(A) HISTORIC FOREST CONDITION

SUPPLEMENTARY DOCUMENTATION

BANCROFT MINDEN FOREST 2021-31 FMP Prepared by: Julie Antler, BMFC

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1 GEOLOGY AND SOILS

The underlying geology of the Bancroft Minden Forest (BMF) Management Unit is composed of the Precambium shield. The area is located within the southern Ontario segment of the Grenville province and is commonly referred to as the “Bancroft shear zone”. In general, the area is dominated by bedrock-controlled hills and ridges. This geology is attributed to the glacial activity which occurred approximately 15,000 years ago when Ontario experienced the retreat of the final ice age. This era experienced the mass melt of the glaciers, which in turn created large lakes. The lakes drained into the oceans, causing mass movement of soils within the flowing water. Also, a northwest-directed continental collision formed an ancient mountain chain stretching through Parry Sound, Haliburton, Bancroft, Pembroke, and the Gatineau Hills of Quebec. Soils in this area are typically thin with exposed bedrock and rock-outcrops being a commonality due to glacial advance and retreat. However, large boulder rocks were too heavy to be moved through the water, which has resulted in the bedrock topography that is currently seen in parts of this forest. Subsequently, most of the area is covered with rugged terrain to include a variety of aspects, slope positions, drainage patterns, moisture regimes, soil depths, and soil textures. The variety of geology, soils, climate, and topography poses both planning and operational challenges for forest management within the Bancroft Minden Forest.

Ground moraine, or water worked till, is the most common deposit with localized sand and gravel outwash occurring in areas where meltwaters flowed. Other deposits resulting from meltwater flow can include eskers, drumlins, kames, kame terraces, and end moraines. Basal till in the Bancroft area is a stony, silty, sand to sand mixture that is referred to as the Faraday till. Large boulders or bedrock are often found within the till. In general, the highland areas contain very shallow drift, whereas lowland deposits can exceed 73 m. Drift depth in the highland areas is dependant on the presence of drumlinoid ridges or meltwater deposits along valleys. In contrast, lowland deposits are mainly formed through meltwater outwash. Well developed outwash deposits are found along the major river valleys; the York and Little Mississippi.

In general, soil in the area is not conducive to agriculture. This is due to the very stony nature of the soil and bedrock. In addition to naturally low levels of fertility, the soil is better suited for forestry. Present-day agriculture is only found on modern alluvium. Other features of the BMF Management Unit include eskers near Clarke Lake, Rutledge Lake, and Graphite, along with kame terrace deposits north of Boulter. These are examples of glaciofluvial deposits and features which are common in the area.

2 HISTORICAL USE OF FOREST RESOURCES

2.1 PRE-EUROPEAN SETTLEMENT

Prior to the arrival of Europeans, the land, forests, and waters of the central Ontario region, including the Bancroft Minden Forest, were home to the local Aboriginal people. The resources of the area provided all the necessities of life and helped shape the spiritual and cultural identity of its people. Most of the area in the Bancroft Minden Forest is the traditional lands of the Anishinaabe peoples, more specifically the Algonquin and Huron nations. In 1638, the Iroquois tribes from up-state New York invaded Ontario and decimated the Huron tribe. However, the Iroquois did not stay in the area for long. Consequently, the Chippewa and Mississauga's from the Blind River/Sault Ste. Marie area moved and settled along the Trent-Severn.

Forests were used as a primary source of food, shelter, and cooking fuel. Fire was used to improve forest conditions and retain small clearings for farming. Small trees were harvested using polished stone axes, while larger trees were girdled. Tree products were common resources used by Aboriginal people. For canoes, birch bark was used for covering, tree roots for threading, and cedar for ribbing. Food was stored in bark casks. Longhouses and wigwam homes were built from pole frames and bark coverings. Cedar, tamarack, or white pine was used to form the frames of longhouses while elm bark was used as a covering. In contrast, wigwams were covered with woven mats and sheets of birch bark.

When the land was no longer plentiful, or distances to resources was too far, the villages moved. Fields would be abandoned, and these lands would support forest stands in various successional stages. Most of the 'virgin' or 'pristine' pine forests perceived by the settlers originated from the Aboriginal population 200 years earlier. It is believed that a combination of climatic and anthropogenic factors most likely resulted in the development of the forests viewed prior to European settlement.

