THINNING LOW SITE PONDEROSA PINE*

May 1985

Throughout the semi-humid western forest zone lies a belt of low site Ponderosa pine. This pine ecotype, made up principally of pine-grass and pine-short shrub communities, stretches from the Black Hills of South Dakota to eastern Washington and Oregon, and from the Mongollon rim of Arizona to the Canadian line in Montana.

One of the limitations to use and management has been overcrowded stand conditions. Many thinnings have been introduced in these stands since the early 1900s. Work begun by Pearson 1/ in the southwest, and later Krauch 2/, and Gaines and Kotok 3/, give us much data on the subject. Recently, Barrett 4/, Boldt 5/, McConnell and Smith 6/, Pearson and Jameson 7/, and Schubert 8/, have given us additional ideas and insights into this limitation.

A summary of diameter growth rates of more recent thinnings are shown in figure 1, from Barrett's, Boldt's ** and Schubert's data. Figure 2 gives some insight into relationships of D+ and herbage production from McConnell and Smith, and Pearson and Jameson. Figure 3 shows D+ -- canopy cover relationships.

In figure 1, note that Barrett's and Schubert's data are comparable. Both are about the same site index, although the climate in each area is considerably different. Boldt's data follows a similar curvilinear relationship below Barrett's and Schubert's data. The site index is only 55 however, and located in the Black Hills. On Boldt's sequentially thinned plots (Boldt 3, figure 1) site index is 70. The benefit of two releases instead of one seems apparent. This does not include the gain in diameter growth by raising the average diameters in the second thinning, but only true diameter growth.

Extra wide spacing by Barrett did not increase diameter growth rate.

In figure 2, McConnell and Smith's and Pearson and Jameson's data show wide spacing to be beneficial in additional herbage production. Exceptionally wide spacing does not apparently increase herbage yield. Composition may change however. Time is also a function of composition.

Figure 3 shows relationship between D+ and crown canopy in Pearson and Jameson's and McConnell and Smith's studies. Since we use four crown canopy divisions as management criteria for our grazing guides in grazeable

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** Boldt's 1 and 2 data, figure 1, from personal communication, 1970.

woodlands, this should clarify the relationship. Note that D+8 to D+14 gives a crown canopy range of 20 to 35%. If we consider the old timber stocking guide of 0-10, 10-40, 40-70, and 70+ for canopy classes, this canopy range would fall in one class, 10-40%. D+8 to D+14 would appear to be a reasonable spacing guide for low site Ponderosa pine where woodland grazing is feasible.

From figures 1 and 2 we can conclude that spacing as shown here is important, and that D+9 to 11 spacing generally at least doubles diameter growth rates found in natural unthinned stands. The same spacing, i.e., D+9 to 11, increases herbage yields by 100% or more. Our Western Pine Woodland Information Stick spacing guides for managed Ponderosa pine approximate these research findings.

BIBLIOGRAPHY

1/ Pearson, G. A., 1950. Management of Ponderosa pine in the Southwest. U. S. Department of Agriculture, Monograph 6, 218pp.

2/ Krauch, Hermann, 1939. The influence of release in relation to diameter growth of Ponderosa pine. U.S. Forest Service, Southwestern Forest and Range Experiment Station, Research Note 59, 2pp.

3/ Gaines, Edward M., and E. S. Kotok, 1954. Thinning Ponderosa pine in the Southwest. U.S. Forest Service, Rocky Mountain Forest and Range Experimetn Station. Pap. 17, 30pp, illustrated.

4/ Barrett, James W., 1965. Spacing and understory vegetation affect growth of Ponderosa pine saplings. U.S. Forest Service Research Note PNW-27, 8pp.

5/ Boldt, Charles E., 1970. Sequential Thinnings Boost Productivity of a Ponderosa Pine Stand in the Black Hills of South Dakota. U.S. Forest Service Research Note RM-172, 8pp.

6/ McConnell, Burt R., and Smith, Justin G., 1965. Understory response three years after thinning pine. Journal of Range Management, Vol. 18:129-132. And Supplemental Progress Report (amended July 12, 1967).

7/ Pearson, Henry A., and D. A. Jameson, 1967. Relationship between timber and cattle production on Ponderosa pine range: The Wild Bill Ranger. U. S. Forest Service, Rocky Mountain Forest and Range Experiment Station, 10pp, illustrated.

