Forest Inventory and Monitoring Program: Growth and Yield Standards and Procedures

Appendices

Prepared by
Ministry of Sustainable Resource Management
Terrestrial Information Branch
for the
Resources Information Standards Committee

March 31, 2003

Version 1.0

Published by the
Resources Information Standards Committee

National Library of Canada Cataloguing in Publication Data

Main entry under title:

Forest Inventory and Monitoring Program : Growth and Yield standards and procedures.

"March 31, 2003"

Contents: 1. Establishing permanent sample plots in natural stands -- 2. Remeasurement of permanent sample plots in natural stands -- 3. Remeasuring experimental plots in natural stands -- 4. Remeasurement of permanent sample plots in silviculturally treated stands -- Appendices.

Also available on the Internet.

ISBN 0-7726-4874-3

1. British Columbia. Forest Inventory and Monitoring Program. 2. Trees - Sampling - British Columbia – Methodology – Handbooks, manuals, etc. 3. Trees - Monitoring - British Columbia – Methodology – Handbooks, manuals, etc. 4. Trees – British Columbia – Growth.

5. Forest productivity – British Columbia. 6. Site index (Forestry) - British Columbia. I. British Columbia. Resources Information Standards Committee. II. British Columbia. Terrestrial Information Branch. III. British Columbia. Ministry of Forests. Growth and Yield Program.

SD387.S86F76 2003 6 34.9 C2002-960246-7

Additional Copies of this publication can be purchased from:

Government Publication Services
Phone: (250) 387-6409 or
Toll free: 1-800-663-6105
Fax: (250) 387-1120
www.publications.gov.bc.ca

Digital Copies are available on the Internet at:
http://srmwww.gov.bc.ca/risc

Preface

The standards and procedures described in this chapter of *the Forest Inventory Manual (Volume 3 – Growth and Yield/ Decay and Volume)* are based upon the *Minimum Standards for the Establishment and Remeasurement of Permanent Sample Plots in British Columbia*.

The latter publication was developed for the Forest Productivity Council (FPC) to recommend minimum standards for measurement of permanent sample plots for the purpose of measuring growth and estimating future yield. It was last revised in March 1999. See the following web-site for further information: http://srmwww.gov.bc.ca/forestproductivity/ .

With the inactivity of the FPC, the Ministry of Sustainable Resource Management (previously Ministry of Forests) continues to upgrade the *Forest Inventory Manual* in response to client needs. The chapter following reflects that updated methodology and supersedes the FPC Minimum Standards document. The Ministry of Sustainable Resource Management recommends that this methodology be followed for all establishments and remeasurements of permanent sample plots.

Acknowledgments

The Government of British Columbia provides funding of the Resources Information Standards Committee work, including the preparation of this document. The Resources Information Standards Committee supports the effective, timely and integrated use of land and resource information for planning and decision making by developing and delivering focussed, cost-effective, common provincial standards and procedures for information collection, management and analysis. Representatives to the Committee and its Task Forces are drawn from the ministries and agencies of the Canadian and the British Columbia governments, including academic, industry and First Nations involvement.

The Resources Information Standards Committee evolved from the Resources Inventory Committee which received funding from the Canada-British Columbia Partnership Agreement of Forest Resource Development (FRDA II), the Corporate Resource Inventory Initiative (CRII) and by Forest Renewal BC (FRBC), and addressed concerns of the 1991 Forest Resources Commission.

For further information about the Resources Information Standards Committee, please access the RISC website at: http://srmwww.gov.bc.ca/risc/.

Table of Contents

Appendix 1: Standards of Measurement for Permanent Samples

Tie Line	
Bearing	±2°
Distance	±2%

Plot	
Missed and extra trees	No error within the plot.
Radius	± 0.5% of plot/sub-plot radius tolerance for borderline trees.
Tree species	No error, but identication to genus level allowable for birch, interior spruce and willow.
Breast height	±5 cm
D.B.H. live	±0.l cm or 1.0%, whichever is greater.
D.B.H. dead	±0.2 cm or 2.0% whichever is greater.
Decay indicators	±1 or 10%, whichever is greater, of the total number of external indicators of all trees checked.
Crown closure	± one 10% class
Live crown	± one 10% class
Crown class	± one crown class
Quality	± 1 or 10%, whichever is greater, of the total number of trees checked.
Measured tree height	± 20 cm or 2%, whichever is greater.
Estimated tree height	+or- 0.5m or 10%, whichever is greater.
Tree age	±2 years or 2%, whichever is greater.
Radial increment	±0.1 cm
Slope	± 5%,
Aspect	± 10 degrees
Elevation	± 50 metres
Wildlife Visual Appearance	± 1 visual appearance class

Stem Mapping	
Bearing	±2°
Distance	±2%

Location	
Latitude	± 1 second
Longitude	± 1 second
UTM	± 20 metres

Appendix 2: Weighted Error Rating Table and the Basis for the Acceptance or Rejection of a Plot

Symbol		Weighted error
⊛	Missed and/or extra plot trees	2
⊛	Missed and/or extra sub-plot trees (less than 2.0 cm d.b.h.)	½
⊛	Missed and/or extra dead trees	½
⊛	Missed an/or extra sub-plot trees (greater than or equal to 2.0 cm d.b.h.	1
⊛	Tree genus/species	2
⊛	Breast height	1
⊛	D.B.H. Live tree	2
	D.B.H. dead tree	½
⊛	Path	1
⊛	Live Crown	½
⊛	Crown Class	½
⊛	Quality	½
⊛	Dead tree wildlife visual appearance	½
⊛	Radial increment	½
⊛	Crown closure	½
⊛	Measured height	2
⊛	Estimated height	½
⊛	Total age	1
⊛	Bearing	1
⊛	Distance	1
⊛	Slope	½
⊛	Aspect	½
⊛	Elevation	½
*	Asterisk	50% of above

Note: If the weighted errors result in a plot rating greater than four, redo the sample or portions of it.

Appendix 3: Species Symbols [1]

Names and Symbols for Tree Species in B.C.

Common Name of Genus/Species	Scientific Name	Genus Symbol	Species Symbol	C/N**	S/G***
Alder	**Alnus**	D			
Red alder	A. rubra		Dr	C	S
Apple	**Malus**	U			
Apple	Malus pumila		Ua	N	S
Pacific crab apple	Malus fusca		Up	N	S
Arbutus	**Arbutus**	R			
Arbutus	A. menziesii		Ra	N	S
Aspen, Cottonwood or Poplar	**Populus**	A			
Poplar	P. balsamifera		Ac	C	S
Balsam poplar	P. b. ssp.balsamifera		Acb	C	S
Black cottonwood	P. b. ssp. trichocarpa		Act	C	S
Hybrid poplars	P. spp.		Ax	C	S
*Southern cottonwood	P. deltoids		Ad	C	S
Trembling aspen	P. tremuloides		At	C	S
Balsam	**Abies**	B			
Amabilis fir	A. amabilis		Ba	C	S
Subalpine fir	A. lasiocarpa		Bl	C	S
*Balsam fir	A. balsamea		Bb	C	S
Grand fir	A. grandis		Bg	C	S
Noble fir	A. procera		Bp	C	S
*Shasta red fir	A. magnifica var. shastensis		Bm	C	S
*White fir	A. concolor		Bc	C	S
Birch	**Betula**	E			
Alaska paper birch	B. neoalaskana		Ea	C	S
Alaska x paper birch hybrid	B. x winteri		Exp	C	G
European birch	B. pendula		Ee	C	G
Paper birch	B. papyrifera		Ep	C	S
Silver birch	B. pubescens		Es	C	G
Water birch	B. occidentalis		Ew	N	S
*Yellow birch	B. alleghaniensis		Ey	C	S

[1] Based on 'The BC Tree Code List' Version 4.3

* Introduced Species

** C - commercial tree; N - non commercial tree

*** S - Code to species level; G - May be coded to genus level

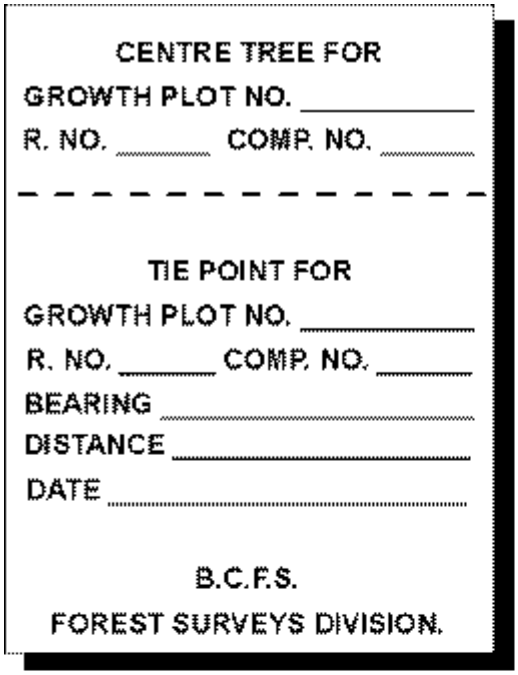
Common Name of Genus/Species	Scientific Name	Genus Symbol	Species Symbol	C/N**	S/G***
Cascara	**Rhamnus**	K			
Cascara	R. purshianus		Kc	N	S
Cedar	**Thuja**	C			
Western red cedar	T. plicata		Cw	C	S
Cherry	**Prunus**	V			
Bitter cherry	P. emarginata		Vb	N	S
Choke cherry	P. virginiana		Vv	N	S
Pin cherry	P. pennsylvanica		Vp	N	S
Sweet cherry	P. avium		Vs	N	S
Cypress	**Chamaecyparis**	Y			
*Port Orford-cedar	C. lawsoniana		Yp	C	S
Yellow cedar	C. nootkatensis		Yc	C	S
Dogwood	**Cornus**	G			
Pacific dogwood	C. nuttallii		Gp	N	S
Douglas-fir	**Pseudotsuga**	F			
Douglas-fir	P. menziesii		Fd	C	S
Coastal Douglas-fir	P. menziesii var. menziesii		Fdc	C	S
Interior Douglas-fir	P. menziesii var. glauca		Fdi	C	S
Hemlock	**Tsuga**	H			
Mountain hemlock	T. mertensiana		Hm	C	S
Mountain x western hemlock hybrid	T. mertensiana x heterophylla		Hxm	C	S
Western hemlock	T. heterophylla		Hw	C	S
Juniper	**Juniperus**	J			
Rocky mountain juniper	J. scopulorum		Jr	N	S
Larch	**Larix**	L			
Alpine larch	L. lyallii		La	C	S
*Dahurian Larch	L. gmelinii		Ld	N	S
Tamarack	L. laricina		Lt	C	S
Western larch	L. occidentalis		Lw	C	S
Maple	**Acer**	M			
Bigleaf maple	A. macrophyllum		Mb	C	S
Box elder	A. negundo		Me	C	S
*Norway maple	A. platanoides		Mn	C	S
*Sycamore maple	A. pseudoplatanaus		Ms	C	S
Vine maple	A. circinatum		Mv	N	S
Oak	**Quercus**	Q			
*English oak	Q. robur		Qe	C	S
Garry oak	Q. garryana		Qg	N	S
*White Oak	Q. alba		Qw	C	S
Other exotics					
*Coast redwood	Sequoia sempervirens		Oc	**C**	S
Common pear	Pyrus communis		Of	N	S
European mountain-ash	Sorbus aucuparia		Od	N	S
*Giant sequoia	Sequoiadendron giganteum		Ob	C	S

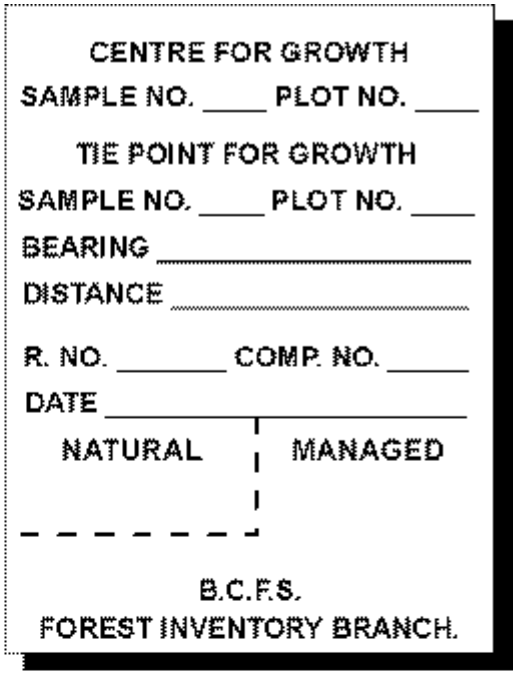
Common Name of Genus/Species	Scientific Name	Genus Symbol	Species Symbol	C/N**	S/G***
*Incense-cedar	Calocedrus decurrens		Oa	C	S
Oregon ash	Fraxinus latifolia		Og	C	S
*White Ash	Fraxinus americana		Oh	C	S
*Shagbark hickory	Carya ovata		Oi	C	S
Siberian elm	Ulmus pumila		Oe	N	S
Pine	**Pinus**	P			
Jack pine	P. banksiana		Pj	C	S
Limber pine	P. flexilis		Pf	C	S
Lodgepole pine	P. contorta		Pl	C	S
Lodgepole pine	P. contorta var. latifolia		Pli	C	S
Lodgepole x jack pine hybrid	P. x murraybanksiana		Pxj	C	S
*Monterey pine	P. radiata		Pm	C	S
Ponderosa pine	P. ponderosa		Py	C	S
*Red pine	P. resinosa		Pr	C	S
Shore pine	P. contorta var. contorta		Plc	C	S
*Sugar pine	P. lambertiana		Ps	C	S
Western white pine	P. monticola		Pw	C	S
Whitebark pine	P. albicaulis		Pa	C	S
Spruce	**Picea**	S			
Black spruce	P. mariana		Sb	C	S
Engelmann spruce	P. engelmannii		Se	C	G
*Norway spruce	P. abies		Sn	C	G
Sitka spruce	P. sitchensis		Ss	C	S
White spruce	P. glauca		Sw	C	G
Spruce hybrid	Picea cross		Sx	C	G
Engelmann x white	P. engelmannii x glauca		Sxw	C	G
Sitka x white	P. x lutzii		Sxl	C	G
Sitka x unknown hybrid	P. sitchensis x ?		Sxs	C	G
Willow	**Salix**	W			
Bebb's willow	S. bebbiana		Wb	N	G
Pacific willow	S. lucida		Wp	N	G
Peachleaf willow	S. amygdaloides		Wa	N	G
Pussy willow	S. discolor		Wd	N	G
Scouler's willow	S. scouleriana		Ws	N	G
Sitka willow	S. sitchensis		Wt	N	G
Yew	**Taxus**	T			
Western yew	Taxus brevifolia		Tw	N	S
Unknown Conifer		X	Xc		S
Unknown Hardwood			Xh		S
Other Conifer		Z	Zc		S
Other Hardwood			Zh		S

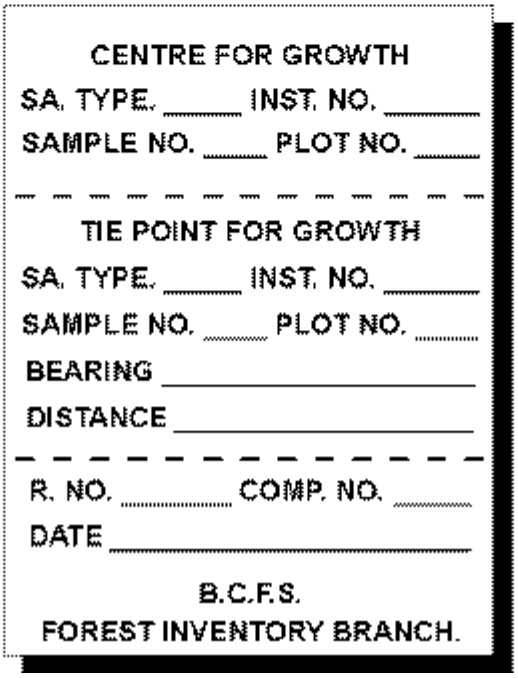
Appendix 4: Equipment List for Permanent Sample Measurements

1. Personal tally gear (Silva compass, d.b.h. tape, Suunto)
2. Safety gear (hard hat, first aid kit, flare kit)
3. Pertinent section of the manual
4. Electronic field recorder
5. Pertinent field sheets
6. Pertinent plot radii slope allowance table
7. 50 m tape
8. GY annotated flagging tape
9. Blue tree paint
10. Aluminum centre stakes (90 cm)
11. Aluminum plot markers
12. Aluminum nails (6 cm)
13. Blue plastic tree tags (with embossed white numbers)
14. Blank aluminum tree tags
15. Claw hammer
16. Increment borer, hand lens
17. Plot string

Appendix 5: Tie Point and Plot Centre Aluminum Markers







Appendix 6: Plot and Sub-plot Radii Slope Allowance for Natural Stands Samples

	Plot Size (ha)/P.H.F. Plot Radii (m)			Plot and Sub-plot Size (ha), P.H.F., and Radii (m)													
	0.102	0.081	0.0503	.1	0.09	0.08	0.07	0.06	0.05	0.04	0.03	0.025	0.02	0.015	0.01	0.007	0.005
	9.88	12.36	19.76	10.0	11.11	12.50	14.29	16.67	20.00	25.00	33.33	40.00	50.00	66.67	100.00	142.86	200.00
	17.98	16.06	12.65	17.84	16.93	15.96	14.93	13.82	12.62	11.28	9.77	8.92	7.98	6.91	5.64	4.72	3.99
Slope %	**Plot Radii Plus Slope Allowance (m)**			**Sub-plot Radii Plus Slope Allowance (m)**													
10	18.07	16.14	12.71	17.93	17.01	16.04	15.00	13.89	12.68	11.34	9.82	8.96	8.02	6.94	5.67	4.74	4.01
12	18.11	16.18	12.74	17.97	17.05	16.07	15.04	13.92	12.71	11.36	9.84	8.98	8.04	6.96	5.68	4.75	4.02
14	18.16	16.22	12.77	18.01	17.10	16.12	15.08	13.95	12.74	11.39	9.87	9.01	8.06	6.98	5.70	4.77	4.03
16	18.21	16.26	12.81	18.07	17.15	16.16	15.12	14.00	12.78	11.42	9.89	9.03	8.08	7.00	5.71	4.78	4.04
18	18.27	16.32	12.85	18.13	17.20	16.22	15.17	14.04	12.82	11.46	9.93	9.06	8.11	7.02	5.73	4.80	4.05
20	18.34	16.38	12.90	18.19	17.27	16.28	15.23	14.09	12.87	11.50	9.96	9.10	8.14	7.05	5.75	4.81	4.07
22	18.41	16.44	12.95	18.27	17.33	16.34	15.29	14.15	12.92	11.55	10.00	9.13	8.17	7.08	5.77	4.83	4.09
24	18.49	16.52	13.01	18.35	17.41	16.41	15.35	14.21	12.98	11.60	10.05	9.17	8.21	7.11	5.80	4.85	4.10
26	18.58	16.59	13.07	18.43	17.49	16.49	15.43	14.28	13.04	11.66	10.09	9.22	8.25	7.14	5.83	4.88	4.12
28	18.67	16.68	13.14	18.53	17.58	16.57	15.50	14.35	13.11	11.71	10.15	9.26	8.29	7.18	5.86	4.90	4.14
30	18.77	16.77	13.21	18.63	17.68	16.66	15.59	14.43	13.18	11.78	10.20	9.31	8.33	7.21	5.89	4.93	4.17
32	18.88	16.86	13.28	18.73	17.78	16.76	15.68	14.51	13.25	11.84	10.26	9.37	8.38	7.26	5.92	4.96	4.19
34	18.99	16.96	13.36	18.84	17.88	16.86	15.77	14.60	13.33	11.91	10.32	9.42	8.43	7.30	5.96	4.99	4.21
36	19.11	17.07	13.44	18.96	17.99	16.96	15.87	14.69	13.41	11.99	10.38	9.48	8.48	7.34	5.99	5.02	4.24
38	19.23	17.18	13.53	19.08	18.11	17.07	15.97	14.78	13.50	12.07	10.45	9.54	8.54	7.39	6.03	5.05	4.27
40	19.37	17.30	13.62	19.21	18.23	17.19	16.08	14.88	13.59	12.15	10.52	9.61	8.59	7.44	6.07	5.08	4.30
42	19.50	17.42	13.72	19.35	18.36	17.31	16.19	14.99	13.69	12.23	10.60	9.67	8.66	7.49	6.12	5.12	4.33
44	19.64	17.55	13.82	19.49	18.50	17.44	16.31	15.10	13.79	12.32	10.67	9.75	8.72	7.55	6.16	5.16	4.36
46	19.79	17.68	13.92	19.64	18.64	17.57	16.43	15.21	13.89	12.42	10.75	9.82	8.78	7.61	6.21	5.20	4.39
48	19.94	17.81	14.03	19.79	18.78	17.70	16.56	15.33	14.00	12.51	10.84	9.89	8.85	7.66	6.26	5.24	4.43
50	20.10	17.96	14.14	19.95	18.93	17.84	16.69	15.45	14.11	12.61	10.92	9.97	8.92	7.73	6.31	5.28	4.46
52	20.27	18.10	14.26	20.11	19.08	17.99	16.83	15.58	14.22	12.71	11.01	10.05	8.99	7.79	6.36	5.32	4.50

