QUANTATATIVE STAND ASSESSMENT TOOLS

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ASSESSMENT TOOLS

- **Stand Stocking**
  - **Spacing – Top Height Ratio**
  - **Stand Density Index**
  - **Relative Density**
  - **RD**

- **Stand Competition**
  - **Live Crown Ratio**
  - **Height – Diameter Ratio**

SPACING – TOP HEIGHT RATIO

- Divide tree spacing by height of a stand
- Generally mean top height is used
- Ratio gets smaller as stocking increases
- Useful in undifferentiated stands

- Typical Minimum Values
  - Douglas-fir 0.14
  - Western Hemlock 0.12
  - Ponderosa Pine 0.16

STAND DENSITY INDEX

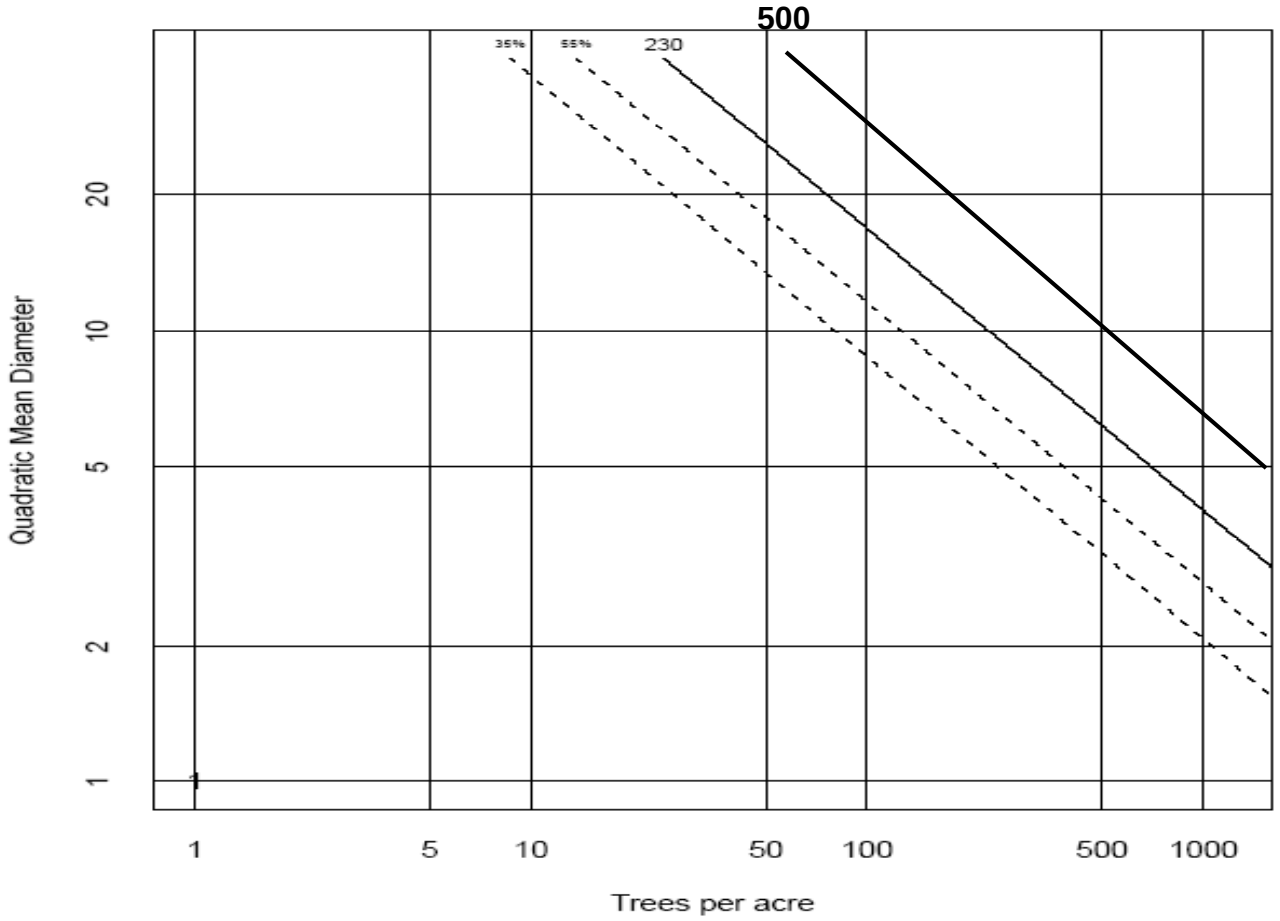
$$SDI = TPA\ (QMD/10)^{1.605}$$

- Developed by L.H. Reineke in 1933
- Relates Trees Per Acre and Diameter

- Typical Maximum Values

– Coast Douglas-fir	595	400
– Western Hemlock	790	530
