

## Natural Regeneration from Planted Conifers in Indiana

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Early tree planting in Indiana consisted mostly of farmstead planting of such species as White pine (*Pinus Strobus*), Norway spruce (*Picea excelsa*), Austrian pine (*Pinus austriaca*), red cedar (*Juniperus virginiana*), and Virginia pine (*Pinus virginiana*). The early settlers in Indiana often brought with them a few trees for homestead, school ground and cemetery planting. From some of these planted trees natural regeneration occurred which invaded adjacent areas and in some cases these conifers appeared to be native to the locality.

Land use practices have caused many thousands of acres of former agricultural land to revert back naturally to forest cover. On other areas soil conditions have been so greatly changed that tree planting is necessary to establish a stand of forest trees.

Investigations of forest tree planting began in Indiana about 1904 when the first experimental plots were established on the "Forest Preserve", now the Clark State Forest, near Henryville in Clark County, Indiana. Since that time tree planting has continued and to-day there are approximately 15,000 acres of coniferous forest plantations that have become established and if properly managed will produce forest products.

That planted conifers were capable of producing viable seed which led to natural regeneration becoming established adjacent to the seed producing trees was first noted in 1928. An old Scotch pine windbreak growing on a sandy soil in White County had produced seed crops from which seedlings became established on the area adjacent to the windbreak. Two other Scotch pine plantings in Pulaski County had also produced viable seed which resulted in the establishment of Scotch pine regeneration on both sandy and muck soils. Later during a period when intensive studies were made of several hundred forest plantations throughout the State, it was observed that natural regeneration from planted trees was frequently encountered though few such observations had been reported.

In order to show what has taken place as well as what is taking place, a few specific examples of natural regeneration from planted conifers will be given.

### White Pine (*Pinus Strobus*)

This species has been used for tree planting in Indiana for a good many years. It is well suited for planting on the better sites. Some of the established plantations of white pine will yield valuable forest product.

Viable seed is produced when planted trees are about 15 to 20 years old. One of the oldest white pine plantings from which natural regeneration has resulted is located on the Clark State Forest. The trees were planted in 1912. Survival has been good and at the present time the 37 year old trees are from 6 to 16 inches d.b.h. and 60 to 90 feet in height. Seedlings have become temporarily established both under the planted trees as well as on adjacent areas. Although the growth of the seedlings has been slow it is interesting to note that they have persisted for several years. Seedlings which were 2 to 4 inches in height when marked 6 years ago still persist but show very little growth.

Viable seed has been produced in several other white pine plantations on the Clark State Forest that are now 25 years old. Regeneration consists of white pine seedlings from one to 5 years old.

The most unusual example of white pine regeneration on a unfavorable site occurs on an area of stripped coal lands in Greene and Sullivan Counties. There white pine trees planted on the spoil banks in 1927-28 have produced viable seed. From these seeds regeneration has become established. The naturally seeded trees are from one to 7 years old and are found adjacent to the parent trees and extending out from the seed trees about 300 feet. These naturally seeded white pine appear to be thrifty and show promise of developing into trees of food form.

These examples and similar ones that have been observed indicate that natural seeding of white pine can be expected from planted trees.

#### Red pine (*Pinus resinosa*)

Although this species has been planted very extensively in Indiana most of the plantings are less than 20 years old. Natural regeneration of this species was first observed on the strip coal lands. Like white pine, viable seed is produced on 15-20 year old trees. The trees which produced the seed from which natural regeneration developed were planted on the spoil banks in 1926-27. The planted trees that became established now occur in small groups with seed trees 4 to 8 inches d.b.h. and 25 to 35 feet in height. Adjacent to several of these groups of seed trees red pine seedlings have established. They vary in size from 2 inches to 5 feet in height and are from 1 to 7 years old. Height growth of the naturally grown seedlings is like that of planted trees. The red pine planting is located in Sullivan County which is several hundred miles south of the natural range of red pine and therefore natural regeneration would ordinarily not have been anticipated. On a few other sites, particularly on the sandy soils in Northern Indiana, red pine seed trees have produced viable seed. The seedlings originating from these seed trees are from one to four years old but not as well developed as those occurring on the spoil banks.

Since red pine is one of the best trees for reforestation purposes in Indiana these examples of natural regeneration from planted trees are

encouraging. It indicates that the species may eventually form a small component part of the mixed hardwood forest in some parts of Indiana.

### Jack pine (*Pinus banksiana*)

This species has been and continues to be used very extensively for planting in all parts of Indiana. It makes a quick initial height growth and begins to bear viable seed when planted trees are 5 years old. Frequent seed crops are produced even though most of the jack pine stands are less than 20 years old. Natural regeneration from planted trees is encountered on many sites ranging from the light sandy soils to the heavy clay soils. There are numerous places where natural seeding of jack pine can be observed and of these, two will be described.

