FIDS Report 93-8

FOREST INSECT AND DISEASE SURVEY

PEST REPORT ON SPECIAL PROJECTS

QUEEN CHARLOTTE ISLANDS

1992

Prepared for:
South Moresby Forest Replacement Account (SMFRA)

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INTRODUCTION

As part of a new Memorandum of Understanding (MOU) between the Ministry of Forest (MOF) and Forestry Canada (ForCan), several long term projects initiated under a similar agreement in 1991 were continued in 1992, during the survey period July 14-23. The main focus again was on project E.P. 862[1]. The survey concentrated on re-assessment for forest pests in the old growth stands at Gregory and Hangover creeks. A permanent plot system was developed along a demonstration trail such that plots could be re-established after logging. Plots could be utilized for scheduled monitoring of pests and as part of any demonstrations, for the life of the project. Results of the pest survey are presented and plot locations documented. Results are also presented on other FIDS projects including; pest damage in plots in currently active aphid infestations, and pest related losses in spaced stands from the 1985-88 western blackheaded budworm (WBHB)/hemlock sawfly outbreak. Findings on all work are discussed and suggestions for continued follow up work under the SMFRA umbrella are also included. All projects were incremental to information normally collected by FIDS during regular surveys on the Queen Charlotte Islands.

Locations: Area #1 - Gregory Creek in Rennell Sound (QCI).
Area #2 - Hangover Creek in Rennell Sound (QCI).

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SUMMARY

At Gregory Creek, in an old growth stand in the process of being harvested under the special project, dwarf mistletoe infected 38% of western hemlock, indicating continued problems after harvest. Sweep, lean, fork, crook and broken tops were the only other conditions noted. At Hangover Creek, Phellinus pini affected 3% of trees, although snags indicative of similar problems were common. Sapsucker damage, crook, broken tops, dead tops, scars and frost cracks were noted as relatively common conditions. Few insect larvae were found in standard three-tree beating samples in adjacent undisturbed stands.

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[1] Project E.P. 862, also designated experiment 34, SMFRA 13.3, and titled "Alternative Silvicultural Systems for Environmentally Sensitive Sites on Steep Slopes.", is designed to test alternate harvest methods on steep, unstable slopes using a helicopter for extraction. The harvest methods to be assessed include single tree selection, patch clearcut (group selection) totalling 25% of an area, group selection totalling 50% of an area and clearcut. Numerous silviculture monitoring plots were established prior to harvest, and various planting regimes are to be implemented post-harvest.

A young hemlock stand defoliated during the 1985-88 western blackheaded budworm/hemlock sawfly infestation and spaced in 1989, showed 38% less increment during the infestation period than after spacing.

Spruce aphid infested Sitka spruce at numerous locations throughout the Queen Charlotte Islands for the second consecutive year. At Heather Lake, an overall average of 57% of foliage in plot trees were affected compared to 41% in 1991. Some growth loss was indicated from initial assessments.

Projects to be continued and initiated are listed.

SURVEY METHODS

At both Gregory and Hangover creeks, all trees in ten-100 m^2 circular plots were examined for pests and pest damage. Plots were located a minimum of 100 m apart on or near a pre-established demonstration trail (Appendix A). Plot centers were established either on numbered reference points (see map-Appendix B), or between numbered reference points at mile posts directly on the trail. Trees within plots were mapped by direction and distance from plot centers on a per plot basis and each individual tree identified. Plot layout was designed such that all treatment types would be represented. Poor lighting, a closed canopy and slopes in excess of 100% resulted in modification in dwarf mistletoe assessments. Generally, where visible, trees were divided into upper, mid, and lower crowns, with severe infection assigned to conditions where multiple brooms were noted in at least one crown level and other brooms noted elsewhere. Light infection was assigned where a total of only one or two brooms were visible.

At Gregory Creek, because the subject areas were separated by a large leave block, two trails had been developed. Five plots were established along each trail. Plots 6-10 were established along trail A, three in treatment #3 (patch clearcut-50%) and two in treatment #4 (clearcut). Plots 1-5 were established along trail B, two in treatment #1 (single tree selection-25%) and three in treatment #2 (patch clearcut-25%).

