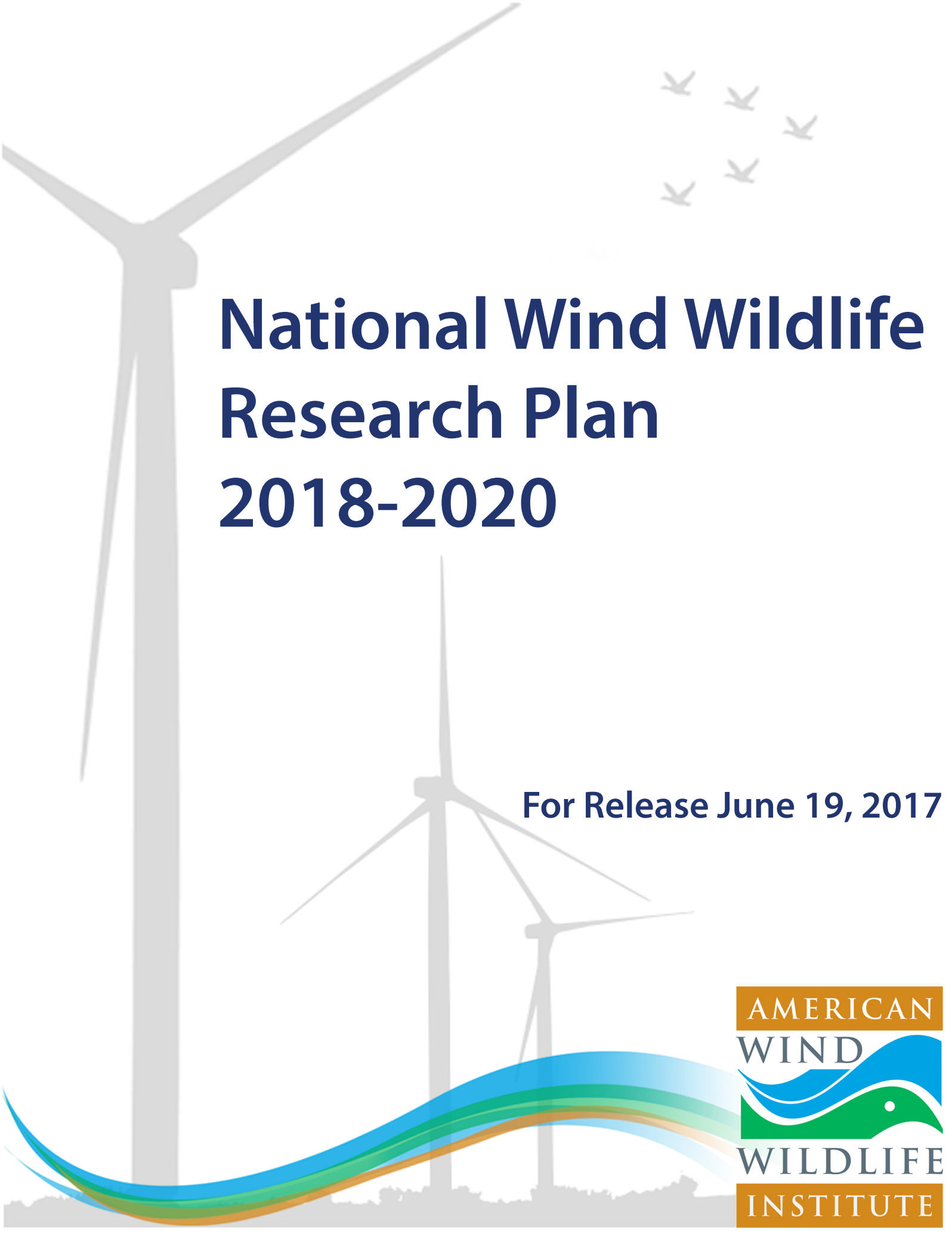

National Wind Wildlife Research Plan 2018-2020

For Release June 19, 2017

AMERICAN WIND WILDLIFE INSTITUTE

National Wind Wildlife Research Plan

American Wind Wildlife Institute
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Washington, DC 20005
awwi.org

For Release June 19, 2017

AWWI is a partnership of leaders in the wind industry, wildlife management agencies, and science and environmental organizations who collaborate on a shared mission: to facilitate timely and responsible development of wind energy while protecting wildlife and wildlife habitat.

