

**Western Redcedar and Yellow-Cypress
Stock Type Trial
(Impact on Browsing)**

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Establishment Report

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by

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1.0 Introduction

A trial was established in TFL 37 (in the vicinity of Woss and Gold River, B.C.) at Claude Elliott Lake and Oktwanch Creek in the spring of 1994 to test the effectiveness of some treatments in reducing damage from browsing by deer and elk. Western redcedar (*Thuja plicata* Donn) and yellow-cypress [*Chamaecyparis nootkatensis* (D. Donn) Spach] are highly favoured foods of deer and elk. Seven different stock types of these two species were planted in areas protected with deer fencing or Vexar¹. In addition, fertilizer (SILVA PAKS Forestry 17-7-12 Time-of-Planting Slow-Release Fertilizer) was applied to some trees to test its effectiveness in encouraging growth despite browsing. The main objective is to get fast-growing seedlings that will overcome browsing loss in the shortest time.

Stock was ordered to be thawed for planting by March 15, 1994. On the first half day of planting, a snowfall delayed the start of planting until March 29. Planting was finished by April 11. The stock was stored in coolers at Pacific Forest Products Ltd. in Gold River and at Canadian Forest Products Ltd. in Woss. Coolers were kept at a constant 1-2°C. The weather cooperated and was perfect throughout the planting period.

2.0 Objectives

The objectives of this study are to:

1. Assess the effectiveness of using large stock types to reduce growth loss to deer browse in western redcedar and yellow-cypress.
2. Assess the effectiveness of Vexar tubes for reducing growth loss to deer browse in western redcedar and yellow-cypress. Performance of seedlings established with Vexar will be compared to that of seedlings in a fenced area from which deer are excluded.
3. Add to existing information regarding the effect of growing yellow-cypress at elevations lower than its natural range.
4. Acquire information that can be used towards production of a field guide for control of deer browse (in western redcedar and yellow-cypress plantations) in the Vancouver Forest Region.
5. Provide a demonstration area that can be used for field workshops and extension programs.

¹Vexar is a plastic net that is put over the seedling. It biodegrades in 4-5 years.

3.0 Methods

3.1 Experimental Design

This experiment uses a randomized complete block design on two sites that are considered replicates, with three blocks on each site. There is one split-plot for three levels of deer control (1 - unfenced, 2 - fenced, 3 - Vexar tubes), the position of which is randomly allocated in each location, but not within each block. There is a second split-plot for two levels of fertilization (0 - unfertilized, 1 - fertilized with slow-release fertilizer) that are randomly allocated within each block and deer control sub-plot (see Appendix 1). Within each sub-sub-plot, there are seven rows of 40 seedlings, each representing one of the seven stock types in the experiment. Seedlings in rows were planted 1.5 m apart. Rows in the Claude Elliott Lake Plots 7 to 18 were placed 3 m apart; however, row interwalls for Plots 1 to 7 at Claude Elliott Lake and all of the plots at Oktwanch Creek were reduced to 2 m apart because of the lack of available space at the planting sites. The total number of seedlings planted was:

40 seedlings
x 7 stock types
x 2 levels of fertilization
x 3 levels of deer control
x 3 blocks
x 2 sites
= 10 080 seedlings.

3.2 Site Selection

Two sites were selected which satisfy the following criteria:

- They can be considered replicates.
- They are expected to have moderate to high deer traffic (and so will most likely be medium to rich in nutrient status).
- Terrain is no more than gently sloping to facilitate fencing.
- Sites are below 500 meters elevation.
- Sites are close enough to roads to simplify installation of fences and allow access to demonstration and extension work.
- Sites are suited to western redcedar.

3.3 Field Location of Sites

In the fall of 1993 sites were surveyed to mark outer boundaries and boundaries between sub-sub-plots. Stakes labelled with row and tree numbers were placed at the beginning of each row and to mark the placement of every fifth seedling to the end of the row, for a total of nine stakes per row. Each row was labelled for treatment according to the plan in Appendices 2 and 3.

3.4 Site Description

The information in Table 1 was obtained for the two sites.

Table 1. Site description.

Location	Claude Elliott Lake		Oktwanch Creek
Zone	CWH	CWH	CWH
Subzone	vm	vm	vh
Variant	1	1	1
Series	06	05	06
Moisture	5	4	4
Nutrients	BC	C	D
Treatment Unit	S3	S1/3	S2
Elevation (m)	300	350	350
Slope	10%	35%	5%
Aspect	E	E	SW
Soils	Mor over SL Mod drained	Mor over SL Mod well drained	SL
Topography	Lower slope relatively flat	Flat to steep	Relatively flat

3.5 Treatments

3.5.1 Deer control

Three levels of deer control were established:

- 1 - Fenced for deer exclusion (Control).
- 2 - Unfenced/unprotected.
- 3 - Vexar tubes.

Fencing to exclude deer was installed in the fall of 1993, according to the site plans in Appendices 1, 2 and 3. The fenced area will be kept as a Control against which to measure the effectiveness of the fertilization treatments for reducing the impact of deer browse. High-tensile wire deer fencing was installed that is approximately 2.1 to 2.5 m (7-8 feet) high. Eighteen-strand Vexar tubes were used that were 2 cm (3/4") diameter X 76 cm (30") in height, and rated to last four years in full sunlight. They were held in place with one 8-gauge wire stake and were installed at the time of planting.

3.5.2 Fertilization

Two levels of fertilization treatments were established:

- 0 - unfertilized.
- 1 - fertilized.

Seedlings were fertilized with SILVA PAKS Forestry 17-7-12 Time-of-Planting, Slow-Release Fertilizer by putting the fertilizer (like a tea-bag) in the bottom of the planting hole and setting the seedling on the top of it (Appendix 6).

3.5.3 Stock types

Three stock types of both western redcedar and yellow-cypress, plus yellow-cypress cuttings, were planted for comparison of their ability to grow out of range of deer browse, and to respond to fertilization for that purpose. This made a total of seven different stock types as described in Table 2. The seedlings were sorted according to standard culling specifications. The western redcedar transplants were frozen and thawed out twice. For this reason, frost damage was noted.

Table 2. List of species and stock types planted.

Code	Species	Age	Stock Type	Seedlot	Nursery	# of Seedlings
1	Cw	1+0	PSB 415D	6753	Surrey	1 500
2	Cw	1+0	PSB 615A	6753	Surrey	1 500
3	Cw	1+1	PBR 313B	6753	Surrey	1 500
4	Yc	1+0	PSB 415D	35134	Sylvan Vale	1 600
5	Yc	1+0	PSB 615A	35134*	Sylvan Vale	1 500
6	Yc	1+1	PBR 313B	32839*	Sylvan Vale	1 550
7	Yc	1+0	CRC 415D	32839	Sylvan Vale	1 440

* The yellow-cypress has two seedlot numbers to indicate different ownership; however, the seed was collected from the same area at the same time.

Table 3. Lifting dates of the seven stock types.

Code	Species	Age	Stock Type	Seedlot	Nursery	Lifting Date
1	Cw	1+0	PSB 415D	6753	Surrey	93-12-17
2	Cw	1+0	PSB 615A	6753	Surrey	93-12-17
3	Cw	1+1	PBR 313B	6753	Surrey	94-01-17
4	Yc	1+0	PSB 415D	35134	Sylvan Vale	94-01-10
5	Yc	1+0	PSB 615A	35134	Sylvan Vale	94-01-13
6	Yc	1+1	PBR 313B	32839	Sylvan Vale	94-01-19
7	Yc	1+0	CRC 415D	32839	Sylvan Vale	94-01-12

3.6 Planting

Shovel planting took place in the spring of 1994. Each seedling was marked with a numbered aluminum tag. In addition, a letter before the number indicates the location: "A" for Claude Elliott Lake seedlings, and "B" for Oktwanch Creek seedlings. The appropriate sub-sub-plots were fertilized with seedlings placed on the top of the fertilizer and Vexar tubes were placed with one metal stake on seedlings in treatments where required (Appendices 2 and 3). Planters' names together with codes were recorded in Appendix 5. Access to planting sites is described in Table 7.

