



MAD Lab Report 2006-25

Evaluating Old Growth Forest at Sixth and Silver Lakes,
Nova Scotia

By

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Abstract

In Nova Scotia, old growth forest is found in only a few scattered small patches. Much of the forested area is found on private land; the protection of Crown land old-growth forest is thus essential. The quality of two patches of old-growth forest found on Bowater Mersey leased land in southwestern Nova Scotia was analyzed using dendrochronological methods. The first forest was found adjacent to Sixth Lake and the second was found next to Silver Lake. At each forest, sampling was conducted at two or three sites to gauge the spatial quality of each site's old growth. Sampling was conducted by extracting 5.1 mm cores using a standard dendrochronology increment boring tool. Tree age was then exacted by counting rings using both a WinDendro™ Image analyzing system and a Velmex light microscope system. Old-growth quality was analyzed based on species distribution, age structure, presence of stumps and presence of coarse woody debris. The stand at Sixth Lake was found to include trees over 300 years old, while trees at Silver Lake contained at least one exceptionally old sample over 400 years. On the basis of these dates, we conclude that both Sixth Lake and Silver Lake are important sites for conservation.

Introduction

The effects of forestry and land clearing over the past 200 years have greatly impacted the forest structure and species distribution in Nova Scotia. One of the most noticeable effects of forestry has been the loss of a diverse age structure. Nova Scotia forests now display an age structure skewed by the high proportion of young trees. In 2001, forests over 100 years old covered only 0.15% of forested area in Nova Scotia (Wilson et al. 2001). With the increasing rate of forestry, the protection of Nova Scotia's remaining old-growth stands is extremely important.

The quality of old growth forest present on Bowater Mersey land at Sixth and Silver Lakes, two lakes in southwestern Nova Scotia, was evaluated using dendrochronology methods by members of the Mount Allison Dendrochronology Laboratory (MAD Lab). The age of selected trees was measured by ring measurement and counting. Based on the Nova Scotia Interim Old Forest Policy, old-growth forest was defined as being over 125 years. Old-growth quality was also analyzed based on species distribution, age structure, presence of stumps and presence of coarse woody debris. The sample sites were also qualitatively compared to other old-growth forests that were sampled in the summer of 2006 by the MAD Lab. In evaluating the old growth of each site, the ultimate goal was to evaluate the quality of each site as a potential Nova Scotia Protected Area.

Research Methods

At Sixth Lake, three sites were chosen for sampling that best represented the spatial and forest variety. At Silver Lake, only two sites were selected. At each site, sampling was conducted within a 50 metre radius from the center of the central pivot point (Table 1; Figure 1).

The dominant species at each site were sampled using a 5.1 mm increment borer. At each of the sampling sites two cores were taken from four trees for each species. Past MAD Lab sampling in southwestern Nova Scotia had resulted in a number of visual cues for identifying the oldest trees in a stand. The bark colour, lichen presence and type, as well as tree morphology were used to sample what appeared to be the oldest trees at each site. At each of the sample sites, UTM coordinates and elevation were also recorded (Table 1).

Table 1: Location of the central pivot points at the Sixth and Silver Lake Sampling sites.

| Site | UTM Zone | Easting | Northing | Elevation (m asl) |
|---------------|----------|---------|----------|-------------------|
| MAD-DEL-1 | 20 T | 324573 | 4888036 | 256 |
| MAD-DEL-2 | 20 T | 324647 | 4888349 | 119 |
| MAD-DEL-3 | 20 T | 324565 | 4888829 | 102 |
| MAD-DEL-3-OLD | 20 T | 324517 | 4888825 | 82 |
| MAD-DEL-4 | 20 T | 322188 | 4886666 | 107 |
| MAD-DEL-5 | 20 T | 322038 | 4887105 | 95 |



Figure 1: Spatial distribution of the sampling points at Sixth and Silver Lakes.

At the third site, MAD-DEL-3, unusually old eastern hemlock, (*Tsuga canadensis*) were found. At this site, it was thought that the stand would possibly be able to extend the MAD Lab *T. canadensis* chronologies for southwestern Nova Scotia, so the sample size from MAD-DEL-3 is larger. To extract representative information about the environment in which a stand of trees is growing, standard dendrochronology practices dictate that a sample size of a minimum of twenty trees should be collected, and so that number was sampled from this site. UTM coordinates for the center of this patch of old growth were taken and the label MAD-DEL-3-OLD was applied.

