

Red Pine on the Minnesota National Forest

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The silvicultural system in vogue for red pine on the Minnesota National Forest consists of clear cutting and leaving scattered seed trees. The first timber sale was made in 1904. At that time, five per cent of the entire stand was left in the form of scattered seed trees for reproductive purposes. Through careful investigations and practical observations by the forest officers in charge, it was shown conclusively that five per cent did not leave enough trees over the area to restock the same successfully. Accordingly, it was recommended and later became a law that, thereafter, on all timber sale areas on the Minnesota National Forest, ten per cent of the stand should be left for reforestation purposes. In stands that cut from twenty to twenty-five thousand board feet per acre five per cent of the trees left standing would be abundant; but, in stands of the more scattered and open types, the seed trees were decidedly lacking in number and very sparsely sprinkled over the area. Then, too, five per cent did not leave a great amount of protection for the ground cover, or for the trees themselves. Many "blow-downs" can be found throughout the timber sale areas.

The leaving of ten per cent of the stand instead of five has, besides the added advantage of much better protection to the ground and ground cover, a greater advantage in the lessening of the danger from windfall. The wind does not do as much damage because the trees serve much more effectively as protectors toward one another. The force and velocity of the wind to which a single, individual tree is subjected is greatly reduced, and we have fewer "blowdowns" resulting. There is a disadvantage in some cases in having too many trees left. This is only applicable, however, to the heavy stands, where the disadvantage is not too many trees for restocking the area, or for protection of soil and ground cover, or for the

carrying on at some future date a logging operation that will be worth the time and money expended; but where the disadvantage lies with the company carrying on the present logging operation.

Perhaps one of the greatest problems, if not the greatest problem, that the logger contends with is that of labor. It is hard to find men who will do efficient work in the woods, especially sawyers. In the heavy stands, where ninety per cent is removed, the ten per cent, from necessity, must be exposed to the felling process. The result is, that, in spite of severe precautionary measures, many trees are damaged and some of them seriously. They are often lodged in felling, and many are felled in such a way that they scrape down the side of a seed tree, breaking and tearing the limbs from it. The fundamental cause of all this is the large majority of foreign men, uneducated, unreliable and uninterested. They are entirely void of any appreciation of conservation and forestry, and, in consequence, the seed trees receive the burden of inefficient labor.

Fire Hazard

A red pine stand is subject to two kinds of fires, the crown fire and the surface fire. The crown fires occur but seldom and are practically unheard of in this section of the country. The surface fires occur frequently. This has been especially true during the past when they have occurred not only frequently but regularly. Through the system of fire prevention and protection of the United States Forest Service, through the State Forest Service and through the co-operative work of the different corporations, the fire hazard has been reduced to a very great extent. During the calendar year of 1913, only .2 of 1 per cent of the entire forest was burned over.

There is not a stand of red pine, however, that has not been damaged by fire at some previous time. The bark of the tree is thin, seldom reaching 1.5 inches in thickness at the base on the very largest and over mature trees, and trees when younger possess bark that is relatively thinner. Considering the life of a tree in chronological order, we may say that, when in the young seedling stage, a surface fire will in the main destroy all that comes in its path. At the height of ten inches to twelve

inches a good part, perhaps 50 per cent of the stand, will escape without being seriously damaged. As the trees grow from then on, they are seldom killed outright, unless it is in the case of a very hard fire. Nevertheless, they are damaged at the base to such an extent that the bark and even the wood itself is burned away, forming a deep fire scar. The scars, aside from the damage they themselves do, play another important part. They pave the way for the development of fungi. They reduce the health, vigor and resisting power of the tree to such an extent that the fungi are offered a ready avenue of admittance. Ninety-five per cent of all the mature red pine trees are fire scarred, and seventy-five per cent of the decay caused by fungi can be attributed to fire and fire scars.

