

**BEFORE
THE OHIO POWER SITING BOARD**

In the Matter of the Application of)
REPUBLIC WIND, LLC for a Certificate of)
Environmental Compatibility and Public) Case No. 17-2295-EL-BGN
Need for a Wind-Powered Electric)
Generating Facility in Seneca and Sandusky)
Counties, Ohio.)

DIRECT TESTIMONY OF

**Christopher J. Farmer
Senior Ecologist
Western EcoSystems Technology, Inc.**

on behalf of

Republic Wind, LLC

September 18, 2020

Q-1. Please state your name, current title, and business address.

A-1. My name is Christopher Farmer. I am employed by Western EcoSystems Technology, Inc. (“WEST”) as a Senior Ecologist and Project Manager for our Lemoyne, Pennsylvania Office. My business address is 1017 Mumma Rd. Ste 103, Lemoyne, Pennsylvania 17043.

Q-2. Please summarize your educational background and professional experience.

A-2. I received a Bachelor of Science degree in Biology and a Master of Science degree in Science Education from The University at Albany, and a Doctorate of Philosophy in Ecology from the State University of New York, College of Environmental Science and Forestry. Prior to joining WEST, I was the Principal Biologist for DNV GL, an international energy advisory company. Prior to DNV GL, I was a Senior Ecologist at Tetra Tech, Inc., and a Senior Research Biologist at Hawk Mountain Sanctuary. My research interests include predator-prey interactions, ungulate demography, avian breeding biology, and raptor migration ecology. At WEST, I provide technical and strategic expertise for energy projects, and serve as a subject area expert for eagles and wind energy, focusing on agency consultation support for complex wildlife-related issues at wind- and solar-energy facilities. I have worked across a broad range of sensitive species including bald and golden eagles, Delmarva fox squirrel, gray wolf, lesser prairie-chicken, whooping crane, Indiana bat, and northern long-eared bat. My consulting experience includes avian, bat, and eagle surveys, post-construction fatality monitoring, Eagle Conservation Plans, Bird and Bat Conservation Strategies, and state and county permitting for energy facilities. I have been involved in the development of over 30 Eagle Conservation Plans since 2010.

I have 21 years of experience conducting wildlife research across the United States (“U.S.”). I have completed projects for private industry, environmental conservation organizations, and various state and federal agencies. At Hawk Mountain Sanctuary, I collaborated on development of the Raptor Population Index Project (RPI), which uses hawk migration counts as an index to population change in migratory raptors. I served as the primary statistical analyst for the RPI project from 2004 – 2010, and authored numerous scientific publications detailing our methods and findings. While at Hawk Mountain Sanctuary, I also served as one of the staff migration observers, an activity that I still

undertake on a volunteer basis for Hawk Mountain. I also volunteer my time as an Associate Editor for the Journal of Raptor Research.

At Tetra Tech and DNV GL, I provided consulting and third party review services to energy projects and lenders throughout the U.S and Canada. My primary roles were technical leadership and mentoring of the biological teams and providing technical support for coordination with regulatory agencies. At DNV GL, I performed due diligence reviews of large numbers of projects seeking financing from banks or seeking to sell assets to other energy companies. As a result, I have thorough knowledge of typical risk to eagles from wind projects, as well as patterns of observed fatalities. At WEST, I provide technical leadership for projects with respect to bald and golden eagles, and I also manage projects in the Western, Central, and Eastern U.S.

I have authored or coauthored 21 peer-reviewed scientific journal articles and book chapters, including 16 focused on raptors, and 38 oral papers or posters at professional conferences, including 19 focused on eagles and wind energy. In addition to research and consulting, I have taught a variety of ornithology, conservation biology, evolution, and ecology courses as an adjunct instructor for Cedar Crest College, Penn State University, Montana State University, and the State University of New York, College of Environmental Science and Forestry.

Attached hereto as Ex. CF-1 is my curriculum vitae.

Q-3. On whose behalf are you offering testimony?

A-3. I am testifying on behalf of the Applicant, Republic Wind, LLC (“Project” or “Republic”), who proposes to build a wind-powered electric generating facility in Seneca and Sandusky Counties, Ohio (“Project”).

Q-4. What is the purpose of your testimony?

A-4. The purpose of my testimony is to address the bald eagle-specific topics noted in the Board’s August 4, 2020 order reopening this proceeding. Specifically, my testimony addresses the “significance of the half-mean inter-nest buffer distance proposed by USFWS” (as stated in the August 4, 2020 Entry); the location of a newly discovered bald

eagle nest referred to as the “N&F Wildlife Nest”; the proximity of the N&F Wildlife Nest to proposed turbine locations; and the ramifications/significance of the N&F Wildlife Nest with respect to the “half-mean inter-nest distance buffer distance proposed by USFWS” (as stated in the August 4, 2020 Entry).

Q-5. Could you please describe the history of your involvement with the Project?

A-5. I have been involved with the Project since August 25, 2020, when Republic asked me to provide my expert opinion on the bald eagle-specific matters the Board raised in its order reopening this proceeding. In addition, my company, WEST, was retained by Republic in March 2020 to aid it in developing an Eagle Conservation Plan (“ECP”) for the Project. I am also involved in providing testimony regarding bald eagles in OPSB proceedings for the Emerson Creek Wind Project, which is near the Republic Project.

Q-6. Have you reviewed any transcript testimony from the prior hearing in this proceeding?

A-6. Yes. I have reviewed Mr. Dalton S. Carr’s testimony before the Board on November 4, 2019, as cited in the Board’s order reopening this proceeding, insofar as Mr. Carr’s testimony addresses eagle nests and a term he referred to as the half-mean inter-nest distance and/or buffer. I have also reviewed various correspondence between the Project and USFWS, contained in the Board record.

Q-7. What is “mean inter-nest distance?”

A-7. Mean inter-nest distance is a term defined by the United States Fish and Wildlife Service (“USFWS”) in its Eagle Conservation Plan Guidance (“ECP Guidance”). The ECP Guidance is utilized by USFWS with wind developers that decide to voluntarily develop what is called an “Eagle Conservation Plan.” An Eagle Conservation Plan (“ECP”) is a project-specific document drafted by the project-developer, in coordination with USFWS, that supports the issuance of an eagle take permit under federal regulation(s). The ECP Guidance provides specific, in-depth guidance for conserving bald eagles in the course of developing wind energy facilities. The developer and USFWS utilize the ECP Guidance in developing the project’s individual ECP. USFWS then uses the project’s individual ECP to set the terms of an eagle take permit.