At Hangover Creek, a single trail covered the entire block, three plots were located in treatment #1, two each in treatment #2,3,4 and one in treatment #5 (control). In all cases, plots followed the trails from beginning to end with approximately 30 m as the maximum off-trail distance for plot establishment.

In 1993, after; the logging project is completed, reference points are re-established and re-tagged, and any silviculture work completed (such as planting), plots will be relocated, trees (or stumps if trees harvested) relocated and regeneration re-identified. Any additions in plot contents (planted seedlings) will also be incorporated and assessed for pests.

Permanent defoliator monitoring areas adjacent to Gregory and Hangover creeks were examined. The standard FIDS three-tree beating method (using a 2.5 m pole to dislodge defoliating insect larvae from branches of each of three trees, to be collected on a 2 x 3 m sheet placed under the sample tree) was used. Resultant larvae were counted and identified.

Damage to western hemlock caused by the most recent blackheaded budworm outbreak was again examined in a young, spaced stand. Trees in ten-50 m^2 circular plots at 50 m intervals were examined for symptoms of crown damage and one increment core was taken at breast height, at each plot. Cores were later read into a "digimic" reader to measure annual growth.

The plot established at Heather Lake to monitor spruce aphid was assessed. Percent healthy foliage remaining per year was recorded from a tagged branch on each of twenty trees. Tree height, leader length, branch tip length and overall attack severity were all recorded.

SURVEY RESULTS AND DISCUSSION

Gregory Creek Survey

At Gregory Creek a total of 83 trees were tallied, half of which were under 25 cm diameter-at-breast-height (dbh), the rest ranging up to about 140 cm dbh. Hemlock represented 95% of assessed trees, western red cedar the rest. Over 80 young hemlock regeneration mostly from 0.5-3 m tall were recorded. Hemlock dwarf mistletoe, Arceuthobium tsugense, was the major pest, infecting 38% of plot trees, compared to 84% in 1991. Of these, 53% were lightly infected, 23% moderately infected and 23% severely infected, based on visual observations in poor lighting under a closed canopy. All diameter classes were affected.

The primary reason for the differential between the 38% infection rate recorded in 1992 and 84% in 1991 at Gregory Creek was that on the upper slopes of Gregory Creek (and at Hangover Creek), no dwarf mistletoe was found. Mistletoe did occur on the lower slopes of the Gregory Creek site, and in adjacent stands below the Hangover Creek area. The survey criteria for 1992 resulted in several plots located well above the apparent "mistletoe zone", thus diluting results.

There were several possible reasons suggested why infection rates were much higher on the lower slopes (pers. com. Dr. R. B. Smith). One is simple gravity; seeds disperse farther downslope than upslope and there is much less foliage available to intercept seed on the upslope side. Frost has been shown to limit the elevational range of mistletoe in lodgepole pine well below the elevational limit of its host. A similar limit may be occurring at these sites, when occasional hard frosts occur on upper slopes, especially in the fall. Finally, heavier snow loads at upper elevations could reduce the ability of seed to successfully adhere to branches or reduce its viability due to long term exposure to excess moisture or cold conditions.

Although hemlock regeneration assessed was free from mistletoe in and adjacent to the plots, it will become infected if infected overstory remains in proximity to the regeneration, as was documented in the 1991 survey. All hemlock in single tree selection trial areas, patch clearcuts and even perimeter hemlock in clearcuts is susceptible. Any hemlock which seeds in after completion of harvest is also subject to the same condition over the long term.

No other major pests were noted at this site. Leaning trees, trees with sweep and the occasional fork, crook or broken top were minor conditions noted. Snags were common in or near a number of plots, commonly festooned with conks of Fomes pinicola and occasionally Ganoderma applanatum, both of which are found primarily on dead wood.

Hangover Creek Survey

At Hangover Creek, a total of only 40 trees were tallied in 10 plots, partly due to logging in process at some plot locations. Diameters ranged from 11 to 130 cm with 82% of trees western hemlock and 18% Sitka spruce. Over 80 young hemlock regeneration were also recorded. The most serious problem was the heart rot Phellinus pini, which affected 3% of plot trees based on evidence of external conks. Sapsucker damage, crooks (occasionally severe), broken tops, dead tops, dead branches, sweep, forks, scars and frost cracks affected many trees in the plots and throughout the stand. These conditions are common for old growth stands, especially on relatively unstable sites. Hemlock dwarf mistletoe was again not found in the stand but was common on adjacent lower slopes.

