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Abstract: Forestry requires a variety of decision-support tools for planning efforts. Site index provides an important quantitative relationship between height, age, and site productivity. Land capability (LC) is another important measure of forest productivity that is used in planning as well (e.g., sustainable future harvest levels). The purpose of this study is to provide guidance on species-level variability in site index and LC values in softwood plantations in Nova Scotia. Another objective is to better integrate growth and yield with the provincial forest ecosystem classification (FEC) system by comparing site index and LC across FEC vegetation types, soil types, and ecosites. Every year from 1986 until 1992, a species stock-type trial (SSTT) with several permanent sample plots was established. The seven trials include a total of 12 softwood species. Data from the research permanent sample plots coupled with FEC data describing soil type, vegetation type, and ecosite at the trials are used in this study. The results were analyzed and presented graphically, as well as tested for significance with one-way Analysis of Variance and Tukey Honestly Significantly Difference Post Hoc tests. There was substantial variation of both site index and LC values across the different softwood species planted at the seven SSTTs. It is hoped that the species-specific results of this study will help practitioners better assess site index, LC, and plantation productivity. Regarding the FEC, the results suggest that high-production softwood plantations are best established on zonal ecosites. There were no significant differences between the four zonal Acadian ecosites, but the more nutrient-poor spruce-pine ecosites and wet ecosites showed significantly lower site index and LC values. Research and evidence-based planning tools that are specific to softwood species and plantations in the province can assist practitioners in their planning and the province as a whole to meet the objectives of the high-production zone of the triad and ecological forestry as a whole.

Keywords: Site index, land capability, growth and yield, plantation, silviculture

1. Introduction

Forestry requires a variety of decision-support tools for planning efforts. The long time horizons of forest growth and sustainable forest management objectives mean that modelling plays a crucial role in planning. Prominent examples include growth and yield modelling and wood supply analysis, all of which rely on measures of site productivity to estimate growth of different species on different sites (Avery & Burkhart, 2015).

Site index provides an important quantitative relationship between height, age, and site productivity. It is more reliable than other tree metrics like diameter at breast height (DBH), which is highly sensitive to stand density. Site index tends to be applied more commonly in even-aged, single-species conditions (Husch et al., 2003). In Nova Scotia, it is defined as the total height of a tree with a dominant crown class at a breast height age of 50 years. Site index estimates and normal yield tables for softwoods were developed from temporary sample plots and permanent sample plot (PSP) data (Hawboldt & Kostjukovits, 1961; NSDNR, 1990). Currently, there is only one site index function for all softwood species and when site index is calculated for trees that are older or younger than 50 years the value must be forecasted or back-casted using the site index function.

Land capability (LC) is another important measure of forest productivity that is used in planning (e.g., sustainable future harvest levels; Bailey & Mailman, 1972). It is derived from stand-level peak mean annual increment (m^3/ha/yr) under full stocking conditions. This is done using the Nova Scotia Growth and Yield model (NSGNY; O'Keefe & McGrath, 2006; Steenberg et al., 2023) to simulate species-specific scenarios and obtain the peak mean annual increment values.

The primary objective of this study is to provide guidance on species-level variability in site index and LC values in softwood plantations in Nova Scotia. This is accomplished using seven plantation research trials called species stock-type trials (SSTTs) that were established between 1986 and 1992. Another objective of the study is to better integrate growth and yield with the provincial forest ecosystem classification (FEC) system (Neily et al., 2013) by comparing site index and LC values across FEC vegetation types, soil types, and ecosites. These FEC units were classified at all seven SSTTs and integrated into the analysis. With the recent Independent Review of Forest Practices (Lahey, 2018) and Nova Scotia's subsequent implementation of ecological forestry and the triad, there is a growing need for new planning tools to meet new objectives. The results of this study can hopefully assist forest practitioners in planning for the high-production zone of the triad.

2. Methods

2.1. Study Area and Research Trials

Every year from 1986 until 1992, an SSTT was established in Nova Scotia. At each location, available stock from all nurseries in the province at that time (i.e., Strathlorne, Lawrencetown, Scott Maritimes, and Wittenburg) was planted. These trials were established to determine the quality of out-planted trees and track the long-term growth and yield of various planted species at different locations in the province (Table 1). PSPs were established within blocks that had good survival and stocking. Some species planted did not show adequate stocking and therefore do not have PSP data to base site comparisons, though blocks without PSPs were selected for additional sampling of individual trees to increase sample size.

Table 1. Details of the seven species stock-type trials (SSTTs), including year of plantation establishment, years of measurement, sample size, total number of blocks and permanent sample plots (PSPs) at each trial, and planted species. Note that the sample size here is at the block scale, with some blocks containing PSPs and others without PSPs but that were measured for this study. The square blocks are 0.1 ha and PSPs are fixed-area circular plots with a 8.92-m radius. See Appendix B for detailed FEC information at each trial.

Trial Location	Establishment	Measurement Year (Blocks and/or PSPs)	Blocks (PSPs)	Species
Antrim	1986	2021 (12), 2017 (5), 2014 (5)	22 (12)	RS,WS,BS,NS,WP,RP,BF,TL,JL
Big Pond	1988	2019 (14), 2014 (4)	18 (14)	RS,WS*,BS*,NS,WP,RP,BF,JP,EL
Delaney Settlement	1987	2021 (7), 2017 (12), 2014 (2)	21 (7)	RS,WS*,BS*,NS,WP,RP,BF,JP,TL
MacQuarrie Lake	1989	2021 (7), 2017 (10), 2016 (1), 2011 (1)	19 (9)	RS,WS,BS,NS,WP,RP,BF
North Intervale	1991	2019 (14), 2017 (3), 2014 (1)	18 (15)	RS,WS*,BS,NS,WP,RP,BF,SS,JP
Scotsburn	1990	2021 (15)	15 (15)	RS,WS*,BS,NS,WP,RP,BF,SS
Shulie Lake	1992	2020 (14)	14 (14)	RS,WS*,BS,NS,WP,RP,BF,JP,TL

*Includes Highland varieties

The seven SSTTs used in this study are located in central and eastern Nova Scotia (Fig. 1). The year of plantation establishment ranged from 1986 to 1992. All SSTTs were planted with only softwood species, with a single species being planted in a square block with 12, 12-tree rows (see Appendix A for block maps). Trees were planted at 2.4-m spacing using marked rope to ensure exact spacing, yielding approximately 1,608 stems/ha. Red spruce (*Picea rubens*), white spruce (*P. glauca*), black spruce (*P. mariana*), Norway spruce (*P. abies*), white pine (*Pinus strobus*), and red pine (*P. resinosa*) were planted at all seven trials, while Sitka spruce (*P. sitchensis*), jack pine (*P. banksiana*), tamarack (*Larix laricina*), and Japanese larch (*L. kaempferi*) were planted at only some sites. Some trials also include Highland varieties of black and white spruce, which are treated separately in the analysis.

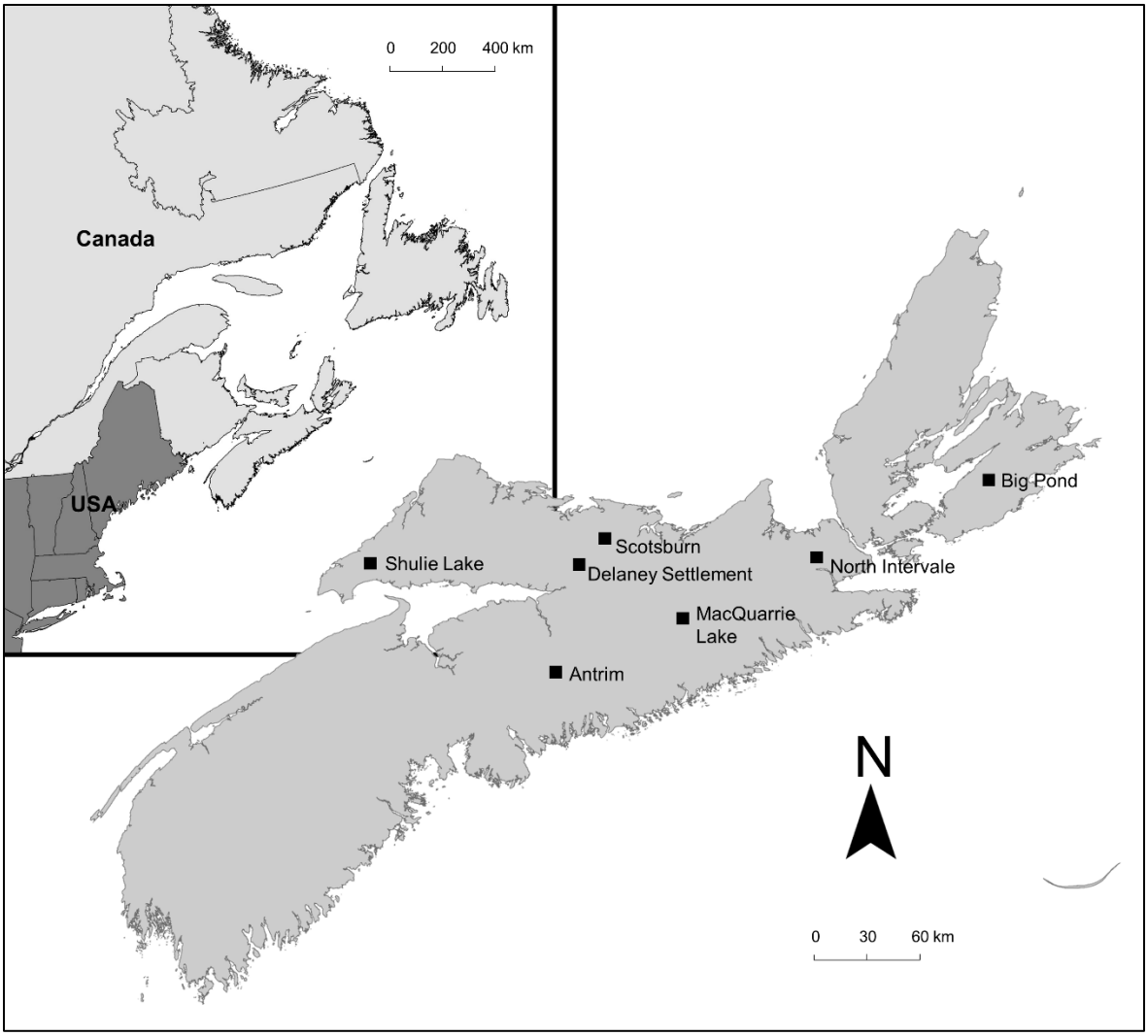

Fig. 1. Locations of the seven species stock-type trials (SSTTs) across Nova Scotia, Canada.

2.2. Data Collection

Two streams of data collection were used to meet the objectives of this study. The first included the standard series of variables collected at PSPs for silvicultural research trials (NSDNR, 2009). Those relevant to this study included species, dominant height (m), DBH (cm), and breast height age (yr). Additional data collected from 2014 to 2017 included soil type, vegetation type prior to plantation establishment, and ecosite following the FEC of Nova Scotia (Neily et al., 2013). Likely vegetation types that existed prior to plantation establishment were determined using vegetation indicator species and soil type. Ecosite is derived from the combination of soil type and vegetation type using the FEC guide. Note that this study uses the previous version of the FEC (Neily et al., 2013), which was used at the time of field data collection. The new FEC (Neily et al., 2023; Keys et al., 2023) has since been published.

2.3. Data Processing and Analysis

Site index was calculated from dominant height and breast height age using the Nova Scotia function for softwoods (Hawboldt & Kostjukovits, 1961; NSDNR, 1990). All site index values are based on a breast height age of 50 years. Recall that there is only one function for all softwood species. LC values were calculated using the Nova Scotia Growth & Yield Model (NSGNY) for all species separately at the respective site index value from the peak mean annual increment value generated by NSGNY. See Steenberg et al. (2023) for further details on the NSGNY model and the site index function. Both site index and LC values were analyzed across species, soil type, vegetation type, and ecosite. These values are also presented for each of the seven SSTTs individually in Appendix B. Stock type from the different nurseries was not considered in this study. We used one-way Analysis of Variance (ANOVA) and Tukey Honestly Significantly Difference (HSD) Post Hoc tests to test for significant differences across the variables as well. Only red, white, black, and Norway spruce, red and white pine, and balsam fir were tested statistically, as the other species did not have sufficient sample sizes.

3. Results

Considerable variation in site index and LC can be seen across species but also often within species across the different trials (Fig. 2. 3. 4. & 5). Note also that the variation of LC between species does not completely match that of site index because LC is also affected by the different taper equations and growth rates of each species (Steenberg et al., 2023). The highest values can be seen among the larch species (Appendix B), though they were not tested statistically due to small sample sizes. Of the three species of spruce considered for the high-production forestry leg of the triad (NSDNR, 2021a), Norway spruce had the highest values. White spruce outperforms red spruce for site index though both species become almost identical for LC and there were no significant differences for either variable. It was expected that white pine and red pine would show higher values for site index than the results illustrate, but the analysis still shows several significant differences.

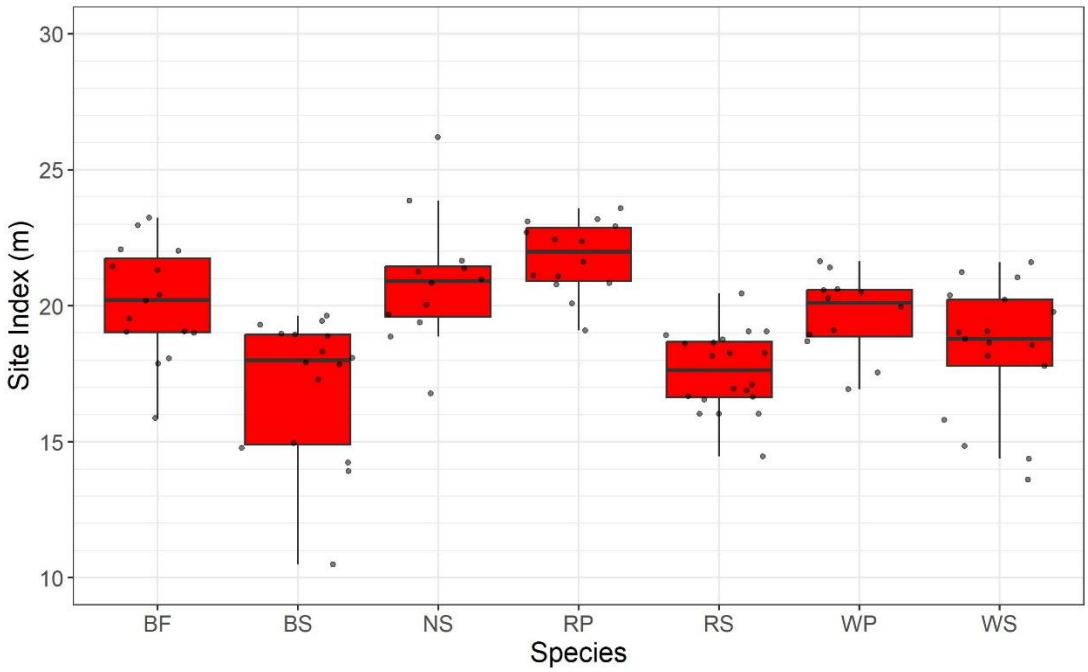

Fig. 2. Site index by species at the block/permanent sample plot (PSP) level.