Find this document online at awwi.org/researchplan

Acknowledgements
This document was made possible by the generous support of AWWI's Partners and Friends. Thank you to those who reviewed and provided insightful feedback during the development of this document. The information contained in this document does not necessarily reflect the opinions of AWWI's Partners and Friends or those who served as reviewers.

Suggested Citation Format
American Wind Wildlife Institute (AWWI). 2017. National Wind Wildlife Research Plan. Washington, DC. Available at www.awwi.org.

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Executive Summary

An expanded role for wind-generated electricity is a leading component of our nation's strategy for **creating jobs, increasing economic and energy security, and reducing the impact of fossil fuel extraction and emissions on wildlife and ecosystems.** The U.S. wind industry already supports more than 100,000 jobs across all 50 states, and is a leading creator of jobs and economic development in rural areas and Rust Belt manufacturing hubs. Wind generating capacity has grown at an average annual pace of 12% over the last five years to over 84 gigawatts (GW) installed across 41 states,[i] and is poised to grow on the order of 8.5 GW/year. The addition of 35 GW of new wind power capacity through 2020 would drive 248,000 jobs and $85 billion dollars in economic activity over the next four years,[ii] supporting wind power's potential to provide 20% of America's electrical demands by 2030.[iii]

Clean, renewable energy development, like all human activity, can have adverse impacts on wildlife and habitat. In the three decades since the earliest efforts to monitor avian interactions with wind turbines, **industry, government, academic, and nonprofit stakeholders have made great strides towards understanding and minimizing wind energy's wildlife impacts** by defining common metrics and protocols, creating risk-assessment guidelines, and collaborating to prioritize research questions and test possible solutions.

Although uncertainties remain, the creation of an independent database[iv] for collecting empirical fatality data across projects, companies, and geographies now enables us to substantially advance our understanding of wind-wildlife risk. Concurrently, a suite of technologies offering practical ways to minimize that risk are ready to be tested and verified. **To achieve the economic and environmental promise of wind energy, now is the time to make a substantial and focused research investment on a national scale** to reduce key remaining uncertainties and develop solutions to wind energy's impacts on key wildlife species.

In 2016, the AWWI Board of Directors asked staff to prepare a National Wind Wildlife Research Plan that would ensure the responsible growth of land-based wind energy development.[v]

This Plan includes a synthesis of research priorities based on what we know. We developed this Plan with input from interviews and informal discussions with federal and state agency personnel, other scientists, AWWI Partners and Friends, and AWWI's Science Advisors during late 2016 and early 2017. The Plan highlights generally what questions need to be addressed and identifies **specific areas of research where AWWI will focus over the next three years to achieve the following outcomes:**

Bald and Golden Eagles
Cost-effective, scientifically accepted technologies and strategies that minimize eagle take, consistent with the Eagle Rule's avoidance standard; reduced need for compensatory mitigation
Cost-effective, practical, scientifically accepted compensatory mitigation practices available for use in permit applications
Bats
Reduced bat fatalities with minimally reduced power production
Improved understanding of variation in impacts of wind energy on bats and of the effectiveness of mitigation efforts[vi]
Improved siting and avoidance of high-risk areas; reduced mitigation costs
Migratory Birds
Improved understanding of impacts of wind energy on avian populations and scientifically sound investment in risk reduction
Expanded best management practice options to reduce hazards to target species such as condors, cranes, and raptors
Prairie Grouse
Expanded mitigation options to reduce impacts and facilitate development in low risk, high wind resource areas
Improved understanding of wind energy's potential impacts and solutions for mitigating those impacts