The ECP Guidance defines “mean inter-nest distance” as the mean (or average) “nearest-neighbor” distance between simultaneously occupied eagle nests. “Nearest-neighbor” distance in this context is the distance between one occupied eagle nest and the next, closest, simultaneously occupied eagle nest to it. Simultaneously occupied eagle nests in a given area are rarely, if ever, uniformly distributed because eagles build their nests some distance apart from one another with some variation. To provide some uniformity to this concept of nearest-neighbor distances for non-uniformly distributed eagle nests, USFWS calculates the mean, or average, of all “nearest-neighbor” eagle nests in a given area. The ECP Guidance recommends that the area of analysis for this calculation be a 10-mile radius around a project. The USFWS released updated guidance for eagle nest surveys in April 2020 which reduced the search area radius for nests from 10 miles to 2 miles around a project, and rescinded the 10-mile recommendation in the ECP Guidance.

So, for example, if the search area around a project footprint has six simultaneously occupied eagle nests, some clustered closer to one another and others spread further out from the others, the “mean inter-nest distance” for that footprint is the sum of all six “nearest-neighbor” distances (because every nest in this hypothetical footprint has a nearest neighbor) divided by six. This yields a single linear distance measure among the occupied nests for the given area, which is the “mean inter-nest distance.”

Q-8. What is “half-mean inter-nest distance?”

A-8. The half-mean inter-nest distance is simply half the mean inter-nest distance. The half-mean inter-nest distance represents the estimated distance an eagle may travel within its territory without overlapping with other nesting eagle territories. This is thought by USFWS to provide a reasonable estimate of the extent of the movements of eagles associated with a nest during the breeding season.

Q-9. What is the significance of the “half-mean inter-nest distance” generally?

A-9. The half-mean inter-nest distance is one of several metrics or factors USFWS uses to assess risk to eagles from wind energy facilities, in the context of developing an individual ECP under the ECP Guidance. This metric is area- or project-specific. If an eagle nest is located within the half-mean inter-nest distance of a wind project footprint, USFWS recommends

the project be carefully evaluated. Based on the results of such evaluation, USFWS may indicate that eagle use at the project warrants voluntary consideration of the development of an ECP and issuance of a take permit, and/or voluntary conservation measures. There is no federal law that mandates a project implement any suggested measures, including developing an ECP and obtaining an eagle take permit.

If an ECP is being developed, the ECP Guidance recommends the project be assigned one of three general categories. The categories are based on the likelihood that the project will meet the take permit issuance standards, with Category 1 being defined generally as high risk to eagles with low potential to avoid or mitigate impacts; Category 2 being defined generally as high or moderate risk to eagles with opportunity to mitigate impacts; and Category 3 being generally defined as minimal risk to eagles. For projects where bald eagles are considered likely to use or pass through a project's footprint and/or where an active eagle nest is located within the half-mean inter-nest distance, a Category 1 designation may, although not necessarily, be appropriate; however, in practice, such presence rarely leads to a "Category 1" designation.

The ECP Guidance recommends calculating the half-mean inter-nest distance to estimate the spatial extent of eagle nesting territories (i.e., how far breeding eagles are likely to move from their nests during breeding season). The ECP Guidance further indicates that eagle pairs nesting within the half-mean inter-nest distance of a wind project are the pairs most likely to be injured or disturbed by the project and should receive consideration. Additionally, nests within this distance of a project may be selected for more focused pre-construction monitoring. Such pre-construction monitoring occurred at the N&F Wildlife Nest in 2020 to refine understanding of eagle space use associated with this nest, as part of Republic's development of its ECP.

USFWS uses the half-mean inter-nest distance metric to consider the terms of any eagle take permit sought under the Bald and Golden Eagle Protection Act ("BGEPA"). Such permits account for estimated eagle mortality levels that the permitted project is projected to cause. USFWS assesses whether the projected level of take is compatible with the standards set forth in the BGEPA and supporting guidance. As part of this process, the half-

mean inter-nest distance is used as one metric, along with site-specific estimates of eagle use of the project footprint, to assess potential take.

Ultimately, this assessment is one factor USFWS evaluates in determining whether a wind project would meet eagle take permit standards. Those standards account for both potential take through fatalities and take from disturbance. USFWS's evaluation typically takes into account the history of alternative project layouts as it pertains to avoidance, as well as how post-construction monitoring will be conducted and used in the future.

The half-mean inter-nest distance metric is not intended, or used in practice, as a way to prohibit turbines within this calculated distance. Rather, it is among the indicators that USFWS considers in eagle take permitting, including conditions that the USFWS imposes on such permits. Such permit conditions vary depending on project features and site consideration, but they typically involve operating practices that are meant to conserve eagles. But, again, the half-mean inter-nest distance metric is not a rule or standard that mandates distances between project features and individual nests.

In summary, the half-mean inter-nest distance metric is one among many inputs that USFWS uses to protect eagles through its voluntary incidental take permit program. The ECP Guidance describes recommended steps and considerations in this voluntary process; including the use of project categories to guide analysis and potential conservation measures. Republic is engaging with USFWS in the process of developing an ECP in support of a take permit application. The USFWS ECP/permitting process will directly address and account for conservation of eagles in the vicinity of the Project, including the N&F Wildlife Nest.

Q-10. What is the half-mean inter-nest distance for the Project?

A-10. The most recent calculation by USFWS was done in late June 2017, and the half-mean inter-nest distance for the Project was calculated to be 1.17 miles. (See Ex. 1C, Amended Appl., Online Docket at Ex. J, Pt. 19, PDF p. 25.)

Q-11. Is it accurate to say that USFWS has proposed a half-mean inter-nest “buffer” distance of 1.17 miles for the Project?

A-11. No. As stated above, the half-mean inter-nest distance is simply one of several metrics or indicators USFWS uses to assess risk to eagles from wind energy facilities, in the context of developing an individual ECP and take permit. It is not a measure used to impose a “buffer” that precludes the existence of wind facilities, including individual turbines, located within that calculated distance from an occupied eagle nest. For the Republic Project, USFWS never imposed a 1.17-mile “buffer.” Instead, Mr. Carr’s testimony during the November 2019 hearing reflects that, at that time, the Project had a self-imposed “buffer” based on the half-mean inter-nest calculation, to guide turbine layout design *in lieu of* seeking an ECP/take permit. This is a common avoidance measure undertaken by wind projects that are being developed in areas with eagle nests. This previous, self-imposed “buffer” (in lieu of an ECP/take permit) is reflected in communications between Republic and USFWS (see, for example, Aug. 23, 2016 Meeting Summary, at Ex. 1C, Amended Appl., Online Docket at Ex. J, Pt. 19, PDF p. 21.) Since that time, however, the Project has determined it will seek an ECP/take permit and is in the process of developing that ECP with USFWS.

Q-12. Is Republic aware of the N&F Wildlife Nest?