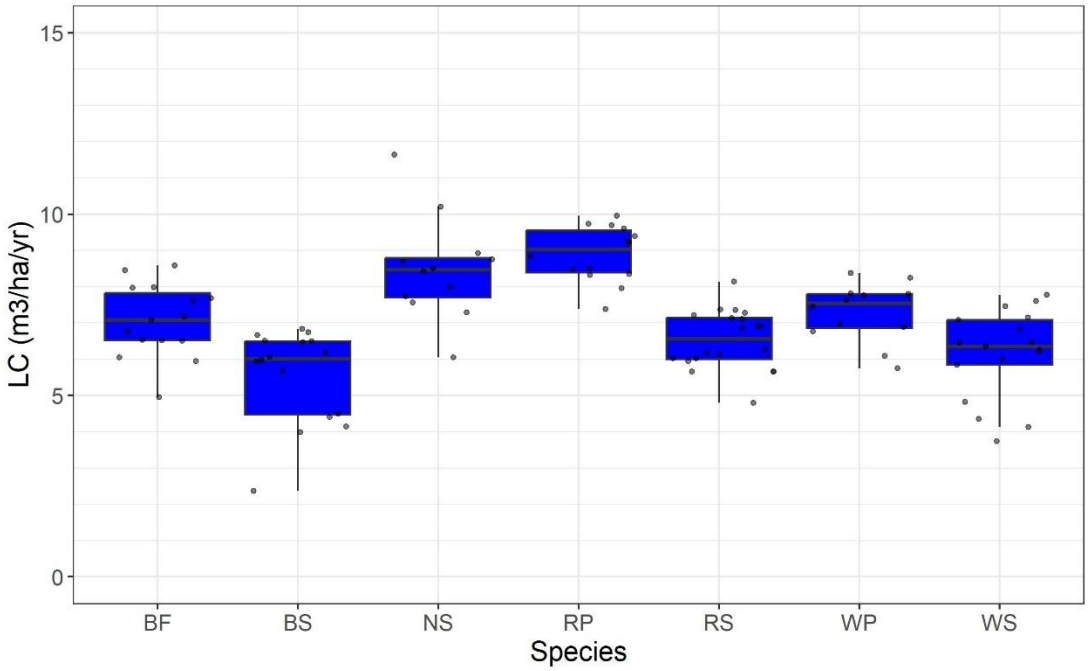

Fig. 3. Land capability (LC) by species at the block/permanent sample plot (PSP) level.

Importantly, site/location explains a great deal of variation in site index and LC along with species, as a comparison of species across each trial site reveals (Fig. 4 & 5), which further justifies the FEC ecosite assessment of these trials and its integration with traditional site index/LC approaches. Moreover, the relative difference in site index and LC values also shows variability between trial locations, which reinforces the latter points but also is a source of uncertainty in applying findings from this study across Nova Scotia.

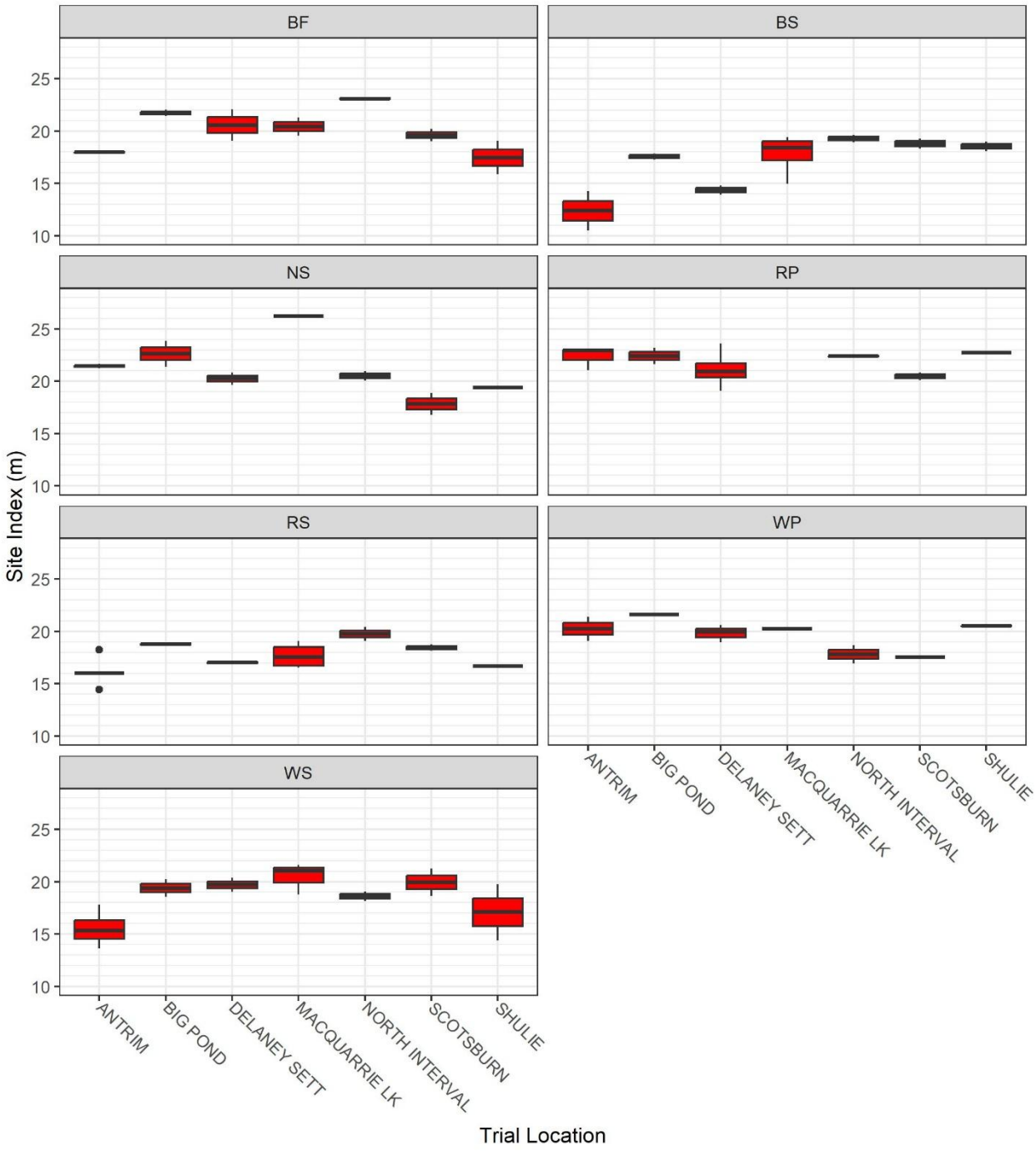

Fig. 4. Site index by species and trial location at the block/permanent sample plot (PSP) level.

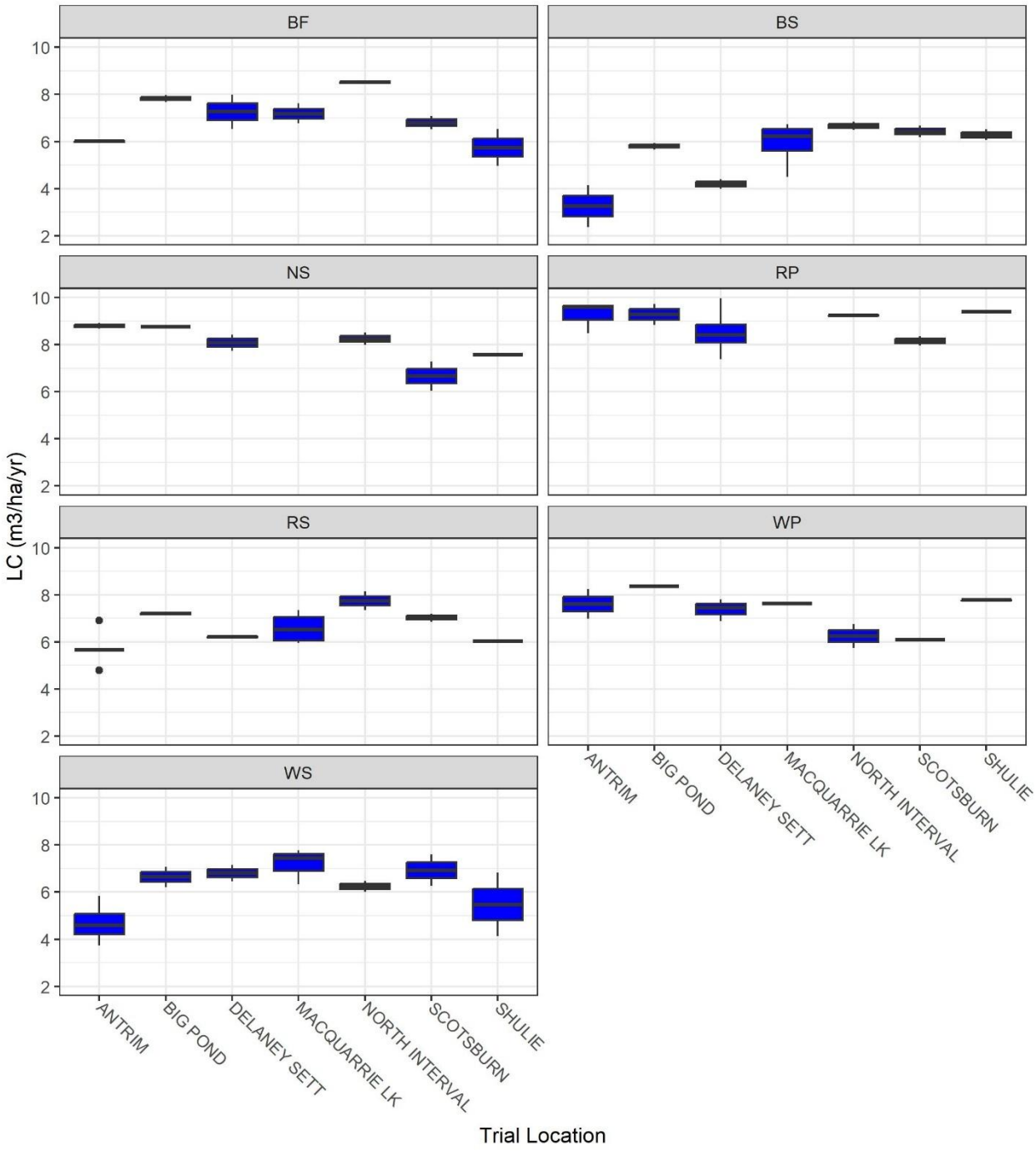

Fig. 5. Land capability (LC) by species and trial location at the block/permanent sample plot (PSP) level.

There were very few differences observed for site index or LC in comparing across FEC soil types (Fig. 6 & 7). The ANOVA was only just significant at a = 0.05 and the post hoc test showed the only differences were the one observed wet soil found in the trials (ST7) compared to all other soil types.

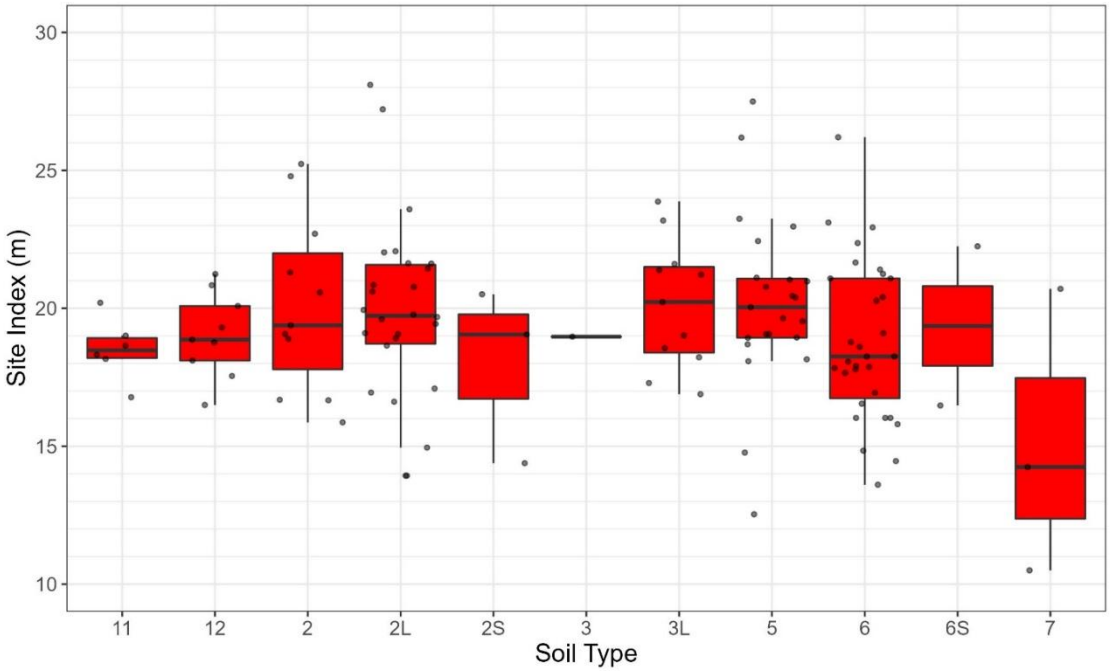

Fig. 6. Site index by soil type at the block/permanent sample plot (PSP) level.

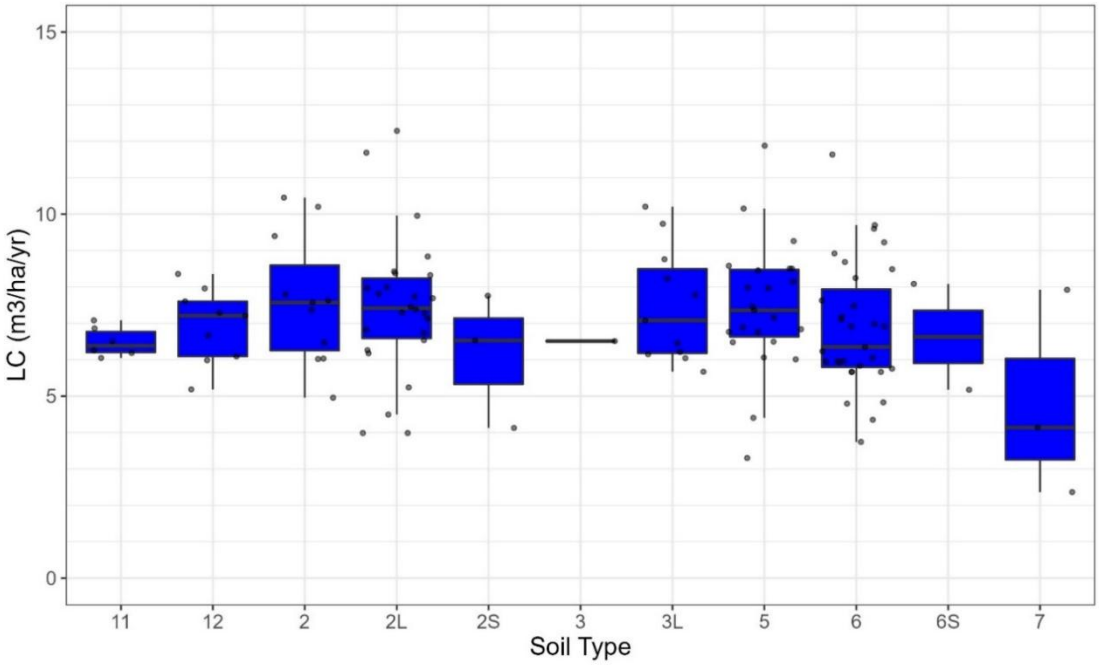

Fig. 7. Land capability (LC) by soil type at the block/permanent sample plot (PSP) level.

