

Appendices

Appendix 1 Species Groupings

Use the following species for stump diameter conversion (Chapter 6), Taper equation coefficients (Chapter 7), and Harvesting Method Summaries (Chapter 13).

Species Reported	Species Codes Used
Alder	D, DR
Aspen	AT
Balsam	B, BA, BG, BL
Birch	E, EP, EN
Red Cedar	C, CW
Yellow Cedar	Y, Yc
Douglas Fir	F, FD
Hemlock	H, HW, HM
Larch	L, LL, LO, LT
Broadleaf Maple	MB
Lodgepole Pine	PL
White Pine	PW
Albicaulis Pine	PA
Yellow Pine	PY
Cottonwood	AC
Spruce	S, SB, SE, SS, SW

Use the following species groupings for all other summaries.

Species Reported	Species Codes Used	Species Reported	Species Codes Used
Alder	D, DR	Larch	L
Aspen	AT	- Tamarack	LT
Balsam	B	- Western	LO
- White Fir	BA	- Alpine	LL
- Grand Fir	BG	Broadleaf Maple	MB
- Mountain Fir	BL	White Pine	PW
Birch	E, EP, EN	Lodgepole Pine	PL
Red Cedar	C, CW	Albicaulis Pine	PA
Yellow Cedar	Y, YC	Yellow Pine	PY
Fir - (Quality 1)	F, FD	Cottonwood	AC
- (Quality 2)	F, FD	Spruce	S
- (Quality 3)	F, FD	- Sitka	SS
Hemlock	H	- Englemann	SE
- Western	HW	- White	SW
- Mountain	HM	- Black	SB
		Western Yew	T

Appendix 2 Allowable Species By Forest Inventory Zone

S P E C I E S																	
		F	C	H	B	S	Y	Pw	Pl	Py	L	Ac	D	Mb	E	AT	Pa
F O R E S T	A	X	X	X	X	X	X	X	X	C	H	X	X	X	X	X	X
	B	X	X	X	X	X	X	X	X	C	H	X	X	X	X	X	X
	C	X	X	X	X	X	X	X	X	X	D	X	X	X	X	X	X
	D	X	X	X	X	X	X	X	X	X	X	X	C	C	X	X	X
	E	X	X	X	X	X	X	X	X	X	X	X	C	C	X	X	X
	F	X	X	X	X	X	G	X	X	X	X	X	C	C	X	X	X
I N V E N T O R Y	G	X	X	X	X	X	X	X	X	X	X	X	C	C	X	X	X
	H	X	X	X	X	X	A	X	X	D	X	X	B	A	X	X	X
	I	X	X	X	X	X	J	H	X	G	X	X	J	A	X	X	X
	J	I	X	X	X	X	X	H	X	G	I	X	X	A	X	X	X
	K	I	J	X	X	X	J	H	X	G	X	X	X	A	X	X	A
	L	I	I	K	X	X	J	H	X	G	X	X	K	A	X	X	J

X -indicates that the species may be found in the Forest Inventory Zone

When a species is not normally found in a FIZ a letter other than an X will be present. This letter represents the FIZ to use for calculating volume as well as Decay Waste and Breakage for the species.

When a letter other than an X is present it will initiate a warning message in the cruise compilation program.

Appendix 3 Allowable Pathological Remarks By Forest Inventory Zone

A3.1 Coast Immature

The following table is for immature trees in Forest Inventory Zones A, B & C.

Species	Conk	Blind Conk	Scars	Fork & Crook	Frost Crack	Mistle Toe	Rotten Branch	Dead Top
Douglas Fir							N	
Cedar						N	N	
Yellow Cedar		N				N		
White Pine						N		
Yellow Pine						N		
Larch	N	N	N	N	N	N	N	N
Cottonwood		N				N		
Alder		N				N		
Maple		N				N		
Birch		N				N		
Aspen		N				N		
White Bark Pine						N		

"N" indicators will be included as warnings in the Edit Error Report. The "N" indicated samples would be allowed to process to completion.

A3.2 Coast Mature

The following table is for mature trees in Forest Inventory Zones A, B and C.

Species	Conk	Blind Conk	Scars	Fork & Crook	Frost Crack	Mistle Toe	Rotten Branch	Dead Top
Cedar						N		
Yellow Cedar		N				N		
White Pine						N		
Yellow Pine						N		
Larch	N	N	N	N	N	N	N	N
Cottonwood		N				N		
Alder		N				N		
Maple		N				N		
Birch		N				N		
Aspen		N				N		
White Bark Pine						N		

"N" indicators will be noted as warnings in the Edit Error report.
The "N" indicated samples would be allowed to process to completion.

A3.3 Interior Immature

The following table is for immature trees in Forest Inventory Zones D-L.

Species	Conk	Blind Conk	Scars	Fork & Crook	Frost Crack	Mistle Toe	Rotten Branch	Dead Top
Douglas Fir							N	
Cedar						N	N	
Hemlock						N		
Yellow Cedar		N				N		
White Pine						N		
Yellow Pine						N		
Cottonwood		N				N		
Alder	N	N	N	N	N	N	N	N
Maple	N	N	N	N	N	N	N	N
Birch		N				N		
Aspen		N				N		
White Bark Pine						N		

"N" indicators will be noted as warnings in the Edit Error report. The "N" indicated samples would be allowed to process to completion.

A3.4 Interior Mature

The following table is for mature trees in Forest Inventory Zones D-L.

Species	Conk	Blind Conk	S cars	Fork & Crook	Frost Crack	Mistle Toe	Rotten Branch	Dead Top
Cedar						N		
Hemlock						N		
Yellow Cedar		N				N		
White Pine						N		
Yellow Pine						N		
Larch						N(1)		
Cottonwood		N				N		
Alder	N	N	N	N	N	N	N	N
Maple	N	N	N	N	N	N	N	N
Birch		N				N		
Aspen		N				N		
White Bark Pine						N		

(1) Zones K and L only

"N" indicators will be noted as warnings in the Edit Error report. The "N" indicated samples would be allowed to process to completion.

Appendix 4 Maximum Height by Forest Inventory Zone

	S P E C I E S																
		F	C	H	B	S	Y	Pw	Pl	Py	L	Ac	D	Mb	E	At	Pa
F O R E S T	A	81	81	81	78	81	60	72	42	42	45	72	45	36	36	42	33
	B	90	81	81	78	81	60	72	42	42	45	72	45	36	36	36	33
	C	81	81	81	78	90	60	72	42	42	54	72	45	36	36	36	33
I N V E N T O R Y	D	60	54	54	51	60	42	53	42	42	54	54	45	36	42	42	33
	E	72	60	60	57	57	42	60	42	48	60	54	45	36	42	42	33
	F	72	60	60	57	57	42	60	42	48	60	54	45	36	42	42	33
Z O N E	G	72	60	60	57	57	42	60	42	48	60	54	45	36	42	42	33
	H	60	54	54	54	54	60	42	42	42	45	54	45	36	42	33	33
	I	60	54	54	54	54	54	42	42	48	45	54	33	36	42	42	33
	J	60	54	54	54	60	54	42	42	48	45	60	33	36	42	42	33
	K	60	54	54	54	60	54	42	42	48	54	60	33	36	42	42	33
	L	60	54	54	45	54	54	42	42	48	36	54	33	36	42	42	33

Minimum height is 3 m.

Appendix 5 Maximum Age by Forest Inventory Zone

S P E C I E S																	
		F	C	H	B	S	Y	Pw	Pl	Py	L	Ac	D	Mb	E	AT	Pa
F	A	800	600	600	500	600	800	500	300	500	500	300	200	200	200	200	400
O	B	800	600	600	500	600	800	500	300	500	500	300	200	200	200	200	400
R	C	800	600	600	500	600	800	500	300	500	500	300	200	200	200	200	400
E	D	500	400	400	400	400	800	500	300	500	500	300	200	200	200	200	400
S	E	500	400	400	400	400	800	500	300	500	500	300	200	200	200	200	400
T	F	500	400	400	400	400	800	500	300	500	500	300	200	200	200	200	400
I	G	500	400	400	400	400	800	400	300	500	500	300	200	200	200	200	400
N	H	500	400	400	400	400	800	500	300	500	500	300	200	200	200	200	400
V	I	500	400	400	400	400	800	500	300	500	500	300	200	200	200	200	400
E	J	500	400	400	400	400	800	500	300	500	500	300	200	200	200	200	400
N	K	500	400	400	400	400	800	500	300	500	500	300	200	200	200	200	400
Z	L	500	400	400	400	400	800	500	300	500	500	300	200	200	200	200	400
O																	
N																	
E																	

Minimum age is 40 years.

Appendix 6 Regions and District Numbers

Region	Number	Code	District Name	Number	FTAS Code
Coast	1	RCO	Chilliwack	01	DCK
			Squamish	02	DSQ
			Sunshine Coast	03	DSC
			South Island	04	DDU
			Campbell River	05	DCR
			North Island-Central Coast (Port McNeill, Mid-Coast)	06	DIC
			Queen Charlotte	07	DQC
			North Coast	08	DNC
Southern Interior	2	RSI	Headwaters (Clearwater, Robson Valley)	01	DHW
			Kamloops	02	DKA
			Okanagan Shuswap (Vernon, Penticton, Salmon Arm)	03	DOS
			Cascades (Merritt, Lillooet)	04	DCS
			Chilcotin	05	DCH
			Central Cariboo (Williams Lake, Horsefly)	06	DCC
			Quesnel	07	DQU
			100 Mile House	08	DMH
			Arrow Boundary (Arrow, Boundary)	09	DAB
			Columbia	10	DCO
			Rocky Mountain (Cranbrook, Invermere)	11	DRM
			Kootenay Lake	12	DKL
Northern Interior	3	RNI	Prince George	01	DPG
			Vanderhoof	02	DVA
			Fort St James	03	DJA
			MacKenzie	04	DMK
			Peace (Dawson Creek, Fort St. John)	05	DPC
			Fort Nelson	06	DFN
			Skeena Stikine (Bulkley, Cassiar, Kispiox)	07	DSS
			Nadina (Lakes, Morice)	08	DND
			Kalum	09	DKM

Re-organization has resulted in the amalgamation of several districts. District names not in brackets replace names in brackets where applicable.

Appendix 7 Lumber Recovery Factors

The following table lists the lumber recovery factors in board feet per cubic meter.

Log Top Dia.	F-db	F-wb	F-qc1	F-qc2	C	H	B	S	YC
4.5 - 5.49	91	91	100	91	91	91	91	91	91
5.5 - 6.49	102	103	109	100	97	102	103	103	102
6.5 - 7.49	111	113	118	109	103	111	113	113	111
7.5 - 8.49	120	123	128	119	108	120	123	123	120
8.5 - 9.99	129	134	139	130	115	129	134	134	129
10.0 - 14.9	151	158	170	160	132	151	158	158	151
15.0 - 19.9	172	185	217	206	156	172	185	185	172
20.0 - 24.9	187	202	246	234	177	187	202	202	187
25.0 - 29.9	199	217	266	251	197	199	217	217	199
30.0 - 34.9	210	226	279	262	215	210	226	226	210
35.0 - 39.9	217	234	287	270	227	217	234	234	217
40.0 - 44.9	222	240	292	275	235	222	240	240	222
45.0 - 49.9	228	246	297	279	238	228	246	246	228
50.0 - 54.9	233	252	299	281	239	233	252	252	233
55.0 - 59.9	237	258	302	282	239	237	258	258	237
60.0 - 64.9	240	263	302	282	237	240	263	263	240
65.0 - 69.9	241	266	303	281	233	241	266	266	241
70.0 - 74.9	240	267	302	280	228	240	267	267	240
75.0 - 79.9	237	265	302	279	223	237	265	265	237
80.0 - 84.9	234	263	301	277	217	234	263	263	234
85.0 - 89.9	231	261	298	275	210	231	261	261	231
90.0 - 94.9	227	259	297	273	201	227	259	259	227
95.0 - 99.9	224	257	295	272	193	224	257	257	224
100.0 +	221	254	295	269	184	221	254	254	221

Figure A.7a Lumber Recovery Factors.

All Balsam logs in trees with DWB summing 48% or over in the interior will have a LRF of zero. See Appendix A10.2 for information concerning dead white pine LRF. See Appendix A10.1 for information concerning hemlock LRF.

