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FOREST RESEARCH REPORT

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BALSAM FIR CHRISTMAS TREE NEEDLE RETENTION VERSUS TIMING OF BUD FLUSH

INTRODUCTION

The Christmas tree industry is an important part of Nova Scotia's economy. In 1990, Nova Scotia producers exported 1.2 million trees, valued at $10.4 million Canadian (Forestry Canada, 1992). To enhance the quality and growth of these trees, the Christmas Tree Council of Nova Scotia[1] has embarked upon a program designed to select genetically superior balsam fir (*Abies balsamea* (L.) Mill.) trees for seed orchard development. One phase of this program involves the selection of trees with late flushing buds. Time of bud flushing is a heritable characteristic (Nienstaedt, 1977), therefore, progeny of late flushers are preferred due to reduced susceptibility to damage by late spring frosts. However, there is a concern that late flushers might exhibit poor post-harvest needle retention. To determine if bud flush time is related to needle retention, a study of harvested early and late flushing balsam fir Christmas trees was carried out during 1991-92.

METHODS

Field Data Collection

Two balsam fir Christmas trees from each of 16 sites were chosen for this study (Figure 1). Except for a minimum of 14 days between bud flush, the two trees selected were similar in traits including needle colour, crown height and width. In addition, both trees were located on similar micro-sites with respect to slope, position on slope, aspect, soil and drainage (Appendix I). Following measurement of the site factors, a sample of the current years needles was removed from the mid-crown of each tree and sent to the Nova Scotia Department of Agriculture and Marketing in Truro for nutrient analysis.

All trees were harvested November 14 or 15,

[1] The Christmas Tree Council of Nova Scotia is an association of private Christmas tree producers/exporters (including 5 regional Christmas tree associations), which provides direction to the industry on issues of general concern.

Canada

Nova Scotia

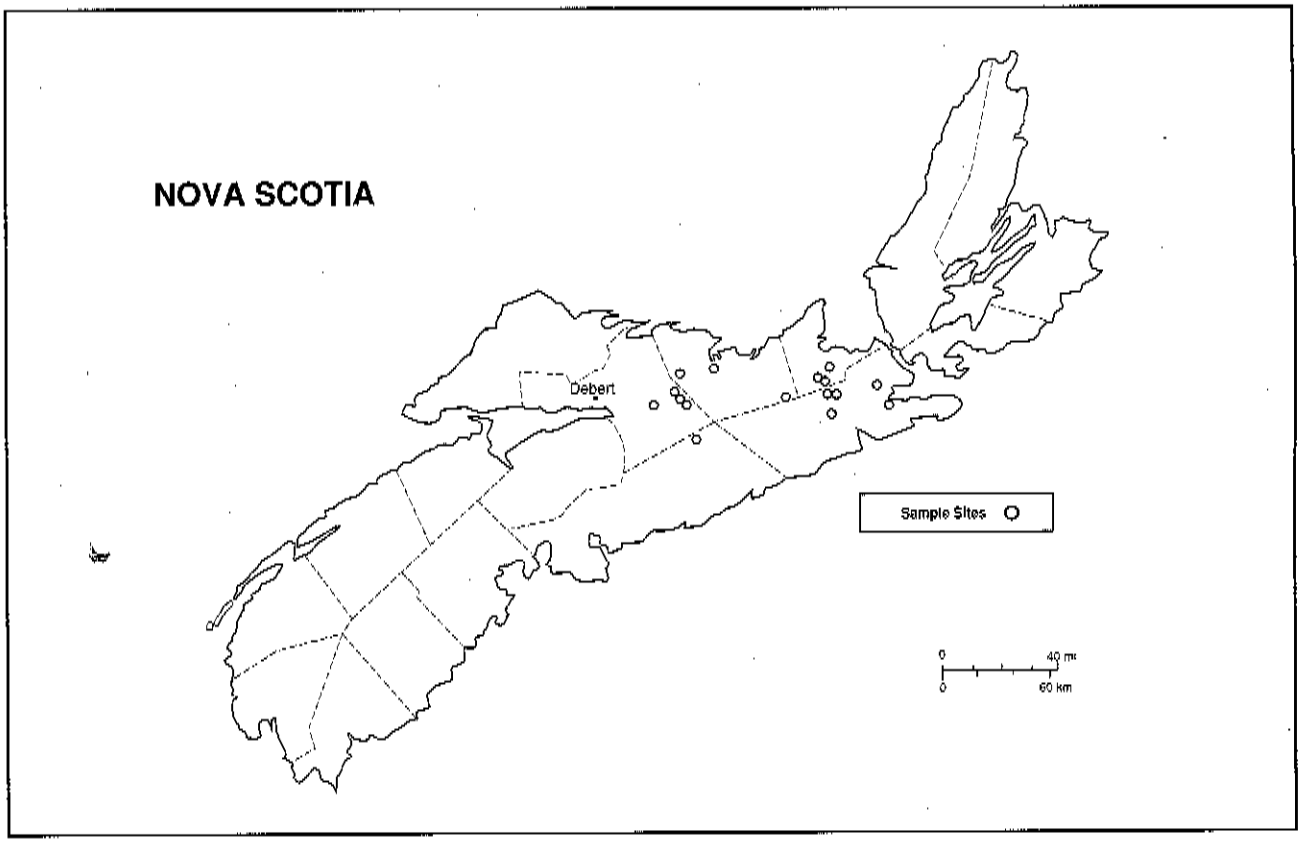

Figure 1. Location of sampled Christmas tree stands

transported to a baling yard, baled and subsequently transported to the Tree Breeding Centre in Debert. Transportation of baled trees took place in the back of a truck at travel times of up to 3 hours. At Debert, the trees were stored in an upright position with their butts in wet sawdust and shaded from direct sunlight (beneath a stand of mature softwood trees) from November 15 to December 2 (17 days).

