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Emulating natural disturbances: clearcut silviculture in Ontario

Ontario's forests have, over thousands of years, adapted to being renewed through natural disturbances such as forest fires, insect and disease outbreaks, and windstorms. Today, forest management practices in Ontario emulate natural disturbances to renew our forests after harvest. Clearcutting is one method used in Ontario to renew and maintain healthy, sustainable forests.



Introduction

Crown forests in Ontario are managed in accordance with a rigorous forest management framework that legally requires Crown forests to be:

- sustainably managed according to an approved forest management plan
- renewed (reforested) following harvest
- assessed and evaluated through an independent forest audit.

Forest managers view the harvesting of trees as the beginning of the new forest – not as the end of an old one. When combined with renewal activities such as tree planting, and maintenance activities such as tending and protection, harvesting is one of a series of actions that make up a silviculture system.

Silvicultural systems

Silviculture is the art and science of growing trees. As part of Ontario's sustainable forest ecosystem management, silviculture practices consider not only timber production, but also ecological concerns such as biodiversity, wildlife habitat, and water quality. Different silviculture systems are used to optimize regeneration of the forest. The silviculture system chosen is based on the characteristics of the current forest stand and its natural disturbance history, as well as the desired future forest condition. Silviculture systems are classified by the method of harvesting.

In Ontario, forests are managed in accordance with one of the three following silviculture systems (see Figure 1 on page 3).

Selection system

- emulates the death of single trees or small groups of trees in the forest
- requires that mature, unhealthy or undesirable trees in a forested stand be harvested individually or in small groups, every 10 to 40 years
- leaves trees behind to provide the necessary shade for the regenerating forest
- produces stands with trees of different ages, known as uneven-aged management
- is used mainly in stands composed of shade tolerant hardwoods, such as maple, ash, and beech
- is used primarily in the Great Lakes-St. Lawrence Forest Region.

Shelterwood system

- emulates low intensity, periodic ground fires, wind storms, and insect infestations in the forest
- harvests mature trees in a series of two or more cuts to encourage natural regeneration and growth under or next to the residual trees
- cuts trees uniformly over the stand area, or in groups or narrow strips
- results in stands with trees that are mostly the same age, known as even-aged management
- is used mainly in stands composed of white and red pine and shade mid-tolerant hardwoods, such as oak and yellow birch
- is used in both the Boreal and Great Lakes-St. Lawrence Forest Regions.

Clearcut system

- emulates larger fires and windstorms
- harvests mature trees usually at the same time in one operation
- retains individual trees within the harvest area and/or parts of forest stands for silvicultural reasons (e.g., seed trees) or to provide protection for forest values (e.g., perch sites for raptors or cavity-dwelling birds)
- results in stands that are regenerated naturally or artificially by planting or seeding, or a combination of both
- produces stands with trees that are mostly the same age, known as even-aged management
- is used mainly in stands composed of tree species that have adapted to regenerating in full sunlight after natural disturbances such as fires (e.g., jack pine, black and white spruce, poplar, and white birch)
- is used primarily in the Boreal Forest Region.

In Ontario's managed forests, clearcutting emulates the way that natural disturbances such as forest fire or windstorm would affect a forest stand. Clearcut harvest areas in managed forests emulate the size, structure, and characteristics of these natural disturbances. For example, because the effects of fires and wind events can range in size from very small to very large, harvest areas in managed forests also range in size.

Clearcutting should not be confused with deforestation. Clearcuts only temporarily change the vegetation type of a forest. Within five to 10 years following clearcutting, a

new, highly productive forest will once again be growing. Deforestation describes areas that are deliberately removed from the growing forest land base for uses such as roads, buildings, and agriculture.

Tree adaptations to forest fires

Jack pine: Jack pine grows rapidly on dry sites where other trees do not grow as well due to inadequate moisture. Due to their dryness, these sites are vulnerable to frequent intense wildfires. Jack pine cones usually don't open and drop seeds to the ground in the year they are formed, the way other tree species do. Year after year of cones accumulate on the trees. Jack pine cones are serotinous, meaning they are sealed with a special resin that requires high temperatures to open. Typically, the cones open only after a wildfire burns hot enough to kill the trees. Hot fires also burn much of the organic material on the ground, which exposes mineral soil. Jack pine seeds require mineral soil exposure to germinate and survive. Jack pine seedlings grow best in full sunlight. Similarly, jack pine grows well in clearcuts due to the following similarities with conditions created after burns:

- heat from the sun in clearcuts can open serotinous jack pine cones scattered on the ground
- silviculture activities can be used to expose mineral soil in clearcuts
- clearcuts create full sunlight conditions that allow jack pine seeds to germinate and seedlings to grow rapidly.

