Multiresource Forest Inventory for Sugarbushes

Foreword

Through a program called "Improvement and Development of Sugarbush Resources", researchers and professional foresters of the Faculty of Forestry of the "*Université de Moncton, campus d'Edmundston*" have completed a multiresource forest inventory in order to better understand the assets and full potential of a sugarbush area. This technical guide was developed as a way to help explain the preferred method to complete a sugarbush multiresource forest inventory, which measures the major components of the area of interest.

The Importance of a Multiresource Forest Inventory for Sugarbushes

This type of inventory enables the owner of the sugarbush to:

- Acquire **knowledge** of the composition and potential of the area to diversify the production;
- Target the **richest sites** that have the highest potential;
- **Integrate vegetative production** at key sites;
- Manage the sugarbush by taking into account **specific attributes** of the area;
- Layout an **action plan** with specific priorities;

How to Complete a Multiresource Forest Inventory

Step 1 - Prepare the Inventory.

a. **Identification of the boundaries** of the area to be inventoried and acquisition of aerial photos (photos can be purchased through Service New Brunswick).

b. **Photo interpretation**: subdivide the sugarbush area into polygons representing:

   i. Non productive areas such as roads, power lines, rivers, lakes, peatlands, buildings, etc.;

   ii. Forest stands (which should be divided on the basis of tree species, stand development, density of the canopy, drainage, topography, etc.).

Topographical and soil maps can help the photo interpreter determine dominant factors influencing the site such as drainage classes, slopes and soil deposits. These maps can be purchased through Service New Brunswick.

c. Identification of the characteristics for each stand (see photo interpretation):

i. The surface area should be calculated for each polygon by establishing a ratio between the scale of the photo and the surface covered by the stand (polygon).

d. Preparation of the sampling plan based on the number of stands (polygons) identified during the photo interpretation (Figure 1):

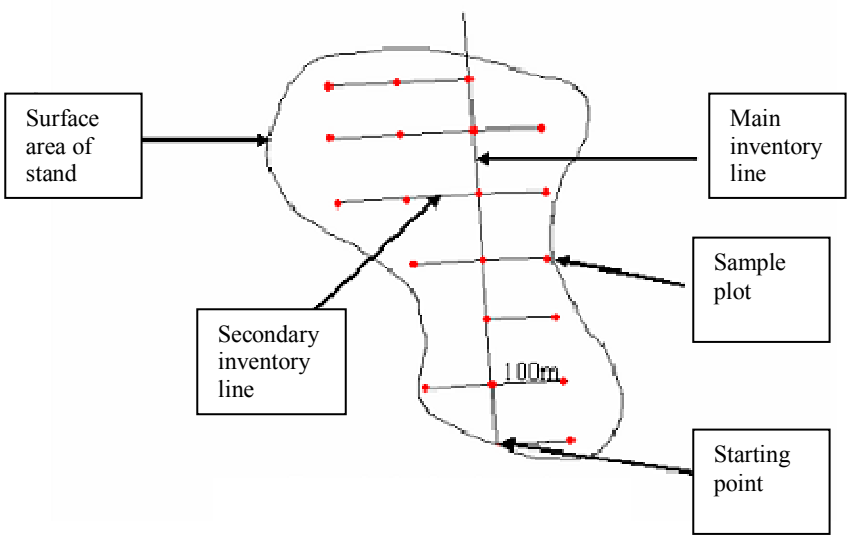
i. The inventory should sample all vegetation found in areas that have unique geophysical features;

ii. Draw a line (main inventory line) through the length of each polygon and place a sampling plot at every 100 meters;

iii. Each center of the sampling plots serves as a starting point for a perpendicular (secondary) inventory line where sampling plots are placed at intervals of 100 meters on either side;

iv. Therefore, the sampling rate is one parcel per hectare (ha).

Fig. 1 - Example of a sampling plan



Step 2 - Carry Out the Inventory.

a. Materials required

i. Materials needed for forest inventory:

- Caliper;
- A 30 cm ruler;
- Diameter Tape;
- Clinometer;
- Compass and GPS;
- Data Entry Sheets;
- Ribon or Paint;
- Hipchain.

ii. Field guides and guides for trees, shrubs, other vegetation, mushrooms and soil identification:

- Trees in Canada (Farrar, J.L.);
- Gray's Manual of Botany: A Handbook of the Flowering Plants and Ferns of the Central and Northeastern U. S. and Adjacent Canada (Gray, A.);
- Edible and Medicinal Mushrooms of New England and Eastern Canada (Spahr, D.L.);
- Mushrooms of Ontario and Eastern Canada (Barron, G.);
- Tree Diseases of Eastern Canada (Myren, D.T.);
- Fern Finder: A Guide to Native Ferns of Central and Northeastern United States and Eastern Canada (Hallowell, B.);
- Soils in our Environment, Eight Edition (Miller, R.; Gardiner D.);
- Soil surveys - New Brunswick (Agriculture and Agri-Food Canada), http://sis2.agr.gc.ca/cansis/publications/nb/index.html;
- Our Landscape Heritage, Second Edition (New Brunswick Department of Natural Resources), http://www.gnb.ca/0399/OurLandscapeheritage/ForewordIntroduction-e.pdf.

iii. Material for soil description (the pedon is a hole of approximately one cubic meter that has been dug out enabling soil analysis):

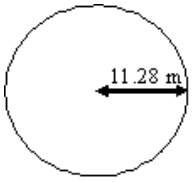
- Shovel;
- Garden Trowel;
- Tape Measure;
- Hellige-Truog Soil pH Test Kit;
- Munsell Color System;
- Water resistant data entry sheets;
- Soil identification guide.

b. Fixed Radius Sample Plot Inventory.

i. When?