2.2 POST EUROPEAN SETTLEMENT

2.2.1 LAND TENURE

Although European "discovery" of the province of Ontario began in the 17th century, it wasn't until the 1850s that land within the Bancroft Minden Forest was surveyed. In 1853, the Legislative Assembly of the Colony of Canada passed the Public Lands Act. This Act formalized the promise of land in central and eastern Ontario to settlers. Settlers were granted 100 acre lots for free under the conditions to clear and cultivate 12 acres of land in addition to building a home. To provide access to the land grants, more than 1,600 kilometers of roads were built. In eastern Ontario, colonization roads include Peterson Road, Hastings Road, Burleigh Road, Bobcaygeon Road, Monk Road, and Mississippi Road (Figure 1).

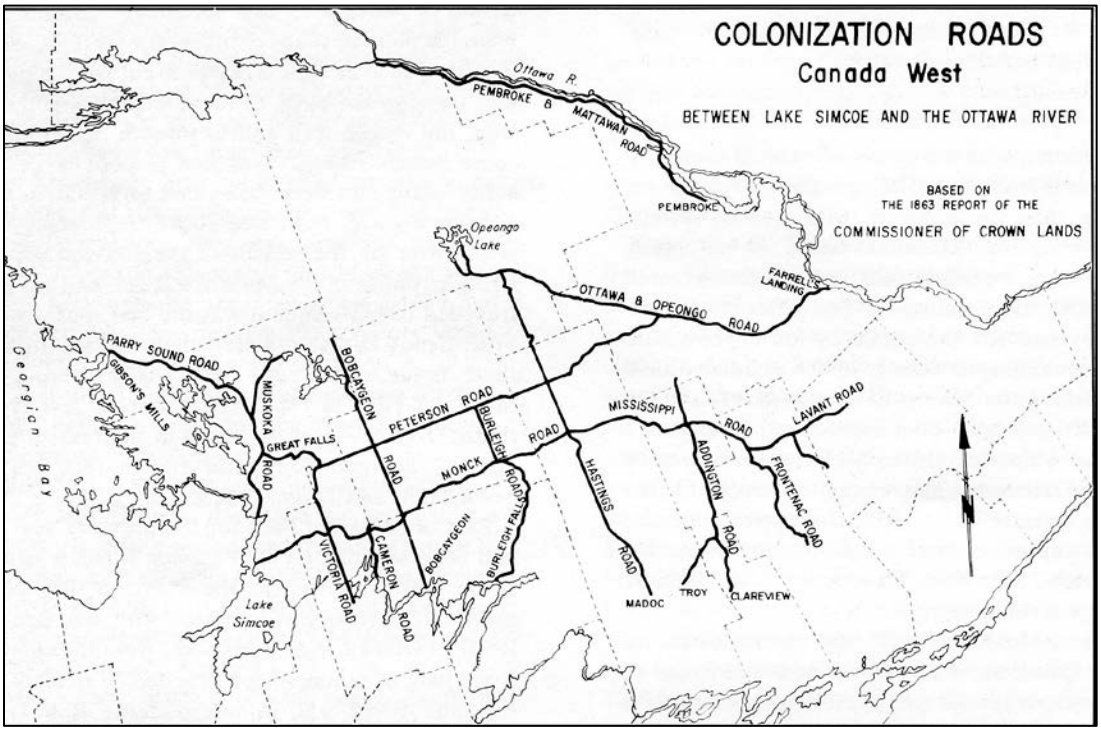

Figure 1. Colonization roads between Lake Simcoe and the Ottawa River by 1863. Source: Spragge 1957.

The focus at the time was on land, consequently, townships with fertile soil were more densely populated. In their efforts to grow crops, early settlers cleared much of the forested land. However, poor soil conditions inhibited the growth of agricultural crops, causing settlers to abandon the area. During the following decades, the previously cleared farmland reverted to forests once again. Many settlers who remained turned to logging, working for sawmillers, or cutting and selling pine to the sawmillers from their own lands to supplement their sustenance farming.

2.3 USE OF TIMBER RESOURCES

2.3.1 LOGGING OR CLEARING OF PINE FORESTS, 1800'S TO EARLY 1900'S

Prior to the early 1900s the area that is now the Bancroft-Minden Forest was managed heavily for pine. Logging mostly occurred during the winter months. Trees were notched by axe and felled by a crosscut saw. The logs were skidded by horse to skidways and piled onto sleighs. Horse-drawn sleighs, piled high with large diameter timber, were transported from the forest to the closest lake or riverbank. The logs were then dumped onto the ice and left to await the spring melt. In the spring, logs would float down the river under the direction of log drivers. In areas where water was naturally slowed, the lumbermen would collect the logs into booms. Horses or steam-powered boats called alligators were used to pull

the booms. The lumbermen also built dams and log chutes to keep the logs moving towards their destined sawmill.