Planting began on March 16, 1994 at Oktwanch Creek. Snow fell after the first eight rows were planted. The stock was taken back to Gold River and kept at the Pacific Forest Products Ltd. cooler at 1-2°C. The snow melted and a second attempt at planting took place March 30. The fenced area was completed that day. The project at Oktwanch Creek was finished on April 2, 1994. See Fire Weather Readings from March 1 to August 1994 in Appendix 7.

The planting was continued at Claude Elliott Lake on April 3 and finished April 11, 1994. Ralph White's crew planted all of the plots at Oktwanch Creek and Plots 4, 5, 6, 7, 8, 9, 13, 14 and 15 at Claude Elliott Lake. Claude Elliott Lake Plots 1, 2, 3, 10, 11, 12, 16, 17 and 18) were planted by Canadian Forest Products Ltd. contract crews, Brinkman and Associates Ltd. Extra planting and fertilizing took place at Oktwanch Creek (see Appendix 6 for details).

3.7 Measurements

3.7.1 Before planting

Seedlings were tested both at the Surrey Nursery and at Sylvan Vale Nursery for frost hardiness when lifted (Table 4). Also, thirty seedlings from each seedlot were taken at random from the boxes in cold storage prior to planting and measured for height and root collar diameter in millimetres (Tables 5 and 6, and Figures 1 and 2). Transplants were not put through the storability test because of a misunderstanding.

Table 4. Storability test results.

Surrey Nursery 1993

Test Date	Species	Seedlot	Stock Type	1	2	3	4	5	6	7	8	9	10	Mean	Std. Dev.
12-08	Cw	6753	1+0 615A	15	10	15	20	20	15	10	15	20	10	15	3.87
12-08	Cw	6753	1+0 415D	15	20	15	15	15	10	15	20	10	10	14.5	3.50

Sylvan Vale Nursery 1994

Test Date	Species	Seedlot	Stock Type	1	2	3	4	5	6	7	8	9	10	Mean	Std. Dev.
01-17	Yc	35134	1+0 615D	10	15	10	10	20	15	15	20	10	15	14.0	3.74
01-17	Yc	32839	CRC 415D	10	15	15	15	15	20	15	20	15	15	15.5	2.69
01-17	Yc	35134	1+0 415D	15	15	15	25	10	15	15	20	15	15	16	3.74

Table 5. Descriptive statistics for root collar diameter. (Stock type descriptions in Table 2.)

Statistic	Stock Type 1	Stock Type 2	Stock Type 3	Stock Type 4	Stock Type 5	Stock Type 6	Stock Type 7
Mean (mm)	3.50	4.43	8.40	3.80	4.50	5.90	4.93
Standard Error	0.09	0.12	0.30	0.13	0.12	0.14	0.17
Median	3.50	5.00	8.00	4.00	5.00	6.00	5.00
Mode	3.00	5.00	8.00	4.00	5.00	6.00	5.00
Standard Deviation	0.51	0.68	1.65	0.71	0.68	0.76	0.94
Variance	0.26	0.46	2.73	0.51	0.47	0.58	0.89
Range	1.00	2.00	6.00	3.00	3.00	3.00	4.00
Minimum	3.00	3.00	6.00	3.00	3.00	5.00	4.00
Maximum	4.00	5.00	12.00	6.00	6.00	8.00	8.00
Sum	105.00	133.00	252.00	114.00	135.00	177.00	148.00
Count	30.00	30.00	30.00	30.00	30.00	30.00	30.00
Confidence Level (0.950000)	0.18	0.24	0.59	0.26	0.24	0.27	0.34

Table 6. Descriptive statistics for height. (See Table 2 for stock type descriptions.)

Statistic	Stock Type 1	Stock Type 2	Stock Type 3	Stock Type 4	Stock Type 5	Stock Type 6	Stock Type 7
Mean (mm)	375.77	487.63	578.73	308.43	328.33	306.77	306.60
Standard Error	10.63	13.25	16.39	6.26	10.32	9.33	7.16
Median	385.50	501.00	561.50	306.00	331.00	313.50	306.00
Mode	360.00	501.00	537.00	305.00	294.00	331.00	354.00
Standard Deviation	58.23	72.55	89.80	34.27	56.53	51.11	39.23
Variance	3390.19	5263.55	8063.24	1174.39	3195.75	2612.05	1539.35
Range	278.00	274.00	339.00	125.00	224.00	189.00	157.00
Minimum	257.00	323.00	436.00	247.00	227.00	199.00	241.00
Maximum	535.00	597.00	775.00	372.00	451.00	388.00	398.00
Sum	11273.00	14629.00	17362.00	9253.00	9850.00	9203.00	9198.00
Count	30.00	30.00	30.00	30.00	30.00	30.00	30.00
Confidence Level (0.950000)	20.84	25.96	32.13	12.26	20.23	18.29	14.04

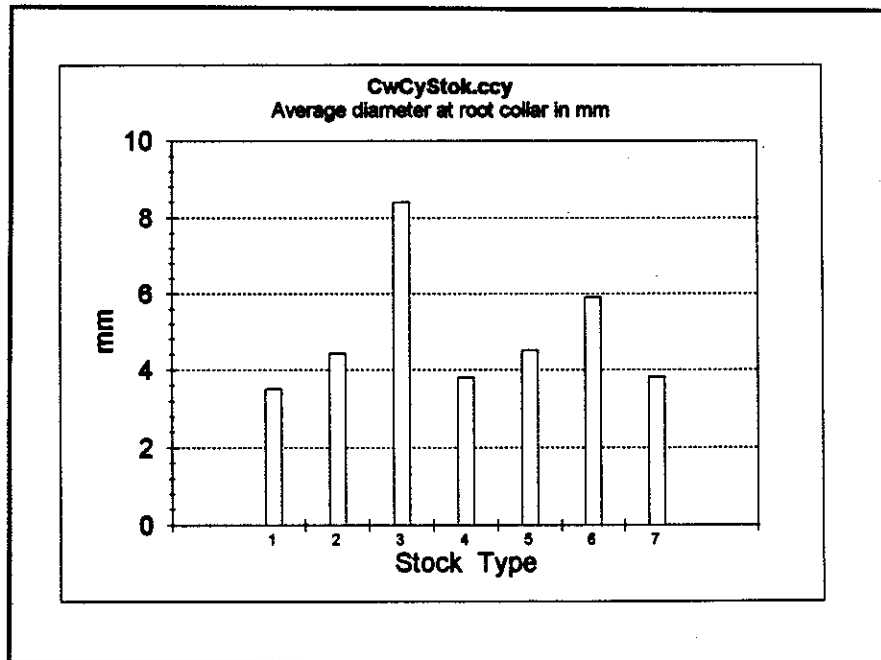


Figure 1. Average seedling diameter (mm) at root collar prior to planting.

