THE CAYUGA LAKE OLD-GROWTH FOREST LANDSCAPE:
AN UNPROTECTED ENDANGERED ECOSYSTEM IN ALGONQUIN PROVINCIAL PARK, ONTARIO

Preliminary Results Bulletin #6

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SUMMARY

This field survey expands on the findings of Henry and Quinby (2006, 2018) that unprotected old-growth forests in Algonquin Park rank among some of the finest examples of old-growth forest found in Ontario. A pristine old-growth forest exceeding 400 years in age was identified and confirmed by tree coring in the recreation / utilization zone of the Park, west of Cayuga Lake. This tract of old-growth forest is one of four large contiguous tracts near Cayuga Lake. These four tracts total 1,845 ha and less than half is protected.

Following implementation of the 2013 Algonquin Park Amendment, 24,000 ha of old-growth forest over 150 years old remains unprotected in the Park, most of which has never been ground-truthed. We repeat our call for a complete and detailed assessment of old-growth forest throughout the entirety of Algonquin Park and for full protection for identified old-growth forests. This inventory should be undertaken prior to the next review of the Algonquin Park Management Plan and the results should be used to inform allocations in the 2020-2030 Forest Management Plan.

Eastern hemlock is under threat from hemlock woolly adelgid (HWA) across most of its range but has not yet established in Ontario. It appears that Algonquin Park is one of a limited number of climatic refugia where winter temperatures may be below the cold tolerance limits of the adelgid. All eastern hemlock forests in Algonquin, but particularly the old-growth stands, have high conservation value and should be protected from logging.

External characteristics of age in eastern hemlock trees can be used to identify probable old trees and age estimates can be confirmed by tree coring. These characteristics include pronounced bark ridges high on the tree, low trunk taper, trunk sinuosity, and large sometimes-twisting branches.

INTRODUCTION

Our 2006 survey of old-growth forests on the west side of Algonquin Provincial Park (Henry & Quinby 2006) identified numerous old-growth forests in both protected and unprotected zones and made the following recommendation.

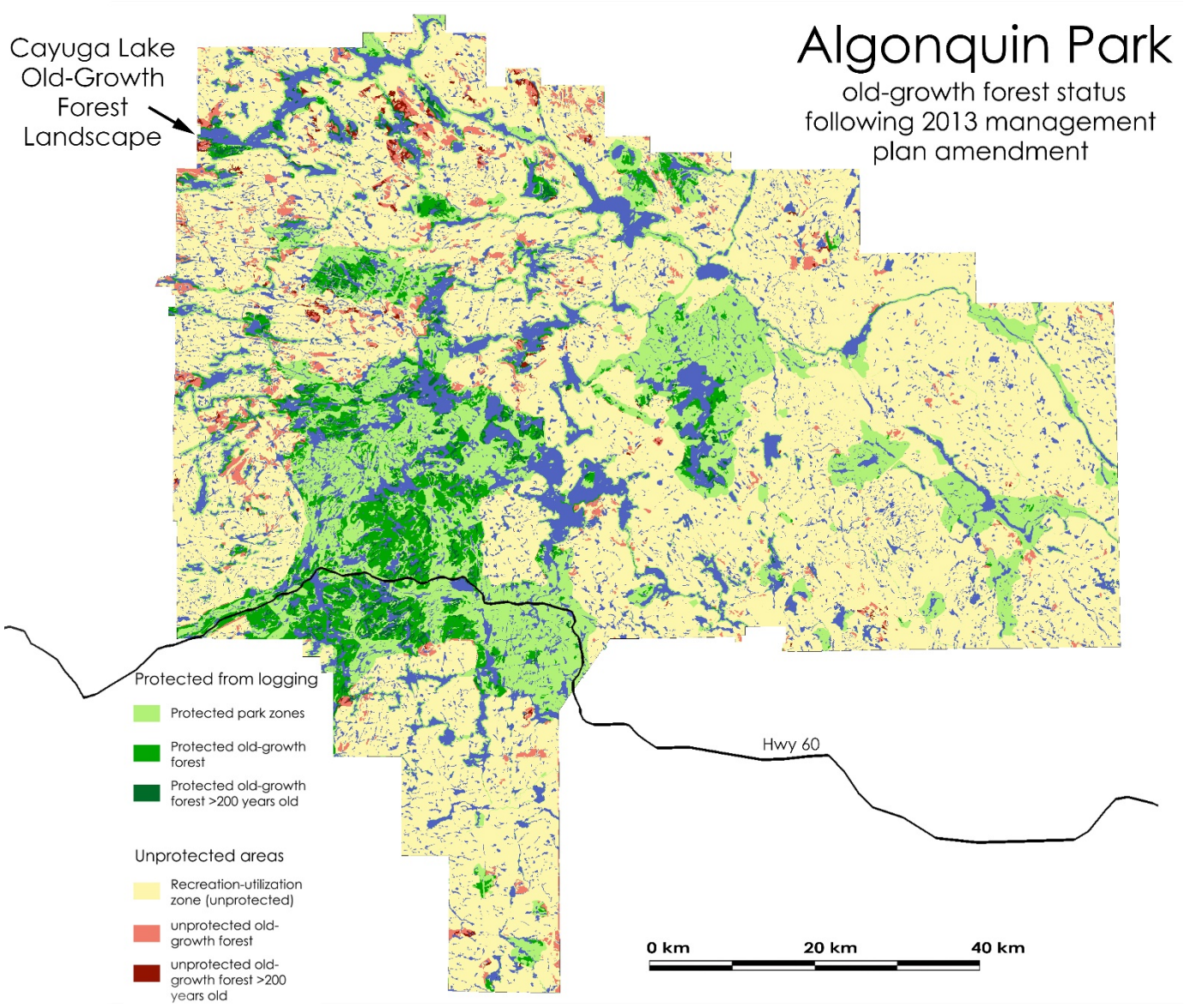
> "To address the lack of adequate information and protection for old-growth forests in Algonquin Park, a detailed assessment of old-growth forests throughout the entirety of the Park should be carried out using digital forest resource inventory data and field inventories."

