



From the Crown Down



Antoine Desrochers collects data with his Trimble GPS receiver.

eCognition helps researchers get to the root of classifying individual trees

A Canadian organization uses Trimble software to create a new branch of tree analysis for forest management

Solution

Trimble® eCognition®

Trimble Pro 6H GPS Receiver

overview

With nearly 50 percent of Quebec—76 million hectares (57 million acres)—covered in forest, forest management in this Canadian province is serious business. A key supporter of this business is the Centre D’enseignement et de Recherche en Foresterie de Sainte-Foy (CERFO), which develops applied research tools for the industry. Recent research using very high-resolution satellite imagery, lidar data, and object-based image analysis (OBIA) software studied the ability to automatically identify individual Broadleaf and Conifer trees in dense, complex forests. The successful test may plant a new path for efficient, targeted tree management.



Location
QUEBEC, CANADA

Rich with forest landscapes that cover an area twice the size of Sweden, Quebec’s forest industry is valued at around \$10 billion CAD (\$7.8 billion US)—the second largest amount of any Canadian province—and employs about 65,000 people.

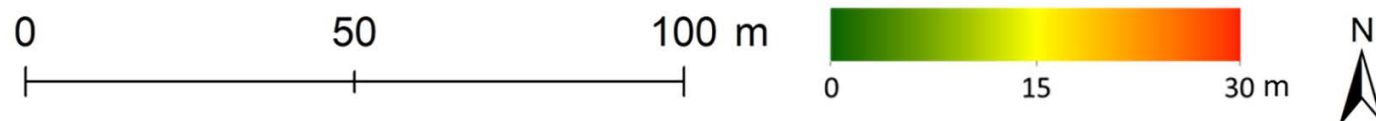
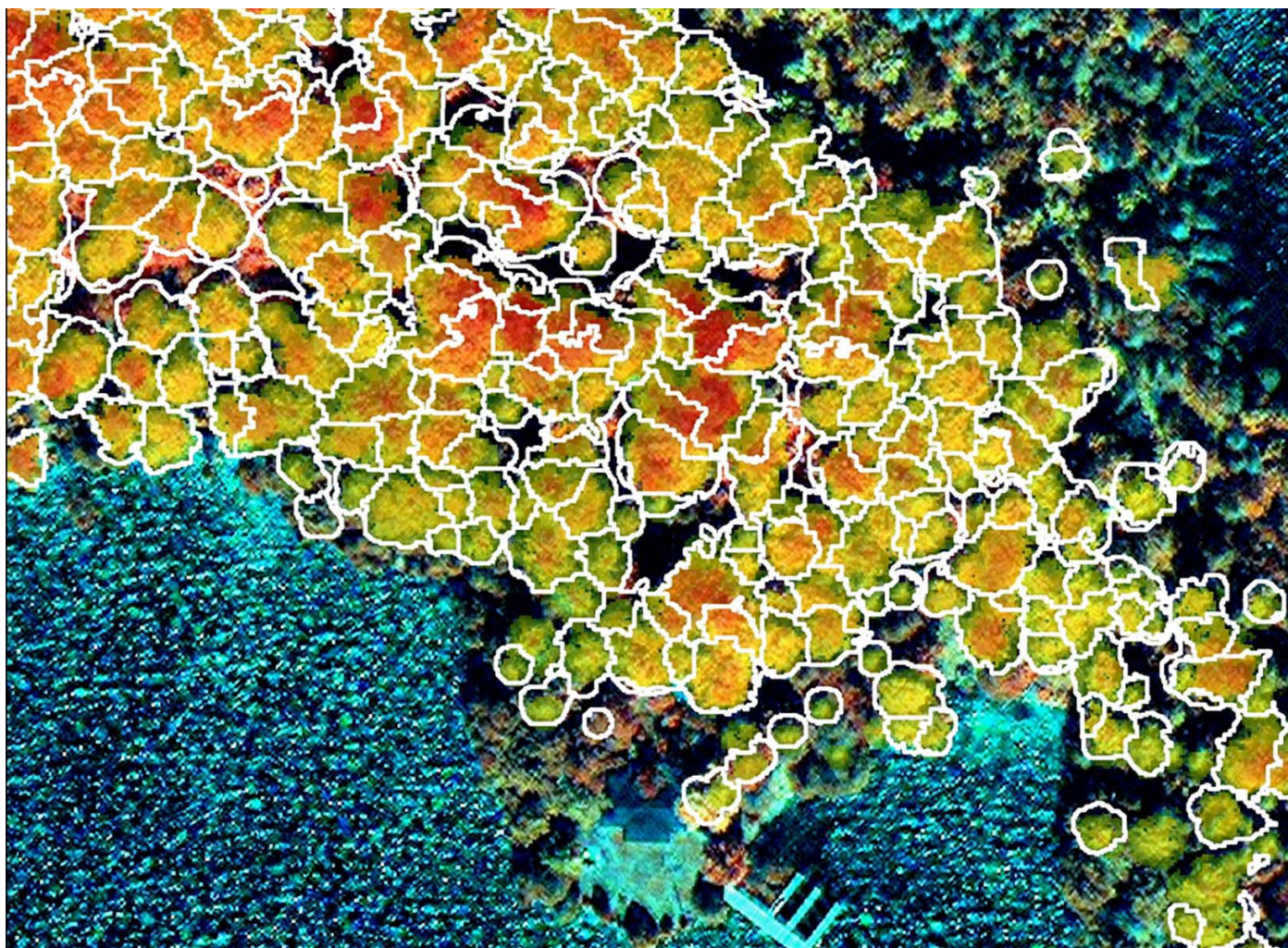
Although forest managers have used geospatial tools to assess their properties, classifying forest land is often done by combining photogrammetry and drawing features by hand.