The samples were transported back to the MAD Lab where each of the cores was then glued into a slotted mounting board. The cores were sanded flat and polished to a 600 grade grit. The cores were then scanned into a computer system at 800 dpi and a ring-width analysis was conducted using a WinDendro™ Image analyzing system. Tree cores that exhibited very small annual rings were measured using a Velmex light microscope system with a resolution of up to 63X.

Observations

SIXTH LAKE

MAD-DEL-1 Field Notes:

The site was an even aged stand co-dominated by red spruce, *Picea rubens*, and eastern hemlock, *Tsuga canadensis*. A few scattered young white pine, *Pinus strobus*, were also present, field sampling suggested that the pine were all less than 50 years old. The red spruce and eastern hemlock were estimated to be about 100 years \pm 15 years. Coarse woody debris, mostly in the form of a few fallen trees, was also present on the site.

MAD-DEL-2 Field Notes:

MAD-DEL-2 was eastern hemlock dominated with red spruce, yellow birch, *Betula alleghaniensis*, and red maple, *Acer rubrum*, interspersed at the site. The oldest hemlock at the site was recorded at roughly 250 years old. The red spruce was estimated to be about 90 years old. Many of the older hemlocks sampled were slightly rotten at the pith. Both red spruce and hemlock saplings were abundant.

MAD-DEL-3 Field Notes:

The site was red spruce dominated. Field estimates suggested that these trees were about 100-150 years old. Although spruce dominated, scattered hemlocks were also found. To extend MAD Lab chronologies, twenty hemlocks were sampled. Not all of the hemlocks were found within 50 m of the MAD-DEL-3 point. The hemlocks sampled were clustered around the point MAD-DEL-3-OLD. The hemlocks were very small in diameter in comparison to other old-growth eastern hemlock sampled by the MAD Lab in Nova Scotia (Figure 2), signifying that they had been growing in shaded environments as non-dominant trees for most of their lives. The tree tops of many of the hemlocks were broken off. Old stumps were also found throughout the site, indicating probable logging in the past (Figure 3).

SILVER LAKE

MAD-DEL-4 Field Notes:

The MAD-DEL-4 site was eastern hemlock dominated. Field estimates suggested the oldest hemlock were about 300 years old. A few white pine were also present, field sampling revealed these trees were very young, less than 50 years old. More coarse woody debris was present in the form of small windblown trees; no stumps were found.



Figure 2: Sampling old growth eastern hemlock at MAD-DEL-3-OLD. Note the small diameter of the tree being sampled.



Figure 3: An old stump found at the MAD-DEL-3 site.

MAD-DEL-5 Field Notes:

This site was also eastern hemlock dominated, but red spruce trees were still fairly common. Dead woody debris was evident. The hemlocks were estimated to be between

200 and 250 years old, but many were rotten in the pith. The in-field age estimates of the red spruce suggested the trees were less than 150 years old.

Lab Results and Discussion

P. rubens has been found to grow up to 445 years in the Maritimes (Pederson 2006). In southwestern Nova Scotia, MAD Lab sampling at Panuke Lake Nature Reserve has created chronologies for red spruce extending to 204 years. Out of the 12 trees sampled at Sixth Lake, only one of the trees would qualify as old-growth under the Nova Scotia Interim Old Forest Policy (see Appendices A, B, C). Most of the trees were dated to be between 90 and 115 years old. Thus the red spruce stand at Sixth Lake cannot be classified as an old growth forest. The predominance of young trees, even age structure and the various stumps found at Sixth Lake suggests there was likely forestry activity at the site about 100 to 125 years ago.

The *T. canadensis* sampled at Sixth Lake was found to be much older than the *P. rubens*. At MAD-DEL-1, the ages fell between 104 and 206 years (Appendix D). Again at MAD-DEL-2, the eastern hemlock was found to be older than the red spruce, with tree ring counts between 100 and 276 (Appendix E). The older hemlock suggests that the historical logging practices included the selective cutting of red spruce, leaving the hemlock to continue to grow.

The dendrochronological analysis of the group of very old hemlock found at MAD-DEL-3-OLD revealed a varied old growth age structure. Of the 34 total cores analyzed, 19 were over 250 years old (Figure 5).

