the lightly cut plots the average number of trees per acre is 472, and the growth is only fair. On the heavily cut plot there are 330 trees per acre, and the growth is much better.

In series 4 the uncut control has 462 trees per acre and poor growth. The lightly cut plot has 398 trees per acre, and the growth rate is quite satisfactory.

In series 8 the uncut control has 434 trees per acre; the lightly cut plot has 388 trees with good growth rate; and the heavily cut plot has 298 trees, also with good growth rate.

Finally, series 7 represents a most striking situation. A complete understory of hemlock has remained suppressed on the uncut control plot but has become aggressively dominant on the cut plot where the overtopping hardwoods were removed. These two plots warrant the further analysis shown in Table 2.

This table is another demonstration of hemlock's response to release. Cut the black birch, the beech, and the popple, thereby releasing the hemlock, and see what happens!

These plots will be maintained and remeasured in 1948.

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A Short-Cut Method for Checking Degree of Forage Utilization

A short cut in estimating the degree of forage utilization that is recommended to the range examiner whose time or whose technical knowledge and skill in range work are limited has been developed and tested at the Southwestern Forest and Range Experiment Station.

Its basis is the fact that the percentage of close grazing is proportional to the percentages of total use. As determined by statistical analysis of grazed stubble-height measurements obtained in repeated range surveys, there exists a high degree of correlation between the percentages of grasses grazed at a stubble height of 2 inches or less, the percentages of partly grazed, and the percentages of ungrazed forage. When the percentage of 2-inch grazing is known the associated percentage of partly grazed and the percentage of ungrazed forage may be read directly from a set of stubble-height distribution curves presented in chart form (Fig. 1).

In using this method the examiner simply makes an estimate of the percentage of the important perennial grasses that have been grazed to a height of 2 inches or less and in Figure 1 finds the vertical bar with the 2-inch percentage nearest to this figure. He then reads directly from the upper part of the bar the percentages of partly grazed and of ungrazed forage that are associated with the given percentage of 2-inch grazing.

If the examiner is inexperienced in making ocular estimates of grazing use, he may determine the percentage of 2-inch grazing by a tuft count. To do this he selects at random on a map of the area 16 to 25 points for observation. At each observation point in the field he observes the first 100 perennial grass plants encountered as he walks in a straight line in a predetermined direction from the starting point previously located on the map. The tufts which have been grazed to a height of 2 inches or less are noted and recorded. If an entire tuft is grazed, it is recorded as 1. If the tuft is only partly grazed, the amount of 2-inch grazing is recorded to the nearest tenth. For example, a tuft that has 50 per cent of its area grazed to a height of 2 inches or less is recorded as 0.5. Only the plants with the 2-inch grazing are recorded.

To determine the percentage of 2-inch grazing (with each observation line containing 100 tufts), it is necessary only to add all the tufts grazed to a height of 2 inches or less on all the lines and divide the sum by the number of lines. For example, if there are 848.7 tufts on 20 lines, the average percentage of tufts grazed to a height of 2 inches or less is 42.4.

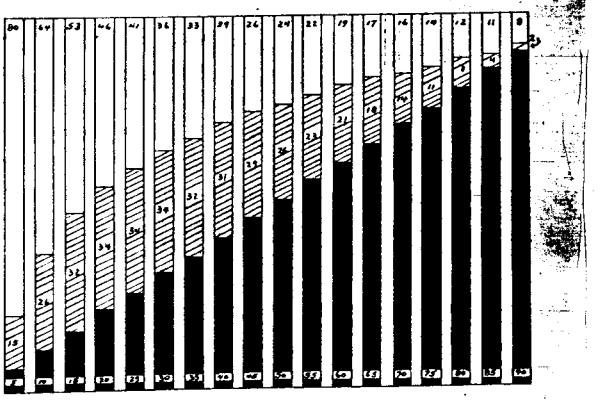

Fig. 1.—Relationship between percentage of total grass stand grazed to 2 inches or less (solid black), percentage grazed above 2 inches (hatched), and percentage ungrazed (unhatched).

The nearest 2-inch percentage on the chart (Fig. 1) is 40. Reading up the 40-per-cent bar, it is found that 31 per cent of the total forage cover is partly grazed and that 29 per cent is ungrazed. These figures indicate with reasonable accuracy how much of the forage has been utilized to date, and consequently how much remains for future use.

Although the short-cut method may not be as precise as some methods, it does not require years of training before the examiner becomes proficient in its use. It rarely misses by a margin as great as 10 per cent, which is much closer than the untrained examiner can estimate the average utilization for a large area. Since the method has not been tested outside the experimental pastures of the Santa Rita Experimental Range in southern Arizona, it should be carefully checked on range types other than the semidesert mixed grass type before being accepted for general use. The basic idea appears to be sound, but its adaptation to use elsewhere may require an index stubble height for each major vegetational type. Information pertaining to the construction of forage utilization tables and the determination of the stubble-height index may be obtained from the Southwestern Station.

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Forestry Officials Discuss Spruce-Fir Tree Pest

Need of a program for joint, international attack on a common foe, the spruce budworm, which in the past five years has killed standing timber valued at $30,000,000 on 90,000 square miles in the province of Ontario, and which now threatens spruce-fir pulpwood forests in New England and the Lake States, is being considered by Canadian and U. S. forestry services.

In preliminary discussions of cooperative means and methods for joint attack on the budworm pest—by officials of the Ontario office of the Department of Lands and Forests and of the U. S. Forest Service—it was agreed that the pest had become a threat to pulpwood production, not only during the war but also afterward.

The Ontario foresters were J. A. Brodie, chief, Division of Forest Protection; H. W. Crosbie, chief, Division of Land and Recreational Areas; R. N. Johnston, chief, Division of Research; J. F. McMillen, chief, Division of Accounts; and J. F. Sharpe, chief, Division of Timber Management.

The importance to the northeast states of combating the spruce budworm, which periodically assumes epidemic proportions and kills vast areas of merchantable timber in a single season, may be seen from the fact that in Maine, New Hampshire, Vermont, Massachusetts, and New York, there are more than 14,000,000 acres of commercial spruce-fir forests, including more than 52,000,000 cords of merchantable timber, worth approximately $105,000,000.

At present, the 94 pulp mills of the Northeast annually cut 1,550,000 cords from these forests, import around 900,000 cords of wood and more than 1,000,000 tons of pulp from Canada, and produce pulp and paper worth approximately $250,000,000 a year. The spruce budworm threatens forests contributory to these mills from both sides of the border.

Lyle F. Watts, chief, U. S. Forest Service, told the Canadian officials that permanent control of the budworm must be through management practices that create and maintain forest conditions unfavorable to the insect. He said that present timber cutting practices, involving much clear cutting and a long interval between cuts—50 or 60 years—create conditions favorable to the budworm, as much defective old fir in the stands attracts the pest.

"Research at the Allegheny Forest Experiment Station," Mr. Watts said, "indicates that shifting to a shorter cutting cycle of 20 to 30 years, with no clear cutting, not only would establish conditions favorable to the control of the budworm, but also would double timber production."