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FIRE PROTECTION GUIDELINES

FOR JUVENILE SPACING PROJECTS

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FIRE PROTECTION GUIDELINES FOR JUVENILE SPACING PROJECTS

A. INTRODUCTION

Juvenile spacing, or pre-commercial thinning, can create substantial loadings of flammable debris. Large, adjoining areas of spaced stands coupled with dangerous fire weather conditions, have the potential to repeat the logging-slash disaster fires of the past. With this danger, forest managers must recognize the importance of fire protection when planning, implementing, and maintaining juvenile spacing projects.

Planning of projects must take into account risk of losing the generally substantial investment. Poor planning can result in the unnecessary expenditure of funds to protect spaced areas from fire. Expected gains in wood volumes can be negated by loss of projects and surrounding productive forest to fire.

The purpose of these guidelines is to assist government and industrial forest managers in choosing cost-effective means of reducing the probability of fire damage in juvenile spacing projects and to minimize the extent of losses should a fire occur.

These guidelines have been developed following three years of in-depth study into power-saw juvenile spacing of coastal Douglas-fir, interior Douglas-fir, and lodgepole pine by a joint CFS/BCFS team. Based on the results of the study, a danger rating system combining elements of fire hazard and risk was constructed to aid in the planning and operation of juvenile spacing projects. The guidelines have been extended to apply to other species as well.

B. JUVENILE SPACING PROJECT DANGER RATING SYSTEM

1. Factors Considered in System Development

When planning and implementing juvenile spacing activities, managers must consider the probability of fire destroying treated stands before they reach harvestable age. Potential fire losses extend beyond the spacing project to surrounding projects and other values. Development of the "juvenile spacing project danger rating system" considers several important factors, including degree and duration of hazard created by spacing activity, fire weather, and risk of fire occurring within the project or spreading to it from adjacent areas.

a) Fire Hazard and its Duration

The major factors used in assessing potential hazard are stand structure, species composition, and site. Another important factor requiring attention is the duration of hazard.

Stand structure refers to tree size and stocking level. Slash loading is directly related to these, in terms of stand height and number of stems cut.

Species composition has a strong effect on fuel hazard and its duration. This is due to differences in the flammability of needles, twigs, and branches and the effects of elapsed time since cutting. Flammability is related to particle size, distribution, and compaction, which determine the rate at which the fuels can be heated to ignition. Also, fine, well-aerated fuels dry and ignite more readily, and burn more rapidly than heavy or compact fuels. The contribution of foliage to hazard generally decreases after needle drop, except in western redcedar which tends to form mats suspended within the fuel bed.

Site factors such as soils, topography, and climate influence hazard through their effect on total biomass production before and vegetation response after spacing. Productive sites generally produce greater slash fuel loadings and post-spacing understory vegetation loadings than poorer sites. However, post-spacing vegetation response on more productive sites may increase the initial rate of slash breakdown through modification of surface microclimate. Also, canopy closure after spacing is attained more rapidly on productive sites, shading out surface vegetation and thus moderating the extremes of slash fuel moisture and temperature.

Duration of hazard in juvenile spacing fuels is determined by such inter-related processes as needle drop, fine fuel breakdown, crown closure, and shading-out of surface vegetation. The elapsed time of needle retention varies by species. Larch has the shortest needle retention, then hemlock, Douglas-fir, spruces, *Abies* species, and longest in the pines and western redcedar. Fine fuel breakdown also varies by species, with the fastest decomposition in larch and hemlock, followed by Douglas-fir, *Abies* species, spruces, pines, and slowest in western redcedar. Decomposition rates generally accelerate with increasing site productivity. The rates of crown closure and eventual shading-out of understory vegetation vary with site productivity.

b) Fire Weather

The moisture content of fine fuels and their flammability can vary greatly on a day-to-day and seasonal basis, depending on weather conditions. Weather can be assessed on local and broader scales, through study of weather station records, and on-site evaluation of local effects such as elevation and aspect. Projects exposed to local wind effects such as those on ridgetops, hillsides, and narrow passes should be given special recognition in fire suppression plans.

c) Topography

Topography has a major influence on fire behavior. Increases in slope greatly increase both fire spread rate and difficulty of control. Southern and westerly aspects generally present greater fire hazard through higher temperatures and lower relative humidities, resulting in faster drying rates and lower fuel moisture contents.

d) Fire Risk

Risk refers to the probability of fire occurring in or near the project. Local risk can be determined from historical fire patterns and from expected trends in access and use. Study of fire records is required to determine the historical risk associated with the area. Often the risk can be isolated to particular locations and/or attributed to specific causes. For example, local lightning risk may be related to topographic features such as ridges and plateaux and as a result, protection efforts may be directed to a particular area. Similar examples can also apply to man-caused fire risk.

2. Danger Rating System Description

The juvenile spacing project danger rating system was developed to assist silviculture and protection managers in establishing consistent ratings of hazard and risk presented by spacing slash. The project danger rating, expressed as the probability of extensive damage to the project and surrounding values, combines hazard and risk as shown in Figure 1. The analysis required to rate a project can be obtained by transmitting the information on the data input form (Appendix I) to the nearest B.C. Forest Service Regional Protection Office. The output received in response to this submission, as shown in Appendix II, will serve as a valuable tool in planning fire protection measures for the project. The following describes the assumptions and mechanics used in the design and construction of the rating system.

