



# RESEARCH NOTES

BRITISH COLUMBIA FOREST SERVICE

VICTORIA, B.C., CANADA

No. 46

1969

## A NATURAL NURSERY PRODUCES PLANTABLE WIDLINGS OF SITKA SPRUCE

by

D. Armit

634.9097  
11  
BCMF  
RES  
RN 46  
1969  
C.2

FOREST SERVICE  
DEPARTMENT OF LANDS, FORESTS, AND WATER RESOURCES

A NATURAL NURSERY PRODUCES  
PLANTABLE WIDLINGS  
OF  
SITKA SPRUCE

by  
D. Armit

LIBRARY  
MINISTRY OF FORESTS  
PARLIAMENT BUILDINGS  
VICTORIA, B.C.  
V8W 3E7

A B S T R A C T

In 1959 a natural nursery was established on Tree Farm Licence No. 1 at Terrace, B.C. to determine if plantable wildlings, particularly Sitka spruce could be produced.

Wildlings were raised in a one-acre clearing in a mature hemlock-spruce stand. After 3 years there were 1.1 million seedlings per acre, 43% spruce, the rest western hemlock. About 50-60% of the spruce was graded as suitable planting stock which could be delivered to the planting site at an estimated cost of \$4.50 per thousand.

Planting trials compared 2 and 3 year-old wildlings with root-pruned 2-0 stock raised from seed of the same source in a local (Terrace) and a southern (Duncan) nursery. The results after 5 years indicated that three year-old wildlings were satisfactory planting stock but 2 year-olds were unsuitable.

These results indicate that in remote areas, or where suitable nursery stock is unavailable natural nurseries may be a solution.

A Natural Nursery produces plantable wildlings of Sitka Spruce\*

## INTRODUCTION

In 1959, the Research Division of the B.C. Forest Service and Celgar Co. Ltd. established a natural nursery on Tree Farm Licence No. 1, Kalum Block, near Terrace, B.C. It was the outcome of several considerations. Raising stock locally was favored because lifting of stock in the nursery could be effectively co-ordinated with planting operations dependent upon certain supply and favorable conditions of weather, access and site. Also plantations of locally raised stock seemed to adapt to the ecology of the region faster than those from nurseries on the south coast. Natural seedlings of Sitka spruce were not readily available, unless deliberately induced by manipulation of the canopy and floor of the forest. A pressing need existed to minimize plantation costs and increase planting stock supplies. Consequently it was decided to assess the feasibility of producing and using stock from a natural nursery.

## OBJECTIVES AND METHODS OF STUDY

The objectives were to produce Sitka spruce wildlings and to compare the performance, after outplanting, with that raised from the same seed source in a local (Terrace) and in a Vancouver Island (Duncan) nursery.

In June 1959, a one-acre block was opened in a mature stand of western hemlock-Sitka spruce situated on a well-drained alluvial soil, south-west of Kalum Lake at an elevation of 700 feet a.s.l. Twenty-seven Sitka spruce seed trees were retained; all other trees, slash, and ground debris were removed from the block. The cleared area was scarified lightly by a D-2 tractor to remove vegetation and mix the duff with the mineral soil. Uniformly light treatment was not possible as levelling and filling of some portions necessitated deep disturbance. Adjacent cottonwood and aspen were girdled and poisoned with ammate crystals to reduce the danger of conifer germinants being smothered by deciduous leaf fall.

The block was divided into eight 1/12th acre plots leaving a narrow margin between them and the surrounding stand of timber. In late November, four plots received a 50 lb. (600 lbs./acre equivalent) application of a 13-16-10 fertilizer just before the clearing was covered with a bumper crop of sound seed during a dry frosty period after the first snowfall. Annually in the fall, from 1960 to 1962 the survival of all germinants was noted on five tally spots, each one foot square, marked along the north-west diagonals of each plot, but only the five most dominant seedlings of Sitka spruce in each spot were measured for height.

