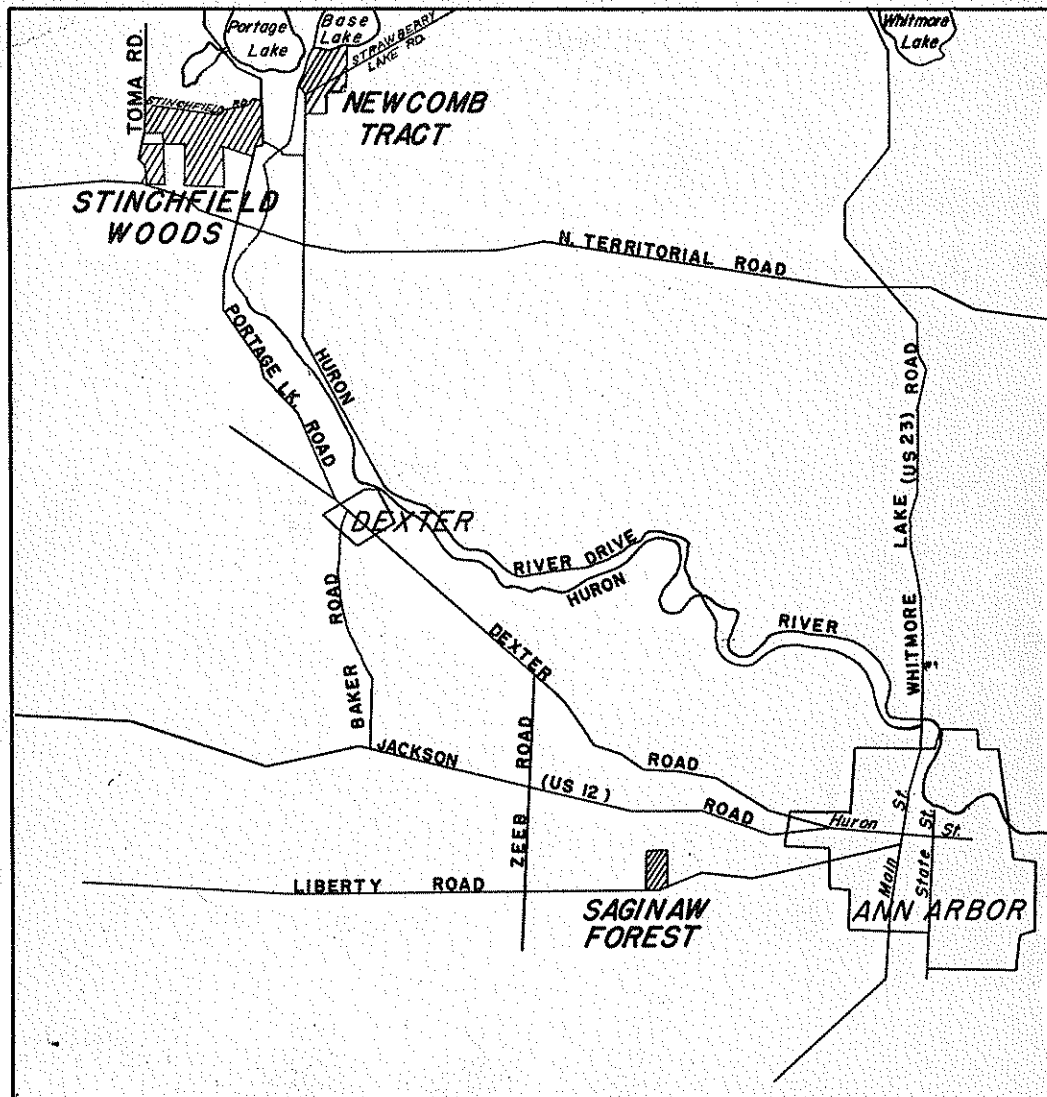


FORESTRY

SD  
408  
M63  
1961

# A GUIDE TO SAGINAW FOREST



SCHOOL OF NATURAL RESOURCES  
UNIVERSITY OF MICHIGAN.  
ANN ARBOR, MICHIGAN

UNIVERSITY OF MICHIGAN LIBRARIES

Forestry  
Gift  
12-18-61

THE SAGINAW FOREST, 1903-1961

Introduction

At the time that the Forestry Department was established in the University, one of the immediate needs was for land on which forestry operations could be carried out and used as a basis for instruction and research.