54	20.43	18.25	14.38	20.27	19.24	18.14	16.97	15.71	14.34	12.82	11.10	10.14	9.07	7.85	6.41	5.36	4.53
56	20.61	18.41	14.50	20.45	19.40	18.29	17.11	15.84	14.46	12.93	11.20	10.22	9.15	7.92	6.46	5.41	4.57
58	20.79	18.57	14.62	20.62	19.57	18.45	17.26	15.98	14.59	13.04	11.29	10.31	9.23	7.99	6.52	5.46	4.61
60	20.97	18.73	14.75	20.80	19.74	18.61	17.41	16.12	14.72	13.15	11.39	10.40	9.31	8.06	6.58	5.50	4.65
62	21.16	18.90	14.88	20.99	19.92	18.78	17.57	16.26	14.85	13.27	11.50	10.50	9.39	8.13	6.64	5.55	4.69
64	21.35	19.07	15.02	21.18	20.10	18.95	17.73	16.41	14.98	13.39	11.60	10.59	9.47	8.20	6.70	5.60	4.74
66	21.54	19.24	15.16	21.38	20.28	19.12	17.89	16.56	15.12	13.52	11.71	10.69	9.56	8.28	6.76	5.66	4.78
68	21.74	19.42	15.30	21.57	20.47	19.30	18.05	16.71	15.26	13.64	11.81	10.79	9.65	8.36	6.82	5.71	4.83
70	21.95	19.60	15.44	21.78	20.67	19.48	18.22	16.87	15.40	13.77	11.93	10.89	9.74	8.43	6.88	5.76	4.87
72	22.16	19.79	15.59	21.98	20.86	19.67	18.40	17.03	15.55	13.90	12.04	10.99	9.83	8.51	6.95	5.82	4.92
74	22.37	19.98	15.74	22.19	21.06	19.85	18.57	17.19	15.70	14.03	12.15	11.10	9.93	8.60	7.02	5.87	4.96
76	22.58	20.17	15.89	22.41	21.26	20.05	18.75	17.36	15.85	14.17	12.27	11.20	10.02	8.68	7.08	5.93	5.01
78	22.80	20.37	16.04	22.63	21.47	20.24	18.93	17.53	16.01	14.31	12.39	11.31	10.12	8.76	7.15	5.99	5.06
80	23.03	20.57	16.20	22.85	21.68	20.44	19.12	17.70	16.16	14.45	12.51	11.42	10.22	8.85	7.22	6.04	5.11
82	23.25	20.77	16.36	23.07	21.89	20.64	19.31	17.87	16.32	14.59	12.63	11.54	10.32	8.94	7.29	6.10	5.16
84	23.48	20.97	16.52	23.20	22.11	20.84	19.50	18.05	16.48	14.73	12.76	11.65	10.42	9.02	7.37	6.16	5.21
86	23.71	21.18	16.68	23.53	22.33	21.05	19.69	18.23	16.65	14.88	12.89	11.76	10.53	9.11	7.44	6.23	5.26
88	23.95	21.39	16.85	23.76	22.55	21.26	19.89	18.41	16.81	15.03	13.01	11.88	10.63	9.20	7.51	6.29	5.31
90	24.19	21.61	17.02	24.00	22.78	21.47	20.09	18.59	16.98	15.18	13.14	12.00	10.74	9.30	7.59	6.35	5.37
92	24.43	21.82	17.19	24.24	23.00	21.69	20.29	18.78	17.15	15.33	13.28	12.12	10.84	9.39	7.66	6.41	5.42
94	24.68	22.04	17.36	24.48	23.24	21.90	20.49	18.97	17.32	15.48	13.41	12.24	10.95	9.48	7.74	6.48	5.48
96	24.92	22.26	17.54	24.73	23.47	22.12	20.70	19.16	17.49	15.64	13.54	12.37	11.06	9.58	7.82	6.54	5.53
98	25.17	22.49	17.71	24.98	23.70	22.35	20.90	19.35	17.67	15.79	13.68	12.49	11.17	9.67	7.90	6.61	5.59
100	25.43	22.71	17.89	25.23	23.94	22.57	21.11	19.54	17.85	15.95	13.82	12.61	11.29	9.77	7.98	6.68	5.64

	The sub-plot sizes can be measured by holding the tape horizontally:					
plot (ha)	0.004	0.003	0.002	0.001	0.0005	0.0003
P.H.F.	250.00	333.33	500.00	1000.00	2000.00	3333.33
Plot Radii (m)	3.57	3.09	2.52	1.78	1.26	0.98

P.H.F. is the Per Hectare Factor.

Appendix 7: Isogonic and Isoporic Table

Magnetic Declination and Annual Change for May 2002

Latitude and Longitude for selected points for Magnetic Declination determination and Annual Change					
Region	**Location**	**Latitude**	**Longitude**	**Declination**	**Annual**
		in degrees, minutes		**May 2002**	**Change**
Cariboo	Quesnel townsite	52,57	122,30	20 41 E	11.5 W
Cariboo	Farwell Canyon	51,49	122,34	20 10 E	10.6 W
Cariboo	mid - Horsefly Lake	52,24	121,02	20 07 E	11.0 W
Cariboo	100 Mile House Townsite	51,39	121,17	19 49 E	10.5 W
Cariboo	Chilanko Forks Settlement	52,07	124,04	20 35 E	10.9 W
Kamloops	Chase	50,49	119,41	19 05 E	9.8 W
Kamloops	Lillooet	50,40	121,56	19 31 E	9.8 W
Kamloops	Merritt	50,07	120,47	19 02 E	9.4 W
Kamloops	Princeton	49,28	120,30	18 42 E	8.9 W
Kamloops	Penticton	49,30	119,35	18 30 E	8.9 W
Kamloops	Vernon	50,16	119,16	18 44 E	9.4 W
Kamloops	Salmon Arm	50,42	119,16	18 56 E	9.7 W
Kamloops	Kamloops	50,40	120,19	19 10 E	9.7 W
Kamloops	Clearwater	51,39	120,02	19 32 E	10.4 W
Nelson	Beaverdell	49,26	119,05	18 21 E	8.8 W
Nelson	Castlegar	49,19	117,39	17 55 E	8.7 W
Nelson	Cranbrook	49,30	115,46	17 23 E	8.8 W
Nelson	Creston	49,06	116,31	17 29 E	8.5 W
Nelson	Flathead	49,22	114,37	16 53 E	8.6 W
Nelson	Golden	51,18	116,58	18 31 E	10.1 W
Nelson	Grand Forks	49,02	118,27	18 02 E	8.6 W
Nelson	Invermere	50,31	116,02	17 52 E	9.5 W
Nelson	Kalso	49,55	116,54	17 56 E	9.1 W
Nelson	Mica Creek	52,05	118,34	19 21 E	10.7 W
Nelson	Nakusp	50,14	117,48	18 20 E	9.3 W
Nelson	Nelson	49,29	117,17	17 52 E	8.8 W
Nelson	Revelstoke	50,59	118,12	18 46 E	9.9 W
Nelson	Sparwood	49,43	114,53	17 07 E	8.9 W
Prince George	Valemount	52,50	119,15	19 53 E	11.3 W
Prince George	McBride	53,18	120,10	20 20E	11.7 W
Prince George	Hixon	53,52	122,35	21 09 E	12.3 W
Prince George	Prince George	53,55	122,45	21 13 E	12.3 W
Prince George	Bear Lake (Hart Hwy)	54,30	122,40	21 30 E	12.8 W
Prince George	Vanderhoof	54,01	124,01	21 30 E	12.4 W
Prince George	Kenny Dam	53,36	124,58	21 27 E	12.0 W
Prince George	Ft. St. James	54,26	124,15	21 46 E	12.8 W
Prince George	Takla Landing	55,29	125,58	22 38 E	13.7 W
Prince George	Manson Creek	55,40	124,29	22 31 E	13.9 W
Prince George	Aiken Lake	56,26	125,45	23 11 E	14.6 W
Prince George	Bear Lake (Driftwood)	56,12	126,51	23 10 E	14.3 W
Prince George	Mackenzie	55,18	123,10	22 03 E	13.5 W
Prince George	Fort Ware	57,26	125,38	23 50 E	15.6 W
Prince George	Ingenika Point	56,47	124,52	23 17 E	15.0 W
Prince George	Ingenika Mine	56,42	125,11	23 17 E	14.9 W
Prince George	Dawson Creek	55,46	120,14	21 36 E	14.0 W
Prince George	Chetwynd	55,42	121,38	21 56 E	13.9 W
Prince George	Tumbler Ridge	55,07	120,55	21 26 E	13.4 W

Latitude and Longitude for selected points for Magnetic Declination determination and Annual Change					
Region	**Location**	**Latitude**	**Longitude**	**Declination**	**Annual**
		in degrees, minutes		**May 2002**	**Change**
Prince George	Fort St. John	56,15	120,51	22 03 E	14.5 W
Prince George	Beaton River (settl.)	57,23	121,25	22 56 E	15.7 W
Prince George	Pink Mountain	57,02	122,31	22 59 E	15.3 W
Prince George	Fort Nelson	58,48	122,43	24 17 E	17.4 W
Prince George	Muncho Lake	58,59	125,47	24 56 E	17.4 W
Prince George	Nelson Forks	59,30	124,01	25 05 E	18.2 W
Prince Rupert	Burns Lake	54,21	126,31	22 04 E	12.6 W
Prince Rupert	Houston	54,27	126,37	22 08 E	12.7 W
Prince Rupert	Smithers	54,47	127,11	22 23 E	13.0 W
Prince Rupert	Hazelton	55,13	127,35	22 40 E	13.4 W
Prince Rupert	Terrace	54,31	128,36	22 23 E	12.7 W
Prince Rupert	Prince Rupert	54,18	130,20	22 23 E	12.5 W
Prince Rupert	Stewart	55,57	130,00	23 13 E	13.9 W
Prince Rupert	Lower Post	55,55	128,32	23 09 E	13.9 W
Prince Rupert	Dease Lake	58,27	130,02	24 40 E	16.3 W
Prince Rupert	Atlin	59,35	133,41	25 00 E	16.8 W
Vancouver	Chilliwack	49,10	121,57	18 55 E	8.7 W
Vancouver	Haney	49,13	122,36	19 05 E	8.8 W
Vancouver	Abbotsford	49,03	122,17	18 57 E	8.6 W
Vancouver	Vancouver	49,15	123,07	19 12 E	8.8 W
Vancouver	Squamish	49,45	123,07	19 24 E	9.1 W
Vancouver	Powell River	49,51	124,32	19 43 E	9.2 W
Vancouver	Campbell River	50,01	125,20	19 56 E	9.3 W
Vancouver	Port McNeill	50,35	127,06	20 26 E	9.7 W
Vancouver	Gold River	49,41	126,07	19 56 E	9.1 W
Vancouver	Nanaimo	49,10	123,56	19 21 E	8.7 W
Vancouver	Tofino	49,07	125,53	19.41 E	8.8 W
Vancouver	Duncan	48,47	123,42	19 09 E	8.5 W
Vancouver	Port Alberni	49,14	124,58	19 34 E	8.8 W
Vancouver	Sayward	50,23	125,58	20 11 E	9.6 W
Vancouver	Holberg	50,39	128,01	20 34 E	9.8 W
Vancouver	Port Renfrew	48,33	124,25	19 13 E	8.4 W
Vancouver	Massett	54,01	132,06	22 16 E	12.2 W
Vancouver	Queen Charlotte City	53,15	128,31	21 45 E	11.7 W
Vancouver	Klemtu	52,35	128,31	21 27 E	11.2 W
Vancouver	Hagensborg	52,23	126,33	21 07 E	11.1 W
Vancouver	Security Bay	51,22	127,28	20 48 E	10.3 W
Vancouver	Alison Sound	51,15	127,00	20 42 E	10.2 W
Vancouver	Pemberton	50,19	122,48	19 34 E	9.5 W
Vancouver	Boston Bar	49,52	121,26	19 05 E	9.2 W
Vancouver	Stuart Island	50,22	125,08	20 02 E	9.6 W
Vancouver	Sewell Inlet	52,53	131,59	21 44 E	11.4 W
Vancouver	Franklin River	49,00	124,45	19 26 E	8.7 W
Vancouver	Rivers Inlet	51,41	127,15	20 55 E	10.5 W

If you require a declination for a location not listed above, the following Internet site will give it to you provided that you know the latitude and longitude in degrees and minutes.

http://www.geolab.nrcan.gc.ca/geomag/e_cgrf.html

Appendix 8: Plot and Sub-Plot Radii Slope Allowance For Treated Stands

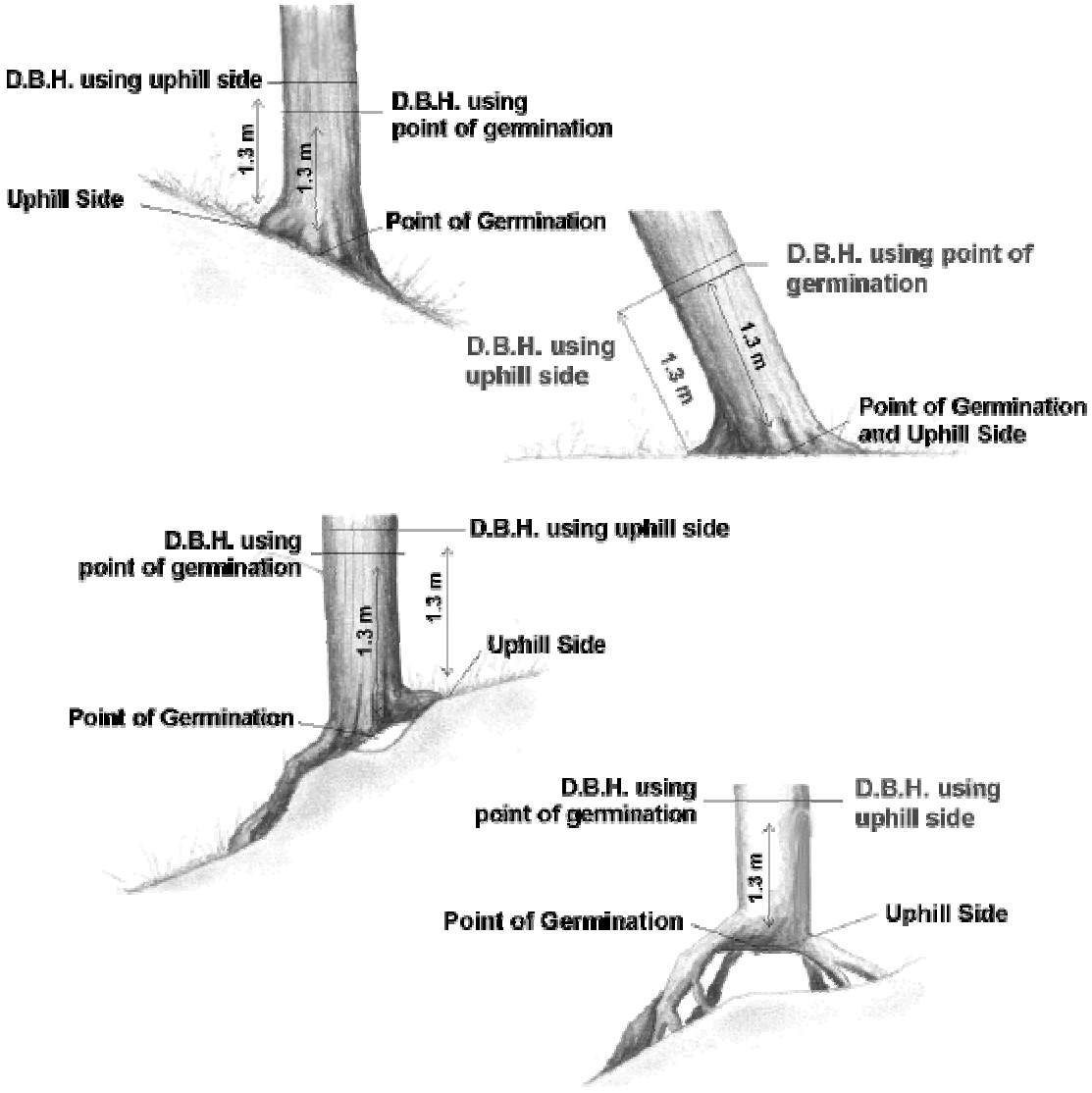
	Plot and Sub-plot Size (ha)/P.H.P./Radii (m)																				
	0.30	0.225	0.19	0.15	0.12	0.1	0.09	0.08	0.07	0.06	0.05	0.04	0.032	0.03	0.025	0.024	0.02	0.016	0.015	0.012	0.01
	3.33	4.44	5.26	6.67	8.33	10.0	11.11	12.50	14.29	16.67	20.00	25.00	31.25	33.33	40.00	41.67	50.00	62.50	66.67	83.33	100.0
	30.90	26.76	24.59	21.85	19.54	17.84	16.93	15.96	14.93	13.82	12.62	11.28	10.09	9.77	8.92	8.74	7.98	7.14	6.91	6.18	5.64
Slope %	**Plot and Sub-plot Radii Plots Slope Allowance (m)**																				
10	31.05	26.89	24.71	21.96	19.64	17.93	17.01	16.04	15.00	13.89	12.68	11.34	10.14	9.82	8.96	8.78	8.02	7.18	6.94	6.21	5.67
12	31.12	26.95	24.77	22.01	19.68	17.97	17.05	16.07	15.04	13.92	12.71	11.36	10.16	9.84	8.98	8.80	8.04	7.19	6.96	6.22	5.68
14	31.20	27.02	24.83	22.06	19.73	18.01	17.10	16.12	15.08	13.95	12.74	11.39	10.19	9.87	9.01	8.83	8.06	7.21	6.98	6.24	5.70
16	31.29	27.10	24.90	22.13	19.79	18.07	17.15	16.16	15.12	14.00	12.78	11.42	10.22	9.89	9.03	8.85	8.08	7.23	7.00	6.26	5.71
18	31.40	27.19	24.99	22.20	19.85	18.13	17.20	16.22	15.17	14.04	12.82	11.46	10.25	9.93	9.06	8.88	8.11	7.25	7.02	6.28	5.73
20	31.51	27.29	25.08	22.28	19.93	18.19	17.27	16.28	15.23	14.09	12.87	11.50	10.29	9.96	9.10	8.91	8.14	7.28	7.05	6.30	5.75
22	31.64	27.40	25.18	22.37	20.01	18.27	17.33	16.34	15.29	14.15	12.92	11.55	10.33	10.00	9.13	8.95	8.17	7.31	7.08	6.33	5.77
24	31.78	27.52	25.29	22.47	20.09	18.35	17.41	16.41	15.35	14.21	12.98	11.60	10.38	10.05	9.17	8.99	8.21	7.34	7.11	6.36	5.80
26	31.93	27.65	25.41	22.58	20.19	18.43	17.49	16.49	15.43	14.28	13.04	11.66	10.43	10.09	9.22	9.03	8.25	7.38	7.14	6.39	5.83
28	32.09	27.79	25.54	22.69	20.29	18.53	17.58	16.57	15.50	14.35	13.11	11.71	10.48	10.15	9.26	9.08	8.29	7.41	7.18	6.42	5.86
30	32.26	27.94	25.67	22.81	20.40	18.63	17.68	16.66	15.59	14.43	13.18	11.78	10.53	10.20	9.31	9.12	8.33	7.45	7.21	6.45	5.89
32	32.44	28.10	25.82	22.94	20.52	18.73	17.78	16.76	15.68	14.51	13.25	11.84	10.59	10.26	9.37	9.18	8.38	7.50	7.26	6.49	5.92
34	32.64	28.26	25.97	23.08	20.64	18.84	17.88	16.86	15.77	14.60	13.33	11.91	10.66	10.32	9.42	9.23	8.43	7.54	7.30	6.53	5.96
36	32.84	28.44	26.13	23.22	20.77	18.96	17.99	16.96	15.87	14.69	13.41	11.99	10.72	10.38	9.48	9.29	8.48	7.59	7.34	6.57	5.99
38	33.06	28.63	26.31	23.37	20.90	19.08	18.11	17.07	15.97	14.78	13.50	12.07	10.79	10.45	9.54	9.35	8.54	7.64	7.39	6.61	6.03
40	33.28	28.82	26.48	23.53	21.05	19.21	18.23	17.19	16.08	14.88	13.59	12.15	10.87	10.52	9.61	9.41	8.59	7.69	7.44	6.66	6.07
42	33.51	29.02	26.67	23.70	21.19	19.35	18.36	17.31	16.19	14.99	13.69	12.23	10.94	10.60	9.67	9.48	8.66	7.74	7.49	6.70	6.12
44	33.76	29.24	26.87	23.87	21.35	19.49	18.50	17.44	16.31	15.10	13.79	12.32	11.02	10.67	9.75	9.55	8.72	7.80	7.55	6.75	6.16
46	34.01	29.46	27.07	24.05	21.51	19.64	18.64	17.57	16.43	15.21	13.89	12.42	11.11	10.75	9.82	9.62	8.78	7.86	7.61	6.80	6.21
48	34.28	29.68	27.28	24.24	21.67	19.79	18.78	17.70	16.56	15.33	14.00	12.51	11.19	10.84	9.89	9.69	8.85	7.92	7.66	6.86	6.26
50	34.55	29.92	27.49	24.43	21.85	19.95	18.93	17.84	16.69	15.45	14.11	12.61	11.28	10.92	9.97	9.77	8.92	7.98	7.73	6.91	6.31
52	34.83	30.16	27.72	24.63	22.02	20.11	19.08	17.99	16.83	15.58	14.22	12.71	11.37	11.01	10.05	9.85	8.99	8.05	7.79	6.97	6.36
54	35.12	30.41	27.95	24.83	22.21	20.27	19.24	18.14	16.97	15.71	14.34	12.82	11.47	11.10	10.14	9.93	9.07	8.11	7.85	7.02	6.41
56	35.42	30.67	28.18	25.04	22.40	20.45	19.40	18.29	17.11	15.84	14.46	12.93	11.56	11.20	10.22	10.02	9.15	8.18	7.92	7.08	6.46
58	35.72	30.94	28.43	25.26	22.59	20.62	19.57	18.45	17.26	15.98	14.59	13.04	11.66	11.29	10.31	10.10	9.23	8.25	7.99	7.14	6.52
60	36.04	31.21	28.68	25.48	22.79	20.80	19.74	18.61	17.41	16.12	14.72	13.15	11.77	11.39	10.40	10.19	9.31	8.33	8.06	7.21	6.58
62	36.36	31.49	28.93	25.71	22.99	20.99	19.92	18.78	17.57	16.26	14.85	13.27	11.87	11.50	10.50	10.28	9.39	8.40	8.13	7.27	6.64
64	36.69	31.77	29.19	25.94	23.20	21.18	20.10	18.95	17.73	16.41	14.98	13.39	11.98	11.60	10.59	10.38	9.47	8.48	8.20	7.34	6.70
66	37.02	21.06	29.46	26.18	23.41	21.38	20.28	19.12	17.89	16.56	15.12	13.52	12.09	11.71	10.69	10.47	9.56	8.55	8.28	7.40	6.76
68	37.37	32.36	29.74	16.42	23.63	21.57	20.47	19.30	18.05	16.71	15.26	13.64	12.20	11.81	10.79	10.57	9.65	8.63	8.36	7.47	6.82
70	37.72	32.66	30.02	26.67	23.85	21.78	20.67	19.48	18.22	16.87	15.40	13.77	12.32	11.93	10.89	10.67	9.74	8.72	8.43	7.54	6.88
72	38.08	32.97	30.30	26.92	24.08	21.98	20.86	19.67	18.40	17.03	15.55	13.90	12.43	12.04	10.99	10.77	9.83	8.80	8.51	7.62	6.95
74	38.44	33.29	30.59	27.18	24.31	22.19	21.06	19.85	18.57	17.19	15.70	14.03	12.55	12.15	11.10	10.87	9.93	8.88	8.60	7.69	7.02
76	38.81	33.61	30.89	27.44	24.54	22.41	21.26	20.05	18.75	17.36	15.85	14.17	12.67	12.27	11.20	10.98	10.02	8.97	8.68	7.76	7.08
78	39.19	33.94	31.19	27.71	24.78	22.63	21.47	20.24	18.93	17.53	16.01	14.31	12.80	12.39	11.31	11.08	10.12	9.06	8.76	7.84	7.15
80	39.57	34.27	31.49	27.98	25.02	22.85	21.68	20.44	19.12	17.70	16.16	14.45	12.92	12.51	11.42	11.19	10.22	9.14	8.85	7.91	7.22
82	39.96	34.61	31.80	28.26	25.27	23.07	21.89	20.64	19.31	17.87	16.32	14.59	13.05	12.63	11.54	11.30	10.32	9.23	8.94	7.99	7.29
84	40.35	34.95	32.11	28.54	25.52	23.30	22.11	20.84	19.50	18.85	16.48	14.73	13.18	12.76	11.65	11.41	10.42	9.32	9.02	8.07	7.37
86	40.76	35.29	32.43	28.82	25.77	23.53	22.33	21.05	19.69	18.23	16.65	14.88	13.31	12.89	11.76	11.53	10.53	9.42	9.11	8.15	7.44
88	41.16	35.65	32.76	29.11	26.03	23.76	22.55	21.26	19.89	18.41	16.81	15.03	13.44	13.01	11.88	11.64	10.63	9.51	9.20	8.23	7.51
90	41.57	36.00	33.08	29.40	26.29	24.00	22.78	21.47	20.09	18.59	16.98	15.18	13.57	13.14	12.00	11.76	10.74	9.61	9.30	8.31	7.59
92	41.99	36.36	33.41	29.69	26.55	24.24	23.00	21.69	20.29	18.78	17.15	15.33	13.71	13.28	12.12	11.88	10.84	9.70	9.39	8.40	7.66
94	42.41	36.73	33.75	29.99	26.82	24.48	23.24	21.90	20.49	18.97	17.32	15.48	13.85	13.41	12.24	12.00	10.95	9.80	9.48	8.48	7.74
96	42.83	37.10	34.09	30.29	27.09	24.73	23.47	22.12	20.70	19.16	17.49	15.64	13.99	13.54	12.37	12.12	11.06	9.90	9.58	8.57	7.82
98	43.26	37.47	34.43	30.59	27.36	27.98	23.70	22.35	20.90	19.35	17.67	15.79	14.13	13.68	12.49	12.24	11.17	10.00	9.67	8.65	7.90
100	43.70	37.84	34.78	30.90	27.63	25.23	23.94	22.57	21.11	19.54	17.85	15.95	14.27	13.82	12.61	12.36	11.29	10.10	9.77	8.74	7.98

