Conservation Planning and Risk Assessment for Golden Eagles in the Western United States

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Western Golden Eagle Conservation Team

Established in 2013 by USFWS managers in four western Regions

In response to increased regulatory and conservation issues due to renewable energy development
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Colorado Parks & Wildlife
Goals and Objectives

• Provide risk assessment and decision support tools for renewable energy development and mitigation

• Develop landscape-scale strategies for Golden Eagle conservation
PROSPECTING: Potential Issues or Fatal Flaws

Desktop Review of Important Parameters
Use publicly available data, in-house expertise, and consultants to evaluate costs, time, risks, and degree of uncertainty

Assess Market Strength
- Competition
  - Too many existing projects

Evaluate Preliminary Project Economics
- Wind Resource
  - NCF too low; high NCF sites already developed
- Transmission & Integration
  - Insufficient demand
  - Overloaded queue; transmission is a long distance from wind resource & interconnection line is not cost effective; voltage is too high on nearest transmission line (to interconnect & build substation is cost prohibitive)

Assess Permitting Needs and Potential Complexity
- Land Use
  - Core habitat area
  - Energy generation prohibited
- Sensitive Areas, species

Assess PPA Potential
- Insufficient demand

Assess Constructability
- Land Availability
  - Easy to permit private lands are limited/unavailable
- Constructability
  - Flat, wide open sites are already developed

Assess Public Perceptions
- Public Perceptions
  - Well known, strong opposition

Assess Political Environment
- Local politicians with distaste for RE

Assess DoD/Radar
- Restricted airspace

Source: NREL (2016) An Initial Evaluation of Siting Considerations on Current and Future Wind Deployment
Relationship to USFWS policy, regulations and guidance for wind development and eagle conservation

• WGET’s role is to develop a suite of science-based products for use in project siting (ECPG Stage 1) and strategic compensatory mitigation (Stage 4)

• WGET’s relevant risk assessment and decision support tools may be incorporated into future versions of FWS’ Eagle Conservation Plan Guidance
Other Customers

• **Federal land management agencies:** Land Management Plans; NEPA compliance for energy, transmission development; recreation development

• **County, municipal, private landowners:** Habitat Conservation Plans, Conservation Easements

• **Nongovernmental organizations:** Land trusts, conservancies, landscape planning
Specific Objectives

1. Predictive Models of Golden Eagle distribution and relative abundance during all seasons, life history stages

2. Spatially explicit evaluation of risk factors including exposure to contaminants, electrocution, collisions with vehicles, disturbance, and energy development

3. Information Resources to support management of Golden Eagles and their prey

4. Incorporate 1-3 into Ecoregional Conservation Strategies
Modeling for Conservation Planning

- **Objective** – Reliable spatial prediction of distribution and relative abundance of eagles. Not quantification of niche!
- **Best available data (plus!)** – invest in data acquisition, then fill data gaps
- **Focus on evaluation of model performance** relative to objectives
- **Adaptive** – improvement of models through implementation and feedback
I. Predictive Models of Golden Eagle Breeding Habitat

Partners: Jeffrey Dunk & Dave LaPlante, Humboldt State University
        Jason Tack & Barry Noon, Colorado State University
Modeling Approach

Objective: Reliable prediction of relative habitat suitability (relative density of use) at the scale of breeding territory

Ecoregion-specific

Species Distribution Models

Environmental variables:
• terrain, aspect, elevation
• land cover
• primary productivity (NDVI)
• climate
• anthropogenic features
• orographic uplift, thermals
Spatial Data – Nest Sites

Compiled nest records from State & Federal agencies, NGOs, researchers, consultants

154 data sets; 107,604 nest records and counting...