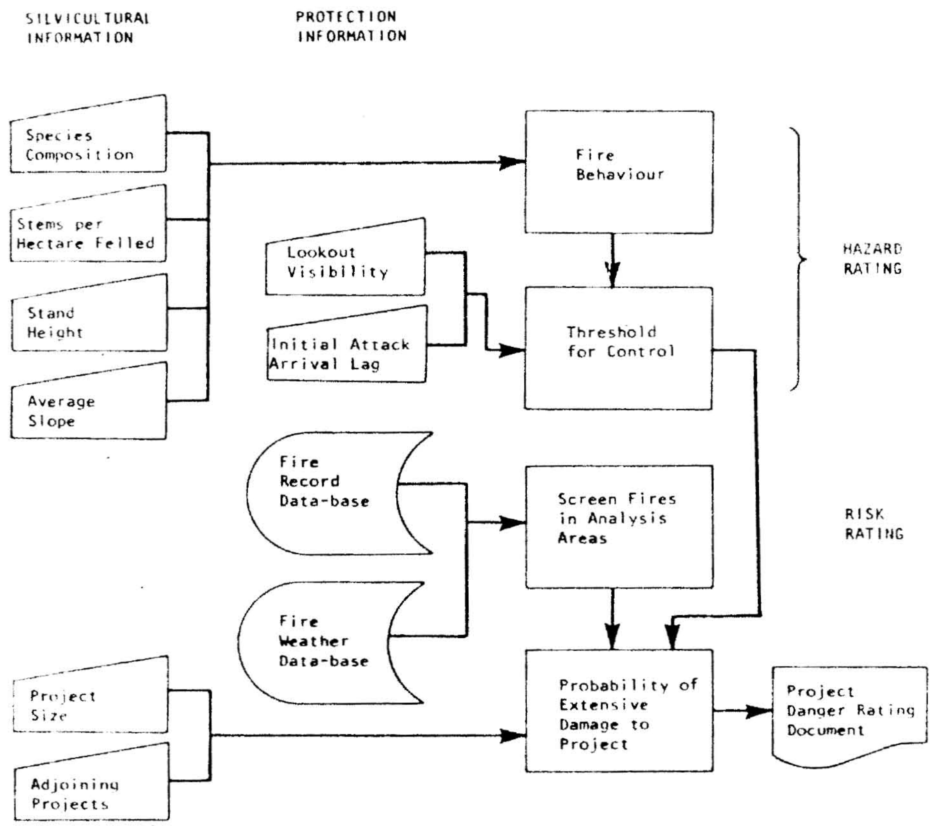


Figure 1. Flow diagram of information used to determine juvenile spacing project danger ratings.

a) Hazard

The hazard rating for a project is an estimate of the threshold of fire control, based on expected fire behavior and the capability of local fire control resources. The values for this rating were determined through a simulation analysis using relationships of rate of spread to Canadian Forest Fire Weather Index System (CFFWI) in B.C. logging slash fuels. The hazard rating is expressed as the Initial Spread Index, adjusted for Buildup Index, above which fire would not be contained at less than 100 ha in this project, and was determined using a simulation based on behavior and availability of fire control resources. Estimation of fire behavior comes from evaluation of potential fuel loading and predicted changes in local wind effects from opening the stand canopy. The fire control resource effectiveness evaluation is based on the visibility of the project to the nearest lookout, the expected arrival time of initial attack forces, and the effectiveness of fire control action based on the fire behavior and resistance to control (line construction).

The assumptions used in the simulation were that the fire was ignited at 1400 hrs, with detection times of 15 minutes for direct visibility, 30 minutes for indirect visibility, and 1 hour for blind areas. The initial attack effort was assumed to be by a crew of 6 members with air tanker support at the reported arrival time lag. (Based on reports of fire in spacing slash, it was considered that a single unsupported crew of 6 members would be able to gain control under only the most favorable fuel and weather conditions.) Further information concerning the simulation study methodology and specific results will be available under separate publication.

b) Fire Risk

Determination of fire risk entails estimation of the probability of fire occurrence. This is done through a computer analysis of the fire records using the B.C. Ministry of Forests fire history data-bank. The rating system estimates risk by calculating the distance from the project to fires dating from 1973. Fires within a 100 km^2 circle (5.64 km radius) are considered to be part of the local risk analysis area. Fires within a 1000 km^2 circle (17.84 km radius) are considered under the general risk analysis area. Based on the fire weather information associated with each reported fire, it is rated as either controllable or uncontrollable. If the ISI conditions on the day of ignition exceed the hazard rating calculated for the project in ISI units, then the fire is considered not controllable.

Due to limitations in estimating increases in the risk of ignitions in spacing slash, no attempt has been made to adjust the analysis although this may in fact be important in many areas. Railway fires are not included in the analysis when railroads are not present within .5 km of the project.

c) Juvenile Spacing Project Danger Rating Formula

The juvenile spacing project danger rating (JSPD) is calculated by using a complementary probability function based on the number of fires and area burned per year within the analysis areas. The function is composed of a term expressing the probability of an uncontrollable fire occurring in the project, and a term for the probability of a fire consuming the project from an outside source: (Note: this calculation is completed within the computer analysis described above.)

$$JSPD = 100\% \times (1 - (1-S/A)^{f} (1-B/A)^{d})$$

Where:

S = project size (hectares)

A = analysis area (100 km^2 or 1000 km^2 converted to hectares)

f = sum of uncontrollable fires over the duration of hazard in the analysis area. (f is assumed to decline at a straight line rate to no uncontrollable fires at hazard abatement.)

B = area burned per year (hectares) in the analysis area

d = hazard duration (years)

The JSPD rating is calculated for lightning and man-caused fires, using the mean of values derived for each of local and general risk analysis areas.