These sub-plot sizes can be measured by holding the tape horizontally							
Sub-plot (ha)	0.008	0.007	0.006	0.005	0.004	0.003	0.002
Per Hectare Factor	125.00	142.86	166.67	200.00	250.00	333.33	500.00
Plot Radii (m)	5.05	4.72	4.37	3.99	3.57	3.09	2.52

Appendix 9: Determining Breast Height

Plots established prior to 1991 used the Point of Germination Method

Plots Established After 1990 used the Uphill Side Method

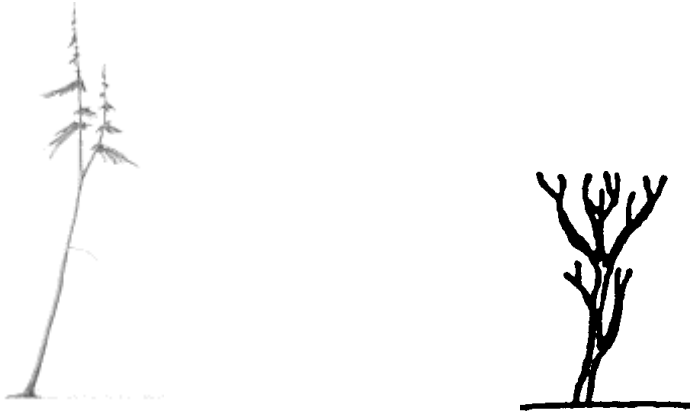


Appendix 10: Special Rules for the Measurement and Classification of Abnormal Trees

Counting and Height Measurement of Abnormal Trees Less than 2.0 cm DBH.

1. Straighten the stem and measure the length from the germination point to the tip of the terminal bud.

2. Count as one tree and measure the length from the germination point to the tip of the terminal bud on the tallest leader.



(Temporary Picture)

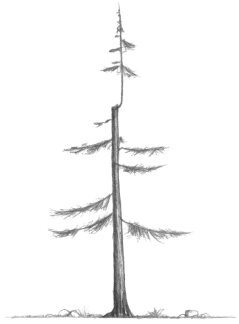
3. Count as one tree and measure the height from the germination point to the tip of the terminal bud on the tallest leader.

(Temporary Picture)

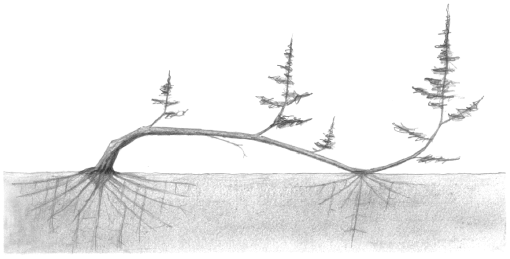
4. Count as one tree and measure the length of the bole (stump height) from the germination point to the cut.

(Temporary Picture)

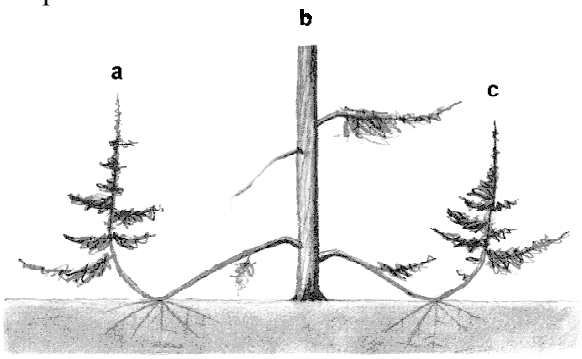
5. Measure the height from the germination point to the tip of the terminal bud on the new leader.



6. Count as two trees (each root system is treated as a tree) and measure the length from each rooting system to the tallest leader.



7. Tag or count as three trees. Measure the length of A and C from the germination point to the tip of the leader.



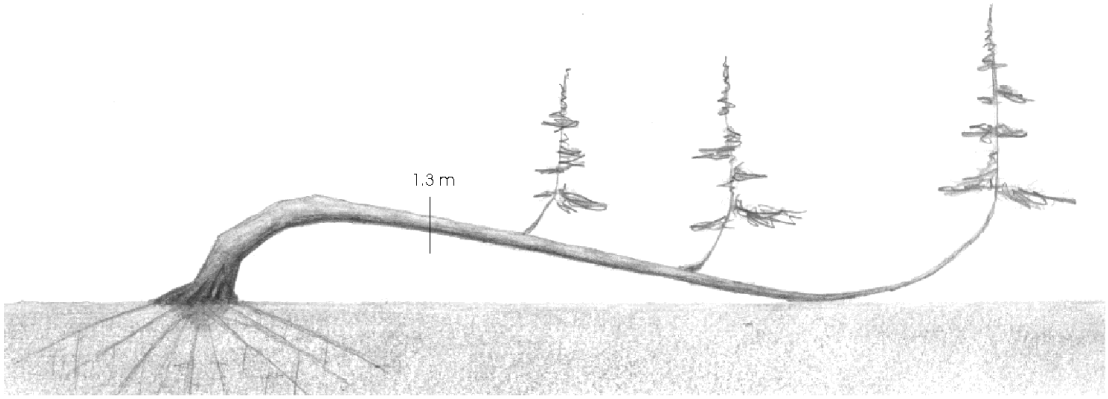
Distinction Between Broken Top and for Trees Greater than 2.0 cm DBH.

1. Classify as broken top until an new leader reaches one metre in length when it will be classified as a fork.

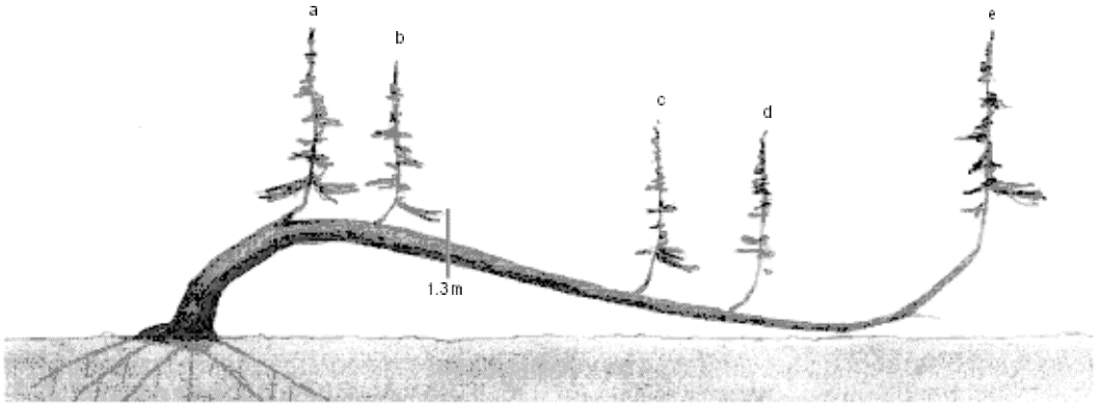
2. Classify as a fork

Trees Greater than 2.0 cm DBH Growing Along the Ground

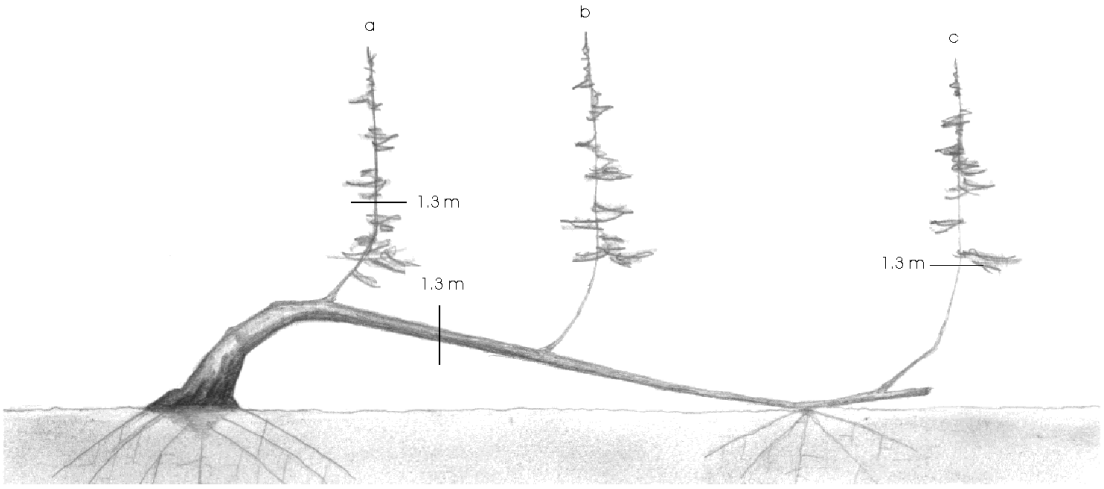
1. One rooting system, tag and record as one tree.



2. One rooting system and one or more trees below breast height A and B are branches which are less than 4.0cm dbh (in plot) or 2.0 cm dbm (in sub-plot), tag and record as a single tree.



3. Two rooting systems and one fork below breast height, tag and record as three trees. A is a fork below DBH and greater than 4.0 cm. B and C have separate rooting systems.



Appendix 11: Pathological Classification of Trees

In mature and older immature stands, the amount of decay that may be present in individual trees can vary considerably. However, reliable estimates of net stand volumes must be obtained. This is accomplished through sampling and through the application of decay reduction factors during sample compilation. But, it must be realized that the correct application of these factors can only be achieved when sampling crews correctly identify and record the presence (or absence) of the decay indicators. This involves the determination of suspect and residual tree classes.

Classes of Trees

All living trees, equal to or greater than 2.0 cm d.b.h. in the sub-plot and 4.0 cm d.b.h. in the plot, are classed as suspect or residual.

Suspect Trees

Suspect trees are living trees which have one or more of the following external indicators of decay on, or immediately adjacent to, the trunk.

1. Conks
2. Blind conks (swollen knots)
3. Scars
4. Fork or pronounced crook
5. Frost crack
6. Trunk infections of mistletoe
7. Rotten branches
8. Dead top
9. Broken top

Note: Classify a tree as suspect on the basis of one or more of the indicators in the preceding list; no other abnormalities are to be used.

Indicators of decay signify decay in the stand rather than in individual trees. The amount of decay indicated varies considerably among species and between individual trees. For example, frost cracks might be highly significant of decay on a particular species in the stand as a whole, but not of individual trees within that stand. On other species within the same

stand, frost cracks may not be indicative of decay. However, we must know the occurrence of each indicator of decay before an evaluation can be attempted for any species or stand.

Residual Trees

Residual trees are living trees which bear none of the external indicators of decay listed in "Suspect Trees".

Suspect Indicators of Decay on Standing Trees

A brief description and explanation of the external indicators of decay listed in "Suspect Trees" follows:

Conks

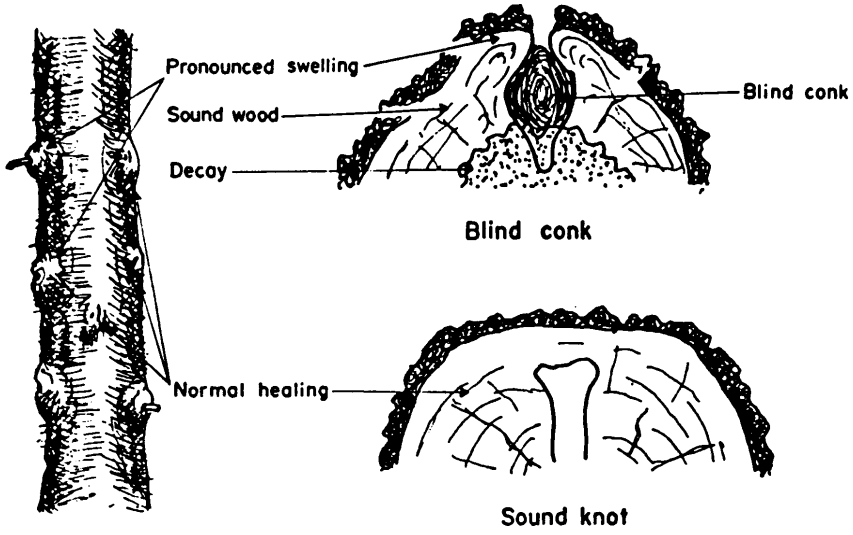
Conks are definite and reliable indicators of decay. They appear most frequently on the underside of dead branch stubs, on branch scars, and on the underside of live branches in the crown of the tree.

Conks vary in size and shape. Consequently, they are hard to spot, particularly when they occur on the upper trunk. Conks of certain fungi, notably *Echinodontium tinctorium* and *Fomes pini*, frequently appear as small hoof-like or shell-like forms on the underside of dead branch stubs on the middle and/or lower trunk of the infected tree.

Moss-covered branch stubs and burls often resemble conks, particularly when viewed from directly below; thus, it is sound practice to view the tree from the side before taking a decision. Remember that conks may appear anywhere on the trunk of an affected tree. Therefore, look for conks on the upper as well as on the lower trunk.

Blind Conks

Blind conks (swollen knots) of Fomes pini are as significant indicators of decay as are conks. Blind conks appear typically as pronounced swellings around knots and are quite different from a normal healed-over sound knot. The swelling results from the tree attempting to heal over an abortive conk or the point from which an old conk has dropped. The swelling is often accentuated by the growing conk which actually pushes out the thick, dead, outer bark of the tree. Often the affected knot is partially covered by sound wood, which is implied by the term "blind" conk. A cut with an axe into a blind conk will reveal the bright yellow or buff colour of the conk (see Figure 1).



Appearance on standing tree

Cross section showing blind conk and a sound knot.

Figure 1. Blind conk and sound knot.

Scars

A scar is any injury, not recent in origin, caused by certain external physical forces or agents, which have exposed the heartwood and/or sapwood of the tree to attack by wood-rotting fungi. We are concerned with scars that signify decay.

Scars are identified as suspect or non-suspect. Suspect scars are indicators of decay whereas non-suspect scars are not, and are not recorded.

Rules

A. Suspect scars may be caused by any of these external physical forces or agents:

1. Fire
2. Lightning
3. Falling trees
4. Logging or other machinery
5. Old blazing
6. Breakage of branches, of secondary leaders, and of suckers from or immediately adjacent to the trunk of the tree caused by wind or heavy snowfall.
7. Animals or birds causing damage to the trunks of trees.
8. Fungi causing cankers on the trunk.

9. Rock slides or falling rocks.

10. Undetermined causes.

Note: Classify cracking of the trunk caused by low extremes of temperature as a frost crack (see Figure 8).

B. Suspect scars caused by the forces or agents listed under A must not be recent or superficial.

These suspect scars are not recent in origin or superficial:

1. Closed scars, that is, scars which have healed (see Figure 3).

2. Open scars or catfaces that show weathered wood (see Figure 4). See the discussion under "Forms of Scars" in this Appendix.

C. Suspect scars can occur anywhere on the trunk of a tree between its germination point and top (see Figure 2).

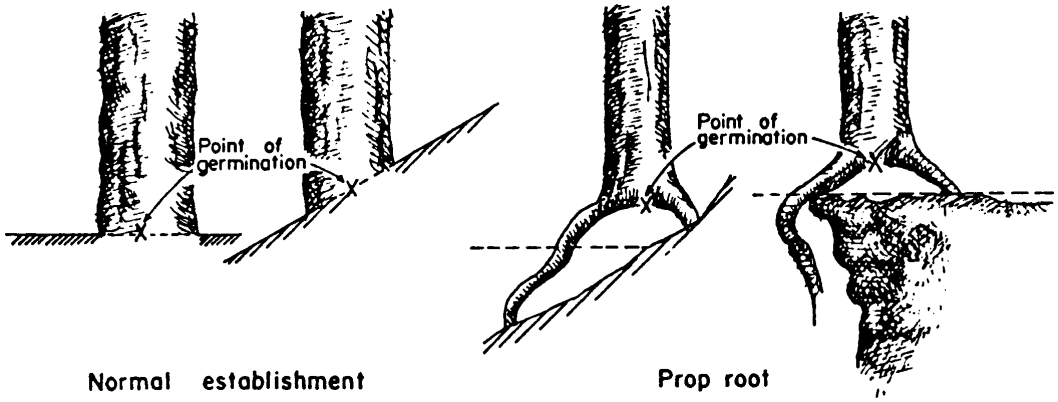


Figure 2. Point of germination.

