QuickNotes

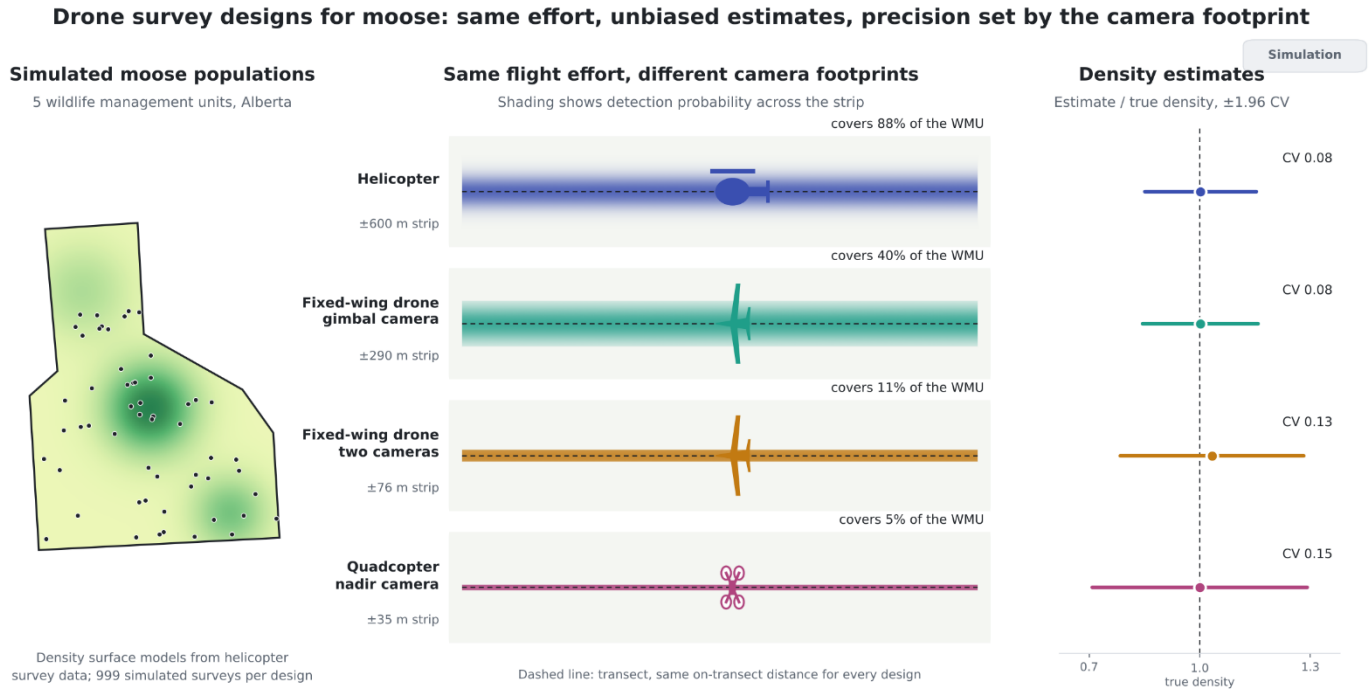
Science Summaries from fRI Research

Can Drones Match Helicopters for Moose Surveys? Answers From Simulations

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Moose populations in Alberta are estimated from helicopter surveys. They work well, but they are expensive, and low-level flying is one of the most dangerous tasks in wildlife work. Drones with thermal cameras could fly similar surveys with no one on board, and recent changes to Canadian aviation regulations allow operators to apply for flights beyond visual line of sight. But drones are not small helicopters: they run on batteries and their cameras see a much narrower strip of ground. Before investing in field trials, it helps to know which drone setups are worth testing.

We used computer simulations built on Government of Alberta moose survey data to compare helicopter, fixed-wing drone and quadcopter surveys flown with the same amount of survey effort.



A gimbal-mounted camera matched helicopter precision while covering less than half the area; narrow two-camera and nadir footprints lowered precision.

Same flight effort, different camera footprints. Shading shows the chance of detecting a moose at each distance from the flight line; the right panel shows that all designs were unbiased.

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Key Findings

- All survey designs produced unbiased density estimates.
- Drones with a gimbal-mounted thermal camera matched helicopter precision while covering less than half the area.
- Effort, not coverage, drove precision: for the same distance flown, what mattered was how wide a strip the camera effectively surveys, not how much of the area was covered.
- Zigzag flight designs maximized time spent on transect. For quadcopters, the bigger hurdle was logistics, not accuracy.

Methods

We used Government of Alberta (GOA) helicopter surveys (2018–2022) from five WMUs to map where moose were concentrated and how the chance of spotting one drops with distance from the aircraft. We then built virtual moose populations matching the official estimates and flew 999 simulated surveys per design. The helicopter flew the full GOA grid of 10 km transects, fixed-wing drones flew six-hour missions in 15 × 15 km blocks or the helicopter grid, and quadcopters flew 4 × 4 km blocks (one battery each), all for roughly the same distance on transect.

Drones flew at 120 m with one of three camera setups: one camera pointing straight down (35 m to each side), two cameras angled to either side (76 m), or a gimbal-mounted camera sweeping up to 290 m to each side. The drone detection curve came from a fixed-wing thermal survey of white-tailed deer, as comparable moose data were not available. We also reduced moose density to as low as 25% in the highest- and lowest-density WMUs.

Implications

For anyone considering drones for moose surveys, these results point to the camera, not the aircraft, as the key decision. In the simulations, a fixed-wing drone with a sweeping thermal camera was as precise as current helicopter surveys for the same distance flown, with no crew in the air. Narrow camera setups would need roughly 2.5 to 3.5 times as much flying for the same precision. Quadcopters may suit small areas, but a whole WMU would take up to several hundred launches.

These results depend on how well the assumed detection curve holds for moose in boreal forest; canopy cover, snow, temperature and animal movement were not simulated. Field trials comparing drone detections with known moose locations, such as GPS-collared animals, are the next step.

More Information

This research was supported by the Forest Resource Improvement Association of Alberta (FRIAA), with moose survey data provided by the GOA. Read the full open-access paper here: https://doi.org/10.1002/ece3.74734