Even as we focus on these species, we will develop and evaluate strategies for shifting priorities as wind energy expands and ecosystems change in response to climate change including:

- Developing ways to characterize and summarize current and future cumulative effects. As wind energy expands, it will be essential to identify future wildlife concerns to focus current research
- Applying existing analytic tools to refine our research priorities and invest in research that provides the greatest value

We are now at a pivotal point. This Research Plan outlines a suite of specific projects that, if funded and completed over the next three years, will **provide the industry and permitting agencies with credible, cost-effective solutions to wind-wildlife challenges.** It will take a continued infusion of funds for these solutions to be effective enough to conserve healthy wildlife populations *and* economic enough for industry to stay competitive. To date, federal funding has made a meaningful contribution; the next, critical phase of this effort will depend on a creative approach to financing – and, more than ever, on collaboration among stakeholders.

We recognize that – nationally and for AWWI – this is an ambitious list and cannot be achieved without considerable resources[vii] and the continued participation of our partners in the wind industry, state and federal government agencies, researchers, and conservation organizations. Drawing on AWWI's demonstrated experience and success in supporting and facilitating collaborative research and leveraging resources, this Plan will help us address key wind-wildlife questions, facilitating the transformation of research results to policies and practices that will achieve conservation outcomes and enable the U.S. to realize the benefits of its wind energy potential.

[i] American Wind Energy Association. 2017. U.S. Wind Industry First Quarter 2017 Market Report. AWEA Public Version. Available at www.awea.org/1Q2017.
[ii] Navigant Consulting. 2017. Economic Development Impacts of Wind Projects. Prepared for American Wind Energy Association. Available at www.awea.org/windbenefits.
[iii] U.S. Department of Energy. 2015. Wind Vision: A New Era for Wind Power in the United States. Available at www.energy.gov/eere/wind/maps/wind-vision.
[iv] AWWI established and began collecting post-construction fatality data in its American Wind Wildlife Information Center (AWWIC) in 2013.
[v] AWWI recognizes the future importance of offshore wind as part of a renewable energy strategy and may work on offshore wind energy if there is a unique and useful role for AWWI to play.
[vi] Unless otherwise qualified, mitigation encapsulates avoidance, minimization, and compensatory mitigation.
[vii] An estimated $4-6 million per year over current levels of research investment.

Introduction

A significantly expanded role for wind-generated electricity is a leading component of our nation's strategy for **creating jobs, increasing economic and energy security, and reducing the impact of fossil fuel extraction and emissions on wildlife and ecosystems.**

- The U.S. wind industry already supports more than 100,000 jobs across all 50 states, and is a leading creator of jobs and economic development in rural areas and Rust Belt manufacturing hubs.
- Wind generating capacity has grown at an average annual pace of 12% over the last five years to over 84 gigawatts (GW) installed across 41 states,[1] and is poised to grow on the order of 8.5 GW/year.
- The addition of 35 GW of new wind power capacity through 2020 would drive 248,000 jobs and $85 billion dollars in economic activity over the next four years,[2] supporting wind power's potential to provide 20% of America's electrical demands by 2030.[3]

Clean, renewable energy development, like all human activity, can have adverse impacts on wildlife and habitat. In the three decades since the earliest efforts to monitor avian interactions with wind turbines, **industry, government, academic, and nonprofit stakeholders have made great strides towards understanding and minimizing wind energy's wildlife impacts by** defining common metrics and protocols, creating risk-assessment guidelines, and collaborating to prioritize research questions and test possible solutions.

Although uncertainties remain, the creation of an independent database[4] for collecting empirical fatality data across projects, companies, and geographies enables us to substantially advance our understanding of wind-wildlife risk. Concurrently, a suite of technologies offering practical ways to minimize that risk are ready to be tested and verified. **To achieve the economic and environmental promise of wind energy, now is the time to make a substantial and focused research investment on a national scale** to reduce key remaining uncertainties and develop solutions to wind energy's impacts on key wildlife species.