D. Certain physical forces or agents cause superficial scars which are not significant of decay. We are not concerned with this type of non-suspect scar as it is not an indicator of decay.

E. Suspect scars may be of any size.

Forms of Scars

A. Closed scars

A closed scar, which is the result of an early injury that has healed, appears as slight to pronounced indentations of the bark; whereas one that is the result of a more recent injury appears as pronounced scar tissue or callus growth, and often seeps considerable amounts of resin (see Figure 3).

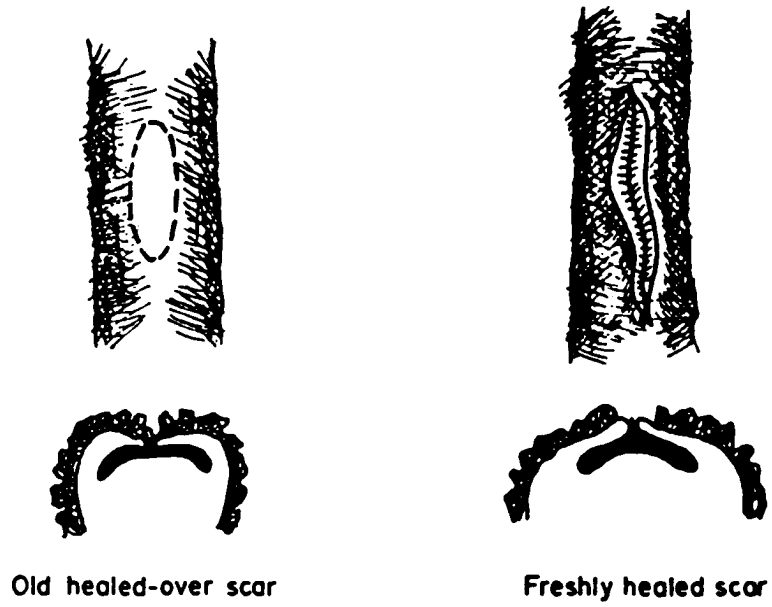


Figure 3. Closed scars.

B. Open scars

Open scars appear as areas of exposed wood of various sizes and shapes. They are the result of severe damage to the tree by fire, lightning, logging, machinery or one of the other causes listed under "Kinds of Scars" in this Appendix.

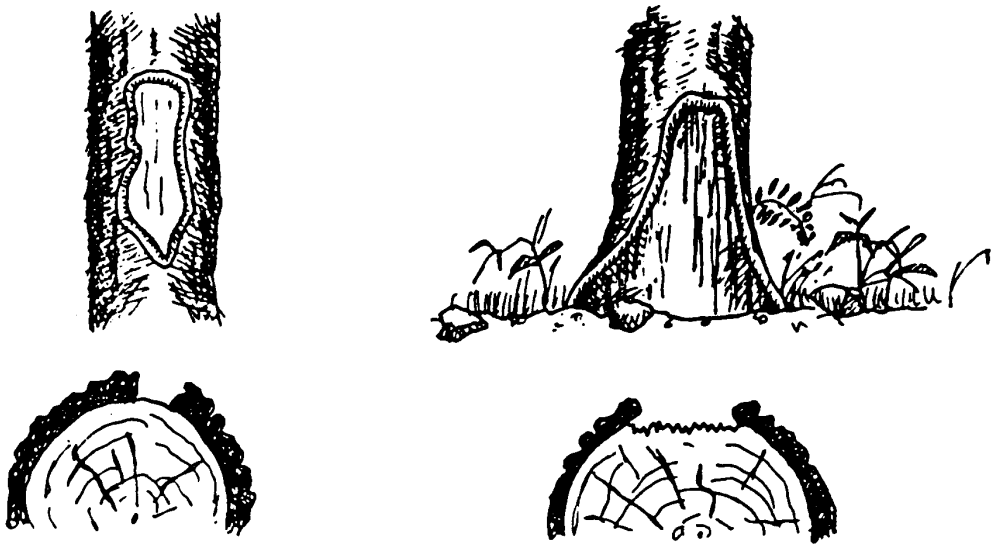
Depending upon the extent and severity of damage to the tree, two types of open scars are recognizable. The first type is the result of damage confined to the bark and cambium layers with little or no damage to the wood, and the appearance and contour of the exposed wood is not appreciably altered. The second type results from extensive damage to the wood and is generally referred to as "catface" (see Figure 4).

Kinds of Scars

A. Old fire scars that have healed over appear typically as slight to pronounced indentations, whereas more recent scars or ones resulting from severe damage appear as open catfaces or hollowings of the trunk.

Fire scars are usually confined to the base of the trunk.

Fire scars are important indicators of decay. In forest stands having a fire history, examine the trees for evidence of them in the form of charred wood within the scar or charring in root crotches and on exposed roots.



Light Damage Extensive Damage

Figure 4. Open scars.

B. Lightning scars

Lightning causes extensive damage to the trunks and tops of trees. Lightning scars appear typically as narrow to fairly wide strips of torn wood, often extending down the entire length of the tree as a spiral.

C. Falling-tree scars

Trees are frequently scarred by other trees falling against them. Scars of this type are common in selectively cut stands as well as in natural stands. Evidence of this kind of scarring is often a fallen tree against or near to the scarred tree.

D. Logging or other machinery scars

Machinery may cause extensive damage to seed trees, to trees adjacent to logging, and to the trees left after selective cutting. These scars are usually confined to the lower trunk, but they may also occur on the upper trunk when caused by rigging.

E. Old blazing

Old blazes are entry points for wood-rotting fungi. Note that recent blazing is not a suspect scar.

F. Scars caused by breakage of branches, of secondary leaders and of suckers

High winds, heavy snow, and branches falling from adjacent trees can break secondary leaders and suckers from the trunks of trees leaving a scar.

G. Animals and birds

Some animals and birds cause scars which might be suspect. Woodpeckers, bears, deer, rodents, and beavers frequently cause extensive damage to the trunks of trees.

Woodpeckers scar the trunks of trees by making holes of considerable size and depth, which remain open for a long time providing entrance for wood-rotting fungi (see Figure 19).

Sapsucker holes, however, are superficial in extent and are non-suspect (see Figure 19).

Bears, deer, moose and elk sometimes cause extensive damage to the trunks of trees by removing bark and cambium. Scars caused by bear claws are common in many forest stands.

Rodents and beavers also cause severe damage to trees by gnawing on the trunk. Be careful to distinguish between superficial non-suspect damage and suspect damage.

H. Cankers caused by fungi

Cankers caused by fungi kill localized areas of bark and cambium on the trunks of trees. Eventually the dead bark sloughs off exposing the underlying wood. Because of repeated callus growth, cankers ate frequently mistaken for 'mechanical' scars. Cankers are usually flat and elongate and may be indefinite in contour. The exposed wood is often stained and impregnated with resin. Fructifications of the fungus may also be evident (see Figure 5).

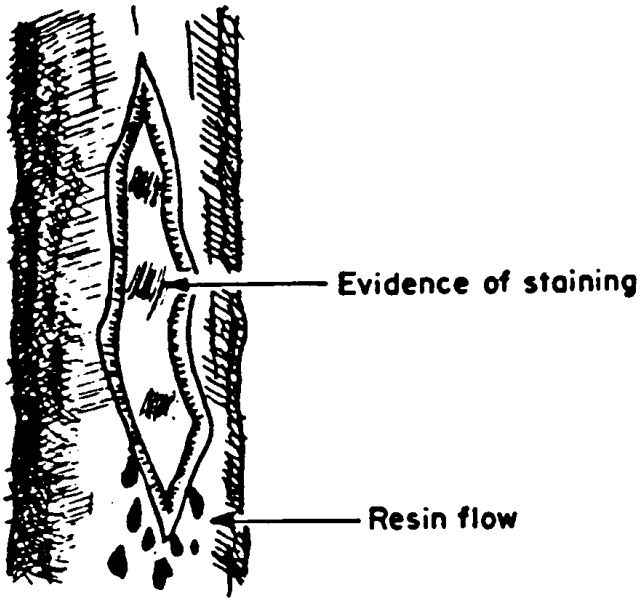


Figure 5. Cankers caused by fungi.

I. Scars caused by rock slides and falling rocks

Rock slides cause extensive damage to trees. Scars caused by rock slides are usually confined to the base of the trunk.

Falling rocks sometimes scar trees at considerable height above the ground because of deep snow or because of the bouncing of the rocks (see Figure 6).

Figure 6. Scars caused by rock slides and falling rocks.

J. Scars of undetermined origin

When it is difficult to ascertain the exact cause of scarring it is essential to adhere to the preceding rules.

Fork or Pronounced Crook

A fork or a pronounced crook between the base and the tip of the tree is a suspect indicator of decay and originates from the development of a secondary leader.

A fork or a crook that develops as the result of an early injury to the top of the tree is a reliable indicator of decay because although the original top may have disappeared or been healed over, the original injury provided an entrance for decay fungi. Usually evidence of the original top is associated with scarring.

Pronounced crook also develops as a result of one of the leaders of a forked tree having broken off.

In Figure 7, A and B illustrate forks in the merchantable part of the trunk. Examples C and D illustrate forks at the base of tree. Example E illustrates non-suspect sucker growth. It is not tallied as a fork. Examples F and G illustrate pronounced crook.

Some forks are non-suspect: for example. those that have formed because of insect or mistletoe attack of the terminal leader and those that are characteristic of the species (yellow pine, and most deciduous species), are not significant of decay.

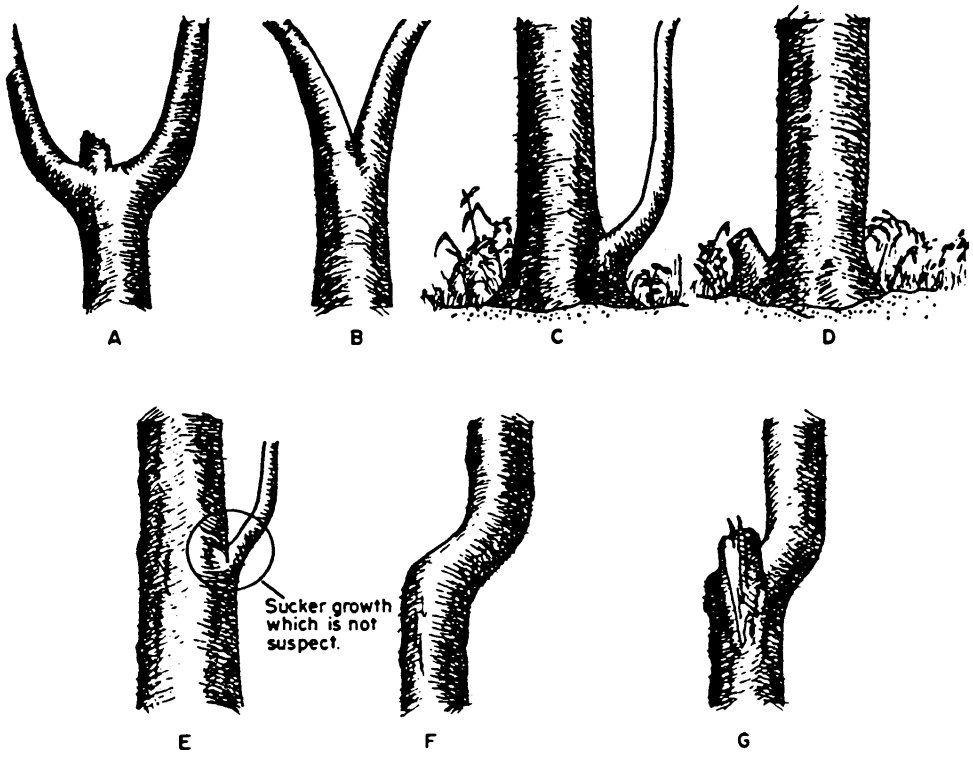


Figure 7. Types of fork and crook (except E).

Frost Cracks

Frost cracks result from deep radial splitting of the trunk caused by uneven shrinkage of the wood after a sudden and pronounced drop in temperature. The cracks usually originate at the base of the trunk and may extend many feet up the tree. Frost cracks are often reopened repeatedly by wind stresses or by low temperatures. Repeated healing of the wood produces considerable callus tissue, giving the wood a pronounced ribbed appearance (see Figure 8).

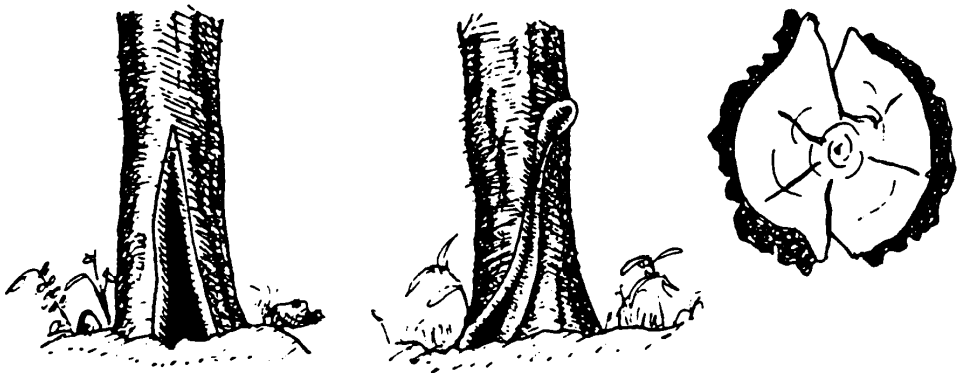


Figure 8. Frost crack on standing trees.

Mistletoe Trunk Infections

Trunk infections of mistletoe are identified by abnormal swelling or malformation of the trunk, or by clusters of dead and broken branches on the trunk or on hypertrophied branches immediately adjacent to the trunk (see Figure 9).

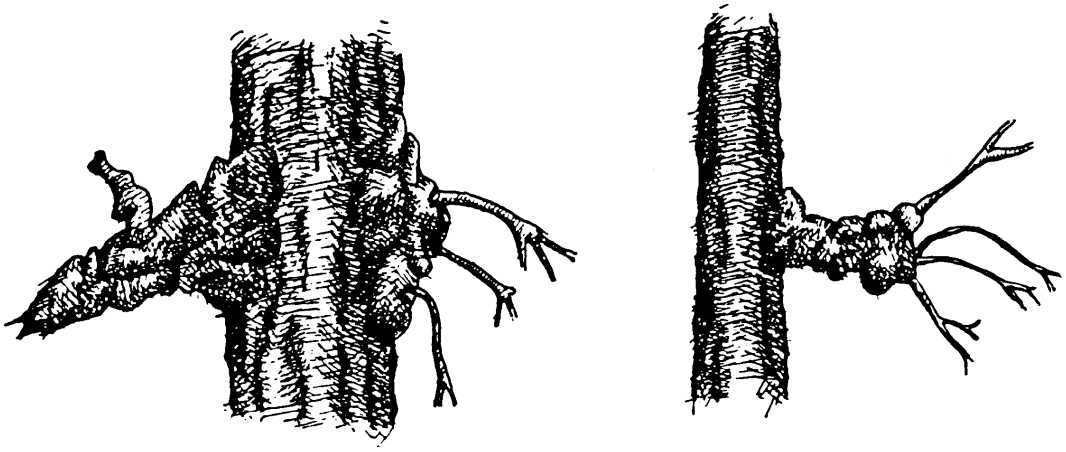


Figure 9. Trunk infections of mistletoe.

Wood-rotting fungi gain entrance to the trunk through the dead hypertrophied branches or through branch stubs where the swelling is on, or adjacent to, the trunk.

For all growth and yield samples, record on the tally sheet any branch or trunk swellings that result from mistletoe infection (see Figure 10).

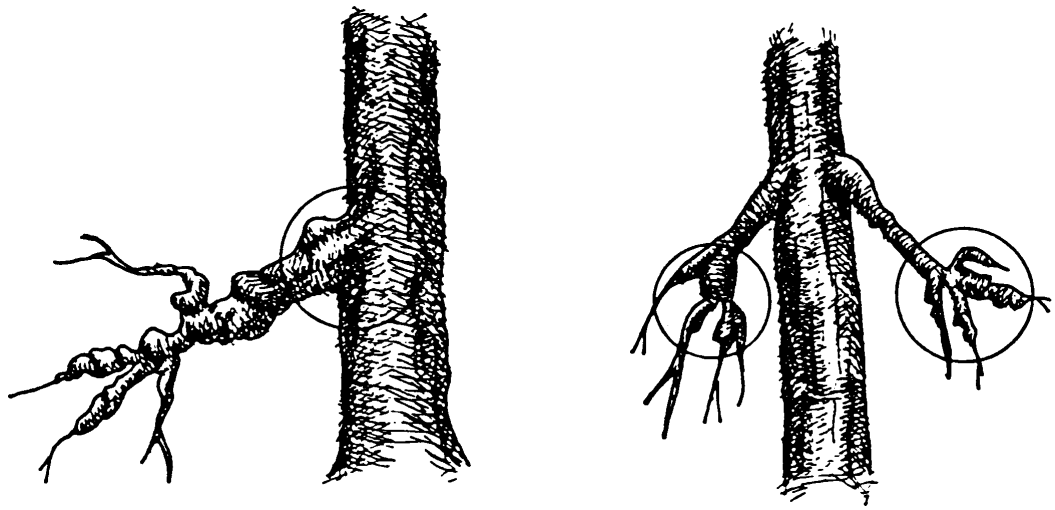


Figure 10. Branch infections of mistletoe.

Rotten Branches

Large, rotten branches, which appear typically on overmature trees, are often indicators of decay in the standing tree. Large branches which are broken off close to the trunk expose a large amount of heartwood to entrance by wood-rotting fungi. Such branches usually appear singly at various points on the trunk, or in groups at some distance below the live crown of the tree.

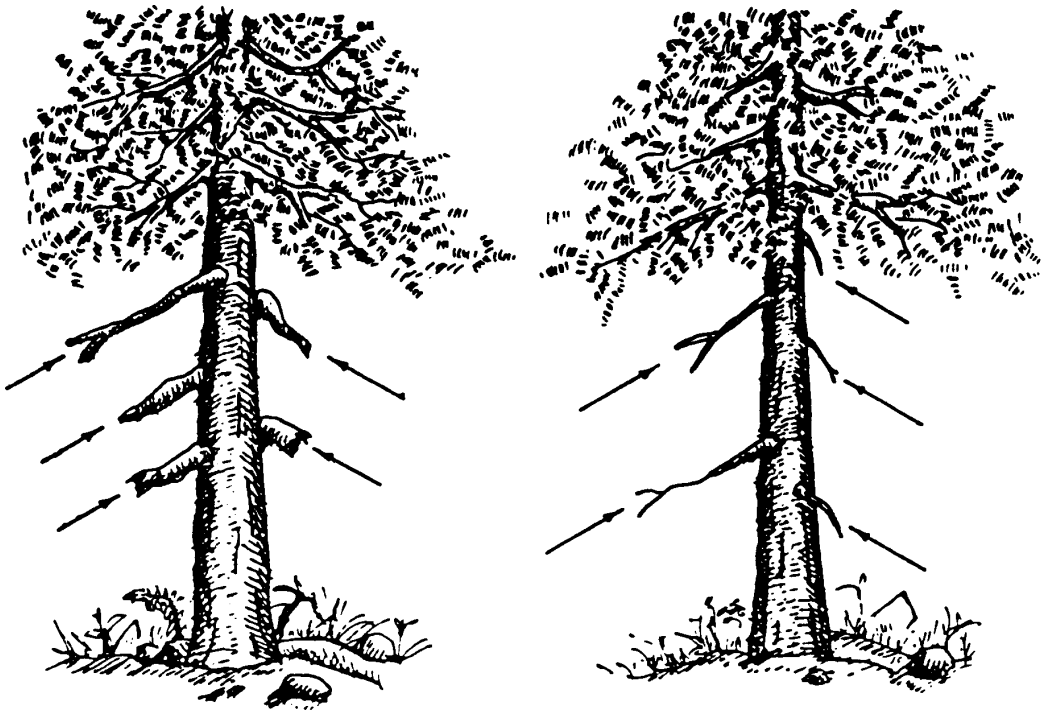
Record only large branches (10 cm or larger in diameter) which are clearly rotten. Do not record small dead branches which appear typically just below the live crown or on the lower trunk of open growing trees (see Figure 11).

Dead Top

Record *only* dead tops that are not recent in origin

Broken Top

Record only broken tops that are not recent in origin; broken tops must be obviously weathered.



Large rotten branches
- suspect -

Small dead branches
- non-suspect -

Figure 11. Rotten branches.

Non-suspect Abnormalities

These abnormalities are not indicators of decay:

External Evidence of Butt Rot Not Associated With Suspect Abnormalities

Butt rot may be evident in exposed roots or within root crotches. However, unless one or more of the suspect abnormalities appears on the tree, do not class the tree as suspect because the butt rot contributes to the decay loss factor associated with the residual tree class.

Flutes

Pronounced flutes on the trunk are characteristic of many species. They do not signify decay (see Figure 12).