Trembling aspen: Trembling aspen seeds are very light and easily carried by the wind. They can disperse over long distances to burned areas. In addition, most wildfires do not kill aspen root systems. From the roots, aspen can send up a number of shoots, called suckers, for several years following a fire. With an extensive pre-formed root system, suckers grow rapidly in full sunlight.

Similarly, trembling aspen grows well in clearcuts due to the following similarities with the conditions created after burns:

- seeds can disperse over long distances to clearcut areas
- clearcutting does not kill aspen root systems
- clearcuts create full sunlight conditions that allow aspen suckers to form and seedlings to grow rapidly.



Figure 1. Silviculture systems used in Ontario. From top to bottom: 1) selection, 2) shelterwood and 3) clearcut.

Why do we clearcut?

Some tree species such as jack pine and trembling aspen actually require large-scale, natural disturbance in order to regenerate and grow. Other tree species, such as maple, are more adapted to very small disturbances, as when a single tree or a small group of trees falls over.

Forest managers use clearcuts in Ontario's managed Crown forests to emulate natural disturbances (Figure 2).

Since natural disturbances do not kill all the trees present or remove dead tree stems from a site, clearcuts are planned with similar characteristics. These characteristics provide wildlife with some of the benefits of natural disturbances, including habitat creation.

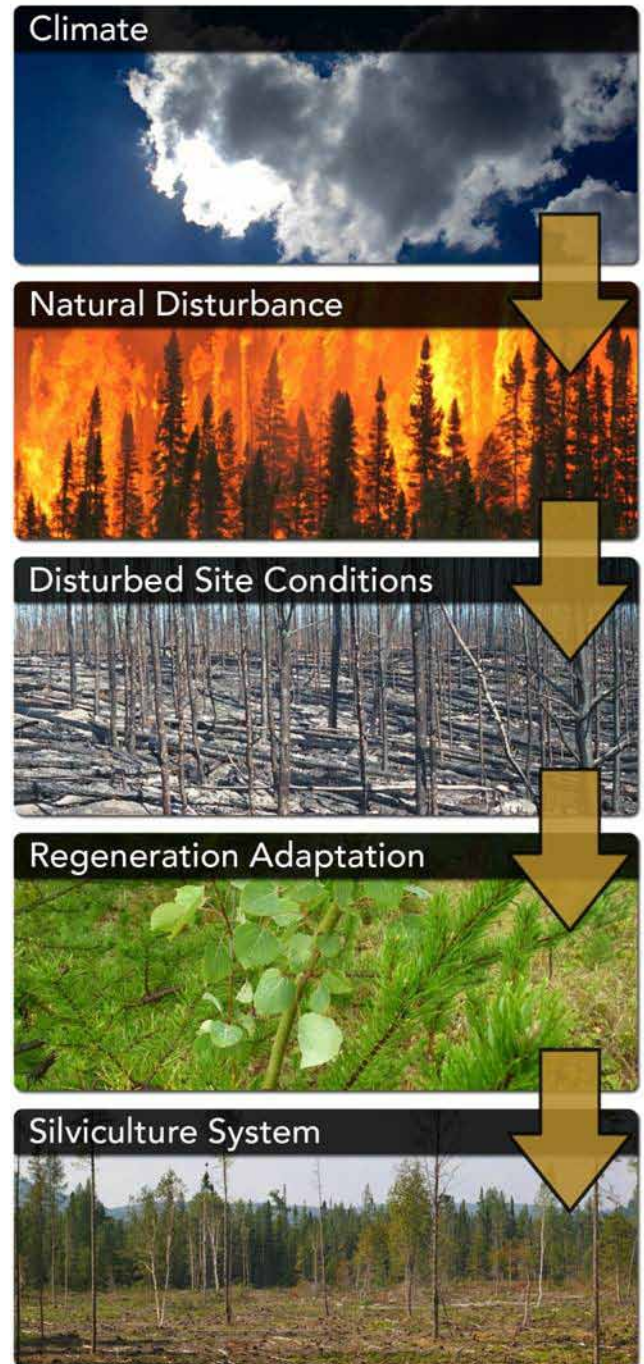


Figure 2: Forest managers consider these four important factors (climate and the associated weather patterns, type of natural disturbance, site conditions, and the adaptations of the species being regenerated) when selecting a silviculture system.