The FEC vegetation types (Fig. 8 & 9) showed a similar pattern to soil types, though in this instance there were two types that were significantly different from all others. The first was a wet coniferous vegetation type (WC2) that would have occurred on the wet soils and the second was a poorer, spruce-pine (i.e., edaphic) site (SP7). This same pattern is seen across ecosites as well with ecosite 4 and 7 being significantly different from all others (Fig. 10 & 11).

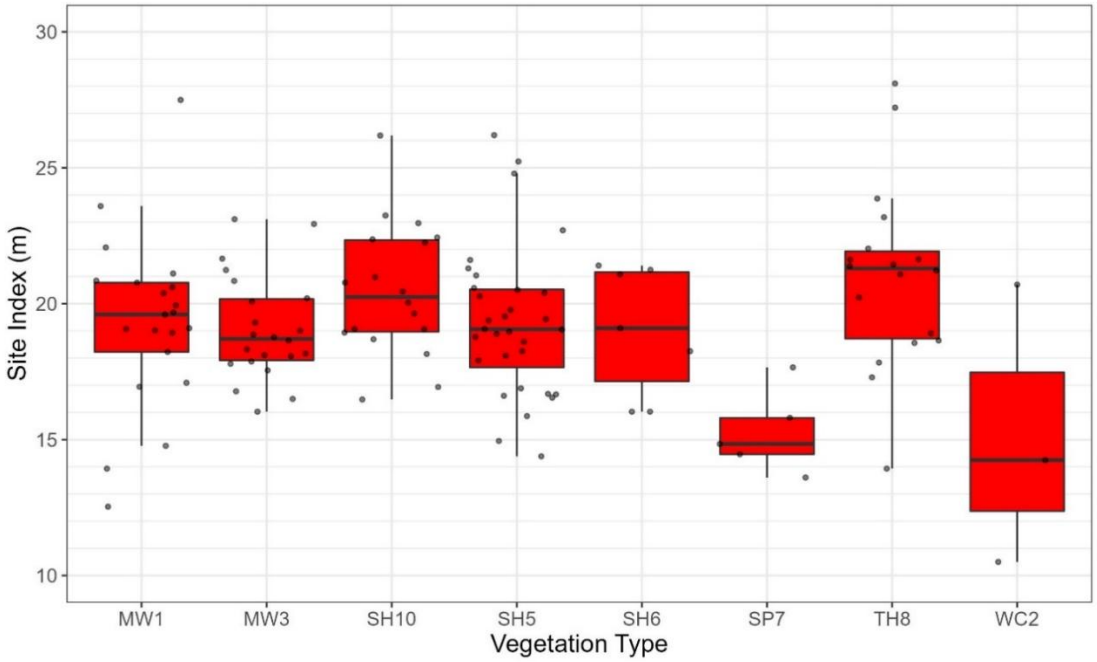

Fig. 8. Site index by vegetation type at the block/permanent sample plot (PSP) level.

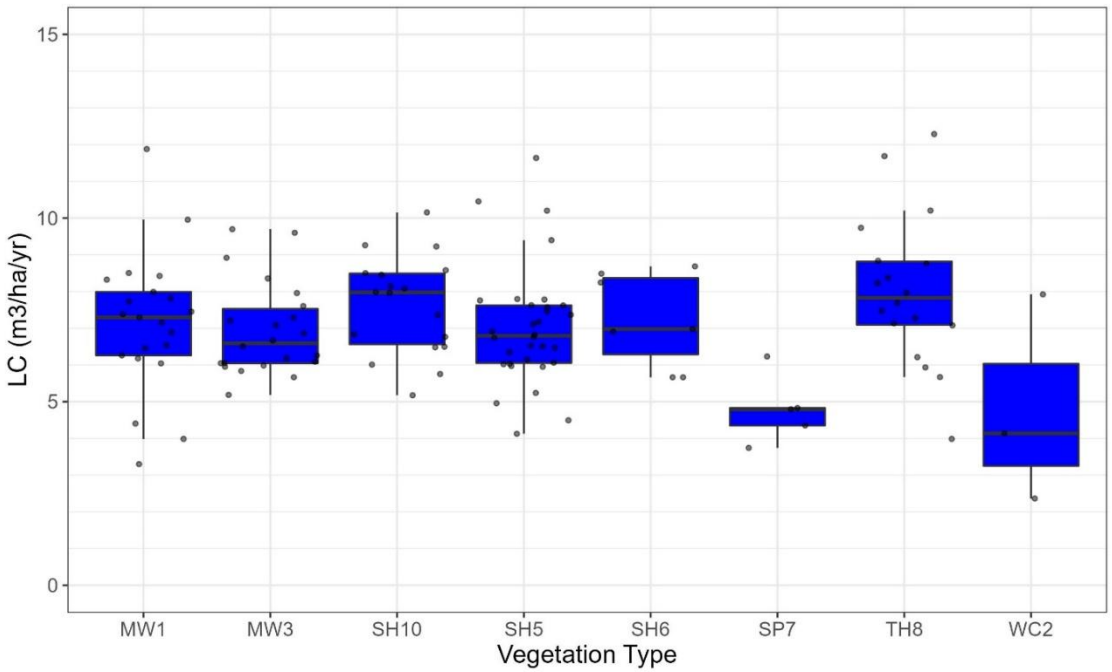

Fig. 9. Land capability (LC) by vegetation type at the block/permanent sample plot (PSP) level.

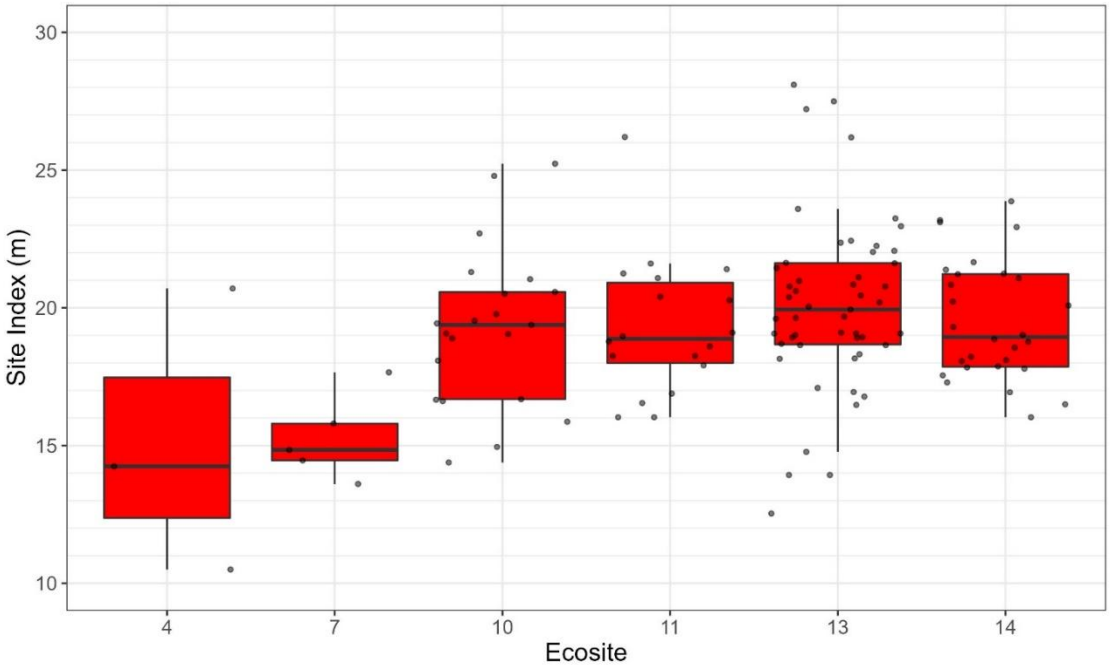

Fig. 10. Site index by ecosite at the block/permanent sample plot (PSP) level.

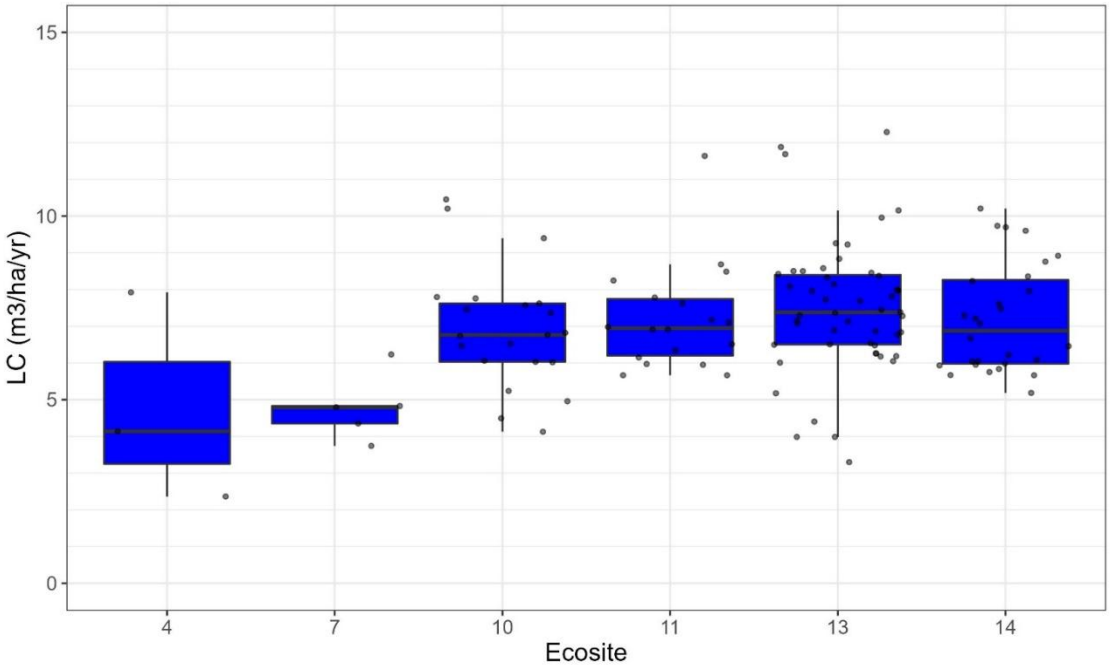

Fig. 11. Land capability (LC) averaged by ecosite at the block/permanent sample plot (PSP) level.

All One-way ANOVA tests were found to be significant (Tables 2 & 3) while the Tukey HSD post hoc tests (Tables 4 & 5) revealed individual significant differences between variables and their magnitude. Only significant differences between variables are presented for the post hoc test results.

Table 2. One-way ANOVA of site index (m) and land capability (LC; m^3/ha/yr) across species, soil type, vegetation type, and ecosite.

Variable	df	*F*	*P*-value
Site Index			
Species*	6	11.39	<0.001
Soil type	9	2.47	0.014
Vegetation type	7	6.28	<0.001
Ecosite	5	8.01	<0.001
Land Capability			
Species*	6	18.72	<0.001
Soil type	9	2.08	0.039
Vegetation type	7	5.48	<0.001
Ecosite	5	4.12	0.002

* Only species with large enough sample size (RS, WS, BS, NS, WP, RP, BF)

Table 3. One-way ANOVA Tukey HSD post hoc test of site index (m) across species, soil type, vegetation type, and ecosite. Only those differences in site index that are significant are shown.

Variable *I*	Variable *J*	Mean Difference (*I* - *J*)	*P*-value
Species			
RP	BS	4.717*	<0.001
RP	RS	4.204*	<0.001
RP	WS	3.374*	<0.001
NS	BS	3.847*	<0.001
NS	RS	3.334*	<0.001
NS	WS	2.504*	0.024
BF	BS	3.078*	0.001
BF	RS	2.564*	0.006
WP	BS	2.616*	0.017
Soil Type			
2	7	6.643*	0.022
2L	7	7.252*	0.004
3L	7	7.853*	0.003
5	7	7.498*	0.003
6	7	6.366*	0.017
12	7	7.149*	0.013
Vegetation Type			
WC2	MW1	-6.914*	0.002
WC2	MW3	-6.889*	0.001
WC2	SH10	-7.840*	<0.001
WC2	SH5	-6.674*	0.002
WC2	SH6	-6.648*	0.007
WC2	TH8	-8.138*	<0.001
SP7	MW1	-4.609*	0.007
SP7	MW3	-4.584*	0.006
SP7	SH10	-5.536*	<0.001
SP7	SH5	-4.369*	0.008
SP7	SH6	-4.343*	0.043
SP7	TH8	-5.834*	<0.001
Ecosite			
4	10	-6.400*	0.003
4	11	-6.938*	<0.001
4	13	-7.391*	<0.001
4	14	-7.297*	<0.001
7	10	-4.095*	0.014
7	11	-4.633*	0.004
7	13	-5.086*	<0.001
7	14	-4.993*	<0.001

* Significant at the $\alpha = 0.05$ level

Table 4. One-way ANOVA Tukey HSD post hoc test of land capability (LC; m^3/ha/yr) across species, soil type, vegetation type, and ecosite. Only those differences in LC that are significant are shown.

Variable *I*	Variable *J*	Mean Difference (*I* - *J*)	*P*-value
Species			
RP	BS	3.350*	<0.001
RP	RS	2.375*	<0.001
RP	WS	2.758*	<0.001
RP	WP	1.356*	0.004
RP	BF	1.851*	<0.001
NS	BS	2.922*	<0.001
NS	RS	1.947*	<0.001
NS	WS	2.330*	<0.001
NS	BF	1.423*	0.015
BF	BS	1.499*	0.003
WP	BS	1.737*	<0.001
Soil Type			
2	7	3.774*	0.039
2L	7	4.052*	0.010
3L	7	4.310*	0.009
5	7	4.017*	0.012
6	7	3.635*	0.029
12	7	4.060*	0.024
Vegetation Type			
SP7	MW1	-2.715*	0.009
SP7	MW3	-2.664*	0.009
SP7	SH10	-3.132*	0.002
SP7	SH5	-2.439*	0.019
SP7	SH6	-2.805*	0.023
SP7	TH8	-3.331*	0.001
WC2	MW1	-3.892*	0.004
WC2	MW3	-3.841*	0.004
WC2	SH10	-4.309*	0.001
WC2	SH5	-3.616*	0.008
WC2	SH6	-3.982*	0.007
WC2	TH8	-4.508*	0.001
Ecosite			
4	10	-3.414*	0.010
4	11	-3.960*	0.002
4	13	-4.097*	0.001
4	14	-4.084*	0.001
7	10	-2.237*	0.034
7	11	-2.783*	0.003
7	13	-2.920*	0.001
7	14	-2.907*	0.001

* Significant at the $\alpha = 0.05$ level

4. Discussion

As was to be expected, there was substantial variation of both site index and LC values across the different softwood species planted at the seven SSTTs. Among the spruce species, Norway spruce was the most productive in both height and volume growth and black spruce was the least. While these results may favour Norway spruce, the species is vulnerable to white pine weevil, which can reduce the capacity for yielding sawable products, and also has some current market limitations. Norway spruce and white pine were known to have been affected by weevil at these trials, which reduced their site index and LC values. As previously mentioned, white and red spruce were not significantly different in their site index or LC values, though height growth was slightly higher for white spruce. While white spruce shows high productivity, it does have high nutrient demands and can show decline and mortality even within the shorter rotation lengths of plantations that may not be reflected in the results of this study (Steenberg et al., 2023; Neily et al., 2025). Importantly, red spruce, white, and black spruce are part of the provincial tree improvement program, with second generation planting stock being recently made available. Growth gains for improved stock are estimated to be as high as 20% (NSDNR, 2021). Tree improvement is not reflected in the results of this study.