3. Use of the System

Rating of a project begins with collection of information for the data input form (Appendix I). This information is available from the Pre-Stand Tending Site-Description/Prescription (Form FS 770 Sil 81/9), project planning files, and District and Regional personnel:

-project location must be to the nearest minute of latitude and longitude.

-the entry for adjoining projects or blocks is for the total area of adjacent juvenile spacing projects or logging slash areas which are separated by a buffer of less than 30 metres from the project or other adjoining projects (see Section C.1.b).

-risk adjustments are made by excluding railway fires if no railways are present within .5 km of the project.

-species composition is based on the % of stems by species group being felled throughout the project. (Species are grouped by expected fuel loading result and hazard duration.)

-stand height is the average of dominants and codominants for all species in the project before spacing.

-number of stems felled/ha and average project slope are available on the F.S. 770.

-information on lookout visibility and initial attack times will be added during the analysis at the Regional Protection Office.

The Juvenile Spacing Project Danger Rating System is an aid to on-site assessment of local factors and situations. Output from the analysis is intended to help the user determine the magnitude of fire danger and give direction to managers in reducing the danger. Study of the causes of fire in the vicinity of the project will help direct specific acitivities to reducing the danger. The scale of Juvenile Spacing Project Danger Rating values are ranked as shown in Table 1.

Table 1. Ranking of Juvenile Spacing Project Danger Rating Values

	J.S.P.D. value (probability of extensive damage)		
JSPD Class	Man-caused	Lightning	Total JSPD (*)
Extreme	8.0 % or greater	4.0 % or greater	10.0 % or greater
High	5.0 - 7.9 %	2.5 - 3.9 %	6.0 - 9.9 %
Moderate	2.0 - 4.9 %	1.0 - 2.4 %	2.6 - 5.9 %
Low	1.9 % or less	0.9 % or less	2.5 % or less

(*) Total JSPD rating is the overall rating for the project combining man-caused and lighting fire occurrence [using the formula in B.2.c)] and is not a simple sum of the two individual ratings.

C. FIRE PROTECTION OF JUVENILE SPACING PROJECTS

Juvenile spacing project danger can be reduced at any phase of a juvenile spacing project:

1. Project planning phase
2. During active spacing operations
3. Following completion of spacing operations

1. Project Planning Phase

Efforts to protect juvenile spacing projects from fire will be most effective when done at the project planning stage. It is essential that project planning involve Silviculture and Protection personnel to ensure mutual understanding of the other's objectives and problems. The following factors, if agreed to at the planning phase will achieve the best compromise between silvicultural and fire protection objectives.

a) Spacing Method

Several spacing methods are available, each affecting fire hazard differently:

Powersaw or brush saw felling usually results in the highest fire hazard due to the resulting continuous and elevated fuel bed.

Mechanical thinning with heavy equipment tends to produce less hazard, especially row spacing with mulching equipment such as the Hydro-axe or Tomahawk which normally result in less continuous and more compact fuel beds with a higher rate of decay.

Chemical spacing reduces immediate protection problems as it does not concentrate ground fuel loadings, and standing dead crown fuels produced do not form a continuous fuel complex.

b) Buffer Strips

Buffer strips are corridors or margins of less hazardous fuel conditions designed to reduce risk of fire starts and reduce fire spread and intensity so that fire control can be more easily achieved. An unspaced buffer is most effective as it offers overstory protection from drying effects of insolation and wind. It consists of an unspaced leave strip kept free from spacing slash and roadside and logging debris. A spaced buffer, with the fuels removed following spacing, is less effective and generates additional cost. For these reasons, the unspaced buffer is generally preferred.

The recommended buffer width for a project may vary depending on local risk, hazard, and topography. Buffer strips along access corridors must account for risk of man-caused fire starts and slope. Buffers between projects must account for danger from both man and lightning fire starts. The widths recommended for both roadside and inter-project buffers are shown in Table 2.

Table 2. Recommended roadside and interproject buffer widths.

Man-caused JSPD rating	Roadside buffers slope up to project 0%	20%	40%	60%	Total JSPD rating	Inter-project buffers inter-project slope 0%	20%	40%	60%
	metres					metres			
0-2%	(likely not required)				0-2.5%	30	45-50	70-80	-*-
2-5%	10	15-20	25-30	40-50	2.5-6%	40	55-70	80-90	-*-
5-8%	20	30-35	45-50	60-70	6 -10%	50	70-80	-*-	-*-
8%+	30	45-50	70-80	90-100	10%+	60	80-90	-*-	-*-

Where designated by "-*-", the project would be more effectively treated by staggering spacing projects (see section d).

c) Project Block Size

The larger the project block, the more likely a target it is for both man and lightning caused fires. For areas of high danger a maximum project size of 50 hectares is recommended. For areas of low danger, blocks up to 100 hectares are acceptable. Larger blocks could be considered where the total danger is minimal. (The analysis program can be used to determine the effect of project size on the danger rating by entering different project sizes and comparing the resulting values.)

Note: Maximum block size should correspond to the area which can acceptably be lost to fire, as experience has shown that the chance of controlling most spacing slash fires exists only when slash and weather conditions are very favourable and control resources are immediately available.

d) Project Arrangement

Arrangement of projects is of concern because of the danger spacing fuels pose to surrounding projects and other values:

Project distribution must account for wildfire contingencies. Large blocks should be well dispersed, whereas small blocks can be concentrated provided adequate inter-block buffers are used.

Staggering projects can also prove valuable as a means of avoiding large continuous areas of slash. Staggering is recommended providing large enough untreated buffers can be left between projects to be economically spaced following abatement of the hazard in the initial spacing areas.