The confirmed incidence of Phellinus pini, coupled with the numerous snags noted throughout parts of the stand, indicated possible serious heart rot problems in this stand. Increased stem breakage may result from increased exposure, although no affect on incidence of infection is expected as a direct result of the harvest.

Permanent Sampling Areas

At Gregory Creek, no defoliating insects were found in a standard three-tree beating sample. At Hangover Creek only three hemlock sawfly larvae were collected from young, understory hemlock. These results mirror findings throughout the Queen Charlotte Islands. Blackheaded budworm/hemlock sawfly infestations tend to develop in old growth stands, therefore both Gregory and Hangover creeks remain vulnerable to developing outbreaks due to their retained old growth components.

Western Blackheaded Budworm Damage Survey

Effects of the western blackheaded budworm/hemlock sawfly infestation of 1985 to 1988 on young trees were assessed in a stand near Alliford Bay. Defoliation information on this stand is sketchy. At the outbreak of the infestation in 1985, the nearest recorded activity was 5 km away at Haans Creek, where trees were moderately defoliated. In 1986 defoliation was light at Alliford Bay, and in 1987, probably light to moderate. The nearest defoliation recorded in 1988 was on the north end of Maude Island. The stand was spaced in 1989.

Assessment of the stand in 1992 did not indicate any residual crown damage caused by the outbreak. Damage was confined to minor sapsucker activity (7% of hemlock), occasional minor crooks, fork, or sweep (6% of trees) and in one area hemlock dwarf mistletoe (2%). An assessment of

growth rates (based on one core sample from each of 10 plots) during the outbreak period indicated a trend but was not conclusive. Radial increment averaged 3.56 mm during the outbreak period, 19% less then the average increment of 4.39 mm for the period of 1977-84 (see figure). After a recovery period and spacing, the 1990-91 increment averaged 4.79 mm, 38% greater then the increment found during the infestation period and already 9% greater then that found during the pre-spacing/pre-infestation period.