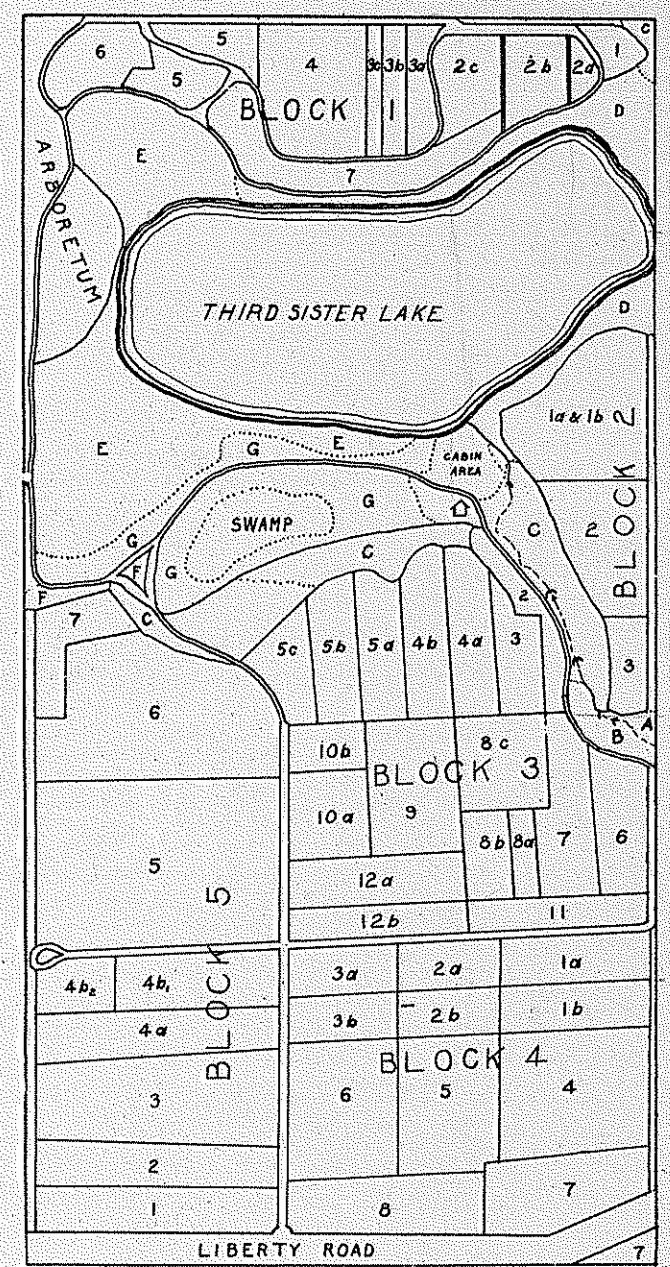
This need was met by the Honorable Arthur Hill of Saginaw, a lumberman and Regent of the University, who purchased this tract in 1903 and deeded it to the University with the stipulation that it was to be used as a forestry demonstration and experimental area. The deed also specified that the official name should be "The Saginaw Forestry Farm". By 1919, the development of the plantations had reached such a stage that the name, "farm", seemed inappropriate, so it was changed by the Regents, at the request of the forestry faculty, to "The Saginaw Forest".

