

PLANTING TRAILS:  
SHARKFIN BARRELS vs C. & H. SCARIFICATION PLOW

January 1981

CJDY

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# Prince George Forest Region Research Report



Province of British Columbia  
Ministry of Forests

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BARRELS vs. C. & H.  
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**RESEARCH**

Regional Research Report No. 1 introduces a new vehicle for the dissemination of research information to the Region. In past years the Research Note and the Research Review, both publications of the Research Branch in Victoria, were the only means of distributing the Ministry's forest research results on a province-wide basis. Now, as more research responsibility has been given to the Regions, there is a need to publish information in a format which is more regionally pertinent. The Regional Research Report series will describe the initiation, preliminary findings and final results of all Prince George regional research projects, as well as present information or results of other research agencies which is pertinent to our Region.

The objective of the Regional Research Report is to fill the gap between the researcher and the forest practitioner.

L. Herring,  
Regional Research Forester

**SILVICULTURE  
BRANCH**

PLANTING TRAILS: SHARKFIN BARRELS vs C. & H. SCARIFICATION PLOW

INTRODUCTION

In cooperation with the Vanderhoof Forest District, an experiment was established in August 1977 to evaluate the planting trail-making capabilities of the C. & H. scarification plow and the sharkfin barrel drag.

The test area is approximately 35 km north of Vanderhoof within the Jackpine Alley Site Rehabilitation Area. Two sites were selected for the study, representing two distinct postlogging site conditions where planting trails might in practise be prescribed. Both areas had supported a mixture of lodgepole pine, spruce and subalpine fir, and were logged to intermediate utilization standards between 1955 and 1960. A "backlog" site remained undisturbed until the study, while a "salvage logged" site was salvage logged during the summer of 1976.

In 1977 the slash loading of the backlog site was classed as heavy with heavy brush, while the salvage logged site was classed as moderate with moderate brush. Both sites occur on the Barrett 4 Association (Cotic, Van Barneveld and Sprout) composed of Orthic and Brunisolic Gray Luvisols developing on medium to fine textured, drumlinized glacial till. The principle brush species are Lonicera involucrata (black twinberry), Rubus idaeus (raspberry), Rubus parviflorus (thimbleberry), and Alnus sitchensis (Sitka alder) and Viburnum edule (squashberry).

TREATMENT DESCRIPTIONS AND PERFORMANCE

The drag configuration of the sharkfin drum treatment was that of two sets of tandem drums harnessed behind a 2.7 m wide "boat". The front drums of each tandem set were fully water ballasted to 770 kg while the rear ones were only half-ballasted to about 640 kg. Trackpad ballast was also coupled to both rear drums. The total weight of the drag unit was approximately 4200 kg., and a D7E tractor was used to tow it.

The scarification plow used in the study was manufactured by Cazes and Heppner Forest Services Ltd. This implement is rigidly mounted to the C-frame

of a crawler tractor, and consists of a front end blade which diverts large debris to either side of the tractor; a narrower plow blade mounted lower and to the rear of the front blade scuffs the litter and upper mineral soil horizons. A skid plate under the front blade limited penetration of the plow. The scarification plow weighed 4000 kg. and was pushed over the study area by a D7E tractor.

In an experimental establishment report, Glen (1978) reported the productivity of the sharkfin drum treatment was 18 - 29% higher than that of the scarification plow, depending on site conditions (see Table 1).

Table 1: Production/Cost comparison of Two Planting-Trail Treatments on Two Site Conditions in the Vanderhoof Forest District.

Treatment	Backlog Site		Salvage Logged Site	
	(Prod.) ha/hr.	(Cost) 1977 \$/ha.	(Prod.) ha/hr.	(Cost) 1977 \$/ha.
Sharkfin Drums	0.90	\$47.50	0.96	\$44.53
Scarification Plow	0.70	\$61.00	0.81	\$52.77

The sharkfin drag treatment created two planting trails, 2.4 m apart with each pass of the drag. The scarification plow, however, created only a single trail with each pass, with a theoretical minimum between-trail distance of 4.5 m.

Ranger staff opinion of the quality of the two treatments is summarized from Glen (1978) as follows:

1. sharkfin drums provided effective planter access at a lower cost than the plow;
2. the scarification plow created wider planting trails, but had a tendency to gouge and strip off excessive amounts of soil;
3. the sharkfin drums periodically jammed up with long slash lengths and required clearing to maintain effective performance.