Reproductive Capacity

Red pine is not a prolific seed producer. It has a good yield of seed every four to six years, and every year a small amount can be found. The seed is borne usually on the scrubby, bushy topped trees that grow in the open. It requires two years for the cones to form and mature. They ripen late in the summer, about September first, and open and free the seed in the fall. They are disseminated by several means; namely, birds, squirrels, chipmunks, by water and by the wind. Very little seed, however, is transported by the first four methods, the wind being the big factor in the distribution. The distance to which the wind will transport a seed depends upon the height of the trees and velocity of the wind. This is illustrated wherever a block of trees stands along side of an area of unused, cut-over land. Next to the trees, for a distance of 250 feet, the reproduction is very abundant; at from 250 to 400 feet the reproduction is still quite uniform, but is gradually thinning out; beyond the 400 foot mark it is very irregular and much scattered.

The red pine seed is hard to collect because of its scarcity and because of the method that must be used in gathering it. Nevertheless, the seed itself possesses a good germinating percentage, 85 to 90 per cent, and, given any sort of a chance, it will thrive and grow. Like many others of the pines, it must have mineral soil in which to germinate. After logging operations and burns, where the seed is present, these areas always abound with young seedlings. Old logging grades, excavations,

etc., when found in the immediate vicinity of a block of timber, always, sooner or later, depending on the seed year, become well stocked with reproduction; while right beside such places where the ground is covered with brush, leaves and grass, there is no reproduction. In all cases where the seed is present and has a chance to reach the mineral soil, good results have been obtained. For instance, on the Minnesota National Forest, where clear cutting with scattered seed trees is used and the timber logged during a good seed year or the year following one, results have been excellent. The ground was torn up and the seeds given a chance to get to the soil. In such cases the area has been restocked successfully.

Attainment of Economic Maturity and Normal Duration of Healthy Growth

Economic maturity is attained in red pine at about the age of one hundred and twenty years, according to results that are representative of many stands and age gradations. It takes into account every class of trees from dominant to suppressed. Taking these facts into consideration, and looking at it from a commercial standpoint, I do not think one hundred and twenty years a fair criterion of what can or will be accomplished with annual rate of growth or increment. In making a careful study of twenty sample plots, ranging from 30 to 60 years in age, the facts are forcibly brought out that there are a great many suppressed and dying trees, also a goodly admixture of Jack pine that must be exterminated through years of struggle for supremacy, and that the red pine, after a period of 80 to 100 years, is the survivor. These are of paramount importance in retarding the growth of red pine during its best stage of development. In stands where these factors do not enter in, but are entirely lacking, figures show that, under good silvical management, an average D. B. H. of 8 inches can be obtained at the age of 45 years with a maximum of 12 inches. These figures are representative of existing stands and conditions.

Red pine retains its healthy, vigorous growth until it is 150 years of age. At that time, it begins to decay, loses its resisting powers and becomes more or less susceptible to injuries. At two hundred years of age, it is a mature tree. It is at this time that the crown commences to thin out; and at the age of

two hundred and fifty, a great many of the trees are dying. The average life of a red pine tree is placed at from two hundred and fifty to two hundred and seventy-five years. Investigations show that the oldest individual tree found on the Minnesota National Forest was three hundred and seven years of age.

Marking the Timber.

Usually all mature and over-ripe trees should be cut. They have passed their stage of usefulness and are no longer of any benefit for seeding purposes. Likewise, all trees which show broken tops, punk knots, bad crooks, badly damaged butts and injurious fire scars should be cut. All defective trees of any size should be given to the logger. Only young, thrifty and rapidly growing trees should be marked as a part of the ten per cent to be left. This plan is followed out as nearly as possible; but there are cases, and they are in the majority, where it is impossible to follow the above outlined plan. Red pine grows in even aged stands, and while there are a good many stands of young, rapidly growing timber, there are a great many of the over-mature kind. In this latter case, the aim is to take the very best, going over the area and carefully selecting trees that are as healthy and free from defect as it is possible to obtain.

There is no iron clad rule regulating the cut to ten per cent of any one stand or division of land, but it must be ten per cent of the timber going to any individual purchaser. Consequently, in mature, over-mature, defective and heavily stocked stands it is desirable to mark the ten per cent low and add the scale to some of the open, scattered, healthy and rapidly growing types. Care should always be taken to leave seed trees in openings or along the edge of clearings and old burns whenever possible.

