

through an alcohol-chloroform series as follows: One part chloroform to three parts of 100 per cent. alcohol, one hour; one part chloroform to one part alcohol, one hour; three parts chloroform to one part alcohol, one hour; pure chloroform, one hour. Saturate the chloroform with paraffin and leave twelve hours, add more paraffin and put in an oven at 58° C. for six hours. Pour off the liquid and add melted paraffin and leave in the oven for forty-eight hours, then embed and section at 12 microns.

Delafield's haematoxylin is a very satisfactory stain, since it shows up the tissues well and has the added advantage of being permanent. The sections should be stained from 10 to 30 minutes and then washed in water and destained in 50 per cent. acid alcohol (3 drops of HCl to 100 cc of alcohol) until the sections are a deep pink color, then wash in ammonia alcohol (5 drops of ammonia to 100 cc of 50 per cent. alcohol) until they are a light blue color. Run up and mount in dammar or balsam.

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#### GRASS VOLUME TABLES FOR DETERMINING RANGE UTILIZATION

FORESTERS have used tree volume tables for decades, but the authors know of no previous effort to develop volume tables for range grasses. There is an urgent need for a mechanical means of determining the degree of grazing of forage plants on national forests and other ranges in the West. The use of such tables offers a very promising aid in range research and in practical range inspection.

More than seven hundred samples of sixteen important range grasses have been collected, mainly from Montana national forests. The plants were cut and weighed to show the weight per inch of height, and tables have been prepared for each species. There appears to be very satisfactory correlation between weight and volume. A much greater concentration of weight exists in the lower portions than is generally known among range ecologists. In *Festuca idahoensis* approximately three fourths of the weight is in the lowest one fourth of height, and other species show similar distribution. The basic method was devised in 1927 by the senior author. Under his direction further development was made in 1934-35 by Chandler Jensen and Kenneth E. Chriswell, and the present form was completed in 1937-38 by Chandler Jensen and Adolph Hecht.

For determining utilization on grazed ranges a table was devised to convert inches of stubble remaining into percentage of height removed. The latter was then aligned with a percentage of volume utilization scale for the species concerned. Edward C. Crafts, of the

Southwestern Forest and Range Experiment Station at Tucson, Ariz., replaced the conversion table with a modified slide rule scale. In this region, we have now developed a partial three-cycle, semi-circular logarithmic scale which converts inches of stubble remaining directly into percentage volume utilization. A full account of this work will be published later.

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