– Ponderosa Pine	800	375

SDI MANAGEMENT DIAGRAM



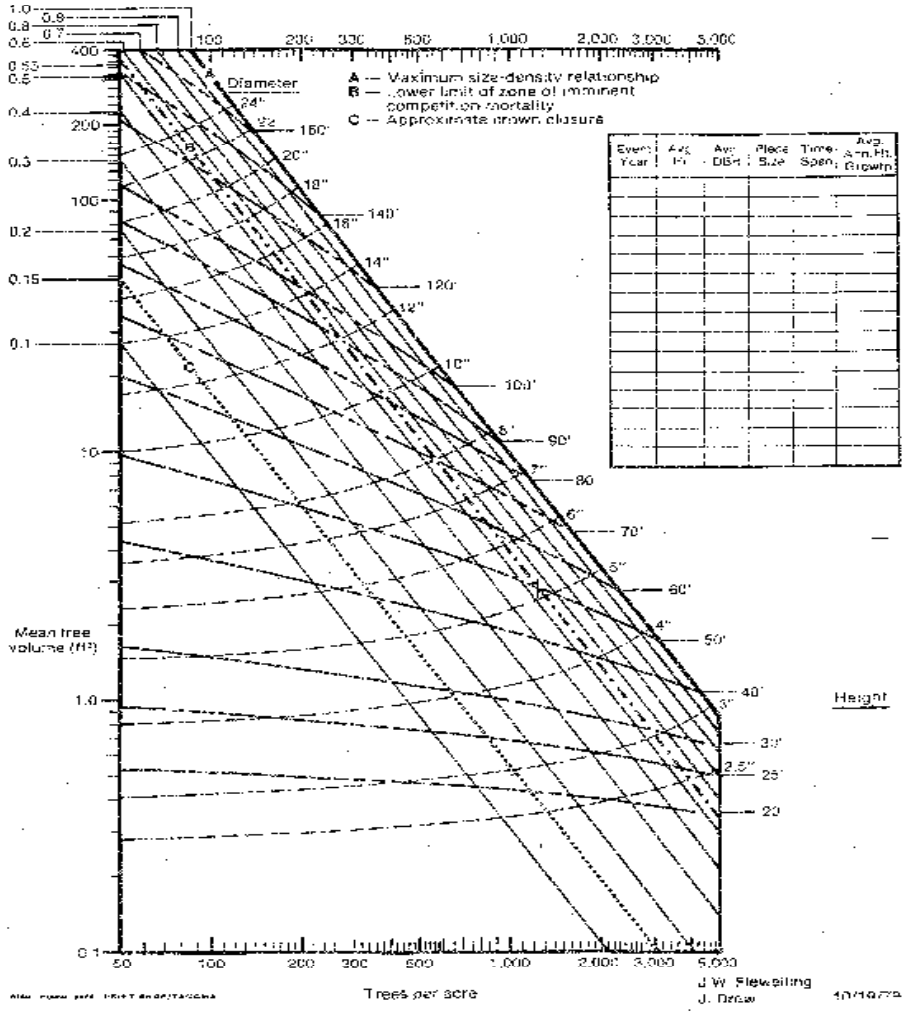
RELATIVE DENSITY

Maximum Size-Density Relationship

Ln volume = 12.644 – 1.5 ln TPA

- **Defined by Drew and Flewelling in 1979**
- **Developed First for Douglas-fir**
- **Relates Trees Per Acre and Tree Volume**
- **Uses –3/2 Self Thinning Law (Yoda et al., 1963)**
- **Typical Values**
  - **0.55 to 1.00 Zone of Imminent Mortality**
  - **0.40 to 0.55 Optimum Growth**
  - **0.15 to 0.40 Crown Closure**

DOUGLAS- FIR DENSITY MANAGEMENT DIAGRAM



CURTIS' RD

$$RD = \frac{\text{Basal Area}}{\sqrt{QMD}}$$

- **Defined by Bob Curtis in 1982**
- **Ratio of Stand Basal Area and Square Root of Quadratic Mean Diameter**
- **Developed for Even-Age Single Species Stands**
- **Typical Maximum Values**
  - **Douglas-fir 65**
  - **Western Hemlock 75**