A-12. Yes. Republic became aware of the N&F Wildlife nest on or about March 19, 2020, after an aerial raptor nest survey was completed by Copperhead Consulting, Inc. The Project requested that Copperhead complete raptor nest surveys to get the most up-to-date information on eagle and large raptor nests within or near the Project. Ongoing surveys and coordination with USFWS normally occur for wind energy projects under development, and discovery of new bald eagle nests being built like this one are not uncommon. Nest locations and occupancy change with frequency, and it is not unusual for new nests to be created and for existing ones to fall into disuse during a wind project’s lifetime, or even during the permitting process itself. When this happens, the project accounts for changing nest locations and occupancy in its ongoing consultation with USFWS, including in the context of developing an ECP and a strategy of adaptive management that facilitates

operational changes in response to any changed conditions that are detected by monitoring in the post-construction period.

As a result of discovering the N&F Wildlife Nest, Republic will work with USFWS to assess what, if any, additional measures should be taken under an eagle take permit to maintain compliance with the BGEPA, which will be memorialized in the final ECP. The N&F Wildlife nest was monitored during summer 2020 to delineate movements associated with the nest; results will be compiled and shared with USFWS during consultation for the ECP. During this consultation, USFWS will take into account any projected impacts to the local population of bald eagles to ensure they are sustainable. Additionally, conservation measures and adaptive management included in the ECP and eagle take permit for the Project will be designed to manage impacts in a way that allows response to changes to and/or new nest locations in the future.

Q-13. Is the N&F Wildlife Nest located within the Project boundary?

A-13. No. The N&F Wildlife Nest is located approximately 0.15 miles outside the Project boundary, to the east of the south-central tip of the Project boundary. The nest location was determined during an aerial survey conducted by Copperhead Consulting, Inc. During this survey, bald eagle nest locations were recorded electronically on mapping software and geographic coordinates were recorded. The nest location was confirmed from the ground by WEST when it initiated nest monitoring at this nest in April 2020. Attached as Ex. CF-2 is a map showing the southern Project boundary and the location of the N&F Wildlife Nest, along with a 1.17-mile radius illustrated around the nest, the proposed turbines within that 1.17-mile distance of the nest, as well as the distance in miles from each turbine to the nest.

Q-14. How many turbines are proposed to be sited within 1.17 miles of the N&F Wildlife Nest?

A-14. There are eight (8) proposed turbine sites that are within 1.17 miles of the N&F Wildlife Nest.

Q-15. What, if any, impact does the 1.17-mile half-mean inter-nest distance previously calculated by USFWS have in relation to the N&F Wildlife Nest and the proposed turbines located within that 1.17-mile radius?

A-15. USFWS will consider the half-mean inter-nest distance in relation to the N&F Wildlife Nest and the proposed turbines within that buffer in developing the terms of a voluntary eagle take permit. Depending on the conclusions of the nest evaluation, it may result in implementation of additional avoidance and minimization measures or other conservation protocols for the Project, as specified in the Project's eagle take permit.

In short, the development of an individual ECP for the Republic Project and the take permit will adequately address minimizing potential impacts to the regional and local-area bald eagle population.

Q-16. Does this conclude your testimony?

A-16. Yes, it does, except that I reserve the right to update this testimony to respond to any further testimony, reports, and/or evidence submitted in this case.

CERTIFICATE OF SERVICE

I hereby certify that the foregoing Testimony was served upon the following parties of record via electronic mail this 18th day of September, 2020.



Jennifer A. Flint

cendsley@ofbf.org

lcurtis@ofbf.org

amilam@ofbf.org

mleppla@theoec.org

tdougherty@theoec.org

ctavenor@theoec.org

jvankley@vankleywalker.com

cwalker@vankleywalker.com

dwd@senecapros.org

jclark@senecapros.org

mulligan_mark@co.sandusky.oh.us

jodi.bair@ohioattorneygeneral.gov

dennyh7@frontier.com

mkessler7@gmail.com

william.cole@ohioattorneygeneral.gov



EDUCATION

Ph.D.
SUNY College of Environmental
Science and Forestry
Syracuse, New York
2002
Ecology

M.S.
State University of New York at
Albany
Albany, New York
1987
Science Education

B.S.
State University of New York at
Albany
Albany, New York
1986
Biology

SCIENTIFIC ORGANIZATION MEMBERSHIPS

The Raptor Research Foundation
Associate Editor- Journal of Raptor
Research

Eastern Golden Eagle Working
Group

ADDITIONAL TRAINING & EDUCATION

Statistical Analysis using R
Statistical Package – National
Conservation Training Center,
2012

OBFS/LTER Training Program in
Ecoinformatics, 2006

Christopher Farmer, Ph.D., *Senior Ecologist*

PROFESSIONAL EXPERIENCE

2019-Present *Senior Ecologist*, Western EcoSystems Technology, Inc., Lemoyne,
Pennsylvania
2016-2018 *Principal Biologist*, DNV GL, Chalfont, Pennsylvania
2010-2016 *Senior Ecologist*, Tetra Tech EC, Inc., Langhorne, Pennsylvania
2004-2010 *Senior Research Biologist*, Hawk Mountain Sanctuary, Kempton,
Pennsylvania

SPECIALTY AREAS

Dr. Farmer is an ecologist with 21 years of experience studying birds, ungulates, and carnivores; specializing in eagle surveys and take permitting, study design, habitat studies, capture techniques, survival analysis, population ecology, population modeling, and statistical ecology. His career has spanned academia, nonprofit conservation organizations and environmental consulting. He has extensive experience in telemetry, raptor migration, statistical analysis, behavioral ecology and avian breeding biology.

His consulting experience includes providing strategic guidance and support to due diligence and permitting for energy projects including pre-construction wildlife surveys, mitigation plans, habitat conservation plans (HCP), eagle conservation plans (ECP), bird and bat conservation strategies (BBCS) and other documents required under the Endangered Species Act, Bald and Golden Eagle Protection Act, and other environmental rules and regulations. He frequently assists clients in negotiations with regulatory agencies, at permit hearings, and as an expert witness, and is widely recognized as an industry thought leader regarding the wildlife impacts of renewable energy development.

PROFFESIONAL SUMMARY

2019- *Senior Ecologist and Project Manager*, WEST, Inc.
Present National Renewable Energy Laboratory, Development of a Computational Framework for Predicting Eagle Risk Near Wind Farms, U.S. (2020). Principal Investigator and Technical Advisor for development of spatially explicit risk prediction models incorporating eagle behavior, topography, and weather.

Confidential Wind Energy Client, CA, Eagle Risk Assessment, Eagle Conservation Plan, and County Permit Review (2019-2020). Project Manager and Technical Lead for development of a risk assessment for golden eagles, leading to development of Eagle Conservation Plan and Eagle Take Permit Application for an operational Project in Altamont Pass Wind Resource Area. Assisted project in reviewing its compliance with County Siting Permit conditions.

Courtenay Wind Farm, ND, Eagle Take Permit Compliance Monitoring (2019-2020). Project Manager leading fatality monitoring to measure bald eagle fatality rate.

