NBDNR Tolerant Hardwood Dendrochronological Analysis

Amanda B. Young, Ben Phillips, and Colin P. Laroque
MAD Lab Report 2010-06
Mount Allison University, Department of Geography
Mount Allison Dendrochronology Lab

NBDNR Tolerant Hardwood Dendrochronological Analysis

Table of Contents

Abstract

The NBDNR cored 15 locations of tolerant hardwood post thinning stands during the fall of 2009. Cores were taken from 638 trees resulting in 1747 cores. Of these cores 88.3% (1544 cores) of the cores were able to be measured, the other 11.7% (203 cores) of the cores were not measured. Cores that were not able to be measured were a result of cores with broken and missing ends. The average measurements of all the cores for the first 5 years are 7.09 mm, first 10 years 14.67 mm, and first 15 years 20.91 mm. The dominate species of trees cored are sugar maple (59.99%), yellow birch (15.91%) and beech (11.79%). The species that has the largest proportion of cores not measured is ironwood (31.6%), followed by red maple (15.4%) and balsam fir (15.0%). Cores were taken from three size classes where 61.9% of the cores are from size class 2. Size class 1 has the highest level of cores not measured (36.9%) followed by size class 2 (13.1%) and size class 3 (5.7%). Future dendrochronological research preformed by the NBDNR could increase the number of measurable cores and better accuracy of measurements through improved field and laboratory methods. In the field, an increased in attentiveness while beginning boring and maintaining borer upkeep will decrease the number of cores with broken ends. In the laboratory cross-dating the cores will identify locally absent rings that cannot be found through simple ring counts.

Introduction

As part of the NBDNR's Tolerant Hardwood Response Project to the thinning of stands, cores were taken from 15 stands (Blocks) from across the province. Before sampling occurred Chris Ward of the NBDNR contacted the MAD Lab for information on coring, labeling and preserving samples. Samples were then collected by two forest technicians in the late summer/fall of 2009. According to the NBDNR sampling strategy, cores were taken primarily from hardwood species in three size class from each stand (class 1 (5.1-9 cm), class 2 (9.1-24 cm), class 3 (>24.1 cm). One core was taken from trees in size class one, while three cores were taken from trees in size class two and three. All cores were taken at breast height. Roughly 2000 cores were supposed to be taken during the sampling period.

Methods

Samples were brought to the MAD Lab in March of 2010 for analysis. Measurements of the most recent 5, 10, and 15 years of growth were requested to be measured. Samples were glued into slotted mounting boards, labeled according to the established sample numbers and set aside to dry. Cores were then sanded with a belt sander using progressively finer sandpaper (120-400 grit). Hand sanding using 400-800 grit sand paper was done to touch up the cores. Using a sliding stage Velmex Measuring System attached to a Nikon SMZ800 continuous zoom 63 power microscope, the rings were measured to the nearest 0.001 mm. Each core was measured from the 2009 to the 1995 ring, encompassing the requested 15 year period. The 2009 ring is identified by being either attached to the bark or showing signs of end wood present. If the 2009 ring was not detectable due to the end being broken up during coring, the core was not measured (Figure 1, Appendix I). Measurements were transferred to an excel spreadsheet where the rings were summed into the periods of 5, 10, and 15 years. These measurements were then inserted into the NBDNR spreadsheet and averaging was preformed for each core. If a core was not measured due to bark end issues, an "x" was placed in the measurement column in the spreadsheet.

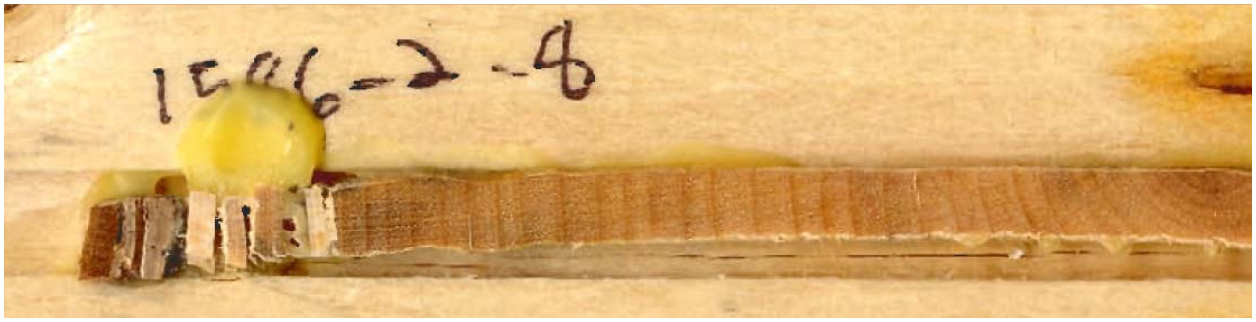


Figure 1. An example (4-08-1586-2-8a) of a core which was too broken up at the beginning to be properly mounted and measured.

