Long-term Stock Type Trial Results in B.C.: Did Stock Performance Meet Today's Standards?

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Abstract—Nursery growers are a part of the system responsible for establishing a free growing crop of trees on a site after harvesting. The seedlings produced, their size, and the condition in which they are delivered to the field can play a large part in the success of the plantation.

This paper briefly outlines the process and legal responsibilities that a forester must follow when preparing a prescription. An integral part of the prescription is the selection of a stock type. The impact of stock type selection on the success of a prescription will be examined using survival and growth results from a 1978 trial established by Forestry Canada near Prince George, British Columbia.

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INTRODUCTION

Nurserygrowers are a part of the system responsible for establishing a free growing crop of trees on a site after harvesting. The seedlings produced, their size, and the condition in which they are delivered to the field can play a large part in the success of the plantation.

The forester must prepare a prescription incorporating products that the nursery can produce. The selection of nursery products will be based on cost and performance variables. They must not only survive but attain acceptable growth given the conditions of the site. This must be done to achieve the legal obligations for the establishment of the free growing crop of trees required by law in British Columbia.

Foresters also must develop a prescription that will achieve a variety of goals for the new forest planned for the site. This prescription and goals are based on the ecosystems that occur on the site.

The identification of the ecosystem is the first step in the prescription process. Associated with each ecosystem, there are legally binding standards of reforestation performance (Table1).

One of the basic requirements of the prescription must ensure that a minimum number of well-spaced trees that have attained a minimum height be established on the site within a specified period following harvesting. In B.C., this legal commitment has to be made before approval to harvest will be granted.

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Table 1. SBSvk-Prince George tree species selection and free growing stocking standard guidelines.

Site series	Tree species		Stocking standards (well-spaced/ha)		Regen delay (yrs)	Assessment		Min.tree height (m)	%tree over brush
	Primary	Secondary	Target	Minimum		Early (yrs)	Late (yrs)		
04	Sx	Bl, Fd, Pl	1200	700	4	9	15	Sx 1.0	150
05	Sx	Bl, P1	1200	700	4	9	15	Sx 1.0	150
06	Sx	Bl, P1	1000	500	4	9	15	Sx 0.8	150
07	Sx	B1. P1	1200	700	4	9	15	Sx 1.0	150

How the forester achieves this free growing crop is of importance to the nurserygrower.

All forest sites in B.C. have been classified according to a variety of site factors including:
- climate,
- soils, and
- vegetation present on the site.

This is further broken down based on:
- moisture status of the site, and
- nutrient status of the site.

For example, the trial site is located in a very wet (v), cool (k) area within the Sub-Boreal Spruce (SBS) biogeoclimatic zone near Prince George. It is classified as the SBSvk zone. A more detailed classification of this particular site would position it in the 04–07 site series (Figure 1).

Foresters make prescription decisions about the size of planting stock, planting densities, season of planting, site preparation needs, and the year the stock will be planted according to the standards established for each of the site series affected. These decisions are based on the site conditions and costs.

For all of these sites, a set of legal minimum performance standards have also been developed. The reforestation standards for a site dictate the end performance that must be achieved but, as one might imagine, there are a multitude of ways to achieve the results. Consequently, stock type selection is one of the critical choices the forester must make. It is also the choice that is of major importance to the nurserygrower.

Table 1 outlines the species and performance standards that are acceptable for the trial sites northeast of Prince George, based on the location on the edatopic grid.

The standards:
- are broken down for each ecological site series;
- indicate acceptable primary and secondary tree species;
- outline stocking standards that have to be achieved within the free growing time frame;
- dictate length of regeneration delay (i.e., the maximum length of time commencing at harvesting by which trees must be established either by planting or natural regeneration); if a forester plans to plant the site, the standards allow up to 4 years following disturbance before the reforesting process must be started;*

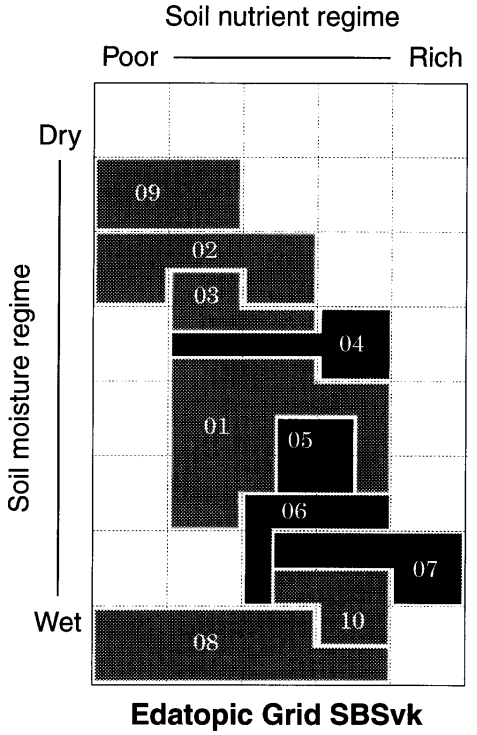

Figure 1. 1978 trial location, Prince George, site series edatopic grid.