Confidential Wind Energy Client, WY (2019). Technical Expert leading development of Eagle Conservation Plan for a Project under development

Confidential Wind Energy Client, CO (2019-2020). Project Manager and Technical Expert leading development of Eagle Conservation Plan for two projects under development and one operational project

Confidential Wind Energy Client, OK (2019-20). Technical Lead and Project Manager for development of an Eagle Conservation Plan and Eagle Incidental Take Permit application at an operational facility.

Confidential Wind Energy Client, KS (2019-20). Technical Lead and Project Manager for development of an Eagle Conservation Plan and Eagle Incidental Take Permit application at an operational facility.



Confidential Wind Energy Client, NC (2019-20). Technical Lead for development of an Eagle Conservation Plan and Eagle Incidental Take Permit application at an operational facility.

Bluestone Wind Project, NY (2019-2020). Technical Lead for development of an Eagle Conservation Plan and Net Conservation Benefit Plan for a project in development. Provided testimony regarding eagles in NY State Public Service Commission Siting Hearing.

2016-2018 Principal Biologist, Environmental and Permitting Services, DNV GL
American Wind Energy Association, Bayesian Collision Risk Model Prior Probabilities Evaluation, U.S. (2018). Technical lead and author of reports evaluating newly proposed priors for collision risk model using simulation modeling and comparison to known fatalities in North America.

Multiple Confidential Wind and Solar Energy Clients. Technical leader of wildlife due diligence assessments for Independent Engineer's Reports in support of project financing and acquisition.

Confidential Wind Energy Client, Eagle Conservation Plans, Eagle Take Permits, and Bird and Bat Conservation Strategies for Two Wind Projects, CA (2017). Biology technical lead for teams preparing ECPs, eagle take permit applications, bird and bat conservation strategies, and NEPA support for the developer of two wind farms in southern California.

Confidential Wind Energy Client, Eagle Surveys and Bird and Bat Conservation Strategy, MT (2016-Present): Biology Technical lead for teams performing eagle use and avian surveys and preparing a BBCE for a proposed wind farm.

Confidential Wind Energy Client, Eagle Surveys and Wildlife Conservation Strategy, ND (2017): Project Manager and technical lead for eagle-use surveys and preparation of a wildlife conservation strategy for a proposed wind project.

National Renewable Energy Laboratory (2016-2019): Member of Expert Panel. Provided advice to National Renewable Energy Laboratory on priorities for its Wind Wildlife Land-Based Collaborative. The expert panel convened annually to assist the Laboratory in identifying priorities, gaps, and opportunities for the program.

Confidential Wind Energy Client, Eagle Strategy Support, NE (2016): Project manager and technical lead for strategic evaluation, agency consultation, and planning support for a proposed wind farm.

Confidential Client, Avian Detection Market Analysis (2016): Project Manager and technical lead for a market analysis for a confidential customer developing an avian detection system for use in avoidance of impacts to raptors and other large birds.

Brady I and II Wind Farms, ND, Expert Witness Support (2016): Provided expert testimony and biological strategy in support of Public Siting Commission review of siting permit application. Testimony focused on due diligence and conservation planning with respect to bald and golden eagles.

Avian Detection and Deterrent Technology White Paper (2016-Present): Lead Biologist for team preparing a summary and synthesis of avian detection and deterrent devices available to the wind energy industry with an emphasis on technology readiness level and evidence of effectiveness.



Confidential Wind Energy Client, ME (2016-Present). Project Manager for grassland bird surveys focused on sensitive grassland species, particularly upland sandpiper at a proposed wind farm.

Canadian Wind Energy Association, (2016-Present): Technical author and reviewer, CanWEA Bats and Wind Energy Review. Reviewed all technical portions of Bat Toolkit during development to ensure technical accuracy and quality, and guided revision process.

American Wind Energy Association, Washington DC, Eagle Rule Support (2016-2017): Lead Biologist and Project Manager. Strategic support to the American Wind Energy Association regarding proposed final eagle permit regulations under the Bald and Golden Eagle Protection Act.

American Wind Wildlife Institute, Washington, DC, Technology Verification Program, Peer Reviewer (2016). Project Manager. June 2016. Technical support of research proposal review for the American Wind-Wildlife Institute. Reviewed proposals for evaluation of eagle detection technology for technical merit.

2010-2016 Tetra Tech EC, Inc.
Biology Discipline Lead, 2015-2016
Senior Ecologist, 2010-2015

Confidential client, pre-construction surveys for wind farm and transmission line, KS (2015): Biology Technical Lead – provided leadership in design and implementation of avian and bat surveys at a proposed wind farm in Kansas. Developed strategy for dealing with proximity of the project and its transmission line to the white-nosed syndrome buffer zone for northern long-eared bats. Assisted client with agency coordination relative to avoidance of impacts to northern long-eared bat.

Confidential client, pre-construction surveys for three wind farms, ND (2015): Biology Technical Lead – provided leadership in design and implementation of avian and bat surveys at three proposed wind farms in North Dakota. Reviewed all technical products for consistency and represented the client in agency discussions. Developed strategy for dealing with proximity of projects to the white-nosed syndrome buffer zone for northern long-eared bats. Provided expert witness testimony regarding impacts to eagles and threatened/endangered species.

Confidential client, pre-construction surveys for two wind farms, TX (2015): Biology Technical Lead – provided leadership in design and implementation of avian and bat surveys at two proposed wind farms in Texas. Surveys included raptor nest surveys, eagle point-count surveys, avian point-count surveys and bat acoustic surveys. Provided technical and strategic advice to the client based on survey findings.

U.S. Army Corps of Engineers, Wildlife Risk Assessment for Tooele Army Depot Renewable Energy Project, UT (2015): Project Manager and Biology Technical Lead – led technical team developing an assessment of risk of impacts to wildlife from development of a wind and/or solar energy project at the Tooele Army Depot, Tooele, Utah. Also designed and managed a raptor nest survey to document golden eagle nests within a 10-mile radius of the project.

Confidential solar client, avian and bat risk assessment for concentrated solar energy facility, NV (2015): Biology Technical Lead – led technical team reviewing available dockets and literature regarding avian impacts of concentrated (power tower) solar facilities and comparing to design of facility undergoing testing prior to full operations. Developed an assessment of avian risks and impacts and comparison to documented wind and solar impacts within the region to inform operational avoidance and minimization measures.



Sempra, Broken Bow Wind Farm, Eagle Risk Assessment and Bird and Bat Conservation Strategy (BBCS) for an Operational Wind Farm, NE (2014–2015): Biology Technical Lead – led technical team developing an assessment of risk to eagles and recommendations for next steps as well as a BBCS for an operational wind farm. Collected agency comments on draft BBCS and negotiated responses, avoidance and minimization measures and adaptive management plan with USFWS.

