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ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION

Estimating Past Diameters of Ponderosa Pines in Arizona and New Mexico

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Past diameters of ponderosa pines in Arizona and New Mexico can be estimated with the tables presented here. Two measurements must be made on each tree, both at breast height: (1) diameter and (2) radial growth of wood for any desired period. Radial growth of wood is measured on increment cores extracted along the best estimate of average radius. Bark thickness is not measured; the tables make allowance for bark growth.

Separate tables are presented for blackjack and old-growth ponderosa pines, because blackjacks have thicker bark than old-growth pines of equal diameter. Rapidly tapering ponderosa pines with dark, furrowed bark are called blackjacks in the Southwest. Old-growth trees are less tapering than blackjacks and have yellowish bark that forms broad, flat plates on the oldest trees.

Past diameters are given in the tables for several combinations of present diameter and periodic radial growth. For example,

if the present diameter of a blackjack is 20.0 inches and radial wood growth totaled 0.45 inch for a particular period, the diameter was 19.0 inches at the beginning of the period. Interpolation may be used to obtain past diameters when present diameters and amounts of radial growth differ from those given in the tables. Past diameters of trees with radial growth less than 0.40 inch (blackjacks) or 0.55 inch (old-growth) can be obtained by subtracting twice the amount of radial growth from present diameter. Bark growth of such trees is too small to affect diameter measurements made to the nearest 0.1 inch.

The following relationships apply to blackjack ponderosa pines now 8 to 38 inches in diameter:

Conversion of diameter outside bark to diameter inside bark:

$$d.i.b. = 0.9344 (d.o.b.) - 1.1923$$

Conversion of diameter inside bark to diameter outside bark:

$$d.o.b. = 1.0698 (d.i.b.) + 1.2840$$

For old-growth ponderosa pines now 12 to 38 inches in diameter:

Conversion of diameter outside bark to diameter inside bark:

$$d.i.b. = 0.9498 (d.o.b.) - 1.1217$$

Conversion of diameter inside bark to diameter outside bark:

$$d.o.b. = 1.0524 (d.i.b.) + 1.1918$$

Correlation coefficient of all four equations is +0.9998.

The standard errors of estimate are 0.0165, 0.0186, 0.0143, and 0.0158, respectively.

Past diameters can be computed with the following equations; they were obtained by

combining the two equations of each set given above.

For blackjacks:

$$\text{Past d.o.b.} = \text{present d.o.b.} + 0.01 - 2.14 (\text{radial growth})$$

For old-growth pines:

$$\text{Past d.o.b.} = \text{present d.o.b.} + 0.01 - 2.10 (\text{radial growth})$$

Basic data were obtained from 676 blackjacks and 595 old-growth trees, with samples taken from all major areas of commercial ponderosa pine in Arizona and New Mexico. Diameters to the nearest 0.1 inch were measured with a diameter tape. Bark thickness at breast height was measured to the nearest 0.05 inch at three points on each tree.

Table 1.--Present and past diameters of blackjack ponderosa pines in Arizona and New Mexico