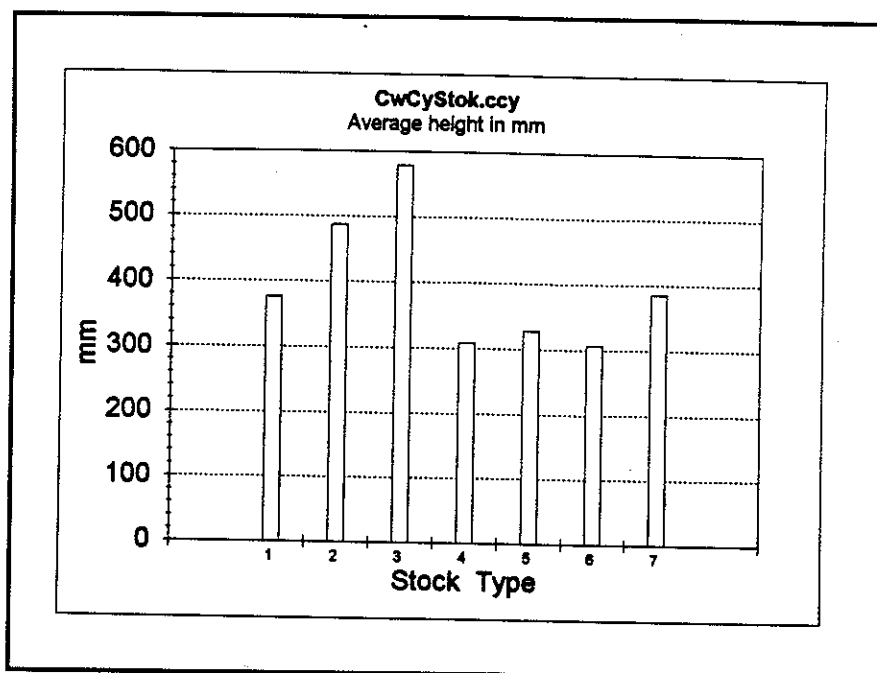


Figure 2. Average seedling height (mm) prior to planting.

3.7.2 Subsequent years

After 1, 2, 3, 5, and 10 growing seasons, the following measurements will be taken on all seedlings:

- Height.
- Diameter at 30 cm.

In addition, the following visual assessments will be recorded:

- Seedling condition (codes in Appendix 4).
- Browse damage (codes in Appendix 4).
- Overtopping by other species (codes in Appendix 4).

Site access is described in Table 7.

3.8 Herbicide Application

If competing vegetation becomes an impediment to seedling growth during the study, an aerial herbicide treatment may be applied. The type of herbicide and timing/rate of application will depend on current site conditions.

4.0 Access Notes

Table 7 describes how to get to the sites.

Table 7. Directions for site access.

Oktwanch Creek		Claude Elliott Lake	
km	Location	km	Location
0.0	Gold River PetroCan.	0.0	Woss turn-off and highway intersection. Go south.
30.5	Intersection, Alston Cr./Hwy.	2.9	Lukwa Creek and Highway junction. Turn left (or to East).
31.1	Oktwanch Creek Bridge.	3.6	Take left fork, go North.
31.5	Take left fork, Oktwanch.	9.5	CE Main. Take left fork.
32.3	Oktwanch Road N and S fork meet.	12.7	CE500 and CE501. Take left and then right fork. Go 0.8 km to Vexar.
35.2	South KLA-ANCH from right.	13.7	Rock quarry entrance to left.
37.2	Pw Blister Rust Trial.	13.8	Plots 1-6 below road on right.
38.8	Take right fork, up hill to Ba Trial. Rock quarry at 39.3 km. Plots are above the road between two rock quarries.	14.1	Fenced plots (7-12) below road.
39.0	Take left fork (over second bridge).		
39.4	Parking before Cw-Yc fence. Fence is 100 m from parking on the left side of the road.		

5.0 Actual Costs of Project Establishment (1993-1994)

In addition to the following costs, twenty working days were donated by Canadian Forest Products Limited to plant half of the plots at Claude Elliott Lake.

Cedar stakes	\$ 1 283.35
Staking contract	5 310.00
Fencing contract	13 040.43
Fertilizer	570.00
Flagging tape	115.00
Aluminum tags	420.30
Cable ties	417.15
Planting	<u>12 440.00</u>
Total	<u>\$33 596.23</u>

6.0 Acknowledgements

Funding for this project was provided by Canadian Forest Products Ltd. (25%), BCFS, Port McNeill Forest District (25%) and BCFS, Vancouver Forest Region (50%).

The stock was grown at Sylvan Vale Nursery by Yola Weedman and at the Surrey Nursery by Tony Willingdon and staff.

Much help and advice was provided by Wayne Cochrane and John Deal of CFP during the time of reconnaissance and planting. Brian McCutcheon of PFP provided help in reconnaissance and storing of stock in the cooler. Excellent cooperation was received from Ralph White and crew during plot staking and planting. Brinkman and Associates have done an excellent planting job under the leadership of Fred Schotter and Ron Biebrich.

Help and advice was received from Chuck van Hemmen, Carol Reagon, Alison Drennan and Heather Jones from the Port McNeill Forest District. Paul Larsen and Noel Vanstone have helped with stock transportation and solving vehicle problems.

The original working plan was written by Jean Heineman and modified by the author. Helpful review comments were received from Terry Rollerson, Larry Sigurdson, Brian Broznitsky, Vera Sit, Brian D'Anjou and Bob Green all through the planning stage. George Shishkov worked on the statistical part of the stock type description. Liz Steele reviewed and edited the Working Plan and the final draft of this report.

This was a real team effort. Without the cooperation of these companies, agencies and individuals the project could have never been established.

Appendix 1

Arrangement of Treatments and Geographical Locations

Claude Elliott Lake

Unprotected			Fenced			Vexar		
1	2	3	7	8	9	13	14	15
1	0	1	0	1	0	0	1	0
4	5	6	10	11	12	16	17	18
0	1	0	1	0	1	1	0	1

Figure 1. Arrangement of treatments in Location 1, Claude Elliott Lake.

Notes for Figure 1:

- Split-plots for deer control and fertilization; 7 stock types randomly allocated in seven rows in each sub-sub-plot. Rows are 2 m apart in Plots 1 to 6 and 3 m in Plots 7 to 18, with 40 seedlings in each row. Seedlings are 1.5 m apart.
- Upper numbers in rectangles 1 to 18 are plot numbers. The lower numbers indicate fertilizer treatment:

0 = no fertilizer.

1 = fertilized.

