FPInnovations: leading R&D in Canadian forest operations

Jean-François Gingras, Research Manager, Forest Operations
FORMEC 2016
Canadian Forests

Source: State of Canada’s forests 2015
Trends in the Canadian Forest Sector

Source: State of Canada’s forests 2015
Forest Operations in Canada

- 95% contractor operations hired by forest companies
- Contractors can own a single machine or a small fleet (large size range)
- Around 3,000 forest machines in use
- Main systems used:
  - Full-tree to roadside with feller-bunchers & grapple skidders & delimiters or processors
  - Cut-to-length with 2-machine harvester/forwarder teams or 3-machine feller-buncher/processor/forwarder
FPInnovations

- A not-for-profit world leader in creating scientific solutions to support the Canadian forest sector’s global competitiveness
- 500 dedicated employees across Canada
- Annual budget of approximately $90 million CAD*
- Shared between Industry, Federal and Provincial Governments
- Approximately 200 industrial members across Canada
- Partner with universities and other R&D institutions

Note: $1 CAD ≈ 3 zł
FPInnovations R&D covers the whole forest sector value chain
Forest Operations R&D Program

Leverage technology, people and best practices to improve the safety, efficiency and quality of fibre supply and delivery, while ensuring environmental sustainability.

Fibre Supply

Roads & Infrastructure

Precise forestry

Transportation

Remote sensing

Modelling & decision-support
Examples of various R&D projects

- All projects done in collaboration with member Canadian forest companies (no in-house equipment or machinery)
- Many projects are also collaborative with equipment manufacturers, universities & other R&D institutes

Contact: firstname.lastname@fpinnovations.ca
GPS-based machine navigation

- In Canadian operations, block boundaries and riparian buffer zones are often manually marked with colored flagging tape.
- With proper working techniques and high-accuracy GPS, probably possible to navigate in forest stands without ribbons.
- FPInnovations is comparing the accuracy of different systems & developing best practices.
- $0.25-$0.50/m³ savings for most operations.

Contact: Matt.thiel@fpinnovations.ca
Lidar-based silvicultural prescription in machine navigation systems

- Use of Lidar point clouds to characterize canopy structure
- Develop specific partial cutting prescription in heterogenous stands
- Color-coded prescription map provided to the operator via the machine navigation system
- Operator applies the specific prescription when machine is in the appropriate « color »

Contact: jean-philippe.gaudreau@fpinnovations.ca
Machine-mounted sensors to help operator decisions

- Install terrestrial Lidar and RGB sensors on forest machine to gather surrounding stand information
- Can we provide data to facilitate operator decisions?
- A step toward harvesting automation

Contact: denis.cormier@fpinnovations.ca

Photo: Clearpath Robotics
Digital measuring of logs or biomass piles

- Provide low-cost alternative for mill yard or forest measurement of log, chip & biomass piles
- Assessment of mobile device apps for log pile scaling
- Working with UAV and variety of sensors (RGB, Lidar, multi-spectral & thermal)
- Superior results for apparent volume calculations; still need development on identification of log diameter distributions & bark/rot/voids

Contact: udayalakshmi.vekapomma@fpinnovations.ca
Advanced communication systems for forest operations

- Critical to move data efficiently from the forest to the office
- Canadian operations not well served by 3G/4G networks – need solutions for remote locations
- Testing technologies and systems related to extending cellular networks, V2V communication, clustered or meshed communication networking and Dedicated Short Range Communications (DSRC)

Contact: jan.michaelsen@fpinnovations.ca
Forest machine monitoring platform

- FPInnovations developed a brand-agnostic machine monitoring system called FPDat
- Machine data (hours, fuel, delays, GPS) is sent via satellite system (FPCom) to web site (FPTrak)
- 800 units sold in Canada in the past 3 years
- Benefits: universal machine performance monitoring

Contact: martin.castonguay@fpinnovations.ca
Use of StanForD production & time files from OEM computers

- **Objective:** Capture StanForD files, compress to essential data and push via satellite network and/or via telephone muling to FPInnovations’ FPTrak web-based data hosting platform
- Performance monitoring of individual machines & fleets
- Cooperating with equipment manufacturers to ensure data can flow efficiently (e.g. Ponsse, LogMax, Dasa)
- Generate productivity KPIs to monitor machine performance; generate roadside inventory information

Contact: jean.plamondon@fpinnovations.ca
Augmented Reality in Forest Machine Cabs

- Exploring potential applications of augmented reality technologies to forest operations (e.g. using Microsoft HoloLensTM)
- Provide the operators with supplemental stand, tree or terrain information through holograms

Contact: martin.castonguay@fpinnovations.ca

HoloLens photos from Microsoft web site
Winch-Assist Technologies for Steep Slopes

- Assess the performance & safety aspects of new equipment, mainly winch-assist systems for steep slope harvesting
- Several technologies under assessment
- Climbmax, ROB, EMS, Summit, HSM, Haas-JD, Ponsse-Herzog, T-winch, T-Mar
- Developing best practice guide for safe & efficient operations
- Benefit: remove manual fallers from the ground

Contact: dzhamal.amishev@fpinnovations.ca
Heart-Rate and Physical Load Monitoring in Manual Operations

- Manual operations (planting, brushing) are high workload activities that lead to fatigue and injuries
- Use smart watch type technology to monitor physical effort and correlate with actual work performed (GPS tracking)
- Develop guidelines to help maintain effort while reducing the risk of injuries related to exhaustion or fatigue

Contact: pamela.matute@fpinnovations.ca
Procalc – Web-based Tool Providing Productivity and Costs Estimates

- Uses FPI productivity database & regressions for specific machines
- Predicts productivity (m³/PMH) as a function of site & stand conditions
- Includes machine hourly cost module to generate cost/m³ results
- Great tool for what-if analysis
- Non-spatial

Contact: philippe.meek@fpinnovations.ca
Energy Intensity Management

- Assess equipment and operational techniques that can reduce the energy intensity (L/m³) and GHG emissions of forest machines and logging trucks
- FPI-designed fuel management system to track consumption of individual machines/operators (RFID-activated pump & Wi-Fi data download to phone)

Contact: vincent.roy@fpinnovations.ca
Maximizing Trucking Efficiency

- Various strategies to optimize trucking and reduce the energy intensity per tonne transported
- FPI helps introduce new axle configurations for more payload (dynamic stability modeling, impact on road infrastructure)
- How to lighten tare weights with proper specifications
- Looking at advanced technologies (platooning, autonomous trucks)

Contact: james.sinnett@fpinnovations.ca
Real-Time Truck Dispatching

- Major issue in Canada: sending the right truck to the right pile at the right time to minimize wait at both ends of the load-unload cycle
- Now better information coming from the forest (e.g. real-time wood inventories from StanForD files) to help plan the dispatch & schedule
- FPI working on several trucking optimization, scheduling & dispatching tools

Contact: francis.charette@fpinnovations.ca
Forestry Reengineering 2025

- « Cristal ball » exercise to predict what the future forest supply chain will look like, or needs to evolve to by 2025
- Integrate all up-and-coming technologies (e.g. robotics, automation, teleoperation, Sensors) and evaluate also future mill fibre requirements
- Road map in development
FPI open to international collaboration

- Technical visits & tours
- Professor sabbatical terms
- Hiring under-grad or graduate students for work terms
- Researcher exchanges
- Memorandums of Agreement
Dziękuję Ci!

jean-francois.gingras@fpinnovations.ca

Follow us on

www.fpinnovations.ca