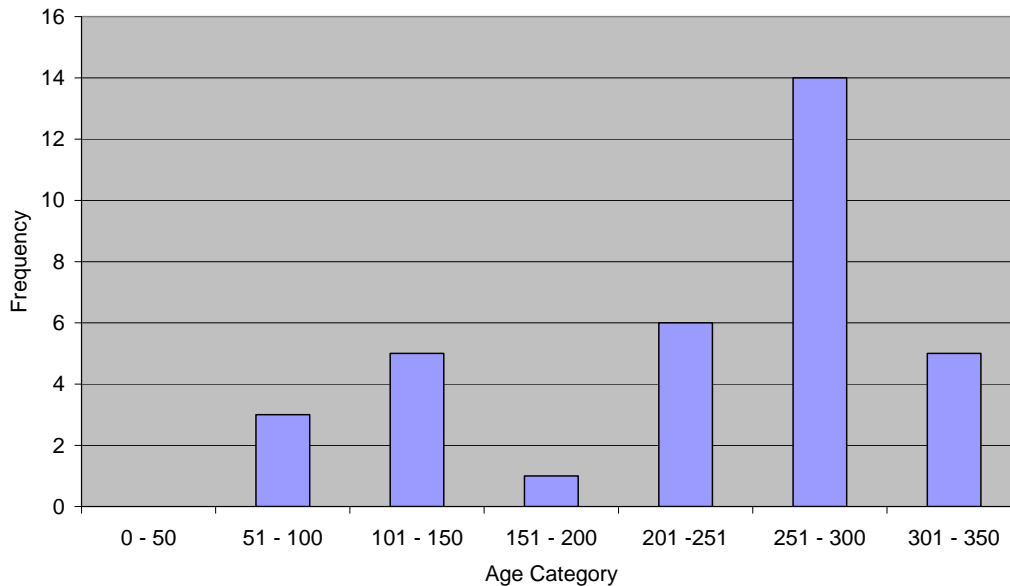


Figure 5: The age distribution of *Tsuga canadensis* at MAD-DEL-3OLD.

Past MAD Lab work in southwestern Nova Scotia had resulted in *T. canadensis* chronologies that had extend only 237 years. Historically, the life span of hemlock in Nova Scotia is estimated to be up to 800 years (Wilson et al 2001) however the oldest eastern hemlock ever recorded in the world is only 555 years old (Pederson 2006). The oldest tree sampled at Sixth Lake was found to be 337 years old. It is likely that this stand of hemlock survived past logging efforts because of the past low economic values of eastern hemlock wood and the extremely small diameters of the trees.

At Silver Lake, only hemlock was sampled because it was found to be the dominate species throughout the plot. The *T. canadensis* sampled showed ring counts between 167 years and 418 years (Appendices E, F). The past record for the oldest confirmed (crossdated) tree in Nova Scotia, was a sample of eastern hemlock collected in southwestern Nova Scotia that dated to 410 years old (Cook 1985). Therefore the sample aged in this study (MAD Lab 2006-25), and left to continue to grow at this site, is the oldest confirmed tree ever recorded in Nova Scotia. Again according to NS Department of Natural Resources standards, Silver Lake classifies as an old-growth eastern hemlock forest.

MAD Lab sampling conducted in the summer of 2006, suggested that *T. canadensis* was one of the more common old-growth conifer species existing in southwestern Nova Scotia; 8 of 9 sites sampled contained old-growth hemlock. However, the *T. canadensis* in Nova Scotia has declined by more than 50% since 1958 (Wilson et al 2001). It has also been concluded that the economic value of hemlock, once previously considered to be low because of its coarse grain and tendency towards splintering, is currently increasing as a result of the effects of spruce budworm on more common forestry species (Quimby 1995). While past MAD Lab sampling had identified many sites of old-growth hemlock in southwestern Nova Scotia, both Sixth Lake and Silver Lake contain much older trees. Forests of this age are rare in Nova Scotia. Both the hemlock stands at Silver Lake and at Sixth Lake, represent important conservation sites.

Conclusion

Sixth Lake and Silver Lake both possess stands of trees that would be classified as old growth under the Nova Scotia Interim Old Forest Policy. The eastern hemlock stand at Sixth Lake was found to include trees over 300 years old. Analysis of Silver Lake showed that there was at least one hemlock exceptionally old, over 400 years. Old growth in Nova Scotia exists today in only few scattered small patches. On this basis, it should be concluded that both Sixth Lake and Silver Lake are important sites for conservation.