The lumber industry assisted the growth of many towns and was able to support the community with the necessities of life. The Bronson and Weston Lumber Company of Ottawa became established in 1864 and began logging white pine and red pine north of Baptiste Lake. In 1887 a second Ottawa firm, Wm. Mason and Sons entered the Bancroft area. This gave rise to the opening of many other successful lumber companies to include the Gilmour Lumber Company, the Rathburn Company, the Pearce Company, and the Eddy Company. Pine logging left the land full of flammable debris and little to no remaining pine to act as a seed source. Logging debris, settlers' land-clearing fires, and lack of any firefighting capacity lent itself to a period of enormous forest fires that affected thousands of hectares of land. New, lesser valued forests emerged from the ashes.

2.3.2 HARDWOOD MANAGEMENT 1900'S TO PRESENT

The major depletion of southern Ontario's pine forests was probably complete by 1900. The nature of the forest changed from pine-dominated forests to mixed hardwoods. Consequently, the area that is the Bancroft Minden Forest is somewhat unique compared to its neighbouring units in that much of the forest is dominated by tolerant hardwood species. The next era (1908-1945) dubbed the 'chemical wood era' was one that focused on hardwood lumbering for charcoal, wood alcohol, and acetate production. The Standard Chemical Company operated a chemical wood plant at Donald near Haliburton whose remains are still there today. Maple stands were clearcut and sleighed out to rail stops. These forests regenerated well, producing good quality second-growth stands of today. All the hills around Wilberforce, Tory Hill, Haliburton, and every other rail siding along the way were clearcut in this way. Standard Chemical ceased operations in 1946 when a large fire decimated an already dwindling supply of local maple trees. Several of the plant's buildings were destroyed at this time as well.

Logging for high-quality saw and veneer logs did not begin until the 1920s. Many areas were high-graded for removal of the biggest and best trees; a far more damaging practice that results in genetic degradation as diseased and defective trees form the future stand. Hardwood logs, especially yellow birch, were in high demand during the 1940s and 1950s, particularly during the Second World War. Hard maple replaced yellow birch as the most heavily cut species. Prior to 1950, little control was exerted on harvest operations. The Crown Timber Act of 1849, was the first timber licensing system that had been developed in Upper Canada. However, reports delivered by the Department of Lands and Forests found a lack of government control over the volume of wood cut. Nevertheless, the twentieth century witnessed the rise of environmentalism in Ontario. The 1950s marked the beginning of forest management planning at the unit level. Allocations of areas for logging were being scrutinized and monitored more carefully. Experimental harvesting and regeneration programs became more popular. Innovations of mechanized logging equipment contributed towards greater productivity to include a series of heavy machinery including skidders, forwarders, and harvesters.

Timber management became a big focus of the Ministry of Natural Resources (MNR) in Ontario during the 1970s into the '80s. The MNRs Timber Production Policy became a source of staffing, funding, and

production targets. At about the same time, there was an effort to improve scientific knowledge and technology transfer. There was a research station at Swan Lake in Algonquin Park, where Harvey Anderson was researching yellow birch regeneration and where Mac McLean was researching selection management. The Region held annual meetings for government forestry staff and field tours were always part of them.

There was still a shortage of money but the MNR unit foresters of the day had considerable latitude in trying new things. Disjointed ad hoc experimentation is not a proper scientific approach but it did result in advancements in forestry practice right across the region. The declining-stock approach to selection was one of these initiatives. Minden developed the six-class system, trained its tree markers, and focused the selection harvest on salvaging declining stock and keeping AGS. The clearcut-with-standards was used in stands not suited to selection. The crop-tree-release approach continued in even-aged, second-growth polewood stands.

The first Timber Management plans (1990s) describe much of the tolerant hardwood component having poor stocking, recommending they be bypassed as inoperable due to low yields. Where hardwood selection was described, the focus was on improvement cutting, however cutting cycle lengths (some as short as 21 years) were overly optimistic with equally optimistic anticipated annual basal area (BA) increment rates (0.4 m^2/ha/year in the 1990 Minden TMP). Prescriptions were often over-zealous in their efforts of improvement cutting, leaving very low residual BAs.

