

**Environment and Natural Resources Trust Fund**

# M.L. 2021 Approved Work Plan

## **General Information**

**ID Number:** 2021-294

**Staff Lead:** Rory Anderson

**Date this document submitted to LCCMR:** July 21, 2021

**Project Title:** Behavioral Response of Bald Eagles to Acoustic Stimuli

**Project Budget:** $261,000

## **Project Manager Information**

**Name:** Christopher Feist

**Organization:** U of MN - St. Anthony Falls Laboratory

**Office Telephone:** (612) 626-0538

**Email:** feist020@umn.edu

**Web Address:** https://www.safl.umn.edu/

## **Project Reporting**

**Date Work Plan Approved by LCCMR:** July 20, 2021

**Reporting Schedule:** December 1 / June 1 of each year.

**Project Completion:** July 31, 2023

**Final Report Due Date:** September 14, 2023

## **Legal Information**

**Legal Citation:** M.L. 2021, First Special Session, Chp. 6, Art. 6, Sec. 2, Subd. 07d

**Appropriation Language:** $261,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota, St. Anthony Falls Laboratory, to protect wildlife by designing and implementing an acoustic deterrence protocol to discourage bald eagles from entering hazardous air space near wind energy installations.

**Appropriation End Date:** June 30, 2024

## **Narrative**

**Project Summary:** The goal of the work is to design and implement an acoustic deterrence protocol that will discourage bald eagles from entering hazardous air space near wind energy installations.

**Describe the opportunity or problem your proposal seeks to address. Include any relevant background information.**

Wind energy is a cost competitive, clean energy source that offers benefits for Minnesota. However, there are some undesirable environmental impacts of wind energy installations; one of primary interest here is federally protected bald eagle collisions with wind turbines resulting in fatalities. A promising method designed to reduce eagle collisions is the installation of acoustic deterrent devices at wind energy installations. In recent years, several studies have attempted to estimate the efficacy of acoustic deterrent systems, but these studies have been conducted in uncontrolled environments with limited data, resulting in a wide range of effectiveness estimates; i.e. estimates of effectiveness on altering flight paths of raptors away from wind turbines range from 7% to 88%. Further, the acoustic stimuli used were developed in the absence of knowledge relating to the hearing attributes of bald eagles. For these devices to be useful as a reliable raptor collision mitigation method, acoustic deterrence developers must have confidence in their effectiveness. This project aims to answer this question under controlled experimental conditions.

**What is your proposed solution to the problem or opportunity discussed above? i.e. What are you seeking funding to do? You will be asked to expand on this in Activities and Milestones.**

In experiments designed to develop the most effective acoustic deterrent, behavioral responses of bald eagles to a battery of natural and synthetic stimuli will be acquired and analyzed to establish a clear understanding of which stimulus types bald and golden eagles are most responsive to and habituate to the least. A set of prospective deterrence signals will be engineered using the most effective stimuli identified in the behavioral response tests referenced above. Those signals will be used to determine if tethered, but otherwise free-flying birds, respond to deterrence signals by altering customary flight paths. Additional experiments will be conducted by associating prospective sound-based deterrent signals with a visual object to determine if the eagles associate objects with acoustic cues and that those cues might enhance the avoidance behaviors that mitigate the taking of birds at wind energy facilities.

**What are the specific project outcomes as they relate to the public purpose of protection, conservation, preservation, and enhancement of the state’s natural resources?**

This project will provide scientifically rigorous data addressing the effectiveness of acoustic deterrence signals to alter the flight path of eagles and therefore mitigate the fatality rate associated with wind turbine collisions. The project will identify and design acoustic deterrence signals that have been tested under controlled experimental conditions with bald eagles. Findings from this study will provide system designers and developers alike a solid foundation upon which to implement acoustic deterrence technologies.

## **Project Location**

**What is the best scale for describing where your work will take place?** Statewide

**What is the best scale to describe the area impacted by your work?** Region(s): Central, NW, SW, NE,

**When will the work impact occur?** In the Future

## **Activities and Milestones**

### **Activity 1: Behavioral testing of perched bald eagles to potential acoustic deterrence signals**

**Activity Budget:** $120,000

**Activity Description:**In this activity, the team will build on work recently concluded as part of a U.S. Department of Energy (DOE) funded project. In phase one of that study, the auditory attributes of bald and golden eagles were investigated. In a second study, a subset of calls from the vocal repertoire of bald and golden eagles were acoustically analyzed, and in a third preliminary data associated with behavioral responses of 3 bald eagles to a collection of natural and synthetic acoustic stimuli in a laboratory setting were acquired and analyzed.  
  