The most unusual case of natural regeneration of jack pine has occurred in southeastern Indiana in Jennings county. Trees planted on a heavy clay soil in 1932 were destroyed by fire in October 1940. The fire burned over about seven acres and only a few trees survived the fire. Natural regeneration became established in the spring of 1941 and it now covers almost the entire seven acres. These naturally seeded jack pine are from 5 to 15 feet in height and density of stocking varies from 2,000 to 15,000 trees per acre.

The naturally seeded trees show growth characteristics similar to that of planted trees and the trees are generally straight-boled.

On the stripped coal lands natural regeneration of jack pine is frequently encountered. The natural regeneration that has originated from seed produced by planted jack pine varies from seedlings to trees 15 feet in height. In one case a 15 year old group of jack pine has produced viable seed from which seedlings have grown and have invaded an adjacent area which formerly supported an orchard. Natural seeding has gradually extended out from the parent trees to a distance of approximately 1,000 feet.

Although many similar examples could be given it appears evident that jack pine natural regeneration from planted trees can be expected wherever land adjacent to seed sources is not used for agriculture and where fire and grazing have been excluded.

### Scotch pine (*Pinus sylvestris*)

Recent studies have shown that the use of Scotch pine should be confined to Christmas tree and windbreak plantings. However, it has been planted in all parts of Indiana and natural regeneration from planted trees is commonly found. It appears that of all the species that have been used for planting in Indiana, excepting Virginia pine, that natural regeneration of Scotch pine was observed earlier than that of other species of pine. It does not begin to produce viable seed until trees are from 15 to 20 years old. Regeneration from seed produced by individual trees or blocks of seed trees is usually scattered and apparently seedlings do not quickly invade adjacent areas. Regeneration can be

found on all sites from the sandy areas of Northern Indiana to the heavier clay soils of Southern Indiana. Like jack pine, natural regeneration is commonly encountered on the spoil banks. Scotch pine trees ranging from small seedlings to 15 foot trees have become established, from seed produced by planted trees.<sup>1</sup> However, dense stands like those described for jack pine have not been observed.

#### Pitch pine (*Pinus rigida*)

Although pitch pine plantings on non-agricultural lands occupy a relatively small acreage compared to red pine, jack pine or white pine, natural regeneration has occurred. Like jack pine, more naturally seeded trees can be found growing on the spoil banks than any other areas in Indiana. On lands in Warrick County, Lawrence County, Jennings County and Clark County trees from seed produced by planted pitch pines have become established. The largest trees that have been observed are approximately 5 feet in height. Most of the pitch pine seedlings are less than 5 feet in height and occur as scattered trees.

#### Japanese red pine (*Pinus densiflora*)

There are only a few small plantings of this species but in four different places natural regeneration has been observed. On the Clark State Forest naturally seeded trees ranging in size from 4 inches to 6 feet in height can be found growing in mixture with naturally seeded white pine, jack pine and Virginia pine. It has also invaded a 36 year old plantation of sycamore on the Clark State Forest and here the Japanese red pine trees are from 1 to 7 feet in height. Stand density of the pine varies from a few trees per acre to 1,000 but most of the seedlings occur in small groups or as scattered individual trees. The planted trees from which seed has come are rapidly dying out while some of the largest of the naturally seeded trees have already produced a few cones. It is doubtful whether enough trees of this species will persist and consequently competition from other pines and hardwoods will eventually eliminate the Japanese red pine. It is not a suitable tree for planting in Indiana and its use was discontinued 10-15 years ago.

#### Virginia pine (*Pinus virginiana*)

Until 1935 this species had not been generally used for reforestation purposes in Indiana. Natural regeneration has come from planted trees of this species where it has been used for farmstead, school ground and church yard planting. Some of these planted trees have been observed and reports of natural regeneration of Virginia pine have been published. These examples are not included and only those cases are considered where the pine has been planted on non-agricultural land as part of a reforestation project.

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<sup>1</sup>DenUyl, Daniel. 1948. Forest plantations, their establishment, growth, and management. Purdue University Agr. Expt. Sta. Circular 331.

Natural regeneration from forest plantations of this species has been found in five places, namely, 2 plantations in Lawrence County—1 in Jackson County and one in Tippecanoe County and one in Washington County. Most of these planted trees from which seed has originated are less than 12 years old. Natural regeneration ranges from small seedlings to trees 6 feet in height. These occur as scattered individual trees adjacent to the parent trees.

This species has been planted in many parts of Indiana during the past 10 years. Its early seeding habit indicates that natural regeneration from planted trees will be frequently observed during the next few years.

#### Summary

Case histories of natural regeneration of seven different conifers that have been used for reforestation in Indiana have been described. It is evident that planted trees of jack pine, Virginia pine, red pine and white pine and to a lesser extent Scotch pine, will produce viable seed from which under favorable conditions seedlings will become established. Protection from fire and domestic livestock grazing of adjacent non-agricultural land will often result in the establishment of pine regeneration from planted trees. Some of these naturally seeded trees may survive hardwood competition and occur as individual pines in a mixed hardwood stand.