VEGETATION RESPONSE TO SLASHBURNING ON CENTRAL VANCOUVER ISLAND: A 7- YEAR PROGRESS REPORT

INTEGRATED WILDLIFE INTENSIVE FORESTRY RESEARCH

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Vegetation Response to Slashburning on Central Vancouver Island: A 7-Year Progress Report

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ABSTRACT

Slashburning on fire-sensitive sites reduced the abundance of existing conifers and shrubs in proportion to burn intensity. Speed of regrowth of surviving species, and establishment of new plant species was variable in the 6 years following treatment. Forb cover increased rapidly, but began to decline by year six. Cover values did not peak simultaneously for all species. For example, fireweed cover peaked within 2 years, while cover of hairy cat's-ear was still increasing 6 years after burning. Deciduous shrub cover was severely reduced by all levels of burning, and did not regain preburn levels within 6 years of treatment. Over the same time period, shrub cover more than doubled on the unburned control area. Existing conifers were killed by burning. Planted conifers increased in cover more rapidly on the high-intensity burn sites. Competition with shrubs probably slowed conifer development on the light burn sites. Much evergreen shrub cover was removed by treatment, but fire also stimulated sprouting and encouraged rapid regrowth. On the light burn treatment areas, cover exceeded preburn levels within 2 years of burning. Effective control of evergreen shrubs was only achieved on the most severe burn sites.

ACKNOWLEDGEMENTS

I am grateful to Karen Sadoway for assistance provided in field sampling during 1989. I would also like to thank the Research Branch biometrics support staff, namely Wendy Bergerud and Vera Sit, for timely assistance on using repeated measures analysis techniques.

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1 INTRODUCTION

This report provides an update to an ongoing study by the Integrated Wildlife−Intensive Forestry Research program (IWIFR) on the response of vegetation to slashburning. The project began in 1985 when MacMillan Bloedel and Forestry Canada designed and implemented a co-operative study to examine the effects of prescribed burning on tree growth and site nutrition. The study area is on central Vancouver Island, southwest of Port Alberni. It encompasses three recently logged cut blocks with portions left unburned (control), or burned in spring (low intensity) or fall (high intensity). These cut blocks are found on moderately steep, southerly aspects between 455 and 600 m in elevation and lie within the wetter maritime subzone of the Coastal Western Hemlock biogeoclimatic zone (CWHb). Because of thin or rocky soils, the fire sensitivity of these sites was rated as high. Details of the main study were reported by Beese (1992). The IWIFR program staff established a parallel study on the same sites and plots, but using different sampling methods. The initial response of assorted plants to the burns during the first 2 years after treatment is already documented (Peterson 1989). This report presents information collected during the 4th and 6th years after burning and examines post-treatment trends in vegetation development. A final report will be prepared after 8th- and 10th-year sampling is conducted.

2 METHODS

2.1 Sampling

Sampling methodology was unchanged from that described by Peterson (1989). In review, the treatments included a light burn, a heavy burn, and an unburned comparison. Each treatment unit was sampled using twenty 0.5 × 0.5 m subplots nested within triangular macroplots. Two or three macroplots were located within each treatment unit and each treatment was present on two of three sites (blocks). The design can thus be described as an incomplete block design, balanced at the treatment level. Figure 1 provides a simple schematic of the relationship of blocks, treatments, and macroplots. Vegetation sampling preceded treatment and was also conducted 1, 2, 4, and 6 years after slashburning. The timing of the vegetation sampling is summarized in Table 1. The percent cover of ground vegetation, woody debris, and exposed surface substrate were estimated for all subplots during each sampling period. Stem density, length, and diameter measurements were also taken for shrubs and trees within each subplot.

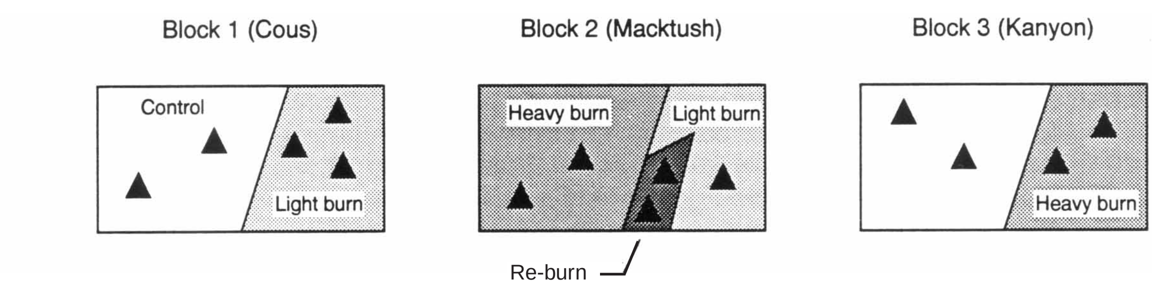

FIGURE 1. A simplified representation of block, treatment, and macroplot ( ) distribution.

TABLE 1. Sampling dates and their corresponding sample periods

Date	Sample period
May 1985	Year 0 (pretreatment sampling)
May and September 1985	burning of treatment units
late September 1986	Year 1 post-treatment sampling
late September 1987	Year 2 post-treatment sampling
late September 1989	Year 4 post-treatment sampling
early October 1991	Year 6 post-treatment sampling

During application of the heavy (fall) burn treatment, part of the adjacent light (spring) burn area was accidentally burned a second time. This resulted in a reduction of the light burn treatment area and created a new, unreplicated treatment (the re-burn) area. While data collection continued on these two plots, the re-burn information could not be used because of the analytical approach (see Section 2.2).

Another unanticipated change occurred in the spring of 1991 (before the 6-year post-treatment sampling) when conifer ingress was removed from one-half of each control plot. This action was taken to reduce competition with planted stock as part of the primary study of fire effects on tree growth and site productivity (W. Beese, Forest Ecologist, MacMillan Bloedel Ltd., pers. comm., 1991). The effect of this removal on the vegetation study could not be determined.

2.2 Analysis

Data analysis procedures were changed from those used initially (Peterson 1989). A repeated measures design rather than a split-block-in-time design has been adopted. Repeated measures analysis emphasizes the changes that take place over time rather than either the treatment *or* time effects. This treatment-by-time interaction is of more interest because it allows comparisons of patterns of development. This type of analysis is also more appropriate because it avoids the serial correlation between consecutive measurements that weakens split-block-in-time analyses (Gurevitch and Chester 1986; Meredith and Stehman 1991).

The subplot cover data were non-normally distributed and heteroscedastic. An angular (arcsine) transformation was initially used to correct the latter. While this decreased the heteroscedasticity slightly, it did little else and was subsequently ignored. Mean cover percentages derived from raw subplot data were used for all analyses and in the presentation of results. Results were usually more conservative without the use of transformed values.

A multiple comparison of preburn means tested the similarity of initial conditions between treatments. Repeated measures analysis involved only the unburned, light burn, and heavy burn treatments and interpretations are exclusive to them. As well, only post-treatment data were analyzed so that treatment and time effects were separate and distinguishable. Preburn values for all treatments are presented in all relevant figures for comparative purposes. Means for the single re-burn treatment are also included. A significance level of 0.10 was used for all tests and associated discussion. Repeated measures procedures were used only for species occurring on at least 5% of all subplots during at least one sampling year. All data analysis was conducted on a personal computer using the SAS Institute (1985) statistical package.

Treatment unit means were used for all analyses. The design was not balanced however, and the two means for the light burn treatment used different sampling intensities (20 and 60 observations) than those for the unburned and heavy burn treatments (40 observations per mean). The repeated measures analysis and graphical presentation of results were based on these unweighted means. Using the six treatment unit means over 4 years yielded a test with limited degrees of freedom that can only detect large differences (the error sums-of-squares has only one degree of freedom). Additional sampling will not improve this and therefore the test's power will remain low.

Orthogonal polynomial contrasts were used in the repeated measures analysis to examine treatment responses over time — that is, the sums-of-squares for the time-by-treatment interactions were partitioned into linear, quadratic, and cubic components. A significant linear effect implies that the data exhibit a strong straight-line increase or decrease from the first sampling period to the last. Significant quadratic time-by-treatment interactions suggest that the data follow a pattern characterized by the formula $Y = aX + bX^2$. Similarly, the overall cubic contrast indicates how well the data are represented by the formula $Y = aX + bX^2 + cX^3$. In addition, partitioning of these overall contrast sums-of-squares allows examination of differences between individual treatment responses. For example, a comparison of linear interaction effects between two treatments assesses whether the slopes (rate of change) of the linear components are the same.

3 RESULTS

Cover values of individual plant species and species groups are examined in this section. The treatment-by-year effects of these values, with emphasis on the linear, quadratic, and cubic (lack of fit) changes over time, are the primary focus. While treatment differences were evaluated, they were of little practical value.

Results of all tests are presented in Table 2. Besides plant cover data, changes in species number and surface substrate, and the frequency of occurrence of certain forbs were also explored, along with density and diameter trends in several shrub species.

3.1 Species Number

Species number exceeded preburn levels for all four treatments during the 1991 sample period (Figure 2). In the 1989 and 1991 sample years, eight new species were recorded, increasing the total species list to 40. These additions included 1 hardwood, 3 forbs, and 4 deciduous shrubs. Appendix 1 provides a list of all species observed.

Forbs were the most numerous overall (18 species), although only 11 were tallied in any one sample year. Deciduous shrubs were the second most abundant group (nine species), followed by conifers, evergreen shrubs, and ferns (5, 3, and 3 species, respectively). Grasses (undifferentiated by species) and one hardwood were also recorded. The number of plants common to all treatments increased from 8 of 24 before treatment to 14 of 32 six years after burning. Fireweed (*Epilobium angustifolium*) and dull Oregon-grape (*Mahonia nervosa*) were the only plants recorded in all treatment types during each sampling period.

Differences in species number between treatments and years are presented in Figure 2. Most noticeable is the greater number of species on the unburned treatment areas because of a substantial increase in deciduous shrub species during the last sampling period. Increases in the number of forbs have allowed both the light and heavy burn treatment areas to attain comparable species totals. There was no decrease in species number associated with the light burn treatment, with species numbers exceeding preburn values the year after treatment. The heavy burn and re-burn treatment areas had species numbers reduced by burning. Totals remained below preburn levels for 1 year on the heavy burn sites, and for 4 years on the re-burn site.

3.2 Surface Substrate

Estimates of ground cover by woody debris decreased in successive sampling periods, as did the proportion of subplots with measurable woody debris values. Cover by woody debris was not significantly different between treatments in preburn comparisons of cover values. Although burning removed a substantial amount of woody debris from the sites (Figure 3), reductions in cover during subsequent sample periods resulted primarily from debris being hidden from view by ground vegetation and associated plant litter. This was most evident in the unburned treatment units, where woody debris cover showed substantial declines in the 6 years following establishment of the study. Ground vegetation may have hidden the woody material more rapidly on these sites.

The decrease in cover values within treatments led to a significant linear treatment-by-time interaction in the repeated measures analysis ($p = 0.0565$). The rates of decline (Table 2), however, did not differ between the unburned and burned treatments, or between the light and heavy burn treatments ($\alpha = 0.10$).

As documented previously (Peterson 1989), exposure of mineral soil and rock was greatest immediately after the burn (Figure 4). Cover values then declined to a fairly stable level 4–6 years after treatment. As for woody debris, the decrease in exposed mineral soil and rock resulted primarily from increased cover by new vegetation and associated litter. The only significant effect in post-treatment analysis was a difference in the coefficients of the cubic component between the light and heavy burns ($p = 0.0794$). This effect can be seen in Figure 4 as a slight increase in the 1991 value for the heavy burn and a more pronounced response curve than that for the light burn treatment. The most likely cause of the 6th year increase is sampling error, but erosion cannot be ruled out.