---

\* E.P. 541 - Natural Nurseries

In April 1960, seed of the same source was sown in the Celgar Co. nursery near Terrace, and at the Forest Service nursery in Duncan, to provide 2-0 stock for a planting trial in which 2 and 3 year-old fertilized and unfertilized wildlings would be compared with standard stock at test-sites in the field.

The planting trials began in 1962.

Two planting blocks were located on each of four sites selected to sample the range of conditions under which Sitka spruce is normally planted. Within each block, fifty seedlings of each type of stock were randomly assigned to a row. All the 2-0 stocks were planted in April 1962, and the 3-0 stocks in May 1963.

In each row survival and vigor was recorded annually from 1962 to 1966, and notes were made of environmental influences which affected mortality or growth.

#### PRODUCTION OF SEEDLINGS IN THE NURSERY

Germination exceeded 60 per ft<sup>2</sup> on the well scarified seed-bed of the natural nursery site but by August 1960, the 1-0 wildlings averaged .46 per ft<sup>2</sup>, 62.5% hemlock, 37.0% Sitka spruce, and 0.5% other species. Average mortality between August 1960 and October 1961 was 34%; a further 11% died prior to the last examination in November 1962. At that time, the 3-0 wildlings averaged 25 per ft<sup>2</sup> or the equivalent of 1.1 million per acre, 57% western hemlock and 43% Sitka spruce.

Sitka spruce seedling height averaged 3.1 inches and 4.7 inches at the end of the second and third growing seasons, and some dominants grew to 9 inches after 2 years, and 15 inches after 3 years. Hemlock seedlings averaged 5.4 inches at the end of the third growing season.

At the end of the second year, less than 25% of the seedlings had sufficient size, vigour, and root development to be classified as fair planting stock. Seedlings had spindly tops, average root-collar diameters, less than 0.1 inches and the root systems were weakly developed. By the end of the third year, 50 to 60% could be rated as satisfactory by normal 2-0 nursery stock standards.

Morphological measurements were obtained for all six Sitka spruce stocks, when the plants were being lifted for planting in the field. The data in Table 1 are based on the measures of 50 randomly selected seedlings per stock.

Table 1 - Morphological Data for 6 Sitka Spruce Stocks

Stock	Length (inches)		Oven Dry-Weight (g)		Root-Collar Diameter (inches)
	Top	Root	Top	Root	
Natural 2-0					
Unfertilized	5.0	3.1	21.8	4.2	.07
Fertilized	5.5	2.6	19.5	5.3	.06
Natural 3-0					
Unfertilized	6.4	5.4	34.2	12.8	.11
Fertilized	7.3	5.1	30.9	14.1	.10
Duncan 2-0	8.4	6.4	63.2	30.8	.11
Terrace 2-0	5.1	4.3	42.2	15.0	.09

The Duncan stock was largest and heaviest followed by the Terrace stock. The 3 year-old natural stocks were similar in size to the standard nursery stocks but their root systems were lighter, stiffer, and possessed less fibrous root-hair mass than those normally developed. The 2 year-old wildlings had poor roots, spindly tops and unsatisfactory top-to-root ratios.

The effect of the fertilizer in the natural nursery was to produce lush ground cover which competed with the seedlings. The probable effect of this competition was a slight reduction in height growth but it did not cause mortality.

Lifting seedlings in quantity and removing extraneous organic matter was difficult without causing extensive damage to the root systems. Roots were enmeshed with those of the understory vegetation. Digging was hampered by extensive root systems of woody shrubs and trees.

The total production was 1.1 million 3-0 wildlings, of which over half were graded as satisfactory planting stock. Net costs of land-clearing, site preparation, and treatments, were \$550.00, or approximately \$1.00 per thousand plantable seedlings. The stock was lifted, bundled, and delivered to the planting site at a cost of \$3.00 per thousand seedlings. Overhead costs of production were \$0.50 per thousand. Thus, the average cost of 3-0 wildling planting stock from the natural nursery was \$4.50 per thousand. A lower cost could be achieved by reducing the difficulties associated with lifting and processing the wildlings. The required improvements would be a more intensive selection of the site and soil type, better preparatory treatments, and a growing period possibly extended to four years to increase the recoverable percentage of plantable stock.