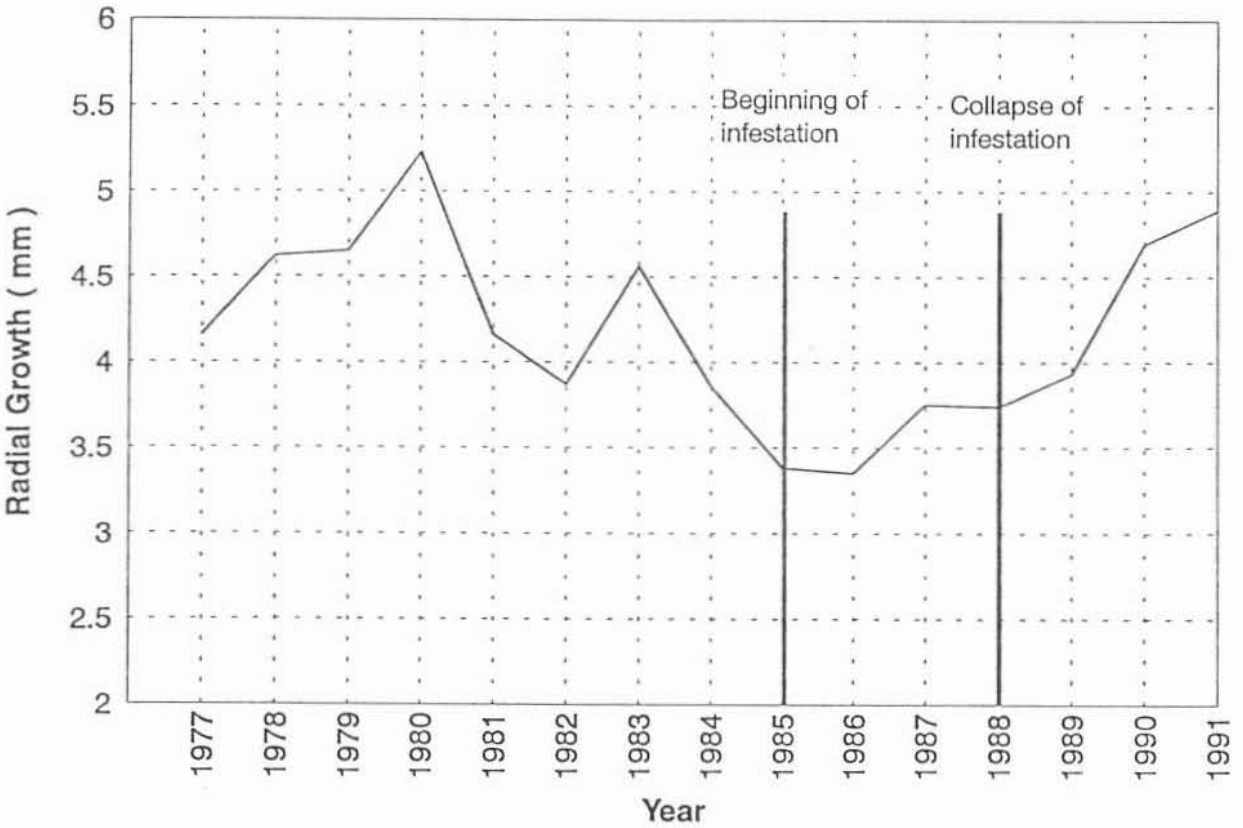

Fig. Radial increment from 10 increment cores of western hemlock in plots defoliated by western blackheaded budworm and hemlock sawfly. Queen Charlotte Islands, 1992.

While results of the core sample analysis were not decisive, increment during the entire period was lowest in each of the four infestation years. Increment was greatest in the two years following spacing, excepting 1980. Trends paralleled those found in the 1991 survey at Tarundl Creek, though conditions were not as well documented at the Alliford Bay site and attack levels were not nearly as severe. The data suggest that on good sites, near 100% defoliation causes dramatic reduction in radial growth (Tarundl Creek), while even light defoliation may impact tree growth. In both these cases, recovery appeared to be rapid and complete. Further plot work in similarly affected young stands, especially those with specifically documented levels of defoliation, are planned. Additional work in control areas (those unaffected by the infestations) and in unspaced but attacked young stands would help confirm results.

Spruce Aphid Survey

Spruce aphid, Elatobium abietinum, infestations expanded causing over 3000 ha of defoliation of shoreline Sitka spruce from Gray Bay to Masset, in this, the second year of attack. At Heather Lake all 20 young spruce in the study plot were again infested. Over 80% (maximum 92%) of older foliage was infested in 10% of trees while from 10-80% of older foliage was missing or discolored in the remaining 90% of the trees (cumulative over two years). To compare levels of attack, damage to one-year-old needles were assessed. As current flush, these needles had remained relatively unaffected. In 1991, 15% of 1990 needles were infested; in 1992, 26% of 1991 needles were affected, an increase of 11%. This appears to confirm that aphid activity was on the increase as was noted elsewhere.

Effects of attack on lateral shoot length were also examined. In 1991, shoots of severely[2] affected trees were 11% shorter then shoots of lightly infested trees. In 1992, comparisons were done between moderate and severely attacked trees as few were lightly attacked. In severely attacked trees, lateral shoot lengths were 28% shorter then shoots of moderately attacked trees. No branch dieback or mortality was noted in young trees to date.

Overall, 57% of foliage was affected in 1992, compared to 41% in 1991. Resultant loss of photosynthetic capacity expressed itself in reduced growth at least of the current branch length with average shoot length in 1992 24% shorter than in 1991. In addition to the cumulative foliage loss already noted, the results also suggest a cumulative growth loss effect following successive years of attack. While effects of repeated attack in young stands have not been well documented and no mortality reported, a third year of severe attack on an already depleted foliage compliment could impact growth not only of the current year but possibly for several years to follow.

Mortality of mature Sitka spruce has been recorded in the past in association with repeated severe spruce aphid attack. To further monitor effects of the infestation, two areas of 20 semi-mature trees each were selected. Trees were chosen in a range of diameters from 20-47 cm and attack levels from very light to severe. Monitoring will continue.