TABLE 2. Results of means separation on preburn treatment cover values and significance levels for post-burn repeated measures analysis of percent cover

Group/species[a]	Mean Difference[b]			Treatment		Linear year × treatment			Quadratic year × treatment			Cubic year × treatment		
	C	L	H	C vs L+H	L vs H	All	C vs L+H	L vs H	All	C vs L+H	L vs H	All	C vs L+H	L vs H
Conifers	a	a	a	0.3521	0.5618	0.3030	0.9773	0.5207	0.5813	0.2452	0.5261	0.3071	0.1050	0.8184
ABIEAMA	a	a	a	0.1596	0.6082	0.9001	0.8781	0.6082	0.7006	0.6455	0.6082	0.9255	0.9090	0.6082
CHAMNOO	a	a	a	0.4275	0.6043	0.4152	0.4076	0.6042	0.2278	0.3404	0.5954	0.7975	0.3867	0.6032
PSEUMEN	a	a	a	0.3526	0.7860	0.2247	0.3103	0.6684	0.1866	0.2322	0.4793	0.2219	0.2733	0.8003
THUJPLI	a	a	a	0.3693	0.6394	0.2847	0.7059	0.6732	0.2289	0.0206	0.0916	0.7863	0.6862	0.2905
TSUGHET	a	a	a	0.3866	0.6051	0.3697	0.3264	0.5930	0.5348	0.4223	0.6485	0.4769	0.4051	0.6178
Deciduous shrubs	a	b	b	0.1304	0.3553	0.1170	0.2336	0.2765	0.0991	0.2423	0.7963	0.4871	0.2213	0.2492
RUBULEU		no data		0.5674	0.6082	0.5990	0.3806	0.6082	0.2431	0.5374	0.6082	0.9289	0.4566	0.6082
VACCALA	a	a	a	0.3510	0.4140	0.2156	0.2768	0.2432	0.9217	0.2171	0.1177	0.5002	0.4427	0.7682
VACCPAR	a	a	a	0.0000	0.0026	0.1301	0.2210	0.4621	0.2327	0.3678	0.5513	0.4644	0.1010	0.1456
All VACCINIUM	a	b	b	0.1193	0.3382	0.1508	0.2213	0.3003	0.3461	0.5296	0.6693	0.7406	0.6922	0.7801
Evergreen shrubs	a	a	a	0.4884	0.3775	0.0205	0.0391	0.0702	0.0995	0.2222	0.1480	0.3619	0.8389	0.8280
GAULSHA	a	a	a	0.5429	0.2617	0.0096	0.0277	0.0168	0.0192	0.0993	0.0273	0.2727	0.9870	0.3471
LINNBOR	a	a	a	0.0231	0.6082	0.7247	0.6724	0.6082	0.1037	0.0849	0.6082	0.8835	0.8580	0.6082
MAHONER	a	a	a	0.6006	0.4823	0.2316	0.3189	0.4136	0.7876	0.3645	0.3362	0.2593	0.4642	0.4371
Forbs	a	a	a	0.3592	0.3236	0.4559	0.6597	0.4599	0.2559	0.7804	0.4432	0.6261	0.4231	0.6752
ACHLTRI	a	a	a	0.1607	0.6082	0.9878	0.9508	0.6082	0.0887	0.2088	0.6082	0.4989	0.2470	0.6082
ANAPMAR		no data		0.8481	0.3577	0.2924	0.5988	0.2914	0.5613	0.9025	0.4360	0.4984	0.9813	0.4084
EIPLANG	a	a	a	0.0780	0.6579	0.1167	0.4548	0.4516	0.1023	0.1956	0.8664	0.3474	0.3472	0.7037
HYPORAD	a	a	a	0.5197	0.8632	0.2700	0.4094	0.9990	0.6748	0.3904	0.5899	0.7040	0.7282	0.7411
MYCEMUR	a	a	a	0.2720	0.9925	0.1701	0.1962	0.3913	0.5325	0.6316	0.7854	0.0845	0.6261	0.3599
RUBUURS	a	a	a	0.3259	0.6082	0.5491	0.5875	0.6082	0.7540	0.5792	0.6082	0.9501	0.9639	0.6082
SENEVUL	a	a	a	0.3526	0.5357	0.4015	0.3875	0.4538	0.0672	0.0565	0.0285	0.4856	0.3919	0.5070
Exposed mineral soil and rock	a	a	a	0.0836	0.0627	0.1081	0.3066	0.1853	0.3028	0.3969	0.9167	0.1062	0.1957	0.0794
Woody debris	a	a	a	0.3631	0.9178	0.0565	0.1854	0.7106	0.1007	0.2265	0.4233	0.8822	0.3262	0.4533

[a] Species are listed by 7-letter code. See Appendix 1 for common names.
[b] Mean difference is the pretreatment comparison of means, with different letters indicating significant differences at $p = 0.10$, and "no data" indicating that the means were all zero. C, L, and H refer to the control (unburned), light burn, and heavy burn treatments, respectively.

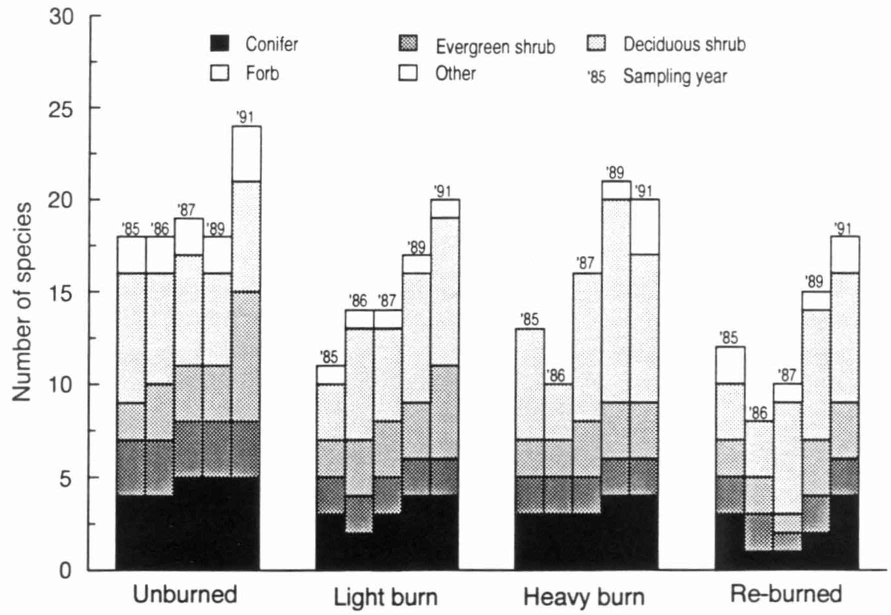

FIGURE 2. A comparison of the total number of species, by species group, for each of the four treatment types during the five sampling periods.

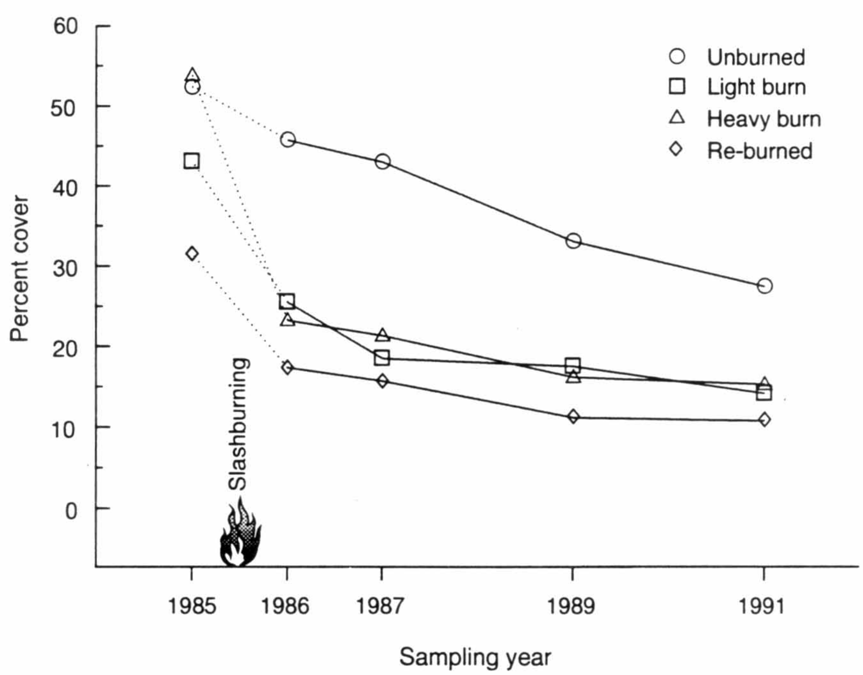

FIGURE 3. Changes in the percent cover of woody debris, by treatment type, for each of the five sampling periods.

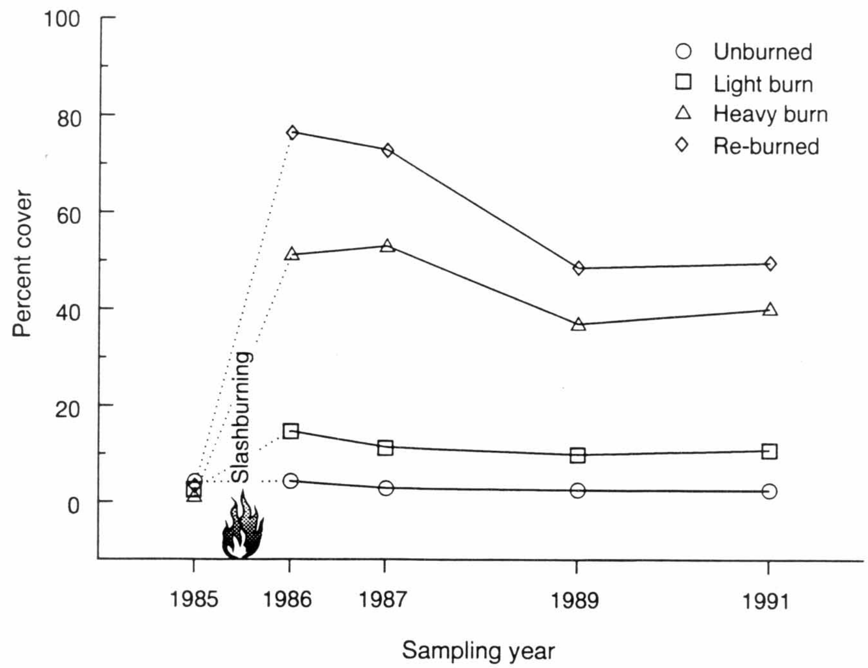

FIGURE 4. Changes in the percentage of exposed mineral soil and rock, by treatment type, for each of the five sampling periods.

3.3 Conifer Foliage

A total of five different conifer species was observed on the study plots during the five sampling periods. In preburn assessments, amabilis fir (*Abies amabilis*) and western hemlock (*Tsuga heterophylla*) were most abundant, although western redcedar (*Thuja plicata*) was also present in all treatment units. Differences in mean percent cover of conifer foliage between treatments were not significant ($\alpha = 0.10$) in preburn comparisons. Burning removed all amabilis fir and western hemlock, while planting added a component of Douglas-fir (*Pseudotsuga menziesii*), western redcedar, and yellow-cedar (*Chamaecyparis nootkatensis*) to all units. By 1991, most of the conifer cover in the burned plots consisted of foliage from the planted species. Western hemlock and amabilis fir were still dominant in the unburned treatment.

All treatment units showed a strong increase in conifer cover, as shown in Figure 5. The smaller response of conifers in the control plots in year six resulted from removal of ingress from one-half of each control plot during the spring of 1991. This alteration was part of the primary burn study and helped to reduce competition with the planted stock. Although not considered statistically significant ($p = 0.1050$), the difference in the cubic trend with time between the control and burned plots is likely a result of partial thinning in the control plots.

The only significant responses in post-burn cover of individual species were differences in the quadratic contrasts of time between the unburned and burned treatments of western redcedar ($p = 0.0206$) and between the light and heavy burns for the same species ($p = 0.0916$). The rate of foliar growth for this species was declining on the unburned plots but still increasing on the burned areas. On the burns, western redcedar growth rates were greatest on the most severe burn treatment. This pattern suggests that competition with other vegetation strongly influences the development of western redcedar on these sites.

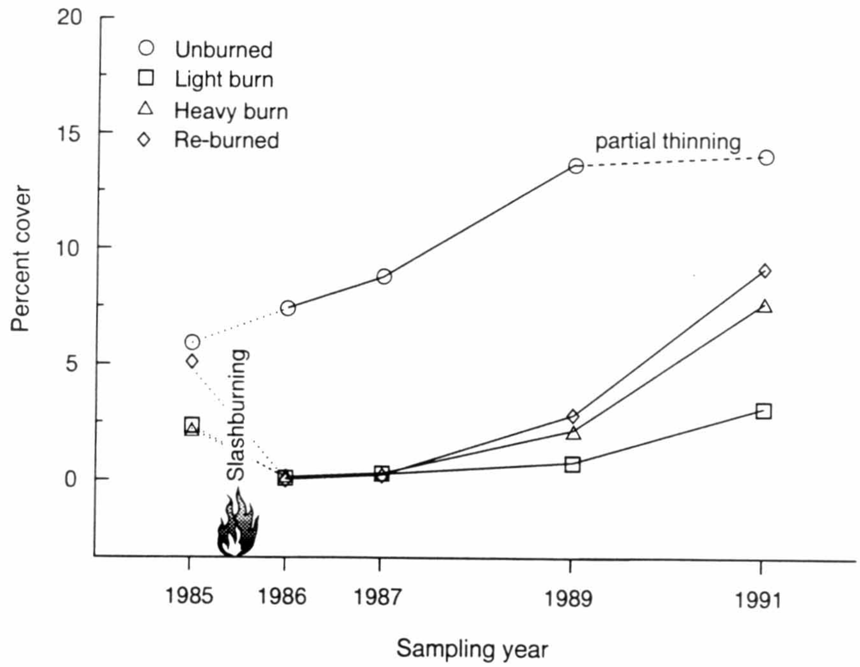

FIGURE 5. Changes in the percent cover of conifer foliage, by treatment type, for each of the five sampling periods.