In the first activity of the proposed study, our goal is to expand the small sample sizes used in the preliminary study to include 10 bald eagles in an effort to identify the most effective alerting acoustic stimuli and to which there is little, if any, habituation. Using this information, acoustic deterrence signals will be developed and used in tests specified in activities 2 and 3. Bald eagles will be tested at the University of Minnesota Raptor Center.

**Activity Milestones:**

|  |  |
| --- | --- |
| **Description** | **Completion Date** |
| Engineer prospective acoustic deterrent stimuli for activities 2 and 3 | October 31, 2021 |
| Complete bald eagle behavioral response testing | November 30, 2021 |
| Complete analysis of bald eagle behavioral responses to acoustic stimuli | December 31, 2021 |

### **Activity 2: Phase 1 behavioral testing of bald eagles to potential acoustic deterrent signals during tethered flight**

**Activity Budget:** $65,000

**Activity Description:**The objective of activity 2 is to measure the effectiveness of acoustic deterrence signals developed in activity 1 to alter the flight path of eagles during tethered flight. Testing in this phase of the project will take place with wild bald eagles that are being rehabilitated at The University of Minnesota Raptor Center. To evaluate the effectiveness of acoustic deterrence signals to alter the flight path of eagles, 10 individuals will be evaluated during this phase of the investigation. Individual eagles will be evaluated multiple times on different days to assess habituation tendencies. By the end of the project, as many as 1200 flights, or more, will have been logged. Half of these flights will have included an acoustic deterrence element and half will not. Analyzing data collected during these flights using tracking sensors (GPS tags) attached to the birds will permit the objective assessment of the acoustic deterrence strategy.

**Activity Milestones:**

|  |  |
| --- | --- |
| **Description** | **Completion Date** |
| Develop data acquisition system | October 31, 2021 |
| Complete analysis of tethered flight trial data | May 31, 2022 |
| Complete bald eagle tethered flight trials | May 31, 2022 |

### **Activity 3: Phase 2 behavioral testing of bald eagles to potential acoustic deterrent signals during tethered flight**

**Activity Budget:** $76,000

**Activity Description:**Activity 3 will expand tethered flight testing into a second season. Tethered flight exercise associated with the Center’s rehabilitation program typically occurs during the months of October through December in preparation for the bird’s release into the wintering population of wild eagles. A second phase of testing will allow refinement of the testing procedure and concentration on acoustic stimuli shown in the earlier phases of this study to be most effective. We will also assess the combined influence of the presence of a structure and the broadcast of deterrence signals, as well as the influence of each element in isolation. Field testing of acoustic deterrence systems at wind farms have indicated some positive association between the noise deterrent and wind turbines.

**Activity Milestones:**

|  |  |
| --- | --- |
| **Description** | **Completion Date** |
| Modify tethered flight procedure and acoustic stimuli | August 31, 2022 |
| Complete tethered flight trials | December 31, 2022 |
| Complete analysis of flight response data | March 31, 2023 |
| Final project report | June 30, 2023 |

## **Project Partners and Collaborators**

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Organization** | **Role** | **Receiving Funds** |
| Peggy Nelson | Speech-Language-Hearing Science, University of Minnesota | Peggy will serve as a co-investigator and assist in the design of behavioral response testing. | Yes |
| Jeffrey Marr | St. Anthony Falls Laboratory, University of Minnesota | Jeff Marr will serve as a co-investigator and assist with project management and research dissemination. | Yes |
| Christopher Milliren | St. Anthony Falls Laboratory, University of Minnesota | Chris Milliren will provide technical support and develop the sensor systems used in the behavioral response and tethered flight testing. | Yes |
| Edward Walsh | VA Loma Linda Healthcare System | Ed will serve as a lead research scientist on the project with responsibilities including developing acoustic stimuli, design of laboratory testing, and analysis of behavioral response test data. | Yes |
| JoAnn McGee | VA Loma Linda Healthcare System | JoAnn will serve as a lead research scientist on the project with responsibilities including developing acoustic stimuli, design of laboratory testing, and analysis of behavioral response test data. | Yes |
| Lori Arent | The Raptor Center, University of Minnesota | Lori Arent will assist in the design of laboratory testing, be responsible for access to test subjects, animal care protocols and permitting requirements, and lead tethered flights of bald eagles. | Yes |
| Julia Ponder | The Raptor Center, University of Minnesota | Julia Ponder will serve as a co-investigator and provide expertise on raptor behavior, design of laboratory testing, animal care protocols, and permitting requirements. | Yes |

## **Dissemination**

**Describe your plans for dissemination, presentation, documentation, or sharing of data, results, samples, physical collections, and other products and how they will follow ENRTF Acknowledgement Requirements and Guidelines.**Results of the project will be communicated with the wind industry and other stakeholders via conferences, journal articles, reports, and direct communication with wind industry partners. Acknowledgement of the Environment and Natural Resources Trust Fund will be done through the use of the trust fund logo or attribution language on project print and electronic media, publications, signage, and other communications as per the ENTRF acknowledgement guidelines. The impact of this project will influence strategic planning activities of primary wind energy stakeholders as they develop the next generation of environment friendly technologies.