PROPOSALS FOR FURTHER FIDS PROJECTS UNDER SMFRA

1. As per previous request, all plots at both Hangover and Gregory creeks need to be re-established after completion of harvest. Plot, tree and regeneration identification method to be consistent with requirements for long term demonstration and monitoring purposes to chart pest activity and development resulting from alternative harvesting regimes on steep slopes.

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[2] light=<31% needles affected, moderate=31-80% needles affected, severe=81%+ needles affected.

2. Damage appraisal of young stands affected by the WBHB epidemic needs to continue (be expanded?). Study locations should be identified in co-operation with British Columbia Forest Service (BCFS) from records of plots established during the infestations.

3. Survey of the spruce aphid plot at Heather Lake should continue, to identify attack levels and measure growth rates. This should continue for at least 2-3 years after the collapse of the infestation to also chart the recovery period.

4. Ten long-term western blackheaded budworm/hemlock sawfly damage appraisal study plots were established by FIDS in western hemlock in South Moresby Island and adjacent archipelago in fall, 1985. Plots were revisited and examined by FIDS in 1989. Core samples indicated a decline in growth following the onset of the infestation. To determine long term rate and level of recovery, plots should now be revisited and re-examined.

5. Aerial pest surveys of Queen Charlotte Islands have not been completed since 1990. A survey of the entire district in 1993 could help detect potential problems, document the spruce aphid activity and provide a long term record of pest status of the area to be housed with BCFS and in the ForCan-FIDS GIS (Geographic Information System).

REFERENCES

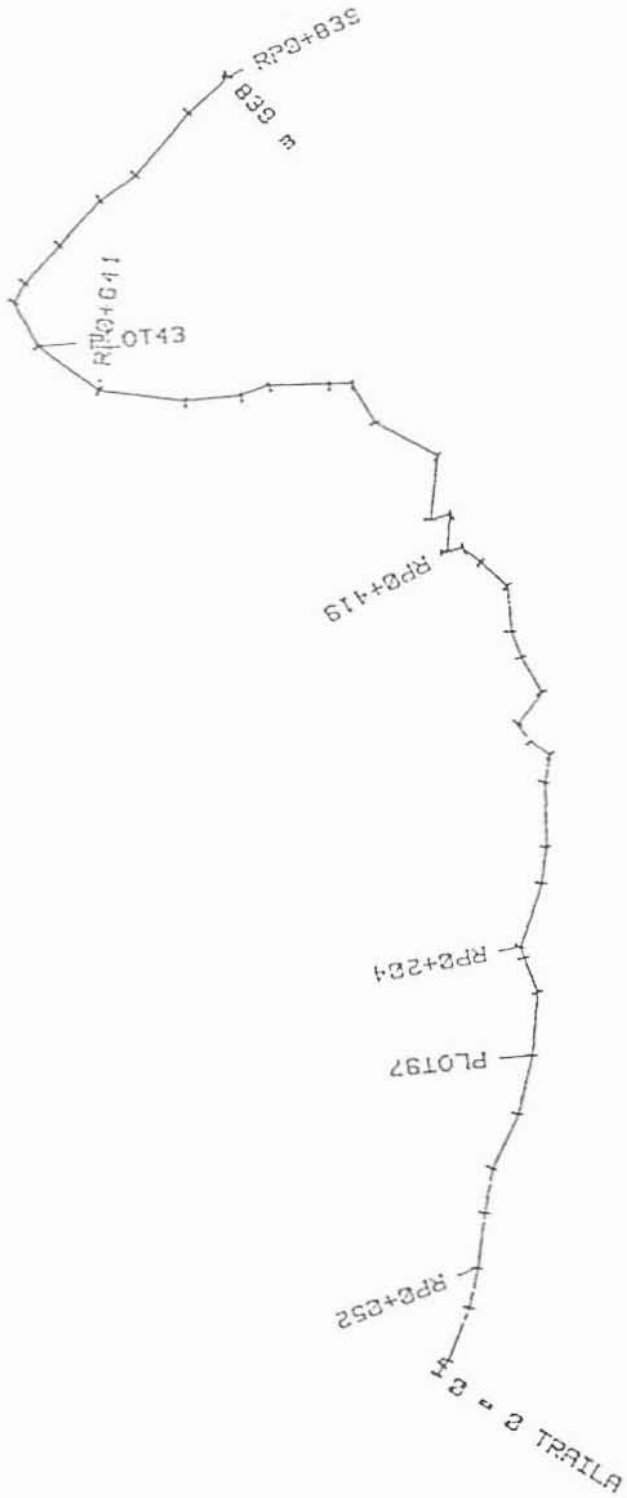
Wood C.; Garbutt R. 1990. Defoliator Damage Assessment and Detection and Mapping of Insect Epidemics, Queen Charlotte Islands and Mainland Coast, 1989. FIDS Report 90-8. 43p.

