Region 1 Common Stand Exam and Inventory and Monitoring Protocols

May 2016

APPENDICES

APPENDICES:

Appendix A: Administrative and Proclaimed National Forest Codes

Administrative and Proclaimed National Forest Codes			
Admin Number	**Administrative Forest Name**	**Proc Number**	**Proclaimed Forest Name**
02	Beaverhead - Deerlodge	02*	Beaverhead
03	Bitterroot	03	Bitterroot
04	Idaho Panhandle	04*	Idaho Panhandle
		05*	Clearwater
08	Custer	08	Custer
02	Beaverhead - Deerlodge	09	Deerlodge
10	Flathead	10	Flathead
11	Gallatin	11	Gallatin
12	Helena	12	Helena
14	Kootenai	14*	Kootenai
15	Lewis and Clark	15	Lewis and Clark
16	Lolo	16	Lolo
17	Nezperce Clearwater	17	Nezperce

Note: *Prior to migration to FSVeg, R1 used TSMRS and R1 Edit to manage stand informaton. Those databases did not discern between Administrative and Proclaimed Forest. Therefore, when migrating to FSVeg and FSVeg Spatial, both Administrative and Proclaimed Nation Forest were populated with the Forest number being used in 2000. So, Proclaimed Forest is not necessarily the Congretionally mandated Forest number but the number that was used by the Region in 2000.

Appendix B: District Codes

Record the 2-digit District code associated with the Proclaimed National Forest. These District numbers *should not* be updated over time due to consolidation. They are the District numbers that were used when the Forest stand layer was migrated to FSVeg Spatial in 2010 based on the TSMRS District codes used in 2005. Refer to appendix B for a list of District Codes.

In order to check the District, associated with a stand in FSVeg Spatial, run the R01 Extract Vegetation Polygons record set writer in the Geospatial Interface, for more information see *Geospatial Interface Content: FSVeg and FSVeg Spatial.*

District Codes

Forest	Code	District
Beaverhead - Deerlodge	1	Dillon
	2	Wise River
	3	Wisdom
	4	Butte
	6	Madison
	7	Jefferson
	8	Pintler
Bitterroot	1	Stevensville
	2	Darby
	3	Sula
	4	West Fork
Clearwater	1	Pierce
	2	Palouse
	3	North Fork
	5	Lochsa
	6	Powell
Custer	1	Sheyenne
	2	Beartooth
	3	Sioux
	4	Ashland
	6	Grand River
	7	Medora
	8	McKenzie
Flathead	1	Swan Lake
	2	Condon
	4	Spotted Bear
	6	Hungry Horse
	7	Glacier View
	8	Tally Lake

District Codes

Forest	Code	District
Gallatin	1	Big Timber
	2	Livingston
	3	Gardiner
	5	Bozeman-North
	6	Bozeman
	7	Hebgen Lake
Helena	1	Townsend
	2	Helena
	3	Helena - West
	4	Lincoln
Idaho Panhandle	1	Wallace
	2	St. Joe (Avery)
	3	Fernan
	4	St. Joe (St. Maries)
	6	Sandpoint
	7	Bonners Ferry
	8	Priest Lake
Kootenai	1	Rexford
	3	Fortine
	4	Three Rivers
	5	Libby
	7	Cabinet
Lewis & Clark	1	Rocky Mountain
	3	Belt Creek
	4	Judith
	6	Musselshell
	7	White Sulpher Springs
Lolo	3	Missoula
	4	Ninemile

District Codes		
Forest	**Code**	**District**
	5	Plains/Thompson Falls
	6	Seeley Lake
	7	Superior
	8	Thompson Falls
Nezperce	1	Salmon River
	3	Slate Creek

District Codes		
Forest	**Code**	**District**
	4	Clearwater
	5	Red River
	6	Moose Creek
	7	Selway
	8	Elk City

Note: Nezperce-Clearwater use the District numbers that were used prior to consolidation.

Appendix C: State Codes

State Codes	
Code	**State**
ID	Idaho
MT	Montana
ND	North Dakota
SD	South Dakota
WA	Washington

Appendix D: County Codes

County Codes		
State	**Code**	**County**
Montana	001	Beaverhead
	007	Broadwater
	009	Carbon
	011	Carter
	013	Cascade
	015	Choteau
	023	Deer Lodge
	027	Fergus
	029	Flathead
	031	Gallatin
	035	Glacier
	037	Golden Valley
	039	Granite
	043	Jefferson
	045	Judith Basin
	047	Lake
	049	Lewis & Clark
	053	Lincoln
	057	Madison
	059	Meagher
	061	Mineral
	063	Missoula
	067	Park
	071	Phillip
	073	Pondera
	075	Powder River
	077	Powell
	081	Ravalli
	087	Rosebud
	089	Sanders
	093	Silver Bow
	095	Stillwater
	097	Sweetgrass
	099	Teton
	107	Wheatland

County Codes		
State	**Code**	**County**
Idaho	009	Benewah
	017	Bonner
	021	Boundary
	035	Clearwater
	049	Idaho
	055	Kootenai
	057	Latah
	061	Lewis
	069	Nez Pierce
	079	Shoshone
South Dakota Washington	063	Hardin
	019	Ferry
	051	Pend Oreille
	065	Stevens

Appendix E: Existing Vegetation Composition References and Codes

Existing Vegetation References:

Existing Vegetation References		
Code	**Name**	**Author**
SAF	Forest Cover Types of the United States and Canada	F.H. Eyre, Editor. Society of American Foresters (1980)
SRM	Society for Range Management	

SRM Existing Vegetation Codes:

SAF Existing Vegetation Codes		
Reference	**Code**	**Description**
SAF	000	Nonforest types
SAF	201	White spruce
SAF	203	Balsam poplar
SAF	205	Mountain hemlock
SAF	206	Engelmann spruce - subalpine fir
SAF	208	Whitebark pine
SAF	210	Interior Douglas-fir
SAF	211	White fir- limber pine
SAF	212	Western larch
SAF	213	Grand fir
SAF	215	Western white pine
SAF	216	Blue spruce
SAF	217	Aspen - Western forests - Middle elevation - Interior
SAF	218	Lodgepole pine
SAF	219	Limber pine
SAF	220	Rocky Mountain juniper
SAF	224	Western hemlock
SAF	227	Western redcedar - western hemlock
SAF	228	Western redcedar
SAF	230	Douglas-fir - western hemlock
SAF	235	Cottonwood - willow
SAF	236	Bur oak - Western forests - Low elevation - Interior
SAF	237	Interior ponderosa pine
SAF	238	Western juniper

SAF Existing Vegetation Codes		
Reference	**Code**	**Description**
SAF	251	White spruce - aspen
SAF	252	Paper birch
SRM	102	Idaho fescue
SRM	104	Antelope bitterbrush-bluebunch wheatgrass
SRM	105	SRM10 Antelope bitterbrush-Idaho fescue
SRM	107	Western juniper-big sagebrush- bluebunch wheatgrass
SRM	109	Ponderosa pine-shrubland
SRM	110	Ponderosa pine-grassland
SRM	203	Riparian woodland
SRM	210	Bitterbrush
SRM	213	Alpine grassland
SRM	215	Valley grassland
SRM	216	Montane meadows
SRM	217	Wetlands
SRM	301	Bluebunch wheatgrass-blue grama
SRM	302	Bluebunch wheatgrass-sandberg bluegrass
SRM	303	Bluebunch wheatgrass-western wheatgrass
SRM	304	Idaho fescue-bluebunch wheatgrass
SRM	305	Idaho fescue-Richardson needlegrass
SRM	306	Idaho fescue-slender wheatgrass
SRM	307	Idaho fescue-threadleaf sedge
SRM	308	Idaho fescue-tufted hairgrass
SRM	309	Idaho fescue-western wheatgrass
SRM	310	Needle-and-thread-blue grama
SRM	311	Rough fescue-bluebunch wheatgrass
SRM	312	Rough fescue-Idaho fescue
SRM	313	Tufted hairgrass- sedge
SRM	314	Big sagebrush-bluebunch wheatgrass
SRM	315	Big sagebrush-Idaho fescue
SRM	316	Big sagebrush-rough fescue
SRM	317	Bitterbrush-bluebunch wheatgrass
SRM	318	Bitterbrush-Idaho fescue
SRM	319	Bitterbrush rough fescue
SRM	320	Black sagebrush-bluebunch wheatgrass
SRM	321	Black sagebrush-Idaho fescue
SRM	322	Curlleaf mountain-mahogany-bluebunch wheatgrass
SRM	323	Shrubby cinquefoil-rough fescue
SRM	401	Basin big sagebrush
SRM	402	Mountain big sagebrush
SRM	403	Wyoming big sagebrush

SAF Existing Vegetation Codes		
Reference	**Code**	**Description**
SRM	405	Black sagebrush
SRM	406	Low sagebrush
SRM	408	Other sagebrush types
SRM	409	Tall forb
SRM	410	Alpine rangeland
SRM	411	Aspen woodland
SRM	415	Curlleaf mountain-mahogany
SRM	420	Snowbush
SRM	421	Chokecherry-serviceberry-rose
SRM	422	Riparian
SRM	501	Saltbush-greasewood
SRM	601	Bluestem prairie
SRM	602	Bluestem-prairie sandreed
SRM	603	Prairie sandreed-needlegrass
SRM	604	Bluestem-grama prairie
SRM	605	Sandsage prairie
SRM	606	Wheatgrass-bluestem-needlegrass
SRM	607	Wheatgrass-needlegrass
SRM	608	Wheatgrass-gama needlegrass
SRM	609	Wheatgrass-gama
SRM	610	Wheatgrass
SRM	611	Blue grama-buffalograss
SRM	612	Sagebrush-grass
SRM	613	Fesque grassland
SRM	614	Crested wheatgrass
SRM	615	Wheatgrass-saltgrass-grama
SRM	704	Blue grama-western wheatgrass
SRM	705	Blue grama-galleta
SRM	706	Blue grama-sideoats grama
SRM	707	Blue grama-sideoats grama-black grama
SRM	708	Bluestem-dropseed
SRM	709	Bluestem-grama
SRM	710	Bluestem prairie
SRM	713	Grama-muhly-threeawn
SRM	714	Grama-bluestem
SRM	715	Grama-buffalograss
SRM	720	Sand bluestem-little bluestem dunes
SRM	721	Sand bluestem-little bluestem plains
SRM	722	Sand sagebrush-mixed prairie
SRM	726	Cordgrass

SAF Existing Vegetation Codes		
Reference	**Code**	**Description**
SRM	730	Sand shinnery oak
SRM	735	Sideoats grama-sumac-juniper
SRM	801	Savanna
SRM	802	Missouri prairie
SRM	803	Missouri glades
SRM	804	Tall fesque
SRM	805	Riparian
SRM	822	Slough
SRM	901	Alder
SRM	902	Alpine herb
SRM	906	Broadleaf forest
SRM	908	Fesque
SRM	909	Freshwater marsh
SRM	910	Hairgrass
SRM	911	Lichen tundra
SRM	914	Mesic sedge-grass-herb meadow tundra
SRM	915	Mixed herb-herbaceous
SRM	916	Sedge-shrub tundra
SRM	917	Tall shrub swamp
SRM	918	Tussock tundra
SRM	921	Willow

Appendix F: Potential Vegetation References

Note: this appendix contains references for non-forest potential vegetation manuals, these are primarily for special projects and generally are not used for timber based stand exams.

Potential Vegetation References		
Forest Where manual is appropriate	**Reference Code**	**Name/Author**
References Applicable to Common Stand Exams		
02, 03, 08, 10, 11, 12, 14, 15, 16	101	**Forest Habitat Types of Montana.** 1977. Pfister, R.D.; Kovalchik, B.L.; Arno, S.F.; Presby. R.C. Gen. Tech. Rep. INT-34. Ogden, UT: USDA Forest Service, Intermountain Forest and Range Experiment Station. 174 p.
04, 05, 17	110	**Forest Habitat Types of Northern Idaho: A Second Approximation.** 1991 (revision). Cooper, S.V.; Neiman, K.E.; Roberts, D.W. Gen. Tech. Rep. INT-236. USDA Forest Service. 135 p. Note: Do not use the 1987 version (due to typographical errors).
14, 16	111	For the inventoried stand, potential vegetation code for the plots came from both references: Reference codes 101 and 110. Note: Only use this code in a stand that will have PV codes from both 101 and 110.
References Specific to Special Projects, Not Generally Used For CSE		
02, 08,11,12, 15	102	**Key to Montana Forest/Woodland Habitat Types East of the Continental Divide.** 1988. Cooper, S., Pfister, R. Developed for FIA Only
All R1 Forests	103	**Grassland and Shrubland Habitat Types of Western Montana.** 1980. Mueggler, W.F.; Stewart, W.L. Gen. Tech. Rep. INT-66. Ogden, UT: USDA Forest Service, Intermountain Forest and Range Experiment Station. 154 p.
08	109	**Native Woodland Habitat Types of Southwestern North Dakota.** 1989. Girard, M.M.; Goetz, H.; Bjugstad, A.J. Research Paper RM-281. USDA Forest Service.
All R1 Forests	112	**Classification and Management of Montana's Riparian and Wetland Sites**. 1995. Hansen, Paul L.; Boggs, Keith L.; Cook, Bradley J.; and others. Misc. Pub. #54. Missoula, MT: Montana Riparian Association.
Alpine Areas in MT	113	**Plant Community Classification for Alpine Vegetation on the Beaverhead National Forest, Montana.** 1997. Stephen V. Cooper, Peter Lesica, and Deborah Page-Dumroese. INT-GTR-362. 61p.

Potential Vegetation References		
Forest Where manual is appropriate	**Reference Code**	**Name/Author**
References Applicable to Common Stand Exams		
08	114	**The Vegetation of the Grand River/Cedar River, Sioux, and Ashland Districts of the Custer NF: A Habitat Type Classification**. 1988. Hansen, Paul L., Hoffman, George R. Gen. Tech. Rep. RM-157. Ft. Collins, CO: USDA FS RMFR Ex St. 68p.
08	115	**Ecological Sites and Habitat Types of Little Missouri National Grasslands and Western North Dakota.** Jensen, Heisner, Dibenedetto, Wessman, Phillipe
02, 08,11,12, 15	116	**The Vegetation of the Sheyenne National Grassland, An Ecological Classification.** 1996. Hansen, Kurt
08	402	**Forest Habitat Types of Eastern Idaho-Western Wyoming.** 1983. Steele, R., Pfister, R.D., Ryker, R. A., Kittams J.A. USDA/FS Gen. Tech. Rep. INT-144
05,17	615	**Plant Associations of the Wallowa-Snake Province, Wallowa-Whitman National Forest.** 1987. Johnson, C.G, Siimon, S.A., R6 Ecol 255-1986. USDA FS PNWR.

Appendix G: Potential Vegetation Codes

Potential Vegetation Codes			
Reference Code	**ADP Code**	**Common Name**	**PLANTS Code Abbreviation**
101	010	Scree	
101,111	000	Limber pine series	PIFL2
101,111	040	Limber pine/bluebunch wheatgrass	PIFL2/PSSPS
101,111	050	Limber pine/Idaho fescue	PIFL2/FEID
101,111	051	Limber pine/Idaho fescue-Idaho fescue	PIFL2/FEID-FEID
101,111	052	Limber pine/Idaho fescue-rough fescue	PIFL2/FEID-FEAL
101,111	070	Limber pine/common juniper	PIFL2/JUCO6
101	100	Ponderosa pine	PIPO
101	110	Ponderosa pine/bluestem	PIPO/ANDRO2
101	130	Ponderosa pine/bluebunch wheatgrass	PIPO/PSSPS
101	140	Ponderosa pine/Idaho fescue	PIPO/FEID
101	141	Ponderosa pine/Idaho fescue-Idaho fescue	PIPO/FEID-FEID
101	142	Ponderosa pine/Idaho fescue-rough fescue	PIPO/FEID-FEAL
101	160	Ponderosa pine/bitterbrush	PIPO/PUTR2
101	161	Ponderosa pine/bitterbrush-bluebunch wheatgrass	PIPO/PUTR2-PSSPS
101	162	Ponderosa pine/bitterbrush-Idaho fescue	PIPO/PUTR2-FEID
101	170	Ponderosa pine/snowberry	PIPO/SYAL
101	171	Ponderosa pine/snowberry-snowberry	PIPO/SYAL-SYAL
101	172	Ponderosa pine/snowberry-creeping Oregon grape	PIPO/SYAL-MARE11
101	180	Ponderosa pine/chokecherry	PIPO/PRVI
101	181	Ponderosa pine/chokecherry-chokecherry	PIPO/PRVI-PRVI
101	182	Ponderosa pine/chokecherry-buffaloberry	PIPO/PRVI-SHCA
101	200	Douglas-fir	PSME
101	210	Douglas-fir/bluebunch wheatgrass	PSME/PSSPS
101	220	Douglas-fir/Idaho fescue	PSME/FEID
101	230	Douglas-fir/rough fescue	PSME/FEAL
101	250	Douglas-fir/dwarf huckleberry	PSME/VACA13
101	260	Douglas-fir/ninebark	PSME/PHMA5
101	261	Douglas-fir/ninebark-ninebark	PSME/PHMA5-PHMA5
101	262	Douglas-fir/ninebark-pinegrass	PSME/PHMA5-CARU
101	280	Douglas-fir/blue huckleberry	PSME/VAME
101	281	Douglas-fir/blue huckleberry-blue huckleberry	PSME/VAME-VAME
101	282	Douglas-fir/blue huckleberry-kinnikinnick	PSME/VAME-ARUV
101	283	Douglas-fir/blue huckleberry-beargrass	PSME/VAME-XETE
101	290	Douglas-fir/twinflower	PSME/LIBO3

Potential Vegetation Codes			
Reference Code	**ADP Code**	**Common Name**	**PLANTS Code Abbreviation**
101	291	Douglas-fir/twinflower-snowberry	PSME/LIBO3-SYAL
101	292	Douglas-fir/twinflower-pinegrass	PSME/LIBO3-CARU
101	293	Douglas-fir/twinflower-blue huckleberry	PSME/LIBO3-VAME
101	310	Douglas-fir/snowberry	PSME/SYAL
101	311	Douglas-fir/snowberry-bluebunch wheatgrass	PSME/SYAL-PSSPS
101	312	Douglas-fir/snowberry-pinegrass	PSME/SYAL-CARU
101	313	Douglas-fir/snowberry-snowberry	PSME/SYAL-SYAL
101	320	Douglas-fir/pinegrass	PSME/CARU
101	321	Douglas-fir/pinegrass-bluebunch wheatgrass	PSME/CARU-PSSPS
101	322	Douglas-fir/pinegrass-kinnikinnick	PSME/CARU-ARUV
101	323	Douglas-fir/pinegrass-pinegrass	PSME/CARU-CARU
101	324	Douglas-fir/pinegrass-ponderosa pine	PSME/CARU-PIPO
101	330	Douglas-fir/elk sedge	PSME/CAGE2
101	340	Douglas-fir/white spirea	PSME/SPBE2
101	350	Douglas-fir/kinnikinnick	PSME/ARUV
101	360	Douglas-fir/common juniper	PSME/JUCO6
101	365	Douglas-fir/bunchberry dogwood	PSME/COCA13
101	370	Douglas-fir/heartleaf arnica	PSME/ARCO9
101	380	Douglas-fir/mountain snowberry	PSME/SYOR2
101	400	Spruce	PICEA
101	410	Spruce/common horsetail	PICEA/EQAR
101	420	Spruce/queencup beadlily	PICEA/CLUN2
101	421	Spruce/queencup beadlily-dwarf huckleberry	PICEA/CLUN2-VACA13
101	422	Spruce/queencup beadlily-queencup beadlily	PICEA/CLUN2-CLUN2
101	430	Spruce/ninebark	PICEA/PHMA5
101	440	Spruce/sweetscented bedstraw	PICEA/GATR3
101	450	Spruce/dwarf huckleberry	PICEA/VACA13
101	460	Spruce/cleft-leaf groundsel	PICEA/PAST10
101	461	Spruce/cleft-leaf groundsel-Douglas-fir	PICEA/PAST10-PSME
101	462	Spruce/cleft-leaf groundsel-spruce	PICEA/PAST10-PICEA
101	470	Spruce/twinflower	PICEA/LIBO3
101	480	Spruce/starry Solomon's seal	PICEA/MAST4
101	500	Grand fir	ABGR
101	501	Western redcedar	THPL
101	502	Western hemlock	TSHE
101	510	Grand fir/beargrass	ABGR/XETE
101	520	Grand fir/queencup beadlily	ABGR/CLUN2
101	521	Grand fir/queencup beadlily-queencup beadlilly	ABGR/CLUN2-CLUN2
101	522	Grand fir/queencup beadlily-wild sarsaparilla	ABGR/CLUN2-ARNU2
101	523	Grand fir/queencup beadlily-beargrass	ABGR/CLUN2-XETE

Potential Vegetation Codes			
Reference Code	**ADP Code**	**Common Name**	**PLANTS Code Abbreviation**
101	530	Western redcedar/queencup beadlily	THPL/CLUN2
101	531	Western redcedar/queencup beadlily-queencup beadlily	THPL/CLUN2-CLUN2
101	532	Western redcedar/queencup beadlily-wild sarsaparilla	THPL/CLUN2-ARNU2
101	533	Western redcedar/queencup beadlily-menziesia	THPL/CLUN2-MEFE
101	550	Western redcedar/devil's club	THPL/OPHO
101	570	Western hemlock/queencup beadlily	TSHE/CLUN2
101	571	Western hemlock/queencup beadlily-queencup beadlily	TSHE/CLUN2-CLUN2
101	572	Western hemlock/queencup beadlily-wild sarsaparilla	TSHE/CLUN2-ARNU2
101	590	Grand fir/twinflower	ABGR/LIBO3
101	591	Grand fir/twinflower-twinflower	ABGR/LIBO3-LIBO3
101	592	Grand fir/twinflower-beargrass	ABGR/LIBO3-XETE
101	600	Subalpine fir	ABLA
101	610	Subalpine fir/devil's club	ABLA/OPHO
101	620	Subalpine fir/queencup beadlily	ABLA/CLUN2
101	621	Subalpine fir/queencup beadlily-queencup beadlily	ABLA/CLUN2-CLUN2
101	622	Subalpine fir/queencup beadlily-wild sarsaparilla	ABLA/CLUN2-ARNU2
101	623	Subalpine fir/queencup beadlily-dwarf huckleberry	ABLA/CLUN2-VACA13
101	624	Subalpine fir/queencup beadlily-beargrass	ABLA/CLUN2-XETE
101	625	Subalpine fir/queencup beadlily-menziesia	ABLA/CLUN2-MEFE
101	630	Subalpine fir/sweetscented bedstraw	ABLA/GATR3
101	640	Subalpine fir/dwarf huckleberry	ABLA/VACA13
101	650	Subalpine fir/bluejoint	ABLA/CACA4
101	651	Subalpine fir/bluejoint-bluejoint	ABLA/CACA4-CACA4
101	653	Subalpine fir/bluejoint-sweetscented bedstraw	ABLA/CACA4-GATR3
101	654	Subalpine fir/bluejoint-dwarf huckleberry	ABLA/CACA4-VACA13
101	660	Subalpine fir/twinflower	ABLA/LIBO3
101	661	Subalpine fir/twinflower-twinflower	ABLA/LIBO3-LIBO3
101	662	Subalpine fir/twinflower-beargrass	ABLA/LIBO3-XETE
101	663	Subalpine fir/twinflower-grouse whortleberry	ABLA/LIBO3-VASC
101	670	Subalpine fir/menziesia	ABLA/MEFE
101	680	Mountain hemlock/menziesia	TSME/MEFE
101	690	Subalpine fir/beargrass	ALBA/XETE
101	691	Subalpine fir/beargrass-blue huckleberry	ALBA/XETE-VAME
101	692	Subalpine fir/beargrass-grouse whortleberry	ALBA/XETE-VASC
101	700	Mountain hemlock	ABLA
101	710	Mountain hemlock/beargrass	TSME/XETE
101	720	Subalpine fir/blue huckleberry	ABLA/VAME
101	730	Subalpine fir/grouse whortleberry	ABLA/VASC
101	731	Subalpine fir/grouse whortleberry-pinegrass	ABLA/VASC-CARU
101	732	Subalpine fir/grouse whortleberry-grouse whortleberry	ABLA/VASC-VASC

Potential Vegetation Codes			
Reference Code	**ADP Code**	**Common Name**	**PLANTS Code Abbreviation**
101	733	Subalpine fir/grouse whortleberry-western meadowrue	ABLA/VASC-THOC
101	740	Subalpine fir/Sitka alder	ABLA/ALVIS
101	750	Subalpine fir/pinegrass	ABLA/CARU
101	770	Subalpine fir/virgin's bower	ABLA/CLCOC2
101	780	Subalpine fir/heartleaf arnica	ABLA/ARCO9
101	790	Subalpine fir/elk sedge	ABLA/CAGE2
101	791	Subalpine fir/elk sedge-elk sedge	ABLA/CAGE2-CAGE2
101	792	Subalpine fir/elk sedge-Douglas-fir	ABLA/CAGE2-PSME
101	800	Upper subalpine h.t.	ABLA
101	810	Subalpine fir/mountain gooseberry	ABLA/RIMO2
101	820	Subalpine fir/subalpinefir-whitebark pine/grouse whortleberry	ABLA-PIAL/VASC
101	830	Subalpine fir/smooth woodrush	ABLA/LUGLH
101	831	Subalpine fir/smooth woodrush-grouse whortleberry	ABLA/LUGLH-VASC
101	832	Subalpine fir/smooth woodrush-menziesia	ABLA/LUGLH-MEFE
101	840	Mountain hemlock/smooth woodrush	TSME/LUGLH
101	841	Mountain hemlock/smooth woodrush-grouse whortleberry	TSME/LUGLH-VASC
101	842	Mountain hemlock/smooth woodrush-menziesia	TSME/LUGLH-MEFE
101	850	Whitebark pine-subalpine fir	PIAL-ABLA
101	860	Subalpine larch-subalpine fir	LALY-ABLA
101	870	Whitebark pine	PIAL
101	890	Timberline h.t.s.	ABLA
101	900	Lodgepole pine	PICO
101	910	Lodgepole pine/bitterbrush	PICO/PUTR2
101	920	Lodgepole pine/dwarf huckleberry	PICO/VACA13
101	930	Lodgepole pine/twinflower	PICO/LIBO3
101	940	Lodgepole pine/grouse whortleberry	PICO/VASC
101	950	Lodgepole pine/pinegrass	PICO/CARU
103	46201	antelope bitterbrush/bluebunch wheatgrass	PUTR2/PSSPS
103	46301	curl-leaf mountain mahogany/bluebunch wheatgrass	CELE3/PSSPS
103	46600	little sagebrush series	ARAR8
103	46601	little sagebrush/Idaho fescue	ARAR8/FEID
103	46602	little sagebrush/bluebunch wheatgrass	ARAR8/PSSPS
103	46603	little sagebrush/bluebunch wheatgrass-needle and thread	ARAR8/PSSPS-HECOC8
103	46610	big sagebrush series	ARTR2
103	46611	big sagebrush/Altai fescue	ARTR2/FEAL
103	46612	big sagebrush/Idaho fescue	ARTR2/FEID
103	46613	big sagebrush/Idaho fescue-sticky purple geranium	ARTR2/FEID-GEVI2
103	46614	big sagebrush/bluebunch wheatgrass	ARTR2/PSSPS
103	46620	shrubby cinquefoil series	DAFL3

Potential Vegetation Codes			
Reference Code	**ADP Code**	**Common Name**	**PLANTS Code Abbreviation**
103	46621	shrubby cinquefoil/Altai fescue	DAFL3/FEAL
103	46622	shrubby cinquefoil/Altai fescue-timber oatgrass	DAFL3/FEAL-DAIN
103	46623	shrubby cinquefoil/Idaho fescue	DAFL3/FEID
103	46630	antelope bitterbrush series	PUTR2
103	46632	antelope bitterbrush/Idaho fescue	PUTR2/FEID
103	46633	antelope bitterbrush/Altai fescue	PUTR2/FEAL
103	46640	skunkbush sumac series	RHTR
103	46641	skunkbush sumac/Idaho fescue	RHTR/FEID
103	46642	skunkbush sumac/bluebunch wheatgrass	RHTR/PSSPS
103	46650	greasewood series	SAVE4
103	46651	greasewood/basin wildrye	SAVE4/LECI4
103	46652	greasewood/western wheatgrass	SAVE4/PASM
103	47003	Idaho fescue-western wheatgrass- streambank wheatgrass	FEID-PASM-ELLAL
103	47004	Idaho fescue/bearded wheatgrass	FEID/ELCA11
103	47100	tufted hairgrass series	DECA18
103	47101	tufted hairgrass/sedge	DECA18/CAREX
103	47110	Altai fescue series	FEAL
103	47111	Altai fescue/Idaho fescue	FEAL/FEID
103	47112	Altai fescue/Idaho fescue-Richardson's needlegrass	FEAL/FEID-ACRI8
103	47113	Altai fescue/Idaho fescue-sticky purple geranium	FEAL/FEID-GEVI2
103	47114	Altai fescue/bluebunch wheatgrass	FEAL/PSSPS
103	47115	Altai fescue/bluebunch wheatgrass-needle and thread	FEAL/PSSPS-HECOC8
103	47120	Idaho fescue series	FEID
103	47121	Idaho fescue/Richardson's needlegrass	FEID/ACRI8
103	47122	Idaho fescue/threadleaf sedge	FEID/CAFI
103	47123	Idaho fescue/tufted hairgrass	FEID/DECA18
103	47124	Idaho fescue/bearded wheatgrass-sticky purple geranium	FEID/ELCA11-GEVI2
103	47125	Idaho fescue/western wheatgrass	FEID/PASM
103	47126	Idaho fescue/bluebunch wheatgrass	FEID/PSSPS
103	47127	Idaho fescue/bluebunch wheatgrass-western needlegrass	FEID/PSSPS-ACOCO
103	47130	needle and thread series	HECOC8
103	47131	needle and thread/blue grama	HECOC8/BOGR2
103	47132	needle and thread/blue grama-western wheatgrass	HECOC8/BOGR2-PASM
103	47140	bluebunch wheatgrass series	PSSPS
103	47141	bluebunch wheatgrass/blue grama	PSSPS/BOGR2
103	47142	bluebunch wheatgrass/blue grama-dotted blazing star	PSSPS/BOGR2-LIPU
103	47143	bluebunch wheatgrass/western wheatgrass	PSSPS/PASM
103	47144	bluebunch wheatgrass/western wheatgrass-green needlegrass	PSSPS/PASM-NAVI4

Potential Vegetation Codes			
Reference Code	**ADP Code**	**Common Name**	**PLANTS Code Abbreviation**
110	100	Ponderosa pine	PIPO
110	130	Ponderosa pine/bluebunch wheatgrass	PIPO/PSSPS
110	140	Ponderosa pine/Idaho fescue	PIPO/FEID
110	170	Ponderosa pine/ninebark	PIPO/SYAL
110	190	Ponderosa pine/ninebark	PIPO/PHMA5
110	200	Douglas fir series	PSME
110	210	Douglas-fir/bluebunch wheatgrass	PSME/PSSPS
110	220	Douglas-fir/Idaho fescue	PSME/FEID
110	250	Douglas-fir/dwarf huckleberry	PSME/VACA13
110	260	Douglas-fir/ninebark	PSME/PHMA5
110	261	Douglas-fir/ninebark-ninebark	PSME/PHMA5-PHMA5
110	263	Douglas-fir/ninebark-starry Solomon's seal	PSME/PHMA5/MAST4
110	280	Douglas-fir/blue huckleberry	PSME/VAME
110	310	Douglas-fir/common snowberry	PSME/SYAL
110	320	Douglas-fir/pinegrass	PSME/CARU
110	322	Douglas-fir/pinegrass-kinnikinnick	PSME/CARU-ARUV
110	323	Douglas-fir/pinegrass-pinegrass	PSME/CARU-CARU
110	330	Douglas-fir/elk sedge	PSME/CAGE2
110	340	Douglas-fir/white spirea	PSME/SPBE2
110	500	Grand fir	ABGR
110	501	Western redcedar series	THPL
110	502	Western hemlock series	TSHE
110	505	Grand fir/white spirea	ABGR/SPBE2
110	506	Grand fir/ninebark	ABGR/PHMA5
110	507	Grand fir/ninebark-western gold thread	ABGR/PHMA5/COOC
110	508	Grand fir/ninebark-ninebark	ABGR/PHMA5-PHMA5
110	510	Grand fir/beargrass	ABGR/XETE
110	511	Grand fir/beargrass-western gold thread	ABGR/XETE/COOC
110	512	Grand fir/beargrass-blue huckleberry	ABGR/XETE-VAME
110	515	Grand fir/blue huckleberry	ABGR/VAME
110	516	Grand fir/wild ginger	ABGR/ASCA2
110	517	Grand fir/wild ginger-wild ginger	ABGR/ASCA2-ASCA2
110	518	Grand fir/wild ginger-menziesia	ABGR/ASCA2-MEFE
110	519	Grand fir/wild ginger-Pacific yew	ABGR/ASCA2-TABR2
110	520	Grand fir/queencup beadlily	ABGR/CLUN2
110	521	Grand fir/queencup beadlily-queencup beadlily	ABGR/CLUN2-CLUN2
110	523	Grand fir/queencup beadlily-beargrass	ABGR/CLUN2-XETE
110	524	Grand fir/queencup beadlily-ninebark	ABGR/CLUN2-PHMA5
110	525	Grand fir/queencup beadlily-menziesia	ABGR/CLUN2-MEFE
110	526	Grand fir/queencup beadlily-Pacific yew	ABGR/CLUN2-TABR2

Potential Vegetation Codes			
Reference Code	**ADP Code**	**Common Name**	**PLANTS Code Abbreviation**
110	529	Grand fir/queencup beadlily-arrowleaf groundsel	ABGR/SETR
110	530	Western redcedar/queencup beadlily	THPL/CLUN2
110	531	Western redcedar/queencup beadlily-queencup beadlily	THPL/CLUN2-CLUN2
110	533	Western redcedar/queencup beadlily-menziesia	THPL/CLUN2-MEFE
110	534	Western redcedar/queencup beadlily-beargrass	THPL/CLUN2-XETE
110	535	Western redcedar/queencup beadlily-Pacific yew	THPL/CLUN2-TABR2
110	540	Western redcedar/lady fern	THPL/ATFI
110	541	Western redcedar/lady fern-maidenhair fern	THPL/ATFI-ADPE
110	542	Western redcedar/lady fern-lady fern	THPL/ATFI-ATFI
110	545	Western redcedar/wild ginger	THPL/ASCA2
110	546	Western redcedar/wild ginger-wild ginger	THPL/ASCA2-ASCA2
110	547	Western redcedar/wild ginger-menziesia	THPL/ASCA2-MEFE
110	548	Western redcedar/wild ginger-Pacific yew	THPL/ASCA2-TABR2
110	550	Western redcedar/devil's club	THPL/OPHO
110	555	Western redcedar/oak fern	THPL/GYDR
110	560	Western redcedar/maidenhair fern	THPL/ADPE
110	565	Western hemlock/oak fern	TSHE/GYDR
110	570	Western hemlock/queencup beadlily	TSHE/CLUN2
110	571	Western hemlock/queencup beadlily-queencup beadlily	TSHE/CLUN2-CLUN2
110	572	Western hemlock/queencup beadlily-wild sarsaparilla	TSHE/CLUN2-ARNU2
110	573	Western hemlock/queencup beadlily-mefe	TSHE/CLUN2-MEFE
110	574	Western hemlock/queencup beadlily-beargrass	TSHE/CLUN2-XETE
110	575	Western hemlock/wild ginger	TSHE/ASCA2
110	576	Western hemlock/wild ginger-wild sarsaparilla	TSHE/ASCA2-ARNU2
110	577	Western hemlock/wild ginger-menziesia	TSHE/ASCA2-MEFE
110	578	Western hemlock/wild ginger-wild ginger	TSHE/ASCA2-ASCA2
110	579	Western hemlock/menziesia	TSHE/MEFE
110	590	Grand fir/twinflower	ABGR/LIBO3
110	591	Grand fir/twinflower-twinflower	ABGR/LIBO3-LIBO3
110	592	Grand fir/twinflower-beargrass	ABGR/LIBO3-XETE
110	600	Subalpine fir series	ABLA
110	620	Subalpine fir/queencup beadlily	ABLA/CLUN2
110	621	Subalpine fir/queencup beadlily-queencup beadlily	ABLA/CLUN2-CLUN2
110	624	Subalpine fir/queencup beadlily-beargrass	ABLA/CLUN2-XETE
110	625	Subalpine fir/queencup beadlily-menziesia	ABLA/CLUN2-MEFE
110	635	Subalpine fir/twisted stalk	ABLA/STAM2
110	636	Subalpine fir/twisted stalk-menziesia	ABLA/STAM2-MEFE
110	637	Subalpine fir/twisted stalk-Canby's ligusticum	ABLA/STAM2-LICA2
110	640	Subalpine fir/dwarf huckleberry	ABLA/VACA13
110	650	Subalpine fir/bluejoint	ABLA/CACA4