STAND STOCKING ASSESSMENT SUMMARY

	OPTIMUM	HIGH
Spacing/Top Height	0.18-0.15	< 0.14
Stand Density Index	325-400	> 425
RD	40-60	> 62
Relative Density	0.40-0.55	> 0.55

DIAMETER - STOCKING - RD RELATIONSHIP

DBH	RD 40	45	50	55	60	65	70	75
9	272	306	340	373	407	441	475	509
10	232	261	290	319	348	377	406	435
11	201	226	251	276	302	327	352	377
12	176	198	221	243	265	287	309	331

THUMB FUN

DBH	*DF (TPA)*	DF (BA)
14	0	_____
15	4	_____
16	6	_____
17	7	_____
18	9	_____
19	11	_____
20	14	_____
21	12	_____
22	13	_____
23	9	_____
24	5	_____
25	3	_____
26	2	_____
27	4	_____
28	6	_____
29	7	_____
30	2	_____
31	1	_____
Total	115	_____

Ht / Dia Ratio = 80

QMD = _____

RD = _____

SDI = _____

STR = _____

Vol = 119.5

Relative Density = _____

THUMB FUN

DBH	*DF (TPA)*	DF (BA)
14	0	0.0
15	4	4.9
16	6	8.4
17	7	11.0
18	9	15.9
19	11	21.7
20	14	30.5
21	12	28.9
22	13	34.3
23	9	26.0
24	5	15.7
25	3	10.2
26	2	7.4
27	4	15.9
28	6	25.7
29	7	32.1
30	2	9.8
31	1	5.2
Total	115	303.6

Ht / Dia Ratio =	80
QMD =	22.0
RD =	64.7
SDI =	407.7
STR =	0.13
Vol =	119.5
Relative Density =	0.64

LIVE CROWN RATIO

- **Divide Length of Live Crown by Total Height**
- **Described in Percent**
- **Most Useful in Undifferentiated Stands**
- **Typical Values**
  - **0.70 to 0.40 — Open Grown**
  - **0.40 t0 0.30 — Optimum Growth**
  - **0.30 to 0.15 — Severe Competition**
  - **Less than 0.15 — Darn Near Dead**

HEIGHT – DIAMETER RATIO

- **Ratio of Total Height to Diameter (DBH)**
- **Ratio uses the same units in calculation**
- **Typical Values**
  - **Greater Than 100 — Noodle**
  - **70 to 80 — Stand Grown**
  - **Less Than 65 — Open Grown**

ASSESSMENT OF MIXED SPECIES STANDS

- Mixed Species < 80 % of a single species
- RD can exceed 120
- Management more ART than SCIENCE
- General Rule
  - Add 5 to 10 RD units to the maximum RD value of the most tolerant species in the stand

