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Forest Trees and Shrubs, What, Where and How to Plant
Michigan State University Extension Service
T.D. Stevens, W. Ira Bull, Forestry
Revised March 1961
24 pages

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FOREST TREES AND SHRUBS

What - Where - How to Plant

By T. D. STEVENS and W. IRA BULL



Contour tree planting on hilly land.

COOPERATIVE EXTENSION SERVICE
MICHIGAN STATE UNIVERSITY

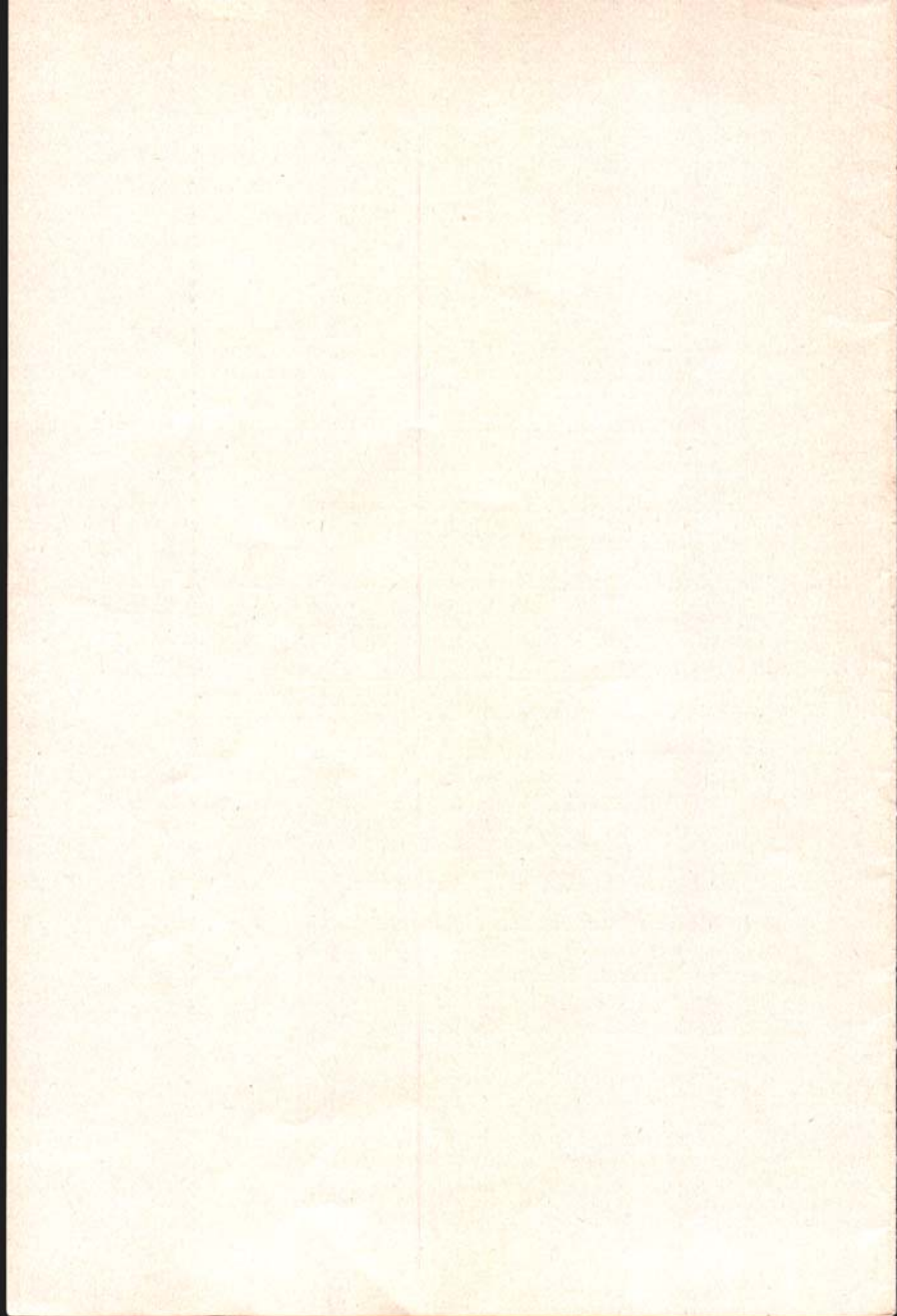
EAST LANSING

Issued October 1944
Second Printing, April 1946
First Revision, March 1948
Second Printing of First Revision, May 1949
Third Printing of First Revision, November 1951
Fourth Printing of First Revision, January 1954
Second Revision, February 1956
Second Printing, Second Revision, March 1956
Third Revision, March 1961

Cooperative extension work in agriculture and home economics. Michigan State University and U. S. Department of Agriculture cooperating. N. P. Ralston, Director, Cooperative Extension Service, Michigan State University, East Lansing. Printed and distributed under acts of Congress, May 8 and June 30, 1914.

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Forest Trees and Shrubs

WHAT, WHERE, AND HOW TO PLANT

By T. D. STEVENS¹ and W. IRA BULL²

Planting unproductive and idle lands to forest trees offers a practical way to change those areas from liabilities to assets. The value of areas planted to forest trees increases from year to year as the trees grow in size and quality.

WHY PLANT FOREST TREES AND SHRUBS?

1. To improve the appearance and value of wornout or badly eroded land.
2. To produce a valuable crop of saw timber, poles, posts, cordwood, or Christmas trees.
3. To prevent the loss of topsoil by checking wind and water erosion.
4. To provide food and cover for wildlife.
5. To provide windbreaks for the protection of the home, fields, and livestock.
6. To make the farm home a more attractive and satisfying place to live.
7. To provide recreational areas.