Results and Discussion

Cores from each of the 15 stands were measured, for a total of 1747 cores. The number of cores taken from each stand varies from 77 to 162 (Table 1). Species varied from two to six between the stands. The average measurement for the first five years was 7.08 mm (range 4.98 – 9.59 mm), first ten years 14.65 mm (range 10.50 – 19.15 mm), and fifteen years 20.99 mm (range 15.30 – 26.16 mm). The smallest measurements all occurred at stand 4-08-1586 and all the largest measurements occurred at stand 1-01-7545-2.

Not all cores were able to be measured. This was due primarily to the tips of cores being broken and sometimes missing. The number of cores that could not be measured per plot ranged from 0 to 41 and averaged at 13.53 cores per plot. Due to each stand having a different number of cores (average of 116.46), percentages of the number of cores not measured was calculated. The percent of the number of cores not measured ranged from 0 to 29.1%. A total of 203 cores were not able to be measured out of the 1747 total number of cores equating to 11.6% across the entire study (Table 1).

Table 1. Number of species, average first 5 years, average first 10 years, average first 15 years, number of cores not measured, number of cores and the percent of cores not measured for each stand (Block Number).

Block Number	Number of Species	Avg. 5 years	Avg. 10 years	Avg. 15 years	Not Measured	Number of Cores	% cores not measured
1_01_6012_1	3	6.34	13.97	20.28	4	109	3.7%
1_01_6012_2	4	7.60	16.26	24.80	7	77	9.1%
1_01_7545_2	4	9.59	19.15	26.16	9	100	9.0%
2_03_6191	6	6.26	13.48	19.09	22	148	14.9%
4_08_1503	6	6.56	14.43	19.47	22	112	19.6%
4_08_1562_1	2	5.35	12.34	19.18	17	117	14.5%
4_08_1562_2	4	5.68	11.83	17.62	30	127	23.6%
4_08_1586	4	4.98	10.50	15.30	41	141	29.1%
4_08_1608	5	7.71	15.30	18.72	24	162	14.8%
5_10_0221_1	5	7.59	14.89	21.52	5	99	5.1%
5_10_0221_2	4	8.87	17.41	24.35	0	122	0.0%
5_10_0255	4	6.73	15.59	23.46	1	118	0.8%
5_10_2531	3	8.28	17.43	24.92	3	112	2.7%
5_10_8394	6	7.90	15.37	21.99	3	98	3.1%
5_10_8394_2	3	6.74	11.84	18.05	15	105	14.3%

Out of the ten species found throughout the plots, the most common species cored were sugar maple (59.99%), yellow birch (15.91%) and beech (11.79%) (Figure 1). The smallest average measurements for species across the first five (2.76 mm) and ten (7.38 mm) years is white birch, while the smallest average measurement for the 15 year measurement is white spruce (11.08) (Table 2). None of these species has a sample depth greater than 6 cores. The largest measurements come from balsam fir. The largest percent of cores not measured for one species is found in ironwood (31.6%) (Table 2).

Table 2. Average first 5 years, average first 10 years, average first 15 years, number of cores not measured, number of cores and the percent of cores not measured for each species.

Species	Avg. 5 years	Avg. 10 years	Avg. 15 years	Not Measured	Number of Cores	% of Cores not Measured
White Spruce	5.88	8.03	11.08	0	3	0.0%
Red Spruce	7.19	12.78	17.21	5	59	8.5%
Balsam Fir	13.59	23.18	30.19	6	40	15.0%
Red Maple	6.55	13.18	20.32	10	65	15.4%
Sugar Maple	6.32	13.81	20.16	130	1048	12.4%
Yellow Birch	8.49	17.01	24.85	12	278	4.3%
Beech	8.55	16.58	20.49	28	206	13.6%
Ironwood	3.86	8.27	12.60	12	38	31.6%
White Ash	4.80	8.88	11.74	0	4	0.0%
White Birch	2.76	7.38	13.00	0	6	0.0%