On December 2nd, a 3 cm disc was cut off the butt of each tree. Trees were then brought inside and placed in a stand containing water for the duration of the trial. They were held at a room temperature of approximately 20°C, and a relative humidity of 55%. Unsheared terminal shoots, at least 10 cm in length, were selected from mid-crown nodal branches of each tree (Figure 2). Shoots from each pair of trees were selected for uniformity of colour, needle arrangement, shoot length etc. (Appendix II). Beginning December 3, and continuing for 6 weeks, these terminal shoots were given a light rub between the thumb and forefinger (Blankenship and Hinesley, 1990) twice a week (Monday and Thursday), and the number of needles that dropped was recorded. At the end of the trial, all remaining needles were removed and the needle scars on the shoot were counted and recorded along with the shoot length. Percent needle drop for each shoot was calculated as a % of the number of needle scars on that shoot. Foliage samples of approximately 2 grams were taken once a week (on Tuesday) from the mid-crown area and "wet" and "oven dry[2]" weights recorded.

Data Analyses

Needle drop was compiled as cumulative percent dropped by time period (Appendix III). Needle moisture content was calculated for each week. A Wilcoxon Matched-pairs Signed-ranks (Sprent, 1989; 33) procedure was used to test the hypothesis that "there are no differences in needle retention between early and late flushing balsam fir Christmas trees".

[2] Oven dry weights were measured after placing the needles in an oven at 90° C for 24 hours.