EDP Renewables, Eagle Surveys, Eagle Conservation Plan, and Bird and Bat Conservation Strategy for Waverly Wind Farm, KS (2014–15): Biology Technical Lead – coordinated bald eagle studies with USFWS and KDWPT on behalf of the client. Designed and implemented eagle point-count and nest surveys to assess risk to eagles. Developed a BBCS and ECP in consultation with USFWS and provided strategic vision for negotiation of adaptive management approach. Assisted client in development of consultation strategy and preparation of an Eagle Take Permit.

Confidential client, eagle risk assessment for proposed wind farm, NM (2014–2015): Biology Technical Lead – synthesized results of previous avian studies and developed a preliminary assessment of risk to golden eagles, including recommendations for next steps and follow-up surveys. Provided support for agency coordination on potential ECP development for the project.

U.S. Army Corps of Engineers, Red Knot Surveys, NJ (2014–2015): Senior Technical Advisor – developed survey and analysis approach, provided technical leadership, and served as report reviewer on surveys for an endangered avian species (red knot) at beach nourishment projects along approximately 160 miles of coastline.

Confidential client, bird and bat conservation strategy for proposed wind farm, MI (2014–16): Biology Technical Lead – led technical team in development of BBCS demonstrating client's adherence to the USFWS Wind Energy Guidelines for protection of avian and bat species in development and operation of the project. Provided strategic vision for negotiation of avoidance and minimization measures and adaptive management plan with agencies.

Confidential client, eagle conservation plans for two operational wind farms, WY (2014–16): Senior Technical Advisor – in coordination with client team composed of Tetra Tech and two other consultants, developed ECPs and ETP applications under a Settlement Agreement for two operational wind farms with a record of golden eagle take. ECP development required intensive, iterative consultation with USFWS Field and Regional offices. Provided strategic vision for consultation/negotiation approach.

EDP Renewables, Eagle Surveys, Eagle Conservation Plan, and Bird and Bat Conservation Strategy for Arbuckle Wind Farm, OK (2013–15): Project Manager and Biology Technical Lead – prepared an eagle risk assessment and negotiated additional studies with USFWS and ODFW on behalf of the client. Designed and implemented eagle point-count and nest surveys demonstrating low risk to eagles despite proximity of an active nest. Developed a BBCS and ECP in consultation with USFWS Regional Eagle Coordinator and provided strategic vision for negotiation of adaptive management approach. Assisted client in development of consultation strategy and preparation of an Eagle Take Permit.

NextEra Energy Resources, Bird and Bat Conservation Strategy, Genesis Solar Energy Project, CA August (2013–2014): Senior Biologist – prepared a revised Bird and Bat Conservation Strategy in response to agency concerns about avian impacts at solar facilities throughout California. Represented the client in agency meetings and tours of the facility.

Confidential solar client, bird and bat conservation strategy, two solar PV projects, CA (2013–2014): Senior Biologist – supervised avian point-count



and radar surveys and developed Bird and Bat Conservation Strategies for two proposed large-scale solar PV projects in southern California. Represented the client in agency meetings and conference calls.

Confidential Client, Avian and Bat Surveys for a Proposed Wind Project on Chesapeake Bay, MD (2013–15): Biology Technical Lead – developed and implemented a survey plan incorporating surveys for eagles and eagle nests following the 2012 ECP Technical Appendices in coordination with USFWS personnel, general avian surveys, breeding bird surveys and bat acoustic surveys for a wind energy site in an area with potentially high bald eagle use. Represented the client in technical assistance meetings with USFWS eagle coordinator and the Chesapeake Bay Field Office. Coordinated data collection with the ECP consultant.

Confidential client, eagle conservation plan for operational wind farm, Tehachapi, CA (2012–2014): Senior Ecologist – developed eagle fatality projections using the USFWS Bayesian modeling approach for an operational wind energy facility with a history of golden eagle fatalities. Helped client develop a risk assessment based on fatality modeling and a novel approach to predicting the spatial distribution of collision risk based on modeling terrain-based updrafts.

Pioneer Green Energy, Eagle Conservation Plan and Agency Consultation for Proposed Great Bay Wind Energy Center on Chesapeake Bay, MD (2012–2014): Biology Technical Lead – developed eagle fatality projections using the USFWS Bayesian modeling approach for a wind energy site with very high Bald Eagle use. Led the project technical team in development of the eagle conservation plan and a bird and bat conservation strategy. Evaluated a variety of potential development scenarios to identify the lowest impact design, and provided guidance to the client regarding implications for seeking an incidental take permit for eagles under BGEPA. Developed several novel avoidance and minimization and mitigation strategies. Represented the client in technical assistance meetings with USFWS eagle coordinator and modelers, as well as in Section 7 consultation process for the endangered Delmarva Fox Squirrel, and developed an Eagle Take Permit application for the project.

CalWEA, Golden Eagle Mitigation Strategies for the DRECP process, CA (2012): Senior Ecologist – developed a summary of sources of golden eagle fatalities in the state of California. Used the summary to suggest fatality sources that appeared feasible for mitigation of wind-energy related impacts in the BLM desert region, and developed mitigation strategies for each of those sources.

BP Wind Energy, Eagle Conservation Plan, Mohave Wind Project, AZ (2011–2012): Senior Ecologist – developed an Eagle Conservation Plan for golden eagles for a wind energy project in Arizona. Developed an eagle risk assessment that includes comparison to other projects, quantitative fatality modeling based on observed use, and a qualitative assessment of risk factors. Developed a novel approach to take mitigation that has since been adopted by USFWS in its Eagle Conservation Plan Guidance. Obtained an acknowledgment letter from USFWS indicating that the ECP was acceptable for use in application for an eagle take permit. Also developed separate Avian Conservation Strategy and Bat Conservation Strategy documents.

EDP Renewables and EnXco, Eagle Conservation Plan Guidance Comments (2011): Task Lead – worked with teams from two confidential wind clients to develop detailed technical comments on the USFWS Eagle Conservation Plan (ECP) Guidance during the public comment period. Economic implications of the draft guidance are far reaching for wind energy projects, and much of the biological rationale for the guidance is either unclear or questionable. Goal of the work was to help USFWS produce implementation



guidelines for eagle take permits that protect eagles and also allow for development of wind energy projects.

Confidential client, article 11 permit application, NY (2011–2012): Senior Ecologist – worked with a confidential wind client to develop a comprehensive application for an incidental take permit for a state-endangered species (northern harrier) at an operating wind farm under Article 11 of the N.Y. Environmental Conservation Law. Developing population and habitat assessment models in support of the application. Working with NYSDEC and the client to develop the permit application and finalize permit terms.

Confidential client, avian and bat protection plan, PA (2011): Biology Technical Lead – working with a confidential wind client to develop an avian and bat protection plan for a proposed wind energy project. As part of plan development, designing and undertaking surveys for golden eagles in consultation with USFWS to collect data for an eagle risk assessment under BGEPA Eagle Conservation Plan Guidance. Providing technical leadership on eagle risk consultation with USFWS and PGC.