Log Top Dia.	Pw	Pl	Py	L	Ac	D	Mb	E	At	Pa
4.5 - 5.49	91	91	91	91	91	91	91	91	91	91
5.5 - 6.49	102	103	103	103	103	103	103	103	103	103
6.5 - 7.49	111	113	113	113	113	113	113	113	113	113
7.5 - 8.49	120	123	123	123	123	123	123	123	123	123
8.5 - 9.99	129	134	134	134	134	134	134	134	134	134
10.0 - 14.9	151	158	158	158	158	158	158	158	158	158
15.0 - 19.9	172	185	185	185	185	185	185	185	185	185
20.0 - 24.9	187	202	202	202	202	202	202	202	202	202
25.0 - 29.9	199	217	217	217	217	217	217	217	217	217
30.0 - 34.9	210	226	226	226	226	226	226	226	226	226
35.0 - 39.9	217	234	234	234	234	234	234	234	234	234
40.0 - 44.9	222	240	240	240	240	240	240	240	240	240
45.0 - 49.9	228	246	246	246	246	246	246	246	246	246
50.0 - 54.9	233	252	252	252	252	252	252	252	252	252
55.0 - 59.9	237	258	258	258	258	258	258	258	258	258
60.0 - 64.9	240	263	263	263	263	263	263	263	263	263
65.0 - 69.9	241	266	266	266	266	266	266	266	266	266
70.0 - 74.9	240	267	267	267	267	267	267	267	267	267
75.0 - 79.9	237	265	265	265	265	265	265	265	265	265
80.0 - 84.9	234	263	263	263	263	263	263	263	263	263
85.0 - 89.9	231	261	261	261	261	261	261	261	261	261
90.0 - 94.9	227	259	259	259	259	259	259	259	259	259
95.0 - 99.9	224	257	257	257	257	257	257	257	257	257
100.0 +	221	254	254	254	254	254	254	254	254	254

Figure A.7b Lumber Recovery Factors.

Appendix 8 Removed

This Appendix has been removed.

Appendix 9 Coast Log Grade Algorithms

Explanatory Notes for Coast Metric Standing Tree Log Grading Flowcharts

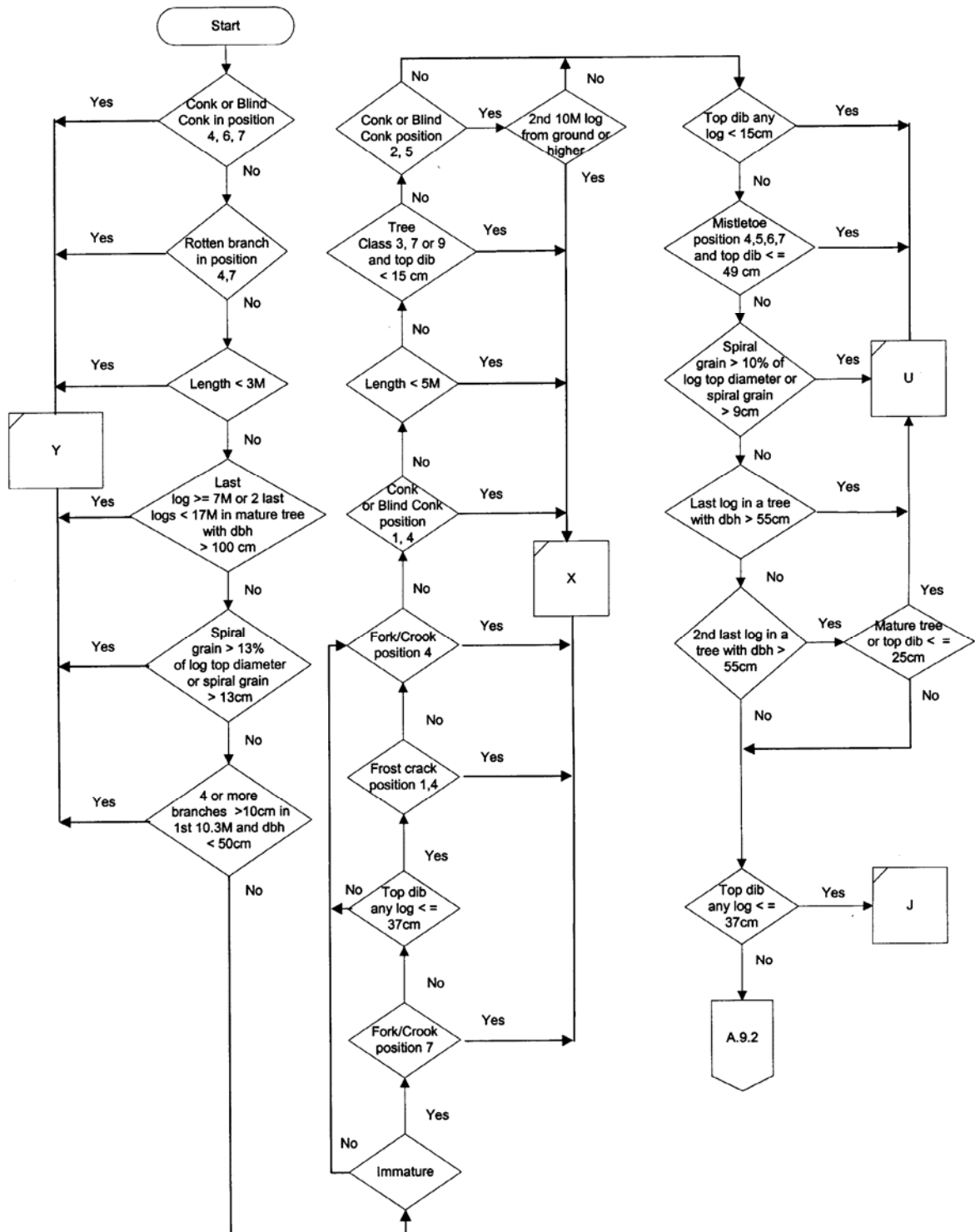
1. The flowcharts contain logic for restricting the grade of logs with spiral grain.

Spiral grain (cm.) = spiral grain code from cruise sheet * 3

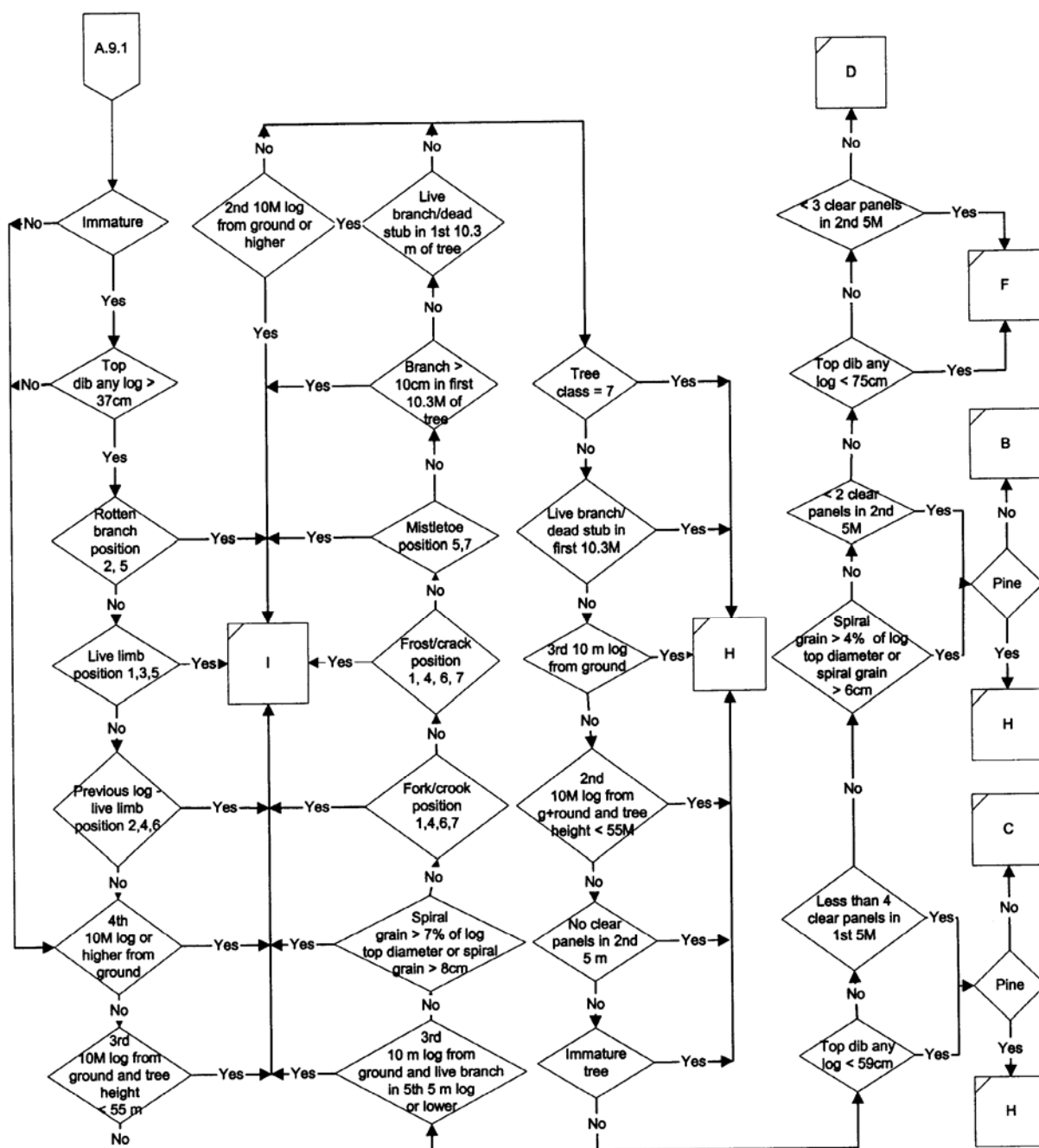
2. The test for two or more other pathological indicators in hemlock and balsam is restricted to the following indicators: frost crack, mistletoe, rotten branches, dead or broken top and scars with open and closed scars occurring together in the same tree counting as only one indicator.
3. The tests for two and three or more other pathological indicators in cypress are restricted to frost crack, fork or crook, rotten branches, dead or broken top and scars with open and closed scars occurring together in the same tree counting as only one indicator.
4. If the sum of the reported grade percents is not exactly 100 percent (due to rounding), then add or subtract from the grade with the highest percent to make the total 100 percent. If there is a tie for the largest grade percent, then adjust the grade letter that is first alphabetically from B to Y.

If D=33%, E=33% and F=33% - Adjust grade D to 34%.