By 1997, the Ministry of Natural Resources had removed itself entirely from operational silvicultural activities on Crown lands licensed to companies. They also began to withdraw from operational activities on Crown Management Units and initiated the process to convert to Sustainable Forest Licences (SFL's). Under an SFL, industry foresters are responsible for carrying out activities of forest management planning subject to OMNRF regulations and approvals. At this time, negotiations were underway with the Bancroft Minden Forest Company Inc. for a SFL for both the Bancroft and adjoining Minden Crown Management Unit. Since 1998 and prior the issuance of the licence, BMFC had already assumed certain management responsibilities on the Units under agreements with OMNRF. The Management Units were combined and an SFL issued to the Company, effective April 1, 2001. Since 2001 BMFC has developed two forest management plans, one in 2006 and one in 2011.

There is an underlying theme throughout previous management plans whereby single-tree selection is the management tool of choice for tolerant hardwoods and it seems the goal was that all tolerant hardwoods should be managed under this system. Uniform shelterwood cuts were employed in sugar maple dominated stands with inferior growth and quality, but with the goal of 'rehabilitating' them to an uneven-aged condition where they could be converted to management under the selection system.

In the 2011 FMP, it was assumed that a significant portion of Hardwood Uniform Shelterwood (HDus) area was expected to transfer to Hardwood Selection (HDsel) after final removal. The rationale was the shelterwood cut is done with the intention of improving the quality and stocking of AGS trees to pave the way for a selection harvest. The Sustainable Forest Management Model (SFMM) used was not able

to calculate this, however, an assumption was made that approximately 60% of the area in HDus is expected to become selection-quality HDsel in the future.

For selection forest units, the desired improvement of 10% AGS (acceptable growing stock) has been consistently modeled through past FMPs with a long-term target proportion AGS of 80%. Meaning the proportion of AGS of the residual stand must be at least 10% greater than before harvest. Once stands have reached 80% AGS or higher, they are considered fully improved and any additional harvests would have to maintain, but not necessarily improve the proportion of AGS. Subsequently, selection harvest cutting cycles are modeled to be longer at the beginning of the modeling timeframe with the assumption that as tree marking and selection harvest practices continue over time, stand quality and growth rate will increase, shortening the return interval.

In the 2011 FMP, growth rates and yield curves were developed under the assumption that the growth rate is variable from year to year with an average of 0.25m^2/ha/yr with a biological maximum of 32.0 m^2/ha. The plan was modeled so that Term 1 harvest cycle in HDsel is 40 years and decreases to 35 years for Term 2 to 6 with a subsequent decrease to 30 years in Terms 7 through 11, ending in a 25-year return cycle for terms 12-15. These intervals were noted in the 2011 FMP analysis package as being much greater than recommended provincially due to heavy harvesting in the past and in some cases, poor stand quality.

While developing the 2021 FMP, the planning team has focused on the principle of adaptive resource management (or learning while doing). Adaptive management forces the forester to think of science in the sense of process. Local approaches to silviculture have been assessed and adjusted based on the findings from previous forest management plans. The threat of invasive species coupled with poor stand quality has forced the Bancroft Minden Forest Company to investigate different silvicultural treatments. Consequently, irregular shelterwood is being proposed as the most common silvicultural treatment on the landscape.

2.3.3 THE MINING INDUSTRY

Historically, mining activity in the Bancroft Minden Forest was an important industry. Several mines were located within proximity to Bancroft including the Princess sodalite mine, the York River nepheline rocks, Cancrinite hill, and the uranium mines. Many other mines existed nearby at Wilberforce, Tory Hill, Gooderham, Hybla, Craigmont, Quadville, Lyndoch, Madoc, and Madawaska. Bancroft is often referred to as the “Mineral Capital of Canada”. The earliest mining in the area was for iron. In 1880, the Coe Hill iron mine opened its doors and was responsible for the settlement of the village of Coe Hill. Corundum was discovered in 1898, which followed the construction of the Burgess mines. Graphite, molybdenite, beryl, feldspar, nepheline syenite, fluorspar, marble, sodalite, and mica were also mined from neighbouring villages. The largest mineral discovery was that of uranium. Between the years 1956 and 1964, the Bancroft area produced 11, 030, 368 pounds of uranium oxide valued at $105, 503, 124. This industry was created from the development and demand for nuclear weapons during the cold war. By the end of the 1960s, the U.S. Army abandoned the need for foreign uranium, which resulted in the closure of the mines.

3 HISTORICAL NATURAL DISTURBANCES AND SPECIES COMPOSITION

3.1 CHANGES IN FOREST COVER TYPE

Pollen sampling indicates that approximately 11,000 ago (following the last glaciation), much of Ontario was sparsely covered by herb-shrub tundra. Approximately 1,500 years later, the vegetation transformed into a coniferous forest that was primarily composed of pine. At approximately 7,500 ago, the forests were dominated by hemlock, mixed with a variety of hardwoods. The pollen sampling research indicates that at approximately 5,000 ago, many of the hemlock trees had died off, likely due to a rapidly spreading disease. There was a dramatic decrease in tree pollen about 150 years ago as settlers arrived and cleared the land through logging and agriculture. With this decrease in tree pollen, there is a huge increase in ragweed pollen which can be used as a marker across the landscape to show when European settlement began.