WHERE TO PLANT TREES

Most of the farmland in need of reforestation is composed of badly eroded hillsides, deep dry sandy soils, or blow sand. Odd corners of fields that are not easy to farm usually make excellent places to grow Christmas trees, timber trees, or trees and shrubs for wildlife food and cover.

Openings in woodlands may be planted to thicken the stand of trees. It is not advisable, however, to plant a cutover woods unless the original stand of trees was quite thin because sprouts and seedlings that grow after cutting will usually crowd out newly planted trees.

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Planting trees in swamp or marsh land is seldom practical because of unfavorable soil conditions and competition with grass and shrubs. Small swamps should be left open for the benefit of wildlife.

Trees planted as windbreaks offer excellent protection for home and field. Plant windbreaks for home protection on that side of the buildings against which blow the prevailing winter winds. Locate the windbreak several rods away from buildings since drifting snow will accumulate on the lee side of the windbreak. Windbreaks for the protection of fields should be located to protect the crop from the most damaging summer winds. A separate folder discussing windbreaks may be obtained from the Forestry Department of Michigan State University, East Lansing.

CHOICE OF SPECIES

While many species adapt themselves to a wide range of conditions, nevertheless, it is best to choose those species which will make their best development on the proposed planting site.

Important site factors are temperature and soil moisture. Very low temperatures may affect young trees through the lack of available soil moisture owing to the frozen condition of the soil. Young trees may be pushed out of the soil by frost heaving, the result of the soil's swelling and shrinking while freezing and thawing. Frost heaving is most common in heavy clay or organic soils. During the dry hot periods in the summer, very high surface soil temperatures may damage the stems of young trees. Bare soils sloping south or west have highest surface temperatures.

Soil type and drainage are very important in deciding the kind of trees to plant. In general, the heavier loamy soils retain more moisture and are more fertile than the lighter sandy soils; therefore, they are better adapted to growing broadleaved or deciduous trees. Conifer or evergreen trees can also be grown profitably on heavier soils but they are much better adapted to poorer light sandy soils. Species of trees to plant in poorly drained soils or soils subjected to flooding should be chosen with care, as only a few species are suitable for planting on wet sites. Groups of one species interspersed with groups of other species according to soil and moisture requirements are preferable to continuous plantings of a single species (Fig. 1). Mixed plantings of two or more species well adapted to the planting site are recommended also. They can be mixed by alternate rows or nar-



Fig. 1. Group planting according to soil and moisture requirements. Spruce was planted on the bottomland and jack and Scotch pine on the drier eroded hillsides and ridges.

row bands. Mixed plantings may help to prevent serious destruction of the trees by insects or disease.

Pines grow well on deep dry sand, stabilized blow sand, and south and west slopes of eroded hillsides. Excellent growth is usually made on sandy loam soils not fertile enough to farm.

Red pine is the most desirable species to plant throughout the state for pulpwood and lumber production. It is comparatively free from disease and insects. Red pine will grow best on upland loam and sandy loam soils. However, it usually grows well on a wide range of sites from deep dry sand to moderately heavy clay. Red pine will grow best on slightly acid soils. It is advisable to avoid strongly acid or alkaline soils when planting this species. In the southern part of the state this species is damaged by the European pine shoot moth.

White pine makes its best growth and development on well drained sandy loam to clay loam soils. It has a wider range of tolerance for acid and alkaline soils than red pine; therefore, this is not an important

factor in selecting a planting site for white pine. Do not plant this species on deep dry sand, blow sand, or poorly drained clay soils. White pine should not be planted within 1,000 feet of currants and gooseberries unless these plants are to be eradicated. Currants and gooseberries are carriers of the blister rust, a serious disease of white pine. This species is also subject to damage by the white pine weevil, an insect that will kill the leaders or terminal growth of young trees.

Jack pine will grow best on very infertile soils, deep dry sand, stabilized blow sand to rather poorly drained sand. It has a very wide range of tolerance for acid and alkaline soils. It is one of the most important coniferous species that can be grown in lower Michigan for pulpwood production. It will reach pulpwood size in 25 to 30 years after planting. This tree is sometimes defoliated by the larva of the sawfly, and is subject to damage by the white pine weevil.

Scotch pine is not a native tree to this country but it has been planted extensively for Christmas trees and pulpwood. It is doubtful that Scotch pine will be of much value as a timber tree in this country. Like jack pine, it will grow well on very infertile soils and on stabilized blow sand.

Ponderosa pine is a western species that seems to grow well on deep dry sand and blow sand. The heavy leaf litter from the long needles soon covers the sand. It is not recommended too highly for general reforestation because the timber value of this species, when grown in the eastern part of the country, is doubtful. Ponderosa pine should not be planted where sweet fern is growing because sweet fern is the carrier of a serious disease to the tree.

Austrian pine is a foreign species that appears to grow well on sandy or gravelly clay alkaline soils. It is not recommended very highly for reforestation but it may serve as a substitute for red pine on sweet soils.

White spruce is a valuable Christmas tree and pulpwood species. It should be planted on moderately acid sandy loam to clay loam soils. Do not plant this tree on dry sand or wet sites. For best survival and growth it is advisable to plow and fit the ground so the trees can be cultivated 2 or 3 years. This practice is especially desirable where the trees are to be cut and sold for Christmas trees.

Balsam fir and **Black spruce** are primarily swamp trees that thrive on strongly acid soils. They will grow well on damp soil where the water table is high. Good growth will also occur on moist, well-drained upland soils in the colder climate of northern Michigan. The major use of these species is for pulpwood production.

Norway spruce is a foreign species that has been used very successfully in lower Michigan for farm windbreaks and Christmas trees. It is also an excellent pulpwood species. It grows best on sandy loam to clay loam soils, being very similar in soil and moisture requirements to white spruce.