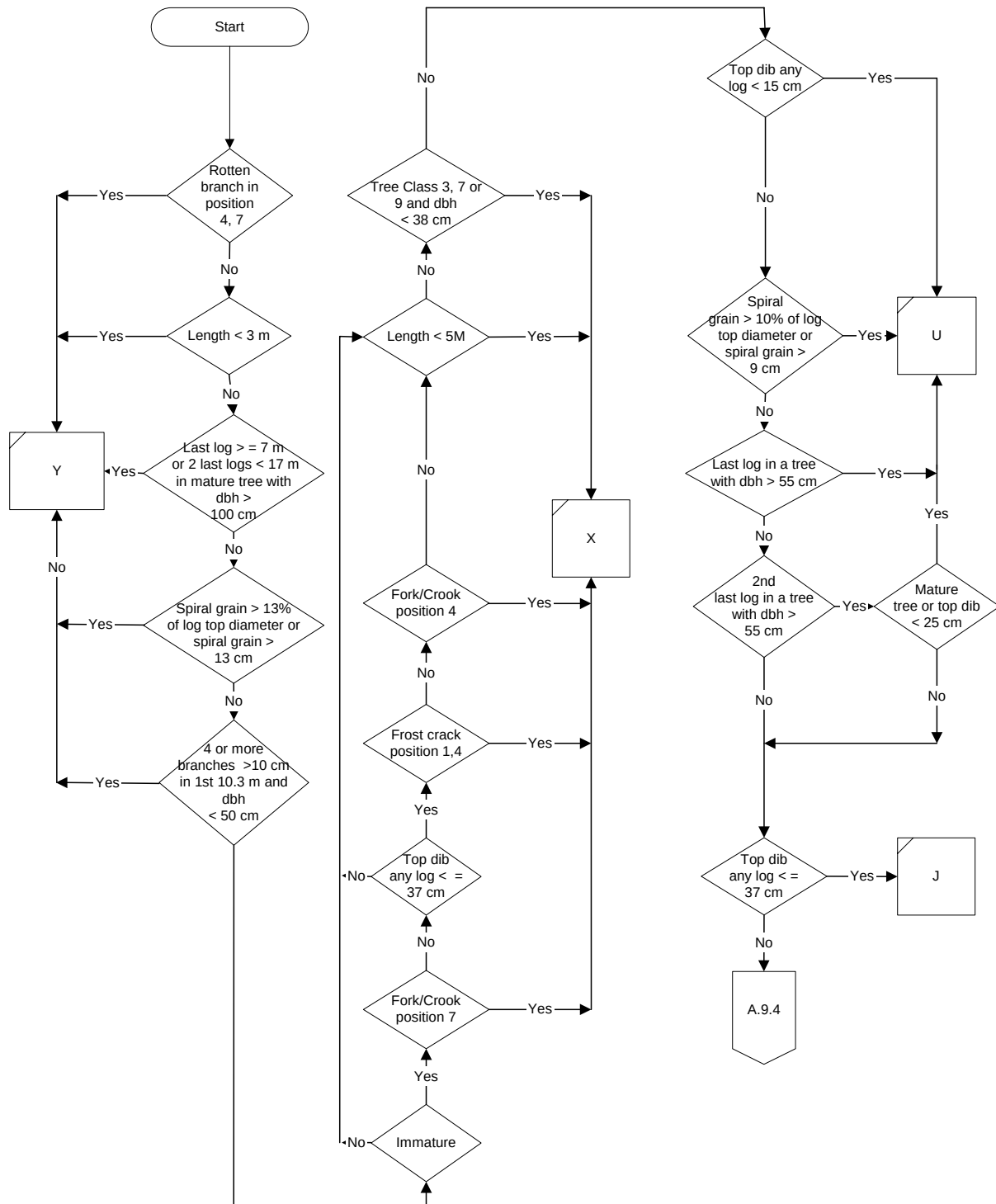
A9.1 Douglas Fir, Pine and Larch



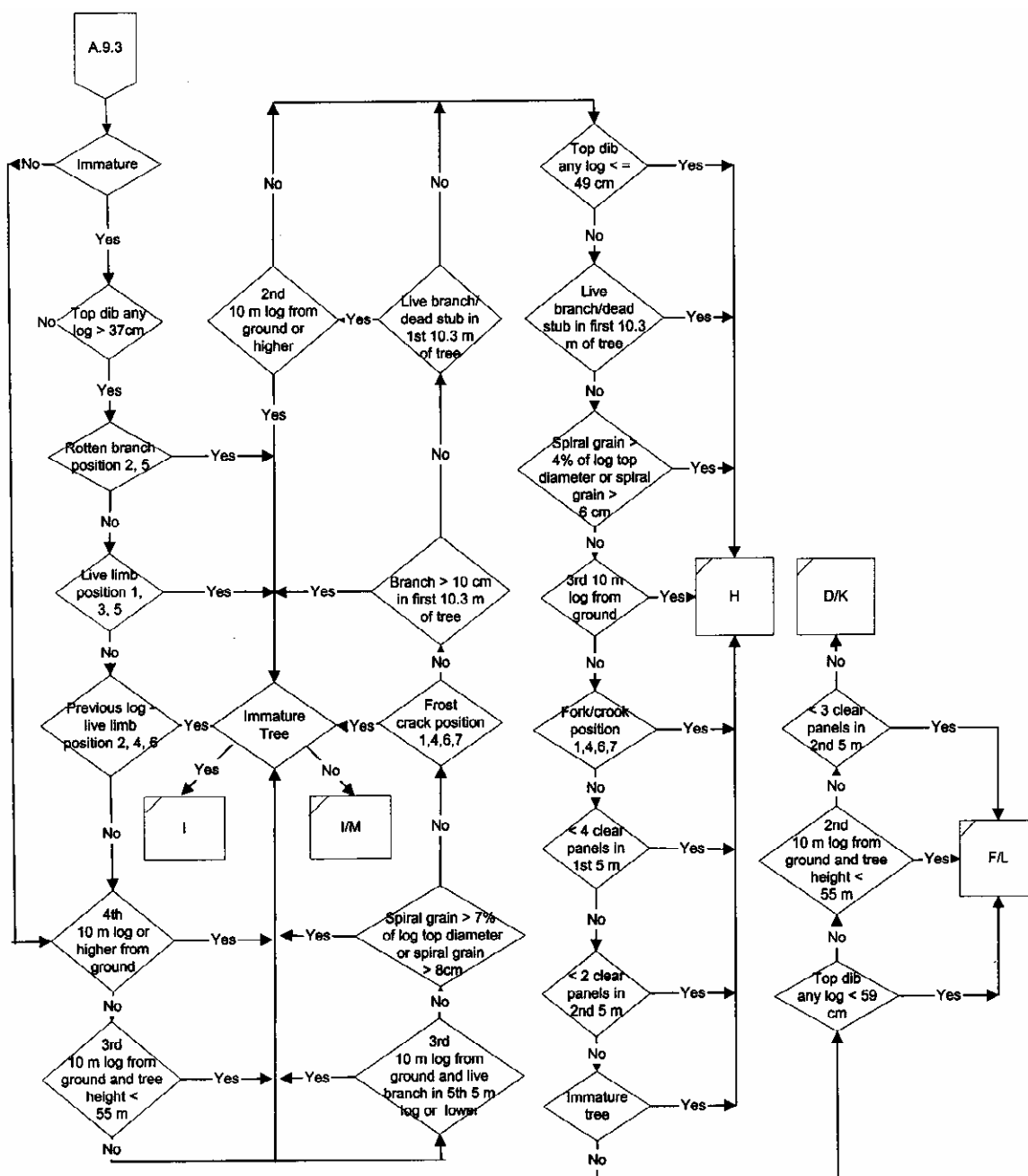
A9.2 Douglas Fir, Pine and Larch



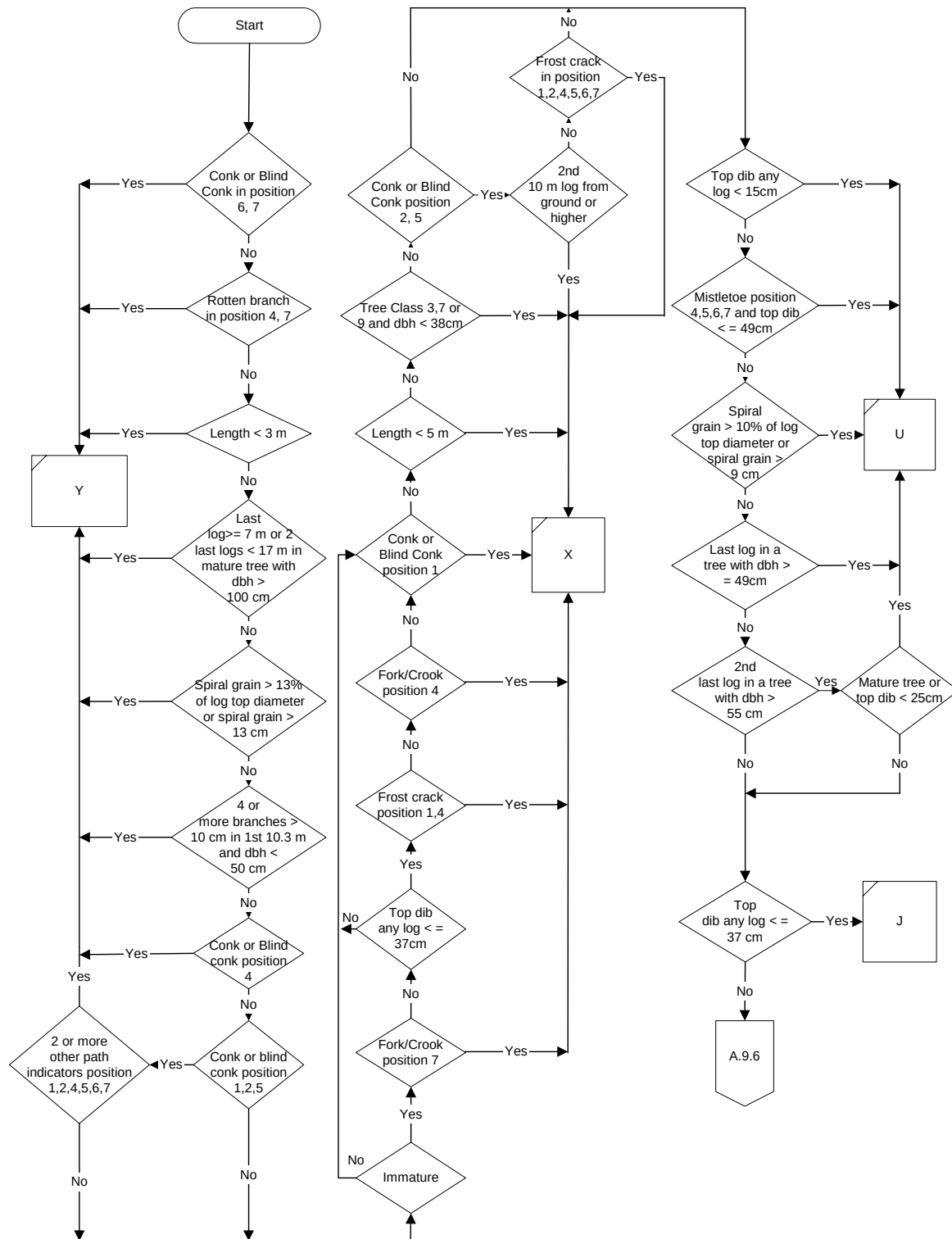
A9.3 Western Red Cedar



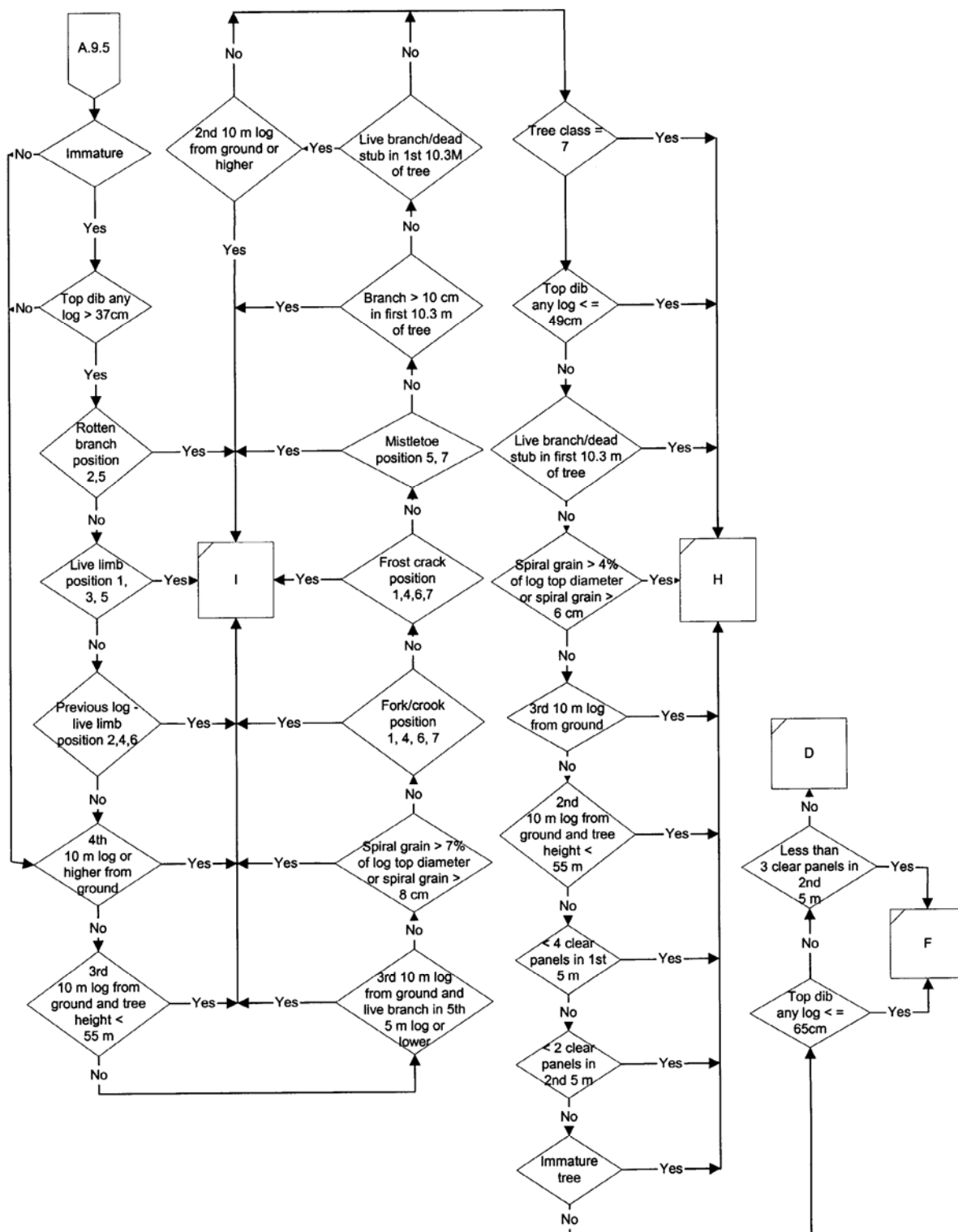
A9.4 Western Red Cedar



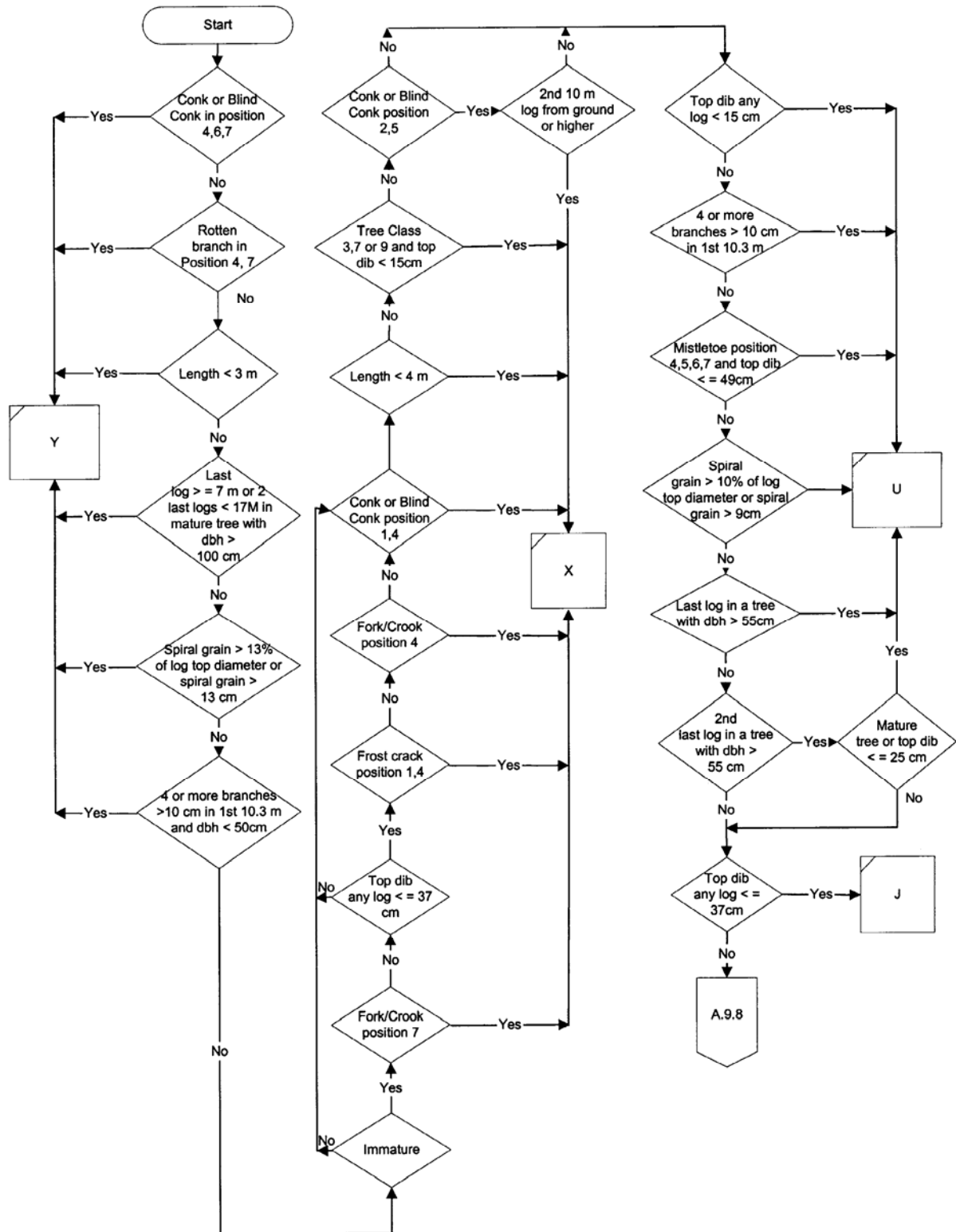
A9.5 Hemlock and Balsam



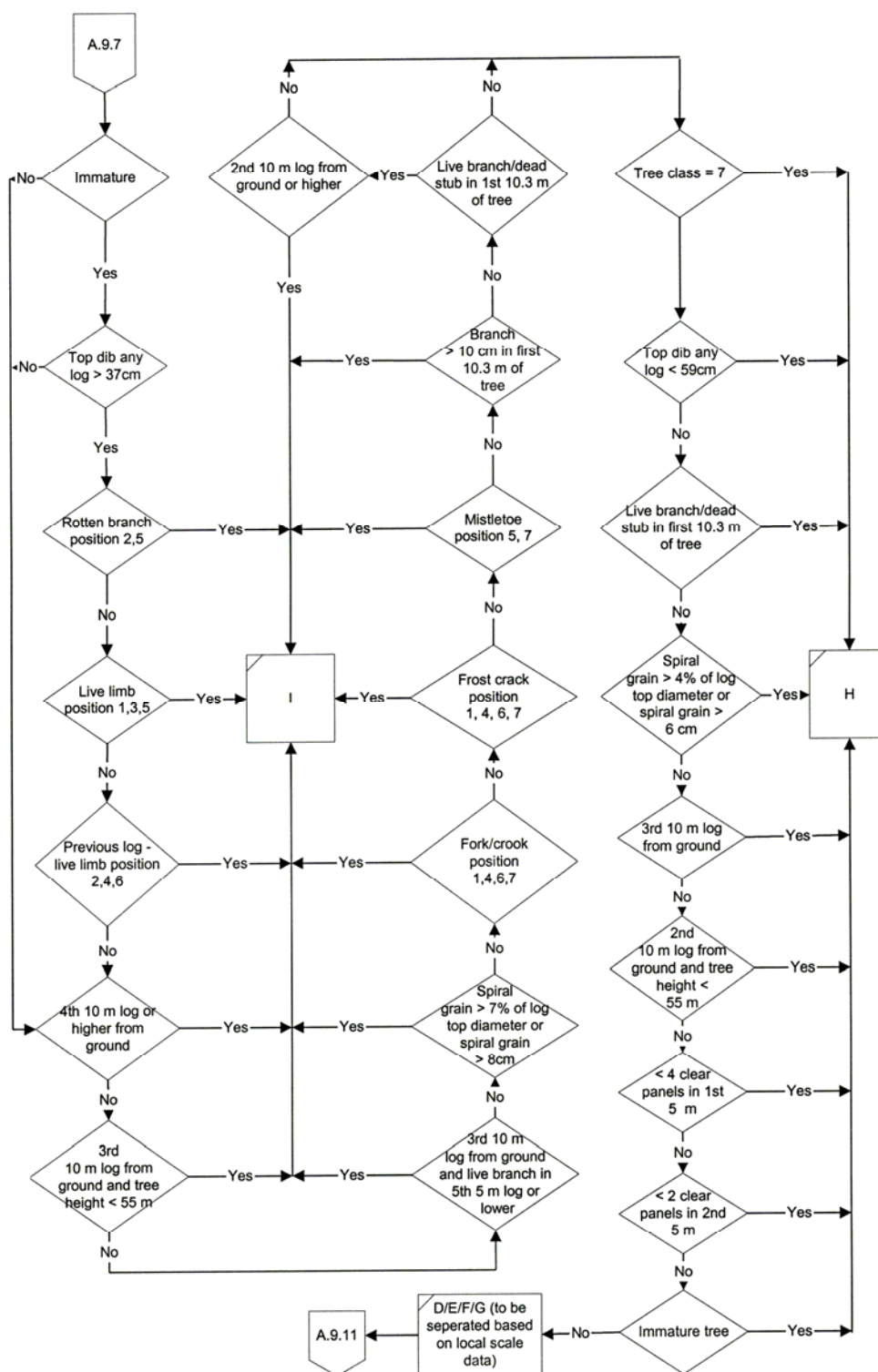
A9.6 Hemlock and Balsam



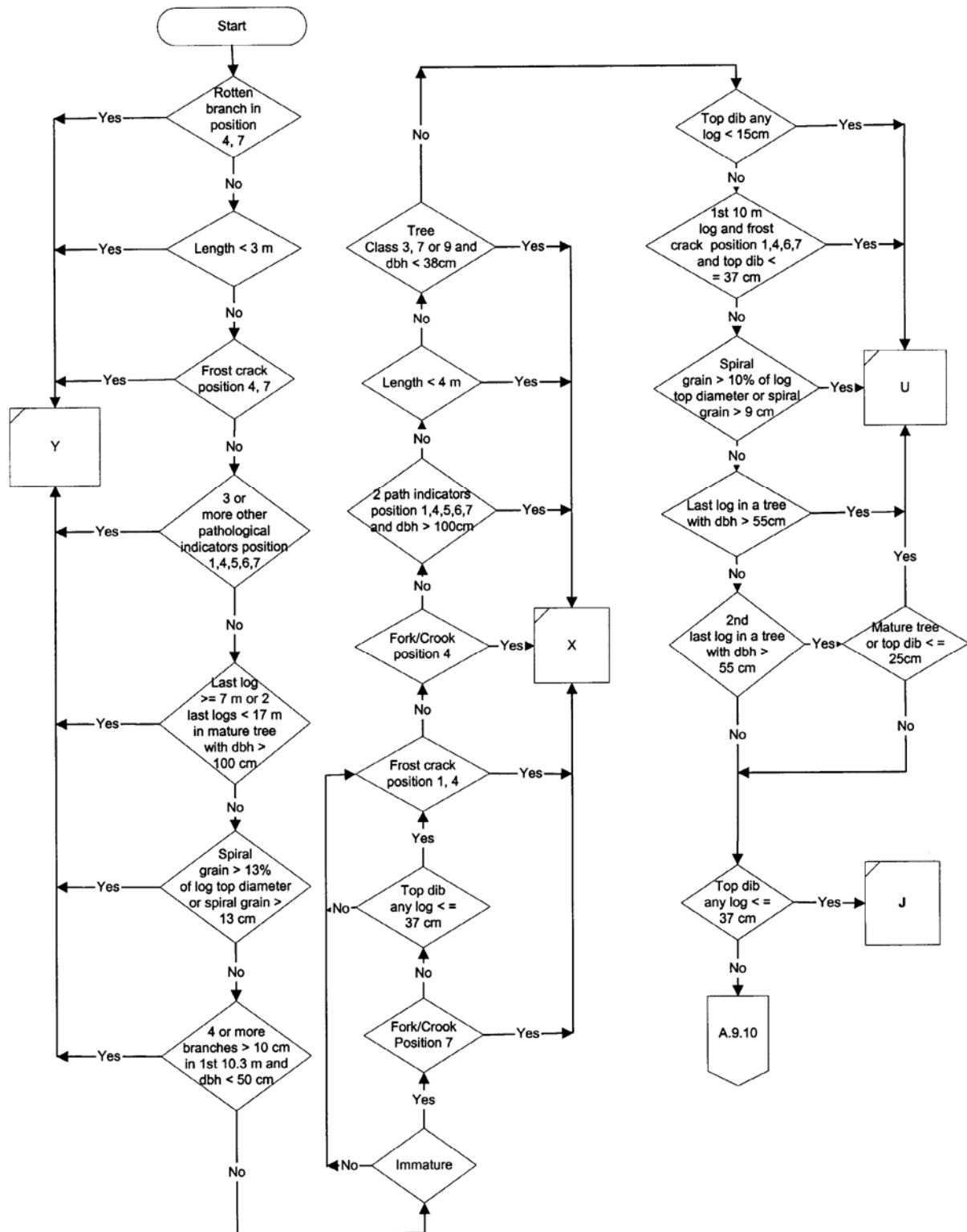
A9.7 Spruce



A9.8 Spruce



A9.9 Cypress



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graph TD
    A99[A.9.9] --> Immature1{Immature}
    Immature1 -- No --> TopDib1{Top dib any log > 37cm}
    Immature1 -- Yes --> TopDib1
    TopDib1 -- No --> RottenBranch{Rotten branch position 2, 5}
    TopDib1 -- Yes --> RottenBranch
    RottenBranch -- Yes --> LiveLimb1{Live limb position 1, 3, 5}
    RottenBranch -- No --> LiveLimb1
    LiveLimb1 -- Yes --> PreviousLog{Previous log - live limb position 2, 4, 6}
    LiveLimb1 -- No --> PreviousLog
    PreviousLog -- Yes --> I[I]
    PreviousLog -- No --> TopDib2{Top dib any log <= 49 cm}
    TopDib2 -- Yes --> H[H]
    TopDib2 -- No --> LiveBranch1{Live branch/dead stub in first 10.3 m of tree}
    LiveBranch1 -- Yes --> H
    LiveBranch1 -- No --> SpiralGrain1{Spiral grain > 4% of log top diameter or spiral grain > 6cm}
    SpiralGrain1 -- Yes --> H
    SpiralGrain1 -- No --> FrostCrack{Frost crack position 1, 6 and dbh > 135}
    FrostCrack -- Yes --> I
    FrostCrack -- No --> SpiralGrain2{Spiral grain > 7% of log top diameter or spiral grain > 8 cm}
    SpiralGrain2 -- Yes --> I
    SpiralGrain2 -- No --> ClearPanels1{2nd 10 m log from ground and < 4 clear panels in 2nd 5 m}
    ClearPanels1 -- Yes --> I
    ClearPanels1 -- No --> ClearPanels2{3rd 10 m log from ground and live branch in 5th 5 m log or lower}
    ClearPanels2 -- Yes --> I
    ClearPanels2 -- No --> TopDib3{Top dib any log <= 49 cm}
    TopDib3 -- Yes --> H
    TopDib3 -- No --> LiveBranch2{Live branch/dead stub in first 10.3 m of tree}
    LiveBranch2 -- Yes --> H
    LiveBranch2 -- No --> SpiralGrain3{Spiral grain > 4% of log top diameter or spiral grain > 6cm}
    SpiralGrain3 -- Yes --> H
    SpiralGrain3 -- No --> FrostCrack2{Frost crack position 1, 6 and dbh > 135}
    FrostCrack2 -- Yes --> I
    FrostCrack2 -- No --> SpiralGrain4{Spiral grain > 7% of log top diameter or spiral grain > 8 cm}
    SpiralGrain4 -- Yes --> I
    SpiralGrain4 -- No --> ClearPanels3{2nd 10 m log from ground and < 4 clear panels in 2nd 5 m}
    ClearPanels3 -- Yes --> I
    ClearPanels3 -- No --> ClearPanels4{3rd 10 m log from ground and live branch in 5th 5 m log or lower}
    ClearPanels4 -- Yes --> I
    ClearPanels4 -- No --> TopDib4{Top dib any log <= 49 cm}
    TopDib4 -- Yes --> H
    TopDib4 -- No --> LiveBranch3{Live branch/dead stub in first 10.3 m of tree}
    LiveBranch3 -- Yes --> H
    LiveBranch3 -- No --> SpiralGrain5{Spiral grain > 4% of log top diameter or spiral grain > 6cm}
    SpiralGrain5 -- Yes --> H
    SpiralGrain5 -- No --> FrostCrack3{Frost crack position 1, 6 and dbh > 135}
    FrostCrack3 -- Yes --> I
    FrostCrack3 -- No --> SpiralGrain6{Spiral grain > 7% of log top diameter or spiral grain > 8 cm}
    SpiralGrain6 -- Yes --> I
    SpiralGrain6 -- No --> ClearPanels5{2nd 10 m log from ground and < 4 clear panels in 2nd 5 m}
    ClearPanels5 -- Yes --> I
    ClearPanels5 -- No --> ClearPanels6{3rd 10 m log from ground and live branch in 5th 5 m log or lower}
    ClearPanels6 -- Yes --> I
    ClearPanels6 -- No --> TopDib5{Top dib any log <= 49 cm}
    TopDib5 -- Yes --> H
    TopDib5 -- No --> LiveBranch4{Live branch/dead stub in first 10.3 m of tree}
    LiveBranch4 -- Yes --> H
    LiveBranch4 -- No --> SpiralGrain7{Spiral grain > 4% of log top diameter or spiral grain > 6cm}
    SpiralGrain7 -- Yes --> H
    SpiralGrain7 -- No --> FrostCrack4{Frost crack position 1, 6 and dbh > 135}
    FrostCrack4 -- Yes --> I
    FrostCrack4 -- No --> SpiralGrain8{Spiral grain > 7% of log top diameter or spiral grain > 8 cm}
    SpiralGrain8 -- Yes --> I
    SpiralGrain8 -- No --> ClearPanels7{2nd 10 m log from ground and < 4 clear panels in 2nd 5 m}
    ClearPanels7 -- Yes --> I
    ClearPanels7 -- No --> ClearPanels8{3rd 10 m log from ground and live branch in 5th 5 m log or lower}
    ClearPanels8 -- Yes --> I
    ClearPanels8 -- No --> TopDib6{Top dib any log <= 49 cm}
    TopDib6 -- Yes --> H
    TopDib6 -- No --> LiveBranch5{Live branch/dead stub in first 10.3 m of tree}
    LiveBranch5 -- Yes --> H
    LiveBranch5 -- No --> SpiralGrain9{Spiral grain > 4% of log top diameter or spiral grain > 6cm}
    SpiralGrain9 -- Yes --> H
    SpiralGrain9 -- No --> FrostCrack5{Frost crack position 1, 6 and dbh > 135}
    FrostCrack5 -- Yes --> I
    FrostCrack5 -- No --> SpiralGrain10{Spiral grain > 7% of log top diameter or spiral grain > 8 cm}
    SpiralGrain10 -- Yes --> I
    SpiralGrain10 -- No --> ClearPanels9{2nd 10 m log from ground and < 4 clear panels in 2nd 5 m}
    ClearPanels9 -- Yes --> I
    ClearPanels9 -- No --> ClearPanels10{3rd 10 m log from ground and live branch in 5th 5 m log or lower}
    ClearPanels10 -- Yes --> I
    ClearPanels10 -- No --> TopDib7{Top dib any log <= 49 cm}
    TopDib7 -- Yes --> H
    TopDib7 -- No --> LiveBranch6{Live branch/dead stub in first 10.3 m of tree}
    LiveBranch6 -- Yes --> H
    LiveBranch6 -- No --> SpiralGrain11{Spiral grain > 4% of log top diameter or spiral grain > 6cm}
    SpiralGrain11 -- Yes --> H
    SpiralGrain11 -- No --> FrostCrack6{Frost crack position 1, 6 and dbh > 135}
    FrostCrack6 -- Yes --> I
    FrostCrack6 -- No --> SpiralGrain12{Spiral grain > 7% of log top diameter or spiral grain > 8 cm}
    SpiralGrain12 -- Yes --> I
    SpiralGrain12 -- No --> ClearPanels11{2nd 10 m log from ground and < 4 clear panels in 2nd 5 m}
