



Wind Energy and Raptors

July 18, 2017

- Summary (and Context) of Impacts
 - Songbirds
 - Raptors
- Reducing Impacts to Raptors
 - Avoidance
 - Minimization
 - Compensation
- Research Needs

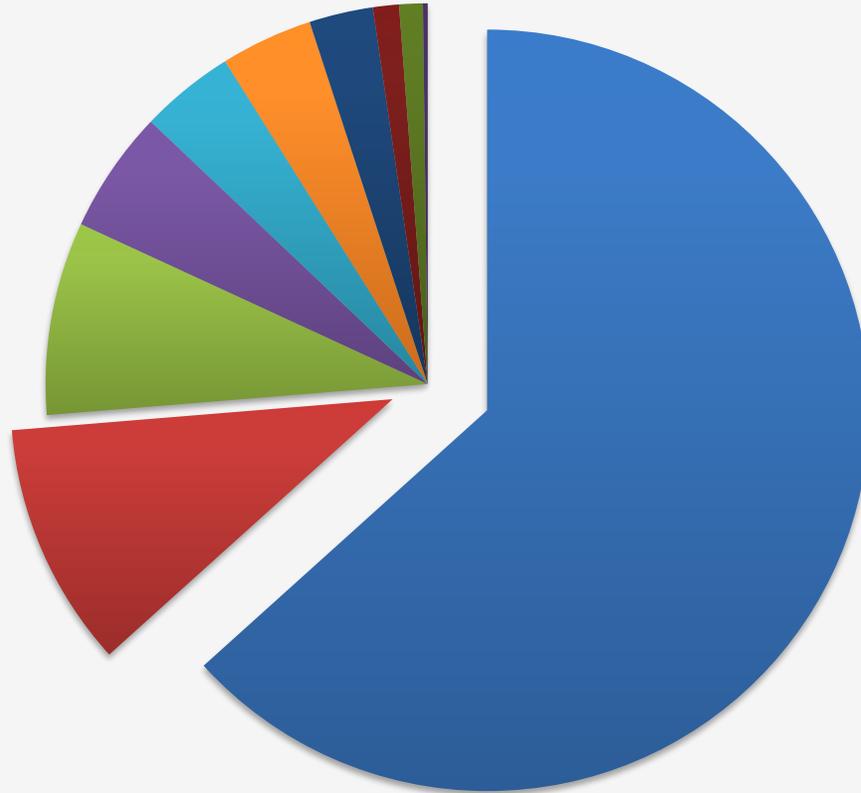
Impacts to Birds

- Birds collide with anthropogenic structures (buildings, towers, transmission lines, wind turbines)
- Fatalities of ~250 species found at wind turbines
- Collision risk likely species-dependent and difficult to assess
 - Unable to relate radar/point count activity in most species to mortality
 - Evidence that collision mortality is related to activity/abundance in raptors (summary in Strickland et al. 2011)
- Issues with fatality estimation (e.g., Huso et al. 2016)
 - Representation
 - Detection