Potential Vegetation Codes			
Reference Code	**ADP Code**	**Common Name**	**PLANTS Code Abbreviation**
110	651	Subalpine fir/bluejoint-bluejoint	ABLA/CACA4-CACA4
110	652	Subalpine fir/bluejoint-Canby's ligusticum	ABLA/CACA4-LICA2
110	654	Subalpine fir/bluejoint-dwarf huckleberry	ABLA/CACA4-VACA13
110	655	Subalpine fir/bluejoint-Labrador tea	ABLA/CACA4-LEGL
110	670	Subalpine fir/menziesia	ABLA/MEFE
110	671	Subalpine fir/menziesia-western gold thread	ABLA/MEFE-COOC
110	672	Subalpine fir/menziesia-smooth woodrush	ABLA/MEFE-LUGLH
110	673	Subalpine fir/menziesia-beargrass	ABLA/MEFE-XETE
110	674	Subalpine fir/menziesia-grouse whortleberry	ABLA/MEFE-VASC
110	675	Mountain hemlock/twisted stalk	TSME/STAM2
110	676	Mountain hemlock/twisted stalk-smooth woodrush	TSME/STAM2-LUGLH
110	677	Mountain hemlock/twisted stalk-menziesia	TSME/STAM2-MEFE
110	680	Mountain hemlock/menziesia	TSME/MEFE
110	681	Mountain hemlock/menziesia-smooth woodrush	TSME/MEFE-LUGLH
110	682	Mountain hemlock/menziesia-beargrass	TSME/MEFE-XETE
110	685	Mountain hemlock/queencup beadlily	TSME/CLUN2
110	686	Mountain hemlock/queencup beadlily-menziesia	TSME/CLUN2-MEFE
110	687	Mountain hemlock/queencup beadlily-beargrass	TSME/CLUN2-XETE
110	690	Subalpine fir/beargrass	ABLA/XETE
110	691	Subalpine fir/beargrass-blue huckleberry	ABLA/XETE-VAME
110	692	Subalpine fir/beargrass-grouse whortleberry	ABLA/XETE-VASC
110	693	Subalpine fir/beargrass-western gold thread	ABLA/XETE-COOC
110	694	Subalpine fir/beargrass-smooth woodrush	ABLA/XETE-LUGLH
110	700	Mountain hemlock	TSME series
110	710	Mountain hemlock/beargrass	TSME/XETE
110	711	Mountain hemlock/beargrass-smooth woodrush	TSME/XETE-LUGLH
110	712	Mountain hemlock/beargrass-blue huckleberry	TSME/XETE-VAME
110	713	Mountain hemlock/beargrass-grouse whortleberry	TSME/XETE-VASC
110	720	Subalpine fir/blue huckleberry	ABLA/VAME
110	730	Subalpine fir/grouse whortleberry	ABLA/VASC
110	750	Subalpine fir/pinegrass	ABLA/CARU
110	830	Subalpine fir/smooth woodrush	ABLA/LUGLH
110	840	Mountain hemlock/smooth woodrush	TSME/LUGLH
110	850	Whitebark pie-subalpine fir	PIAL-ABLA
110	860	Subalpine larch-subalpine fir	LALY-ABLA
110	900	Lodgepole pine series	PICO
110	920	Lodgepole pine/dwarf huckleberry	PICO/VACA13
110	925	Beargrass	PICO/XETE
110	940	Lodgepole pine/grouse whortleberry	PICO/VASC
112	4	Engelmann spruce/field horsetail	PIEN/EQAR

Potential Vegetation Codes			
Reference Code	**ADP Code**	**Common Name**	**PLANTS Code Abbreviation**
112	6	spruce/bluejoint	PICEA/CACA4
112	12	spruce/fragrant bedstraw	PICEA/GATR3
112	30	Sitka alder communities	ALVIS
112	43	Engelmann spruce/redosier dogwood	PIEN/COSEO
112	44	Engelmann spruce/American skunkcabbage	PIEN/LYAM3
112	103	narrowleaf cotonwood/recent alluvial barr	POAN3
112	104	narrowleaf cotonwood/herbaceous	POAN3
112	105	narrowleaf cottonleaf/western snowberry	POAN3/SYOC
112	106	narrowleaf cottonleaf/western snowberry	POAN3/COSES
112	110	green ash/chokecherry	FRPE/PRVI
112	111	boxelder/chokecherry	ACNE2/PRVI
112	112	Russian olive	ELAN
112	113	plains cottonwood/redosier deogwood	PODEM/COSES
112	114	plains cottonwood/herbaceous	PODEM
112	115	plains cottonwood/recent alluvial bar	PODEM
112	116	plains cottonwood/western snowberry	PODEM/SYOC
112	117	quaking aspen/creeping barberry	POTR5/MARE11
112	118	quakingaspen/bluejoint	POTR5/CACA4
112	119	quaking aspen/redoiser dogwood	POTR5/COSES
112	120	quaking aspen/western sweetroot	POTR5/OSOC
112	121	quaking aspen/Kentucky bluegrass	POTR5/POPR
112	122	black cottonwood/redosier dogwood	POBAT/COSES
112	123	black cottonwood/herbaceous	POBAT
112	124	black cottonwood/recent alluvial bar	POBAT
112	125	Black cottonwood/western snowberry	POBAT/SYOR
112	130	peachleaf willow	SAAM2
112	131	Bebb willow	SABE2
112	132	sageleaf willow/beaked sedge	SACA4/CARO6
112	133	Drummond's willow/bluejoint	SADR/CACA4
112	134	Drummond's willow/beaked sedge	SADR/CARO6
112	135	Drummond's willow	SADR
112	136	Geyer willow/bluejoint	SAGE2/CACA4
112	137	Geyer willow/beaked sedge	SAGE2/CARO6
112	138	Geyer willow	SAGE2
112	139	Pacific willow	SALUL
112	140	yellow willow/bluejoint	SALU2/CACA4
112	141	yellow willow/beaked sedge	SALU2/CARO6
112	142	yellow willow	SALU2
112	143	diamondleaf willow/water sedge	SAPL2/CAAQ
112	144	Wolf's willow/water sedge	SAWO/CAAQ

Potential Vegetation Codes			
Reference Code	**ADP Code**	**Common Name**	**PLANTS Code Abbreviation**
112	145	Wolf/s willow/tufted hairgrass	SAWO/DECA18
112	146	gray alder	ALIN2
112	150	silver sagebrush/western wheatgrass	ARCA13/PASM
112	151	silver sagebrush/Idaho fescue	ARCA13/FEID
112	152	resin birch/beaked sedge	BEGL/CARO6
112	153	water birch	BEOC2
112	154	fleshy hawthorn	CRSU5
112	155	alpine laurel/mountain sedge	KAMI/CASC12
112	156	chockcherry	PRVI
112	157	Woods' rose	ROWO
112	158	greasewood/westerm wheatgrass	SAVE4/PASM
112	159	silver buffaloberry	SHAR
112	160	rose spirea	SPDO
112	161	western snowberry	SYOC
112	162	five-stamen tamarisk	TACH2
112	180	ponderosa pine/chokecherry	PIPO/PRVI
112	181	ponderosa pine/redosier dogwood	PIPO/COSES
112	200	water sedge/water sedge	CAAQ/CAAQ
112	201	water sedge/tufted hairgrass	CAAQ/DECA18
112	202	mud sedge	CALI7
112	203	beaked sedge/water sedge	CARO6/CAAQ
112	204	beaked sedge/beaked sedge	CARO6/CARO6
112	205	beaked sedge/tufted hairgrass	CARO6/DECA18
112	210	westerm wheatgrass	PASM
112	211	creeping bentgrass	AGST2
112	212	smooth brome	BRIN2
112	213	bluejoint	CACA4
112	214	saltgrass	DISP
112	215	water horsetail	EQFL
112	216	small floating mannagrass	GLBO
112	217	American licorice	GLLE3
112	218	foxtail barley	HOJU
112	219	reed canarygrass	PHAR3
112	219	reed canarygrass	PHAR3
112	220	common reed	PHAU7
112	221	fowl bluegrass	POPA2
112	222	water knotweed	POAM8
112	223	red swampfire	SARU
112	224	hardstem bulrush	SCAC3
112	225	cosmopolitan bulrush	SCMA8

Potential Vegetation Codes			
Reference Code	**ADP Code**	**Common Name**	**PLANTS Code Abbreviation**
112	226	chairmaker's bulrush	SCAM6
112	227	arrowleaf ragwort	SETR
112	228	prairie cordgrass	SPPE
112	400	Rocky Mountain juniper/redosier dogwood	JUSC2/COSES
112	540	western red cedar/common ladyfern	THPL/ATFI
112	542	western red cedar/common ladyfern-common ladyfern	THPL/ATFI-ATFI
112	550	western red cedar/devilsclub	THPL/OPHO
112	555	western red cedar/western oakfern	THPL/GYDR
112	565	western hemlock/western oakfern	TSHE/GYDR
112	601	subalpine fir/red baneberry	ABLA/ACRU2
112	610	subalpine fir/devilsclub	ABLA/OPHO
112	613	grand fir/common ladyfern	ABGR/ATFI
112	630	subalpine fir/fragrant bedstraw	ABLA/GATR3
112	631	subalpine fir/western labrador tea	ABLA/LEGL
112	632	subalpine fir/western labrador tea-bluejoint	ABLA/LEGL-CACA4
112	633	subalpine fir/western labrador tea-western labrador tea	ABLA/LEGL-LEGL
112	635	subalpine fir/claspleaf twistedstalk	ABLA/STAM2
112	636	subalpine fir/claspleaf twistedstalk- claspleaf twistedstalk	ABLA/STAM2-STAM2
112	637	subalpine fir/claspleaf twistedstalk-rusty menziesia	ABLA/STAM2-MEFE
112	650	subalpine fir/bluejoint	ABLA/CACA4
112	651	subalpine fir/bluejoint-bluejoint	ABLA/CACA4-CACA4
112	652	subalpine fir/bluejoint-Canby's licorice-root	ABLA/CACA4-LICA2
112	654	subalpine fir/bluejoint-dwarf bilberry	ABLA/CACA4-VACA13
112	700	Dougals-fir/redosier dogwood	PSME/COSES
112	HCS113	black cottonwood/thinleaf alder-redosier dogwood	POBAT/ALINT-COSES
112	MD3111	Kentucky bluegrass (dry meadow)	POPR
112	MM1912	tufted hairgrass (moist meadow)	DECA18
112	MM2911	woolly sedge (moist meadow)	CAPE42
112	MM2912	Nebraska sedge (moist meadow)	CANE2
112	MM2914	water sedge (aquatic moist meadow)	CAAQ
112	MM2915	analogue sedge (moist meadow)	CASI2
112	MM2917	Northwest Territory sedge (moist meadow)	CAUT
112	MM2920	woollyfruit sedge (moist meadow)	CALA11
112	MS3111	mountain sedge (subalpine wet meadow)	CASC12
112	MW3912	Baltic rush	JUBA
112	MW4911	fewflower spikerush	ELQU2
112	MW4912	common spikerush	ELPA3
112	SW1117	narrowleaf willow	SAEX
112	SW3111	black hawthorn	CRDO2

Potential Vegetation Codes			
Reference Code	**ADP Code**	**Common Name**	**PLANTS Code Abbreviation**
112	SW5112	redosier dogwood	COSES
112	SW5113	shrubby cinquefoil/tufted hairgrass	DAFL3/DECA18
113	1	Idaho fescue/varileaf cinquefoil	FEID/PODI2
113	2	tufted hairgrass/varileaf cinquefoil	DECA18/PODI2
113	3	spike fescue/field locoweed	LEKI2/OXCA4
113	4	blackroot sedge	CAEL3
113	5	northern singlespike sedge/varileaf cinquefoil	CASC10/PODI2
113	6	northern singlespike sedge/Ross's avens	CASC10/GERO2
113	7	eightpetal mountain-avens/alpine bistort	DROC/POVI3
113	8	arctic willow/American bistort	SAAR27/POBI6
113	9	curly sedge/sheep cinquefoil	CARU3/POOV2
113	10	Ross's avens/twinflower sandwort	GERO2/MIOB2
113	11	eightpetal mountain-avens/curly sedge	DROC/CARU3
113	12	black alpine sedge	CANI2
113	13	Drummond's rush/woolly pussytoes	JUDR/ANLA3
113	14	pink mountainheath/woolly pussytoes	PHEM/ANLA3
113	15	western moss heather/Payson's sedge	CAME7/CAPA31
113	16	Parry's rush/Bear River fleabane	JUPA/ERUR2
113	17	grayleaf willow	SAGL
113	18	tufted hairgrass/white marsh marigold	DECA18/CALE4
113	19	mountain sedge/white marsh marigold	CASC12/CALE4
113	20	netleaf willow/white marsh marigold	SARE2/CALE4
113	21	diamondleaf willow/mountain sedge	SAPL2/CASC12
113	22	Dry slope communities	
113	23	Moist slope communities	
113	24	spike fescue	LEKI2
113	25	Ross' avens, Parry's clover	GERO2/TRPA5
113	26	flowery phlox/dwarf clover	PHMU3/TRNA2
113	27	cushion phlox/alpine clover	PHPU5/TRDA2
113	28	alpine clover/Ross' avens	TRDA2/GERO2
113	29	littleleaf pussytoes/alpine sagebrush	ANMI3/ARSC
115	100	western wheatgrass/green needlegrass	PASM/NAV14
115	1000	Silver sagebrush/western wheatgrass	ARCA13/PASM
115	1100	Wyoming big sagebrush/western wheatgrass	ARTRW8/PASM
115	1200	Wyoming big sagebrush/bluebunch wheatgrass	ARTRW8/PSSPS
115	1300	Shadescale saltbrush/Wyoming big sagebrush	ATCO/SRTRW8
115	1400	creeping juniper/little bluestem	JUHO2/SCSCS
115	1500	shrubby cinquefoil/little bluestem	DAFR6/SCSCS
115	1600	fragrant sumac/bluebunch wheatgrass	RHAR4/PSSPS
115	1700	fragrant sumac/plains muhley	RHAR4/MUCU3

Potential Vegetation Codes			
Reference Code	**ADP Code**	**Common Name**	**PLANTS Code Abbreviation**
115	1800	greasewood/western wheatgrass	SAVE4/PASM
115	1900	greasewood/bluebunch wheatgrass	SAVE4/PSSPS
115	200	little bluestem/threadleaf sedge	SCSCS/CAFI
115	2000	silver buffaloberry	SHAR
115	2100	western snowberry	SYOC
115	300	big bluestem	ANGE
115	400	western wheatgrass/needle and thread	PASM/HECOC8
115	500	prairie sandreed/carex	CALO/CAREX
115	600	saltgrass	DISP
115	700	Nuttall's alkaligrass/saltgrass	PUNU2/DISP
115	800	needle and thread/threadleaf sedge	HECOC8/CAFI
115	900	little sagebrush/bluegramma	ARAR8/BOGR2
116	10	American basswood/bur oak	TIAM/QUMA2
116	20	quaking aspen/western poinson ivy	POTR5/TORY
116	30	sand bluestem/little bluestem	ANHA/BOCU
116	40	big bluestem/little bluestem	ANGE/SCSC (ANGE/ANSC10)
116	50	wolly sedge/slimstem reedgrass	CALA30/CAST36
116	60	Hummock types	BOGR2 or POPR
199	090	Limber pine series	PIFL2
199	091	Limber pine/bluebunch wheatgrass	PIFL2/PSSPS
199	092	Limber pine/Idaho fescue	PIFL2/FEID
199	093	Limber pine/Idaho fescue-Idaho fescue	PIFL2/FEID-FEID
199	094	Limber pine/Idaho fescue-rough fescue	PIFL2/FEID-FEAL
199	095	Limber pine/common juniper	PIFL/JUCO6

Appendix H: List of Species

List of Species			
Symbol	**Common Name**	**Scientific Name**	**Comments**
Tree Species (temporary symbol):			
2TD	Tree, deciduous		To be used temporarily until local Botanist identifies species. Not to be loaded into FSVeg.
2TE	Tree, evergreen		To be used temporarily until local Botanist identifies species. Not to be loaded into FSVeg.
Tree Species:			
ABGR	grand fir	*Abies grandis*	
ABLA	subalpine fir	*Abies lasiocarpa*	
ALRU2	red alder	*Alnus rubra*	
BEOC2	water birch	*Betula occidentalis*	
BEPA	paper birch	*Betula papyrifera*	
CELE3	Curl-leaf mountain mahogany	*Cercocarpus ledifolius*	
FRPE	green ash	*Fraxinus pennsylvanica*	
JUOS	Utah juniper	*Juniperus osteosperma*	
JUSC2	Rocky Mountain juniper	*Juniperus scopulorum*	
LALY	subalpine larch	*Larix lyallii*	
LAOC	western larch	*Larix occidentalis*	
PIAL	whitebark pine	*Pinus albicaulis*	
PICO	lodgepole pine	*Pinus contorta*	
PIEN	Engelmann spruce	*Picea engelmannii*	
PIFL2	limber pine	*Pinus flexilis*	
PIGL	white spruce	*Picea glauca*	
PIMO3	western white pine	*Pinus monticola*	
PIPO	ponderosa pine	*Pinus ponderosa*	
POBA2	Balsam poplar	*Populus balsamifera*	Includes *P. trichocarpa* – black cottonwood
POTR5	quaking aspen	*Populus tremuloides*	
PSME	Douglas-fir	*Pseudotsuga menziesii*	
TABR2	Pacific yew	*Taxus brevifolia*	
THPL	western redcedar	*Thuja plicata*	

List of Species			
Symbol	**Common Name**	**Scientific Name**	**Comments**
TSHE	western hemlock	*Tsuga heterophylla*	
TSME	mountain hemlock	*Tsuga mertensiana*	
Shrub Species:			
ACGL	Rocky Mountain maple	*Acer glabrum*	
ALIN2	mountain alder	*Alnus incana*	Includes *A. tenuifolia*- thinleaf alder
ALVI5	green alder	*Alnus viridis*	Includes *A. sinuata* – Sitka alder
AMAL2	Saskatoon serviceberry	*Amelanchier alnifolia*	
ARUV	kinnikinnick	*Arctostaphylos uva-ursi*	
ARTR2	big sagebrush	*Artemisia tridentata*	
ARVU	Common wormwood	*Artemisia vulgaris*	
BENA	bog birch	*Betula nana*	
BEOC2	water birch	*Betula occidentalis*	
CESA	redstem ceanothus	*Ceanothus sanguineus*	Also called bog birch
CEVE	Snowbrush ceanothus	*Ceanothus velutinus*	
CEMO2	mountain mahogany	*Cercocarpus montanus*	
CHME	little pipsissewa	*Chimaphila menziesii*	
CHUM	common prince's-pine	*Chimaphila umbellata*	
CLCO2	rock clematis	*Clematis columbiana*	Includes *C. columbiana* and *C. tenuiloba*
CLDO2	yerba buena	*Clinopodium douglasii*	Includes *Satureja douglasii*
COCA13	Bunchberry dogwood	*Cornus canadensis*	
COSE16	redosier dogwood	*Cornus sericea*	Includes *C. stolonifera*
CRDO2	black hawthorn	*Crataegus douglasii*	
DAFL3	shrubby cinquefoil	*Dasiophora floribunda*	
ERNA10	rubber rabbitbrush	*Ericameria nauseosa*	
FRPU7	Cascara	*Frangula purshiana*	Includes *Rhamnus purshiana*
GABO2	northern bedstraw	*Galium boreale*	
GAHU	alpine spicywintergreen	*Gaultheria humifusa*	
GAOV2	wintergreen	*Gaultheria ovalifolia*	
HODI	oceanspray	*Holodiscus discolor*	
JUCO6	common juniper	*Juniperus communis*	
JUHO2	creeping juniper	*Juniperus horizontalis*	
LEGL	western Labrador tea	*Ledum glandulosum*	
LIBO3	Twinflower	*Linnaea borealis*	
LOCI3	orange honeysuckle	*Lonicera ciliosa*	

List of Species			
Symbol	**Common Name**	**Scientific Name**	**Comments**
LOIN5	twinberry honeysuckle	*Lonicera involucrata*	
LOUT2	Utah honeysuckle	*Lonicera utahensis*	
MAAQ2	tall Oregon grape	*Mahonia aquifolium*	Includes *Berberis aquifolium*
MARE11	creeping barberry	*Mahonia repens*	Includes *Berberis repens*
MEFE	rusty menziesia	*Menziesia ferruginea*	
OPHO	Devilsclub	*Oplopanax horridum*	
PAMY	Oregon boxleaf	*Paxistima myrsinites*	*= Pachistima myrsinites*
PHLE4	mockorange; syringa	*Philadelphus lewisii*	
PHEM	pink mountainheath	*Phyllodoce empetriformis*	
PHMA5	mallow ninebark	*Physocarpus malvaceus*	
PREM	bittercherry	*Prunus emarginata*	
PRVI	chokecherry	*Prunus virginiana*	
PUTR2	antelope bitterbrush	*Purshia tridentata*	
RHAL	alder buckthorn	*Rhamnus alnifolia*	
RHAL2	Cascade azalea	*Rhododendron albiflorum*	
RHTR	skunkbush sumac	*Rhus trilobata*	
RICE	squaw currant	*Ribes cereum*	
RIHU	stinking currant	*Ribes hudsonianum*	
RILA	prickly currant	*Ribes lacustre*	
RIMO2	gooseberry currant	*Ribes montigenum*	
RIVI3	sticky currant	*Ribes viscosissimum*	
ROAC	prickly rose	*Rosa acicularis*	
ROGY	dwarf rose	*Rosa gymnocarpa*	
RONU	nootka rose	*Rosa nutkana*	
ROWO	Woods' rose	*Rosa woodsii*	
RUID	red raspberry	*Rubus idaeus*	
RUNI2	snow dewberry	*Rubus nivalis*	
RUPA	thimbleberry	*Rubus parviflorus*	
RUUR	blackberry	*Rubus ursinus*	
SALIX	Willow	*Salix spp.*	
SASC	Scouler's willow	*Salix scouleriana*	
SANI4	European black elderberry	*Sambucus nigra*	Includes *S. cerulea*
SARA2	elderberry	*Sambucus racemosa*	
SHCA	russet buffaloberry	*Shepherdia canadensis*	
SOSC2	Greene mountain-ash	*Sorbus scopulina*	
SOSI2	Sitka mountain-ash	*Sorbus sitchensis*	
SPBE2	white spirea	*Spiraea betulifolia*	
SYAL	common snowberry	*Symphoricarpos albus*	

List of Species			
Symbol	**Common Name**	**Scientific Name**	**Comments**
SYHE	creeping snowberry	*Symphoricarpos hesperius*	
VAME	thinleaf huckleberry	*Vaccinium membranaceum*	Includes *V. globulare*
VACA13	dwarf huckleberry	*Vaccinium caespitosum*	Includes *V. cespitosum*
VAMY	Velvetleaf blueberry	*Vaccinium myrtilloides*	
VAMY2	whortleberry	*Vaccinium myrtillus*	
VAOV	early blueberry	*Vaccinium ovalifolium*	
VAOX	small cranberry	*Vaccinium oxycoccos*	
VASC	grouse whortleberry	*Vaccinium scoparium*	
VAUL	alpine blueberry	*Vaccinium uliginosum*	Includes *V. occidentale*
Forb Species:			
ACMI2	common yarrow	*Achillea millefolium*	
ACCO4	monkshood	*Aconitum columbianum*	
ACRU2	red baneberry	*Actaea rubra*	
ADBI	American trailplant	*Adenocaulon bicolor*	
ALCE2	nodding onion	*Allium cernuum*	
ANMA	common pearly-everlasting	*Anaphalis margaritacea*	
ANPI	windflower	*Anemone piperi*	
ANAR3	sharptooth angelica	*Angelica arguta*	
ANRA	raceme pussy-toes	*Antennaria racemosa*	
APAN2	spreading dogbane	*Apocynum androsaemifolium*	
AQFL	yellow columbine	*Aquilegia flavescens*	
AQFO	red columbine	*Aquilegia formosa*	
ARNU2	wild sarsaparilla	*Aralia nudicaulis*	
ARCO9	heartleaf arnica	*Arnica cordifolia*	
ARLA8	Broadleaf arnica	*Arnica latifolia*	
ASCA2	British Columbia wildginger	*Asarum caudatum*	
BASA3	Arrowleaf balsamroot	*Balsamorhiza sagittata*	
CAAP	pointed mariposa	*Calochortus apiculatis*	
CALE4	white marsh marigold	*Caltha leptosepala*	Includes *C. biflora*
CABU	fairy slipper	*Calypso bulbosa*	
CARO2	Harebell	*Campanula rotundifolia*	
CACO27	Constance's bittercress	*Cardamine constancei*	
CAMI12	scarlet paintbrush	*Castilleja miniata*	

List of Species			
Symbol	**Common Name**	**Scientific Name**	**Comments**
CEBI2	spotted knapweed	*Centaurea biebersteinii*	Noxious weed
CESO3	yellow starthistle	*Centaurea solstitalis*	Noxious weed
CHAN9	Fireweed	*Chamerion angustifolium*	Includes *Epilobium angustifolium*
CIAL	enchanter's nightshade	*Circaea alpina*	
CIAR4	Canada thistle	*Cirsium arvense*	Noxious weed
CLCO3	broadleaved montia	*Claytonia cordifolia*	Includes *Montia cordifolia*
CLUN2	bride's bonnet / Queen's cup beadlily	*Clintonia uniflora*	
COOC	Idaho goldthread	*Coptis occidentalis*	
COMA4	Pacific coralroot	*Corallorhiza maculata*	
COME4	western coralroot	*Corallorhiza mertensiana*	
COST	striped coralroot	*Corallorhiza striata*	
DIHO3	drops of gold	*Disporum hookeri*	
DITR2	Roughfruit fairybells	*Disporum trachycarpum*	
DOJE	sierra shootingstar	*Dodecatheon jeffreyi*	
ERPE3	Subalpine daisy	*Erigeron peregrinus*	
ERGR9	glacier-lily	*Erythronium grandiflorum*	
EUCO36	eastern showy aster	*Eurybia conspicua*	
EUES	leafy spurge	*Euphorbia esula*	Noxious weed
FRVE	Woodland strawberry	*Fragaria vesca*	
FRVI	Virginia strawberry	*Fragaria virginiana*	
FRFA	Clustered frasera	*Frasera fastigiata*	
GATR3	fragrant bedstraw	*Galium triflorum*	
GELI2	northern comandra	*Geocaulon lividum*	
GERI	Richardson's geranium	*Geranium richardsonii*	
GEVI2	sticky geranium	*Geranium viscosissimum*	
GOOB2	western rattlesnake plantain	*Goodyera oblongifolia*	
HEMA80	common cowparsnip	*Heracleum maximum*	Includes *H. lanatum*
HECY2	Roundleaf alumroot	*Heuchera cylindrica*	
HIAL2	white-flowered hawkweed	*Hieracium albiflorum*	
HICY	houndstongue hawkweed	*Hieracium cynoglossoides*	
HIGR	slender hawkweed	*Hieracium gracile*	
HYPE	common St. John's-wort	*Hypericum perforatum*	
LANE	sierran peavine	*Lathyrus nevadensis*	
LAOC2	cream pea	*Lathyrus ochroleucus*	
LICA2	Canby's licorice-root	*Ligusticum canbyi*	

List of Species			
Symbol	**Common Name**	**Scientific Name**	**Comments**
LIVE	verticillate-umbel licorice-root	*Ligusticum verticillatum*	
LICA10	western twayblade	*Listera caurina*	
LICO6	heart-leaved twayblade	*Listera cordata*	
LODI	fern-leaved desert-parsley	*Lomatium dissectum*	
LOTR2	nine-leaf lomatium	*Lomatium triternatum*	
LUAR3	silvery lupine	*Lupinus argenteus*	
LUSE4	silky lupine	*Lupinus sericeus*	
MARA7	feathery false lily of the valley	*Maianthemum racemosa*	
MAST4	starry false lily of the valley	*Maianthemum stellatum*	Includes *Smilacina stellatum*
MELI2	cow-wheat	*Melampyrum lineare*	
MEPA	tall bluebells	*Mertensia paniculata*	
MIBR6	Brewer's miterwort	*Mitella breweri*	
MICA5	Miterwort	*Mitella caulescens*	
MINU3	naked miterwort	*Mitella nuda*	
MIPE	fivestamen miterwort	*Mitella pentandra*	
MIST3	smallflower mitrewort	*Mitella stauropetala*	
MOMA3	bigleaf sandwort	*Moehringia macrophylla*	Includes *Arenaria macrophylla*
MOUN2	single delight	*Moneses uniflora*	Includes *Pyrola uniflora*
ORSE	sidebells wintergreen	*Orthilia secunda*	Includes *Pyrola secunda*
OSBE	sweetcicely	*Osmorhiza berteroi*	Includes *Osmorhiza chilensis*
PAST10	Rocky Mountain groundsel	*Packera streptanthifolia*	Includes *Senecio streptanthifolius*
PEBR	bracted lousewort	*Pedicularis bracteosa*	
PERA	leafy lousewort	*Pedicularis racemosa*	
PHHE2	varileaf phacelia	*Phacelia heterophylla*	
PIEL2	hillside rein-orchid	*Piperia elegans*	
PIUN3	Alaska rein-orchid	*Piperia unalascensis*	Includes *Habenaria unalascensis*
PLOR4	large rein-orchid	*Platanthera orbiculata*	Includes *Habenaria orbiculata*
PLST4	slender bog-orchid	*Platanthera stricta*	Includes *Habenaria saccata*
POPU3	showy Jacob's-ladder	*Polemonium pulcherrimum*	
POGL9	sticky cinquefoil	*Potentilla glandulosa*	
POGR9	slender cinquefoil	*Potentilla gracilis*	
PORE5	sulfer cinquefoil	*Potentilla recta*	Noxious weed
PRVU	self-heal	*Prunella vulgaris*	
PTAN2	Woodland pinedrops	*Pterospora andromedea*	

List of Species			
Symbol	**Common Name**	**Scientific Name**	**Comments**
PYAS	liverleaf wintergreen	*Pyrola asarifolia*	
PYCH	green wintergreen	*Pyrola chlorantha*	Includes *Pyrola virens*
PYPI2	white-veined pyrola	*Pyrola picta*	
RAUN	little buttercup	*Ranunculus uncinatus*	
RUPE	strawberry bramble	*Rubus pedatus*	
RUOC2	western coneflower	*Rudbeckia occidentalis*	
SEST2	Wormleaf stonecrop	*Sedum stenopetalum*	
SETR	Arrowleaf ragwort	*Senecio triangularis*	
SIME	Menzie's silene	*Silene menziesii*	
STAM2	claspleaf twistedstalk	*Streptopus amplexifolius*	
SYMI	Mountain kittentails	*Synthyris missurica*	
SYPL	Idaho kittentails	*Synthyris platycarpa*	
THOC	western meadow-rue	*Thalictrum occidentale*	
THMO6	Montana golden pea	*Thermopsis montana*	
TITR	threeleaf foamflower	*Tiarella trifoliata*	
TRCA	Carolina bugbane	*Trautvetteria caroliniensis*	
TRBO2	starflower	*Trientalis borealis*	
TROV2	white trillium	*Trillium ovatum*	
TRLA14	American globeflower	*Trollius laxus*	
VASI	Sitka valerian	*Valeriana sitchensis*	
VECA2	California false-hellebore	*Veratrum californicum*	
VEVI	green false-hellebore	*Veratrum viride*	
VIAM	American vetch	*Vicia americana*	
VIAD	hookedspur violet	*Viola adunca*	
VICA4	Canadian white violet	*Viola canadensis*	
VIGL	pioneer violet	*Viola glabella*	
VIOR	darkwoods violet	*Viola orbiculata*	
XETE	common beargrass	*Xerophyllum tenax*	
Graminoid Species:			
AGSC5	rough bentgrass	*Agrostis scabra*	
BRTE	cheatgrass	*Bromus tectorum*	
BRVU	Columbia brome	*Bromus vulgaris*	
CACA4	Bluejoint	*Calamagrostis canadensis*	
CARU	pinegrass	*Calamagrostis rubescens*	
CACO11	northwestern sedge	*Carex concinnoides*	
CAGE2	Geyer's sedge	*Carex geyeri*	

List of Species			
Symbol	**Common Name**	**Scientific Name**	**Comments**
CARO5	Ross sedge	*Carex rossii*	
CILA2	drooping woodreed	*Cinna latifolia*	
DAGL	orchard-grass	*Dactylis glomerata*	
ELGL	blue wildrye	*Elymus glaucus*	
FECA4	rough fescue	*Festuca campestris*	
FEID	Idaho fescue	*Festuca idahoensis*	
FEOC	western fescue	*Festuca occidentalis*	
JUNCU	Rush	*Juncus spp.*	
KOMA	prairie Junegrass	*Koeleria macrantha*	Includes *K. cristata* and *K. nitida*
LEKI2	spike fescue	*Leucopoa kingii*	Includes *Hesperochloa kingii*
LUCA2	field woodrush	*Luzula campestris*	
LUGL2	smooth woodrush	*Luzula glabrata*	Includes *L. hitchcockii*
LUPA4	small-flowered woodrush	*Luzula parviflora*	
MESU	Alaska oniongrass	*Melica subulata*	
ORAS	Roughleaf ricegrass	*Oryzopsis asperifolia*	
PHPR3	common timothy	*Phleum pratense*	
POPR	Kentucky bluegrass	*Poa pratensis*	
PSSP6	bluebunch wheatgrass	*Pseudoroegneria spicata*	Includes *Agropyron spicatum* and *Elytrigia spicata*
SCPU	false melic	*Schizachne purpurascens*	
TRCA21	tall trisetum	*Trisetum canescens*	
Fern Species:			
Note: For Lifeform, classify fern species as “Forb” (FB).			
ADAL	Aleutian maidenhair	*Adiantum aleuticum*	Includes *A. pedatum*
ADPE	maidenhair fern	*Adiantum pedatum*	
ATFI	common ladyfern	*Athyrium filix-femina*	
BOVI	Virginia grape-fern	*Botrychium virginianum*	
CYFR2	brittle bladder-fern	*Cystopteris fragilis*	
DRAU8	mountain woodfern	*Dryopteris austriaca*	
DRFI2	male fern	*Dryopteris filix-mas*	
EQAR	field horsetail	*Equisetum arvense*	
GYDR	western oakfern	*Gymnocarpium dryopteris*	
LYAN2	stiff club-moss	*Lycopodium annotinum*	
POMU	western swordfern	*Polystichum munitum*	
PTAQ	bracken fern	*Pteridium aquilinum*	
WOOR	woodsia	*Woodsia oregana*	