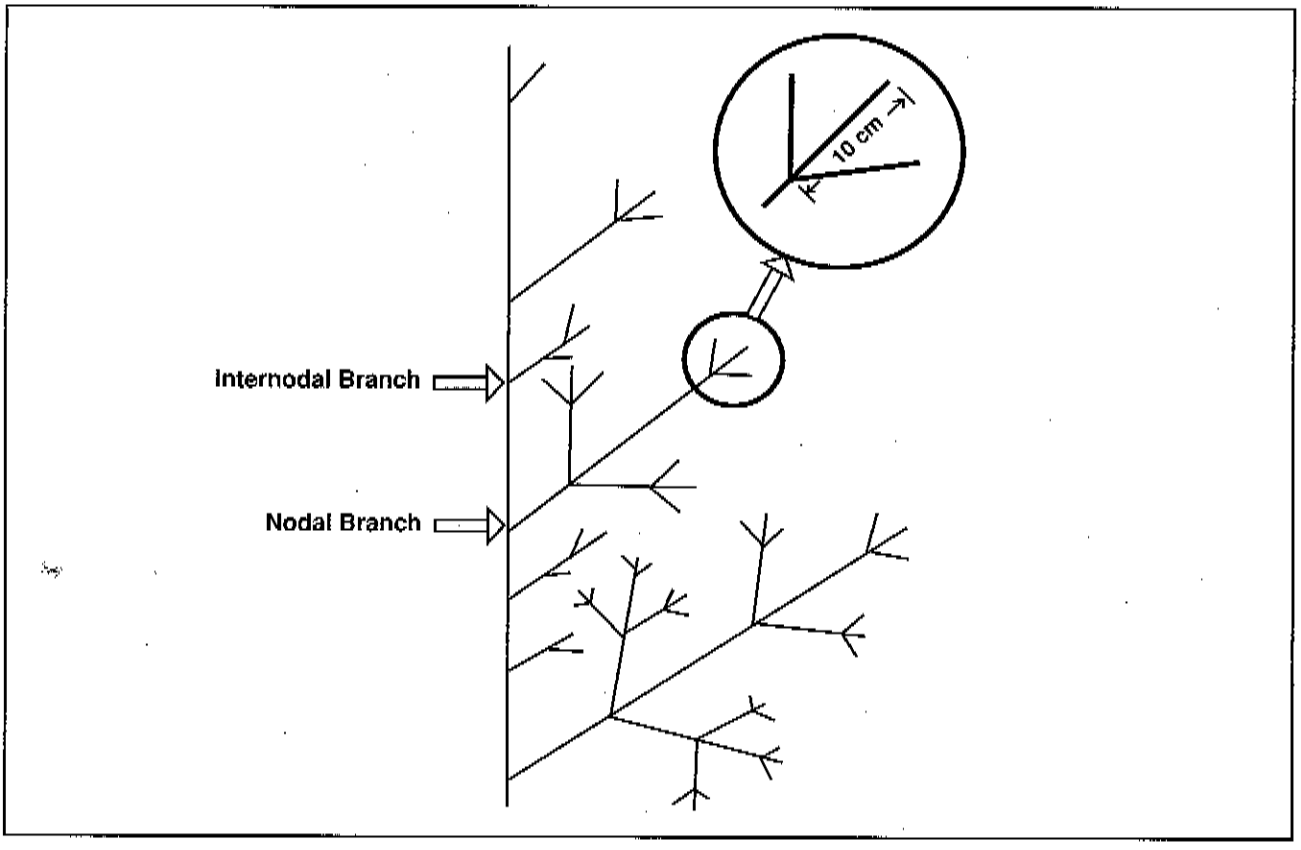

Figure 2. Schematic showing the position of sampled terminal shoots (≥ 10 cm) used for needle retention study.

RESULTS

Figure 3 shows a comparison of needle retention over time of early versus late flushing trees. The differences between needle retention were small until day 17 when the late flushing trees began to exhibit greater needle retention. This difference,from day 17 on, was significant according to the Wilcoxon Matched-pair Signed-ranks test at the 13% level (Table 1). From this data it appears that by selecting late flushers, retention capability is not compromised.

The greatest needle drop for both early and late flushers occurred during the third week, approximately 1 week after moisture content began to decline rapidly (Figure 4). During this time period, the early flushers exhibited greater needle drop than the late flushers despite approximately equal moisture contents. By the end of the trial, both early and late flushing trees were very dry (20 % moisture content).

LITERATURE CITED

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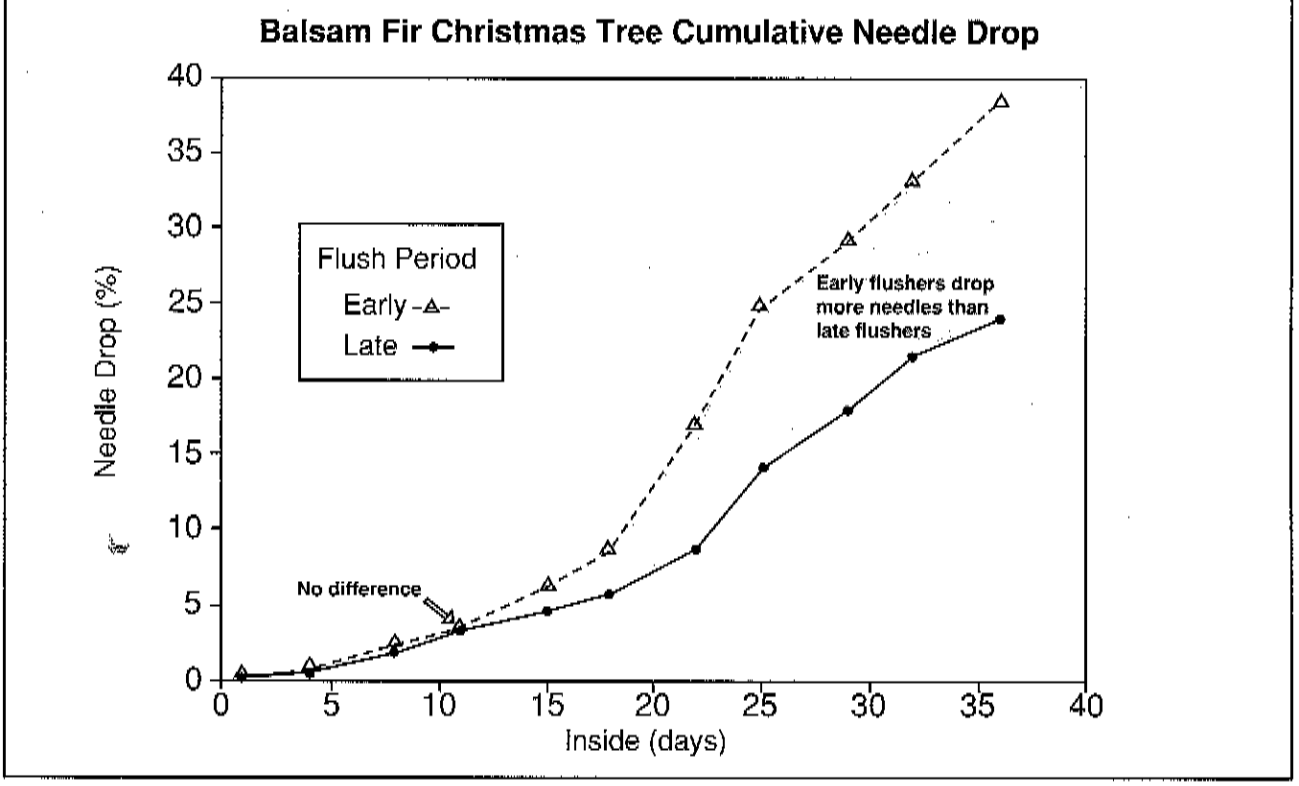

Figure 3. Percent cumulative needle drop for both early and late flushing trees.