Although no such inventory was carried out, in 2007 the Ontario Parks Board released the report *Lightening the Ecological Footprint of Logging in Algonquin Provincial Park*, which recommended expansion of the protection zones to include 54% of the Park. Following the release of this report, the Minister of Natural Resources asked the Ontario Parks Board and the Algonquin Forestry Authority (AFA) Board to work together to develop a new set of joint recommendations. The resulting report, the *Joint Proposal for Lightening the Ecological Footprint of Logging in Algonquin*, proposed much less ambitious changes that would expand protection to only 35% of the Park. This proposal was accepted in 2009 and in 2013 it was incorporated into an amendment to the Algonquin Park Management Plan (Ontario Parks 2013).

Due to this policy change, the protected area of the Park increased from 22% to 35%. However, after the 2013 Park amendment, roughly 24,000 ha of old-growth forest over 150 years old remains unprotected in the recreation-utilization zone (Fig. 1). Most of these old-growth forest stands have never been ground-truthed.

For this study, we carried out a rapid field survey of one of these unprotected old-growth forest areas and compared it to the adjacent protected Cayuga Lake Hemlock Nature Reserve (Figs. 2 and 3). We also performed a simple mapping analysis of contiguous old-growth forest tracts in the vicinity of Cayuga Lake.

Figure 1. Old Growth Status Following the 2013 Management Plan Amendment and Study Site Location



MAPPING ANALYSIS

Forest resource inventory maps (FRI; from MNRF) were used to identify four large tracts of contiguous old-growth forest surrounding Cayuga Lake that were over 150 years in age and greater than 150 ha (including the Cayuga Lake Hemlock Nature Reserve). The four tracts total 1,845 ha with only 864 ha (46.8%) currently protected (Fig. 2, Table 1).