8/ Schubert, Gilbert H., 1971. Growth Response of Even-aged Ponderosa Pine Related to Stand Density Levels in Arizona. Journal of Forestry, Vol. 69:857-860.

FIGURE 1

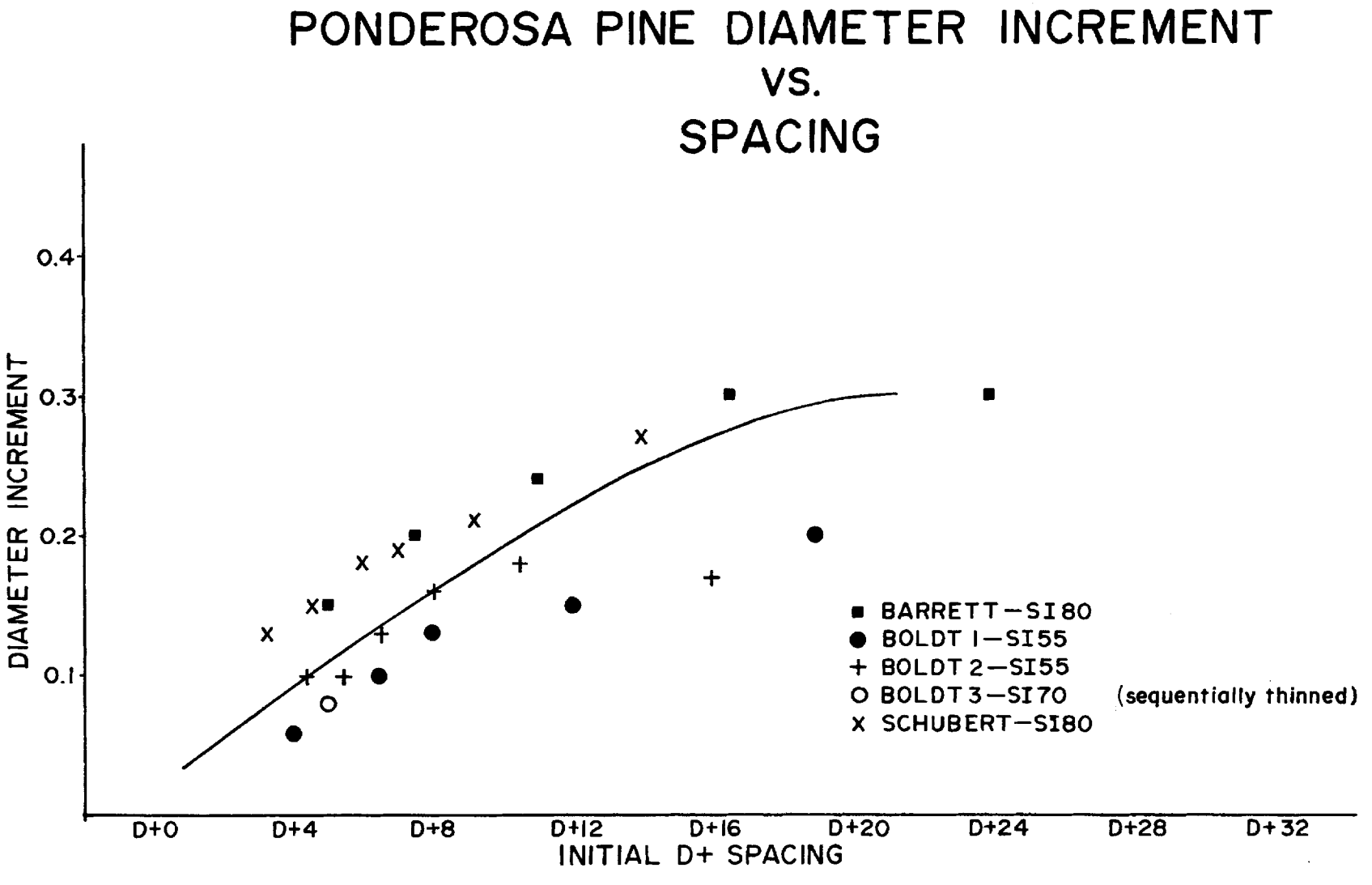

PONDEROSA PINE DIAMETER INCREMENT
VS.
SPACING
DIAMETER INCREMENT
0.4
0.3
0.2
0.1
D+0
D+4
D+8
D+12
D+16
D+20
D+24
D+28
D+32
INITIAL D+ SPACING
BARRETT—SI80
BOLDT 1—SI55
BOLDT 2—SI55
BOLDT 3—SI70
SCHUBERT—SI80
(sequentially thinned)

