

INTERIM GUIDELINES DEFINING OLD GROWTH STANDS:
PACIFIC PONDEROSA PINE (SAF 245)
PACIFIC SOUTHWEST REGION

Old Growth Definition Team #4:
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1. INTRODUCTION

Ecology and Forest Inventory data were examined and analyzed to formulate a set of old growth stand descriptors for the Pacific Ponderosa Pine existing vegetation cover type in California. This is an Interim Definition.

Pacific Ponderosa Pine, SAF cover type 245 is represented by ponderosa pine in pure (greater than 80% basal area stocking), or nearly pure stands, although other conifer and hardwood species may be present in small amounts. The Pacific ponderosa pine type is most extensive and best developed in the Pacific Southwest Region in the Sierra Nevada from Shasta southward through El Dorado County. It lies in a narrow elevational band that varies from 1000 to 2000 ft. in the northern part of the state to about 3500 ft. in the central Sierra Nevada mountains. The type has been subject to heavy disturbance from fire, cutting, recreation, grazing, road construction, and other activities for many years (Eyre, 1980).

Synonyms for Pacific Ponderosa Pine in the Pacific Southwest Region are: Ponderosa Pine (Mayer et al 1988); Westside Ponderosa Pine Forest (CNDDB, 1986); Sierran Yellow Pine Forest; (Kuchler, 1977); Yellow Pine Forest (Munz and Keck, 1973); Ponderosa Pine; Mixed Conifer-Pine (Parker and Matyas, 1981); Ponderosa/Jeffrey Pine (Payson et al, 1980); and Yellow Pine Forest (Thorne, 1976).

2. METHODS

Data were derived from two sources: Ecosystem Classification plots and Forest Inventory plots. A total of 53 plots were used in the analysis.

A. ECOSYSTEM CLASSIFICATION PLOTS

Data collection followed the procedures outlined in the Region 5 Ecosystem Classification Handbook (USDA Forest Service 1987). Procedures included a modified Region 5 Forest Inventory Analysis (FIA) (USDA Forest Service 1988) sample at each plot. Minimally disturbed sample stands were selected in a variety of environments in order to sample the variation in the target type. The data were collected as part of the Zone 4 Mixed Conifer Classification (Benson, Fites, in draft). Homogeneous, older stands were

best represented in the data set. A total of 14 Ecology Program plots were used in the analysis.

Each ecosystem classification plot included a cluster of three variable radius points using a 20 or 40 basal area factor prism. The points were placed at: cluster plot center, and one chain north, and one chain east of cluster plot center, respectively. Attributes collected at each point included basal area, diameter at breast height, age, height, crown class, and 10 and 20 year radial growth increment of a dominant or codominant site tree.

A complete species list and percent cover of vegetative layers were recorded on a 1/10 acre circular plot placed at cluster plot center

Data were collected on the Plumas, Eldorado, Lassen, Shasta-Trinity, and Tahoe National Forests.

B. FOREST INVENTORY ANALYSIS (FIA) PLOTS

Thirty-nine plots from the Region 5 Forest Inventory were used in the analysis. Inventory data bases from the Angeles, Mendocino, Lassen, Plumas, Sierra, Eldorado, Stanislaus, Tahoe National Forests and the Lake Tahoe Basin Management Unit were examined for suitable plots. Plots were deemed to be suitable if basal area stocking was at least 80% ponderosa pine. These data were collected using the procedures in the R-5 Timber management plan inventory handbook (USDA Forest Service 1988). These plots were located in various seral stages, and disturbance history of the plots could not be determined from the raw data.

Age of the oldest measure tree was used in the combined data set as the measure of stand age. This resulted in more consistency between the two somewhat different data sets:

The Ecosystem plots were sited for purposes of classification. Sample stands were selected subjectively, without preconceived bias (Mueller-Dombois and Ellenberg, 1974). The cluster points in these stands tended to represent homogeneous forest stand conditions, with uniform aggregations of tree sizes. The FIA plots were stratified and located randomly, and these plots tend to show more variation with respect to stocking, tree size, and age. Average measure tree age is a suitable estimate of stand age in the more homogeneous Ecosystem plots, but not in the FIA plots. Age of the oldest tree is therefore a "common denominator" measure of stand age in the two different data sets.