Present d.b.h. outside bark	Radial wood growth in inches																			
	0.40	0.45	0.55	0.65	0.75	0.85	0.95	1.05	1.15	1.25	1.35	1.45	1.55	1.65	1.75	1.85	1.95	2.05	2.15	2.25
8.0	7.0	6.8	6.6	6.3	6.1	5.8	5.6	5.3	5.1	4.8	4.6	4.3	4.0	3.8	3.5	3.3	3.0	2.8	2.5	2.3
9.0	8.1	8.0	7.8	7.5	7.3	7.0	6.8	6.5	6.3	6.0	5.8	5.5	5.2	5.0	4.7	4.5	4.2	4.0	3.7	3.5
10.0	9.1	9.0	8.8	8.6	8.4	8.2	8.0	7.7	7.4	7.2	6.9	6.7	6.4	6.2	5.9	5.7	5.4	5.2	4.9	4.6
11.0	10.1	10.0	9.8	9.6	9.4	9.2	9.0	8.8	8.5	8.3	8.1	7.9	7.6	7.4	7.1	6.9	6.6	6.4	6.1	5.8
12.0	11.1	11.0	10.8	10.6	10.4	10.2	10.0	9.8	9.5	9.3	9.1	8.9	8.7	8.5	8.3	8.0	7.8	7.5	7.3	7.0
13.0	12.1	12.0	11.8	11.6	11.4	11.2	11.0	10.8	10.5	10.3	10.1	9.9	9.7	9.5	9.3	9.0	8.8	8.6	8.4	8.2
14.0	13.1	13.0	12.8	12.6	12.4	12.2	12.0	11.8	11.5	11.3	11.1	10.9	10.7	10.5	10.3	10.0	9.8	9.6	9.4	9.2
15.0	14.1	14.0	13.8	13.6	13.4	13.2	13.0	12.8	12.5	12.3	12.1	11.9	11.7	11.5	11.3	11.0	10.8	10.6	10.4	10.2
16.0	15.1	15.0	14.8	14.6	14.4	14.2	14.0	13.8	13.5	13.3	13.1	12.9	12.7	12.5	12.3	12.0	11.8	11.6	11.4	11.2
17.0	16.1	16.0	15.8	15.6	15.4	15.2	15.0	14.8	14.5	14.3	14.1	13.9	13.7	13.5	13.3	13.0	12.8	12.6	12.4	12.2
18.0	17.1	17.0	16.8	16.6	16.4	16.2	16.0	15.8	15.5	15.3	15.1	14.9	14.7	14.5	14.3	14.0	13.8	13.6	13.4	13.2
19.0	18.1	18.0	17.8	17.6	17.4	17.2	17.0	16.8	16.5	16.3	16.1	15.9	15.7	15.5	15.3	15.0	14.8	14.6	14.4	14.2
20.0	19.1	19.0	18.8	18.6	18.4	18.2	18.0	17.8	17.5	17.3	17.1	16.9	16.7	16.5	16.3	16.0	15.8	15.6	15.4	15.2
21.0	20.1	20.0	19.8	19.6	19.4	19.2	19.0	18.8	18.5	18.3	18.1	17.9	17.7	17.5	17.3	17.0	16.8	16.6	16.4	16.2
22.0	21.1	21.0	20.8	20.6	20.4	20.2	20.0	19.8	19.5	19.3	19.1	18.9	18.7	18.5	18.3	18.0	17.8	17.6	17.4	17.2