    ClearPanels11 -- Yes --> I
    ClearPanels11 -- No --> ClearPanels12{3rd 10 m log from ground and live branch in 5th 5 m log or lower}
    ClearPanels12 -- Yes --> I
    ClearPanels12 -- No --> TopDib8{Top dib any log <= 49 cm}
    TopDib8 -- Yes --> H
    TopDib8 -- No --> LiveBranch7{Live branch/dead stub in first 10.3 m of tree}
    LiveBranch7 -- Yes --> H
    LiveBranch7 -- No --> SpiralGrain13{Spiral grain > 4% of log top diameter or spiral grain > 6cm}
    SpiralGrain13 -- Yes --> H
    SpiralGrain13 -- No --> FrostCrack7{Frost crack position 1, 6 and dbh > 135}
    FrostCrack7 -- Yes --> I
    FrostCrack7 -- No --> SpiralGrain14{Spiral grain > 7% of log top diameter or spiral grain > 8 cm}
    SpiralGrain14 -- Yes --> I
    SpiralGrain14 -- No --> ClearPanels13{2nd 10 m log from ground and < 4 clear panels in 2nd 5 m}
    ClearPanels13 -- Yes --> I
    ClearPanels13 -- No --> ClearPanels14{3rd 10 m log from ground and live branch in 5th 5 m log or lower}
    ClearPanels14 -- Yes --> I
    ClearPanels14 -- No --> TopDib9{Top dib any log <= 49 cm}
    TopDib9 -- Yes --> H
    TopDib9 -- No --> LiveBranch8{Live branch/dead stub in first 10.3 m of tree}
    LiveBranch8 -- Yes --> H
    LiveBranch8 -- No --> SpiralGrain15{Spiral grain > 4% of log top diameter or spiral grain > 6cm}
    SpiralGrain15 -- Yes --> H
    SpiralGrain15 -- No --> FrostCrack8{Frost crack position 1, 6 and dbh > 135}
    FrostCrack8 -- Yes --> I
    FrostCrack8 -- No --> SpiralGrain16{Spiral grain > 7% of log top diameter or spiral grain > 8 cm}
    SpiralGrain16 -- Yes --> I
    SpiralGrain16 -- No --> ClearPanels15{2nd 10 m log from ground and < 4 clear panels in 2nd 5 m}
    ClearPanels15 -- Yes --> I
    ClearPanels15 -- No --> ClearPanels16{3rd 10 m log from ground and live branch in 5th 5 m log or lower}
    ClearPanels16 -- Yes --> I
    ClearPanels16 -- No --> TopDib10{Top dib any log <= 49 cm}
    TopDib10 -- Yes --> H
    TopDib10 -- No --> LiveBranch9{Live branch/dead stub in first 10.3 m of tree}
    LiveBranch9 -- Yes --> H
    LiveBranch9 -- No --> SpiralGrain17{Spiral grain > 4% of log top diameter or spiral grain > 6cm}
    SpiralGrain17 -- Yes --> H
    SpiralGrain17 -- No --> FrostCrack9{Frost crack position 1, 6 and dbh > 135}
    FrostCrack9 -- Yes --> I
    FrostCrack9 -- No --> SpiralGrain18{Spiral grain > 7% of log top diameter or spiral grain > 8 cm}
    SpiralGrain18 -- Yes --> I
    SpiralGrain18 -- No --> ClearPanels17{2nd 10 m log from ground and < 4 clear panels in 2nd 5 m}
    ClearPanels17 -- Yes --> I
    ClearPanels17 -- No --> ClearPanels18{3rd 10 m log from ground and live branch in 5th 5 m log or lower}
    ClearPanels18 -- Yes --> I
    ClearPanels18 -- No --> TopDib11{Top dib any log <= 49 cm}
    TopDib11 -- Yes --> H
    TopDib11 -- No --> LiveBranch10{Live branch/dead stub in first 10.3 m of tree}
    LiveBranch10 -- Yes --> H
    LiveBranch10 -- No --> SpiralGrain19{Spiral grain > 4% of log top diameter or spiral grain > 6cm}
    SpiralGrain19 -- Yes --> H
    SpiralGrain19 -- No --> FrostCrack10{Frost crack position 1, 6 and dbh > 135}
    FrostCrack10 -- Yes --> I
    FrostCrack10 -- No --> SpiralGrain20{Spiral grain > 7% of log top diameter or spiral grain > 8 cm}
    SpiralGrain20 -- Yes --> I
    SpiralGrain20 -- No --> ClearPanels19{2nd 10 m log from ground and < 4 clear panels in 2nd 5 m}
    ClearPanels19 -- Yes --> I
    ClearPanels19 -- No --> ClearPanels20{3rd 10 m log from ground and live branch in 5th 5 m log or lower}
    ClearPanels20 -- Yes --> I
    ClearPanels20 -- No --> TopDib12{Top dib any log <= 49 cm}
    TopDib12 -- Yes --> H
    TopDib12 -- No --> LiveBranch11{Live branch/dead stub in first 10.3 m of tree}
    LiveBranch11 -- Yes --> H
    LiveBranch11 -- No --> SpiralGrain21{Spiral grain > 4% of log top diameter or spiral grain > 6cm}
    SpiralGrain21 -- Yes --> H
    SpiralGrain21 -- No --> FrostCrack11{Frost crack position 1, 6 and dbh > 135}
    FrostCrack11 -- Yes --> I
    FrostCrack11 -- No --> SpiralGrain22{Spiral grain > 7% of log top diameter or spiral grain > 8 cm}
    SpiralGrain22 -- Yes --> I
    SpiralGrain22 -- No -->
```

A9.11 Percentages within Spruce Grades

District	D	E	F	G
Campbell River	25	0	50	25
Chilliwack	0	0	0	100
South Island	33	11	22	34
North Island – Central Coast	22	11	22	45
Queen Charlotte	11	22	11	56
Squamish	0	0	0	100
Sunshine Coast	0	0	0	100
North Coast	16	25	17	42

Source of the table is the Coast Grade Distribution Report 2005-04 to 2007-03.

5. Mature spruce logs (greater than 120 years based on the age in 10s and tree class) will be separated into D, E, F and G grades where appropriate.

Example: In the Campbell River District when a log reaches the D/E/F/G decision box 22% of the log will be deemed to be D grade, 11% will be deemed to be E grade, 22% will be deemed to be F grade and 45% will be deemed to be G grade.

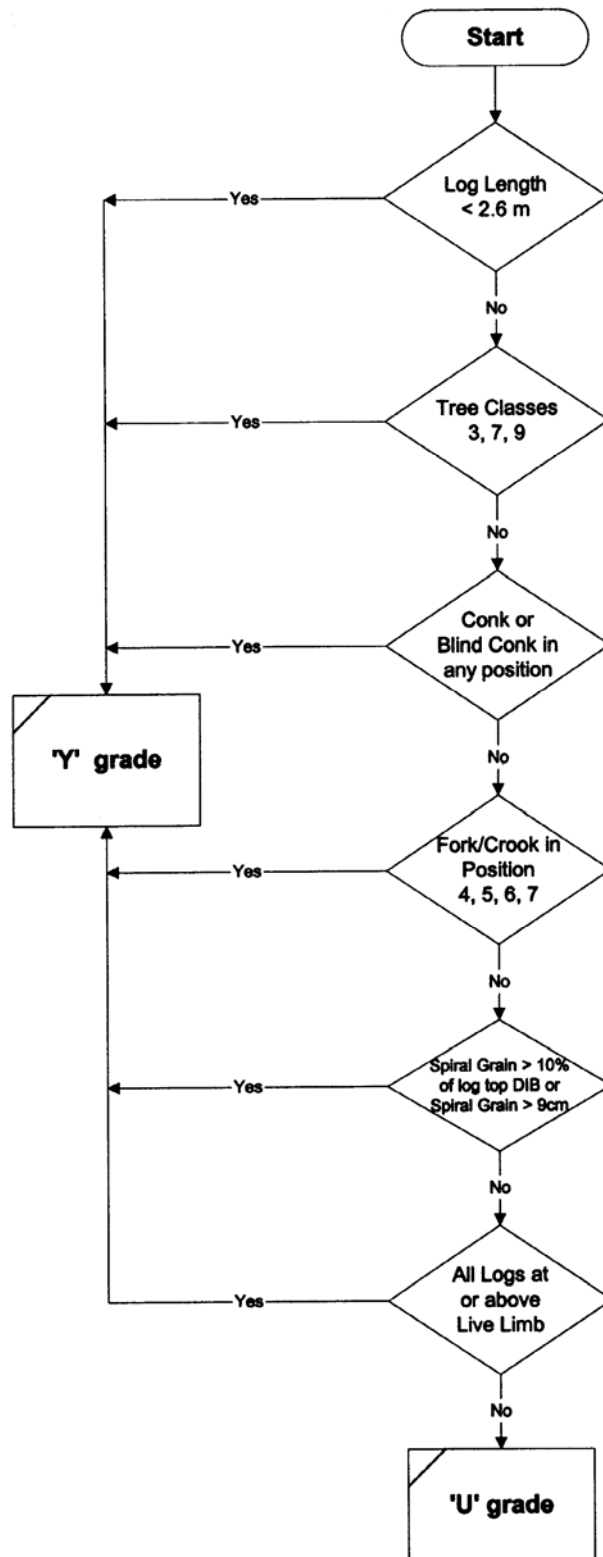
A9.11.1 Percentages within Cedar Grades

District	D	F	I
	K	L	M
Campbell River	44 56	18 82	70 30
Chilliwack	33 67	0 100	64 36
South Island	47 53	14 86	62 38
North Island – Central Coast	29 71	8 92	67 33
Queen Charlotte	33 67	14 86	77 23
Squamish	0 100	0 100	63 37
Sunshine Coast	0 100	0 100	69 31
North Coast	20 80	22 78	88 12

- Source of the table is the Coast Grade Distribution Report 2005-04 to 2007-03.
- Immature red cedar logs (up to 120 years old based on the age in 10s and tree classes) flow only into the I-grade where appropriate. Mature red cedar (greater than 120 years based on the age in 10s and tree class) will be separated into I and M grades where appropriate.

Example: In the Campbell River District when a log reaches the D/K decision box 33% of the log will be deemed to be D grade and 67% will be deemed to be K grade.

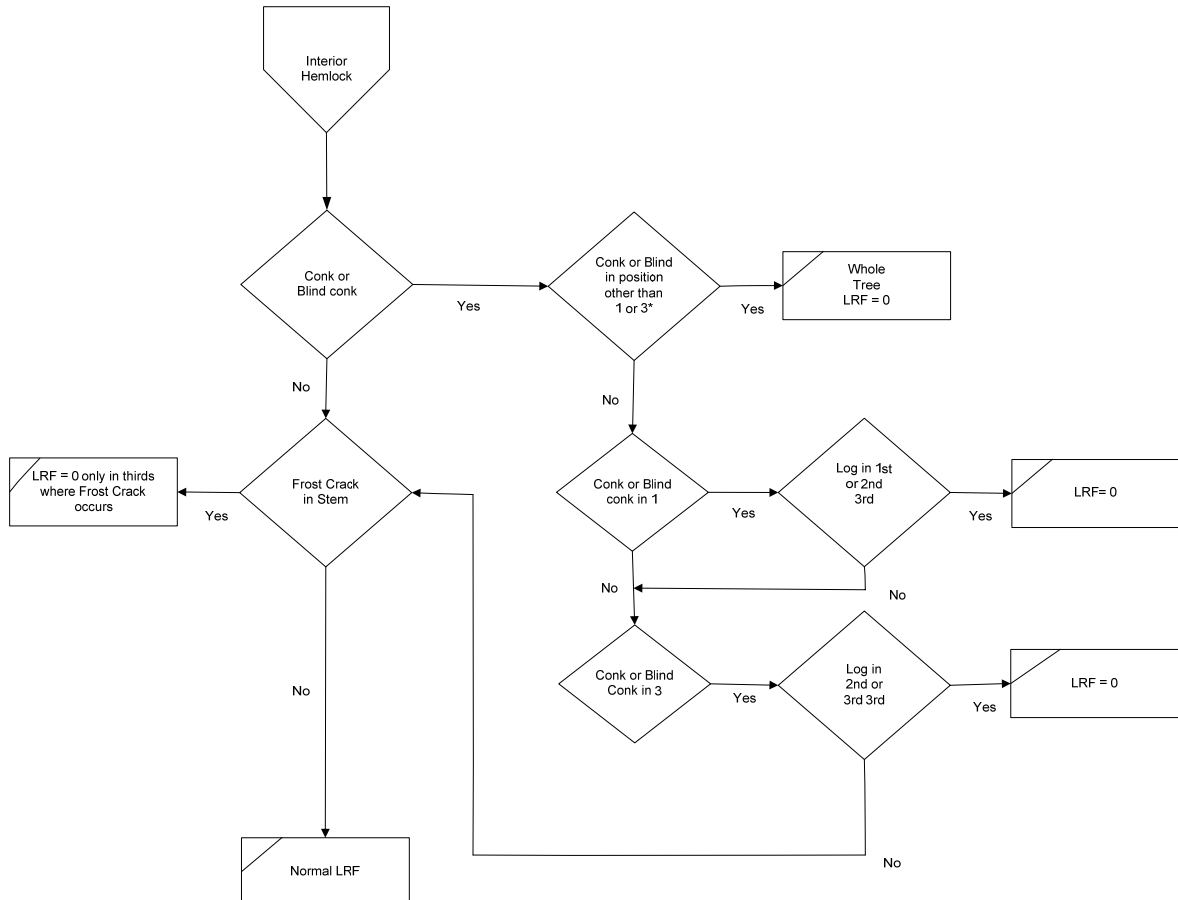