Figure 2. Cayuga Lake Old-Growth Forest Landscape

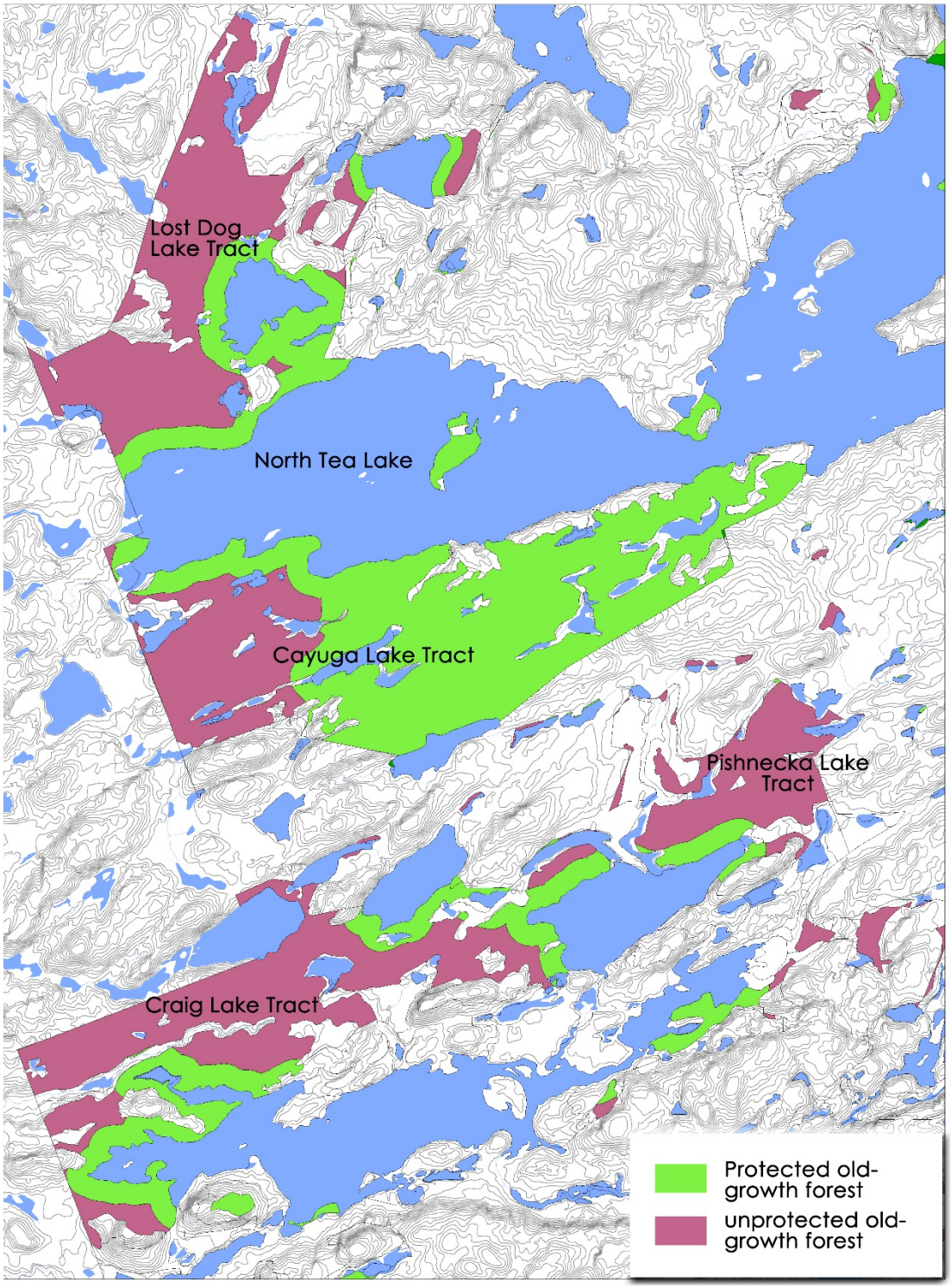


Table 1. Summary of Forest Tracts in the Cayuga Lake Old-Growth Forest Landscape

Old-Growth Contiguous Landscapes	Protected (ha)	Unprotected (ha)	Total (ha)
Cayuga Lake Tract	561	176	737
Pishnecka Lake Tract	18	137	155
Craig Lake Tract	164	339	503
Lost Dog Lake Tract	121	329	450
Total	864 ha / 46.8 %	981 ha / 53.2%	1,845 ha