23.0	22.1	22.0	21.8	21.6	21.4	21.2	21.0	20.8	20.5	20.3	20.1	19.9	19.7	19.5	19.3	19.0	18.8	18.6	18.4	18.2
24.0	23.1	23.0	22.8	22.6	22.4	22.2	22.0	21.8	21.5	21.3	21.1	20.9	20.7	20.5	20.3	20.0	19.8	19.6	19.4	19.2
25.0	24.1	24.0	23.8	23.6	23.4	23.2	23.0	22.8	22.5	22.3	22.1	21.9	21.7	21.5	21.3	21.0	20.8	20.6	20.4	20.2
26.0	25.1	25.0	24.8	24.6	24.4	24.2	24.0	23.8	23.5	23.3	23.1	22.9	22.7	22.5	22.3	22.0	21.8	21.6	21.4	21.2
27.0	26.1	26.0	25.8	25.6	25.4	25.2	25.0	24.8	24.5	24.3	24.1	23.9	23.7	23.5	23.3	23.0	22.8	22.6	22.4	22.2
28.0	27.1	27.0	26.8	26.6	26.4	26.2	26.0	25.8	25.5	25.3	25.1	24.9	24.7	24.5	24.3	24.0	23.8	23.6	23.4	23.2
29.0	28.1	28.0	27.8	27.6	27.4	27.2	27.0	26.8	26.5	26.3	26.1	25.9	25.7	25.5	25.3	25.0	24.8	24.6	24.4	24.2
30.0	29.1	29.0	28.8	28.6	28.4	28.2	28.0	27.8	27.5	27.3	27.1	26.9	26.7	26.5	26.3	26.0	25.8	25.6	25.4	25.2
31.0	30.1	30.0	29.8	29.6	29.4	29.2	29.0	28.8	28.5	28.3	28.1	27.9	27.7	27.5	27.3	27.0	26.8	26.6	26.4	26.2
32.0	31.1	31.0	30.8	30.6	30.4	30.2	30.0	29.8	29.5	29.3	29.1	28.9	28.7	28.5	28.3	28.0	27.8	27.6	27.4	27.2
33.0	32.1	32.0	31.8	31.6	31.4	31.2	31.0	30.8	30.5	30.3	30.1	29.9	29.7	29.5	29.3	29.0	28.8	28.6	28.4	28.2
34.0	33.1	33.0	32.8	32.6	32.4	32.2	32.0	31.8	31.5	31.3	31.1	30.9	30.7	30.5	30.3	30.0	29.8	29.6	29.4	29.2
35.0	34.1	34.0	33.8	33.6	33.4	33.2	33.0	32.8	32.5	32.3	32.1	31.9	31.7	31.5	31.3	31.0	30.8	30.6	30.4	30.2
36.0	35.1	35.0	34.8	34.6	34.4	34.2	34.0	33.8	33.5	33.3	33.1	32.9	32.7	32.5	32.3	32.0	31.8	31.6	31.4	31.2
37.0	36.1	36.0	35.8	35.6	35.4	35.2	35.0	34.8	34.5	34.3	34.1	33.9	33.7	33.5	33.3	33.0	32.8	32.6	32.4	32.2
38.0	37.1	37.0	36.8	36.6	36.4	36.2	36.0	35.8	35.5	35.3	35.1	34.9	34.7	34.5	34.3	34.0	33.8	33.6	33.4	33.2