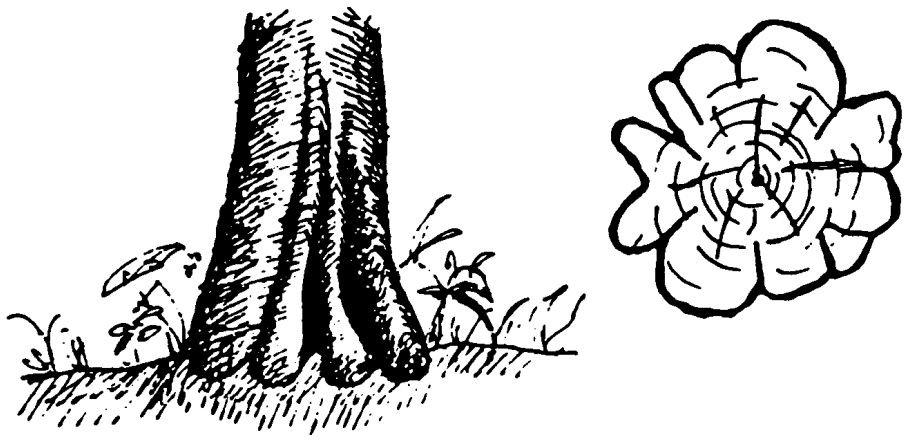


Figure 12. Flutes.

Candelabra Branches

Candelabra branches develop as a result of abnormal branch growth and do not signify decay. they are confused with suspect forking. Note that candelabra branches do not originate in the trunk of a tree as do forks (see Figure 13).

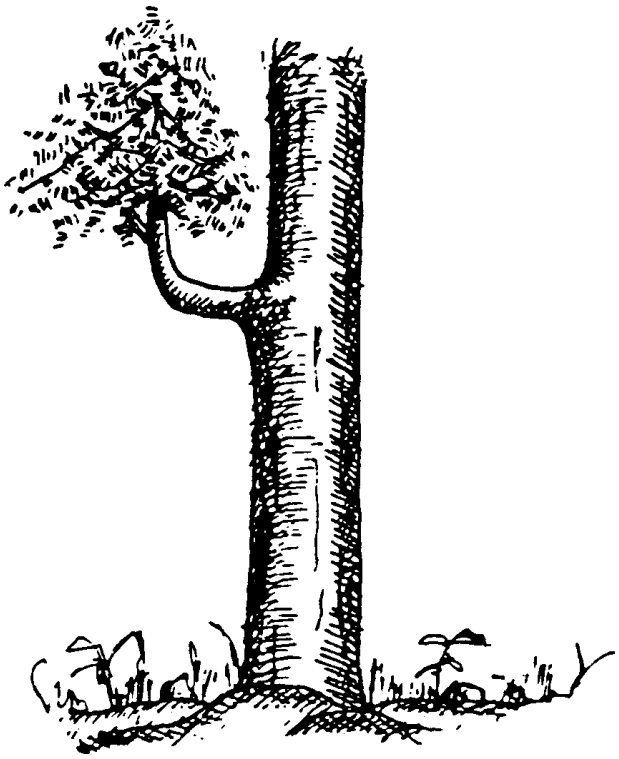


Figure 13. Candelabra branches.

Branch Fans

A branch fan develops through abnormal branching and is not suspect. It appears most commonly as a 'fan' of branches originating from a burl-like swelling on the trunk (see Figure 14).

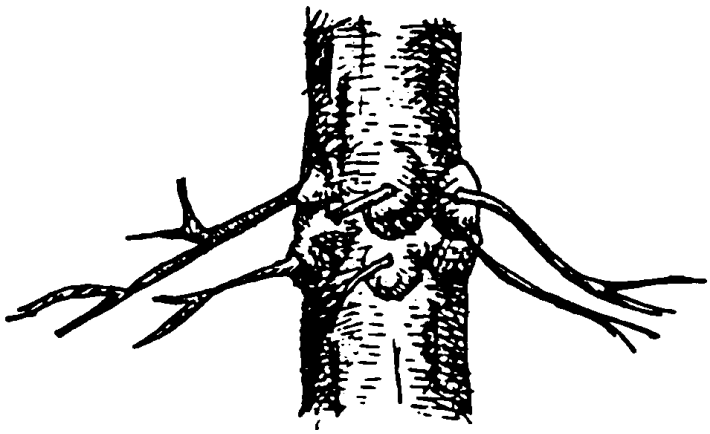


Figure 14. Branch fans.

Black Knots

Black knots frequently develop around unhealed knots and wounds. A superficial saprophytic fungus, which feeds on the exuded sap, causes the blackness. Black knots are quite sound when cut into with an axe and do not signify decay (see Figure 15).

Figure 15. Black knots.

Burls and Galls

Burls and galls develop from abnormal cell growth in trees and although formidable in appearance, do not signify decay (see Figure 16).

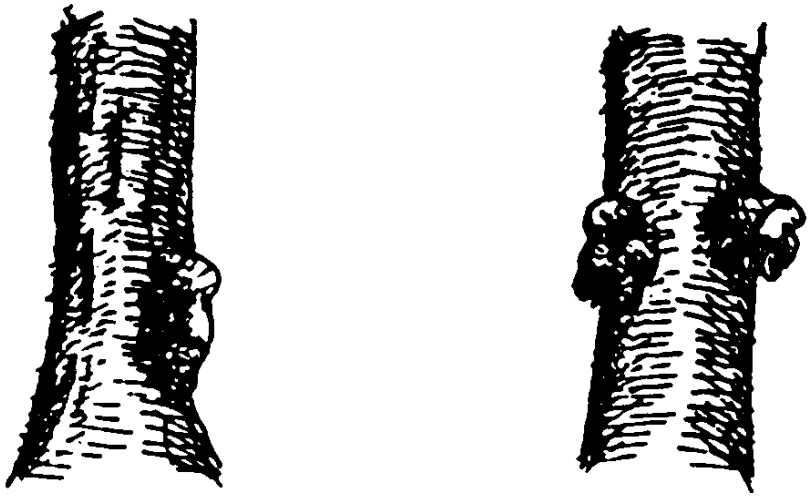


Figure 16. Burls and galls.

Sweep

Sweep which develops as a slight curvature or distortion of the trunk is not significant of decay and is non-suspect (see Figure 17).

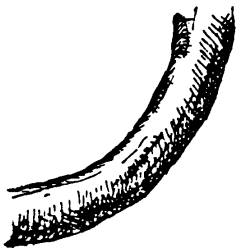


Figure 17. Sweep.

Exposed Roots

Exposed roots and buttress roots do not signify decay unless scarring is present above the point of germination (see Figure 19).

Spiral Grain

Spiral grain is a growth characteristic of some trees and does not signify decay.

Dry Side

Dry side results from the death of the cambium through bruising by other trees or by other physiological causes. Dry side appears as a narrow to wide strip or as a small localized area on the side of a tree. The bark often remains intact over the dead areas. Although dry side may be responsible for the complete rejection, or degrade of a pole tree, it does not signify the presence of decay.

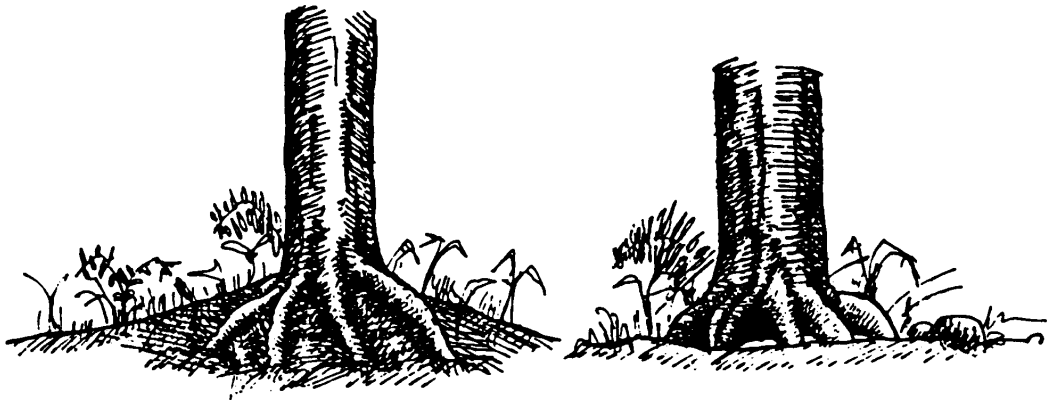


Figure 18. Exposed roots.

Sapsucker Holes

Sapsucker holes are superficial and do not signify decay. Do not confuse the non-suspect scarring of sapsuckers with the suspect scarring of woodpeckers (see Figure 19).

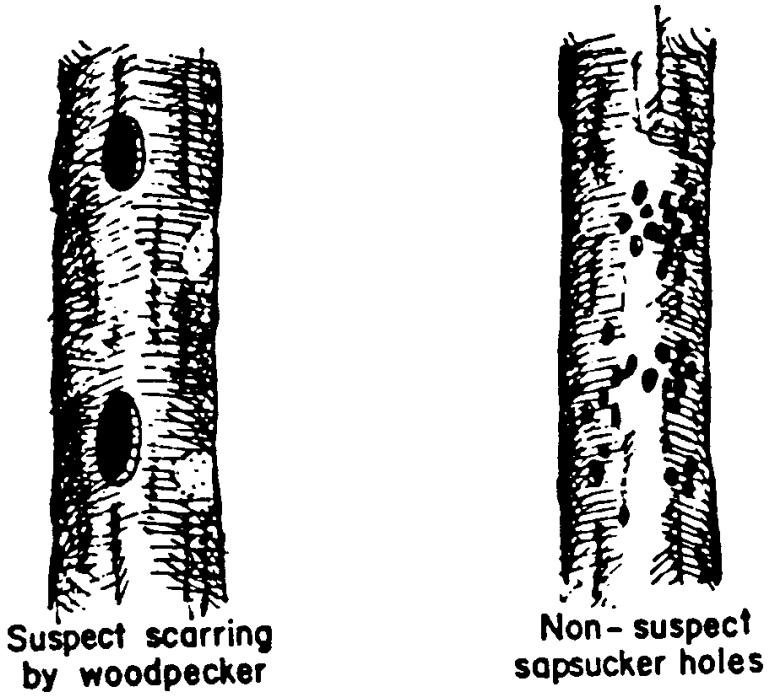


Figure 19. Sapsucker holes and scarring by woodpeckers.

Insect Borings

Borings by bark beetles or by other insects do not signify decay and are non-suspect.

Appendix 12: Crown Class

1. Crown class l (dominant, D)

   Dominant trees having crowns extending above the general level of the crown canopy and receiving full light from above and partly from the side.

2. Crown class 2 (codominant, CD)

   Codominant trees having crowns forming the general level of the crown canopy and receiving full light from above and comparatively little from the sides.

3. Crown class 3 (intermediate, Int)

   Intermediate trees having crowns below, but still extending into, the general level of the crown canopy and receiving little direct light from above but none from the sides.

4. Crown class 4 (overtopped, OT)

   Overtopped trees having crowns below the general level of the crown canopy and receiving no direct light either from above or from the sides.

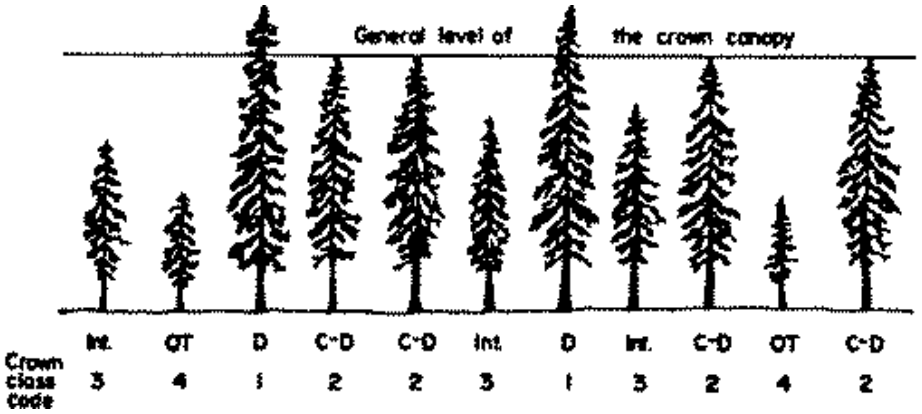
5. Crown class 5 (veteran, VT)

   Veteran trees having large stems and of a much older (40 years) age class than the main stand in an even age stand. Veterans are living remnants of a former stand.

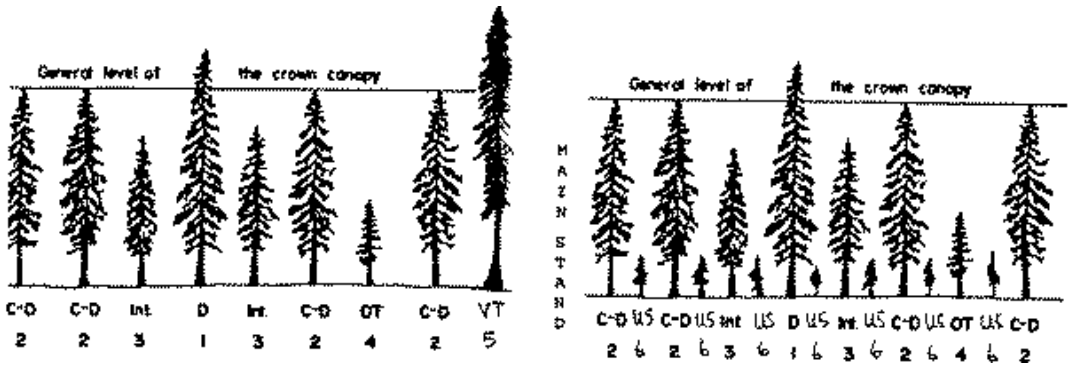
6. Crown class 6 (understory, US)

   Understory trees having a clearly much younger age - usually sapling stage - than the main even-aged stand.

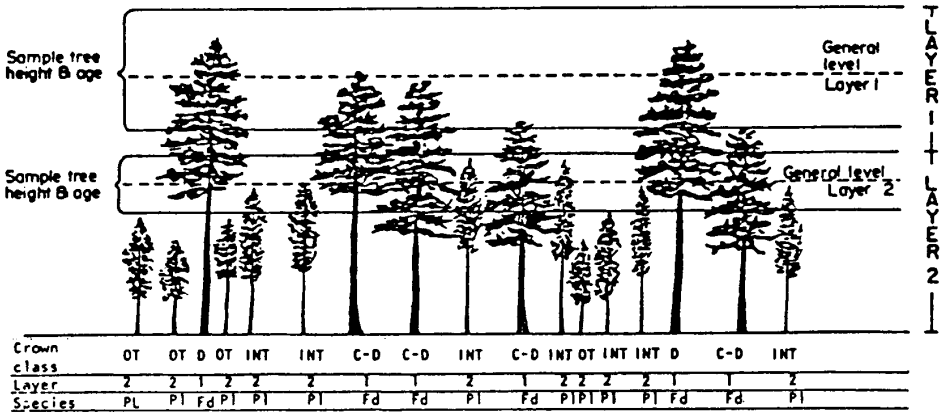
Classify trees with broken tops according to the relative position of the broken top and not to that of the original top.



Crown classes in single-layered stands.



Crown Classes in a multi-layered stand.



Appendix 13: Stand Structure

Single-layered Stand Structure

Single-layered, simple structure without veterans

The origin of single-layered, simple stands is characterized by a short period of regeneration after a major disturbance or denudation. The tree species may be shade tolerant or intolerant. Tree height varies little, although several height classes may be present because of the differences in growth rates between trees and among species. The distribution of trees by diameter classes is bell shaped.

For a profile of a single-layered, simple stand, see Figure 1

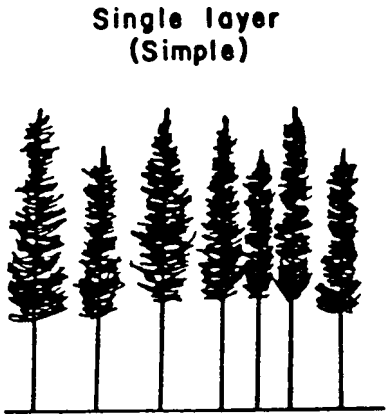


Figure 1. Profile of a single-layered, simple stand.

Single-layered, simple structure with veterans

The stand structure is the same as that described under A but veterans are present.

Fully describe the veteran component for species composition, age, height, and crown closure to the nearest one percent when possible. Do not describe a veteran component in stands older than 120 years except when the leading species is lodgepole pine. However, if a tree is designated as a veteran in a stand < 120 years at establishment, it must remain a veteran even when the stand becomes older than 120 years.

Exceptions for Lodgepole Pine

A veteran component of either Douglas-fir or larch may be included in stands of lodgepole pine if the lodgepole pine is older than 120 years.

Prefix veteran components with a (V) to distinguish them from recognized layers.

Example:

Pl_{10} 122-20.2-5 (Main stand or layer)
(V) Fd_{10} 160-32-03 (Veteran component)

Complex stand structure

The structure of a single-layered, complex stand is characterized by trees of many ages or sizes occurring singly or in groups (see Figure 24). Tree species are usually shade tolerant. Stocking is often patchy and uneven, and the numbers of trees in each size class decrease as diameters increase. The term, complex structure, is intended to describe stands with atypical and unpredictable variations. Examples are partially disturbed stands of interior dry-belt Douglas-fir and yellow pine, and residual stands of spruce-balsam after logging.

Do not describe old growth climax stands as complex, because variations in stand structure are normal and predictable.

Complex stand structure with veterans

The stand structure is the same as that described under a complex stand structure but veterans are present. Fully describe the veteran component for species composition, age, height, and crown closure to the nearest one percent when possible.

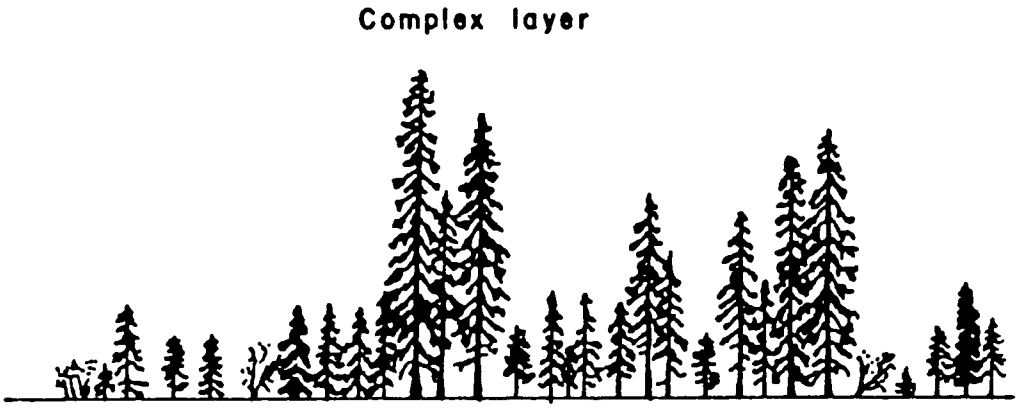


Figure 2. Profile of a single-layered, complex stand.

To describe complex layer:

A. Treat the stand as one heterogeneous layer.

B. Vertically stratify the stand into three equal zones (upper, middle and lower).

C. Provided that the crown closure for the upper zone is greater than or equal to 6 percent, select the required representative sample trees for age and height measurements from the upper zone and average them for the stand.

D. If crown closure for the upper zone is less than six percent, include the top portion of the middle zone to raise the crown closure to six percent or greater before selecting sample trees for measurement.

E. Estimate crown closure for the type for all stems in the main canopy.

F. When assigning a label to the sample, show the age variation in brackets after the stand age.

Example:

B_{10} 95(40/120)
Age Age variation

Multi-layer Stand Structure

Note: Do not establish growth natural samples in multi-layered stands except in Forest Districts in which this type of stand structure is prominent.

A multi-layered stand (see Figure 3) has two distinct layers that can be recognized on the medium-scale photographs used for forest stratification.

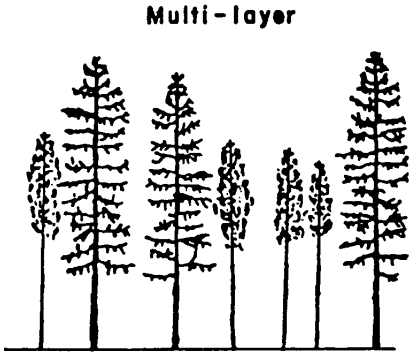


Figure 3. Multi-layered Stand.

The multi-layer classification must be used with caution. Such stands are difficult to sample and to characterize for volume, density and species composition by layer. Unless the difference between the layers is distinct then classify and sample as a single layer. For example, a climax stand of spruce-balsam with an understorey of balsam-spruce should be classified as a single layer whereas a young lodgepole stand established after a fire under an old growth layer of Douglas-fir is best described by two layers.

To be classified as multi-layered, a stand must satisfy the following criteria based upon an assessment of the medium-scale forest classification photographs:

A. Each layer must be distinct and relatively homogeneous throughout the type.

B. Each layer should consist of different species except for a layer of regeneration or samplings under a volume component.

C. Differences in age and height between layers should be at least 40 years and approximately 10 metres, respectively.

D. Estimated crown closure for each layer must be six percent or greater, except for a very young layer when 750 stems per hectare or greater is the criterion used.

E. The bottom layer was normally established as a result of a major disturbance such as fire or logging.

F. With one exception, the age of the younger of the two layers must always be 120 years or less. Thus, if both layers are 121 years or older, treat them as one layer.

Exception: If one layer is predominantly lodgepole pine, 121 years or older, and the second is a much older layer of Douglas-fir or larch, then classify and describe the stand as multi-layered.

