22.9
W	33	2	stop	DS	34.7666	-114.8068	0.0
W	34	1	start	DS	34.9260	-118.4835	34.2
W	34	2	stop	DS	34.9254	-118.1087	0.0
W	35	1	start	DS	34.9297	-117.5414	50.1
W	35	2	stop	DS	34.9301	-116.9918	0.0
W	36	1	start	DS	34.9250	-115.8980	13.0
W	36	2	NA	R	34.9298	-116.0407	11.9
W	36	3	NA	DS	34.9289	-116.1713	16.5
W	36	4	NA	R	34.9295	-116.3521	8.5
W	36	5	stop	R	34.9308	-116.4455	0.0
W	37	1	start	DS	34.9059	-114.8031	49.8
W	37	2	stop	DS	34.9182	-115.3493	0.0
W	38	1	start	DS	35.0672	-118.0912	50.0
W	38	2	stop	DS	35.0738	-117.5417	0.0
W	39	1	start	DS	35.0731	-116.4433	12.3
W	39	2	NA	R	35.0746	-116.5781	7.5
W	39	3	NA	DS	35.0756	-116.6607	30.2
W	39	4	stop	DS	35.0754	-116.9931	0.0
W	40	1	start	DS	35.0720	-115.8976	50.0
W	40	2	stop	DS	35.0641	-115.3478	0.0
W	41	1	start	DS	35.0536	-114.6998	9.2
W	41	2	stop	DS	35.0549	-114.8007	0.0

Season	Transect	Point	Start/Stop	Habitat[1]	Latitude	Longitude	Length (km)
W	42	1	start	CR	35.2104	-118.4989	36.9
W	42	2	stop	CR	35.2123	-118.0924	0.0
W	43	1	start	DS	35.2203	-116.9920	50.0
W	43	2	stop	DS	35.2193	-117.5428	0.0
W	44	1	start	DS	35.2163	-115.8913	28.6
W	44	2	NA	R	35.2188	-116.2063	8.9
W	44	3	NA	DS	35.2176	-116.3045	12.4
W	44	4	stop	DS	35.2179	-116.4408	0.0
W	45	1	start	DS	35.2073	-115.3445	10.3
W	45	2	NA	DS	35.2059	-115.2306	31.5
W	45	3	stop	DS	35.2009	-114.8838	0.0
W	46	1	start	R	35.3609	-117.5434	5.2
W	46	2	NA	DS	35.3640	-117.6006	29.3
W	46	3	NA	R	35.3577	-117.9242	8.5
W	46	4	NA	DS	35.3589	-118.0179	5.3
W	46	5	NA	R	35.3604	-118.0763	1.5
W	46	6	stop	R	35.3587	-118.0931	0.0
W	47	1	start	DS	35.3625	-116.4510	22.7
W	47	2	stop	DS	35.3570	-116.7016	0.0
W	48	1	start	DS	35.3573	-115.8929	49.9
W	48	2	stop	DS	35.3519	-115.3423	0.0
W	49	1	start	R	35.4985	-118.2604	15.0
W	49	2	stop	R	35.5019	-118.0950	0.0
W	51	1	start	DS	35.5078	-116.4394	9.2
W	51	2	NA	R	35.5046	-116.3380	9.4
W	51	3	NA	DS	35.5057	-116.2342	18.2
W	51	4	NA	R	35.5040	-116.0331	2.4
W	51	5	NA	DS	35.5035	-116.0070	10.6
W	51	6	stop	DS	35.5018	-115.8904	0.0
W	52	1	start	DS	35.4938	-115.2500	8.0
W	52	2	stop	DS	35.4961	-115.3387	0.0
W	54	1	start	DS	35.6537	-116.9155	43.0
W	54	2	stop	DS	35.6500	-116.4391	0.0
W	55	1	start	DS	35.6471	-115.4355	3.4
W	55	2	NA	R	35.6427	-115.4731	16.1
W	55	3	NA	DS	35.6459	-115.6514	21.3
W	55	4	stop	DS	35.6464	-115.8876	0.0
W	57	1	start	DS	35.7911	-115.8846	47.7
W	57	2	NA	R	35.7939	-116.4133	2.3
W	57	3	stop	R	35.7916	-116.4385	0.0
W	58	1	start	DS	35.9376	-116.4386	1.8

