List of Approved Projects for KTTD Round 4 (2024)

Large-Scale KTTD Projects: Funding >$35,000 (+ HST) and up to Two-Year Duration

Project Number	KTTD 1B-2024
Project Name	Field Plot Measurement using Mobile LiDAR Scanning
Company	Forest Analysis Ltd.
Contact	Dr. Margaret Penner
Maximum Project Funding	$101,983 (includes HST)
Project Description	The objective of this project is to evaluate the use of mobile LiDAR scanning technology for collecting field data, specifically calibration (VSN) and growth and yield permanent (PSP, PGP) field plots. We will test methods to accurately acquire and process tree diameters and heights on fixed-area plots of mixedwood, hardwood and conifer forest types during leaf-off and leaf-on seasons. Scanned data will be compared to field crew measurements. Operational solutions will be suggested to meet the challenges with tracking tree numbers, tree status, species, geo-referencing plot centre and ground control targets, etc.
Deliverables	MLS scanned point clouds of LiDAR calibration plots in leaf-off and leaf-on conditions – March 2025
	Open-source Computree/R scripts for extracting tree attributes – December 2025
	Technical report and Technology Transfer Session – March 2026
Project Number	KTTD 2B-2024
Project Name	Implementing Structurally Guided Sampling (SGS) approaches to guide FRI plot placement and prioritization
Company	University of British Columbia
Contact	Dr. Nicholas Coops
Maximum Project Funding	$251,086 (includes HST)
Project Description	Structurally guided sampling (SGS) is a data-driven approach to help guide where, and how many, forest plots should be established or remeasured to sample the entire range of structural attributes across the landscape. Currently in Ontario a number of forest management areas have large existing plot networks which are expensive to continue to remeasure moving forward. Forests are rapidly changing and by using SGS we plan to optimize the network of plots within Ontario and derive new plots needed in order to fully represent the structure of diverse forest environments over time.
Deliverables	Competed transfer of SGS to Ontario cloud computing platform. Documentation and example datasets also transferred and available to users - 8 months from project start.
	Report detailing assessment of existing plot network / recommendation of critical plots and duplicate plots at Sudbury / French – Severn and Draft peer reviewed publication on the use of SGS approaches in high value stands. 18 months from project start
	Report on insights shared about influence of changing disturbance regimes, compositional shifts and age on SGS strategies in different forest ecosystems. 24 months from start
	Final report –End of Project - Best Practice guides, code demos (or online tutorials), open-source code packaging. Final validation of analyses. 24 Months from start

Project Number	KTTD 3B-2024
Project Name	Deep Learning to Estimate Species Proportions using SPL data
Company	University of British Columbia
Contact	Dr. Nicholas Coops
Maximum Project Funding	$198,880 (includes HST)
Project Description	Deep learning offers significant potential to extract more and different types of information from 3D point clouds, than traditional classification techniques. Initial research has demonstrated that point-based deep learning estimation of tree species proportions in forest stands in Ontario can be undertaken with accuracies of over 70%. Given this initial success, this project will build on these approaches and develop a more robust deep learning estimation algorithm through including additional geospatial information, testing over additional species diverse areas in Ontario, and completing additional accuracy assessments using available plot-based data. The outcome will be a quantifiable open access, AI based method for estimation of tree species over key regions of Ontario to augment ongoing eFRI inventory approaches using SPL data.
Deliverables	Report on the compiled SPL and species occurrence data over the focus sites in GreenFirst, Ottawa Valley and Haliburton Forests. 6 months from signing.
	Draft peer review publication on the trained deep learning algorithm on new datasets and assessment of the transferability of the model to different forest types. 12 months from signing
	Report on accuracy assessment / field plot compilation and plot based initial accuracy assessment across the 3 companies sites. 18 months from signing.
	Workshop (in person or online), code demos, open source code packaging and peer reviewed publication. 24 Months from signing.
Project Number	KTTD 4B-2024
Project Name	Refining Species, Disturbance and Age information within eFRI Inventories
Company	Université Laval
Contact	Dr. Alexandre Morin-Bernard
Maximum Project Funding	$137,500 (tax exempt)
Project Description	In recent work, we have developed open access tools to integrate photo-interpreted and airborne laser scanning forest attributes into a comprehensive polygonal forest inventory. Subsequent development is needed as we move towards operational implementation, including integrating older eFRI inventory data, and dealing with challenges in merging attributes when disturbance has occurred on the landscape. There is an additional need to develop a validation protocol for the newly derived polygons and to better understand the nuances between the new polygons and conventional FRI polygons in areas where the current FRI has been rejected by industry.
Deliverables	Raster layers with SPL and spectral metrics required for polygon segmentation as well as disturbance layers produced over the two study sites. October 2024
	Newly segmented polygons over two focus areas using the optimized and updated algorithm. December 2024
	Updated species composition in areas where attributes are outdated. Updated age and disturbance. Initial accuracy assessment for species and age. April 2025
	Newly derived polygons with imputed species, age and disturbance. Initial accuracy assessment for global product. October 2025
	Report on performance assessment/validation for RMF and OVF. February 2026.
	Workshop, packaging of open-source tool and peer-reviewed publication. April 2026