Figure 2

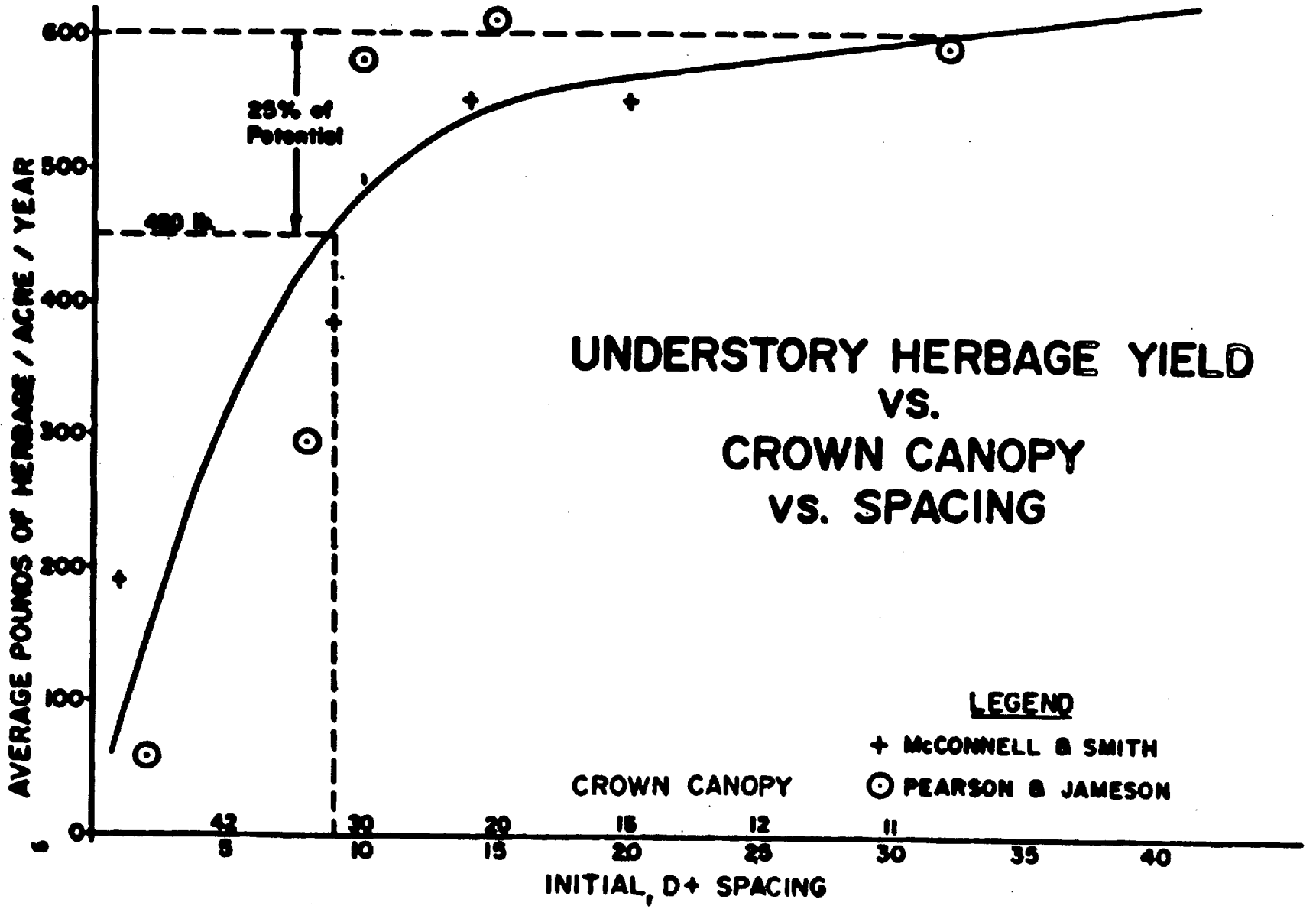