Vallentgoed J. 1992. Forest Insect and Disease Survey Report on Special Projects, Queen Charlotte Islands, 1991. FIDS Report 92-11 9p.

Pendl F.T.; D'Anjou B.N. 1991. Alternative Silvicultural Systems for Environmentally Sensitive Sites on Steep Slopes:- Operational Trial. Research Branch, British Columbia Ministry of Forest - Working Plan. Project E.P. 862. 22p.

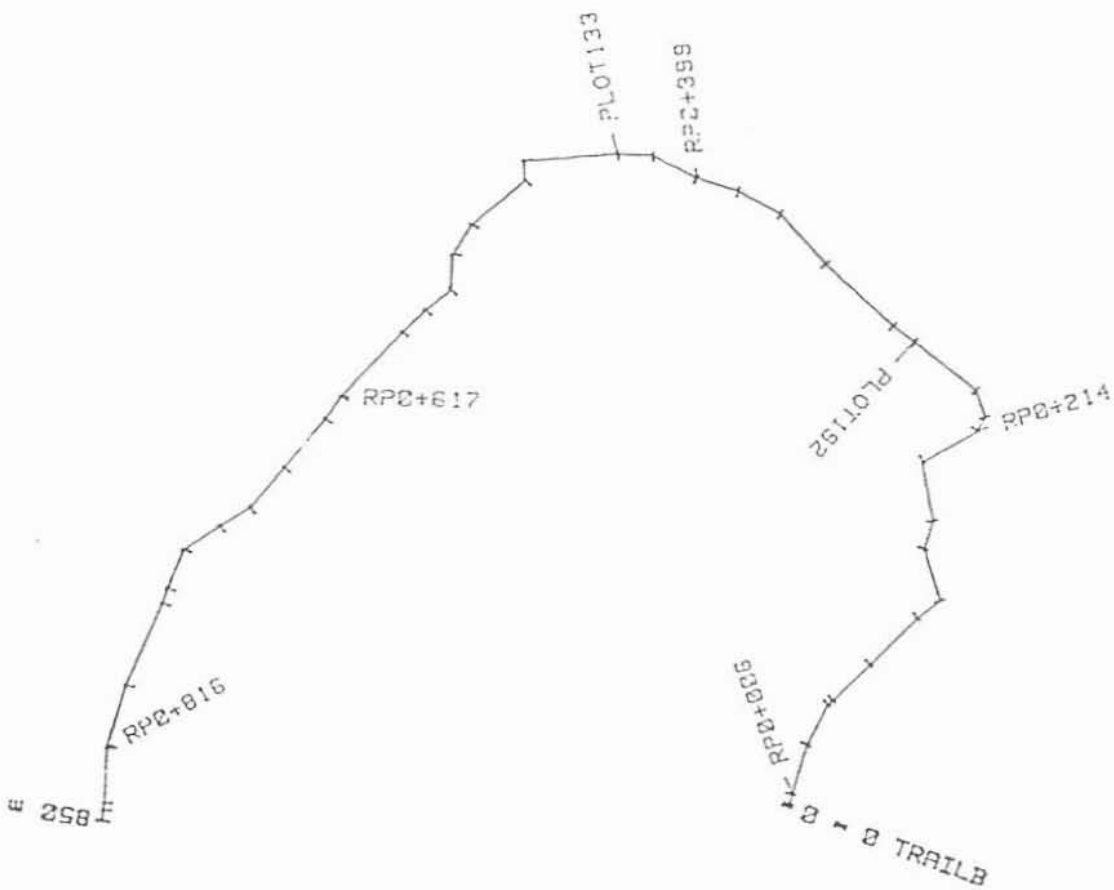
APPENDICES

Appendix A, Demonstration trails for Gregory and Hangover creeks project.
Gregory Creek-Trail A