Project Number	KTTD 5B-2024
Project Name	Automated Road Extraction and Integration Across Forest Management Units
Company	Université Laval
Contact	Dr. Alexis Achim
Maximum Project Funding	$154,000 (tax exempt)
Project Description	The derivation of forest roads from airborne laser scanning (ALS) data offers a promising way to help forest managers update and assess the condition of their road network. Algorithms coupled with artificial intelligence methods have been developed and applied to automatically detect new and existing roads in Ontario using ALS data. This project seeks to build upon previous progress by applying and refining the approach in study sites across Ontario, while developing materials to aid in the integration of new road coverages into existing road network layers and additionally assessing and validating road age and condition.
Deliverables	October 2024 – D1: Compiled SPL and road datasets over study area. Metadata statements and vector road coverages of existing road networks at test sites.
	July 1st, 2025 – D2: Project meeting and road assessment workshop. First full-scale implementation of the road detection, positioning, and condition assessment algorithm for feedback from the partners.
	January 15th, 2026 – D3: Integration of road age algorithm into GEE. D4: Final full-scale road networks delivered to partners at each FMU. D5: Model of vegetation development after road abandonment distributed.
	April 15th, 2026 – D6: All code and packages publicly released for download. D7: Draft paper on vegetation development after road abandonment including proposed set of criteria to determine “when should an abandoned road no longer be considered a road”. D8: Workshops developed and run for OMNRF and Forest Company staff on the application of the algorithms and their effective use.
Project Number	KTTD 6B-2024
Project Name	Use of RPAS and AI technologies to classify managed forest stands by silviculture intensity
Company	Canadian Institute of Forestry
Contact	Natasha Machado
Maximum Project Funding	$97,900 (tax exempt)
Project Description	Forest inventories are incomplete without a record of disturbances such as harvesting, fire, roads, spruce budworm outbreaks and other disturbances such as silviculture. The goal of the project is to classify forest stands by silviculture intensity. We plan to determine if this can be accomplished using remotely piloted aircraft systems (RPAS)/drone-based and artificial intelligence (AI) technologies.
Deliverables	Report #1 Report on status of Objective I (Steps 1 to 3) regarding RPAS and field data acquisitions and Objective III Step #6 review of current advances in machine learning (target November 2024)
	Report #2: Report on status of Objective II (Step #4) analyses of compositional, structural and wood quality analyses and Objective III Step #7 Process RPAS imagery and LiDAR data (target April 2025)
	Report #3: Report on status of Objective II (Step #5) preparation of compositional and structural and wood quality theses and Objective III (Steps 7 to 9) (target November 2025)
	Report #4: Final report (target March 2026)