Fuel breaks, both natural and man-made, can be used when planning the location of projects. Lakes, rivers, deciduous stands, roads and powerlines offer fire protection advantages at no cost.

e) Protection Measures

Fire Prevention

Fire prevention is the first line of defense in fire protection:

Forest area and road closures are direct and project-specific measures to prevent man-caused fires during periods of dangerous fire weather. Section 115 of the Forest Act provides authority for the Minister to order imposition of forest use restrictions.

Signs and news media can be effectively employed to protect specific project areas.

Public contact is valuable for projects where the types of man-caused fires experienced in the area can be reduced by such contact.

Suspension of spacing operations may be necessary during periods of dangerous fire weather.

Fire Detection and Reporting

Rapid detection and reporting of fires on or adjacent to spacing projects is essential to protecting them. Due to higher than normal rates of fire spread in spacing fuels, detection must be rapid. For example, fires must be reported in less than 15 minutes during days of Danger Class III and greater to ensure that control efforts are successful. It is important to train all lookout and patrol staff on the location of spacing areas.

Manning of secondary lookouts may be required for the duration of hazard in spacing slash where coverage from existing lookouts is inadequate.

Ground patrols are an aid to detection as well as prevention especially where man-caused project danger is rated as high to extreme.

Air patrols are often of limited value as they cannot guarantee the quick detection times required to protect spacing projects. However, patrol routes which pass near concentrations of spacing projects should be adjusted to supplement ground coverage.

Fire Pre-Suppression

Pre-suppression refers to the planning and organizational efforts carried out in anticipation of fire occurrence. The first activity required is a study of spacing areas to determine protection requirements and to produce initial attack plans. These plans should include the required level of initial attack ground crews and air attack strength and on-site modifications such as fuel breaks. It may also be expedient to construct helispots near projects where access is not adequate. Where the hazard presents potential risk to life or property, it is advisable to establish formal control and contingency plans and inform local agencies of potentially dangerous fire situations.

2. During Active Spacing Operations

Fire problems can be reduced during the spacing activity itself, first by minimizing fire risk through observation of the Forest Fire Prevention Regulations, and second by reducing hazard under the spacing contract.

a) Forest Fire Prevention Regulations

It is required that all spacing operations conform to the provincial Forest Fire Prevention Regulations. These must be made clear to spacing supervisors, silviculture contractors, and crew members prior to commencement of activities. Enforcement of these Regulations is the responsibility of District Protection Staff.

b) Contract Requirements

Several activities during spacing operations can have positive effects in reducing the fire hazard. The following are possible options that could be used, either singly or in combination, to alleviate the hazard, none should be used unless cost-effective:

Directional falling, the practice of falling all trees in the same direction, is a cost-effective means of getting slash close to the ground to increase rate of decay, decrease fire spread rate and aid fire control efforts. Experience has shown that directional falling is easily accommodated in most contracts, and yields excellent results, often reducing spacing costs by minimizing hangups.

Lopping and scattering, although more expensive, can be beneficial, especially in cases where directional falling is difficult or resultant slash depths will exceed 1 metre.

Slash-height clauses which stipulate a maximum fuel depth, can be used as a form of hazard control.

Snag falling may also be considered, however, its value is more in the safety of the thinning operations (as covered by W.C.B.) than in fire hazard reduction. Snag falling may be useful in areas where lightning danger is extreme.

3. Following Completion of Spacing Operations

A variety of activities following the completion of spacing operations can effectively reduce the fire hazard. These measures may not be economically feasible for the entire project, but can often be for certain critical portions of the project.

Fuel removal is costly and should be used only where danger and values warrant.

Hand piling and burning is also expensive and presents a risk of damage to the residual stand. Burning of slash piles must be carried out with caution, during periods of Class I and possibly Class II fire weather, and only in projects where risk to the residual stems is limited, i.e., where openings between stems are adequate for safe burning.

Chipping is likely the most expensive means of fuel modification.

Walking-down or compacting slash can be cost-effective where the residual spacing is sufficiently wide to use small-scale heavy equipment without risk to the residual stems. The fuels should have dried for at least one season to permit adequate compaction.

Utilization (for firewood, posts and poles, rails, Christmas trees, and various other small products) is an additional means to cost-effectively reduce fuel-loading.

D. REPORTING OF JUVENILE SPACING SLASH FIRES

It is important that the behavior of fires in spacing and thinning slash be documented and reported so that the rating system can be calibrated. A copy of fire reports for spacing slash fires should be forwarded to Planning, Development, and Research Section, Protection Branch, Victoria. Where possible also include estimates of rate of fire spread on the head and flanks (with associated flame lengths if available), and the apparent effects the fire on the residual stand, surrounding stands, and values. As well, describe the suppression forces, strategies used, and effectiveness in combatting the fire.

E. SUMMARY

Rating the fire danger presented by juvenile spacing projects involves sincere effort on the part of both silviculture and protection personnel. The rating process outlined in this paper requires an investigation of the fuels being created, the proximity of other projects, and the capacity of local fire control resources. The Juvenile Spacing Project Danger Rating System provides values for project comparisons and estimates of the potential danger of particular practices in the planning and execution phases of spacing operations.

Table 3 consolidates protection measures by JSPD class. The recommended measures are cumulative for increasing danger, i.e. measures applied under low danger also apply under moderate, high, etc. Actions which are considered particularly effective for man-caused fires are found under man-caused danger, as are lightning fire measures under lightning danger. For inter-project and roadside buffers required on slopes, refer to Table 2. Details of all recommended measures are outlined in Section C of the guidelines.

