



Environment and Natural Resources Trust Fund

M.L. 2024 Approved Work Plan

General Information

ID Number: 2024-215

Staff Lead: Tom Dietrich

Date this document submitted to LCCMR: June 5, 2024

Project Title: White-Tailed Deer Movement and Disease in Suburban Areas

Project Budget: \$699,000

Project Manager Information

Name: Meggan Craft

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Project Reporting

Date Work Plan Approved by LCCMR: June 20, 2024

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

Project Completion: June 30, 2027

Final Report Due Date: August 14, 2027

Legal Information

Legal Citation: M.L. 2024, Chp. 83, Sec. 2, Subd. 03u

Appropriation Language: \$699,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to better understand white-tailed deer movement, habitat use, and disease dynamics at the suburban-agricultural interface to inform more efficient deer management and disease control.

Appropriation End Date: June 30, 2027

Narrative

Project Summary: Our project aims to better understand white-tailed deer movement, habitat use, and disease dynamics at the suburban/agricultural interface to inform more efficient deer management and disease control.

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

White-tailed deer are an important natural resource to the state of Minnesota. Yet we know little about basic deer biology (e.g., movement, habitat use) at the suburban/agricultural interface. Deer studies typically occur in rural landscapes. Better understanding of movement and habitat use can help target management of the deer population and reduce human-wildlife conflict (e.g., deer-vehicle collisions). White-tailed deer in Minnesota are also hosts for diseases that threaten deer, humans, and pets. For example, Chronic Wasting Disease (CWD) has spread to deer populations in proximity of the Twin Cities, yet applying what is known of deer ecology in rural settings may not be appropriate in making accurate predictions of CWD spread in suburban/urban areas. Also, white-tailed deer are competent hosts for SARS-CoV-2 and could be a source of new viral strains to humans, yet we do not understand how and where deer are exposed to, and spread, the virus. Finally, deer movements facilitate the spread of tick-borne diseases across landscapes (e.g., Lyme disease), with negative implications for humans and our pets. We know little about how diseases like these spread through white-tailed deer populations because we lack information on basic deer biology in suburban areas.

What is your proposed solution to the problem or opportunity discussed above? Introduce us to the work you are seeking funding to do. You will be asked to expand on this proposed solution in Activities & Milestones.

To better understand white-tailed deer movement, habitat use, and disease dynamics at the suburban/agricultural interface, we will leverage initial successes of a USDA-funded pilot study on SARS-CoV-2 in deer. This pilot study occurred over the winter of 2022/2023 at Elm Creek Park Reserve where: 1) 36% of hunter-harvested white-tailed deer had antibodies to SARS-CoV-2; 2) 40 GPS-collars (that record deer location data every 30 minutes for two years) were placed on deer using efficient helicopter capture; and 3) biological samples were stored for future testing. We seek LCCMR funding to expand this study to a new area (Carver Park Reserve) to collect and analyze movement and disease data via GPS-collars, camera traps, and biological sampling to model connectivity and disease spread. We aim to: 1) Describe deer movement and disease status at an interface between white-tailed deer and humans (and our pets) through GPS collaring and disease sampling white-tailed deer for SARS-CoV-2, CWD, Lyme and other diseases; 2) Use movement and camera trap data to better understand habitat use, local deer density, and group size, with implications for deer management; and 3) Use movement data to create mathematical models to predict disease transmission hotspots in deer populations.

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?

Better understanding of white-tailed deer biology at the suburban/agricultural interface can help us provide much needed information to managers. This information will help managers more efficiently manage deer populations and reduce human-wildlife conflict (e.g., deer-vehicle collisions). Second, we will engage the public through creation of an iNaturalist site and through education at nature centers. Finally, understanding deer disease status (in combination with deer movement and habitat use) can help us better predict how various diseases would spread among deer at the high-density interfaces between deer, humans, and our pets, with implications for how to target disease control.

Project Location

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

Region(s): Metro

What is the best scale to describe the area impacted by your work?

Statewide

When will the work impact occur?

During the Project and In the Future

Activities and Milestones

Activity 1: Quantify deer movement and disease status at the suburban/agricultural interface

Activity Budget: \$344,918

Activity Description:

Preliminary results from our USDA study suggest that white-tailed deer occur in high densities in Elm Creek Park Reserve, have overlapping space use relevant for transmission of diseases through both direct (i.e., deer-to-deer) and indirect routes (i.e., through ticks, insect vectors, or the environment), and frequently spend time in the neighborhoods around the Park Reserve (Figures 1 and 2a). Here the goal is to gather additional data on deer movements and disease status; the current study is only 40 deer in one “green patch” (i.e., the park). Studying additional “green patches” will give us the ability to make generalizable insights into how deer move and contact each other within and between green patches, as well as at the interface of the green patches, agricultural lands, and neighborhoods.