A9.12 Deciduous



Appendix 10 Interior LRF Algorithms

A10.1 Interior Hemlock

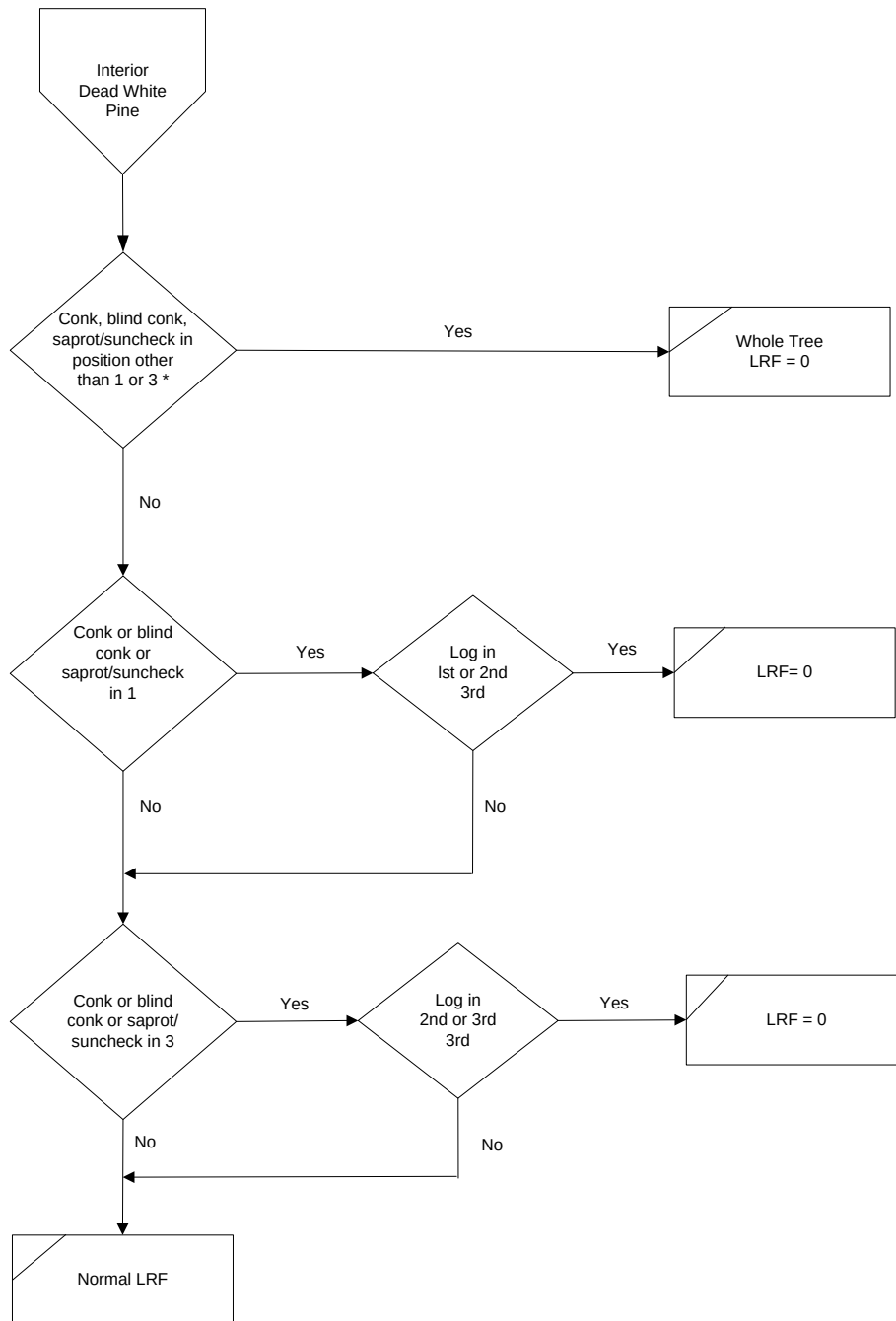
The use of Appendix A10.1 is mandatory for Interior Hemlock.



Pathological codes are required for tree classes 3, 7 and 9 for Hemlock in the Interior.

- * Any combination of 1 and 3, of the pathological indicators in question, in the first decision box indicates a yes answer.

A10.2 Dead Potential White Pine



Pathological codes are required for White Pine tree classes 3, 7 and 9 in the Interior.

- * Any combination of 1 and 3, of the pathological indicators in question, in the first decision box indicates a yes answer.

A10.4 Allocation of Path in Thirds

1. See table below for allocation of path in thirds to the log.
2. Spiral grain is collected as per the *Cruising Manual* (at 5 m).
3. Sap rot checks are collected by thirds and recorded in root rot column.

No. of Logs	Path Location						
	1	2	3	4	5	6	7
1	1	1	1	1	1	1	1
2	1	1	2	1	2	1,2	1,2
3	1	2	3	1,2	2,3	1,3	1,2,3
4	1	2,3	4	1,2,3	2,3,4	1,4	1 to 4
5	1,2	3	4,5	1,2,3	3,4,5	1,2,4,5	1 to 5
6	1,2	3,4	5,6	1 to 4	3 to 6	1,2,5,6	1 to 6
7	1,2	3,4,5	6,7	1 to 5	3 to 7	1,2,6,7	1 to 7
8	1,2,3	4,5	6,7,8	1 to 5	4 to 8	1-3,6-8	1 to 8
9	1,2,3	4,5,6	7,8,9	1 to 6	4 to 9	1-3,7-9	1 to 9
10	1,2,3	4 to 7	8 to 10	1 to 7	4 to 10	1-3,8-10	1 to 10
11	1 to 4	5 to 7	8 to 11	1 to 7	5 to 11	1-4,8-11	1 to 11
12	1 to 4	5 to 8	9 to 12	1 to 8	5 to 12	1-4,9-12	1 to 12
13	1 to 4	5 to 9	10 to 13	1 to 9	5 to 13	1-4,10-13	1 to 13
14	1 to 5	6 to 9	10 to 14	1 to 9	6 to 14	1-5,10-14	1 to 14
15	1 to 5	6 to 10	11 to 15	1 to 10	6 to 15	1-5,11-15	1 to 15

Appendix 11 Student's "T" Table

This appendix shows the t-values used to calculate the 95 percent confidence interval for the given degree of freedom.

Degrees of Freedom	t-value
1	12.706
2	4.303
3	3.182
4	2.776
5	2.571
6	2.447
7	2.365
8	2.306
9	2.262
10	2.228
11	2.201
12	2.179
13	2.160
14	2.145
15	2.131
16	2.120
17	2.110
18	2.101
19	2.093
20	2.086
21	2.080
22	2.074
23	2.069
24	2.064
25	2.060
26	2.056
27	2.052
28	2.048
29	2.045
30	2.042
31-67	2.000
68-112	1.980
113+	1.960

Appendix 12 Wet and Dry Belt Douglas Fir BEC Zones

WET AND DRY BELT DOUGLAS FIR ZONES

	Biogeoclimatic Zone	Biogeoclimatic Subzone and Variant
Wet Belt Code = 1	ICH (Interior Cedar Hemlock)	dw, dk, mw, mm, mk, mc, wk, vk, vc
	SBS (Sub-Boreal Spruce)	dh, dw, dk, mh, mw, mm, mk, mc, wk, vk
	IDF (Interior Douglas Fir)	mw, ww
	ESSF (Englemann Spruce - Subalpine Fir)	dc, dk, dv, mw, mv, mm, mk, mc, vv, wm, wk, wc, vc, vv
	SBPS (Sub-Boreal Pine - Spruce)	mk, dc, mc
Dry Belt Code = 2	ICH (Interior Cedar Hemlock)	xw
	IDF (Interior Douglas Fir)	undifferentiated, dk1, dk2, dm2, xh, xw, xm, dm
	ESSF (Englemann Spruce - Subalpine Fir)	xc
	MS (Montane Spruce)	xk, dc, dk, dm, xv
	SBPS (Sub-Boreal Pine - Spruce)	xc
	PP (Ponderosa Pine)	xh, dh

If subzones are missing from the above listing, the general rule to apply is: very dry and dry subzones are Dry Belt; and moist, wet and very wet are Wet Belt.

Appendix 13 Volume Calculation

This appendix will demonstrate how to calculate the volume for a tree using Kozak's taper equation, and will provide the associated regression coefficients and inflexion points. The volume is calculated for three sections of the tree. Section 1 is the stump, section two is the merchantable volume, and section 3 is the top of the tree. Hence, by applying these steps, both the total volume and the merchantable volume are calculated.

The merchantable portion of the tree is between the stump height and the height where the merchantability required top diameter is achieved. This portion is divided into logs based on the utilization log length in the Map Area Statement.

The last merchantable log is generally shorter than the other logs. If the last log is less than 2.5 m, then add its length and volume to next to last log.

There are two equations that must be used in order to determine the volume of the tree. The first is the taper equation, used to determine the diameter inside bark at a specified height above the ground. The second equation calculates the volume of a log given an upper and lower height above the ground, with associated diameters.

Taper Equation

$$d_i = a_1 D^{a_2} a_3^D X^{\exp}$$

Where:

d_i	=	diameter inside bark in cm. at height h_i from the ground
$\exp$	=	$a_4 z^2 + a_5 \ln(z + 0.001) + a_6 \sqrt{z} + a_7 (D/H) + a_8 e^z$
D	=	diameter at breast height in cm
X	=	$(1 - \sqrt{h_i/H}) / (1 - \sqrt{p})$
H	=	total height of tree in meters
h_i	=	height from ground in meters
z	=	h_i/H
p	=	inflexion point, see the end of this Appendix
$a_1 \dots a_8$	=	regression coefficients, see the end of this Appendix
$\ln$	=	natural logarithm
e	=	2.718281828

Volume calculation

For logs ≤ 5 m:

$$V = C * L_1 [D_1/2 + 2D_2 + D_3 + 2D_4 + D_5/2]$$

For logs > 5 m:

$$V = C * L_2 [D_1/2 + 2D_2 + D_3 + 2D_4 + D_5 + 2D_6 + D_7/2]$$

Where:

V	=	volume of log in m ³
C	=	0.00005236
L ₁	=	log length / 4
L ₂	=	log length / 6
d ₁	=	diameter inside bark at a given height from ground calculated using the Taper Equation
D ₁	=	d ₁ ²

To determine the height intervals for log volume calculation, use the following method:

Set the 1st height as the butt end of the log and the last height as the top end of the log. Assign the other heights at equal intervals between the butt and top of the log.

Example

For a 5 m log whose butt starts at 0.3 m and top is 5.3 m up the tree:

Interval	Height	Diameter
1	0.30 m	d ₁
2	1.55 m	d ₂
3	2.80 m	d ₃
4	4.05 m	d ₄
5	5.30 m	d ₅

For a 10 m log whose butt is 0.3 m and top is 10.3 m:

Interval	Height	Diameter
1	0.30 m	d_1
2	1.97 m	d_2
3	3.63 m	d_3
4	5.30 m	d_4
5	6.97 m	d_5
6	8.63 m	d_6
7	10.30 m	d_7

Substitute each of the heights into the taper equation to yield a corresponding diameter, d_i , then substitute these diameters into the appropriate volume equation to yield the volume of the log.