## **Long-Term Implementation and Funding**

**Describe how the results will be implemented and how any ongoing effort will be funded. If not already addressed as part of the project, how will findings, results, and products developed be implemented after project completion? If additional work is needed, how will this be funded?**Results of the project will be communicated with the wind industry and other stakeholders via conferences, journal articles, reports, and direct communication with wind industry partners. The impact of this project will influence strategic planning activities of primary wind energy stakeholders as they develop the next generation of environment friendly technologies. The US Department of Energy and the American Wind Wildlife Institute are committed to reducing the environmental impacts of wind energy and fund research aimed at this goal. Proposals for funding additional work can be submitted to these sources, as well as by establishing partnerships with private energy companies.

## **Budget Summary**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Category / Name** | **Subcategory or Type** | **Description** | **Purpose** | **Gen. Ineli gible** | **% Bene fits** | **# FTE** | **Class ified Staff?** | **$ Amount** |
| **Personnel** |  |  |  |  |  |  |  |  |
| Technician |  | Veterinarian Technician - Animal Care |  |  | 24% | 0.18 |  | $8,042 |
| Lori Arent |  | Scientist - Bird Handling |  |  | 27% | 0.24 |  | $21,257 |
| Julia Ponder |  | Co PI |  |  | 27% | 0.06 |  | $11,438 |
| Peggy Nelson |  | Co PI |  |  | 27% | 0.04 |  | $6,784 |
| Benjamin Erickson |  | Scientist |  |  | 24% | 0.16 |  | $11,062 |
| Christopher Milliren |  | Engineer |  |  | 24% | 0.48 |  | $29,447 |
| Jeffrey Marr |  | Co PI |  |  | 27% | 0.02 |  | $3,165 |
| Christopher Feist |  | PI |  |  | 27% | 0.4 |  | $30,649 |
|  |  |  |  |  |  |  | **Sub Total** | **$121,844** |
| **Contracts and Services** |  |  |  |  |  |  |  |  |
| Ed Walsh and JoAnn McGee | Professional or Technical Service Contract | Ed and JoAnn will serve as lead researchers on the project. They bring expertise in experimental design, data analysis, and animal bio-acoustics. |  | X |  | 1 |  | $128,000 |
|  |  |  |  |  |  |  | **Sub Total** | **$128,000** |
| **Equipment, Tools, and Supplies** |  |  |  |  |  |  |  |  |
|  | Equipment | Audio Equipment | Amplifiers and signal generators for use in the tethered flight testing |  |  |  |  | $2,000 |
|  | Equipment | Speakers | Speakers used in tethered flight testing to emit acoustic stimuli |  |  |  |  | $4,000 |
|  | Equipment | Tethered flight materials | Equipment used in tethered flights of bald eagles such as harness, gauntlets, creance line, etc. |  |  |  |  | $1,675 |
|  | Equipment | RTK GPS tracking | Tracking device system to measure the flight path of bald eagles during tethered flights |  |  |  |  | $3,000 |
|  |  |  |  |  |  |  | **Sub Total** | **$10,675** |
| **Capital Expenditures** |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  | **Sub Total** | **-** |
| **Acquisitions and Stewardship** |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  | **Sub Total** | **-** |
| **Travel In Minnesota** |  |  |  |  |  |  |  |  |
|  | Miles/ Meals/ Lodging | Travel rate set at $0.54 per mile for personal vehicles. Total miles of 297 for three individuals. | Reimbursement for travel to the eagle tethered flight location and the raptor center. |  |  |  |  | $481 |
|  |  |  |  |  |  |  | **Sub Total** | **$481** |
| **Travel Outside Minnesota** |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  | **Sub Total** | **-** |
| **Printing and Publication** |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  | **Sub Total** | **-** |
| **Other Expenses** |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  | **Sub Total** | **-** |
|  |  |  |  |  |  |  | **Grand Total** | **$261,000** |