- outline free growing assessment—earliest and latest time following commencement of harvesting; and
- dictate minimum tree heights that must be achieved by free growing assessment.

The ability of the different stocktypes are compared in the 1978 trial to the above standards.

(* Leaving reforestation this long can affect the achievement of free growing requirements as is illustrated in the trial results.)

TRIAL OBJECTIVES

Trials were designed to examine stock type survival and performance under different site conditions.

In 1978, the container program was still under development and the trial tested newer container stock types against more traditional bareroot options.

While a total of four trials were established, this paper reports the results from one of the representative sites—Severeid. Severeid represents a cross section of the site associations in the subzone (Figure 1).

TRIAL LOCATIONS

The trials were established in the north central Interior of B.C., north east of Prince George. All four trials were in the SBSvk zone, covering a range of site series.

BACKGROUND ON TRIAL

The Severeid site was logged in 1974 and planted in 1978. By the time of planting there was significant brush development including Sitka alder, huckleberry, thimbleberry and fireweed.

Discussion will be limited to stock performance on the two largest site series (04 and 07) of the Severeid site. Of the five stock types planted, four have been chosen for analysis because they are still used in B.C. They are also significant in terms of cost. The stock types are 2+1 bareroot transplants, PSB211 1+0 container, PSB312 1+0 container, and PSB415 1+0 container.

A 2+0 bareroot stock was also planted, however, it suffered close to 80% mortality in the first two years and it was not measured after that time.

Survival and growth results are presented for each of the remaining four stock types and discussed in terms of whether they would have resulted in the achievement of the free growing obligations by 1994 Ministry of Forests standards for stocking and growth (Table 1).

Two issues are addressed: "Did any or all of the stock types meet the free growing requirements?" Second: "If they did, can we now develop a stock type recommendation for the different site series based on the costs of each of the stock types used?"

Site 1 – 04 Site Series:

The first site is classified as a 04 site series which is mesic or in the middle of the moisture gradient with a rich nutrient status. The earliest free growing assessment would be year 9 or 1983. The latest assessment would be in year 15 or 1989.

Figure 2 illustrates the change in stocking for the four stock types relating to time following planting and regeneration delay.

All of the stock types have maintained sufficient survival at the start of the free growing assessment window (5 years after planting – 1983) to achieve the requirements for free growing assessment.

However, mortality is still occurring and by the latest free growing date (1989) the stocking for 211 and 2+1 stock types has dropped below the minimums outlined in Table 1.

On such a rich site association, it is concluded that the choice of stock type is critical. Extra costs for site preparation and/or re-planting are high and

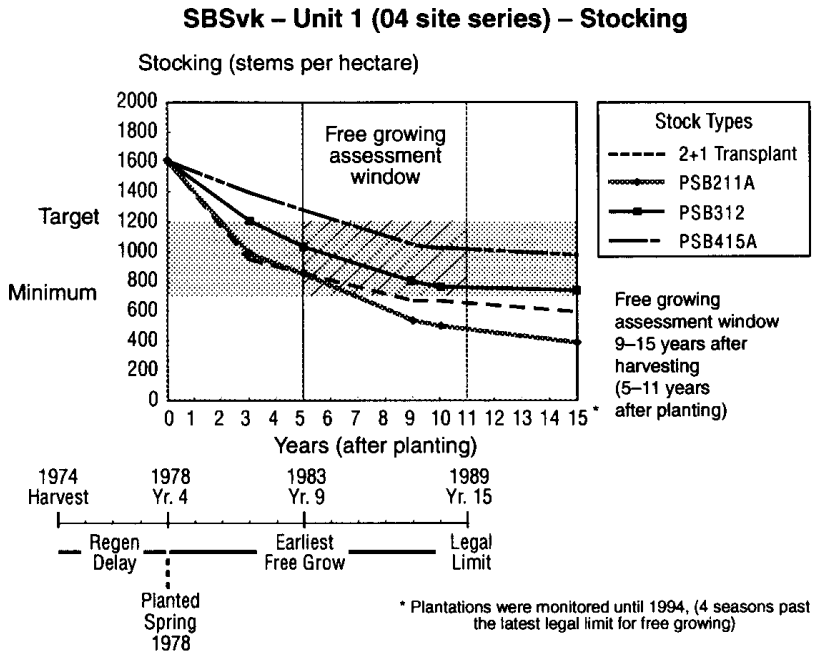

Figure 2. Stocking over time for four stocktypes on the 04 association.

further work will be required to achieve a free growing crop.