3.4 Deciduous Shrubs

In pretreatment plots, the deciduous shrub cover was provided by two huckleberry species: *Vaccinium parvifolium* and *V. alaskaense*. The abundance of these species differed between the control plots and those slated for burning ($\alpha = 0.10$). While burning removed most of the huckleberry cover, it created an environment suitable for the establishment of other deciduous shrubs. Seven additional deciduous shrubs were recorded on the plots in the 6 years following treatment, although most of these occurred infrequently (Appendix 1). Of the new deciduous shrubs recorded, only black raspberry (*Rubus leucodermis*) was observed on at least 5% of the subplots within a treatment unit in any single sampling period. It also provided most of the shrub response on the re-burn plots.

There was a significant quadratic trend with time for deciduous shrub cover (Table 2). Individually, none of the species displayed a similar response. Following slashburning, deciduous shrubs on the light burn recovered more rapidly than those on the heavier burn (Figure 6). Red huckleberry, the most abundant deciduous shrub, showed highly significant post-treatment differences between the control and the two burns and also between the two intensities of burn. Since these differences are between average post-treatment cover values, they are not surprising or of appreciable interest.

Huckleberry stem survival and recovery from burning were strongly linked to burn intensity (Figure 7a). *Vaccinium* stem density and average basal diameter both doubled from 1985 to 1991 in the control plots. For the light burn areas, density was one-half of the preburn value 1 year after treatment. Basal diameter was also lower then, suggesting that there was some re-sprouting. Stem density returned to preburn levels in subsequent sampling years. In contrast, all stems in the heavy burn plots were killed by the treatment, and measurable stems were not noted again until 6 years after burning. On the re-burn plots, huckleberry stems were also removed by burning. Six years later, there were still no stems present in any of the samples.

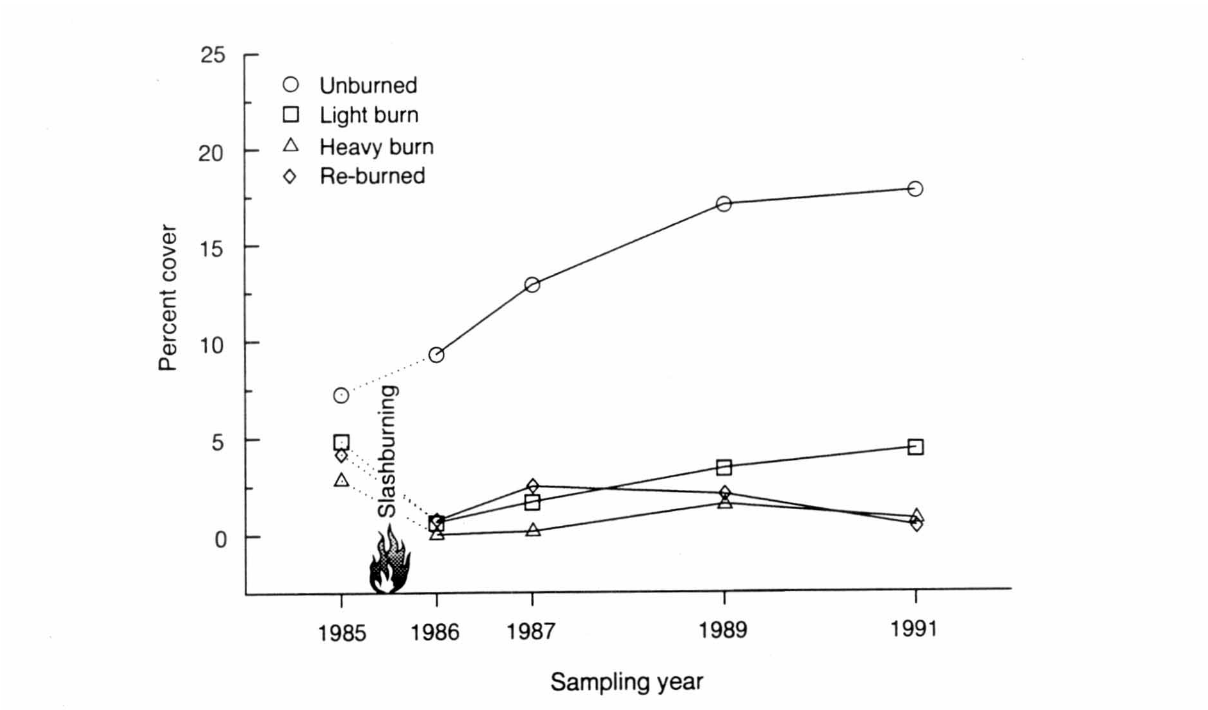

FIGURE 6. Changes in the percent cover of deciduous shrubs, by treatment type, for each of the five sampling periods.

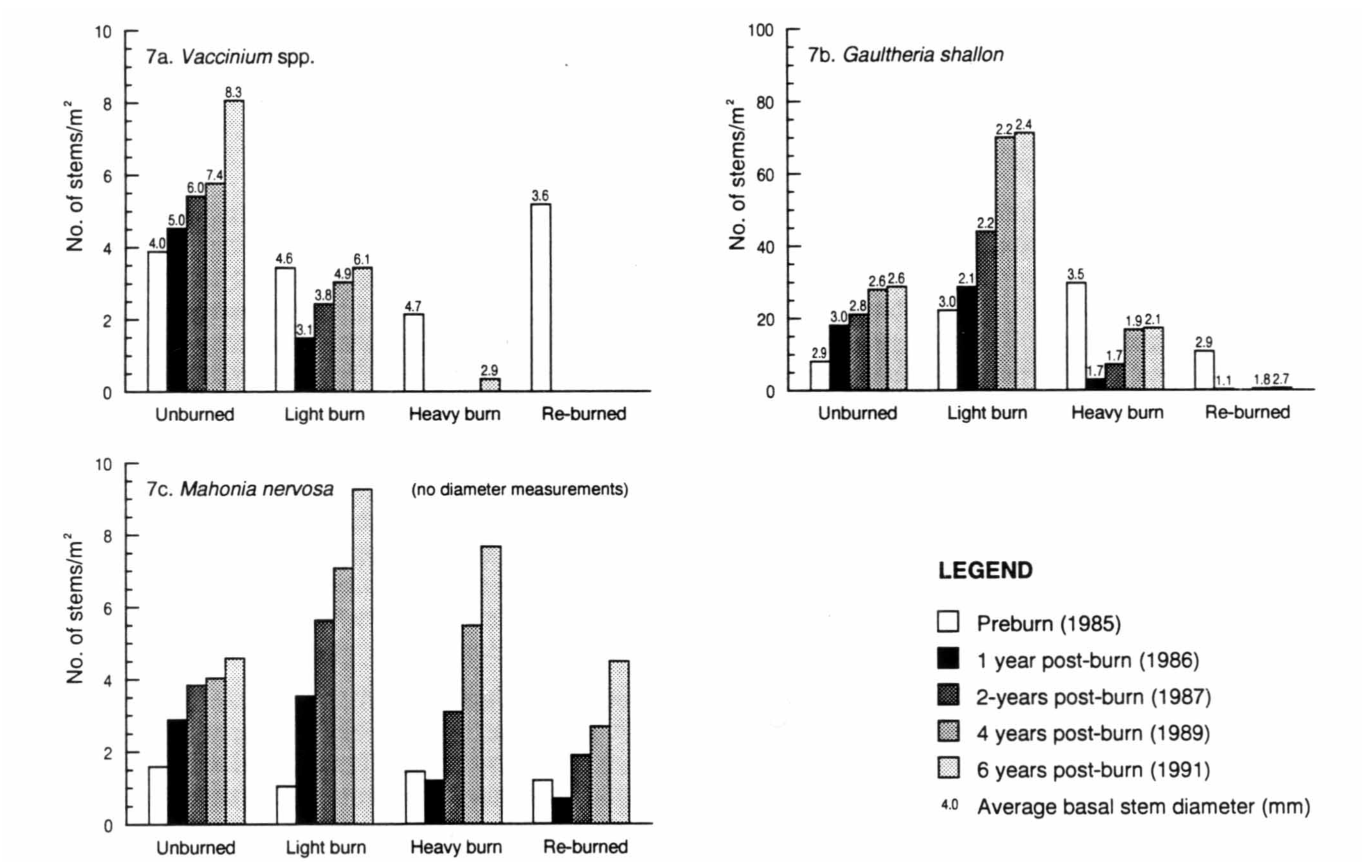

FIGURE 7. A comparison of stem densities of three shrubs, by treatment type, for each of the five sampling periods.

3.5 Evergreen Shrubs

Only three evergreen shrubs were recorded during the five sampling periods: salal (*Gaultheria shallon*), twinflower (*Linnaea borealis*), and dull Oregon-grape. Combined preburn cover means for these species were not significantly different between treatments; however, repeated measures analysis of post-burn cover data showed significant linear and quadratic trends with time (Table 2). The strong increasing linear trend in evergreen shrub cover on the burn treatment units is apparent in Figure 8. On the control plots, evergreen shrub cover had declined by the 6th year of sampling, yielding the significant quadratic result. This is mainly because of a decline in the observed cover of twinflower.

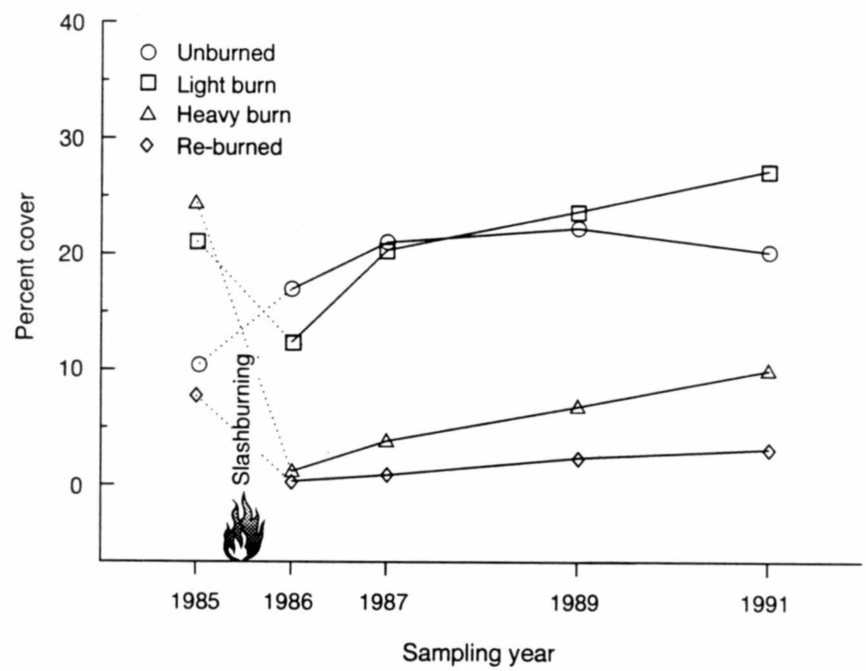

FIGURE 8. Changes in the percent cover of evergreen shrubs, by treatment type, for each of the five sampling periods.

Salal contributed most to the combined cover total of evergreen shrubs before burning, and demonstrated the same significant contrasts. Salal cover increased linearly following burning. The unburned plots showed less change over the same period. No decrease in stem density was apparent on the light burn treatment units 1 year after burning, although a reduction was evident on the heavily burned and re-burned plots (Figure 7b). Basal diameter information was consistent with expectations concerning sprouting and subsequent plant growth — that is, most post-burn plants represented newly sprouted individuals, therefore average stem diameter was lower immediately after burning. Basal diameters increased in subsequent years as the plants developed. On the unburned plots, mean basal stem diameter was lower in 6th-year observations than it was initially, probably because the increase in new sprouts lowered the average.