- Mid-June.
- Checkups can also be done during the end of July and the end of August in order to verify the development of certain species. For some plants, the above ground part only emerges during a short period of time.

ii. How?



Fixed radius sample plot

- Using your GPS and/or your compass and hipchain, go to the first sample plot.
- With an 11.28 m cord, define the fixed radius sample plot. The following information should be gathered within the plot and recorded on the data entry sheet (Appendix 1):
  - Trees and saplings (small trees measuring 1.3 to 4 meters in height) should be identified and diameters measured;
  - Regeneration (woody vegetation measuring between 0 and 1.3 meters in height) should be evaluated and the percentage of cover estimated for each species;
  - Herbaceous plants, such as ferns, grasses, lycopodiums, lichens, mosses, sphagnum should also be evaluated by the percentage of cover estimated for each species;
  - Mushrooms should be identified and counted by species. Separate the ones on the ground versus those on trees.
- Each parcel with a radius of 11.28 m has a 400 square meter surface area (1/25 of a hectare or 1/10 of an acre).
- For each sample plot, a hole of one cubic meter, called a pedon, is dug up to analyse the distinctive layers and to measure certain physico-chemical components of the soil (Appendix 2). The following is the information that should be acquired:
  - Configuration of each specific layer;
  - Thickness of the humus (this gives an idea of the decomposition rate of organic material);
  - Texture (sandy, loamy etc.);
  - pH of the soil;
  - Depth of the roots;
  - Presence of seepage (indicates a rich site);
  - Humidity of the soil and drainage type.
- Other details can be added if necessary:
  - Accessibility;
  - Developmental stage of the forest;
  - Slope and positioning (affects nutrients, hydrology, winds, etc.);

- Presence of animal species.

The multiresource forest inventory requires knowledge of many different environmental disciplines. It is recommended that the maple producer uses the services of a professional to ensure all of the pertinent information and observations are tallied.

c. Time required to complete one sample plot:

It can take approximately two hours for a team of two experienced people to complete one sample plot.

Step 3 - Compile the Data.

a. In a spreadsheet program such as Excel, compile the data sets for each stand taking into consideration that each parcel is 1/25 of an hectare. This will enable you to get the following basic information:
   - Density (number of stems/ha);
   - Volume per tree (m^3/stem); volume per ha (m^3/ha); total volume (m^3);
   - Surface area with specific particularities;
   - Layout of different species.

** Remember: This inventory is very technical and requires expertise. It is strongly recommended that a qualified team is consulted in order to obtain the proper information. **

b. You should also strongly consider using a Geographical Information System (GIS). This would enable you to:

   i. Map some of the information (topography, streams, stands, etc.);

   ii. Intergrate GPS coordinates of:
   - The sample plots;
   - Various infrastructure such as the sap-collection system;
   - Roads;
   - Other polygons, such as silviculture treatments, protected areas, etc.

A GIS software enables the user to print out various types of maps. Data tables are bound to specific features such as a stand (polygon) which makes it easier to visualize and understand the links between the data and the maps.

** It is not necessary for the maple producer to have such software. The forestry professional should have the tools and knowledge necessary to efficiently execute the work and produce different maps for the sugar maple producer. The forestry professional should present a document resuming the findings with maps, data tables and personal comments. **

Step 4 - Analyse and Evaluate the Data and then Make Management Decisions.

After the inventory and the compilation of the data, a document summarizing the findings is delivered to the sugar maple producer. The document should include:

- Tables containing field data;
- Maps;
- A description of each forest stand;
- A description of different zones (protected zone, for example);
- Other information such as the names and composition of vegetation, physical characteristics, problems found such as nutritional deficiencies or presence of diseases and other particularities of the land.