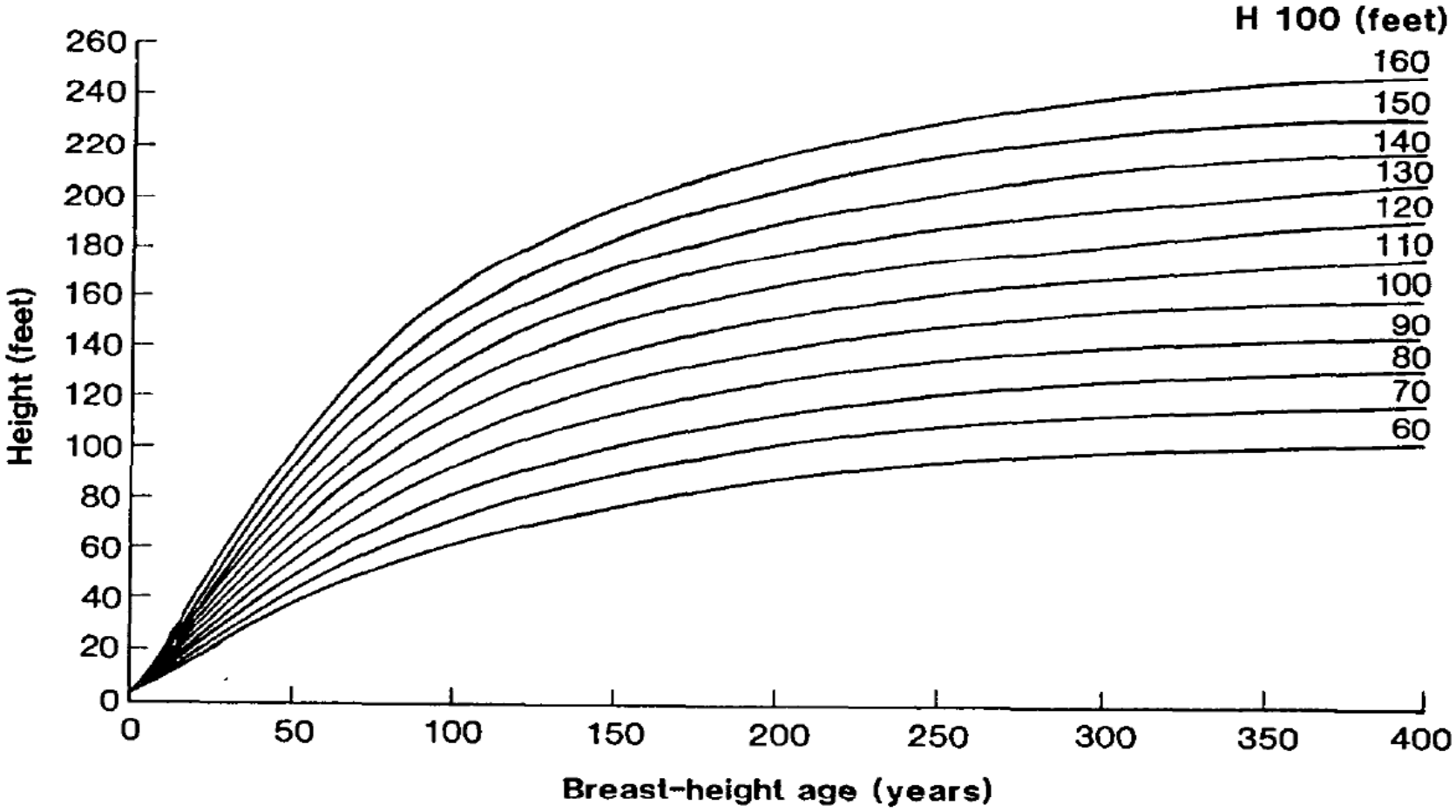
UNEVEN AGE STANDS

- Q-factor:
  - A devise used to describe the structure of an uneven aged stand. The q-factor is the ratio of the number of trees in a diameter class divided by the number of trees in the next smaller diameter class. The lower the q-factor, the higher the proportion of large diameter trees.

PRODUCTIVITY ASSESSMENT

- Site Index
- Plant Association
- Biogeographic Zones

DOUGLAS FIR SITE INDEX CURVES



DOUGLAS FIR SITE INDEX CURVES

Age bh	Height at index age 100										
	60	70	80	90	100	110	120	130	140	150	160
Years	*Feet*										
10	9	10	11	12	13	14	15	16	17	18	19
20	16	18	20	22	25	27	29	32	34	36	39
30	22	26	30	34	37	41	45	48	52	56	60
40	29	34	39	44	49	54	59	64	69	74	79
50	36	42	48	54	60	66	72	79	85	91	97
60	42	49	56	63	70	77	84	92	99	106	113
70	47	55	63	71	79	87	95	103	111	119	127
80	52	60	69	78	87	96	104	113	122	131	140
90	56	66	75	84	94	103	113	122	132	141	150
100	60	70	80	90	100	110	120	130	140	150	160
110	64	74	84	95	106	116	126	137	148	158	168
120	67	78	88	100	110	121	132	143	154	165	176
130	70	81	92	104	115	126	137	149	160	171	183
140	72	84	95	107	119	130	142	154	165	177	189
150	74	86	98	110	122	134	146	158	170	182	194
160	77	89	101	113	126	138	150	162	174	187	199
170	78	91	103	116	128	141	153	166	178	191	203
180	80	93	106	118	131	144	156	169	182	194	207