White cedar is a species that grows naturally in swamps in the northern part of the state, but it also grows well on upland sandy loam to clay soils. It seems to prefer alkaline soil, although it also will grow well on slightly acid soils. The major use of white cedar is for fence posts, although it can be used for windbreak planting, but the trees do not grow as tall as spruce or pine.

Hardwood or **broadleaved** trees for timber production make their best growth on fairly good agricultural soil. They can also be grown successfully on marginal agricultural land if planted on the best sites such as north and east slopes of hills or valleys. White ash, green ash, sugar maple, American elm and black cherry can be planted throughout the state for lumber production. White and green ash are the best of these five species to plant on alkaline soils. If gravelly hillsides are to be planted, these two species can be used on north and east slopes.

Tulip poplar, **Black walnut** and **Hickory** should be planted only in the southern half of lower Michigan. They should be planted on good agricultural soil ranging from sandy loam to well drained clay soils. Black walnut and hickory will grow on both slightly acid to alkaline soils while tulip poplar prefers a slightly acid condition. Black walnut and tulip poplar are valuable veneer species but hickory has little use except for handle stock.

Black locust is recommended mainly for planting in gullies on eroded hillsides. It is a legume. The nitrogen given off by the roots will influence the growth of bluegrass to the extent that the gullies are usually covered with sod in a few years after planting the trees. It is usually not desirable for a forest plantation because the locust borer is likely to damage the trees seriously. Root suckers that grow from borer-damaged trees create a nuisance when they are close to

cultivated land. In some cases on sweet soils where the trees grow fast, they are not seriously damaged by this insect.

Red and White oak are valuable timber trees that are native to the sandy gravel and clay gravel hills of southern Michigan. They, like walnut and hickory, grow a taproot that makes them more difficult to transplant than other species of hardwoods or coniferous trees. They will grow on well drained sandy gravel to heavy clay soils with slightly acid to alkaline reaction.

Cottonwood, Basswood, American elm and Red maple are well suited for reforesting damp soils. Cottonwood is best for moist sand, but the other three species can be planted on a variety of soils from moist sand to heavy clay. Cottonwood will also grow well on dry sand. Table 1 lists species recommended for various sites. For information concerning special planting problems write to the Forestry Department, Michigan State University, East Lansing.

REFORESTING BLOW SAND

Stabilizing blow sand is usually necessary before it can be reforested. There are three recommended methods of sand stabilization: planting beach or dune grass, scattering brush or corn stalks over open sand, or planting a barrier of trees on the windward side and gradually reforesting the open sand.

Stools of beach grass containing four or five stalks planted 18 inches apart in curving rows, 6 to 8 feet apart has been a satisfactory method for temporary stabilization. The grass will spread rapidly by means of lateral roots. Trees can be planted between the rows of grass a year or two later (Fig. 2).

Scattering brush over the open sand is also a satisfactory method of stabilization but more costly than planting beach grass. When this method is used the trees should be planted first, then brush cut from nearby woodlands or fence rows hauled to the planting site and scattered thinly over the open sand. The butt ends of the brush should be placed toward the direction of the prevailing winds.

Small blow holes not over 2 acres in size can be brought under control by planting a few rows of trees on the windward side of the open sand to break the force of the wind. At 5-year intervals, 8 to 10 rows of trees can be planted to the leeward in the sand. If wind protection is provided as the planting progresses, the entire blow sand



Fig. 2. Temporary stabilization of blow sand by planting curving rows of beach grass.

area can be reforested in time without serious sandblasting of the trees. Smaller blow sand areas less than an acre in size can be reforested immediately with relative safety without stabilization.

The species recommended for planting blow sand are jack pine, Scotch pine, red pine and ponderosa pine. On the fore dune along Lake Michigan where the wind currents are the strongest it is usually difficult to establish a stand of pine trees. In this location it may be necessary to plant cuttings of willow or lombardy poplar to provide protection for the coniferous trees. These cuttings should be a half-inch in diameter at the butt and 8 to 10 inches long. They should be made of new wood from sprouts or root suckers rather than the limbs from large trees. After the cuttings grow 4 to 6 feet high, pine trees can be planted under them.

PLANNING THE PLANTATION

The rapidly increasing number of coniferous plantations that are being established all over the state is providing a larger food supply for insects. This may result in more serious insect infestations in the

future than have been experienced in the past. It is advisable, therefore, to plan the plantation so the trees can be sprayed with power equipment, if necessary, in order to save the plantation from destruction. For example, the larvae of the several species of sawflies will occasionally eat the foliage off conifers over a large area, thus causing the death of several hundred or perhaps thousands of trees. A poison spray applied at the proper season of the year will prevent this destruction.

A plantation of trees spaced 6 by 6 feet cannot be sprayed with power equipment, because it is impossible to get a spray rig through such narrow spaces. It is therefore advisable to leave a 12-foot driveway between each eighth row of trees. These roadways will also be very useful if some Christmas trees are cut from the plantation and when the first thinning is made for pulpwood.

In case of fire it would be an advantage to be able to get power fire fighting equipment into the plantation in order to save it from total destruction. These roadways can be straight or winding, depending on the desires of the plantation owner.

SIZE AND AGE OF PLANTING STOCK

Use the smallest stock that can be planted with safety. Where soil and moisture conditions are favorable, 2- and 3-year-old coniferous seedlings will be satisfactory. On dry and exposed sands or on sites densely covered with shrubs, weeds, or grass it is generally desirable to use 3- to 4-year-old transplant stock. Transplants are much better than seedlings for Christmas tree and windbreak plantings. The older and larger stock is also superior for planting heavier soils where frost heaving is likely. One-year-old seedlings or 2-year-old transplants are satisfactory for white ash, green ash, tulip poplar, sugar maple, American elm, black locust, and basswood. Where squirrels are not too numerous, the nuts or acorns of black walnut, hickory, and oak may be planted directly on the area where the trees are to be grown. Cottonwood and willows are easily started from cuttings in the early spring.