Tracking changes and developing an accurate description of the forest cover types after European settlement in the Bancroft Minden Forest is difficult. One method relies on the review of a variety of literature and survey reports conducted within the Bancroft Minden Forest. Of particular, a review of C.D. Howe and J.H. White's report titles the "Trent Watershed Survey" was performed as part of Bancroft Minden's 2006 FMP and was further updated in the current 2021 FMP.

The Trent Watershed Survey refers to areas assessed within Hasting, Peterborough, Victoria and Haliburton Counties that drain into the Trent watershed system. It does not include all of the Townships within the Management Unit but provides a representative picture of what the Bancroft Minden Forest would have looked like at the time. The watershed area studied is approximately 2, 100 square miles (5, 376 km^2). At this time, 1, 000 square miles (2,560 km^2) consisted of pine. The lower townships of the watershed consisted of 2/3 pine or pine/hardwood mixture and 1/3 pure hardwood.

At the time of publication, the upper watershed (which included the townships of Burton, Dudley, Eyre, Guilford, Harburn, Harcourt, and Havelock), was "still covered with a virgin or semi-virgin forest". There was also little to no damage by fire and wasn't heavily logged as the hilly terrain made it difficult to harvest. The report categorized forest types into four broad groupings: Hardwood (not more than 10% conifer in the overstory), Conifer (not more than 10% hardwood in overstory), Mixedwood and Poplar/Birch (dominated by poplar and white birch as a result of burns in cutover areas). The following table shows the breakdown of forest cover types.

Table 1. Forest cover type component of upper townships in the Trent Watershed in 1913.

	Hardwood	Mixed	Conifer	Poplar/Birch
Area (acres)	80, 737	7, 202	77, 605	5, 221
% of Total	47%	4%	45%	3%

In contrast, the area of the lower townships in the watershed had a different forest type breakdown. The lower townships consisted mostly of conifer or conifer mixedwoods with about 33% hardwoods (Table 2). This may be because the area was heavily logged and was more densely populated compared to the townships in the upper watershed. The loss of conifers was also attributed to the fact that most of the forests in the lower watersheds were burnt over several times in most places.

Table 2. Forest cover type component of the lower townships near the Trent Watershed in 1913.

	Hardwood	**Mixedwood/Conifer**
Area (acres)	338, 074	676, 149
% of Total	33%	67%

The area in the poplar/birch forest cover type consisted of trees less than 50 years of age. This cover type resulted from repeated burning, which destroyed any pine regeneration that would have been established on these sites. According to Howe and White, these sites had been “clean cut” to remove all merchantable pine.

More recent research has used land survey records to compare pre-European settlement with the current forest composition in central Ontario (Jackson et al 2000, Leadbitter et al 2002, Quinn 2004, Pinto et al 2008). Their research suggests a similar trend of declining conifer components within the Bancroft Minden Forest. Pinto et al.’s (2008) review of the presettlement forest (mid to late 1800s) area suggests significant decreases in the amount of hemlock, pine, and cedar and increases in poplar, oak, balsam fir, and maple. Leadbitter et al (2002) reviewed the change in forest composition for Central Ontario and found a general increase in maple and a decline in conifer cover since the late 1800s. Reference to a significant decline in pine and hemlock in Algonquin Park since the early 1880s is discussed in Quinn (2004).