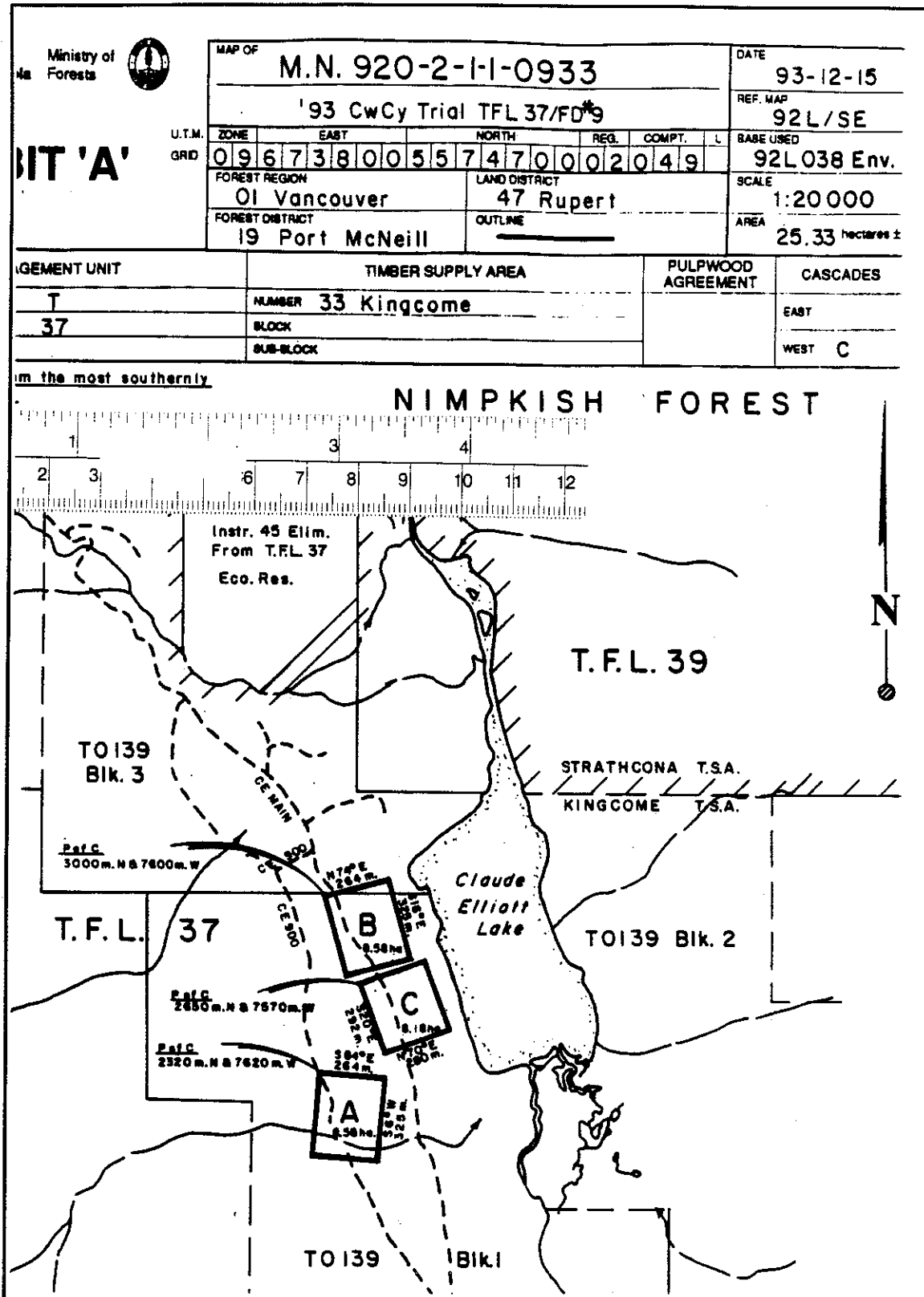


Figure 2. Geographical location, Claude Elliott Lake.

Oktwanch Creek

Fenced			Unprotected			Vexar		
1	2	3	7	8	9	10	11	12
0	1	0	1	0	1	1	0	1
4	5	6	16	17	18	13	14	15
1	0	1	0	1	0	0	1	0

Figure 3. Arrangement of treatments in Location 2, Oktwanch Creek.

Notes for Figure 3:

- Split-plots for deer control and fertilization; 7 stock types randomly allocated in seven rows in each sub-sub-plot. Rows are 2 m apart, with 40 seedlings in each row. Seedlings are 1.5 m apart.
- Upper numbers in rectangles 1 to 18 are plot numbers. The lower numbers indicate fertilizer treatment:

0 = no fertilizer

1 = fertilized

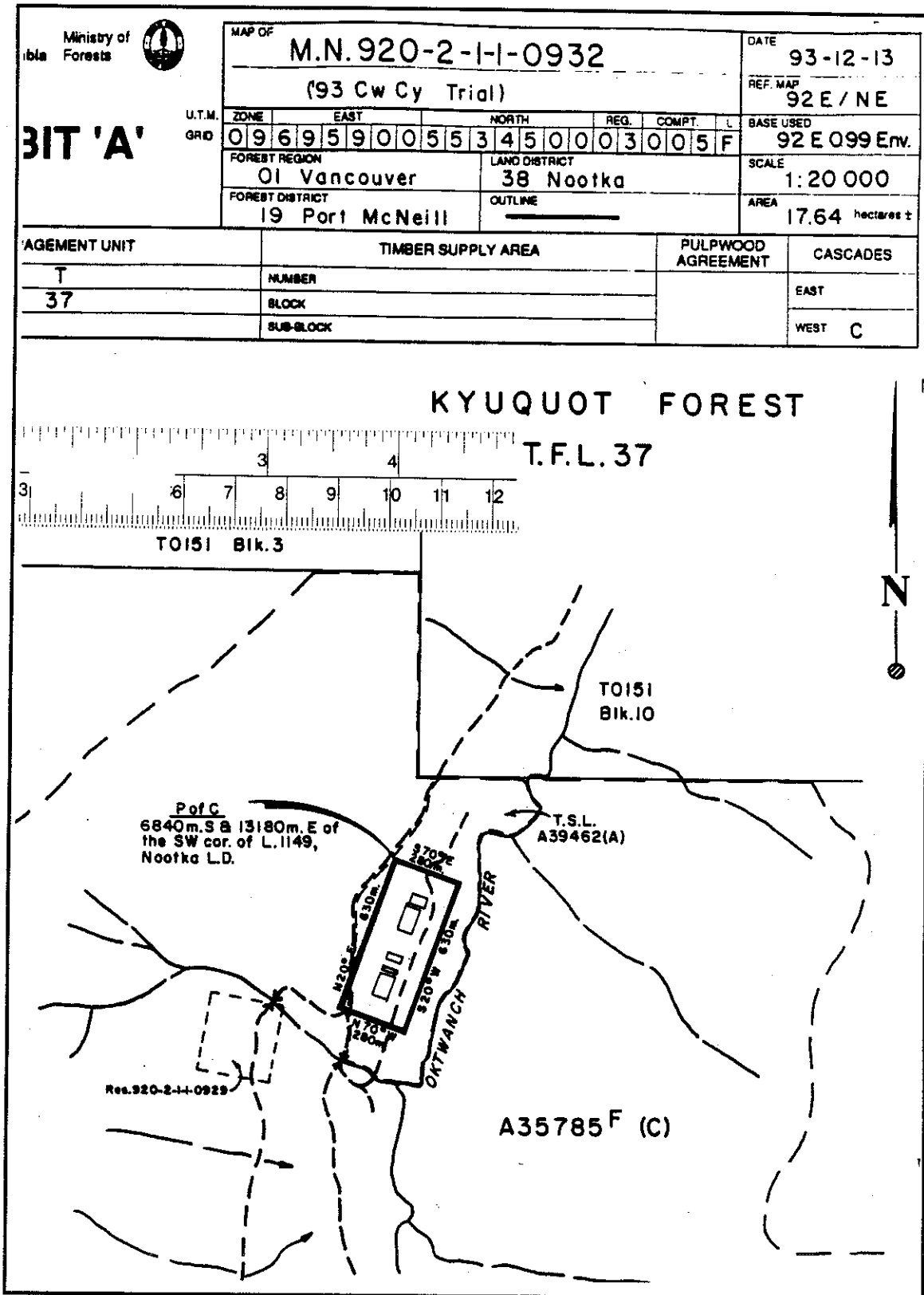


Figure 4. Geographical location, Oktwanch Creek.

Appendix 2

Random Allocation of Treatments Location 1, Claude Elliott Lake

Within each numbered experimental unit (below), there are 7 rows of seedlings. Each row contains one of 7 randomly assigned stock types. The following list identifies the treatment in each experimental unit, and assigns stock types to rows. Rows are numbered 1 to 7, from left to right within each experimental unit.