Identified portions of ecoregions with few data, or poorly distributed data

In 2014 – 2016, WGET supported nest surveys in TX, OK, KS, MT, CA, OR, ID, UT, AZ, CO

Roughly 314 new nest locations were used to evaluate model performance
Composite of Ecoregional Models

Northwestern Great Plains
Wyoming Basin
Central Basin and Range
Northern Basin and Range
Columbia Plateau
Colorado Plateau*
Arizona/New Mexico Plateaus*

Western High Plains/
Southwestern Tablelands
Field evaluation of model predictions

Surveyed random sample of 2.5km² hexagons, stratified by mean RHS value

62 cells surveyed
37 occupied nests
• 29 in upper 10%
• 33 in upper 25%
• 37 in upper 50%
II. Predictive Model of MID-WINTER Landscape Use by Golden Eagles

Partners: Leo Salas, Dennis Jongsomjit, Nathan Elliott & Sam Veloz
Point Blue Conservation Science

Eastern Cascades Audubon
Nevada Dept. of Wildlife
Hawkwatch International

Photo: Donna Delite
Modeling Approach

- **Data Sources:**
  - California Avian Data Center area searches
  - Rocky Mountain Avian Data Center surveys
  - eBird (AKN datasets - filtered appropriately)
  - USFWS Mid-winter Bald Eagle survey

- Aggregated data by 10-km x 10-km cell to create survey history per cell

- Fit **Historic-Data Imperfect Detection Model** for mean occupancy rate

- Used **Boosted Regression Tree Model** to improve predicted occupancy model fit with environmental variables
Results – landscape model

Predictive Accuracy

Tested against independent datasets from Oregon, Idaho and Nevada

RESULT: the landscape models predict relative abundance (categorical) with 84% accuracy

Seeking additional winter survey data for model evaluation
III. Predictive Models of Golden Eagle Movements and Migration
Objectives -

- **Step 1:** Describe and map patterns of movement
- **Step 2:** Predictive model of movement ‘habitat’
  - Compile and analyze telemetry data (ARGOS, GPS, GSM) from cooperators throughout North America
  - Focus on landscapes and ecological conditions disproportionately used for movement and migration

**Core Team:**
- Jessica Brown – U. Nevada, Reno
- Dave LaPlante – NRG
- Todd Katzner – USGS
- Robert Murphy – USFWS
- Todd Lickfett – USFWS
- Carol McIntyre – NPS
- Brian Woodbridge – USFWS

Photo: Sky Delite
Telemetry Meta-analysis...

- Identified gaps in geographic distribution of satellite telemetry studies
- In 2014-2016 WGET deployed 72 GPS PTT on GOEA nestlings in WA, OR, CA, NV, AZ, ID, UT, MT
- FWS Regions 6 & 2 deployed 65 GPS PTT in CO, WY, MT, SD, NB, TX (2013, 2014)
Current Status

- 28 collaborators
- ~800 individual Golden Eagles tracked
- 4,960,946 locations

Always looking for more...

Data resource for multiple research projects
Step 1: Describe and map patterns of movement
Modeling approach:

Using Bayesian State-Space Switching model ("bsam" R-package) to discriminate:

- Transiting – directed long-distance movements
- Settling – localized movements

Develop separate RSF models for each behavior
Step 2: Predictive modeling of movement areas

- Work in progress
- Compare alternative modeling methods
- Evaluate model performance with independent data from new deployments
Predicting Relative Risk of Golden Eagle Exposure to Development

Wyoming Basin

Breeding habitat

Winter habitat

Movement and Settling habitat
Spatially Explicit Evaluation of Risk Factors

Objective:
Support prioritization and effectiveness of mitigation efforts

Evaluation and predictive modeling of stressors:

- Electrocution
- Contaminants
- Collisions on roads
- Disturbance
- Disease and parasites
Electrocution and Mitigation

- Review and Synthesis of Research Investigating and Mitigating Golden Eagle Electrocutions
  *EDM International*

- Power Pole Density Informs Spatial Prioritization for Mitigating Avian Electrocution
  *Dwyer et al. 2016 Journal of Wildlife Management*

- Avian Electrocution Risk Assessment Predictive Model
  *EDM International*

- Avian Electrocutions on Incorrectly Retrofitted Power Poles
  *Dwyer et al. (in prep.)*

Partners: APLIC, Powder River Electric Corp.
Predicting Landscape-scale Electrocution Risk for Mitigation and Proactive Retrofit Planning: A Pilot Study

Photo: Sky Delite
Predictive Model of Electrocution Hazard

- Model power pole density as surrogate for electrocution hazard
- Increased PPD correlated with increased complexity of equipment (= hazard)

CO/WY Model accurately predicts pole density
NE Wyoming

282 Golden Eagle electrocution mortalities

Compared with:

Hazard model

Breeding model

Winter model

Partner: Powder River Electric Corp.
Risk: Interaction of Exposure with Hazard
Contaminants and Mitigation