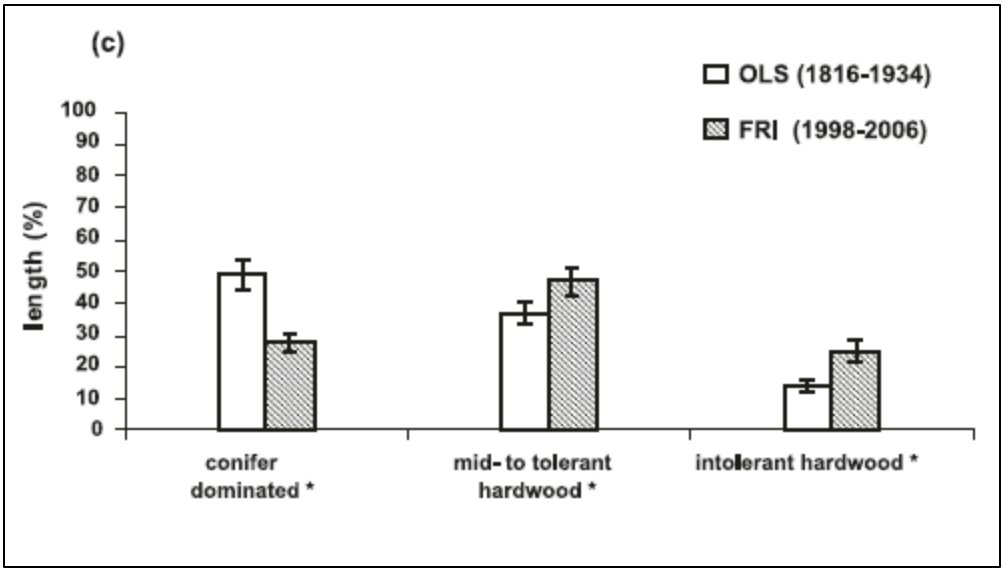

Figure 2. Changes to preindustrial forest tree species composition for the Great Lakes-St Lawrence Region. Source: Pinto et al 2008.

These changes in abundance suggest the occurrence of events that limit the regeneration and growth of conifers while favouring the growth and occurrence of white birch, poplars, and maples (Pinto et al 2008). It is important to acknowledge that, in addition to pressures associated with increased human population, changes to forest types and their disturbance are also a reflection of changing disturbance regimes on the landscape. Changes to the landscape can include timber harvest techniques, forest fire suppression, the nature of shade-tolerant species, windthrow, and insect and disease infestations.

3.2 HISTORICAL NATURAL DISTURBANCES

The forests within the Bancroft Minden Forest Management Unit are continuously subjected to a wide range of factors that affect their composition, growth, and demise. Many of these factors are non-human and uncontrollable. Forest fires, tornado force winds, floods, along with insects and disease are major forms of disturbance within the Bancroft Minden Forest. These events often occur in combination or sequence to create a mosaic of forest types and age classes. The effect of these disturbances is highly variable and depends on the magnitude, intensity, frequency, and duration.

3.2.1 FIRE DISTURBANCE HISTORY AND SUPPRESSION IMPACT

Forest fires resulting from lightning has been critical to the development of forests within the Great Lakes-St Lawrence region. Not only do fires burn forests down, but they also create conditions for regeneration and development of new forests. Different areas burn with different heat intensities due to the variation of site conditions and fuel types. This results in a patchwork of deeply, lightly, or unburned areas. For example, high-intensity crown fires in mature pine forests often result in much higher proportions of deciduous species such as birch and poplars. In contrast, ground fires in polewood

stands often remove the smaller, thinner barked trees to make room for the growth of larger residual trees. This variation contributes to a wide variety of vegetative species and stocking densities. Forest fires in the Bancroft Minden Forest were responsible for the establishment and maintenance of the pine stands and are necessary for the continuation of the red oak, yellow birch, and other shade mid-tolerant hardwoods through the forest unit.

White, red, and jack pine respond positively to low-intensity fires by reducing competition and establishing seed beds, with the thick bark survivors supplying the seed source. Prior to human interference, the frequency of major fires was every 50 to 80 years. Yet, conditions and increase in fuel supply were seldom severe enough for fires to replace entire stands. Less intense fires, like ground fires, occurred more frequently. However, European settlement brought about new ignition sources including locomotives, settlers, and lumbermen. Uncontrolled early logging left debris and slash that fostered extensive wildfires. Most of the area had been burnt over multiple times. In 1913, the Trent Watershed reported several thousand hectares burned. (Figure 3). At this time, red oak was abundant in the landscape. Anthropogenic burning and natural fires favoured the recruitment of northern red oak over sugar maple. Unfortunately, the combination of fire with intensive pine logging left little to no pine seed source. As a result, a higher concentration of broadleaved species succeeded in the forest.

