

desirable elements, both pine and hardwood, was overtopped and suppressed by inferior species and clumps of stump sprouts.

Harvard Forest Experiments.

In respect to the various ways of handling the pure pine type which have been tested on the Harvard Forest it can be said that all of those methods which involve the removing of the stand in two or more cuts have proved successful. On account of certain practical and financial factors good reproduction, however, is not the only criterion of a workable method. This will perhaps appear more clearly from a statement of experience with the different systems of cutting.

Clear-cutting the Whole Stand.—This method has been tried on areas of from two to four acres. Cuts were made in the winters following the seed years of 1908 and 1914. All slash was burned in piles. A reproduction followed in which there were from three to four thousand thrifty pine seedlings per acre at the end of four years. This method is obviously the best from the point of view of cheapness in logging, but can be practiced with success only in seed years.

Clear-Cutting in Strips.—Strip cuttings have been made in several different years. The cleared areas varied from 100 to 200 feet in width and in all cases were made on the margin of the stand away from the prevailing wind. The results have been variable. On well-drained sites, where the underbrush and small vegetation was scanty, good reproduction has appeared within five years. On moist or rich land pine has been entirely kept out by dense herbaceous growth.

Clear-Cutting in Patches.—The patches cleared by this method varied from 50 to 100 feet in diameter. The results have been similar to those on the cleared strips, although the reproduction has been, on the whole, more successful. Abundant seedlings have come in on the drier sites where the competition with woody vegetation was not so keen. This method, like the preceding, is open to the serious objection of greater cost due to

the smaller, scattered area. Furthermore, even if the groups of young growth become established, it is difficult later to log the surrounding uncut timber without undue damage or expense.

The Selection Method.—Small areas cut over by the selection method where only single large trees or groups of trees were cut, have resulted in fair reproduction. It is not, however, a practicable means of handling pure pine, being too costly and not calculated to provide the necessary density and growing conditions for the new crop.

The Seed Tree Method.—All experiments with the seed tree method have proved failures. In many cases the trees blew down.

The Shelterwood Method.—Of all methods tested this has resulted in the best reproduction. The first cutting has consisted in a uniform thinning in which mainly the overtopped and defective trees were taken. This meant the removal of about one-quarter of the trees and one-fifth of the volume per acre. Up to the point where windfall becomes a risk the heavier the thinning the better was the reproduction. Stands so treated have in five years shown as many as 25,000 seedlings per acre. Where the overwood was allowed to stand more than five years the reproduction became stunted and too weak to recover promptly when the removal cutting was made.

A New Forest Ensured.

The cutting method now in practice on the Harvard Forest, though based largely on the outcome of the experiments above described, was adopted with considerable reference also to practical and financial considerations. The rotation for white pine is set at 60 years. As the working plan is based upon the principle of a sustained annual yield, final cuttings have to be made each year. In this respect the property is in the same case as that