Literature Cited

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Appendices

Appendix A: Red spruce ages from the MAD-DEL-1 site at Sixth Lake

| Core | Age |
|-------------|------------|
| 06ASL901A | 106 |
| 06ASL901B | 102 |
| 06ASL902A | 98 |
| 06ASL902B | 110 |
| 06ASL903A | 107 |
| 06ASL903B | 115 |
| 06ASL904A | 101 |
| 06ASL904B | 116 |

Appendix B: Red spruce ages from the MAD-DEL-2 site at Sixth Lake

| Core | Age |
|-------------|------------|
| 06ASL941A | 93 |
| 06ASL941B | 105 |
| 06ASL942A | 107 |
| 06ASL942B | 98 |
| 06ASL943A | 107 |
| 06ASL943B | 114 |
| 06ASL944A | 111 |
| 06ASL944B | 89 |

Appendix C: Red spruce ages from the MAD-DEL-3 site at Sixth Lake

| Core | Age |
|-------------|------------|
| 06ASL961A | 133 |
| 06ASL961B | 120 |
| 06ASL962A | 112 |
| 06ASL962B | 119 |
| 06ASL963A | 120 |
| 06ASL963B | 110 |
| 06ASL964A | 112 |
| 06ASL964B | 111 |

Appendix D: Eastern hemlock ages from the MAD-DEL-1 site at Sixth Lake

| Core | Age |
|-------------|------------|
| 06ASL801A | 101 |
| 06ASL801B | 101 |
| 06ASL802A | 110 |
| 06ASL802B | 108 |
| 06ASL803A | 161 |
| 06ASL803B | 206 |
| 06ASL804A | 98 |
| 06ASL804B | 104 |

Appendix E: Eastern hemlock ages from the MAD-DEL-2 site at Sixth Lake

| Core | Age |
|-------------|------------|
| 06ASL841A | 276 |
| 06ASL841B | 202 |
| 06ASL842A | 101 |
| 06ASL842B | 100 |
| 06ASL843A | 113 |
| 06ASL843B | 127 |
| 06ASL844A | 271 |
| 06ASL844B | 237 |

Appendix F: Eastern hemlock ages from the MAD-DEL-4 site at Silver Lake

| Core | Age |
|-------------|------------|
| 06AUL801A | 279 |
| 06AUL801B | 268 |
| 06AUL802A | 252 |
| 06AUL802B | 182 |
| 06AUL803A | 308 |
| 06AUL803B | 282 |
| 06AUL804A | 167 |
| 06AUL804B | 150 |

Appendix G: Eastern hemlock ages from the MAD-DEL-5 site at Silver Lake

| Core | Age |
|-------------|------------|
| 06AUL831A | 418 |
| 06AUL831B | 275 |
| 06AUL832A | 207 |
| 06AUL832B | 162 |
| 06AUL833A | 285 |
| 06AUL833B | 303 |
| 06AUL834A | 251 |
| 06AUL834B | 262 |

Appendix H: Eastern hemlock ages from the MAD-DEL-3OLD site at Sixth Lake

| Core | Age |
|-------------|------------|
| 06ATL801A | 301 |
| 06ATL801B | 198 |
| 06ATL802A | 277 |
| 06ATL802B | 274 |
| 06ATL803A | 309 |
| 06ATL803B | 285 |
| 06ATL805A | 256 |
| 06ATL805B | 286 |
| 06ATL806A | 227 |
| 06ATL806B | 222 |

| | |
|-----------|-----|
| 06ATL807A | 231 |
| 06ATL807B | 106 |
| 06ATL808A | 109 |
| 06ATL808B | 109 |
| 06ATL809A | 280 |
| 06ATL809B | 307 |
| 06ATL810A | 259 |
| 06ATL810B | 91 |
| 06ATL811A | 250 |
| 06ATL811B | 255 |
| 06ATL812A | 270 |
| 06ATL812B | 241 |
| 06ATL813A | 99 |
| 06ATL813B | 108 |
| 06ATL814A | 314 |
| 06ATL814B | 270 |
| 06ATL815A | 335 |
| 06ATL815B | 284 |
| 06ATL816A | 279 |
| 06ATL816B | 222 |
| 06ATL817A | 213 |
| 06ATL817B | 282 |
| 06ATL818A | 105 |
| 06ATL818B | 78 |