In 2016, the AWWI Board of Directors asked staff to prepare a National Wind Wildlife Research Plan that would ensure the responsible growth of land-based wind energy development.[5] The goal of AWWI's National Wind Wildlife Research Plan is to identify and prioritize key areas where additional, strategically targeted research investments are needed to advance:

- Our understanding of the nature and magnitude of the impacts of wind energy on wildlife and wildlife habitat
- The development, evaluation, and widespread application of strategies to avoid, minimize, and compensate for those impacts when necessary to conserve healthy wildlife populations

In preparing this Plan, AWWI reviewed the results of recent priority-setting exercises conducted by the U.S. Department of Energy's Wind Energy Technologies Office, the Bats and Wind Energy Cooperative, the Cornell Lab of Ornithology, and research on wind energy and wildlife conducted by the U.S. Geological Survey. We also interviewed members of the wind industry and a dozen experts with knowledge of wind-wildlife issues from state and federal agencies, and received input from AWWI Partners and Friends. (See Appendix A for a summary of common themes from the interviews.)

We begin this Plan with a brief review of what we know about adverse wind-wildlife impacts and how to avoid and minimize them, identifying key areas of uncertainty and knowledge gaps. We then outline the areas of research and specific topics where additional, focused research investments are needed, highlighting the specific areas of research where AWWI will focus and the anticipated outcomes over the next three years. As a next step, AWWI will develop a detailed workplan, schedule, and budget to guide our work towards implementation.

For both projects AWWI leads and those others will lead, AWWI will continue to work closely with industry, state and federal government agencies, researchers, and conservation organizations to accomplish national research objectives, and to facilitate the transformation of research results into policy and practice to achieve conservation outcomes and realize the potential of wind energy in the U.S.

Avoiding and Minimizing Adverse Impacts – Current Knowledge

Concerns about adverse impacts of wind energy can be grouped broadly as **direct** or **indirect** impacts. For the purposes of this document, we define **direct impacts** to include fatalities resulting from collisions with turbine blades or towers. **Indirect impacts** result from the effects of the construction and operation of a wind energy facility on a species' use of habitat. These impacts may include displacement of a species from suitable habitat, or demographic effects due to fragmentation of a species' habitat or disturbance from the construction and operation of a wind facility.

The following summary is based on AWWI's "Wind Turbine Interactions with Wildlife and Their Habitats: A Summary of Research Results and Priority Questions," which contains a complete list of citations of the research supporting the synthesis statements below (and can be found at www.awwi.org/summary); specific studies are cited in endnotes.

We are at an important point in the history of studying wind and wildlife. We now have empirical data to better identify and avoid high risk sites. Increased investment in technological solutions to detect and/or deter birds and bats will enable us to minimize risk that can't be avoided. AWWI's mission to facilitate wind development and conserve wildlife and habitat is more possible than ever.

Collision Fatalities

Birds

As many as 250 species of birds have been reported as turbine collision fatalities in the U.S., but the number of bird species that may be at population-level risk from fatalities is much smaller. Raptors as a group appear to be most vulnerable to collisions relative to their abundance, and there is concern regarding the potential population effects of fatalities on some raptor species. Available evidence indicates that raptor abundance in the vicinity of a wind energy facility is a good predictor of collision risk; other attributes, such as flight behavior, are thought to be important but poorly understood factors influencing raptor collision risk.

Most nocturnal migrants fly above the height of the current rotor-swept zone (~140 m). Higher capacity and taller wind turbines are under development to take advantage of wind speeds at higher altitudes, and there is a question whether these taller turbines will increase collision risk of night migrants.