INDICATOR SPECIES

Plant Indicator Species Of Coastal Forested Slopes

Botanical Name	Common Name	Non-Native Invasive Plant	Life Form	Successional Stage	Hydrologic Regime	Tolerance	Erosion Control Value	Relative Slope Stability
See Common Name Index for Cross Reference		Usually indicative of disturbed and/or unstable conditions.	A..... Annual P..... Perennial H..... Herbaceous W.... Woody D ..... Deciduous E..... Evergreen O..... Overstory Canopy U..... Understory Canopy	E..... Early T..... Transitional L..... Late	W.... Wet M..... Moist D ..... Dry	SS..... Salt & Spray S..... Shade NI.... No Information	D ..... Detrimental V..... Variable EC ... Surface Erosion Control SS..... Slope Stabilization	U..... Unstable V..... Variable D ..... Disturbed S..... Stable
Lowest Strata: Groundcovers, Subshrubs, And Vines								
Arctostaphylos uva-ursi	Kinnikinnik		P, W, E	T	D		EC	D
Blechnum spicant	Deer Fern		P, H, D, E	T, L	W, M	S	EC	S
Carex spp.(1)	Sedge		P, H, D, E	T, L	W, M, D (1)	S	EC	U,V
Cirsium arvense	Canada Thistle	√	P, H, D	E	M, D		D	U, D
Cornus unalaschkensis	Bunchberry		P, H, D	T, L	M, D	S	EC	S
Digitalis purpurea	Foxglove	√	P, H, D	E	D		D	U, D
Epilobium angustifolium	Fireweed		P, H, D	E, T	D		D,V	U, D
Equisetum spp.(2)	Horsetail		P, H, D, E	E, T	W, M, D (2)	S	EC, D,V	U, D

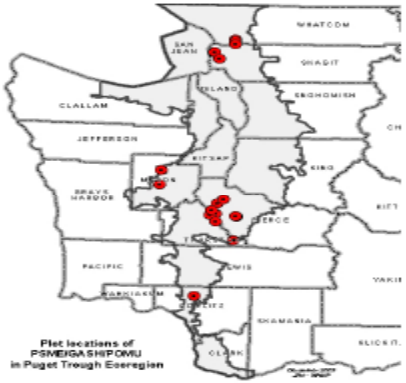
PLANT ASSOCIATION GUIDE

KEY TO THE PLANT SERIES

1a.	Sitka spruce (PISI) is the dominant regenerating species on the site.	SITKA SPRUCE FIRST RED
1b.	Sitka spruce (PISI) is absent or not dominant compared to other regenerating species on the site.	2
2a.	Oregon white oak (QUGA4) is the dominant regenerating species on the site.	OREGON WHITE OAK FIRST BLUE
2b.	Oregon white oak (QUGA4) is absent or not dominant compared to other species regenerating on the site.	3
3a.	Ponderosa pine (PIPO) is the dominant regenerating species on the site.	PONDEROSA PINE FIRST YELLOW
3b.	Ponderosa pine (PIPO) is absent or not dominant compared to other regenerating species on the site.	4
4a.	Tanoak (LIDE3) is the dominant regenerating species on the site.	TANOAK FIRST GREEN
4b.	Tanoak (LIDE3) is absent or subordinant to other regenerating species on the site.	5

PLANT ASSOCIATION GUIDE

Douglas-fir / salal / sword fern



Plot locations of PSMEGASHPOMU in Puget Trough Ecoregion

Douglas-fir / salal / sword fern

Soil series: Everett, Dystric xerochrepts, Seaquest, Hesson, Xerochrepts, Alderwood, Guemes, Andic xerochrepts, Fidalgo, Rainier, Pheeny, Cagey, Typic udorthents

DISTURBANCE/SUCCESSION: Fire is the primary natural disturbance. The few old-growth stands show evidence of past low- to moderate-severity fire (underburns). Most stands are young or mature in age, and many of our samples were disturbed by past logging activities (especially on Fort Lewis). Most stands are located in landscapes that formerly supported prairies or savannas maintained by Native American burning practices. It is probable that some of these stands could support more shade-tolerant conifers in the absence of long-term disturbance.