Where does clearcutting take place?

Clearcutting is used in the Boreal Forest Region where the tree species are best adapted to regenerating after large disturbances like forest fires. Clearcutting is also used in the Great Lakes-St. Lawrence Forest Region, typically for ecosystems that are dominated by tree species that regenerate best in full sunlight.

Stands managed with the clearcut silviculture system commonly include those dominated by one or more of jack pine, black spruce, trembling aspen, and white birch. Forest managers may also choose clearcut silviculture for other tree species such as balsam fir and white spruce, to create habitat for wildlife that prefer young forests (e.g., moose browse).

Clearcutting silviculture system harvest methods

Clearcuts are harvested in different ways depending on the types of ecosystems being harvested and the objectives identified in the forest management plan (Figure 3).

Different ways of clearcut harvesting include:

- **Careful logging around advanced growth (CLAAG) and harvesting with regeneration protection (HARP):** Clearcuts can be harvested to preserve small trees and seedlings already growing in the area. These trees naturally regenerate the area. This type of harvesting can shorten the time between successive harvests.
- **Strip, block, and patch cuts:** Clearcuts can be harvested in a pattern that relies on seeding from the uncut areas to naturally regenerate the clearcut. These patterns can also have additional benefits related to soil moisture, wildlife habitat, and aesthetics in certain circumstances.



Figure 3: Examples of clearcutting harvest options (top to bottom): 1) conventional clearcut modified for environmental values, 2) HARP in spruce forest, 3) strip clearcut black spruce lowland, 4) single seed-tree white pine clearcut.

- **Seed tree cuts:** Clearcuts can be harvested to retain individuals or groups of canopy trees. The trees left on site provide seed to naturally regenerate the clearcut area. The seed trees can provide additional biodiversity benefits.

Status of clearcutting in Ontario

Approximately 26 million hectares of Crown forest are actively managed following approved forest management plans. Clearcutting is the most dominant silvicultural system in use, representing 87% of the total area harvested (Figure 4). This is because the majority of managed forests in Ontario are in the Boreal Forest Region, where the natural disturbance regime suggests clearcutting to be the most appropriate silvicultural system. From 2006 to 2010 Ontario's average annual harvest using clearcut silviculture was approximately 140,000 hectares. To put this into context, 2.5 million hectares of forest were disturbed annually from fire, wind, insects and disease during the same time period (Figure 5).

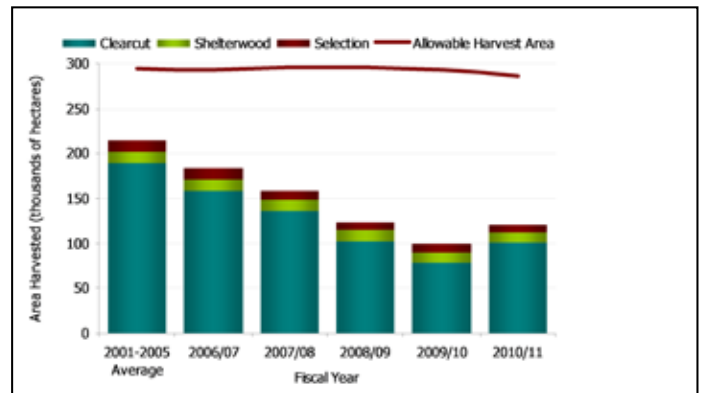


Figure 4: Area harvested by silvicultural system. The reduction in the total area harvested after 2005 is due in large part to the downturn in the global economy.

