Department of Defense
Legacy Resource Management Program

PROJECT NUMBER (15-631)

Status and Distribution Modeling of Golden Eagles on Southwestern Military Installations and Overflight Areas: Assessing "Take" for this Sensitive Species at Risk

Conference Poster

Predicting high likelihood Golden Eagle nest habitat and assessing occupancy across military lands and their overflight training routes

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Abstract

Golden Eagle (GOEA; *Aquila chrysaetos*) management has become a top priority in the desert southwest as potential breeding habitats continue to be altered by human development and activities. This project focused specifically on military disturbance associated with military training routes (MTR) and Bald and Golden Eagle Act (BGEPA) compliance. Our efforts combined with in-kind support resulted in the detection of 914 GOEA nesting territories. Over the three year coarse of this study we monitored 521 territories multiple times throughout the breeding season. Using a presence-absence framework and 914 nesting territories, we analyzed 10 topographic and climatic covariates potentially associated with GOEA nest habitat within each of the 4 Bird Conservation Regions (BCRs) in our study area. Our top preforming regression model visualized high-likelihood GOEA nesting habitat through a Geographic Information System (GIS). Finally, amount of time GOEA were present within military disturbance areas (MTR) versus outside (Non-MTR) did not differ significantly. Application of these models will help focus future survey efforts for GOEA nests and develop a framework to monitor and compare GOEA occupancy based on specific disturbance types to determine compliance with BGEPA.

Introduction

Nest monitoring of golden eagles (Aquila chrysaetos; GOEA) has become a management priority in the desert southwest as revisions to the Bald and Golden Eagle Protection Act (BGEPA; 16 U.S.C. § 668, et seq.) have led to a change in GOEA protection with the promulgation of take permits. Military activities, primarily fixed-wing aircraft and helicopter training should be assessed for their impacts on GOEA to ensure compliance with the BGEPA. The Arizona Game and Fish Department's Wildlife Contracts Branch (AGFD) designed a three year study to evaluate the impact of airborne military training activities on GOEAs. This presentation provides a summary of the findings of this three year study focused on three objectives:

1) Identify and survey potential golden eagle nesting habitat within the Barry M. Goldwater Range, Yuma Proving Ground, and overflight areas used by Luke AFB, Davis-Monthan AFB, Marine Corps Air Station Yuma, Arizona Army National Guard, Creech AFB, Nellis AFB, Fort Huachuca, El Centro Naval Station and White Sands Missile Range and their associated MTRs;

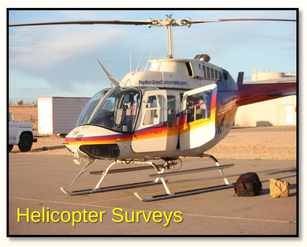
2) Validate an existing landscape-level model previously funded by DoD Legacy and augmented with previous efforts by White Sands Missile Range that will allow natural resource managers to identify golden eagle nesting habitat within and adjacent (i.e., within the MTRs) to southwestern military installations, and;

3) Provide management recommendations that will allow southwestern military installations to maintain their military training opportunities while complying with the revised Bald and Golden Eagle Protection Act statues. This project was funded through the Department of Defense (DoD) Legacy Resource Program (Legacy Projects 12-631, 13-631 and 15-631).

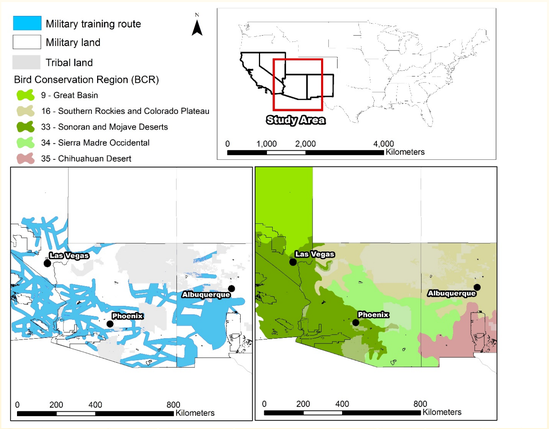
Golden eagle nesting on a ledge outcrop.

Methods

Primary survey strategies



Study Area



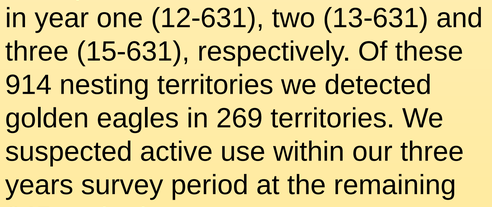
Study area for golden eagle surveys on military lands (black outline) in the southwestern United States. Military training routes (lower left) and Bird Conservation Regions (lower right) are shown. Tribal lands (gray fill; excluded from project) are displayed for reference.

- **Surveys included**
  - Mapping of surveyed areas
  - GPS locations of nests
  - Demographic data (*e.g.,* incubating, brooding, number of young, etc.)
- **Identify and survey potential golden eagle nesting habitat**
  - Identified 914 nesting territories
  - Surveyed 521 nest territories three times to determine period of breeding occupancy
  - Compare period of breeding occupancy across BCR and MTR*sample year
- **Modeling nest distribution**
  - Regressed 10 landscape covariates across 914 known nest territories and 914 random selections with no known nests within each BCR and displayed graphical model results for each.

