

Only if the protecting strips are young, it is safer to have a second strip, 36 feet wide and arranged like the first, kept up behind it.

When a new railway is built, a menaced stand will be handled like any other forest, i.e., only a broad enough lane will be made for the right of way, and on both sides a protecting strip as described above. The forest is not changed except to clean up the ground, remove all material which in burning would generate much heat, as dry twigs, heather, etc. At the edge of the road-bed and on the outside of the forest toward the protection strip, the ground must be cleared entirely, 4.5 feet wide, so that the mineral soil will prevent any spread of the ground fire. The trees on this 4.5 feet strip may be left; they must, however, be pruned so that the yearly clearing of this strip can be done by horse-drawn harrows.

If the timber on a protecting strip must be cut off on account of overmaturity, the strip must be replanted immediately. The protecting strip on the other side of the track, as well as the forest lying next the strip to be lumbered, must not be cut until the young growth has reached a height sufficient to prevent a transverse wind from blowing the sparks into the forest.

Choice of Species.

The kind of trees to be chosen for planting must satisfy the following conditions:—

- (1) The trees must be adapted to the soil, so that they start well and continue to thrive.
- (2) They must form a thick bark early, so that they will not be killed by ground fires.
- (3) Their crowns must be thick enough at all seasons to catch flying sparks and to shade the soil in order to prevent a thick growth of grass.

According to a current opinion, hardwoods are better than pines; this view is based on an incorrect observation. Where hardwood thrives, as a rule the ground is fresher and the fire risk less than where pine grows. The young pine, one inch in diameter, is safer from a running fire than the same-sized hardwood tree (beech, oak, birch) because it early forms a thicker, non-conducting bark than the other. Its crown is a better spark-arrester, because it is green in the danger season, spring, before the leaves of the hardwoods have appeared. It must, however, be pruned to a sufficient height to prevent a weak fire striking up into the crown. For the narrow protecting strips, pruning up to 3 to 4.5 feet is sufficient.

On the dry sand of the North European plains the common pine is the only indigenous tree which forms a safe protecting stand. In other forested areas, there are evergreens which have the same resistance to fires, and are suitable as *Pinus silvestris*.

Formation and Care of Strips.

Sowing is the best way to start a stand, for the main object is to have strong even-growing plants, and it allows us to keep the ground between the plants clean for several years. If the ordinary pine is chosen, it is best to plant in rows parallel to the track 3 ft. 6 in. apart; in the rows, 18 inches is the spacing for strong one- or two-year-old pines. If possible, a little good soil should be put in the holes. Strong plants with well-balled roots, or three-year-old transplants should be set three feet apart. Between the rows a horse harrow should be used once a year, so that if a running fire starts in the young growth, it will go out at once. If the ground is too rough for horses, it must be bared by hand. This harrowing must be kept up until the stand is so high that ground fires cannot catch in the tops. In order to reach this stage as soon as possible, the lower, dry and suppressed branches are cut off as soon as the pines are three feet high; only on the outside row are all the branches left, so that they form a mantel reaching nearly to the ground to catch the sparks.

Simultaneously with the pruning, all superfluous trees are cut, i.e., those which stand too close to another tree. In their early years, a spacing of 3 ft. to 3 ft. 6 in. is about right. Later all suppressed trees are cut, so that only thrifty trees with thick crowns remain. By means of the thick close crowns the undergrowth of grass, lichens, etc., is prevented, so as to furnish little nourishment to a ground fire, which then runs harmlessly through. It is desirable that these protecting strips should burn often, so that no accumulation of fuel can occur to be dangerous for a later fire. If there is no fire for a year from sparks, the advisability of setting a fire under favorable weather and wind conditions (toward the track) to burn the ground-cover, should be considered.

As soon as it becomes impossible to work the ground between the rows, precautions should be taken that a fire catching in the protecting strip does not run into the stand to be protected. For this purpose, before mentioned, the bare strips are laid out, whose surface must be made fireproof, each year, by raking off inflammable matter or by working the soil. On the woodward side, the strips are 4.5 feet wide, and those toward the embankment and the right-angled strips 3 feet.

This barring of the soil can be well accomplished by using a spring harrow. In this case the bare strips must be arranged so that the animals drawing the harrows can work uninterruptedly, and a uniform width of six feet should be chosen. A form as shown in the sketch is good. The

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