Table 3. Summary of protection measures for Juvenile Spacing Projects

Total JSPD (% probability)	Inter-project Buffers (no slope)	Maximum Block Size	Recommended Measures
Low (0-2.5%)	30 metres	100 ha	Use directional falling
Moderate (2.5-5%)	40 metres	100 ha	Increase local detection and develop specific initial attack strategies
High (5-10%)	50 metres	75 ha	Stagger projects or treat surrounding hazardous fuels, increase presuppression capabilities
Extreme (10% +)	60 metres	50 ha	Consider alternative projects, reduce project size, review spacing methods, etc.

Man-caused JSPD (% probability)	Road-side Buffers (no slope)	Recommended Measures
Low (0-2%)	may not be required	Increase local prevention efforts
Moderate (2-5%)	10 metres	Apply road closures & specific prevention programs (Patrols, signs, etc.)
High (5-8%)	20 metres	Increase lookout coverage if economically feasible (manning of secondary lookouts, etc.)
Extreme (8% +)	30 metres	Develop specific prevention strategies

Lightning JSPD (% probability)	Recommended Measures
Low (0-1%)	No specific measures recommended
Moderate & High (1-4%)	Construct helispots within project or vicinity
Extreme (4% +)	Consult the Regional & District Fire Suppression Officers to assess fire detection and suppression capabilities.

APPENDIX I

Juvenile Spacing Project Danger Rating System Input Form

PROJECT IDENTIFICATION ________________ BLOCK ______________

LOCATION: LATITUDE _____° ___' LONGITUDE _____° ___'

FOREST REGION ------------------- ____________________
- Other FOREST REGIONS within ____________________
  40 km of the project ____________________

PROJECT/BLOCK SIZE __________.__ ha

AREA OF ADJOINING PROJECTS/BLOCKS SEPARATED BY LESS THAN 30 m OF BUFFER:

PROJECT/BLOCK	AREA	YEAR SPACING COMPLETED
____________	_______.__ ha	19__
____________	_______.__ ha	19__
____________	_______.__ ha	19__
____________	_______.__ ha	19__
____________	_______.__ ha	19__
____________	_______.__ ha	19__

ACTIVE RAILWAYS WITHIN .5 km OF PROJECT?
☐-YES ☐-NO

SPECIES COMPOSITION: (% of total felled stems for all species in Group)

GROUP 1	GROUP 2	GROUP 3	GROUP 4	GROUP 5
_____.__ %	_____.__ %	_____.__ %	_____.__ %	_____.__ %
Coastal Douglas-fir Biogeoc. zone: (check one) ☐- Coastal west. hemlock ☐- Coastal Douglas-fir	Hemlock species	Interior Douglas-fir, Abies species, Spruce species	Redcedar, Yellow cedar, Pine species	Larch species, Broadleaf species

(Note: Ensure that the total composition is 100%.)

STAND HEIGHT (Dom. & Codom. prior to treatment) _____.__ m

NUMBER OF STEMS FELLED PER HECTARE DURING SPACING _______.__

AVERAGE PROJECT SLOPE _____.__ %

VISIBILITY FROM MOST VISIBLE MANNED LOOKOUT - (check one)
☐-DIRECTLY VISIBLE ☐-INDIRECTLY VISIBLE ☐-BLIND

ESTIMATED ARRIVAL TIMES (both initial attack crews may have the same arrival time)

NEAREST ESTABLISHED INITIAL ATTACK CREW ______ minutes
SECOND NEAREST INITIAL ATTACK CREW ______ minutes
NEAREST AIR TANKER UNDER YELLOW ALERT ______ minutes

APPENDIX II

Sample Calculation of Juvenile Spacing Project Danger Rating

Included are:

Appendix II(a) - completed Pre-Stand Tending Site-Description/Prescription (Form FS 770 Sil 81/9) & area map showing surrounding projects
Appendix II(b) - completed Juvenile Spacing Project Danger Rating System Input Form
Appendix II(c) - J.S.P.D. Rating System printout and interpretation

Application of the rating system for hypothetical project "92K4 - 999" began with completion of the Juvenile Spacing Project Danger Rating Input Form. (For blocks separated by more than 30 metres of unspaced buffer, a separate form would be required.) The location of the center of the project was determined to the nearest minute of latitude and longitude. Measurement of the distance to other forest regions was also carried out to ensure inclusion of fires from other regions. However, this example is not within 40 km of any outside region. The project size was estimated at 81 hectares. There were 5 blocks within 30 metres of the project as indicated on the form. Distance to the nearest active railroad was checked and found to be within .5 km. The species composition and stand height was estimated based on pre-spacing stem counts as found on the F.S. 770. The number of stems to be felled during spacing operations was obtained by subtracting the number of stems to be left from the total pre-treatment stem count. Lookout visibility was determined from visibility maps. Crew arrival times were estimated based on anticipated crew locations and transportation.

The data collected on the Juvenile Spacing Danger Rating System Input Form was entered into the computer program using Protection Fire Report Menu, Option 8 (available through Protection computing facilities in all Forest Service Regional offices).