Twinflower was only observed on the control plots. Although its occurrence increased, its percent cover values were substantially lower in the 6-year post-burn observations. This reduction in twinflower cover caused a decline in the total cover of evergreen shrubs, and accounts for significant differences in results of repeated measures analysis of the species (Table 2).

Dull Oregon-grape showed increases in percent cover on all treatment units after slashburning. Repeated measures analysis showed no significant treatment-by-time differences because the rate of increase was similar for all treatments. Burning stimulated sprouting of dull Oregon-grape, and more rapid increases in stem density on burned plots were evident (Figure 7c). Stem densities for salal were apparently lower only on the heavy burn and re-burn treatment units a year after treatment.

3.6 Ferns

Ferns were uncommon on all blocks within this study. Only three species were recorded and none of these averaged more than 1% cover or was found on more than 5% of the samples (Appendix 2). Of the three ferns, sword fern (*Polystichum munitum*) was most abundant, followed by deer fern (*Blechnum spicant*) and licorice fern (*Polypodium glycyrrhiza*). Repeated measures analysis was not conducted on the ferns because of the limited amount of data. The scarcity of ferns is not surprising on fire-sensitive sites such as those sampled in this study because many ferns prefer richer or moister growing sites.

3.7 Forbs

Eighteen forb species were recorded at the study sites during the five sampling periods, although the most observed in a single year was 11. Eight forbs were tallied only once. Five of these were recorded during pretreatment sampling. Fireweed was the only species common to all treatments and years. However, during the 6-year post-treatment sampling, five forbs were represented in all treatments.

Collectively the forbs showed no significant treatment or treatment-by-year response (Table 2). Each treatment followed a similar pattern of development during post-burn sampling. In the 1st year after burning, all treatment units showed substantial increases in forb cover compared to preburn values (Figure 9). Most cover values continued to increase during the following year. The only anomalous trend was a marked decline in forbs in the re-burn treatment area 2 years after burning. The occurrence of forbs on re-burn plots increased over the previous year although cover values did not. All treatment units showed a decline in cover values between the 1989 and 1991 sampling dates. Displacement of the initial invader species with slower-growing perennials may explain this.

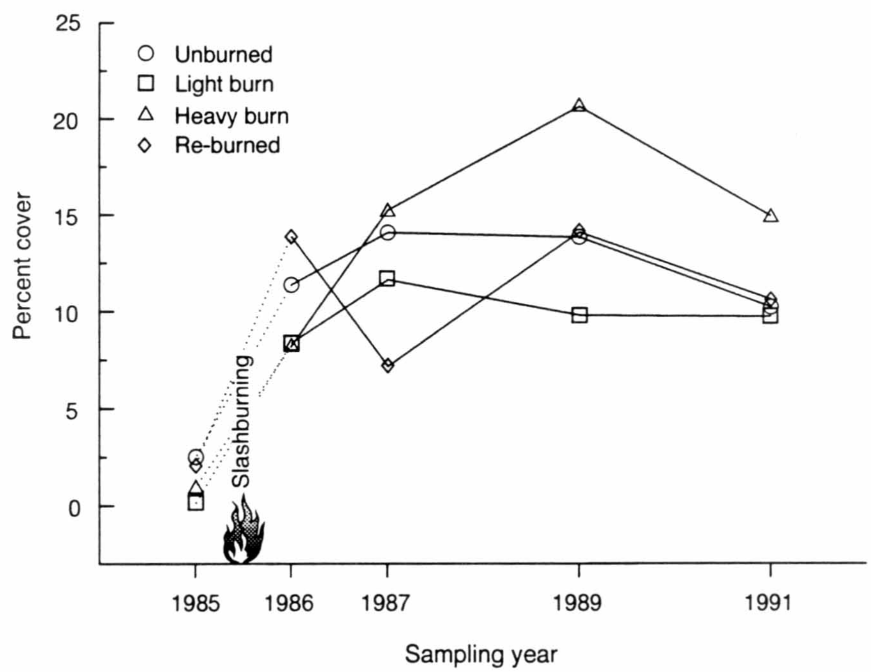

FIGURE 9. Changes in percent cover of forbs, by treatment type, for each of the five sampling periods.

Several species yielded response patterns of interest, particularly with respect to their frequency of occurrence (Figure 10). These included pearly everlasting (*Anaphalis margaritacea*), fireweed, hairy cat's-ear (*Hypochaeris radicata*), wall-lettuce (*Mycelis muralis*), and common groundsel (*Senecio vulgaris*).

Pearly everlasting was not recorded during preburn sampling. In the 6 years following treatment, it had invaded all treatments areas. Frequency data show that establishment of pearly everlasting was best on the heavy burn and re-burn treatment units (Figure 10a). Exposed mineral soil is apparently an optimal substrate. Percent ground cover was positively correlated with frequency; cover values were quite low for all treatment areas, however, and no significant trends were observed (Table 2).

Fireweed was the most common forb. Cover values peaked 2 years after treatment, except on the re-burn unit, where values peaked at 1 year. Percent cover declined after that. Repeated measures analysis showed no treatment-by-year interaction, but did show significant ($\alpha = 0.10$) differences between cover on the unburned and burned treatment units, and between the light and heavy burns. For the three original treatments, fireweed frequency increased immediately after treatment, then stabilized during subsequent sampling periods. The occurrence of fireweed on the re-burn treatment unit remained relatively stable during all sampling years. Overall occurrence of fireweed was higher on the burned plots than on the control (Figure 10b). This result is predictable because fireweed grows better on disturbed sites. The changes in fireweed cover were not apparent in the frequency data, which suggests a change in plant density or size.

Although cover values for hairy cat's-ear were appreciably higher on the burned plots, repeated measures analysis showed no significant trends (Table 2). Cat's-ear was observed more frequently on the burned treatment areas (Figure 10c). Occurrence increased substantially during the last two sampling periods.

Wall-lettuce re-establishment on burned plots also resulted in greater cover and frequency of occurrence than on the unburned control plots 4 years after burning. Wall-lettuce showed significant linear and cubic treatment-by-year interactions in repeated measures analysis ($p = 0.0850$ and 0.0238, respectively) (see Table 2). Declines in cover values on the unburned and heavy burn treatment units were not reflected in occurrence values (Figure 10d), which suggests an adequate seed source but declining plant survival.

Common groundsel occurrence peaked in the four treatment areas at different times. In the control, it was only observed in 1985 and 1986. The light burn treatment areas showed a peak in occurrence 2 years after burning, while the heavy burn and re-burn plots had peaks 4 years after treatment. In each case, however, common groundsel presence appears short-lived (Figure 10e). A comparable result was described by West and Chilcote (1968). They found that a similar species, *Senecio sylvaticus*, flourished for only 2 years after invading a newly burned site.

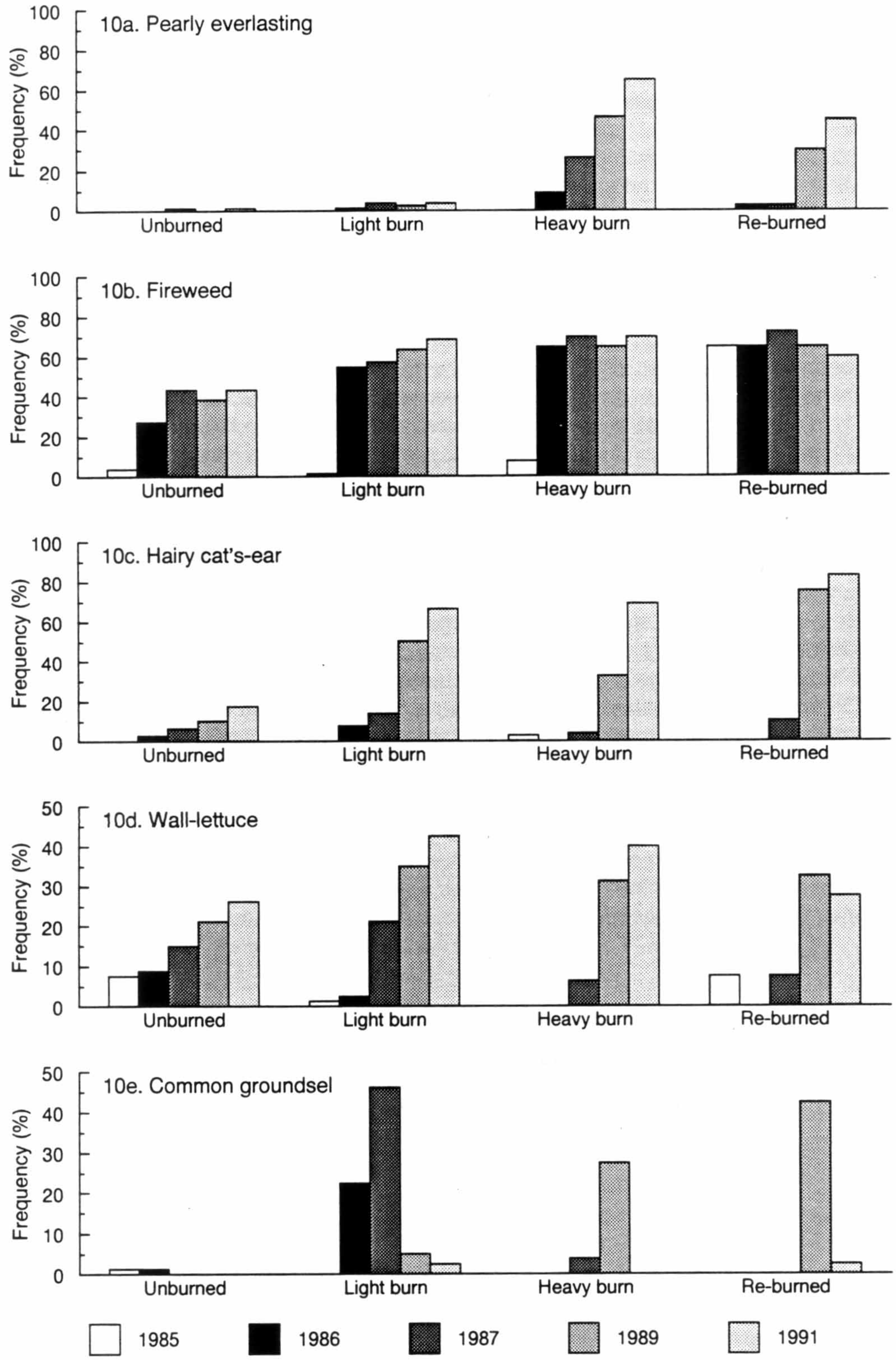

FIGURE 10. A comparison of the occurrence of five forb species, by treatment type, for each of the five sampling periods.

4 DISCUSSION

Vegetation abundance on spring (light intensity) and fall (high intensity) burn areas was compared with unburned clearcutting before, and 1, 2, 4, and 6 years after treatment. From post-burn observations, certain growth and development trends are becoming apparent. However, significant differences in trends are absent for most of the species groups and common species examined. The differences, or a lack of them, may be a function of the limited number of years of data collection. The evidence does support the idea that the magnitude of response depends on the intensity of slashburning. Burn severity also influences the speed with which established species recover from the treatment.

In the 6 years following treatment, the burned plots showed a greater recruitment of new species than did the unburned control plots, even though the latter maintained a greater species total. Over the same period, estimated cover by woody debris dropped and the proportion of exposed mineral soil showed a gradual decline. Increasing amounts of ground vegetation and associated litter are considered likely causes of this change in substrate cover. After 6 years, total vegetation cover was inversely related to burn intensity. Relative importance of the different species groups varied for each treatment.

Cover of conifer foliage increased more rapidly each year. The higher levels of conifer cover on the unburned plots resulted from growth of advanced regeneration, whereas post-treatment cover on the burn treatment units originated from planted stock only. Lower cover levels on the light burn areas, compared to the high burn intensity and re-burned treatments, could indicate that competition with established ground vegetation (especially shrubs) is limiting conifer development there. On the fire-sensitive sites studied, competition for water and nutrients is expected to be much greater than competition for light.

After 6 years, deciduous shrubs showed an increase in percent cover, density, and stem diameter on the unburned plots. Over the same period, burn treatment units had not regained preburn cover values, and only the light burn areas had a stem density similar to their preburn level. In contrast, evergreen shrub cover had stabilized on unburned plots, but continued to increase on burned plots. Stem density is stabilizing on the control, light, and heavy burn plots, although at different values for each treatment.