Confidential client, eagle risk studies, ME (2011–2012): Senior Ecologist – worked with a confidential wind client to develop strategies to monitor bald and golden eagles in the vicinity of a potential wind energy facility and evaluate the risk of incidental takes. Represented client interests in consultation meetings with state and federal agencies and served as senior reviewer on eagle survey reports.

Confidential client, bald eagle use study and avian and bat protection plan, OH (2011–2012): Senior Project Biologist – working with a confidential wind client to design and implement a year-round, pre-construction survey plan for bald eagles, including nest surveys, flight behavior surveys, and migration surveys. Aiding client with USFWS and ODNR consultation regarding avian and bat species, and developing an avian and bat protection plan that details the assessment of risk for bald eagles and Indiana Bats at the project.

Confidential client, golden eagle use study and eagle conservation plan, CA (2011–2012): Senior Ecologist – worked with a confidential wind client to evaluate the behavior of golden eagles in the vicinity of a wind energy facility and develop appropriate avoidance and minimization measures. Designed ground and aerial behavioral surveys and telemetry research using GPS-GSM transmitters to gather high resolution information about eagle movements. Lead efforts to team with academic researchers to create products useful to eagle risk analysis in the vicinity of the project. Results assisted the client in evaluating mitigation strategies and reaching a decision regarding a potential Eagle Take Permit.

BP Wind Energy, Post-construction Mortality Monitoring, Goshen Wind Farm, ID (2011): Senior Ecologist – member of design team for a post-construction mortality study for the Goshen Wind Farm. Post-construction mortality monitoring study included bias correction trials for scavenging and searcher efficiency. Performed initial plot setup and clearance and aided in field crew training and the design of the project report.

SELECTED PROFESSIONAL PUBLICATIONS

Watson, R.T., P.S. Kolar, M. Ferrer, T. Nygard, N. Johnston, W. G. Hunt, H.A. Smit-Robinson, **C.J. Farmer**, M. Huso, and T.E. Katzner. 2018. Raptor Interactions with Wind Energy: Case Studies from Around the World. *Journal of Raptor Research* 52(1): 1-18.

Farmer, C.J., A. Klehr, and E. Crivella. 2016. Does Utility-scale Solar Pose a Major Threat to Birds? *Solar Industry Magazine*.

Goodrich, L.J., **C.J. Farmer**, D.R. Barber, and K.L. Bildstein. 2012. What Banding Tells us About the Movement Ecology of Raptors. *Journal of Raptor Research* 46: 21-35.



- Katzner, T, B.W. Smith, T.A. Miller, D.Brandes, J.Cooper, M. Lanzone, D.Brauning, **C.J. Farmer**, S. Harding, D. E. Kramar, C. Koppie, C. Maisonneuve, M. Martell, E. K. Mojica, C. Todd, J. A. Tremblay, M. Wheeler, D. F. Brinker, T. E. Chubbs, R. Gubler, K. O'Malley, S. Mehus, B. Porter, R. P. Brooks, B. D. Watts, and K. L. Bildstein. 2011. Status, Biology, and Conservation Priorities for North America's Eastern Golden Eagle (*Aquila chrysaetos*) Population. *Auk* 129: 168-176 (2012)
- Farmer, C.J.**, K. Safi, D.R. Barber, I. Newton, M. Martell, and K.L. Bildstein. 2010. Efficacy of Migration Counts for Monitoring Continental Populations of Raptors: An Example Using the Osprey (*Pandion haliaetus*). *The Auk* 127:863-870.
- Farmer, C.J.** 2010. American Kestrel, *Second Pennsylvania Breeding Bird Atlas*.
- Farmer, C.J.** 2010. Red-shouldered Hawk, *Second Pennsylvania Breeding Bird Atlas*.
- Farmer, C.J.** and J.P. Smith. 2010. Seasonal Differences in Migration Counts of Raptors: Utility of Spring Counts for Population Monitoring. *Journal of Raptor Research* 44:101-112.
- Farmer, C.J.** and J.P. Smith. 2009. Migration Monitoring Indicates Widespread Declines of American Kestrels (*Falco sparverius*) in North America. *Journal of Raptor Research* 43:261-273.
- Bildstein, K.L., M.J. Bechard, **C.J. Farmer**, and L. Newcomb. 2009. Narrow Sea Crossings Present a Significant Barrier to Migrating Griffon Vultures *Gyps fulvus*, *ibis* 151: 382-391.
- Bildstein, K.L., **C.J. Farmer**, and R. Yosef. 2009. Raptor Population Monitoring: Examples from Migration Watchsites in North America, *Avocetta* 33: 43-51
- Farmer, C.J.** and D.J.T. Hussell. 2008. The Raptor Population Index in Practice, pages 165-178 in K.L. Bildstein, J.P. Smith, E. Ruelas Inzunza, and R. Veit (eds.), *State of North America's Birds of Prey*. American Ornithologists' Union and Nuttall Ornithological Club, Series in Ornithology, No. 3.
- Klem, D, **C.J. Farmer**, N. Delacretaz, Y. Gelb, and P. Saenger. 2009. Architectural and Landscape Risk Factors Associated with Bird-glass Collisions in an Urban Environment. *Wilson Journal of Ornithology* 121: 126-134.
- Kunkle, D., B. Silfies, L.J. Goodrich, D. Barber, **C.J. Farmer**, and K.L. Bildstein. 2009. Movements of Red-tailed Hawks Color-marked During Autumn Migration on the Kittatinny Ridge, Eastern Pennsylvania, *Hawk Migration Studies* 34:18-24.
- Farmer, C. J.**, L.J. Goodrich, R. Bell, B. Drolet, E. Greenstone, D. Grove, D.J.T. Hussell, D. Mizrahi, F. Nicoletti, and J. Sodergren, Trends in Autumn Counts of Migratory Raptors in Northeastern North America, 1974-2004. 2008. pages 179-216 in K.L. Bildstein, J.P. Smith, E. Ruelas Inzunza, and R. Veit (eds.), *State of North America's Birds of Prey*. American Ornithologists' Union and Nuttall Ornithological Club, Series in Ornithology, No. 3.
- Farmer, C. J.**, L.J. Goodrich, E. Ruelas, and J. Smith,. 2008. Conservation Status of North American Raptors. pages 303-420 in K.L. Bildstein, J.P. Smith, E. Ruelas Inzunza, and R. Veit (eds.), *State of North America's Birds of Prey*, American Ornithologists' Union and Nuttall Ornithological Club, Series in Ornithology, No. 3.
- Smith, J.P., **C.J. Farmer**, S.W. Hoffman, G.S. Kaltenecker, K.Z. Woodruff, and P. Sherrington. 2008. Trends in Autumn Counts of migratory Raptors in Western North America, 1983-2005, pages 217-252 in K.L. Bildstein, J.P. Smith, E. Ruelas Inzunza, and R. Veit (eds.), *State of North America's Birds of Prey*, American Ornithologists' Union and Nuttall Ornithological Club, Series in Ornithology, No. 3.
- Smith, J.P., **C.J. Farmer**, S.W. Hoffman, C.A. Lott, L.J. Goodrich, J. Simon, C. Riley, and E. Ruelas Inzunza. 2008. Trends in Autumn Counts of Migratory Raptors Around the Gulf of Mexico, 1995-2005, pages 253-278 in K.L. Bildstein, J.P. Smith, E. Ruelas Inzunza, and R. Veit (eds.), *State of North America's Birds of Prey*, American Ornithologists' Union and Nuttall Ornithological Club, Series in Ornithology, No. 3.
- Farmer, C. J.**, D. J. T. Hussell, and D. Mizrahi. 2007. Methods for Detecting Population Trends in Migratory Birds of Prey, *The Auk* 124: 1047-1062.