“Standard practice is to manually delineate forest species at the stand level, which is time consuming and subject to misinterpretation,” said Mathieu Varin, head of CERFO’s

remote sensing laboratory. “Automizing that process and scaling it down to classify individual trees would allow managers to individually oversee specific tree species and develop targeted silviculture and harvesting plans.”

Varin and colleagues not only wanted to test an automated classification method on Broadleaf and Conifer species—tree types that are challenging to delineate—they wanted to test it in a complex forest. They chose three areas of interest (AOI) totaling 26 square kilometers in the Kenauk Nature preserve, one of the largest private nature reserves in North America. Located in the southwest of Quebec, the property encompasses 26,000 ha (65,000 ac) of heterogenous forest.

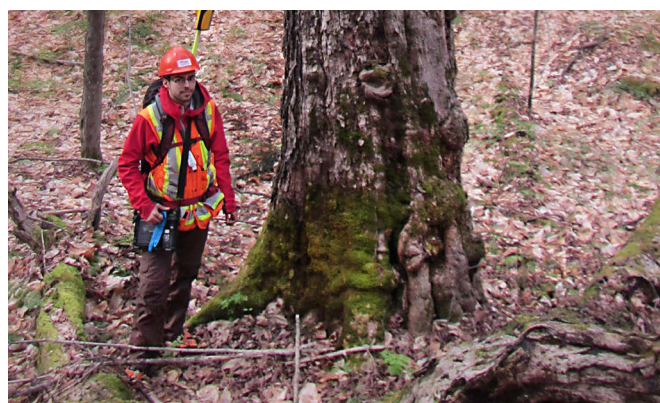




Individual tree crown segmentation based on lidar (canopy height model) and WorldView-3 imagery. The background image displays WorldView-3 in true colors.

For the data analysis and classification they acquired two 30-cm WorldView-3 satellite images, orthorectified them with a 5-m lidar DEM and then mosaicked them. The lidar data was also used to create a canopy height model (CHM) which they overlaid on the mosaic.

Based on existing aerial imagery, researchers first identified relevant trees for field data collection. Using Trimble Pro 6H GPS receivers, teams navigated to the pre-selected trees in each AOI to capture their position, height, diameter and species type. In total, they surveyed 515 trees, which they further processed into 338 reference samples for both training Trimble eCognition and validating the results.



Mathieu Varin, CERFO's remote sensing lab manager, stands next to a Yellow Birch with his Trimble Pro6H GPS receiver.

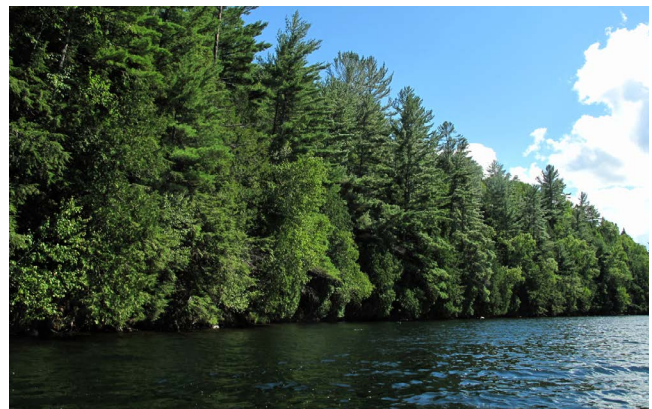


With the data sources prepared, Varin and his team were ready to test the eCognition classification workflow. Using advanced artificial intelligence and machine-learning algorithms, the software focused only on trees higher than 17m and used the WorldView mosaic and the CHM to first segment the whole AOI into individual tree crowns. From there it considered pre-defined object thresholds and textural indices to identify and delineate Broadleaf trees from Conifers, and then it targeted the individual species within those two groups. In about two hours, eCognition classified 11 tree types including Red Oak, Sugar Maple, Balsam Fir, Eastern Hemlock and White Spruce.

“The delineation process was surprisingly quick and precise,” said Varin. “The overall accuracy for Conifers was 94 percent. That is very good considering the complex heterogeneity of the AOI.”

The CERFO team shared the results with forest managers, many of whom can already see the potential value in having a tree-specific data layer in their GIS for developing targeted harvesting or planning.

Supported by that positive feedback, Varin and colleagues are furthering their eCognition work to refine the approach and provide forest managers with new seeds of information for their management operations.



Top: Looking into the crown of a Red Oak, one of the five Broad Leaf species classified in the project.

Bottom: Navigating along one of the 60 lakes that ring and cut through Kenauk Forest.

“eCognition is incredibly teachable. It absorbs various forms of data, it strictly follows rules and it adapts when the information or rules change. It’s the ideal student.”

— Mathieu Varin, Remote Sensing Laboratory Manager, Centre D’enseignement et de Recherche en Foresterie de Sainte-Foy



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