Estimates of forb abundance were influenced by the state of plant development (as affected by sampling date). Frequency was not affected in the same way, but was insensitive to changes in forb density. Together, they show that different rates of colonization and population change have given the forb category a gradual rate of cover increase, despite the rapid growth of many individual forb species.

APPENDIX 1. Species found on the study plots from 1985 to 1991

Scientific name	Common name	Species code	Group code[a]
Abies amabilis	amabilis fir	ABIEAMA	CNTR
Achlys triphylla	vanilla-leaf	ACHLTRI	FORB
Alnus rubra	red alder	ALNURUB	BRTR
Anaphalis margaritacea	pearly everlasting	ANAPMAR	FORB
Blechnum spicant	deer fern	BLECSPI	FERN
Chamaecyparis nootkatensis	yellow-cedar	CHAMNOO	CNTR
Cirsium vulgare	bull thistle	CIRSVUL	FORB
Cornus canadensis	bunchberry	CORNCAN	FORB
Epilobium angustifolium	fireweed	EPILANG	FORB
Epilobium spp.	willowherb	EPILOBI	FORB
Galium spp.	bedstraw	GALIUM	FORB
Gaultheria shallon	salal	GAULSHA	EVSH
Goodyera oblongifolia	rattlesnake-plantain	GOODOBL	FORB
	assorted grasses	GRASS	GRAM
Hieracium albiflorum	white-flowered hawkweed	HIERALI	FORB
Hypochaeris radicata	hairy cat's-ear	HYPORAD	FORB
Linnaea borealis	twinflower	LINNBOR	EVSH
Listera cordata	heart-leaved twayblade	LISTCOR	FORB
Mahonia nervosa	dull Oregon-grape	MAHONER	EVSH
Mycelis muralis	wall-lettuce	MYCEMUR	FORB
Polypodium glycyrrhiza	licorice fern	POLYGLY	FERN
Polystichum munitum	sword fern	POLYMUN	FERN
Pseudotsuga menziesii	Douglas-fir	PSEUMEN	CNTR
Rosa gymnocarpa	baldhip rose	ROSAGYM	DCSH
Rubus leucodermis	black raspberry	RUBULEU	DCSH
Rubus parviflorus	thimbleberry	RUBUPAR	DCSH
Rubus spectabilis	salmonberry	RUBUSPE	DCSH
Rubus ursinus	trailing blackberry	RUBUURS	FORB
Sambucus racemosa	red elderberry	SAMBRAC	DCSH
Senecio vulgaris	common groundsel	SENEVUL	FORB
Taraxacum officinale	common dandelion	TARAOFF	FORB
Thuja plicata	western redcedar	THUJPLI	CNTR
Tiarella laciniata	cut-leaved foamflower	TIARLAC	FORB
Tiarella trifoliata	three-leaved foamflower	TIARTRI	FORB
Trientalis latifolia	broad-leaved starflower	TRIELAT	FORB
Tsuga heterophylla	western hemlock	TSUGHET	CNTR
Vaccinium alaskaense	Alaskan blueberry	VACCALA	DCSH
Vaccinium membranaceum	black huckleberry	VACCMEM	DCSH
Vaccinium ovalifolium	oval-leaved blueberry	VACCOVA	DCSH
Vaccinium parvifolium	red huckleberry	VACCPAR	DCSH
	woody material	WOOD	SUBS
	mineral soil and rock	MINSOIL	SUBS

[a] BRTR = hardwood
FERN = fern
CNTR = conifer
FORB = forb
DCSH = deciduous shrub
GRAM = graminoid
EVSH = evergreen shrub
SUBS = surface substrate

APPENDIX 2a. Descriptive statistics[a] for percent cover values on the unburned treatment at the Cous site

Group/species[b]	Pretreatment (1985)				1 Year post-treatment (1986)				2 Years post-treatment (1987)				4 Years post-treatment (1989)				6 Years post-treatment (1991)			
	Mean	S.E.	Range	#Obs>0	Mean	S.E.	Range	#Obs>0	Mean	S.E.	Range	#Obs>0	Mean	S.E.	Range	#Obs>0	Mean	S.E.	Range	#Obs>0
Conifers	8.3575	3.5272	0–105	14/40	10.7300	3.4438	0–100	16/40	12.5775	3.8870	0–90	16/40	19.6775	4.9740	0–105	21/40	24.0025	5.5908	0–130	24/40
ABIEAMA	3.3275	1.8286	0–45	5/40	3.6275	1.8860	0–55	7/40	4.6250	2.2673	0–65	5/40	4.7250	2.4664	0–85	7/40	7.5500	3.0774	0–90	8/40
CHAMNOO	0			0/40	0.0750	0.0750	0–3	1/40	0.0750	0.0750	0–3	1/40	0.1750	0.1750	0–7	1/40	0.5250	0.5000	0–20	2/40
PSEUMEN	0.0025	0.0025	0–0.1	1/40	0			0/40	0.0025	0.0025	0–0.1	1/40	0.0025	0.0025	0–0.1	1/40	0.1525	0.0843	0–2	4/40
THUJPLI	0.0025	0.0025	0–0.1	1/40	0.6500	0.4245	0–15	3/40	0.8000	0.5538	0–20	3/40	1.6500	0.7455	0–20	6/40	2.0000	1.1255	0–40	7/40
TSUGHET	5.0250	2.1524	0–60	11/40	6.3775	2.8810	0–100	9/40	7.0750	2.6798	0–90	12/40	13.1250	4.1513	0–100	12/40	13.7750	4.1146	0–100	12/40
Deciduous shrubs	7.1250	2.3089	0–80	17/40	7.4000	2.1873	0–50	17/40	9.0250	2.4973	0–55	17/40	12.6079	3.7351	0–95	24/38	12.3825	3.7016	0–90	28/40
ROSAGYM	0			0/40	0			0/40	0			0/40	0			0/40	0			0/40
RUBULEU	0			0/40	0			0/40	0			0/40	0			0/40	0			0/40
RUBUPAR	0			0/40	0			0/40	0			0/40	0			0/40	0			0/40
RUBUSPE	0			0/40	0			0/40	0			0/40	0			0/40	0			0/40
SAMBRAC	0			0/40	0			0/40	0			0/40	0			0/40	0			0/40
VACCALA	0			0/40	0.1250	0.1250	0–5	1/40	0.1500	0.1268	0–5	2/40	0.6500	0.4028	0–15	4/40	0.2775	0.1753	0–5	4/40
VACCMEM	0			0/40	0			0/40	0			0/40	0			0/40	0.3750	0.3750	0–15	1/40
VACCOVA	0			0/40	0			0/40	0			0/40	0			0/40	0.3750	0.3750	0–15	1/40
VACCPAR	7.1250	2.3089	0–80	17/40	7.2750	2.1871	0–50	17/40	8.8750	2.4885	0–55	16/40	11.9237	3.7400	0–95	22/38	11.3550	3.5417	0–90	25/40
All VACCINIUM	7.1250	2.3089	0–80	17/40	7.4000	2.1873	0–50	17/40	9.0250	2.4973	0–55	17/40	11.9775	3.5731	0–95	24/40	12.3825	3.7016	0–90	28/40
Evergreen shrubs	13.5525	2.8465	0–75	27/40	21.7750	3.7125	0–90	31/40	26.4750	3.9474	0–81	32/40	23.4300	3.1760	0–70	35/40	24.5350	3.1651	0–62	34/40
GAULSHA	7.0000	2.1888	0–55	15/40	10.3250	2.8400	0–80	19/40	11.4000	2.6708	0–60	20/40	11.8275	2.4300	0–50	23/40	12.6750	2.3059	0–50	25/40
LINNBOR	2.9025	1.1258	0–35	12/40	4.3750	1.4455	0–45	13/40	7.3750	1.9692	0–50	14/40	4.6525	1.5554	0–50	15/40	2.3800	1.0956	0–40	14/40
MAHONER	3.6500	1.1715	0–35	16/40	7.0750	2.0052	0–45	17/40	7.7000	2.2090	0–70	17/40	6.9500	2.0248	0–60	19/40	9.4800	2.3266	0–55	21/40
Ferns	0.0525	0.0500	0–2	2/40	0.3250	0.2592	0–10	2/40	0.0500	0.0500	0–2	1/40	0.0025	0.0025	0–0.1	1/40	0.0500	0.0500	0–2	1/40
BLECSPI	0.0025	0.0025	0–0.1	1/40	0			0/40	0.0500	0.0500	0–2	1/40	0.0025	0.0025	0–0.1	1/40	0.0500	0.0500	0–2	1/40
POLYGLY	0			0/40	0			0/40	0			0/40	0			0/40	0			0/40
POLYMUN	0.0500	0.0500	0–2	1/40	0.3250	0.2592	0–10	2/40	0			0/40	0			0/40	0			0/40
Forbs	4.1800	1.5043	0–40	19/40	12.7250	2.9393	0–80	24/40	14.4500	2.6513	0–70	28/40	10.8075	2.1087	0–51	29/40	9.1900	1.9221	0–61	32/40
ACHLTRI	1.5500	1.0615	0–35	3/40	0.2000	0.1569	0–6	2/40	0.5500	0.3938	0–15	3/40	0.0025	0.0025	0–0.1	1/40	0.0025	0.0025	0–0.1	1/40
ANAPMAR	0			0/40	0			0/40	0			0/40	0			0/40	0			0/40
CIRSVUL	0			0/40	0			0/40	0			0/40	0			0/40	0			0/40
CORNCAN	0			0/40	0			0/40	0			0/40	0			0/40	0			0/40
EPILANG	0.1750	0.1334	0–5	2/40	5.9500	2.6691	0–80	9/40	5.4250	1.6889	0–55	16/40	3.5775	1.0625	0–25	14/40	2.6000	0.7973	0–20	16/40
EPILOBI	0			0/40	0			0/40	0			0/40	0			0/40	0			0/40
GALIUM	0			0/40	0			0/40	0			0/40	0			0/40	0			0/40
GOODOBL	0.0025	0.0025	0–0.1	1/40	0			0/40	0			0/40	0			0/40	0			0/40
HIERALI	0			0/40	0			0/40	0			0/40	0			0/40	0			0/40
HYPORAD	0			0/40	0.1000	0.0784	0–3	2/40	0.2250	0.1409	0–5	3/40	0.2500	0.1174	0–3	5/40	0.5025	0.2726	0–10	7/40
LISTCOR	0			0/40	0			0/40	0			0/40	0			0/40	0			0/40
MYCEMUR	0.2525	0.1117	0–3	6/40	0.8250	0.3684	0–10	5/40	1.9250	0.7011	0–20	10/40	0.8275	0.2838	0–8	13/40	0.5325	0.1889	0–7	16/40
RUBUURS	2.2000	0.8096	0–20	12/40	5.6500	1.6011	0–35	13/40	6.3250	1.8185	0–50	13/40	6.1500	1.7794	0–45	17/40	5.5525	1.4212	0–40	18/40
SENEVUL	0			0/40	0			0/40	0			0/40	0			0/40	0			0/40
TARAOFF	0			0/40	0			0/40	0			0/40	0			0/40	0			0/40
TIARLAC	0			0/40	0			0/40	0			0/40	0			0/40	0			0/40
TIARTRI	0			0/40	0			0/40	0			0/40	0			0/40	0			0/40
TRIELAT	0			0/40	0			0/40	0			0/40	0			0/40	0			0/40
Graminoids	0			0/40	0			0/40	0			0/40	0			0/40	0.0025	0.0025	0–0.1	1/40
GRASS	0			0/40	0			0/40	0			0/40	0			0/40	0.0025	0.0025	0–0.1	1/40
Hardwoods	0			0/40	0			0/40	0			0/40	0			0/40	0			0/40
ALNURUB	0			0/40	0			0/40	0			0/40	0			0/40	0			0/40
Exposed mineral soil and rock	4.2500	2.0689	0–55	5/40	4.1250	1.8160	0–50	6/40	3.7500	1.8059	0–50	5/40	4.5000	1.7705	0–45	7/40	4.3750	1.8535	0–50	7/40
Woody debris	46.3750	4.6719	5–100	40/40	43.1250	4.8161	0–105	37/40	39.7500	5.1077	0–100	36/40	29.3750	4.5085	0–100	34/40	26.3750	3.1265	0–85	34/40

[a] Mean, standard error, range and frequency of occurrence are based on subplot observations.
[b] Species are listed by 7-letter code. See Appendix 1 for common names.

