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AN OVERVIEW OF ANCIENT FOREST ECOLOGY IN THE LAKE TEMAGAMI SITE REGION

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Introduction

By definition, ancient forests have not been significantly altered by human activity. They include many types of tree species and can be in any stage of succession - from young to old. The most studied kind of ancient forest is called "old-growth forest". Old-growth forests differ from younger forests in three main ways. First, they have trees that are much older than the average age for the tree species. Second, they generally have greater numbers of snags, or dead standing trees, than younger forests. And third, they have a large number of logs on the forest floor compared to younger forests. In some old-growth forest ecosystems there are numerous logs across streams which tend to form debris dams that are less common in younger forests.

Old-growth forests are valuable for many reasons. They keep soil from eroding away; help to keep water clean; hold on to nutrients which are very important for plant growth; provide large, natural areas which are required to maintain healthy animal populations; and by building up dead wood (snags and logs) instead of converting wood to carbon dioxide gas, they help to mitigate the problem of global warming (increased carbon dioxide leading to increased temperature at the earth's surface). The study of old-growth forests has also helped us to better understand the field of ecology.

The best known old-growth forests in central Ontario are the old-growth white and red pine forests. Sadly, however, less than one percent of the world's original old-growth white and red pine forests remain, which makes them "endangered ecosystems". If the few remaining old-growth forests are to be saved we must develop a better understanding of what they are and what makes them work. Water, light and fire are three of the most important factors determining the nature of ancient forested landscapes in the Lake Temagami Site Region.

Water and Topography

Water is one of the most important resources that plants (including forest trees) need to grow and reproduce. It is used by the plant to make food, it brings nutrients into the plant mainly through the roots, and it transports materials within the plant to various parts. In the central Ontario forested landscape, the amount of water in the soil which comes from precipitation has a major influence on the kinds of plants which are able to grow, the size that the plant can attain, and how fast the plant can grow. The soils are driest on the hilltops where there is very little water buildup from rainfall. They are wettest in the valleys which receive water draining down through the soil from all the uphill areas next to each valley. Due to their particular abilities, white and red pine are generally common on the drier hilltops and less so in the wetter valleys where species such as white cedar, black spruce and yellow birch tend to do well. In addition, the amount (or volume) of plant growth in valleys and on lower slopes, where water is more plentiful, generally tends to be greater than on hilltops.

Light

Because of greater plant volume including a thicker forest canopy in valleys compared to hilltops, the amount of light that reaches the forest floor in the valleys is generally lower than on the hilltops. This

has important effects on the kinds of trees that can reproduce and grow well in valleys compared to hilltops. Some species such as black spruce and yellow birch are better suited to germinate and grow in the shaded conditions of the valleys compared to species such as red pine and jack pine that require the more open, lighted conditions of the hilltops for germination and growth. In addition, the amount of light reaching the forest floor determines the kinds of understory herbaceous plants that can grow. For example, bracken fern is more typically found in the drier, more open environments of hilltops and spinulose wood fern is more typical of the wetter, darker valley floors. The more open conditions of hilltops and the resulting greater amounts of sunlight at the forest floor also contribute to drier soil conditions through increased evaporation.

Fire

Until only recently, fire has played an important role in the ecology of central Ontario's ancient forests. In these forests, fire tends to burn uphill due to winds that generally get stronger towards the hilltops. These strong winds on the upper slopes provide lots of oxygen to the fire which makes the fire burn larger and hotter. Thus, there are fewer fires in valleys than on hilltops. In addition, the wetter soil conditions in valleys helps to prevent fire and the drier soil conditions on hilltops tends to promote fire. Most forest fires do not destroy the entire forest. In central Ontario, fires most commonly burn along the forest floor killing a few large trees and many small plants, and reducing the thickness of the dead leaves and needles (litter) on the forest floor. When the litter is burned, the mineral soil below is exposed. This exposed mineral soil plays an important role in the germination and early growth of some tree species such as red and white pine. Red pine is particularly dependent on these wildfires for regeneration. Since wildfires have been suppressed in central Ontario, starting around the early 1920's, very little red pine forest has been regenerating naturally.

Some Features of Old-Growth White and Red Pine Forest Communities

White and red pine trees in central Ontario are commonly found growing with at least 15 other tree species. The pines (including jack pine) often out-compete other trees on dry coarse-textured soils. Relative to red pine, white pine grows on a wider range of soil moisture conditions, however, red pine is usually more abundant on the coarser sandy soils, and white pine on the soils with finer sands and silt. With its limited extent due in large part to logging, the rarest of the old-growth white and red pine forest communities is characterized by tolerant (to shade) hardwood species such as sugar maple, yellow birch and American beech growing in association with large old white pine. It is often called the "white pine-tolerant hardwood" forest type. The density of white pine in this old-growth forest type is normally lower than when it grows in association with other conifers or early successional hardwoods such as white birch and poplar. However, the individual white pine themselves are often much larger and taller than those found in the other forest types. This is due mainly to the better growing conditions in areas where tolerant hardwoods are common.

Old-growth forests dominated by red pine are much less common in Ontario than those dominated by white pine. For example, in Algonquin Park, there is six times more white pine dominated forest than red pine dominated forest (most is intermediate to mature in age). In the Temagami Region, there is three times more white pine forest than red pine forest. In the Lower Spanish Forest near Espanola, however, initial studies indicate that there is as much red pine as white pine meaning that this area may have one of the highest concentrations of red pine forest in Ontario.