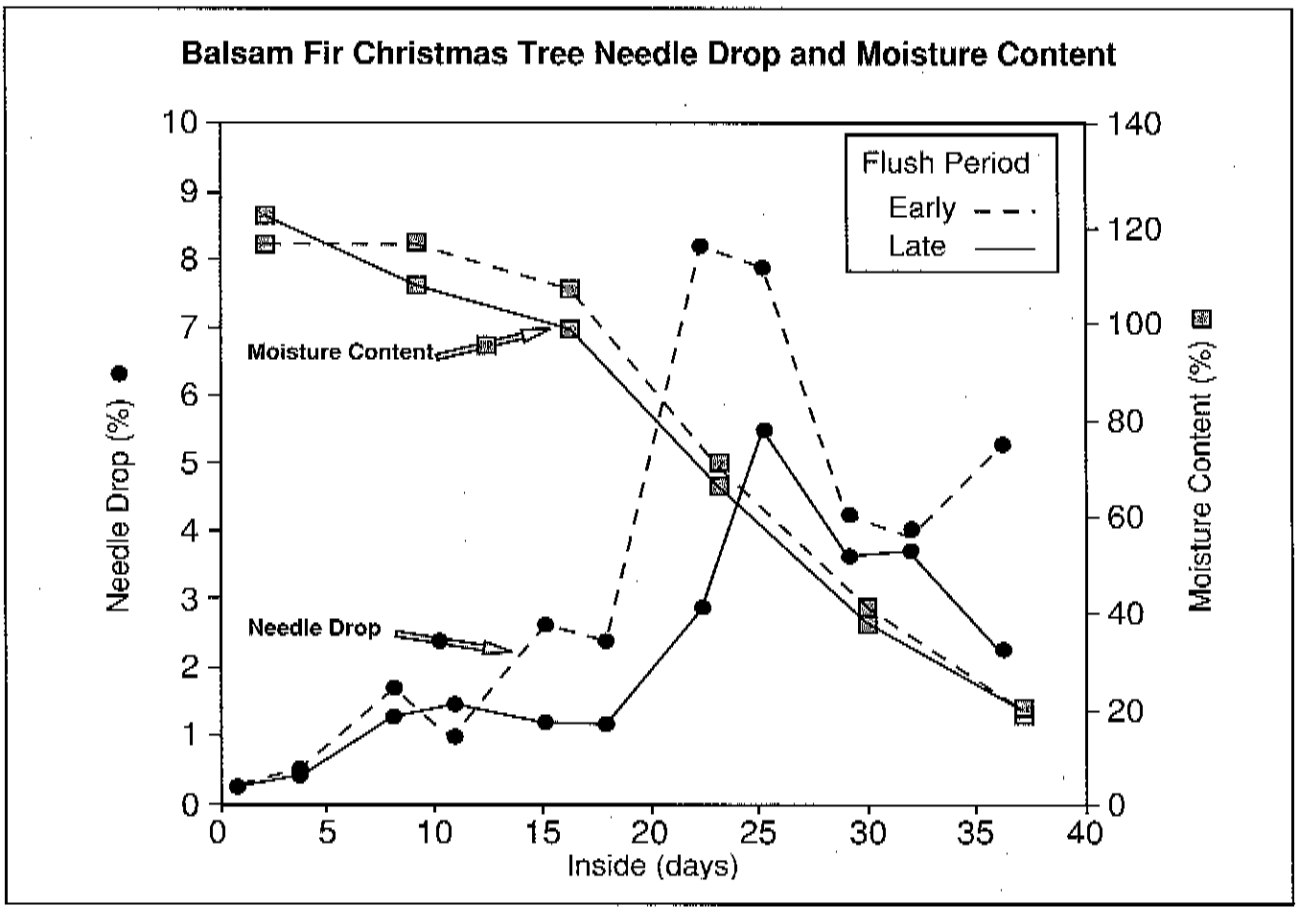

Figure 4. Percent needle drop and moisture content for early and late flushing balsam fir Christmas trees.

Table 1. Results of the Wilcoxon Matched-pairs Signed-ranks Test - early versus late flushing balsam fir Christmas trees.

Inside (days[1])	Average Cumulative Needle Drop (%)			Z^2	Level of Significance[3]
	Early Flushers	Late Flushers	Difference		
1	0	0	0	-0.60	55
4	1	1	0	-0.28	78
8	2	2	0	-1.09	28
11	3	3	0	-0.10	92
15	6	5	1	-1.34	18
18	9	6	3	-1.55	12
22	17	9	8	-1.71	9
25	25	14	11	-1.50	13
29	29	18	11	-1.65	10
32	33	22	11	-1.55	12
36	38	24	14	-1.76	8

[1] The cumulative number of days the Christmas trees were inside.
[2] Z = Statistic, used for testing the null hypothesis.
[3] The level of significance is the probability that the null hypothesis "no differences in needle retention between early and late flushers" is incorrectly rejected.