TABLE 1—Planting guide

| SPECIES | DRY UPLANDS | | | | WELL-DRAINED UPLANDS | | | | WET LOWLANDS | |
|--------------------------------|-------------------------|-----------------------|--------------------|--------------------|----------------------|------------------|------------------|------------------|------------------|------------------|
| | Dunes and Shifting Sand | Sand | | Sandy Loam | | Clay—Clay Loam | | Sands to Clays | Muck or Peat | |
| | | Exposure ¹ | | Exposure | | Exposure | | | | |
| | | Level | N & E ¹ | S & W ¹ | Level | N & E | S & W | | | Level |
| Forest Trees | | | | | | | | | | |
| CONIFERS (Evergreen) | | | | | | | | | | |
| Cedar, Northern White | | | | Yes | Yes | | Yes | Yes | Yes ² | Yes ² |
| Fir, Balsam | | | | Yes | Yes | | Yes | Yes | Yes | Yes |
| Fir, Douglas | | | | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Larch, European | | | | Yes | Yes | | Yes | Yes | | |
| Pine, Jack | | Yes ² | Yes ² | Yes ² | Yes ² | Yes | Yes | Yes | Yes | |
| Pine, Red | Yes ² | Yes ² | Yes ² | Yes ² | Yes ² | Yes ² | Yes ² | Yes ² | Yes ² | Yes ² |
| Pine, Scotch | Yes ² | Yes ² | Yes ² | Yes ² | Yes ² | Yes ² | Yes ² | Yes ² | Yes ² | Yes ² |
| Pine, White | | | Yes | Yes ² | Yes ² | | Yes ² | Yes ² | Yes ² | Yes ² |
| Spruce, Black | | | | Yes ² | Yes ² | | Yes ² | Yes ² | Yes ² | Yes ² |
| Spruce, Norway* | | | | Yes ² | Yes ² | | Yes ² | Yes ² | Yes ² | Yes ² |
| Spruce, White | | | | Yes ² | Yes ² | | Yes ² | Yes ² | Yes | Yes |
| BROADLEAVES (Deciduous) | | | | | | | | | | |
| Ash, Green | | | | Yes | Yes | Yes ² | Yes | Yes | | |
| Ash, White | | | | Yes ² | Yes ² | | Yes ² | Yes ² | | |
| Basswood | | | | Yes | Yes | | Yes | Yes | Yes | |
| Cherry, Black** | | | | Yes ² | Yes ² | | Yes ² | Yes ² | | |
| Cottonwood | Yes ² | | | Yes | Yes | | Yes | Yes | Yes | Yes |
| Elm, American | | | | Yes | Yes | | Yes | Yes | Yes ² | Yes ² |
| Hickory, Pignut** | | | | Yes | Yes | | Yes | Yes | Yes | Yes |
| Hickory, Shagbark** | | | | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Locust, Black** | | | | Yes | Yes | | Yes | Yes | Yes | Yes |
| Locust, Honey** | Yes ² | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Maple, Soft | Yes ² | Yes | Yes | Yes | Yes | | Yes | Yes | Yes | Yes |
| Maple, Sugar | | | | Yes ² | Yes ² | | Yes ² | Yes ² | | |
| Oak, Red | | | | Yes | Yes | Yes ² | Yes | Yes | Yes | Yes |
| Oak, White | | | | Yes | Yes | | Yes ² | Yes ² | | |
| Poplar, Tulip** | | | | Yes | Yes | | Yes ² | Yes ² | | |
| Walnut, Black* | | | | Yes | Yes | | Yes | Yes | | |
| Willow | Yes | | | | | | | | Yes | Yes |
| SHRUBS AND WOODY VINES | | | | | | | | | | |
| Ash, Mountain | | | | Yes | Yes | | Yes | Yes | Yes | Yes |
| Blackberry | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Black-haw** | | | | Yes | Yes | | Yes | Yes | Yes | Yes |
| Coralberry | Yes | Yes | Yes | Yes | Yes | | Yes | Yes | Yes | Yes |
| Crab, Wild | | Yes | Yes | Yes | Yes | | Yes | Yes | Yes | Yes |
| Dogwood, Gray | | | | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Dogwood, Red-Osier | | | | Yes | Yes | | Yes | Yes | Yes | Yes |
| Dogwood, Silky | | | | Yes | Yes | | Yes | Yes | Yes | Yes |
| Elder | | | | Yes | Yes | | Yes | Yes | Yes | Yes |
| Grape, Wild | Yes | Yes | Yes | Yes | Yes | | Yes | Yes | Yes | Yes |
| Hawthorn | Yes | Yes | Yes | Yes | Yes | | Yes | Yes | Yes | Yes |
| Hazel | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Honeysuckle | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Juniper, Prostrate | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Nanny-berry | | | | Yes | Yes | | Yes | Yes | Yes | Yes |
| Ninebark | | | | Yes | Yes | | Yes | Yes | Yes | Yes |
| Olive, Russian | | | | Yes | Yes | | Yes | Yes | Yes | Yes |
| Pea, Siberian | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Plum, Wild | Yes | Yes | Yes | Yes | Yes | | Yes | Yes | Yes | Yes |
| Rose, Wild | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Shadbush | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Snowberry | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Sunae | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Withe-rod | | | | Yes | Yes | | Yes | Yes | Yes | Yes |

*Plant in mixture with other species on fertile soils in southern Michigan only

**Southern Michigan

¹Pronounced slopes facing north and east (N & E) or south and west (S & W)²Especially recommended for this planting location as bringing high returns in the production of wood products