Plot 1: Unfenced; Fertilized

<u>Row</u>	<u>Planter</u>	<u>Stock Code</u>
1	7	4-Yc PSB 415D
2	9	5-Yc PSB 615A
3	8	1-Cw PSB 415D
4	6	2-Cw PSB 615A
5	7	7-Yc CRC 415D
6	6	6-Yc PBR 313B
7	8	3-Cw PBR 313B

Plot 4: Unfenced; Unfertilized

<u>Row</u>	<u>Planter</u>	<u>Stock Code</u>
1	2	2-Cw PSB 615A
2	3	4-Yc PSB 415D
3	4	5-Yc PSB 615A
4	1	7-Yc CRC 415D
5	2	6-Yc PBR 313B
6	3	3-Cw PBR 313B
7	4	1-Cw PSB 415D

Plot 2: Unfenced; Unfertilized

<u>Row</u>	<u>Planter</u>	<u>Stock Code</u>
1	9	6-Yc PBR 313B
2	7	4-Yc PSB 415D
3	6	7-Yc CRC 415D
4	8	5-Yc PSB 615A
5	7	1-Cw PSB 415D
6	6	3-Cw PBR 313B
7	9	2-Cw PSB 615A

Plot 5: Unfenced; Fertilized

<u>Row</u>	<u>Planter</u>	<u>Stock Code</u>
1	2	1-Cw PSB 415D
2	3	6-Yc PBR 313B
3	1	3-Cw PBR 313B
4	4	5-Yc PSB 615A
5	2	4-Yc PSB 415D
6	3	7-Yc CRC 415D
7	4	2-Cw PSB 615A

Plot 3: Unfenced; Fertilized

<u>Row</u>	<u>Planter</u>	<u>Stock Code</u>
1	7	5-Yc PSB 615A
2	6	1-Cw PSB 415D
3	8	7-Yc CRC 415D
4	7	4-Yc PSB 415D
5	9	2-Cw PSB 615A
6	8	6-Yc PBR 313B
7	6	3-Cw PBR 313B

Plot 6: Unfenced; Unfertilized

<u>Row</u>	<u>Planter</u>	<u>Stock Code</u>
1	2	1-Cw PSB 415D
2	1	3-Cw PBR 313B
3	3	7-Yc CRC 415D
4	2	4-Yc PSB 415D
5	4	6-Yc PBR 313B
6	3	2-Cw PSB 615A
7	2	5-Yc PSB 615A

Plot 7: Fenced; Unfertilized

<u>Row</u>	<u>Planter</u>	<u>Stock Code</u>
1	4	1-Cw PSB 415D
2	3	2-Cw PSB 615A
3	1	7-Yc CRC 415D
4	2	6-Yc PBR 313B
5	3	4-Yc PSB 415D
6	4	5-Yc PSB 615A
7	2	3-Cw PBR 313B

Plot 11: Fenced; Unfertilized

<u>Row</u>	<u>Planter</u>	<u>Stock Code</u>
1	9	6-Yc PBR 313B
2	7	5-Yc PSB 615A
3	6	7-Yc CRC 415D
4	6	2-Cw PSB 615A
5	7	1-Cw PSB 415D
6	6	4-Yc PSB 415D
7	6	3-Cw PBR 313B

Plot 8: Fenced; Fertilized

<u>Row</u>	<u>Planter</u>	<u>Stock Code</u>
1	1	2-Cw PSB 615A
2	3	7-Yc CRC 415D
3	3	4-Yc PSB 415D
4	2	3-Cw PBR 313B
5	4	6-Yc PBR 313B
6	3	1-Cw PSB 415D
7	4	5-Yc PSB 615A

Plot 12: Fenced; Fertilized

<u>Row</u>	<u>Planter</u>	<u>Stock Code</u>
1	6	7-Yc CRC 415D
2	6	3-Cw PBR 313B
3	7	4-Yc PSB 415D
4	7	5-Yc PSB 615A
5	7	2-Cw PSB 615A
6	6	1-Cw PSB 415D
7	7	6-Yc PBR 313B

Plot 9: Fenced; Unfertilized

<u>Row</u>	<u>Planter</u>	<u>Stock Code</u>
1	2	6-Yc PBR 313B
2	2	1-Cw PSB 415D
3	2	3-Cw PBR 313B
4	3	5-Yc PSB 615A
5	2	2-Cw PSB 615A
6	3	7-Yc CRC 415D
7	3	4-Yc PSB 415D

Plot 13: Vexar; Unfertilized

<u>Row</u>	<u>Planter</u>	<u>Stock Code</u>
1	4	3-Cw PBR 313B
2	3	2-Cw PSB 615A
3	2	5-Yc PSB 615A
4	3	6-Yc PBR 313B
5	2	4-Yc PSB 415D
6	1	7-Yc CRC 415D
7	4	1-Cw PSB 415D

Plot 10: Fenced; Fertilized

<u>Row</u>	<u>Planter</u>	<u>Stock Code</u>
1	7	2-Cw PSB 615A
2	7	4-Yc PSB 415D
3	9	7-Yc CRC 415D
4	7	6-Yc PBR 313B
5	7	5-Yc PSB 615A
6	6	3-Cw PBR 313B
7	8	1-Cw PSB 415D

Plot 14: Vexar; Fertilized

<u>Row</u>	<u>Planter</u>	<u>Stock Code</u>
1	3	5-Yc PSB 615A
2	2	1-Cw PSB 415D
3	4	2-Cw PSB 615A
4	1	3-Cw PBR 313B
5	2	6-Yc PBR 313B
6	3	4-Yc PSB 415D
7	4	7-Yc CRC 415D

Plot 15: Vexar; Unfertilized

<u>Row</u>	<u>Planter</u>	<u>Stock Code</u>
1	2	4-Yc PSB 415D
2	1	3-Cw PBR 313B
3	3	1-Cw PSB 415D
4	2	5-Yc PSB 615A
5	3	2-Cw PSB 615A
6	2	7-Yc CRC 415D
7	2	6-Yc PBR 313B

Plot 17: Vexar; Unfertilized

<u>Row</u>	<u>Planter</u>	<u>Stock Code</u>
1	6	7-Yc CRC 415D
2	7	6-Yc PBR 313B
3	6	2-Cw PSB 615A
4	6	3-Cw PBR 313B
5	7	4-Yc PSB 415D
6	9	5-CY PSB 615A
7	7	1-Cw PSB 415D

Plot 16: Vexar; Fertilized

<u>Row</u>	<u>Planter</u>	<u>Stock Code</u>
1	7	1-Cw PSB 415D
2	9	6-Yc PBR 313B
3	6	3-Cw PBR 313B
4	7	4-Yc PSB 415D
5	6	5-Yc PSB 615A
6	7	7-Yc CRC 415D
7	9	2-Cw PSB 615A

Plot 18: Vexar; Fertilized

<u>Row</u>	<u>Planter</u>	<u>Stock Code</u>
1	6	6-Yc PBR 313B
2	7	5-Yc PSB 615A
3	9	7-Yc CRC 415D
4	7	4-Yc PSB 415D
5	7	1-Cw PSB 415D
6	6	2-Cw PSB 615A
7	6	3-Cw PBR 313B

Appendix 3

Random Allocation of Treatments Location 2, Oktwanch Creek

Within each numbered experimental unit (below), there are 7 rows of seedlings, each containing one of 7 randomly assigned stock types. The following list identifies the treatment in each experimental unit; and assigns stock types to rows. Rows are numbered 1 to 7, from left to right within each experimental unit.