APPENDIX 2b. Descriptive statistics[a] for percent cover values on the unburned treatment at the Kanyon site

Group/species[b]	Pretreatment (1985)				1 Year post-treatment (1986)				2 Years post-treatment (1987)				4 Years post-treatment (1989)				6 Years post-treatment (1991)			
	Mean	S.E.	Range	#Obs>0	Mean	S.E.	Range	#Obs>0	Mean	S.E.	Range	#Obs>0	Mean	S.E.	Range	#Obs>0	Mean	S.E.	Range	#Obs>0
Conifers	3.5000	2.1856	0–65	5/40	4.1250	2.2000	0–70	6/40	5.0000	2.4308	0–70	6/40	7.7500	3.4908	0–95	11/40	4.3025	2.4757	0–70	7/40
ABIEAMA	3.2250	2.1817	0–65	3/40	3.0250	2.0561	0–70	3/40	3.2500	2.1300	0–70	3/40	4.4500	2.9874	0–95	3/40	0			0/40
CHAMNOO	0			0/40	0.9500	0.8763	0–35	2/40	0.0750	0.0750	0–3	1/40	0.6250	0.6250	0–25	1/40	0.7500	0.7500	0–30	1/40
PSEUMEN	0			0/40	0			0/40	0			0/40	0			0/40	0.0025	0.0025	0–0.1	1/40
THUJPLI	0.2500	0.2500	0–10	1/40	0			0/40	1.3000	1.2497	0–50	2/40	1.5500	1.4996	0–60	2/40	1.8750	1.7513	0–70	2/40
TSUGHET	0.0250	0.0250	0–1	1/40	0.1500	0.1047	0–3	2/40	0.3750	0.2766	0–10	2/40	1.1250	0.7589	0–30	7/40	1.6750	1.1079	0–40	5/40
Deciduous shrubs	7.3750	2.4136	0–80	24/40	11.2525	2.9632	0–95	32/40	16.8025	3.0888	0–75	34/40	21.5000	3.7331	0–80	33/40	23.1750	3.3695	0–77	33/40
ROSAGYM	0			0/40	0			0/40	0			0/40	0			0/40	0			0/40
RUBULEU	0			0/40	0.9500	0.7570	0–30	4/40	2.3750	1.5084	0–55	4/40	1.5000	1.1569	0–45	3/40	0.9750	0.6430	0–25	5/40
RUBUPAR	0			0/40	0			0/40	0			0/40	0			0/40	0.4750	0.3856	0–15	2/40
RUBUSPE	0			0/40	0			0/40	0			0/40	0			0/40	0.1250	0.1250	0–5	1/40
SAMBRAC	0			0/40	0			0/40	0			0/40	0			0/40	0			0/40
VACCALA	3.8500	1.4307	0–50	15/40	5.2525	1.8784	0–50	15/40	4.9500	1.5912	0–40	12/40	9.0000	2.8070	0–75	20/40	10.5000	2.7335	0–75	20/40
VACCMEM	0			0/40	0			0/40	0			0/40	0			0/40	0			0/40
VACCOVA	0			0/40	0			0/40	0			0/40	0			0/40	0.1250	0.1250	0–5	1/40
VACCPAR	3.5250	1.8605	0–70	12/40	5.0500	1.7025	0–55	21/40	9.4775	2.8788	0–75	22/40	11.0000	2.7325	0–65	23/40	10.9750	2.7667	0–60	24/40
All VACCINIUM	7.3750	2.4136	0–80	24/40	10.3025	2.9512	0–95	28/40	14.4275	2.9226	0–75	32/40	20.0000	3.7434	0–80	31/40	21.6000	3.3909	0–77	31/40
Evergreen shrubs	7.0750	1.9610	0–50	18/40	12.1750	3.0791	0–90	22/40	15.5250	3.4803	0–95	25/40	21.0250	3.9682	0–90	27/40	15.8275	2.4676	0–50	29/40
GAULSHA	5.4500	1.6188	0–45	16/40	8.4000	1.9929	0–45	19/40	10.8500	2.3068	0–50	20/40	13.2250	2.9088	0–70	20/40	11.4000	2.3672	0–45	19/40
LINNBOR	1.6250	1.2958	0–50	2/40	3.7750	2.6712	0–90	3/40	4.6750	3.0648	0–95	5/40	7.7750	3.5476	0–90	6/40	4.3025	1.7566	0–50	9/40
MAHONER	0			0/40	0			0/40	0			0/40	0.0250	0.0250	0–1	1/40	0.1250	0.1250	0–5	1/40
Ferns	0.3500	0.2596	0–10	3/40	0.4500	0.2908	0–10	3/40	1.1250	0.7046	0–25	3/40	1.0500	0.8807	0–35	3/40	1.0275	0.7200	0–25	4/40
BLECSPI	0.0250	0.0250	0–1	1/40	0.0500	0.0500	0–2	1/40	0.2500	0.2500	0–10	1/40	0.1250	0.1250	0–5	1/40	0.3750	0.3750	0–15	1/40
POLYGLY	0			0/40	0			0/40	0			0/40	0			0/40	0			0/40
POLYMUN	0.3250	0.2592	0–10	2/40	0.4000	0.2882	0–10	2/40	0.8750	0.6672	0–25	2/40	0.9250	0.8751	0–35	2/40	0.6525	0.6248	0–25	3/40
Forbs	0.7800	0.5254	0–20.1	5/40	9.9550	2.9856	0–70	14/40	13.6250	3.2991	0–75	19/40	16.8050	4.5234	0–108	18/40	11.1925	2.7036	0–70	20/40
ACHLTRI	0.6500	0.5121	0–20	3/40	0.1250	0.1250	0–5	1/40	0.4500	0.2841	0–10	3/40	0.7250	0.3755	0–10	5/40	0.5025	0.3822	0–15	4/40
ANAPMAR	0			0/40	0			0/40	0.0500	0.0500	0–2	1/40	0			0/40	0.2500	0.2500	0–10	1/40
CIRSVUL	0			0/40	0			0/40	0			0/40	0			0/40	0			0/40
CORNCAN	0			0/40	0			0/40	0			0/40	0			0/40	0			0/40
EPILANG	0.1250	0.1250	0–5	1/40	9.4525	2.8189	0–65	13/40	12.8750	3.1566	0–75	19/40	11.7500	3.2549	0–90	17/40	5.8750	1.5247	0–45	19/40
EPILOBI	0			0/40	0			0/40	0			0/40	0			0/40	0			0/40
GALIUM	0			0/40	0			0/40	0			0/40	0			0/40	0			0/40
GOODOBL	0			0/40	0			0/40	0			0/40	0			0/40	0			0/40
HIERALI	0			0/40	0			0/40	0			0/40	0			0/40	0			0/40
HYPORAD	0			0/40	0			0/40	0.0750	0.0553	0–2	2/40	2.5750	1.8473	0–70	3/40	1.6800	1.2680	0–50	7/40
LISTCOR	0			0/40	0			0/40	0			0/40	0			0/40	0			0/40
MYCEMUR	0			0/40	0.2525	0.2499	0–10	2/40	0.0500	0.0349	0–1	2/40	0.2300	0.2008	0–8	4/40	0.2550	0.1590	0–5	5/40
RUBUURS	0			0/40	0			0/40	0.1250	0.1250	0–5	1/40	1.5250	1.2532	0–50	4/40	2.6300	1.3631	0–50	9/40
SENEVUL	0.0025	0.0025	0–0.1	1/40	0.1250	0.1250	0–5	1/40	0			0/40	0			0/40	0			0/40
TARAOFF	0			0/40	0			0/40	0			0/40	0			0/40	0			0/40
TIARLAC	0			0/40	0			0/40	0			0/40	0			0/40	0			0/40
TIARTRI	0.0025	0.0025	0–0.1	1/40	0			0/40	0			0/40	0			0/40	0			0/40
TRIELAT	0			0/40	0			0/40	0			0/40	0			0/40	0			0/40
Graminoids	0			0/40	0			0/40	0			0/40	0			0/40	0			0/40
GRASS	0			0/40	0			0/40	0			0/40	0			0/40	0			0/40
Hardwoods	0			0/40	0			0/40	0			0/40	0			0/40	0			0/40
ALNURUB	0			0/40	0			0/40	0			0/40	0			0/40	0			0/40
Exposed mineral soil and rock	4.0000	2.7977	0–85	2/40	4.3750	2.7861	0–95	4/40	1.8750	1.5368	0–60	2/40	0.5000	0.5000	0–20	1/40	0.6250	0.6250	0–25	1/40
Woody debris	58.1500	5.1309	1–105	40/40	48.1250	5.3997	0–115	39/40	46.0000	5.2690	0–100	38/40	36.6250	4.4049	0–100	36/40	28.3750	4.4807	0–95	28/40

[a] Mean, standard error, range and frequency of occurrence are based on subplot observations.
[b] Species are listed by 7-letter code. See Appendix 1 for common names.

APPENDIX 2c. Descriptive statistics[a] for percent cover values on the light burn treatment at the Cous site