Although the Pishnecka Lake Tract is the smallest, it is significant because nearly half (74 ha) of the area is over 200 years old (FRI map age). Eighty two percent of the oldest forest in this Tract (64 ha) is unprotected and available for logging. The Cayuga Lake and Lost Dog Lake Tracts are significant for old stands with a high proportion of eastern hemlock, which is a foundation species that is at risk due to the threat that HWA poses across most of its range

There is no record of modern logging in the old-growth forest tracts identified in the mapping analysis, except that most of the Lost Dog Tract was allocated in the 2010-2020 forest management plan and may have already been lost or substantially degraded. This represents nearly a fifth of the old-growth forest surrounding Cayuga Lake that may have been lost within a single ten-year period, highlighting the ongoing urgency of identifying and protecting pristine old-growth forest landscapes in the Park. A field visit to the Cayuga Lake Tract was conducted to confirm the ecological significance of unprotected forest within one of the old growth tracts (Fig. 3). Other tracts were not visited due to time constraints.

FIELD METHODS AND RESULTS

Old-growth characteristics were surveyed along three sets of transects totalling approximately 3.8 km in length within the Cayuga Lake Old-growth Tract in the summer of 2018 (Fig. 3). Along these transects we surveyed for historical stumps and any other evidence of significant human disturbance, and for old-growth forest characteristics including old trees, logs, snags, and pit and mound topography. A total of 10 tree cores were taken within the old-growth forest, eight within unprotected forest and two within the protected Cayuga Lake Nature Reserve.

Ages obtained from tree core analysis ranged from 216 to over 408 years, with the oldest tree found in the unprotected forest west of Cayuga Lake. Old-growth forest characteristics (large old trees, snags and logs) were found throughout the forest, and a small number of cut stumps were found in some areas within both the protected and unprotected areas. All stumps were likely white pine and the state of decay of these stumps suggested they were harvested upwards of 80 years ago. No portion of the old-growth forest had enough stumps to suggest that white pine had been a significant component indicating that the area is largely pristine.

The old-growth characteristics, maximum age, and presence / absence of historical logging in the sampled unprotected forest was equal to or higher in quality than the sampled portion of the protected forest. It is particularly striking that the oldest and most pristine forest occurs in the recreation / utilization zone, which lacks any formal protection. The forests surveyed were well over 200 yrs. old, and our data and evaluation indicate that some of the unprotected forest likely exceeds the maximum age obtained from core analysis (408 years).

Figure 3. Locations of Transects, Tree Cores and Significant Features in the Cayuga Lake Old-growth Tract

