

Response of Douglas-fir and the Fireweed Complex to Manual Brushing and Glyphosate Treatment in the ICH zone

INTRODUCTION

This report describes trends in conifer and vegetation responses to herbicide and manual brushing treatment of the *Fireweed* complex, a very common vegetation community on logged sites in southern interior BC. ([Description of the *Fireweed* complex](#))

The results presented here are from just 3 individual sites with varying treatments, which is insufficient replication to allow full statistical analysis of the data. For each site, t-tests have been carried out to determine if treatment responses are statistically different between brushed and untreated areas. However, because a full analysis of variance was not possible with the small number of sites, the reader is cautioned that results can not be directly extrapolated to other sites across the landscape. It is important to understand that brushing outcomes may differ on individual sites from the results presented here.

ABSTRACT

The following trends were identified following manual cutting and glyphosate treatment of the *Fireweed* complex:

- Single manual cutting treatments reduced vegetation height and cover only in the year of treatment, but glyphosate reduced vegetation cover and height for at least 4 years.
- On our sites, manual brushing or glyphosate treatment did not significantly improve Douglas-fir root collar diameter, total height, or leader growth.
- On all of our sites Douglas-fir leader growth greatly improved over time, regardless of whether brushing was done.
- The brushing treatments did not improve seedling vigour or survival.
- Survival was greater than 90% and most seedlings were of good or moderate vigour at the mesic sites, regardless of whether brushing was done.
- Survival was worse (75-85%) at the subhygric site but most surviving seedlings were of moderate vigour, regardless of whether brushing was done.
- Manual cutting significantly increased the height of Douglas-fir relative to the vegetation only in the year of treatment.
- Glyphosate improved the height of Douglas-fir relative to the vegetation but seedlings were outgrowing the vegetation regardless of treatment.
- On all of our sites, the minimum requirements for free-growing are expected to be easily met within the required time period, with or without brushing.

STUDY AREA

Table 1. Characteristics of sites where the Fireweed complex was treated.

Location	Tillis Landing (Shuswap Lake)	Longridge (Seymour Arm)	Simard Road (Mabel Lake)
BEC unit	ICHmw2/04 (subhygric)	ICHmw3/01 (mesic)	ICHmw2/01 (mesic)
Elevation (m)	1075	1060	
Slope/aspect	30% North	25% West	30% North
Soil class/texture	Brunisol, silt loam	Podzol, loam	Brunisol, sandy loam
Logging history	Clearcut 1992	Clearcut 1993	Clearcut 1992
Site preparation	Mechanical 1994	None	Broadcast burn 1993
Brushing treatment	Spot manual June 1995	Spot manual Aug. 1997	Glyphosate Aug. 1995
Regeneration	Fd planted, 1 year-old	Fd planted, 1 year-old	Fd planted, 1 yr-old
Seedling vigour	Moderate and good	85% moderate and good, 15% poor	Good
Seedling competitive status	Threatened	Overtopped	Overtopped
Vegetation cover and height	50%, 65 cm	65%, 90 cm	60%, 90 cm
Measurement years ¹	0, 1, 4, 5	0, 1, 3	0, 1, 4

¹ 0 = immediately prior to brushing. 1 = 1 year post-brushing. 3 = 3 years post-brushing. 4 = 4 years post-brushing.

VEGETATION RESPONSE

- Glyphosate treatment reduced the cover of fireweed, total vegetation, total herbs and total shrubs by half, and height was reduced by a third (Figure 1). Four years after brushing, cover of these vegetation groups was still significantly reduced, but height had nearly recovered.
- Manual cutting reduced fireweed height and cover only in the year of treatment (Figure 2).

