QuickNotes

Science Summaries from fRI Research

Eyes in the Sky: Tracking Moose with Drones

Leonard Hambrecht, Hiroto Goto & Nicholas Coops

Background

Monitoring moose populations is essential to understand the impacts of human activity and climate change on the landscape.[1] Traditionally, surveys are conducted in winter using helicopters, but drones are emerging as a promising alternative. Unlike helicopters, drones are battery-powered, making them quieter and less disruptive to wildlife.[2–4] They may reduce carbon emissions, though their flight time is limited, and they cover less area per flight. Drones can be equipped with cameras and follow pre-programmed flight paths, which reduces the need for people on the ground and improves safety.[5]

Fixed-wing drone. Image courtesy of Superwake.

Thermal cameras improve the ability to detect animals in dense forests or low-light conditions, while visible light (RGB) cameras provide more detail in daylight conditions.[6] In addition, deep learning models can automatically detect animals in drone images, which may improve accuracy, reduce human error, and minimize the need for manual work.[7,8]

Objectives

We use both simulations and thermal imagery to assess the feasibility and potential of drones for wildlife surveys, and to compare them with current survey methods. Our objectives are to:

- Evaluate the statistical validity of different drone flight plans
- Validate the detection of moose on snow using thermal/RGB cameras using automated deep learning methods
- Conduct a full-scale proof-of-concept survey

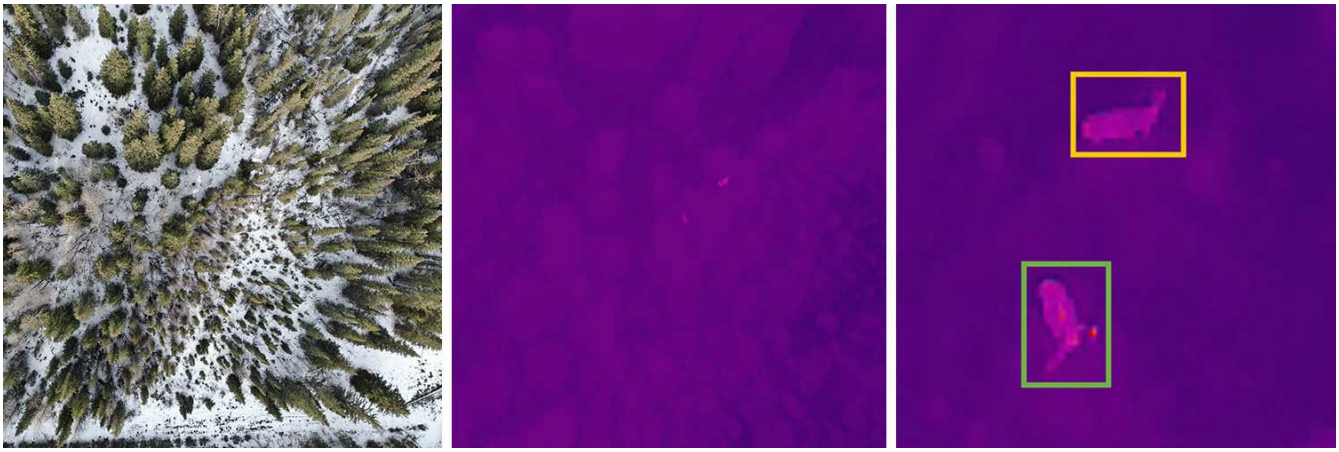
Our findings will be summarized in a best-practice guide.

fRI Research

For more information about this research, contact:
leonard@hambrecht.phd

Progress to date

As of April 2025, we have simulated various drone flight patterns and compared them with helicopter surveys. Fixed-wing drones were found to be suitable for surveying moose, and these results are currently under review for publication. A literature review on the use of deep learning to automate the detection of wildlife in drone images has also been completed. Additionally, planning is underway for a full-scale proof-of-concept survey comparing fixed-wing drones and helicopters, scheduled for winter 2025–2026.



Left: visible light (RGB) image of a conifer forest. Centre: thermal image showing two animals. Right: IR image zoomed in on the thermal signatures.

Citations

1. Karina Lamy, Laura Finnegan. Moose Habitat and Populations in Alberta. Published online 2019. Accessed December 3, 2024. https://www.cclmportal.ca/sites/default/files/2024-02/CP_2021_07_Moose_Lit_Review.pdf

2. Bennitt E, Bartlam-Brooks HLA, Hubel TY, Wilson AM. Terrestrial mammalian wildlife responses to Unmanned Aerial Systems approaches. *Sci Rep*. 2019;9(1):2142. doi:10.1038/s41598-019-38610-x

3. Duporge I, Spiegel MP, Thomson ER, et al. Determination of optimal flight altitude to minimise acoustic drone disturbance to wildlife using species audiograms. *Methods Ecol Evol*. 2021;12(11):2196-2207. doi:10.1111/2041-210X.13691

4. Rebolo-Ifrán N, Graña Grilli M, Lambertucci SA. Drones as a Threat to Wildlife: YouTube Complements Science in Providing Evidence about Their Effect. *Environ Conserv*. 2019;46(3):205-210. doi:10.1017/S0376892919000080

5. Buckland ST, Marques TA, Oedekoven CS, Rexstad EA. *Distance Sampling: Methods and Applications*. 1st ed. 2015. Springer International Publishing : Imprint: Springer; 2015. doi:10.1007/978-3-319-19219-2

6. Corcoran E, Denman S, Hamilton G. New technologies in the mix: Assessing N-mixture models for abundance estimation using automated detection data from drone surveys. *Ecol Evol*. 2020;10(15):8176-8185. doi:10.1002/ece3.6522

7. Delplanque A, Foucher S, Théau J, Bussière E, Vermeulen C, Lejeune P. From crowd to herd counting: How to precisely detect and count African mammals using aerial imagery and deep learning? *ISPRS J Photogramm Remote Sens*. 2023;197:167-180. doi:10.1016/j.isprsjprs.2023.01.025

8. Xu Z, Wang T, Skidmore AK, Lamprey R. A review of deep learning techniques for detecting animals in aerial and satellite images. *Int J Appl Earth Obs Geoinformation*. 2024;128:103732. doi:10.1016/j.jag.2024.103732