Appendix I
Site descriptions

Location	County	Soil Series	Soil Moisture	Slope		
				Aspect	(%)	Position
Dean	Halifax	Kirkhill	Imperfectly Drained	NW	10	Middle
Greenfield	Colchester	Greenfield	Well Drained	SE	0	Flat
Riversdale (A)	Colchester	Shulie	Well Drained	NE	10	Middle
Riversdale (B)	Colchester	Shulie	Well Drained	NE	5	Lower
Kemptown	Colchester	Shulie	Well Drained	SW	30	Middle
Millbrook	Pictou	Millbrook	Well Drained	W	5	Upper
Hopewell	Pictou	Woodbourne	Well Drained	SW	0	Upper
East River St. Marys	Pictou	Cobequid	Well Drained	SE	6	Upper
Beauly	Antigonish	Woodbourne	Well Drained	SW	5	Middle
Dunmore	Antigonish	Herbert	Well Drained	SE	35	Middle
Loch Katrine	Antigonish	Woodbourne	Well Drained	SW	0	Upper
Guysborough	Guysborough	Thom	Well Drained	NW	8	Middle
Country Harbour	Guysborough	Halifax	Well Drained	NW	10	Upper
Lundy	Guysborough	Bridgewater	Well Drained	NW	8	Middle
Giant Lake (A)	Guysborough	Thom	Well Drained	SW	0	Lower
Giant Lake (B)	Guysborough	Thom	Well Drained	E	0	Lower

Appendix II
Comparison of vegetation characteristics - early and late flushing balsam fir Christmas trees

Description	Units	Average of 16 trees	
		Early Flush	Late Flush
Average needle count per shoot	(#)	302	289
Number of buds on shoot	(#)	7	7
Shoot length	(cm)	16	16
Average length of needles on sample shoot	(mm)	20	20
Nitrogen	(%)	1.85	1.84
Phosphorous	(%)	0.16	0.18
Potassium	(%)	0.55	0.63
Calcium	(%)	0.49	0.46
Magnesium	(%)	0.11	0.11
Boron	(ppm)	14	16
Iron	(ppm)	47	47
Manganese	(ppm)	1012	851
Copper	(ppm)	1	1
Zinc	(ppm)	49	48
Crown length	(m)	2.3	2.3
Crown diameter	(m)	1.6	1.6
Average needle length on sample tree	(mm)	23	22
Number of mid-crown internode limbs	(#)	12	12
Mid-crown internode length	(m)	0.3	0.3
Length of mid-crown mid-internode limbs	(m)	0.6	0.6
Length of mid-crown nodal limbs	(m)	0.7	0.7
Angle of branch to bole	(degree)	42	42
Angle of shoot to branch	(degree)	42	41
Needle colour	(description)	dark green	dark green
Age of oldest limbs with needles	(years)	4.6	4.9
Needle arrangement	(code[1])	2.1	2.2
Age at end of handle	(years)	12	12

[1]Needle arrangement: 1 = single, 2 = double, 3 = multiple.

Appendix III

Cumulative percent needle drop for each shoot by site and early and late flushing trees for the 11 measurement periods