Bats

Twenty-four of the 47 species of North American bats have been reported as collision fatalities at U.S. wind energy facilities. Concern about possible population-level effects of fatalities is greater for some bats than for birds because:

- Cumulative estimates of bat fatalities are typically higher for bats than birds
- Fatalities are concentrated in fewer species, notably three species of migratory tree-roosting bats that account for 70-80% of the observed fatalities in the Central Plains and the Northeast
- Little is known about population sizes of those migratory tree bats
- Cave-dwelling bats have declined substantially in the eastern U.S. from White Nose syndrome
- As a group, bats are longer-lived with relatively high adult survival and lower reproductive potential than most bird species, and thus may be at greater risk from increases in mortality from wind energy or other sources

Bat fatalities at wind facilities peak in late summer and early fall in the northern latitudes of the U.S., coinciding with the migration and mating season of tree bats. A smaller peak in fatalities has been observed at some wind facilities during spring migration. We have not yet successfully modeled collision risk from pre-construction measurements of bat activity. Bats may be attracted to wind energy facilities, especially in forested landscapes, and collision risk may increase after construction of the wind facility.

Avoiding & Minimizing Collision Fatalities

Siting

Project siting is the first strategy to avoid or minimize collision impacts.[6] For example, landscape features that concentrate prey or create favorable conditions for raptor nesting, feeding, and flying influence raptor abundance. Similarly, topographical features affect raptor behavior, which may put them at greater risk of collision if wind turbines are sited in these areas. Avoiding bat hibernacula and known roosting areas also is important. To date, however, scientists have been unable to relate pre-construction activity of bats or most bird species to collision risk.

Operations

There has been increased interest in operational strategies and technologies that minimize fatalities at operating projects. In some locations, operations are being curtailed at certain times during migration. There has also been exploration of deterrence methods to cause birds and bats to avoid operational turbines.

- *Curtailment:* Multiple, controlled experiments reducing turbine operations at low wind speeds have demonstrated substantial reductions in bat fatalities, but there are concerns about power loss and associated loss of revenue. Informed curtailment – where turbines are shut down when target species are observed by human or automated detection systems – is being applied at some facilities in the western U.S. to reduce eagle collision risk, and its effectiveness is now being evaluated experimentally.
- *Deterrence:* Ultrasonic deterrence methods to reduce bat fatalities has undergone preliminary testing, and results indicate significant reductions in hoary bat and silver-haired bat fatalities at test turbines. Several projects are evaluating alternative approaches to acoustic deterrence, and other researchers are evaluating the use of low intensity ultraviolet light as a bat deterrent. Acoustic deterrents for birds, particularly raptors, have also been developed and used at European wind energy facilities and currently are undergoing testing in the U.S.

Habitat-Based Impacts

Studies on habitat impacts from wind energy development are relatively few and show mixed effects, with species varying in their sensitivity to the transformation and disturbance associated with siting and operating wind facilities. Species' responses have ranged from no detectable effect to statistically significant reductions in productivity and use of suitable habitat as a function of distance to roads, turbines, and other wind facility infrastructure. In the U.S., specific attention has focused on birds of grasslands and shrublands because these species have seen substantial population declines due to transformation of their habitat for agriculture, grazing, and oil and gas development prior to the expansion of wind energy development. A few studies have looked at potential impacts to grassland and shrubland species, as summarized below:

- Greater prairie-chicken showed increased female survival and no negative effects on nest site selection or nest survival in proximity to wind turbines. The persistence of leks (i.e., the areas used in mating displays) appeared to decrease in proximity to wind turbines.[7,8]
- Selection of brood rearing and post-rearing habitat by female greater sage-grouse were negatively influenced by ground disturbance related to roads and turbine pads, but no negative effect on nest site selection or nest, brood, female survival, or lek attendance was detected.[9,10]
- Some species of grassland birds declined in abundance in proximity to wind turbines, while others did not decline, or responded inconsistently.[11]
- Pronghorn and elk have shown no negative effects of proximity to wind turbines.[12,13]
- Habitat use and survival of desert tortoise at a California wind energy facility has shown no negative effects.[14]

Avoiding & Minimizing Habitat Impacts

The species-specific response to wind energy facilities makes generalizations for mitigating habitat impacts difficult. A focus on offsetting impacts or habitat management in the vicinity of projects to possibly minimize for species of concern may provide the best approaches, but additional research is needed.