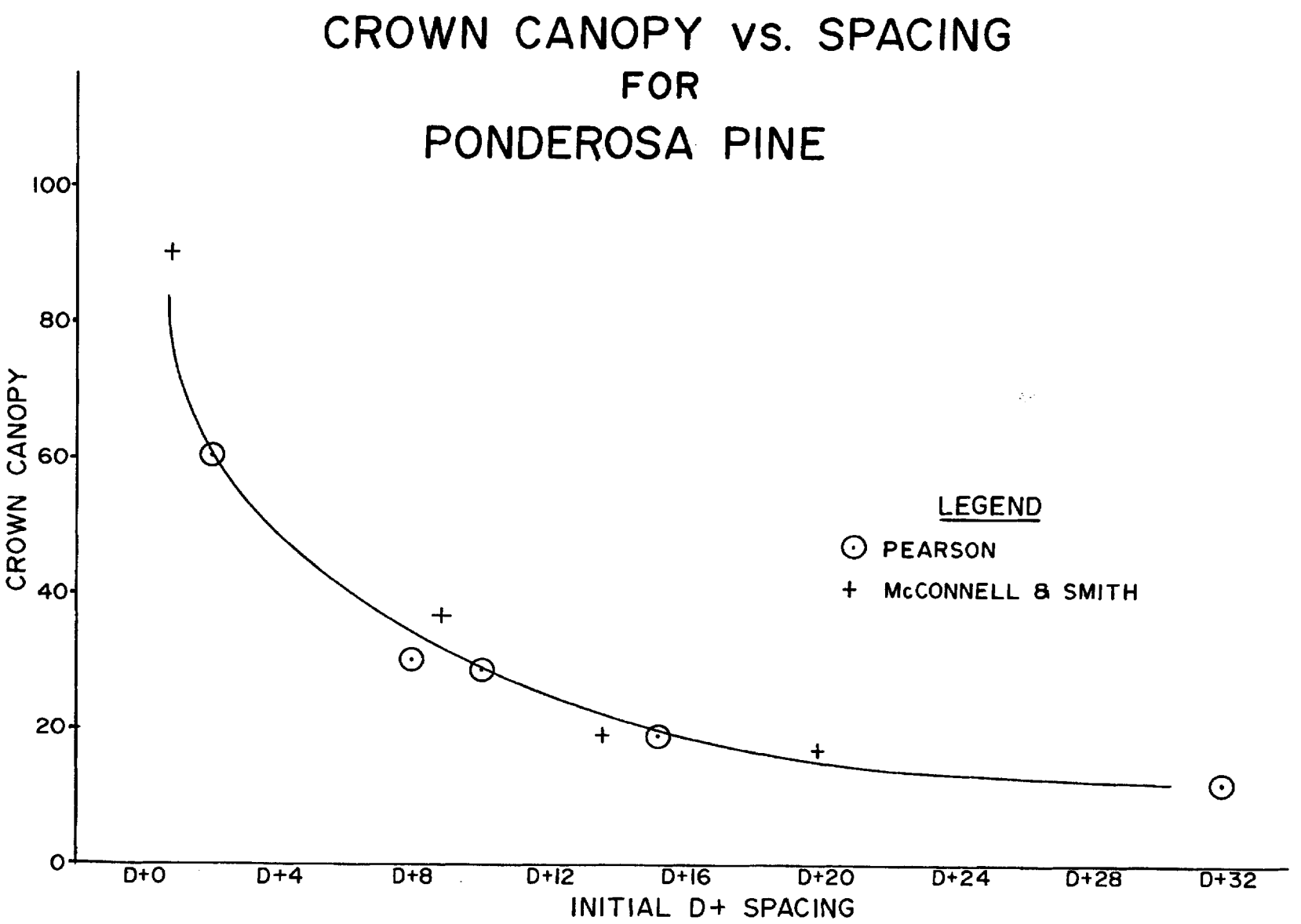