Of the other main softwood species with sufficient sample sizes to test statistically, red and white pine tended towards higher site index and LC values while balsam fir was slightly higher than red and white spruce though not significantly. It should be noted, however, that balsam fir has issues with rot, is not a long-lived species (O'Keefe et al., 2004), and highly vulnerable to climate change. For this reason balsam fir often is not favoured but it may still have benefits on certain sites and with shorter rotations. All of the SSTTs are on Acadian ecosites so as expected the Highland (i.e., Maritime Boreal) varieties of black spruce and white spruce yielded lower values. It is hoped that the species-specific results of this study will help practitioners and researchers better assess site index, LC, and plantation productivity. Moreover, future research at NSDNR will explore the feasibility of developing species-specific site index and LC curves, as there are known limitations in applying site index values between species (Avery & Burkhart, 2015). However, recall that while this study shows actual differences in height growth across species (Appendix B) that are needed to calculate LC, the calculation of LC values with NSGNY is not sensitive to species and may overpredict (e.g., black spruce) or underpredict values. The observed mean annual increment data (Appendix B) provide some additional insight and nuance to the LC values in this study.

Regarding the FEC dimension of the study, the results showed no substantial surprises in terms of variability across soil type, vegetation type, and ecosite. Perhaps the most important result was confirming that high-production softwood plantations are best to be established on zonal ecosites. There were no significant differences between the four zonal Acadian ecosites (i.e., 10, 11, 13, and 14), though median site index values were slightly lower for imperfectly drained ecosites compared to well-drained ones. It was the more nutrient-poor spruce-pine ecosite and the wet, poor ecosite (i.e., 7 and 4) that showed significantly lower site index and LC values.

The lack of major variation across FEC units alongside the known large-scale variability in plantation performance (Nicholson, 2007) demonstrate that while ecological factors are important, within zonal ecosites it is other silvicultural factors like competition control and planting practices that shape outcomes. It should be noted, however, that there are limitations and uncertainties both with this study and with the application of site index and LC in a forest planning context. While the seven SSTTs are fairly unique and provide valuable information, the results of this study are limited only to these seven sites and the sample size could be increased with further research. Stock type/nursery source was not considered in the study and that is an source of uncertainty. There is a fair amount of confidence in soil type classification in plantations but the vegetation type classifications in this study require some inference based on indicator plant species and professional judgment, which is also a source of uncertainty. Site index as a planning tool in general has some known limitations as well (Husch et al., 2003; Avery & Burkhart, 2015). Site index is not particularly well-suited for uneven-aged, mixed-composition stands and it relies on stand age as in input variable, which is difficult to measure variable in uneven-aged stands. Additionally, the LC values in Nova Scotia are also based on peak mean annual increment of fully stocked stands using the NSGNY, which are conditions that are not always achieved in operational plantations.

Lastly, it will be critical to look at the climate change implications of future plantation management in Nova Scotia. While the warming climate may possibly translate to increases in productivity, the increasing frequency of extreme weather (e.g., drought) and natural disturbances (e.g., hurricanes) mean that climate change will likely pose more challenges than opportunities (Taylor et al., 2020). There is active research in the province looking at assisted migration to help adapt planted forests to climate change (D'Orangeville, 2024). Moreover, climate-sensitive growth and yield modelling is another area of research adaptation that is on-going in Nova Scotia and across Canada (Metsaranta et al., 2024).

This study and future research on site index and LC that builds upon it will hopefully help practitioners conducting plantation management in Nova Scotia. Regarding the implementation of ecological forestry and the triad, the high-production forestry zone is outcomes based and has specific targets for plantation productivity (i.e., 6 m^3/ha/yr; NSDNR, 2021). Over 40 years of silviculture research in Nova Scotia (see NSDNR, 2021b & 2025) have shown that well-managed plantations can have four-to-five times the yield of natural, unmanaged stands and thus a core function of the smaller high-production zone of the triad is to offset wood supply losses from the ecological matrix and conservation zones. Research and evidence-based planning tools that are specific to plantations in the province can assist practitioners in their planning and the province as a whole to meet these outcomes and objectives.

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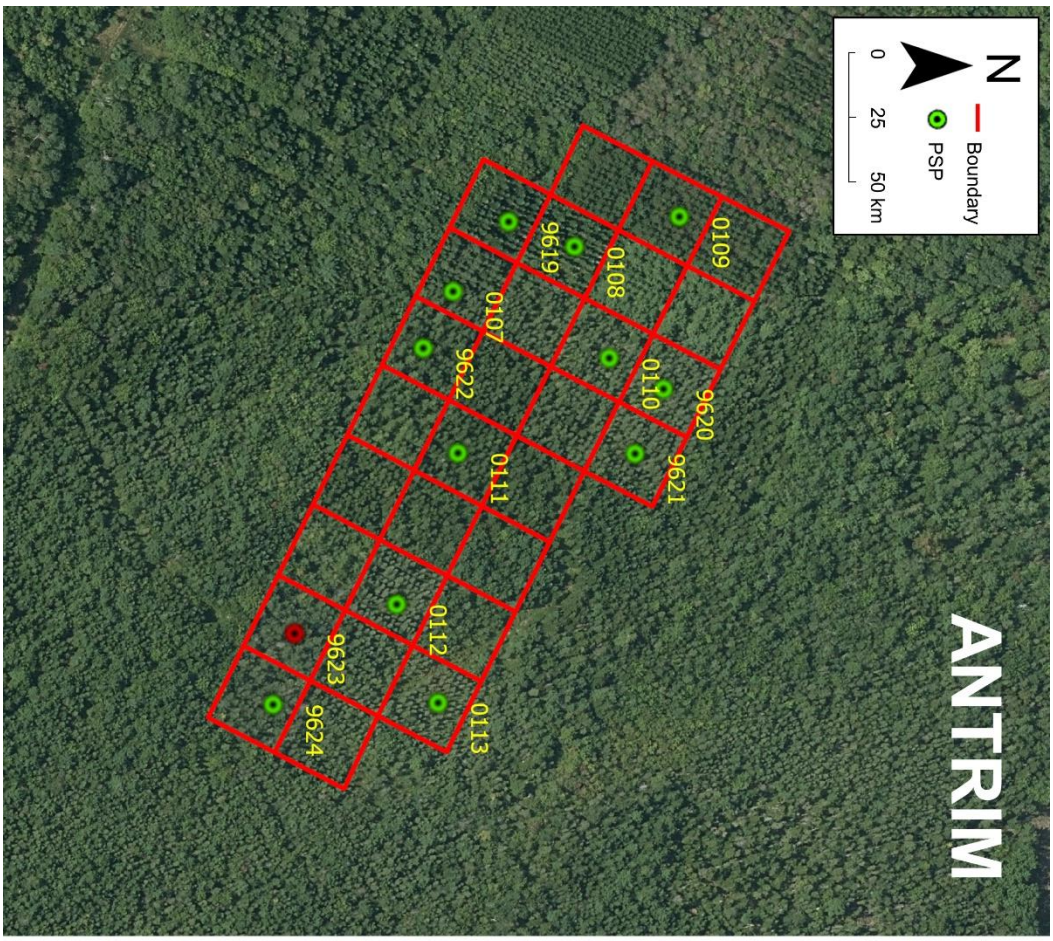
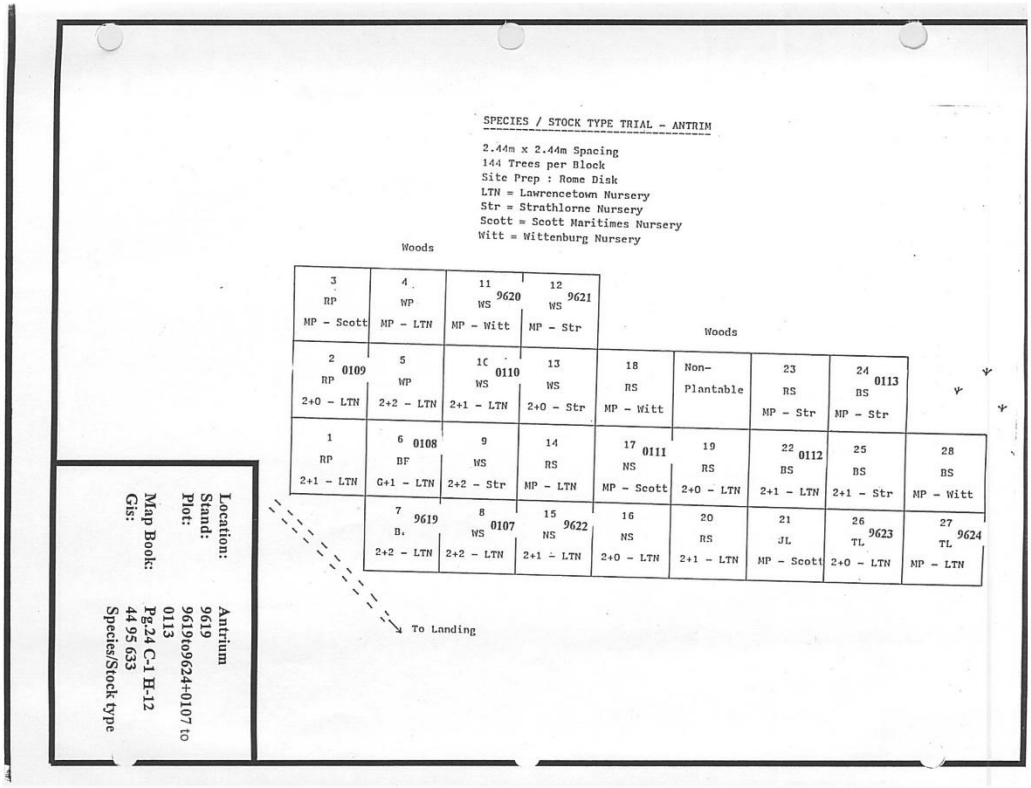
Appendix A – Species Stock-Type Trial Block Maps





SPECIES / STOCK TYPE TRIAL – ANTRIM

2.44m x 2.44m Spacing
144 Trees per Block
Site Prep : Rome Disk
LTN = Lawrencetown Nursery
Str = Strathlorne Nursery
Scott = Scott Maritimes Nursery
Witt = Wittenburg Nursery

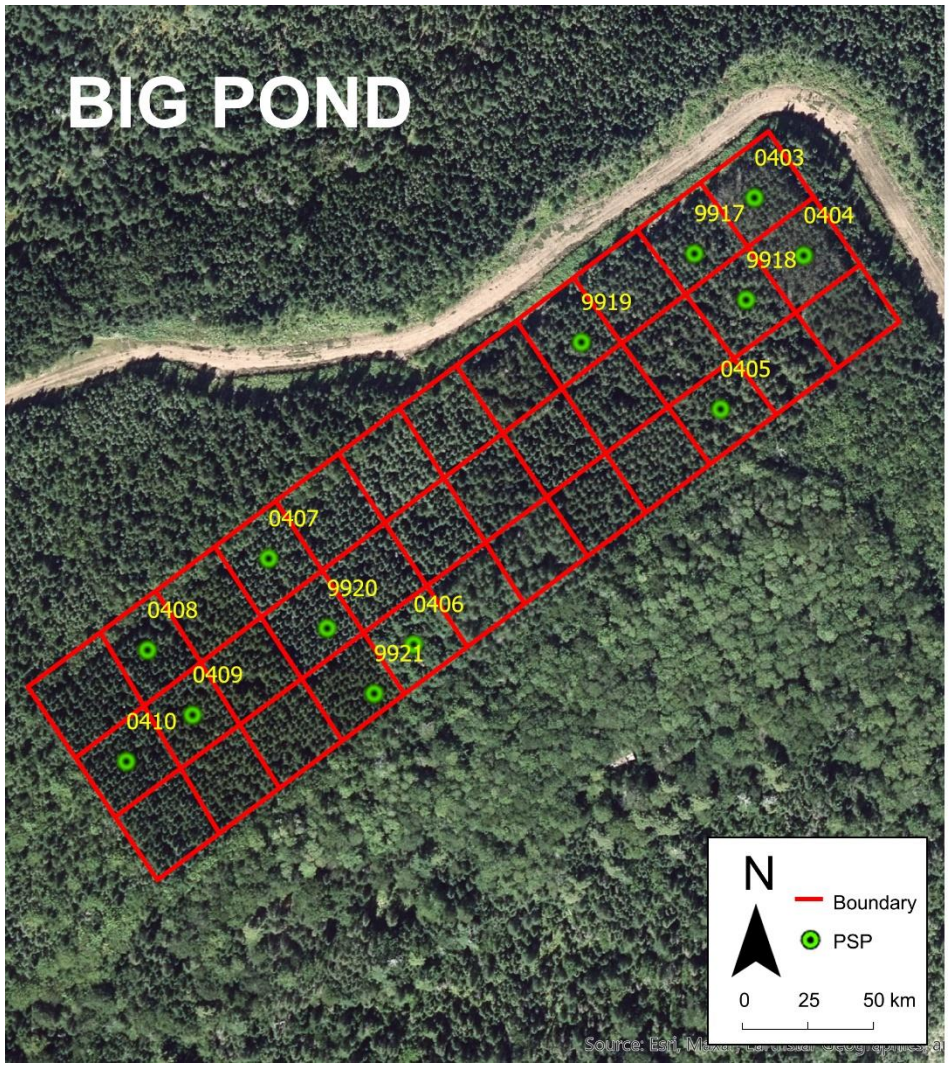
Woods

3 RP MP – Scott	4 WP MP – LTN	11 WS 9620 MP – Witt	12 WS 9621 MP – Str					
2 RP 0109 2+0 – LTN	5 WP 2+2 – LTN	10 WS 0110 2+1 – LTN	13 WS 2+0 – Str	18 RS MP – Witt	Non-Plantable	23 RS MP – Str	24 BS 0113 MP – Str	
1 RP 2+1 – LTN	6 BF 0108 G+1 – LTN	9 WS 2+2 – Str	14 RS MP – LTN	17 NS 0111 MP – Scott	19 RS 2+0 – LTN	22 BS 0112 2+1 – LTN	25 BS 2+1 – Str	28 BS MP – Witt
	7 B. 9619 2+2 – LTN	8 WS 0107 2+2 – LTN	15 NS 9622 2+1 – LTN	16 NS 2+0 – LTN	20 RS 2+1 – LTN	21 JL MP – Scott	26 TL 9623 2+0 – LTN	27 TL 9624 MP – LTN