## ASSESSMENT OF PLANTED SITKA SPRUCE STOCKS

The survival and growth of wildlings graded as suitable planting stock was compared to standard 2-0 seedlings in experimental plantations. Because analysis of the experiment disclosed no important difference between the survival and growth of fertilized and unfertilized trees in the plantation, the results for these two treatments have been averaged in tables 2 and 3.

The 3-0 natural nursery stocks were planted in 1963, the year after the 2-0 stocks and direct comparisons must be tempered by the realization that seasonal differences possibly influenced the results. But general comparisons appear appropriate, as the critical year for all stocks is the season following planting, and site and climatic conditions through 1962 and 1963 were quite similar. Survival trends established in the first growing season remained consistent for the next 5 years with no evidence that climatic or environmental abnormalities confounded the results (Table 2).

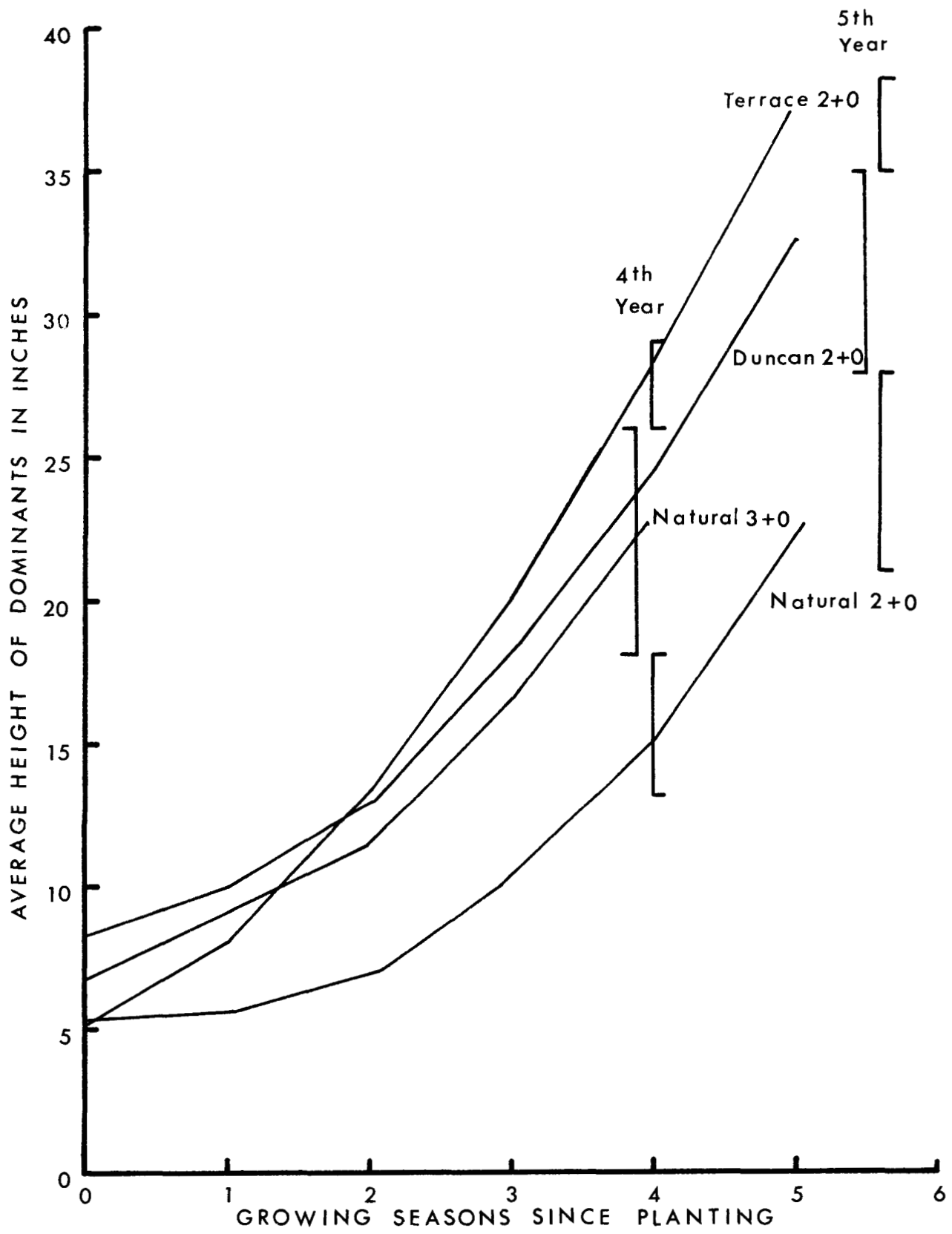
Table 2 - Survival of Sitka Spruce Stocks

