

The Ontario Ministry of Natural Resources (OMNR) and Ontario forest industries (see partner list below) are comparing the effects of natural forest disturbance with those of a range of intensities of silvicultural practices throughout the boreal and Great Lakes-St. Lawrence forests of Ontario.

### What is NEBIE?

The acronym NEBIE stands for increasing levels of silvicultural intensity defined as:

- **Natural disturbance:** Forest ecosystem responds (e.g., to fire, insects, and/or disease) without human inputs
- **Extensive:** Stocking is greater than 40% and desired tree species are free of major insect pests
- **Basic:** Stocking is greater than 60% and desired tree species are free of interspecific competition and major insect pests
- **Intensive:** Stocking is greater than 80% and desired tree species are free from inter- and intraspecific competition and major insect pests
- **Elite:** Stocking is greater than 80% and desired tree species are free from inter- and intraspecific competition, nutrient deficiencies, and major insect pests

The objectives of the NEBIE research project are to:

- Determine the effects of natural disturbance and silvicultural practices on tree survival, growth, wood quality, and genetic diversity
- Monitor the effects of silvicultural practices on microclimate, soil moisture and nutrient cycling, vegetation diversity, and wildlife habitat
- Develop a defensible database to accurately forecast allowable cut while maintaining ecological and economic viability

### Where are the project sites?

NEBIE research is being conducted on 8 study sites, selected to cover the major commercial forest types, in northern and central Ontario (Figure 1).

Study design is a Randomized Complete Block (RCB) with 2 factors: (1) tree species, referred to as "installation sets," and (2) management intensity (NEBIE).

Each treatment is replicated 4 times at each of the 8 installation sets. Plots measure 100 m x 200 m (2 hectares) (Figure 2).

#### Northwestern Ontario

Sioux Lookout:

- *Forest type:* jack pine/black spruce
- *Soil:* coarse sand
- *Treatments to date:* harvested fall 2002; site prepared (mechanical) summer 2004; seeded to jack pine winter 2005, infill plant 2007
- *Data collected:* pretreatment summer 2002; post-harvest summer 2004, 2007 (5th year)

Dryden:

- *Forest type:* mixedwood with black spruce, white birch, balsam fir, and trembling aspen
- *Soil:* shallow variable coarse loamy to clayey
- *Treatments to date:* harvested winter 2005, (mechanical) site prepared 2005, planted 2006, released 2007, I and EL released 2010
- *Data collected:* pretreatment summer 2002, post-harvest summer 2006, 2009 (5th year)

Thunder Bay:

- *Forest type:* mixedwood with trembling aspen and balsam fir
- *Soil:* fine loamy to clayey
- *Treatments to date:* 1 block harvested 2008, 1 block site prepared 2009, planted 2010
- *Data collected:* pretreatment summer 2005, 1 block post-harvest summer 2010

#### Northeastern Ontario

Wawa:

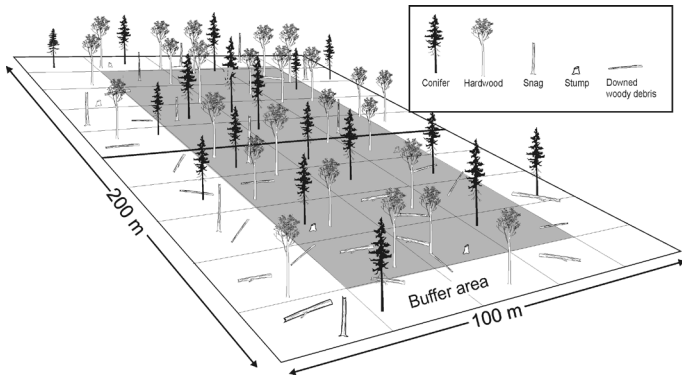
- *Forest type:* boreal transition forest with white birch, red and sugar maple, and trembling aspen
- *Soil:* fresh, sandy to silty
- *Treatments to date:* blocks 1 and 2 harvested 2003 and 2007, respectively
- *Data collected:* pretreatment summer 2003

Kapuskasing:

- *Forest type:* mixedwood with black and white spruce, trembling aspen, white birch, balsam poplar and balsam fir
- *Soil:* heavy clay with <40 cm surface organic
- *Treatments to date:* harvested summer 2003; site prepared (chemical) summer 2004, planted spring 2005, released 2006, infill plant 2007, I and EL released 2010
- *Data collected:* pretreatment summer 2002-03; post-harvest summer 2005; 2008 (5th year)



Figure 1. NEBIE plot network installation sets in Ontario.