Woods

To Landing

Location: Antrium
Stand: 9619
Plot: 9619o9624+0107 to 0113
Map Book: Pg 24 C-1 H-12
Gis: 44 95 633
Species/Stock type



SPECIE STOCK TYPE TRIAL Est. MAY, 1988

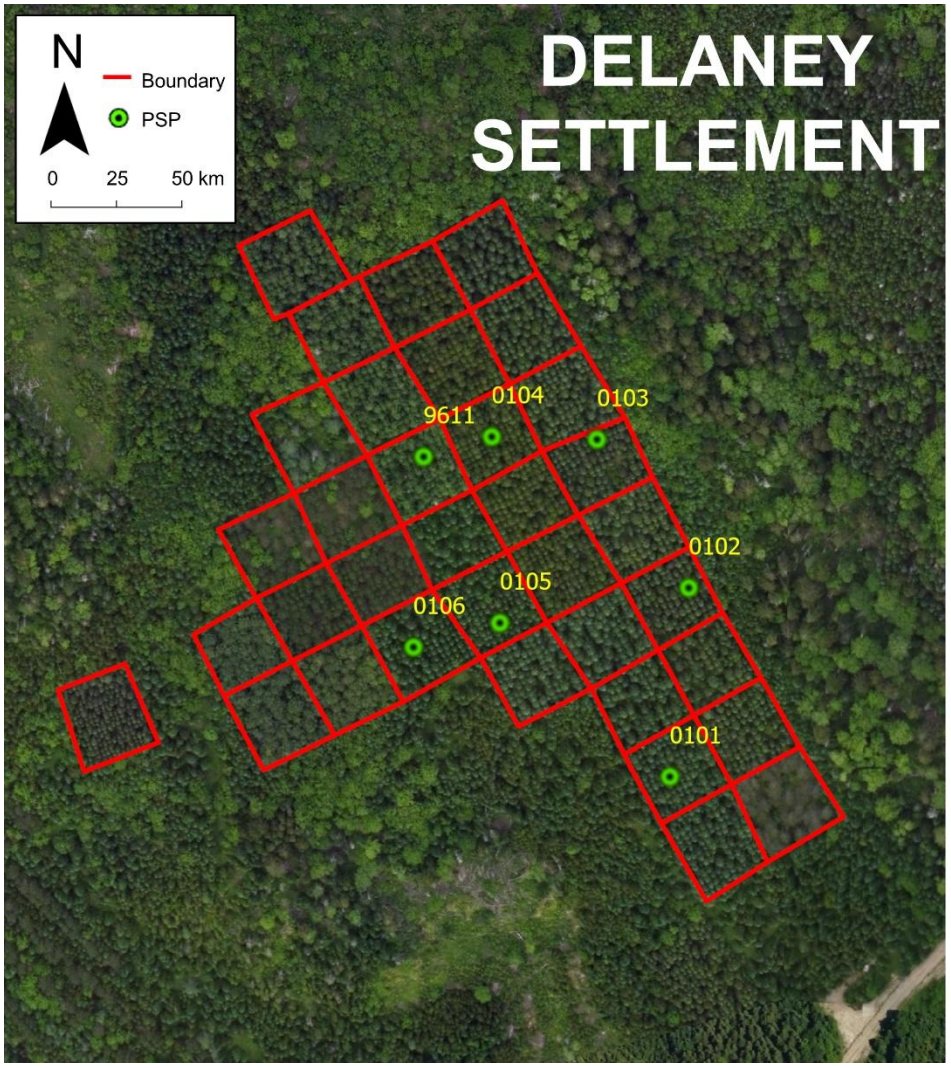
Big Pond, Cape Breton

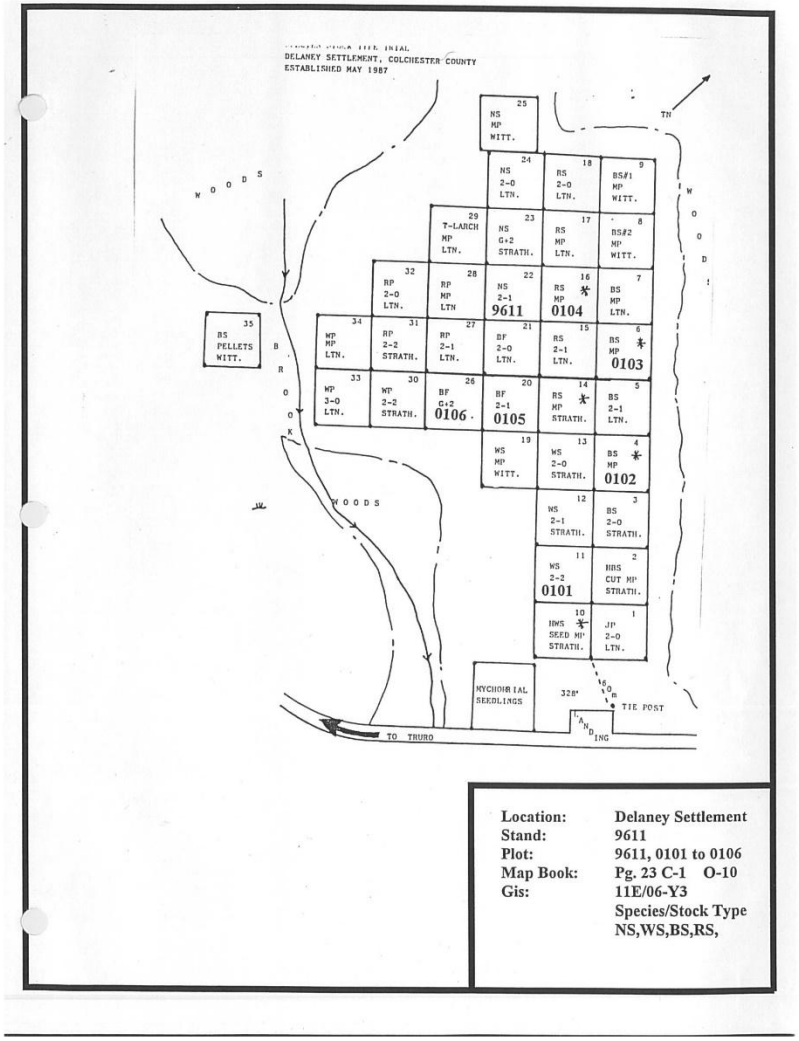
JP 25 2 + 0 LTN.	NS 26 Mp LTN.	NS 27 PSP 0405	WS 28 Mp STR.	WS 29 Mp WITT	EL 30 Mp LTN.	EL 31 2 + 0 LTN.	WP 32 PSP 2 + 2 0406	RS 33 PSP 2 + 2 9921	RS 34 Mp WITT	RS 35 Mp STR.	BF 36 Mp LTN.
RP 13 PSP 2 + 1 0404	NS 14 PSP 2 + 1 9918	NS 15 MP WITT	WS 16 2 + 2 STR.	BS 17 2 + 1 STR.	HWS 18 Mp STR.	BS 19 Mp WITT	BS 20 Mp STR.	HBS 21 PSP Mp 9920	RS 22 3 + 0 LTN.	BS 23 PSP 2 + 1 0409	BF 24 PSP 3 + 0 0410
RP 1 PSP MP 0403 LTN.	WS 2 PSP 2 + 2 9917 Fall	WS 3 2 + 1 STR.	WS 4 PSP Mp 9919 WITT	NS 5 2 + 1 LTN.	BS 6 Mp WITT	BS 7 2 + 2 STR.	BS 8 2 + 1 STR.	BS 9 PSP 2 + 1 0407	RS 10 Mp WITT	BF 11 PSP 2 + 2 0408	BF 12 2 + 1 LTN.

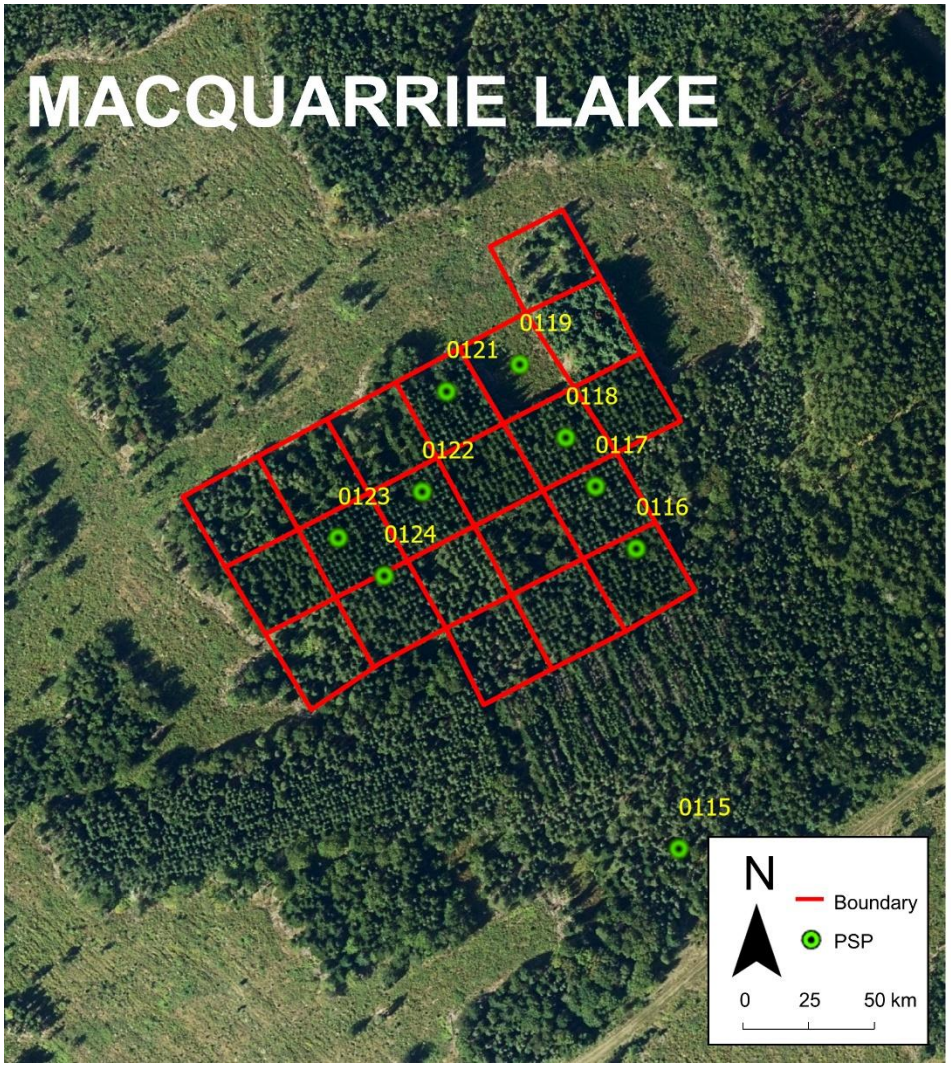
Block 1 PSP 0403
Block 2 PSP 9917
Block 4 PSP 9919
Block 9 PSP 0407
Block 11 PSP 0408
Block 13 PSP 0404
Block 14 PSP 9918
Block 21 PSP 9920
Block 23 PSP 0409
Block 24 PSP 0410
Block 27 PSP 0405
Block 32 PSP 0406
Block 33 PSP 9921