Relative Composition of Bird Fatalities

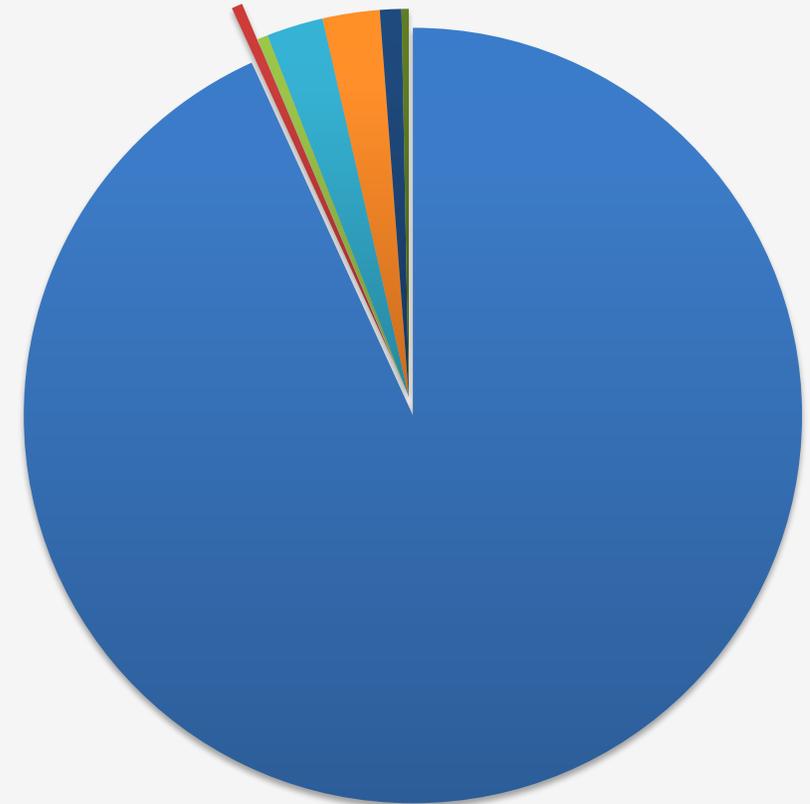
Wind Turbines

(Erickson et al. 2014. PLOS ONE)



Communication Towers

(Gehring et al. 2011. JWM)



Impacts to Raptors

- National estimate for raptor fatalities by species and region
 - Review by Howlin et al. (2016 and in progress) ([Proceedings of Wind Wildlife Research Meeting 2016](#))
 - Higher numbers in western U.S.
 - Percentages of populations 0.5% or less (higher percentage than songbirds)
- Concerns about (possible) additive mortality for long-lived, low fecundity group



2016 NWCC Research Meeting

- Generalized Fatality Estimator (Hein et al. 2016)
- Innovative fatality search protocols (e.g., Rabie et al. 2016; Hallingstad et al. 2016)
- “Raptor-appropriate” correction factors (Howlin et al. 2016)
- Technology to record collision impacts (Albertani et al. 2016)

Analysis of increased available data – American Wind Wildlife Information Center (AWWIC)



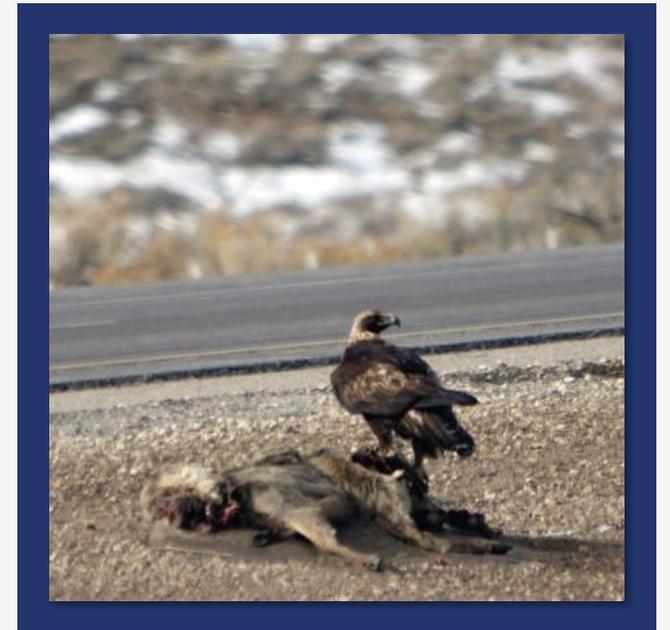
Reducing Impacts to Raptors



Avoidance



Minimization



Compensation

Avoiding Impacts to Raptors

Macro- and Micro-Siting – effects of topography on use of airspace

- California Condor (Poessel et al. 2016)
- Golden Eagle (Todd Katzner, Tricia Miller; e.g., Katzner et al. 2012)