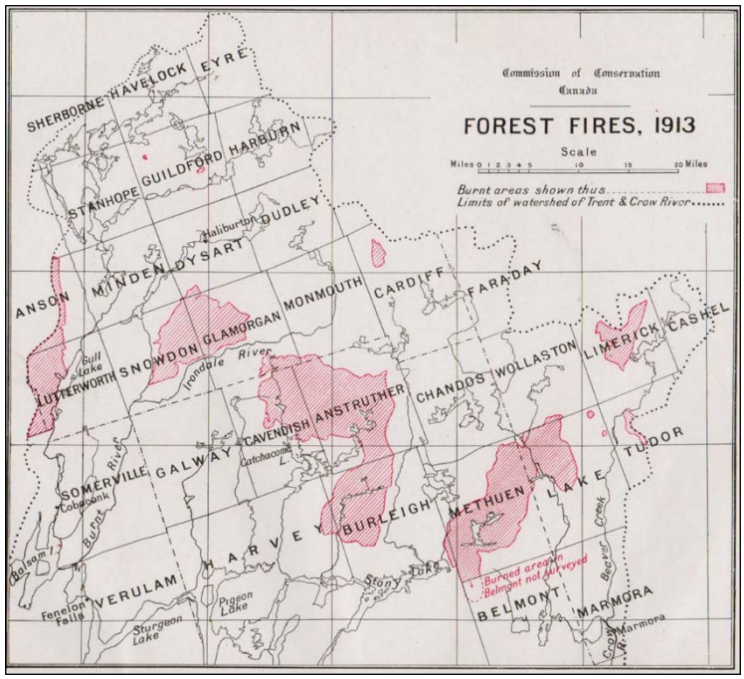

Figure 3. Map of forest fires in the Trent Watershed during 1913. Source: Howe and White 1913.

Fire suppression began in central Ontario around 1920 when the effects of wildfire started to negatively impact human life and property. It wasn't until the 1950s that fire suppression became a major occupation. Bush telephone systems were built for better communication, fire towers were constructed to aid in identifying and locating fires, and the fire ranger system included air services to aid in Ontario's forest fire fighting program.

While fire suppression seemed like an important strategy to protect human interests, the long-term health of fire secluded ecosystems became an important topic of discussion for forest management. The absence of fire has been found to promote the establishment of more shade-tolerant understory species. For example, yellow birch requires exposed mineral soil to establish, and without some sort of disturbance other species would eventually take over. Red oak has also been negatively affected by fire suppression. Sugar maple has been able to grow on drier sites that would have been dominated by a fire-adapted species like red oak. The long term absence of fire may result in the loss of diverse ecosystems and pose a threat to flora and fauna that benefit from the forest renewal initiated by fire.

3.2.2 INSECTS AND DISEASES

The larch sawfly (*Pristiphora erichsonii* Htg.) is one of the earliest known insects to cause significant damage to North American forests. Between 1880 and 1915 the larch sawfly killed most of the mature tamarack, with losses estimated at 20 billion board feet. International trade and movement of people from Europe is largely responsible for the movement of larch sawfly to North America. The main damage is caused by larvae defoliation. Although moderate defoliation reduces growth and weakens the tree, repeated severe infestations over many years often result in dieback and tree mortality. Fortunately, since the 1970s the larch sawfly has remained at an endemic level.

Dutch elm disease (*Ophiostoma ulmi* and *Ophiostoma novo-ulmi*) is a forest vascular disease introduced to Ontario in the 1920s. It is an invasive, highly infectious fungal disease native to Europe and Asia. All native elm trees are susceptible to the fungus, but the greatest impact has been on American elm (*Ulmus americana*) and rock elm (*Ulmus thomasii*). It is estimated that 80% of Ontario's elm trees were killed by the disease by 1980. In addition to the losses originating from the disease, thousands of healthy elms have been removed as part of aggressive efforts to stop the spread. In recent years, monitoring efforts and insecticides have been introduced to assist in the recovery of elm on the landscape.

The forest tent caterpillar (*Malacosoma disstria* Hbn.) is the most common defoliator of broad-leaved species in Ontario. It is a native pest that feeds primarily on sugar maple in the southern forest units. Forest tent caterpillar outbreaks are an expected part of Great Lakes-St Lawrence ecology, and are considered a natural disturbance. Outbreaks occur every 10-12 years and typically last anywhere between three to five years (**Error! Reference source not found.**). Defoliation from these pests will weaken the tree but often will not cause death. Defoliation of the broad leaves results in increased light, precipitation, and temperature to species in the understory. This facilitates the growth of coniferous species into the canopy.