• Role of contaminants in Golden Eagle populations: assessment report
  *USGS-FRESC, USFWS Contaminants Specialists*

• Evaluating exposure to lead, anticoagulant rodenticides and other contaminants in Golden Eagles
  *USGS National Wildlife Health Center, USFWS Region 6 and USFWS Ashland Forensics Laboratory*

• Mapping relative availability of hunter-killed carrion and potential Pb exposure in Western U.S.
  *Humboldt State University*
Predicting Potential Lead Exposure from Hunter-killed Big Game Remains
Deer/Elk Harvest by Game Management Unit (animals/km² 5-year average)

Represents relative hazard of Pb exposure during fall hunting season

Fall paths of 79 PTT-tagged Golden Eagles originating in Alaska and northern Canada

Partners:
Matthew Lau
James Graham
Jeffrey Dunk
Humboldt State University
Quantifying GOEA exposure to lead at recreational ground squirrel shooting areas

• Sample sites in E. Oregon (Harney Co.) and N. California (Siskiyou Co.)
• Analyzed 180 squirrel carcasses for Pb
• Blood samples from 209 raptors captured at shooting sites
• 150 blood samples from 90 GOEA nestlings at 60 nests
• 273 scavenger observation surveys

Partners: Collin Eagles-Smith and Garth Herring, USGS-FRESC
Oregon Eagle Eagle Foundation, Oregon High Desert Museum
Organized recreational shooting of ground squirrels and prairie dogs may provide an opportunity for focused lead remediation through carcass removal and/or non-toxic ammunition.
Collisions with Vehicles

Spatial model of relative risk based on:

- Road characteristics – traffic, speed, terrain
- Big game winter range, migration route models
- Jackrabbit habitat
- Golden Eagle winter and movement models

Model evaluation using State-identified road segments with history of vehicle - eagle collisions
Habitat Management and Mitigation

Information resources for landscape-specific management of Golden Eagles

• Prey resources
• Nest sites, nest survival, disturbance
• Mortality factors
Golden Eagle Diets, Prey Communities, and Prey Management

Information resources for habitat management and mitigation

Photo: Sky Delite
Information Resources for Prey Management

• Spatial and Temporal Patterns in Golden Eagle Diets in the Western United States, with Implications for Conservation Planning  
  *USFWS - Bedrosian et al. In review*

• Golden Eagle Dietary Responses to Habitat Alteration in the Morley Nelson Snake River Birds of Prey Area  
  *USGS - Kochert et al. In press*

• A Retrospective Meta-analysis of Jackrabbit and Cottontail Populations in the Western United States  
  *USGS - Esque et al. in review*

• Black-tailed and White-tailed Jackrabbits in the American West: History, ecology, ecological significance and survey methods  
  *USGS – Simes et al. 2015*
• Prey Species Accounts:
  Ecology, populations, habitat relationships, and management of key prey species

• Golden Eagle Prey Enhancement Model
  WGET collaboration with AWWI

• The Influence of Greater Sage-grouse Management on Golden Eagles in the Wyoming Basin
  WGET collaboration with Jason Carlisle & Trent McDonald, WEST, Inc.

Photos: Sky Delite
Nest Site Management

• Moving nests, artificial nests

• Enhancing existing nests and nest sites to improve nest survival

• *Effect of Exposure and High Temperatures on Golden Eagle Nest Success in SE Idaho* USGS & WGET
Disturbance: Effects and Management

• Expert elicitation, and review and synthesis of research on disturbance effects to Golden Eagles
   Humboldt State University, USFWS Eagle Technical Assistance Team

• Modeling population effects of disturbance to breeding Golden Eagles in SW Idaho
   Pauli, Spaul and Heath, Boise State University

• Recreation disturbance to Golden Eagles: Biological consequences, behavioral mechanisms, and management implications
   Spaul and Heath, Boise State University
Ecoregional Conservation Strategies

- Combine ecoregion-specific models, risk assessments and information resources
- Developed with collaboration by State and federal agencies, Flyways, research institutions, industry, Tribes, NGOs
- In progress: Northern Basin & Range, Wyoming Basin, Central Basin & Range, Northern Great Plains
- When complete, available online through ECOS-IPAC, USFWS-WGET web site
Take home message...