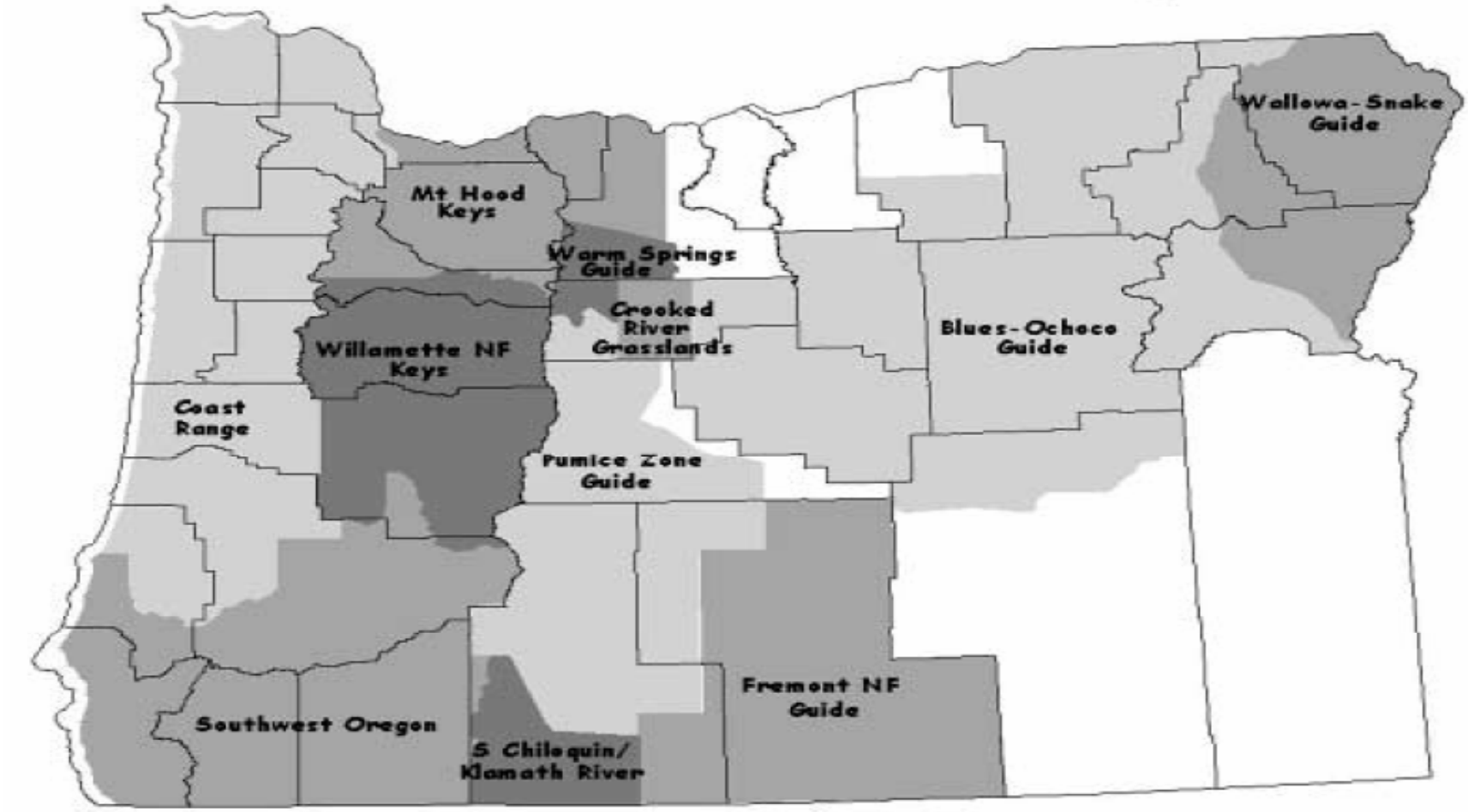
VEGETATION: Canopy dominated by Douglas-fir or occasionally co-dominated as well by bigleaf maple. Douglas-fir is sometimes regenerating under its own canopy in these stands. Salal dominates or co-dominates the understory. Oceanspray and/or beaked hazelnut usually form a prominent to co-dominant tall shrub layer. Trailing blackberry (an increaser with disturbance), dwarf Oregongrape, and common snowberry are often prominent in the shrub or dwarf-shrub layers. Other frequent shrubs and vines are baldhip rose, red huckleberry, and orange honeysuckle. Sword fern is always prominent to dominant in the herb layer; bracken fern is often prominent. Sweet-scented bedstraw, western starflower, Coast Range fescue, and twinflower are frequently occurring herbs.

CLASSIFICATION NOTES: First described by Chappell (2001). Without a better sample of naturally-regenerated post-logging stands in western Washington lowlands, it is difficult at this point to be certain about the classification of this unit. It may very well be part of a larger association that includes many young seral stands. NatureServe (2005) does not recognize this association, but it is slated to be included in the future in a new global PSME/GASH-MANE/POMU association, which is broader in concept than this Puget Trough unit.