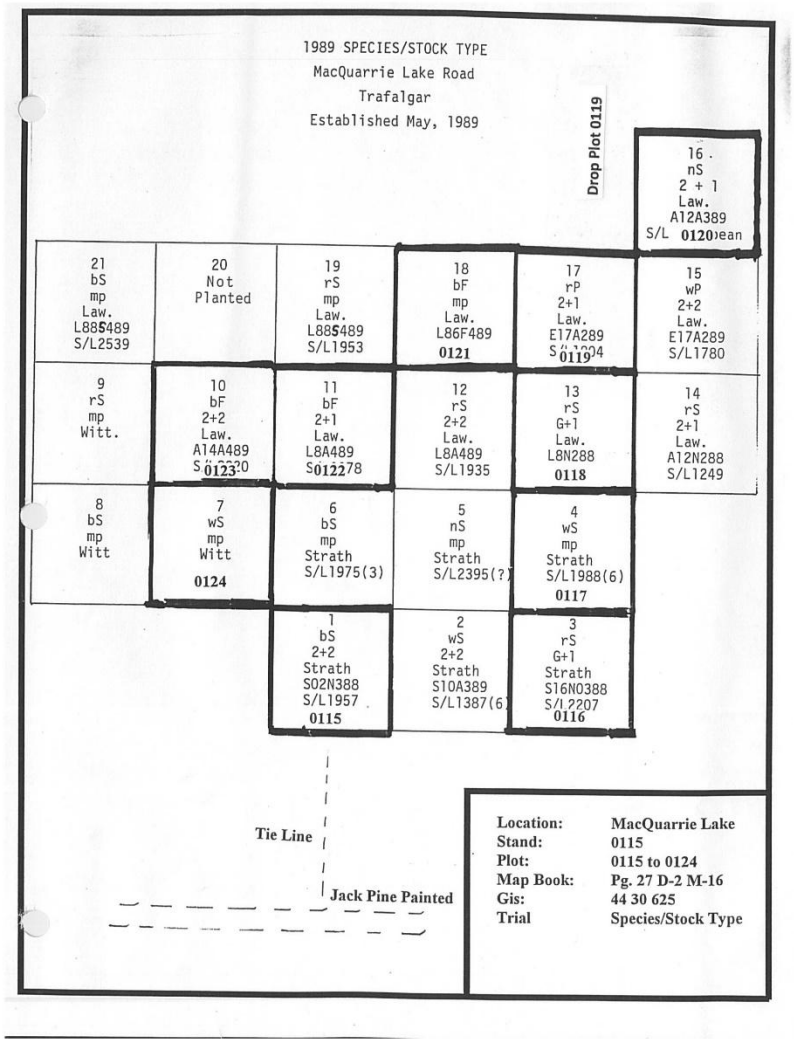
LAKING

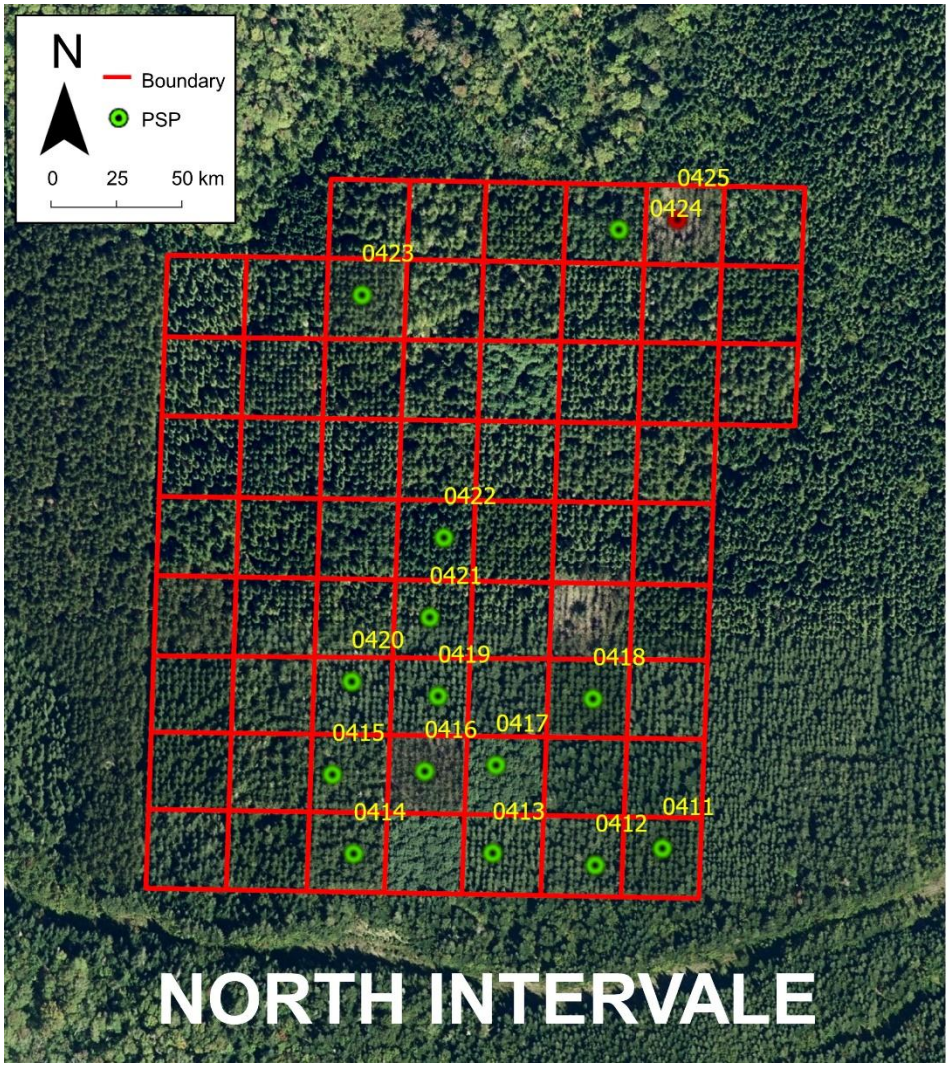
Location:	Big Pond
Stand:	9917
Plot:	9917 to 9921,0403 to 0410
Map Book:	Page 39 E-1 M-16
Gis:	45 85 604
Species	Rs,Ws,Bs,,Ns,Wp,Rp Bf,HBs,

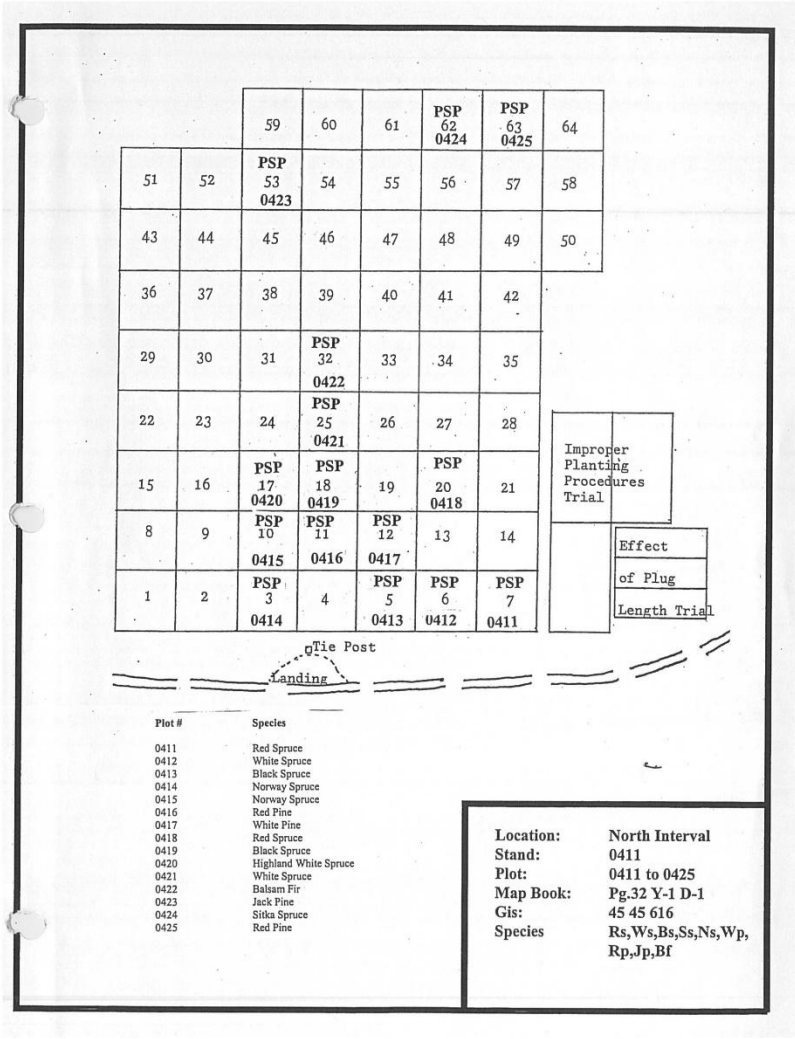

N
Boundary
PSP
0 25 50 km
DELANEY SETTLEMENT
9611
0104
0103
0102
0105
0106
0101


DELANEY SETTLEMENT, COLCHESTER COUNTY
ESTABLISHED MAY 1987
9611
0104
0103
0102
0105
0106
0101
TO TRURO
TIE POST
Location: Delaney Settlement
Stand: 9611
Plot: 9611, 0101 to 0106
Map Book: Pg. 23 C-1 O-10
Gis: 11E/06-Y3
Species/Stock Type
NS,WS,BS,RS,


MACQUARRIE LAKE
0119
0121
0118
0122
0117
0123
0116
0124
0115
N
Boundary
PSP
0
25
50 km


1989 SPECIES/STOCK TYPE
MacQuarrie Lake Road
Trafalgar
Established May, 1989
Drop Plot 0119
16
nS
2 + 1
Law.
A12A389
S/L 0120
21
bS
mp
Law.
L885489
S/L2539
20
Not
Planted
19
rS
mp
Law.
L885489
S/L1953
18
bF
mp
Law.
L86F489
0121
17
rP
2+1
Law.
E17A289
S/L1704
0119
15
wP
2+2
Law.
E17A289
S/L1780
9
rS
mp
Witt.
10
bF
2+2
Law.
A14A489
S/L2320
0123
11
bF
2+1
Law.
L8A489
S/L2278
0122
12
rS
2+2
Law.
L8A489
S/L1935
13
rS
G+1
Law.
L8N288
0118
14
rS
2+1
Law.
A12N288
S/L1249
8
bS
mp
Witt
7
wS
mp
Witt
0124
6
bS
mp
Strath
S/L1975(3)
5
nS
mp
Strath
S/L2395(?)
4
wS
mp
Strath
S/L1988(6)
0117
1
bS
2+2
Strath
S02N388
S/L1957
0115
2
wS
2+2
Strath
S10A389
S/L1387(6
3
rS
G+1
Strath
S16N0388
S/L2207
0116
Tie Line
Jack Pine Painted
Location: MacQuarrie Lake
Stand: 0115
Plot: 0115 to 0124
Map Book: Pg. 27 D-2 M-16
Gis: 44 30 625
Trial Species/Stock Type





		59	60	61	PSP 62 0424	PSP 63 0425	64
51	52	PSP 53 0423	54	55	56	57	58
43	44	45	46	47	48	49	50
36	37	38	39	40	41	42	
29	30	31	PSP 32 0422	33	34	35	
22	23	24	PSP 25 0421	26	27	28	
15	16	PSP 17 0420	PSP 18 0419	19	PSP 20 0418	21	
8	9	PSP 10 0415	PSP 11 0416	PSP 12 0417	13	14	
1	2	PSP 3 0414	4	PSP 5 0413	PSP 6 0412	PSP 7 0411	

Improper Planting Procedures Trial

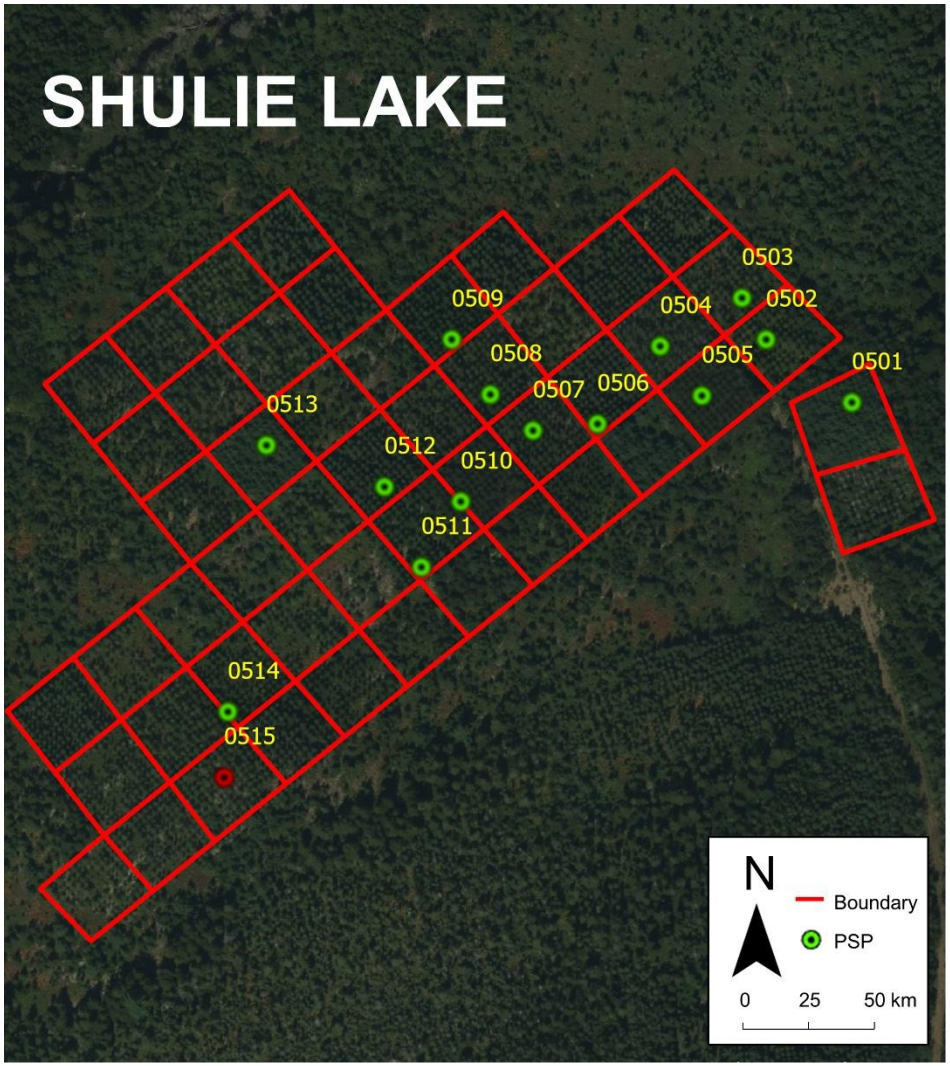
Effect of Plug Length Trial

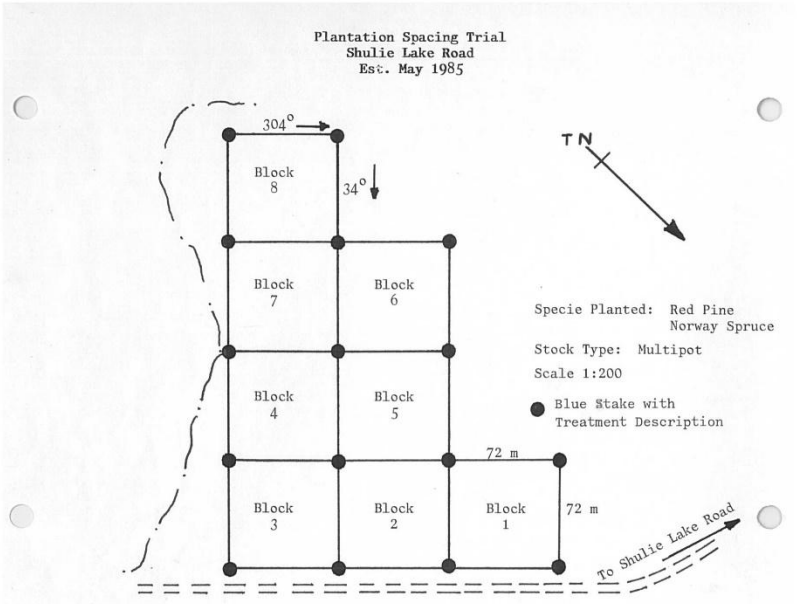
Tie Post

Landing

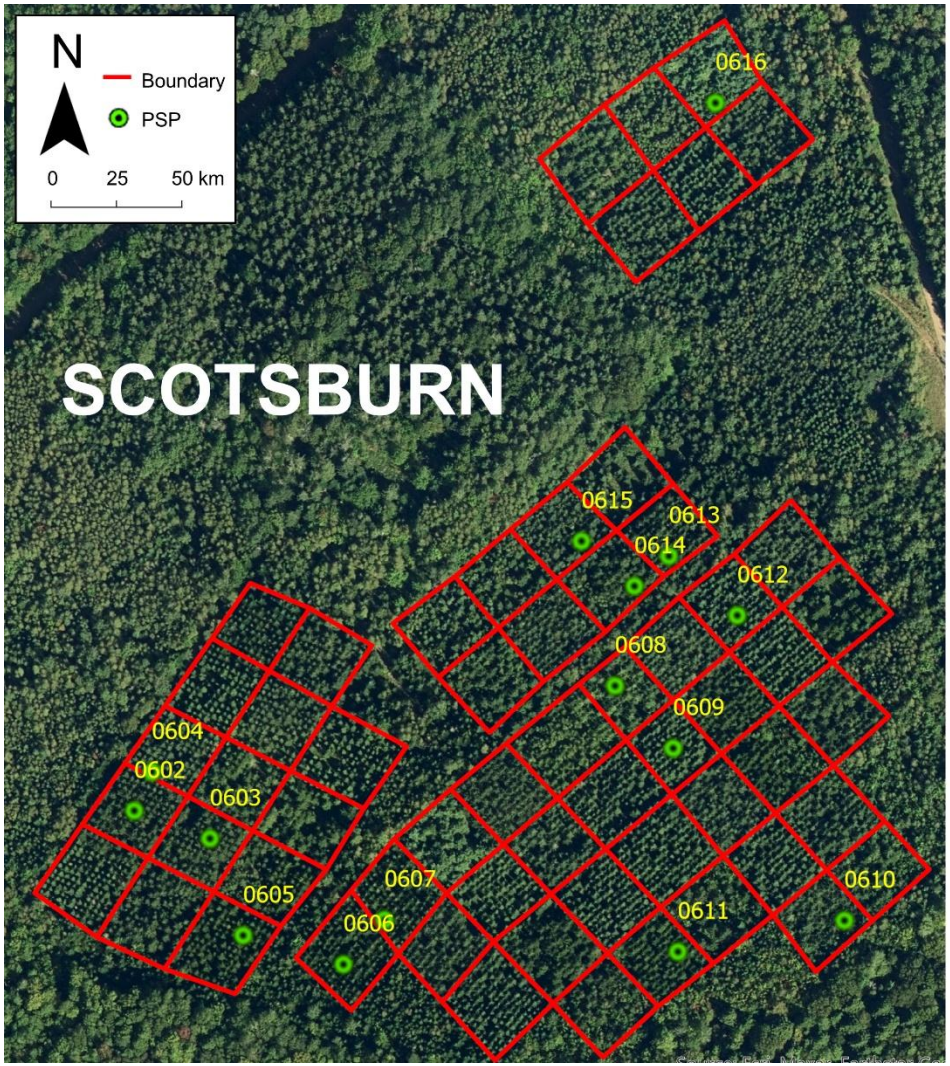
Plot #	Species
0411	Red Spruce
0412	White Spruce
0413	Black Spruce
0414	Norway Spruce
0415	Norway Spruce
0416	Red Pine
0417	White Pine
0418	Red Spruce
0419	Black Spruce
0420	Highland White Spruce
0421	White Spruce
0422	Balsam Fir
0423	Jack Pine
0424	Sitka Spruce
0425	Red Pine