National Wind-Wildlife Research Priorities – AWWI's Focus

As a first step towards drafting AWWI's research priorities, we reviewed the results of recent priority-setting exercises conducted by federal agencies and other stakeholders. We also asked people with knowledge of wind-wildlife issues from state and federal agencies about the wind-wildlife impacts of greatest concern to them, and for each impact, how well we understand its relative significance for species sustainability, the underlying risk factors, and ways to avoid or minimize the impact.

Common themes that emerged from this review/interview process included research questions focused on bats, eagles, migratory birds, and prairie grouse. There were several cross-species themes as well, pertaining to topics such as how biological research translates to policy and permitting decisions, how to assess cumulative effects, and concerns related to changes in technology. A synthesis of common themes from our review can be found in Appendix A.

From this information gathering process, we identified the specific research priorities that are most important for accomplishing AWWI's mission and are the best match to our structure and expertise. AWWI has **demonstrated experience and success** in supporting and **facilitating collaborative research** and **leveraging resources to make progress on key wind-wildlife questions**, and our unique collaborative structure has contributed to that success.

Accomplishing many of the priorities listed in this section in three years will involve working with subject-matter experts and raising the necessary funding. AWWI's specific role and involvement in each priority will vary. The details of how we will accomplish the priorities are not addressed in this Plan, but will be the subject of next steps for implementation.

In developing our list of research priorities, we applied the following guidelines:

- Research supported by AWWI should focus on species or groups of species where:
  - Sufficient concern exists regarding the level of impacts but corroborating data is needed
  - Data is needed to address regulatory issues
  - Predicted or assumed population-level impacts require action to minimize these impacts and prevent the need for additional regulatory protections in the future
- Substantial progress can be made on a research topic in a reasonable time frame and with the resources available to AWWI and its collaborating organizations
- Research can be structured to promote data pooling to increase the rate at which results are incorporated into best practice

Approach

AWWI will continue to focus our research on data analysis and technology verification to address risk and solutions for **four key species groups: eagles, bats, migratory birds, and prairie grouse.** Recognizing the substantial amount of research in these areas, there are still outstanding questions on evaluating and mitigating the impacts of wind energy on these species to justify our continued focus on these topics over the next three years. In addition to the specific topics listed in the following section, common themes for research on these species include:

- Developing and testing predictive models that aid understanding and management of risk to wildlife as wind energy expands
- Evaluating available and emerging technologies to detect and deter wildlife at operational wind energy facilities
- Defining statistically robust analysis to evaluate infrequent but potentially significant impacts

Even as we focus on these species, AWWI will develop and evaluate **strategies for shifting priorities as wind energy expands and ecosystems change** in response to climate change, including:

- Developing ways to characterize and summarize current and future cumulative effects. As wind energy expands, it will be essential to identify future wildlife concerns to focus current research
- Applying existing analytic tools to refine our research priorities and invest in research that provides the greatest value

Species-Specific Topics

AWWI's specific research priorities are outlined below by species group. All research on these priorities will

involve **collaboration with our wind-wildlife partners**, including state and federal agencies, conservation and science organizations, academic scientists, and the wind industry. Research topics that we believe are important in the context of AWWI's research priorities, but not a specific focus for AWWI, are listed below each table of our objectives. For example, there are many research questions reflecting important gaps in our knowledge of basic biology for most species of concern. This research is most appropriately led by organizations other than AWWI, although we will contribute to these efforts when appropriate.