Location	Shoot	December 2		December 5		December 9		December 12		December 16		December 19		December 23		December 26		December 30		January 2		January 6	
		Early	Late	Early	Late	Early	Late	Early	Late	Early	Late	Early	Late	Early	Late	Early	Late	Early	Late	Early	Late	Early	Late
Dean	1	0.0	0.0	0.0	0.3	1.0	1.6	2.0	1.9	4.9	2.2	5.2	3.1	7.1	3.1	11.7	5.3	24.4	8.4	29.6	9.6	32.1	9.9
Halifax Co.	2	0.0	0.0	0.0	1.3	0.6	2.1	0.6	2.9	1.6	3.2	2.7	4.2	3.0	4.7	3.2	6.8	5.2	11.1	6.9	11.8	9.3	12.4
	3	0.5	0.0	0.5	0.6	1.0	1.3	1.5	1.9	3.2	1.9	4.5	2.2	4.5	3.2	5.5	4.8	7.0	5.4	8.5	6.1	9.5	6.4
	Average	**0.2**	**0.0**	**0.2**	**0.8**	**0.8**	**1.6**	**1.3**	**2.2**	**3.3**	**2.4**	**4.1**	**3.2**	**4.9**	**3.7**	**7.5**	**5.6**	**12.2**	**8.3**	**15.0**	**9.2**	**17.0**	**9.6**
Greenfield	1	0.0	0.0	0.0	2.2	0.5	3.4	1.8	3.7	3.0	3.9	4.1	4.9	5.5	6.3	8.9	6.8	12.3	9.3	16.2	10.2	22.6	11.2
Colchester Co.	2	0.0	0.0	0.0	0.7	1.0	1.7	1.5	3.3	1.7	4.1	2.4	5.3	3.7	6.2	5.9	8.1	6.8	10.5	8.1	11.2	10.5	11.7
	3	0.0	0.2	0.0	1.2	1.0	1.7	2.8	2.1	4.1	2.4	4.6	3.1	5.9	3.8	8.5	6.2	12.8	7.4	13.6	8.1	17.4	8.6
	Average	**0.0**	**0.1**	**0.0**	**1.4**	**0.8**	**2.2**	**2.0**	**3.0**	**2.9**	**3.4**	**3.7**	**4.4**	**5.0**	**5.4**	**7.7**	**7.0**	**10.7**	**9.0**	**12.6**	**9.8**	**16.8**	**10.5**
Riversdale (A)	1	0.0	0.0	3.2	0.0	6.7	1.1	7.7	2.8	11.2	4.9	15.1	6.7	35.6	7.7	47.4	10.2	52.9	11.2	68.7	16.5	71.8	17.5
Colchester Co.	2	0.0	0.0	0.0	0.0	2.3	1.1	3.0	1.1	4.3	2.2	5.3	3.0	10.9	4.9	18.5	5.5	24.0	5.7	55.3	6.3	66.1	6.8
	3	0.0	0.0	0.3	0.0	2.2	0.3	2.8	0.7	3.1	1.0	4.3	1.0	10.2	1.4	42.8	3.4	61.2	3.8	67.7	4.8	68.3	5.2
	Average	**0.0**	**0.0**	**1.2**	**0.0**	**3.7**	**0.8**	**4.5**	**1.5**	**6.2**	**2.7**	**8.2**	**3.6**	**18.9**	**4.7**	**35.2**	**6.4**	**46.0**	**6.9**	**62.9**	**9.2**	**68.7**	**9.8**
Riversdale (B)	1	0.4	0.0	0.7	0.4	1.5	2.2	2.2	2.6	4.0	3.0	5.5	4.3	11.7	13.4	17.5	18.2	19.3	20.4	20.1	33.8	21.9	41.6
Colchester Co.	2	0.0	0.0	0.0	0.0	0.9	0.7	1.9	0.7	2.8	1.1	4.4	1.4	7.8	2.5	9.4	4.9	11.2	5.6	16.5	6.0	23.1	7.4
	3	0.0	0.0	0.0	0.4	1.0	1.8	2.3	2.7	3.0	4.0	3.3	5.3	4.6	13.3	5.6	16.4	6.6	19.0	7.3	21.2	8.3	30.1
	Average	**0.1**	**0.0**	**0.2**	**0.3**	**1.1**	**1.5**	**2.1**	**2.0**	**3.3**	**2.7**	**4.4**	**3.7**	**8.0**	**9.7**	**10.8**	**13.2**	**12.4**	**15.0**	**14.6**	**20.3**	**17.7**	**26.3**
Kemptown	1	0.9	2.2	0.9	3.5	1.3	6.5	2.2	8.2	5.0	9.1	6.6	10.0	22.6	13.9	34.8	16.0	36.7	17.8	40.4	19.5	43.9	20.8
Colchester Co.	2	0.7	2.3	2.0	2.3	4.0	4.2	4.6	4.7	7.6	5.6	12.2	10.3	39.9	15.4	83.6	22.9	84.9	25.2	85.9	28.0	85.9	31.8
	3	0.6	1.3	0.9	2.2	2.0	3.6	3.2	5.4	4.1	6.3	7.9	7.1	42.4	9.4	61.6	12.5	66.9	14.3	73.0	17.0	80.5	17.4
	Average	**0.7**	**1.9**	**1.3**	**2.7**	**2.4**	**4.8**	**3.3**	**6.1**	**5.6**	**7.0**	**8.9**	**9.1**	**41.6**	**12.9**	**60.0**	**17.1**	**62.8**	**19.1**	**66.4**	**21.5**	**70.1**	**23.3**
Millbrook	1	0.0	0.0	0.0	0.0	0.8	0.5	0.8	0.5	0.8	0.5	0.8	1.0	0.8	1.5	0.8	1.5	1.6	2.0	2.4	2.6	68.4	3.1
