Research Project Work Plan

for

HABITAT CONNECTIVITY ASSESSMENT AND MAPPING FOR PRIORITIZATION OF WILDLIFE CROSSING PROJECTS

SPR 836

Submitted by

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1.0 Identification

1.1 Organizations Sponsoring Research

Oregon Department of Transportation (ODOT)
Research Section
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Salem, OR 97301 Phone: (503) 986-2700

Federal Highway Administration (FHWA)
Washington, D.C. 20590

1.2 Principal Investigator

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1.3 Associate Investigators

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1.4 Technical Advisory Committee (TAC) Members

Cidney Bowman, ODOT Wildlife Passage Program Coordinator, *Champion*
Rachel Wheat, Ph.D., ODFW

Jennifer Lanzarotta, ODOT GIS
Christian Jilek, ODOT Region 5
Julie Worsley, ODOT Region 3
Alex Bettinardi, ODOT TPAU
Cindy Callahan, FHWA
Kira Glover-Cutter, ODOT Research
Andrea Hanson, ODFW
Arthur Rodriguez, ODFW
Sara Gregory, ODFW
Tony Knudson, ODOT Research Coordinator, *Chair*

1.5 Friends of the Committee

Leslie Bliss-Ketchum, SAMARA Group

1.6 Research Coordinator

Tony Knudson, ODOT Research Coordinator Phone: 503-986-2848

1.7 Project Champion

Cidney Bowman, ODOT Wildlife Passage Program Coordinator
Susan Haupt, ODOT Chief Environmental Manager

2.0 Background

2.1 Problem Statement

Large mammals cross highways to access core habitat areas, presenting significant safety hazards for Oregon drivers. In 2017, more than 7,400 wildlife-vehicle collisions, resulting in more than 700 serious injuries and two fatalities occurred throughout ODOT's highway system. Though ODOT has documented progressively increasing animal-vehicle collisions over several years, ODOT lacks a statewide, science-based approach for identifying and prioritizing the most effective project sites for wildlife collision mitigation. Instead, crossing sites are considered on a project-by-project basis, risking both effectiveness for the traveling public and inefficient use of public funds.

Multiple state DOTs have demonstrated the utility of using statewide wildlife corridor mapping, informed by animal-vehicle collision data, as a methodology for prioritizing wildlife-vehicle mitigation sites across state highway networks. For migratory animals such as mule deer and elk, current and future projections of road crossing zones can be approximated through computational modeling of habitat linkages.

Improvements in the availability and resolution of spatial data, as well as new and more robust statistical modeling techniques, have made fine-resolution, landscape-scale habitat connectivity modeling feasible. Modeling tools including those used by Washington and

California DOTs, have been widely used, are cost-efficient, and user-friendly, with numerous publications highlighting significance and limitations that can be leveraged for more optimized modeling. Most importantly to ODOT, the critical information and tools needed for developing an Oregon wildlife corridor prioritization map are either available or currently under development by our partner agencies including: field-based deer and elk movement data from ODFW, base modeling tools from the Nature Conservancy, landscape based corridor maps that consider climate resiliency from the Nature Conservancy, ODOT wildlife-vehicle crash density zones, and ODOT current and future traffic projections. This ODOT:PSU work plan is informed by and is intended to support the ODFW led multi-partnership effort "Oregon Connectivity Assessment and Mapping Project (OCAMP)" to develop high resolution maps for ODOT prioritization of mitigation sites along ODOT infrastructure. The OCAMP Implementation Plan is provided as Attachment #1. This OCAMP partnership together with readily available ODOT datasets, presents ODOT with a timely and cost-effective opportunity to successfully identify critical areas on the state highway system with the highest wildlife collision safety concerns.