Appendix I: Fuel Photo References and Codes

Fuel Photo References and Codes	
Reference Code	**Fuel Photo Reference**
1	**Photo Guide for Appraising Downed Woody Fuels in Montana Forests: Grand fir - Larch - Douglas-fir, Western Redcedar Cover Types.** 1981. Fischer, William C. Gen. Tech. Rep. INT-96. Ogden, UT: USDA Forest Service, Intermountain Forest and Range Experiment Station. 53 p.
2	**Photo Guide for Appraising Downed Woody Fuels in Montana Forests: Interior Ponderosa Pine, Ponderosa Pine - Larch - Douglas-fir, Larch -Douglas-fir, and Interior Douglas-fir Cover Types.** 1981. Fischer, William C. Gen. Tech. Rep. INT-97. Ogden, UT: USDA Forest Service, Intermountain Forest and Range Experiment Station. 133 p.
3	**Photo Guide for Appraising Downed Woody Fuels in Montana Forests: Lodgepole Pine and Engelmann Spruce-Subalpine Fir Cover Types.** 1981. Fischer, William C. Gen. Tech. Rep. INT-98. Ogden, UT: USDA Forest Service, Intermountain Forest and Range Experiment Station. 143 p.
4	**Photo Guides for Appraising Downed Woody Fuels in Montana Forests: How They Were Made.** 1981. Fischer, William C. Research Note INT-299. Ogden, UT: USDA Forest Service, Intermountain Forest and Range Experiment Station. 12 p.
5	**Photo series for Appraising Thinning Slash in North Idaho: Western Hemlock, Grand fir, and Western Redcedar Timber Types.** 1979. Koski, Wayne H.; Fischer, William C. Gen. Tech. Rep. INT-46. Ogden, UT: USDA Forest Service, Intermountain Forest and Range Experiment Station. 50 p.
6	**Photo series for Quantifying Forest Residues in the: Ponderosa Pine Type, Ponderosa Pine and associated species type, Lodgepole pine type.** 1976. Maxwell, Wayne G.; Ward, Franklin R. Gen. Tech. Rep. PNW-52. Portland, OR: USDA Forest Service, Pacific Northwest Forest and Range Experiment Station. 74 p.
8	**Photo Series for Quantifying Natural Forest Residues in Common Vegetation Types of the Pacific Northwest**. 1980. Maxwell, Wayne G; Ward, Franklin R. Gen Tech. Rep. PNW-105. Portland, OR: USDA Forest Service, Pacific Northwest Forest and Range Experiment Station. 229 p.
10	**Photo Series for Quantifying Forest Residues in: Douglas-fir, Engelmann Spruce Type, Limber Pine Type, Lodgepole Pine Type, Ponderosa Pine Type, Subalpine Fir Type for Eastern Montana.** Mackay, Douglas H.; Stiger, Everett M.; Goss, Delman; Bonney, Byron. USDA Forest Service, Northern Region. 162 p

Associated Fuel Photo Codes:

Associated Fuel Photo Codes	
Reference Code	**Residue Code**
1	3A
1	4A
1	5A
1	6A
1	7A
1	8A
1	9A
1	10A
1	11A
1	13A
1	15
1	15A
1	16
1	16A
1	17A
1	18A
1	19A
1	25
1	63
1	65
1	66
1	67
2	5
2	7
2	8
2	9
2	12A
2	13
2	14
2	14A
2	17
2	18
2	23
2	24

Associated Fuel Photo Codes	
Reference Code	**Residue Code**
2	27A
2	28
2	28A
2	29
2	29A
2	30
2	30A
2	31
2	31A
2	32
2	32A
2	33
2	33A
2	34
2	37A
2	38A
2	39A
2	40A
2	41A
2	42
2	42A
2	43
2	43A
2	48
2	49
2	56
2	64
2	68
2	69
2	70
2	71
2	72
2	73
2	74
2	75

Associated Fuel Photo Codes	
Reference Code	**Residue Code**
2	76
2	77
2	78
2	79
2	80
2	84
2	86
2	88
2	89
2	91
2	95
3	1
3	1A
3	2
3	2A
3	3
3	4
3	6
3	10
3	11
3	12
3	19
3	20
3	20A
3	21
3	21A
3	22
3	22A
3	23A
3	24A
3	25A
3	26
3	26A
3	27

Associated Fuel Photo Codes	
Reference Code	**Residue Code**
3	34A
3	35
3	35A
3	36
3	37
3	38
3	39
3	40
3	41
3	44
3	44A
3	45
3	45A
3	46
3	46A
3	47
3	47A
3	48A
3	49A
3	50
3	51
3	53
3	54
3	55
3	57
3	58
3	59
3	60
3	61
3	62
3	81
3	82
3	83
3	85
3	87
3	90
3	92

Associated Fuel Photo Codes	
Reference Code	**Residue Code**
3	93
3	94
3	96
3	97
3	98
6	1PP4CC
6	2PP4CC
6	1PP4PC
6	2PP4PC
6	3PP4PC
6	4PP4PC
6	5PP4PC
6	1PP1TH
6	2PP1TH
6	3PP1TH
6	4PP1TH
6	5PP1TH
6	6PP1TH
6	1PP&ASSOC4PC
6	2PP&ASSOC4PC
6	3PP&ASSOC4PC
6	4PP&ASSOC4PC
6	5PP&ASSOC4PC
6	6PP&ASSOC4PC
6	7PP&ASSOC4PC
6	8PP&ASSOC4PC
6	1LP3CC
6	1LP3PC
6	2LP3PC
6	3LP3PC
6	4LP3PC
6	5LP3PC
6	5PP&ASSOC4PC
6	6PP&ASSOC4PC
6	7PP&ASSOC4PC
6	8PP&ASSOC4PC

Associated Fuel Photo Codes	
Reference Code	**Residue Code**
8	1BR
8	1DF2
8	1DF3
8	1DF4
8	1DFHD3
8	1DFHD4
8	1GR
8	1HD2
8	1JU2
8	1LP1
8	1LP2
8	1LP3
8	1MC2
8	1MC3
8	1MC4
8	1PP&ASSOC3
8	1PP&ASSOC4
8	1PP1
8	1PP2
8	1PP3
8	1PP4
8	1SA1
8	1SA2
8	1SA3
8	1SA4
8	2BR
8	2DF2
8	2DF3
8	2DF4
8	2DFHD3
8	2DFHD4
8	2GR
8	2HD2
8	2JU2
8	2LP1
8	2LP2

Associated Fuel Photo Codes	
Reference Code	**Residue Code**
8	2LP3
8	2MC2
8	2MC3
8	2MC4
8	2PP&ASSOC3
8	2PP&ASSOC4
8	2PP1
8	2PP2
8	2PP3
8	2PP4
8	2SA1
8	2SA2
8	2SA3
8	2SA4
8	3DF4
8	3DFHD3
8	3DFHD4
8	3LP1
8	3LP2
8	3LP3
8	3MC2

Associated Fuel Photo Codes	
Reference Code	**Residue Code**
8	3MC3
8	3PP&ASSOC3
8	3PP&ASSOC4
8	3PP1
8	3PP2
8	3PP3
8	3PP4
8	3SA1
8	3SA3
8	4DF4
8	4DFHD4
8	4LP2
8	4PP&ASSOC3
8	4PP2
8	4PP3
8	4PP4
8	5DF4
8	5DFHD4
8	5PP&ASSOC3
8	5PP3
8	5PP4

Associated Fuel Photo Codes	
Reference Code	**Residue Code**
8	6DF4
8	6PP3
8	6PP4
8	7DF4
8	7PP3
8	7PP4
8	8PP3
8	8PP4

Appendix J: Fixed-Radius Plot (slope correction; borderline trees)

For all **fixed-radius plots located on slopes ≥ 10 percent**, it will be necessary to determine a "corrected" radius distance that is equivalent to the horizontal fixed-radius plot distance of the sample plot. To determine the "corrected" fixed-radius plot distance, refer to section A below.

To determine the limiting distance for **borderline trees** located on slopes, and if the tree is "in" or "out" of the fixed-radius plot area, refer to section B below.

A. Fixed-radius Plot Slope Correction

To determine the "corrected" plot radius for a fixed-plot area located on slope, complete the following steps:

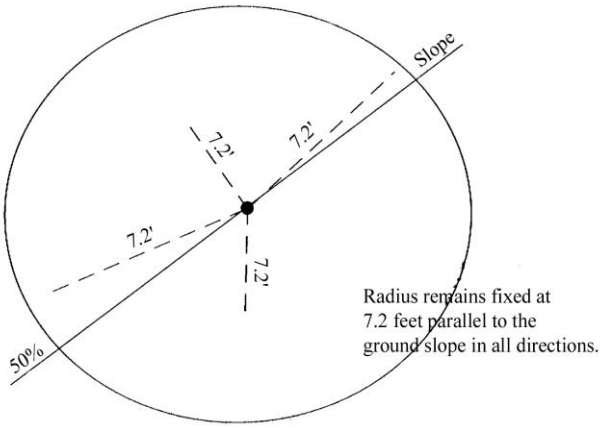
1. Determine the average percent slope for the sample plot area (using a clinometer).

2. Use the "Circular Plot Radii Corrected for Slope" table below to determine the corrected fixed-radius plot distance; values listed in the table are in feet. Find the row that contains the slope percent, and then locate the "corrected" radius distance under the appropriate column for the plot size.

Measure the "corrected" radius distance along the slope of the ground, or parallel to the ground line. This method always results in a circular plot on the slope.

Example:

- Fixed-radius plot size – 1/300th acre
- Slope percent for sample area – 50 percent
- Corrected radius distance (value from table) – 7.2 feet



Circular Plot Radii Corrected for Slope (radius distance – feet):

Circular Plot Radii Corrected for Slope (radius distance – feet)						
Slope Percent	**Plot Size in Acres**					
	1/300	**1/100**	**1/50**	**1/20**	**1/10**	**1/5**
Horizontal 0-9	6.8	11.8	16.7	26.3	37.2	52.7
10-17	6.8	11.8	16.7	26.5	37.4	52.9
18-22	6.9	11.9	16.8	26.6	37.6	53.2
23-26	6.9	12.0	16.9	26.7	37.8	53.4
27-30	6.9	12.0	17.0	26.9	38.0	53.7
31-33	7.0	12.1	17.1	27.0	38.2	54.0
34-36	7.0	12.1	17.1	27.1	38.3	54.2
37-39	7.0	12.2	17.2	27.2	38.5	54.5
40-42	7.1	12.2	17.3	27.4	38.7	54.7
43-44	7.1	12.3	17.4	27.5	38.9	55.0
45-47	7.1	12.3	17.5	27.6	39.1	55.2
48-49	7.2	12.4	17.5	27.7	39.2	55.5
50-51	7.2	12.5	17.6	27.9	39.4	55.7
52-53	7.2	12.5	17.7	28.0	39.6	56.0
54-55	7.3	12.6	17.8	28.1	39.8	56.2
56-57	7.3	12.6	17.9	28.2	39.9	56.5
58-59	7.3	12.7	17.9	28.4	40.1	56.7
60-61	7.4	12.7	18.0	28.5	40.3	57.0
62-63	7.4	12.8	18.1	28.6	40.4	57.2
64-65	7.4	12.8	18.2	28.7	40.6	57.4
66-67	7.4	12.9	18.2	28.8	40.8	57.7
68-69	7.5	13.0	18.3	29.0	41.0	57.9
70	7.5	13.0	18.4	29.1	41.1	58.2
71-72	7.5	13.1	18.5	29.2	41.3	58.4
73-74	7.6	13.1	18.5	29.3	41.5	58.6
75	7.6	13.2	18.6	29.4	41.6	58.7
76-77	7.6	13.2	18.7	29.6	41.8	59.1
78-79	7.7	13.3	18.8	29.7	42.0	59.3
80	7.7	13.3	18.8	29.8	42.1	59.6
81-82	7.7	13.4	18.9	29.9	42.3	59.8
83	7.8	13.4	19.0	30.0	42.5	60.0
84-85	7.8	13.5	19.1	30.1	42.6	60.3
86	7.8	13.5	19.1	30.3	42.8	60.5
87-88	7.8	13.6	19.2	30.4	42.9	60.7

Circular Plot Radii Corrected for Slope (radius distance – feet)						
Slope Percent	**Plot Size in Acres**					
	1/300	**1/100**	**1/50**	**1/20**	**1/10**	**1/5**
89	7.9	13.6	19.3	30.5	43.1	61.0
90-91	7.9	13.7	19.3	30.6	43.3	61.2
92	7.9	13.7	19.4	30.7	43.4	61.4
93-94	8.0	13.8	19.5	30.8	43.6	61.6
95	8.0	13.8	19.6	30.9	43.7	61.9
96-97	8.0	13.9	19.6	31.0	43.9	62.1
98	8.0	13.9	19.7	31.2	44.1	62.3
99-100	8.1	14.0	19.8	31.3	44.2	62.5
101	8.1	14.0	19.8	31.4	44.4	62.8
102	8.1	14.1	19.9	31.5	44.5	63.0
103-104	8.2	14.1	20.0	31.6	44.7	63.2
105	8.2	14.2	20.1	31.7	44.8	63.4
106-107	8.2	14.2	20.1	31.8	45.0	63.6
108	8.2	14.3	20.2	31.9	45.1	63.8
109	8.3	14.3	20.3	32.0	45.3	64.1
110-111	8.3	14.4	20.3	32.1	45.5	64.3
112	8.3	14.4	20.4	32.2	45.6	64.5
113	8.4	14.5	20.5	32.4	45.8	64.7
114-115	8.4	14.5	20.5	32.5	45.9	64.9
116	8.4	14.6	20.6	32.6	46.1	65.1
117	8.4	14.6	20.7	32.7	46.2	65.3
118-119	8.5	14.7	20.7	32.8	46.4	65.6
120	8.5	14.7	20.8	32.9	46.5	65.8
121	8.5	14.8	20.9	33.0	46.7	66.0
122	8.5	14.8	20.9	33.1	46.8	66.2
123-124	8.6	14.8	21.0	33.2	47.0	66.4
125	8.6	14.9	21.1	33.3	47.1	66.6
130	8.7	15.1	21.3	33.7	47.7	67.4
135	8.8	15.3	21.6	34.1	48.3	68.3
140	8.9	15.4	21.8	34.5	48.8	69.1
145	9.0	15.6	22.1	34.9	49.4	69.9
150	9.1	15.8	22.3	35.3	50.0	70.7

B. Determining Sample Status for Borderline Trees on a Slope (fixed-radius plot)

To determine if a borderline tree located on a slope is "in" or "out" of the fixed-radius plot area, complete the following steps:

1. Determine the slope percent from plot center to the borderline tree (using a clinometer). Note: This slope percent is not necessarily the same as the average slope percent for the overall sample area; measure slope parallel to the ground line.

2. Use the "Slope Correction Table" below to determine the slope correction factor (SCF) associated with the slope percent to the borderline tree.

3. Compute the slope limiting distance using the following formula (horizontal fixed-radius plot distances are listed below):

   Slope Limiting Distance = horizontal fixed-radius plot distance **x** SCF

4. Measure the **slope distance** (parallel to the ground line) from plot center to the **geographic center** (where tree comes out of the ground) of the borderline tree.

   If the measured distance is *less than or equal* to the "slope limiting distance," then the tree is "in" the fixed-radius plot area and should be included in the sample. If the measured distance is *greater than* the "slope limiting distance," then the tree is "out" of the fixed-radius plot area.

Example:

- Fixed-radius plot size – 1/10th acre (horizontal plot radius = 37.2 feet)
- Slope percent from plot center to borderline tree – 25 percent
- SCF – 1.03 (value from table)
- Slope limiting distance:

  Slope Limiting Distance = 37.2 feet **x** 1.03
  = 38.3 feet

- Measured slope distance from plot center to geographic center of borderline tree – 38.2 feet

The tree is "in" the fixed-radius plot sample area (the measured slope distance of 38.2 feet is *less than or equal to* the slope limiting distance of 38.3 feet).

This method always results in an oval plot on the slope.

Horizontal fixed-radius plot distances:

Horizontal fixed-radius plot distances	
Plot Size (acre)	**Plot Radius**
1/1000	3.7 feet
1/500	5.3 feet
1/400	5.9 feet
1/300	6.8 feet
1/250	7.4 feet
1/200	8.3 feet
1/150	9.6 feet
1/100	11.8 feet
1/50	16.7 feet

Horizontal fixed-radius plot distances	
Plot Size (acre)	**Plot Radius**
1/24	24.0 feet
1/20	26.3 feet
1/10	37.2 feet
1/5	52.7 feet
1/4	58.9 feet
1/3	67.6 feet
1/2	83.3 feet
1	117.1 feet

Slope Correction Table:

Slope Correction Table		
Percent of Slope	**Degree of Slope**	**Slope Correction Factor (SCF)**
0 to 9	0-6	1.00
10 to 17	7-10	1.01
18 to 22	11-12	1.02
23 to 26	13-14	1.03
27 to 30	15-17	1.04
31 to 33	18	1.05
34 to 36	19-20	1.06
37 to 39	21	1.07
40 to 42	22	1.08
43 to 44	23	1.09
45 to 47	24	1.10
48 to 49	25-26	1.11
50 to 51	27	1.12
52 to 53	28	1.13
54 to 55	29	1.14
56 to 57	29	1.15
58 to 59	30	1.16
60 to 61	31	1.17

Slope Correction Table		
Percent of Slope	**Degree of Slope**	**Slope Correction Factor (SCF)**
62 to 63	32	1.18
64 to 65	33	1.19
66 to 67	34	1.20
68 to 69	34	1.21
70	35	1.22
71 to 72	36	1.23
73 to 74	37	1.24
75	37	1.25
76 to 77	38	1.26
78 to 79	38	1.27
80	39	1.28
81 to 82	39	1.29
83	40	1.30
84 to 85	40	1.31
86	41	1.32
87 to 88	41	1.33
89	42	1.34
90 to 91	42	1.35

Slope Correction Table		
Percent of Slope	**Degree of Slope**	**Slope Correction Factor (SCF)**
92	43	1.36
93 to 94	43	1.37
95	44	1.38
96 to 97	44	1.39
98	44	1.40
99 to 100	45	1.41
101	45	1.42
102	46	1.43
103 to 104	46	1.44
105	46	1.45
106 to 107	47	1.46
108	47	1.47
109	47	1.48
110 to 111	48	1.49
112	48	1.50
113	48	1.51
114 to 115	49	1.52
116	49	1.53
117	49	1.54
118 to 119	50	1.55
120	50	1.56
121	50	1.57
122	51	1.58

Slope Correction Table		
Percent of Slope	**Degree of Slope**	**Slope Correction Factor (SCF)**
123 to 124	51	1.59
125	51	1.60
126	52	1.61
127 to 128	52	1.62
129	52	1.63
130	52	1.64
131	53	1.65
132 to 133	53	1.66
134	53	1.67
135	53	1.68
136	54	1.69
137 to 138	54	1.70
139	54	1.71
140	54	1.72
141	55	1.73
142 to 143	55	1.74
144	55	1.75
145	55	1.76
146	56	1.77
147	56	1.78
148 to 149	56	1.79
150	56	1.80

Appendix K: Variable-Radius Plot *(borderline trees)*

Variable-radius plot sampling is a method that involves selection of trees with a probability proportional to their size. Under this sampling method, a plot center is established, and trees are selected for sample by rotating a fixed angle around the plot. The plot radius varies according to the diameter (DBH or DRC) and distance of each tree from plot center.

The experienced field person using a wedge prism, angle gauge, or relaskop can quickly tell in most cases if a tree is “in" or "out" of the variable plot. However, there are certain trees that are questionable (borderline) for tally because they are located at the outer limits of the variable-plot radius. This narrative describes the procedures needed to ascertain if borderline trees qualify for tally.

For information on the theory and mathematics of variable plot cruising; and formulas for determining the plot radius factor for any given BAF, refer to *Log Scaling and Timber Cruising* (1973, J. R. Dilworth, OSU Book Stores, Inc., Corvallis, Oregon).

Measurement of Borderline Trees to Determine “In” or “Out” Status:

In variable-radius plot sampling, limiting distance is a function of the selected basal area factor (e.g., 20 or 40) and the diameter of the tree. The limiting distance is the maximum distance that a tree can be from plot center and still qualify for tally.

To determine if a borderline tree is “in” or “out” of the variable-radius plot area, complete the following steps. Refer to section A if the borderline tree is located on a slope that is < 10 percent. Refer to section B if the borderline tree is located a slope that is ≥ 10 percent.

Note: For **down-dead trees** on a variable-radius plot, determine the sample status (“in” or “out”) based on where DBH (or DRC) now lies, not on where the tree once stood. Measure distance from plot center to the nearest face of the tree at DBH (or DRC).

A. Determining Sample Status for Borderline Trees (when slope is < 10 percent)

Tables K-1 through K-5 display **horizontal limiting distances** for various tree diameters and commonly used basal area factors (BAF). For these tables, limiting distance is measured from plot center to the **face of the tree** at DBH (or DRC) along a horizontal line; the table value is the maximum horizontal distance that a tree can be from plot center and still be considered ”in.”

Procedure:

1. Measure the diameter of the tree to the nearest tenth of an inch.

2. Determine the **horizontal limiting distance** using one of the following options:

- Option 1 – Refer to tables K-1 through K-5 (listed below); use the table that is applicable to the specified BAF. Locate the limiting distance value within the table based on the row and column for the tree diameter; the values listed are in feet.

- Option 2 – Compute limiting distance using the following formula:

Limiting Distance = Plot Radius Factor **x** Diameter

Plot Radius Factors – limiting distance to face of tree									
BAF	10	15	20	25	30	35	40	50	60
Plot Radius Factor*	2.708	2.203	1.902	1.697	1.546	1.428	1.333	1.188	1.081

***** The plot radius factors (PRF) listed have been corrected for determining the limiting distance to the **face of the tree.** A standard plot radius factor is used to determine limiting distance to the center of a tree, and is computed by 8.696/SQR(BAF). A corrected PRF subtracts 1/24 (.041666) from the standard plot radius factor.

3. Measure the **horizontal distance** from plot center to the nearest face of the tree at DBH (or DRC).

If the measured distance is *less than or equal* to the "limiting distance," then the tree is "in" and is tallied as a sample tree. If the measured distance is *greater than* the "limiting distance," then the tree is "out" and is not tallied.

Example 1 (determining sample status for borderline tree on slope < 10 percent):

- Basal Area Factor – 40 BAF
- Slope Percent (from face of tree to plot center) – 5 percent
- DBH – 20.9 inches
- PRF – 1.333 (value from table above)
- Horizontal Distance (from plot center the face of the tree at DBH) – 27.7 feet

- Compute limiting distance:

Limiting Distance = Plot Radius Factor **x** DBH
= 1.333 **x** 20.9
= 27.9 feet

Since the measured horizontal distance of 27.7 feet is *less than or equa*l *to* the limiting distance of 27.9 feet, the tree is "in" and is tallied as a sample tree.

B. Determining Sample Status for Borderline Trees (when slope is ≥ 10 percent)

Procedure:

1. Measure the diameter of the tree to the nearest tenth of an inch.

2. Measure the percent slope from the face of the tree at DBH (or DRC), nearest plot center, to plot center. Note: This slope measurement and the distance measurement, from step 4 below, must be along the same line.

3. Determine the **limiting distance** using one of the following options:

- Option 1 (use of table K-6)–

  a. First, determine the **slope corrected plot radius factor** listed in table K-6 (refer to table below) – look under the "Combined Factor" column for the appropriate BAF. Locate the value associated with the percent slope from the face of the tree to plot center; this value will be referred to as the "Combined Factor" in the formula below.

  b. Compute limiting distance using the following formula:

  Limiting Distance = Diameter **x** "Combined Factor"

- Option 2 (formulas)–

  a. First, compute the **slope correction factor (SCF)** using the following formula (note: this value is also listed in table K-6 under the "Slope Correction Factor" column; locate the SCF associated with the percent slope from the face of the tree to plot center):

  $$\textbf{SCF} = \text{SQR}\,(1 + (\text{slope}/100)^2)$$

  b. Next, compute the slope corrected plot radius factor using the following formula; plot radius factors (PRF) are listed above under step 3:

  Slope Corrected PRF = Slope Correction Factor **x** PRF

c. Compute limiting distance using the following formula:

Limiting Distance = Slope Corrected PRF **x** Diameter

4. Measure the **slope distance** from plot center to the nearest face of the tree at DBH (or DRC). Note: This distance measurement and the slope percent measurement, from step 2 above, must be along the same line.

If the measured distance is *less than or equal* to the "limiting distance," then the tree is "in" and is tallied as a sample tree. If the measured distance is *greater than* the "limiting distance," then the tree is "out" and is not tallied.

Example 2 (determining limiting distance for borderline tree on slope using formulas):

- Basal Area Factor – 40 BAF
- Slope Percent (from face of tree at DBH to plot center) – 20 percent
- DBH – 20.9 inches
- PRF – 1.333 (value from table above)

Slope Correction Factor: = SQR $(1 + (\text{slope}/100)^2)$
= $(1 + (20/100)^2)$
= 1.0198

Slope Corrected PRF: = SCF **x** PRF
= 1.0198 **x** 1.333
= 1.359

Limiting Distance: = Slope Corrected PRF **x** DBH
= 1.359 **x** 20.9
= 28.4 feet

Example 3 (determining sample status for borderline tree on slope ≥ 10 percent – using table K-6):

- Basal Area Factor – 40 BAF
- Slope Percent (from face of tree at DBH to plot center) – 50 percent
- DBH – 15.0 inches
- Slope Distance (from face of tree at DBH to plot center) – 21.0 feet

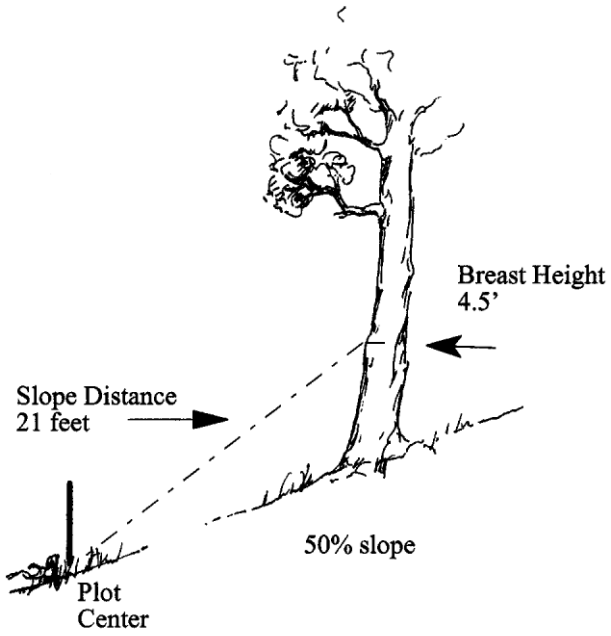


Figure K-1 – Determining limiting distance on a slope.

The "Combined Factor" for a slope of 50 percent with a 40 BAF is 1.490 (referring to table K-6).

Limiting Distance = DBH **x** "Combined Factor"
= 15.0 **x** 1.490
= 22.35 feet

Since the measured slope distance of 21.0 feet is *less than or equal to* the limiting distance of 22.35 feet, the tree is "in" and is tallied as a sample tree.

Table K-1: BAF 10 plot radii from plot center to face of tree at DBH for 0% slope (in feet)

10 BAF										
Inches	**0**	**0.1**	**0.2**	**0.3**	**0.4**	**0.5**	**0.6**	**0.7**	**0.8**	**0.9**
5	13.5	13.8	14.1	14.4	14.6	14.9	15.2	15.4	15.7	16.0
6	16.2	16.5	16.8	17.1	17.3	17.6	17.9	18.1	18.4	18.7
7	19.0	19.2	19.5	19.8	20.0	20.3	20.6	20.9	21.1	21.4
8	21.7	21.9	22.2	22.5	22.7	23.0	23.3	23.6	23.8	24.1
9	24.4	24.6	24.9	25.2	25.5	25.7	26.0	26.3	26.5	26.8
10	27.1	27.4	27.6	27.9	28.2	28.4	28.7	29.0	29.2	29.5
11	29.8	30.1	30.3	30.6	30.9	31.1	31.4	31.7	32.0	32.2
12	32.5	32.8	33.0	33.3	33.6	33.9	34.1	34.4	34.7	34.9
13	35.2	35.5	35.7	36.0	36.3	36.6	36.8	37.1	37.4	37.6
14	37.9	38.2	38.5	38.7	39.0	39.3	39.5	39.8	40.1	40.3
15	40.6	40.9	41.2	41.4	41.7	42.0	42.2	42.5	42.8	43.1
16	43.3	43.6	43.9	44.1	44.4	44.7	45.0	45.2	45.5	45.8
17	46.0	46.3	46.6	46.8	47.1	47.4	47.7	47.9	48.2	48.5
18	48.7	49.0	49.3	49.6	49.8	50.1	50.4	50.6	50.9	51.2
19	51.5	51.7	52.0	52.3	52.5	52.8	53.1	53.3	53.6	53.9
20	54.2	54.4	54.7	55.0	55.2	55.5	55.8	56.1	56.3	56.6
21	56.9	57.1	57.4	57.7	58.0	58.2	58.5	58.8	59.0	59.3
22	59.6	59.8	60.1	60.4	60.7	60.9	61.2	61.5	61.7	62.0
23	62.3	62.6	62.8	63.1	63.4	63.6	63.9	64.2	64.5	64.7
24	65.0	65.3	65.5	65.8	66.1	66.3	66.6	66.9	67.2	67.4
25	67.7	68.0	68.2	68.5	68.8	69.1	69.3	69.6	69.9	70.1
26	70.4	70.7	70.9	71.2	71.5	71.8	72.0	72.3	72.6	72.8
27	73.1	73.4	73.7	73.9	74.2	74.5	74.7	75.0	75.3	75.6
28	75.8	76.1	76.4	76.6	76.9	77.2	77.4	77.7	78.0	78.3
29	78.5	78.8	79.1	79.3	79.6	79.9	80.2	80.4	80.7	81.0
30	81.2	81.5	81.8	82.1	82.3	82.6	82.9	83.1	83.4	83.7
31	83.9	84.2	84.5	84.8	85.0	85.3	85.6	85.8	86.1	86.4
32	86.7	86.9	87.2	87.5	87.7	88.0	88.3	88.6	88.8	89.1
33	89.4	89.6	89.9	90.2	90.4	90.7	91.0	91.3	91.5	91.8
34	92.1	92.3	92.6	92.9	93.2	93.4	93.7	94.0	94.2	94.5
35	94.8	95.1	95.3	95.6	95.9	96.1	96.4	96.7	96.9	97.2
36	97.5	97.8	98.0	98.3	98.6	98.8	99.1	99.4	99.7	99.9
37	100.2	100.5	100.7	101.0	101.3	101.6	101.8	102.1	102.4	102.6
38	102.9	103.2	103.4	103.7	104.0	104.3	104.5	104.8	105.1	105.3
39	105.6	105.9	106.2	106.4	106.7	107.0	107.2	107.5	107.8	108.0
40	108.3	108.6	108.9	109.1	109.4	109.7	109.9	110.2	110.5	110.8
41	111.0	111.3	111.6	111.8	112.1	112.4	112.7	112.9	113.2	113.5
42	113.7	114.0	114.3	114.5	114.8	115.1	115.4	115.6	115.9	116.2
43	116.4	116.7	117.0	117.3	117.5	117.8	118.1	118.3	118.6	118.9
44	119.2	119.4	119.7	120.0	120.2	120.5	120.8	121.0	121.3	121.6
45	121.9	122.1	122.4	122.7	122.9	123.2	123.5	123.8	124.0	124.3
46	124.6	124.8	125.1	125.4	125.7	125.9	126.2	126.5	126.7	127.0
47	127.3	127.5	127.8	128.1	128.4	128.6	128.9	129.2	129.4	129.7
48	130.0	130.3	130.5	130.8	131.1	131.3	131.6	131.9	132.2	132.4
49	132.7	133.0	133.2	133.5	133.8	134.0	134.3	134.6	134.9	135.1
50	135.4	135.7	135.9	136.2	136.5	136.8	137.0	137.3	137.6	137.8

Prepared by multiplying the BAF 10 Plot Radius Factor 2.708 * DBH.
For example, if DBH = 14.3 inches, then 2.708 * 14.3 = 38.7 feet

Table K-2: BAF 20 plot radii from plot center to face of tree at DBH for 0% slope (in feet)

20 BAF										
Inches	**0**	**0.1**	**0.2**	**0.3**	**0.4**	**0.5**	**0.6**	**0.7**	**0.8**	**0.9**
5	9.5	9.7	9.9	10.1	10.3	10.5	10.7	10.8	11.0	11.2
6	11.4	11.6	11.8	12.0	12.2	12.4	12.6	12.8	12.9	13.1
7	13.3	13.5	13.7	13.9	14.1	14.3	14.5	14.7	14.8	15.0
8	15.2	15.4	15.6	15.8	16.0	16.2	16.4	16.6	16.7	16.9
9	17.1	17.3	17.5	17.7	17.9	18.1	18.3	18.5	18.6	18.8
10	19.0	19.2	19.4	19.6	19.8	20.0	20.2	20.4	20.6	20.7
11	20.9	21.1	21.3	21.5	21.7	21.9	22.1	22.3	22.5	22.6
12	22.8	23.0	23.2	23.4	23.6	23.8	24.0	24.2	24.4	24.5
13	24.7	24.9	25.1	25.3	25.5	25.7	25.9	26.1	26.3	26.5
14	26.6	26.8	27.0	27.2	27.4	27.6	27.8	28.0	28.2	28.4
15	28.5	28.7	28.9	29.1	29.3	29.5	29.7	29.9	30.1	30.3
16	30.4	30.6	30.8	31.0	31.2	31.4	31.6	31.8	32.0	32.2
17	32.4	32.5	32.7	32.9	33.1	33.3	33.5	33.7	33.9	34.1
18	34.3	34.4	34.6	34.8	35.0	35.2	35.4	35.6	35.8	36.0
19	36.2	36.3	36.5	36.7	36.9	37.1	37.3	37.5	37.7	37.9
20	38.1	38.3	38.4	38.6	38.8	39.0	39.2	39.4	39.6	39.8
21	40.0	40.2	40.3	40.5	40.7	40.9	41.1	41.3	41.5	41.7
22	41.9	42.1	42.2	42.4	42.6	42.8	43.0	43.2	43.4	43.6
23	43.8	44.0	44.1	44.3	44.5	44.7	44.9	45.1	45.3	45.5
24	45.7	45.9	46.1	46.2	46.4	46.6	46.8	47.0	47.2	47.4
25	47.6	47.8	48.0	48.1	48.3	48.5	48.7	48.9	49.1	49.3
26	49.5	49.7	49.9	50.0	50.2	50.4	50.6	50.8	51.0	51.2
27	51.4	51.6	51.8	52.0	52.1	52.3	52.5	52.7	52.9	53.1
28	53.3	53.5	53.7	53.9	54.0	54.2	54.4	54.6	54.8	55.0
29	55.2	55.4	55.6	55.8	55.9	56.1	56.3	56.5	56.7	56.9
30	57.1	57.3	57.5	57.7	57.9	58.0	58.2	58.4	58.6	58.8
31	59.0	59.2	59.4	59.6	59.8	59.9	60.1	60.3	60.5	60.7
32	60.9	61.1	61.3	61.5	61.7	61.8	62.0	62.2	62.4	62.6
33	62.8	63.0	63.2	63.4	63.6	63.8	63.9	64.1	64.3	64.5
34	64.7	64.9	65.1	65.3	65.5	65.7	65.8	66.0	66.2	66.4
35	66.6	66.8	67.0	67.2	67.4	67.6	67.7	67.9	68.1	68.3
36	68.5	68.7	68.9	69.1	69.3	69.5	69.6	69.8	70.0	70.2
37	70.4	70.6	70.8	71.0	71.2	71.4	71.6	71.7	71.9	72.1
38	72.3	72.5	72.7	72.9	73.1	73.3	73.5	73.6	73.8	74.0
39	74.2	74.4	74.6	74.8	75.0	75.2	75.4	75.5	75.7	75.9
40	76.1	76.3	76.5	76.7	76.9	77.1	77.3	77.5	77.6	77.8
41	78.0	78.2	78.4	78.6	78.8	79.0	79.2	79.4	79.5	79.7
42	79.9	80.1	80.3	80.5	80.7	80.9	81.1	81.3	81.4	81.6
43	81.8	82.0	82.2	82.4	82.6	82.8	83.0	83.2	83.4	83.5
44	83.7	83.9	84.1	84.3	84.5	84.7	84.9	85.1	85.3	85.4
45	85.6	85.8	86.0	86.2	86.4	86.6	86.8	87.0	87.2	87.3
46	87.5	87.7	87.9	88.1	88.3	88.5	88.7	88.9	89.1	89.3
47	89.4	89.6	89.8	90.0	90.2	90.4	90.6	90.8	91.0	91.2
48	91.3	91.5	91.7	91.9	92.1	92.3	92.5	92.7	92.9	93.1
49	93.2	93.4	93.6	93.8	94.0	94.2	94.4	94.6	94.8	95.0
50	95.2	95.3	95.5	95.7	95.9	96.1	96.3	96.5	96.7	96.9