Raw data from both data sets were reduced and compiled by means of the Region 5 Forest Inventory data analysis programs. These programs were used to derive information on stand structure, growth, and species composition for each plot. These data were then examined using statistics and graphics programs. Analysis methods are described in : 5. Data Analysis Procedures.

3. OLD GROWTH ATTRIBUTES

The National Old Growth Task Group (2410 letter, 11/21/90, Enclosure 2) requires the following attributes:

I. Live Trees in Main Canopy; Trees per Acre:

A. R-5 Site Classes 1a, 1 (High)

n = 18

Beginning of Old Growth stage: 125 years.

Stand Basal Area: Mean = 248; standard dev. =119; typical range= 113-327.

Conifers ≥ 30 " + Hardwoods ≥ 15 ":

Mean=19.6 sd=11.1 minimum (hypothesis) =11

Typical range=11-28

Large pine trees have yellow platy bark.

B. R-5 Site Classes 2,3,4,5 (Moderate-Low)

n = 20

Beginning of Old Growth stage: 145 years

Stand Basal Area: Mean =101 ; standard dev. =50; typical range= 54-149.

Conifers ≥ 30 " + Hardwoods ≥ 15 ":

Median=2.7 minimum (hypothesis) = 2 Typical range= 2 - 11

Large trees have yellow platy bark.

II. Variation in Tree Diameters

Some variation in tree diameters is acceptable.

III. Dead Trees

A. Standing snags per acre: Greater than or equal to 2/acre.

B. Down pieces per acre: Greater than or equal to 1/acre.

Numbers of snags and down logs vary widely in Pacific Ponderosa Pine depending on stand history. Stands with a history of frequent low-intensity fires and low mortality from insect and disease pathogens may have few or no snags or logs.

IV. Tree Decadence (Flattening tops, spike tops, bole or root decay, large fire scars)

Greater than or equal to 1/acre

V. Number of Tree Canopies

Greater than or equal to 2.

4. LIMITATIONS

The data set used for this definition is small and variable. The type has been subjected to heavy disturbance and different kinds of type conversion in the last 100 years, and there is no way to determine the level of disturbance in the measured plots. These definitions are Interim, and documented field testing is required.

5. DATA ANALYSIS PROCEDURES

Data were expanded and summarized using the Region 5 Forest Inventory and Analysis computer programs FIA*SUMMARY and FIA*MATRIX. Attributes extracted from these programs included total basal area/acre, basal area by tree diameter groups, quadratic mean diameter, trees per acre by stand and by diameter groups; R-5 Site Class; and growth estimates.

The data were analyzed with the SYSTAT and SYGRAPH statistical software (Wilkinson, 1990). Some 40 attributes and attribute combinations were examined. Scatterplots of different stand attributes vs age of the oldest tree were constructed and smoothed via a robust locally weighted regression algorithm (Cleveland, 1979, Chambers et al 1983). These plots were examined visually and inflection points hypothesized that are typical of the onset and cycling of old growth characteristics in the stands. A comparison of different groupings of attributes by site classes with one-way analysis of variance and Tukey box plots resulted in the combining of site classes into two categories: High (R-5 Site Classes 0,1) and Moderate-low (R-5 Site Classes 2,3,4,5). Cutoff points in the data set were determined for "old growth" and "non-old growth" plots by site class grouping, and summary statistics generated for each group.

Distributions were examined, and, where appropriate, parametric descriptors were used to describe the data. When distributions were non-normal, rank order statistics were used to describe the data (Chatfield, 1990).

The hypothesized minimum is the lower interquartile.

The "typical range" reported is the interquartile range in both normal and non-normal data.

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PROCEDURE FOR TESTING STANDS