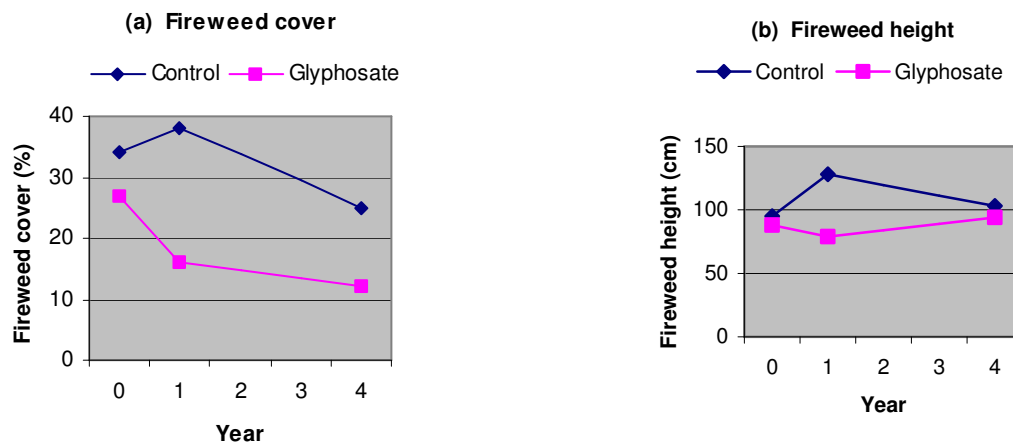


Figure 1. Fireweed cover (a) and height (b) before and after glyphosate treatment at Simard Road.

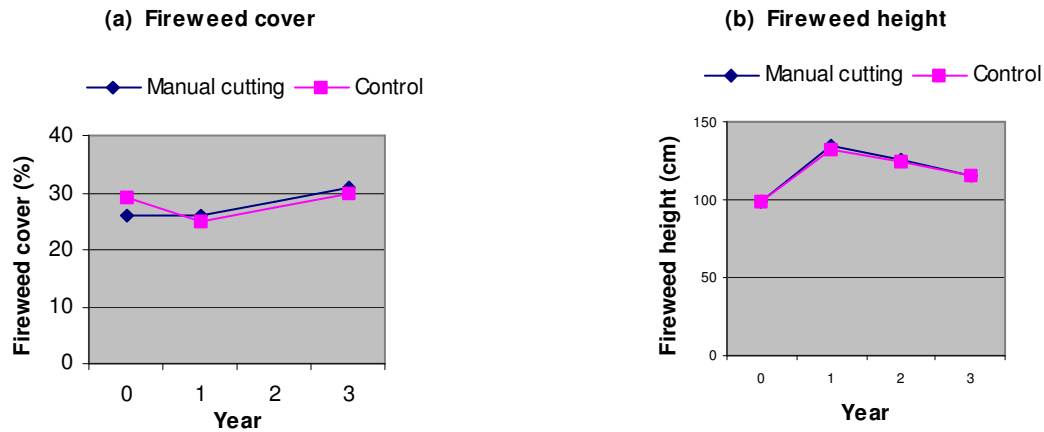


Figure 2. Fireweed cover (a) and height (b) before and after manual cutting at Longridge.

CONIFER RESPONSES

Douglas-fir growth

- Root collar diameter was not significantly increased by manual cutting or glyphosate treatments.
- Total height of Douglas-fir was not significantly increased by the manual cutting treatment and it significantly decreased 1-4 years following glyphosate treatment.
- Leader height was not significantly increased by manual cutting or chemical treatment.
- Leader growth greatly increased over time at the 3 sites, regardless of whether brushing was done.

Table 2. Conifer responses.

Response variable	Pre-treatment			1 st year response			3 rd year response ³			5 th year response		
	C ¹	T	Sig. ²	C	T	Sig.	C	T	Sig.	C	T	Sig.
MANUAL CUTTING – Tillis Landing												
Root collar diam (cm)	0.6	0.6	ns	1.2	1.3	s	2.8	2.8	ns	3.6	3.6	ns
Total height (cm)	37	35	ns	61	58	ns	114	111	ns	141	139	ns
Leader height (cm)	12	11	ns	22	21	ns	19	19	ns	27	28	ns
Survival (%)	100	100		100	94		86	78		86	75	
MANUAL CUTTING – Longridge												
Root collar diam (cm)	0.7	0.6	ns	1.1	1.0	ns	2.4	2.3	ns			
Total height (cm)	44	38	s	62	53	s	113	104	ns			
Leader height (cm)	8	6	ns	17	17	ns	34	32	ns			
Survival (%)	100	100		100	100		100	97				
GLYPHOSATE – Simard Road												
Root collar diam (cm)	0.7	0.7	ns	1.5	1.5	ns	3.7	3.6	ns			
Total height (cm)	43	41	ns	71	61	s	171	146	s			
Leader height (cm)	13	10	s	30	22	s	34	29	ns			
Survival (%)	100	100		100	97		97	92				

