March 11, 2026

Living Lab Program for Climate Change and Conservation - Final Report

Project title: Tools for Connecting Thermal Refugia

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Research findings

Drones are useful tools for the safe and efficient acquisition of high-resolution geospatial data over small areas ($\leq$20km^2). Geospatial products produced for the lower 3.2km of the Tranquille River include,

- Normalized Difference Vegetation Index (NDVI) indicates approximately 21.7% of the mapped area is covered by vegetation.
- NDVI performed better than the Normalized Difference RedEdge (NDRE) index in identifying areas of vegetation when compared to the colour orthomosaic.
- The lower 3.2km of the Tranquille River exhibits moderate slope stability based on slope angle and relief within 50m of the riverbank.
- No evidence of thermal refugia areas were found along this stretch of the river.
- A comprehensive guide to the capture, processing and analysis of the data listed above.

Methods summary

Colour, multi-spectral and thermal images along with LiDAR data were collected using a remotely piloted aircraft system (RPAS, aka drone), namely the DJI Matrice M350, along the lower 3.2km of the Tranquille River, from 1km above the diversion downstream to just south of the gate. The colour and thermal images were collected on June 10, 2025 using the DJI Zenmuse H20T payload, along with the LiDAR data, collected using the DJI Zenmuse L1. The multi-spectral data, collected using the Micasense Altum-PT sensor, were collected on both June 10th and August 26th, 2025. In addition, LiDAR data was captured for the Tranquille Wildlife Management Area on August 26th, 2025.

- ThermoConverter software was used to calibrate and standardize the thermal images into radiometric JPG (RJPG) files.
- The RJPG thermal, colour and multi-spectral images were processed using Agisoft Metashape Pro software into digital surface models (DSM) and orthomosaic maps in GeoTIFF format.
- The LiDAR data was first pre-processed using DJI Terra software and subsequently imported into Agisoft Metashape Pro in LAS format.
- The DSMs, orthomosaics and LAS files were exported from Agisoft Metashape into QGIS software for analysis.
- The DSM and LiDAR data were used to identify areas of potential slope instability along the riverbanks based on proximity, slope and aspect factors.
- The multi-spectral images were processed into a normalized difference edge index (NDRE) to show the extent and health of the vegetation.

- Using a raster calculator, the thermal dataset was transformed to show surface water temperatures along the river.

Key outcomes for BC Parks

In total, 5,931 Colour, 2,170 thermal, and 45,634 multi-spectral images were collected along with over 3 million LiDAR points over two days of flights. These data were used to produce three digital surface models (two along the river and one of the wildlife management area), 16 orthomosaic maps and two LiDAR point clouds.

Drones are an effective and efficient means of collecting high-resolution, time-sensitive geospatial data in BC Parks. The data captured by the drone-based sensors are valuable inputs to support decision-making processes related to conservation, recreation and cultural uses of the area.

Acquisition of the right drone equipment (aircraft, sensors and software) coupled with Transport Canada certification and customized training, can significantly expand the data collection, analysis and decision-making capabilities of BC Parks staff in a cost-effective and safety-oriented manner.

Relevance to BC Parks management

The main recommendation to BC Parks is for an increase in awareness of the capability of drone-based sensors to provide Parks staff with timely, high-resolution data in a safe manner.

The data captured as part of this project are readily available to be used for a wide range of purposes spanning geomorphological investigations, to vegetation analysis through to planning of infrastructure upgrades and site use objectives.

Geospatial data acquired by drone sensors can inform decisions about management of natural hazards and processes, vegetation management and condition of infrastructure.

Project's challenges/opportunities

Drone operations are subject to certain weather conditions meaning there will be times when they cannot be safely used to collect data. As technology continues to improve, this is becoming less of an operational barrier. In some instances, site access via a road may be difficult or restricted, in which case, smaller, more portable drones could be deployed.

During operations, it is important to remain vigilant for wildlife and stay in proximity to a vehicle, if possible, to maintain safety.

New Transport Canada regulations (as of Nov. 4th, 2025), allow for low risk beyond visual line of sight (BVLOS) flights with a Level 1 Complex RPAS certification. This effectively extends the operational range of a drone in certain low ground-risk environments allowing for more efficient capture of data without the need for repositioning to maintain visual line of sight on the drone.

Conclusions/next steps

This project demonstrates the effectiveness of employing drone technology to collect timely, accurate, high-resolution geospatial data to aid in the decision-making and management of BC Parks inventory, resources and infrastructure in a safe and efficient manner. Drones, equipped with a

variety of sensors can collect data pertinent to different objectives to help Parks staff understand and evaluate the various aspects of Parks management and operations.

Building on the success of this project, suggested next steps include,

- Training Parks staff on the operation and regulatory requirements of operating drones safely and within Transport Canada rules and regulations.
- Guide Parks staff on the acquisition of drone equipment that would best suit their needs to address specific management goals.
- Provide support to staff relating to the acquisition, processing and analysis of geospatial data for specific management objectives.
- Advise Parks staff on how to get the most out of drone technology to safely and effectively address specific issues.

Drones are by no means the right technology in all instances, but they can be right tool in certain situations, as demonstrated by the outcomes of this project.

References and links

The geospatial products created as part of this project can be accessed using the link below. Please contact Dr. Eric Saczuk at eric_saczuk@bcit.ca with any questions, thank you.

Output

Checklist

- Have you filled out the separate Living Lab Story Form? If not, this is due no later than 30 days after the end of the term of your agreement.
- Have you added any relevant Living Lab project data or reports to the BC Data warehouse and/or EcoCat? Please contact Stephen Ban (Stephen.ban@gov.bc.ca) or Jeanine Bond (Jeanine.bond@gov.bc.ca) for assistance.
- Invoice submitted? An invoice is required to receive the final instalment of your Living Lab transfer agreement funds. The invoice should include:
    - the university address,
    - the Transfer Payment number (as per your agreement),
    - a one-line description of what the project is about,
    - the amount due (you may need to send this via your financial arm) and indicate that this is the final instalment. The invoice should follow or accompany the completion of this final report template of which both are due on or before March 17th, 2025. **If we do not receive an invoice from you by this date, we will not be able to issue your final payment.**