Predictive Models for Golden Eagle Conservation Planning and Renewable Energy Development in the Western United States

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Objective: Develop reliable predictive models for...

- **Decision support tools** – support project siting, effects analysis at landscape scales (project footprint, Local Area Population)

- **Conservation prioritization** – land management planning

- **Risk Assessments** – spatial overlay of predicted eagle distribution with energy resource development potential
Three-season Modeling Approach

The distribution and abundance of Golden Eagles, and their potential for interaction with energy production and transmission infrastructure, vary seasonally.

To incorporate seasonal patterns, we are developing models separately for:

1. Breeding Distribution and Habitat
2. Winter Distribution and Habitat
3. Movement and Migration
I. Golden Eagle breeding distribution and habitat suitability
Clearly stated objectives
Prediction
Scale
Accuracy

Develop conceptual model
- Literature review
- Expert elicitation
- Landscape analyses

Compile spatial data
- GOEA nest locations
- Environmental data

Evaluate model performance
- Cross validation
- Independent data sets
- Expert review
- Additional surveys in data gaps

Refine models

Develop models
- Compare multiple platforms
- Use-Availability
- Species Distributional Models

Compile spatial data
- GOEA nest locations
- Environmental data
Conceptual Model Development

Nest substrates and terrain features
Diet, prey species habitat associations
Vegetation types, primary productivity (NDVI), climate
Spatial Scales: Nest area (120 m) and territory (4km²) based on telemetry, nearest-neighbor distances

Example: Cliff index
Wyoming Basin
Relative Habitat Suitability - Breeding

Project Partners:
Dr. Barry Noon, Jason Tack, Dr. Bradley Fedy
Colorado State University
USGS Fort Collins Science Center
Evaluating model performance

Model predictions evaluated with expert reviews, testing with independent data sets, strategic surveys

Wyoming Basin IPP (lasso penalized)

Testing with independent data:

25 nests from randomized surveys (R. Oakleaf 2011)

24 (96%) nests fall within top 10% of the WY Basin landscape
Preliminary Model Results

Northwestern Great Plains

Wyoming Basin

Colorado Plateau

Arizona & New Mexico Plateaus
II. Golden Eagle distribution and habitat use in winter

• Development and comparison of predictive models based on:
  – AKN eBird data
  – Christmas Bird Count
  – Midwinter Eagle Count
  – Satellite telemetry

Project partners:
Leo Salas and Sam Veloz, Point Blue Conservation Science, Petaluma, CA
III. Golden Eagle movements and migration

**Objective:** Develop predictive models and maps of movement patterns, highlighting landscapes used disproportionately by migrating eagles.

Meta-analysis of satellite telemetry data sets for GOEA in North America
Obtained telemetry data for over 425 individual Golden Eagles

Deployed > 100 additional PTTs in 2013-2014

Continue to pursue additional data sets (!)

Currently compiling databases, QA/QC

Expect to begin analysis in March 2015
Product Availability

- **Timeframe** – Ecoregional models posted individually as completed, beginning in May 2015. West-wide composite model expected in Fall 2015

- **Availability** – will be publicly available at USFWS (ECOS-IPAC) and WGET websites
For more information...

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