We propose to: 1) Use helicopter capture to deploy GPS-collars to 40 white-tailed deer; and 2) Study deer for SARS-CoV-2, CWD, Lyme, and other pathogens (e.g., Powassan virus, EHD, HPAI) and toxic chemicals (PFAS, an immunosuppressant).

Specific outcomes will include: 1) Locations of 40 deer every 30 minutes for two years; and 2) Disease status from a variety of pathogens of importance to deer, human, and domestic animals.

Activity Milestones:

Description	Approximate Completion Date
Obtain permits, order and acquire GPS collars, hire helicopter company	December 31, 2024
Use helicopter to place GPS collars on deer, collect biological samples; resample deer	March 31, 2025
Obtain results of diagnostic testing for pathogens from Carver and banked samples from Elm Creek	July 31, 2025
Conduct pathogen risk factor analyses and summarize disease results for final report	January 31, 2026
Collect movement data for collared deer over two years for Activities 2 and 3	March 31, 2027

Activity 2: Use movement and camera trap data to better understand deer habitat use, density and group size, through a management lens

Activity Budget: \$184,663

Activity Description:

The goal of this aim is to better understand deer habitat use, deer density, group size, and dispersal to better manage deer at the suburban/agricultural interface and reduce deer-human conflict. We will supplement Activity 1’s data with a camera trap study at Elm Creek and Carver Park and a website for public engagement (iNaturalist) where citizens can report collared deer and their group sizes. Our current Elm Creek movement study is a cooperative agreement where we share deer location data with USDA for a national analysis; however USDA funds do not cover local analyses of the movement data. Therefore we will hire a postdoctoral associate (or graduate student) and undergraduates to deploy the camera traps, monitor the iNaturalist site, and conduct the following analyses (Figure 2): 1) Use GPS and camera data to determine which habitats deer use daily and seasonally; 2) Use camera and iNaturalist data to determine how deer group sizes and local densities change seasonally; and 3) Use GPS data to quantify dispersal events away from the park reserves. Outcomes will include: deer home ranges; drivers of deer movement, grouping, and dispersal; as well as interactive discourse with managers about implications for management and public education.

Activity Milestones:

Description	Approximate Completion Date
Create iNaturalist site and deploy cameras at Elm Creek (Year 1) and Carver (Year 2)	June 30, 2026
Analyze camera trap and movement data from Elm Creek (Year 2) and Carver (Year 3)	January 31, 2027
Compare results between sites and determine generalizable conclusions; submit manuscript for publication	June 30, 2027
Continually work with managers to interpret results for management and public education	June 30, 2027

Activity 3: Use movement data to create mathematical models to predict transmission hotspots in deer populations at the suburban/agricultural interface

Activity Budget: \$169,419

Activity Description:

The goal is to use a new tool that links animal movement to animal contacts (i.e., “movement-driven modeling of spatio-temporal infection risk”: MoveSTIR; Wilber et al., Ecology Letters, 2022) to predict deer-to-deer contact relevant for disease transmission. This mathematical approach leverages movement data to predict transmission hotspots (see Figure 3). Next, we can determine environmental drivers of contact, allowing us to predict hotspots of transmission in novel landscapes. We will hire a postdoctoral associate to use the deer movement data (Activity 1) to predict where and when contact hotspots occur for diseases transmitted by direct contact (e.g., SARS-CoV-2), indirect contact (e.g., Lyme), or both modes of transmission (e.g., CWD). Outcomes from this activity will include: 1) a map of transmission risk for Elm Creek and Carver for a variety of diseases with different transmission modes; 2) determination of environmental drivers of contact for each disease (e.g., season and/or specific habitat type); and 3) a regional risk map for the greater metro region for the spread of directly and indirectly transmitted pathogens. Knowing predicted hotspots can help target disease surveillance and control.