Plot 1: Fenced; Unfertilized

<u>Row</u>	<u>Planter</u>	<u>Stock Code</u>
1	2	4-Yc PSB 415D
2	1	1-Cw PSB 415D
3	5	2-Cw PSB 615A
4	3	3-Cw PBR 313B
5	3	7-Yc CRC 415D
6	1	5-Yc PSB 615A
7	2	6-Yc PBR 313B

Plot 4: Fenced; Fertilized

<u>Row</u>	<u>Planter</u>	<u>Stock Code</u>
1	4	4-Yc PSB 415D
2	3	2-Cw PSB 615A
3	2	7-Yc CRC 415D
4	1	5-Yc PSB 615A
5	2	3-Cw PBR 313B
6	4	6-Yc PBR 313B
7	3	1-Cw PSB 415D

Plot 2: Fenced; Fertilized

<u>Row</u>	<u>Planter</u>	<u>Stock Code</u>
1	5	6-Yc PBR 313B
2	3	3-Cw PBR 313B
3	2	1-Cw PSB 415D
4	3	7-Yc CRC 415D
5	4	5-Yc PSB 615A
6	1	4-Yc PSB 415D
7	2	2-Cw PSB 615A

Plot 5: Fenced; Unfertilized

<u>Row</u>	<u>Planter</u>	<u>Stock Code</u>
1	2	6-Yc PBR 313B
2	3	1-Cw PSB 415D
3	4	7-Yc CRC 415D
4	2	4-Yc PSB 415D
5	3	3-Cw PBR 313B
6	1	5-Yc PSB 615A
7	2	2-Cw PSB 615A

Plot 3: Fenced; Unfertilized

<u>Row</u>	<u>Planter</u>	<u>Stock Code</u>
1	3	5-Yc PSB 615A
2	1	2-Cw PSB 615A
3	4	7-Yc CRC 415D
4	3	3-Cw PBR 313B
5	2	1-Cw PSB 415D
6	1	4-Yc PSB 415D
7	1	6-Yc PBR 313B

Plot 6: Fenced; Fertilized

<u>Row</u>	<u>Planter</u>	<u>Stock Code</u>
1	3	6-Yc PBR 313B
2	4	1-Cw PSB 415D
3	2	4-Yc PSB 415D
4	3	5-Yc PSB 615A
5	2	2-Cw PSB 615A
6	4	7-Yc CRC 415D
7	1	3-Cw PBR 313B

Plot 7: Unfenced; Fertilized

<u>Row</u>	<u>Planter</u>	<u>Stock Code</u>
1	1	5-Yc PSB 615A
2	3	1-Cw PSB 415D
3	2	7-Yc CRC 415D
4	4	3-Cw PBR 313B
5	2	2-Cw PSB 615A
6	3	4-Yc PSB 415D
7	4	6-Yc PBR 313B

Plot 11: Vexar; Unfertilized

<u>Row</u>	<u>Planter</u>	<u>Stock Code</u>
1	4	2-Cw PSB 615A
2	3	7-Yc CRC 415D
3	2	3-Cw PBR 313B
4	1	6-Yc PBR 313B
5	3	1-Cw PSB 415D
6	4	4-Yc PSB 415D
7	2	5-Yc PSB 615A

Plot 8: Unfenced; Unfertilized

<u>Row</u>	<u>Planter</u>	<u>Stock Code</u>
1	1	7-Yc CRC 415D
2	1	3-Cw PBR 313B
3	2	5-Yc PSB 615A
4	3	2-Cw PSB 615A
5	2	1-Cw PSB 415D
6	4	6-Yc PBR 313B
7	3	4-Yc PSB 415D

Plot 12: Vexar; Fertilized

<u>Row</u>	<u>Planter</u>	<u>Stock Code</u>
1	2	6-Yc PBR 313B
2	3	7-Yc CRC 415D
3	4	2-Cw PSB 615A
4	1	3-Cw PBR 313B
5	2	5-Yc PSB 615A
6	3	1-Cw PSB 415D
7	3	4-Yc PSB 415D

Plot 9: Unfenced; Fertilized

<u>Row</u>	<u>Planter</u>	<u>Stock Code</u>
1	4	4-Yc PSB 415D
2	2	1-Cw PSB 415D
3	3	2-Cw PSB 615A
4	3	6-Yc PBR 313B
5	2	3-Cw PBR 313B
6	4	7-Yc CRC 415D
7	1	5-Yc PSB 615A

Plot 13: Vexar; Unfertilized

<u>Row</u>	<u>Planter</u>	<u>Stock Code</u>
1	3	6-Yc PBR 313B
2	2	3-Cw PBR 313B
3	4	4-Yc PSB 415D
4	3	2-Cw PSB 615A
5	2	1-Cw PSB 415D
6	1	5-Yc PSB 615A
7	3	7-Yc CRC 415D

Plot 10: Vexar; Fertilized

<u>Row</u>	<u>Planter</u>	<u>Stock Code</u>
1	3	3-Cw PBR 313B
2	2	7-Yc CRC 415D
3	1	6-Yc PBR 313B
4	4	5-Yc PSB 615A
5	2	2-Cw PSB 615A
6	3	4-Yc PSB 415D
7	1	1-Cw PSB 415D

Plot 14: Vexar; Fertilized

<u>Row</u>	<u>Planter</u>	<u>Stock Code</u>
1	2	4-Yc PSB 415D
2	4	6-Yc PBR 313B
3	3	1-Cw PSB 415D
4	1	2-Cw PSB 615A
5	2	7-Yc CRC 415D
6	4	3-Cw PBR 313B
7	3	5-Yc PSB 615A