Bald and Golden Eagles

Challenge: There have been three eagle take permits issued to date under the Bald and Golden Eagle Protection Act (BGEPA). The U.S. Fish & Wildlife Service (Service) recently issued a new rule to improve the implementation of its eagle take permitting program and increase the number of permitted wind energy facilities (Eagle Rule). The Service's *Eagle Conservation Plan Guidance*[15] was developed to assist applicants pursuing Eagle Take Permits and avoid legal liability. The Guidance offers a conservative approach that lacks specific tools for avoiding, minimizing, and compensating for take. *AWWI's National Eagle Research Framework*[16] provides an approach for addressing these issues.

AWWI Research Objectives:

Bald and Golden Eagles *(Listed in order of priority)*	**Outcomes**
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

Important Research Objectives Outside the Scope of AWWI's Plan:

- **Enhance eagle take prediction models** to provide more accurate take predictions
- **Assess eagle population trends** and anthropogenic sources of mortality, yielding continued updates to take thresholds and compensatory mitigation requirements

Bats

Challenge: In parts of the U.S., the need to substantially reduce bat collision fatalities while minimizing power losses represents the greatest conservation challenge for wind energy development. There is an immediate need for empirically based research to enhance the use of existing impact minimization technologies and strategies and to develop new tools and technologies. Also needed is an increase in our understanding of basic bat biology to understand and mitigate risk, resulting in improved and targeted strategies that better mitigate for that risk.

AWWI Research Objectives:

Bats *(Listed in order of priority)*	**Outcomes**
Support development and evaluation of ultrasonic acoustic and other bat deterrents	Reduced bat fatalities with minimally reduced power production

Bats *(Listed in order of priority)*	**Outcomes**
Use the American Wind Wildlife Information Center (AWWIC)[17] to **develop more accurate estimates of impacts to bats**	Improved understanding of variation in impacts of wind energy on bats and of the effectiveness of mitigation efforts[18]
Improve risk prediction using innovative approaches and AWWIC	Improved siting and avoidance of high-risk areas; reduced mitigation costs

Important Research Objectives Outside the Scope of AWWI's Plan:

- **Optimize curtailment prediction** by defining peak bat fatality risk, resulting in refined operational mitigation techniques and minimization of power production loss
- **Support bat population estimation modeling** to develop population-based fatality reduction targets
- **Develop a generalized fatality estimator** to standardize fatality estimation and improve comparability

Migratory Birds

Challenge: The U.S. Fish and Wildlife Service's voluntary Land-Based Wind Energy Guidelines (WEGs) are intended to minimize risk of wind power to most migratory bird species and other wildlife by providing a tiered risk-assessment framework applicable during siting, construction, and operation of wind facilities. These include best management practices (BMPs) for siting, design, and configuration of wind facilities. Uncertainties remain as to the amount of risk to migratory birds and how to avoid and minimize this risk.

AWWI Research Objectives:

Migratory Birds *(Listed in order of priority)*	**Outcomes**
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

Prairie Grouse

Challenge: The presence of tall turbines and other site disturbances are assumed to reduce habitat quality for prairie grouse. Evaluating potential habitat effects requires expensive, detailed studies that run for several years, and that are replicated at multiple wind facilities.

AWWI Research Objectives:

Habitat-Based Impacts on Prairie Grouse *(Listed in order of priority)*	**Outcomes**
Evaluate the hypothesis that improved habitat management increases resilience of prairie grouse to disturbance from wind energy projects	Expanded mitigation options to reduce impacts and facilitate development in low risk, high wind resource areas
Identify alternative scientifically accepted protocols and **conduct research on post-construction impacts of wind energy on prairie grouse**	Improved understanding of wind energy's potential impacts and solutions for mitigating those impacts

Conclusion

We are now at a pivotal point. This Research Plan outlines a suite of specific projects that, if funded and completed over the next three years, will **provide the industry and permitting agencies with credible, cost-effective solutions to wind-wildlife challenges.** It will take a continued infusion of funds for these solutions to be effective enough to conserve healthy wildlife populations *and* economic enough for industry to stay competitive. To date, federal funding has made a meaningful contribution; the next, critical phase of this effort will depend on a creative approach to financing – and, more than ever, on collaboration among stakeholders.