Prepared by multiplying the BAF 20 Plot Radius Factor 1.902 * DBH.
For example, if DBH = 14.3 inches, then 1.902 * 14.3 = 27.2

Table K-3: BAF 30 plot radii from plot center to face of tree at DBH for 0% slope (in feet)

30 BAF										
Inches	**0**	**0.1**	**0.2**	**0.3**	**0.4**	**0.5**	**0.6**	**0.7**	**0.8**	**0.9**
5	7.7	7.9	8.0	8.2	8.3	8.5	8.7	8.8	9.0	9.1
6	9.3	9.4	9.6	9.7	9.9	10.0	10.2	10.4	10.5	10.7
7	10.8	11.0	11.1	11.3	11.4	11.6	11.7	11.9	12.1	12.2
8	12.4	12.5	12.7	12.8	13.0	13.1	13.3	13.5	13.6	13.8
9	13.9	14.1	14.2	14.4	14.5	14.7	14.8	15.0	15.2	15.3
10	15.5	15.6	15.8	15.9	16.1	16.2	16.4	16.5	16.7	16.9
11	17.0	17.2	17.3	17.5	17.6	17.8	17.9	18.1	18.2	18.4
12	18.6	18.7	18.9	19.0	19.2	19.3	19.5	19.6	19.8	19.9
13	20.1	20.3	20.4	20.6	20.7	20.9	21.0	21.2	21.3	21.5
14	21.6	21.8	22.0	22.1	22.3	22.4	22.6	22.7	22.9	23.0
15	23.2	23.3	23.5	23.7	23.8	24.0	24.1	24.3	24.4	24.6
16	24.7	24.9	25.0	25.2	25.4	25.5	25.7	25.8	26.0	26.1
17	26.3	26.4	26.6	26.7	26.9	27.1	27.2	27.4	27.5	27.7
18	27.8	28.0	28.1	28.3	28.4	28.6	28.8	28.9	29.1	29.2
19	29.4	29.5	29.7	29.8	30.0	30.1	30.3	30.5	30.6	30.8
20	30.9	31.1	31.2	31.4	31.5	31.7	31.8	32.0	32.2	32.3
21	32.5	32.6	32.8	32.9	33.1	33.2	33.4	33.5	33.7	33.9
22	34.0	34.2	34.3	34.5	34.6	34.8	34.9	35.1	35.2	35.4
23	35.6	35.7	35.9	36.0	36.2	36.3	36.5	36.6	36.8	36.9
24	37.1	37.3	37.4	37.6	37.7	37.9	38.0	38.2	38.3	38.5
25	38.7	38.8	39.0	39.1	39.3	39.4	39.6	39.7	39.9	40.0
26	40.2	40.4	40.5	40.7	40.8	41.0	41.1	41.3	41.4	41.6
27	41.7	41.9	42.1	42.2	42.4	42.5	42.7	42.8	43.0	43.1
28	43.3	43.4	43.6	43.8	43.9	44.1	44.2	44.4	44.5	44.7
29	44.8	45.0	45.1	45.3	45.5	45.6	45.8	45.9	46.1	46.2
30	46.4	46.5	46.7	46.8	47.0	47.2	47.3	47.5	47.6	47.8
31	47.9	48.1	48.2	48.4	48.5	48.7	48.9	49.0	49.2	49.3
32	49.5	49.6	49.8	49.9	50.1	50.2	50.4	50.6	50.7	50.9
33	51.0	51.2	51.3	51.5	51.6	51.8	51.9	52.1	52.3	52.4
34	52.6	52.7	52.9	53.0	53.2	53.3	53.5	53.6	53.8	54.0
35	54.1	54.3	54.4	54.6	54.7	54.9	55.0	55.2	55.3	55.5
36	55.7	55.8	56.0	56.1	56.3	56.4	56.6	56.7	56.9	57.0
37	57.2	57.4	57.5	57.7	57.8	58.0	58.1	58.3	58.4	58.6
38	58.7	58.9	59.1	59.2	59.4	59.5	59.7	59.8	60.0	60.1
39	60.3	60.4	60.6	60.8	60.9	61.1	61.2	61.4	61.5	61.7
40	61.8	62.0	62.1	62.3	62.5	62.6	62.8	62.9	63.1	63.2
41	63.4	63.5	63.7	63.8	64.0	64.2	64.3	64.5	64.6	64.8
42	64.9	65.1	65.2	65.4	65.6	65.7	65.9	66.0	66.2	66.3
43	66.5	66.6	66.8	66.9	67.1	67.3	67.4	67.6	67.7	67.9
44	68.0	68.2	68.3	68.5	68.6	68.8	69.0	69.1	69.3	69.4
45	69.6	69.7	69.9	70.0	70.2	70.3	70.5	70.7	70.8	71.0
46	71.1	71.3	71.4	71.6	71.7	71.9	72.0	72.2	72.4	72.5
47	72.7	72.8	73.0	73.1	73.3	73.4	73.6	73.7	73.9	74.1
48	74.2	74.4	74.5	74.7	74.8	75.0	75.1	75.3	75.4	75.6
49	75.8	75.9	76.1	76.2	76.4	76.5	76.7	76.8	77.0	77.1
50	77.3	77.5	77.6	77.8	77.9	78.1	78.2	78.4	78.5	78.7

Prepared by multiplying the BAF 30 Plot Radius Factor 1.546 * DBH.
For example, if DBH = 14.3 inches, then 1.546 * 14.3 = 22.1

Table K-4: BAF 40 plot radii from plot center to face of tree at DBH for 0% slope (in feet)

40 BAF										
Inches	**0**	**0.1**	**0.2**	**0.3**	**0.4**	**0.5**	**0.6**	**0.7**	**0.8**	**0.9**
5	6.7	6.8	6.9	7.1	7.2	7.3	7.5	7.6	7.7	7.9
6	8.0	8.1	8.3	8.4	8.5	8.7	8.8	8.9	9.1	9.2
7	9.3	9.5	9.6	9.7	9.9	10.0	10.1	10.3	10.4	10.5
8	10.7	10.8	10.9	11.1	11.2	11.3	11.5	11.6	11.7	11.9
9	12.0	12.1	12.3	12.4	12.5	12.7	12.8	12.9	13.1	13.2
10	13.3	13.5	13.6	13.7	13.9	14.0	14.1	14.3	14.4	14.5
11	14.7	14.8	14.9	15.1	15.2	15.3	15.5	15.6	15.7	15.9
12	16.0	16.1	16.3	16.4	16.5	16.7	16.8	16.9	17.1	17.2
13	17.3	17.5	17.6	17.7	17.9	18.0	18.1	18.3	18.4	18.5
14	18.7	18.8	18.9	19.1	19.2	19.3	19.5	19.6	19.7	19.9
15	20.0	20.1	20.3	20.4	20.5	20.7	20.8	20.9	21.1	21.2
16	21.3	21.5	21.6	21.7	21.9	22.0	22.1	22.3	22.4	22.5
17	22.7	22.8	22.9	23.1	23.2	23.3	23.5	23.6	23.7	23.9
18	24.0	24.1	24.3	24.4	24.5	24.7	24.8	24.9	25.1	25.2
19	25.3	25.5	25.6	25.7	25.9	26.0	26.1	26.3	26.4	26.5
20	26.7	26.8	26.9	27.1	27.2	27.3	27.5	27.6	27.7	27.9
21	28.0	28.1	28.3	28.4	28.5	28.7	28.8	28.9	29.1	29.2
22	29.3	29.5	29.6	29.7	29.9	30.0	30.1	30.3	30.4	30.5
23	30.7	30.8	30.9	31.1	31.2	31.3	31.5	31.6	31.7	31.9
24	32.0	32.1	32.3	32.4	32.5	32.7	32.8	32.9	33.1	33.2
25	33.3	33.5	33.6	33.7	33.9	34.0	34.1	34.3	34.4	34.5
26	34.7	34.8	34.9	35.1	35.2	35.3	35.5	35.6	35.7	35.9
27	36.0	36.1	36.3	36.4	36.5	36.7	36.8	36.9	37.1	37.2
28	37.3	37.5	37.6	37.7	37.9	38.0	38.1	38.3	38.4	38.5
29	38.7	38.8	38.9	39.1	39.2	39.3	39.5	39.6	39.7	39.9
30	40.0	40.1	40.3	40.4	40.5	40.7	40.8	40.9	41.1	41.2
31	41.3	41.5	41.6	41.7	41.9	42.0	42.1	42.3	42.4	42.5
32	42.7	42.8	42.9	43.1	43.2	43.3	43.5	43.6	43.7	43.9
33	44.0	44.1	44.3	44.4	44.5	44.7	44.8	44.9	45.1	45.2
34	45.3	45.5	45.6	45.7	45.9	46.0	46.1	46.3	46.4	46.5
35	46.7	46.8	46.9	47.1	47.2	47.3	47.5	47.6	47.7	47.9
36	48.0	48.1	48.2	48.4	48.5	48.7	48.8	48.9	49.1	49.2
37	49.3	49.5	49.6	49.7	49.9	50.0	50.1	50.3	50.4	50.5
38	50.7	50.8	50.9	51.1	51.2	51.3	51.5	51.6	51.7	51.9
39	52.0	52.1	52.2	52.4	52.5	52.7	52.8	52.9	53.1	53.2
40	53.3	53.5	53.6	53.7	53.9	54.0	54.1	54.3	54.4	54.5
41	54.7	54.8	54.9	55.1	55.2	55.3	55.5	55.6	55.7	55.9
42	56.0	56.1	56.2	56.4	56.5	56.7	56.8	56.9	57.1	57.2
43	57.3	57.5	57.6	57.7	57.9	58.0	58.1	58.3	58.4	58.5
44	58.7	58.8	58.9	59.1	59.2	59.3	59.5	59.6	59.7	59.9
45	60.0	60.1	60.2	60.4	60.5	60.7	60.8	60.9	61.1	61.2
46	61.3	61.5	61.6	61.7	61.9	62.0	62.1	62.3	62.4	62.5
47	62.7	62.8	62.9	63.1	63.2	63.3	63.5	63.6	63.7	63.9
48	64.0	64.1	64.2	64.4	64.5	64.7	64.8	64.9	65.1	65.2
49	65.3	65.5	65.6	65.7	65.9	66.0	66.1	66.3	66.4	66.5
50	66.7	66.8	66.6	67.0	67.2	67.3	67.4	67.6	67.7	67.8

Prepared by multiplying the BAF 40 Plot Radius Factor 1.333 * DBH.
For example, if DBH = 14.3 inches, then 1.333 * 14.3 = 19.1

Table K-5: BAF 60 plot radii from plot center to face of tree at DBH for 0% slope (in feet)

60 BAF										
Inches	**0**	**0.1**	**0.2**	**0.3**	**0.4**	**0.5**	**0.6**	**0.7**	**0.8**	**0.9**
5	5.4	5.5	5.6	5.7	5.8	5.9	6.1	6.2	6.3	6.4
6	6.5	6.6	6.7	6.8	6.9	7.0	7.1	7.2	7.4	7.5
7	7.6	7.7	7.8	7.9	8.0	8.1	8.2	8.3	8.4	8.5
8	8.6	8.8	8.9	9.0	9.1	9.2	9.3	9.4	9.5	9.6
9	9.7	9.8	9.9	10.1	10.2	10.3	10.4	10.5	10.6	10.7
10	10.8	10.9	11.0	11.1	11.2	11.4	11.5	11.6	11.7	11.8
11	11.9	12.0	12.1	12.2	12.3	12.4	12.5	12.6	12.8	12.9
12	13.0	13.1	13.2	13.3	13.4	13.5	13.6	13.7	13.8	13.9
13	14.1	14.2	14.3	14.4	14.5	14.6	14.7	14.8	14.9	15.0
14	15.1	15.2	15.4	15.5	15.6	15.7	15.8	15.9	16.0	16.1
15	16.2	16.3	16.4	16.5	16.6	16.8	16.9	17.0	17.1	17.2
16	17.3	17.4	17.5	17.6	17.7	17.8	17.9	18.1	18.2	18.3
17	18.4	18.5	18.6	18.7	18.8	18.9	19.0	19.1	19.2	19.3
18	19.5	19.6	19.7	19.8	19.9	20.0	20.1	20.2	20.3	20.4
19	20.5	20.6	20.8	20.9	21.0	21.1	21.2	21.3	21.4	21.5
20	21.6	21.7	21.8	21.9	22.1	22.2	22.3	22.4	22.5	22.6
21	22.7	22.8	22.9	23.0	23.1	23.2	23.3	23.5	23.6	23.7
22	23.8	23.9	24.0	24.1	24.2	24.3	24.4	24.5	24.6	24.8
23	24.9	25.0	25.1	25.2	25.3	25.4	25.5	25.6	25.7	25.8
24	25.9	26.1	26.2	26.3	26.4	26.5	26.6	26.7	26.8	26.9
25	27.0	27.1	27.2	27.3	27.5	27.6	27.7	27.8	27.9	28.0
26	28.1	28.2	28.3	28.4	28.5	28.6	28.8	28.9	29.0	29.1
27	29.2	29.3	29.4	29.5	29.6	29.7	29.8	29.9	30.1	30.2
28	30.3	30.4	30.5	30.6	30.7	30.8	30.9	31.0	31.1	31.2
29	31.3	31.5	31.6	31.7	31.8	31.9	32.0	32.1	32.2	32.3
30	32.4	32.5	32.6	32.8	32.9	33.0	33.1	33.2	33.3	33.4
31	33.5	33.6	33.7	33.8	33.9	34.1	34.2	34.3	34.4	34.5
32	34.6	34.7	34.8	34.9	35.0	35.1	35.2	35.3	35.5	35.6
33	35.7	35.8	35.9	36.0	36.1	36.2	36.3	36.4	36.5	36.6
34	36.8	36.9	37.0	37.1	37.2	37.3	37.4	37.5	37.6	37.7
35	37.8	37.9	38.1	38.2	38.3	38.4	38.5	38.6	38.7	38.8
36	38.9	39.0	39.1	39.2	39.3	39.5	39.6	39.7	39.8	39.9
37	40.0	40.1	40.2	40.3	40.4	40.5	40.6	40.8	40.9	41.0
38	41.1	41.2	41.3	41.4	41.5	41.6	41.7	41.8	41.9	42.1
39	42.2	42.3	42.4	42.5	42.6	42.7	42.8	42.9	43.0	43.1
40	43.2	43.3	43.5	43.6	43.7	43.8	43.9	44.0	44.1	44.2
41	44.3	44.4	44.5	44.6	44.8	44.9	45.0	45.1	45.2	45.3
42	45.4	45.5	45.6	45.7	45.8	45.9	46.1	46.2	46.3	46.4
43	46.5	46.6	46.7	46.8	46.9	47.0	47.1	47.2	47.3	47.5
44	47.6	47.7	47.8	47.9	48.0	48.1	48.2	48.3	48.4	48.5
45	48.6	48.8	48.9	49.0	49.1	49.2	49.3	49.4	49.5	49.6
46	49.7	49.8	49.9	50.1	50.2	50.3	50.4	50.5	50.6	50.7
47	50.8	50.9	51.0	51.1	51.2	51.3	51.5	51.6	51.7	51.8
48	51.9	52.0	52.1	52.2	52.3	52.4	52.5	52.6	52.8	52.9
49	53.0	53.1	53.2	53.3	53.4	53.5	53.6	53.7	53.8	53.9
50	54.1	54.2	54.3	54.4	54.5	54.6	54.7	54.8	54.9	55.0

Prepared by multiplying the BAF 60 Plot Radius Factor 1.081 * DBH.
For example, if DBH = 14.3 inches, then 1.081 * 14.3 = 15.5

Table K-6: Limiting distance to face of tree for various basal area factors

This table provides an expanded list of slope correction factors (SCF) to the face of the tree for use with various basal area factors. To use the table, measure the slope and the distance from plot center to the face of the tree at DBH. To obtain the corrected limiting distance to a tree, multiply DBH by the "Combined Factor" shown under the appropriate BAF heading.

Combined Factors – limiting distance to face of tree							
Percent Slope	**SCF**	**Combined Factor**					
		5 BAF	**10 BAF**	**15 BAF**	**20 BAF**	**30 BAF**	**40 BAF**
1	1.00000	3.847	2.708	2.203	1.902	1.546	1.333
2	1.00020	3.848	2.709	2.203	1.902	1.546	1.333
3	1.00045	3.849	2.709	2.204	1.903	1.547	1.334
4	1.00080	3.850	2.710	2.205	1.904	1.547	1.334
5	1.00125	3.852	2.711	2.206	1.904	1.548	1.335
6	1.00180	3.854	2.713	2.207	1.905	1.549	1.335
7	1.00245	3.856	2.715	2.208	1.907	1.550	1.336
8	1.00319	3.859	2.717	2.210	1.908	1.551	1.337
9	1.00404	3.863	2.719	2.212	1.910	1.552	1.338
10	1.00499	3.866	2.722	2.214	1.911	1.554	1.340
11	1.00603	3.870	2.724	2.216	1.912	1.555	1.341
12	1.00717	3.875	2.727	2.219	1.916	1.557	1.343
13	1.00841	3.879	2.731	2.222	1.918	1.559	1.344
14	1.00975	3.884	2.734	2.224	1.921	1.567	1.346
15	1.01119	3.890	2.738	2.228	1.923	1.563	1.348
16	1.01272	3.896	2.742	2.231	1.926	1.566	1.350
17	1.01435	3.902	2.747	2.235	1.921	1.568	1.352
18	1.01607	3.909	2.752	2.238	1.933	1.571	1.354
19	1.01789	3.916	2.756	2.245	1.936	1.574	1.357
20	1.01980	3.923	2.762	2.245	1.940	1.577	1.359
21	1.02181	3.931	2.767	2.251	1.943	1.580	1.362
22	1.02391	3.939	2.773	2.256	1.947	1.583	1.365
23	1.02611	3.947	2.779	2.261	1.952	1.586	1.368
24	1.02840	3.956	2.785	2.266	1.956	1.590	1.371
25	1.03078	3.965	2.791	2.271	1.967	1.594	1.374
26	1.03325	3.975	2.798	2.276	1.965	1.597	1.377
27	1.03581	3.985	2.805	2.282	1.970	1.601	1.381
28	1.03846	3.995	2.812	2.288	1.975	1.605	1.384
29	1.04120	4.005	2.820	2.294	1.980	1.610	1.388
30	1.04403	4.016	2.827	2.300	1.986	1.614	1.392
31	1.04695	4.028	2.835	2.306	1.991	1.619	1.396
32	1.04995	4.039	2.843	2.313	1.997	1.623	1.400

Combined Factors – limiting distance to face of tree							
Percent Slope	**SCF**	**Combined Factor**					
		5 BAF	**10 BAF**	**15 BAF**	**20 BAF**	**30 BAF**	**40 BAF**
33	1.05304	4.051	2.852	2.320	2.003	1.628	1.404
34	1.05622	4.063	2.960	2.327	2.009	1.633	1.408
35	1.05948	4.076	2.869	2.334	2.015	1.638	1.412
36	1.06283	4.089	2.878	2.341	2.022	1.643	1.417
37	1.06626	4.102	2.887	2.349	2.028	1.648	1.421
38	1.06977	4.115	2.897	2.357	2.035	1.654	1.426
39	1.07336	4.129	2.907	2.365	2.042	1.659	1.431
40	1.07703	4.143	2.917	2.373	2.049	1.665	1.436
41	1.08079	4.158	2.927	2.381	2.056	1.671	1.441
42	1.08462	4.173	2.937	2.389	2.063	1.677	1.446
43	1.08853	4.188	2.948	2.398	2.070	1.683	1.451
44	1.09252	4.203	2.959	2.407	2.078	1.689	1.456
45	1.09659	4.219	2.970	2.416	2.086	1.695	1.462
46	1.10073	4.235	2.981	2.425	2.094	1.702	1.467
47	1.10494	4.251	2.992	2.434	2.102	1.708	1.473
48	1.10923	4.267	3.004	2.444	2.110	1.715	1.479
49	1.11360	4.284	3.016	2.453	2.118	1.723	1.484
50	1.11803	4.301	3.028	2.463	2.126	1.728	1.490
51	1.12254	4.318	3.040	2.473	2.135	1.735	1.496
52	1.12712	4.336	3.052	2.483	2.144	1.743	1.502
53	1.13177	4.354	3.065	2.493	2.153	1.750	1.509
54	1.13649	4.372	3.078	2.504	2.162	1.757	1.515
55	1.14127	4.390	3.091	2.514	2.171	1.764	1.521
56	1.14612	4.409	3.104	2.525	2.180	1.772	1.528
57	1.15104	4.428	3.117	2.536	2.189	1.780	1.534
58	1.15603	4.447	3.131	2.547	2.199	1.788	1.541
59	1.16108	4.467	3.144	2.558	2.208	1.795	1.548
60	1.16619	4.486	3.158	2.569	2.218	1.803	1.555
61	1.17137	4.506	3.172	2.581	2.228	1.811	1.561
62	1.17661	4.526	3.186	2.592	2.238	1.819	1.568
63	1.18191	4.547	3.201	2.604	2.248	1.827	1.575
64	1.18727	4.567	3.215	2.616	2.258	1.836	1.583
65	1.19269	4.588	3.230	2.627	2.268	1.844	1.590
66	1.19817	4.609	3.245	2.640	2.279	1.852	1.597
67	1.20370	4.631	3.260	2.652	2.289	1.861	1.605
68	1.20930	4.652	3.275	2.664	2.300	1.870	1.612
69	1.21949	4.691	3.302	2.687	2.319	1.885	1.626
70	1.22066	4.696	3.306	2.689	2.322	1.887	1.627
71	1.22642	4.718	3.321	2.702	2.333	1.896	1.635

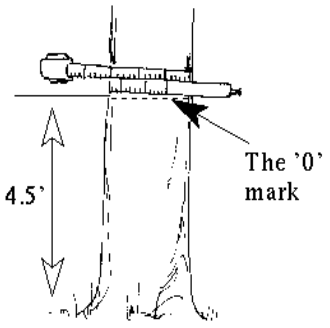
Combined Factors – limiting distance to face of tree							
Percent Slope	**SCF**	**Combined Factor**					
		5 BAF	**10 BAF**	**15 BAF**	**20 BAF**	**30 BAF**	**40 BAF**
72	1.23223	4.740	3.337	2.715	2.344	1.905	1.643
73	1.23810	4.763	3.353	2.728	2.355	1.914	1.650
74	1.24403	4.786	3.369	2.741	2.366	1.923	1.658
75	1.25000	4.809	3.385	2.754	2.378	1.933	1.666
76	1.25603	4.832	3.401	2.767	2.389	1.942	1.674
77	1.26210	4.855	3.418	2.780	2.401	1.951	1.682
78	1.26823	4.879	3.434	2.794	2.412	1.961	1.691
79	1.27440	4.903	3.451	2.808	2.424	1.970	1.699
80	1.28062	4.927	3.468	2.821	2.436	1.980	1.707
81	1.28690	4.951	3.485	2.835	2.448	1.990	1.715
82	1.29321	4.975	3.502	2.849	2.460	1.999	1.724
83	1.29958	4.999	3.519	2.863	2.472	2.009	1.732
84	1.30599	5.024	3.537	2.877	2.484	2.019	1.741
85	1.31244	5.049	3.554	2.891	2.496	2.029	1.749
86	1.31894	5.074	3.572	2.906	2.509	2.039	1.758
87	1.32548	5.099	3.589	2.920	2.521	2.049	1.767
88	1.33207	5.124	3.607	2.935	2.534	2.059	1.776
89	1.33870	5.150	3.625	2.949	2.546	2.070	1.784
90	1.34536	5.176	3.643	2.964	2.559	2.080	1.793
91	1.35207	5.201	3.661	2.979	2.572	2.090	1.802
92	1.35882	5.227	3.680	2.993	2.584	2.101	1.811
93	1.36561	5.254	3.698	3.008	2.597	2.111	1.820
94	1.37244	5.280	3.717	3.023	2.610	2.122	1.829
95	1.37931	5.306	3.735	3.039	2.623	2.132	1.839
96	1.38622	5.333	3.754	3.054	2.637	2.143	1.848
97	1.39316	5.359	3.773	3.069	2.650	2.154	1.857
98	1.40014	5.386	3.792	3.085	2.663	2.165	1.866
99	1.40716	5.413	3.811	3.100	2.676	2.175	1.876
100	1.41421	5.440	3.830	3.116	2.690	2.186	1.885
102	1.42843	5.495	3.868	3.147	2.717	2.208	1.904
103	1.43558	5.523	3.888	3.163	5.730	2.219	1.914
104	1.44278	5.550	3.907	3.178	2.744	2.231	1.923
105	1.45000	5.578	3.927	3.194	2.758	2.242	1.933
106	1.45726	5.606	3.946	3.210	2.772	2.253	1.943
107	1.46455	5.634	3.966	3.226	2.786	2.264	1.952
108	1.47187	5.662	3.986	3.243	2.799	2.276	1.962
109	1.47922	5.691	4.006	3.259	2.813	2.287	1.972
110	1.48661	5.719	4.026	3.275	2.828	2.298	1.982
111	1.49402	5.747	4.046	3.291	2.842	2.310	1.992

Combined Factors – limiting distance to face of tree							
Percent Slope	**SCF**	**Combined Factor**					
		5 BAF	**10 BAF**	**15 BAF**	**20 BAF**	**30 BAF**	**40 BAF**
112	1.50147	5.776	4.066	3.308	2.856	2.321	2.001
113	1.50894	5.805	4.086	3.324	2.870	2.333	2.011
114	1.51644	5.834	4.107	3.341	2.884	2.344	2.021
115	1.52498	5.863	4.127	3.357	2.899	2.356	2.031
116	1.53154	5.892	4.147	3.374	2.913	2.368	2.042
117	1.53912	5.921	4.168	3.391	2.927	2.379	2.052
118	1.54674	5.950	4.189	3.407	2.942	2.391	2.062
119	1.55438	5.980	4.209	3.424	2.956	2.403	2.072
120	1.56205	6.000	4.230	3.441	2.971	2.415	2.082
121	1.56975	6.039	4.251	3.458	2.985	2.427	2.092
122	1.57747	6.069	4.272	3.475	3.000	2.439	2.103
123	1.58521	6.098	4.293	3.492	3.015	2.451	2.113
124	1.59298	6.128	4.314	3.509	3.030	2.463	2.123
125	1.60078	6.158	4.335	3.527	3.045	2.475	2.134
126	1.60860	6.188	4.356	3.544	3.060	2.487	2.144
127	1.61645	6.218	4.377	3.561	3.074	2.499	2.155
128	1.62432	6.249	4.399	3.578	3.089	2.511	2.165
129	1.63221	6.279	4.420	3.595	3.104	2.523	2.176
130	1.64012	6.310	4.441	3.613	3.120	2.536	2.186
131	1.64806	6.340	4.463	3.631	3.135	2.546	2.197
132	1.65602	4.370	4.485	3.648	3.150	2.560	2.207
133	1.66400	6.401	4.506	3.666	3.165	2.573	2.218
134	1.67200	6.432	4.528	3.683	3.180	2.585	2.229
135	1.68003	6.463	4.550	3.701	3.195	2.597	2.239
136	1.68808	6.494	4.571	3.719	3.211	2.261	2.250
137	1.69614	6.525	4.593	3.737	3.226	2.622	2.261
138	1.70423	6.556	4.615	3.754	3.241	2.635	2.272
139	1.71234	6.587	4.637	3.772	3.257	2.647	2.283
140	1.72047	6.619	4.659	3.790	3.272	2.660	2.293
141	1.72861	6.650	4.681	3.808	3.288	2.672	2.304
142	1.73678	6.681	4.703	3.826	3.303	2.685	2.315
143	1.74497	6.713	4.725	3.844	3.319	2.698	2.326
144	1.75317	6.744	4.748	3.862	3.335	2.710	2.337
145	1.76139	6.776	4.770	3.880	3.350	2.723	2.348
146	1.76963	6.808	4.792	3.898	3.366	2.736	2.359
147	1.77789	6.840	4.815	3.917	3.382	2.749	2.370
148	1.78617	6.871	4.837	3.935	3.397	2.761	2.381

Appendix L: Measuring Diameter

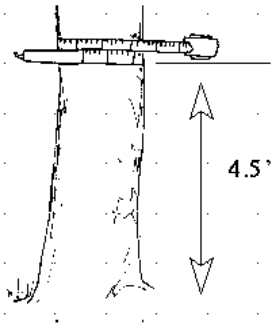
Tree diameter at breast height (DBH) is the outside bark diameter at 4.5 feet above the forest floor on the uphill side of the tree. To determine breast height, the forest floor includes the duff layer that may be present, but does not include unincorporated woody debris that may rise above the ground line. If a dead tree (snag) is missing bark, measure the DBH without the bark and record that measurement.

Correct Method



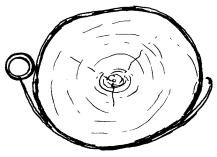
End of tape (with the '0' mark or hook) crossed under.

Optional method if left handed



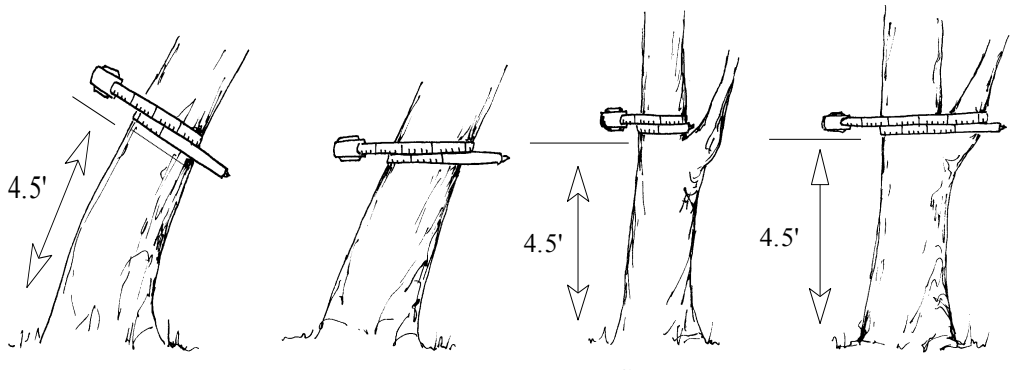
End of tape crossed under (Becareful -- reading will be be made from upside down d-tape marks).

Press the tape firmly against the tree. Do not pull it out at a tangent to the tree at the point of measurement



Correct

Incorrect



Correct | Incorrect | Correct | Incorrect

Tape must be at right angles to lean of tree.

Do not place tape at abnormal location on bole of tree.

Diameter at Root Collar (DRC) is the diameter measured at the root collar or at the natural ground line, whichever is higher, outside the bark. Measure tree stems only, not branches. A stem generally grows in an upright position and contributes to the main structural support of a tree crown. If the diameter is measured at root collar, the number of stems is required.

Point of Measurement for DRC

Measure at ground line when reasonable

Measure above butt swell

Excessive diameter below stems.
Measure each stem and compute DRC

Multistemmed above diameter

Measure missing stem(s) and
compute DRC

Multistemmed at or below ground.
Measure each stem and compute DRC.

Appendix M: Point of Diameter Measurement

DBH guidelines – point of measurement for trees measured at breast height:

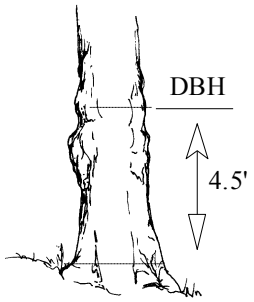
DBH guidelines	
Tree Description	**Point of Measurement**
Tree species with no abnormalities	For tree species that are measured at breast height (i.e., timber species), the diameter measurement (DBH) is the outside bark diameter at 4.5 feet above the forest floor on the uphill side of the tree. To determine breast height, the forest floor includes the duff layer that may be present, but does not include unincorporated woody debris that may rise above the ground line.
Forked tree	In order to qualify as a fork, the stem in question must be at least 1/3 the diameter of the main stem and must branch out from the main stem at an angle of 45 degrees or less. Forks originate at the point on the bole where the piths intersect. Forked trees are handled differently depending on whether the fork originates above or below 4.5 feet.
	Trees forked below 4.5 feet are treated as distinctly separate trees. DBH is measured for each stem at 4.5 ft above the ground.
	Trees forked at or above 4.5 feet count as one tree. If a fork occurs at or immediately above 4.5 ft, measure diameter below the fork just beneath any swelling that would inflate DBH.
Stump sprouts	Stump sprouts originate between ground level and 4.5 feet on the boles of trees that have died or been cut. Stump sprouts are handled the same as forked trees, with the exception that stump sprouts are not required to be 1/3 the diameter of the dead bole. Stump sprouts originating below 1.0 ft are measured at 4.5 ft from ground line.
Tree with irregularities at DBH	On trees with swellings, bumps, depressions, and branches at DBH, measure diameter immediately above the irregularity at the place it ceases to affect normal stem form. If this is not possible, because of the vertical extent of the irregularity, then adjust the DBH measurement to better reflect the diameter of a regular bole.
Tree on slope	Measure diameter at 4.5 feet from the ground along the bole on the uphill side of the tree.
Leaning tree	Measure diameter at 4.5 feet from the ground along the bole.
Turpentine tree	On trees with turpentine face extending above 4.5 feet, estimate the diameter at 10.0 ft above the ground and multiply by 1.1 to estimate DBH outside bark.

DBH guidelines	
Tree Description	**Point of Measurement**
Independent trees that grow together	If two or more independent stems have grown together at or above the point of DBH, continue to treat them as separate trees.
Dead Tree – missing wood or bark	To qualify as "standing," dead trees (snags) must have 50% or more of the circumference of the bole intact at DBH, and lean less than 45 degrees from vertical. If a dead tree is missing bark, measure the DBH without the bark and record that measurement.

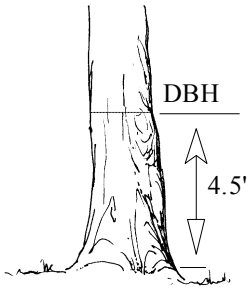
DRC guidelines – point of measurement for trees measured at root collar:

DRC Guidelines	
Tree Description	**Point of Measurement**
Tree species measured at root collar	For tree species that are measured at root collar (Rocky Mountain Juniper, Utah Juniper, and Curl-Leaf Mountain Mahogany), the diameter measurement (DRC) is taken at the root collar or at the point nearest the natural ground line (whichever is higher) that represents the basal area of the tree stem or stems. The place of diameter measurement may vary for trees with stems that are abnormally formed.
Stump sprouts	For multi-stemmed woodland species, treat all new sprouts as part of the same new tree.
Minimum Stem Size	Stems must be at least 1.5" dia and one foot in length to be included in the DRC calculation.