### **Classified Staff or Generally Ineligible Expenses**

|  |  |  |  |
| --- | --- | --- | --- |
| **Category/Name** | **Subcategory or Type** | **Description** | **Justification Ineligible Expense or Classified Staff Request** |
| **Contracts and Services** - Ed Walsh and JoAnn McGee | Professional or Technical Service Contract | Ed and JoAnn will serve as lead researchers on the project. They bring expertise in experimental design, data analysis, and animal bio-acoustics. | Ed and JoAnn are critical partners to the success of this project. They served as lead researchers on the previous work completed by this team that is directly leading to the project proposed here. Ed and JoAnn were responsible for much of the experimental design, acoustic signal design, and data processing from our previous project where bald and golden eagle hearing were mapped as well as a pilot behavioral response experiment. Ed and JoAnn will be largely responsible for acoustic signal development, experimental design, and data processing in the project proposed here. Without Ed and JoAnn on the team this proposal would not have been submitted. There are no other researchers with their experience working with bald eagle hearing. Because of this, the single source contract is needed.  Ed Walsh and JoAnn McGee are researchers with the VA Loma Linda Healthcare System. They have previously held affiliated research positions at the University of Minnesota in the Speech, Language, and Hearing Sciences department. They are being included on this proposal as a professional service contract as this was deemed the easiest way of including them on the proposal.  Ed Walsh and JoAnn McGee each have a rate of $100/hour. It was estimated their involvement on the project would total 640 hours. **This is a single source contract.** |

### **Non ENRTF Funds**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Category** | **Specific Source** | **Use** | **Status** | **Amount** |
| **State** |  |  |  |  |
|  |  |  | **State Sub Total** | **-** |
| **Non-State** |  |  |  |  |
| In-Kind | Unrecovered F&A | Support of SAFL facilities where research will be conducted. | Secured | $143,550 |
|  |  |  | **Non State Sub Total** | **$143,550** |
|  |  |  | **Funds Total** | **$143,550** |

## **Attachments**

### **Required Attachments**

#### ***Visual Component***

File: [4f8fffc1-b7b.pdf](https://lccmrprojectmgmt.leg.mn/media/map/4f8fffc1-b7b.pdf)

#### ***Alternate Text for Visual Component***

The visual shows two of the experimental setups planned for the project. One figure shows a bald eagle in an indoor pen at the Raptor Center where behavioral testing to acoustic stimuli is occurring, image is from a previous DOE funded study. Speakers are located on either side of the eagle and researchers are monitoring/controlling the test from a remote location using video. The second figure shows an experimental setup with a bald eagle flying down a corridor with speakers on either side. ...

### **Optional Attachments**

#### ***Support Letter or Other***

|  |  |
| --- | --- |
| **Title** | **File** |
| Proposal endorsement - UMN | [bfa95df9-195.pdf](https://lccmrprojectmgmt.leg.mn/media/attachments/bfa95df9-195.pdf) |
| Peer Review Research Addendum | [a6971368-350.docx](https://lccmrprojectmgmt.leg.mn/media/attachments/a6971368-350.docx) |
| Background Check Form | [31e142ec-15d.pdf](https://lccmrprojectmgmt.leg.mn/media/attachments/31e142ec-15d.pdf) |

## **Difference between Proposal and Work Plan**

#### ***Describe changes from Proposal to Work Plan Stage***

To reduce the project budget to the recommenced funding amount, some of the project scope was removed. Specifically, our plan to travel to Cyril, OK to test golden eagle behavioral response as part of Activity 1 was removed. As MN has a low population of golden eagles, this part of the scope had the least significant impact to MN natural resources. Additionally, results from bald eagle behavioral response testing will have relevance to an acoustic deterrence system that would also work for golden eagles. The project title was changed to reflect the removal of behavioral response testing of golden eagles.

## **Additional Acknowledgements and Conditions:**

The following are acknowledgements and conditions beyond those already included in the above workplan:

**Do you understand and acknowledge the ENRTF repayment requirements if the use of capital equipment changes?**   
 N/A

**Do you agree travel expenses must follow the "Commissioner's Plan" promulgated by the Commissioner of Management of Budget or, for University of Minnesota projects, the University of Minnesota plan?**   
 Yes, I agree to the UMN Policy.

**Does your project have potential for royalties, copyrights, patents, or sale of products and assets?**   
 No

**Do you understand and acknowledge IP and revenue-return and sharing requirements in 116P.10?**   
 N/A

**Do you wish to request reinvestment of any revenues into your project instead of returning revenue to the ENRTF?**   
 N/A

**Does your project include original, hypothesis-driven research?**   
 Yes

**Does the organization have a fiscal agent for this project?**   
 Yes, Sponsored Projects Administration