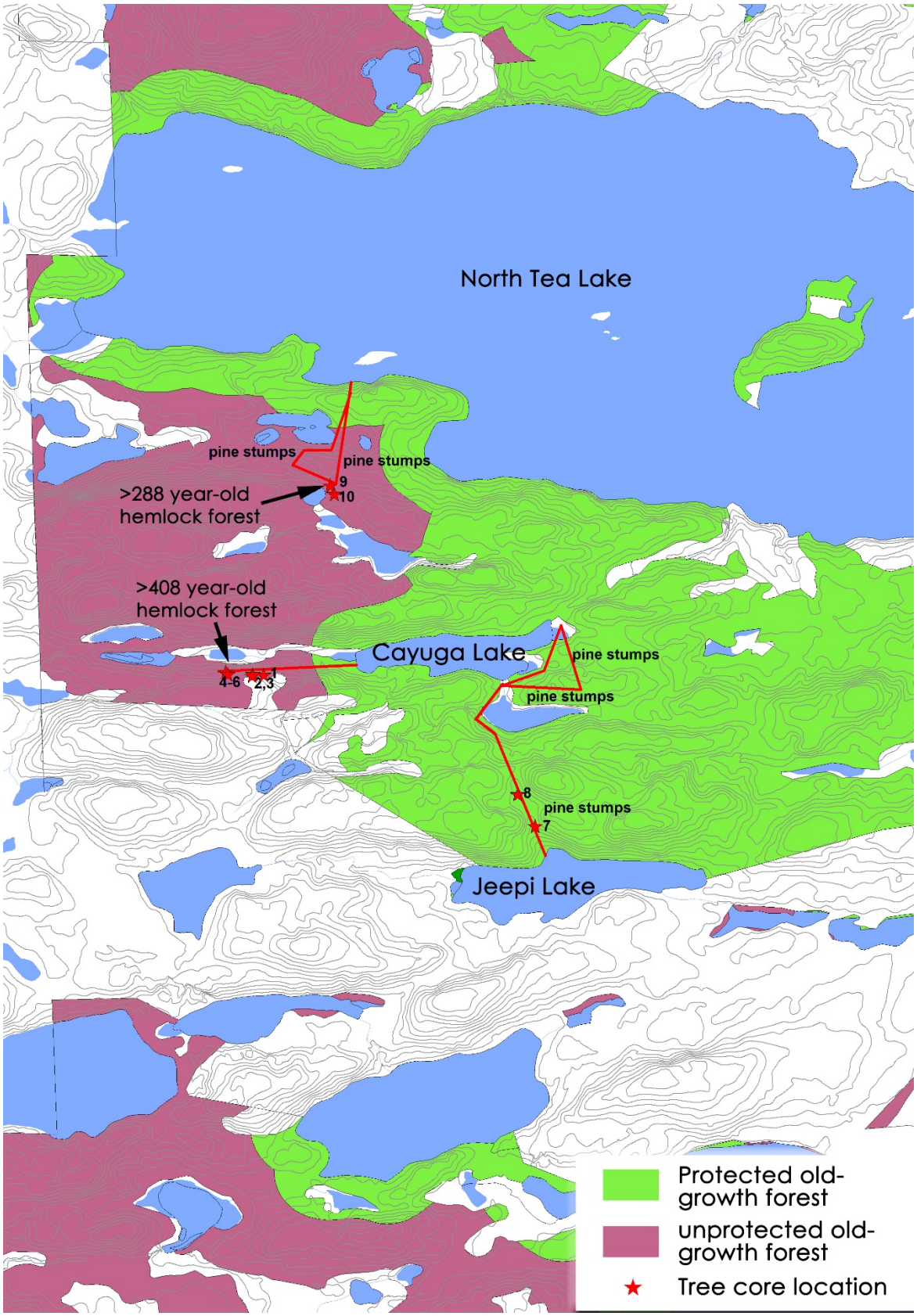


Table 1. Tree Core and Transect Results

NO.	SPECIES	DBH	RING COUNT	AGE	NOTES
1	HEMLOCK	61	194	218	Large, old trees, logs and snags present in the area; no sign of cut stumps; **unprotected**
2	HEMLOCK	73	253	277	Large, old trees, logs and snags present in the area; no sign of cut stumps; **unprotected**
3	HEMLOCK	66	298	322	Large, old trees, logs and snags present in the area; no sign of cut stumps; **unprotected**
4	HEMLOCK	72			Hollow tree with signs of advanced age; 111 rings were counted in 4.5 cm of core (tree 72 cm DBH); another hollow tree nearby had 154 rings in 6.6 cm of core; **unprotected**
5	HEMLOCK	42	309	>333	Missing center; many hemlocks on this ridge have signs of extreme old age; **unprotected**
6	HEMLOCK	51	384	>408	Missed center; many hemlocks on this ridge have signs of extreme old age; this tree was only 51 cm DBH; **unprotected**
7	HEMLOCK	68	211	235	Large, old trees, logs and snags in the area; also numerous historical stumps, likely white pine; protected
8	HEMLOCK	51	325	349	Large, old trees, logs and snags; protected
9	HEMLOCK	58	264	288	Large, old trees, logs and snags; **unprotected**
10	HEMLOCK	59	192	216	Large, old trees, logs and snags; **unprotected**

EXTERNAL CHARACTERISTICS OF OLD HEMLOCK TREES

Old-growth forests have significant biodiversity, genetic diversity, ecosystem services, recreational, educational and scientific values that can accumulate with stand age (Buchert et al. 1997, Mosseler et al. 2003a, Mosseler et al. 2003b, Luyssaert et al. 2008, Shaffer 2009). It is therefore useful to be able to identify old trees / old forests without necessarily using an increment borer. However, diameter is often a poor indicator of age in old-growth forests (Pederson 2010). For example, the three oldest trees in the Cayuga Lake Tract were also the three smallest (Table 1).