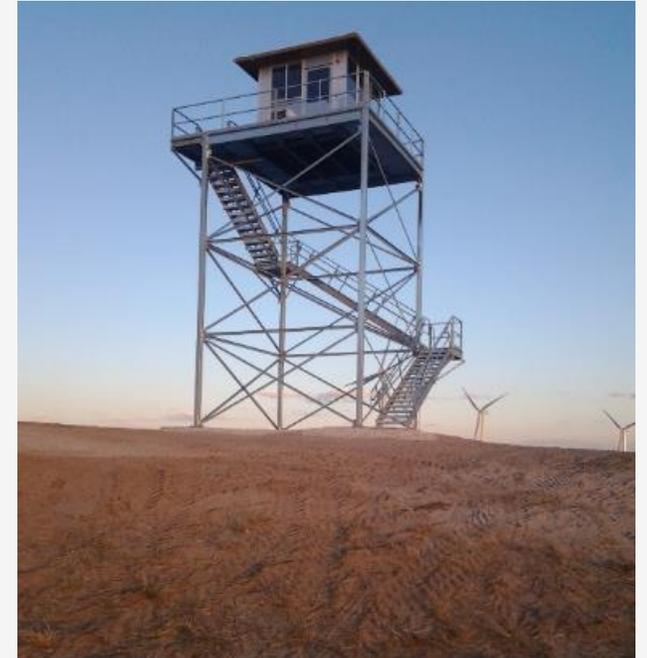


Impact Reduction

- Increase turbine visibility?
 - UV blade painting: no effect detected (Young et al. 2013; Foote Creek Rim, WY)
- Repowering? (Altamont Pass)
 - Substantial reduction in raptor mortality: 67-96% (Smallwood and Karas 2009)
- Removal of “problem turbines” (Altamont Pass e.g., Smallwood et al. 2009)

Curtailment: Informed vs. Blanket

- Seasonal (Altamont Pass, Nov - Feb)
 - Goal: reduce focal species mortality by 50%
 - Successful in reducing mortality of large raptors (ICF International 2016)
- Night migrants (Gulf of Mexico/TX, radar)
- Target species (e.g., condors, whooping cranes, eagles)
 - Radar/VHF Tracking
 - Biomonitoring (various Eagle Conservation Plans)
 - Camera-based systems



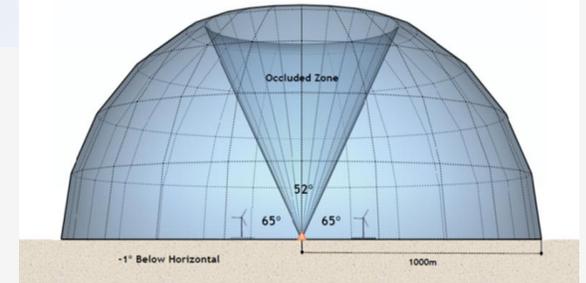
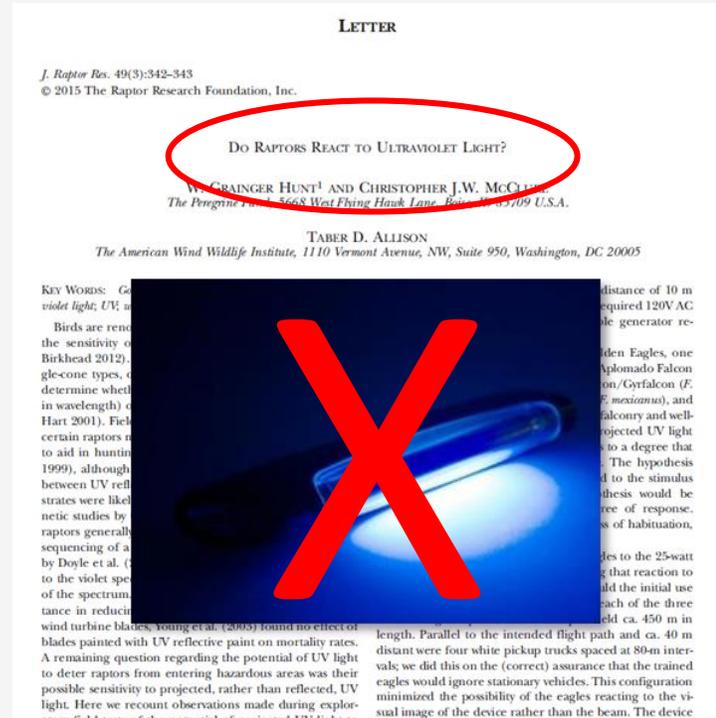
Technologies to Minimize Impacts

Detection

- Visual cameras ?
- Radar ?

Deterrence

- Light (visual & UV) ? ~~X~~
- Sound ?



Evaluating effectiveness, e.g., Hunt et al. 2015



AWWI's Technology Verification Program

AWWI Technology Verification Services

Catalog of Available Technologies



Wind Industry

Streamlined Testing at Appropriate Number of Sites

Tech Vendors

Peer Review

**Verified Detection/
Deterrent Technologies**

Outcomes:

- ✓ Operational Tools
- ✓ Avenues for Compliance
- ✓ Published Studies



Pooling knowledge/resources to find best solutions

Ongoing Projects at Operational Facilities

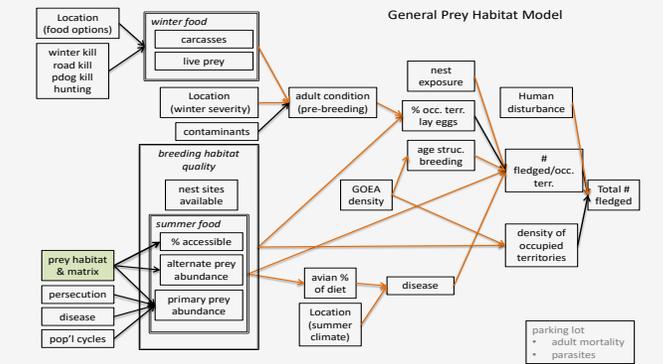
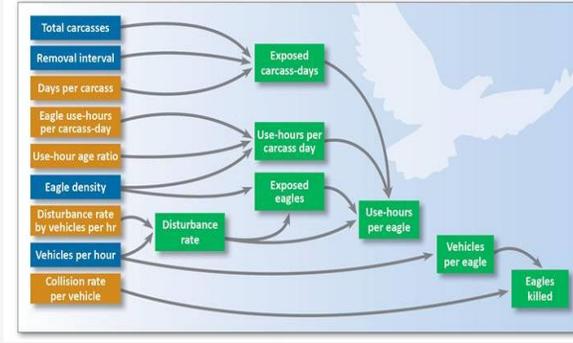
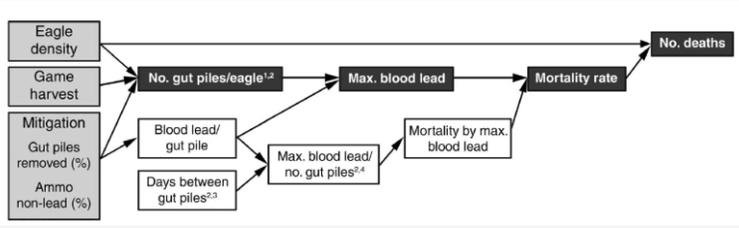
1. Eagle detection & deterrent technology (CA, 2016 – 2017)
2. IdentiFlight – detection & informed curtailment (WY, Fall 2016)
3. DOE-funded evaluations (Summer 2017 – 2020)
 - IdentiFlight – detection & informed curtailment
 - DTBird – detection & deterrent

Future Projects (2018 and Beyond)

- Bat deterrent technologies (Summer/Fall 2018)
- Technologies for other target species (e.g., condors)



Compensating for Take – Golden Eagle



Ecological Applications, 25(6), 2015, pp. 1518–1533
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Modeling with uncertain science: estimating mitigation credits from abating lead poisoning in Golden Eagles

Jean Fitty Cochran^{1,3}, Eric Lonsdorf², Tarr D. Allen³, and Carol A. Sanders-Reed^{1,4}

¹American Wind Wildlife Institute, 118 Vermont Ave. NW, Suite 959, Washington, D.C. 20005 USA
²Biology Department, Franklin and Marshall College, P.O. Box 8003, Lancaster, Pennsylvania 17604-8003 USA

Abstract. Challenges arise when renewable energy development triggers “no net loss” policies for protected species, such as where wind energy facilities affect Golden Eagles in the western United States. When established mitigation approaches are insufficient to fully avoid or offset losses, conservation goals may still be achievable through experimental implementation of unproven mitigation methods provided they are analyzed within a framework that deals transparently and rigorously with uncertainty. We developed an approach to quantify and analyze compensatory mitigation that (1) relies on expert opinion elicited in a thoughtful and structured process to design the analysis (models) and supplement available data, (2) builds computational models as hypotheses about cause-effect relationships, (3) represents scientific uncertainty in stochastic model simulations, (4) provides mortality with and without mitigation, (5) presents risk management preferences (regulatory standards) for immediate action, and (6) defines predictive iterated effectively, to support experimental adaptive inquiry. We illustrate the approach with a case study underlying biological processes and high conservation stakes of voluntary strategies to abate lead poisoning in stags of spent game hunting ammunition.

and Golden Eagle Protection Act; compensatory mitigation; opinion; incidental take; lead abatement; lead poisoning.

insufficient to meet offsetting demand. The gap between pressing needs for mitigation and available methods can be bridged with experimental implementation of “unproven” methods, provided care is taken to deal transparently and rigorously with uncertainty throughout permitting analysis and implementation. Such is the case in the western United States where the Bald and Golden Eagle Protection Act of 1940 (Eagle Act), as interpreted by the U.S. Fish and Wildlife Service (Eagle Rule; USFWS 2009a), allows for development of innovative mitigation approaches to offset incidental taking of Golden Eagles (*Aquila chrysaetos*) associated with wind energy development.