Fire Weather System

All Days Summary For Year: 1994

Station: 0204 WOSS CAMP

Date	Weather Indices								1300 Hour Observations					Drought Analysis			Fire Behaviour		
YY/MM/DD	FFMC	DMC	DC	ISI	BUI	FWI	DSR	DGR	TEMP	RH	WD	WS	PREC	NORM	%	DATE	ROS	SROS	INT
94/04/19	49.7	6	15	0.2	6	0.1	0.0	1	11.4	71	SE	3	4.8	0	0	0000	0.0	0.0	0.0
94/04/20	66.3	8	19	0.6	8	0.3	0.0	1	15.5	54	W	2	0.8	0	0	0000	0.0	0.0	0.0
94/04/21	62.4	7	22	0.7	8	0.4	0.0	1	11.4	59	SE	9	2.5	0	0	0000	0.0	0.0	0.0
94/04/22	79.7	9	25	1.7	10	1.1	0.0	2	13.4	37	S	9	0.0	0	0	0000	0.0	0.0	0.0
94/04/23	87.0	12	29	3.4	12	4.0	0.3	2	16.2	31	S	4	0.0	0	0	0000	0.1	0.1	0.0
94/04/24	50.0	8	25	0.2	9	0.1	0.0	1	9.9	57	SW	2	5.6	0	0	0000	0.0	0.0	0.0
94/04/25	70.6	9	28	1.0	10	0.6	0.0	1	11.8	51	NW	9	0.0	0	0	0000	0.0	0.0	0.0
94/04/26	79.2	11	31	1.7	11	1.3	0.0	2	11.7	56	NW	9	0.0	0	0	0000	0.0	0.0	0.0
94/04/27	84.2	13	34	3.5	13	4.3	0.4	2	14.8	51	NW	12	0.0	0	0	0000	0.0	0.0	0.0
94/04/28	86.3	15	38	2.9	15	4.0	0.3	2	16.9	47	W	3	0.0	0	0	0000	0.0	0.0	0.0
94/04/29	86.9	17	42	5.0	17	7.2	0.9	2	13.0	45	S	12	0.0	0	0	0000	0.1	0.1	0.0
94/04/30	79.9	19	45	1.4	19	1.7	0.1	2	11.0	40	NW	4	1.3	0	0	0000	0.0	0.0	0.0
94/05/01	85.5	21	49	4.6	21	7.4	0.9	2	10.8	38	E	14	0.0	45	109	0506	0.1	0.1	0.0
94/05/02	81.9	22	53	2.1	22	3.6	0.3	2	11.3	46	E	8	1.0	45	119	0507	0.0	0.0	0.0
94/05/03	87.1	25	59	3.4	25	6.5	0.7	2	15.3	34	SE	4	0.0	45	130	0509	0.1	0.1	0.0
94/05/04	66.5	23	63	0.6	24	0.6	0.0	2	14.0	62	NA	1	2.3	46	138	0510	0.0	0.0	0.0
94/05/05	83.5	26	69	2.7	27	5.3	0.5	2	19.5	39	NW	9	0.0	48	144	0512	0.0	0.0	0.0
94/05/06	91.1	30	75	11.3	30	18.9	5.0	3	19.1	22	NW	16	0.0	50	150	0515	1.1	1.1	0.0
94/05/07	91.2	34	81	7.2	34	14.3	3.0	3	18.5	32	W	7	0.0	53	153	0517	0.5	0.5	0.0
94/05/08	91.9	38	87	6.8	38	14.6	3.1	3	22.7	28	W	4	0.0	56	156	0518	0.3	0.3	0.0
94/05/09	89.2	40	92	7.7	40	16.5	3.9	3	14.0	49	NW	14	0.0	60	154	0520	0.5	0.5	0.0
94/05/10	87.6	42	97	3.0	42	7.9	1.0	2	14.2	61	S	0	0.0	63	154	0524	0.0	0.0	0.0
94/05/11	87.9	45	103	4.3	45	11.0	1.9	3	16.4	43	S	6	0.0	66	156	0528	0.1	0.1	0.0
94/05/12	88.0	47	107	3.2	47	8.9	1.3	3	12.2	39	E	0	0.0	69	155	0529	0.1	0.1	0.0
94/05/13	64.0	40	112	0.6	42	0.8	0.0	2	10.4	64	NW	2	2.5	71	157	0530	0.0	0.0	0.0
94/05/14	78.9	43	117	1.1	45	3.0	0.2	3	14.6	36	SE	2	0.0	74	158	0531	0.0	0.0	0.0
94/05/15	50.2	24	105	0.3	31	0.3	0.0	2	12.0	55	NW	8	8.9	77	137	0529	0.0	0.0	0.0
94/05/16	67.6	27	110	0.6	33	0.7	0.0	2	14.8	41	NA	0	0.0	80	138	0530	0.0	0.0	0.0
94/05/17	82.6	30	116	2.7	36	6.4	0.7	2	17.1	42	NW	11	0.0	84	138	0531	0.0	0.0	0.0
94/05/18	91.3	34	122	6.3	40	14.1	2.9	3	21.0	19	NE	4	0.0	87	140	0601	0.3	0.3	0.0
94/05/19	95.5	40	129	14.5	45	27.4	9.5	4	24.2	12	NW	9	0.0	90	143	0603	1.6	1.6	0.0
94/05/20	93.2	44	135	7.1	48	17.0	4.1	3	19.8	36	SW	1	0.0	92	147	0604	0.4	0.4	0.0
94/05/21	90.8	46	140	6.5	51	16.3	3.8	3	15.5	43	W	6	0.0	94	149	0606	0.3	0.3	0.0
94/05/22	90.8	49	145	7.2	53	18.0	4.6	4	17.1	37	S	8	0.0	96	152	0609	0.4	0.4	0.0
94/05/23	89.9	52	151	4.2	56	12.3	2.3	3	16.0	46	W	0	0.0	96	157	0614	0.1	0.1	0.0
94/05/24	91.7	56	157	7.4	59	19.5	5.2	4	21.0	26	W	6	0.0	97	162	0616	0.4	0.4	0.0
94/05/25	71.8	47	162	0.8	55	2.3	0.1	3	14.4	41	NW	4	2.8	98	165	0618	0.0	0.0	0.0
94/05/26	81.6	49	166	2.3	57	7.3	0.9	3	11.6	44	NW	10	0.3	99	168	0619	0.0	0.0	0.0
94/05/27	86.3	52	171	4.2	59	12.6	2.4	3	12.9	38	E	10	0.0	101	169	0620	0.1	0.1	0.0
94/05/28	28.5	26	150	0.0	36	0.0	0.0	2	8.1	73	NE	0	11.7	104	145	0613	0.0	0.0	0.0
94/05/29	20.4	14	135	0.0	22	0.0	0.0	2	10.0	65	SW	0	9.9	109	124	0604	0.0	0.0	0.0
94/05/30	54.5	13	137	0.4	21	0.4	0.0	2	15.2	35	E	8	3.0	113	121	0605	0.0	0.0	0.0
94/05/31	44.8	8	127	0.2	13	0.1	0.0	1	10.3	65	S	14	7.6	117	109	0602	0.0	0.0	0.0
94/06/01	59.6	8	133	0.6	14	0.5	0.0	1	11.4	50	S	9	2.0	117	114	0604	0.0	0.0	0.0
94/06/02	78.0	11	139	1.0	18	0.9	0.0	1	17.4	34	SW	1	0.0	123	113	0605	0.0	0.0	0.0
94/06/03	80.9	14	146	1.2	22	1.7	0.1	2	16.6	39	SW	0	0.8	128	114	0611	0.0	0.0	0.0
94/06/04	75.2	15	152	1.0	24	1.1	0.0	2	15.2	46	SE	5	1.8	132	115	0614	0.0	0.0	0.0
94/06/05	85.7	18	158	3.5	28	6.9	0.8	2	16.1	33	E	8	0.0	136	116	0616	0.0	0.0	0.0
94/06/06	83.4	20	165	2.0	31	4.2	0.3	2	16.6	53	NW	3	0.8	139	118	0618	0.0	0.0	0.0