2.2 Objectives

ODOT's current wildlife collision mapping data is subjective and of limited use, providing only low-resolution estimates of kill zones. This data does not show where wildlife are crossing safely and does not show areas that are already a barrier to wildlife movement. For effective crossing site project prioritization, integrating collision mapping data together with wildlife corridor models, predicted traffic models, and climate resiliency mapping is required. Specific objectives include:

1. Delivery of six species-specific corridor maps across each species' range in the state. Must include mule deer, black-tailed deer, Roosevelt elk, rocky mountain elk, pronghorn, and bighorn sheep.
2. Delivery of initial methodology for prioritization of movement pathways to support OCAMP project tasks (e.g., may use climate resiliency, traffic data, future traffic and growth models, and wildlife-vehicle collision data).
3. Development of ODOT tailored priority maps for identifying critical areas on the highway system with the highest wildlife collision safety concerns.
4. Distribution of these results as 1) presentations to multiple ODOT managers and management teams, 2) presentation to ODOT Environmental Coordinators, Biologists, Planners, and Project Leaders, 3) integration of these spatial data layers into ODOT's TransGIS environment for readily available maps for use by ODOT or contractors, and 4) publication of final report and potentially additional peer review publications.

2.3 Benefits

Wildlife vehicle collisions present substantial safety hazards to our traveling public, resulting in costly vehicle damage, human injuries, and deaths. By modeling these wildlife corridors across preferred habitats, wildlife-crossing corridors along highways can be predicted and prioritized in a cost-effective manner using the best available science. These areas of concern can then be included for consideration in planning and design for possible

inclusion of wildlife mitigation structures during highway project construction. The current practice of negotiating project-by-project puts ODOT at a serious disadvantage for on-time project completion, as ODOT must meet the mitigation demands of the federal land agency. By being proactive and deciding which corridors pose a threat to wildlife passage, ODOT can systematically address problem areas and not be bound by project timelines. Further, this work helps demonstrate that wildlife passage fixes are not needed everywhere in the state. There are certain corridors where collisions are occurring at increased rates. This modeling effort will narrow the scope of the problem and allow ODOT to focus energy only where fixes are needed—not project-by-project. In sum, when effectively placed, wildlife-crossing structures can 1) enhance driver safety, 2) enhance ODOT maintenance worker safety, 3) reduce collision costs to drivers, and 4) reduce carcass removal costs to ODOT. Identification of high-priority wildlife crossing areas will also help ODOT address recent HB 2834 legislation requiring ODOT to reduce wildlife-vehicle collisions.

2.4 Implementation

Implementation of this research will require a coordinated effort between the PIs, ODOT Wildlife Passage Coordinator, ODFW, ODOT Research Staff, and the TAC. Accessibility and clarity of delivered map products together with an outreach effort highlighting the availability of this information will be essential for successful implementation of this research project.

3.0 Research Tasks

The PIs will meet with the Research Coordinator at least twice per fiscal year to discuss progress, data, and analysis. If needed, the Research Coordinator will schedule additional TAC meetings to share progress and receive direction. Throughout the duration of this project, at the end of each quarter, quarterly reports reflecting project progress will be delivered in a timely manner to the Research Coordinator. Additionally, at project completion, pre-transformed data will be made available to ODOT with storage instructions noting the contact information for the original data owner; and any associated code with appropriate commenting will be made available to ODOT.

3.1 Expected tasks:

Task 1: Model Development, Validation, and Delivery of Interim Connectivity Maps for Six Species

Develop and deliver interim connectivity maps following OCAMP guidelines for six individual species. Each of these maps will show movement pathways for black-tailed deer, mule deer, Roosevelt elk, Rocky Mountain elk, pronghorn, bighorn sheep. Building from the current OCAMP Implementation Plan (Attachment #1) the following additional subtasks will be completed:

A. TAC Kickoff Meeting within three months of Work Order execution.
B. Provide methodology developed in coordination with the OCAMP science core team for species habitat requirements.

C. Provide methodology developed in coordination with the OCAMP science core team for model development, calculation of resistance values, and calculation of source weights.
D. Provide peer review summary including OCAMP science core team review for species habitat models.
E. Provide methodology for development of habitat model and validation procedure.
F. Deliver methodology for determination of pixel size and moving window for running models for six species.
G. Deliver interim connectivity maps for each of the individual species for TAC review. Species include black-tailed deer, mule deer, Roosevelt elk, Rocky Mountain elk, pronghorn, and bighorn sheep.
H. ODOT TAC meeting #2 to overview methodology and individual maps.