### PLANTABILITY FOLLOWING TREATMENT

In the spring of 1978 the treated test sites were planted with 1 + 0 spruce plug stock of mean height 12.6 cm. A small, untreated portion of both the salvage logged and backlog sites was also planted as an experimental control. A planting report by Hooper (1978) yielded the following summary of treatment quality in terms of:

- Plantability:
1. sharkfin treatment permitted the planting of 1119 and 1478 sph on the backlog and salvage logged sites respectively;
  2. approximately 17% of the backlog site treated with the sharkfin was unplantable due to the large proportion of rotting logs on the ground caused by I.U. logging and subsequent windfall;
  3. the scarification plow permitted the planting of 815 sph (backlog site) and 902 sph (salvage logged site); these figures coincide with the theoretical maximum number of plantable spots based on the width of the scarifier. In practise, this theoretical maximum may not be reached where slash accumulation between planting trails is excessive;
  4. the untreated control blocks were planted at an intensity of 988 sph (backlog site) and 897 sph (salvage logged site);

### Planter Production:

1. planter production rates were similar (167 trees/hr) on both treatments of the salvage logged site, whereas on the backlog site the trails created by the plow permitted a 20% greater production rate (192 trees/hr. on the plowed treatment compared with 161 trees/hr. on the sharkfin treatment);
2. planter production on the untreated sites were 86 trees/hr. (backlog site) and 142 trees/hr. (salvage logged site), reflecting the added difficulty of planting without trails.

### PLANTATION PERFORMANCE

The ultimate test of the two trail-making techniques is whether they improve early plantation performance over that of the untreated control. In order to assess the treatments in terms of their effect on growth, two factors were measured after the third growing season, the relative brushiness of planted

spots and total seedling height in each treatment.

Planted spot brushiness was subjectively assessed by using a brush rating scale of 1 to 5 based on the presence and density of brush and minor vegetation within a radius of 15 cm from planted trees. A rating of 1 represents a totally vegetation free, mineral soil surface; a rating of 5 represents a seedling totally obscured by vegetation growing within or beyond 15 cm radius. While the relative brushiness of each treated site is a somewhat indirect measure of the treatments effect on seedling performance, it is a rather more direct means of comparing the physical impact of treatments on the sites after three years.

