



THREE RESEARCH QUESTIONS: ADVANCING TURTLE CONSERVATION THROUGH APPLIED SCIENCE IN THE LAND BETWEEN

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INTRODUCTION

The Turtle Guardians program of The Land Between Charity undertakes applied research and on-the-ground conservation to reduce threats to turtles and improve their recovery prospects in Ontario. Through monitoring, mitigation testing, and partnerships with academic and government institutions, several important questions have emerged from field experience and observations over the past decade.

This report highlights three of the current research questions being actively pursued through Turtle Guardians and collaborating researchers. These studies address different but complementary aspects of turtle conservation, from understanding environmental influences on egg viability, to tracking long-term population trends, and testing innovative infrastructure solutions for road mitigation.

1. Egg Collapse Phenomenon and Calcium Deficiency Hypothesis

Between 2020 and 2023, Leora Berman observed a recurring phenomenon during controlled turtle nest excavations. Within minutes of exposure, some eggs audibly emitted a “snap, crackle, pop” sound before imploding entirely, collapsing in on themselves within seconds.

This consistent observation raised important physiological and environmental questions. The collapse may indicate deficient shell calcification, potentially linked to the mother’s inability to deposit adequate calcium or to a broader environmental calcium limitation. Anecdotally, sites exhibiting this collapse pattern were located near hydro corridors and areas recently treated with glyphosate, and commonly on oligotrophic Shield substrates, which are naturally low in calcium and more acidic.

This observation formed the foundation of a new study, now being pursued by Michaela Bouffard, Research Lead for Turtle Guardians, as part of her Master’s thesis at Trent University. The study will examine shell strength and composition, against potential links from maternal health to environmental calcium availability and contaminants. In the long term it may help to answer questions related to chemical exposure, nutrient-poor substrates, or ecosystem acidification influences on shell formation and early embryonic viability in Ontario’s turtle species.



2. Seven-Year Road Patrol Dataset: Tracking Population Change

Since 2016, Turtle Guardians staff have conducted standardized road patrols under provincial research permits, surveying extensive stretches of municipal, county, and provincial roads across The Land Between region. These patrols were implemented by trained field staff following consistent methods and schedules, forming a core Turtle Guardians research project developed and coordinated through The Land Between.

The project was designed to serve two equally important objectives:

1. **Immediate application:** to identify and validate high-priority road-mitigation sites and inform the placement of exclusion fencing and ecopassages; and
2. **Long-term scientific assessment:** to monitor trends in turtle populations over time, using mortality, biomass, and recruitment indicators to evaluate how road use and surrounding land-use pressures influence population stability.

Now in its seventh year, the resulting dataset represents one of the most continuous and spatially comprehensive records of turtle road mortality in Ontario. It is currently under analysis as a cooperative applied project with students through the Trent Centre for Conservation Biology and Ecology (TCCBE). Depending on the research direction, the study will either focus on population ecology modelling or a comparative biomass analysis across regions with differing traffic volumes and development intensity.

This work is expected to provide a stronger empirical foundation for evidence-based mitigation planning, while demonstrating the value of long-term, standardized field research in guiding conservation policy and infrastructure design.

The results are expected to clarify how turtle populations are responding to road density, traffic volume, and development intensity, thereby providing an empirical foundation for targeted mitigation and long-term conservation planning in The Land Between.

Additionally, the dataset can be used to answer other questions related to population ecology or conservation planning for individual turtle species.

3. Ecopassage Innovation: Barrel Fencing Prototype

The third research focus arises from a multi-year engineering and field trial of an innovative prototype of exclusion jump-out fencing led by Leora Berman in collaboration with David Gafni. The project tested a low-cost, durable alternative to conventional HDPE exclusion fencing: steel barrel-section fencing fabricated from half-cut barrels and adapted into a field-ready mitigation solution.

Two prototype versions were developed: one secured with a footing constructed from the barrel's lid, and a second "buttress" design using a welded half-barrel footing for added stability. (See Appendix A).



Both designs were conceived to address persistent weaknesses documented in common HDPE fencing, which is known to become brittle under UV exposure, shift or deform under frost-heave, and require frequent maintenance or replacement under long-term field conditions (Ontario Road Ecology Group, 2016; EcoKare International, 2017; Baxter-Gilbert et al., 2015; Aresco, 2005). Although HDPE may be inexpensive to purchase, it typically requires heavy equipment for installation, and because it is often installed as continuous single sheets, even minor damage can necessitate costly replacement or complex repair.

By contrast, the barrel prototypes can be hand-installed, are modular and easily replaced in sections, and have been tested for over five years under diverse weather and hydrological regimes, demonstrating strong durability and structural resilience.

Next, Turtle Guardians will assess willingness to use and species passage success, testing whether turtles of varying size classes can navigate through or alongside the second-generation design with welded buttresses and without obstruction.

The project has drawn interest from the Ontario Ministry of Transportation (MTO) as a potentially scalable and affordable model for ecopassage and jump-out installations across highways.

This innovation directly supports the broader ecopassage strategy for The Land Between, linking applied design testing with field feasibility and road-permeability objectives.

CONCLUSION

Each of these three research questions reflects the integrated, applied nature of Turtle Guardians' work, linking physiological ecology, population dynamics, and engineering innovation to address the most pressing threats to turtle survival in Ontario.

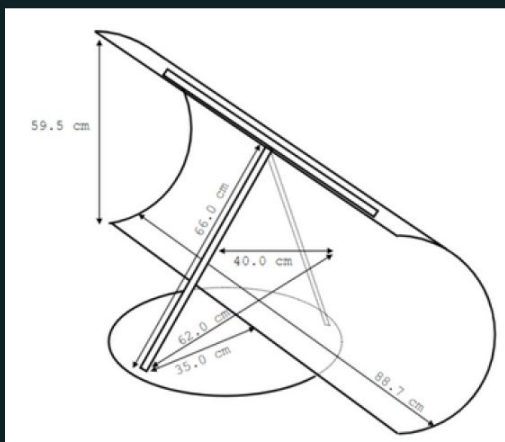
Together, they form a continuum of inquiry that connects the individual to the ecosystem scale: from the micro-scale chemistry of eggshell formation, to the population-level consequences of road mortality, and finally to the applied design solutions that restore habitat connectivity. As these studies progress, they will collectively inform evidence-based conservation policy and infrastructure standards across The Land Between and beyond.



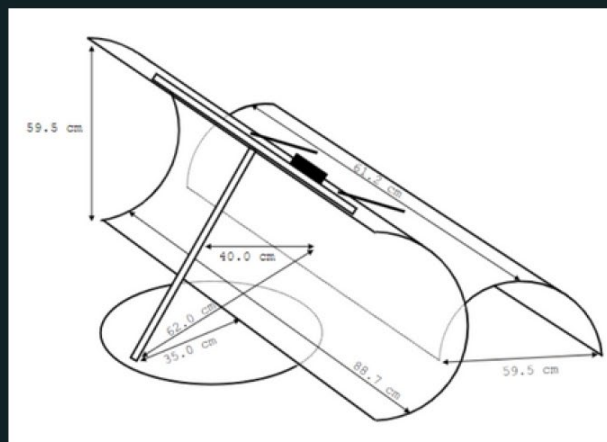
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APPENDIX A: EXCLUSION JUMP UP FENCING PROTOTYPES



Prototype 1 ("Ernie")



Prototype 2 ("Bert")