Steps for Calculating the Volume of a Tree

An example of the volume calculations for a single tree is given. The tree parameters are:

Species:	Cypress
DBH:	110.0 cm
Total height:	41.0 m
F.I.Z.	C
Stump height:	30 cm
Top diameter:	15.0 cm
Log length:	10 m

Step 1 Look up the appropriate regression coefficients, a_1 , a_2 , a_8 and the inflection point, p . These parameters are dependent on species and Forest Inventory Zone. They are provided in the tables in the back of this Appendix.

Example for Cypress in F.I.Z C:

$$\begin{aligned}
 p &= 0.30 \\
 a_1 &= 0.928138 \\
 a_2 &= 0.945293 \\
 a_3 &= 0.999206 \\
 a_4 &= 0.301423 \\
 a_5 &= -0.040792 \\
 a_6 &= -1.235630 \\
 a_7 &= 0.030743 \\
 a_8 &= 0.672879
 \end{aligned}$$

Step 2 Determine the biological and gross merchantable volume.

- 2.1 Calculate the diameter inside bark at stump height using the Taper equation. Substitute the stump height for h_i . [If the resultant diameter is less than the specified top diameter, return 0 volume.]

Example A13.1

Solve the taper equation using 0.3 m as h_i (only 8 decimal places are shown).

$$\begin{aligned}
 X &= (1 - \sqrt{0.3/41.0}) / (1 - \sqrt{0.3}) \\
 &= (0.914460107...) / (0.452277442...) \\
 &= 2.021900767...
 \end{aligned}$$

$$\begin{aligned}
 \text{Exp} &= a_4 z^2 + a_5 \ln(z + 0.001) + a_6 \sqrt{z} + a_7 (D/H) + a_8 e^z \\
 &= 0.301423(0.30 / 41.0)^2 - 0.040792 \ln((0.30 / 41.0) + 0.001) \\
 &\quad - 1.235630 \sqrt{0.3 / 41} + 0.030743(110.0 / 41.0) \\
 &\quad + 0.672879(2.718281828)^{0.30/41.0}
 \end{aligned}$$

$$= 0.849993$$

$$\begin{aligned} d_{30} &= (0.928138(110.0)^{0.945293})(0.999206)^{110.0}(2.02190)^{0.849993} \\ &= 131.604 \end{aligned}$$

- 2.2 Calculate the diameter inside bark at stump height using the Taper equation. Substitute the stump height for h_i . [If the resultant diameter is less than the specified top diameter, return 0 volume.]

Example:

Using the Taper equation for height 36.1405 m, the calculated diameter is 14.99368 cm, which is within the allowable range for merchantable height.

- 2.3 Calculate the number of merchantable logs.

$$\# \text{ of logs} = \frac{\text{merchantable height} - \text{stump height}}{\text{log length}} + 1$$

Truncate the trailing decimal points.

Example:

$$\# \text{ of logs} = \frac{(36.14 - 0.30)}{10.0} + 1$$

$$= 3.58 + 1$$

$$= 3 + 1$$

$$= 4$$

- 2.4 Calculate the length of the last log.

Last log = merch. Height – (# of logs – 1) * log length – stump height

Generally speaking the last log will be shorter than the other logs.

Example:

$$\text{Last log} = 36.14 - (4 - 1) * 10.0 - 0.30$$

$$= 6.14 - 0.30$$

$$= 5.84 \text{ m}$$

If the last log is less than 2.5 m, then append it to the next to last log.

- 2.5 Calculate the top diameter of each merchantable log using the Taper equation and then, calculate the volume of the log using the appropriate volume equation, based on the length of the log.

Example:

Consider a tree with four merchantable logs, with the following top heights and top diameters.

Log #	Top Height	Top Diameter (Taper Equation)
1	10.3000 m	75.25 cm
2	20.3000 m	60.58 cm
3	30.3000 m	35.58 cm
4	36.1400 m	15.00 cm

For the 1st log, if the stump height is less than 30 cm, then use the volume of a cylinder formula to calculate the volume of the merchantable portion below 30 cm. Use the Taper equation and corresponding volume formula for the portion of the log above 30 cm. The total length of the 1st log would be the merchantability required length based on the Map Area Statement, with the butt end of the log starting at the specified stump height.

Example:

Calculate the below 30 cm portion using:

$$C * d_{30}^2 * (0.30 - \text{stump height})$$

Where $C = 0.00007854$

d_{30} = diameter at 30 cm

Volume of a Single Log:

Use the Taper equation to determine the 7 diameters for log # 1:

Position	h_i	d_i - taper equation	$D_i = d_i^2$
1	0.3000 m	131.60 cm	17318.56
2	1.9666 m	102.70 cm	10547.29
3	3.6333 m	92.18 cm	8497.15
4	5.3000 m	85.85 cm	7370.22
5	6.9666 m	81.42 cm	6629.22
6	8.6333 m	78.04 cm	6090.24
7	10.300 m	75.25 cm	5662.56

Volume of Log # 1:

$$V_1 = C * L_2 [D_1/2 + 2D_2 + D_3 + 2D_4 + D_5 + 2D_6 + D_7/2] = 0.00005236 * (10/6) * 74632.65 = 6.513 \text{ m}^3$$

The other 3 merchantable logs volumes are 3.659 m^3 , 1.957 m^3 and 0.313 m^3 respectively.

Step 3 Calculate the stump volume.

If the stump height ≤ 30 cm, then:

$$\frac{\text{Stump volume}}{\text{(30cm \& below)}} = C * d_{30}^2 * (\text{stump height})$$

Where $C = 0.00007854$

d_{30} = diameter at 30 cm

Example A13.2

$$\text{Stump volume} = (0.00007854) * (0.30) * (131.60)^2 = 0.408 \text{ m}^3$$

If the stump height is greater than 30 cm, then calculate the stump volume below 30 cm as shown above. Then, apply the appropriate log volume equation using the lower bound parameters (30 cm, d_{30}) and the upper bound parameters (stump height, diameter at stump height).

Step 4 Calculate the top volume.

Depending on the length of the log, apply the appropriate log volume equation using the lower bound parameters of (merch. height and top diameter) and the upper bound parameters of (total height and 0.0).

Example:

The log length is $41.0 - 36.14 = 4.86$ m, so the volume equation for logs less than 5 m would be used.

5 diameters for top:

Position	h_i	d_i - taper equation	$D_i = d_i^2$
1	36.1405 m	15.00 cm	225.00
2	37.3553 m	10.74 cm	115.35
3	38.5702 m	6.71 cm	45.02
4	39.7850 m	3.07 cm	9.42
5	41.0000 m	0.00 cm	0.00

$$V_{\text{top}} = C * L_1 [D_1/2 + 2D_2 + D_3 + 2D_4 + D_5/2] = 0.00005236 * (4.8595/4) * 407.06 = 0.026 \text{ m}^3$$

Inflection Points

p

Species	F.I.Z. A, B & C	F.I.Z. D - J	F.I.Z. K & L
F	0.25	0.25	0.25
C	0.25	0.30	0.30
H	0.20	0.25	0.25
B	0.25	0.30	0.30
S	0.25	0.30	0.30
Y	0.30	0.30	0.30
PW	0.25	0.25	0.25
PL	0.25	0.25	0.25
PY	0.25	0.25	0.25