Fire Weather System

All Days Summary For Year: 1994

Station: 0204 WOSS CAMP

Date YY/MM/DD	Weather Indices								1300 Hour Observations					Drought Analysis			Fire Behaviour		
	FFMC	DMC	DC	ISI	BUI	FWI	DSR	DGR	TEMP	RH	WD	WS	PREC	NORM	%	DATE	ROS	SROS	INT
94/06/07	42.6	11	149	0.1	18	0.1	0.0	1	14.2	73	SW	6	10.4	141	106	0613	0.0	0.0	0.0
94/06/08	68.9	13	156	0.9	22	0.8	0.0	2	16.1	51	S	7	0.0	143	109	0616	0.0	0.0	0.0
94/06/09	74.2	14	162	0.8	23	0.8	0.0	2	15.6	77	NW	2	0.0	144	112	0618	0.0	0.0	0.0
94/06/10	81.2	16	168	2.0	26	3.8	0.3	2	17.4	62	S	9	0.0	145	116	0619	0.0	0.0	0.0
94/06/11	47.2	10	162	0.1	17	0.1	0.0	1	16.6	74	W	5	6.9	145	111	0618	0.0	0.0	0.0
94/06/12	58.5	10	167	0.6	18	0.5	0.0	1	10.6	83	E	8	0.0	146	114	0619	0.0	0.0	0.0
94/06/13	29.0	5	96	0.0	8	0.0	0.0	1	11.5	81	E	13	35.6	148	65	0522	0.0	0.0	0.0
94/06/14	31.8	5	101	0.0	9	0.0	0.0	1	12.0	91	NW	4	1.5	150	68	0527	0.0	0.0	0.0
94/06/15	42.4	6	107	0.1	10	0.0	0.0	1	14.2	84	NA	1	0.3	152	71	0529	0.0	0.0	0.0
94/06/16	66.5	7	114	0.8	13	0.6	0.0	1	17.6	64	NW	8	0.3	155	73	0531	0.0	0.0	0.0
94/06/17	41.0	4	107	0.1	8	0.0	0.0	1	14.4	82	NW	12	7.4	158	68	0529	0.0	0.0	0.0
94/06/18	41.1	3	108	0.0	6	0.0	0.0	1	16.1	69	NA	2	4.1	161	67	0529	0.0	0.0	0.0
94/06/19	38.5	2	88	0.0	4	0.0	0.0	1	15.4	73	NW	13	14.2	165	53	0519	0.0	0.0	0.0
94/06/20	69.1	4	95	1.1	8	0.6	0.0	1	19.2	59	NW	12	0.0	169	56	0522	0.0	0.0	0.0
94/06/21	81.3	7	102	2.5	12	2.8	0.2	2	20.6	60	NW	13	0.0	173	59	0528	0.0	0.0	0.0
94/06/22	85.0	9	109	4.0	15	5.5	0.6	2	19.9	57	NW	13	0.0	177	62	0529	0.0	0.0	0.0
94/06/23	85.4	11	116	3.5	18	5.4	0.5	2	20.4	61	SW	9	0.0	180	64	0531	0.0	0.0	0.0
94/06/24	38.7	6	101	0.0	11	0.0	0.0	1	16.6	77	W	3	11.4	183	55	0527	0.0	0.0	0.0
94/06/25	52.7	7	108	0.2	13	0.2	0.0	1	16.7	77	NW	1	0.0	186	58	0529	0.0	0.0	0.0
94/06/26	69.1	10	115	0.9	16	0.7	0.0	1	19.9	57	NW	7	1.5	189	61	0531	0.0	0.0	0.0
94/06/27	77.8	11	121	2.1	18	3.0	0.2	2	16.0	72	NW	16	0.0	192	63	0601	0.1	0.1	0.0
94/06/28	81.8	13	128	2.7	20	4.4	0.4	2	16.5	67	NW	13	0.0	194	66	0602	0.0	0.0	0.0
94/06/29	82.7	14	134	3.0	22	5.2	0.5	2	15.5	70	NW	13	0.0	195	69	0604	0.0	0.0	0.0
94/06/30	40.3	9	132	0.0	15	0.0	0.0	1	13.2	90	E	4	4.8	196	67	0603	0.0	0.0	0.0
94/07/01	32.6	5	118	0.0	9	0.0	0.0	1	14.1	74	NW	6	10.9	195	60	0601	0.0	0.0	0.0
94/07/02	30.9	3	117	0.0	6	0.0	0.0	1	15.1	75	W	1	4.6	194	60	0531	0.0	0.0	0.0
94/07/03	50.3	4	124	0.2	8	0.1	0.0	1	14.4	72	W	3	0.0	194	64	0602	0.0	0.0	0.0
94/07/04	71.7	6	130	1.3	11	0.8	0.0	1	15.4	61	NW	13	0.5	196	66	0603	0.0	0.0	0.0
94/07/05	81.4	8	137	2.7	14	3.4	0.2	2	20.2	63	NW	14	0.0	197	70	0605	0.0	0.0	0.0
94/07/06	84.8	10	145	4.1	17	6.0	0.6	2	20.8	60	NW	14	0.0	200	72	0609	0.1	0.1	0.0
94/07/07	85.0	12	152	2.5	20	3.9	0.3	2	21.1	64	SW	3	0.0	202	75	0614	0.0	0.0	0.0
94/07/08	86.3	14	159	3.8	23	6.6	0.8	2	18.2	52	NW	8	0.0	204	78	0617	0.1	0.1	0.0
94/07/09	87.8	17	167	5.4	27	10.0	1.6	3	20.5	46	NW	11	0.0	205	81	0619	0.1	0.1	0.0
94/07/10	88.6	20	174	6.4	31	12.4	2.3	3	21.2	43	NW	12	0.0	206	85	0621	0.3	0.3	0.0
94/07/11	88.7	22	182	6.5	34	13.2	2.6	3	20.8	49	NW	12	0.0	206	88	0623	0.3	0.3	0.0
94/07/12	88.6	25	189	6.4	37	13.7	2.8	3	21.8	54	NW	12	0.0	207	91	0625	0.3	0.3	0.0
94/07/13	88.6	27	197	6.1	40	13.8	2.8	3	20.5	52	NW	11	0.0	210	94	0705	0.2	0.2	0.0
94/07/14	88.6	30	204	7.5	43	16.7	4.0	3	22.1	54	NW	15	0.0	213	96	0708	0.3	0.3	0.0
94/07/15	87.6	32	212	7.6	46	17.4	4.3	4	21.2	60	NW	18	0.0	217	98	0714	0.3	0.3	0.0
94/07/16	87.7	34	220	5.1	49	13.3	2.6	3	21.7	58	NW	10	0.0	222	99	0716	0.1	0.1	0.0
94/07/17	68.1	34	226	0.7	50	1.4	0.0	3	15.2	92	NW	2	1.5	228	99	0717	0.0	0.0	0.0
94/07/18	71.2	32	234	1.0	47	2.6	0.1	3	21.9	59	NW	8	2.3	235	99	0718	0.0	0.0	0.0
94/07/19	80.6	34	242	1.4	50	4.2	0.4	3	23.7	63	SW	3	0.0	241	100	0930	0.0	0.0	0.0
94/07/20	87.5	37	250	4.7	54	13.3	2.6	3	27.7	49	NW	9	0.0	247	101	0930	0.1	0.1	0.0
94/07/21	87.6	40	258	5.8	58	16.1	3.7	3	24.8	56	NW	13	0.0	254	102	0930	0.2	0.2	0.0
94/07/22	89.9	44	267	8.5	62	22.2	6.6	4	26.1	40	NW	14	0.0	260	103	0930	0.5	0.5	0.0
94/07/23	89.9	47	276	5.7	66	17.2	4.2	4	27.7	50	NW	6	0.0	266	104	0930	0.2	0.2	0.0
94/07/24	90.9	52	285	6.3	71	19.1	5.0	4	30.9	40	NW	5	0.0	272	105	0930	0.3	0.3	0.0
94/07/25	85.7	53	292	2.3	72	8.9	1.3	4	17.8	80	NW	0	0.0	279	105	0930	0.0	0.0	0.0

Fire Weather System

All Days Summary For Year: 1994

Station: 0204 WOSS CAMP

Date	Weather Indices								1300 Hour Observations					Drought Analysis			Fire Behaviour		
	YY/MM/DD	FFMC	DMC	DC	ISI	BUI	FWI	DSR	DGR	TEMP	RH	WD	WS	PREC	NORM	%	DATE	ROS	SROS
94/07/26	85.8	55	299	2.5	75	9.5	1.5	4	21.7	63	NA	1	0.0	286	105	0930	0.0	0.0	0.0
94/07/27	87.9	58	308	5.0	79	17.1	4.1	4	26.0	50	S	9	0.0	293	105	0930	0.1	0.1	0.0
94/07/28	88.0	60	315	5.0	82	17.5	4.3	4	22.2	53	SW	9	0.0	300	105	0930	0.1	0.1	0.0
94/07/29	87.6	62	322	5.5	84	19.0	5.0	4	18.0	57	S	12	0.3	308	105	0930	0.2	0.2	0.0
94/07/30	87.3	64	329	3.4	86	13.3	2.7	4	18.4	59	SE	3	0.0	317	104	0930	0.1	0.1	0.0
94/07/31	53.7	54	336	0.2	77	0.6	0.0	2	14.7	90	NE	0	2.5	325	103	0930	0.0	0.0	0.0
94/08/01	76.2	56	343	1.2	79	5.2	0.5	3	22.1	58	S	8	0.0	335	102	0930	0.0	0.0	0.0
94/08/02 F	84.3	58	350	2.9	82	11.4	2.0	4	23.0	55	SW	8	0.0	343	102	0930	0.0	0.0	0.0
94/08/03 F	85.7	60	357	3.5	84	13.4	2.7	4	23.0	60	SW	8	0.0	349	102	0930	0.0	0.0	0.0
94/08/04 F	86.7	62	364	4.0	87	15.3	3.4	4	23.0	55	SW	8	0.0	355	103	0930	0.1	0.1	0.0