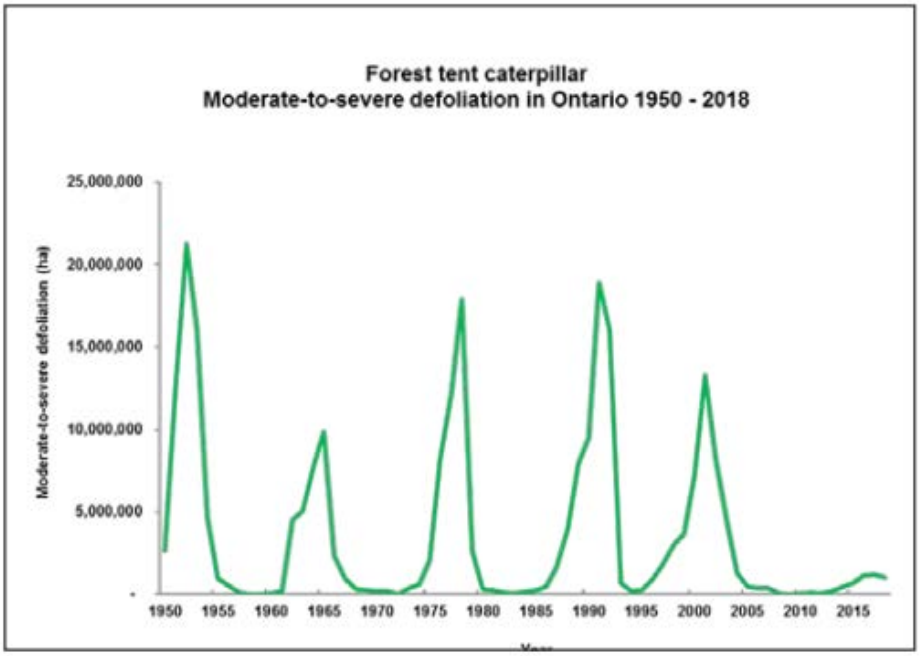

Figure 4. Trend in forest tent caterpillar defoliation in Ontario. Source: OMNRF 2018.

More recent pests and diseases that occur within the Bancroft Minden forest include the emerald ash borer and beech bark disease. Emerald ash borer (*Agrilus planipennis* Fairmaire) is an Asian species that was first detected in 2002. All species of ash in Canada are highly susceptible to the emerald ash borer. Mortality occurs through girdling when the larvae feed between the bark and the sapwood. Since ash is an important species in stream-side habitats, the loss of this species will result in soil erosion along with changes in water temperature and microclimates.

Beech bark disease is a non-native insect-fungus complex caused by the beech scale *Cyptococcus fagisuga* and the canker fungus *Neonectria faginata*. Large trees are the first to become diseased and experience crown dieback. The combined effects of the decay fungi and the insects often result in stem breakage. In 1999, beech bark disease was officially confirmed in Ontario and has since spread throughout most of the species' local range. In 2010, the range of beech bark disease expanded into the Bancroft Minden forest. This resulted in the rapid mortality of old beech trees. Many questions remain on how to best manage for beech bark disease. The long-term effects on Ontario's forests are still unknown.

3.2.3 WINDTHROW

Windthrow is a common form of disturbance in the broadleaved forests of the Great Lakes-St. Lawrence region. Windthrow of individual trees is a chronic form of disturbance, providing small openings for regeneration or allowing young trees to grow more rapidly. However the blowdown of entire stands, often resulting from tornados, result in stem breakage creating an environment conducive

to fires and build-ups of insect populations. After large blowdowns occur, a salvage cut is often performed to reduce fuel loading. Very infrequently, as happened in the Bancroft Minden Forest in 2006, a large tornado occurs, which destroys many trees, particularly the broadleaved, and causes major losses in woodlots and sugar bushes. In the summer of 2006, approximately 4, 000 hectares of forested land and cottage country within the northeast quadrant of the unit were disturbed by 8 separate tornados.

3.3 CHANGES IN POPULATIONS OF FLORA AND FAUNA AND WILDLIFE HABITAT

As mentioned earlier, the history of European settlement, logging, wildfires, and fire suppression changed the forest from predominantly pine-dominated forest to a forest that is dominated by shade-tolerant species. Broad changes in forest composition and age have resulted in simultaneous changes in the wildlife populations inhabiting those forests. The increase in hardwoods and declines in softwoods means that there are fewer conifers in the forest and this could have detrimental effects for species such as white-tailed deer (*Odocoileus virginianus*) and moose (*Alces alces*) that rely on softwoods such as hemlock for food and winter shelter. Changes to bird communities of this forest have also occurred as the forest changed. Certain species, such as Red-shouldered Hawks (*Buteo lineatus*), that prefer hardwood forests may have experienced increases in their breeding or foraging habitat supply. However, populations of other softwood-dependent species may have less breeding habitat which could contribute to a decline in populations because of the significant increase in hardwoods in the region. Habitat is just one factor that influences the increase or decrease in wildlife populations. Consequently, monitoring for changes and impacts on wildlife in the region will need to continue as population monitoring occurs.

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