Time Frame: by March 2022
Responsible Party: PIs
Cost: $168,704; includes computing costs
Deliverables: 1) Two ODOT TAC meetings and 2) individual interim connectivity maps for Black-tailed deer, mule deer, Roosevelt elk, and Rocky Mountain elk, pronghorn, and bighorn sheep. The following documentation is expected:

- Publication quality Methodology for Subtask 1B: Habitat species requirements
- Publication quality Methodology for Subtask 1C: Model development, selection of resistance values and source weights
- Memo Summary of peer review of model from Subtask 1D
- Publication quality Methodology for Subtask 1E: Habitat model development and validation procedure
- Publication quality Methodology for Subtask 1F: Determination of pixel size and moving window model selection
- Map descriptions (detailed figure legends) with delivery of 6 species maps

TAC Action: Review associated documentation, attend TAC meetings, and provide insight to the Research team and Research Coordinator regarding project progress and final species maps.
ODOT Action or Decision: Organize TAC meetings, review TAC advice, discuss with PIs, and if necessary, coordinate needed change.

Task 2: Development of Initial Methodology for Prioritization of Movement Pathways

Following the guidelines in the OCAMP Implementation Plan, develop and apply initial methodology to prioritize movement corridors. The methodology developed from this task should support ODOT's need to identify known and potential infrastructure barriers that negatively affect wildlife habitat connectivity. Building from the current OCAMP Implementation Plan (Attachment #1) the following additional subtasks will be completed:

A. Provide memo that summarizes 1) the development of key criteria for prioritizing corridors, and 2) the decision process for selection of cost/utility functions and weighting schemes across surrogate and focal species.
B. Provide memo that summarizes OCAMP and partner feedback and corresponding changes to methodology.
C. ODOT TAC meeting #3.

Time Frame: by September 2022
Responsible Party: PIs
Cost: $31,515; includes computing costs
Deliverable: 1) TAC meeting and 2) documentation for subtasks A and B.
TAC Action: Review methodology, advise PIs on refinement, communicate concerns to Research Coordinator.
ODOT Action or Decision: Fully understand methodology and apply as needed to Task 4. Organize TAC meetings, review TAC advice, discuss with PIs, and if necessary, coordinate needed change.

Task 3: Development and Delivery of ODOT Connectivity Planning Map

ODOT may need information from single ungulate species maps for other transportation related purposes (e.g. vehicle crash avoidance) that differ from but do not conflict with the OCAMP multi-species composite map. For this Task, consult with ODOT GIS professionals and ODOT Research TAC for delivery of finalized connectivity map to highlight ODOT-specific priorities, for use in highlighting safety concerns and ODOT planning purposes. With a goal of reducing wildlife-vehicle collisions, this map shall highlight the movement pathways from the OCAMP composite map as well as identify additional areas the six ungulate species may cross current and planned ODOT infrastructure.

Time Frame: by April 2023
Responsible Party: ODOT GIS Section, ODOT TAC, ODOT Research Coordinator, PIs
Cost: $1,750
Deliverable: Up to three 2-hour meetings with ODOT GIS team and sub-TAC group.
TAC Action: Develop criteria for ODOT tailored species map, develop advice for prioritization method for future planning.
ODOT Action or Decision: Development of tailored maps in consultation with PIs, memo of advice for prioritization method for future planning.