Farmer, C. J., and M.D. Kirchhoff. 2007. Ecological Classification of Deer Habitat in the Tongass National Forest, Alaska, *Northwestern Naturalist* 88: 73-84.

Bildstein, K.L., M.J. Bechard, P. Porras, E. Campo, and **C.J. Farmer**. 2007. Seasonal Abundances and Distributions of Black Vultures (*Coragyps atratus*) and Turkey Vultures (*Cathartes aura*) in Costa Rica and Panama: Evidence for Reciprocal Migration in the Neotropics. pages 47-60 in K.L. Bildstein, D.R. Barber and A. Zimmerman (eds.), *Neotropical raptors*, Hawk Mountain Sanctuary, Orwigsburg, PA, USA.

Farmer, C. J., D. K. Person, and R. T. Bowyer. 2006. Risk Factors and Mortality of Sitka Black-tailed Deer in a Managed Forest Landscape. *Journal of Wildlife Management* 70: 1403-1415.

SELECTED PROFESSIONAL PRESENTATIONS

Ostridge, C. and **C. Farmer**. 2018. Understanding the true costs of bat curtailment. Bats and wind energy collaborative science meeting, Broomfield, CO.

Farmer, C.J. 2018. (Session Moderator). Eagles II – (Not!) For the Nerds. AWEA Siting and Environmental Compliance Conference, Memphis, TN.

Hiester, T., **C. Farmer**, and K. Peters. 2018. Machine vision field survey data and implications for risk modeling. Poster presentation at AWEA Siting and Environmental Compliance Conference, Memphis, TN.

Parkhe, V., K. Peters, and **C.J. Farmer**. 2018. Technical verification of risk reduction technologies. AWEA Siting and Environmental Compliance Conference, Memphis, TN

Farmer, C.J. and Stauffer-Curtiss, S. 2017. Civil Settlement Agreements to resolve past eagle take. MBTA & BGEPA: Hot topics in Avian Protection, CLE International Conference, Denver, CO .

Farmer, C.J. 2017. (Session Moderator). Research – Mr. Watson – come here-I want to see you. AWEA Siting and Environmental Compliance Conference, Austin, TX (2017)

Farmer, C.J., T. Hiester, G. Aldrich, and D. Brandes. 2017. Validating a prior risk estimates using machine vision technology. AWEA Siting and Environmental Compliance Conference, Austin, TX

Farmer, C.J., G. Constantine, K. Peters, and T.J. Mabey. 2017. Budget impacts of fatality monitoring: common vs rare events. CanWEA Operations and Maintenance Conference, Toronto, ON

Farmer, C.J. 2016. (Session Moderator). Using Advanced Technologies to Study and Minimize Impacts. National Wind Coordinating Collaborative Research Meeting XI, Panel Discussion

Peters, K, T. Hiester, and **C.J. Farmer**. 2016. Potential effects of using machine vision monitoring to estimate eagle fatality risk at wind facilities. National Wind Coordinating Collaborative Research Meeting XI, Poster Session, Denver, CO

Farmer, C.J., K. Peters, A. Klehr, and E. Crivella. 2016. Avian deterrents and detection devices: What do we know and where do we go from here? AWEA WindPower Conference Thought Leader Lecture, New Orleans, LA.

Farmer, C.J., A. Klehr, and E. Crivella. 2016. Lesser prairie-chickens: Status changes and implications for wind development. AWEA WindPower Poster Session, New Orleans, LA.

Farmer, C.J. and T. Snetsinger. 2015. Post-construction monitoring for raptors: balancing cost vs accuracy, Raptor Research Foundation Annual Conference, Sacramento, CA

Farmer, C.J. and M. Martell. 2015. Energy industry update, Eastern Golden Eagle Working Group Meeting, Rangeley, ME

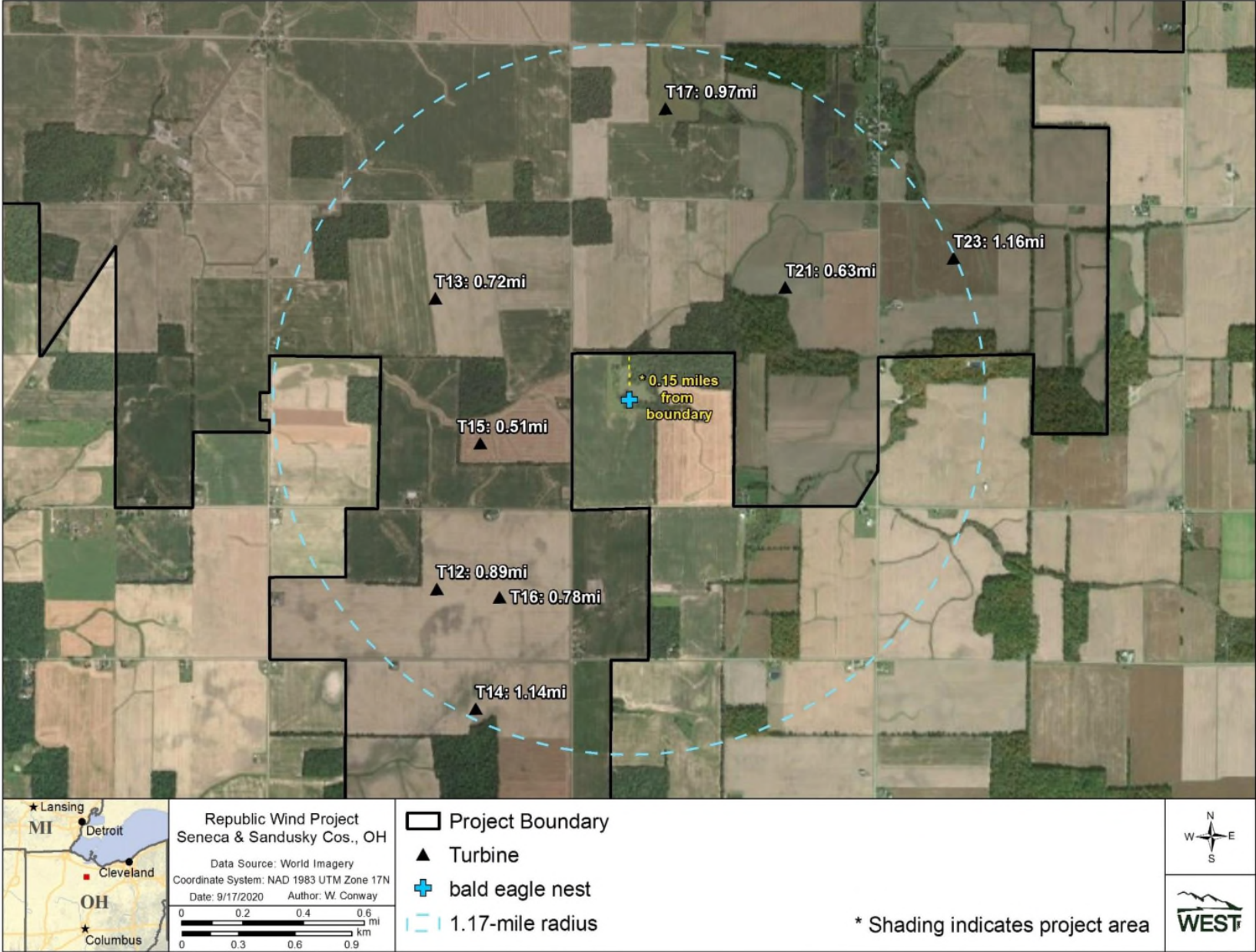
Farmer, C.J., D. Brandes, L.R. Nagy, and K Kosciuch. 2014. Predicting raptor collision risk from first principles: application of updraft modeling to wind farms, National Wind Coordinating Collaborative, Research Meeting X. Denver, CO.