Example:

L_{10} 260 - 33.0 - 1 (layer l)
Pl_{10} 130 - 26.0 - 5 (layer 2)

For examples of two common multi-layered stands, see Figure 4 and 5.

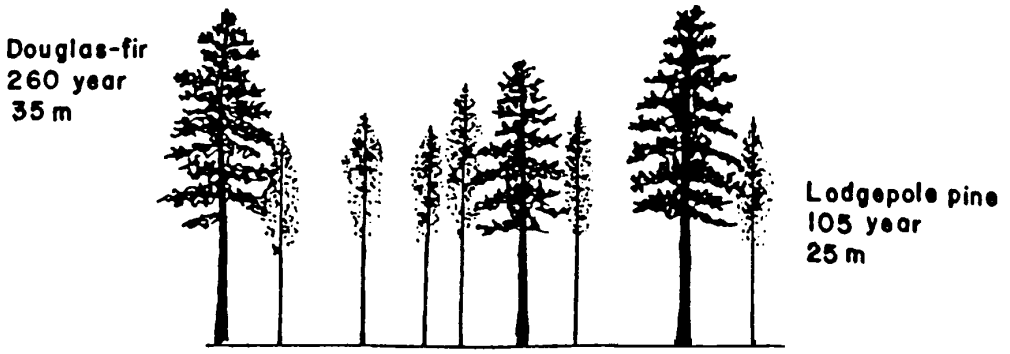


Figure 4. A 260-year old layer of Douglas-fir with a 105-year old layer of lodgepole pine.

Figure 5. A 40-year old stand of white spruce with an 80-year old overstorey of trembling aspen.

To describe multi-layered stands:

A. Stratify the type into two distinct layers (top and bottom) and consider each one as a unique entity.

B. Select representative sample trees in each layer according to previously defined guidelines for simple layers.

C. Fully describe each layer for species composition, age, height, crown closure, and density if it is available from measured samples.

D. Always describe and label from the top layer down (only the most important layer will be shown on the published map).

E. Rank the relative importance of each layer based on regional guidelines, and indicate and bracket the rank in front of the description. The layer with the highest rank will be the basis for sample allocation.

F. Unless otherwise directed, do not describe a veteran component in a multi-layered stand. Example:

	Rank			
	(2)	S_7B_3	200-32.0-1	(Top layer)
Most important layer	(1)	$Pl_4\ S_3\ B_3$	40-10.0-4	(Bottom layer)
		Sp. comp.	Age Ht. C.C.	

Appendix 14: Damage Agents and Severity Codes

I. Damage Agents

Acceptable Codes	Description	Scientific Name
A	**Animal Damage**	
AB	Bear	
AC	Cattle	
AD	Deer	
AE	Elk	
AH	Hare or rabbit	
AM	Moose	
AP	Porcupine	
AS	Squirrel	
AV	Vole	
AX	Birds	
AZ	Beaver	
C	**Cone and Seed Insects**	
CAH	Cone resin midge	(*Asynapta hopkinsi*)
CBC	Fd cone moth	*(Barbara colfaxiana)*
CBX	Fir cone moth	*(Barbara sp.)*
CCP		*(Camptomyia pseudotsugae)*
CDC	Sx cone gall midge	*(Dasineura canadensis)*
CDD	Fir seed midge	*(Dasineura abiesemia)*
CDR	Sx cone axis midge	*(Dasineura rachiphaga)*
CDX	Dasineura midges	*(Dasineura spp.)*
CEA	Fir cone maggot	*(Earomyia abietum)*
CEB		*(Earomyia babara)*
CEQ		*(Earomyia aquilonia)*
CEX	Earomyia maggots	*(Earomyia spp.)*
CFP	Fd cone beetle	*(Emobius Punctulatus)*
CHX	Budworms	*(Choristoneura spp.)*
CIA	Fir coneworm	*(Dioryctria abietivorella)*
CIP	Fd coneworm	*(Dioryctria psuedotsugella)*
CIR	Sx coneworm	*(Dioryctria reniculelloides)*
CIS	Pine coneworm	*(Dioryctria rossi)*
CIV	Py coneworm	*(Dioryctria auranticella)*
CIX	Coneworms	*(Dioryctria spp.)*
CLO	Western conifer seed bug	*(Leptogiossus occidentalis)*
CMA	Py seed chalcid	*(Megastigmus albifrons)*
CMC	Sx seed chalcid	*(Megastigmus piceae)*
CML	Bl seed chalcid	*(Megastigmus lasicocarpae)*
CMP	Fir seed chalcid	*(Megastigmus pinus)*
CMR		*(Mestigmus rafni)*
CMS	Fd seed chalcid	*(Mestigmus spermotrophus)*
CMT	Hw seed chalcid	*(Megastigmus tsugae)*
CMX	Seed chalcids	*(Megastigmus spp.)*
CNP	Pine cone beetle	*(Conophthorus ponderosae)*
CPS		*(Pineus similis)*
CRX	Cone scale midges	*(Resseliella spp.)*

Acceptable Codes	Description	Scientific Name
CSN	Spiral spruce cone borer	*(Strobilomyia neanthracina)*
CTO	Fd cone gall midge	*(Contarinia oregonensis)*
CTW	Fd cone scale midge	*(Contarinia washintonensis)*
CVP	Pw cone borer	*(Eucosma ponderosa)*
CVR	Pl cone borer	*(Eucosma recissoriana)*
CYC	Sx seed midge	*(Mayetiola carpophaga)*
CYP	Py seedworm	*(Cydia piperana)*
CYS	Sx seedworm	*(Cydia strobilella)*
D	**Diseases**	
DB	Broom rust	
DBF	Fir broom rust	*(Melampsorella caryophyliacearum)*
DBS	Spruce broom rust	*(Chrysomyxa arctostaphyli)*
DD	**Stem rot**	
DDB	Birch trunk rot	*(Fomes fomentarius)*
DDD	Sulfur fungus	*(Laetiporus sulphureus)*
DDE	Rust red stringy rot	*(Echinodontium tinctorium)*
DDF	Brown crumbly rot	*(Fomitopsis pinicola)*
DDH	Hardwood trunk rot	*(Phellinus ignarius)*
DDO	Cedar brown pocket rot	*(Poria sericeomollis)*
DDP	Red ring rot	*(Phellinus pini)*
DDQ	Quinine conk rot	*(Fomitopsis officinalis)*
DDS	Schweinitzii butt rot	*(Phaeolus schweinitzii)*
DDT	Aspen trunk rot	*(Phellinus tremulae)*
DF	**Foliage Disease**	
DFA	Western pine aster rust	*(coleosporium asterum)*
DFC	Large spored spruce-labrador tea rust	*(Chrysomyxa ledicola)*
DFD	Spruce needle cast	*(Lirula macrospora)*
DFE	Elytroderma needle cast	*(Elytroderma deformans)*
DFH	Larch needle cast	*(Hypodermella laricis)*
DFL	Pine needle cast	*(Lophodermella concolor)*
DFM	Larch needle blight	*(Meria laricis)*
DFP	Fir fireweed rust	*(Pucciniastrum epiobi)*
DFR	Douglas-fir needle cast	*(Rhabdocline pseudotsugae)*
DFS	Red band needle blight	*(Mycosphaerella [Sirrhia] pini)*
DL	**Disease-caused dieback of leader**	
DLD	Dermea canker	*(Dermea pseudotsugae)*
DLF	Red flag disease	*(Potebniamyces balsamicola)*
DLP	Phomopsis canker	*((phomopsis lokoyae)*
DLS	Sydowia (Sclerophoma) tip dieback	*(Sclerophoma pithyophila)*
DLV	Aspen-poplar twig blight	*(Venturia spp.)*
DM	**Dwarf Mistletoe**	
DMF	Douglas-fir mistletoe	*(Arceuthobium douglasii)*
DMH	Hemlock dwarf mistletoe	*(Arceuthobium tsugense)*
DML	Larch dwarf mistletoe	*(Arceuthobium laricis)*
DMP	Lodgepole pine dwarf mistletoe	*(Arceuthobium americanum)*
DR	**Root Disease**	
DRA	Armillaria root disease	*(Armillaria ostoyae)*
DRB	Black Stain root disease	*(Leptographium wageneri)*
DRC	Laiminated root rot (cedar strain)	*(Phellinus weirii)*
DRL	Laminated root rot	*(Inonotus sulphurascens)*
DRN	Annosus root disease	*(Heterobasidion annosum)*

Acceptable Codes	Description	Scientific Name
DRR	Rhizina root disease	*(Rhizina undulata)*
DRT	Tomentosus root rot	*(Inonotus tomentosus)*
DS	**Stem Diseases (Cankers & Rusts)**	
DSA	Atropellis canker (Lodgepole pine)	*(Atropellis piniphila)*
DSB	White pine blister rust	*(Cronartium ribicola)*
DSC	Comandra blister rust	*(Cronartium comandrae)*
DSE	Sooty bark canker	*(Encoelia pruinosa)*
DSG	Western gall rust	*(Endocronartium harknessii)*
DSH	Hypoxylon canker	*(Hypoxylon mammatum)*
DSP	Cryptosphaeria canker	*(Cryptosphaeria populina)*
DSR	Ceratocystis canker	*(Ceratocystis fimbriata)*
DSS	Stalactiform blister rust	*(Cronartium coleosporioides)*
DST	Target canker	*(Nectria galligena)*
DSY	Cytospora canker	*(Cytospora chrysosperma)*
I	**Insects**	
IA	Aphids or adelgids	
IAB	Balsam woolly adelgid	*(Adelges piceae)*
IAC	Giant conifer aphid	*(Cinara spp.)*
IAG	Cooley spruce gall adelgid	*(Adelges cooleyi)*
IAL	Western larch cone woolly aphid	*(Adelges lariciatus)*
IAS	Green spruce aphid	*(Elatobium abietinum)*
IB	**Bark Beetles**	
IBB	Western balsam bark beetle	*(Dryocetes confusus)*
IBD	Douglas-fir beetle	*(Dendroctonus pseudotsugae)*
IBI	Engraver beetles	*(Ips spp.)*
IBM	Mountain pine beetle	*(Dendroctonus ponderosae)*
IBP	Twig beetles	*(Pityogenes, pityophthorus spp.)*
IBS	Spruce beetle	*(Dendroctonus rufipennis)*
IBT	Red turpentine beetle	*(Dendroctonus valens)*
IBW	Western pine beetle	*(Dendroctonus brevicomis)*
ID	**Defoliating Insects**	
IDA	Black army cutworm	*(Actebia fennica)*
IDB	2-year budworm	*(Choristoneura biennis)*
IDC	Larch casebearer	*(Coleophora laricella)*
IDD	Western winter moth	*(Erannis tiliaria vancouverensis)*
IDE	Spruce budworm	*(Choristoneura fumiferana)*
IDF	Forest tent caterpillar	*(Malacosoma disstria)*
IDG	Greenstriped forest looper	*(Melanolophia imitata)*
IDH	Western blackheaded budworm	*(Acleris gloverana)*
IDI	Pine needle sheath miner	*(Zellaria haimbachi)*
IDL	Western hemlock looper	*(Lambdina fiscellaria lugubrosa)*
IDM	Gypsy moth	*(Lymantria dispar)*
IDN	Birch leaf miner	*(Fenusa pusilla)*
IDP	Larch sawfly	*(Pristophora erichsoni)*
IDR	Alder sawfly	*(Eriocampa ovata)*
IDS	Conifer sawfly	*(Neodiprion spp.)*
IDT	Douglas-fir tussock moth	*(Orgyia pseudotsugata)*
IDU	Satin moth	*(Leucoma salicis)*
IDV	Variegated cutworm	*(Peridroma saucia)*
IDW	Western spruce budworm	*(Choristoneura occidentalis)*
IDX	Large aspen tortix	*(Choristoneura conflictana)*
IDZ	Western false hemlock looper	*(Nepytia freemani)*

Acceptable Codes	Description	Scientific Name
IS	**Shoot Insects**	
ISB	Western cedar borer	*(Trachykele blondeli)*
ISE	European pine shoot moth	*(Rhyaconia buoliana)*
ISG	Gouty pitch midge	*(Cecidomyia piniinopis)*
ISP	Pitch nodule moths	*(Petrova spp.)*
ISQ	Sequoia pitch moth	*(Vespamima sequoiae)*
ISS	Western pine shoot borer	*(Eucosma sonomana)*
IW	**Weevils**	
IWC	Conifer seedling weevil	*(Steremnius carinatus)*
IWM	Magdalis species	*(Magdalis spp.)*
IWP	Lodgepole pine terminal weevil	*(Pissodes terminalis)*
IWS	White pine weevil (on spruce)	*(Pissodes strobi)*
IWW	Warren's root collar weevil	*(Hylobius warreni)*
IWY	Cylindrocopturus weevil	*(Cylindrocopturus spp.)*
IWZ	Yosemite bark weevil	*(Pissodes schwartzii)*
M	**Mite Damage**	***(Trisetacus spp.)***
N	**Non-biological (Abiotic) Injuries**	
NB	Fire	
ND	Drought	
NF	Flooding	
NG	Frost	
NGC	Frost crack	
NGH	Frost heaved	
NGK	Shoot/bud frost kill	
NH	Hail	
NK	Fumekill	
NL	Lightning	
NN	Road salt	
NR	Redbelt	
NS	Slide	
NW	Windthrow	
NWS	windthrow - soil failure	
NWT	windthrow - treatment or harvested related	
NX	Scarring/rubbing	
NY	Snow or ice (includes snow press)	
NZ	Sunscald	
P	**Cone and Seedling fungal Pathogens**	
PAX		*(Alternaria spp.)*
PBC	Gray mould	*(Botrytis cinera)*
PCD		*(Cylindrocarpon destructans)*
PCF	Seed or cold fungus	*(Caloscypha fulgens)*
PCP	Inland spruce cone rust	*(Chrysomyxa pirolata)*
PDT	Cedar leaf blight	*(Didymascella thujina)*
PFX		*(Fusarium spp.)*
PPG	Damping-off disease	*(Phoma glomerata)*
PPX		(Penicillium spp.)
PSS	Sirococcus blight	*(Sirococcus strobilinus)*
PTX		*(Trichothecium spp.)*

Acceptable Codes	Description	Scientific Name
T	**Treatment Injuries**	
TC	Chemical	
TH	Harvested	
TL	Logging	
TM	Other chemical damage (non-logging)	
TP	Planting	
TPM	Poor planting microsite	
TR	Pruning	
TT	Thinning or spacing wound	
V	**Problem Vegetation**	
VH	Herbaceous competition	
VP	Vegetation press	
VS	Shrub competition	
VT	Tree competition	

II. Damage Severity and Mortality Condition Codes

Damage Code	Damage/Condition Or agent	Severity Code	Code description and Classification
A's	Mammals, birds, and root collar weevil (girdlers)	Enter % 1=10%, 10=100%	Record % girdle
C, DD, DL, IA, N, P, T, and V	Cone/seed insects and fungal pathogens, Abiotic	Subjective Rating L M S	 Low Moderate Severe
DB, DM	Broom rust and Dwarf mistletoe	Enter one of 1,2,3,4,5,6 and N M	See Fig. 1 for Hawkworth's 6-class rating system for all species and for **coastal western hemlock**: Minor stem swelling Major stem swelling
DR	Root Rots	W5 LC SC RL RS BR CS	Within 5 m of *A. Ostoyae* infection source Light Crown symptons Severe Crown symptons Basal resinosis (Light) $\leq$ 50% circumference Basal resinosis (Severe) > 50% circumference Butt Rot Confirmatory Symptoms: stain, decay, mycelia, rhizomorphs, or sporophores
DS	Stem rusts	BC SC TK	Branch Canker(s) Stem Canker(s) Top-kill

Damage Code	Damage/Condition Or agent	Severity Code	Code description and Classification
IB	Bark Beetle	FA GR RA GY	Failed Attack Current (Green) attack Red Attack Grey Attack
ID, DF, M	Defoliators, Mites, needle rusts, and blight	Enter % defoliated 1=10%, 10+100%	Record % defoliated, discoloured, or infected **(past and present attacks)**
IDW	Defoliators Western Spruce Budworm	Enter % defoliated 1=10%, 10=100%	Record % **current year's foliage**, bud and or shoot destruction
IS, IW	Terminal weevils	Enter # of attacks (1-9) And M N F S	Record # of years of attacks (1 – 9) Major crook Minor crook Forking Staghead

Appendix 15: Quality Assurance Report

```
REPORT No: 8                    MSRM - Terrestrial Information Branch                      Page:1
 Vers 2002(2002.06.01)      Data Collecting, Editing and Reporting System                Q.A. REPORT
2002 Aug 14                       Reg  Comp  Let  Inst  Sample  Type
10:51:05                           55   18          0      1     G

Measurement# 4   Meas.Date:2002-07-03         Crown Closure, Layer 1:60  (_____)  Layer 2/V:0   (_____)

Species Comp:   Lyr : PL=94.2 AT=3.4 S=2.3 BL=0.2

Stem Map?:N  Plot Centre Offset?:N  Bearing from Compass to PlotCentre:0    Slope:0    Slope Dist:0.00
Plot Area:0.0810  Radius:16.06        Lgth:0.00     Width:0.00      Sub-Plot Area:0.0810   Radius:16.06

Plot#:1  Aspect:230 (_____)    Slope:4   (_____)    Elev:884  (______)   Slope Pos:M (_______)
       T/L Bear:0   (_____) T/L Dist:0.0   (_______)

DBH SAMPLE TREES:
```

L	S	M	Tre	-Sector-			DBH	Dia	TC	- Path -	Ht	S	Br	Wld	CC	LC%		Ht	S	Sw	DmAgt1	DmAgt2	Near	Miss
Y	u	#	No	CsTs	Ss	Sp	1.3M	1.37M		fscdbcmbr	Bk	D	Tp	App		Est	Msd		t	Ln	TAg Sv	TAg Sv	Tree	Dr/F
	3	18		2	0	PL	24.1	0.0	2	210000000	0		0	0	2	30	0	23.1	H	0 0			17	
Y	4			2	1	PL	26.4	0.0	2	210000000	0		0	0	2	30	0	24.4	D	0 0			17	
	3	66		0	0	PL	12.7	0.0	4	000000000	0		0	0	0	0	0	0.0		0 0			65	
N	4			6	4	PL	12.7	0.0	4	000000000	0		0	0	0	0	0	0.0	N	0 0			65	
	3	104		8	0	PL	21.1	0.0	2	200000000	0		0	0	2	30	0	21.3		0 0			103	
Y	4		C	8	5	PL	24.7	0.0	2	100000000	0		0	0	2	40	0	23.0	H	0 0			103	
	3	106		8	0	PL	18.4	0.0	2	310000000	0		0	0	2	40	0	0.0		0 0	DSG	10	105	
Y	4			8	5	PL	20.0	0.0	2	310000000	0		0	0	2	40	0	0.0	O	0 0	DSG	BC	105	
	3	107		8	0	PL	16.1	0.0	2	110000000	0		0	0	2	20	0	20.4		0 0			106	
Y	4			8	5	PL	17.5	0.0	2	110000000	0		0	0	2	20	0	21.1	M	0 0			106	

REPORT No: 8 — MSRM - Terrestrial Information Branch — Page:2

2002 Aug 14 10:51:05	Reg	Comp	Let	Inst	Sample	Type
	55	18		0	1	G

DBH SAMPLE TREES:

L Y	S u	M #	Tree No	Sector- CsTs	Ss	Sp	DBH 1.3M	Dia TC 1.37M	Path - fscdbcmbr	Ht Bk	S D	Br Tp	Wld App	CC	LC% Est	Msd	Ht	S t	Sw Ln	DmAgt1 TAg	Sv	DmAgt2 TAg	Sv	Near Tree	Miss Dr/F
	3	109	9	0	PL	13.5	0.0 4	000000000		0	0	0	0	0	0	0	0.0	0	0	D	R	L		108	
N	4		9	6	PL	13.5	0.0 4	000000000	3.5	S	0	6	0	0	0	0	0.0	N	0 0					108	
	3	111	9	0	PL	11.0	0.0 2	520000000			3	0	2	10	0		0.0	0	0	DSG	30			110	
C	4		9	6	PL	12.0	0.0 2	420000000			0	0	3	10	0		11.8	M	0 0	DSG	BC			110	
	3	192	11	0	S	4.5	0.0 1	000000000			0	0	4	80	0		0.0	0	0	IAG	S			143	
Y	4		11	8	S	4.9	0.0 1	000000000			0	0	4	80	0		4.8	M	0 0	IAG	S			143	
Y	4	300	7	5	BL	3.5	0.0 1	000000000			0	0	4	70	0		3.1	M	0 0					126	

HEIGHT SAMPLE TREES:

L Y	S u	M #	Tree No	Sector- CsTs	Ss	Sp	DBH 1.3M	Dia TC 1.37M	Height Readings Top	Bot	Tot	SDst	Slp	Ht	Cor	TotHt	BH Age	Bor Ht	Pith	Sup	Radial Inc. 5yr	10yr	20yr	Near Tree
	3	18	2	0	PL	24.1	0.0 2	84	-3	81	0	25.0	21.8	1.3	23.1						0	0	0	17
Y	4		2	1	PL	26.4	0.0 2	0	0	0	0	0.0	23.1	1.3	24.4						0	0	0	17
	3	104	8	0	PL	21.1	0.0 2	84	4	88	0	25.0	20.0	1.3	21.3		0	0.00			0	0	0	103
Y	4		C 8	5	PL	24.7	0.0 2	0	0	0	0	0.0	21.7	1.3	23.0		102	1.30	Y	N	6	12	25	103

REPORT No: 8 — MSRM - Terrestrial Information Branch — Page:3

2002 Aug 14 — Reg 55, Comp 18, Let —, Inst 0, Sample 1, Type G

10:51:05

HEIGHT SAMPLE TREES:

L Y	S u	M #	Tree No	Sector- CsTs	Ss	Sp	DBH 1.3M	Dia TC 1.37M	Height Readings Top	Bot	Tot	SDst	Slp	Ht	Cor	TotHt	BH Age	Bor Ht	Pith	Sup	Radial Inc. 5yr	10yr	20yr	Near Tree
		3	107	8	0	PL	16.1	0.0 2	82	-1	81	0	23.0	19.1	1.3	20.4	0	0.00			0	0	0	106
Y		4		8	5	PL	17.5	0.0 2	0	0	0	0	0.0	19.8	1.3	21.1	94	1.30	Y		5	9	18	106
		3	112	9	0	PL	12.5	0.0 2	0	0	0	0	0.0	-1.3	1.3	0.0	0	0.00			0	0	0	111
C		4		9	5	PL	15.0	0.0 2	0	0	0	0	0.0	12.6	1.3	13.9	0	0.00			0	0	0	111
		3	156	1	0	AT	9.0	0.0 1	76	3	79	0	15.0	11.0	1.3	12.3	0	0.00			0	0	0	9
Y		4		1	1	AT	9.9	0.0 1	0	0	0	0	0.0	11.6	1.3	12.9	0	0.00			0	0	0	9

DOT COUNT:

Meas No.	Sp	DBH Class	No. Trees
4	BL	1	1

TREES MISSED / OUT:

L Y	S u	M #	Tre No	Sector- CsTs	Ss	Sp	DBH 1.3M	Dia TC 1.37M	Path - fscdbcmbr	Ht Bk	S D	Br Tp	Wld App	CC	LC% Est	Msd	Ht	S t	Sw Ln	DmAgt1 TAg	Sv	DmAgt2 TAg	Sv	Near Tree	Miss Dr/F

REPORT No: 8 MSRM - Terrestrial Information Branch Page:4

2002 Aug 14	Reg	Comp	Let	Inst	Sample	Type
10:51:05	55	18		0	1	G

	Y	N	Notes:
Location and Access Notes correct and easy to follow?.....			
Tie point correct and reasonably easy to locate?.....			
Tie line bearing and distance marked and run correctly?.....			
Plot centre plaque correctly filled in and attached?.....			
Tree tags face correct direction and nails at correct height?..			
Tree tag nails out sufficiently until next measurement?.....			
Plot/subplot radii checked in 3 places and no trees missed/out?			
All ingrowth trees tagged and measured?.....			
Other?.....			