Season	Transect	Point	Start/Stop	Habitat[1]	Latitude	Longitude	Length (km)
W	58	2	NA	R	35.9382	-116.4588	18.2
W	58	3	NA	DS	35.9426	-116.6606	29.8
W	58	4	stop	DS	35.9402	-116.9917	0.0
W	59	1	start	DS	35.9320	-115.8178	5.9
W	59	2	stop	DS	35.9360	-115.8832	0.0
W	60	1	start	DS	36.0818	-117.3946	0.3
W	60	2	stop	DS	36.0842	-117.3929	0.0
W	61	1	start	DS	36.0795	-116.0036	39.0
W	61	2	stop	DS	36.0833	-116.4373	0.0
W	62	1	start	DS	36.2261	-118.0076	6.2
W	62	2	stop	DS	36.2258	-117.9383	0.0
W	63	1	start	DS	36.2280	-116.9496	16.5
W	63	2	NA	R	36.2405	-116.7663	6.3
W	63	3	NA	DS	36.2305	-116.6974	23.6
W	63	4	stop	DS	36.2270	-116.4338	0.0
W	64	1	start	DS	36.3722	-116.3784	5.1
W	64	2	stop	DS	36.3712	-116.4355	0.0
W	65	1	start	DS	36.5138	-117.8515	22.2
W	65	2	stop	DS	36.5142	-118.0998	0.0
W	66	1	start	DS	36.5161	-116.5667	5.5
W	66	2	NA	R	36.5177	-116.6285	3.5
W	66	3	NA	DS	36.5146	-116.6673	29.2
W	66	4	stop	DS	36.5191	-116.9945	0.0
W	67	1	start	DS	36.6555	-118.2144	9.2
W	67	2	stop	DS	36.6569	-118.1114	0.0
W	68	1	start	DS	36.6584	-116.9924	25.0
W	68	2	stop	DS	36.6621	-117.2723	0.0
W	69	1	start	DS	36.9449	-118.1924	6.1
W	69	2	stop	DS	36.9436	-118.2616	0.0
W	70	1	start	R	35.6446	-118.0173	10.6
W	70	2	NA	DS	35.6471	-117.8997	7.2
W	70	3	stop	DS	35.6488	-117.8200	0.0

[1] Habitat along transect segment as determined by observers during survey. The researchers distinguished four habitat types; chaparral rugged (CR), desert scrub (DS), forested rugged (FR), and rugged (R).

APPENDIX B:
Research and Special Use Permits.

Revised 06-10
Form 10-114

UNITED STATES DEPARTMENT OF THE INTERIOR
National Park Service
Mojave National Preserve
Special Use Permit

NAME T. Luke George	
ORGANIZATION California State University, Humboldt	
ADDRESS c/o Colorado State University, Dept. of Fish, Wildlife & Conservation Biology 3150 Centre Ave.	
Fort Collins, CO 80526	
TELEPHONE NUMBER (970) 226-9170/(707) 499-4053	FAX NUMBER

Park Alpha Code: MOJA
Type of Use: Avian Survey
Permit #: PWR-MOJA-9500-13-0037

is hereby authorized to use the following described land or facilities in the above named area:

East-west linear transects throughout Mojave National Preserve.

The area must be restored to its original condition at the end of the permit.

The permit begins at 06:00 (am/~~pm~~) on 08/01/2013 (Month/Day/Year)

The permit expires at 12:00 (~~am~~/pm) on 08/06/2013 (Month/Day/Year).

SUMMARY OF PERMITTED ACTIVITY: (see attached sheets for additional information and conditions)

Aerial survey for golden eagle (*Aquila chrysaetos*). Fixed wing aircraft will survey along linear transects (see attached transect map). Up to four personnel in one Cessna 206 (tail No. N4216Q) will be flying between 300 and 500 feet above ground level (AGL). Aircraft will take off and land outside of the Preserve; no staging or refueling is permitted in Mojave National Preserve. Survey is expected to last no longer than one day.