TABLE 2—Use of different species

| SPECIES | Wood Production | | | | | Cover or Food for Wildlife | | | | | | | Miscellaneous Uses | | | | | |
|--------------------------------|-----------------|-------|------|------|---------|----------------------------|------|------|--------|----------|-----------|--------|--------------------|-----------------|------------------|---------------|-------|-----------|
| | Lumber | Poles | Pulp | Ties | Baskets | Beaver | Deer | Fish | Ground | Pheasant | Songbirds | Rabbit | Squirrel | Christmas Trees | Christmas Greens | Frost Control | Honey | Windbreak |
| Forest Trees | | | | | | | | | | | | | | | | | | |
| CONIFERS (Evergreen) | | | | | | | | | | | | | | | | | | |
| Cedar, Northern White..... | | Yes | | | | | Yes | Yes | Yes | Yes | Yes | Yes | | | Yes | | | Yes |
| Fir, Balsam..... | Yes | | Yes | | | | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | | | Yes |
| Fir, Douglas..... | | | | | | | | | | | | | Yes | Yes | Yes | | | Yes |
| Larch, European..... | Yes | Yes | | | | | | | | | | | Yes | | | | | |
| Pine, Jack..... | | | Yes | | | | Yes | | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | | Yes |
| Pine, Red..... | Yes | | Yes | | | | Yes | | Yes | Yes | Yes | Yes | Yes | Yes | Yes | | | Yes |
| Pine, Scotch..... | Yes | | | | | | Yes | | Yes | Yes | Yes | Yes | Yes | Yes | Yes | | | Yes |
| Pine, White..... | Yes | | | | | | Yes | | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | | Yes |
| Spruce, Black..... | | | Yes | | | | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | | | Yes |
| Spruce, Norway**..... | Yes | | | | | | Yes | | Yes | Yes | Yes | Yes | Yes | Yes | Yes | | | Yes |
| Spruce, White..... | Yes | | Yes | | | | Yes | | Yes | Yes | Yes | Yes | Yes | Yes | Yes | | | Yes |
| BROADLEAVES (Deciduous) | | | | | | | | | | | | | | | | | | |
| Ash, Green..... | Yes | | | | | | | | | | | | Yes | | | Yes | Yes | |
| Ash, White..... | Yes | | | | | | | | | | | | Yes | | | | Yes | |
| Basewood..... | Yes | | | | | | Yes | | Yes | Yes | Yes | Yes | Yes | | | | Yes | |
| Cherry, Black**..... | Yes | | | | | Yes | Yes | | Yes | Yes | Yes | Yes | Yes | | | | Yes | Yes |
| Cottonwood..... | Yes | | | | Yes | Yes | Yes | | Yes | Yes | Yes | Yes | Yes | | | Yes | Yes | Yes |
| Elm, American..... | Yes | | Yes | | Yes | Yes | Yes | | Yes | Yes | Yes | Yes | Yes | | | | Yes | Yes |
| Hickory, Pignut**..... | Yes | | | | | Yes | Yes | | Yes | Yes | Yes | Yes | Yes | | | | Yes | |
| Hickory, Shagbark**..... | Yes | | | | | Yes | Yes | | Yes | Yes | Yes | Yes | Yes | | | | Yes | |
| Locust, Black**..... | Yes | Yes | Yes | | | | | | Yes | Yes | Yes | Yes | Yes | | | Yes | Yes | |
| Locust, Honey**..... | Yes | Yes | | | | | | | Yes | Yes | Yes | Yes | Yes | | | | Yes | Yes |
| Maple, Soft..... | Yes | | | | Yes | Yes | Yes | | Yes | Yes | Yes | Yes | Yes | | | | Yes | Yes |
| Maple, Sugar..... | Yes | | | Yes | | Yes | | | Yes | Yes | Yes | Yes | Yes | | | | Yes | Yes |
| Oak, Red..... | Yes | Yes | | Yes | | | | | Yes | Yes | Yes | Yes | Yes | | | | Yes | Yes |
| Oak, White..... | Yes | Yes | | Yes | | | | | Yes | Yes | Yes | Yes | Yes | | | | Yes | Yes |
| Poplar, Tulip**..... | Yes | | | | | Yes | | | | | Yes | Yes | Yes | | | | Yes | Yes |
| Walnut, Black*..... | Yes | | | | | | | | | | Yes | Yes | Yes | | | | Yes | Yes |
| Willow..... | | | | | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | | | Yes | Yes | Yes |
| SHRUBS AND WOODY VINES | | | | | | | | | | | | | | | | | | |
| Ash, Mountain..... | | | | | | | Yes | | Yes | Yes | Yes | Yes | Yes | | | | Yes | Yes |
| Blackberry..... | | | | | | | | Yes | Yes | Yes | Yes | Yes | Yes | | | Yes | Yes | Yes |
| Black-haw**..... | | | | | | | Yes | | Yes | Yes | Yes | Yes | Yes | | | | Yes | Yes |
| Cornalberry..... | | | | | | | Yes | | Yes | Yes | Yes | Yes | Yes | | | | Yes | Yes |
| Crab, Wild..... | | | | | | Yes | Yes | | Yes | Yes | Yes | Yes | Yes | | | | Yes | Yes |
| Dogwood, Gray..... | | | | | | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | | | Yes | Yes | Yes |
| Dogwood, Red-Osier..... | | | | | | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | | | Yes | Yes | Yes |
| Dogwood, Silky..... | | | | | | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | | | Yes | Yes | Yes |
| Elder..... | | | | | | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | | | Yes | Yes | Yes |
| Grape, Wild..... | | | | | | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | | | Yes | Yes | Yes |
| Hawthorn..... | | | | | | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | | | Yes | Yes | Yes |
| Hazel..... | | | | | | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | | | Yes | Yes | Yes |
| Honeysuckle..... | | | | | | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | | | Yes | Yes | Yes |
| Juniper, Prostrate..... | | | | | | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | | | Yes | Yes | Yes |
| Nanny-berry..... | | | | | | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | | | Yes | Yes | Yes |
| Ninebark..... | | | | | | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | | | Yes | Yes | Yes |
| Olive, Russian..... | | | | | | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | | | Yes | Yes | Yes |
| Pen, Siberian..... | | | | | | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | | | Yes | Yes | Yes |
| Plum, Wild..... | | | | | | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | | | Yes | Yes | Yes |
| Rose, Wild..... | | | | | | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | | | Yes | Yes | Yes |
| Shadbush..... | | | | | | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | | | Yes | Yes | Yes |
| Snowberry..... | | | | | | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | | | Yes | Yes | Yes |
| Sumac..... | | | | | | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | | | Yes | Yes | Yes |
| Withe-rod..... | | | | | | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | | | Yes | Yes | Yes |