MANAGEMENT NOTES: These sites appear to be moderately productive for tree growth. Stands previously disturbed may be good candidates for selective logging techniques. Non-native English ivy (*Hedera helix*) may be a threat on some of these sites.

Chappell, C.B. 2006. Upland plant associations of the Puget Trough ecoregion, Washington. Washington Department of Natural Resources, Natural Heritage Program, Olympia, WA. [http://www.dnr.wa.gov/nhp/refdesk/communities/pdf/intro.pdf].

OREGON PLANT ASSOCIATION GUIDES



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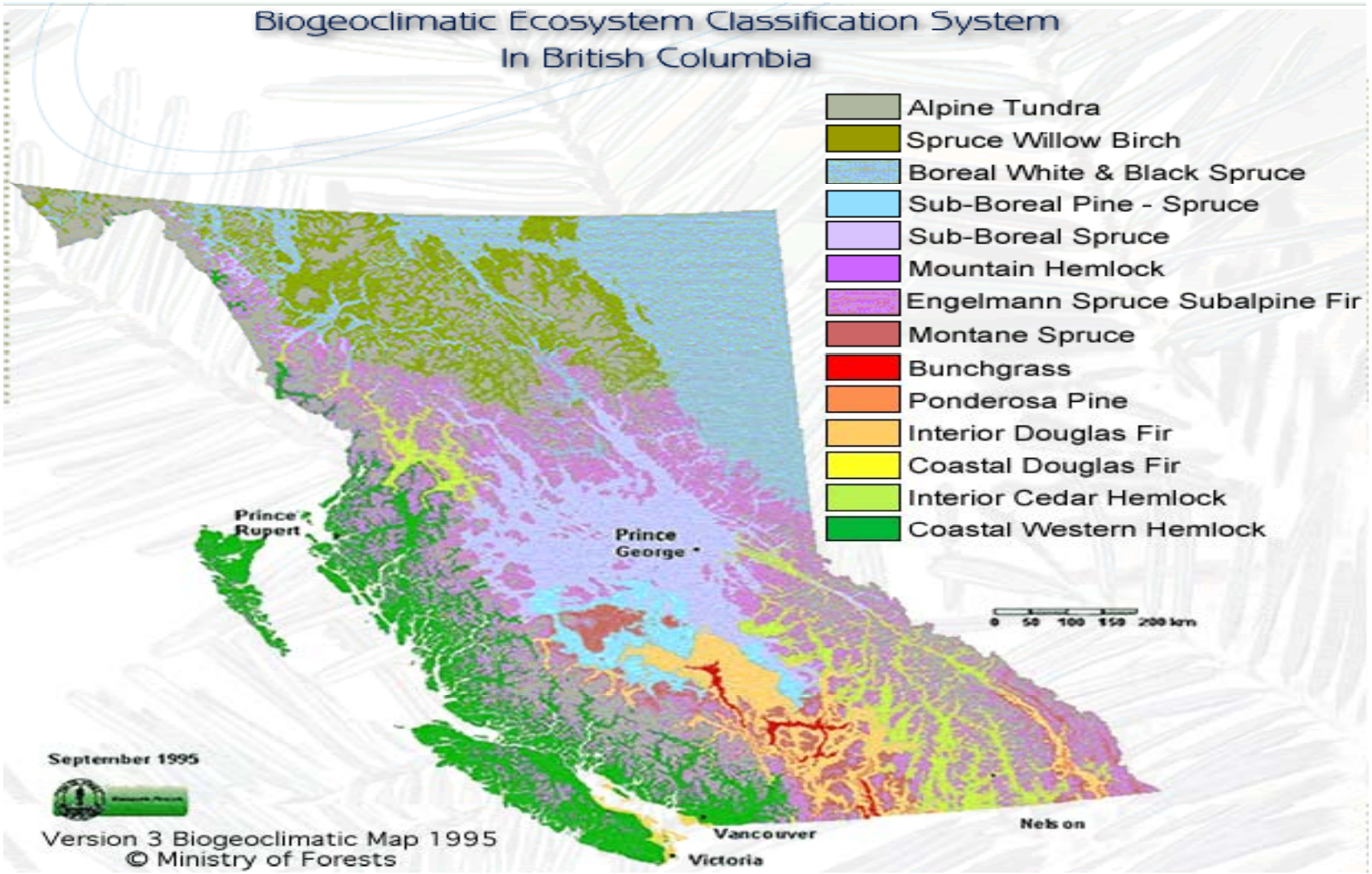
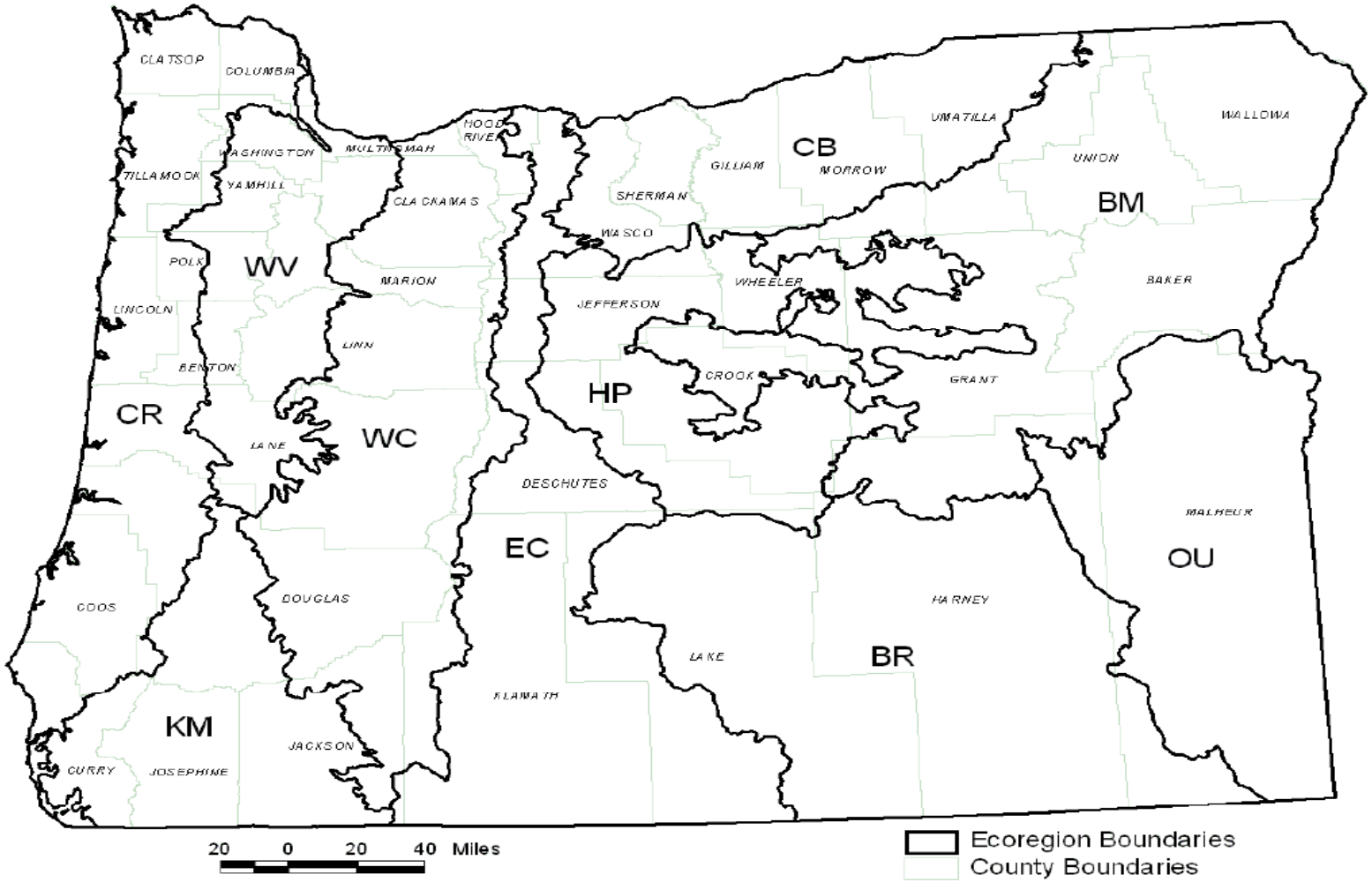
BIOGEOCLIMATIC ZONES



OREGON ECOREGIONS



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BLM – ODF Joint Thinning Training – Silver Falls State Park

WHAT DID YOU LEARN?