Person on site responsible for adherence to the terms and conditions of the permit (include contact information): T. Luke George (see above)

Authorizing legislation or other authority: Organic Act of 1916 and Redwoods Act of 1978; California Desert Protection Act of 1994.

NEPA Compliance: CATEGORICALLY EXCLUDED √ EA/FONSI __ EIS __ OTHER __

Reference/PEPC # 13-moja-040/PEPC 48308

APPLICATION FEE	Received √	Not Required __	Amount $	69.00
PERFORMANCE BOND:	Required __	Not Required √	Amount $	
LIABILITY INSURANCE:	Required √	Not Required __	Amount $	1,000,000.00
COST RECOVERY:	Required √	Not Required __	Amount $	216.00
FACILITY USE FEE:	Required __	Not Required √	Amount $	

LOCATION FEE: Required __ Not Required √ Amount $ _____

ISSUANCE of this permit is subject to the attached conditions. The undersigned hereby accepts this permit subject to the terms, covenants, obligations, and reservations, expressed or implied herein.

PERMITTEE T. Luke George Professor Emeritus 7/25/13
Signature Title Date

Authorizing NPS Official Lawrence J. Whalen ACTING 7/31/13
Signature Superintendent Date

Authorizing NPS Official _____
(additional if required) Signature Title Date

CONDITIONS OF THIS PERMIT

1. The Permittee is prohibited from giving false information; to do so will be considered a breach of conditions and be grounds for revocation: [36 CFR 2.32(a)(3)].

2. The Permittee shall exercise this privilege subject to the supervision of the Superintendent or designee, and shall comply with all applicable Federal, State, county and municipal laws, ordinances, regulations, codes, and the terms and conditions of this permit. Failure to do so may result in the immediate suspension of the permitted activity or the termination of the permit.

3. If any provision of this permit shall be found to be invalid or unenforceable, the remainder of this permit shall not be affected and the other provisions of this permit shall be valid and be enforced to the fullest extent permitted by law.

4. The Permittee is responsible for making all necessary contacts and arrangements with other Federal, State, and local agencies to secure required inspections, permits, licenses, etc.

5. Failure to comply with any of the terms and conditions of this permit may result in the immediate suspension or revocation of the permit. All costs associated with clean up or damage repairs in conjunction with a terminated permit will be the responsibility of the Permittee.

6. This permit may be revoked at the discretion of the Superintendent upon 24 hours notice, or without notice if damage to resources or facilities occurs or is threatened, notwithstanding any other term or condition of the permit to the contrary.

7. This agreement is made upon the express condition that the United States, its agents and employees shall be free from all liabilities and claims for damages and/or suits for or by reason of any injury, injuries, or death to any person or persons or property of any kind whatsoever, whether to the person or property of the (Permittee/Grantee), its agents or employees, or third parties, from any cause or causes whatsoever while in or upon said premises or any part thereof during the term of this agreement or occasioned by any occupancy or use of said premises or any activity carried on by the (Permittee) in connection herewith, and the (Permittee) hereby covenants and agrees to indemnify, defend, save and hold harmless the United States, its agents, and employees from all liabilities, charges, expenses and costs on account of or by reason of any such injuries, deaths, liabilities, claims, suits or losses however occurring or damages growing out of the same.

8. Permittee agrees to carry general liability insurance against claims occasioned by the action or omissions of the Permittee, its agents and employees in carrying out the activities and operations authorized by this permit. The policy shall be in the amount of $ 1,000,000.00 and underwritten by a United States company naming the United States of America as **additionally insured**. The Permittee agrees to provide the Superintendent with a Certificate of Insurance with the proper endorsements prior to the effective date of the permit.

9. Permittee agrees to deposit with the park a bond in the amount of $ 0.00 from an authorized bonding company or in the form of cash or cash equivalent, to guarantee that all financial obligations to the park will be met, including the restoration and rehabilitation of the permitted area.