UNDERSTORY HERBAGE YIELD
VS.
CROWN CANOPY
VS. SPACING
AVERAGE POUNDS OF HERBAGE / ACRE / YEAR
600
500
400
300
200
100
0
25% of Potential
LEGEND
+ McCONNELL & SMITH
⊙ PEARSON & JAMESON
CROWN CANOPY
42
30
20
15
12
11
5
10
15
20
25
30
35
40
INITIAL, D+ SPACING

FIGURE 3


CROWN CANOPY vs. SPACING
FOR
PONDEROSA PINE
CROWN CANOPY
100
80
60
40
20
0
D+0
D+4
D+8
D+12
D+16
D+20
D+24
D+28
D+32
INITIAL D+ SPACING
LEGEND
PEARSON
McCONNELL & SMITH

ADDITIONAL NOTES 1/

Figure Two

Data in figure two from McConnell and Smith come from north-central Washington. Common understory species of the ponderosa pine stands were balsam root (Balsamorhiza sagitata), pine grass (Calamagrostis rubescens), silky lupine (Lupinus sericeus), beardless bluebunch wheatgrass (Agropyron inerme), prairie junegrass (Koelaria christata), Idaho fescue (Festuca idahoensis), and bitterbrush (Purshia tridentata). Understory vegetation from the Pearson study was Arizona fescue. (Festuca arizonica), mountain muhly (Muhlenbergia cuspidata), bottlebrush squirreltail (Sitanion hystrix), and sedge (Carex geophila). Location of the study was near Flagstaff, Arizona. The data from the two areas is in good agreement even though it comes from two areas far apart with different understory composition. This suggests the curve is applicable to Montana situations where the ponderosa pine stands are dominated in the understory by grasses and forbs.

It is not clear how quickly herbage production increases can occur after thinning a ponderosa pine from the data presented in figure two of the technical note. However, the values presented in figure two from McConnell and Smith were obtained 3 years after the initial thinning to the respective D+ spacings (values on X axis). Data presented by Pearson at the 20th meeting of the American Society of Range Management, Seattle, February 14-17, 1967 shows high levels of herbage production are attained two years after treatment.

In a follow up study to the one from which the data in table two was taken, McConnell and Smith found that herbage production 7 years after thinning had continued to increase. They found for the 8 year period a 6-pound increase in understory yield for each percent decrease in tree canopy and a 9-pound increase in grass yield for each 1-foot increase in pine spacing.

They also reported in this study increases in yield of grasses, forbs and shrubs with decreasing canopy percent. Average increase in yield (air-dry lbs/ac.) at 30% canopy (D+8 or D+9) over control (90% canopy) is: 200 lbs. for grasses, 175 lbs. for forbs, 35 lbs. for shrubs.

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1/ Prepared by H. E. Hunter, State Staff Forester, SCS, Bozeman, Montana.

2/ McConnell, Burt R., and Smith, Justin G., 1970. Response of understory vegetation to ponderosa pine thinning in Eastern Washington. Journal of Range Management, Vol. 23:208-212.

Figure Three

In figure three the relationship of crown canopy to initial D+ spacing can be used to estimate from our grazable woodland guides future forage value.

Calculations

Example:

1. Ponderosa pine, west of continental divide. Nineteen inches of annual precipitation. Forage condition good.

2. Current stand spacing D+2
   Site index 80

3. Desired spacing for
   SI 80 from guides D+9

4. Canopy at D+2 = 70%

5. Canopy at D+9 = 30%

Using the stocking guide in "Technician's Guide to Grazable Woodland Ponderosa Pine West of Continental Divide - Montana":

Stocking at 30% canopy = .35 aum/A.
70% canopy = .10 aum/A.
.25 aum/A = future forage value if stand is thinned to D+9 spacing.

For canopy densities more than 70%, one can estimate (for excellent forage condition) using the curve in figure two or estimate from measurements or observation.

Using the curve in figure two, for a ponderosa pine stand with 85% canopty (D+1 spacing) herbage production is about 150 pounds/A. Consider 80% of this forage of which 50% can be consumed; we can utilize then, 40% of the herbage production or 60 pounds/A.

Assume 700# of forage per cow month.

60#/A ÷ 700# per cow month = .085 aum/A.

Caution

Use this material as a general guide. These curves have not been tested in Montana. Figures one and three should apply well to ponderosa pine stands in Montana with comparable site indices.

Figure two should apply to climax ponderosa pine stands or climax Douglas-fir (Pseudotsugsi taxifolia) stands invaded by ponderosa pine, where the understory is predominantly grass. Figure two and the sample calculations have little application where the understory is dominated by shrubs or where the climax forest type is alpine fir (Abies lasiocarpa), grand fir (Abies grandis), western hemlock (Tsuga heterophylla), western red cedar (Thuja plicata).