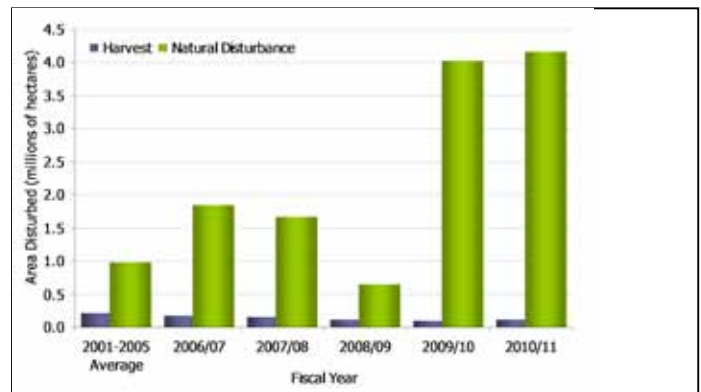


Figure 5: Disturbance area within Ontario's managed Crown forests.

Regulating the clearcut harvest system in Ontario

The Crown Forest Sustainability Act (CFSA)¹ regulates forest management on Crown lands in Ontario. The Act is intended to ensure the long-term health of forest ecosystems, while meeting the social, economic, and ecological needs of present and future generations.

Foresters use clearcutting where it is consistent with ecological and management objectives. In Ontario's managed Crown forests, clearcutting can take place only after a detailed forest management plan is prepared by a Registered Professional Forester and approved by the Ontario Ministry of Natural Resources (MNR).

Forest management planning² is a detailed process that includes opportunities for Aboriginal involvement, public consultation, and direct participation of a local citizens committee. The Forest Management Planning Manual and the forest management guides are used to implement the ecosystem approach to forest management. The forest management guides include standards and optional measures for implementing the clearcut silviculture system as a sustainable forest management practice.

Foresters protect biodiversity values in clearcuts by modifying operations consistent with the forest management guides³. Clearcuts are typically planned with consideration given to the following set of characteristics:

- a natural landscape pattern
- a range of clearcut sizes
- patches of live trees retained inside the clearcut
- an irregular boundary including 'peninsulas' of unharvested live forest
- standing live and dead trees to provide wildlife habitat and biodiversity values
- downed woody debris, including trees, branches, and twigs.

MNR analyzes and reports on all forest operations, including clearcutting, in an annual report on forest management and a five-year state of Ontario's forests report. The ministry tables both reports in the Ontario Legislature and makes them available to the public on its website.

Outlook for the clearcutting silviculture system

The current scientific understanding of forest ecology makes clearcutting an effective forest management tool in Ontario. Clearcuts have been successfully regenerated for decades and there is a strong scientific basis for their continued use.

Adaptive management is a cornerstone of Ontario's forest management framework. MNR monitors the effectiveness of current forest policy and then refines or changes policy direction based on the results of the monitoring and the best scientific information available. Therefore, forest management policy and practices are continually being refined as experience and knowledge of our complex ecosystems improves over time. MNR has initiated a series of multi-scale scientific studies to increase our understanding of the characteristics of natural fire regimes in Ontario to better emulate natural disturbance.

What you can do to get involved in the management of Ontario's forests

Forests on Crown land in Ontario are owned by the public. Ontario's rigorous forest management planning process provides opportunities for you to be involved in the management of Crown forests.

Ensuring Ontario's forests are well-managed means Ontarians can be confident that our forests will remain healthy and continue to provide environmental, economic, and social benefits to the people of Ontario.

You can:

- Learn more about good forest practices from:
 - » the Ministry of Natural Resources
 - » Ontario Stewardship
 - » the Ontario Woodlot Association
 - » the Ontario Forest Industry Association
 - » the Ontario Professional Foresters Association
 - » Conservation Ontario
- Be engaged in forest management on Crown lands
- Get involved with your schools' curriculum.

¹ <http://www.e-laws.gov.on.ca/index.html/>

² http://www.mnr.gov.on.ca/en/Business/Forests/2ColumnSubPage/STEL02_163549.html

³ <http://www.ontario.ca/forestguides>

Information sources

For information on public participation in forest management visit: http://www.mnr.gov.on.ca/en/Business/Forests/2ColumnSubPage/STEL02_166838.html

Choosing a Silviculture System

http://www.lrconline.com/Extension_Notes_English/forestry/slvcltr.html

Harvesting in the Boreal Forest

<http://www.mnr.gov.on.ca/en/Business/Forests/2ColumnSubPage/240959.html>

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More information

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