Activity Milestones:

Description	Approximate Completion Date
Develop analytical workflow using preliminary movement data from Elm Creek	July 31, 2025
Analyze Elm Creek movement data using MoveSTIR, consider standalone publication	July 31, 2026
Analyze Carver movement data, and joint movement data with Elm Creek, using MoveSTIR	March 31, 2027
Submit joint movement manuscript for publication	June 30, 2027
Work with managers to devise disease control strategies from model results	June 30, 2027

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Tiffany Wolf	University of Minnesota, College of Veterinary Medicine	Co-PI / Provide guidance for the capture and disease sampling in Activity 1	Yes
James Forester	University of Minnesota, Twin Cities, College of Food, Agriculture and Natural Resource Science	Co-PI / Provide technical oversight for the camera trapping and movement analysis in Activity 2	Yes
John Moriarty	Three Rivers Park District	Collaborator / Provide access to Three Rivers Park District properties and facilities. Assist in the tracking and recovery of deer during the length of the study. Utilize results from this study for managing white-tailed deer on Three Rivers Park District properties.	No
Steven Hogg	Three Rivers Park District	Collaborator / Provide access to Three Rivers Park District properties and facilities. Assist in the tracking and recovery of deer during the length of the study. Utilize results from this study for managing white-tailed deer on Three Rivers Park District properties.	No

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.

Our plans for sharing of data and dissemination and presentation of research results is as follows: 1) Deer GPS locations will be posted to Movebank.org (a free, online database of animal tracking data) and will become publicly available after peer-reviewed publications. 2) We are partnering with Three Rivers Park District (TRPD) for this study. 3) Results pertaining to deer management and human-wildlife conflict will be directly implemented by TRPD managers and will be presented at the Twin Cities Urban Deer Meeting. 4) Study findings will be disseminated to management and academic audiences through conference presentations (e.g., The Wildlife Society) and peer-reviewed publications. 5) Study findings will be translated for outreach and public engagement via TRPD nature centers (e.g. Elm Creek and Carver Park Reserves) and via TRPD mechanisms such as TRPD's Wandering Naturalist Podcast or their Facebook pages. 6) We will acknowledge the Environment and Natural Resources Trust Fund through the use of the trust fund logo or attribution language on project print and electronic media, publications, signage, and other communications and outreach per the ENRTF Acknowledgment Guidelines.

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 work be funded?

Results pertaining to deer management and human-wildlife conflict will be directly implemented by Three Rivers Park District managers. Study findings will be disseminated to management and academic audiences through conference presentations (e.g., The Wildlife Society) and peer-reviewed publications, and translated for outreach and public engagement for the nature centers at Elm Creek and Carver Park Reserves. In expanding our existing project to

encompass two suburban parks in the study of deer biology and disease dynamics, we will be well-positioned to submit a 4-5 year proposal to the National Science Foundation for additional funding to grow and enhance the study.

Other ENRTF Appropriations Awarded in the Last Six Years

Name	Appropriation	Amount Awarded
Mapping Habitat Use and Disease of Urban Carnivores	M.L. 2019, First Special Session, Chp. 4, Art. 2, Sec. 2, Subd. 03g	\$500,000

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	\$ Amount
Personnel								
Meggan Craft/ Associate Professor/ PI		Overall project management / Provide expertise and mentorship for disease modeling in Activity 3			26.9%	0.21		\$37,000
James Forester/ Associate Professor/ Co-PI		Provide technical expertise for the GPS collars (Activity 1) and mentorship for the camera trapping and movement analysis in Activity 2			26.9%	0.18		\$25,000
Tiffany Wolf/ Assistant Professor/ Co-PI		Dr. Wolf is a DVM/PhD and will lead the deer health component for the capture and disease sampling in Activity 1.			26.9%	0.18		\$21,000
Postdoctoral Associate		Lead for Activity 2 / Deploy the camera traps and conduct analysis of the camera and movement data			20.45%	2.5		\$210,000
Postdoctoral Associate		Lead for Activity 3 / Conduct the disease modeling			20.45%	2.5		\$211,000
							Sub Total	\$504,000
Contracts and Services								
HeliWild (Helicopter Wildlife Capture Services)	Professional or Technical Service Contract	Efficient and safe helicopter capture and sampling of 40 deer, plus recapture and resampling of as many of those deer as possible				0		\$70,000
Diagnostic Laboratory	Internal services or fees (uncommon)	Disease testing for pathogens and toxins including SARS-CoV-2, Lyme, CWD, Powassan Virus, Epizootic Hemorrhagic Disease (EHD), highly pathogenic avian influenza (HPAI, "bird flu"), and Per- and Polyfluorinated Substances (PFAS).				0		\$16,000
							Sub Total	\$86,000
Equipment, Tools, and Supplies								