*Plant in mixture with other species on fertile soils in southern Michigan only

**Southern Michigan



Fig. 3. Eroded land planted to pine and other wildlife food and cover species. Black locust has checked active erosion in the gully at the extreme right. (Soil Conservation Service photo.)

WILDLIFE SPECIES

Planting species to provide food and cover for wildlife usually makes it possible to increase the amount of game and other wildlife. Food and cover species may be planted on ditch shoulders, rough land, eroding slopes, odd pieces of waste land, and around or mixed with plantations of trees for timber (Fig. 3). See Table 2 for suitable wildlife food and cover species.

WHEN TO PLANT

Early spring planting is preferable to fall planting as the trees are not in immediate danger of being heaved out of the soil by alternate freezing and thawing. Fall planting may be satisfactory for light sandy soils. Direct sowing of nuts and acorns is best accomplished in the fall; however, spring sowing is recommended if there is danger of rodents disturbing the seed during the winter.

CARE OF TREES ON ARRIVAL

Trees are shipped with their roots packed in damp moss or other similar material. When the trees are to be planted within 48 hours, they may be left in their shipping container if stored in a cool place and kept moist. If the trees are not to be planted within a day or two, they should be "heeled-in". This consists of digging a trench in a shady place with one side sloping at a 45-degree angle. The trench should be deep enough to accommodate the entire root system and the lower portion of the stem. Cut the strings on each bundle of trees, dip the roots in water, and spread the trees evenly along the sloping side of the trench. Cover the roots with soil, pack well to eliminate air pockets, and keep moist. "Heeled-in" trees will keep in good condition for 2 weeks or more but should be permanently planted before new growth starts.

SOIL PREPARATION

Some form of soil preparation is most always desirable as a means of eliminating competition with weeds and grass. The three common methods of preparation are scalping, furrowing, and plowing.

Scalping consists of removing the sod from an area about 2 feet square. Be sure all surface roots are removed with the sod scalp to prevent immediate regrowth of grass and weeds. After the sod is removed, a tree is planted in the center of the scalped area. A shovel, grub hoe, or mattock is a satisfactory handtool for scalping.

Furrowing consists of plowing shallow furrows and planting the trees in the bottom of the furrow. Furrows should be plowed either on the contour when the planting site is hilly (see page 1) or at right angles to the prevailing winds when the planting site is comparatively level. Where the water table is extremely high, it is recommended that the trees be planted on the furrow slice; plow the furrow in the fall and plant on the slice the following spring.

Plowing the entire planting area is decidedly beneficial when heavy sod is present or when it is planned to plant hardwoods, or evergreens for Christmas trees. The area should be plowed in the fall and disked in the spring before planting the trees. To increase the chances of survival, the trees should be cultivated the first year and preferably the second as well. Cultivation helps to conserve moisture and keep down the competition of weeds and grass. Generally, two cultivations a year will be sufficient to control the weeds.

PLANTING METHODS

Carry the trees in a pail partly filled with water to keep the roots moist. If the roots are permitted to dry out, the trees may die.

Hole Method

A shovel, grub hoe, or mattock is the most practical planting tool for the hole method. Dig a hole large enough to accommodate the roots when spread out in their normal position. Insert the tree into the hole $\frac{1}{2}$ inch deeper than it was in the nursery, being careful not to crowd the roots. *Never double up the roots* (Fig. 4). Cover the roots with moist fine soil and press down with the back of the hand (Fig. 5). No grass, leaves, or stones should be in contact with roots. Fill in the remaining soil and firmly pack with the heel of the shoe (Fig. 6). Leaves and grass may be placed around the newly planted tree to form a moisture-conserving mulch. Inexperienced men can plant 300 to 400 trees per day by the hole method.

Slit Method

The slit method of planting is often preferred because it is more rapid than the hole method. Nevertheless, the slit method should only be used with small-sized planting stock and sandy soils. The most practical planting tools for this method are the common spade, tiling spade, or planting bar. A planting bar may be constructed from a steel bar 4 inches wide by 12 inches long by $\frac{3}{8}$ inch thick and a 30-inch piece of $\frac{3}{4}$ -inch iron pipe. Draw one end of the bar to a knife-like edge and weld the other end to the iron pipe which serves as a handle.

Insert the planting tool into the soil, moving it back and forth to form a V-shaped slit. With the planting tool still in the slit, insert the young tree to the proper depth, making sure the roots are not doubled up. Remove the planting tool and insert it in the ground again 2 inches back of the slit. To close the bottom of the slit and assure that no air pockets are left around the roots, work the planting tool back and forth to pack the soil firmly against the roots of the tree. Remove the planting tool, kick the second slit full of dirt with the heel and firm the surface soil around the tree with the heel. (See Extension Folder F-32 for diagram of the slit-planting method.)