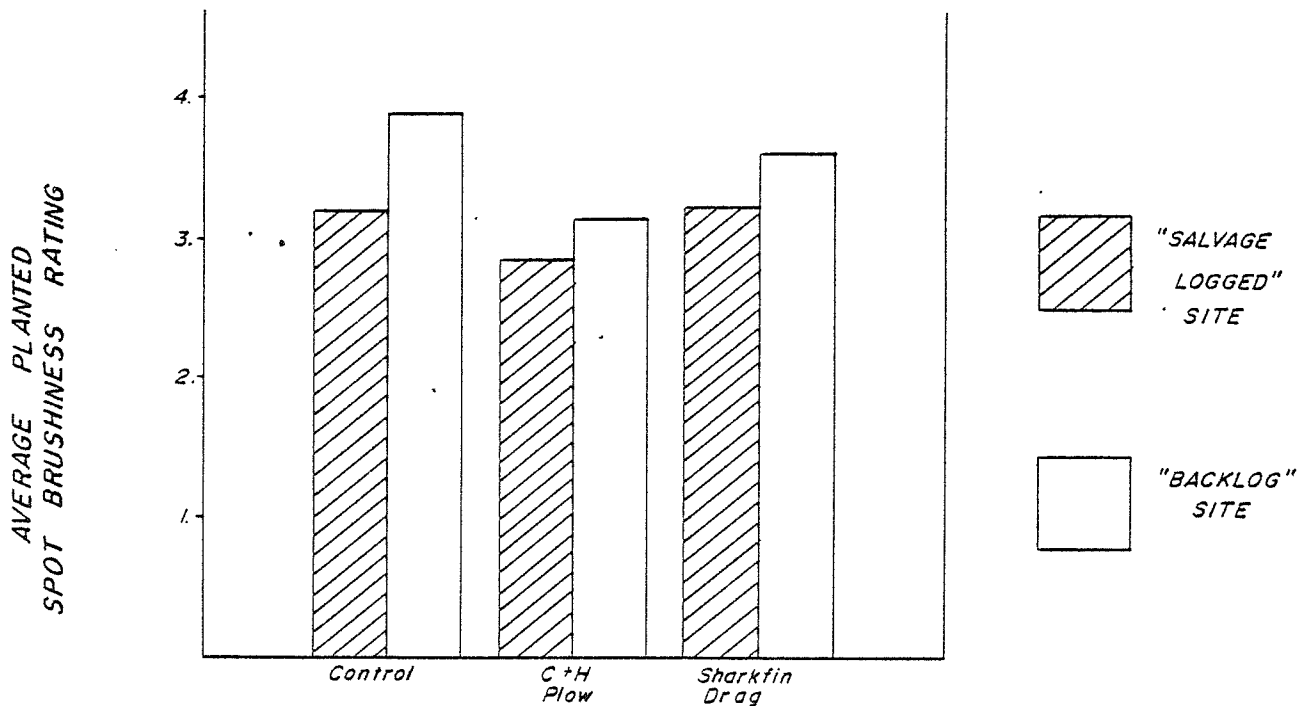


Figure 1. Planted spot brushiness ratings three growing seasons after planting trail treatments to two sites in the Vanderhoof Forest District.

Figure 1 presents the relative brushiness of planted spots on the salvage logged and backlog sites based on the mean of 150 planted spots per treatment per-site. There is a significantly\* lower (17%) brush rating for the control block of the salvage logged site compared with the backlog site. This likely reflects the recent general site disturbance resulting from salvage logging in 1976. While this trend is also apparent for the other treatments, it was found to be insignificant\*.

On the salvage logged site the average planted spot rating for the scarification plow treatment was approximately 16% lower than the ratings for the control or drag scarification treatments. This difference is significant\* and indicates that planted seedlings on this treatment/site combination are experiencing less vegetative competition after three growing seasons than either the untreated control or drag scarified treatments. The brush ratings for these latter two treatments were not found to be significantly\* different.

On the backlog site the scarification plow also proved superior in reducing brush competition. It resulted in a 20% lower brush rating than the control, and an 8% advantage over the drag scarification treatment. (Only the former value was found to be significant\*). On this site the drag treatment also resulted in reduction in brush rating compared with the control, however, it was found to be insignificant.

Seedling growth performance after three growing seasons is likely the most important indicator of the relative advantages of each treatment. Since the size of planting stock was similar for all treatment-site combinations (at 95% confidence level), and assuming seedling and planting quality was also homogeneous, total seedling height to the fall of 1980 was chosen as the appropriate variable with which to assess treatment effect.

The relationship between the brush rating and total seedling height proved to be a weak one at best. The correlation coefficient indicated that only 10% of the variation in seedling height is explained by the brush competition rating assigned to it. Three possible explanations for this weak relationship are offered:

1. the brush rating system used did not adequately describe the actual

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\* - significant at the 95% level of confidence.

- site competition experienced by each assessed seedling;
2. the brush competition observed on the planted spots was not a limiting factor to the early (1 - 3 year) growth of the seedlings;
  3. factors other than brush competition alone may determine the growth response to the treatments; specifically these additional factors might include growth-favourable increases in soil temperature in the deeply disturbed microsites which may not occur with lighter disturbance, even though the brush ratings assigned to each may be similar.

Figure 2 presents the total height of seedlings on the salvage logged and backlog sites based on the mean of 150 seedlings in 15 plots per treatment per site. As shown in Figure 2, it is clear that site treatment with the two implements has resulted in, on average, a 33% (24 to 45%) growth advantage over the untreated control after three growing seasons.

On the salvage logged site both the scarification plow and drag scarifier treatments resulted in similar total seedling heights. Both these treatments provided, on average, a significant\* 44% growth advantage over the untreated control. While a similar significant\* advantage in both treatments (42 and 24% respectively for plow and drag treatment), over the control is indicated for the backlog area, the scarification plow also provided a 15% advantage in seedling growth over the drag scarification treatment. This result, while minor and only marginally significant, likely reflects the difficult slash and debris conditions in the backlog area and the resulting inefficiencies of the sharkfin barrel drags previously described.

#### CONCLUSIONS

After very limited operational experience with two planting trail-making implements, the following summary of their performance on backlog and salvage logged, I.U., pine-spruce sites in the Prince George Region can be made:

1. Treatment production rates using the tandem sharkfin barrel-drag unit behind a D7E tractor was 18 to 29% greater than that of the Cazes and Heppner scarification plow in front of the same tractor.
2. The sharkfin barrel treatment created 27 to 39% more plantable spots, depending on site conditions than the scarification plow.

