Innovative Tools to Improve Integration and Planning through the Wood Supply Chain.  
*Case studies from the Canadian forestry industry.*

**Luc LeBel**, ing.f., MEA, PHD  
Director  
FORAC research consortium

---

**Sustainable forest management for an optimized value chain**

- Can we hear the demand from the forest?  
- Necessity to « qualify » the resource with the objective of providing higher value  
- Tools for improved forest-to-market integration  
- Collaboration as a means to move from economies of scale to network economies
FORAC’s Partners

FORAC: sample of research contributions

Value Chain Design
Production planning under uncertainty
Agent based planning system
Development of optimization, simulation and visualizing tools
Virtual business cases for research
Economic evaluation of business practices

Forest
- Operation planning
- Road networks
- High value merchandizing yards
- Collaborative planning
- Integrated decision making
  (transportation/operations, short/long term, inter-enterprises, etc.)

Sawing
- Logs classification
- Supply planning and management

Drying
- Tactical planning (costs and CO2)

Finishing
- Order promising
- Revenue management
- Tactical planning integration

Paper
- Producer-customer collaboration models
- Chips procurement collaborative planning

OSB
- Integrated sales and operations planning

Sales
- Contracts and price policies design
- Demand management

Customers
- Modeling and simulation of customers’ behaviors

Retailers
- Robust supply chains design
- Collaborative transportation planning
- Cost savings sharing policies

Wholesalers
- 2nd and 3rd transformations
  (cold production planning)
- Furniture components production planning
- Business models for value chain in the non-residential construction

FEDERATION DE LA FORET AU CLIENT

ForestTECH 2012
28-29 November 2012, Melbourne, Australia
Forests and the value creation network

Evolution and transformation of the Canadian value creation network
More value creation

Diversification et transformation

Construction systems

Clients

Forests and the value creation network

Divergent product flows
Problem – Forest Management vs Supply Chain

Forest Management
- Inventory (m3/ha)
- Silvicultural Regime
- Growth Models
- Wood Quality
- AAC Calculations
- Sustained yield
- Protection constraints
- Silvicultural Investments
- Network Optimization
- Reduce inventory costs
- Maximize revenues/profits
- Transportation efficiency
- Supply Chain
- Wood Inventory
- Production Processes
- Transportation
- Demand/Supply

Integrated decision-support systems

Forest Management
Silvilab

Supply Chain
LogiLab
Silvilab

- Strategic planning tool for forest management
- Uses existing data from forest inventory
  - Inventory
  - Yields, Growth models
  - Silvicultural treatments
- Multi-criteria geographical-spatial visualization based on the planning period
- Optimisation planning tool integration with market consideration
- Helps assess the impact of forest planning models on industrial development.
Stand characteristics

Growth models

Biomass*

Supply chain planning problem

* according to the Carbon Budget Model of the Canadian Forest Service (CBM-CFS3)
LogiLab

- Integrates generic mathematical models

- Represent/Design logistic network
  - Graphical representation of a network
  - Provides templates of business units
  - Assists the user to input data

- Display results in a user interface
  - Compute economical indicators
  - Material flows presentation
  - Graphs and tables (inventory, shippings, etc.)

LogiLab problem representation
Consequences of adding wood chips consumer?

Consequences of adding wood chips consumer?
Silvilab vs Logilab – Integrated Planning

Silvilab becomes the forest supplier of Logilab

Industrial value of decoupled forest management plan

Profit: 17,614,383
Transportation cost: 21,839,367
Harvested volume: 544,621
Industrial value of forest management plan w/anticipation

**Profit:**
- Coupled: 19,905,315
- Decoupled: 17,614,383

**Transportation cost:**
- Coupled: 20,974,401
- Decoupled: 21,839,367

**Harvested volume**
- Coupled: 514,625
- Decoupled: 544,621

Carbon sequestration

<table>
<thead>
<tr>
<th></th>
<th>Volume (m$^3$)</th>
<th>C Sequestration (T)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural growth</td>
<td>0</td>
<td>10,420,924</td>
</tr>
<tr>
<td>Max volume</td>
<td>18,244,114</td>
<td>10,070,181</td>
</tr>
<tr>
<td>Max sequestration</td>
<td>18,109,953</td>
<td>11,866,718</td>
</tr>
<tr>
<td>Max sequestration</td>
<td>18,244,000</td>
<td>11,841,852</td>
</tr>
</tbody>
</table>

*Industrial value of forest management plan w/anticipation*

*Carbon sequestration*
Scheduling operations (tactical)

- Inventory
- Growth curves
- Yields
- Actions
- Transitions

Accounting for stem quality and mechanical properties

- Inventory
- Actions
- Transitions
- Timber inventory
- Sawing processes
Accounting for Sawmilling recovery and coproducts

In the supply chain

- Increased value of sawmill outputs

Conclusion

- Efficient solver and algorithm
  - generate and solve large problems quickly
- Cloud based tools
  - Collaborative use: different users can work on the same problem
  - Easier to use, deploy and maintain
- To come:
  - Road building integration
  - Integration of approved carbon sequestration methods (CBM-CFS3)
A peek into Material Handling at FORAC

1) Design and operations rules for improved log yard operations

2) VTM: Virtual transport manager

1) VTM: Virtual Transportation Manager
User Interfaces
2) Inventories – a wood supply perspective

- Inventories are inevitable due to seasonal factors (...).
- Large amount of inventory kept in the log yard next to the mill (...).
FRP : Decision variables

Primary decision variables
- \( \Omega \) Configuration for the forward area
- \( X \) Periodic log classes assignment to the forward area

General conclusions
- Forest products industry can still be (is) a major economic force in Canada
- Collaborative tactical/operational planning remains a challenge:
  - Problems are large and “real,”
  - “Optimized” solutions must often be negotiated,
  - Collaboration is not natural in a competitive setting,
- FORAC, through its dynamic partnerships, provides a favourable environment to tackle these challenges.
Digging ourselves out of a whole

www.forac.ulaval.ca

Thank you – Merci !