Rating_____

ABC Ltd.	Andy & Barry	_____	_____
Contractor	Field Crew	Inspecting Officer	Date

Appendix 16: Completing the Field Sheets

Item	Instruction
Sample ID	
Reg	Enter the region: - a provincial inventory reference number obtained from inventory maps.
Comp. No.	Enter the compartment number: - a provincial inventory reference number obtained from inventory maps.
Letter	Enter the letter (if applicable). – applies mostly in coastal areas; if the compartment letter does not exist, the field is left blank.
Instal.	Enter the installation number for **I** (Intensive) samples only.
Samp. No.	Enter the sample number: - the consecutive sample number for the compartment.
Type	Enter the type of sample: - **G** for natural stands; **R** for experimental; **T** for silviculturally treated stands; and **I** for Intensive.
Plot	Enter the plot number: - usually 1; but can be 1, 2, or 3 up to 5.
Plot Description	
Aspect	Enter the plot aspect in azimuth (0-360 degrees).
Slope	Enter the average % slope of the plot.
Elev.	Enter the elevation above sea level.
Sample Details	
Meas. No.	Enter **0** at establishment, **1** for the first remeasurement, **2** for the second, and so on.
Meas. Date	Enter the date of plot measurement (year-month-day).
Suitable for Remeas.	Enter at remeasurement: - **Y** (Yes) or **N** (No) - *(Appendix 20)*.
Buffer Dist.	Buffer disturbance: - enter **Y** (Yes) if plot buffer disturbed; otherwise **N** (No).
Disturb. Dist.	Disturbance distance: - enter distance from plot perimeter to disturbance.
Centre Stake O.K.	Enter at remeasurement if centre stake moved: - **Y** (Yes) or **N** (No).
Diam. 1.3 m	Enter **Y** (Yes) if diameter is measured @ 1.3 m; otherwise enter **N** (No).
Diam. 1.37 m	Enter **Y** (Yes) if diameter is measured @ 1.37 m; otherwise enter **N** (No).
Break Pt.	Enter the break point number for tagging plot trees: - usually 4.0 cm DBH.
Diam. or Ht.	Enter **D** (Diameter) or **H** (Height) for break point criteria.
DBH Ref. Pt.	Enter **PoG** (Point of Germination) reference point for samples established before 1991. Enter **UpH** (Uphill side) reference point for samples established after 1990.
Stem Map	Enter **Y** (Yes) if the sample is being stem mapped; if not, enter **N** (No).
Stumps	Enter **Y** (Yes) if stumps are to be measured at establishment; otherwise **N** (No).
Selct. Logged	Enter **Y** (Yes) if the area has been selectively logged; if not enter **N** (No).
Special Site	If age and height of plot trees are not representative of Site Index, enter a corrected number.
Special Program	Enter **Y** (Yes) if the sample represents a special project.
THSS	Top Height Site Sector:- Enter **C** (Centre sector) if the top height tree(s) come from the centre sector or **A** (All) for all sectors.

Item	Instruction
Lean/Sweep	Enter **Y** (Yes) if Lean or Sweep is being recorded; otherwise **N** (No).
	Note: This is primarily used for **I** (Intensive) Samples.
Stand Struct.	Stand Structure: - Enter **1** for simple layer; **2** for complex; and **3** for multi-layer.
Primary Layer	Enter primary layer **1**; (**1** or **2)** if multi-layer stand structure.
Crown Closure	
Layer 1	Enter the crown closure of the plot (for layer 1) to the nearest 10%.
Layer 2	Enter the crown closure of the plot (for layer 2 if applicable) to the nearest 10%.
Layer V	Enter the crown closure of the plot for the veteran component (must be less than 6%).
Spacing Type	Enter **S** (Square) or **T** (Triangular).
Stand Damage	*(Appendix 14.)*
Compl./Partl./Blnk.	Enter the stand damage for sample: - **C** (Complete); **P** (Partial); or blank for nor
Agent 1 - Year	Enter the year of damage from 1st. damage agent.
Type	Enter the code for the type of 1st. damage agent.
Severity	Enter the % severity level for 1st. damage agent.
Agent 2 - Year	Enter the year of damage from 2nd damage agent.
Type	Enter the code for type of 2nd damage agent.
Severity	Enter the % severity level for 2nd damage agent.
Slope Position	Enter the slope position for the plot: - **C** (Crest); **U** (Upper); **M** (Mid Slope); **L** (Lower); **T** (Toe); **D** (Depression); or **F** (Flat).
Plot Size	
Plot Radius	Enter the plot radius.
Plot Area	Enter the plot area.
Sub-plot Radius	Enter the sub-plot radius.
Sub-plot Area	Enter the sub-plot area.
Live Tree Measurements	
Meas. No.	Enter **0** at establishment, **1** for the first remeasurement, **2** for the second, and so on.
Layer	Enter **1** for single layer stand; **2** for second layer; and **V** for veteran layer.
Delete Tree	Enter **Y** (Yes) to delete a tree at establishment or an ingrowth at remeasurement.
Tree No.	Enter the tag number of the tree being examined.
Species	Enter the species code of the tree being examined (Appendix l4).
Centre Sector	Enter a **C** if the tree is a potential Top Height tree.
Tagging Sector No.	Enter the tagging sector number in which the tree is located.
Site Sector No.	Enter the site sector number in which the tree is located.
Tag O.K.	Enter **Y** (Yes) if original tag is on tree at remeasurement. Enter **N** (No) if tag and/ or nail is missing.
DBH @ 1.3 m	Enter the diameter at breast height to the nearest millimetre.
Crown Class	Record the crown class (**1** to **6**) of each tree.
Live Cr.	Enter the length of the live crown expressed as a percentage of the total length of the tree (to the nearest 10%; **1** = 10%, etc.).
Tree Class	Enter the correct tree class code: **1** to **6**.
Path Remarks	Record the decay indicator code present on each tree (Appendix 11).

Item	Instruction
Ht. to Break	Record the height to break for live and dead trees.
Dead Tree Measurements	*(Appendix 22.)*
Tree Cert. Code	Enter **1** for tree certainty positively identified; **2** for likely correct; and **3** for uncertain.
Sp. Cert. Code	Enter **1** for species certainty positively identified; **2** for likely correct; and **3** for uncertain.
Vert. Position	Enter **S** for free standing tree and **D** for down on the ground (including supported by other trees).
Wildlife App.	Use visual description codes **1** to **7**.
Down Position	Enter down position: **S** for supported off the ground and **D** for down on ground.
Dead Tr. Stmp.	Enter **Y** (Yes) if stump originated from cut tree.
Missed Tree	At remeasurement enter **M** if the tree was missed at previous measurement; **D** if the tree is to be dropped because it is determined to be outside of the plot; or **F** if the tree is gone and most likely dead and fallen.
Estimated Ht. (Vets) or Small Tree	Record the estimated height for veteran trees or for **I** (Intensive) samples measure the small tree height.
Sweep	Record sweep for **I** (Intensive) samples: - **1** for minor; **2** for major lean.
Lean	Record Lean for **I** (Intensive) samples: - **1** for minor; **2** for major sweep..
Other Diameter	
Stump	Enter at establishment: - **N** (New) for a stump <5 years old; **O** (old) for a stump $\geq$ 5 years old.
Stump diam./ or DBH @ 1.37 m	Measure diameter of the stump/ or DBH of tree if measured at 1.37 m.
Stump Ht.	Measure height of stump.
Near Tree No.	Record the tree number of the closest sequentially numbered living tree to the ingrowth; sub-plot; or dead tree being measured.
In Plot	Record **Y** (Yes) if the tree is measured outside of plot. **N** (No) is the default.
Damage Agent 1	*(Appendix 14)*
Type	Enter single letter code for damage agent 1.
Agent	Enter two letter code for detailed description.
Severity	Enter appropriate code for damage severity.
Damage Agent 2	
Type	Enter single letter code for damage agent 2.
Agent	Enter two letter code for detailed description.
Severity	Enter appropriate code for damage severity.
Ht. Suitable	Enter height suitable code: **Y** (Yes); **N** (No); **C** (Could be); **V** (Very difficult); **E** (Easy); or **F** (Flagged).
Stem Mapping	
Bearing	Record the azimuth bearing from plot centre (PC) to the tree.
Slope	Record the % slope between PC and the tree.
Slope Dist.	Record the slope distance between PC and the tree.

2nd page

Item	Instruction
Reg	Enter the region: - a provincial inventory reference number obtained from inventory maps.
Comp. No.	Enter the compartment number: - a provincial inventory reference number obtained from inventory maps.
Letter	Enter the letter (if applicable). – applies mostly in coastal areas; if the compartment letter does not exist, the field is left blank.
Instal.	Enter the installation number for **I** (Intensive) samples only.
Samp. No.	Enter the sample number: - the consecutive sample number for the compartment.
Type	Enter the type of sample: - **G** for natural stands; **R** for experimental; **T** for silviculturally treated stands; and **I** for Intensive.
Plot	Enter the plot number: - usually 1; but can be 1, 2, or 3 and up to 5.
Meas. No.	Enter **0** at establishment, **1** for the first remeasurement, **2** for the second, and so on.
Centre Sector	Enter **C** for a potential Top Height tree or SIBEC tree; otherwise leave blank.
Tag. Sector No.	Enter the tagging sector in which the tree is located.
Site Sector No.	Enter the site sector in which the tree is located.
Tree No.	Enter the tag number of the tree being examined.
Species	Enter the species code of the tree being examined.
Height Calculation	
Top	Enter the top Suunto reading (% scale).
Bottom	Enter the bottom Suunto reading (% scale, + or -).
Total	Enter the total of the top and bottom readings.
Slope Dist.	Enter the slope distance from the tree to the measurer.
Slope %	Enter % slope.
Horiz. Dist.	Enter the horizontal distance between the tree and the measurer.
Height	Enter the calculated height.
Height Correction	Enter the height correction (normally 1.3 m).
Total Height	Enter the total height.
Age Calculation	
Age Core Tkn.	Age core taken: Enter **Y** (Yes) or **N** (No).
Boring Age	Enter the boring age.
Boring Height	Enter the boring height (1.3 m).
Age Correction	Enter the age correction.
Total Age	Enter the total age.
Pith	If the pith is included, enter **Y**(Yes); if missed, enter **N** (No); and if the core has rot, enter **R** (Rotten), and if the age was taken on a similar size out of plot tree, enter **E** (estimate).
Radial Increment	
Last 5 Yrs.	Enter the radial increment for the last 5 years.
Last 10 Yrs.	Enter the radial increment for the last 10 years.
Last 20 Yrs.	Enter the radial increment for the last 20 years.
Age Suppression	*(Appendix 23)*
Suppression	Enter presence of age suppression in core: **Y** (Yes); **N** (No); or **P** (Possibly).
Core Length	Enter core length to pith.

Item	Instruction
Supp. Age	Enter number of years of suppression.
Supp. Length	Enter length of total suppression.
Supp. 10 Yrs.	Enter length of last 10 years of suppression.
Released 10 Yrs.	Enter length of first 10 years after release.
Tree In/Out of Plot	Record **Y** (Yes) if the tree is measured outside of plot; otherwise **N** (No).
Compass Offset	
Compass at PC	If compass is not at plot centre, enter **N** (No); otherwise **Y** (Yes).
Bearing From Compass to Plot Centre	Enter bearing (0-360) from the compass to plot centre.
Slope	Enter % slope from the compass to plot centre.
Slope Distance	Enter the slope distance from the compass to plot centre.
Dot Count Summary	
Meas. No.	Enter **0** at establishment, **1** for the first remeasurement, **2** for the second, and so on.
Species	Enter the species code of the tree being examined.
0.3-1.3 m (0)	Enter the number of trees $\geq$ 0.3 m and $\leq$ 1.3 m height
0.1-1.9 cm (1)	Enter the number of trees > 1.3 m and < 2.0 cm DBH.
Total	Enter the total dot count trees for each species.

Appendix 17: Location and Access Notes Example

Region 18 Comp. 8 Sample 2

Cranbrook - Proceed along Gold Creek Rd. past the Natural Gas Station to 17th Street South.

0 km - Junction of Gold Creek Rd. & 17th St. South. Proceed West on Gold Creek. Rd.

15.3 km - Gold Creek Ranch on left.

28.6 km - Bridge over Gold Creek at B.C.F.S. campsite

30.6 km - Turn left off of Gold Creek Rd.

30.7 km - Cross over creek (bridge).

30.9 km - Keep right at Y.

30.9 km - Cross pipeline - keep right.

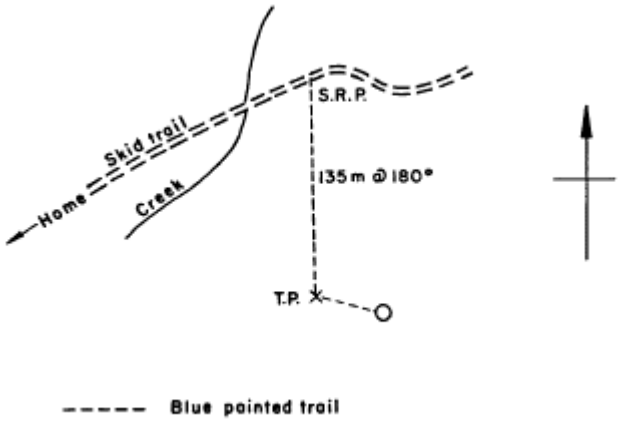
31.2 km - Driving parallel to pipeline.

3l.6 km - Keep right - leave pipeline.

32.4 km - Make sharp left turn - cross pipeline and turn right.

32.6 km - Merge with road on left - keep straight.

33.4 km - Cross creek and park truck. Sample reference point is 50 m from the creek along skid trail. Tie point is 135 m at 180° from sample reference point.

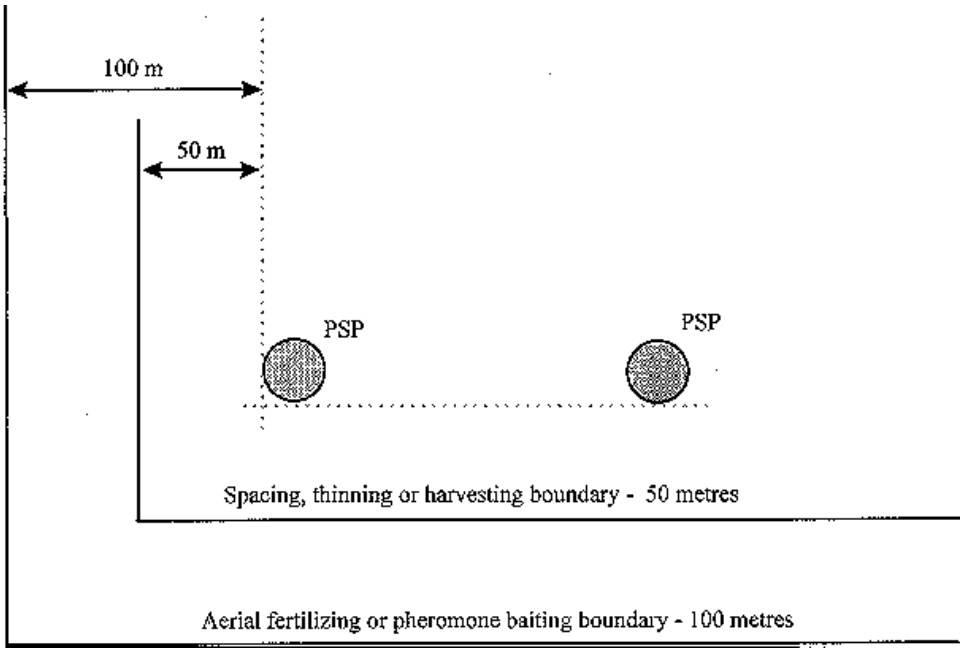


Appendix 18: Recommended Protection Buffers for Permanent Samples

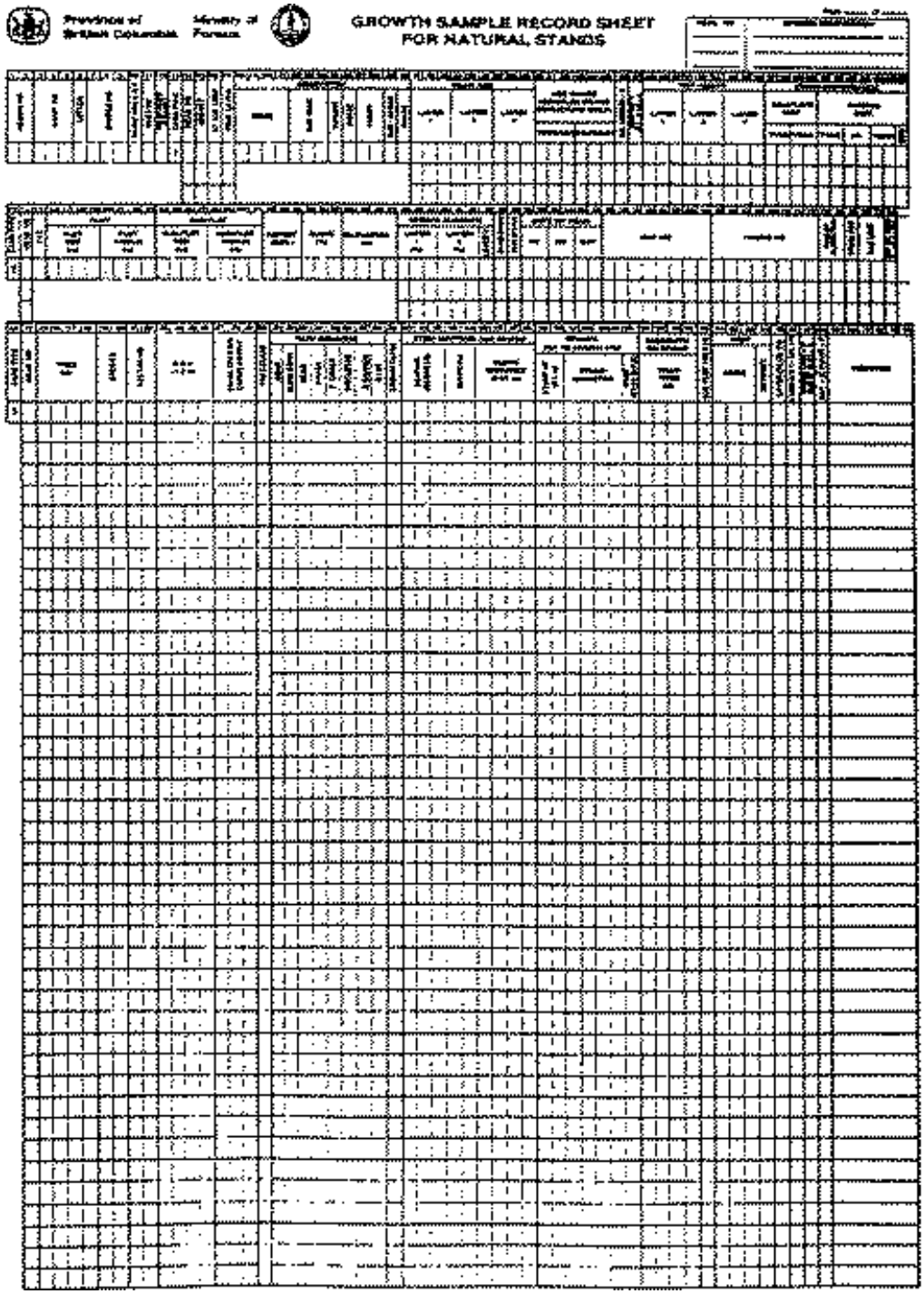
Hypothetical Permanent Sample Plots (PSP) showing buffer zones required for operational spacing, thinning, harvesting and fertilizing.

