Excellence and Innovation in Operational Block Planning

A Presentation by Allan Foley, R.P.F.
Inspiration for FRMG

• Focusing on “core business”.
• A model for forestry and related services where we invest, innovate and improve upon our professional skills, methods, tools and services for the benefit of forest land owners and managers.
• Providing impartial expert services and advice for a fee; without the expectation of other business gain.
About FRMG

• Employee owned, Ontario based forest management company founded in 2009 (*but together since 1996*).
• Over 150 combined years of experience in forest management planning and related services.
• Managing a total of 50,000 Km² of forest on behalf of the Crown and forest industry tenure holders in northeastern Ontario.
• Also working collaboratively with several First Nations.
• Managing private forests for carbon sequestration.
• Main offices located in New Liskeard and Kirkland Lake and customers in Ontario, Saskatchewan, Manitoba and Quebec.
“Geomatics offers the opportunity to improve the intelligence with which we manage the forest resource.”

Kevin Edgson
CEO, EACOM Timber Corporation
Keynote address,
GeoForest 2016
Edmonton AB., March 1, 2016
Information Gaps for Forest Operators and Managers.

- Species composition.
- Terrain.
- Canopy height.
- Volume of timber.
- Which;
  - **Is accurate.**
  - **Is live** (current data).
  - **Is automated.**
  - **And can be queried to create timber quality profiles.**
Motivated by Frustration

• Google is on the cusp of launching face-recognition software in commercial satellites and the mining industry uses technology to accurately identify what is a mile under the ground.....

• But we can’t tell the logger what’s over the hill.

  So.......

• “If you want something new; you have to stop doing something old.”

  Peter F. Drucker
Rapid Evolution of Technology

- Geomatics technology applicable to forestry has rapidly evolved in the last 10 years:
  - New and improving airborne sensors
  - Innovation in satellites and nano-satellites
  - Drones
  - LiDAR
  - GeoSAR
  - SkyForest™
  - LEDDAR

2006 Mobile Phone
Why Have a Forest Inventory?

You need to define the questions

_before_

you can compare technologies that create inventories.
The Right Tool for the Job
What are Inventory “Jobs”? 

- What “jobs” are you trying to get done in planning forest operations?
- What are some of the questions you are trying to answer with a forest inventory?
- What new questions would you ask if faster, cheaper remote sensing tools were available?
Advance, accurate knowledge of forest inventory.

- Get the right wood/product (softwood or hardwood) to the right mill on time – at the lowest possible cost.
- Requires advance, accurate and recent knowledge of the forest inventory – species, height, volume, quality plus terrain details.
What Prompted Us?

- What’s in the field is often different than the inventory.
- Hardwood/softwood mix in the forest is changing.
- Need more granular and 3D data than that in large 2D uniform polygons (i.e. FRI stands).
- Inventory is old before it’s received; developed and delivered years after imagery acquired.
- Satellites and aerial imagery not being used to full potential.
FRMG’s 2-Year R&D Project to Bridge the Gap.

• A “developed in Ontario solution” to the age-old requirements for accurate forest inventories.

• In partnership with Professor Benoît St-Onge.
  – Department of Geography, Université du Québec à Montréal.
  – Ph.D. In Geography (U. of M. 1994).
  – Remote sensing expert: mapping forest structure using the texture of high resolution images, high resolution image analysis, LidAR, digital photogrammetry, Interferometric SAR.

• Patent is pending.
• Processing available remotely sensed data.
• The enhancement and fusion of Landsat, space-borne radar and a digital surface model (airborne or space-borne).

Digital surface model (DSM)

Digital terrain model (DTM)

Canopy height model (CHM)
• Cost effective, “agnostic” tool to deliver current forest inventories with predictable accuracy from available remotely sensed data.

• Delivering species, canopy height, volume, wood quality and digital terrain results within months/weeks.

• Near real-time tool to enable photo interpreters through to forest operators.
• Fast (weeks).
• Current (current year’s data).
• High resolution (20m pixels).
• Accuracy calculated for each project.
• Very low cost.
• Requires small-moderate fieldwork.
• Measures height and volume directly from imagery at pixel level.
What’s Our Real Objective?