The forest professional can offer his or her own opinion on the management strategies that should be undertaken and the diversification possibilities of each stand or each specific zone based on the findings. However, these are only suggestions. The management strategy to adopt is the owner's ultimate decision.

a. How to Determine the Management Strategy.

i. Categorize and estimate the potential of different sites according to the observations noted during the inventory and the data analysis. Sites can be categorized according to:

- Abundance;
- Accessibility;
- Site condition.

ii. Adopt a sustainable management philosophy.

iii. Define a vision for your land (management objectives) relating to the varying possibilities that the different sites offers. The following are examples of management objectives and/or considerations:

- Production of high quality wood;
- Short or long term revenue;
- Monetary investments;
- Development of specific species;

- Protection and valorization of biodiversity;
- Enhancement of maple stands;
- Non Timber Forest Products harvesting
- Cultivation of Non Timber Forest Products;
- Availability for maintenance.

iv. Identify different constraints, such as:

- internal constraints (tied to the company):
    - Knowledge;
    - Availability of material and equipment;
    - Workforce;
    - Land;
    - Accessibility;
    - Motivation;
    - Time.
- external constraints (not in the control of the owner):
    - Regulations (provincial or municipal);
    - Markets;
    - Availability of documentations.

v. Determine the actions that need to be taken:

- Inform yourself on the many possibilities;
- Associate the adaptable species or those that are already found in the area to the findings of the inventory;
- Try to protect a certain species by adopting sustainable harvesting methods or by using siliviculture prescription that improves the stand;
- Define what, where, when and how;
- Consult specialists.

Costs Evaluation

The costs associated with this type of inventory varies largely according to the type of management completed by the land owner. Given that the multiresource inventory is quite technical and requires highly specialized knowledge, personnel and material, the following cost evaluation scenario is an example of an owner hiring an external resource (such as a forestry consultant company) to complete the work.

Table 1 - Approximate cost to complete a multiresource inventory on a 40 hectares (100 acres) woodlot situated at 70 km from an urban center:

	Rate	Time or distance required	Cost
Cost for the Labour			
Consultation	$75/h	40 hours	3 000.00 $
Cost for the Material			
Aerial photos and maps			200.00 $
Inventory tools and equipment			0.00 $
Other Costs			
Travel	0.40$/km	700 km	280.00 $
Subtotal costs			3 480.00 $
Taxes (13% in N.-B.)			452.40 $
Total costs			**3 932.40 $**
Cost per ha			98.31 $
Cost per ac			39.32 $

Additional information

This technical guide is presented by the Faculty of forestry of the *"Université de Moncton - Campus d'Edmundston"* within the context of the "Improvement and Development of Sugarbush Resources Program". The main objective of the program is to optimize the economic model of sugarbushes in New Brunswick by investing in development, research and technology transfer. The program aims to meet the following specifics objectives:

- Diversify production and find new innovative products for commercialization;
- Technology and knowledge transfer;
- Training and professionalization of the workforce.

Do not hesitate to ask professionals for help and to share your experience.

Conferences and workshops are available at the "Montagne Verte" sugarbush. Moreover, other forestry extension materials regading other aspects of the program are available for interested people. Other technical guides about cultivation of American ginseng, hazelnut, wild Indian cucumber, mushrooms and organic fertilization in maple stands are also available. For more information, contact Jeff Levesque or visit our website at www.umce.ca/foresterie/érablière.

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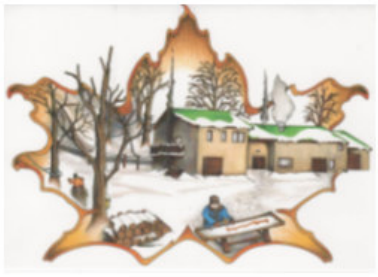

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Appendix 1: Multiresource Forest Inventory Data Table Entry Sheet for Vegetation

Woody vegetation

Trees (4m+)

Species/dbh	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66
HM																														
RM																														
YB																														
WB																														
BE																														
BF																														
WS																														
BS																														

Shrubs (1.3 to 4 m)

Species/dbh	1	2	3	4	5	6	7	8	9	10	%

Regeneration (0 to 1.3 m)
Species/ % of cover

Mycologie
Amount/on the ground species

Amount/on the trees species

Other vegetation

herbaceous plants
Species / % of cover

Ferns
Species / % of cover

Lichen
Species / % of cover

Grasses
Species / % of cover

Mosses and sphagnum
Species / % of cover

Lycopodium
Species / % of cover

Appendix 2: Soil Analysis Data Entry Sheet

Soil Analysis

block/inventory line/parcel _____/_____/_____ Team: _____

slope (%) _____
Slope orientation _____
Microtopography (% flat) _____

Soil characteristics

Humus: type, thickness (cm)		
Decomposition of organic soil	20 cm	60 cm
Lenght of profile (cm)		
Mottles: types, depth (cm)		
Texture of horizon B		
Texture of horizon C		
Ardening: type, depth (cm)		
Thickness of mineral deposit (cm)		
Total depth (cm)		
Stoniness: type, percentage		
Distribution of the rock fragments: position, type		
Depth of root system (cm)		
Depth of water table (cm)		
Geology: rock fragments, Bedrock		
Ground subsidence of the site		
Deposit and thickness		
Secondary deposit: type, position and thickness		

Coarse Fragments	G	C	S	B
Percentage				

Rock distribution _____
Root development (cm) _____

Horizon	O	A	E	B	BC	C
Depth (cm)	to	to	to	to	to	to
Color (code)						
Texture (code)						
pH						
Roots						

VT _____
ST _____
TU _____

Other _____