1 C = Control T = Treatment

2 s = Treatment and Control means significantly different at $p = 0.05$

ns = Treatment and Control means not significantly different at $p = 0.05$

3 At Tillis Landing and Simard Road the third measurement was done in year 4 not year 3.

Douglas-fir survival and vigour

- Manual cutting and glyphosate treatment did not improve survival of Douglas-fir. At all 3 sites, survival was actually lower in the treated area than the control, but differences were small (Figure 3).
- At all of the sites, the survival rate gradually decreased over time, but survival remained acceptable (>90%) except at Tillis Landing where it dropped to 75% by the fifth year after brushing.
- Manual brushing and glyphosate treatment had no effect on seedling vigour. At one site (Longridge) vigour in both the treated area and control improved over time, and at the other two, vigour declined regardless of treatment (data not shown).
- Even though vigour declined at some sites, few trees were of poor vigour.
- All sites had seedlings that were bent or forked due to vegetation- or snow-press. At the subhygric manually brushed site (Tillis Landing) there were more damaged seedlings in the control than the treated area (Figure 4). Trends were not evident at the other sites.

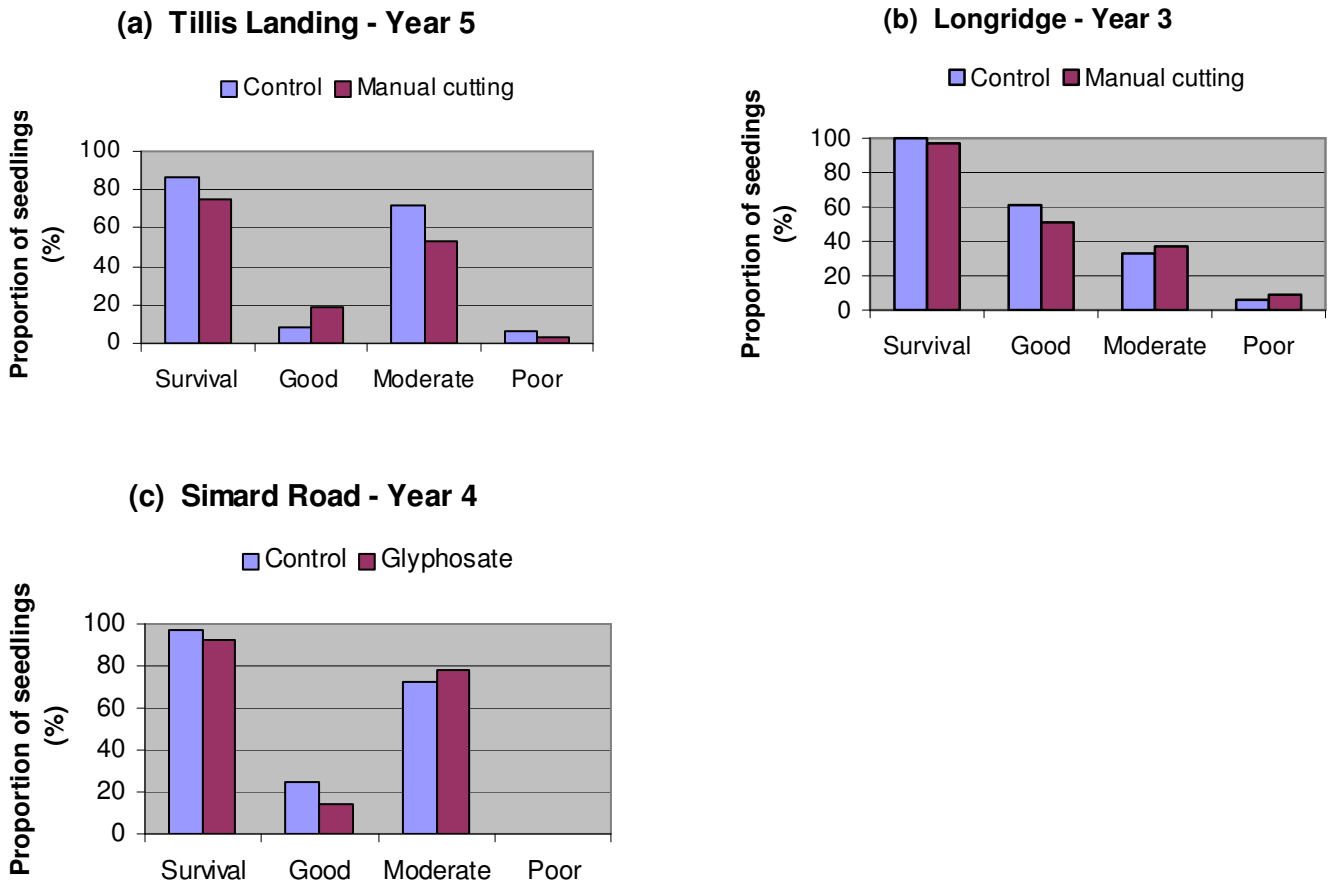


Figure 3. Survival and vigour (a) 5 years after manual cutting at Tillis Landing, (b) 3 years after manual cutting at Longridge, and (c) 4 years after glyphosate treatment at Simard Road.



Figure 4. Proportion of seedlings that were bent or forked due to snow- or vegetation-press at Tillis Landing.

Douglas-fir competitive status

- Glyphosate reduced the percentage of seedlings that were overtopped by vegetation and vegetation regrowth was not immediate, resulting in release of seedlings 2 years earlier than in the control.
- Manual cutting reduced the percentage of seedlings that were overtopped only in the year of treatment.
- At Simard Road, Douglas-fir in the chemically treated area and control met the minimum height for free-growing (1.4 m) at age 4. At the 2 manually brushed sites it was met or is expected to be met at age 6. Brushing did not shorten the time it took to meet this requirement (Figure 5).
- The required conifer:brush height ratio was met at age 3 at the chemically treated area and one of the manually treated areas (Tillis Landing) and at age 4-5 at Longridge. Glyphosate treatment reduced the time it took to meet this requirement by one year.