• Why do we need a forest inventory and how will we use it......and who needs it now?
• “Mining” data to produce operational products that are practical and make visual sense to forest operators who are on the ground today.
• Painting a “real picture” for users to help them avoid surprises in the field and improve the efficiency by which they operate in our forests.
• It’s not about the software; it’s about the user.
• Is the tail wagging the dog?
• Who are the front-line users?
• What is the opportunity cost of under-utilized local operator brain trust?
• At least 3 years (start-to-finish) for a multi-disciplinary team to write a Forest Management Plan in Ontario.

• Upwards of 10 years (start-to-finish) to deliver a Forest Resource Inventory in Ontario.

• Less than 10 minutes for an unqualified or “blind” operator to trash a site.
• Qualified field personnel require integrated data to operate efficiently and effectively in situ.

• Need to build on and combine the wealth of information contained in individual layers of remotely sensed data.
User Ownership

- The value of user engagement (i.e. forest operators).
- Making sure mapping products are timely, field relevant and useful.
- Not trying to “replicate” typical Forest Resource Inventory” products from modern automation technologies in remote sensing?
SkyForest™ Digital Terrain Model
Compared to Photo-Interpreted FRI
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Compared to Photo-Interpreted FRI
SkyForest data and photo-interpreted polygons match well
Compared to Photo-Interpreted FRI
SkyForest can provide granular data on attributes such as canopy height, volume or basal area within uniform photo-interpreted polygons.
• Bringing all the information from multiple raster layers conveniently together for easy interpretation by forest planners and operators.

• But...technical terms like Vector, Polygon, Raster, Pixel, Point Cloud, Digital Surface Model, Spectral Signature, etc.. are not relevant for users like forest operators.
SkyStands combined multiple SkyForest™ outputs into customer designed polygons designed to meet user requirements for timber and operability.
• Operators have their own specifications for the timber they require and their realistic operability limitations.

• From their input, we can generate profiles for terrain and timber quality.

• Modernization = automation = toggling = flexibility = sound tactical planning.
SkyStands vs. FRI
User-Borne... How do we measure up?

Provincial Forest Resource Inventory (FRI)

How does a user-borne wood quality profile compare?
• 600,000 ha:
  – 16 days to produce digital terrain model.
  – 3 weeks to produce SkyForest™ raster layers (species, canopy height, volume).
  – 1 week to produce SkyStands.
  – ~80 sample plots.

• 2015 Landsat imagery used.
• 2007-2008 ortho-imagery (DSM).
• SkyForest™ is the leading remote sensing technology when cost, speed and scale are important.
Planning with Confidence

Before They Get There:
• Know where and how much wood there is.
• Know what’s suitable.
• Know where you can operate.
• Focus harvest plans that line up with mill demand.
• Isolate available timber supply.
• Source wood in line with market demand (pulpwood, saw log, veneer, poles).
• Reduce access and logging costs = minimize operation footprints.
• Make informed operational decisions in advance.
• Hire confident and efficient logging contractors.

After Things Start:
• Reduced wasted effort.
• Fewer surprises for the harvesters and mills.
• Resulting in lower delivered wood costs.
“We're very impressed with the progress that's been made and look forward to some real game-changers with the SkyForest™ technology.”

— Frank Dottori; CEO, White River Forest Products
• “We have been using our SkyForest™ data to identify key areas to harvest, and more importantly, areas, while available for harvest, that have limited utility from a logging perspective.”

• “SkyForest™ identified an allocated stand of timber as having low ‘scattered’ volume. This is exactly what was encountered.”

• “Ground crews found features in the field that were visible in the SkyForest™ Digital Terrain Model but were not visible from the Forest Resource Inventory data. This provided for more efficient establishment of road lines with less adjustment.”

— Don Larmer; Superintendent-Operations and Fibre Supply, White River Forest Products
We can conveniently “mine” the data on behalf of planners and operators, but the user needs to have ownership of the parameters in order to produce operational map products that are practical and make visual sense for them.

“Data has no ego and makes an excellent co-pilot.”
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