Danger from windfall is one of the main factors to be taken into consideration in marking. Extreme care should be practised in selecting a type of tree that will withstand the wind. Each tree marked should have crown enough for vigorous, healthy growth. Length and breadth of crown is compatible to a strong, well formed root system, which, in turn, has greater power and strength to resist the wind.

Innumerable differences and many problems will be encoun-

tered in marking a sale area, so that there is no set rule or rules that will apply to the entire tract. A rule in vogue in one place might be very much out of place in another.

Disposal of Brush

Under every well regulated system of management, red pine brush and debris resulting from thinnings or clear cutting should be burned or removed. In burning, of course, the brush should be piled where it will not endanger any of the remaining trees, whether large or small. Whenever and wherever possible, brush burning should follow the other operations closely, and should, under no consideration, be allowed to lag behind unless through danger of fire in an excessively dry season.

In summer logging, it is impossible to burn daily or to burn while the swamping is going on. Nevertheless, the brush should be swamped and piled, and should be burned after the first rainy weather, and by no means when it is dry, just because it may be easier and cheaper. This latter will not only burn the brush but also all of the vegetable and humus matter out of the soil, thus robbing it of its most valuable constituent. All small stock is destroyed and even the larger trees are badly fire scarred and damaged.

In winter logging, the brush should be piled and burned as it is cut; for at such a time there is considerably less swamping, the brush burns a great deal better, and the chances of a fire running through and destroying soil or endangering stands of trees or plots of reproduction is reduced to a minimum. The operation is carried on cheaper at this time, and in that respect makes it a business proposition for the logger.

Reforestation

Under the present silvicultural system as used on the Minnesota National Forest, there are but few areas that have been restocked successfully. Seed trees have had but very little to do with regeneration. Nearly all of the reproduction found on the timber sale area is confined to the edges of blocks of standing timber, or it is the result of the removal of old, over-mature



Clear cutting, allowing ten per cent of the stand to remain for seed trees

stands while the seedlings were from one to five years of age at the date of cutting.

The first timber sale was made in 1904, so that nine years have elapsed since the present system went into operation. It would seem that nine years ought to be a representative time for the reforestation of cut areas. It is certainly a sufficient length of time for a good seed year to have occurred and restocked the area, especially in the immediate vicinity of the individual seed trees. But, this is not the case. We find very little reproduction coming in, even in the neighborhood of standing trees that are young, healthy and vigorous. In a few instances, where a fire has happened to run over the ground the year preceding a seed year, the reproduction is coming in very plentifully. Otherwise, the ground is covered with grasses and low bushes that produce considerable litter and thus form a thick carpet. This effectually keeps the seed from reaching the mineral soil and germinating. In many cases, after certain logging operations, the reproduction comes in thick without any apparent reason, which circumstance can only be accounted for in that the seed has been stirred and shaken from the litter and deposited in the mineral soil.

Old, over-mature seed trees seldom if ever succeed in establishing a second growth. They have passed their stage of usefulness and no longer bear seed. Such areas can only be restocked by artificial methods.

In old, mature stands of red pine, there are usually enough trees so that the ten per cent for regeneration will leave three and four and even more trees to the acre. In case an acre produces 20,000 board feet, which is quite common, ten per cent or 2,000 board feet is left standing. The average timber sale stumpage price over the entire Forest is \$8.50 per thousand. In the above case, seventeen dollars worth of seed trees are left standing for one individual acre.

On the other hand, three year old nursery stock once transplanted can be grown and planted out in the field for five dollars per thousand. (This figure is obtained from the actual cost of the different operations on the Minnesota National Forest.) In planting out the transplants, 8x8 foot spacing would be sufficiently close, thus making a total of about seven hundred plants to the acre. It seems as though it would be

far better to plant seven hundred transplants to the acre, with the idea that most of them will live, than to plant twelve hundred seedlings, with the idea that half of them will die.

Considering the fact that three, four and even five acres could be planted from the sale of the remaining ten per cent on the acre, why would it not be practical and economical to clear cut and plant the area? Then there would be the added advantages of having the area restocked, no land to be left idle and allowed to grow up to grass and low bushes for a period of years and no public sentiment against idle and useless land.