Planting of the cleared portions began in the spring of 1904 and was completed in 1915. Later, some of the species proved to be unsuited to the sites on which they had been planted. Others suffered serious damage from insects and diseases. Most of these unsuccessful plantations have been clear cut and the areas replanted with different species. A few have been kept untouched because of their demonstration value.

The total area of experimental plantations is 55 acres, with the balance of the area occupied by the lake, swamp, natural second-growth, roads, buildings, and a small arboretum. Most of the plantings are now so far advanced that the history of their development furnishes much information that can serve as a guide for future operations in reforestation in southern Michigan. Even the failures have been valuable in this respect.

During the summer and fall of 1915, the stone cabin was built as a storage place for tools and materials and as a shelter for classes and work-crews in inclement weather. It was unfortunate that the need for a caretaker's residence could not have been foreseen, so that a design better suited to the present use of the building could have been adopted.

In 1947, the building east of the cabin was erected for a garage and storage place and to furnish some supplementary living space.



Block	Lot	Species	Stock	Date	Acres	
1	1	Scotch Pine	2-0	Sp.'04	.24	
1	2a	Austrian Pine	2-0	"	.12	
1	2b	White Pine	2-0	"	.54	
1	2c	"	2-0	"	.57	
1	3a	Douglas Fir	2-0	"	.37	
1	3b	Western Y. Pine	2-0	Sp.'08		
1	3c	Tulip Poplar	2-0	Sp.'04	.28	
1	4	White Pine	2-2	Sp.'08		
1	5	Douglas Fir	2-2	Sp.'21	.23	
1	6	White Pine	2-0	Sp.'04	1.63	
1	7	Western Y. Pine	2-0	Sp.'08	.75	
1	8	Scotch, Austrian	2-0	Sp.'06	.61	
1	9	W.Y. Pine	2-0	Sp.'08	.91	
1	10	Scotch Pine	1-0	Sp.'04		
2	1a+1b	Norway Spruce	3-0	Sp.'04	1.68	
2	2	Norway Pine	3-1	Sp.'23	1.04	
2	3	Scotch Pine	2-2	Sp.'22	.34	
3	1	Black Locust	1-0	Sp.'04	.53	
3	2	Hickory	1-0	Sp.'07		
3	3	Black Locust				
3	4	Elm				
3	5	Scotch Pine	2-2			
3	6	Japanese Red Pine	2-2	Sp.'27	.53	
3	7	Scotch Pine	2-2	Sp.'26	.77	
3	8	Scotch Pine	2-2	Sp.'24	.64	
3	9	Japanese Red Pine	2-2	Sp.'25		
3	10	Black Locust	1-0	Sp.'06	1.86	
3	11	Norway Spruce	2-2	"	.15	
3	12	Basswood	1-0	"	.06	.75
3	13	W. Yellow Pine	2-1	"	.38	.85
3	14	Sugar Maple	1-0	"	.06	.24
3	15	"	1-0	"	.06	.45
3	16	Norway Pine	2-2	"	.21	.90
3	17	Cor. Italian Pine	2-0	"	.30	1.30
3	18	Red Oak	1-0	"	.06	.76
3	19	White Oak	1-0	"	"	.35
3	20	Wh. Burr Oak	Seed	"	"	.62
3	21	Bl. Walnut	1-0	"	"	.46
3	22	"	Seed	Fall '06	"	.61
4	1a	Wh. Oak	Seed	Fall '06		.74
4	1b	Wh. Pine	Seed	Fall '06		.74
4	2	Chestnut	Seed	Fall '06		.74
4	3	Wh. Pine				
4	4	Red Oak	1-0	Sp.'08		1.02
4	5	Scotch + Wh. Pine				
4	6	Red Oak	Seed	Fall '06		
4	7	Bl. Walnut	"	Sp.'07		1.08
4	8	Pine-Oak	2-2	"	'09	1.87
4	9	Larch-Spruce	2-2	"		
4	10	Red Oak	1-0	Sp.'07		1.45
4	11	"	Seed	"	"	1.54
4	12	Nor. Spruce	2-2	"	'14	1.03
4	13	Red Oak	1-0	"	'08	1.17
5	1	W.Y. Pine	2-0	Sp.'09		1.07
5	2	"	2-0	"	'37	.97
5	3	Nor. Spruce	3-0	Fall '11		2.21
5	4	Cottonwood	Cuttings	Sp.'12		1.05
5	5	W.Y. Pine	2-1	"	'15	1.00
5	6	Nor. Pine	2-2	"	'21	.37
5	7	W.Y. Pine	2-0	"	'09	4.04
5	8	"	2-0	"	'12	2.76
5	9	Filled Douglas Fir		"	'18	
5	10	Nor. Spruce	2-0	"	'37	.64