10. Costs incurred by the park as a result of accepting and processing the application and managing and monitoring the permitted activity will be reimbursed by the Permittee. Administrative costs and estimated costs for activities on site must be paid when the permit is approved. If any additional costs are incurred by the park, the Permittee will be billed at the conclusion of the permit. Should the estimated costs paid exceed the actual costs incurred; the difference will be returned to the Permittee.

11. The person named on the permit as in charge of the permitted activity on-site must have full authority to make any decisions about the activity and must remain on-site at all times. He/she shall be responsible for all individuals, groups, vendors, etc. involved with the permit

12. As a condition of acceptance of this permit by the Permittee and pursuant to 41 U.S. C. 22, "No Member of Congress shall be admitted to any share or part of any contract or agreement made, entered into, or accepted by or on behalf of the United States, or to any benefit to arise thereupon."

13. Nothing herein contained shall be construed as binding the Service to expend in any one fiscal year any sum in excess of appropriations made by Congress or administratively allocated for the purpose of this Agreement for the fiscal year, or to involve the Service in any contract or other obligation for the further expenditure of money in excess of such appropriations or allocations.

14. This permit may not be transferred or assigned without the prior written consent of the Superintendent.

15. The Permit Holder will notify by email Mojave National Preserve within 24 hours before the start of the event covered under this permit.
Email notification: **moja_le_rangers@nps.gov**
Alternate Contacts: **(760) 252-6131, Kirk Gebicke**

16. The Permit Holder or representative must communicate with the Federal Interagency Communications Center (FICC) regularly to avoid conflicts with other air operations. At a minimum, FICC must be notified both before the aircraft crosses into the airspace above Mojave National Preserve and when it exits the airspace upon survey completion.
FICC non-emergencies: (909) 383-5652 or (909) 383-5653

17. The Permittee must submit copies of all data sheets and a final report of survey results to Mojave National Preserve, Attention: Danette Woo.

18. To minimize adverse impacts to desert bighorn sheep, aircraft are prohibited from circling or swooping at lower elevations (400 feet) and within one kilometer from the base of the Soda Mountains, Old Dad and Kelso Peak Mountains, and Piute Mountain Range.

19. All aviation aspects of the project shall be in compliance with FAA regulations.

20. Collecting, defacing, destroying historic or prehistoric artifacts is prohibited. Archeological, historic structures and/or artifacts will be left in place, undisturbed. Rubbings or other type of transfer of any form of rock art is prohibited. Permittee will immediately bring to the attention of the Chief Ranger, Mojave NP any archaeological resources encountered during operations, and maintain the integrity of such resources pending subsequent investigation.
Contacts: **(760) 252-6131, Kirk Gebicke**
(760) 928-2101, David Nichols

21. Natural features will not be disturbed. Collecting of plants, animals, or mineral specimens is prohibited; destruction of any vegetation or natural areas is not permitted. No exotic plants/animals will be introduced and/or left behind.

22. Discarding/spilling of any fuel/hazardous materials is prohibited; any discharge or spill should be reported immediately.
Contacts: **(760) 252-6131, Kirk Gebicke**
(760) 252-6147, Dave Burdette

Wilderness (#s 23-24)

23. No motorized vehicles or mechanized transport may be operated in wilderness. In general, Wilderness begins:
    - 100' to either side of the centerline of all maintained roads (e.g., Kelbaker Road, Cedar Canyon Road, Black Canyon Road, etc.)
    - 30' to either side of unmaintained roads.

24. Vehicles will use only existing roads or previously disturbed areas outside of wilderness. Permittee shall not in any way harm or damage any vegetation or wildlife. Parking along the roadway shall occur on previously disturbed sites only.

Desert Tortoise (#s 25-31)

25. This event(s) may be conducted at a time when the desert tortoise is active above ground. All participants must exercise the utmost in care to prevent injury or death to tortoises. A threatened species, this reptile is susceptible to crushing by automobile and foot traffic. Juvenile tortoises are particularly vulnerable; they are soft-shelled, slow moving, and difficult to see because of their small size and drab coloring. Tortoises are particularly active in the early mornings, evenings, and during the day when temperatures are mild (mid 70's-low 80's). They are frequently seen on or near paved road areas. All participants must be informed of and comply with these conditions.