L	0.30	0.30	0.30
AC	0.25	0.25	0.25
D	0.30	0.30	0.30
MB	0.25	0.25	0.25
E	0.25	0.25	0.25
AT	0.20	0.20	0.20
PA	0.25	0.25	0.25

Regression Coefficients a_1

Species	F.I.Z. A, B & C	F.I.Z. D - J	F.I.Z. K & L
F	1.012675	0.920840	0.920840
C	1.218296	1.033575	1.033575
H	0.830874	0.752027	0.752027
B	0.988964	1.008741	0.764353
S	0.924126	0.897311	0.897595
Y	0.928138	0.928138	0.928138
PW	0.868943	0.984019	0.984019
PL	0.774601	0.774601	0.793793
PY	0.856592	0.856592	0.856592
L	0.746827	0.746827	1.164819
AC	0.802839	0.802839	0.852579
D	0.718188	0.718188	0.718188
MB	0.802839	0.802839	0.852579
E	0.648830	0.648830	0.633306
AT	0.855966	0.855966	0.891641
PA	1.078961	1.078961	1.078961

a₂

Species	F.I.Z. A, B & C	F.I.Z. D - J	F.I.Z. K & L
F	0.899136	0.923867	0.923867
C	0.855983	0.896971	0.896971
H	1.005210	1.028970	1.028970
B	0.951803	0.916357	1.053220
S	0.950707	0.957090	0.957499
Y	0.945293	0.945293	0.945293
PW	0.976312	0.941322	0.941322
PL	1.040320	1.040320	1.049320
PY	0.936402	0.936402	0.936402
L	1.003900	1.003900	0.831995
AC	0.993776	0.993776	0.952969
D	1.052190	1.052190	1.052190
MB	0.993776	0.993776	0.952969
E	1.121390	1.121390	1.110510
AT	0.987014	0.987014	0.957835
PA	0.894083	0.894083	0.894083

a₃

Species	F.I.Z. A, B & C	F.I.Z. D - J	F.I.Z. K & L
F	1.000123	1.000568	1.000568
C	0.999921	0.999079	0.999079
H	0.999142	0.998660	0.998660
B	0.999789	1.001159	0.994711
S	0.999518	0.999370	0.998952
Y	0.999206	0.999206	0.999206
PW	0.999773	0.999700	0.999700
PL	0.996984	0.996984	0.995709
PY	1.002104	1.002104	1.002104
L	0.997233	0.997233	1.003909
AC	0.998974	0.998974	1.000477
D	0.997551	0.997551	0.997551
MB	0.998974	0.998974	1.000477
E	0.992077	0.992077	0.994733
AT	0.999828	0.999828	1.001450
PA	1.001749	1.001749	1.001749

a₄

Species	F.I.Z. A, B & C	F.I.Z. D - J	F.I.Z. K & L
F	0.968978	1.095560	1.095560
C	2.037620	1.598260	1.598260
H	1.770670	1.174800	1.174800
B	2.336270	1.415990	1.381630
S	1.750510	1.532270	1.110150
Y	0.301423	0.301423	0.301423
PW	1.676930	1.571030	1.571030
PL	0.745750	0.745750	0.583403
PY	0.566217	0.566217	0.566217
L	0.747048	0.747048	1.880250
AC	0.706093	0.706093	0.731911
D	0.599235	0.599235	0.599235
MB	0.706093	0.706093	0.731911
E	0.865974	0.865974	1.021680
AT	0.424473	0.424473	0.695143
PA	1.377540	1.377540	1.377540

a₅

Species	F.I.Z. A, B & C	F.I.Z. D - J	F.I.Z. K & L
F	-0.190913	-0.202191	-0.202191
C	-0.486492	-0.411541	-0.411541
H	-0.329190	-0.263576	-0.263576
B	-0.502311	-0.325671	-0.306534
S	-0.408021	-0.364679	-0.281544
Y	-0.040792	-0.040792	-0.040792
PW	-0.372195	-0.369344	-0.369344
PL	-0.130177	-0.130177	-0.077654
PY	-0.087141	-0.087141	-0.087141
L	-0.133729	-0.133729	-0.401856
AC	-0.096789	-0.096789	-0.084192
D	-0.033036	-0.033036	-0.033036
MB	-0.096789	-0.096789	-0.084192
E	-0.106757	-0.106757	-0.141481
AT	-0.037553	-0.037553	-0.039652
PA	-0.286807	-0.286807	-0.286807

a₆

Species	F.I.Z. A, B & C	F.I.Z. D - J	F.I.Z. K & L
F	0.825961	0.967329	0.967329
C	2.632080	2.402420	2.402420
H	2.185610	2.233330	2.233330
B	4.154490	2.793270	2.637080
S	2.659000	2.741210	2.125100
Y	-1.235630	-1.235630	-1.235630
PW	2.567510	2.703200	2.703200
PL	0.558818	0.558818	-0.036267
PY	-0.063450	-0.063450	-0.063450
L	0.397110	0.397110	3.082780
AC	0.312724	0.312724	0.196339
D	-0.261339	-0.261339	-0.261339
MB	0.312724	0.312724	0.196339
E	0.257139	0.257139	0.641499
AT	-0.517540	-0.517540	-0.603404
PA	1.038780	1.038780	1.038780

a₇

Species	F.I.Z. A, B & C	F.I.Z. D - J	F.I.Z. K & L
F	0.048766	0.081696	0.081696
C	0.109094	0.094283	0.094283
H	0.105050	0.045184	0.045184
B	0.086560	0.108427	0.163996
S	0.092651	0.117756	0.148340
Y	0.030743	0.030743	0.030743
PW	0.071928	0.049628	0.049628
PL	0.198687	0.198687	0.142531
PY	0.071720	0.071720	0.071720
L	0.078345	0.078345	0.276300
AC	0.119634	0.119634	0.148285
D	0.215536	0.215536	0.215536
MB	0.119634	0.119634	0.148285
E	0.254574	0.254574	0.258921
AT	0.102211	0.102211	0.193706
PA	0.072537	0.072537	0.072537

a₈

Species	F.I.Z. A, B & C	F.I.Z. D - J	F.I.Z. K & L
F	-0.426214	-0.514604	-0.514604
C	-1.486550	-1.252170	-1.252170
H	-1.192970	-1.002020	-1.002020
B	-2.186240	-1.326790	-1.292080
S	-1.396760	-1.362760	-1.005560
Y	0.672879	0.672879	0.672879
PW	-1.340830	-1.334700	-1.334700
PL	-0.324178	-0.324178	-0.022523
PY	0.051415	0.051415	0.051415
L	-0.183542	-0.183542	-1.661550
AC	-0.080057	-0.080057	-0.069852
D	0.123059	0.123059	0.123059
MB	-0.080057	-0.080057	-0.069852
E	-0.149926	-0.149926	-0.359508
AT	0.303931	0.303931	0.209159
PA	-0.647372	-0.647372	-0.647372

Appendix 14 Diameter Classes

Assign a DBH class by determining what DBH range the tree falls into.

DBH Class	Tree DBH Range (cm)
10	7.5 - 12.4
15	12.5 - 17.4
20	17.5 - 22.4
25	22.5 - 27.4
30	27.5 - 32.4
35	32.5 - 37.4
40	37.5 - 42.4
45	42.5 - 47.4
50	47.5 - 52.4
55	52.5 - 57.4
60	57.5 - 62.4
65	62.5 - 67.4
70	67.5 - 72.4
75	72.5 - 77.4
80	77.5 - 82.4
85	82.5 - 87.4
90	87.5 - 92.4
95	92.5 - 97.4
100	97.5 - 102.4
105	102.5 - 107.4
110	107.5 - 112.4
115	112.5 - 117.4
120	117.5 - 122.4
125	122.5 - 127.4
130	127.5 - 132.4
135	132.5 - 137.4
140	137.5 - 142.4
145	142.5 - 147.4
150	147.5 - 162.4
175	162.5 - 187.4
200	187.5 - 212.4
225	212.5 - 237.4
250	237.5 - 262.4
275	262.5 +

Appendix 15 Volume Constants

The following tables are indexed by Species, Maturity and Forest Inventory Zone. They are used to determine the S.E.E. and Bias for volume for height-curve calculations (see Chapter 7).

Volume Constant A, B and C

Species	Maturity	F.I.Z.	A	B	C
Douglas Fir	Immature	A, B, C	-4.319071	1.81382	1.042420
Douglas Fir	Mature	A, B, C	-4.348375	1.69244	1.181970
Douglas Fir	All	D – L	-4.383102	1.74294	1.156410
Red Cedar	Immature	A, B, C	-4.139118	1.71677	1.047420
Red Cedar	Mature	A, B, C	-4.103107	1.74324	0.981729
Red Cedar	All	D – L	-4.178431	1.75995	1.019080
Hemlock	Immature	A, B, C	-4.418820	1.86778	1.099890
Hemlock	Mature	A, B, C	-4.337451	1.78350	1.120230
Hemlock	All	D – L	-4.394633	1.94290	0.990275