Figure 3 displays the number of surviving trees that have reached 1.0 m in height.

None of the stock type(s) had the minimum number of trees achieve the minimum height requirement during the free growing assessment period.

Both the stocking levels and the fact that these trees must have achieved the minimum height required determines whether the site will be free growing. This did not happen on Site 1.

If the block had been planted right after harvesting, one could have expected the results to have been different. The data suggested that the 415 stock type would have achieved the free growing obligations for Site 1.

Planting earlier might also have improved survival and growth.

Site 2 – 07 Site Series:

On the second site, unit 2 is comprised of an 07 site series, which is wetter than mesic and has a rich nutrient status (Figure 1). All of the stock types maintained at least minimum stocking levels at free growing (Figure 4). Figure 5 shows that stock types 415, 211, and 2+1 all achieved the free growing minimum heights of 1.0 metre during the free growing assessment period.

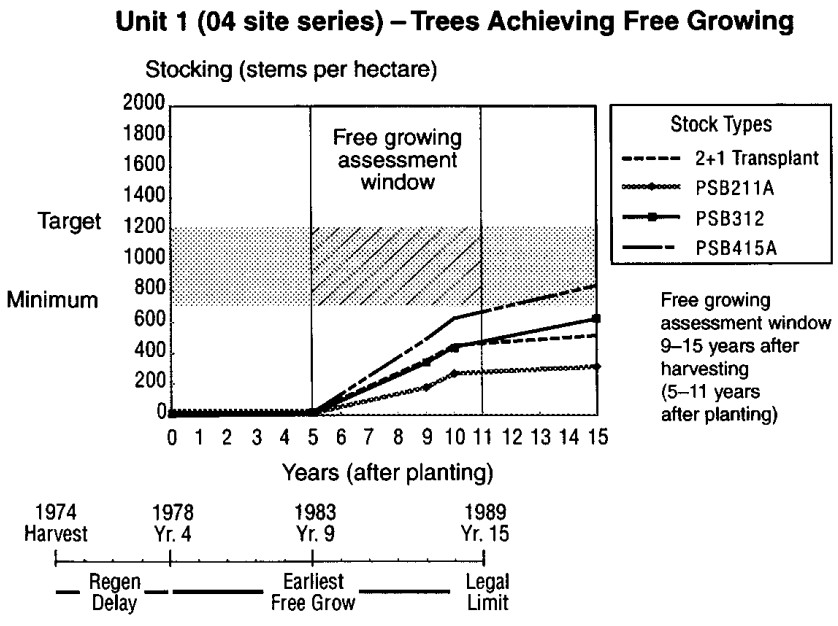

Figure 3. Number of surviving trees by stocktype and over time that have reached the minimum height requirement of 1.0 metres for the 04 association (number of free growing trees).

The PSB 415 stocking remained above the target number of trees as outlined in the prescription. This is a more expensive stock type than the PSB 312. Therefore, based on this result for this site series, a stock type prescription based on lowest cost (i.e., the site does not require the extra size of a 415, or the initial planting density may have been reduced on the unit and still satisfied the free growing stocking requirements), could be made.

One point worth noting is that these stock types reached the minimum height requirement at different times. This information could have a major impact on a foresters initial stock type decision.

Trade offs can be made considering cost versus risk of plantation failure and are reflected in the following relationships:

- 211 reaches free growing at year 10 from planting
- 312 reaches free growing at year 9 from planting, and
- 415 reaches free growing at year 8 from planting.

On Site 2, it can be concluded that stock type selection on this association is not as critical in terms of survival and growth as it was on the 04 association, but may have an impact on the costs of establishment and the amount of time that a licencee carries the legal liability for free growing on the site.