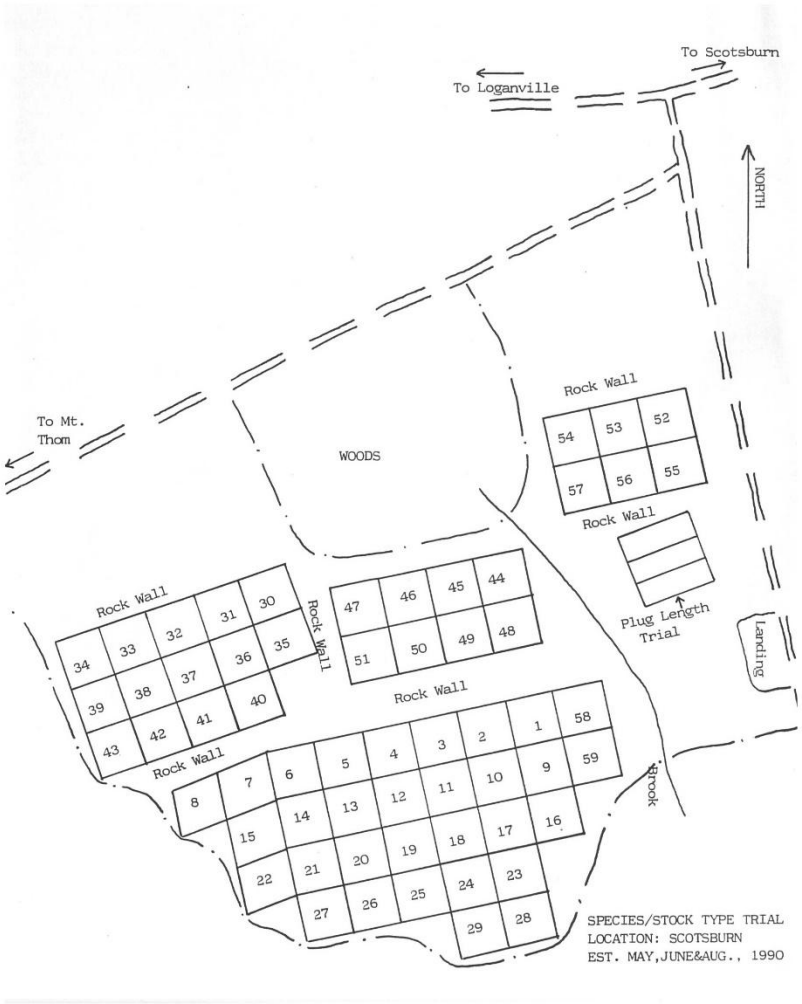
Location:	North Interval
Stand:	0411
Plot:	0411 to 0425
Map Book:	Pg.32 Y-1 D-1
Gis:	45 45 616
Species	Rs,Ws,Bs,Ss,Ns,Wp, Rp,Jp,Bf





Block	Specie	Area (ha)	# Trees	Spacing (m)
1	Pine	.50	560	3.0x3.0
2	Pine	.50	3500	1.2x1.2
3	Spruce	.50	3500	1.2x1.2
4	Spruce	.50	1550	1.8x1.8
5	Pine	.50	1550	1.8x1.8
6	Pine	.50	870	2.4x2.4
7	Spruce	.50	870	2.4x2.4
8	Spruce	.50	560	3.0x3.0
TOTAL		4.0	12,960	


N
Boundary
PSP
0 25 50 km
SCOTSBURN
0616
0615
0613
0614
0612
0608
0609
0604
0602
0603
0605
0607
0606
0611
0610


To Scotsburn
To Loganville
NORTH
To Mt. Thom
WOODS
Rock Wall
54 53 52
57 56 55
Rock Wall
Plug Length Trial
Landing
Rock Wall
34 33 32 31 30
39 38 37 36 35
43 42 41 40
Rock Wall
47 46 45 44
51 50 49 48
Rock Wall
8 7 6 5 4 3 2 1 58
15 14 13 12 11 10 9 59
22 21 20 19 18 17 16
27 26 25 24 23
29 28
Brook
SPECIES/STOCK TYPE TRIAL
LOCATION: SCOTSBURN
EST. MAY,JUNE&AUG., 1990

Appendix B – Detailed Site Index and Land Capability Results

Table B1. Site index (m) at 50 years breast height age by species for each species stock-type trial and all trials combined. Values for mean (*X*), standard deviation (SD), and block/PSP sample size (*N*) are given.

	Antrim			Big Pond			Delaney Settlement			MacQuarrie Lake			North Intervale			Scotsburn			Shulie Lake			Total		
	X	**SD**	***N***	***X***	**SD**	***N***	***X***	**SD**	***N***	***X***	**SD**	***N***	***X***	**SD**	***N***	***X***	**SD**	***N***	***X***	**SD**	***N***	***X***	**SD**	***N***
RS	16.16	1.35	5	18.78	0.19	2	17.02	0.1	2	17.67	1.1	6	19.76	0.98	2	18.46	0.43	2	16.68		1	17.58	1.45	20
WS	15.51	1.77	4	19.39	1.18	2	19.7	0.97	2	20.47	1.5	3	18.61	0.65	2	19.94	1.83	2	17.08	3.81	2	18.41	2.43	17
WS*				21.08		1	18.22		1				16.48		1	16.5		1	16.61		1	17.78	1.99	5
BS	12.37	2.65	2	17.56	0.38	2	14.35	0.59	2	17.8	2	4	19.29	0.49	2	18.81	0.7	2	18.53	0.63	2	17.06	2.61	16
BS*				13.93		1	12.53		1													13.23	0.99	2
NS	21.45	0.29	2	22.63	1.76	2	20.26	0.82	2	26.2		1	20.51	0.66	2	17.82	1.48	2	19.38		1	20.91	2.4	12
SS													24.22	2.79	2	18.1		1				22.18	4.04	3
WP	20.25	1.63	2	21.63		1	19.83	0.85	3	20.27		1	17.81	1.24	2	17.55		1	20.54	0.05	2	19.68	1.46	12
RP	22.37	1.12	3	22.4	1.1	2	21.14	1.85	4				22.4	0.05	2	20.46	0.53	2	22.7		1	21.78	1.33	14
JP				21.22		1	19.6		1				20.78		1				25.23		1	21.71	2.45	4
TL	20.7		1				27.5		1										24.79		1	24.33	3.42	3
EL				27.66	0.63	2																27.66	0.63	2
JL	17.66		1																			17.66		1
BF	17.97	0.14	2	21.74	0.41	2	20.57	2.12	2	20.41	0.88	3	23.1	0.2	2	19.61	0.84	2	17.46	2.25	2	20.14	2.07	15

* Highland variety

Table B2. Land capability (m^3/ha/yr) by species for each species stock-type trial and all trials combined. Values for mean (*X*), standard deviation (SD), and block/PSP sample size (*N*) are given.

	Antrim			Big Pond			Delaney Settlement			MacQuarrie Lake			North Intervale			Scotsburn			Shulie Lake			Total		
	X	**SD**	***N***	***X***	**SD**	***N***	***X***	**SD**	***N***	***X***	**SD**	***N***	***X***	**SD**	***N***	***X***	**SD**	***N***	***X***	**SD**	***N***	***X***	**SD**	***N***
RS	5.74	0.76	5	7.21	0.1	2	6.22	0.06	2	6.58	0.62	6	7.75	0.55	2	7.03	0.25	2	6.03		1	6.53	0.81	20
WS	4.69	0.88	4	6.64	0.61	2	6.8	0.49	2	7.19	0.75	3	6.24	0.33	2	6.93	0.95	2	5.47	1.91	2	6.15	1.23	17
WS*				7.48		1	6.04		1				5.17		1	5.18		1	5.24		1	5.82	0.99	5
BS	3.25	1.25	2	5.8	0.19	2	4.19	0.3	2	5.92	1	4	6.67	0.24	2	6.43	0.34	2	6.28	0.32	2	5.56	1.29	16
BS*	8.8	0.17	2	3.98		1	3.3		1													3.64	0.49	2
NS	8.8	0.17	2	9.48	1.02	2	8.08	0.49	2	11.64		1	8.24	0.37	2	6.67	0.88	2	7.57		1	8.48	1.42	12
SS													9.12	1.46	2	5.98		1				8.07	2.08	3
WP	7.61	0.89	2	8.37		1	7.38	0.46	3	7.63		1	6.26	0.71	2	6.09		1	7.78	0.03	2	7.29	0.81	12
RP	9.26	0.67	3	9.28	0.64	2	8.54	1.06	4				9.24	0.03	2	8.16	0.28	2	9.4		1	8.91	0.76	14
JP				8.23		1	7.29		1				7.96		1				10.45		1	8.48	1.37	4
TL	7.92		1				11.88		1										10.2		1	10	1.99	3
EL				11.99	0.42	2																11.99	0.42	2
JL	6.23		1																			6.23		1
BF	6	0.07	2	7.83	0.2	2	7.26	1.03	2	7.19	0.43	3	8.52	0.09	2	6.79	0.41	2	5.74	1.11	2	7.06	1.01	15

* Highland variety

Table B3. Site index (m) at 50 years breast height age by soil type for each species stock-type trial and all trials combined. Values for mean (*X*), standard deviation (SD), and block/PSP sample size (*N*) are given.

	Antrim			Big Pond			Delaney Settlement			MacQuarrie Lake			North Intervale			Scotsburn			Shulie Lake			Total		
	X	**SD**	***N***	***X***	**SD**	***N***	***X***	**SD**	***N***	***X***	**SD**	***N***	***X***	**SD**	***N***	***X***	**SD**	***N***	***X***	**SD**	***N***	***X***	**SD**	***N***
2										18.98	1.89	4							20.75	3.71	7	20.1	3.18	11
2L				21.5	4.31	9	19.48	2.45	13	17.19	3.17	2							18.19	2.23	2	19.91	3.36	26
2S																			17.98	3.2	3	17.98	3.2	3
3																			18.97		1	18.97		1
3L				20.82	2.36	7	18.62	0.56	2	19.25	3.34	2										20.13	2.33	11
5							19.2	5.25	6	20.29	1.07	2	20.76	2.24	#				18.08		1	20.2	3.16	23
6	18.26	2.92	19	19.46	2.3	2				19.62	2.94	8	19.65	3.84	2							18.78	2.87	31
6S													19.36	4.08	2							19.36	4.08	2
7	15.15	5.16	3																			15.15	5.16	3
11																18.52	1.12	6				18.52	1.12	6
12																19.03	1.54	9				19.03	1.54	9

Table B4. Land capability (m^3/ha/yr) by soil type for each species stock-type trial and all trials combined. Values for mean (*X*), standard deviation (SD), and block/PSP sample size (*N*) are given.

	Antrim			Big Pond			Delaney Settlement			MacQuarrie Lake			North Intervale			Scotsburn			Shulie Lake			Total		
	X	**SD**	***N***	***X***	**SD**	***N***	***X***	**SD**	***N***	***X***	**SD**	***N***	***X***	**SD**	***N***	***X***	**SD**	***N***	***X***	**SD**	***N***	***X***	**SD**	***N***
2										6.87	0.75	4							8.06	2.09	7	7.62	1.77	11
2L				8.36	2.48	9	7.33	1.42	13	5.61	1.59	2							6.03	1.12	2	7.45	1.95	26
2S																			6.14	1.85	3	6.14	1.85	3
3																			6.51		1	6.51		1
3L				7.98	1.73	7	6.25	0.29	2	6.96	1.15	2										7.48	1.57	11
5							7.02	3.05	6	7.11	0.49	2	7.78	1.18	#				6.06		1	7.45	1.78	23
6	6.65	1.8	19	6.7	1.09	2				7.34	1.84	8	7.49	2.45	2							6.88	1.76	31
6S													6.63	2.06	2							6.63	2.06	2
7	4.81	2.84	3																			4.81	2.84	3
11																6.49	0.41	6				6.49	0.41	6
12																6.93	1.03	9				6.93	1.03	9

Table B5. Site index (m) at 50 years breast height age by vegetation type for each species stock-type trial and all trials combined. Values for mean (*X*), standard deviation (SD), and block/PSP sample size (*N*) are given.

	Antrim			Big Pond			Delaney Settlement			MacQuarrie Lake			North Intervale			Scotsburn			Shulie Lake			Total		
	X	**SD**	***N***	***X***	**SD**	***N***	***X***	**SD**	***N***	***X***	**SD**	***N***	***X***	**SD**	***N***	***X***	**SD**	***N***	***X***	**SD**	***N***	***X***	**SD**	***N***
MW1							19.32	3.25	21													19.32	3.25	21
MW3	19.64	2.86	7													18.82	1.37	15				19.08	1.93	22
SH10													20.48	2.45	18							20.48	2.45	18
SH5										19.24	2.49	18							19.47	3.18	14	19.34	2.77	32
SH6	19.02	2.36	7																			19.02	2.36	7
SP7	15.27	1.55	5																			15.27	1.55	5
TH8				21.01	3.38	18																21.01	3.38	18
WC2	15.15	5.16	3																			15.15	5.16	3
MW1							19.32	3.25	21													19.32	3.25	21
MW3	19.64	2.86	7													18.82	1.37	15				19.08	1.93	22
SH10													20.48	2.45	18							20.48	2.45	18

Table B6. Land capability (m^3/ha/yr) by vegetation type for each species stock-type trial and all trials combined. Values for mean (*X*), standard deviation (SD), and block/PSP sample size (*N*) are given.