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\* - significant at the 95% level of confidence.

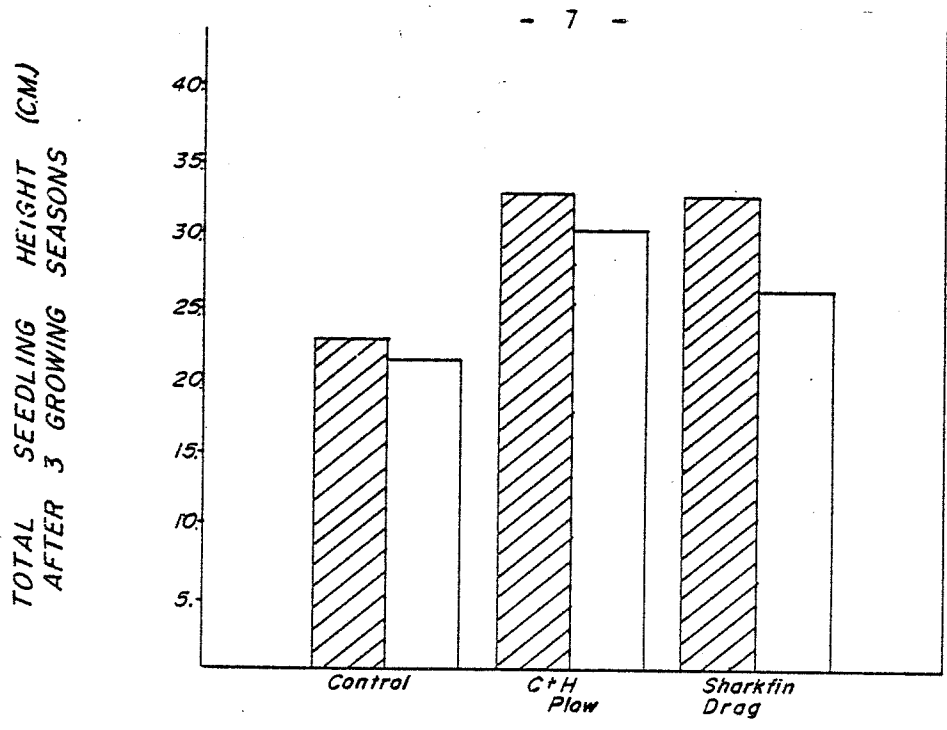


Figure 2. Total spruce seedling heights three growing seasons after two treatments to two sites in the Vanderhoof Forest District.

3. The scarification plow permitted a maximum of only 900 plantable spots/ha. based on the normal between-tree spacing of 2 to 2.5 m within rows.
4. The sharkfin barrel drag was prone to jam-up with long slash lengths, particularly on the backlog site where debris accumulation was high; this caused operational inefficiencies resulting in up to 17% of the treated site being unplantable.
5. The scarification plow permitted a 20% greater planting-productivity on the backlog site due to its more effective trail-making capability.
6. Salvage logging shortly before trail-making treatments may increase treatment efficiency by reducing debris accumulations and increasing disturbed, potentially plantable microsites.

Three growing seasons following planting with 1 - 0 plugs, the following summary of brush competition and seedling growth can be made:

1. Only the scarification plow treatment resulted in a significant reduction in the brush ratings of planted spots on both site types studied.

2. A poor correlation between brush rating and seedling height makes the former variable alone an unreliable indicator of treatment effect.
3. On both the salvage logged and backlog sites, both trail-making implements resulted in significantly greater seedling growth performance (24 to 45%) than on the untreated control.
4. Only on the backlog site did the scarification plow provide a modest (though insignificant) improvement in growth over the sharkfin drum scarification treatment.

Evidence appears adequate, three growing seasons since treatment, that both trail-making implements are capable of increasing the ease of planting and the early growth performance of plantations in residual pine-spruce stands in the region. It appears too early to determine which of the two implements provides the best biological advantage to seedling growth. Observations suggest, however, that the benefits provided by the scarification plow may be longer lasting than those of the sharkfin drums. In any event, a further growth assessment in 1982, five growing seasons after treatment should prove more decisively whether one implement is superior to another. Until then, however, the operational characteristics of both trail-making treatments suggest that the sharkfin barrel drag is a good choice for sites with light to moderate brush and debris cover. Where debris accumulation is excessive, the scarification plow appears to be a more efficient and effective trail-making tool.

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