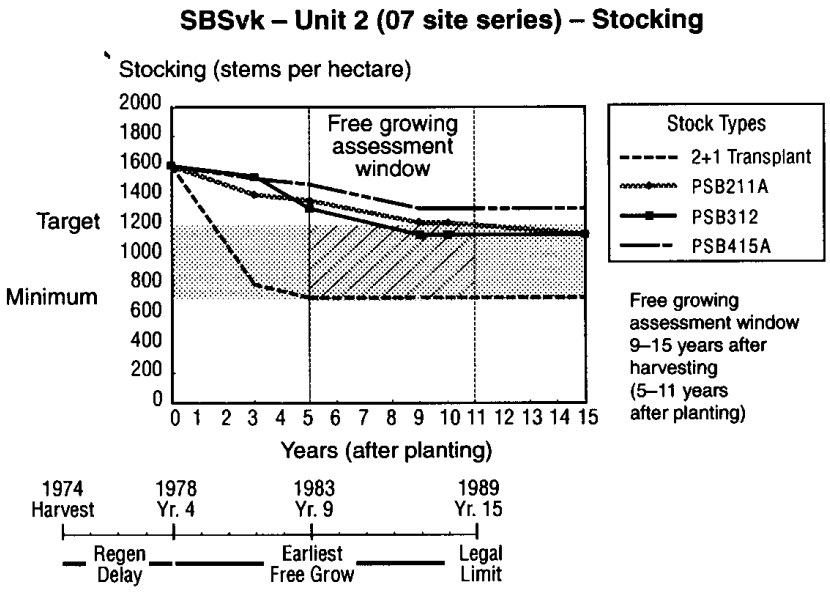

Figure 4. Stocking over time for four stocktypes on the 07 association.

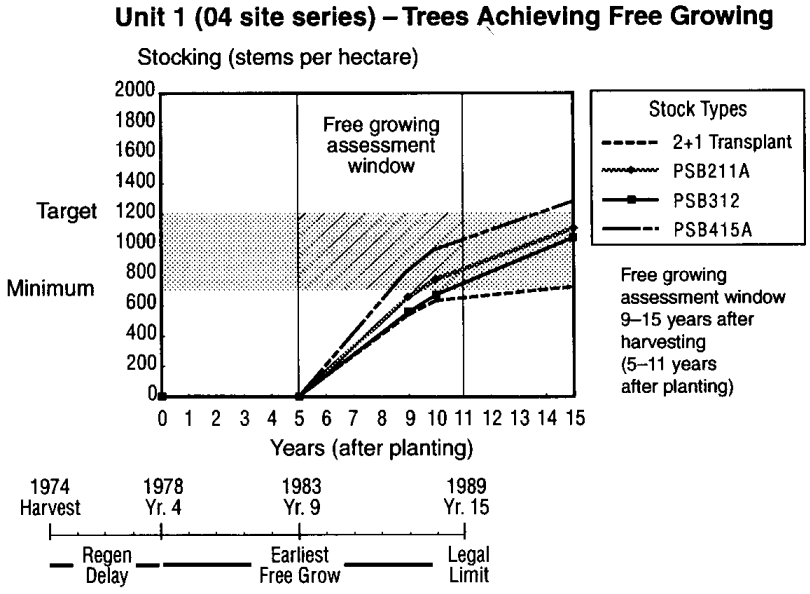

Figure 5. Number of surviving trees by stocktype over time that have reached the minimum height requirement of 1.0 metre on the 07 association (number of free growing trees).

CONCLUSIONS

In British Columbia, planting prescriptions, of which a stock type selection is an integral part, are ecosystem based with a series of legal standards tied to each ecosystem. Trial results such as these serve as a basis upon which to make a cost effective stock type decision.

On the Severeid site there are clear differences in the abilities of the stock types to produce a free growing crop.

Depending on the site conditions, certain stock types may not achieve the basic legal obligations of creating a free growing crop. This failure would result in additional costs for fill-planting or site preparation and planting. All options would require additional expenditure and hold the risk of penalties due to non-conformance with the prescription.

Achievement of free growing obligations can also be jeopardized by delaying planting.

Waiting four years allowed only a maximum of 11 years for those trees to grow to 1.0 m. Results for unit 1 show that for this area of B.C. that was not enough time.

Other factors observed, but not tested for, have affected the results. One of the largest factors observed on these sites was microsite selection. Better microsite selection consistently resulted in an observed improvement in survival and growth.

A lot of factors influence seedling survival and growth but choice of stock type can be critical to plantation success. Given the stock type order the nurserygrower must produce the highest quality planting stock to the specifications set by the forester. Field performance and achievement of legal requirements depend on the stock being able to perform in the field. Delays or problems in stock quality, handling and other site factors may affect success as well.