

TECHNICAL NOTES

PRODUCTION OF NATIVE AND INTRODUCED GRASSES IN THE PONDEROSA PINE REGION OF ARIZONA

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The herbaceous vegetation of

the ponderosa pine region of southwestern United States is an important source of forage for domestic livestock and wildlife. Arnold (1950) has pointed out that the quantity of this forage has been reduced by excessive grazing and by competition from increasingly dense pine reproduction.

The vegetation at Malay Gap, in the extreme northeast corner of the San Carlos Indian Reservation in east central Arizona, has been as little altered by man as that of any place in the Southwest. Until recently there has been no usable stock water in the vicinity, and its remoteness and lack of roads has kept out all

but a few visitors. The area serves as a wintering ground for elk that move down from the high country to the east, but has otherwise been ungrazed.

The ground cover at Malay Gap is composed almost wholly of a dense stand of screwleaf muhly (*Muhlenbergia virescens*) (Figure 1). There are a few other grasses and forbs, but in most places more than 90 percent of the volume of herbaceous cover consists of the one species of *Muhlenbergia*. Other species present are *Blepharoneuron tricholepis*, *Sitanion hystrix*, *Panicum bulbosum*, *Stipa pringlei*, *Poa fendleri*, and *Koeleria cristata*. On dry exposed slopes, *Muhlenbergia rigens*, *M. longiligula*, and *Ceanothus fendleri* become more abundant.

The dense grass cover at Malay Gap is perhaps close to the maximum attainable under natural conditions in the ponderosa pine region of Arizona. Grass production was estimated at the end of the growing season by harvesting all of the current year's crop from a number of rectangular plots 9.6 square feet in area. The weight in grams of the grass from one

such plot, multiplied by 10, estimates grass production in pounds per acre. The estimated air-dry weight of the current year's forage production in openings at Malay Gap was 1620 pounds per acre. The standard error of the mean of this estimate is 108.5 pounds.

An area burned by a severe forest fire at Kinney Mountain, near McNary, Arizona, was reseeded in 1954 with a mixture of orchard grass, tall wheatgrass, intermediate wheatgrass, and crested wheatgrass. Growing conditions were good in the years following seeding, and an excellent grass stand was obtained, as good as any reseeded stands in the Arizona pine region. Kinney Mountain is about fifty miles northeast of Malay Gap, at about the same elevation. Soils and growing conditions are closely similar at the two locations.

The Kinney Mountain stand was sampled three years after seeding, when the stand was fully established but before it had been grazed. Average seasonal grass production of the artificially seeded stand at

Kinney Mountain was 2210 pounds per acre. At-test demonstrates that this is significantly greater than the production of native grass at Malay Gap. No analyses were made of the nutritive values of grass from the two areas.

The quantity of herbaceous vegetation in ungrazed stands at Malay Gap is strongly affected by the density of the forest tree canopy. Ground vegetation was harvested from plots under several degrees of tree cover. Percentage of crown cover was estimated at each sampling point with the spherical densiometer described by Lemmon (1956). Based on a total of 20 separate 9.6 square foot plots from 7 sampling points, $V=1600-21C$ where V is grass production in pounds per acre and C is percentage of crown cover. The standard deviation of the regression coefficient is 2.5. The regression accounts for about 81 percent of the observed variance in forage production.

This equation states that production of screwleaf muhly at Malay Gap declines about 21 pounds per acre with each one percent increase in crown cover of ponderosa pine. If projected far enough, the equation indicates no herbaceous vegetation at crown densities above about 75 percent. There is in fact little or no grass beneath dense pine stands. Grass growth in ungrazed stands at Malay Gap is largely dependent on the density of the pine overstory.

LITERATURE CITED

- ARNOLD, J. F. 1950. Changes in ponderosa pine bunchgrass ranges in northern Arizona resulting from pine regeneration and grazing. *Jour. Forestry* 48:118-126.
- LEMMON, P. E. 1956. A spherical densiometer for estimating forest overstory density. *For. Science* 2:314-320.



FIGURE 1. A dense stand of screwleaf muhly in an opening in the ungrazed ponderosa pine forest at Malay Gap.