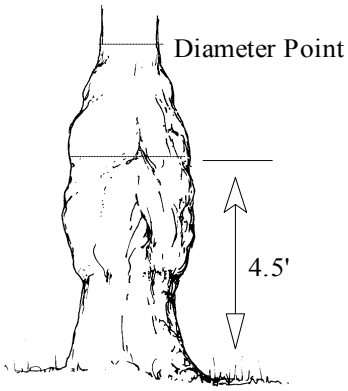
Point of Measurement for DBH:



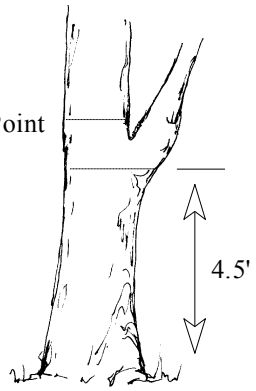
Tree on slope



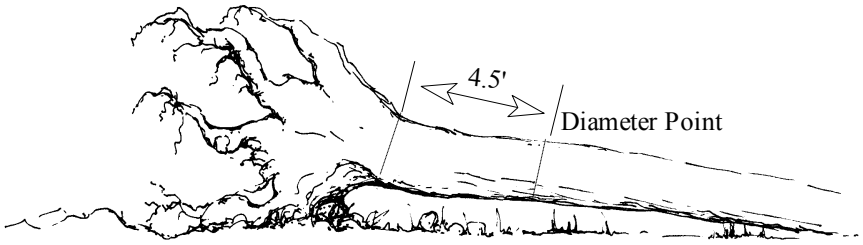
Tree on level ground



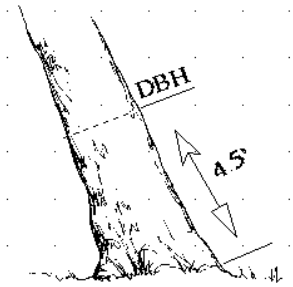
Tree deformed at DBH



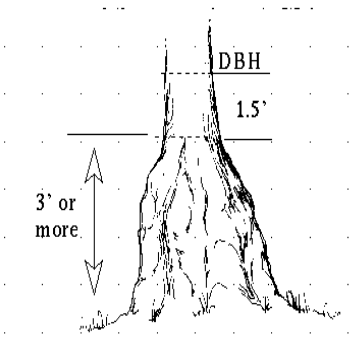
Tree with branch at 4.5 feet



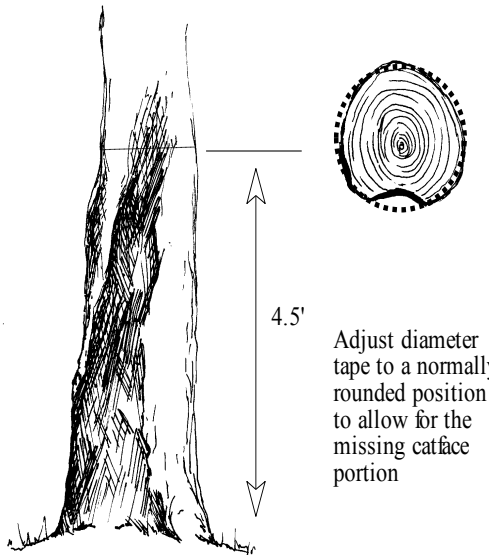
Windthrown tree



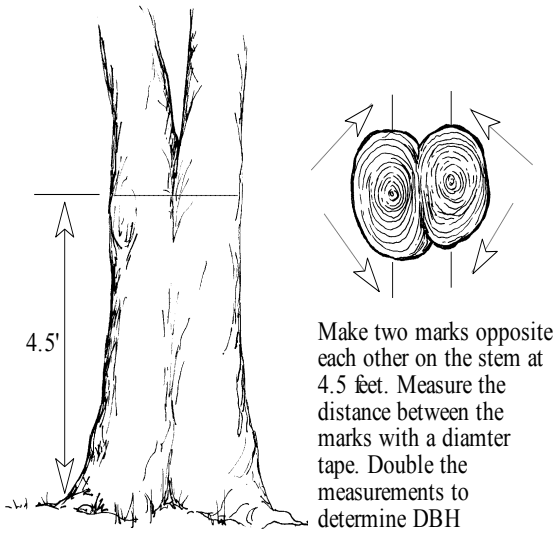
Leaning tree

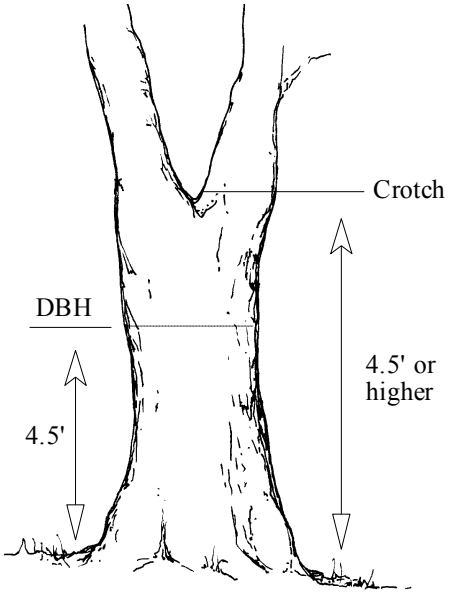


Bottleneck tree

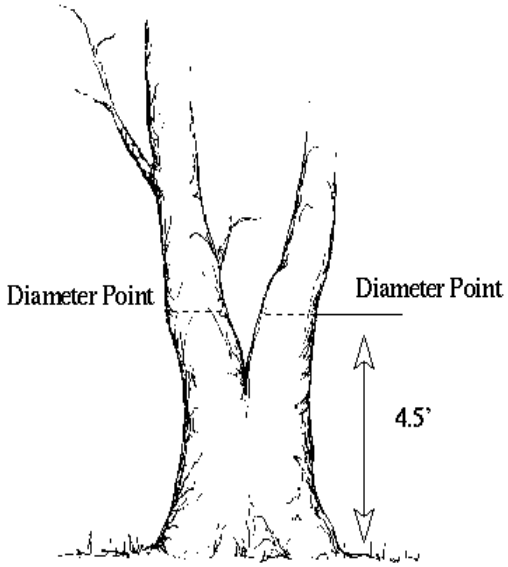


Tree with a catface





Tree forked at 4.5 feet or higher. Record as one tree and consider only the main fork



Tree forked below 4.5 feet. Record each fork that is "in" as a separate tree. Measure diameter at 4.5 feet.

Appendix N: Radial Growth and Height Growth

Refer to section A for procedures on measuring radial growth. Refer to section B for procedures on measuring height growth.

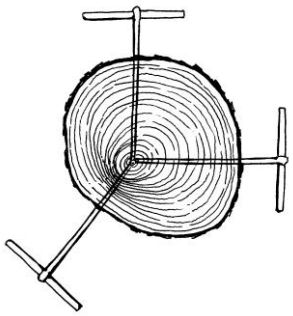
A. Radial Growth Measurement

The procedures outlined below are for a 10-year radial growth increment measurement:

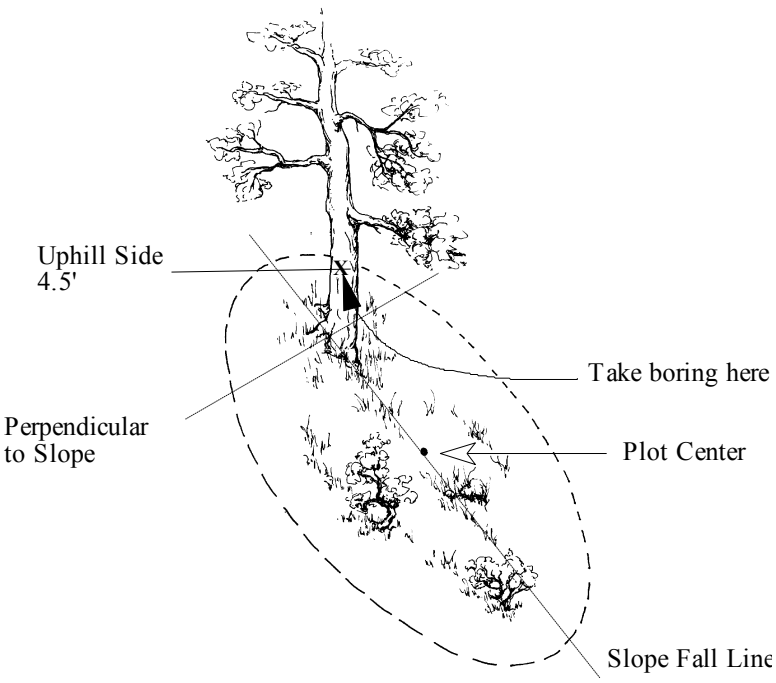
1. Bore the tree just below the point of diameter measurement, on the side of the tree facing plot center to reduce bias in selecting the radial growth sampling cores. There can be considerable growth difference between the various areas of the same breast height X-section. Slope, aspect, influence from neighboring trees, etc., can affect the width of the growth rings in any given core area.

2. Count back 10 growth rings from the cambium end of the core.

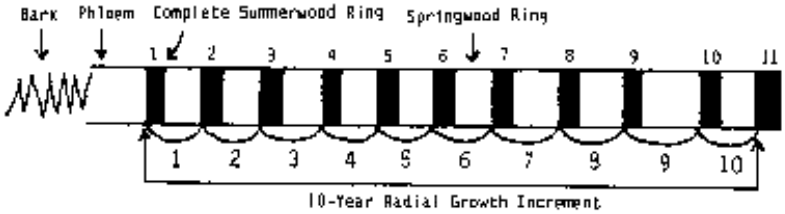
3. Measure the length of this segment of the core to the nearest 1/20th-inch to get radial increment. Enter this radial increment as the number of twentieths, e.g. 18/20 is recorded "18" and 27/20 is recorded "27."



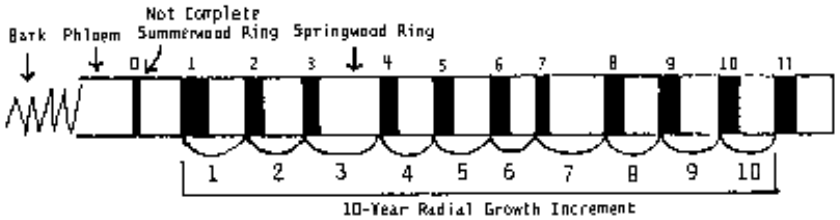
Steep slopes – It may be difficult or impossible to obtain an increment boring at breast height on very steep slopes when the plot center is downhill from the tree. In this circumstance, obtain the core at breast height on a side of the tree perpendicular to the slope fall line.



The radial increment growth period is usually 10 years. The measurement is taken from the outside edge of the most current, complete summerwood (denser, dark-colored) ring to the outside edge of the eleventh summerwood ring, so that 10 complete annual increments are included. The last summerwood growth ring is considered complete by September 1 each year.



Example of a 10-year radial growth increment with the first summerwood ring being a complete growth ring.

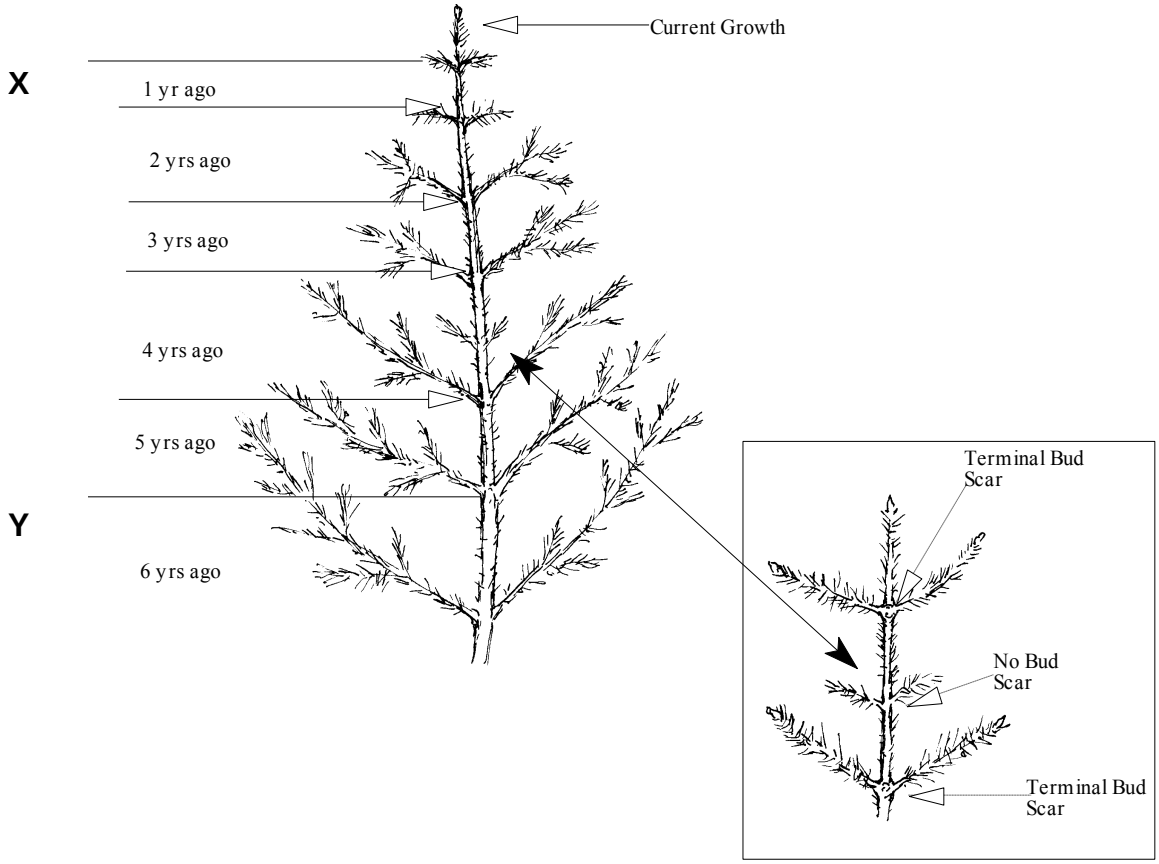


Example of a 10-year radial growth increment with the first summerwood ring not a complete growth ring.

Use a ruler with a 1/20th-inch scale to measure the radial growth increment.

B. Height Growth Measurement

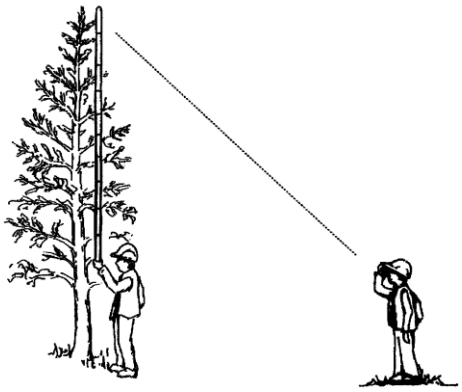
Five-year height growth is measured on trees less than 3.0 inches DBH. It is measured in feet (to the nearest 0.1 foot). The measurement is taken on the most recent five complete height segments. The current terminal leader is excluded unless subset has occurred. Height increments are recognized by the presence of budscale scars on the nodes (except western redcedar) or by dissecting the leader and counting annual rings with a hand lens.



Between lines **X** and **Y** is the 5-year Height Increment.

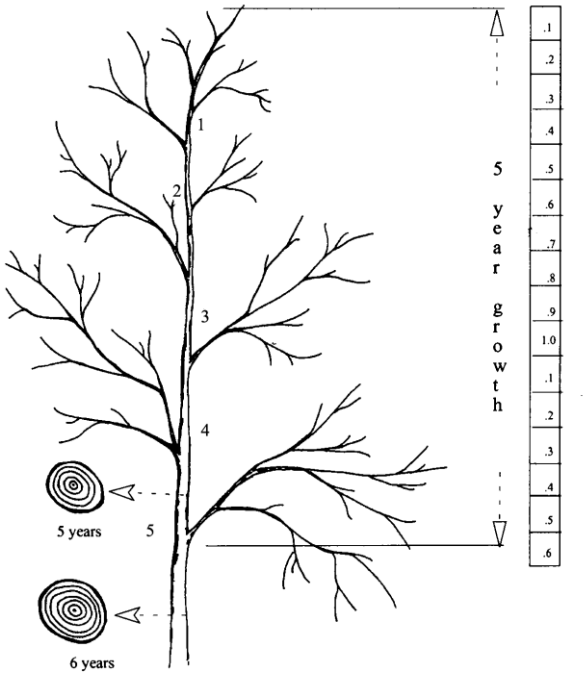
Height Growth on Trees Taller than 10 Feet:

One crewmember holds up the height pole to the top of the tree. The other crewmember uses binoculars to locate 5 year growth node and read the length on the height pole.



Using Destructive Sampling:

Cut down the tree and measure the 5-year growth.



1. Cut at suspected internode between 5 and 6 years.
2. Cut between suspected internode between 4 and 5 years.
3. Measure at the 5th node.

Note: This graphic illustrates measurement to the top of the tree. If the measurement is taken during the spring or summer, when the tree has a partial years flush of new growth, do NOT include the partial growth. Measure the 5 most recent COMPLETE increments of height growth

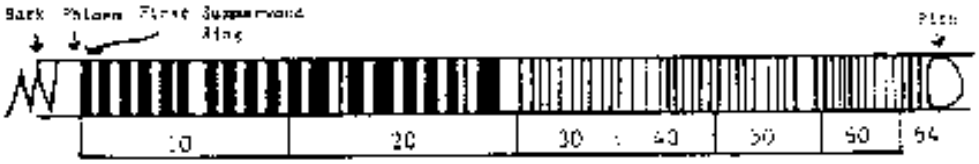
Appendix O: Measuring Age

Refer to section A for procedures on measuring age for trees ≥ 3.0 inches DBH. Refer to section B for procedures on measuring age for trees < 3.0 inches DBH.

A. Age Measurements for Trees ≥ 3.0-inches DBH

For sample trees 3.0-inches DBH and larger, age is determined from an increment boring made at breast height. The increment boring should be made at breast height facing plot center, to reduce bias. Usually the boring for measuring radial growth is also used for age measurement.

Age is counted from the most current summerwood ring to the pith of the tree. Record the age counted, do not add an estimate of the number of years to grow to breast height.



The ring count is 64 years. Record “64” for Tree Age.

Procedure for Estimating Age:

If a tree is rotten or hollow, or if a tree has a radius greater than the length of the increment borer, use the following procedure:

Bore into the tree as far as possible, extract core and count the rings. Measure the diameter or the tree and divide by two, then subtract the bark thickness. This gives the radius of the wood part of the tree. Measure the length of the core and subtract from the radius of the wood to determine how much longer the core would have to be to reach the pith. Count the number of rings in the inner-most inch and extrapolate to the center.

Note: It is critical to keep increment borers properly sharpened and regularly cleaned. A dull, chipped, or gummed-up increment borer will not take a usable core. Age estimates are only to be used for rotten or hollow trees, or for trees so large that the center cannot be reached. Age estimates are not acceptable due to improper maintenance of increment borers.

Example (age estimate for large tree):

- DBH – 40.0-inches
- Bark thickness – 2.0 inches
- Core – 16.0 inches long
- Ring count – 200 rings, and inner-most inch has 5 rings

Procedure for estimating age:

Step	Procedure	Measurement or Calculation
1	DBH	40.0 inches
2	Radius of bark and wood (DBH / 2)	40.0 / 2 = 20.0
3	Bark Thickness	2.0 inches
4	Radius of wood (*step 2 – step 3*)	20.0 – 2.0 = 18.0 inches
5	Core length	16.0 inches
6	Distance short of hitting center: Radius of wood – core length (*step 4 – step 5*)	18.0 – 16.0 = 2.0 inches
7	Number of rings (inner-most inch)	5 rings
8	Product (*step 6 x step 7*)	2 X 5 = 10 rings
9	Ring count (number of rings on core)	200 years
9	**Estimated Tree Age:** Ring count + product (*step 9* + *step 8*)	200 + 10 = 210 years

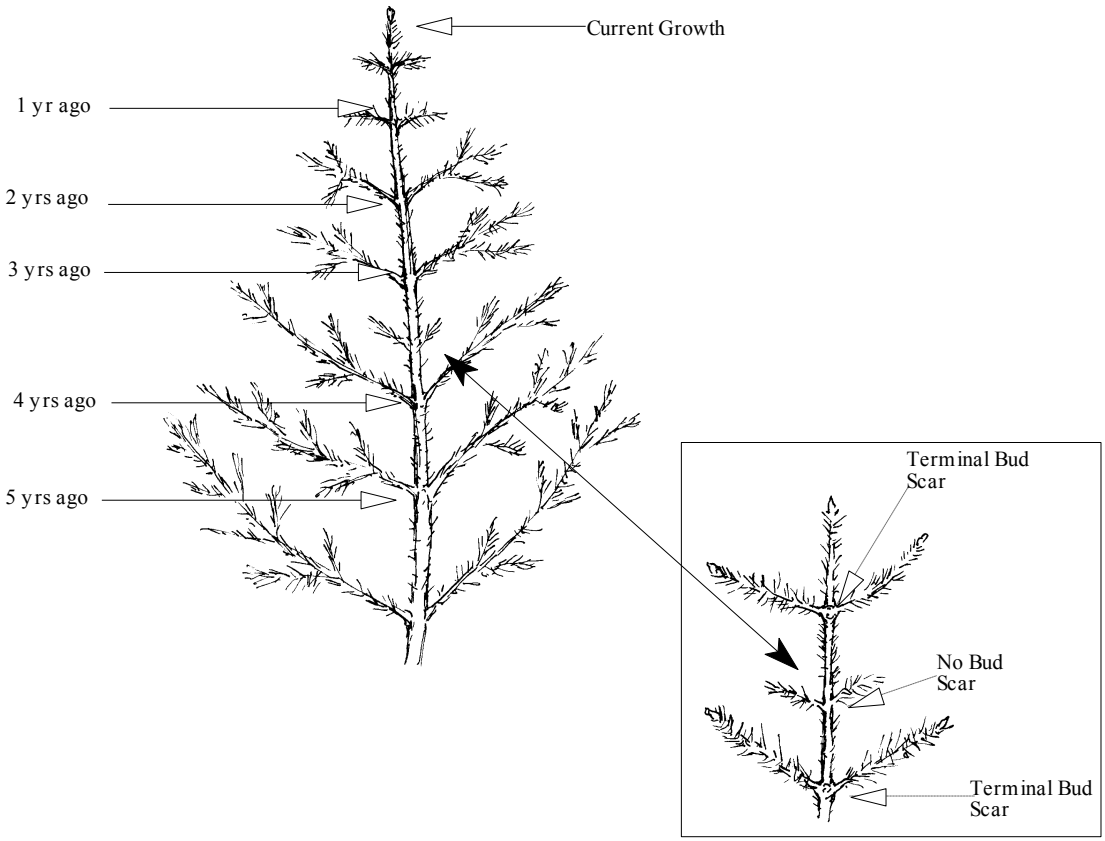
B. Age Measurements for Trees < 3.0-inches DBH

For sample trees less than 3.0-inches DBH, total tree age may be determined by one of the following methods: (1) counting branch whorls that represent annual height increments, (2) severing the tree at the root collar and counting annual rings, or (3) taking an increment boring at the root collar.

1. Counting Branch Whorls

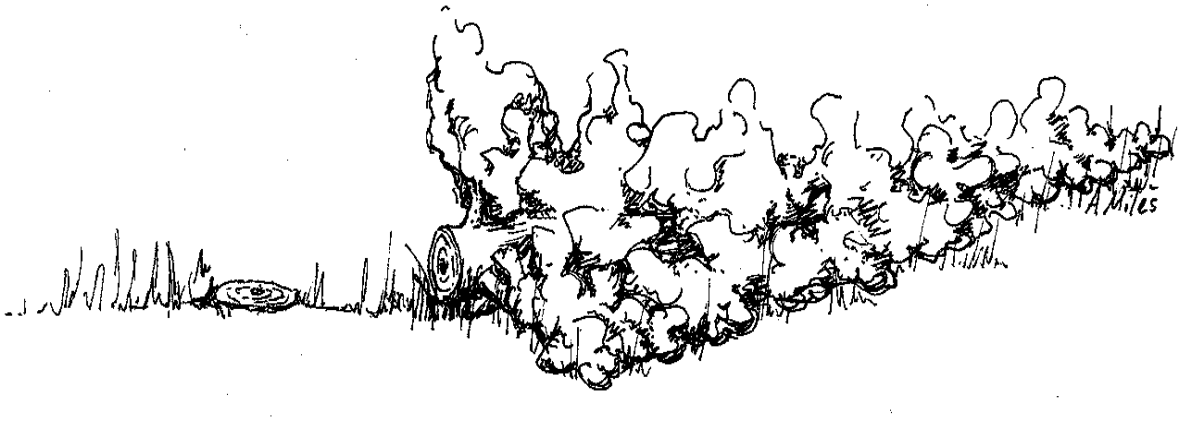
In general, the presence of budscale scars guarantees that the branch whorl represents an annual growth increment. However, as a tree ages, budscale scars become masked by bark development. Be cautious of false branch whorls; these whorls will never have budscale scars at the node, and they sometimes have shorter branches. The total age is recorded in Tree Age.

Note: Western redcedar does not have budscale scars and false whorls are common. Therefore, counting branch whorls is never appropriate for cedar.



1. Cutting Tree at Root Collar to Count Annual Rings

Sample trees can be severed at the root collar in order to count annual rings. The root collar is the transition zone between the stem and the root, and may be recognized by the presence of a slight swelling. The counted age is recorded in Tree Age.



2. Increment Boring at Root Collar

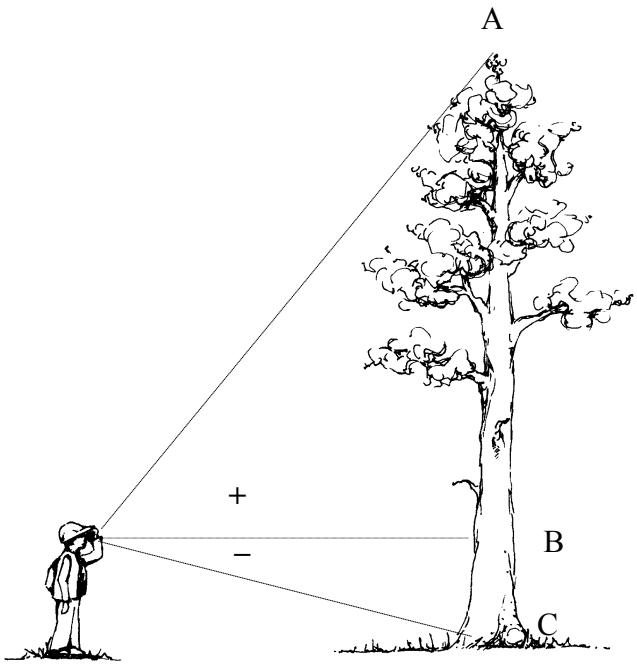
Sample trees can be bored at the root collar to determine age. The same procedures for boring trees at breast height (see above) are used for boring trees at root collar. The counted age is recorded in Tree Age.

Appendix P: Measuring Height

Refer to section A for procedures on measuring total tree height. Section B describes height procedures for leaning trees. Section C describes height procedures for trees with forked, broken, or missing tops.

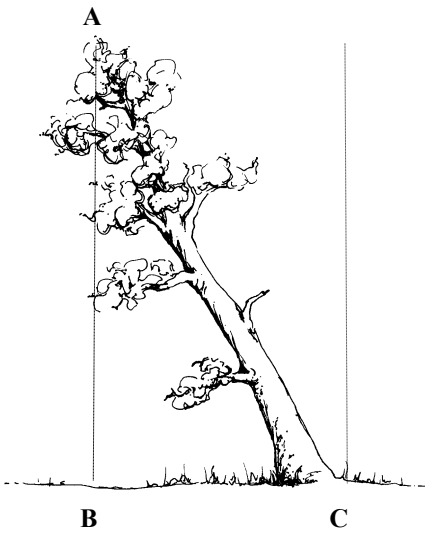
A. Total Tree Height

To determine total tree height, measure from the base of the tree on the high ground side to the tip of the tree leader. Measure height from a point uphill or on the same contour line as the tree. Record total tree height to the nearest foot.



B. Height for Leaning Trees

Trees leaning 25% (about 15°) or more from vertical require the following special height measuring technique.



Procedure: Locate point on ground directly under tip of leaning tree. Measure height **A B**. Measure horizontal distance **B C**. Determine actual tree height (**A C**) using either the Pythagorean theory for right triangles where:

Tree Height = $\sqrt{AB^2 + BC^2}$

Example:

Measured height (AB) = 120'
Horizontal distance (BC) = 40'

Corrected tree height = $\sqrt{120^2 + 40^2}$ = 126.49

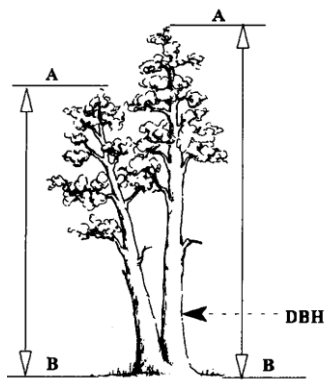
Actual tree height (**A C** in above diagram) may also be obtained using the following table:

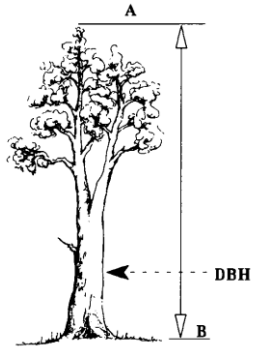
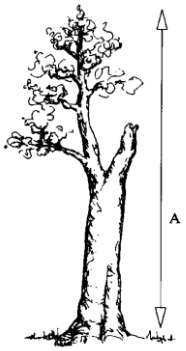
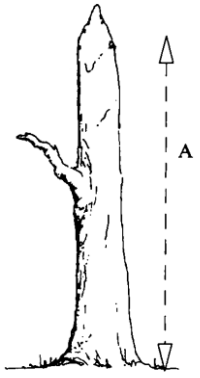
Actual Tree Height (feet)																		
MS HT	**Horizontal Distance** - tip to center of bole at ground (**B C**)																	
	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	81	85	90
40	40	41	43	45														
50	50	51	52	54	56													
60	60	61	62	63	65	67												
70		71	72	73	74	76	78											
80		81	81	82	84	86	87	89										
90		91	91	92	94	95	97	98	101									
100		101	101	102	103	104	106	108	110	112								
110			111	112	113	114	116	117	119	121	123							
120			121	122	123	124	125	126	128	130	132	134						
130			131	131	132	133	135	136	138	139	141	143	145					
140			141	141	142	143	144	146	147	149	150	152	154	157				
150			151	151	152	153	154	155	157	158	160	162	164	166	168			
160			161	161	162	163	164	165	166	168	169	171	173	175	177	179		
170			171	171	172	173	174	175	176	177	179	180	182	184	186	188	190	
180			181	181	182	183	183	184	176	187	188	190	191	193	195	197	199	201
190				191	192	192	193	194	195	196	198	200	201	203	204	206	208	210
200				201	202	202	203	204	205	206	208	209	211	212	214	215	217	219

MS HT = (**A B**) Measured Height

C. Height for Trees with Forked, Broken, or Missing Tops

<table>
<tr>
<td>Forked Trees
If tree forks below DBH, treat as two trees and measure height of each stem from base of tree to tip of tree.

If the fork crotch occurs at or above 4.5 feet on high ground side, the tree is treated as a single tree. Measure height of the tallest fork.</td>
<td> 


</td>
</tr>
<tr>
<td>Forked Tree with a Broken Top
Measure height of the tallest fork and record in the "Total Height" field. Record a tree damage of “broken top.”</td>
<td> 
</td>
</tr>
<tr>
<td>Trees with a Missing Top
Measure height of stub and record in the "Total Height" field. Record a tree damage of “missing top.” If the tree is forked, measure the height of the stub of the dominant fork.</td>
<td> 
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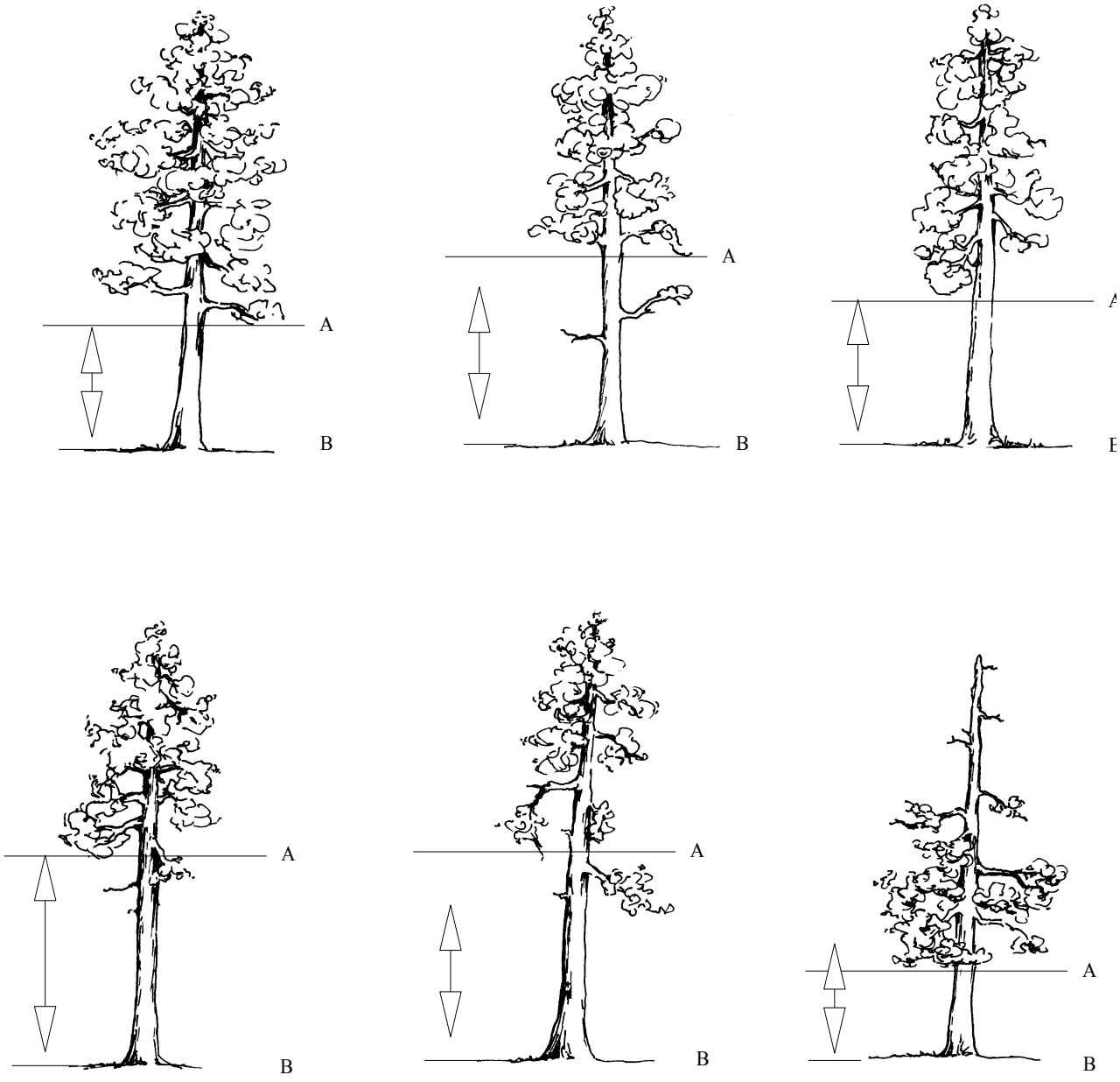
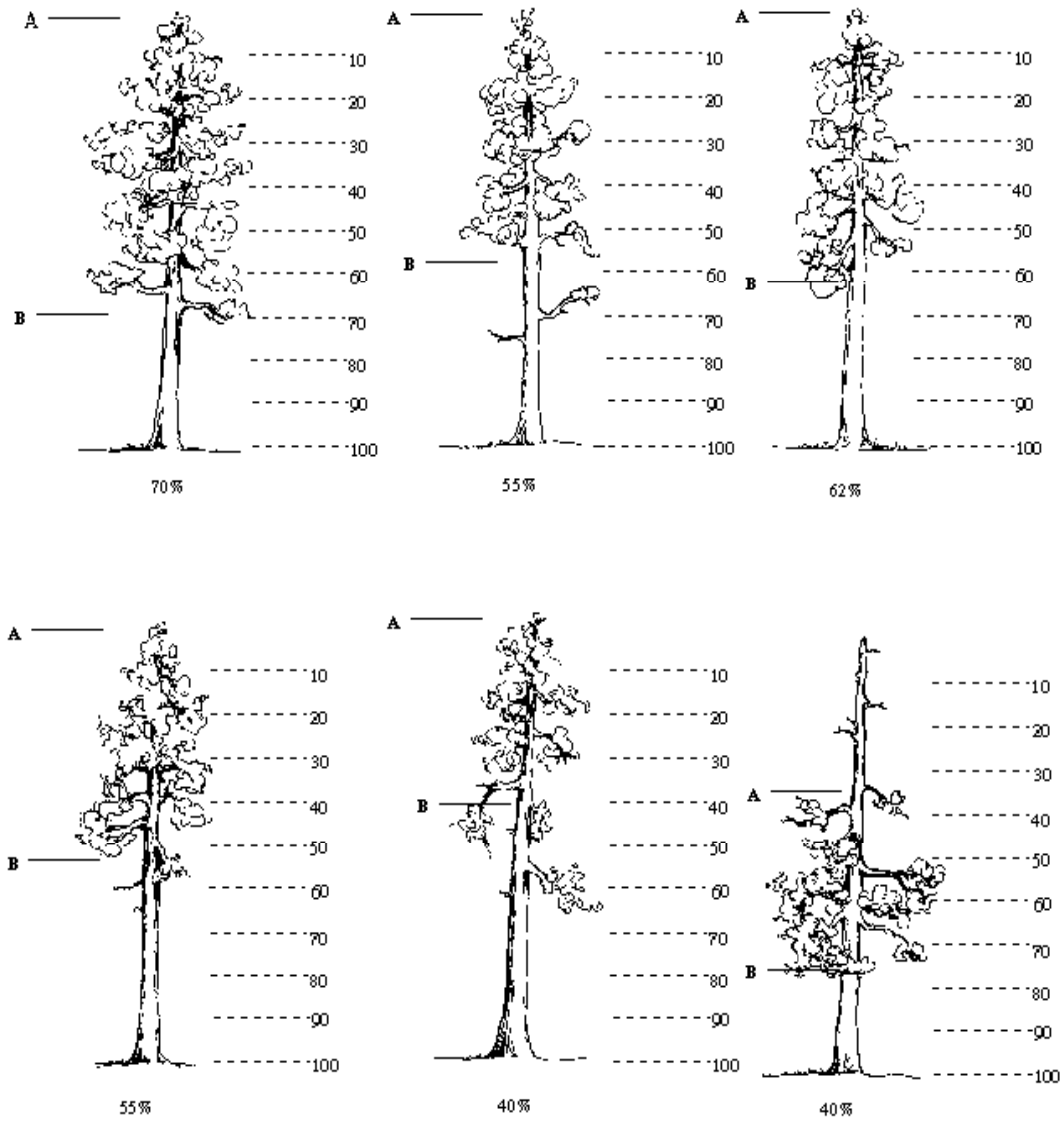
Appendix Q: Measuring Crowns

Height to Live Crown:



Measure the height from the base of the tree on the uphill side (**B**) to the base (**A**) of the live crown. Base of the live crown is the lowest branch whorl with live branches in at least two quadrants exclusive of epicormic branching and of whorls not continuous with the main crown.