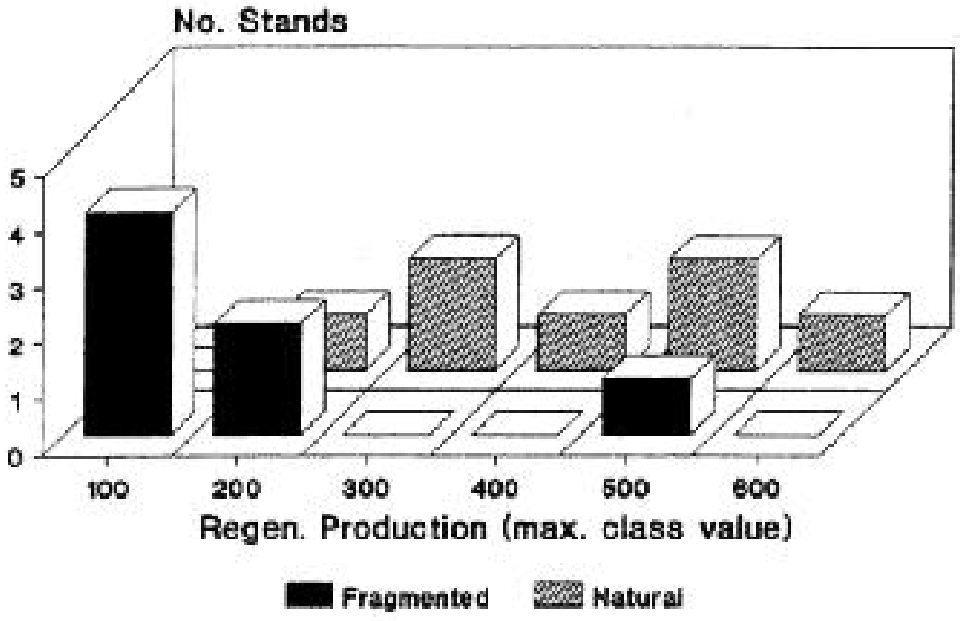
Ecological studies of old-growth white and red pine forests in the Temagami Region of Ontario (Quinby 1993) have produced minimum standards for these unique forest types (Table 1). These minimum standards for old trees, snags (dead standing trees) and logs can be used for field identification of old-growth pine stands or pine stands with one or two old-growth characteristics.

Table 1. Minimum standards for old-growth white and red pine forests in Temagami, Ontario

Stand Features	Red Pine	White Pine
Old Trees		
minimum age	140 years	140 years
density	9/ha	10/ha
Snags		
density	30/ha	30/ha
minimun dbh (diameter at breast height)	10 cm	10 cm
minimum height	2 m	2 m
Logs		
density	10/ha	10/ha
diameter at large end	25 cm	28 cm
length	8 m	8 m
Human Disturbance	minimal to none	minimal to none

One of the most valuable features of old-growth white pine forests is their frequent ability to replace themselves whenever they are not significantly affected by human activity (Quinby 1991). By studying the processes of natural white pine regeneration in ancient forested landscapes, we may learn enough to successfully restore and regenerate previously logged white pine areas that are now dominated by other plant communities. Old-growth white pine stands in the Temagami Region that have not been fragmented by logging are almost three times healthier in terms of white pine regeneration (Fig. 1).

Figure 1. White pine regeneration in natural (unfragmented) and fragmented old-growth white pine forests in Temagami, Ontario



Only one study has evaluated the later stages of white and red pine forest succession as animal habitat. This study identified animals that need or prefer older white and red pine forests to complete some or all stages of their life cycle including species of amphibians, birds and mammals (Table 2).

Table 2. Animal species with preference for at least one mature/old-growth white and/or red pine forest community type in Ontario (adapted from Bellhouse and Naylor undated)

Group	Species	Mature Forest	Old-Growth Forest
Amphibians	Spotted Salamander	X	X
	Two-lined Salamander	X	X
	Eastern Redback Salamander	X	X
Birds	Northern Goshawk	X	X
	Red-tailed Hawk	X	X
	Black-billed Cuckoo	X	X
	Great Horned Owl	X	X
	Northern Saw-whet Owl	X	X
	Yellow-bellied Sapsucker	X	X
	Downy Woodpecker	X	X
	Pileated Woodpecker		X
	American Crow	X	X
	Red-breasted Nuthatch	X	X
	White-breasted Nuthatch	X	X
	Blue-gray Gnatcatcher	X	X
	Swainson's Thrush	X	X
	Cedar Waxwing	X	X
	Solitary Vireo	X	X
	Warbling Vireo	X	X
	Northern Parula	X	X
	Oven Bird	X	X
	Northern Waterthrush	X	X
	Red Crossbill	X	X
	White-winged Crossbill	X	X
Mammals	Little Brown Myotis	X	X
	Small-footed Bat	X	X
	Silver-haired Bat	X	X
	Eastern Pipistrelle	X	X
	Big Brown Bat	X	X
	Southern Flying Squirrel	X	X
	Northern Flying Squirrel	X	X
	Southern Red-backed Vole	X	X
	Marten	X	X
	Lynx	X	X
	Bobcat	X	X

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