	Tools and Supplies	Trail cams, SD card, protective boxes and locks, lithium batteries	Estimate group size and local densities of deer					\$13,500
	Tools and Supplies	Data Packages for collars based on at least 12 relocations a day for 24 months, flat rate at \$25/month per collar: Quantity 40 (*24 months)	Data packages for GPS collars based on at least 12 relocations a day for 24 months,					\$24,000
	Tools and Supplies	1 set of binoculars	For resighting of collared individuals and visual observations of group size.					\$1,000
	Tools and Supplies	40 GPS collars (model G5-2D from Advanced Telemetry Systems, Isanti, MN)	Track movements of 40 white-tailed deer					\$49,000
	Tools and Supplies	Programmed release mechanism for collars (from Advanced Telemetry Systems)	For 40 GPS collars to automatically 'drop off' after 2 years					\$16,000
	Tools and Supplies	Supplies for capture and sampling of 40 deer (including write in field paper, pens, needles, syringes, tubes, swabs, darts, immobilization drugs, if needed)	Supplies for capture and sampling of 40 deer					\$500
							Sub Total	\$104,000
Capital Expenditures								
							Sub Total	-
Acquisitions and Stewardship								
							Sub Total	-
Travel In Minnesota								
	Miles/ Meals/ Lodging	5573 miles (camera trap checking, collar deployment, sampling and resighting) to and from field sites	Check camera traps, collaring and sampling deer, visual observations of collared deer					\$3,650
	Conference Registration Miles/ Meals/ Lodging	Formal presentation by postdoctoral associate or graduate student at state chapter Wildlife Society Meeting	Presenting at the Minnesota Chapter of The Wildlife Society will highlight the research in the state and serve an outreach function					\$500
							Sub Total	\$4,150
Travel Outside Minnesota								
	Conference Registration	Formal presentation by postdoctoral associate or graduate student at a professional society meeting	Formal presentation at a national level professional society research	X				\$850

	Miles/ Meals/ Lodging		conference (e.g. The Wildlife Society). An out-of-state conference is necessary to: (1) get feedback from a diverse set of colleagues who are doing similar work (there are few experts in MN on this subject) which will improve the quality of our research, and 2) disseminate our results more broadly to additional management audiences at a meeting that the TRPD managers attend annually. Dissemination to a national audience will raise the profile of Minnesota's research to a national stage.					
							Sub Total	\$850
Printing and Publication								
							Sub Total	-
Other Expenses								
							Sub Total	-
							Grand Total	\$699,000

Classified Staff or Generally Ineligible Expenses

Category/Name	Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request
Travel Outside Minnesota	Conference Registration Miles/Meals/Lodging	Formal presentation by postdoctoral associate or graduate student at a professional society meeting	The Wildlife Society annual meetings normally occur outside of Minnesota. An out-of-state conference is necessary to: (1) get feedback from a diverse set of colleagues who are doing similar research (there are few experts in MN on this subject) which will improve the quality of our research, and 2) disseminate our results more broadly to additional management audiences at a meeting that the TRPD managers attend annually. Dissemination to a national audience will raise the profile of Minnesota's research to a national stage.

Non ENRTF Funds

Category	Specific Source	Use	Status	\$ Amount
State				
			State Sub Total	-
Non-State				
In-Kind	University of Minnesota Indirect Costs	55% MTDC	Pending	\$384,000
			Non State Sub Total	\$384,000
			Funds Total	\$384,000

Attachments

Required Attachments

Visual Component

File: [31c0bfa6-f8c.pdf](#)

Alternate Text for Visual Component

Fig. 1. Locations of GPS-collared deer at Elm Creek Park Reserve with inset of collared deer.

Fig. 2. Collared deer routinely visit backyards. Camera traps and iNaturalist observations will estimate how group sizes change seasonally.

Fig. 3. High risk contact hotspots for disease transmission can be predicted by movement....

Supplemental Attachments

Capital Project Questionnaire, Budget Supplements, Support Letter, Photos, Media, Other

Title	File
Support letter from Three Rivers Park District	a8728978-7a1.pdf
Institutional Endorsement by University of Minnesota	8798c387-bb6.pdf
Research Addendum revised 2-24-215 final	1e096c51-600.pdf

Difference between Proposal and Work Plan

Describe changes from Proposal to Work Plan Stage

I have revised the workplan according to the requested revisions. In addition to mentioning testing for EHD and HPAI (as requested in the revisions), I also added that we would test the deer for PFAS ("forever chemicals") which can cause immunosuppression and could increase susceptibility to diseases in deer.

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, sale of products and assets, or revenue generation?

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

Does your project include the pre-design, design, construction, or renovation of a building, trail, campground, or other fixed capital asset costing \$10,000 or more or large-scale stream or wetland restoration?

No

Do you propose using an appropriation from the Environment and Natural Resources Trust Fund to conduct a project that provides children's services (as defined in Minnesota Statutes section 299C.61 Subd.7 as "the provision of care, treatment, education, training, instruction, or recreation to children")?

No