	Antrim			Big Pond			Delaney Settlement			MacQuarrie Lake			North Intervale			Scotsburn			Shulie Lake			Total		
	X	**SD**	***N***	***X***	**SD**	***N***	***X***	**SD**	***N***	***X***	**SD**	***N***	***X***	**SD**	***N***	***X***	**SD**	***N***	***X***	**SD**	***N***	***X***	**SD**	***N***
MW1							7.14	1.91	21													7.14	1.91	21
MW3	7.39	1.91	7													6.75	0.84	15				6.95	1.27	22
SH10													7.62	1.35	18							7.62	1.35	18
SH5										6.98	1.42	18							7.1	1.9	14	7.03	1.62	32
SH6	7.23	1.28	7																			7.23	1.28	7
SP7	4.79	0.92	5																			4.79	0.92	5
TH8				8.03	2.07	18																8.03	2.07	18
WC2	4.81	2.84	3																			4.81	2.84	3
MW1							7.14	1.91	21													7.14	1.91	21
MW3	7.39	1.91	7													6.75	0.84	15				6.95	1.27	22
SH10													7.62	1.35	18							7.62	1.35	18

Table B7. Site index (m) at 50 years breast height age by ecosite for each species stock-type trial and all trials combined. Values for mean (*X*), standard deviation (SD), and block/PSP sample size (*N*) are given.

	Antrim			Big Pond			Delaney Settlement			MacQuarrie Lake			North Intervale			Scotsburn			Shulie Lake			Total		
	X	**SD**	***N***	***X***	**SD**	***N***	***X***	**SD**	***N***	***X***	**SD**	***N***	***X***	**SD**	***N***	***X***	**SD**	***N***	***X***	**SD**	***N***	***X***	**SD**	***N***
4	15.15	5.16	3																			15.15	5.16	3
7	15.27	1.55	5																			15.27	1.55	5
10										18.86	2.13	8							19.51	3.31	13	19.26	2.87	21
11	19.02	2.36	7							19.55	2.82	10							18.97		1	19.31	2.5	18
13				21.5	4.31	9	19.39	3.42	19				20.69	2.35	17	18.52	1.12	6				20.09	3.17	51
14	19.64	2.86	7	20.52	2.28	9	18.62	0.56	2				16.93		1	19.03	1.54	9				19.55	2.19	28

Table B8. Land capability (m^3/ha/yr) by ecosite for each species stock-type trial and all trials combined. Values for mean (*X*), standard deviation (SD), and block/PSP sample size (*N*) are given.

	Antrim			Big Pond			Delaney Settlement			MacQuarrie Lake			North Intervale			Scotsburn			Shulie Lake			Total		
	X	**SD**	***N***	***X***	**SD**	***N***	***X***	**SD**	***N***	***X***	**SD**	***N***	***X***	**SD**	***N***	***X***	**SD**	***N***	***X***	**SD**	***N***	***X***	**SD**	***N***
4	4.81	2.84	3																			4.81	2.84	3
7	4.79	0.92	5																			4.79	0.92	5
10										6.62	1.01	8							7.15	1.97	13	6.95	1.66	21
11	7.23	1.28	7							7.27	1.67	10							6.51		1	7.21	1.44	18
13				8.36	2.48	9	7.23	1.99	19				7.73	1.3	17	6.49	0.41	6				7.51	1.81	51
14	7.39	1.91	7	7.7	1.65	9	6.25	0.29	2				5.75		1	6.93	1.03	9				7.2	1.48	28

Table B9. Site index (m) at 50 years breast height age by species for each ecosite. Values for mean (*X*), standard deviation (SD), and block/PSP sample size (*N*) are given.

	4			7			10			11			13			14		
	X	**SD**	***N***	***X***	**SD**	***N***	***X***	**SD**	***N***	***X***	**SD**	***N***	***X***	**SD**	***N***	***X***	**SD**	***N***
RS				14.46		1	17.47	1.38	3	17.23	1.11	7	18.47	1.21	7	17.4	1.94	2
WS				14.75	1.1	3	18.40	3.53	3	20.19	2.00	2	19.06	0.96	4	19.37	1.37	5
WS*							16.61		1				16.48		1	18.60	2.32	3
BS	12.37	2.65	2				17.84	2.01	4	18.44	0.75	2	17.12	2.59	5	18.14	1.04	3
BS*													13.23	0.99	2			
NS							19.38		1	23.72	3.50	2	19.66	1.70	5	21.44	2.05	4
SS													24.22	2.79	2	18.10		1
WP							20.54	0.05	2	20.26	1.15	3	19.96	1.21	5	17.24	0.43	2
RP							22.70		1	21.08		1	21.57	1.44	7	22.03	1.46	5
JP							25.23		1				20.19	0.83	2	21.22		1
TL	20.70		1				24.79		1				27.5		1			
EL													27.66	0.63	2			
JL				17.66		1												
BF							18.94	2.26	4	20.40		1	21.25	1.65	8	17.97	0.14	2

* Highland variety

Table B10. Land capability (m^3/ha/yr) by species for each ecosite. Values for mean (*X*), standard deviation (SD), and block/PSP sample size (*N*) are given.

	4			7			10			11			13			14		
	X	**SD**	***N***	***X***	**SD**	***N***	***X***	**SD**	***N***	***X***	**SD**	***N***	***X***	**SD**	***N***	***X***	**SD**	***N***
RS				4.79		1	6.47	0.77	3	6.34	0.62	7	7.03	0.68	7	6.44	1.09	2
WS				4.31	0.54	3	6.13	1.77	3	7.06	1.01	2	6.47	0.49	4	6.64	0.70	5
WS*							5.24		1				5.17		1	6.23	1.16	3
BS	3.25	1.25	2				5.94	1.00	4	6.24	0.38	2	5.58	1.30	5	6.09	0.52	3
BS*													3.64	0.49	2			
NS							7.57		1	10.16	2.09	2	7.74	1.00	5	8.79	1.19	4
SS													9.12	1.46	2	5.98		1
WP							7.78	0.03	2	7.62	0.63	3	7.46	0.66	5	5.92	0.24	2
RP							9.40		1	8.49		1	8.78	0.82	7	9.07	0.85	5
JP							10.45		1				7.63	0.47	2	8.23		1
TL	7.92		1				10.20		1				11.88		1			
EL													11.99	0.42	2			
JL				6.23		1												
BF							6.47	1.11	4	7.17		1	7.6	0.81	8	6.00	0.07	2

* Highland variety

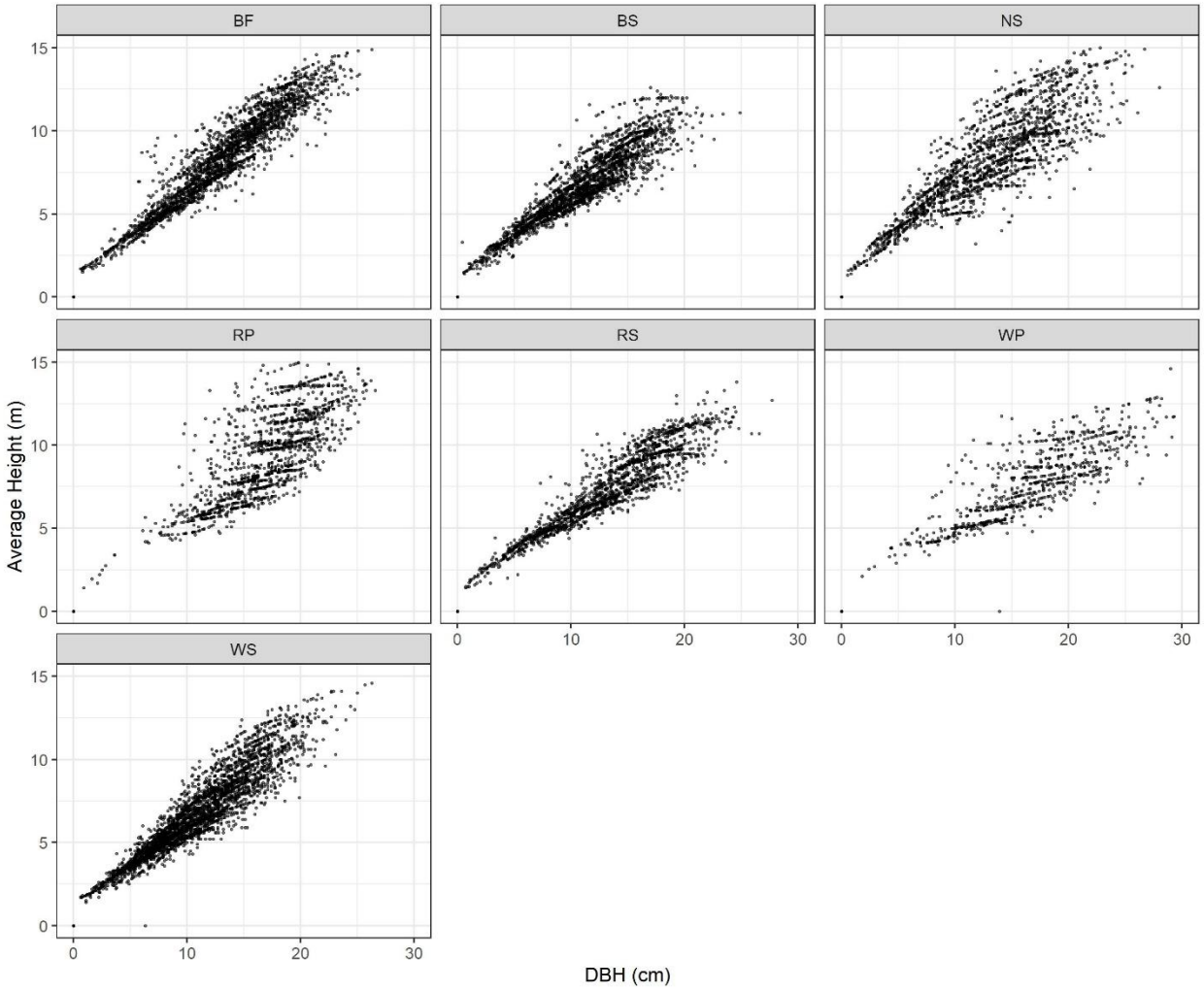


Fig. B1. Observed diameter and height values of the main softwood species.

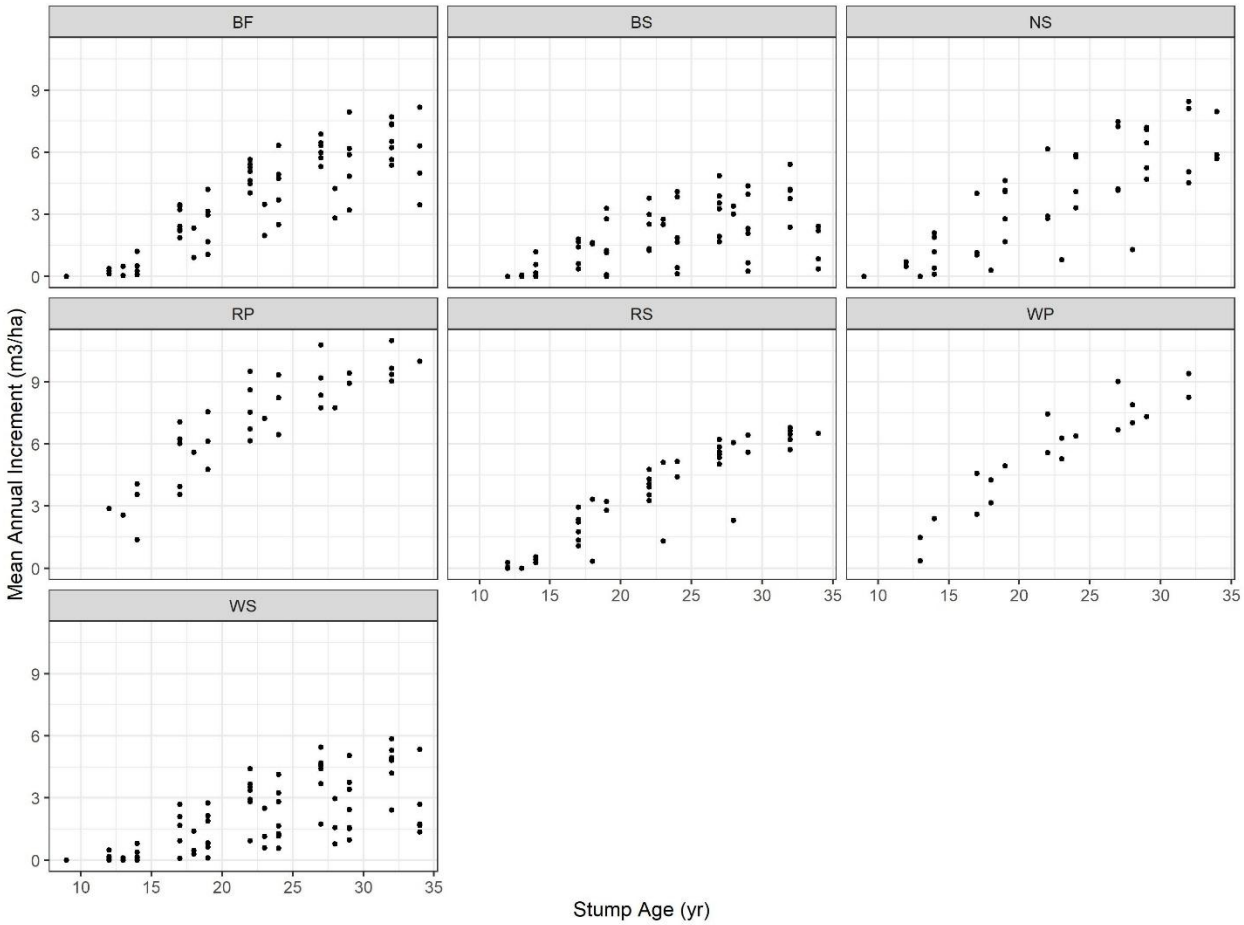


Fig. B2. Observed mean annual increment values of the main softwood species.

Appendix C – Site Index and Land Capability Comparison Tables for Practitioners

Table C1. Site Index (m) at 50 years breast height age of common softwood species in zonal ecosites standardized to the value of red spruce.

Ecosite	RS	WS	BS	NS	WP	RP	BF
10	1	1.053	1.021	1.109	1.176	1.299	1.084
11	1	1.172	1.070	1.377	1.176	1.223	1.184
13	1	1.032	0.927	1.064	1.081	1.168	1.151
14	1	1.113	1.043	1.232	0.991	1.266	1.033
All	1	1.047	0.971	1.190	1.120	1.239	1.146

Table C2. Land capability (m3/ha/yr) of common softwood species in zonal ecosites standardized to the value of red spruce.

Ecosite	RS	WS	BS	NS	WP	RP	BF
10	1	0.947	0.918	1.170	1.202	1.453	1.000
11	1	1.114	0.984	1.603	1.202	1.339	1.131
13	1	0.920	0.794	1.101	1.061	1.249	1.081
14	1	1.031	0.946	1.365	0.919	1.408	0.932
All	1	0.942	0.851	1.299	1.116	1.364	1.081