Pictou Co.	2	0.0	0.0	0.0	0.0	1.0	0.0	1.3	0.5	2.0	0.9	2.0	0.9	2.7	1.9	3.0	2.4	5.3	2.4	10.3	2.4	47.5	2.8
	3	0.0	0.0	0.0	0.0	0.8	0.0	0.8	0.0	0.8	0.0	1.6	0.0	1.6	0.5	1.6	1.6	4.9	1.6	37.7	2.2	70.5	2.2
	Average	**0.0**	**0.0**	**0.0**	**0.0**	**0.9**	**0.2**	**1.0**	**0.3**	**1.2**	**0.5**	**1.5**	**0.7**	**1.7**	**1.3**	**1.8**	**1.8**	**3.9**	**2.0**	**16.8**	**2.4**	**62.1**	**2.7**
Hopewell	1	0.0	0.5	0.0	0.5	0.0	0.9	0.5	1.4	0.9	1.9	0.9	1.9	2.3	2.3	3.3	3.3	5.6	4.2	8.8	4.7	10.7	5.1
Pictou Co.	2	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.8	0.4	1.2	0.4	1.2	0.7	1.2	3.6	2.0	5.7	2.8	5.7	4.4	6.1	6.3
	3	0.0	0.0	0.0	0.0	1.1	0.4	1.8	0.4	2.1	0.8	2.1	0.8	3.2	0.8	8.0	1.6	10.1	1.6	16.4	1.6	25.5	3.2
	Average	**0.0**	**0.2**	**0.0**	**0.2**	**0.4**	**0.6**	**0.7**	**0.9**	**1.1**	**1.3**	**1.1**	**1.3**	**2.1**	**1.4**	**5.0**	**2.3**	**7.1**	**2.9**	**10.3**	**3.5**	**14.1**	**4.9**
East River	1	0.7	0.0	1.0	0.4	2.6	0.4	3.2	6.3	3.9	8.8	5.5	11.2	11.3	17.5	18.5	25.3	23.3	39.7	24.9	42.8	25.6	47.4
St. Marys	2	0.0	0.0	0.0	0.8	0.9	0.8	1.2	2.5	3.0	2.9	3.0	3.3	4.1	6.6	4.7	9.4	4.7	22.5	5.0	27.5	5.3	37.3
Pictou Co.	3	0.4	0.0	0.4	0.4	3.5	0.4	4.2	10.2	6.1	14.6	6.5	15.5	8.1	19.5	14.2	23.0	20.7	36.3	35.3	58.9	36.4	64.6
	Average	**0.3**	**0.0**	**0.5**	**0.5**	**2.3**	**0.5**	**2.9**	**6.3**	**4.3**	**8.7**	**5.0**	**10.0**	**7.8**	**14.5**	**12.5**	**19.2**	**16.2**	**32.8**	**21.7**	**43.0**	**22.4**	**49.8**
Beauly	1	0.0	0.0	0.3	0.0	0.9	1.5	0.9	1.8	0.9	2.2	0.9	2.2	0.9	2.6	0.9	5.8	0.9	6.2	1.6	6.6	2.8	8.0
Antigonish Co.	2	0.0	0.3	0.0	0.7	1.0	1.0	1.0	1.6	1.8	2.3	2.9	2.3	3.1	3.3	4.7	5.5	5.7	7.2	6.2	8.1	6.2	8.8
	3	0.0	0.0	0.0	0.0	0.8	0.4	0.8	2.3	1.4	3.4	2.2	4.6	2.7	5.7	4.1	8.4	4.3	9.5	4.3	13.3	4.3	14.1
	Average	**0.0**	**0.1**	**0.1**	**0.2**	**0.9**	**0.9**	**0.9**	**1.9**	**1.4**	**2.6**	**2.0**	**3.0**	**2.3**	**3.8**	**3.2**	**6.6**	**3.7**	**7.6**	**4.0**	**9.3**	**4.5**	**10.3**
Dunmore	1	0.0	0.0	2.6	0.8	5.3	4.1	7.2	7.1	16.5	10.7	25.7	14.0	65.1	19.1	100.0	22.2	100.0	23.7	100.0	24.5	100.0	24.7
Antigonish Co.	2	0.0	0.0	0.5	0.8	2.0	2.2	2.6	4.5	6.6	8.6	8.2	12.0	32.7	13.4	39.8	18.9	51.5	19.5	55.1	19.8	57.7	20.9
	3	1.7	0.3	3.5	0.7	9.2	4.6	10.9	9.2	27.0	14.8	48.9	17.7	74.7	21.3	93.1	27.2	94.3	28.2	94.3	29.5	94.3	32.8
	Average	**0.6**	**0.1**	**2.2**	**0.8**	**5.5**	**3.6**	**6.9**	**6.9**	**16.7**	**11.4**	**27.6**	**14.6**	**57.5**	**17.9**	**77.6**	**22.8**	**81.9**	**23.8**	**83.1**	**24.6**	**84.0**	**26.1**
Loch Katrine	1	0.9	0.0	1.2	0.4	3.6	1.7	5.5	2.5	7.3	5.0	9.7	5.8	13.6	12.8	20.9	42.6	26.7	44.6	31.2	45.3	33.6	46.7
Antigonish Co.	2	2.3	0.0	2.9	0.8	7.5	0.8	9.3	1.7	10.7	2.9	15.6	3.4	26.3	8.8	49.1	26.8	63.3	32.2	67.1	37.2	69.7	40.6
	3	0.7	0.0	2.1	0.0	3.4	0.8	5.2	1.5	8.6	2.3	11.0	2.7	30.6	3.0	43.3	9.1	52.6	14.8	54.6	48.9	55.7	50.8
	Average	**1.3**	**0.0**	**2.1**	**0.4**	**4.9**	**1.1**	**6.6**	**1.9**	**8.9**	**3.4**	**12.1**	**3.9**	**23.5**	**8.2**	**37.8**	**26.1**	**47.5**	**30.5**	**51.0**	**43.9**	**53.0**	**46.0**