A = Box Elder B = Douglas Fir C = Oak-Hickory  
D = Soft Maple, Willow, Aspen E = Elm, Soft Maple Swamp  
F = Nor. + Wh. Spruce G = Wh. Cedar

SAGINAW FOREST  
SCHOOL OF NATURAL RESOURCES  
UNIVERSITY OF MICHIGAN

Scale: 1" = 100'

REVISED AUG. '57

1-10-61

The first progress report on the plantations was published in 1928 in the Papers of the Michigan Academy of Science, Arts, and Letters, 9:541-594, under the title, "Growth and Cultural Experiments on the Saginaw Forest." The principal subjects covered in the report are the methods of establishment, survival obtained with different species and methods of establishment, effects of variations in spacing, growth and development of the individual stands, thinning experiments, sources of injury and their degree of seriousness.

Many investigations have been carried out here in such sciences as forest entomology and pathology, limnology, ichthyology, wildlife, silviculture, and soils. That the use of the area for research along a variety of lines will increase with time, is a certainty.

In the hearts of many of the older alumni, there is much sentiment for the old "Forestry Farm". It was there they struggled with grub hoes and spades to establish the first plantations, while arguing vigorously as to the feasibility of starting forests in such an artificial way. There they enjoyed the fellowship of the annual "Camp Fire" in the fall and of the weekend-long "Field Day" in the spring. On the hillside back of the present cabin, they sat and listened to the inspirational talks of "Daddy" Roth and wondered just what the future had in store for forestry and for them. To these men, this Forest will always be far more than just a piece of land planted with trees.

#### DESCRIPTION OF THE AREA

Most of the tract of eighty acres consists of level to gentle slopes with a small percentage of short, steep slopes. Toward the north end is Third Sister Lake, covering 11 acres, with about six acres of swamp around the west and south sides. A deep ravine runs southeasterly from the lake to about the midpoint of the east boundary.

The bulk of the soil is Miami loam, rated as fairly productive and durable for agriculture. The swamp soils are typed as Rifle peat. The upland north of the lake is Fox sandy loam, a lighter, more acid, and less fertile soil than Miami loam.

At the time of purchase, most of the land had been cleared for farming, but a few small pieces of second-growth hardwoods had been left on some of the steeper slopes, and there was a fairly good growth of elm, aspen, willow, and red and silver maples on the wet soils around the lake. The old farm buildings and a small orchard were located in the southeast corner of the tract, so that this land was not depleted by cultivation and crop-production. Under improper farming methods, the soils had deteriorated in fertility, and the steeper slopes had suffered badly from sheet erosion and gullying.

After the abandonment of cultivation, a dense growth of weeds took possession of the old fields, but this was displaced by a grass cover within a few years, which formed a heavy, tough sod on all of the heavier soil.

## STAND SUMMARIES

Each plantation is summarized on a separate sheet of paper, using a standard form of presentation. The species listed first are those in the earliest planting that have survived to the present day. In many cases, species planted at a later date are now found in the dominant canopy. Information on this will be found in the measurement summary and in the discussion.

The age of each stand is given in terms of the number of growing seasons since planting. The measurement data are taken prior to any thinning that might have been carried out at the time of most recent measurement.