Fig. 4. (left) Dig a hole large enough to accommodate all the roots without crowding.



Fig. 5. (above) Set the tree about one-half inch deeper than it grew in the nursery, cover the roots with moist, fine soil, and press down with the back of the hand.

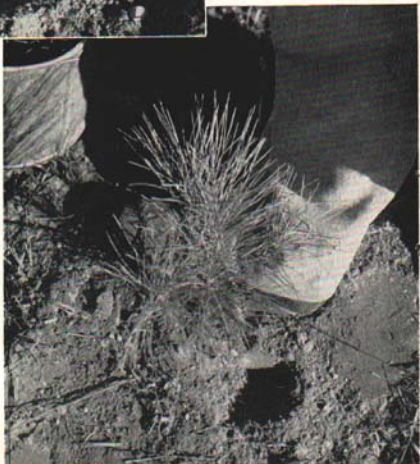


Fig. 6. (right) Fill in the remaining soil and firmly pack with the heel of the shoe so the tree cannot easily be pulled out.



Fig. 7. Tools used in planting trees.
Spade; shovel; mattock; planting bar.

SPACING

Evergreen trees for forest planting should be spaced from 6 by 7 to 8 by 8 feet apart depending on the species used. White, jack, Scotch and Austrian pine should be planted 6 by 7 feet, but it is best to space red and ponderosa pine a little farther apart, 8 by 8 feet. Hardwood trees may vary in spacing from 8 by 8 to 12 by 12 feet. For more complete land use in wider spacing of hardwood trees, white

TABLE 3—*Trees per acre for different spacing*

| Spacing in feet..... | 5 x 5 | 6 x 6 | 6 x 7 | 6 x 8 | 8 x 8 | 10 x 10 | 12 x 12 |
|-------------------------------|-------|-------|-------|-------|-------|---------|---------|
| Number of trees per acre..... | 1,742 | 1,210 | 1,037 | 908 | 680 | 435 | 302 |

or Norway spruce can be planted between them and can be cut when they are 6 or 8 feet tall for Christmas trees.

For solid Christmas tree plantations the spacing should not be less than 5 by 5 feet. The minimum spacing recommended for growing 8-foot Christmas trees is 6 by 6 feet.

WHERE PLANTING STOCK CAN BE PURCHASED

A number of the coniferous species which are printed in the planting guide (Table 1) may usually be obtained, at low cost, from the Michigan Conservation Department, Lansing. Planting stock from this source may not be used for ornamental purposes, Christmas trees, or resold with roots attached. Order blanks may be obtained from the Extension Forester at Michigan State University, East Lansing, or from the State Forester, Stevens T. Mason Building, Lansing. Many species may also be purchased from private nurseries.

TREE PLANTING MACHINES

Several machines which both prepare the ground and plant the trees in one operation have been developed and are now being used in Michigan. Although these machines differ in detail, the essential features are: (1) a coulter to cut sod and small roots, (2) plow to turn the furrow, (3) trencher to open a slit, (4) packer wheels to close the slit, (5) and a container for the planting stock. One man rides the machine to insert the root of the tree in the slit just ahead of the packing wheels. These machines are tractor drawn. Three men, one driving the tractor and two planting the trees and preparing the stock for planting, can plant up to 10,000 trees in an 8-hour day. For more information on planting machines write to the Forestry Department, Michigan State University, East Lansing.

CARE AND MANAGEMENT OF PLANTATIONS

During the first few years after the plantation is established very little can be done to improve conditions for the growing trees. A close watch should be kept for signs of insect or disease damage on the trees. Before sprays are applied consult the Entomology or Forestry departments of Michigan State University for information on spray materials to use and timing of the sprays. On fairly good agricultural soils where the sod is heavy it is sometimes more difficult to obtain a good stand of trees than on more infertile soils where the sod is light. The grass will encroach on the furrows and give the trees severe competition. Thick grass will also harbor field mice that sometimes girdle pine and hardwood trees. Rabbits will also gnaw the bark off hardwood trees. Such damage can be minimized by fall plowing prior to spring planting and the trees cultivated for 2 or 3 years. If the land is hilly and subject to serious erosion, plowing and cultivation is not recommended. Cultivation will not eliminate mice damage because they often girdle trees that are 6 to 8 feet tall.

When losses occur from drought or heat and the survival falls below 60 percent it is advisable to replant. Watering or irrigation is too costly to consider because it is cheaper to replant.

When the trees are 6 to 8 feet high and a good survival is attained (80 percent or more of the trees living) approximately 10 to 15 percent of the trees can be harvested for Christmas trees. Select the best-shaped trees well distributed over the plantation and do not remove two adjacent trees. No harm will result to the plantation, and a small income at this period will pay for the cost of establishing the plantation.

Pruning the lower limbs from approximately one-fourth of all the trees in a stand is recommended for plantations of red and white pine which are located on good sites and making rapid growth. It is doubtful if it pays to prune jack pine, Scotch pine, or spruce as these species will be grown principally for pulpwood. The first pruning should be done as soon as the branches on the lower 5 feet of the tree bole can be removed without reducing the remaining live crown to less than 40 percent of the total tree height. At that time it is fairly easy to select 150 to 200 thrifty, well-formed individuals per acre which show promise as good final crop trees.

Eventually, the selected crop trees should be pruned to a height of 17 feet above the ground, so that one log of relatively knot-free lumber can be obtained from each crop tree. This can usually be

accomplished in two or three operations at about 5-year intervals. Pruning should be done during the dormant season; if accomplished in the late fall before Christmas, it may be possible to sell enough boughs for greens to pay for the cost of pruning.