Guysborough	1	0.0	0.7	0.0	1.6	0.7	3.0	1.4	5.8	3.5	15.4	4.5	20.3	10.0	28.9	16.3	44.3	19.7	63.0	20.1	67.9	24.6	70.8
Intervale	2	0.3	0.7	0.6	1.0	0.6	3.7	0.6	4.3	1.8	5.7	2.4	7.6	9.4	10.6	12.1	16.0	13.3	28.2	14.6	51.5	17.0	61.1
Guysborough Co.	3	0.0	0.0	0.0	0.3	0.0	3.1	0.0	6.9	0.6	8.6	0.9	12.8	3.4	26.6	7.7	40.7	9.9	60.0	9.9	66.2	11.1	74.8
	Average	**0.1**	**0.4**	**0.2**	**1.0**	**0.4**	**3.2**	**0.7**	**6.6**	**2.0**	**9.9**	**2.6**	**13.6**	**7.6**	**22.0**	**12.0**	**33.6**	**14.3**	**50.4**	**14.8**	**61.9**	**17.5**	**68.9**
Country Harbour	1	0.0	0.0	0.0	0.0	0.4	0.0	4.8	0.3	5.2	0.3	5.9	0.6	8.1	1.5	10.0	2.6	12.6	2.9	15.9	7.0	20.3	8.2
Guysborough Co.	2	0.0	0.0	0.0	0.0	0.6	0.0	0.9	0.0	0.9	0.0	2.5	0.0	6.6	0.9	8.5	1.2	9.1	1.8	9.7	3.1	11.9	4.0
	3	0.4	0.0	2.2	0.0	4.4	0.0	10.4	0.3	10.9	0.3	13.0	0.3	34.8	0.6	46.5	2.2	49.6	2.8	55.7	4.7	57.8	4.7
	Average	**0.1**	**0.0**	**0.7**	**0.0**	**1.8**	**0.0**	**5.4**	**0.2**	**5.7**	**0.2**	**7.2**	**0.3**	**16.5**	**1.0**	**21.6**	**2.0**	**23.7**	**2.5**	**27.1**	**4.9**	**30.0**	**5.6**
Lundy	1	1.3	1.1	4.3	1.1	6.5	1.9	8.2	2.7	10.3	3.0	11.2	3.8	12.5	8.8	29.3	34.2	32.3	37.6	36.2	47.9	42.2	53.6
Guysborough Co.	2	0.0	0.0	0.4	0.0	2.3	0.4	3.4	0.8	5.3	1.7	6.4	2.1	7.9	3.3	13.6	8.3	36.6	10.3	38.5	11.6	42.3	12.8
	3	1.0	0.0	1.5	0.0	3.0	0.0	3.5	0.5	3.5	2.3	4.5	3.7	6.0	10.7	9.6	46.3	14.1	57.9	19.1	62.0	23.1	65.7
	Average	**0.8**	**0.4**	**2.1**	**0.4**	**3.9**	**0.8**	**5.0**	**1.3**	**6.4**	**2.3**	**7.4**	**3.2**	**8.8**	**7.6**	**17.5**	**29.6**	**27.7**	**35.3**	**31.3**	**40.5**	**35.9**	**44.1**
Giant Lake (A)	1	0.7	0.0	1.4	0.4	2.5	2.3	4.2	3.1	8.5	5.1	9.9	6.6	14.1	12.7	19.4	22.4	22.6	24.3	28.3	25.1	31.1	25.9
Guysborough Co.	2	0.6	0.0	1.3	0.4	2.2	2.1	4.1	4.9	9.2	5.7	12.1	6.2	18.1	9.0	29.2	14.8	34.6	15.6	37.1	17.2	39.1	18.4
	3	0.3	0.0	1.0	0.8	2.6	2.8	3.3	3.2	6.3	3.6	7.6	4.4	13.2	6.8	17.4	12.1	20.1	12.9	21.4	14.5	23.4	16.9
	Average	**0.6**	**0.0**	**1.2**	**0.5**	**2.4**	**2.4**	**3.9**	**3.7**	**8.0**	**4.1**	**9.8**	**5.7**	**15.1**	**9.5**	**22.0**	**16.4**	**25.8**	**17.6**	**28.9**	**18.9**	**31.2**	**20.4**
Giant Lake (B)	1	0.0	1.2	0.6	1.6	8.4	5.1	10.9	6.5	33.8	7.9	46.0	8.4	61.4	9.7	78.1	11.1	79.4	13.5	79.4	14.4	80.1	16.5
Guysborough Co.	2	0.0	0.0	0.4	0.2	8.8	6.9	11.0	11.1	22.3	12.9	32.5	14.4	50.9	18.2	68.2	25.1	73.1	36.8	74.6	39.9	75.3	43.0
	3	0.0	0.6	0.7	1.7	5.0	6.2	8.6	9.6	11.2	12.7	18.2	15.0	41.6	19.8	62.4	22.9	69.0	24.3	70.3	26.6	72.0	28.3
	Average	**0.0**	**0.6**	**0.6**	**1.2**	**7.4**	**6.1**	**9.2**	**9.1**	**22.4**	**11.2**	**32.2**	**12.6**	**51.3**	**15.9**	**69.6**	**19.7**	**73.8**	**24.9**	**74.8**	**27.0**	**75.8**	**29.2**
Average of All		**0.3**	**0.2**	**0.8**	**0.6**	**2.5**	**1.9**	**3.5**	**3.4**	**6.2**	**4.6**	**8.6**	**5.8**	**17.0**	**8.7**	**25.1**	**14.3**	**29.4**	**18.0**	**33.5**	**21.9**	**38.8**	**24.2**

Metric	Conversion Factor		Imperial
mm	x	0.0393701	in
cm	x	0.393701	in
m	x	3.28084	ft
grams	x	0.035274	ounces

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