Province of British Columbia
Ministry of Forests

Appendix II(a)

PRE-STAND TENDING SITE-DESCRIPTION/PRESCRIPTION

AREA IDENTIFICATION:

~~PSYU~~ (TSA): COAST District: CAMPBELL RIVER
Location: S-W END OF CAMPBELL LAKE (50°00' 125°34')
Area Name: ______ Unit: 92K4 - 999 Mapsheets: 92K4
Air Photo Numbers: ______ U.T.M. Grid: ______

Project Proposed By: F.S. ✓ or Licensee (name) ______

Sec. 88 Ref. Number: ______ Licence/Agreement Number: ______

ACCESS:

Distance: ______ km From: ______ By: ______
______ Travel Time One Way: ______ Hrs.
Road Improvements Required: ______

AREA DESCRIPTION:

Net Area to be Treated: 81 ha. Ecosystem Association: CDF
Soils: ______ Drainage: ______
Avg. Slope Per Cent: 10 Slope Position: MID Slash Class: ______ Slash Per Cent ______
Brush Class ______ Aspect: NE Elevation Range: ______
Topography: ______ Machine Trafficability: ______

STAND DESCRIPTION:

Forest Type: FHC Site Index: ______ History: ______

Density (stems per hectare):

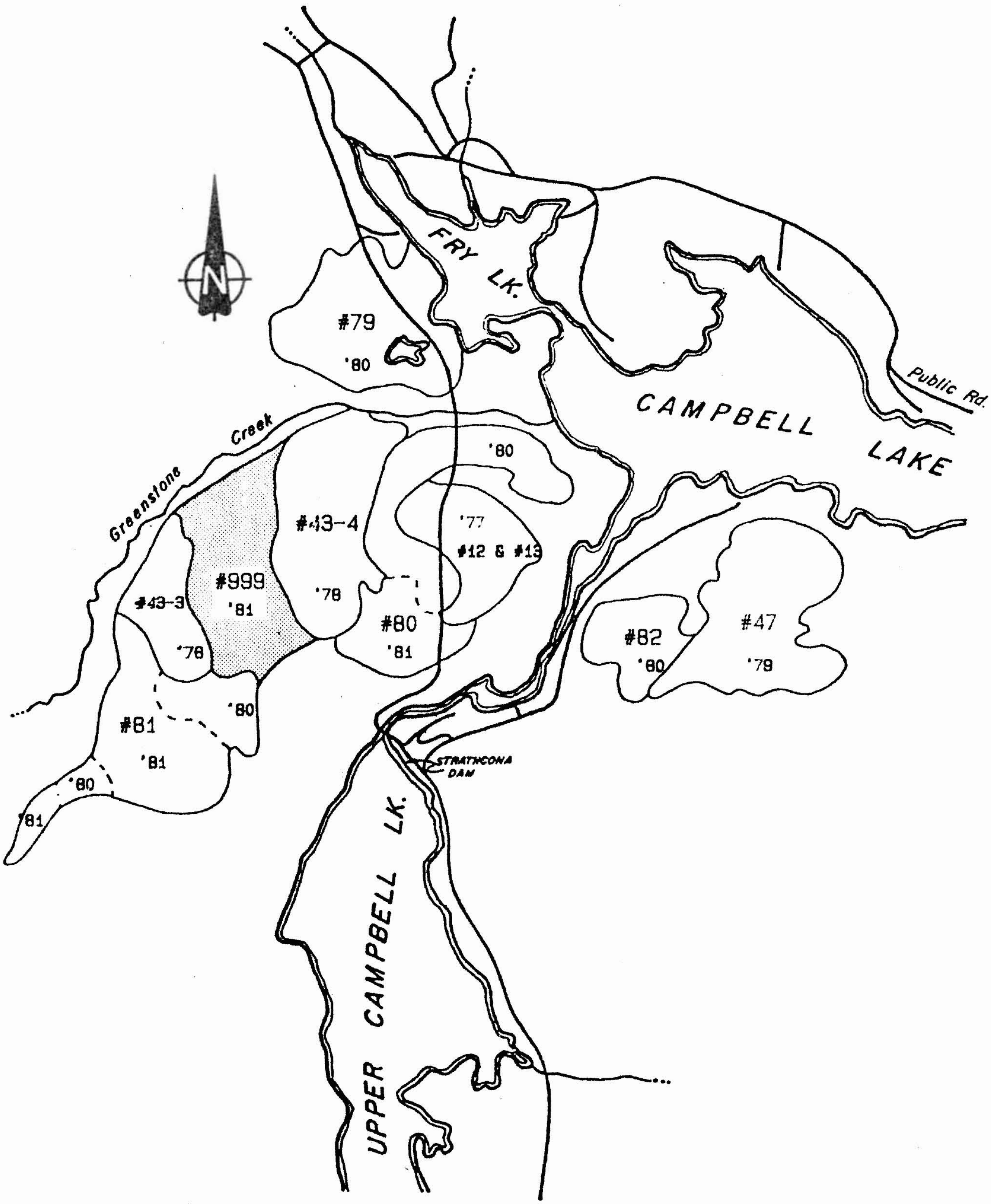
SPP	DBH Class (cm)							Unaac	Σ	Snags
DF									4020	
H									1237	
C									928	
Σ									6185	Total S.P.H.

Sample Tree Information: Per Cent Stocking: ______

SPP	DBH (cm)		Height (m)		Age		Per Cent Live Crown	
	Average	Range	Average	Range	Average	Range	Average	Range
			13 m					

FS 770 SIL 81.9

Map of Campbell River 92K4 Juvenile Spacing Projects
Surrounding Project 92K4 - 999 (Planned for 1981)



Appendix II(b)

Juvenile Spacing Project Danger Rating System Input Form

PROJECT IDENTIFICATION 92K4-999 BLOCK N/A

LOCATION: LATITUDE 50 ° 00 ' LONGITUDE 125 ° 34 '

FOREST REGION -------------------- VANCOUVER
- Other FOREST REGIONS within 40 km of the project ______

PROJECT/BLOCK SIZE 81. ha

AREA OF ADJOINING PROJECTS/BLOCKS SEPARATED BY LESS THAN 30 m OF BUFFER:

PROJECT/BLOCK	AREA	YEAR SPACING COMPLETED
92K4-81	114. ha	1981
43	122. ha	1978
12	16. ha	1977
13	19. ha	1977
80	98. ha	1981
	. ha	19

ACTIVE RAILWAYS WITHIN .5 km OF PROJECT?
[✓]-YES [ ]-NO

SPECIES COMPOSITION: (% of total felled stems for all species in Group)

GROUP 1	GROUP 2	GROUP 3	GROUP 4	GROUP 5
65. %	20. %	. %	15. %	. %
Coastal Douglas-fir	Hemlock species	Interior Douglas-fir, Abies species, Spruce species	Redcedar, Yellow cedar, Pine species	Larch species, Broadleaf species

Group 1 — Biogeoc. zone: (check one)
[ ]- Coastal west. hemlock
[✓]- Coastal Douglas-fir

(Note: Ensure that the total composition is 100%.)

STAND HEIGHT (Dom. & Codom. prior to treatment) 13. m

NUMBER OF STEMS FELLED PER HECTARE DURING SPACING 5785.

AVERAGE PROJECT SLOPE 10. %

VISIBILITY FROM MOST VISIBLE MANNED LOOKOUT - (check one)
[ ]-DIRECTLY VISIBLE [ ]-INDIRECTLY VISIBLE [✓]-BLIND

ESTIMATED ARRIVAL TIMES (both initial attack crews may have the same arrival time)

NEAREST ESTABLISHED INITIAL ATTACK CREW 25 minutes
SECOND NEAREST INITIAL ATTACK CREW 35 minutes
NEAREST AIR TANKER UNDER YELLOW ALERT 30 minutes

Appendix II(c)
J.S.P.D. Rating System printout and interpretation.

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JUVENILE SPACING PROJECT DANGER RATING SYSTEM   (RUN DATE: 82/12/30)
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PROJECT/BLOCK NAME - 92K4 - 999              LAT. 50  0' LONG. 125 34'
PROJECT/BLOCK AREA -  81.0 HA, YEAR OF SPACING - 1981
ADJOINING AREAS:      PROJ./BLOCK  AREA   YEAR SPACED
                           1      114.0      1981
                           2      122.0      1978
                           3       16.0      1977
                           4       19.0      1977
                           5       98.0      1981

  SPECIES COMPOSITION:
 65.0% COASTAL DOUGLAS-FIR
   (COASTAL DOUGLAS-FIR BIOGEOCLIMATIC ZONE)
 20.0% HEMLOCK SPECIES
 15.0% REDCEDAR, YELLOW CEDAR, PINE SPECIES
STAND HT -  13.0 M, STEMS/HA FELLED -  5875.0, SLOPE - 10.0 %
PROJECT VISIBILITY CLASS - 3, EXPECTED I.A. LAG - 30.0 MINUTES

   LIFE EXPECTANCY OF THE HAZARD IS  7.7 YEARS
   INITIAL SPREAD INDEX CONTROL THRESHOLD =       1.4

THE FOLLOWING IS A LIST OF ALL FIRES OCCURRING FROM 1973 TO 1981
  WITHIN A 1000 SQ. KM CIRCLE (17.84 KM RADIUS) OF THE PROJECT
  FIRES MARKED WITH "****" HAVE OCCURRED WITHIN A 100 SQ KM
  CIRCLE (5.64 KM RADIUS) OF THE PROJECT.

  (RAILWAY FIRES ARE INCLUDED IN THIS ANALYSIS)