Crown Ratio:



Crown ratio is the portion of the tree bole supporting live, healthy foliage and is expressed as a percent of the actual tree height. The distance between **A** and **B** is the existing crown length.

Appendix R: Damage Categories, Agents, Severity Ratings, and Tree Parts

Damage Categories:

Damage Categories	
Code	**Description**
10	General Insects
11	Bark Beetles
12	Defoliators
13	Chewing Insects
14	Sucking Insects
15	Boring Insects
16	Seed / Cone / Flower / Fruit Insects
17	Gallmaker Insects
18	Insect Predators
19	General Diseases
20	Biotic Damage
21	Root / Butt Diseases
22	Stem Decays / Cankers
23	Parasitic / Epiphytic Plants
24	Decline Complexes / Dieback / Wilts
25	Foliage Diseases
26	Stem Rusts
27	Broom Rusts
30	Fire
41	Wild Animals
42	Domestic Animals
50	Abiotic Damage
60	Competition
70	Human Activities
71	Harvest
80	Multi-damage (insect/disease)
90	Unknown
99	Physical Effects

Damage Categories, Agents, and Severity Ratings:

Damage Categories, Agents, and Severity Ratings			
Category 10: General Insects			
SEVERITY RATING			
1	**Minor –** tree has reduced growth rate, or some defect associated with product yield.		
2	**Severe –** tree is expected to die within 10 years, or will not yield merchantable sawlog product.		
Category	**Agent**	**Common Name**	**Scientific Name**
10	**000**	**General Insects**	
10	001	Thrips	
10	007	Clerid beetle	*Cleridae*
10	009	Green Rose Chafer	*Dichelonyx backi*
10	017	Bagworm moth	*Psychidae*
10	019	Scarab	*Scarabaeidae*
10	021		*Steremnius carinatus*
10	023	Wood wasps	*Siricidae spp.*
Category 11: Bark Beetles			
SEVERITY RATING			
1	**Unsuccessful bole attack** – pitchout and beetle brood absent; pitchouts are recognized by clear or cream colored pitch tubes (globules) on pines and streams of pitch on true firs; no boring dust is present.		
2	**Strip attacks –** galleries and brood present; presence of boring dust and/or reddish-brown colored pitch tubes or streams occurring on less than ¾ of the bole circumference.		
3	**Successful bole attack –** galleries and brood present; boring dust and/or reddish-brown pitch exudations are found on greater than ¾ of the bole circumference.		
4	**Topkill** – the upper portion of the crown fading or dead.		
5	**Successful attack last year**		
6	**Older dead**		
Category	**Agent**	**Common Name**	**Scientific Name**
11	**000**	**Bark Beetles**	
11	001	Roundheaded pine beetle	*Dendroctonus adjunctus*
11	002	Western pine beetle	*Dendroctonus brevicomis*

Damage Categories, Agents, and Severity Ratings			
11	005	Lodgepole pine beetle	*Dendroctonus murrayanae*
11	006	Mountain pine beetle	*Dendroctonus ponderosae*
11	007	Douglas-fir beetle	*Dendroctonus pseudotsugae*
11	009	Spruce beetle	*Dendroctonus rufipennis*
11	012	Red turpentine beetle	*Dendroctonus valens*
11	013		*Dryocoetes affaber*
11	015	Western balsam bark beetle	*Dryocoetes confusus*
11	016		*Dryocoetes sechelti*
11	017	Ash bark beetles	*Hylesinus spp.*
11	018	Native elm bark beetle	*Hylurgopinus rufipes*
11	021	Sixspined ips	*Ips calligraphus*
11	022	Emarginate ips	*Ips emarginatus*
11	024		*Ips latidens*
11	026	Monterey pine ips	*Ips mexicanus*
11	028	Northern spruce engraver beetle	*Ips perturbatus*
11	029	Pine engraver	*Ips pini*
11	030	Ips engraver beetles	*Ips spp.*
11	031		*Ips tridens*
11	032	Western ash bark beetle	*Leperisinus californicus*
11	034		*Orthotomicus caelatus*
11	035	Cedar bark beetles	*Phleosinus spp.*
11	036	Western cedar bark beetle	*Phloeosinus punctatus*
11	037	Tip beetles	*Pityogenes spp.*
11	038	Douglas-fir twig beetle	*Pityophthorus pseudotsugae*
11	039	Twig beetles	*Pityophthorus spp.*
11	040	Foureyed spruce beetle	*Polygraphus rufipennis*
11	041	Fir root bark beetle	*Pseudohylesinum granulatus*
11	042		*Pseudohylesinus dispar*
11	043	Douglas-fir pole beetle	*Pseudohylesinus nebulosus*
11	044	Silver fir beetle	*Pseudohylesinus sericeus*
11	045	Small European elm bark beetle	*Scolytus multistriatus*
11	046	Spruce engraver	*Scolytus piceae*
11	048	True fir bark beetles	*Scolytus spp.*
11	049	Douglas-fir engraver	*Scolytus unispinosus*
11	050	Fir engraver	*Scolytus ventralis*
11	053	Four-eyed bark beetle	*Polygraphus spp.*
11	054	Hemlock beetle	*Pseudohylesinus tsugae*
Category 12: Defoliators			

Damage Categories, Agents, and Severity Ratings		
SEVERITY RATING		
1	**Light Defoliation** (1 – 25%)	No topkill
2	**Light Defoliation** (1 – 25%)	Topkill ≤ 10 percent
3	**Light Defoliation** (1 – 25%)	Topkill > 10 percent
4	**Moderate Defoliation** (26 – 75%)	No topkill
5	**Moderate Defoliation** (26 – 75%)	Topkill ≤ 10 percent
6	**Moderate Defoliation** (26 – 75%)	Topkill > 10 percent
7	**Heavy Defoliation** (76 – 100%)	No topkill
8	**Heavy Defoliation** (76 – 100%)	Topkill ≤ 10 percent
9	**Heavy Defoliation** (76 – 100%)	Topkill > 10 percent

Category	Agent	Common Name	Scientific Name
12	**000**	**Defoliators**	
12	001	Casebearer	
12	003	Looper	
12	005	Sawfly	
12	007	Larger elm leaf beetle	*Monocesta coryli*
12	008	Spanworm	
12	011	Western blackheaded budworm	*Acleris gloverana*
12	013	Whitefly	*Aleyrodoidae*
12	014	Fall cankerworm	*Alsophila pometaria*
12	015	Alder flea beetle	*Altica ambiens*
12	016	Mountain mahogany looper	*Anacamptodes clivinaria profanata*
12	018	Oak worms	*Anisota spp.*
12	020	Western larch sawfly	*Anoplonyx occidens*
12	021	Fruit tree leafroller	*Archips argyrospila*
12	022	Uglynest caterpillar	*Archips cerasivorana*
12	023	Boxelder defoliator	*Archips negundanus*
12	030	Pear sawfly	*Caliroa cerasi*
12	033	Boxelder leafroller	*Caloptilia negundella*
12	035	Spruce webspinning sawfly	*Cephalcia fascipennis*
12	036	Two-year budworm	*Choristoneura biennis*
12	037	Large aspen tortrix	*Choristoneura conflictana*
12	039	Sugar pine tortrix	*Choristoneura lambertiana*
12	040	Western spruce budworm	*Choristoneura occidentalis*
12	043	Aspen leaf beetle	*Chrysomela crotchi*
12	044	Cottonwood leaf beetle	*Chrysomela scripta*
12	045	Leafhopper	*Cicadellidae*
12	046	Poplar tentmaker	*Clostera inclusa*

Damage Categories, Agents, and Severity Ratings			
12	047	Larch casebearer	*Coleophora laricella*
12	049	Lodgepole needleminer	*Coleotechnites milleri*
12	050	Ponderosa needleminer	*Coleotechnites spp.*
12	051	Black Hills pandora moth	*Coloradia doris*
12	052	Pandora moth	*Coloradia pandora*
12	053	Sycamore lace bug	*Corythucha ciliata*
12	054	Lace bugs	*Corythucha spp.*
12	055	Oak leaftier	*Croesia semipurpurana*
12	058	Yellownecked caterpillar	*Datana ministra*
12	059	Walkingstick	*Diapheromera femorata*
12	060	Spruce coneworm	*Dioryctria reniculelloides*
12	061	Introduced pine sawfly	*Diprion similis*
12	066	White fir needleminer	*Epinotia meritana*
12	071	Elm leafminer	*Fenusa ulmi*
12	072	Geometrid moth	*Geometridae*
12	073	Leafblotch miner	*Gracillariidae*
12	074	Spotted tussock moth	*Halisidota maculata*
12	077	Brown day moth	*Hemileuca eglanterina*
12	082	Fall webworm	*Hyphantria cunea*
12	083	Hemlock looper	*Lambdina fiscellaria*
12	085	Tent caterpillar moth	*Lasiocampidae*
12	086	Satin moth	*Leucoma salicis*
12	087	Willow leafblotch miner	*Lithocolletis spp.*
12	088	Aspen blotchminer	*Lithocolletis tremuloidiella*
12	089	Gypsy moth	*Lymantria dispar*
12	090	Cottonwood leafminers	*Lyonetia spp.*
12	094	Western tent caterpillar	*Malacosoma californicum*
12	096	Forest tent caterpillar	*Malacosoma disstria*
12	098	Leafcutting bees	*Megachilidae*
12	099	Blister beetle	*Meloidae*
12	102	Willow sawfly	*Nematus spp.*
12	104	Lodgepole sawfly	*Neodiprion burkei*
12	106	Pine infesting sawflies	*Neodiprion fulviceps*
12	109	Ponderosa pine sawfly	*Neodiprion mundus*
12	115	Hemlock sawfly	*Neodiprion tsugae*
12	116	Pine butterfly	*Neophasia menapia*
12	117	False hemlock looper	*Nepytia canosaria*
12	118	California tortoiseshell	*Nymphalis californica*
12	120	Bruce spanworm	*Operophtera bruceata*
12	121	Rusty tussock moth	*Orgyia antiqua*
12	122	Whitemarked tussock moth	*Orgyia leucostigma*
12	123	Douglas-fir tussock moth	*Orgyia pseudotsugata*

Damage Categories, Agents, and Severity Ratings			
12	124	Western tussock moth	*Orgyia vetusta*
12	125	Spring cankerworm	*Paleacrita vernata*
12	135	Aspen leafminer	*Phyllocnistis populiella*
12	136	Yellowheaded spruce sawfly	*Pikonema alaskensis*
12	137	Tenlined June beetle	*Polyphylla decemlineata*
12	138	Japanese beetle	*Popillia japonica*
12	139	Larch sawfly	*Pristiphora erichsonii*
12	140	Mountain-ash sawfly	*Pristiphora geniculata*
12	141	Elm leaf beetle	*Pyrrhalta luteola*
12	142	Spearmarked black moth	*Rheumaptera hastata*
12	143	Giant silkworm moth	*Saturniidae*
12	144	Redhumped caterpillar	*Schizura concinna*
12	146	Larch looper	*Semiothisa sexmaculata*
12	150	Spruce needleminer (west)	*Taniva albolineana*
12	154		*Thyridopteryx ephemeraeformis*
12	155	Leafroller/seed moth	*Tortricidae spp.*
12	156	Willow defoliation	*Tortricidae*
12	157	Euonymus caterpillar	*Yponomeuta spp.*
12	159	Larch bud moth	*Zeiraphera improbana*
12	160	Pine needle sheathminer	*Zelleria haimbachi*
12	162	Cottonwood leaf beetle	*Chrysomela spp.*
12	164	Saddle-backed looper	*Ectropis crepuscularia*
12	165	Leaf roller	*Epinotia solandriana*
12	168	Green-striped looper	*Melanoplophia imitata*
12	174	Pine looper	*Phaeoura mexicanaria*
12	176		*Zadiprion townsendi*
12	177	Douglas-fir budmoth	*Zeiraphera hesperiana*
12	179	Phantom hemlock looper	*Nepytia phantasmaria*
12	180	Tent caterpillar	*Malacossoma spp.*
12	188	Elm sawfly	*Cimbex americana*
12	189	June Beetles / Leaf Chafers	*Phyllophaga spp.*

Category 13: Chewing Insects

SEVERITY RATING

1	**Minor –** tree has reduced growth rate, or some defect associated with product yield.
2	**Severe –** tree is expected to die within 10 years, or will not yield merchantable sawlog product.

Category	Agent	Common Name	Scientific Name
13	**000**	**Chewing Insects**	
13	001	Grasshopper	

13	002	Shorthorn grasshoppers	*Acrididae*
13	005	Clearwinged grasshopper	*Camnula pellucida*
13	006	Cicadas	*Cicadidae*
13	007	Eurytomids	*Eurytoma spp.*
13	008	Cutworms	*Euxoa excellens*
13	010	Pales weevil	*Hylobius pales*
13	012	Periodical cicada	*Magicicada septendecim*
13	013	Migratory grasshopper	*Melanoplus sanguinipes*
13	014	Valley grasshopper	*Oedaleonotus enigma*
13	015	Strawberry root weevil	*Otiorhyhchus ovatus*
13	020	Northern pitch twig moth	*Petrova albicapitana*
13	021	Ponderosa pine tip moth	*Rhyacionia zozana*
13	022	Pine needle weevil	*Scythropus spp.*
13	025		*Thrips madronii*
13	026	Ash plant bug	*Tropidosteptes amoenus*
13	028	Pitch-eating weevil	*Pachylobius picivorus*

Category 14: Sucking Insects

SEVERITY RATING

1	**Minor –** tree has reduced growth rate, or some defect associated with product yield.
2	**Severe –** tree is expected to die within 10 years, or will not yield merchantable sawlog product.

Category	Agent	Common Name	Scientific Name
14	**000**	**Sucking Insects**	
14	001	Scale insect	
14	002	Western larch wooly aphid	*Adelges oregonensis*
14	003	Balsam woolly adelgid	*Adelges piceae*
14	004	Hemlock woolly adelgid	*Adelges tsugae*
14	006	Aphid	*Aphididae*
14	008	Western pine spittlebug	*Aphrophora permutata*
14	010	Spittlebug	*Cercopidae*
14	012	Pine needle scale	*Chionaspis pinifoliae*
14	014	Giant conifer aphids	*Cinara spp.*
14	017	Spruce aphid	*Elatobium abietinum*
14	018	Wooly apple aphid	*Erisoma lanigerum*
14	022	Pine thrips	*Gnophothrips spp.*
14	026	Lecanium scale	*Lecanium spp.*
14	028	Oystershell scale	*Lepidosaphes ulmi*
14	029	Pinyon needle scale	*Matsucoccus acalyptus*
14	030	Ponderosa pine twig scale	*Matsucoccus bisetosus*

14	035	Treehoopers	*Membracidae*
14	039	Black pineleaf scale	*Nuculaspis californica*
14	040	Spruce spider mite	*Oligonychus ununquis*
14	043	Maple aphids	*Periphyllus spp.*
14	044	Spruce bud scale	*Physokermes piceae*
14	046	Pine leaf adelgid	*Pineus pinifoliae*
14	047	White pine adelgid	*Pineus spp.*
14	048	Pine bark adelgid	*Pineus strobi*
14	049	Root aphid	*Prociphilus americanus*
14	050	Mealybug	*Pseudococcidae*
14	051	Cottony maple scale	*Pulvinaria innumerabilis*
14	052	Fir mealybug	*Puto cupressi*
14	061	Pine tortoise scale	*Toumeyella parvicornis*
14	063	Birch aphid	*Euceraphis betulae*
14	068	European elm scale	*Gossyparia spuria*

Category 15: Boring Insects

SEVERITY RATING

1	**Minor –** tree has reduced growth rate, or some defect associated with product yield.
2	**Severe –** tree is expected to die within 10 years, or will not yield merchantable sawlog product.

Category	Agent	Common Name	Scientific Name
15	**000**	**Boring Insects**	
15	001	Shoot borer	
15	002	Termite	
15	003	Ponderosa pine bark borer	*Acanthocinus princeps*
15	004	Bronze birch borer	*Agrilus anxius*
15	006	Bronze poplar borer	*Argilus liragus*
15	007	Carpenter bees	*Apidae*
15	008	Flatheaded borer	*Buprestidae*
15	009	Golden buprestid	*Buprestis aurulenta*
15	010	Carpenter ants	*Camponotus spp.*
15	011	Gouty pitch midge	*Cecidomyia piniinopis*
15	012	Shootboring sawflies	*Cephidae*
15	013	Roundheaded borer	*Cerambycidae*
15	014	Flatheaded apple tree borer	*Chrysobothris femorata*
15	017	Pitted ambrosia beetle	*Corthylus punctatissimus*
15	018	Carpenterworm moths	*Cossidae*
15	019	Poplar and willow borer	*Cryptorphynchus lapathi*
15	020	Pine reproduction weevil	*Cylindrocopturus eatoni*

Damage Categories, Agents, and Severity Ratings			
15	021	Douglas-fir twig weevil	*Cylindrocopturus furnissi*
15	027	Ponderous borer	*Ergates spiculatus*
15	029	Western pine shoot borer	*Eucosma sonomana*
15	030	Eucosma species	*Eucosma spp.*
15	034	Warren's collar weevil	*Hylobius warreni*
15	035	Powderpost beetle	*Lyctidae*
15	036	Tarnished plant bug	*Lygus lineolaris*
15	037		*Magdalis spp.*
15	038	White pine bark miner	*Marmara fasciella*
15	039	Locust borer	*Megacyllene robiniae*
15	040	California flathead borer	*Melanophila californica*
15	041	Flatheaded fir borer	*Melanophila drummondi*
15	042	Whitespotted sawyer	*Monochamus scutellatus*
15	043	Redheaded ash borer	*Neoclytus acuminutus*
15	045	Oberea shoot borers	*Oberea spp.*
15	048		*Pissodes dubius*
15	050	White pine weevil	*Pissodes strobi*
15	051	Lodgepole terminal weevil	*Pissodes terminalis*
15	052	Ambrosia beetles	*Platypus spp.*
15	053	Cottonwood borer	*Plectrodera scalator*
15	056	Ash borer	*Podesesia syringae fraxini*
15	057	Lilac borer	*Podosesia syringae*
15	058	Carpenterworm	*Prionoxystus robiniae*
15	059	Maple shoot borers	*Proterteras spp.*
15	060	Western subterranean termite	*Reticulitermes hesperus*
15	063	European pine shoot moth	*Rhyacionia buoliana*
15	064	Western pine tip moth	*Rhyacionia bushnelli*
15	065	Nantucket pine tip moth	*Rhyacionia frustrana*
15	066	Lodgepole pine tip moth	*Rhyacionia montana*
15	067	Southwestern pine tip moth	*Rhyacionia neomexicana*
15	070	Saperda shoot borer	*Saperda spp.*
15	071	Clearwing moths	*Sesiidae*
15	073	Roundheaded fir borer	*Tetropium abietis*
15	074	Western larch borer	*Tetropium velutinum*
15	075	Western cedar borer	*Trachykele blondeli*
15	076	Douglas-fir pitch moth	*Vespamima novaroensis*
15	077	Sequoia pitch moth	*Vespamima sequoia*
15	083	Ottonwood twig borer	*Gypsonama haimbachiana*
15	085	Banded ash borer	*Neoclytus capraea*

Damage Categories, Agents, and Severity Ratings

Category 16: Seed / Cone / Flower / Fruit Insects

SEVERITY RATING

1	**Minor –** tree has reduced growth rate, or some defect associated with product yield.
2	**Severe –** tree is expected to die within 10 years, or will not yield merchantable sawlog product.

Category	Agent	Common Name	Scientific Name
16	**000**	**Seed / Cone / Flower / Fruit Insects**	
16	001	Douglas-fir cone moth	*Barbara colfaxiana*
16	002	Lodgepole cone beetle	*Conophthorus contortae*
16	003	Limber pine cone beetle	*Conophthorus flexilis*
16	004	Mountain pine cone beetle	*Conophthorus monticolae*
16	005	Ponderosa pine cone beetle	*Conophthorus ponderosae*
16	010	Douglas-fir cone midge	*Contarinia oregonensis*
16	011	Cone scale midge	*Contarinia washingtonensis*
16	012	Pecan	*Curculio spp.*
16	015	Fir coneworm	*Dioryctria abietivorella*
16	017	Pine coneworm	*Dioryctria auranticella*
16	019	Ponderosa twig moth	*Dioryctria ponderosae*
16	020		*Dioryctria pseudotsugella*
16	021	Dioryctria moths	*Dioryctria spp.*
16	022	Lodgepole cone moth	*Eucosma rescissoriana*
16	023	Seed chalcid	*Eurytomidae*
16	025	Cone maggot	*Hylemya anthracina*
16	027	Ponderosa pine seed worm/moth	*Laspeyresia piperana*
16	028	Spruce seed moth	*Laspeyresia youngana*
16	029	Boxelder bug	*Leptocoris trivittatus*
16	031	Western conifer seed bug	*Leptoglossus occidentalis*
16	033		*Magastigmus lasiocarpae*
16	034	Spruce seed chalcid	*Magastigmus piceae*
16	035	Ponderosa pine seed chalcid	*Megastigmus albifrons*
16	036	Fir seed chalcid	*Megastigmus pinus*
16	037	Douglas-fir seed chalcid	*Megastigmus spermotrophs*
16	040	Roundheaded cone borer	*Paratimia conicola*
16	042	Coneworm	*Phycitidae*
16	043	Harvester ants	*Pogonomyrmex spp.*
16	048	Coneworm	*Hylemia spp.*
16	049	Prairie tent caterpillar	*Malacosoma lutescens*

Category 17: Gallmaker Insects

SEVERITY RATING

1	**Minor –** tree has reduced growth rate, or some defect associated with product yield.
2	**Severe –** tree is expected to die within 10 years, or will not yield merchantable sawlog product.

Category	Agent	Common Name	Scientific Name
17	**000**	**Gallmaker Insects**	
17	003	Cooley spruce gall adelgid	*Adelges cooleyi*
17	006	Gall midge	*Cecidomyiidae*
17	007	Douglas-fir needle gall midge	*Contarinia pseudotsugae*
17	008	Gall mite	*Eriophyidae*
17	009	Spruce gall midge	*Mayetiola piceae*
17	013	Gall aphid	*Phylloxeridae*
17	014	Alder gall mite	*Phytoptus laevis*
17	015	Psyllid	*Psyllidae*
17	018	Gouty pitch midge	*Cedidomyia piniinopsis*
17	019	Spider mites	*Oligonychus spp.*

Category 18: Insect Predators

SEVERITY RATING

1	**Minor –** tree has reduced growth rate, or some defect associated with product yield.
2	**Severe –** tree is expected to die within 10 years, or will not yield merchantable sawlog product.

Category	Agent	Common Name	Scientific Name
18	**000**	**Insect Predators**	
18	001	Lacewing	
18	002	Blackbellied clerid	*Enoclerus lecontei*
18	003	Redbellied clerid	*Enoclerus sphegeus*
18	005	Western yellowjacket	*Vespula pennsylvanica*

Category 19: General Diseases

SEVERITY RATING

1	**Minor –** tree has reduced growth rate, or some defect associated with product yield.
2	**Severe –** tree is expected to die within 10 years, or will not yield merchantable sawlog product.

Damage Categories, Agents, and Severity Ratings			
Category	**Agent**	**Common Name**	**Scientific Name**
19	**000**	**General Diseases**	

Category 20: Biotic Damage

SEVERITY RATING	
1	**Minor –** tree has reduced growth rate, or some defect associated with product yield.
2	**Severe –** tree is expected to die within 10 years, or will not yield merchantable sawlog product.

Category	**Agent**	**Common Name**	**Scientific Name**
20	**000**	**Biotic Damage**	
20	001	Damping off	
20	002	Gray mold	*Botrytis cinerea*

Category 21: Root / Butt Diseases

SEVERITY RATING		
1	**Tree Code**	Tree within 30 feet of other tree with deteriorating crown, other tree with diagnostic symptoms or signs, or other tree killed by root disease
2	**Tree Code**	Pathogen (sign) or diagnostic symptom detected - no crown deterioration
3	**Tree Code**	Crown deterioration detected - no diagnostic symptoms or signs
4	**Tree Code**	Both crown deterioration and diagnostic signs symptoms detected
G0	**Setting Code**	No evidence of RDS within 50 feet of plot
G1	**Setting Code**	RDS present within 50 feet of plot, not on plot
G2	**Setting Code**	Minor evidence of RDS on plot
G3	**Setting Code**	RDS present; canopy reduction < 20%
G4	**Setting Code**	RDS present; canopy reduction 20% to < 30%
G5	**Setting Code**	RDS present; canopy reduction 30% to < 50%
G6	**Setting Code**	RDS present; canopy reduction 50% to < 75%, most ground area infested
G7	**Setting Code**	RDS present; canopy reduction ≥ 75%
G8	**Setting Code**	Entire area infested with RDS; one or very few susceptible overstory trees
G9	**Setting Code**	Entire area infested with RDS; no susceptible overstory trees present

Category	**Agent**	**Common Name**	**Scientific Name**
21	**000**	**Root / Butt Diseases**	
21	001	Armillaria root disease	*Armillaria spp.*

21	004	Brown crumbly rot	*Fomitopsis pinicola*
21	007	White mottled rot	*Ganoderma applanatum*
21	010	Annosus root disease	*Heterobasidion annosum*
21	012	Tomentosus root disease	*Inonotus tomentosus*
21	014	Black stain root disease	*Ophiostoma wageneri*
21	015	Schweinitzii butt rot	*Phaeolus schweinitzii*
21	017	Laminated root rot	*Phellinus weirii*
21	026	Yellow pitted rot	*Hericium abietis*

Category 22: Stem Decays / Cankers

SEVERITY RATING

0	0-4% rotten
1	5-15% rotten
2	16-25% rotten
3	26-35% rotten
4	36-45% rotten
5	46-55% rotten
6	56-65% rotten
7	66-75% rotten
8	76-85% rotten
9	86-100% rotten

Severity codes for Stem Decay and Cankers describe the amount of sawlog volume loss, in terms of cubic feet. For trees smaller than merchantable size, the severity codes are used to record the amount of rotten wood in order to indirectly estimate the sound wood volume yield suitable for pulp or firewood. The percent rotten estimate for these "unmerchantable" trees should thus be made in terms of cubic foot measure. The extent of decay in one-log or smaller trees is estimated directly in cubic foot terms.

Category	Agent	Common Name	Scientific Name
22	**000**	**Stem Decays / Cankers**	
22	001	Heart rot	
22	002	Stem rot	
22	003	Sap rot	
22	006	Black knot of cherry	*Apiosporina morbosa*
22	007	Atropellis canker	*Atropellis piniphila*
22	012	Black canker of aspen	*Ceratocystis fimbriata*
22	024	Gray-brown saprot	*Cryptoporus volvatus*
22	025	Cryptosphaeria canker of aspen	*Cryptosphaeria populina*
22	026	Cytospora canker of fir	*Cytospora abietis*
22	027	Western red rot	*Dichomitus squalens*
22	028	Rust-red stringy rot	*Echinodontium tinctorium*
22	029	Sooty-bark canker	*Encoelia pruinosa*
22	035	Amelanchier rust	*Gymnosporangium harknessianum*
22	036	Cedar apple rust	*Gymnosporangium juniperi-virginianae*
22	038	Hypoxylon canker of aspen	*Hypoxylon mammatum*

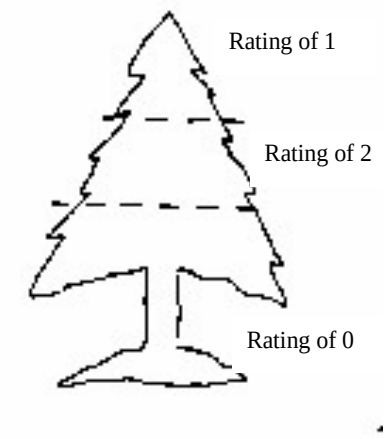
Damage Categories, Agents, and Severity Ratings			
22	040	Sterile conk trunk rot of birch	*Inonotus obliquus*
22	047	Red ring rot	*Phellinus pini*
22	048	Aspen trunk rot	*Phellinus tremulae*
22	051	Phomopsis canker	*Phomopsis spp.*
22	057	Cytospora canker of aspen	*Cytospora chrysosperma*
22	059	Red belt fungus	*Fomitopsis pinicola*
22	062	Brown heartrot	*Fomitopsis Officinalis*
22	063		*Coniophora puteana*
22	064	Tinder fungus	*Fomes fomentarius*
22	065	Purple conk	*Hirschioporus abietinus*
22	066		*Leptographium wagnerii*
22	067		*Phellinus hartigii*
22	068	False tinder fungus	*Phellinus igniarius*
22	070	Yellow cap fungus	*Pholiota spp.*
22	071	Oyster mushroom	*Pleurotus ostreatus*
22	074	Cedar brown pocket rot	*Poria sericeomollis*
22	075	Lanchnellula canker	*Lachnellula flavoirens*
22	077	Phomopsis blight	*Phomopsis juniperovora*

Category 23: Parasitic / Epiphytic Plants

SEVERITY RATING

1	**Dwarf Mistletoe Rating**	Hawksworth tree DMR rating 1
2	**Dwarf Mistletoe Rating**	Hawksworth tree DMR rating 2
3	**Dwarf Mistletoe Rating**	Hawksworth tree DMR rating 3
4	**Dwarf Mistletoe Rating**	Hawksworth tree DMR rating 4
5	**Dwarf Mistletoe Rating**	Hawksworth tree DMR rating 5
6	**Dwarf Mistletoe Rating**	Hawksworth tree DMR rating 6
7	**Vine Damage**	Less than 50% of crown exhibiting vine damage
8	**Vine Damage**	50% or more of crown exhibiting vine damage

Damage Categories, Agents, and Severity Ratings

Instructions: Hawksworth Dwarf Mistletoe Rating (DMR)		Example:
Step 1	Divide live crown into thirds.	
Step 2	Rate each third separately. Each third should be given a rating of 0, 1, or 2 as described below. **0** = No visible infections **1** = Light infection (1/2 or less of the total number of branches in the crown-third are infected). **2** = Heavy infection (more than 1/2 of total number of branches in the crown-third are infected).	
Step 3	Add ratings of thirds to obtain rating for total tree.	The dwarf mistletoe rating for the above tree is **3** (top **1** + middle **2** + bottom **0**).

Category	Agent	Common Name	Scientific Name
23	**000**	**Parasitic / Epiphytic Plants**	
23	001	Mistletoe	
23	003	Vine damage	
23	006	Lodgepole pine dwarf mistletoe	*Arceuthobium americanum*
23	008	Western dwarf mistletoe	*Arceuthobium campylopodum*
23	009	Limber pine dwarf mistletoe	*Arceuthobium cyanocarpum*
23	011	Douglas-fir dwarf mistletoe	*Arceuthobium douglasii*
23	013	Larch dwarf mistletoe	*Arceuthobium laricis*

Category 24: Decline Complexes / Dieback / Wilts

SEVERITY RATING

1	**Minor –** tree has reduced growth rate, or some defect associated with product yield.
2	**Severe –** tree is expected to die within 10 years, or will not yield merchantable sawlog product.

Category	Agent	Common Name	Scientific Name
24	**000**	**Decline Complexes / Dieback / Wilts**	
24	004	Ash decline / yellow	
24	022	Dutch elm disease	*Ceratocystis ulmi*

Damage Categories, Agents, and Severity Ratings

Category 25: Foliage Diseases

SEVERITY RATING

1	**Minor –** tree has reduced growth rate, or some defect associated with product yield.
2	**Severe –** tree is expected to die within 10 years, or will not yield merchantable sawlog product.