26. The desert tortoise is protected by law. It is illegal to disturb a tortoise or its habitat in any way. This includes touching, handling, moving, or possessing a tortoise.

27. Vehicle parking must occur on previously disturbed areas, destruction of any natural undisturbed areas, including vegetation, is not permitted.

28. Tortoises will sometimes crawl under vehicles to escape the heat of the sun. Check under vehicles prior to leaving, particularly if the vehicle has been parked for a long time.

29. All event-related tortoise injuries and/or deaths must be reported to the National Park Service as soon as possible.

30. All motorized vehicles shall remain on existing roads, designated routes and vehicle ways. No cross-country travel by motorized vehicles is permitted. Vehicle use is prohibited in wilderness areas. Observe speed limits. Watch for tortoises on the road or road shoulder area. Driving off the established roadways and parking outside of designated parking areas is prohibited.

31. When vehicles travel in a group, each vehicle will be spaced far enough apart to ensure visibility of the road surface to avoid desert tortoises.

32. Permission for travel on or across private property is required by the appropriate land owner. Permittee and participants will observe and respect areas of private property. All gates must be left as they are found (either open or shut). Permittee is responsible to the property owner for all costs incurred for damages to range improvements and/or if stock is injured or killed.

33. Permittee shall provide for basic first aid and initial transport at the standard first aid level. For all other emergencies, Permittee shall notify the Federal Interagency Communications Center. **FICC emergencies: (909) 383-5651**

34. All emergency costs of participants will be borne by the Permittee. Monitoring fees may be charged $45.00 per hour (minimum of two hours), for NPS staff to ensure compliance with park regulations and stipulations of this permit. Permittee will remit to NPS any recovery of costs incurred by NPS in conjunction with this permit. <u>If such costs are incurred, the Permittee will be billed at the conclusion of this permit.</u>

35. No sales of promotional items or promotional filming of activities is authorized under this permit. Any filming of activities for commercial use must be authorized under a separate permit.

36. All participants will be made aware of stipulations stated in this permit.

37. The Permittee expressly agrees that the terms and conditions of the permit shall not establish a precedent for any future permit within Mojave National Preserve or any other unit of the National Park System; failure to follow the conditions of the Permit may result in revocation of this permit and denial of future permits.

TLG
Initials

SCIENTIFIC RESEARCH AND COLLECTING PERMIT Grants permission in accordance with the attached general and special conditions United States Department of the Interior National Park Service Death Valley NP	Study#: DEVA-00138 Permit#: DEVA-2010-SCI-0029 Start Date: Aug 15, 2010 Expiration Date: Sep 15, 2015 Coop Agreement#: n/a Optional Park Code: n/a

Name of principal investigator:

Name: Ryan Nielson **Phone:** (307) 634-1756 **Email:** rnielson@west-inc.com

Name of institution represented:

Western EcoSystems Technology, Inc.

Co-Investigators:

Name: Troy Rintz **Phone:** 307-721-3155 **Email:** trintz@west-inc.com

Project title:

Population Survey of Golden Eagles (Aquila chrysaetos) in the Western United States

Purpose of study:

To estimate adult, subadult and juvenile golden eagle population sizes in the western U.S. using transect procedures such that, if replicated annually, would have at least 80 % power to detect an annual rate of total population change greater than or equal to 3 percent over a 20-year period using a test of size alpha = 0.1 (or 90 % conifidence interval).

In order to calculate a rigorous population estimate, it is essential that transects within National Parks are surveyed. Your National Park will benefit from the study in several ways: 1) A population estimate of golden eagles within the entire study area and within Bird Conservation Region 9 2) Information on golden eagle population trends within the entire study area and within Bird Conservation Region 9 3) Data from the transect within the Park can be used to help interpret golden eagle trends within your National Park.

Subject/Discipline:

Birds / Ornithology

Locations authorized:

One east west transect.

Survey will be conducted sometime between August 15 and September 15. The portion of the transect that goes over the National Park will require only a total of 15 - 30 minutes to survey, and will only be conducted once each year.