## SCIENTIFIC NAMES OF TREES CITED

Nomenclature of native species follows Gray's Manual of Botany, 8th Edition, by M. L. Fernald, American Book Co., New York. 1632 pp. 1950.

Nomenclature of introduced species follows Alfred Redher, Manual of Cultivated Trees and Shrubs. Second edition. MacMillan Co., New York. 996 pp. 1940.

White spruce	<i>Picea glauca</i> (Moench) Voss
✓ Norway spruce	<i>Picea Abies</i> (L.) Karst
European larch	<i>Larix decidua</i> Mill.
✓ White pine	<i>Pinus Strobus</i> L.
✓ Red pine	<i>Pinus resinosa</i> Ait.
✓ Austrian pine	<i>Pinus nigra</i> Arnold
Corsican pine	<i>Pinus nigra</i> Poiretiana (Ant.) Aschers and Graebn.
✓ Scotch pine	<i>Pinus sylvestris</i> L.
✓ Ponderosa pine	<i>Pinus ponderosa</i> Laws.
Japanese red pine	<i>Pinus densiflora</i> Sieb. and Zucc.
Northern white cedar	<i>Thuja occidentalis</i> L.
✓ Douglas fir	<i>Pseudotsuga taxifolia</i> (Lam.) Britton
✓ Cottonwood	<i>Populus deltoides</i> March.
✓ Black walnut	<i>Juglans nigra</i> L.
✓ Shagbark hickory	<i>Carya ovata</i> (Mill.) K. Koch
✓ Mockernut hickory	<i>Carya tomentosa</i> Nutt.
✓ Chestnut	<i>Castanea dentata</i> (Marsh.) Borkh
✓ White oak	<i>Quercus alba</i> L.
✓ Northern red oak	<i>Quercus rubra borealis</i> (Michx. f.) Farw.
Bur oak	<i>Quercus macrocarpa</i> Michx.

## Scientific Names, continued.

American elm	<i>Ulmus americana</i> L.
✓ Russian mulberry	<i>Morus alba tatarica</i> (L.) Ser.
✓ Osage orange	<i>Maclura pomifera</i> (Raf.) Schneid.
✓ Yellow poplar	<i>Liriodendron Tulipifera</i> L.
Black cherry	<i>Prunus serotina</i> Ehrh.
✓ Black locust	<i>Robina Pseudo-Acacia</i> L.
Ailanthus	<i>Ailanthus altissima</i> (Mill.) Swingle
✓ Sugar maple	<i>Acer saccharum</i> Marsh.
Red maple	<i>Acer rubrum</i> L.
Silver maple	<i>Acer saccharinum</i> L.
✓ Box elder	<i>Acer Negundo</i> L.
✓ Basswood	<i>Tilia americana</i> L.
✓ White ash	<i>Fraxinus americana</i> L.
✓ Catalpa	<i>Catalpa speciosa</i> Warder

Species: Scotch pine  
 Planted: Spring, 1904  
 Soil : Fox sandy loam

1961  
 Lot No. I-1  
 0.24 acres

#### PLANTATION ESTABLISHMENT

Stock: 2-0  
 Seed source: unknown  
 Site preparation: plowed and harrowed  
 Planting method: slit with spade  
 Spacing: 4 x 4  
 Initial survival %: 98

#### CULTURAL HISTORY

Thinning: One plot of 0.072 acres thinned 10 times (1916, and at 5-year intervals from 1920 through 1960). One plot of 0.055 acres left unthinned, this area was thinned in 1955 and entire lot measured as a unit.

#### DAMAGE:

No serious damage. Heavy wind of November 1919 tipped a dozen or so trees near the west edge. These later developed considerable sweep in their boles. Heavy glaze storm of March, 1922 broke the crowns out of 15 trees with lopsided crowns at edge of stand. Spittle bug attacks have occurred frequently, but without pronounced ill effects.