Category	Agent	Common Name	Scientific Name
25	**000**	**Foliage Diseases**	
25	001	Blight	
25	002	Broom rust	
25	003	Juniper blights	
25	004	Leaf spots	
25	005	Needlecast	
25	006	Powdery mildew	
25	009	True fir needlecast	
25	013	Large-pored spruce-laborador tea rust	*Chrysomyxa ledicola*
25	014	Ink spot of aspen	*Ciborinia whetzelii*
25	015	Pine needle rust	*Coleosporium spp.*
25	019	Cedar leaf blight	*Didymascella thujina*
25	020	Dogwood anthracnose	*Discula spp.*
25	022	Elytroderma disease	*Elytroderma deformans*
25	023	Fire blight	*Erwinia amylovora*
25	027	Brown felt blight	*Herpotrichia juniperi*
25	028	Larch needle blight	*Hypodermella laricis*
25	031	Spruce needle cast	*Lirula macrospora*
25	032	Fir needle cast	*Lirula spp.*
25	033	White pine needle cast	*Lophodermella arcuata*
25	034	Lophodermella needle cast	*Lophodermella spp.*
25	035	Lophodermium needle cast	*Lophodermium spp.*
25	036	Marssonina blight	*Marssonina populi*
25	037	Melampsora rusts	*Melampsora medusae*
25	039	Larch needle cast	*Meria laricis*
25	040	Dothistroma needle blight	*Mycosphaerella pini*
25	041	Brown felt blight of pines	*Neopeckia coulteri*
25	042	Snow blight	*Phacidum abietis*
25	043	Swiss needle cast	*Phaeocryptopus gaumannii*
25	049	Fir needle rust	*Pucciniastrum spp.*
25	050	Douglas-fir needle cast	*Rhabdocline spp.*
25	052	Rhizophaeria needle cast	*Rhizophaeria spp.*
25	054	Brown spot needle blight	*Scirrhia acicola*

25	056	Septoria leaf spot and canker	*Septoria musiva*
25	058	Diplodia blight	*Sphaeropsis sapinea*
25	061	Shepherd's crook	*Venturia tremulae*
25	062	Dothistroma needle blight	*Dothistroma septospora*
25	064	Broom rust	*Chrysomyxa arctostaphyli*
25	065	Spruce needle rust	*Chrysomyxa weirii*
25	067	Spruce needle cast	*Lophodermium picea*
25	068	Hardwood leaf rusts	*Melampsora spp.*
25	072	Sirococcus shoot blight	*Sirococcus strobilinus*
25	073	Shepherds crook	*Venturia populina*
25	074	Delphinella shoot blight	*Delphinella abietis*

Category 26: Stem Rusts

SEVERITY RATING

1	Branch infections located greater than 2 feet from tree bole
2	Branch infections located between 6 inches and 2 feet from tree bole
3	Bole infections or branch infections located within 6 inches of bole
4	Topkill

Category	Agent	Common Name	Scientific Name
26	**000**	**Stem Rusts**	
26	001	White pine blister rust	*Cronartium ribicola*
26	002	Western gall rust	*Peridermium harknessii*
26	003	Stalactiform blister rust	*Cronartium coleosporioides*
26	004	Comandra blister rust	*Cronartium comandrae*
26	011	Bethuli rust	*Peridermium bethuli*

Category 27: Broom Rusts

SEVERITY RATING

1	**Minor –** tree has reduced growth rate, or some defect associated with product yield.
2	**Severe –** tree is expected to die within 10 years, or will not yield merchantable sawlog product.

Category	Agent	Common Name	Scientific Name
27	**000**	**Broom Rusts**	
27	001	Spruce broom rust	*Chrysomyxa arctostaphyli*
27	003	Juniper broom rust	*Gymnosporangium nidus-avis*
27	004	Fir broom rust	*Melampsorella caryophyllacearum*

Category 30: Fire

SEVERITY RATING	
1	**Minor –** tree has reduced growth rate, or some defect associated with product yield.
2	**Severe –** tree is expected to die within 10 years, or will not yield merchantable sawlog product.

Category	Agent	Name
30	**000**	**Fire**
30	031	Wildfire
30	032	Human caused fire
30	033	Crown fire damage
30	034	Ground fire damage

Category 41: Wild Animals

SEVERITY RATING	
1	**Minor –** tree has reduced growth rate, or some defect associated with product yield.
2	**Severe –** tree is expected to die within 10 years, or will not yield merchantable sawlog product.

Category	Agent	Name
41	**000**	**Wild Animals**
41	001	Bear
41	002	Beaver
41	003	Big game (deer) use if you can identiy to 011, 012, or 013
41	004	Mice or voles
41	005	Pocket gophers
41	006	Porcupines
41	007	Rabbits or hares
41	008	Sapsucker
41	009	Squirrels
41	010	Woodpeckers
41	011	Moose
41	012	Elk
41	013	Deer
41	014	Feral pigs
41	015	Mountain beaver

Category 42: Domestic Animals

Damage Categories, Agents, and Severity Ratings		
SEVERITY RATING		
1	**Minor –** tree has reduced growth rate, or some defect associated with product yield.	
2	**Severe –** tree is expected to die within 10 years, or will not yield merchantable sawlog product.	
Category	**Agent**	**Name**
42	**000**	**Domestic Animals**
42	001	Cattle
42	002	Goats
42	003	Horses
42	004	Sheep
Category 50: Abiotic Damage		
SEVERITY RATING		
1	**Minor –** tree has reduced growth rate, or some defect associated with product yield.	
2	**Severe –** tree is expected to die within 10 years, or will not yield merchantable sawlog product.	
Category	**Agent**	**Name**
50	**000**	**Abiotic Damage**
50	001	Air pollutants
50	002	Chemical
50	003	Drought
50	004	Flooding/high water
50	005	Frost
50	006	Hail
50	007	Heat
50	008	Lightning
50	009	Nutrient imbalances
50	010	Radiation
50	011	Snow/ice
50	013	Wind/tornado
50	014	Winter injury
50	015	Avalanche
50	016	Mud/land slide
50	018	Other geologic event
50	019	Mechanical (non-human caused)

Damage Categories, Agents, and Severity Ratings		
Category 60: Competition		
SEVERITY RATING		
1	**Minor –** tree has reduced growth rate, or some defect associated with product yield.	
2	**Severe –** tree is expected to die within 10 years, or will not yield merchantable sawlog product.	
Category	**Agent**	**Name**
60	**000**	**Competition**
Category 70: Human Activities		
SEVERITY RATING		
1	**Minor –** tree has reduced growth rate, or some defect associated with product yield.	
2	**Severe –** tree is expected to die within 10 years, or will not yield merchantable sawlog product.	
Category	**Agent**	**Name**
70	**000**	**Human Activities**
70	001	Herbicides
70	003	Imbedded objects
70	004	Improper planting technique
70	005	Land clearing
70	006	Land use conversion
70	007	Logging damage
70	008	Mechanical
70	009	Pesticides
70	010	Roads
70	011	Soil compaction
70	012	Suppression
70	013	Vehicle damage
70	014	Road salt
Category 71: Harvest		
SEVERITY RATING		
1	**Minor –** tree has reduced growth rate, or some defect associated with product yield.	
2	**Severe –** tree is expected to die within 10 years, or will not yield merchantable sawlog product.	

Damage Categories, Agents, and Severity Ratings			
Category	**Agent**	**Name**	
71	**000**	**Harvest**	
Category 80: Multi-damage (insect/disease)			
SEVERITY RATING			
1	**Minor –** tree has some reduced growth rate, or some defect associeated with product yield		
2	**Severe –** tree is expected to die within 10 years, or will not yield merchantable sawlog product.		
Category	**Agent**	**Name**	
80	**000**	**Multi-damage (insect/disease)**	
80	001	Aspen defoliation	12037 = Defoliator/ large aspen tortrix
			12096 = Defoliator/ forest tent caterpillar
			25036 = Foliage disease/ Marssonina blight
			25037 = Foliage disease/ Melampsora rusts
80	002	Subalpine fir mortality	11015 = Bark beetles/ Western balsam bark beetle
			21001 = Root/butt disease/ armillaria root disease
			21010 = Root/butt disease/ annosus root disease
			50014 = Abiotic damage/ winter injury
Category 90: Unknown			
SEVERITY RATING			
0	0 – 9% affected		
1	10 – 19% affected		
2	20 – 29% affected		
3	30 – 39% affected		
4	40 – 49% affected		
5	50 – 59% affected		
6	60 – 69% affected		
7	70 – 79% affected		
8	80 – 89% affected		
9	90 – 100% affected		
Category	**Agent**	**Name**	
90	**000**	**Unknown**	
Category 99: Physical Effects			

Damage Categories, Agents, and Severity Ratings			
Category	**Agent**	**Physical Effects**	**Severity Rating** Note: for items that do not have a severity code listed below, record the **percent** of the tree area affected (eg., percent of height, percent of bole, percent of volume) as specified.
99	001	**Broken or missing top** Record for all species when the break occurs at or above 4.5 feet, for hardwoods, record when the break occurs on the main stem.	**Percent of original height that is missing** For example, if a tree was originally 75 feet high, but 15 feet of the top is broken or missing, enter "20" for the severity code (15/75 = 20%).
99	002	**Dead top** Record for all trees with a dead terminal leader.	**Percent of total tree height that is dead**
99	003	**Limby** Large limbs top to bottom	**Percent of total tree height with many limbs/knots**
99	004	**Forked top** For trees ≥ 5.0-inches DBH, fork must be below 4.0-inch diameter top. Do not record for hardwoods.	**Percent of total tree height above fork**
99	006	**Crook or sweep**	**Percent of total tree height containing thecrook or sweep**
99	007	**Checks, bole cracks**	**Percent of bole affected**
99	008	**Foliage discoloration**	**Percent of foliage discolored**
99	009	**Mortality**	Use for R1 Intensified FIA grid plots only
99	010	**Lack of seed source** For plantation surveys only	If present, code 100%
99	011	**Poor planting stock** For plantation surveys only	If present, code 100%
99	012	**Poor growth**	**1** = minor (reduced growth) **2** = severe (affecting survival)
99	013	**Total board foot volume loss**	**Percent of total board foot volume loss** (only examine the merchantable portion of the tree)
99	014	**Total cubic foot volume loss**	**Percent of total cubic foot volume loss** (only examine the merchantable portion of the tree)
99	015	**Bark removal**	**Percent of tree circumference missing bark**

Damage Categories, Agents, and Severity Ratings			
99	016	**Foliage loss**	**1** = minor (reduced growth) **2** = severe (affecting survival)
99	017	**Sunscald**	**1** = minor (reduced growth) **2** = severe (affecting survival)
99	018	**Uproot**	NA
99	019	**Scorched foliage**	% of total crown foliage killed by fire
99	020	**Scorched bark**	% of tree circumfrance that has cambium killed by fire
99	021	**Dieback** For plantation surveys only	**1** = minor (reduced growth) **2** = severe (affecting survival)
99	022	**Poor crown form**	**1** = minor (reduced growth) **2** = severe (affecting survival)
99	023	**Severe forking**	NA
99	026	**Open wound**	**Percent of bole/trunk affected** Examine the height and width of the wound. For example, if a tree is 72 feet tall and the wound covers 12 feet of the bole, enter a value of “16” (12/72 = 16%).
99	033	**Damaged shoots, buds, or foliage**	1 = minor 2 = severe
99	036	**Fire scar**	**Percent of bole/trunk affected** Examine the height and width of the wound. For example, if a tree is 72 feet tall and the wound covers 12 feet of the bole, enter a value of “16” (12/72 = 16%).
99	037	**Self-supporting Leaning Tree** Lean angle > 15%	**Percent lean from vertical**

Tree Damage Parts:

Tree Damage Parts	
Code	**Description**
UN	Unspecified
TO	Top
FO	Foliar (Crown)
LI	Limb
BO	Bole, other than Top or Base
BA	Base
RO	Roots
WT	Whole Tree
TT	Top Third of Crown
MT	Middle Third of Crown
BT	Bottom Third of Crown

Appendix S: Down-Woody Materials

There are two recommended methods to inventory dead, down-woody debris:

- **Photo Series Method –** the Photo Series for Quantifying Forest Residues. This method is an estimation technique. The actual data contained in the Photo series tables were obtained by sampling the photo plots using the Planar Intercept method

- **Brown's Protocol Method –** the Planar Intercept Method referenced in the *Handbook for Inventorying Down, Woody Material* by James K. Brown (1974). This method uses data measurements that are accurate to a specific statistical reliability.

Each method requires a different level of training, and the amount of time and expense needed for data collection varies. These methods are described in further detail below.

Photo Series Method

This method involves making visual comparisons between the on-site fuel condition and the conditions depicted on the photos. The Photo Series is intended to allow fast, easy and inexpensive quantifications of forest residues. Before using a particular Photo Series, become thoroughly familiar with the photo series book. To best understand how the photo series works, conduct several samples utilizing James K. Brown's *Handbook for Inventorying Downed Woody Material*. Actual "hands on" sampling using the Brown method provides the ability to fine-tune ocular estimates. The photo series relies heavily on the estimator's ability to visually compare actual on-the-ground conditions to characteristics on representative photos.

Sampling Procedures

Enter the weight (tons/acre) and volume (MBF/acre) by size class by selecting the representative photo based on the instructions found within the photo series. Compare photos to best match the ground conditions being evaluated. Only the dead and down-woody material (twigs, stems, branches, and bolewood) from trees and shrubs is evaluated. Do not allow the live species in the sample area to skew the visual estimate. Since the photo series requires an interpolation of photos to actual conditions, it is helpful to begin by estimating mid-size fuels first before moving to the finer fuels.

Brown's Protocol Method

Sampling Procedures

For average amounts of downed debris, about 5 to 6 minutes per sample point is required for the measurements. More time is usually spent in traveling and locating sample points than in making the measurements. If only down-woody material is inventoried, a two-person crew can complete 2O to 4O plots a day, depending on how much debris is present.

The Sampling Planes

The inventory is based on the planar intersect technique [(1)],[(2)] which has the same theoretical basis as the line intersect technique [(3)]. The planar intersect technique involves counting intersections of woody pieces with vertical sampling planes that resemble guillotines dropped through the downed debris.

Sampling Plane Height

The sampling plane height (vertical height) is undefined so that all intersections of dead down material are tallied regardless of their height above the ground. Tree boles are considered down if they lean greater than 45 degrees from the perpendicular. Sampling plane lengths vary by size and amount of down-woody material.

Sampling Plane Length

Length of sampling plane can be varied by users to obtain desired sampling precision. Generally, as fewer sample points are taken, sampling plane lengths should be longer to achieve desired sampling precision.

Sampling plane lengths are horizontal lengths. Slope distance will need to be adjusted to a horizontal distance. If a sampling plane extends beyond the border of the stand, truncate the plane at the stand boundary and project the remaining length along the reverse azimuth from the point center.

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(1) Brown, James K. 1974. Handbook for inventorying downed woody material. USDA For. Serv. Gen. Tech. Rep. INT-16, 24 p. Intermt. For. and Range Exp. Stn., Ogden, Utah.

(2) Brown, James K., and Peter J. Roussopoulos. 1974. Eliminating biases in the planner intersect method for estimating volumes of small fuels. For. Sci. 20(4): 350-356.

(3) Van Wagner, C. E. 1968. The line intersect method in forest fuel sampling. For. Sci. 14(1): 20-26.

The table that follows suggests sampling plane lengths and number of sample points needed to obtain specified percent errors (standard error of estimate divided by the mean, expressed as percentage). These recommendations are based on average distributions of naturally fallen down-woody material sampled in the northern Rocky Mountains [4]. The sampling plane lengths can be expected to vary from one-half of the table values, for heavy fuels that are uniformly distributed, to twice the table values, for light and unevenly distributed fuels. For heavy slash, the sampling plane lengths recommended for naturally fallen fuels could be cut in half.

A standard error of estimate within 20 percent of the mean is often considered adequate for fuel appraisal. A smaller percent error may be desirable for planning utilization of down-woody material. Percent errors greater than 35 percent afford poor reliability. If sampling cannot provide at least this level of reliability, it may not be worthwhile.

Fuel Estimate

Decide whether an estimate of fuels is needed for an individual stand or for several stands together. If fuel quantities are believed to be similar in several stands, then a single estimate is appropriate for appraising fuels in these stands. This is often the case for several adjacent stands in a timber sale area. If fuel estimates are desired for individual stands, then choose a sampling plane length appropriate for the number of sample points planned for the stand. The same sampling plane length should be used throughout each stand or group of stands for which fuel estimates are sought.

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[4] Brown, James K., Rick D. Oberheu, and Cameron M. Johnston. 1982 Handbook for Inventorying surface fuels and biomass in the Interior West. USDA For. Serv. Gen. Tech. Rep. Int-129, 48 p. Intermt. For. and Range Exp. Stn., Ogden, Utah

Length of Sampling Plane for Percent Errors and Number of Sample Points									
Diameter Class Range	**Percent Error**	**Number of Sample Points**							
		5	**6**	**7**	**8**	**10**	**15**	**20**	**30**
		Sampling Plane Lengths in Feet							
0.1 - 1 inch	**15**	34	28	24	21	17	11	8	6
	20	19	16	14	12	10	6	5	4
	25	12	10	9	8	6	4	3	2
	30	8	7	6	5	4	3	2	2
	35	6	5	5	4	3	2	2	1
1 - 3 inches	**15**	85	70	60	55	45	30	22	14
	20	50	40	35	30	24	16	12	8
	25	30	25	22	20	16	10	8	5
	30	22	18	15	14	11	7	5	4
	35	16	13	11	10	8	5	4	3
3+ inches	**15**	380	315	270	235	190	125	95	65
	20	210	175	150	130	105	70	50	35
	25	140	115	100	90	70	50	35	25
	30	100	80	70	60	50	35	25	15
	35	70	60	50	45	35	25	18	12

Record each Sampling Plane Length once per sample stand (on the Sample Design form). For example, if number of sample points is 20 and desired percent of error is 20%, then record:

05 for the 0.1- to 1-inch diameter class range

12 for the 1- to 3-inch diameter class range

50 for the ≥ 3-inch diameter class range

In medium fuel situations, these sampling planes should provide percent errors of about 20 percent with 20 sample points, and 30 percent with 10 sample points. Unless users specify sampling plane lengths on the field record, the following lengths should be used and are assumed (defaults) in the computer programs:

Defaults:

Fuel Diameter	Sampling Plane Length
3 + inches	27 feet
1 – 3 inches	7 feet
0.1 – 1 inch	7 feet

Tally Rules for the Downed Fuel Inventory

1. Particles qualifying for tally include downed, dead woody material (twigs, stems, branches, and bolewood) from trees and shrubs. Dead branches attached to boles of standing trees are omitted because they are not downed vegetation. Consider a particle "downed" if it has fallen to the ground, or is severed from its original source of growth. Cones, bark flakes, needles, leaves, grass, and forbs are not counted. Dead woody stems and branches still attached to standing brush and trees are not counted.

2. Twigs or branches lying in the litter layer and above are counted. However, they are not counted when the intersection between the central axis of the particle and the sampling plane lies in the duff (forest floor below the litter).

3. If the sampling plane intersects the end of a piece, tally only if the central axis is crossed. If the plane exactly intersects the central axis, tally every other such piece.

4. Don't tally any particle having a central axis that coincides perfectly with the sampling plane.

5. If the sampling plane intersects a curved piece more than once, tally each intersection.

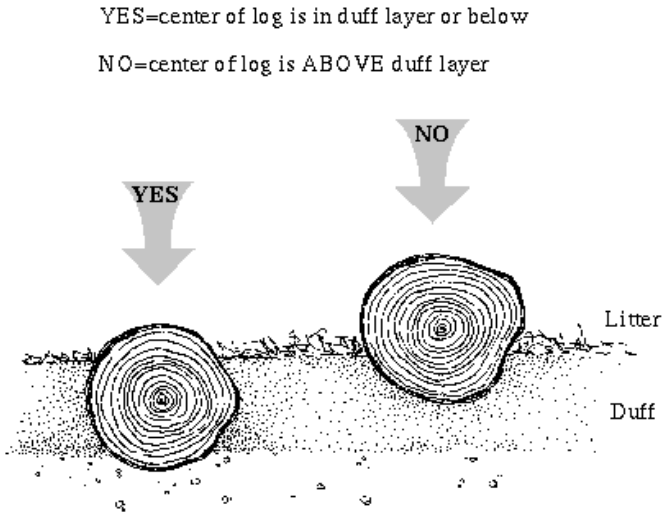
6. Tally wood slivers and chunks left after logging. Visually mold these pieces into cylinders to determine size class or diameters.

7. Tally uprooted stumps and roots not encased in dirt. For tallying, consider uprooted stumps as tree boles or individual roots, depending on where the sampling planes intersect the stumps. Do not tally undisturbed stumps.

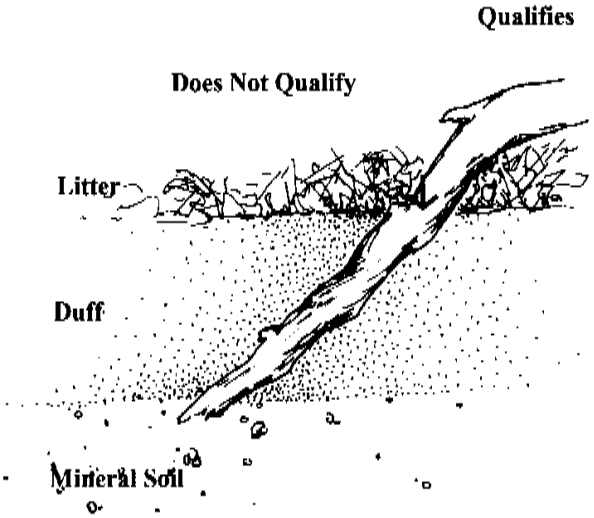
8. Tally all intersections of dead tree boles which lean greater than 45 degrees from the perpendicular regardless of the height of these intersections. Do not tally intersections of any standing dead trees which do not lean greater than 45 degrees from the perpendicular even if the point of intersection is within 6 feet of the ground.

Explanatory Figures

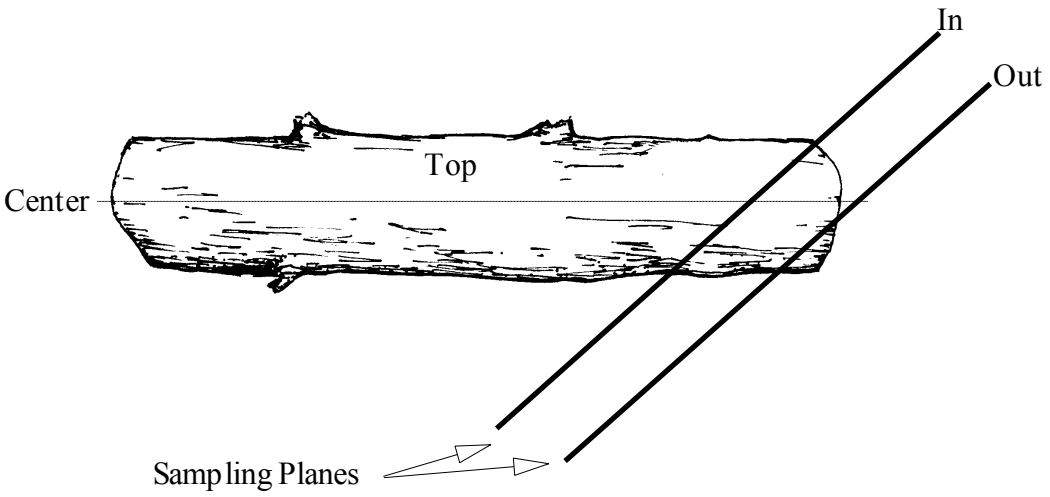
1. When stumps, logs, and trees occur at the point of duff measurement, offset 1 foot perpendicular to the right of the sampling plane. Measure through rotten logs whose central axis is in the duff layer.



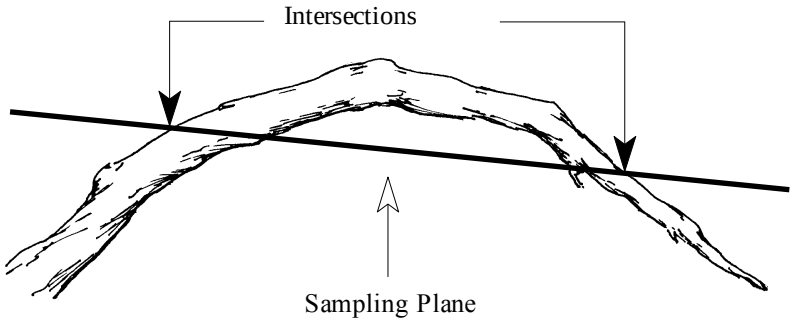
2. Twigs or branches lying in the litter layer and above are counted. However, they are not counted when the intersection between the central axis of the particle and the sampling plane lies in the duff (forest floor below the litter).



3. If the sampling plane intersects the end of a piece, tally only if the central axis is crossed. If the plane exactly intersects the central axis, tally every other such piece.

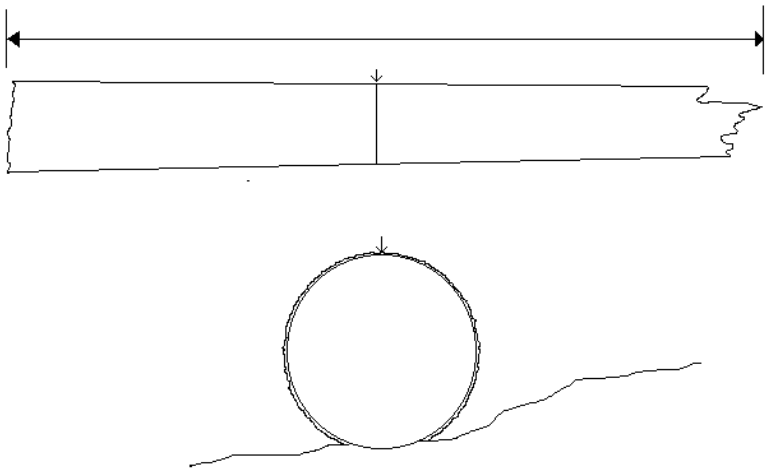


4. If the sampling plane intersects a curved piece more than once, tally each intersection.

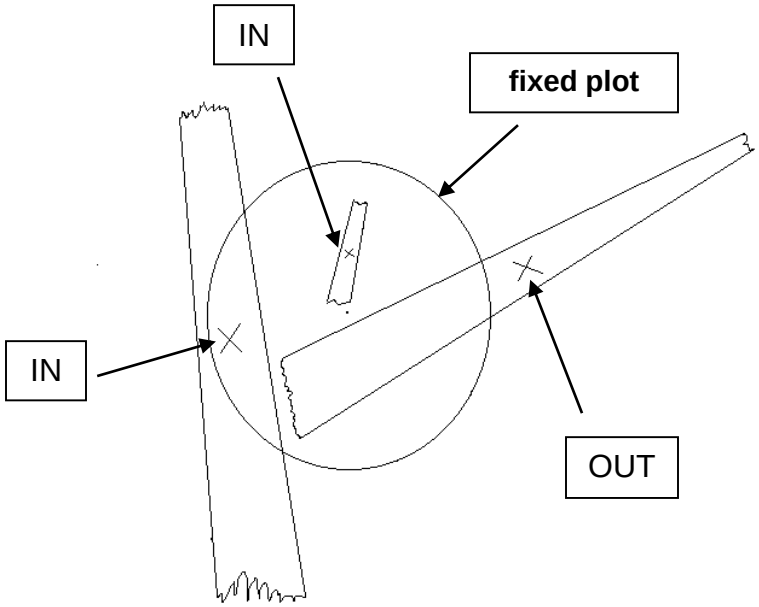


Determining Tally Pieces on a Fixed Area Plot

If collecting down-woody information on a fixed-area plot, the piece is tallied if the point on the upper most surface of the cylinder, mid-length of the piece, is within the fixed-area plot. To determine the midpoint of a piece, measure the length, in feet, and divide by 2.

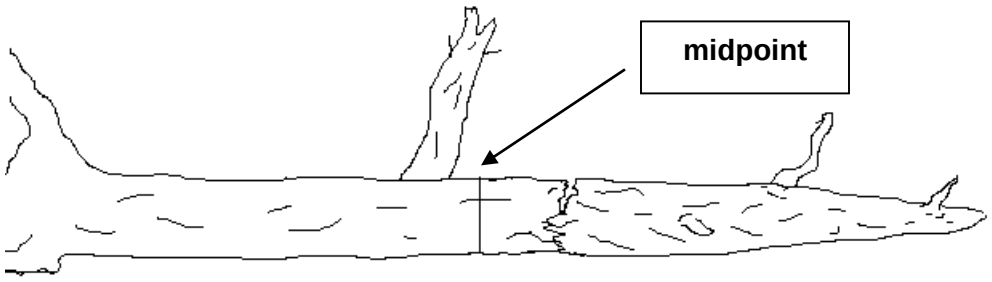


Midpoint is the uppermost point at the mid-length of the piece.



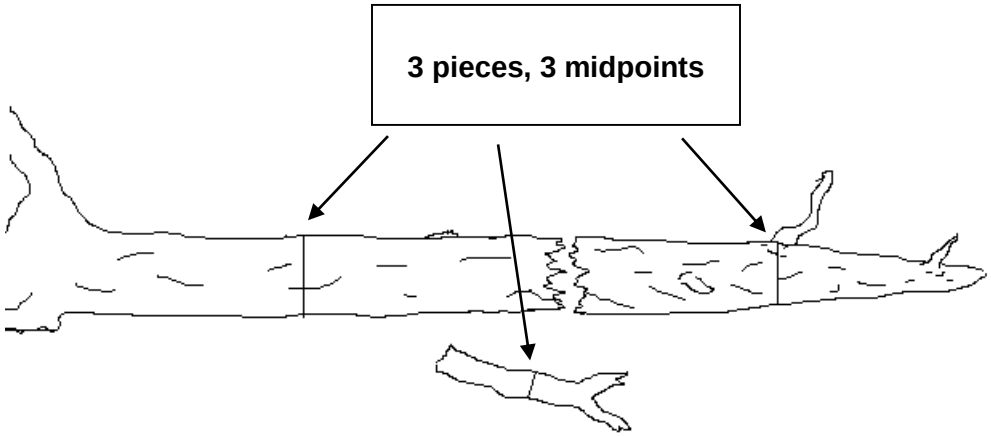
Position of midpoint of piece on the plot determines tally.

A down log may be broken into more than one piece. If a log is cracked, broken, or partially cut, but the two parts are still physically touching, then consider the log to be one piece.



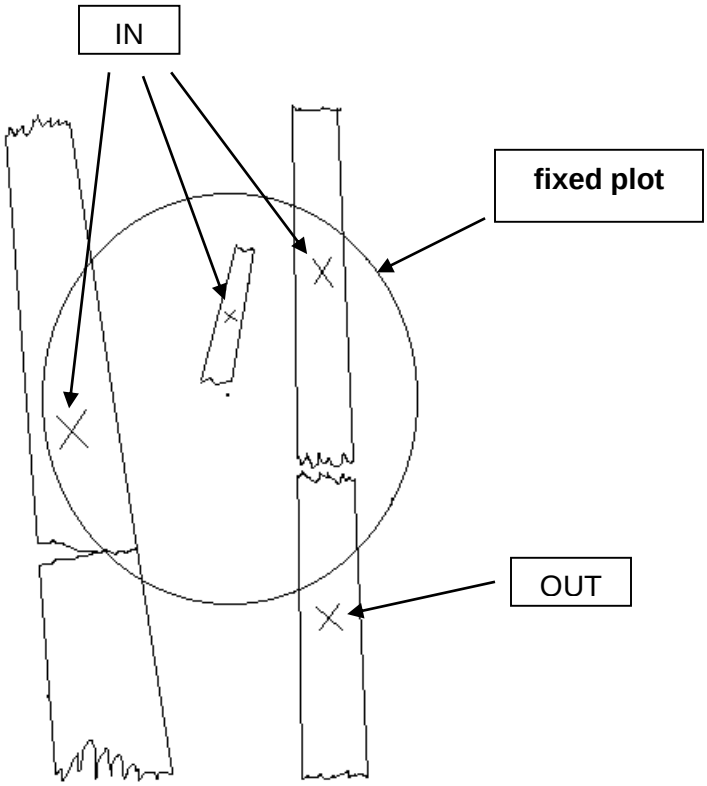
Midpoint on a one piece log.

However, if the two or more parts are not physically touching, then consider the parts to be separate pieces, each having their own midpoint. This may affect whether all parts of the down log are within the fixed-radius plot.



Broken pieces not touching are measured separately.

(continued on next page)



Broken pieces have separate midpoints; this can affect which pieces are tallied.

Appendix T: Tolerances for Region 1 Common Stand Exam

Item Numbers listed are in reference to the Region 1 CSE Field Guide.