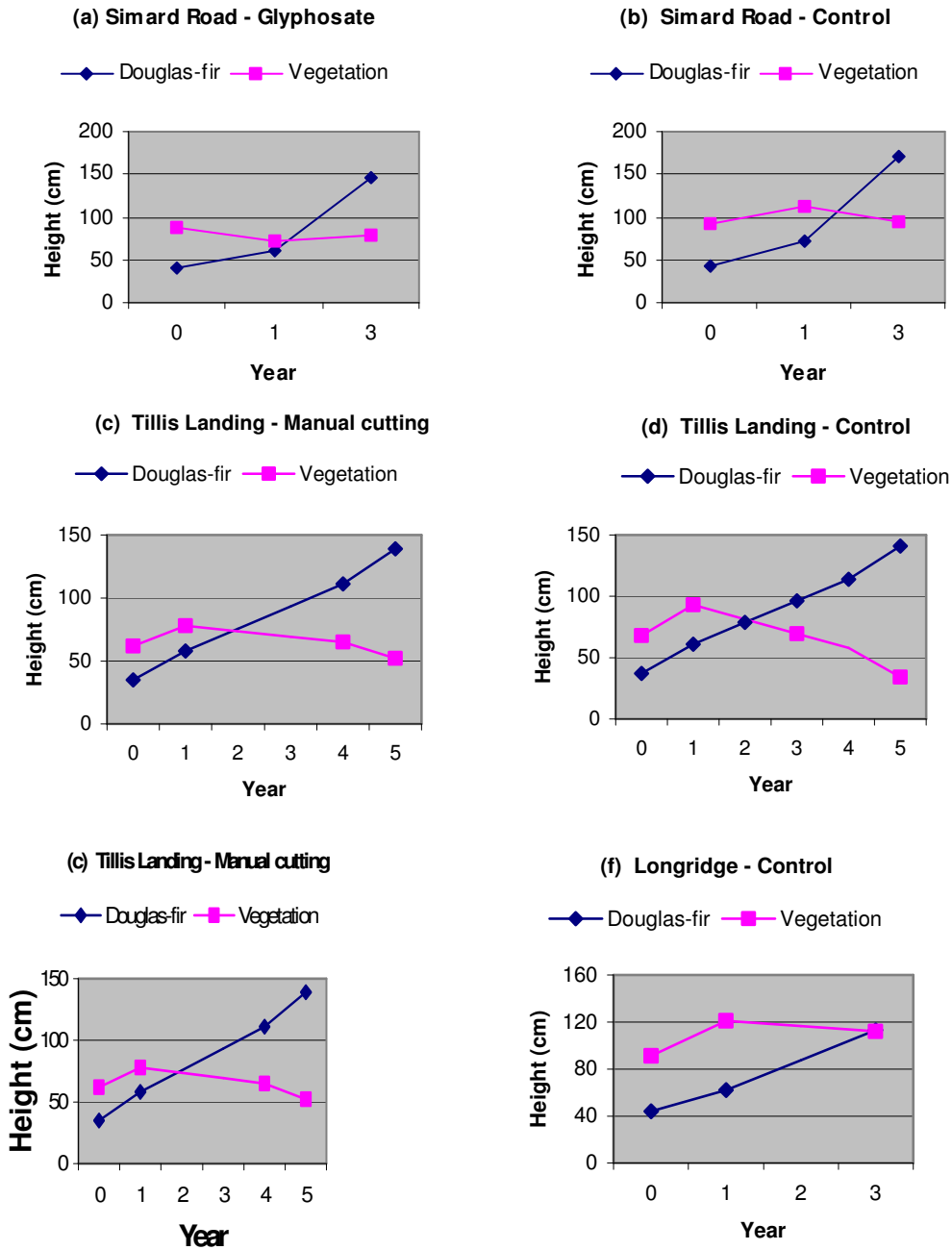


Figure 5. Height of Douglas-fir and vegetation before and after glyphosate treatment at Simard Road and manual brushing at Tillis Landing and Longridge.

Conifer stocking

- At Tillis Landing, conifer stocking was close to the target level in both the manually brushed area and control before treatment and 5 years after brushing. Total number of conifers greatly increased over time (from 1800 to 9000 stems/ha) (Table 3).
- At the other manually treated site, stocking was barely above the minimum requirement of 700 stems/ha when brushing was done. Stocking was not evaluated after brushing, but the mortality rate was low.
- Stocking was close to the target level at the glyphosate treated site before brushing. Stocking was not evaluated after brushing.

Table 2. Conifer stocking.

Response variable	Pre-treatment		5 Years Post-treatment	
	C	T	C	T
Tillis Landing - Manual cutting				
Total conifers/ha	1706	1877	9839	8722
Well-spaced/ha	1092	1088	1167	1139
Longridge – Manual cutting				
Total conifers/ha	2500	2494		
Well-spaced/ha	1089	733		
Simard Road – Glyphosate				
Total conifers/ha	1338	1363		
Well-spaced/ha	1167	1112		

PRELIMINARY MANAGEMENT IMPLICATIONS

- Manual brushing of the *Fireweed* complex on our mesic sites was not required for good survival of Douglas-fir seedlings. On our subhygric site, the survival rate was lower, regardless of whether brushing was done. Further study is required to identify sites where competition from this complex is so intense that it threatens conifer survival.
- Manual brushing and glyphosate treatment had no effect on seedling vigour. It was adequate on all sites, whether brushed or not.
- Manual brushing and glyphosate treatment had no effect on seedling growth.
- A single manual brushing or glyphosate treatment did not shorten the time to free-growing. The minimum conifer:brush ratio and the minimum height requirement for free-growing were easily met within the required time period.
- On our subhygric site, brushing benefited the plantation by decreasing the proportion of seedlings damaged by snow- or vegetation-press.
- On the mesic sites, there was no apparent benefit to the brushing treatments.