#### MEASUREMENT (per acre basis)

Year	1960	1960
Species or treatment	Before thinning	After thinning
Age	57	57
No. trees	250	200
Basal area	182.2	154.2
Ht. dom. trees	67.0'	67.0'
Av. DBH	11.6"	11.6"
Merch. cu. ft. (3" min. Top-Peeled)	---	---
Bd. ft. 5" min. Top Int. 1/4"	19,375	17,000

7,000 Bd. ft. per acre has been removed in thinnings.

#### DISCUSSION:

Before the last thinning in 1950, the thinned plot had less than one-half as many trees as the unthinned. The live crown length on dominant trees, however, was about 30% of total height on both plots. The relatively poor response of the Scotch pine to thinning is in marked contrast to the adjacent white pine.

Adjacent hardwoods, especially black cherry, have seeded into the stand, and have established a complete understory more than 6 feet high.

A small number of white pine were planted with the Scotch pine, possibly due to accidental mixing of the stock. These were quickly overtopped.

This Scotch pine plantation is intermediate from the standpoint of form and growth rate. Enough well-formed trees are present to give a fully-stocked stand by the end of the rotation, if they are favored in thinnings.



1961

Species Austrian pine Lot No. 1-2a  
 Planted: Spring, 1904 0.127 acres  
 Soil : Fox sandy loam  
 Previous land use: Farm land

## PLANTATION ESTABLISHMENT

Stock: 2-0  
 Seed source: Unknown  
 Site preparation: Plowed and harrowed  
 Planting method: Slit with spade  
 Spacing: 4 x 4  
 Initial survival percent: 99

## CULTURAL HISTORY

Thinning: Eight times at 5-year intervals, beginning in the winter of 1924. The thinning of 1949 was somewhat heavier than the earlier treatments.

DAMAGE: No insect or disease damage. Four trees were broken by ice in 1944, and two were wind-thrown in January 1949. The large amount of sweep in a few trees was caused by wind and tipping in the storm of November, 1919.

## MEASUREMENTS (per acre basis)

Year	Before thinning		After thinning		Total after thinning
	1959		1959		
Species or treatment	A Pine	W. Pine	A. Pine	W. Pine	all
Age	56	56	56	56	
No. trees	220	24	188	24	212
Basal area	148.0	20.0	129.4	20.0	149.4
Ht. dom. trees	69'	--	69'	----	69'
Av. DBH	11.1	12.5	11.2'	12.5	
Merch. cu. ft (3" min. top-peeled)					
Bd. ft. 5" min. top					
Int. 1/4"	All- 18,850		All - 16,810		
10,000 bd. ft. per acre removed in thinnings.					

## Discussion;

The bole form of this stand is excellent, except for an occasional forked tree, all these have been removed in thinnings.

The hardwood understory is similar to that in the adjacent Scotch pine stand (I-1). It includes much poison ivy.

A few white pine were planted in the stand, and have managed to stay in the upper canopy.

1961

Species: White pine  
 Planted: Spring, 1904  
 Soil : ;Fox sandy loam  
 Previous land use: farm land

Lot No. I-2B  
 0.54 acres

## PLANTATION ESTABLISHMENT

Stock 2-0  
 Seed source: Unknown  
 Site preparation: plowed and harrowed  
 Planting method: Slit with spade  
 Spacing: 3x3  
 Initial survival percent: 99

## CULTURAL HISTORY

Thinning: 10 times at 5-year intervals from 1915 through 1960. Thinned plot 0.236 acres. Two unthinned plots on either side of thinned plot total 0.173 acres.

DAMAGE: Only minor injuries. Some sawfly defoliation in first few years. Broken and deformed terminals resulted from hail in Fomes Pini June 1916, and from ice and wind in 1917. A few trees with resulting crooks are still present. A few dominants died from drought in the summer of 1932. In January 1949 one tree was blown down and two others were tipped so badly that they were cut. Fomes Pini discovered in 1960.