Group/species[b]	Pretreatment (1985)				1 Year post-treatment (1986)				2 Years post-treatment (1987)				4 Years post-treatment (1989)				6 Years post-treatment (1991)			
	Mean	S.E.	Range	#Obs>0	Mean	S.E.	Range	#Obs>0	Mean	S.E.	Range	#Obs>0	Mean	S.E.	Range	#Obs>0	Mean	S.E.	Range	#Obs>0
	2.5333	0.9680	0–40	10/60	0.2000	0.1207	0–5	3/60	0.2833	0.1873	0–10	3/60	0.7517	0.4202	0–20	7/60	3.8050	1.3230	0–50	16/60
	2.1833	0.9229	0–40	8/60	0			0/60	0			0/60	0			0/60	0			0/60
	0			0/60	0.0333	0.0333	0–2	1/60	0.0333	0.0333	0–2	1/60	0.1000	0.0847	0–5	2/60	0.7500	0.5292	0–25	2/60
	0			0/60	0			0/60	0			0/60	0.0667	0.0467	0–2	2/60	1.3517	0.7756	0–40	7/60
	0			0/60	0.1667	0.1168	0–5	2/60	0.2500	0.1851	0–10	2/60	0.5833	0.4133	0–20	2/60	1.6350	1.0117	0–50	6/60
	0.3500	0.3335	0–20	2/60	0			0/60	0			0/60	0.0017	0.0017	0–0.1	1/60	0.0683	0.0667	0–4	2/60
shrubs	3.0017	1.2288	0–60	15/60	0.3500	0.2097	0–12	6/60	1.0367	0.6128	0–35	10/60	4.2050	1.7367	0–75	15/60	4.1200	1.5529	0–75	21/60
	0			0/60	0			0/60	0			0/60	0			0/60	0			0/60
	0			0/60	0.0333	0.0333	0–2	1/60	0.0500	0.0500	0–3	1/60	0			0/60	0.2500	0.1851	0–10	2/60
	0			0/60	0			0/60	0			0/60	0			0/60	0			0/60
	0			0/60	0			0/60	0			0/60	0			0/60	0.8000	0.6705	0–40	4/60
	0			0/60	0			0/60	0			0/60	0.0167	0.0167	0–1	1/60	0.0167	0.0167	0–1	1/60
	0.4667	0.2498	0–10	4/60	0.0333	0.0333	0–2	1/60	0			0/60	0.3350	0.3333	0–20	2/60	0.3667	0.3344	0–20	2/60
	0			0/60	0			0/60	0			0/60	0			0/60	0			0/60
	0			0/60	0			0/60	0			0/60	0			0/60	0			0/60
	2.5350	1.0783	0–50	13/60	0.2833	0.1764	0–10	5/60	0.9867	0.6108	0–35	10/60	3.8533	1.5262	0–55	13/60	2.6867	1.1513	0–55	15/60
ACCINIUM	3.0017	1.2288	0–60	15/60	0.3167	0.2079	0–12	5/60	0.9867	0.6108	0–35	10/60	4.1883	1.7373	0–75	14/60	3.0533	1.4231	0–75	16/60
shrubs	11.1367	2.0446	0–70	37/60	7.5683	1.4185	0–50	38/60	13.1217	2.2802	0–80	43/60	17.8867	2.4710	0–70	47/60	22.5883	2.7252	0–80	48/60
	9.7517	1.9852	0–70	31/60	3.0500	0.6025	0–20	26/60	6.9333	1.4370	0–40	30/60	11.3517	2.0677	0–65	35/60	15.1200	2.4911	0–75	40/60
	0			0/60	0			0/60	0			0/60	0			0/60	0			0/60
	1.3850	0.7898	0–45	14/60	4.5183	1.2789	0–50	21/60	6.1883	1.8201	0–75	26/60	6.6458	1.3911	0–40	31/59	7.4683	1.5937	0–50	32/60
	0.4167	0.4167	0–25	1/60	0.4167	0.4167	0–25	1/60	0.7500	0.7500	0–45	1/60	0.3333	0.3333	0–20	1/60	0.2833	0.2517	0–15	2/60
	0			0/60	0			0/60	0			0/60	0			0/60	0			0/60
	0			0/60	0			0/60	0			0/60	0			0/60	0			0/60
	0.4167	0.4167	0–25	1/60	0.4167	0.4167	0–25	1/60	0.7500	0.7500	0–45	1/60	0.3333	0.3333	0–20	1/60	0.2833	0.2517	0–15	2/60
	0.1850	0.1416	0–8	3/60	13.0600	2.3519	0–85	45/60	19.7383	2.2266	0–71	59/60	14.8017	2.4502	0–85	54/60	13.7033	2.3955	0–72	57/60
	0			0/60	0			0/60	0			0/60	0			0/60	0			0/60
	0			0/60	0			0/60	0.0500	0.0370	0–2	2/60	0.4167	0.4167	0–25	1/60	1.0000	1.0000	0–60	1/60
	0			0/60	0.0333	0.0333	0–2	1/60	0			0/60	0.0333	0.0234	0–1	2/60	0.0183	0.0167	0–1	2/60
	0			0/60	0			0/60	0			0/60	0			0/60	0			0/60
	0.0500	0.0500	0–3	1/60	8.7733	1.9284	0–80	40/60	10.5183	1.9480	0–70	43/60	7.6333	1.4493	0–45	44/60	3.9100	0.7343	0–20	45/60
	0			0/60	0			0/60	0			0/60	0			0/60	0			0/60
	0			0/60	0			0/60	0			0/60	0			0/60	0			0/60
	0			0/60	0			0/60	0			0/60	0			0/60	0			0/60
	0			0/60	0			0/60	0			0/60	0			0/60	0.0333	0.0333	0–2	1/60
	0			0/60	0.7333	0.3832	0–20	6/60	1.4017	0.6462	0–30	11/60	4.7083	1.6572	0–80	38/60	7.4250	1.9567	0–70	48/60
	0			0/60	0			0/60	0			0/60	0			0/60	0			0/60
	0.0017	0.0017	0–0.1	1/60	0.0033	0.0023	0–0.1	2/60	1.9683	0.5689	0–20	16/60	1.7383	0.4580	0–20	23/60	0.9133	0.2802	0–10	25/60
	0			0/60	0			0/60	0			0/60	0.1350	0.0769	0–3	4/60	0.4000	0.3388	0–20	2/60
	0			0/60	3.5167	1.0035	0–35	17/60	5.8000	1.2412	0–40	35/60	0.0867	0.0684	0–4	4/60	0.0033	0.0023	0–0.1	2/60
	0.1333	0.1333	0–8	1/60	0			0/60	0			0/60	0			0/60	0			0/60
	0			0/60	0			0/60	0			0/60	0			0/60	0			0/60
	0			0/60	0			0/60	0			0/60	0			0/60	0			0/60
	0			0/60	0			0/60	0			0/60	0			0/60	0			0/60
	0			0/60	0			0/60	0			0/60	0			0/60	0			0/60
	0			0/60	0			0/60	0			0/60	0			0/60	0			0/60
	0			0/60	0			0/60	0			0/60	0			0/60	0			0/60
	0			0/60	0			0/60	0			0/60	0			0/60	0			0/60
mineral rock	1.7167	1.1679	0–50	4/60	14.6667	3.2063	0–95	29/60	10.2500	2.9387	0–100	17/60	11.5833	3.2231	0–100	18/60	11.6667	3.3312	0–100	17/60
debris	55.1667	3.7393	5–100	60/60	36.0833	4.7361	0–100	46/60	24.3333	3.8574	0–100	41/60	25.9167	4.0625	0–100	41/60	21.0000	3.5471	0–95	39/60

standard error, range and frequency of occurrence are based on subplot observations.
are listed by 7-letter code. See Appendix 1 for common names.

APPENDIX 2d. Descriptive statistics[a] for percent cover values on the light burn treatment at the Macktush site

Group/species[b]	Pretreatment (1985)				1 Year post-treatment (1986)				2 Years post-treatment (1987)				4 Years post-treatment (1989)				6 Years post-treatment (1991)			
	Mean	**S.E.**	**Range**	**#Obs>0**	**Mean**	**S.E.**	**Range**	**#Obs>0**	**Mean**	**S.E.**	**Range**	**#Obs>0**	**Mean**	**S.E.**	**Range**	**#Obs>0**	**Mean**	**S.E.**	**Range**	**#Obs>0**
Conifers	2.2000	1.1978	0–20	4/20	0			0/20	0.2500	0.2500	0–5	1/20	0.8000	0.7490	0–15	2/20	2.5000	2.2507	0–45	2/20
ABIEAMA	0.7500	0.4523	0–8	3/20	0			0/20	0			0/20	0			0/20	0			0/20
CHAMNOO	0			0/20	0			0/20	0			0/20	0			0/20	0			0/20
PSEUMEN	0			0/20	0			0/20	0.2500	0.2500	0–5	1/20	0.7500	0.7500	0–15	1/20	2.2500	2.2500	0–45	1/20
THUJPLI	1.4000	1.0573	0–20	2/20	0			0/20	0			0/20	0.0500	0.0500	0–1	1/20	0.2500	0.2500	0–5	1/20
TSUGHET	0.0500	0.0500	0–1	1/20	0			0/20	0			0/20	0			0/20	0			0/20
Deciduous shrubs	6.7000	1.9922	0–35	13/20	0.9550	0.4316	0–7	7/20	2.3500	1.0445	0–15	7/20	2.6500	1.2841	0–25	9/20	4.7050	2.4046	0–45	10/20
ROSAGYM	0			0/20	0			0/20	0			0/20	0			0/20	0			0/20
RUBULEU	0			0/20	0			0/20	0			0/20	0			0/20	0			0/20
RUBUPAR	0			0/20	0			0/20	0			0/20	0			0/20	0			0/20
RUBUSPE	0			0/20	0			0/20	0			0/20	0			0/20	0			0/20
SAMBRAC	0			0/20	0			0/20	0			0/20	0			0/20	0			0/20
VACCALA	4.4500	1.2470	0–15	10/20	0.4550	0.2659	0–5	5/20	1.0000	0.5572	0–10	4/20	1.7000	1.2463	0–25	5/20	3.3550	2.2722	0–45	6/20
VACCMEM	0			0/20	0			0/20	0			0/20	0			0/20	0			0/20
VACCOVA	0			0/20	0			0/20	0			0/20	0			0/20	0			0/20
VACCPAR	2.2500	1.2647	0–25	6/20	0.5000	0.3591	0–7	3/20	1.3500	0.8744	0–15	4/20	0.9500	0.4381	0–7	5/20	1.3500	0.9955	0–20	5/20
All VACCINIUM	6.7000	1.9922	0–35	13/20	0.9550	0.4316	0–7	7/20	2.3500	1.0445	0–15	7/20	2.6500	1.2841	0–25	9/20	4.7050	2.4046	0–45	10/20
Evergreen shrubs	31.0050	4.6094	0–70	19/20	17.2500	2.5914	0–45	19/20	27.5500	3.7944	1–70	20/20	29.4500	4.0643	5–70	20/20	31.8050	3.9756	6–70	20/20
GAULSHA	31.0050	4.6094	0–70	19/20	17.0000	2.6147	0–45	19/20	27.0500	3.7756	1–70	20/20	28.3500	3.9883	5–70	20/20	31.0500	3.9165	6–70	20/20
LINNBOR	0			0/20	0			0/20	0			0/20	0			0/20	0			0/20
MAHONER	0			0/20	0.2500	0.2500	0–5	1/20	0.5000	0.5000	0–10	1/20	1.1000	0.9997	0–20	2/20	0.7550	0.5468	0–10	3/20
Ferns	0			0/20	0			0/20	0			0/20	0			0/20	0.0500	0.0500	0–1	1/20
BLECSPI	0			0/20	0			0/20	0			0/20	0			0/20	0			0/20
POLYGLY	0			0/20	0			0/20	0			0/20	0			0/20	0			0/20
POLYMUN	0			0/20	0			0/20	0			0/20	0			0/20	0.0500	0.0500	0–1	1/20
Forbs	0			0/20	3.6100	1.9864	0–30.1	5/20	3.4500	1.9146	0–30	6/20	4.7250	2.8544	0–52	9/20	5.6750	2.0335	0–31	13/20
ACHLTRI	0			0/20	0			0/20	0			0/20	0			0/20	0			0/20
ANAPMAR	0			0/20	0.0050	0.0050	0–0.1	1/20	0.0500	0.0500	0–1	1/20	0.5000	0.5000	0–10	1/20	0.1500	0.1094	0–2	2/20
CIRSVUL	0			0/20	0			0/20	0			0/20	0			0/20	0			0/20
CORNCAN	0			0/20	0			0/20	0			0/20	0			0/20	0			0/20
EPILANG	0			0/20	2.8550	1.8960	0–30	4/20	2.8500	1.8964	0–30	3/20	3.8100	2.2848	0–40	7/20	3.4100	1.4006	0–20	10/20
EPILOBI	0			0/20	0			0/20	0			0/20	0			0/20	0			0/20
GALIUM	0			0/20	0			0/20	0			0/20	0			0/20	0			0/20
GOODOBL	0			0/20	0			0/20	0			0/20	0			0/20	0			0/20
HIERALI	0			0/20	0			0/20	0			0/20	0			0/20	0			0/20
HYPORAD	0			0/20	0			0/20	0			0/20	0.0100	0.0069	0–0.1	2/20	0.4550	0.2659	0–5	5/20
LISTCOR	0			0/20	0			0/20	0			0/20	0			0/20	0			0/20
MYCEMUR	0			0/20	0			0/20	0.0500	0.0500	0–1	1/20	0.4050	0.1969	0–3	5/20	1.6600	0.7846	0–15	9/20
RUBUURS	0			0/20	0			0/20	0			0/20	0			0/20	0			0/20
SENEVUL	0			0/20	0.7500	0.7500	0–15	1/20	0.5000	0.3441	0–5	2/20	0			0/20	0			0/20
TARAOFF	0			0/20	0			0/20	0			0/20	0			0/20	0			0/20
TIARLAC	0			0/20	0			0/20	0			0/20	0			0/20	0			0/20
TIARTRI	0			0/20	0			0/20	0			0/20	0			0/20	0			0/20
TRIELAT	0			0/20	0			0/20	0			0/20	0			0/20	0			0/20
Graminoids	0			0/20	0			0/20	0			0/20	0			0/20	0			0/20
GRASS	0			0/20	0			0/20	0			0/20	0			0/20	0			0/20
Hardwoods	0			0/20	0			0/20	0			0/20	0			0/20	0			0/20
ALNURUB	0			0/20	0			0/20	0			0/20	0			0/20	0			0/20
Exposed mineral soil and rock	3.7500	2.0798	0–30	3/20	14.7500	5.7523	0–90	7/20	12.5000	5.0328	0–80	7/20	8.2500	3.7218	0–50	5/20	10.1500	4.4065	0–65	7/20
Woody debris	30.7000	6.9567	0–95	17/20	14.7500	3.9815	0–50	12/20	12.5000	3.6364	0–45	10/20	9.0000	2.3952	0–25	10/20	7.2500	2.4993	0–30	8/20

[a] Mean, standard error, range and frequency of occurrence are based on subplot observations.
[b] Species are listed by 7-letter code. See Appendix 1 for common names.