Transportation method to research site(s):

Fixed wing aircraft (Cessna 205)

Collection of the following specimens or materials, quantities, and any limitations on collecting:

No collections authorized.

Name of repository for specimens or sample materials if applicable:

n/a

Specific conditions or restrictions (also see attached conditions):

Prior to visiting Death Valley National Park, one of the employees listed below will be advised of the locations and the times of the field research.

Linda Manning: Linda_Manning@nps.gov (760) 786-3252

Steve Mazur: Steve_Mazur@nps.gov (760) 786-3248

This permit is subject to the General Permit Conditions and the Death Valley National Park Specific Conditions in the National Park Service Research Permit and Reporting System websites https://science.nature.nps.gov/research/ac/ResearchIndex and https://science.nature.nps.gov/research/ac/parks/ParkInfo respectively. It is the researcherâ s responsibility to read, understand, and comply with these conditions.

All data, reports and publications resulting from this study shall be provided to Death Valley National Park, to the attention of the Research Permit Coordinator and the Wildlife Biologist.

Recommended by park staff(name and title):

, Environmental Protection Specialist

Reviewed by Collections Manager: Yes ___ No ✓

Approved by park official:

Wildlife Biologist

Date Approved: 9-1-10

Title:

Superintendent

I Agree To All Conditions And Restrictions Of this Permit As Specified
(Not valid unless signed and dated by the principal investigator)

(Principal investigator's signature)

8/29/2010
(Date)

THIS PERMIT AND ATTACHED CONDITIONS AND RESTRICTIONS MUST BE CARRIED AT ALL TIMES WHILE CONDUCTING RESEARCH ACTIVITIES IN THE DESIGNATED PARK(S)

SCIENTIFIC RESEARCH AND COLLECTING PERMIT Grants permission in accordance with the attached general and special conditions United States Department of the Interior National Park Service Joshua Tree	Study#: JOTR-00213 Permit#: JOTR-2013-SCI-0027 Start Date: Jul 30, 2013 Expiration Date: May 29, 2014 Coop Agreement#: Optional Park Code:

Name of principal investigator:
Name: Dr Thomas George **Phone:**970-226-9170 **Email:**tlg2@humboldt.edu

Name of institution represented:
Humboldt State University

Co-Investigators:

Name: Ryan Nielson	**Phone:** 307-760-5147	**Email:** rnielson@west-inc.com
Name: Joel Thompson	**Phone:** 307-214-2799	**Email:** jthompson@west-inc.com
Name: Troy Rintz	**Phone:** 541-230-1793	**Email:** trintz@west-inc.com

Study Title:
Aerial line transect surveys for golden eagles (Aquila chrysaetos) within the Desert Renewable Energy Conservation Plan area and additional lands of Southwestern Imperial County, California

Purpose of study:
The Desert Renewable Energy Conservation Plan (DRECP) region in southeastern California has been identified as a key region for development of large-scale wind and solar energy production in the coming years. Golden eagles (Aquila chrysaetos) may be negatively impacted by both wind and solar energy development but there has been no region-wide survey of the golden eagle population within the DRECP area. In order to comply with the Bald and Golden Eagle Protection Act (BGEPA), it is critical to obtain baseline information on the golden eagle population within the region before large-scale energy development occurs. The primary objective of the survey is to estimate the abundance of golden eagles within the DRECP area and southwestern Imperial County, California, during the early breeding season (January-March) and during the post-fledging period (July-September). The surveys will allow for an assessment of the size of the golden eagle population within the study area and provide a baseline for detecting trends in the population over time.

Subject/Discipline:
Birds / Ornithology

Locations authorized:
We will be flying parts of 3 50 km transects over Joshua Tree National Park (see attached map).

Transportation method to research site(s):
We will be flyiing over the park in a Cessna 206 aircraft at 100-150 m above the ground.

Collection of the following specimens or materials, quantities, and any limitations on collecting:

Name of repository for specimens or sample materials if applicable:

Specific conditions or restrictions (also see attached conditions):
Joshua Tree National Park Research Conditions & Restrictions

Permits must be carried at all times by all individuals covered under the permit while conducting research in the park.