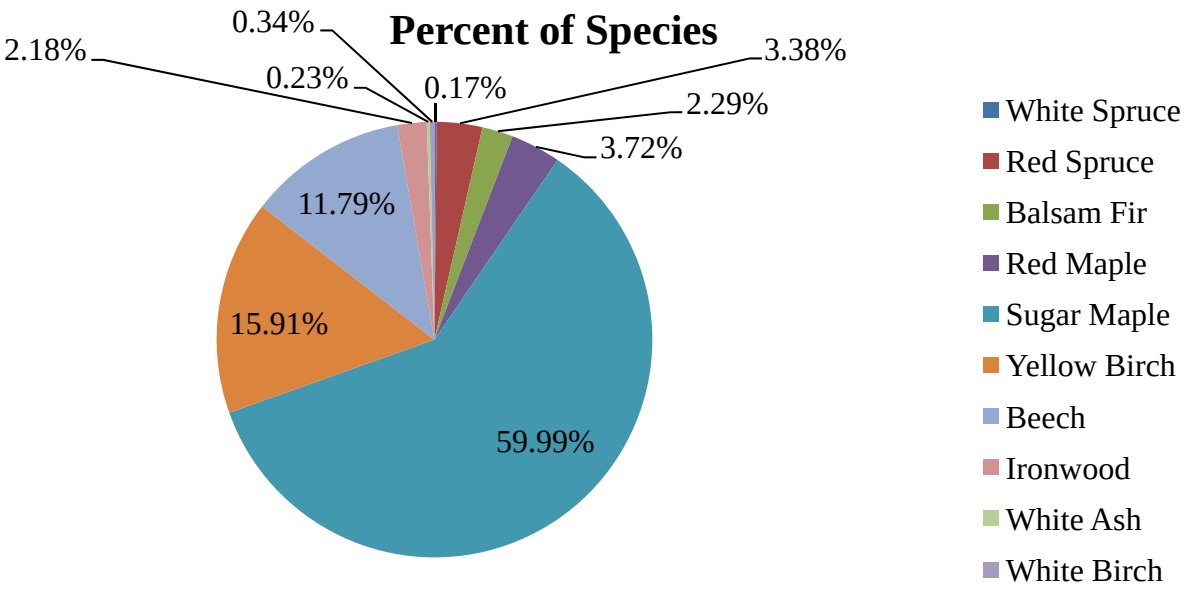


Figure 2. Percent of species found in the 15 stands (blocks) by the number of cores.

Trees that were sampled belong to three size classes. Approximately two thirds of the trees belonged to size class 2 (61.9%), a third to size class 3 (33.8%), and just a small proportion of the trees belong to size class 1 (4.17%) (Figure 3). There are no apparent differences in growth between the three periods by size class. There were differences in the percent of cores that were not able to be cored related to class size. The smaller the size class, the greater number of cores that were not able to be measured (Table 3).

Table 3. Average first 5 years, average first 10 years, average first 15 years, number of cores not measured, number of cores and the percent of cores not measured for each species.

Size Class	Avg. 5 years	Avg. 10 years	Avg. 15 years	Not Measured	Total # of Cores	% Cores not Measured	# of Species
Size Class 1	7.06	16.18	23.37	27	73	36.99%	8
Size Class 2	7.04	14.52	20.27	142	1082	13.12%	10
Size Class 3	7.07	14.42	20.99	34	592	5.74%	7

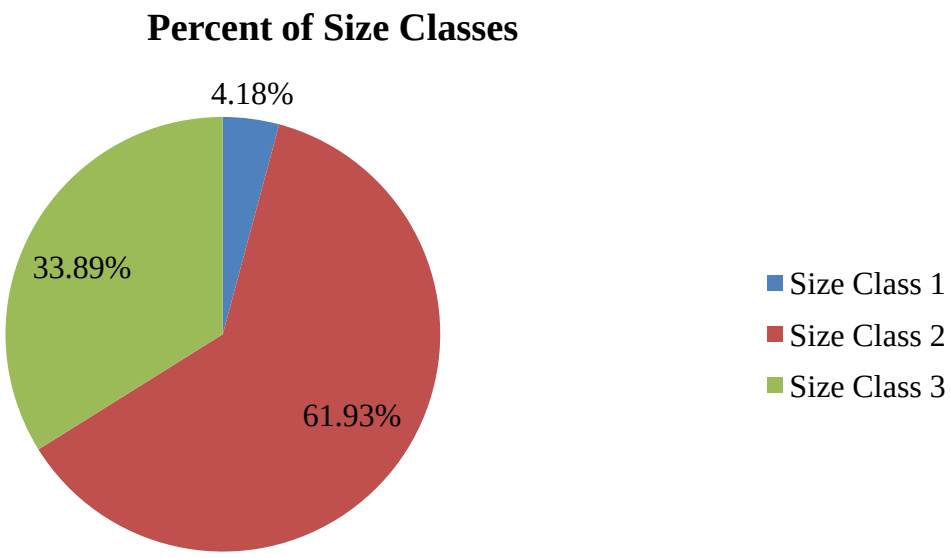


Figure 2. Percent of cores found in each size class found in the 15 stands (blocks).