Task 4: Tailoring and Delivery of Composite Connectivity Map for ODOT Needs

ODOT may need to work with a composite ungulate map for other transportation related purposes (e.g. crash avoidance) that differ from but do not conflict with the OCAMP multi-species composite map. For this task, consult with ODOT GIS professionals and ODOT Research TAC for delivery of a composite map of the six ungulates (black-tailed deer, mule deer, Roosevelt elk, Rocky Mountain elk, pronghorn, bighorn sheep). This task entails compiling the six maps of individual species

movements into one map that highlights which ODOT infrastructure areas are likely to see crossings by multiple large-bodied species.
Time Frame: by April 2023
Responsible Party: ODOT GIS Section, ODOT TAC, ODOT Research Coordinator, PIs
Cost: $1,750
Deliverable: Up to three 2-hour meetings with ODOT GIS team and sub-TAC group.
TAC Action: Develop criteria for ODOT tailored composite map, develop advice for prioritization method for future planning.
ODOT Action or Decision: Development of tailored map in consultation with PIs, memo of advice for prioritization method for future planning.

Task 5: Short Technical Report and Product Demonstration

This task supports the delivery of a short technical report documenting Tasks 1-4 as well as rollout of the map products as demonstrations and Q&A to be performed at up to four ODOT Regions HQs.
Time Frame: January 2023 – July 2023
Responsible Party: PIs, ODOT Research Coordinator
Cost: $4,282
Deliverable: Demonstrations
TAC Action: Attend demonstrations
ODOT Action or Decision: Coordinate demonstrations

3.2 Reporting

Deliverables shall be produced in the standard ODOT Research Section report format provided to the Project Investigator by the Research Coordinator unless some other format is deemed to be more appropriate. The Project Investigator shall be responsible for submitting deliverables as professional-level written composition equivalent to the writing standards of peer-reviewed journals. These writing considerations include grammar, spelling, syntax, organization, and conciseness.

The Project Investigator, in consultation with the TAC and Research Coordinator, shall deliver to ODOT in electronic format the data produced during the project. The Project Investigator shall ensure the data is labeled and organized to facilitate future access. ODOT shall warehouse the data. Note that prior to submitting any peer-review publication(s) resulting from this work order, the Research Coordinator will work with PI to discuss external publication goals as referenced in ODOT/PSU contract 16292.

4.0 Time Schedule

Task	2019						2020						2021						2022						2023					
	FY20						FY21						FY22						FY23											
	Jul - Sep		Oct - Dec			Jan - Mar		Apr - Jun			Jul - Sep		Oct - Dec		Jan - Mar		Apr - Jun		Jul - Sep		Oct - Dec		Jan - Mar		Apr - Jun		Jul - Sep		Oct - Dec		Jan - Mar		Apr - Jun		
Task 1: Model Development, Validation, and Delivery of Interim Connectivity Maps for Six Species				T																S	T												
Task 2: Development of Initial Methodology for Prioritization of Movement Pathways																										S	T						
Task 3: Development and Delivery of ODOT Connectivity Planning Map																																	
Task 4: Tailoring and Delivery of Composite Connectivity Map for ODOT Needs																																	
Task 5: Short Technical Report and Product Demonstration																																S	D

Deliverables

T - TAC Meeting Due.

S - Task Documentation Due.

D - Demonstration Delivery Deadline. End of Contract.

5.0 Budget Estimate

Task	FY20 July 2019- June 2020	FY21 July 2020- June 2021	FY22 July 2021- June 2022	FY23 July 2022- June 2023	Total
1: Model Development, Validation, and Delivery of Interim Connectivity Maps for Six Species	$64,997	$66,846	$36,861		$168,704
2: Development of Initial Methodology for Prioritization of Movement Pathways	$7,908	$8,996	$14,611		$31,515
3: Development and Delivery of ODOT Connectivity Planning Map				$1,750	$1,750
4: Tailoring and Delivery of Composite Connectivity Map for ODOT Needs				$1,750	$1,750
5: Short Technical Report and Product Demonstration				$4,282	$4,282
Total for Tasks (Contract Amount)	**$72,905**	**$75,842**	**$51,472**	**$7,782**	**$208,001**
Support/Management	$7,000	$6,000	$7,000	$5,000	$25,000
Total for ODOT	**$79,905**	**$81,842**	**$58,472**	**$12,782**	**$233,001**