Project Number	KTTD 7B-2024
Project Name	Stand density for evaluating silvicultural opportunities and future yields
Company	Ministry of Natural Resources and Forestry
Contact	Dr. Doug Reid
Maximum Project Funding	$93,948 (includes HST)
Project Description	Density estimates from lidar based canopy height models tend to be underestimates of total density in juvenile managed stands when performance can be evaluated (age 20-30). Predictive density management models that provide detailed and precise forecasts of future yields in Ontario forests (i.e. Croplanner, FVS-ON) rely on accurate stand density and site index inputs. This work will develop a model to accurately estimate total density from Forest Resources Inventory data (Density Adjustment Tool; DAT), that can be incorporated into the Performance Assessment Tool (PAT) currently under development at CNFER. Together, the PAT and DAT will allow planning foresters to explore density management options that can be used to optimize the timing, nature and value of wood fibre yields from managed stands.
Deliverables	October 2024: Minimum 50 plots established in pure (>70% species composition), conifer-dominated, 20-40 year old managed stands representing a range of total tree densities above 1500 stems per hectare.
	February 2025: Project meeting and density assessment workshop (virtual). The project team will develop a presentation that can be shared with potential users within Ontario. Focus will be on explanation of the utility of the model for planning and operations, and identification of missing conditions (ecoregion, species, density, etc.) where additional sampling is needed
	March 2025: Interim report prepared for FFT documenting progress including an explanation of how the DAT could be incorporated into the PAT to provide critical data for forest management planning and operations.
	September 2025: Field data collection completed.
	December 2025: Draft Training materials on how to use the DAT prepared and circulated to ROD and Forest Industry for feedback.
	January 2026: Draft report and/or manuscript submitted for external peer review. Training materials prepared for workshops to be held in 2026.
	February 2026: Workshops in the NE and NW regions to present train users of the PAT and associated DAT. Open-source code will be made available to users in an accessible format (i.e. ArcGIS bridging and/or Shiny app.). A manuscript prepared and submitted for peer review to an open source scientific journal.
	March 2026: Final Report prepared for FFT

Project Number	KTTD 8B-2024
Project Name	Tree Classification and Monitoring Using UAV Technologies
Company	University of Guelph
Contact	Dr. Ben DeVries
Maximum Project Funding	$67,815 (tax exempt)
Project Description	The aim of this project is to develop an automated workflow for the identification of vulnerable tree species in target forest stands in Ontario. A UAV Hyperspectral-LiDAR platform will be flown over select forest sites on a weekly to bi-weekly basis to retrieve high-resolution spectral and structural information at key phenological phases during the growing season. Libraries of spectral signatures and indices for individual tree species will be used to develop classification models applicable to individual trees. Spectral libraries and classification models will be published under open-access licenses, allowing for improved stand-level inventories of vulnerable tree species like Eastern Hemlock in Ontario.
Deliverables	UAV flights (Year 1): April 2024 – October 2024
	Development of data-preprocessing workflow: April 2024 – October 2024
	Development of tree crown segmentation workflow: September 2024 – May 2025
	Development of tree species spectral library and indices: January 2025 – April 2025
	UAV flights (Year 2): April 2025 – October 2025
	Development of tree species classification models: April 2025 – December 2025
	Finalization of tree species spectral library and indices: April 2025 – December 2025
	Validation of tree species classification models: September 2025 – April 2026
	Documentation and release of spectral libraries and classification models: January 2026 – April 2026
Project Number	KTTD 9B-2024
Project Name	A climate-sensitive growth simulator for Ontario
Company	Natural Resources Canada
Contact	Dr. Mathieu Fortin
Maximum Project Funding	$113,000 (includes HST)
Project Description	This project aims at developing a climate-sensitive growth simulator for most tree species in Ontario with the purpose of quantifying and reducing the uncertainty of forest inventory estimates and supporting decision-making in forest management. This simulator will be made available through the CAPSIS platform. This Java platform provides a user-friendly environment to run growth and yield simulations. Our new simulator within the CAPSIS platform will be open source and freely available.
Deliverables	Development of a tree recruitment model for 26 species and 4 species groups in Ontario. A scientific manuscript completed by June 2025.
	Development of a diameter increment model for 26 species and 4 species groups in Ontario. A scientific manuscript completed by Sept 2025.
	Implementation of the two models into software. This is the intermediate milestone of this project. An open-source Java library including the recruitment and the diameter increment models completed by Sept 2025.
	Integration of the three models into CAPSIS and final implementation of the simulator. This is the final milestone of this project. A CAPSIS package including the new simulator completed by Feb 2026.
	Presentation of the simulator to practitioners through a seminar or a dedicated training. A final report to the KTTD program by March 2026.