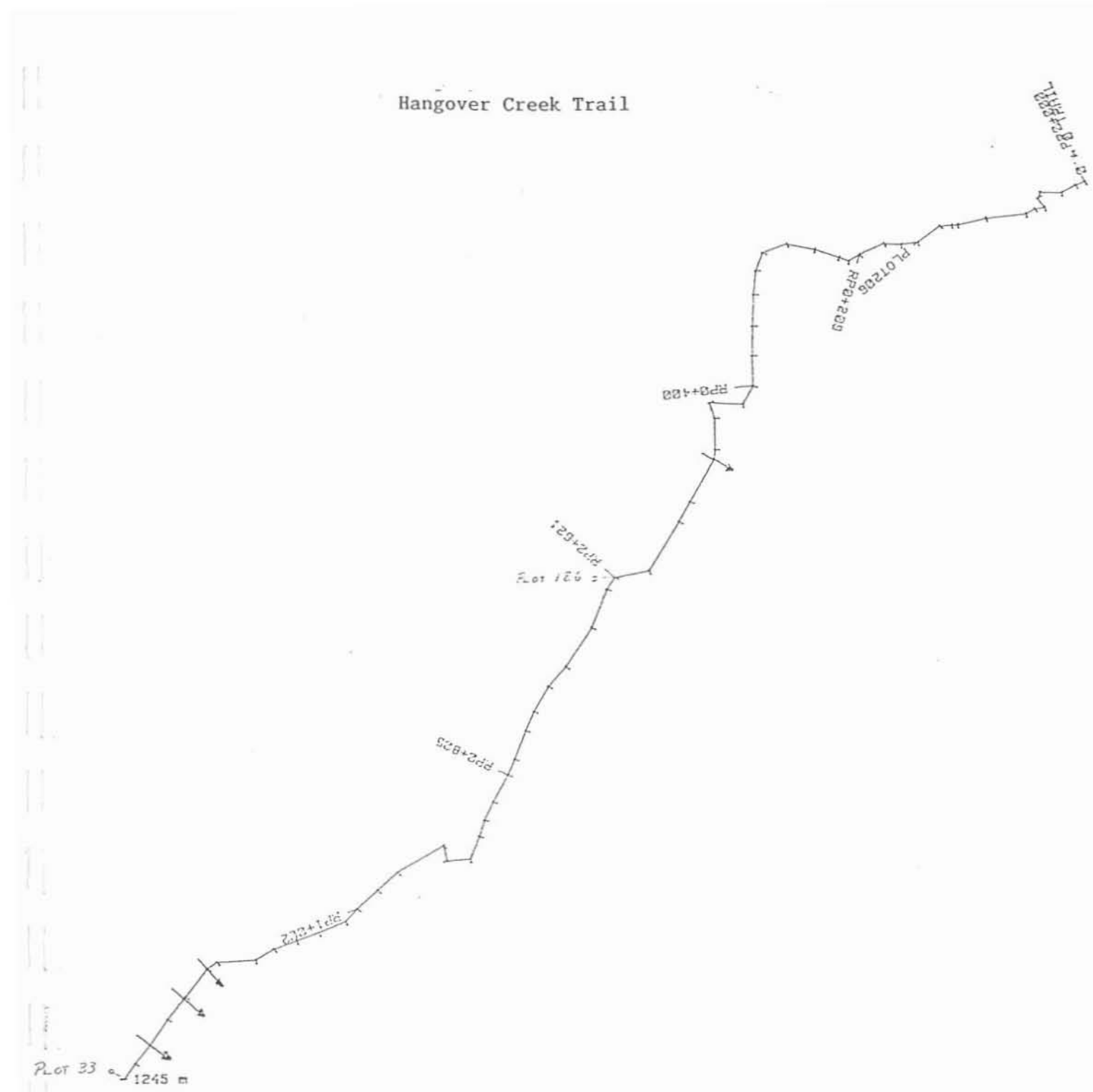
ROAD RP or TL STREAMS

Gregory Creek-Trail B



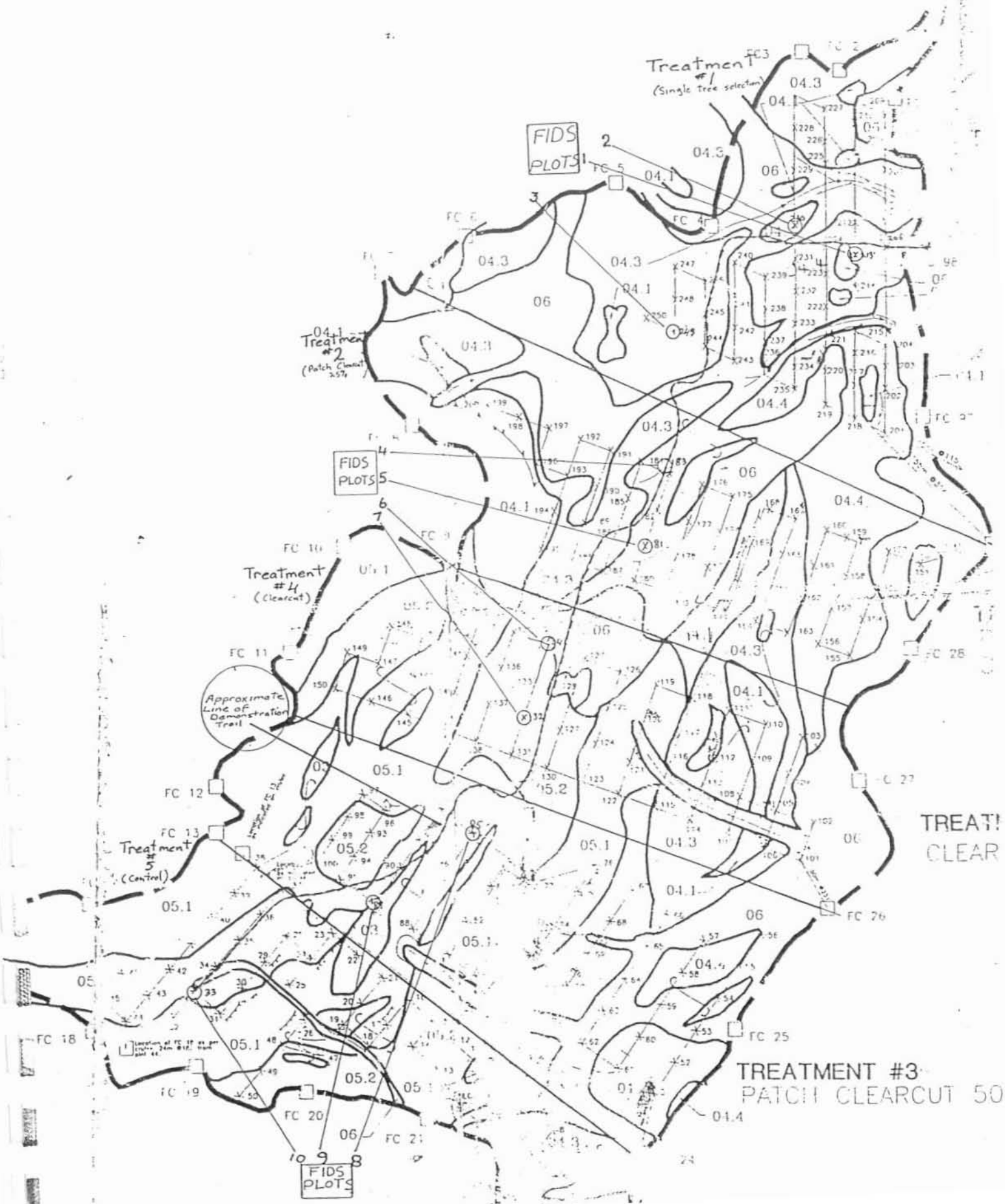
—— ROAD —·— RP or TL —▸ STREAMS

Hangover Creek Trail



—— ROAD — - RP or TL —➤ STREAMS

Hangover Creek Treatment Blocks



Appendix B, Site maps of Gregory and Hangover creeks alternative harvest project, detailing trail locations and FIDS plots.

Gregory Creek Treatment Blocks