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Appendix A: National Wind-Wildlife Research Priorities – A Synthesis

The following is a summary produced by AWWI intended to capture the themes from interviews and reviews of research priorities of other wind-wildlife stakeholders.

Common Themes by Species Group

Bats

- Develop better models to predict collision risk and evaluate variation in fatality risk among projects
- Refine/optimize curtailment strategies to maximize fatality reduction and minimize power loss
- Further develop and evaluate effectiveness of acoustic and other deterrents and determine commercial readiness
- Use population-based models to evaluate the significance of impacts from wind energy development to populations
- Conduct basic biological research to assess population status and determine migration pathways

Eagles and Other Raptors

- Refine risk prediction models to include a landscape-level understanding of risk and cumulative impacts
- Improve monitoring protocols of preconstruction activity
- Develop and evaluate impact reduction measures to identify best management practices
- Develop and evaluate compensatory mitigation options
- Continue assessing population trends and mortality from all anthropogenic sources

Prairie Grouse

- Conduct replicated Before-After-Control-Impact (BACI) studies to evaluate impacts of wind energy development on different grouse species at different life stages
- Identify sources of mortality (energy, non-energy) and evaluate compensatory mitigation options
- Assess population status, trends, and genetic diversity
- Use population risk models to evaluate the significance of impacts from wind energy development to populations

CROSS-SPECIES THEMES

IMPLICATIONS OF TALLER TURBINES

As taller turbine technology enables the wind industry to produce electricity at lower wind speeds, what are the impacts on:

- Bats, given that curtailment at low wind speeds has been the most effective strategy?
- Species at greatest risk, such as bats and raptors, in areas that have not yet been targeted for wind energy development because the wind resource is lower (e.g., the Southeast)?
- Migratory species that fly within the taller turbines' rotor-swept-zone?

TRANSLATION OF BIOLOGICAL RESEARCH TO PERMITTING AND POLICY DECISIONS

- Enhance the connection between research and regulations/policy on siting and permitting, particularly related to the calculation of take of protected species
- Aggregate existing information and summarize what we know, particularly for species such as golden eagles, lesser prairie-chicken, and greater sage-grouse, to guide future research
- Develop models for estimating impacts relative to individuals and populations

EVALUATION OF CUMULATIVE EFFECTS

As wind energy capacity expands, there is a need to develop approaches to evaluate the accumulation of local, minimal impacts and whether they will result in regional or population-level declines of protected species.

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[1] American Wind Energy Association. 2017. U.S. Wind Industry First Quarter 2017 Market Report. AWEA Public Version. Available at www.awea.org/1Q2017.
[2] Navigant Consulting. 2017. Economic Development Impacts of Wind Projects. Prepared for American Wind Energy Association. Available at www.awea.org/windbenefits.
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[6] A risk-based approach for evaluating potential project sites is described in U.S. Fish and Wildlife Service. 2012. Land-Based Wind Energy Guidelines. Available at www.fws.gov/ecological-services/es-library/pdfs/WEG_final.pdf.
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[15] U.S. Fish & Wildlife Service. 2013. Eagle Conservation Plan Guidance, Module 1 – Land-based Wind Energy, Version 2. Available at www.fws.gov/migratorybirds/pdf/management/eagleconservationplanguidance.pdf.
[16] American Wind Wildlife Institute. 2014. Developing a Research Framework for Increasing Understanding of Interactions between Eagles and Wind Energy. Washington, DC. Available at awwi.org/eagleframework.
[17] AWWI is collecting post-construction fatality data in its American Wind Wildlife Information Center to enable more detailed and representative analyses of bird and bat fatalities at wind energy facilities.
[18] Unless otherwise qualified, mitigation encapsulates avoidance, minimization, and compensatory mitigation.
[19] An estimated $4-6 million per year over current levels of research investment.