- Nagy, L.R., **C.J. Farmer**, M. Braham, A. Duerr, A. Fesnock, T. Katzner, L. LaPre, T. Miller, and E. Mix. 2014. Golden eagle point counts and telemetry data: a project-specific comparison, National Wind Coordinating Committee, Research Meeting X. Denver, CO
- Garvin, J., L.R. Nagy, K. Wells, and **C.J. Farmer**. 2014. Carcass removal to reduce eagle-vehicle collisions as a compensatory mitigation strategy, poster presentation at WindPower 2014, Las Vegas, NV
- Brandes, D. and **C. J. Farmer**. 2014. Trends in eastern golden eagle count data: an update, Eastern Golden Eagle Working Group Meeting, Blackwater Falls State Park, WV
- Nagy, L.R., K. Kosciuch, and **C.J. Farmer**. 2013. Eagle conservation plans: a review of avoidance, minimization, mitigation and adaptive management from ECPs, AWEA Wind Power Conference, Chicago, IL
- Farmer, C.J.**, L.R. Nagy, and J. Garvin. 2012. USFWS Bayesian eagle collision model: input implications, study design, and fatality estimates, poster, California-Nevada Golden Eagle Working Group Symposium, McClellan, CA
- Farmer, C.J.**, and L. R. Nagy. 2012. The Bayesian eagle-risk model: input implications, study design, and fatality estimates. National Wind Coordinating Committee, Research Meeting IX. Denver, CO
- Farmer, C.J.** 2012. Trends in wind energy development: how eagle researchers can aid intelligent wind farm siting, Eastern Golden Eagle Working Group Annual Meeting, Saint Anne des Monts, QC, Canada
- Nagy, L. and **C.J. Farmer** 2012. USFWS Risk Assessment Models – Current ECP Guidance and West Butte, American Wind Energy Association Siting Workshop, Las Vegas, NV (2012)
- Nagy, L. **C.J. Farmer**, and K. Kosciuch, 2011. Eagle fatalities in the United States: Data, Data Gaps, and Implications, Raptor Research Foundation Conference, Duluth, MN
- Farmer, C.J.** 2019. American Kestrels: the view from Hawk Mountain, North American Bluebird Society Conference, Grantville, PA
- Farmer, C.J.** 2009. How well does migration monitoring sample Osprey (*Pandion haliaetus*) migration in North America? American Ornithologists' Union, Philadelphia, PA (2009)
- Farmer, C.J.** 2008. The quiet decline of a common raptor, University of Minnesota, Biology Department Seminar, Duluth, MN
- Farmer, C.J.** 2007. Migration monitoring points to widespread American Kestrel (*Falco sparverius*) declines, Raptor Research Foundation and Hawk Migration Association of North America, Fogelsville, PA
- Farmer, C.J.** 2007. The raptor population index in practice: hawk counts as population indexes, Raptor Research Foundation and Hawk Migration Association of North America, Fogelsville, PA
- Farmer, C.J.** 2007. Trends in autumn counts of migratory raptors in northeastern North America, 1974-2004, Raptor Research Foundation and Hawk Migration Association of North America, Fogelsville, PA
- Farmer, C.J.** 2007. Assessing the conservation status of North America's birds of prey, Raptor Research Foundation and Hawk Migration Association of North America, Fogelsville, PA
- Farmer, C.J.** 2007. The raptor population index: a migration monitoring network for raptors, Association of Field Ornithologists, Orono, ME (2007)
- Farmer, C.J.** 2006. Population trends of migratory raptors in northeastern North America, Eastern Bird Banding Association, Bethlehem, PA
- Farmer, C.J.** 2006. Counts and flight altitudes of migrating raptors at Hawk Mountain Sanctuary, Wildlife and Wind Energy Conference, Kutztown University, Kutztown, PA



- Farmer, C.J.** 2006. Long-term population trends of migratory raptors in eastern North America, 1974-2004, IV North American Ornithological Congress, Veracruz, MX (2006)
- Farmer, C.J.** 2003. Killing them softly with chainsaws: habitat correlates of fitness in Sitka black-tailed deer, Montana State University Ecology Department Seminar, Bozeman, MT
- Farmer, C.J., D.K. Person, and R.T.** 2003. Bowyer, Survival and habitat selection of Sitka black-tailed deer, Alaska Chapter of The Wildlife Society, Juneau, AK
- Farmer, C.J. and M.D. Kirchhoff.** 2003. Habitat categories in the coastal temperate rainforest that are meaningful to deer and managers, Northwest Section of the Wildlife Society, Eugene, OR
- Farmer, C.J., D.K. Person, and R.T. Bowyer,** Effects of even-aged timber management on survivorship of deer in Southeast Alaska, The Wildlife Society, National Meeting, Reno, NV (2001)



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Summary: Testimony of Christopher J. Farmer of behalf Republic Wind, LLC electronically filed by Teresa Orahod on behalf of Jennifer A. Flint