Military aircraft flying over rugged terrain potentially suitable for golden eagle nests.

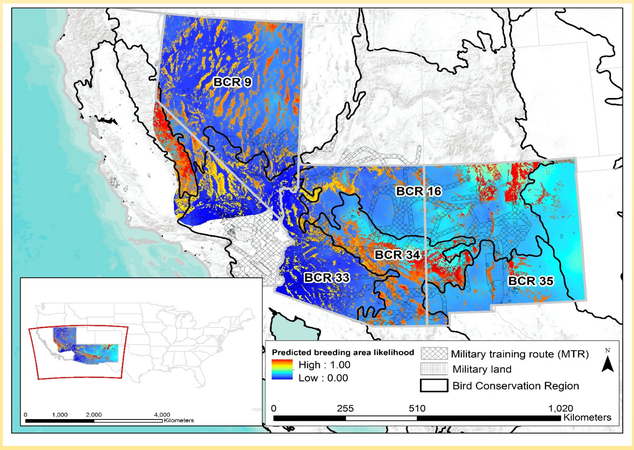
Results

- **Identify and survey potential golden eagle nesting habitat**
  - In the course of this study we identified and surveyed 914 discrete nesting territories (active nest with and 800m buffer). We detected 251, 415 and 248 in year one (12-631), two (13-631) and three (15-631), respectively. Of these 914 nesting territories we detected golden eagles in 269 territories. We suspected active use within our three years survey period at the remaining 645 territories.
  - Golden eagle occupancy within the sample territories varied across MTR status and year. Golden eagle occupancy varied significantly across MTR and year (F=2.29; p=0.0473). We detected significantly greater numbers of golden eagle nesting occupancy in year two than all other years. Golden eagle nesting occupancy did not vary between MTR and non-MTR in year two or year three. However, in year one golden eagle nest occupancy was significantly lower in the non-MTR territories than in the MTR territories.



Comparison of calculated occupancy across year and status as an MTR or non MTR. Letters indicate statistical significance (F=2.29; p=0.0473) Fishers protected LSD (p< 0.05).

- We detected no significant difference in golden eagle nest occupancy across the four BCRs sampled (F=0.56; p=0.6939).
- Modeled distribution of GOEA nesting habitat across the landscape using 914 potential GOEA nests and 914 non-GOEA nesting locations.



Predicted likelihood of golden eagle nesting habitat in using our global model.

- Our global model performed well at predicting absence and presence in the validation data set for a total correct classification of 89%. The global model also performed well at predicting presence and absence at White Sands Missile Range, correctly classifying 92% of events. Overall, the global model correctly classified 90% of events.

Confusion matrix of training and validation datasets used to develop predictive models for golden eagle nesting likelihood in southwestern BCRs, United States.

BCR 9								
Validation			WSMR					
		0	1	% Correct		0	1	% Correct	Total Accuracy
	0	11	3	79%	0	196	39	83%	
	1	2	12	86%	1	5	230	98%	
				82%				91%	86%
BCR 16								
Validation			WSMR					
		0	1	% Correct		0	1	% Correct	Total Accuracy
	0	33	4	89%	0	62	173	26%	
	1	13	24	65%	1	230	5	2%	
				77%				14%	46%
BCR 33								
Validation			WSMR					
		0	1	% Correct		0	1	% Correct	Total Accuracy
	0	121	12	91%	0	201	34	86%	
	1	10	123	92%	1	69	166	71%	
				92%				78%	85%
BCR 34								
Validation			WSMR					
		0	1	% Correct		0	1	% Correct	Total Accuracy
	0	117	10	88%	0	201	34	86%	
	1	15	112	84%	1	5	230	98%	
				86%				92%	89%
Global								
Validation			WSMR					
		0	1	% Correct		0	1	% Correct	Total Accuracy
	0	282	29	91%	0	201	34	86%	
	1	40	271	87%	1	5	230	98%	
				89%				92%	90%

Conclusions

- No difference in occupancy between BCRs and no difference in occupancy under MTR-designated airspace suggesting compliance with BGEPA within our measured parameters.
- Nests were more successful within MTRs in year one suggesting potential benefits within MTR designated airspace.

Although this project was designed to evaluate nest distribution and reproductive status of GOEA within military disturbance areas (i.e., MTR), but rather to develop models that can help direct complementary management supporting both mission objectives and environmental compliance.

These models may have additional benefits beyond military application and may help address and quantify potential impacts from other sources of human disturbance.

Golden eagles utilizing a wildlife waterer adjacent to high-likelihood nesting habitat.

Management Recommendations

1. **Continue monitoring known and suspected GOEA nests to better understand temporal breeding patterns.**
2. **Coordinate with local authorities on current status and distribution of GOEA nests.**
3. **Develop avoidance zones around known GOEA nests occupied in the past 5 years during the breeding season.**
4. **Avoid disturbance of suspected GOEA nests and high likelihood nesting habitat during the early breeding season.**

Acknowledgments

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