Conclusions

The NBDNR cored 15 stands of tolerant hardwoods post thinning. Cores were taken from 638 trees resulting in 1747 cores. Of these cores 88.3% (1544 cores) of the cores were able to be measured, the other 11.7% (203 cores) of the cores were not measured. Cores that were not able to be measured were a result of cores with broken and missing ends. The average measurements

of all the cores for the first 5 years are 7.09 mm, first 10 years 14.67 mm, and first 15 years 20.91 mm. The dominate species of trees cored are sugar maple (59.99%), yellow birch (15.91%) and beech (11.79%). The species that has the largest proportion of cores not measured is ironwood (31.6%), followed by red maple (15.4%) and balsam fir (15.0%). Cores were taken from three size classes where 61.9% of the cores are from size class 2. Size class 1 has the highest level of cores not measured (36.9%) followed by size class 2 (13.1%) and size class 3 (5.7%).

Future Research

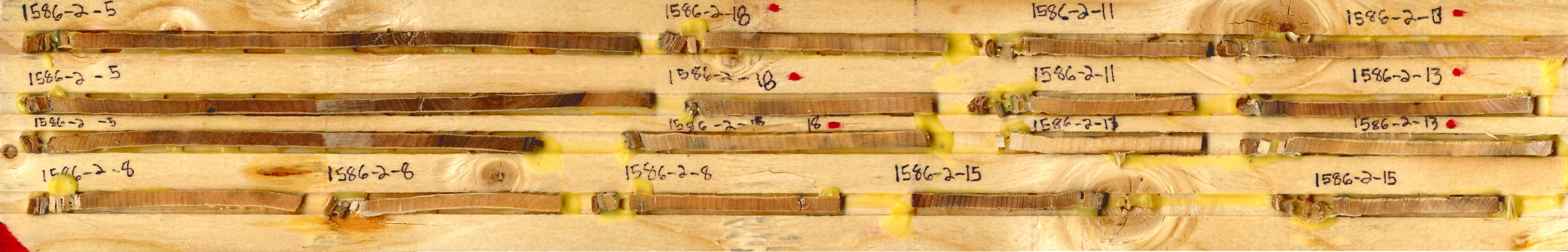
Field techniques

There is much room for improvement in the field techniques if future research by the NBDNR will use dendrochronology again. Improved techniques in the taking of the cores from trees would help greatly in the dendrochronological analysis. Improvements would come from two possible areas. 1) Being more attentive while starting the boring bit. The reason most of the cores that were not measureable, were not able to be measured, was because the ends of the cores were broken or missing (e.g., see Appendix I). Broken ends most commonly occur when the boring bit wobbles while the borer is being started into the tree. Using more pressure and staying attentive to any unnecessary lateral or up and down motions frequently resolves this issue. It has been found that taking the extra time at this critical point in the field sampling, makes the costs of all of the field and lab analysis worthwhile. Lost bark ends while coring hardwoods should be about 1 in 100 cores, and slightly higher in softwoods. 2) Coring tool upkeep. Coring tools wear out, especially on the boring edges of the shaft. Small knicks, and dull edges increase the chances of 'wobble' and 'pop corning' of the cores when sampling is taking place. In short, if the tools are old, or poorly maintained, they should probably be replaced. In these types of cases, more money is spent on trying to get good data, and getting nothing, then if new boring bits were purchased at the start of the project. Associated with this point is extractor design. There have recently been some improvements after a few bad manufacturing years with extractors. Some extractors from 2-3 years ago were manufactured so poorly that they ripped apart more cores while being extracted, then they pulled clean. This was particularly evident with Haglof corers (blue handled corers).

Laboratory techniques

Better measurement numbers could be attained from the cores if they were cross-dated, instead of just having the most recent 15 years measured. This is especially true for species that are susceptible to locally absent rings such as sugar maple. These species have been shown to frequently have missing rings that would not be detected when measured, but would be found through cross-dating.

Appendix I. A board from block 4-08-1586-2. Labels with a red dot indicate the cores that were measurable. All other cores were missing end wood or broken up, and deemed unmeasurable as defined by the project goals.


1586-2-5
1586-2-18
1586-2-11
1586-2-13
1586-2-5
1586-2-18
1586-2-11
1586-2-13
1586-2-5
18
1586-2-13
1586-2-8
1586-2-8
1586-2-8
1586-2-15
1586-2-15