1.This permit, issued by the National Park Service (hereafter referred to as NPS), allows the named principal investigator to collect certain animal, plant, or mineral resources in the locations and quantities specified. Archeological and paleontological materials may not be collected or disturbed under this permit unless accompanied by a current Antiquities Permit.

2.Field assistants may collect only under the direct supervision of the principal investigator named on the permit. The permit holder is responsible for seeing that each assistant understands the permit stipulations. Assistants collecting independently must be issued their own collecting permits.

3.This permit does not give the bearer license to violate any NPS regulations.

4.A pre-field work meeting may be required between the principal investigator(s) and NPS staff to clarify and reinforce permit conditions, access, research/collecting methods, reporting, communications and other items related to this permit and the research proposal.

5.Before initiating field research please contact the park Research Coordinator at (760)367-5560. Identify yourself by name, organization, or agency, and describe where you will be working, and vehicle(s) being used.

6.If designated parking areas are not convenient, park in a safe place with plenty of sight distance for other traffic that does not cause any damage to the resources.

7.Place a copy of the enclosed Research and/or Collecting Permit in the driver side window of your parked vehicle.

8.If access is required outside of normal park hours, make advance arrangements, obtain permission, and advise dispatch before going into those closed park areas.

9.Provide information to inquiring park visitors in a courteous and informative manner.

10.All collecting (if permitted) must be done away from roads, trails, and developments, unless otherwise specified in the permit. Collection methods shall not attract attention or cause unapproved damage to the environment.

11.Collected specimens will remain Federal property unless and until ownership is conveyed.

12.The Research Coordinator does require locality records (UTMs) for all plots, survey areas, research vicinities, excavations, transects or any other georeferenceable aspects of activities noted in this permit. The Research Coordinator may require an inventory and locality record (UTMs) for any or all specimens before they are removed and, after the collection has been assembled, to submit it for examination. An electronic metadata form to be used for this purpose is available through the Research Coordinator. Applicability of this requirement to your research activity should be discussed with the park Research Coordinator prior to any activities.

13.Collected specimens may be used for scientific or educational purposes only, shall be dedicated to public benefit, and shall not be used for commercial profit.

14.The NPS reserves the right to designate the depository of all specimens removed from the park and to approve or restrict transfers of specimens between depositories. The NPS also reserves the right to designate the U.S. National Museum or the park museum as the depository of any specimen removed from the park, after the collector has made necessary studies and published the results of those studies.

15.Each specimen (or groups of specimens labeled as a group) that is stored, exhibited, conserved, etc. must bear labels stating that they are the property of the NPS and must be accessed and cataloged in the NPS National Catalog.

16.One copy (or more if specified) of all scientific and other publications resulting entirely or in part from research and/or collecting through the issuance of this permit will be furnished to the Superintendent of the park. Field notes should be copied and furnished in either electronic format (portable document file – pdf) or as a hard copy. For information regarding cataloging, identification or deposition of field notes and reports, contact Museum Curator Melanie Spoo at (760) 367-5571.

17.This permit expires on the date shown, but no later than December 31 of the year issued. A new collecting permit may be issued for each subsequent calendar year of study only after the Investigator's Annual Report for the completed year is received by the park Superintendent.

18.Nothing in this permit shall be construed as granting any exclusive research privileges or automatic right to continue, extend, or renew this or any other line of research under new permit(s). Each research\collecting proposal request will be evaluated on its own merit.

19.Violation of these terms and conditions may result in the suspension or revocation of the permit. Failure on the part of the collector(s) to adhere to the policies outlined by the park and those policies as stipulated in the Code of Federal Regulations (CFR), Title 36, Section 2.5, and National Park Service (NPS) Management Policies may result in the withdrawal of this collecting permit.

20.36 CFR, Chapter 1, Section 2.5 -- Research Specimens: further defines and clarifies the basic conditions under which this permit is issued.

21.Authority - The permittee is granted privileges covered under this permit subject to the supervision of the superintendent or a designee, and shall comply with all applicable laws and regulations of the National Park System area and other federal and state laws.

A National Park Service (NPS) representative may accompany the permittee in the field to ensure compliance with regulations.