1. The stand to be sampled should be at least five acres in area.
2. Lay out a standard R-5 FIA cluster with the center point near the middle of the stand. If the stand is linear, sample along a transect where the tree points are at least two chains (one chain = 66') apart.
3. Measure basal area with variable radius plot techniques at each point. Record tree and snag tallies by diameter on the Stand Structure Worksheet (Appendix B). Use this information to determine if you are in the correct SAF type. If in Interior Ponderosa Pine, you should be within the geographic area of the type, and 80% of the stand basal area should be ponderosa or Jeffrey pine. Ponderosa pine should comprise the majority (>50%) of the pine stocking.
4. Measure the height and age of at least two dominant or codominant trees and use the table in Appendix A to determine R-5 Site Class.
5. Fill out the Stand Evaluation Standard Error Calculation Sheet (Appendix C) to determine if the stand has been adequately sampled.
6. Compare the numbers on the completed Stand Structure Worksheet to the tabular numbers in this report to determine if the stand meets the old growth criteria.
7. A fixed area belt or circular plot may be installed to estimate snag and log numbers.
8. Note other important features in the stand, such as number of canopy layers; stand stability; regeneration; disturbance.
9. Use the (Draft!!) Old Growth Rating Spreadsheet (Appendix D) to rate the relative value of the stand on a 1-100 scale.

Comments are welcome. Please return them to:

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TIMBER MANAGEMENT PLAN INVENTORY HANDBOOK

TABLE 1. REGION FIVE SITE CLASSES
(HEIGHT BY AGE AND SITE CLASS CODE)

Age	Site Class (Field 9)					
	0	1	2	3	4	5
40	95	81	66	49	43	35
50	106	90	75	56	49	39
60	115	98	82	63	53	43
70	122	105	88	68	58	45
80	129	111	93	73	61	48
90	135	116	98	77	64	50
100	140	121	102	81	67	54
110	145	125	106	84	70	54
120	149	129	109	87	72	55
130	153	133	112	90	74	57
140	157	136	115	93	76	58
150	160	139	118	95	78	60
160	163	142	120	98	80	61
170	166	144	123	100	81	62
180	169	147	125	102	83	63
190	172	149	127	104	84	64
200	175	152	129	106	86	65
220	179	156	133	109	88	67
240	184	160	136	112	90	68
260	188	163	139	115	93	70
280	191	166	142	117	95	71
300	195	169	145	120	96	73
320	198	172	147	122	98	74
340	201	175	150	124	100	75
360	204	177	152	126	101	76
380	206	180	154	128	103	77
400	209	182	156	130	104	78

Note: Based on ponderosa pine, Jeffrey pine, sugar pine, Douglas-fir, red fir, and white fir. Age is in years. Total height is in feet of average dominant and predominant trees with tree age of at least 50 years. Adapted from Dunning's site index curves for height at 300 years. Bulletin #28 Forest Research Notes 12/1/42, rerun 11/58. (Predominant and dominant are defined in Field 21, Crown Position.)

STAND STRUCTURE WORKSHEET

SAF Type:

Location:

Examiner:

Diam	Tally x BAF = Total BA - BA/Tree - #PTS = TPA						% Stand BA	Diam	Tally x BAF = Total BA - BA/Tree - #PTS = TPA						% Stand BA
8				3491				27				39767			
9				4418				28				42761			
10				5454				29				45869			
11				6600				30				49087			
12				7854				31				52414			
13				9218				32				55851			
14				10690				33				59396			
15				12272				34				63050			
16				13963				35				66813			
17				15763				36				70686			
18				17671				37				74667			
19				19689				38				78758			
20				21817				39				82958			
21				24053				40				87266			
22				26398				41				91684			
23				28852				42				96211			
24				31416				43				100847			
25				34080				44				105592			
26				36870				45				110447			
For live trees, use Dot Tally: 10 =															
For snags 1.5' DBH, 20' high, use Line Tally: 5 =															
								TOTAL							

Number of Points =

Total TPA =

Total Snags per Acre =

Stand BA = $\frac{\left\{ \sum \text{Live Tree Tally} \right\} \times \text{BAF}}{\text{No. of Points}}$ = _____

Comments:

Stand Evaluation Standard Error Calculation Sheet

Location: _____

Examiner: _____

Date: _____

Cluster Point (n)	BA/Point (x)	x ²
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
	$\Sigma x =$	$\Sigma x^2 =$

$$\bar{x} = \frac{\Sigma x}{n} = \boxed{}$$

$$\text{Standard Deviation (Sd)} = \frac{\sqrt{\Sigma x^2 - \frac{(\Sigma x)^2}{n}}}{n - 1} = \sqrt{\frac{ - }{}}$$

$$= \sqrt{\frac{}{}} = \sqrt{} = \boxed{}$$

$$\text{Standard Error (SE)} = \frac{Sd}{\sqrt{n}} = \frac{}{\sqrt{}} = \boxed{}$$

$$\% \text{ Standard Error (\% SE)} = \frac{SE}{\bar{x}} \times 100 = \frac{}{} \times 100 = \boxed{} \%SE^*$$

$$\text{Coefficient of Variation (\%)} = \frac{Sd}{\bar{x}} \times 100 = \frac{}{} \times 100 = \boxed{}$$

*If %SE is >20%, then take more points and recalculate %SE.