To address this, AFER has been compiling information on external characteristics of all the trees that we core. While our sample size is still too small for rigorous analysis, our observations suggest the following for eastern hemlock.

- Eastern hemlock trees over approximately 200 years in age tend to have low trunk taper, and commonly have large upper branches (Figs. 4-7).
- Eastern hemlock trees over approximately 300 years in age often have pronounced bark ridging in the upper 25% of the trunk (Figs. 4 and 6) and sometimes have pronounced curves and twists in upper branches, and/or high trunk sinuosity.
- Eastern hemlock trees growing with a combination of sun exposure and deep soil (lakeshores, some ridge locations) may have exaggerated old-age characteristics and be younger than they appear.

Figure 4. Hemlock >408 Years Old (Tree 6)

Figure 5. A Very Old Hemlock (hollow, Tree 4)

Figure 6. Hemlock, 349 yrs. Old (Tree 8)

Figure 7. Unprotected Forest >400 yrs. Old

Figure 8. Tree Cores from Trees 5 (top) and 6 (bottom)

CONCLUSIONS

This report adds to a growing body of evidence that provincially significant old-growth forest remains unprotected in Algonquin Park, often rivalling (or even surpassing) the quality of forest singled out for protection in Algonquin Park's system of nature reserves. Eastern hemlock forests are of particular concern because they are threatened by HWA across most of its range. The Algonquin Park highlands is one of few regions in the North American range of eastern hemlock that has the potential to remain a climatic refuge against HWA for decades to come (Paradis 2008, Trotter 2010, Henry and Quinby 2018). However, the trend of increasing temperatures may affect the future of this refuge from HWA; this will need to be carefully monitored. It is clear that eastern hemlock forests in the Park have conservation significance from local to international scales.

It is alarming that forests exceeding 400 years in age are still available for logging in Algonquin Park, and that no effort has been made to identify and protect the Park's remaining old-growth forests. Until such an effort is made, no stands identified as old growth on Forest Resource Inventory maps should be allocated in forest management planning, and road development should be avoided near large contiguous tracts of old-growth forest.

We repeat our call for a complete and detailed assessment of old-growth forests throughout the entirety of Algonquin Park using GIS, digital FRI data, and field inventory work (Henry and Quinby 2006). All remaining old-growth forests in the recreation/utilization zone should be identified and protected from logging.

Logging of old-growth forest in Algonquin Park clearly undermines the ecological integrity of the Park and may be addressed in one of two ways: the province could phase out commercial logging in the Park as urged by the Environmental Commissioner of Ontario (ECO 2014), or old-growth forest areas could be properly identified and given additional protection. A review of the Algonquin Park Management Plan is due to occur in 2018 (ECO 2014), and a strategy for properly identifying and protecting remaining old-growth forest in the Park should be a part of this review.

AFER'S MISSION AND GUIDING PRINCIPLES

AFER is a non-profit scientific organization with a mission to carry out research and education that lead to the identification, description and protection of ancient (pristine) forested landscapes, including old-growth forests. The earth-stewardship principles that guide our work include the following.

- Many forest ecosystem types are now endangered. We consider these ecosystems and other ancient forests to be non-renewable resources, which is not consistent with the practice of mining or logging them.
- We consider biodiversity conservation needs at local, provincial, federal and international scales.
- We support the Government of Canada's official commitment to increase protected areas to 17% of the Canadian land base (Government of Canada 2018).
- We support the *New York Declaration on Forests* to end natural forest loss by 2030 (Climate Focus 2015).
- We support the *Tree-SMART Trade* policy initiatives proposed by the Cary Institute of Ecosystem Studies (2017) to eliminate the importation of invasive insects and pathogens and to prevent tree species declines.

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