Stock	Date Planted	Average Survival (%)				
		Years after Planting				
		1	2	3	4	5
Natural 2-0	April, 1962	57	51	51	51	51
Natural 3-0	May, 1963	94	92	92	91	-
Duncan 2-0	April, 1962	81	80	80	80	80
Terrace 2-0	April, 1962	88	87	87	87	87

The 3 year-old natural nursery stocks and the Duncan 2-0 stock were strikingly similar in general vigour and survival for the four years following planting. All appear well established, with healthy stem and foliage growth.

The 2 year-old natural nursery stock was very much poorer in survival, height growth, and general vigour, than other stocks (Table 3). Development of the 2-0 natural nursery stocks after planting was minimal for the next two years, and although growth and vigour subsequently improved, the initial lag has not been overcome (Fig-1).

Fig:1 SEASONAL HEIGHT GROWTH OF SITKA SPRUCE STOCKS



Note:1 Stocks differ significantly at the  $p_{0.05}$  level when not within the same bracket

Note:2 2+0 stock was planted April 1962 and 3+0 in May 1963



Stock	Date Planted	Accumulative Total Height Growth (Inches)				
		Years after Planting				
		1	2	3	4	5
Natural 2-0	April, 1962	0.5	1.7	5.0	10.0	17.2
Natural 3-0	May, 1963	2.5	4.7	10.0	16.5	-
Duncan 2-0	April, 1962	1.5	4.5	9.5	16.0	24.0
Terrace 2-0	April, 1962	3.0	8.0	15.0	23.0	32.0

Local stock-rearing seems to provide Sitka spruce seedlings better adapted to the environment of the region. The standard 2-0 stock grown near Terrace had a growth performance superior to the other stocks tested. The 3 year-old natural nursery seedlings grew as well as the standard 2-0 stock reared in the southern coastal nursery at Duncan, despite the fact that the latter stock was initially larger, with superior fibrous root and root-hair development.

#### DISCUSSION

The experiment has shown that abundant production of Sitka spruce and hemlock seedlings can be achieved in a forest by proper manipulation of forest floor and canopy.

The high survival, good growth and low established-seedling cost of graded 3-0 Sitka spruce seedlings from the natural nursery compare favorably with the standard 2-0 stocks.

The 2 year-old natural nursery seedlings are not suitable for plantation work, being too small, spindly, and weakly developed. In terms of initial quality, survival, development, or cost per established seedling, their performance was grossly inferior to that of the standard 2-0 stocks and the 3 year-old wildlings.

Natural nursery stock could be employed as a practical supplement for reforestation in situations where the supply of stock from production nurseries is insufficient or unavailable. There are countless examples of plantable wildlings growing fortuitously on road sides and the results of this trial would indicate that the creation of a natural nursery is a practical venture. In this case, a one-acre clearing was located within the forest at the end of a branch-logging road but site selection need not always follow this approach. It would seem a simple task for example to prepare a strip of land alongside a main-hauling road during its construction and to make sure that stumps and slash were cleared and burnt, mineral and organic matter mixed to form a seedbed, and timber left on the margin to provide seed.