Setting Form – Intensive/Extensive Exam Levels:

Setting Form – Intensive/Extensive Exam Levels		
Item No.	**Field Name**	**Tolerance**
2.1	Project Name	No Errors
2.2	Proclaimed Region	No Errors
2.3	Proclaimed National Forest	No Errors
2.4	District	No Errors
2.5	Location	No Errors
2.6	Stand Number	No Errors
2.7	Owner	No Errors
2.8	State	No Errors
2.9	County	No Errors
2.10	Administrative Forest	No Errors
2.11	Date	No Errors
2.12	Photo ID	No Errors
2.13	Examination Level	No Errors
2.14	Exam Purpose	No Errors
2.15	Stratum	No Errors
2.16	Existing Vegetation Reference	No Errors
2.17	Existing Vegetation Composition Type	No Errors
2.18	Potential Vegetation Reference	No Errors
2.19	Potential Vegetation	No Errors
2.20	Structure	No Errors
2.21	Setting Capable Growing Area	± 10 percent
2.22	Setting Fuel Model	No Errors
2.23	Setting Elevation	± 2 contour intervals
2.24	Setting Aspect	± 45 degrees
2.25	Setting Slope	± 10 percent
2.26	Setting Slope Position	± 1 class

Setting Form – Intensive/Extensive Exam Levels		
Item No.	**Field Name**	**Tolerance**
2.27	Acres	No Errors
2.28	Examiner	No Errors
2.29	Precision Protocol	No Errors
2.30	Radial Growth Interval	No Errors
2.31	Radial Growth Interval 2 (NOT used in Region 1)	---
2.32	Height Growth Interval	No Errors
2.33	Fuel Photo Reference	No Errors
2.34	Setting User Code	No Errors
2.35	Setting Remarks	No Errors
2.36	Setting Damage Category (if found along transect and not in Tree Damage or Plot History)	No Errors
2.37	Setting Damage Agent	Locally specified
2.38	Setting Damage Severity	Locally specified
2.39	Species of Management Interest	No Errors
2.40	Sketch Map and Traverse Notes	

Sample Design Form – All Exam Levels:

Sample Design Form – All Exam Levels		
Item No.	**Field Name**	**Tolerance**
3.1	Form Type	
3.2	Sample Selection Method Type	No Errors
3.3	Sample Expansion Factor	No Errors
3.4	Starting Azimuth	No Errors
3.5	Subpopulation Filter	No Errors
3.6	Sample Design Remarks	No Errors
3.7	Selection Criteria Number or Criteria Condition	No Errors
3.8	Subpopulation Variable	No Errors
3.9	Subpopulation Minimum Value	No Errors
3.10	Subpopulation Maximum Value	No Errors

Plot Data Form – All Exam Levels:

Plot Data Form – All Exam Levels		
Item No.	**Field Name**	**Tolerance**
4.1	Plot Number	No Errors
4.2	Acquiring GPS Locations:	
	• Plot Latitude	• Estimated Horizontal Distance: ± 15 meters (49.2 feet) • Position Error: ± 15 meters (49.2 feet) 85% of the time
	• Plot Longitude	
4.3	Plot Capable Grow Area	No Errors
4.4	Plot Aspect	± 45 degrees
4.5	Plot Slope	± 10 percent
4.6	Plot Slope Position	± 1 class
4.7	Slope Horizontal Shape	No Errors
4.8	Slope Vertical Shape	No Errors
4.9	Plot Elevation	• ± 100 feet (GPS Method) • ± 2 contour intervals (from provided maps)
4.10	Plot Existing Vegetation Composition Type	No Errors
4.11	Plot Potential Vegetation	Accurate to series, understory union, and Forest/District specified phases
4.12	Plot Fuel Model	No Errors
4.13	Residual Descriptive Code (Fuel Photo Series)	No Errors
4.14	Distance to Seed Wall	± 100 feet
4.15	Plot User Code	No Errors
4.16	Plot History	No Errors
4.17	Plot History Date	No Errors
4.18	Plot Remarks	

Tree Data Form – Intensive Exam Level:

Tree Data Form – Intensive Exam Level		
Item No.	**Field Name**	**Tolerance**
5.1	Plot Number	No Errors
5.2	Tag ID Number	No Errors
5.3	Tree Status	No Errors
5.4	Tree Class	Tree Class Code / Tolerance: DE — DE, AC AC — DE, AC, UA UA — AC, UA, RF* RF — RF, UA* RN — RN, UA* SV — SV, US US — SV, US * acceptable code providing damage/severity is consistent with the TREE CLASS definition.
5.5	Growth Sample (GST) / Site Trees	No Errors
5.6	Tree Species	No Errors
5.7	Tree Count	Number of Trees on Plot / Diameter (DBH/DRC) / Height or Height Class / Mixed/Extra Tree Tolerance: 0 — NA — NA — No Errors 1 - 5 — -- — ≤ 0.5 feet — ± 2 trees 6+ — -- — ≤ 0.5 feet — ± 50% 1 - 5 — < 0.5 inches — > 0.5 feet — ± 1 tree 6+ — < 0.5 inches — > 0.5 feet — ± 20% 1 - 5 — 0.5 in - Breakpoint DBH — All — ± 1 tree 6+ — 0.5 in - Breakpoint DBH — All — ± 10% 1+ — Breakpoint DBH+ — All — No Errors
5.8	Number Stems (used only for EXAM PURPOSE 'FI')	No Errors

Tree Data Form – Intensive Exam Level		
Item No.	**Field Name**	**Tolerance**
5.9	DBH/DRC	DBH (range): < 0.5 inch — No Errors 0.5 – 13.9 inches — ± 0.1 inch 14.0 – 23.9 inches — ± 0.2 inch 24.0 – 34.9 inches — ± 0.3 inch 35.0+ inches — ± 0.5 inch Borderline variable-plot trees — ± 0.1 inch (to determine trees in or out)
5.10	Height	± 10 percent of actual standing tree height
5.11	Height to Crown	± 10 percent of actual crown height
5.12	Radial Growth	± 1/20th inch
5.13	Radial Growth #2 (NOT used in Region 1)	---
5.14	Height Growth	trees ≥ 6 feet: ± 1 foot trees < 6 feet: ± 0.1 foot
5.15	Tree Age	trees < 300 years old: ± 10 percent trees ≥ 300 years old: ± 15 percent
5.16	Crown Ratio	± 10 percent
5.17	Crown Class	± 1 class
5.18	Crown Width	± 10 percent
5.19	Wildlife Use	No Errors
5.20	Snag Decay Class	± 1 class
5.21	Cone Serotiny	No Errors
5.22	Tree Damage Category	No Errors **(unless otherwise specified)** Refer to Damage Category Table below
5.23	Tree Damage Agent	(see Damage Category)
5.24	Tree Damage Part	No Errors (when required)
5.25	Tree Damage Severity	(see Damage Category)
5.26	Tree Remarks (additional items):	
	• Estimated Age	Recorded when applicable

Tree Data Form – Intensive Exam Level		
Item No.	**Field Name**	**Tolerance**
	• Tree Class (optional recording)	Tree Class Code / Tolerance 1 — 1, 2 2 — 1, 2, 3 3 — 2, 3, (4, 5)* 4 — 4, (3)* 5 — 5, (3)* 6 — 6, 8, (7, 9)* 7 — 7, 9, (6, 8)* 8 — 6, 8, (7, 9)* 9 — 7, 9, (6, 8)* * acceptable code providing damage/severity is consistent with the TREE CLASS definition.
5.27	Tree User Code	No Errors
5.28	Tree Treatment Option	No Errors
5.29	Tree Distance	Microplot ± 0.2 ft Large-tree plot: ± 1.0 ft if tree is located more than 1.0' from plot boundary ± 0.2 ft if trees is < 1.0' from plot boundary
5.30	Tree Azimuth	± 10 Degrees

Damage Category (item 5.22):

Damage Category (item 5.22)			
Code	**Category**	**Damage Tolerance**	**Severity Tolerance**
11	Bark Beetles	No misses on live trees with a severity of ≥ 2	± 0
12	Defoliators	No misses on live trees with a severity of ≥ 3	± 1 code
13	Chewing Insects	No misses on live trees with a severity of 2	± 0
14	Sucking Insects	No misses on live trees with a severity of 2	± 0
15	Boring Insects	No misses on weevils (Pissodes) or shoot moths (Eucosma) on live trees	± 0
16	Seed / Cone / Flower / Fruit Insects	No misses of shoot moths (Eucosma) on live trees	± 0
17	Gallmaker Insects	No misses on live trees with a severity of 2	± 0

Damage Category (item 5.22)			
Code	**Category**	**Damage Tolerance**	**Severity Tolerance**
18	Insect Predators	No misses on live trees with a severity of 2	± 0
19	General Disease	No misses on live trees with a severity of 2	± 0
20	Biotic Damage	No misses on live trees with a severity of 2	± 0
21	Root/Butt Diseases	No misses on live trees with a severity of ≥ 2	± 0
22	Stem Decays / Cankers	No misses on live trees with a severity of ≥ 3	± 1 code
23	Parasitic - Mistletoe	No misses on live trees with a severity of ≥ 3	± 1 code
24	Decline Complexes / Dieback / Wilts	No misses on live trees with a severity of 2	± 0
25	Foliage Diseases	No misses on Elytroderma on live trees	± 0
26	Stem Rusts	No misses on live trees with a severity of ≥ 2	± 0
27	Broom Rusts	No misses on live trees with a severity of 2	± 0
30	Fire	No misses if damage affects > ¼ of the bole circumference, or if an open wound is in contact with the ground	± 0
41	Wild Animals	No misses on live trees with terminal leader damage or with greater than 1/4 of bole circumference affected	± 0
42	Domestic Animals	No misses on live trees with terminal leader damage, or with greater than 1/4 of bole circumference affected	± 0
50	Abiotic Damage	No misses on live trees if wind, snow, or ice bending, breakage, or bole cracks and frost damage to shoots on trees < 1-inch diameter, and lightning on live trees ≥ 5-inch diameter	± 0
60	Competition	No misses on live trees with a severity of 2	± 0
70, 71	Human Activity, Harvest	No misses on live trees for logging, human activity, or fire if the damage affects > ¼ of the bole circumference, or if an open wound is in contact with the ground	± 0
80	Multi-Damage (Insect/Disease)	No misses on live trees with a severity of 2	± 0
90	Unknown	No misses on live trees with a severity of 2 (≥ 20 percent)	± 10 percent
99	Physical Effects	No misses on live trees with a severity of ≥ 2 (≥ 20 percent)	± 10 percent

Vegetation Composition and Ground Surface Cover Forms:

Vegetation Composition:

Vegetation Composition	
Item	**Tolerance**
Lifeform	No Errors
Canopy Cover	• ± 5 percent for cover ≤ 30% • ± 10 percent for cover > 30%
Layer	No Errors
Species	No Errors

Ground Surface Cover (Transects Method):

Ground Surface Cover (Transects Method)	
Item	**Tolerance**
Transect Azimuth	± 2 degrees
Number of Hits per category	± 10 percent
Cover Type Category	No Errors
Ground Surface Cover Percent (calculation)	± 10 percent

Down-Woody Materials Form:

Down-Woody Materials Form		
Item No.	**Field Name**	**Tolerance**
DWM Sample Transect Azimuths		± 2 degrees
7.1	Plot Number	No Errors
7.2	First Duff	± 1/2 inch
7.3	Second Duff	± 1/2 inch
7.4	Fuel Depth	± 20 percent of depth
7.5	Twig1 (0.01 to 0.24 inch)	± 40 percent
7.6	Twig2 (0.25 to 0.99 inch)	± 30 percent
7.7	Twig3 (1.00 to 2.99 inches)	± 20 percent
7.8	Piece Count	± 10 percent of total pieces
7.9	Log Decay Class	± 1 class
7.10	Diameter (at point of intersection)	▪ Pieces < 20-inch diameter: ± 3 inches ▪ Pieces ≥ 20-inch diameter: 20 percent
7.11	Piece Length	± 10 percent
7.12	Diameter Large End	± 1 inch
7.13	Diameter Small End	± 1 inch

Tree Data Form – Extensive and Quick Plot Exam Levels:

Note: For Tree Data items not listed below, refer to tolerance limits listed under "Tree Data Form – Intensive Exam Level."

Tree Data Form – Extensive and Quick Plot Exam Levels

Item No.	Field Name	Tolerance
8.7 / 10.7	Tree Count	Number of Trees on Plot / Diameter (DBH/DRC) / Height or Height Class / Mixed/Extra Tree Tolerance 0 / NA / NA / No Errors 1 - 10 / -- / ≤ 0.5 feet / ± 5 trees 11+ / -- / ≤ 0.5 feet / ± 50% 1 - 10 / < 0.5 inches / > 0.5 feet / ± 2 trees 11+ / < 0.5 inches / > 0.5 feet / ± 20% 1 - 10 / 0.5 in - Breakpoint DBH / All / ± 2 trees 11+ / 0.5 in - Breakpoint DBH / All / ± 20% 1+ / Breakpoint DBH+ / All / No Errors
8.9 / 10.9	DBH/DRC	DBH (range): / Tolerance < 0.5 inch / No Errors 0.5 – 13.9 inches / ± 1 inch 14.0 – 23.9 inches / ± 2 inch 24.0 – 34.9 inches / ± 3 inch 35.0+ inches / ± 4 inch Borderline variable-plot trees / ± 0.1 inch (to determine trees in or out)
8.10 / 10.10	Height	± 20 percent of actual standing tree height
8.11 / 10.11	Height to Crown	± 20 percent of actual crown height

Setting Form – Quick Plot Exam Level:

Note: For Setting items not listed below, refer to tolerance limits listed under "Setting Form – Intensive/Extensive Exam Levels."

Setting Form – Quick Plot Exam Level		
Item No.	**Field Name**	**Tolerance**
9.19	Potential Vegetation	Accurate to habitat type (series and understory, but exclusive of phase)
9.21	Setting Capable Growing Area	± 10 percent
9.24	Setting Aspect	± 45 degrees (1 class)
9.25	Setting Slope	± 15 percent

Appendix U: Fuel Model

The original 13 fuel models are from "**Aids to Determining Fuel Models for Estimating Fire Behavior,**" Hal E. Anderson, INT-122, 1982. The remaining fuel models are from "Standard Fire Behavior Fuel Models: A Comprehensive Set for Use with Rothermel's Surface Fire Spread Model" by Joe H. Scott and Robert E. Burgan. RMRS –GTR-153. June 2005.

Fuel Model	Fuel Model Code	Fuel Model Name	Fuel Type	Model Set	Fuel 1-Hr	Fuel 10-Hr	Fuel 100-Hr	Fuel Bed Depth
1		Short grass (1 foot)	Grass and grass-dominated	Anderson	0.74	0	0	1
2		Timber (grass and understory)	Grass and grass-dominated	Anderson	2	1	0.500	1
3		Tall grass (2.5 feet)	Grass and grass-dominated	Anderson	3.01	0	0	2.50
4		Chaparral (6 feet)	Chaparral and shrub fields	Anderson	5.01	4.010	2	6
5		Brush (2 feet)	Chaparral and shrub fields	Anderson	1	0.500	0	2
6		Dormant brush, hardwood slash	Chaparral and shrub fields	Anderson	1.50	2.500	2	2.50
7		Southern rough	Chaparral and shrub fields	Anderson	1.13	1.870	1.500	2.50
8		Closed timber litter	Timber litter	Anderson	1.50	1	2.500	0.20
9		Hardwood litter	Timber litter	Anderson	2.92	0.410	0.150	0.20
10		Timber (litter and understory)	Timber litter	Anderson	3.01	2	5.010	1
11		Light logging slash	Slash	Anderson	1.50	4.51	5.510	1
12		Medium logging slash	Slash	Anderson	4.01	14.03	16.53	2.30
13		Heavy logging slash	Slash	Anderson	7.01	23.04	28.05	3
91	NB1	Urban/Developed	Nonburnable	Scott and Burgan	0	0	0	0
92	NB2	Snow/Ice	Nonburnable	Scott and Burgan	0	0	0	0
93	NB3	Agricultural	Nonburnable	Scott and Burgan	0	0	0	0
98	NB4	Open Water	Nonburnable	Scott and Burgan	0	0	0	0
99	NB5	Bare Ground	Nonburnable	Scott and Burgan	0	0	0	0
101	GR1	Short, Sparse Dry Climate Grass (Dynamic)	Grass	Scott and Burgan	0.10	0	0	0.40

Fuel Model	Fuel Model Code	Fuel Model Name	Fuel Type	Model Set	Fuel 1-Hr	Fuel 10-Hr	Fuel 100-Hr	Fuel Bed Depth
102	GR2	Low Load, Dry Climate Grass (Dynamic)	Grass	Scott and Burgan	0.10	0	0	1
103	GR3	Low Load, Very Coarse, Humid Climate Grass (Dynamic)	Grass	Scott and Burgan	0.10	0.40	0	2
104	GR4	Moderate Load, Dry Climate Grass (Dynamic)	Grass	Scott and Burgan	0.25	0	0	2
105	GR5	Low Load, Humid Climate Grass (Dynamic)	Grass	Scott and Burgan	0.40	0	0	1.50
106	GR6	Moderate Load, Humid Climate Grass (Dynamic)	Grass	Scott and Burgan	0.10	0	0	1.50
107	GR7	High Load, Dry Climate Grass (Dynamic)	Grass	Scott and Burgan	1	0	0	3
108	GR8	High Load, Very Coarse, Humid Climate Grass (Dynamic)	Grass	Scott and Burgan	0.50	1	0	4
109	GR9	Very High Load, Humid Climate Grass (Dynamic)	Grass	Scott and Burgan	1	1	0	5
121	GS1	Low Load, Dry Climate Grass-Shrub (Dynamic)	Grass-Shrub	Scott and Burgan	0.20	0	0	0.90
122	GS2	Moderate Load, Dry Climate Grass-Shrub (Dynamic)	Grass-Shrub	Scott and Burgan	0.50	0.500	0	1.50
123	GS3	Moderate Load, Humid Climate Grass-Shrub (Dynamic)	Grass-Shrub	Scott and Burgan	0.30	0.250	0	1.80
124	GS4	High Load, Humid Climate Grass-Shrub (Dynamic)	Grass-Shrub	Scott and Burgan	1.90	0.300	0.100	2.10
141	SH1	Low Load, Dry Climate Shrub (Dynamic)	Shrub	Scott and Burgan	0.25	0.250	0	1
142	SH2	Moderate Load, Dry Climate Shrub	Shrub	Scott and Burgan	1.35	2.400	0.750	1
143	SH3	Moderate Load, Humid Climate Shrub	Shrub	Scott and Burgan	0.45	3	0	2.40
144	SH4	Low Load, Humid Climate Timber-Shrub	Shrub	Scott and Burgan	0.85	1.150	0.200	3
145	SH5	High Load, Dry Climate Shrub	Shrub	Scott and Burgan	3.60	2.100	0	6
146	SH6	Low Load, Humid Climate Shrub	Shrub	Scott and Burgan	2.90	1.450	0	2
147	SH7	Very High Load, Dry Climate Shrub	Shrub	Scott and Burgan	3.50	5.300	2.200	6
148	SH8	High Load, Humid Climate Shrub	Shrub	Scott and Burgan	2.05	3.400	0.850	3
149	SH9	Very High Load, Humid Climate Shrub (Dynamic)	Shrub	Scott and Burgan	4.50	2.450	0	4.40

Fuel Model	Fuel Model Code	Fuel Model Name	Fuel Type	Model Set	Fuel 1-Hr	Fuel 10-Hr	Fuel 100-Hr	Fuel Bed Depth
161	TU1	Low Load, Dry Climate Timber-Grass-Shrub (Dynamic)	Timber-Understory	Scott and Burgan	0.20	0.900	1.500	0.60
162	TU2	Moderate Load, Humid Climate Timber-Shrub	Timber-Understory	Scott and Burgan	0.95	1.800	1.250	1
163	TU3	Moderate Load, Humid Climate Timber-Grass-Shrub (Dynamic)	Timber-Understory	Scott and Burgan	1.10	0.150	0.250	1.30
164	TU4	Dwarf Conifer With Understory	Timber-Understory	Scott and Burgan	4.50	0	0	0.50
165	TU5	Very High Load, Dry Climate Timber-Shrub	Timber-Understory	Scott and Burgan	4	4	3	1
181	TL1	Low Load Compact Conifer Litter	Timber Litter	Scott and Burgan	1	2.200	3.600	0.20
182	TL2	Low Load Broadleaf Litter	Timber Litter	Scott and Burgan	1.40	2.300	2.200	0.200
183	TL3	Moderate Load Conifer Litter	Timber Litter	Scott and Burgan	0.50	2.200	2.800	0.30
184	TL4	Small Downed Logs	Timber Litter	Scott and Burgan	0.50	1.500	4.200	0.40
185	TL5	High Load Conifer Litter	Timber Litter	Scott and Burgan	1.15	2.500	4.400	0.60
186	TL6	Moderate Load Broadleaf Litter	Timber Litter	Scott and Burgan	2.40	1.200	1.200	0.30
187	TL7	Large Downed Logs	Timber Litter	Scott and Burgan	0.30	1.400	8.100	0.40
188	TL8	Long-Needle Litter	Timber Litter	Scott and Burgan	5.80	1.400	1.100	0.30
189	TL9	Very High Load Broadleaf Litter	Timber Litter	Scott and Burgan	6.65	3.300	4.150	0.60
201	SB1	Low Load Activity Fuel	Slash-Blowdown	Scott and Burgan	1.50	3	11	1
202	SB2	Moderate Load Activity Fuel or Low Load Blowdown	Slash-Blowdown	Scott and Burgan	4.50	4.250	4	1
203	SB3	High Load Activity Fuel or Moderate Load Blowdown	Slash-Blowdown	Scott and Burgan	5.50	2.750	3	1.20
204	SB4	High Load Blowdown	Slash-Blowdown	Scott and Burgan	5.25	3.500	5.250	2.70

Fuel Model Code	Detailed Description
1	Contains fine, very porous, and continuous herbaceous fuels that have cured or are nearly cured. Generally less than one-third of the area contains shrubs or timber. Grasslands and savanna are represented along with stubble, grass-tundra, and grass-shrub combinations. Annual and perennial grasses are included in this fuel model.
2	Herbaceous material with litter and dead-down stem wood from the open shrub or timber overstory. Open shrub lands and pine stands or scrub oak stands that cover one-third to two-thirds of the area. Stand may include clumps and may include pinyon-juniper.

Fuel Model Code	Detailed Description
3	Stands are tall, averaging about three feet, but considerable variation may occur. Approximately one-third or more of the stand is considered dead and cured. May include cultivated grains that have not been harvested, tall prairie, and marshland grasses.
4	Stands of mature shrubs, 6 feet or more tall such as California mixed chaparral, the high pocosin along the east coast, the pine barrens of New Jersey, or the closed jack pine stands of the north-central states. Besides flammable foliage, stand may contain dead woody material. May contain a deep litter layer.
5	Shrubs are young with little dead material, and the foliage contains little volatile material. Usually shrubs are short and almost totally cover the area. Young, green stands with no dead wood qualify: laurel, vine maple, alder, or even chaparral, manzanita, or chamise.
6	The shrubs are older, but not as tall as model 4, nor do they contain as much fuel as model 4. This model covers a broad range of shrub conditions: intermediate stands of chamise, chaparral, oak brush, low pocosin, Alaskan spruce taiga, and shrub tundra. May include hardwood slash that has cured. Pinyon-juniper shrub lands may be represented.
7	Stands of shrubs are generally between 2 and 6 feet high. Palmetto-galliberry understory, with a pine overstory, are typical. Low pocosin may be represented. Black spruce shrub combinations in Alaska may also be represented.
8	Contains closed canopy stands of short needle conifers or hardwoods that have leafed out. The compact litter layer is mainly needles, leaves, and occasionally twigs because little undergrowth is present. Representative conifer types are white pine, lodgepole pine, spruce, fir, and larch.
9	Both long-needle conifer stands and hardwood stands, especially the oak-hickory types, are typical. Closed stands of long-needled pine like ponderosa, Jeffrey, red pines, or southern pine plantations are grouped in this model. May contain concentrations of dead-down woody material.
10	Dead-down fuels include quantities of 3-inch or larger limb wood resulting from over maturity or natural events that create a large load of dead material on the forest floor. Any forest type may be considered if heavy down material is present; examples are insect- or disease-ridden stands, wind thrown stands, overmature situations with deadfall, and aged light thinning or partial cut slash.
11	Contains slash and herbaceous material intermixed with slash. Light partial cuts or thinning operations in mixed conifer stands, hardwood stands, and southern pine harvests are considered. Clearcuts generally produce more slash than represented here. The less than 3-inch material load is less than 12 tons per acre. The greater than 3 inch is represented by not more than 10 pieces, 4 inches in diameter, along a 50 foot transect.
12	The visual impression is dominated by slash and much of it is less than 3 inches in diameter. The fuels are well distributed. Heavily thinned conifer stands; clearcuts, and medium or heavy partial cuts are represented. The material larger than 3 inches is represented by encountering 11 pieces, 6 inches in diameter along a 50 foot transect.
13	There is a continuous layer of slash. Large quantities of material larger than 3 inches are present. Clearcuts and heavy partial cuts in mature and over mature stands are depicted where the slash load is dominated by the greater than 3 inch diameter material. Fuels less than 3 inches are generally only 10 percent of the total load. May include situations where the slash still has "red" needles attached.
91	Land covered by urban and suburban development. The area must not support wildland fire spread. In some cases the area may experience structural fire losses during a wildland fire incident; however, structure ignition in those cases is either house-to-house or by firebrands, neither of which is directly modeled using fire behavior fuel models. If sufficient vegetation surrounds structures such that wildland fire spread is possible, then choose a fuel model appropriate for the wildland vegetation.
92	Land covered by permanent snow and ice. Areas covered by seasonal snow and ice can be mapped to two different fuels models.
93	Agricultural land maintained in a nonburnable condition; examples include irrigated annual crops, mowed or tilled orchards, and so forth. However, there are many agricultural areas that are not kept in a non burnable condition. For example, grass is often allowed to grow beneath vines or orchard trees, and wheat or similar crops are allowed to cure before harvest; in those cases use a different fuel model.
98	Land covered by open bodies of water such as lakes, rivers and oceans.
99	Land devoid of enough fuel to support wildland fire spread. Such areas include gravel pits, arid deserts with little vegetation, sand dunes, rock outcroppings, beaches and so forth.

Fuel Model Code	Detailed Description
101	The primary carrier of fire is sparse grass, though small amounts of fine fuel may be present. The grass is generally short, either naturally or by grazing, and may be sparse or discontinuous. The moisture extraction is indicative of a dry climate fuelbed, but may also be applied in high-extinction moisture fuelbeds because in both cases predicted spread rate and flame length are low compare to other grass models.
102	The primary carrier of fire is grass, though small amounts of fine dead fuel may be present. Load is greater than 101, and fuelbed may be more continuous. Shrubs, if present, do not affect fire behavior.
103	The primary carrier of fire is continuous, coarse, humid-climate grass. Grass and herb fuel load is relatively light; fuelbed depth is about 2 feet. Shrubs are not present in significant quantity to affect fire behavior.
104	The primary carrier of fire is continuous, dry-climate grass. Load and depth are greater than 102; fuelbed depth is about 2 feet.
105	The primary carrier of fire is humid-climate grass. Load is greater than 103 but depth is lower, about 1-2 feet.
106	The primary carrier of fire is continuous humid-climate grass. Load is greater than 105 but depth is about the same. Grass is less coarse than 105.
107	The primary carrier of fire is continuous dry-climate grass. Load and depth are greater than 104. Grass is about 3 feet tall.
108	The primary carrier of fire is continuous, very coarse, humid-climate grass. Load and depth are greater than 106. Spread rate and flame length can be extreme if grass is fully cured.
109	The primary carrier of fire is dense, tall, humid-climate grass. Load and depth are greater than 108, about 6 feet tall. Spread rate and flame length can be extreme if grass is fully or mostly cured.
121	The primary carrier of fire is grass and shrubs combined. Shrubs are about 1 foot high, grass load is low. Spread rate is moderate; flame length is low. Moisture of extinction is low.
122	The primary carrier of fire is grass and shrubs combined. Shrubs are 1 to 3 feet high, grass load is moderate. Spread rate is high; flame length moderate. Moisture of extinction is low.
123	The primary carrier of fire is grass and shrubs combined. Moderate grass/shrub load, average grass/shrub depth less than 2 feet. Spread rate is high; flame length moderate. Moisture of extinction is high.
124	The primary carrier of fire is grass and shrubs combined. Heavy grass/shrub load, depth greater than 2 feet. Spread rate high; flame length very high. Moisture of extinction is high.
141	The primary carrier of fire is woody shrubs and shrub litter. Low shrub fuel load, fuelbed about 1 foot; some grass may be present. Spread rate is very low; flame length very low.
142	The primary carrier of fire is woody shrubs and shrub litter. Moderate fuel load (higher than 141), depth about 1 foot, no grass fuel present. Spread rate is very low; flame length low.
143	The primary carrier of fire is woody shrubs and shrub litter. Moderate shrub load, possibly with pine overstory or herbaceous fuel, fuel bed depth 2 to 3 feet. Spread rate is low; flame length low.
144	The primary carrier of fire is woody shrubs and shrub litter. Low to moderate shrub and litter load, possibly with pine overstory, fuel bed depth about 3 feet. Spread rate is high; flame length moderate.
145	The primary carrier of fire is woody shrubs and shrub litter. Heavy shrub load, depth 4-6 feet. Spread rate very high; flame length very high. Moisture of extinction is high.
146	The primary carrier of fire is woody shrubs and shrub litter. Dense shrubs, little or no herbaceous fuel, fuelbed depth about 2 feet. Spread rate is high; flame length high.
147	The primary carrier of fire is woody shrubs and shrub litter. Very heavy shrub load, depth 4 to 6 feet. Spread rate lower than 146, but flame length similar. Spread rate is high, flame length is very high.
148	The primary carrier of fire is woody shrubs and shrub litter. Dense shrubs, little or no herbaceous fuel, fuelbed depth about 3 feet. Spread rate is high; flame length high.
149	The primary carrier of fire is woody shrubs and shrub litter. Dense, finely branched shrubs with significant fine dead fuel, about 4-6 feet tall; some herbaceous fuel may be present. Spread rate is high; flame length very high.
161	The primary carrier of fire is low load of grass and/or shrub with litter. Spread rate is low; flame length is low.

Fuel Model Code	Detailed Description
162	The primary carrier of fire is moderate litter load with shrub component. High extinction moisture. Spread rate is moderate; flame length is low.
163	The primary carrier of fire is moderate forest litter with grass and shrub components. High extinction moisture. Spread rate is high; flame length is moderate.
164	The primary carrier of fire is short conifer trees with grass or moss understory. Spread rate is moderate; flame length is moderate.
165	The primary carrier of fire is heavy forest litter with a shrub or small tree understory. Spread rate is moderate; flame length is moderate.
181	The primary carrier of fire is compact forest litter. Light to moderate load, fuels 1 to 2 inches deep. May be used to represent a recently burned forest. Spread rate is very low; flame length is very low.
182	The primary carrier of fire is broadleaf (hardwood) litter. Low load, compact broadleaf litter. Spread rate is very low; flame length is very low.
183	The primary carrier of fire is moderate load conifer litter, light load of coarse fuels. Spread rate is very low; flame length low.
184	The primary carrier of fire is moderate load of fine litter and coarse fuels. Includes small diameter downed logs. Spread rate is low; flame length low
185	The primary carrier of fire is high load of fine litter; light slash or mortality fuel. Spread rate is low; flame length low.
186	The primary carrier of fire is moderate load broadleaf litter, less compact than 182. Spread rate is very moderate; flame length is low.
187	The primary carrier of fire is heavy load of forest litter, includes large diameter downed logs. Spread rate low; flame length low.
188	The primary carrier of fire is moderate load long-needle pine litter, may include small amount of herbaceous load. Spread rate is moderate; flame length low.
189	The primary carrier of fire is very high load, fluffy broadleaf litter. This can also be used to represent heavy needle-drape. Spread rate is very moderate; flame length moderate.
201	The primary carrier of fire is light dead and down activity fuel. Fine fuel load is 10 to 20 t/ac weighted towards fuels 1 to 3 inch diameter class; depth is less than 1 foot. Spread rate is moderate; flame length moderate.
202	The primary carrier of fire is moderate dead and down activity fuel or light blowdown. Fine fuel load is 7 to 12 t/ac, evenly distributed across 0 to 0.25, 0.25 to 1, and 1 to 3 inch diameter classes, depth is about 1 foot. Blowdown is scattered, with many trees still standing. Spread rate is moderate; flame length moderate.
203	The primary carrier of fire is heavy dead and down activity fuel or moderate blowdown. Fine fuel load is 7 to 12 t/ac, weighted toward 0 to 0.25 inch diameter class, depth is more than 1 foot. Blowdown is moderate; trees compacted to near the ground. Spread rate is high; flame length high.
204	The primary carrier of fire is heavy blowdown fuel. Blowdown id total, fuelbed is not compacted, most foliage and fine fuel still attached to blowdown. Spread rate is very high; flame length very high.

Appendix V: Glossary of Terms

Glossary of Terms	
Aspect	A position facing or commanding a given direction; exposure. Aspect is the compass direction of the prevailing slope with respect to true north.
Azimuth	A horizontal angular measure from true north to an object of interest.
Basal Area	The cross-sectional area of the stem or stems of a plant, or of all plants in a stand, generally expressed as square units per unit area. For trees, measured at 4.5 feet above ground, for forbs and grasses, measured at the root crown.
Bole Length	The straight-line distance measured parallel to the main bole of a tree, from its base to its tip.
Breast Height	A point located on the uphill side of the main stem, by measuring 4.5 feet along the uphill side of the bole from ground level or the predominant root collar. Preclude slight, non-compacted litter accumulations when establishing breast height.
CALVEG	Classification and Assessment with LANDSAT of Visible Ecological Groupings. It is a California wide system for classifying vegetative and non-vegetative cover types. The primary cover type relates to life form and uses a 3-character alpha code.
Canopy Cover	The percent of a fixed area covered by the crown of an individual plant species, or delimited by the vertical projection of its outermost perimeter; small openings in the crown are included.
Compacted Live Crown Ratio	The percent of the total height of the tree which supports a full, live crown. For trees that have uneven length crowns, ocularly transfer lower branches to fill holes in the upper portions of the crown, until a full, even crown is created.
Compartment	A land area, usually between 3,000 and 8,000 acres, easily identified on the ground by physical features. A compartment is comparable in size to a sub-watershed, or landscape management unit. It is used as a convenience for maintaining stand records and planning vegetation management projects.
Crown Class	The relative position of the tree or shrub crown with respect to the competing vegetation around it. Crown class for each tree or shrub is judged in the context of its immediate environment, that is, those trees or shrubs which are competing for sunlight with the subject tree or shrub.
Crown Length	The vertical distance from the top of the leader to the base of the crown, measured to the lowest live branch-whorl with live branches in at least 3 quadrants, and continuous with the main crown.
Crown Ratio	The ratio of compacted live-crown length to bole length. Lengths are measured parallel to the bole from the base of the tree to the tip.

Glossary of Terms	
DEM	Digital Elevation Model. USGS geographic elevation data distributed in raster form. Digital representation of the shape of the earth's surface. Typically digital elevation data consists of arrays of values that represent topographic elevations measured at equal intervals on the Earth's surface.
Diameter	The length of a straight-line segment passing through the center of an item and terminating at its periphery.
Diameter at Breast Height (DBH)	A measure of the tree bole at breast height (4.5 feet), outside bark, perpendicular to the tree bole.
Diameter at Root Collar (DRC)	The straight line passing through the center of a cross section of a bole measured at the root collar of a shrub or tree.
Down Log	Stem material (conifer or hardwood) that is lying on the ground. If a stem material is leaning more than 45 degrees from vertical, is not self-supporting, and/or in contact with the ground, it is considered a down log.
Down Woody Material	Woody pieces of trees and shrubs that have been uprooted (no longer supporting growth) or severed from their root system, not self supporting, and are lying on the ground.
Duff Layer	Duff is the fermentation and humus layer of the forest floor. It does not include the freshly cast material in the litter layer. The top of the duff is where needles, leaves, and other cast-off vegetative material have noticeably begun to decompose. Individual particles usually will be bound by fungi mycelium. When moss is present, the top of the duff is just below the green portion of the moss. The bottom of the duff is the start of the soil ("A" horizon).
Elevation	Vertical distance from a datum, usually mean sea level, to a point or object on the earth’s surface. Not to be confused with altitude, a reference to points above the earth’s surface.
Fuel Bed	The fuel bed is the accumulation of dead, woody residue on the forest floor. It begins at the top of the duff layer and above. It includes litter, dead limbwood and bolewood from tree species, as well as dead material from shrub, herbaceous, and grass species.
Fuel Model	Mathematical descriptions of fuel properties (e.g., fuel load and fuel depth) that are used as inputs to calculations of fire danger indices and fire behavior potential.
GPS	Global Positioning System. A network of radio-emitting satellites deployed by the U.S. Department of Defense. Ground-based GPS receivers can automatically derive accurate surface coordinates for all kinds of GIS, mapping, and surveying data collection.
Ground Level	The forest floor, made up by soil and duff layer. It does not include unincorporated woody debris that may rise above the ground line. In reference to a point of measure, it is the highest point of the ground touching the base of the object being referenced.
Group Talley	A count of one or more items of the same type or species and recorded as a single line entry.

Glossary of Terms	
Growth	A measure of the increase in growth layers for a specified time frame.
Height Growth	The increase in height over a set period of time.
Intersect Diameter	Measurement of diameter at a point where the sampling plane intersects the geometric center of the object being tallied. No adjustment is made for stem irregularities at the point of intersection.
Lean (Tree)	The deflection from vertical, > 15 degrees of a straight line passing through the geometric center of the base and top of the main stem.
Length	The measurement of the extent of something along its greatest dimension.
Life Form	Species and individuals that are grouped into classes on the basis of their similarities in structure and function. A growth form which displays an obvious relationship to important environmental factors.
Limiting Distance	A comparative measurement between the subplot radius and the distance from the subplot center to the center of the object. The comparison is used to determine whether the object is IN or OUT of the fixed-area subplot. **IN** - The object is "in" if the measured distance is equal to or less than the subplot radius. **OUT** - The object is "out" if the measured distance is greater than the subplot radius.
Live Crown Length	The straight-line distance measured parallel to the main bole of a tree, from the top of the live crown to the base of the live crown.
Ownership	The identification of the legal owner/administrator on both the surface and subsurface estates.
Plant Species	The major subdivision of a genus or subgenus of a plant being described or measured.
Plot Configuration	The size and shape of the sampling unit (plot) and the spatial arrangement of subplots within that unit.
Plot	A sub-sample of a plot or stand exam. This is the unit on which data are recorded to individual trees, snags, logs, understory vegetation, and fuels. Data can be collected on either a fixed-radius or variable-radius area.
Proclaimed Forest	Units of the National Forest System as originally proclaimed or designated by Congress.
Quadratic Mean Diameter	The diameter of the tree of average basal area.
Radial Growth Increment	The increase in tree radius over a period of time at breast height, or occasionally at the base.
Random Sample	Any method of sample selection based on the theory of probability (degree of certainty). At any stage of the operation of selection, the probability of any set of units being selected must be known. It is the only method that can provide a measure of precision of the estimate.

Glossary of Terms	
Reconciliation Code	A code used to reflect the status of an individually tallied item with regards to previous surveys.
Slope	A deviation from the horizontal.
Species	A code that represents a fundamental category of taxonomic classification of an organism.
Stand	A spatially continuous group of trees and associated vegetation having similar structures and growing under similar soil and climatic conditions.
Stand Exam Grid	Basic data collection method for stand exams. It consists of a set of plots, separated by equal distances on a grid pattern. The lines of the grid (transects) are oriented in cardinal directions. There is a predetermined distance between plots. The number of transects and grid plots will vary depending upon the size and shape of the stand.
Stratified Sample	A method of sampling forest resources where stands or polygons of similar properties are lumped into strata. This improves the efficiency of an inventory by reducing the variability within a given population. The less variability there is within a strata, the fewer samples will need to be taken to achieve a statistically valid result.
Stratum	A group of stands within a condition class; similar characteristics such as forest type, tree-size class, and canopy density.
Stump	The woody base of a tree remaining in contact with the soil after the trunk or main stem has been severed at a point less than 4.5 feet above ground height (measured on the uphill side).
Tree	A woody perennial plant, typically large, with a single well-defined stem carrying a more or less definite crown.
Tree Age	Total age of the above ground stem of a tree (not age of the root stock or the total age from seed). Total age is usually the annual ring count to the pith of the tree at breast height plus an estimate of the number of years it took the tree to reach breast height.