Measurement (per acre basis)	Thinned plot		Old unthinned area	
	1960	1960	1960	
Species or treatment	Before	After	Before	After
Age	57	57	57	57
No. trees	279	254	728	386
Basal area	166.0	156.0	237.0	170.0
Ht. dom. trees	74'	74'	74'	74'
Av. HBh	10.4"	10.5"	7.7"	9.0"
Merch. cu. ft. (3" min. top peeled)				
Bd. ft. 5" min. top Int. 1/4"	17,000	16,150	18,800	15,750

Early thinnings were relatively light to favor natural pruning (in 1950, the live crown was 37 percent of the length of the tree on thinned plot dominants, 27 percent on unthinned dominants). The last two thinnings have been heavier. Branches have been killed on dominants on the thinned plot to a height of 40 ft.

Basal area per acre increased on both plots up to an age of 42 years. At that time, the thinned plot had 215 square feet and the unthinned 231. During that period 1945-50, mortality exceeded gross growth on the unthinned plot for the first time; while net growth on the thinned plot was insufficient to replace the amount removed in 1945. Unthinned plot was thinned in fall of 1960.

Slash from the first two thinnings was very heavy. It was removed from the stand and burned. Since then, the slash has been lopped and scattered.



Species: White pine  
Planted: Spring 1904  
Soil : Fox sandy loam  
Previous land use: Farm land

Lot No. I-2c  
0.57 acres

PLANTATION ESTABLISHMENT:

Stock: 2-0  
Seed source; Unknown  
Site preparation: Plowed and harrowed  
Planting method : Slit with spade  
Spacing : 6x6, 4-1/2 x 4-1/2 (south half)  
Initial survival %: 96

CULTURAL HISTORY:

Thinning: Nine times at 5-year intervals from 1920 through 1960.  
Thinned plot 0.212 acres. Unthinned plot 0.172 acres.  
Lot method, Grade B, removing suppressed and many intermediates.

DAMAGE:

Same as adjacent white (I-2b)

Measurement (per acre basis)	Thinning plot		Unthinned plot
	1960	1960	1960
Year	1960	1960	1960
Species or treatment	Before thinning	After thinning	Unthinned
Age	57	57	57
No. trees	390	292	528
Basal area	237.0	198.0	248.0
Ht. dom. trees			
Av. dbh	10.5"	11.2"	9.3"
Merch.cu.ft. (3' min. top peeled)			
Bd.ft. 5" min. top Int.1/4"	24,100	20,800	23,450

DISCUSSION

The basal area per acre of both plots has increased steadily up to the time of the last measurement in 1950. At the end of each 5-year period, the basal area of the thinned plot has exceeded that of the unthinned until the 1960 measurements were made.

7000 ;bd. ft. of logs has been removed from Lots 2b and 2c combined.

Species: Douglas fir 1961  
 Planted: Spring 1904  
 Soil: Fox sandy loam  
 Previous land use: Farm land Lot No. I-3a  
 0.428 acres

**PLANTATION ESTABLISHMENT:**

Stock: 2-0  
 Seed source: Rocky Mountain origin  
 Site preparation: plowed and harrowed  
 Planting method: slit with spade  
 Spacing: 4 x 4  
 Initial survival %: 60

**CULTURAL HISTORY:**

Replanting: Failed spots filled in with ponderosa and white pines, spring 1908, and some rows of ponderosa were planted between the Douglas fir rows. Scalped spots, grub hoes.

Thinning: Eight times at 5-year intervals from 1924 through 1959.

**DAMAGE:** The low survival was due to drought, frost, mice, and rabbits. Damage by the latter two agencies continued up to 1912. In 1915, many Douglas fir shoots were killed by frost. The 1916 hail storm broke many terminals on the white pines.