Balsam	All	A, B, C	-4.266202	1.78296	1.103820
Balsam	All	D – L	-4.291919	1.87293	0.998274
Spruce	Immature	A, B, C	-4.310416	1.82284	1.057290
Spruce	Mature	A, B, C	-4.368545	1.64699	1.282450
Spruce	All	D – L	-4.294193	1.85859	1.007790
Yellow Cedar	All	A – L	-4.187127	1.77736	1.032990
White Pine	All	A – L	-4.300522	1.85780	1.022250
Lodgepole Pine	All	A – L	-4.349504	1.82276	1.108120
Albicaulis Pine	All	A – L	-4.300522	1.85780	1.022250
Yellow Pine	All	A – L	-4.482485	1.95443	1.016770
Larch	All	A – L	-4.350486	1.71236	1.135270
Cottonwood	All	A – L	-4.648431	1.73518	1.356010
Alder	All	A – L	-4.431705	1.89057	1.090770
Maple	All	A – L	-4.536696	1.90785	1.120160
Birch	All	A – L	-4.443142	1.90956	1.052050
Aspen	All	A – L	-4.419728	1.89476	1.053730

Appendix 16 Rounding

Round all reported parameters to the specified number of significant digits from this manual. Use the normal rules for rounding (i.e. digits 0 - 4 are rounded down and digits 5 - 9 are rounded up). For example if a parameter is to be reported to one decimal place, then:

825.123 would round to 825.1, whereas
825.158 would round to 825.2

In cases where a reported parameter is based on summing or weighting the parameters of previously reported parameters, then save all the intermediate calculations to the maximum precision and round at the end. For example, the gross total volumes for 2 types in a cutting permit are as follows:

825.123 would round to 825.1, whereas
825.158 would round to 825.2

Type 1	5555.423	would round to 5555
Type 2	4444.423	would round to 4444
	<hr/>	
	9999.84	would round to 10000

In other words, the cutting permit total would be 10000, not 9999.

The MOF mainframe PL/1 code uses variables with a maximum precision of 32 significant digits. The log volume routine uses variables with 6 significant digits.

Throughout the manual the sample calculations will show all the necessary digits for intermediate calculations. It is assumed that any intermediate calculation that is not shown in this manual uses an adequate number of significant digits to carry the precision to result in the values used in the sample calculations that are shown. Whenever constants, e.g., pi, are used in this manual, use the constants as shown.

Use the following rules to determine how many decimal places are required for intermediate calculations.

Addition and Subtraction

Save the resultant sum or difference with the maximum precision in the operands used.

Multiplication

Add the number of decimal places for each of the operands used in the calculation.

Division, Square Root, Exponential and Logarithm

Carry enough decimal places to achieve the required precision for the output value. For example, if the output value is reported to 1 decimal place, the program variable should be accurate to 2 decimal places to produce accurate rounded numbers.

Appendix 17 Mathematical Notation

Subscripts:

In x_d the d means that x can take on different forms or values. Putting in a particular value of d tells which form or value of x we are concerned with. The d may be a particular characteristic of an individual tree. The term x_1 might be the height of the tree, x_2 might be its' DBH. Or the subscript might imply a particular tree. In this case, x_1 could be the height of the first tree and x_2 the height of the second tree. Which meaning is intended will usually be clear in the text.

A variable (say x) will often be identified in more than one way. Multiple classification is accomplished with more subscripts. In $x_{d,u}$ the d might identify the characteristic (for height, $d = 1$; for DBH, $d = 2$). The u could identify which individual we are dealing with. Then $x_{2,7}$ would tell us that we are dealing with the DBH ($d = 2$) of the seventh tree ($u = 7$). If the individuals are from different groups we can use another subscript (say h).

The symbol $x_{d,u,h}$ would indicate the d^{th} characteristic of the u^{th} individual of the h^{th} group.

Summations:

To indicate that several (say 6) values of a variable (x) are to be added together we could write $\sum_{d=1}^6 x_d$. In words this tells us to sum all values of x_d , letting d go from 1 up to 6.

The symbol $\sum$ indicates that a summation should be performed. The x is what should be summed and the values above and below the $\sum$ indicate the limits over which the subscript d will be allowed to vary.

Brackets:

The equation $\sum_d \left(\sum_u x_{d,u} \right)$ says that for each value of d we should first add up the $x_{d,u}$ over all values of u . Then add these up over all values of d .

If the range of d is from 1 to 3 and the range of u is 1 to 4 then:

$$\sum_{d=1}^3 \left(\sum_{u=1}^4 x_{d,u} \right) = (x_{1,1} + x_{1,2} + x_{1,3} + x_{1,4}) + (x_{2,1} + x_{2,2} + x_{2,3} + x_{2,4}) + (x_{3,1} + x_{3,2} + x_{3,3} + x_{3,4}).$$

Appendix 18 Interior Fir Quality Class Algorithm

This is computed on a tree by tree basis.

Quality Class 1

- No conk,
- no blind conk,
- no scars in lower third,
- no forks or crooks in lower two thirds,
- no frost cracks in lower third,
- no rotten branches greater than 10 cm in diameter in lower third,
- no dead or broken top, and
- no $\left(\frac{\text{DBH (cm)}}{\text{Height (cm)}} \right)$ ratio less than 1:48.

Quality Class 2

- Trees of lower quality than those above, and
- tree class 3, 4, 6, 7 and 9 trees.

Appendix 19 Valid Compilation Versions

- The valid compilation versions are listed at the following site:

<http://www.for.gov.bc.ca/hva/manuals/cruising/compversions.htm>

Appendix 20 CGNF Compilation for the Coast Forest Region

For the Coast Forest Region, the effective date is January 1, 2007.

The CGNF Compilation for the Coast Forest Region is available at:

<http://www.for.gov.bc.ca/hva/manuals/cgnfcompilation/index.htm>

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