**Figure 2.** Sample treatment plot.

**Timmins:**

- **Forest type:** Mixedwood with trembling aspen, white spruce, and balsam fir
- **Soil:** silty fine sand
- **Treatments to date:** harvested winter 2002-03; site prepared 2003, planted 2004, released 2005, 2007, infill plant 2008
- **Data collected:** Pretreatment summer 2002; post-harvest 2004, 2007 (5th year)

**Southcentral Ontario**

**North Bay:**

- **Forest type:** Mixed hardwood with sugar maple, beech, and yellow birch
- **Soil:** Loamy soil
- **Treatments to date:** harvested fall 2004, site prepared 2005, planted Canada yew 2006, blading and seeding yellow birch, Blk 3 I, EI 2008
- **Data collected:** pretreatment data summer 2004, post-treatment summer 2006, 2009 (5th year)

**Petawawa:**

- **Forest type:** mixedwood with white pine, red pine, trembling aspen, and balsam fir
- **Soil:** shallow fine sand
- **Treatments to date:** harvested 2005-06, released 2007, salvage logged after windstorm 2007, release Blk 4 B 2008, I and EI released 2010
- **Data collected:** pretreatment data summer 2004, post-treatment summer 2007, 2010 (5th year)

**What information is being collected?**

Information being collected at each of the study sites includes:

- **Crop trees:** Height, diameter, and stocking of regenerating crop trees are being measured following establishment to compare treatment effects on wood volume.
- **Biodiversity:** Abundance of all plant species is being assessed before and at 2, 5, and 10 years after harvesting.
- **Soils:** Information about above- and belowground nutrient pools, fine litterfall, soil chemistry, nutrient turnover and leaching, above- and belowground carbon pools, coarse and fine woody debris, and physical parameters are being assessed to determine if soil processes respond similarly to treatments across the range of geography, forest types, and soil types.

- **Genetics:** When possible, genetically superior planting stock will be used in the Intensive and Elite silviculture treatments. Genetic diversity research will be conducted following stand establishment.
- **Pathology:** The incidence, severity, uniformity, and impact of root and butt rot diseases will be assessed, focussing primarily on Armillaria. Survey results will be used to predict future disease problems in similar stands and to prescribe control methods. Additional insect and disease surveys will be conducted as required.
- **Economics:** A real options economics model was used to examine proposed investments in silviculture in Ontario.

**What are the expected project outcomes?**

This research will help resource managers to:

- Maintain or enhance fibre quantity and quality
- Maintain soil and water resources
- Conserve biological diversity
- Reduce risk of losses to fire, insect, and disease
- Maintain economic sustainability

**Who's involved in the project?**

Between October 2001 and February 2011, the following research partners have been involved:

- Ontario Ministry of Natural Resources
- **Forest industry:** AbiBow Canada, Buchanan, Clergue Forest Management, Green Forest Management, Domtar, Nipissing Forest Resource Management, Tembec, Weyerhaeuser
- Natural Resources Canada - Petawawa Research Forest
- **Universities and colleges:** University of Guelph, Lakehead University, University of Waterloo, Sault College
- **Non-government organizations:** Forest Ecosystem Science Coop (FESC), Upper Lakes Environmental Research Network (ULERN), Canadian Ecology Centre-Forestry Research Partnership (CEC-FRP), Forest Engineering Research Institute (FERIC).

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More detailed fact sheets for the boreal sites are available at [www.forestco-op.ca/projects\\_gysu/nebie.htm](http://www.forestco-op.ca/projects_gysu/nebie.htm).

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