l/ Values below the dashed line were computed from the equations. Elsewhere, past d.i.b. was converted to past d.o.b. by extending the computed line to the origin.

Table 2.--Present and past diameters of old-growth ponderosa pines in Arizona and New Mexico

Present d.b.h. outside bark inches	Radial wood growth in inches																		
	0.55	0.65	0.75	0.85	0.95	1.05	1.15	1.25	1.35	1.45	1.55	1.65	1.75	1.85	1.95	2.05	2.15	2.25	2.35
12.0	10.7	10.5	10.2	10.0	9.8	9.5	9.3	9.1	8.8	8.6	8.4	8.1	7.9	7.7	7.4	7.2	7.0	6.7	6.4
13.0	11.8	11.6	11.4	11.1	10.9	10.7	10.4	10.2	10.0	9.7	9.5	9.3	9.0	8.8	8.6	8.3	8.1	7.9	7.6
14.0	12.8	12.6	12.4	12.2	12.0	11.8	11.5	11.3	11.1	10.8	10.6	10.4	10.1	9.9	9.7	9.4	9.2	9.0	8.7
15.0	13.8	13.6	13.4	13.2	13.0	12.8	12.6	12.4	12.2	11.9	11.7	11.5	11.2	11.0	10.8	10.5	10.3	10.1	9.8
16.0	14.8	14.6	14.4	14.2	14.0	13.8	13.6	13.4	13.2	13.0	12.7	12.5	12.3	12.1	11.9	11.6	11.4	11.2	10.9
17.0	15.8	15.6	15.4	15.2	15.0	14.8	14.6	14.4	14.2	14.0	13.7	13.5	13.3	13.1	12.9	12.7	12.5	12.3	12.0
18.0	16.8	16.6	16.4	16.2	16.0	15.8	15.6	15.4	15.2	15.0	14.7	14.5	14.3	14.1	13.9	13.7	13.5	13.3	13.0
19.0	17.8	17.6	17.4	17.2	17.0	16.8	16.6	16.4	16.2	16.0	15.7	15.5	15.3	15.1	14.9	14.7	14.5	14.3	14.0
20.0	18.8	18.6	18.4	18.2	18.0	17.8	17.6	17.4	17.2	17.0	16.7	16.5	16.3	16.1	15.9	15.7	15.5	15.3	15.0
21.0	19.8	19.6	19.4	19.2	19.0	18.8	18.6	18.4	18.2	18.0	17.7	17.5	17.3	17.1	16.9	16.7	16.5	16.3	16.0
22.0	20.8	20.6	20.4	20.2	20.0	19.8	19.6	19.4	19.2	19.0	18.7	18.5	18.3	18.1	17.9	17.7	17.5	17.3	17.0
23.0	21.8	21.6	21.4	21.2	21.0	20.8	20.6	20.4	20.2	20.0	19.7	19.5	19.3	19.1	18.9	18.7	18.5	18.3	18.0
24.0	22.8	22.6	22.4	22.2	22.0	21.8	21.6	21.4	21.2	21.0	20.7	20.5	20.3	20.1	19.9	19.7	19.5	19.3	19.0
25.0	23.8	23.6	23.4	23.2	23.0	22.8	22.6	22.4	22.2	22.0	21.7	21.5	21.3	21.1	20.9	20.7	20.5	20.3	20.0
26.0	24.8	24.6	24.4	24.2	24.0	23.8	23.6	23.4	23.2	23.0	22.7	22.5	22.3	22.1	21.9	21.7	21.5	21.3	21.0
27.0	25.8	25.6	25.4	25.2	25.0	24.8	24.6	24.4	24.2	24.0	23.7	23.5	23.3	23.1	22.9	22.7	22.5	22.3	22.0
28.0	26.8	26.6	26.4	26.2	26.0	25.8	25.6	25.4	25.2	25.0	24.7	24.5	24.3	24.1	23.9	23.7	23.5	23.3	23.0
29.0	27.8	27.6	27.4	27.2	27.0	26.8	26.6	26.4	26.2	26.0	25.7	25.5	25.3	25.1	24.9	24.7	24.5	24.3	24.0
30.0	28.8	28.6	28.4	28.2	28.0	27.8	27.6	27.4	27.2	27.0	26.7	26.5	26.3	26.1	25.9	25.7	25.5	25.3	25.0
31.0	29.8	29.6	29.4	29.2	29.0	28.8	28.6	28.4	28.2	28.0	27.7	27.5	27.3	27.1	26.9	26.7	26.5	26.3	26.0
32.0	30.8	30.6	30.4	30.2	30.0	29.8	29.6	29.4	29.2	29.0	28.7	28.5	28.3	28.1	27.9	27.7	27.5	27.3	27.0
33.0	31.8	31.6	31.4	31.2	31.0	30.8	30.6	30.4	30.2	30.0	29.7	29.5	29.3	29.1	28.9	28.7	28.5	28.3	28.0
34.0	32.8	32.6	32.4	32.2	32.0	31.8	31.6	31.4	31.2	31.0	30.7	30.5	30.3	30.1	29.9	29.7	29.5	29.3	29.0
35.0	33.8	33.6	33.4	33.2	33.0	32.8	32.6	32.4	32.2	32.0	31.7	31.5	31.3	31.1	30.9	30.7	30.5	30.3	30.0
36.0	34.8	34.6	34.4	34.2	34.0	33.8	33.6	33.4	33.2	33.0	32.7	32.5	32.3	32.1	31.9	31.7	31.5	31.3	31.0
37.0	35.8	35.6	35.4	35.2	35.0	34.8	34.6	34.4	34.2	34.0	33.7	33.5	33.3	33.1	32.9	32.7	32.5	32.3	32.0
38.0	36.8	36.6	36.4	36.2	36.0	35.8	35.6	35.4	35.2	35.0	34.7	34.5	34.3	34.1	33.9	33.7	33.5	33.3	33.0

1/ Values below the dashed line were computed from the equations. Elsewhere, past d.i.b. was converted to past d.o.b. by extending the computed line to the origin.