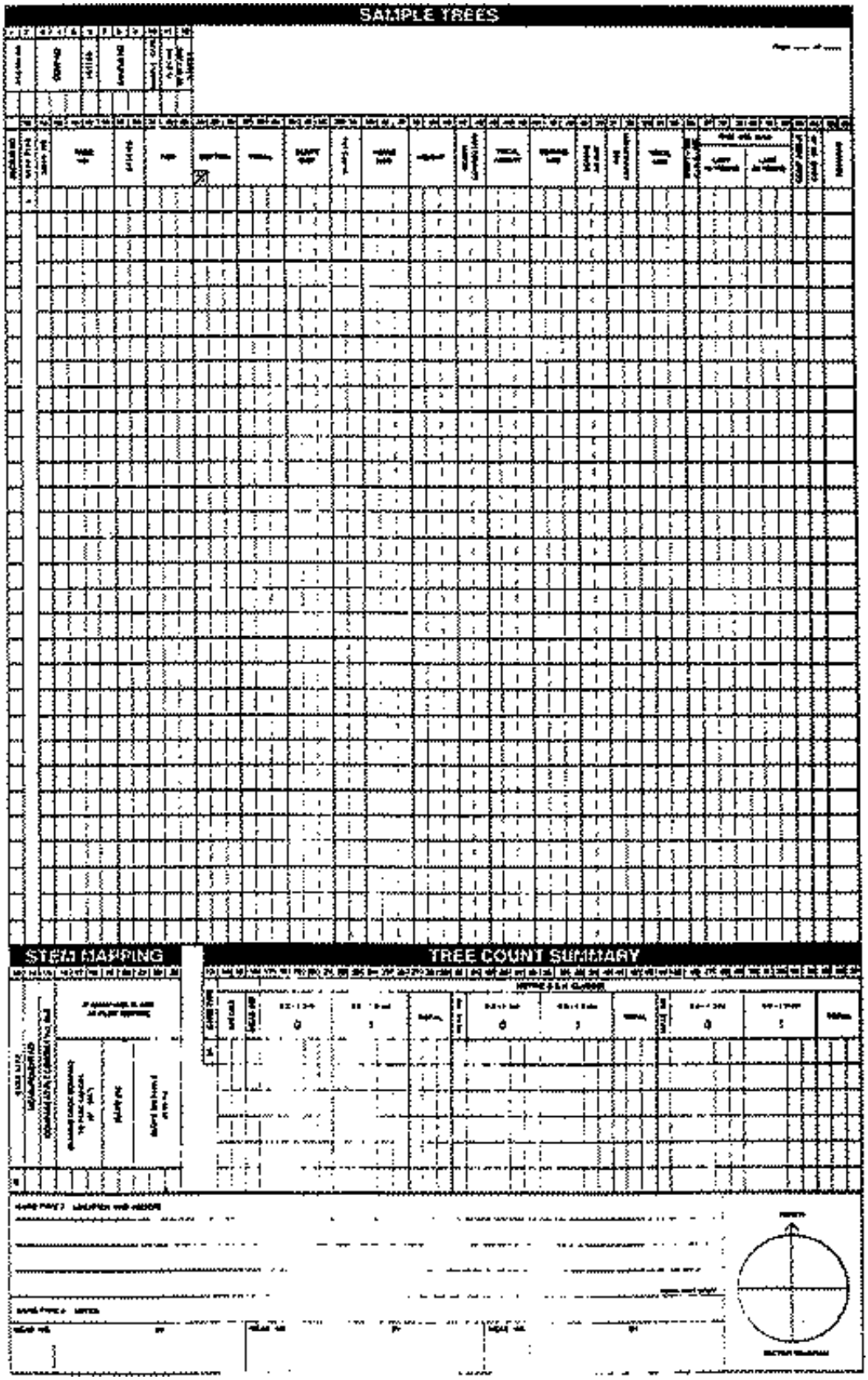
These buffers may be reduced with documented rationale but must be at least 20 metres or Top Height, whichever is greater.

The person responsible must take into consideration the nature of the silvicultural treatment (up-slope or up-wind aerial application of fertilizer) or the susceptibility to windthrow.



Appendix 19: Growth Sample Record Sheet




SAMPLE TREES
STEM MAPPING
TREE COUNT SUMMARY

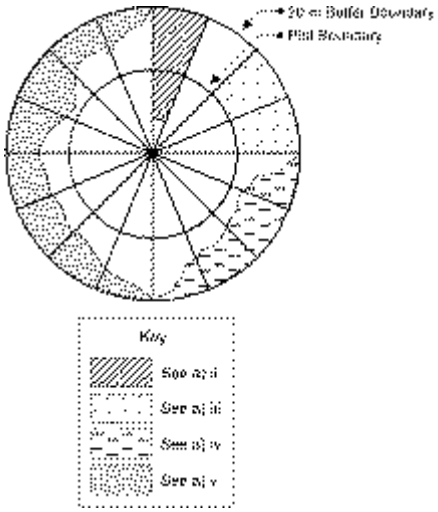
Appendix 20: Guidelines for Deciding if Damaged Permanent Plots Should be Remeasured

To decide if a damaged plot should be remeasured, the source of the damage must be considered.

1. If the damage is the result of natural causes such as slides, fungi, insects, disease and fire, it should be remeasured if at least 25% for the plot trees are still living.

2. If the damage is the result of human activities, it must be considered in one of two ways:

   a) **Major disturbance** (i.e., harvesting, road building, hydro right of way, etc.) remeasure if:



      i. the disturbance is outside the 20 metre buffer.

      ii. the 20 meter buffer is destroyed over an area less than 1/16th of the plot circumference and less than 5% of the plot trees are destroyed.

      iii. the 20 meter buffer is destroyed but only over an area less than 1/8th of the plot circumference and none of the plot trees are destroyed.

      iv. The 20 meter buffer is 75% destroyed but only over an area less than 1/4 of the plot circumference and none of the plot trees are destroyed.

      v. the 20 meter buffer is 50% destroyed but only over an area less than 1/2 of the plot circumference and none of the plot trees are destroyed.

   b) **Minor disturbance** (i.e., spacing, pruning, firewood cutting, small trails, etc.) remeasure if:

      i. less than 10% of the plot trees are destroyed, and

      ii. less than 10% of the sample area is destroyed, and

      iii. the disturbance is not localised (no more than 5% of crown closure in one spot).

Appendix 21: Converting Breast Height in Industrial Permanent Samples

Convert all industrial permanent sample plots (PSPs) from imperial (1.37 m) to metric (1.3 m) breast height. The conversion is done once to give a base-year measurement.

For all commercial and non-commercial trees 4 cm d.b.h. and greater in the plot and commercial trees 2 cm d.b.h. and greater in the sub-plot, measure the diameters at 1.3 m and at 1.37 m above the germination point. Measure all of the originally tagged trees, including those that died since the last measurement or were cut down as well as ingrowth plot and sub-plot trees.

To convert, use only one of the two methods described below. The first is the preferred one.

Method 1

For trees tagged originally:

1. Make sure the tree number tags are nailed to each tree 1.37 m above the germination point.
2. If necessary, replace the nail and tag. The new tag must have the same number as the old one. Make sure the nail is out far enough to allow for future growth.
3. Drive a second nail at 1.3 m (0.07 m below the nail at 1.37 m).
4. Measure both diameters above the nail.

Method 2

For trees tagged originally:

1. Measure the diameter at 1.37 m above the germination point.
2. Mark the metric breast height at 1.3 m (0.07 m below the nail at 1.37 m).
3. Move the nail and tag to the 1.3 m mark. If necessary, replace the nail and tag with a new tag with the same number.
4. Measure the diameter at 1.3 m.

For trees not previously tagged—example, ingrowth and sub-plot trees:

1. Mark the breast heights at 1.3 m and 1.37 m above the germination point.
2. Nail the tag at 1.3 m.
3. Measure the diameters at 1.3 m and at 1.37 m.

Establishing a Sub-plot in Industrial Plots

If a sub-plot is not already established, you must establish one at plot center to have some representation from trees below the tagging limit, that is, trees less than 4 cm d.b.h.

In a square or rectangular experimental plot, the sub-plot center is identified by an aluminum tubular stake driven into the ground where the two diagonal lines from the corner posts intersect.

When you establish a sub-plot, the perimeter must not extend beyond the plot boundary. The objective in each sub-sample is to obtain a minimum of 20 commercial trees that are less than 4 cm d.b.h. but are at least 0.3 m high. The sub-sample size depends on stand density. See Appendix 6 for a list of sub-plot radii.

1. Choose the sub-sample size and mark the sub-plot circumference with string.

2. Within the sub-plot, tag all living commercial trees with a d.b.h. of 2 cm and greater, but under 4 cm at 1.3 m and 1.37 m above germination using methods 1 or 2 above.

For the trees in the sub-plot with a d.b.h. of less than 2 cm:

1. Count the trees in a dot tally.

2. Derive their metric d.b.h. classes—either d.b.h. class 0 or 1. See “Table 1 below”.

Table 1 Metric d.b.h. Classes and Limits

d.b.h. class	Limits
0	0.3 m to 1.3 m high
1	0.1 cm to 1.9 cm d.b.h.

Appendix 22: Dead Tree Attributes

For each dead tree that is ≥10.0 cm in d.b.h. and ≥1.3 meters in height, collect the following attributes if, the tree is standing - both at establishment and remeasurement - or down if it was living at the last measurement:

Number

Number certainty

- positively identified (1)
- likely correct (2)
- uncertain (3)

Species

Species certainty

- positively identified (1)
- likely correct (2)
- uncertain (3)

Diameter at 1.3 meters

Tagging sector

Near tree number

Tree class

Vertical position

- standing (S)
- down (D)
  - supported (S)
  - on ground (G)

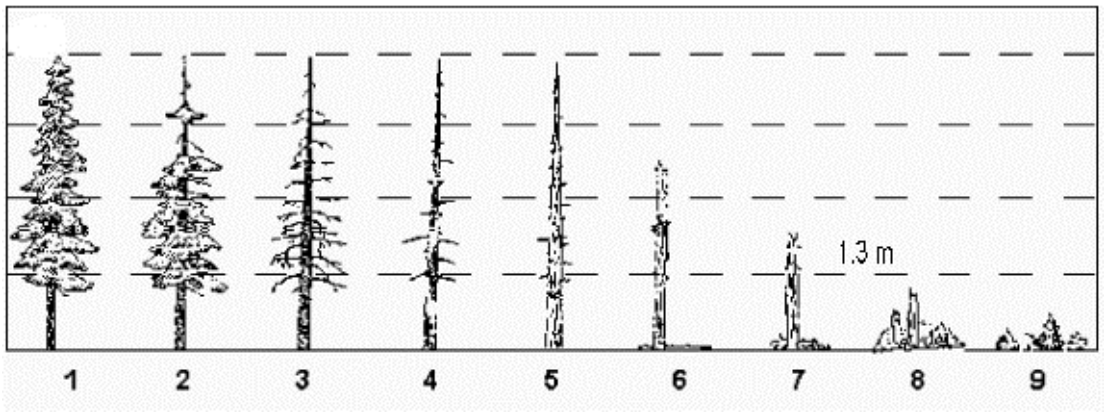
Broken and standing

- yes (Y)
- no (N)

Height to break (ocular estimate to the nearest meter)

Damage agent code and Severity (see Appendix 14)

Wildlife tree appearance as follows: Use codes (1) to (7).

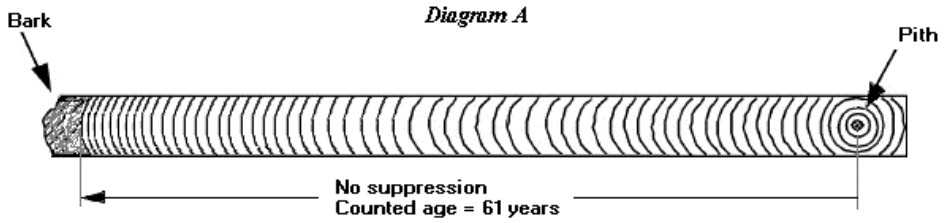

1.3 m
1
2
3
4
5
6
7
8
9

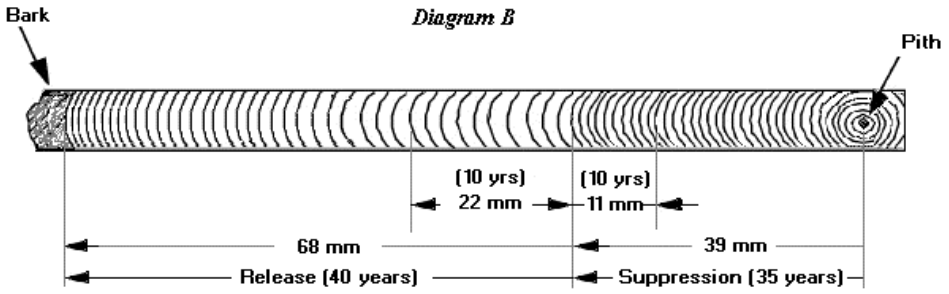
Appendix 23: Field Assessment of Suppressed Trees

Suppression Ratio is defined as the ratio of the mean annual growth increment after release divided by the mean growth of the preceding period of suppressed growth.

- the period of time will be 10 to 20 years in determining the ratio. The maximum period shall be no longer than 20. Unequal periods of suppressed and released growth can be compared as long as mean annual growth is the variable used.
- reduced ring growth near the bark (after a period with larger rings) will be considered normal
  (see Diagram "A").
- suppression is only recorded when the ratio of released to suppressed interval is 2 times or more.
- suppression can occur more than once in a tree's life and the same criteria will be used to determine suppression on each occasion. Two or more periods of suppression can be averaged to determine the mean ratio.
- field measurements required to determine suppression are: total breast height age (to pith); core length (to pith); suppressed age; suppressed length; and 10 year increment of suppressed and released growth. If the period of suppression or released growth is less than 10 years, use an equivalent period based on the lower of the two. This shorter period should be at least five years.

e.g.	*Diagram "B"*	*total BH age (pith)*	***75 years***
		core length	***107 mm***
		suppressed age	***35 years***
		suppressed length	***39 mm***
		10 yr. suppressed length	***11 mm***
		10 yr. released length	***22 mm***

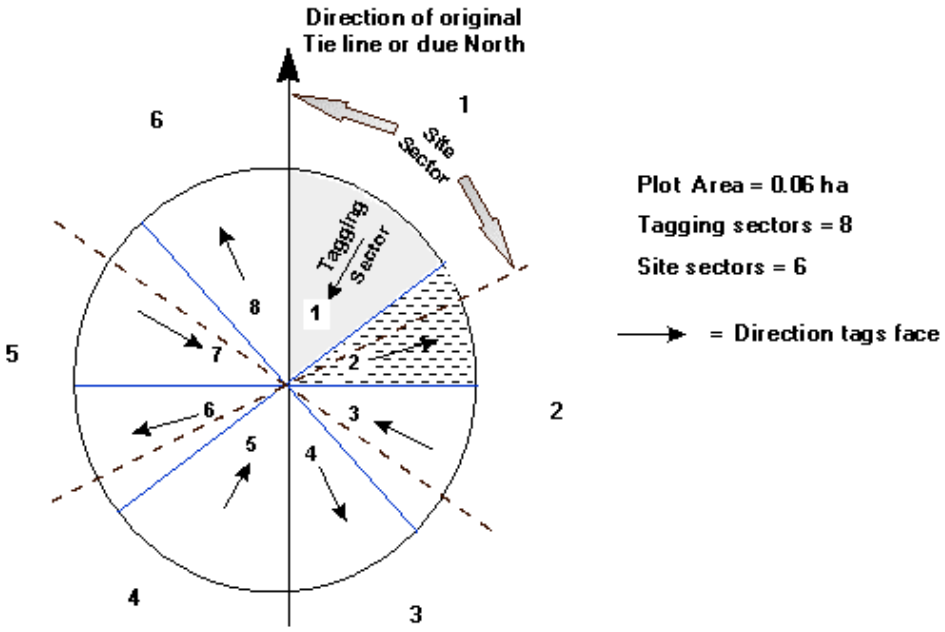


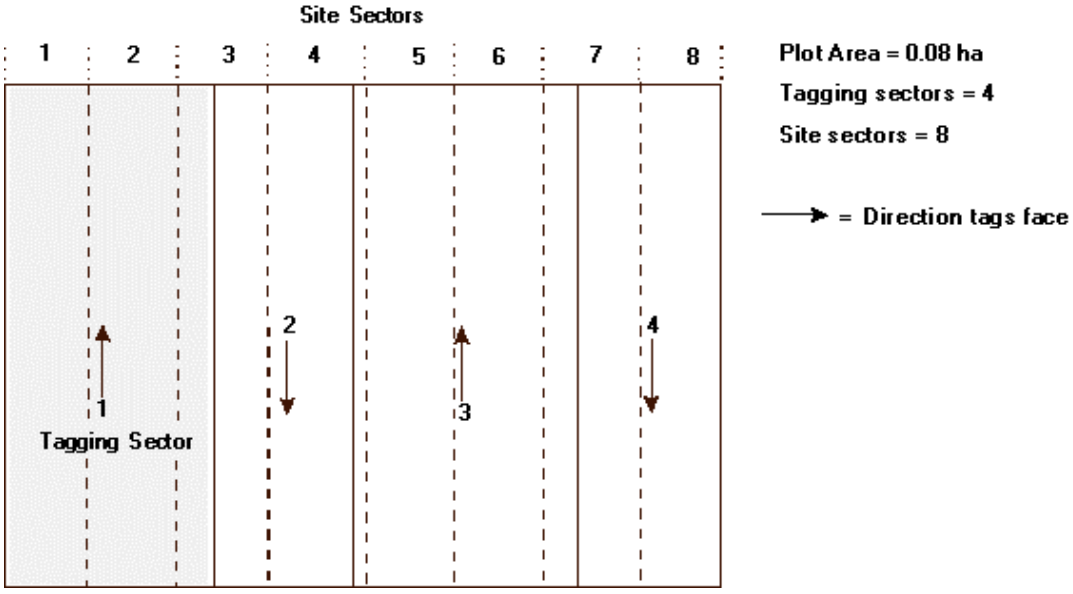


In this example, the field data used in the calculation of suppression ratio is:

(22 mm/10yr) / (11 mm/10yr) = 2

Appendix 24: Example of Tagging and Site Sectors for Remeasuring Plots





Appendix 25: Minimum Data Collection Requirements for Ecological Field Forms (FS 882)

Site Form

1. Date (Y/D/M)
2. Plot number
3. Surveyor(s)
4. General location
5. Forest region
6. Mapsheet
7. UTM (zone, easting and northing) or latitude and longitude
8. Site diagram
9. Plot representing
10. Biogeoclimatic unit
11. Site series
12. Transition/Distribution
13. Moisture regime
14. Nutrient regime
15. Successional status
16. Structural stage
17. Site disturbance
18. Elevation
19. Slope
20. Aspect
21. Meso slope position
22. Surface topography
23. Exposure type (if applicable)
24. Surface substrates (organic matter, decaying wood, bedrock, rocks, mineral soil, water)

Soil Form

1. Plot number
2. Surveyor(s)
3. Bedrock (at least to general level, where significant to site)
4. Coarse fragment lithology (at least to general level)
5. Terrain texture, surficial material, surface expression
6. Soil classification (to subgroup)
7. Humus classification (at least to group)
8. Hydrogeomorphic unit (at least to system)
9. Rooting depth
10. Rooting zone particle size
11. Root restricting type and depth (if applicable)
12. Water source (if applicable)
13. Seepage depth (if applicable)
14. Soil drainage
15. Flooding regime (if applicable)
16. Organic horizons/layers; for each: horizon/layer code depth
    - mycelial abundance
    - fecal abundance
    - von Post (for organic soils)
17. Mineral horizons/layers; for each: horizon/layer code
    - depth
    - colour (when required for diagnostic purposes)
    - colour aspect (when colour entered)
    - soil texture (< 2 mm fraction)
    - % coarse fragments (gravel, cobbles, stones, and total)
    - comments (especially mottles)
18. Profile diagram
19. Notes

Vegetation Form

1. Surveyor(s)
2. Plot Number
3. % cover by layer (A, B, C, D)
4. Species by layer
5. Cover for each species by layer and sublayers
6. Note

B.C. Ministry of Forests, Research Branch, 1999