The first thinning of coniferous plantations should be made when the trees crowd to the extent that annual growth is reduced. The length of the live crown in relation to the total tree height is a good indicator of the need for thinning. Thinnings should start when the percentage of total bole length occupied by live branches is reduced to approximately 40 per cent. Trees planted the recommended spacing should reach this stage of development in approximately 15 to 25 years.

To make the thinning profitable, the trees should be tall enough that most of those cut will have two 8-foot sticks of pulpwood. In the first thinning, approximately one-fourth to one-third of the trees should be removed.

The most practical way to thin a plantation of close-spaced trees in which there are no openings is by the row method. This is accomplished by cutting all of the trees in every third row. Trees can be successively felled into the opening made by the removal of trees previously cut in the row. Harvested products can easily be skidded out of the plantation by way of the lane created by the removal of the row of trees.

Later thinnings should be made when the live crown again approximates 40 percent of the total tree height. These thinnings should remove inferior trees crowding or threatening to crowd the final crop trees; usually less than one-third of the remaining trees should be removed.

GLOSSARY OF COMMON AND SCIENTIFIC PLANT NAMES

Conifers (Evergreen)

| | |
|----------------------------|---|
| Cedar, Northern White..... | <i>Thuja occidentalis</i> L. |
| Fir, Balsam..... | <i>Abies balsamea</i> (L.) Mill. |
| Fir, Douglas..... | <i>Pseudotsuga menziesii</i> (Mirb.) Franco |
| Larch, European..... | <i>Larix decidua</i> Mill. |
| Pine, Jack..... | <i>Pinus banksiana</i> Lamb. |
| Pine, Red..... | <i>Pinus resinosa</i> Ait. |
| Pine, Scotch..... | <i>Pinus sylvestris</i> L. |
| Pine, White..... | <i>Pinus strobus</i> L. |
| Spruce, Black..... | <i>Picea mariana</i> (Mill.) B.S.P. |
| Spruce, Norway..... | <i>Picea abies</i> (L.) Karst |
| Spruce, White..... | <i>Picea glauca</i> (Moench) Voss |

Broadleaves (Deciduous)

| | |
|------------------------|--------------------------------------|
| Ash, Green..... | <i>Fraxinus pennsylvanica</i> Marsh. |
| Ash, White..... | <i>Fraxinus americana</i> L. |
| Basswood..... | <i>Tilia americana</i> L. |
| Cherry, Black..... | <i>Prunus serotina</i> Ehrh. |
| Cottonwood..... | <i>Populus deltoides</i> Bartr. |
| Elm, American..... | <i>Ulmus americana</i> L. |
| Hickory, Pignut..... | <i>Carya glabra</i> (Mill.) Sweet |
| Hickory, Shagbark..... | <i>Carya ovata</i> (Mill.) K. Koch |
| Locust, Black..... | <i>Robinia pseudoacacia</i> L. |
| Locust, Honey..... | <i>Gleditsia triacanthos</i> L. |
| Maple, Soft..... | <i>Acer rubrum</i> L. |
| | <i>Acer saccharinum</i> L. |
| Maple, Sugar..... | <i>Acer saccharum</i> Marsh. |
| Oak, Red..... | <i>Quercus rubra</i> L. |
| Oak, White..... | <i>Quercus alba</i> L. |
| Poplar, Tulip..... | <i>Liriodendron tulipifera</i> L. |
| Walnut, Black..... | <i>Juglans nigra</i> L. |
| Willow..... | <i>Salix</i> spp. |

Shrubs and Woody Vines

| | |
|-------------------------|--|
| Ash, Mountain..... | <i>Sorbus americana</i> (Marsh.) DC. |
| Blackberry..... | <i>Rubus</i> spp. |
| Black-haw..... | <i>Viburnum prunifolium</i> L. |
| Coralberry..... | <i>Symphoricarpos orbiculatus</i> Moench. |
| Crab, Wild..... | <i>Malus</i> spp. |
| Dogwood, Gray..... | <i>Cornus racemosa</i> Lam. |
| Dogwood, Red-Osier..... | <i>Cornus stolonifera</i> Michx. |
| Dogwood, Silky..... | <i>Cornus Amomum</i> Mill. |
| Elder..... | <i>Sambucus canadensis</i> L. |
| | <i>Sambucus pubens</i> Michx. |
| Grape, Wild..... | <i>Vitis vulpina</i> L. |
| Hawthorn..... | <i>Crataegus</i> spp. |
| Hazel..... | <i>Corylus americana</i> Walt. |
| | <i>Corylus cornuta</i> Marsh. |
| Honeysuckle, Bush..... | <i>Diervilla lonicera</i> Mill. |
| Honeysuckle, Fly..... | <i>Lonicera canadensis</i> Batr. |
| Juniper, Prostrate..... | <i>Juniperus communis</i> var. <i>depressa</i> Pursh |
| Nanny-berry..... | <i>Viburnum Lentago</i> L. |
| Ninebark..... | <i>Physocarpus opulifolius</i> (L.) Maxim. |
| Olive, Russian..... | <i>Elaeagnus augustifolia</i> L. |
| Pea, Siberian..... | <i>Caragana arborescens</i> Lam. |
| Plum, Wild..... | <i>Prunus nigra</i> Ait. |
| Rose, Wild..... | <i>Rosa</i> spp. |
| Shadbush..... | <i>Amelanchier arborea</i> (Michx. f.) Fern. |
| Snowberry..... | <i>Symphoricarpos albus</i> (L.) Blake |
| Sumac..... | <i>Rhus glabra</i> L. |
| | <i>Rhus typhina</i> L. |
| Withe-rod..... | <i>Viburnum cassinoides</i> L. |