Ecological Applications
A PUBLICATION OF THE ECOLOGICAL SOCIETY OF AMERICA

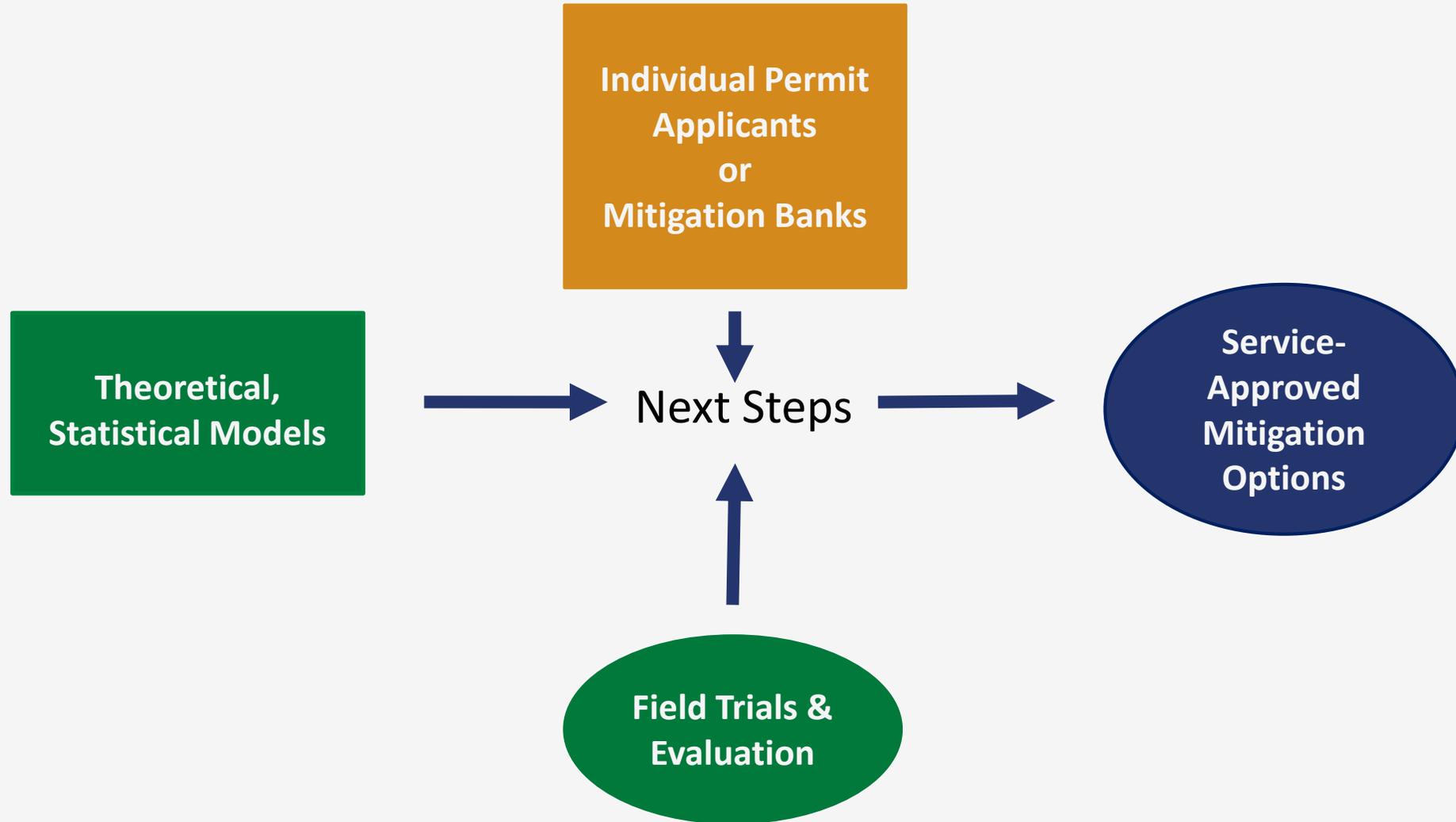


Lead Model: **Published**

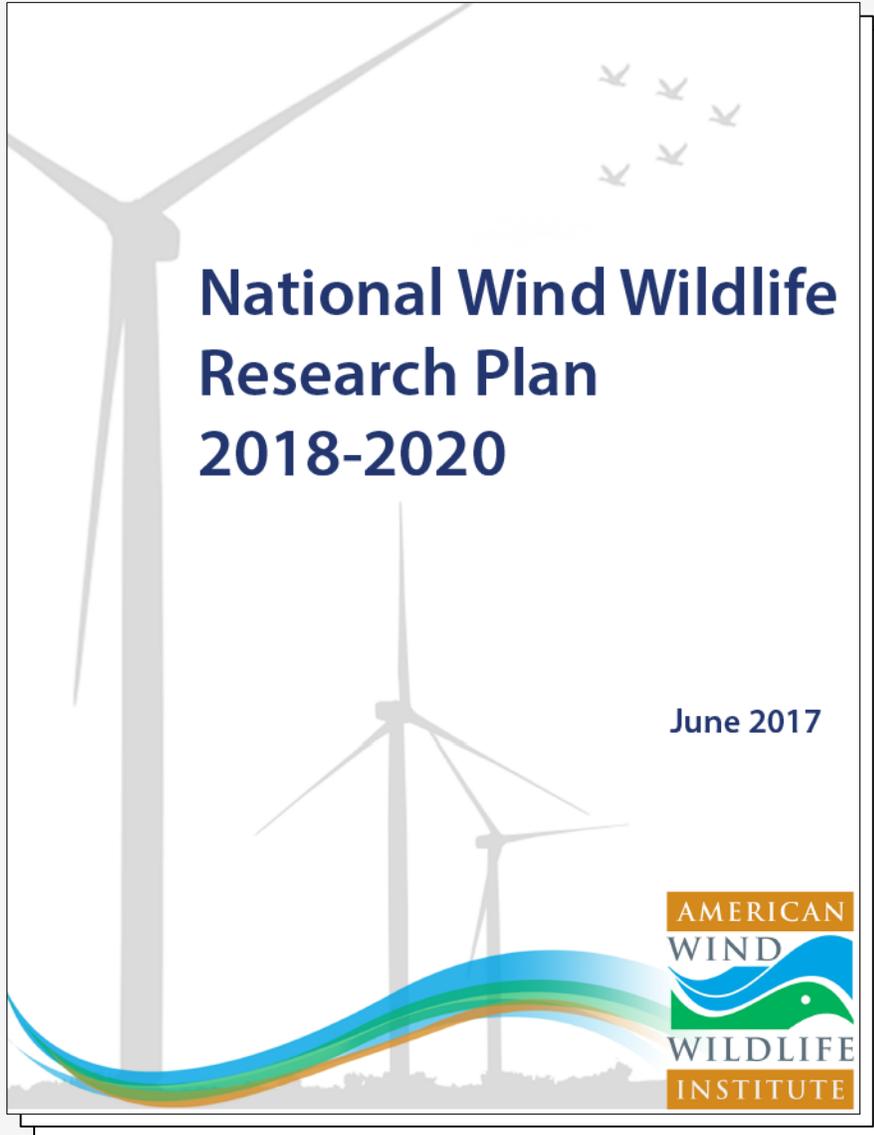
Vehicle Model: **In Review**

Habitat Model:
Under Development

Implementing Compensation Strategies



Further Research Needs



<https://awwi.org/june-28-2017-awwis-2018-2020-national-wind-wildlife-research-plan-now-online-2/>



Wind Wildlife Research Plan – Priorities & Outcomes

| Priority | Outcome |
|--|---|
| Bald and Golden Eagles | |
| Develop and evaluate potential best management practices (BMPs) for avoiding and minimizing take, including technologies intended to minimize impacts | Cost-effective, scientifically accepted technologies and strategies that minimize eagle take, consistent with the Eagle Rule’s avoidance standard; reduced need for compensatory mitigation |
| Create and evaluate quantifiable and verifiable options for offsetting eagle take | Cost-effective, practical, scientifically accepted compensatory mitigation practices available for use in permit applications |
| Enhance eagle take prediction models to provide more accurate take predictions | Cost-effective, scientifically accepted technologies and strategies that minimize eagle take, consistent with the Eagle Rule’s avoidance standard; reduced need for compensatory mitigation |
| Migratory Birds | |
| Use AWWIC to develop more accurate estimates of avian impacts | Improved understanding of impacts of wind energy on avian populations and scientifically sound investment in risk reduction |
| Support development and evaluation of measures to mitigate collision impacts for target avian species | Expanded BMP options to reduce hazards to target species such as condors, cranes, and raptors |

Questions?