APPENDIX 2e. Descriptive statistics[a] for percent cover values on the heavy burn treatment at the Kanyon site

Group/species[b]	Pretreatment (1985)				1 Year post-treatment (1986)				2 Years post-treatment (1987)				4 Years post-treatment (1989)				6 Years post-treatment (1991)			
	Mean	S.E.	Range	#Obs>0	Mean	S.E.	Range	#Obs>0	Mean	S.E.	Range	#Obs>0	Mean	S.E.	Range	#Obs>0	Mean	S.E.	Range	#Obs>0
Conifers	3.9250	1.4616	0–40	12/40	0.1250	0.1025	0–4	2/40	0.4775	0.2807	0–10	5/40	2.6250	1.2612	0–40	9/40	10.9550	3.8643	0–95	21/40
ABIEAMA	2.7000	1.2212	0–40	9/40	0			0/40	0			0/40	0			0/40	0			0/40
CHAMNOO	0			0/40	0.1250	0.1025	0–4	2/40	0.4500	0.2795	0–10	4/40	1.9000	1.1271	0–40	5/40	5.8000	2.6136	0–80	9/40
PSEUMEN	0			0/40	0			0/40	0.0275	0.0251	0–1	2/40	0.7000	0.5129	0–20	4/40	4.8250	2.5475	0–95	8/40
THUJPLI	0.8750	0.8750	0–35	1/40	0			0/40	0			0/40	0			0/40	0.2025	0.1349	0–5	4/40
TSUGHET	0.3500	0.2336	0–8	3/40	0			0/40	0			0/40	0.0250	0.0250	0–1	1/40	0.1275	0.0732	0–2	4/40
Deciduous shrubs	1.5250	0.6998	0–25	9/40	0.0500	0.0349	0–1	2/40	0.3500	0.2546	0–10	4/40	3.1250	1.7817	0–60	11/40	1.5750	0.6117	0–20	11/40
ROSAGYM	0			0/40	0.0250	0.0250	0–1	1/40	0.0500	0.0500	0–2	1/40	0.0750	0.0750	0–3	1/40	0.0750	0.0750	0–3	1/40
RUBULEU	0			0/40	0			0/40	0.2500	0.2500	0–10	1/40	2.8500	1.7865	0–60	7/40	1.0750	0.5733	0–20	5/40
RUBUPAR	0			0/40	0			0/40	0			0/40	0			0/40	0			0/40
RUBUSPE	0			0/40	0			0/40	0			0/40	0			0/40	0			0/40
SAMBRAC	0			0/40	0			0/40	0			0/40	0			0/40	0			0/40
VACCALA	0.0500	0.0500	0–2	1/40	0			0/40	0			0/40	0			0/40	0			0/40
VACCMEM	0			0/40	0			0/40	0			0/40	0			0/40	0			0/40
VACCOVA	0			0/40	0			0/40	0			0/40	0			0/40	0			0/40
VACCPAR	1.4750	0.6934	0–25	9/40	0.0250	0.0250	0–1	1/40	0.0500	0.0349	0–1	2/40	0.2000	0.1349	0–5	3/40	0.4250	0.2628	0–10	5/40
All VACCINIUM	1.5250	0.6998	0–25	9/40	0.0250	0.0250	0–1	1/40	0.0500	0.0349	0–1	2/40	0.2000	0.1349	0–5	3/40	0.4250	0.2628	0–10	5/40
Evergreen shrubs	18.1775	4.1334	0–91	21/40	1.5250	0.5981	0–19	10/40	3.3025	1.0315	0–26	14/40	8.7750	2.4389	0–52	15/40	13.0775	3.1248	0–60	18/40
GAULSHA	16.5275	3.8415	0–90	21/40	0.3500	0.1583	0–4	6/40	0.8525	0.3712	0–10	9/40	2.4750	1.3004	0–50	9/40	3.2775	1.3227	0–45	14/40
LINNBOR	0			0/40	0			0/40	0			0/40	0			0/40	0			0/40
MAHONER	1.6500	0.5365	0–12	13/40	1.1750	0.4947	0–15	7/40	2.4500	0.9439	0–25	9/40	6.3000	2.0737	0–50	13/40	9.8000	2.6388	0–50	14/40
Ferns	0			0/40	0			0/40	0			0/40	0			0/40	0.0025	0.0025	0–0.1	1/40
BLECSPI	0			0/40	0			0/40	0			0/40	0			0/40	0			0/40
POLYGLY	0			0/40	0			0/40	0			0/40	0			0/40	0			0/40
POLYMUN	0			0/40	0			0/40	0			0/40	0			0/40	0.0025	0.0025	0–0.1	1/40
Forbs	0.6675	0.3842	0–15	12/40	11.1825	3.4562	0–101	29/40	22.4525	3.7294	0–80	38/40	19.4925	3.8809	0–104	36/40	17.1475	3.1351	0–82	38/40
ACHLTRI	0.3800	0.2573	0–10	6/40	0.0250	0.0250	0–1	1/40	0.0500	0.0349	0–1	2/40	0.2750	0.2056	0–8	3/40	0			0/40
ANAPMAR	0			0/40	0			0/40	0			0/40	0.6025	0.2368	0–7	9/40	3.2275	1.3166	0–50	20/40
CIRSVUL	0			0/40	0			0/40	0			0/40	0.1282	0.0913	0–3	2/39	0.0500	0.0500	0–2	1/40
CORNCAN	0			0/40	0			0/40	0.0250	0.0250	0–1	1/40	0			0/40	0			0/40
EPILANG	0.0026	0.0026	0–0.1	1/39	11.1575	3.4396	0–100	29/40	21.9525	3.7575	0–80	37/40	16.0500	3.2591	0–85	33/40	8.5050	1.8371	0–55	33/40
EPILOBI	0			0/40	0			0/40	0			0/40	0.2500	0.2500	0–10	1/40	0			0/40
GALIUM	0			0/40	0			0/40	0			0/40	0			0/40	0.0025	0.0025	0–0.1	1/40
GOODOBL	0			0/40	0			0/40	0			0/40	0			0/40	0			0/40
HIERALI	0			0/40	0			0/40	0			0/40	0.0250	0.0250	0–1	1/40	0			0/40
HYPORAD	0.0250	0.0250	0–1	1/40	0			0/40	0			0/40	0.3500	0.1700	0–5	5/40	3.9625	1.8892	0–75	27/40
LISTCOR	0.0050	0.0035	0–0.1	2/40	0			0/40	0			0/40	0			0/40	0			0/40
MYCEMUR	0			0/40	0			0/40	0			0/40	0.7300	0.4049	0–15	7/40	1.1700	0.6724	0–25	15/40
RUBUURS	0			0/40	0			0/40	0			0/40	0.0025	0.0025	0–0.1	1/40	0.0025	0.0025	0–0.1	1/40
SENEVUL	0			0/40	0			0/40	0.4000	0.3752	0–15	2/40	0.6325	0.3350	0–10	8/40	0			0/40
TARAOFF	0			0/40	0			0/40	0			0/40	0			0/40	0			0/40
TIARLAC	0.2500	0.1509	0–5	3/40	0			0/40	0			0/40	0			0/40	0			0/40
TIARTRI	0.0050	0.0035	0–0.1	2/40	0			0/40	0			0/40	0			0/40	0			0/40
TRIELAT	0			0/40	0			0/40	0.0250	0.0250	0–1	1/40	0.4500	0.2055	0–7	7/40	0.2275	0.1102	0–3	6/40
Graminoids	0			0/40	0			0/40	0			0/40	0			0/40	0			0/40
GRASS	0			0/40	0			0/40	0			0/40	0			0/40	0			0/40
Hardwoods	0			0/40	0			0/40	0			0/40	0			0/40	0.3750	0.3750	0–15	1/40
ALNURUB	0			0/40	0			0/40	0			0/40	0			0/40	0.3750	0.3750	0–15	1/40
Exposed mineral soil and rock	2.2500	2.2500	0–90	1/40	47.5000	5.9620	0–100	33/40	46.1250	6.7213	0–100	25/40	30.3750	5.7884	0–100	22/40	39.0000	6.3956	0–100	24/40
Woody debris	44.9250	5.2438	1–100	40/40	22.3000	4.4587	0–100	31/40	19.7500	4.5218	0–100	21/40	15.0000	4.0232	0–100	18/40	14.0000	3.5725	0–100	20/40

[a] Mean, standard error, range and frequency of occurrence are based on subplot observations.
[b] Species are listed by 7-letter code. See Appendix 1 for common names.

APPENDIX 2f. Descriptive statistics[a] for percent cover values on the heavy burn treatment at the Macktush site

Group/species[b]	Pretreatment (1985)				1 Year post-treatment (1986)				2 Years post-treatment (1987)				4 Years post-treatment (1989)				6 Years post-treatment (1991)			
	Mean	S.E.	Range	#Obs>0	Mean	S.E.	Range	#Obs>0	Mean	S.E.	Range	#Obs>0	Mean	S.E.	Range	#Obs>0	Mean	S.E.	Range	#Obs>0
Conifers	0.5250	0.5000	0–20	2/40	0.1275	0.1250	0–5	2/40	0.1250	0.1250	0–5	1/40	1.7025	1.2945	0–50	5/40	4.4275	2.6495	0–86	10/40
ABIEAMA	0.5000	0.5000	0–20	1/40	0			0/40	0			0/40	0			0/40	0			0/40
CHAMNOO	0			0/40	0			0/40	0			0/40	0			0/40	0.0250	0.0250	0–1	1/40
PSEUMEN	0			0/40	0			0/40	0			0/40	0.4025	0.3751	0–15	3/40	1.9775	1.6268	0–65	6/40
THUJPLI	0			0/40	0.1250	0.1250	0–5	1/40	0.1250	0.1250	0–5	1/40	1.3000	1.2497	0–50	2/40	2.3000	2.1247	0–85	3/40
TSUGHET	0.0250	0.0250	0–1	1/40	0.0025	0.0025	0–0.1	1/40	0			0/40	0			0/40	0.1250	0.1250	0–5	1/40
Deciduous shrubs	4.1250	1.1199	0–35	20/40	0			0/40	0			0/40	0			0/40	0.0025	0.0025	0–0.1	1/40
ROSAGYM	0			0/40	0			0/40	0			0/40	0			0/40	0			0/40
RUBULEU	0			0/40	0			0/40	0			0/40	0			0/40	0			0/40
RUBUPAR	0			0/40	0			0/40	0			0/40	0			0/40	0			0/40
RUBUSPE	0			0/40	0			0/40	0			0/40	0			0/40	0			0/40
SAMBRAC	0			0/40	0			0/40	0			0/40	0			0/40	0			0/40
VACCALA	3.0750	1.1370	0–35	12/40	0			0/40	0			0/40	0			0/40	0			0/40
VACCMEM	0			0/40	0			0/40	0			0/40	0			0/40	0			0/40
VACCOVA	0			0/40	0			0/40	0			0/40	0			0/40	0			0/40
VACCPAR	1.0500	0.3562	0–8	8/40	0			0/40	0			0/40	0			0/40	0.0025	0.0025	0–0.1	1/40
All VACCINIUM	4.1250	1.1199	0–35	20/40	0			0/40	0			0/40	0			0/40	0.0025	0.0025	0–0.1	1/40
Evergreen shrubs	30.6000	4.4170	0–85	33/40	0.9300	0.3742	0–10	12/40	4.4025	2.2519	0–85	16/40	4.9075	1.5655	0–50	18/40	6.8800	1.7624	0–45	22/40
GAULSHA	30.0000	4.4429	0–85	31/40	0.5300	0.2022	0–5	11/40	3.1500	1.7994	0–70	13/40	3.2775	1.3824	0–50	14/40	3.8800	1.1015	0–30	17/40
LINNBOR	0			0/40	0			0/40	0			0/40	0			0/40	0			0/40
MAHONER	0.6000	0.2904	0–10	6/40	0.4000	0.2769	0–10	3/40	1.2525	0.8294	0–30	6/40	1.6300	0.8656	0–30	7/40	3.0000	1.3895	0–40	10/40
Ferns	0			0/40	0			0/40	0			0/40	0			0/40	0.0025	0.0025	0–0.1	1/40
BLECSPI	0			0/40	0			0/40	0			0/40	0			0/40	0			0/40
POLYGLY	0			0/40	0			0/40	0			0/40	0			0/40	0			0/40
POLYMUN	0			0/40	0			0/40	0			0/40	0			0/40	0.0025	0.0025	0–0.1	1/40
Forbs	1.2050	1.0006	0–40	7/40	5.1825	1.3293	0–30	25/40	7.9550	1.8331	0–50	31/40	21.7000	4.1857	0–91	36/40	12.6350	2.1279	0–70.1	37/40
ACHLTRI	0			0/40	0			0/40	0			0/40	0			0/40	0			0/40
ANAPMAR	0			0/40	0.2275	0.1102	0–4	7/40	4.4025	1.2181	0–25	21/40	16.0000	3.7459	0–80	28/40	7.3025	1.8638	0–70	32/40
CIRSVUL	0			0/40	0			0/40	0			0/40	0			0/40	0.0250	0.0250	0–1	1/40
CORNCAN	0			0/40	0			0/40	0			0/40	0			0/40	0			0/40
EPILANG	1.1275	1.0001	0–40	5/40	4.9550	1.3131	0													

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