Project Number	KTTD 10B-2024
Project Name	Towards a Living Forest Inventory with Forest Dynamics Modelling
Company	Ministry of Natural Resources and Forestry
Contact	Drs. Jiaxin Chen, Stephen J. Mayor, and Muhammad Waseem Ashiq
Maximum Project Funding	$137,295 (includes HST)
Project Description	To project future forests from baseline inventories, a key step in developing a living forest inventory (LFI), we will develop predictive models of forest dynamics (e.g., growth, mortality, natural succession, and post-disturbance succession). We will integrate a variety of historical and contemporary data sources to elucidate long term dynamics and clarify changes over space. We will utilize advanced modelling techniques (e.g., machine learning, and structural equation modelling) to develop a new understanding of succession trajectories for Ontario's boreal forests to guide sustainable forest management under global change.
Deliverables	We will produce a final report to FRI KTTD by March 2026. In addition, the project will deliver the following products by the three modelling components, succession, growth, and mortality:
	1. Succession Modelling:
	A stand-level natural succession model for boreal forest in Ontario and aggregated succession rules (Target date: December 2024)
	A stand-level post-disturbance (fire and clearcut) succession model and aggregated succession rules (Target date: June 2025)
	Peer reviewed journal publication(s) (Target date: March 2026)
	2. Mortality modelling:
	A stand-level boreal forest mortality model and analysis of mortality rates and variable importance by species and/or forest types (Target date: December 2024).
	Projection of boreal forest mortality 100-year in the future under different climate change scenarios (Target date: September 2025).
	Peer reviewed journal publication(s) (Target date: March 2026).
	3. Growth Modelling:
	A stand-level boreal forest growth model and analysis of variable importance and interactions in determining boreal forest growth (Target date: December 2024).
	Projection of boreal forest growth 100-year in the future under different climate change scenarios by species and/or forest type (Target date: July 2025).
	Peer reviewed journal publication(s) (Target date: March 2026).

Small-Scale KTTD Projects: Funding <$35,000 (+ HST) and One-Year Duration

Project Number	KTTD 11A-2024
Project Name	Automation of Polygon Delineation for Forested Landscapes
Company	Forsite Consultants Ltd
Contact	Grant McCartney
Maximum Project Funding	$36,160 (includes HST)
Project Description	This project will continue exploring methods of automated forest inventory polygon generation for forested landscapes using both open source and proprietary (eCognition) software tools on a subset of the Romeo Malette Forest. The goal will be to better integrate forest stand attributes (Ht, Species, CC) with ecological factors (e.g. soil type, soil moisture) during polygon development. Datasets developed in the KTTD 16B-2021 Romeo Malette Forest Inventory project will provide foundation data.
Deliverables	Target Dec 20, 2024:
	Example polygons suitable for strategic inventory purposes (polygon feature class in geodatabase)
	Documentation of recommended approach and associated eCognition ruleset
	PowerPoint presentation of results
Project Number	KTTD 12A-2024
Project Name	Linking FRI data to FVS-Ontario – Phase 2
Company	ESSA Technologies Ltd.
Contact	Donald Robinson
Maximum Project Funding	$31,230 (includes HST)
Project Description	This small-scale open-source project will continue work begun in a KTTD Round 3 project (5A-2021), to develop methods that will link Provincial and Federal forest inventory with the FVS Ontario growth and yield model, to support forest management. Round 3 focused on developing links from the Federal inventory (gyNFI) using R-language scripts to produce SQLite-format databases used by FVS. This new round of proposed work will emphasize development of linkages with the Provincial inventory (PSPPGP and forthcoming VSN), ways to accommodate repeated measurements, and options for extending the methods beyond R-
Deliverables	1. March 31 2024 - Project Progress Report and Draft Scripts
	2. Sept 1, 2024 - Draft Documentation
	3. September 30, 2024 – Final Documentation and Scripts (including GitHub publication)
Project Number	KTTD 13A-2024
Project Name	Lichen mapping facilitated by Single Photon LiDAR (SPL)
Company	York University
Contact	Dr. Baoxin Hu
Maximum Project Funding	$23,100 (tax exempt)
Project Description	Terrestrial and arboreal macrolichens are critical winter forage for woodland caribou and have a great impact on water and nutrient cycles and forest ecosystem dynamics. However, the distribution of lichen cover is not well known, and the drivers of lichen cover dynamics are poorly understood. Mapping macrolichens is crucial for social license in sustainable forest management and biodiversity conservation. This project aims to exploit single photon LiDAR (SPL) data to map macrolichens in the Ontario boreal forest.
Deliverables	May 2024: Compiled datasets over study area, including SPL, photos, and existing inventory data.
	August 2024: Obtained ground truthing via processing photos, initial methods/codes to extract LiDAR features.
	Jan 2025: The finalized LiDAR features and methods/models.
	March 2025: Journal manuscript, technical report, open-source code.