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PRELIMINARY ANALYSIS OF FACTORS RELATED TO UPLAND-BRUSH DENSITY IN MINNESOTA PINE STANDS (1)

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Data reported from surveys in nine northern Minnesota counties (3) indicate that grass and upland brush constitutes the vegetative cover on 13.8 per cent of the 6,379,300 acres of commercial forest land in those counties while the three pine types (jack, red, and white) occupy only 8.2 per cent. Furthermore, a comparison of the 1936 and 1949 survey data (4) on the Central Pine District indicated an average increase of 13 per cent for the brush and grass type during this 13 year period. During the same period comparable data for the pine types indicate an area loss of 19 per cent in the white and red pine types and a three per cent decrease in jack pine acreage.

The brush problem is considered to be a major obstacle to the successful practice of sustained yield forestry because of this large area in brush types and because of the ability of this secondary vegetation to compete successfully with desirable forms of forest regeneration. Before suitable measures to control brush can be developed, the population dynamics of the brush types need to be studied to determine the rates and trends of upland brush population fluctuations as well as the relationships of brush abundance to environmental factors and stand conditions.

In connection with the present study "brush" is considered to include woody species which will reach two feet in height but which do not attain tree size. Field data were collected from 30 sets of concentric plots (1/10, 1/100, 1/200 acres) located in jack pine stands of northern Minnesota for the determination of stand basal area, diameter of the tree with average basal area, stand age, site index, brush density, brush age, silt plus clay content of the soil and soil reaction. The plots were selected to sample a range of brush densities. In the pine stands sampled, hazel was found to be the most frequently encountered brush species. Several species of willow, juneberry, cherry and alder were also common in many stands in addition to several minor species. Bush honeysuckle, blueberries and raspberries were most common of the lower growth forms of woody vegetation.

The study substantiates earlier research (5) on hazel in several ways. Upland brush invasion appears to be a relatively slow process in its initial stages. However, after

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 - (3) Office of Iron Range Resources and Rehabilitation county reports for Aitkin, Beltrami, Cass, Carlton, Clearwater, Crow Wing, Hubbard, Itasca and Wadena counties.
 - (4) Cunningham, R.N. 1951. Changes in forest conditions 1936-1949 North Central Minnesota and Upper Peninsula of Michigan (a preliminary analysis). Lake States Forest Expt. Sta. Paper No. 25.
 - (5) Hsiung, Wen-Yue. 1951. An ecological study of beaked hazel (*Corylus cornuta* Marsh.) in the Cloquet Experimental Forest, Minnesota. Thesis, Ph.D., Univ. of Minn. Unpublished.

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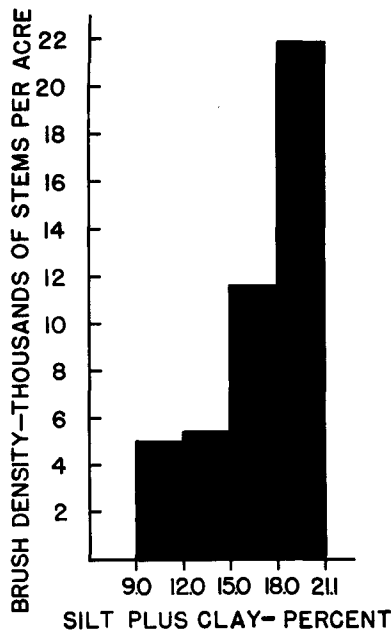


Fig. 1. The relationship between brush density and site index in jack pine stands.

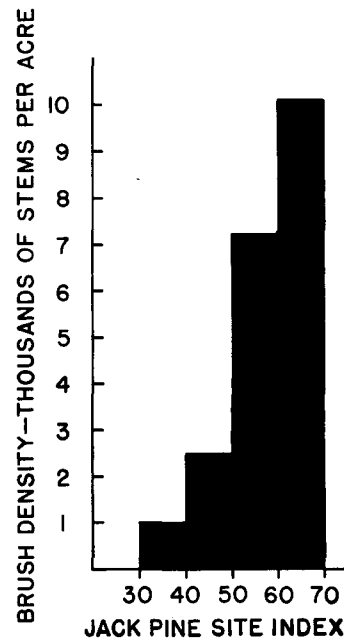


Fig. 2. The relationship of brush density in jack pine stands to the silt plus clay content (per cent by weight) of the soil layer three to six inches below the mineral surface.

brush is once established, the rate of increase in density is very rapid under certain conditions. The present data show that where beaked hazel has been established in jack pine stands for 10 years an average of fewer than two thousand hazel stems are present per acre while after 25 years well over twenty thousand stems per acre are commonly encountered.

It was also evident from the vegetation counts that as site quality increases in terms of the site index for jack pine, both the number of species and the abundance of brush increase. This had been noted earlier (6). Figures 1 and 2 summarize the information obtained relating brush density respectively to jack pine site index and the silt plus clay content of the surface soil.

Although the study is not complete and additional information and data are to be acquired, it is felt that several preliminary conclusions are evident:

1. The abundance of brush in existing forest stands as well as the large and increasing acreage now classified as brush types makes it essential that basic information on the dynamics of brush populations be obtained. Likewise, the interrelationships between brush abundance and environmental and stand conditions need to be better understood.

2. The better the site quality, the more serious the brush problem. Good sites as evidenced by high site index for jack pine and by greater silt plus clay content have average brush densities of 10 to 20 thousand stems per acre. On the poor sites where densities are less than two to three thousand stems per acre, brush can hardly be considered a problem.

3. The relative slowness of the initial brush invasion process suggests that early recognition of the beginning of invasion is important in connection with any control measures, cultural or chemical, which might be undertaken.

(6) Hansen, H.L. 1946. *Analysis of jack pine sites in Minnesota with special reference to site index, plant indicators, and certain soil features. Thesis, Ph.D., Univ. of Minn. Unpublished.*
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