THE LISTED INFORMATION INCLUDES THE FIRE NUMBER, DETECTION
  LAG (INCLUDING REPORT) AND INITIAL ATTACK LAG IN MINUTES,
  THE LATITUDE AND LONGITUDE REPORTED FOR THE FIRE,
  THE INITIAL SPREAD INDEX ADJUSTED FOR BUILDUP INDEX,
  FINAL FIRE SIZE, GENERAL CAUSE, AND DISTANCE FROM PROJECT
```

FIRE NUMBER	TIME LAG(MIN) DETECT.	ATTACK	LAT.	LONG.	I.SPREAD INDEX	SIZE (HA)	GENERAL CAUSE	SPECIFIC CAUSE	DISTANCE (KM)
73 217 8	30	150	49555	125394	0.0	1.6	RECREATIONAL	SMOKER	13.47
****73 217 33	672	84	50032	125572	5.6	0.1	RECREATIONAL	SMOKER	3.62
73 217 55	618	138	49948	125521	6.2	0.1	RECREATIONAL	SMOKER	6.72
****73 217 59	18	36	49952	125610	7.0	9.3	RECREATIONAL	SMOKER	3.26
73 217203	330	12	49861	125521	14.5	0.1	RECREATIONAL	SMOKER	16.12
73 217216	60	132	49992	125644	1.5	0.1	LIGHTNING		5.66
74 217 11	60	36	49862	125632	11.0	0.1	RECREATIONAL	SMOKER	15.47
****74 217120	78	54	50039	125571	14.5	0.8	RECREATIONAL	CAMPFIRE	4.40
75 217121	6	156	50119	125414	6.1	0.1	MISC KNOWN	BURNING BUILDING	17.33
75 217673	60	36	50003	125753	7.4	0.1	RECREATIONAL	CAMPFIRE	13.47
76 217 5	930	30	50075	125776	0.0	2.9	LOGGING	SMOKER	17.30
77 217 68	90	30	50014	125368	1.4	0.1	RECREATIONAL	SMOKER	14.50
77 217179	18	6	50010	125356	16.3	0.1	RECREATIONAL	SMOKER	15.27
78 217 4	15	60	50125	125471	2.1	1.0	RECREATIONAL	SMOKER	15.76
78 217 11	18	48	50046	125333	11.7	0.1	RECREATIONAL	SMOKER	17.65
78 217 12	24	12	50016	125379	13.5	0.1	RECREATIONAL	SMOKER	13.71
78 217 14	1260	120	49883	125631	0.6	0.1	UNKNOWN	NO INFORMATION	13.98
79 217 3	228	12	50046	125744	2.9	0.1	RECREATIONAL	SMOKER	13.61
79 217 5	120	210	49992	125438	0.2	0.1	RECREATIONAL	SMOKER	9.35
79 217 7	6	12	50133	125687	7.2	0.1	LOGGING	BURNING VEHICLE	17.29
79 217 12	1242	84	49869	125460	0.2	0.1	LIGHTNING		16.63
79 217 13	1020	6	50018	125765	1.9	8.0	LOGGING	SLASH BURN	14.48
80 2 6 5	6	24	50075	125492	4.4	0.1	MISC KNOWN	INCENDIARY	10.01
80 2 6 24	1440	1656	49912	125632	10.5	0.1	RECREATIONAL	CAMPFIRE	10.97
81 2 5 21	168	24	50119	125414	0.2	0.1	LIGHTNING		17.33
81 2 8 22	30	15	50082	125471	0.3	0.1	LIGHTNING		11.61

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================  FIRE OCCURRENCE SUMMARY  ================

   SUMMARY OF AVERAGE ANNUAL NUMBER OF FIRES AND AREA BURNED
    -UNCONTROLLABLE FIRES ARE THOSE WHOSE ISI EXCEEDS THE
    THRESHOLD CALCULATED FOR THE SLASH HAZARD CONDITIONS.
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ANALYSIS AREA	MAN CAUSED CONTROLLABLE FIRES (#)	MAN CAUSED CONTROLLABLE AREA (ha)	MAN CAUSED UNCONTROLLABLE FIRES (#)	MAN CAUSED UNCONTROLLABLE AREA (ha)	LIGHTNING CAUSED CONTROLLABLE FIRES (#)	LIGHTNING CAUSED CONTROLLABLE AREA (ha)	LIGHTNING CAUSED UNCONTROLLABLE FIRES (#)	LIGHTNING CAUSED UNCONTROLLABLE AREA (ha)
	AVERAGE PER YEAR							
100 SQ.KM.	0.	0.	0.33	1.13	0.	0.	0.	0.
1000 SQ.KM.	0.44	0.01	2.00	2.25	0.33	0.03	0.11	0.01

```
================  PROJECT DANGER ANALYSIS  ================

THE ESTIMATED RISK OF PROJECT/BLOCK 92K4 - 999          AND SURROUNDING
  BLOCKS SUFFERING EXTENSIVE DAMAGE THROUGH FIRE IS  3.60 %
  OVER THE ESTIMATED   7.7 YEAR LIFE OF THE SPACING-SLASH HAZARD.
    3.53 % IS ATTRIBUTABLE TO MAN-CAUSED FIRES AND
    0.07 % IS A RESULT OF LIGHTNING FIRE RISK.
  (THE TOTAL RISK VALUE IS NOT A NUMERICAL SUM OF MAN-CAUSED
        AND LIGHTNING CAUSED RISK VALUES)

FOLLOWING THE ABATEMENT OF THINNING-SLASH HAZARD,
  RISK OF LOSING THE PROJECT STILL REMAINS BUT AT A
  MORE NORMAL LEVEL OF ABOUT 0.007 % PER YEAR.

================  PROJECT DANGER RATING CLASSES  ================

  THE MAN-CAUSED PROJECT-DANGER IS RATED MODERATE
  THE LIGHTNING-CAUSED PROJECT-DANGER IS RATED LOW
  THE TOTAL PROJECT-DANGER IS RATED MODERATE
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Interpretation of the Juvenile Spacing Project Danger Rating results:

This example shows the result of rating the hypothetical project "92K4 - 999". The output indicates that the project is under moderate danger of being destroyed by fire, estimated at a probability of just over 3.5 **%**. The major source of the danger is man-caused fires, and more specifically, as shown by the fire listing, due to careless smoking by recreationists. This would indicate that the collection of projects including 92K4 - 999 could be better protected through a prevention effort such as road closures and patrols on all access routes. Development of specific initial attack strategies is also recommended. Protection from lightning fires does not appear to be critical.

Any spacing area neighboring this collection of projects should be separated by a buffer of at least 40 metres on level ground (see Table 2). Spacing of surrounding untreated buffers should be possible at approximately 7 to 8 years following completion of this project.

It may be useful to determine the degree of fire danger to estimate the cost-effectiveness of fire protection measures. An estimate of the positive side of a cost/benefit analysis could be applied as follows:

$$B = (JSPD/100\%) \times (E/100\%) \times I$$

Where: B = benefit in $

JSPD = appropriate Juvenile Spacing Project Danger value in %

E = the expected reduction of fires in %

I = the investment in the project and adjoining blocks in $

For example, where man-caused fires contributed an 8% probability of fire damage to a $100,000 spacing investment, and prevention measures could reduce the number of expected fires by 25% at a cost of $1000, the potential benefit could be calculated at about $2000. Consideration should also be given to the expected reduction in potential suppression costs which may be included as additional benefit, whereas surrounding forest and property values at risk may be included as part of the investment component.

For further assistance in interpretation of the results of this or other output, contact Protection Branch, Victoria.