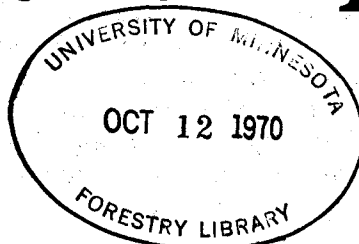


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THE CHARACTER AND EXTENT OF REPRODUCTION IN CERTAIN UPLAND CUTOVER SPRUCE-BALSAM-HARDWOOD STANDS IN NORTH-CENTRAL MINNESOTA

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Studies to determine the extent, composition, thrift and distribution of reproduction in cutover spruce-balsam-hardwood stands in north-central Minnesota were undertaken during the summers of 1952 and 1953 (2). The most common tree species making up this extensive and economically important forest type are balsam fir (Abies balsamea), white spruce (Picea glauca), quaking aspen (Populus tremuloides) and white birch (Betula papyrifera). Other numerically less important species scattered throughout the type include white pine (Pinus strobus), red pine (Pinus resinosa), jack pine (Pinus banksiana), northern white-cedar (Thuja occidentalis), black spruce (Picea mariana), balm-of-Gilead (Populus balsamifera) and black ash (Fraxinus nigra).

The following table summarizes the stocking situation found:

Quadrat Stocking By Local Cover Type.

Local cover types of previous stands	Number of quadrats	Average number of stems of reproduction per acre	Percentage of quadrats stocked			
			Before allowance for mortality ^{1/}	Stand-ard error (%)	After allowance for mortality ^{2/}	Stand-ard error (%)
Pine ^{3/}	330	4463	77.0	5.5	67.3	6.7
Spruce-balsam ^{4/}	1700	4634	83.9	2.1	70.5	2.8
Mixed conifer ^{5/}	240	6947	94.2	2.0	85.8	3.9
Mixed hardwood ^{6/}	1130	4638	86.4	2.7	72.2	3.6
All cover types	3400	4701	84.8	1.5	71.9	2.0

- 1/ Includes all stocked quadrats regardless of the survival chance rating of the best specimen of reproduction. (Survival chance ratings: good, fair, poor.)
- 2/ Includes all quadrats stocked with a best specimen of reproduction having an estimated survival chance rating of good.
- 3/ Pine species predominate.
- 4/ White spruce and balsam fir predominate.
- 5/ White-cedar the most common species, with some pine, spruce and fir present.
- 6/ Fifty per cent or more of original stand basal area made up of hardwoods.

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 (2) These investigations were made under the Minnesota and Ontario Paper Company Graduate Research Fellowship in Forestry.

Data upon which the above table is based were gathered on 3400 quadrats (6.6 ft. x 6.6 ft.) taken within 72 descriptions scattered over an extensive area in the vicinity of Big Falls, Effie and Loman, Minnesota. All areas had been commercially clear-cut prior to the 1946-47 logging season. The sampling unit was a group of 10 milacre quadrats in linear combination forming a plot 66 feet long and 6.6 feet wide. Plots were laid out in transects at right angles to strip roads. Within each stocked quadrat the specimen of reproduction estimated to have the best chance to survive and become a crop tree was designated as "best". Each such specimen was classified as to species, size class, establishment before or after cutting, how it originated (from seed, sucker, sprout, layering), vigor and estimated survival chance. The total number of reproduction was also recorded by species, and for each quadrat the number and size of residual trees and stumps, by species, the degree of brush and overhead cover, and observed damage by causal agency, were noted. Original stands were reconstructed by tallying all stumps and residual trees, by species and diameter, on 1/20-acre plots 66 ft. long by 33 ft. wide centered on and encompassing the reproduction transects.

The preceding data and following conclusions are considered to be of importance in evaluating past cutting practice in terms of future productivity of the area concerned, and as a partial basis for analyzing or establishing cutting guides for the spruce-balsam-hardwood type in north-central Minnesota.

In general it may be concluded that numerically adequate amounts of reproduction have resulted under cutting practices in effect when the sampled stands were logged. In some stands reproduction appears to be more abundant than necessary, yet crowding is not expected to become a problem since the regeneration consists of many species with large variations in rate of growth, tolerance and degree of expression of dominance.

Differences in the percentage of quadrats found to be stocked within local areas appeared to be related to differences in the species composition of the original stands and to differences in soil and soil moisture conditions. Cover types originally dominated by pine species showed the lowest stocking, and corresponded to the better-drained sites and lighter soils. Slightly better stocking was found in the spruce-balsam and mixed hardwood local cover types, which in general occupy sites intermediate as to soil texture and moisture condition. Cover types originally dominated by northern white-cedar and a mixture of other conifers showed the highest stocking and corresponded to the wetter sites and heavier soils.

While the number of balsam fir reproduction per acre after cutting was found to be greater in all cover types than the total number of overstory stems of this species present before cutting, the percentage representation of balsam fir in the total reproduction stand has decreased in all but the mixed conifer cover type. In all but the pine type the number of white spruce reproduction per acre was found to be less than the number of overstory white spruce prior to cutting. However, the combined total of balsam fir and white spruce reproduction is either greater than or has remained approximately the same as the number of overstory stems of these species prior to cutting for all cover types, though their percentage representation has diminished. All other coniferous species have virtually disappeared from the areas examined. Quaking aspen and other hardwood species have increased greatly both in number and percentage representation in the reproduction stands as compared to the original stands of all local cover types.

It appears that a more or less extensive understory of predominantly balsam fir can be expected to develop under the hardwood portions of reproduction stands. This understory already exists in many places.

Approximately half of the best specimens of balsam fir and white spruce reproduction originated prior to logging, while almost all hardwood regeneration became established after the area had been cut over.