APPENDIX D
 OLD GROWTH IMPORTANCE RATING SPREADSHEET
 DRAFT DRAFT DRAFT
 6/1/91

UNIT- TOTAL VALUE - O RATING IS:

USE THE FOLLOWING CHART TO DETERMINE THE RELATIVE OLD GROWTH IMPORTANCE LEVEL:

TOTAL VALUE	CLASS
<30	VERY LOW
31-40	LOW
41-50	MODERATE
51-75	HIGH
75+	VERY HIGH

INSTRUCTIONS

ENTER A "1" IN COLUMN ONE FOR EACH FACTOR WHICH IS PRESENT ON THE SITE BEING RATED AND A "0" FOR EACH FACTOR WHICH IS ABSENT. PICK ONLY ONE FROM EACH GROUP OF FACTORS BETWEEN THE SINGLE DASHED LINES. IF NONE OF THE FACTORS ARE TRUE THAN ENTER ALL ZEROS.

RATING TABLE

PRESENT - 1 ABSENT - 0	RATING FACTOR	WEIGHT	VALUE
1. STAND SIZE			
0	100 ACRES PLUS	25	0
0	50-99 ACRES	15	0
0	25-49 ACRES	10	0
0	10-24 ACRES	7	0
0	<10 ACRES	5	0
2. LARGE TREES			
0	MEETS OG REQ FOR LARGE TREES, WITHIN 1 SD OF THE MEAN	15	0
0	MEETS MINIMUM OG REQ FOR LARGE TREES, FROM 1.28 TO 1 SD FROM MEAN	12	0
0	POTENTIAL TO MEET LARGE TREE NUMBERS WITHIN 50 YEARS	10	0
0	POTENTIAL IN 50-100 YEARS	3	0
3. SITE INTEGRITY			
0	UNDISTURBED; SHR, HERBS INTACT	15	0
0	LIGHT DISTURBANCE, >10 YRS OLD	12	0
0	RECENT, HEAVY DISTURBANCE	5	0
4. SNAGS			
0	>=3/ACRE >20"DBH; 20 FT HIGH	15	0
0	2-3/ACRE >20"DBH; 20 FT HIGH	12	0
0	0.5-2/ACRE >15"DBH; 20 FT HIGH	10	0
0	0-0.5/ACRE >15"DBH; 20 FT HIGH	5	0
5. LOGS			
0	>=1.5/ACRE, 20in x 10in x 10ft	15	0
0	0.5-1.5/ACRE, 20in x 10in x 10	10	0
0	0-0.5/ACRE, 20in x 10in x 10ft	5	0
6. STAND CONTINUITY			
0	GAPS/OPENINGS <= 10% OF AREA	5	0
0	GAPS/OPENINGS >=11% OF AREA	3	0

7. STAND STABILITY

0.....	STABLE: STOCKING; FUELS PRECLUDE STAND REPLACING EVENTS INCLUDING HIGH INTENSITY FIRE; PANDEMIC INSECT; PATHOGEN OUTBREAKS. STAND APPEARS STABLE FOR AT LEAST 50 YEARS	10	0
0.....	MODERATELY UNSTABLE: PRESENCE OF FUEL OR STAND STRUCTURE CONDITIONS AS ABOVE ON >35% OF THE AREA. STAND APP STABLE FOR 25-50 YRS.	8	0
0.....	MANAGEMENT ACTIVITIES IN PLACE TO SPECIFICALLY MAINTAIN AND PROMOTE OLD GROWTH INTEGRITY AND STABILITY. INCLUDES THINNING, UNDERBURNING, ETC.	7	0
0.....	UNSTABLE CONDITIONS THROUGHOUT THE AREA. STAND AT HIGH RISK FOR STAND REPLACING FIRES, HEAVY INSECT; PATHOGEN OUTBREAKS.	3	0

TOTAL OLD GROWTH IMPORTANCE VALUE- 0