22.Responsibility - The permittee is responsible for ensuring that all persons working on the project adhere to permit conditions and applicable NPS regulations.

23.False information - The permittee is prohibited from giving false information that is used to issue this permit. To do so will be considered a breach of conditions and be grounds for revocation of this permit and other applicable penalties.

24.Assignment - This permit may not be transferred or assigned. Additional investigators and field assistants are to be coordinated by the person(s) named in the permit and should carry a copy of the permit while they are working in the park. The principal investigator shall notify the park's Research and Collecting Permit Office when there are desired changes in the approved study protocols or methods, changes in the affiliation or status of the principal investigator, or modification of the name of any project member.

25.Revocation - This permit may be terminated for breach of any condition. The permittee may consult with the appropriate NPS Regional Science Advisor to clarify issues resulting in a revoked permit and the potential for reinstatement by the park superintendent or a designee.

26.Reports - The permittee is required to submit an Investigator's Annual Report and copies of final reports, publications, and other materials resulting from the study. Instructions for how and when to submit an annual report will be provided by NPS staff. Park research coordinators will analyze study proposals to determine whether copies of field notes, databases, maps, photos, and/or other materials may also be requested. The permittee is responsible for the content of reports and data provided to the National Park Service.

27.Confidentiality - The permittee agrees to keep the specific location of sensitive park resources confidential. Sensitive resources include threatened species, endangered species, and rare species, archeological sites, caves, fossil sites, minerals, commercially valuable resources, and sacred ceremonial sites.

28.Methods of travel - Travel within the park is restricted to only those methods that are available to the general public unless otherwise specified in additional stipulations associated with this permit.

29.Other permits - The permittee must obtain all other required permit(s) to conduct the specified project.

30.Insurance - If liability insurance is required by the NPS for this project, then documentation must be provided that it has been obtained and is current in all respects before this permit is considered valid.

31.Mechanized equipment - No use of mechanized equipment in designated, proposed, or potential wilderness areas is allowed unless authorized by the superintendent or a designee in additional specific conditions associated with this permit. No use of artificial lights during the night unless pre-approved by Park Research Coordinator.

32.NPS participation - The permittee should not anticipate assistance from the NPS unless specific arrangements are made and documented in either an additional stipulation attached to this permit or in other separate written agreements.

33.Permanent markers and field equipment - The permittee is required to remove all markers or equipment from the field after the completion of the study or prior to the expiration date of this permit. The superintendent or a designee may modify this requirement through additional park specific conditions that may be attached to this permit. Additional conditions regarding the positioning and identification of markers and field equipment may be issued by staff at individual parks.

34.Access to park and restricted areas - Approval for any activity is contingent on the park being open and staffed for required operations. No entry into restricted areas is allowed unless authorized in additional park specific stipulations attached to this permit.

35.Notification - The permittee is required to contact the park's Research and Collecting Permit Office (or other offices if indicated in the stipulations associated with this permit) prior to initiating any fieldwork authorized by this permit. Ideally this contact should occur at least one week prior to the initial visit to the park.

36.Expiration date - Permits expire on the date listed. Nothing in this permit shall be construed as granting any exclusive research privileges or automatic right to continue, extend, or renew this or any other line of research under new permit(s).

37.Other stipulations - This permit includes by reference all stipulations listed in the application materials or in additional attachments to this permit provided by the superintendent or a designee. Breach of any of the terms of this permit will be grounds for revocation of this permit and denial of future permits.

Recommended by park staff(name and title):

Michael S. Vamstad Wildlife Ecologist

Reviewed by Collections Manager:

Yes X No ___

Approved by park official:

Mark A Burns

Date Approved:

7/25/13

Title:

Superintendent

I Agree To All Conditions And Restrictions Of this Permit As Specified
(Not valid unless signed and dated by the principal investigator)

(Principal investigator's signature)

7-24-2013
(Date)

THIS PERMIT AND ATTACHED CONDITIONS AND RESTRICTIONS MUST BE CARRIED AT ALL TIMES WHILE CONDUCTING RESEARCH ACTIVITIES IN THE DESIGNATED PARK(S)