**MEASUREMENT (per acre basis)**

Year	Before After		Before After		Before After		Before After		Before After	
	1959		1959		1959		1959		1959	
Species or Treatment	D. Fir		Pond Pine		W. Pine		A. Pine		All	
Age	56		52		52		?			
No. trees	103	95	37	26	91	89	12	5	243	215
Basal area	39.3	37.1	14.9	11.2	57.9	56.9	9.6	4.4	121.7	109.6
Ht. dom. trees	59'		-----		-----		-----		-----	
Av. DBH	8.4"	8.5"	8.6"	8.9"	10.8"	10.9"	11.8	12.9'	-----	
Merch. cu. ft. (3" min Top-peeled)										
Int. 1/4"	2,910	2,810	1,140	890	6,075	5,980	1,080	510	11,205	10,190
3,000 bd. ft. per acre removed in thinnings.										

**DISCUSSION:**

Early growth of the Douglas fir was very slow. The seedlings were pale and yellow-green. The replanting in 1908 resulted in a very dense stand. In the crown thinning of 1924, a mistake was made in not thinning the groups of secondary trees between the crop trees. As a result, many of these later became small-crowned and developed slender boles. Many were badly bent by snow and ice and were subsequently cut. Large numbers of shrubs, and hardwood seedlings have become established.

1961

Species: Yellow poplar-White Pine Lot No. I-3B  
 Planted: Spring, 1904; spring 1908 0.28 acres  
 Soil : Fox sandy loam  
 Previous land use: Farm land

## PLANTATION ESTABLISHMENT:

Stock: 2-0  
 Seed source: From nursery in Tennessee  
 Site preparation: Plowed and harrowed  
 Planting method : Slit with spade  
 Spacing: 4 x 4  
 Initial survival percentage: c.50

## CULTURAL HISTORY

Replanting: White pine, spring 1908. Scalped spots and center hole planting.  
 Thinning: Eight times at 5-year intervals from winter of 1924 through 1949.  
 Pruning : White pine to 17 ft. in 1935.

## DAMAGE:

In the early years many of the yellow poplars were girdled by mice. Since then, there have been no serious injuries, except for the breakage of new shoots of white pine by hail in 1916.

## MEASUREMENT (per acre basis)

Year	Before		After		Before		After	
	1959		1959		1959		1959	
Species or treatment	Tulip	Poplar	White Pine		all			
Age	56		52					
No. trees	75	71	221	198	296	269		
Basal area	32.0	31.0	159.0	147.0	191.0	178.0		
Ht. dom trees	-----		70'		-----			
Av. DBH	8.8"	8.9"	11.5"	11.7"	-----			
Merch. cu. ft. (3" min. top-peeled)								
Bd. ft. 5" min. top								
Int. 1/4"	2,980	2,870	17,000	15,840	19,980	18,710		
4800 bd. ft. per acre removed in thinnings.								

## DISCUSSION:

The white pine have, in general grown more rapidly with the result that many of the yellow poplars have been overtopped. A small number of yellow poplars, however, have maintained a dominant position in the stand.

Natural pruning on the yellow poplar has been excellent. The clear length extends practically to the base of the live crown.

Species:	Douglas fir	Lot No. I-3c
Planted:	Spring 1921	0.23 acres
Soil :	Fox sandy loam	
Previous land use:	Farm land, catalpa plantation 1904-1921	

## PLANTATION ESTABLISHMENT:

Stock	2-2
Seed source:	Unknown

## DAMAGE:

The Douglas fir has suffered defoliation from a needle blight, and has been suppressed by adjacent white pine and by black cherry.

## MEASUREMENTS (per acre basis)

Year:	1932
Species or treatment:	DF
Age:	12
Height:	5.9

## DISCUSSION:

Originally planted to catalpa, 1-0 stock, in spring of 1904. Spacing was 4 x 4 and initial survival about 90 per cent. The site was plowed and harrowed and the trees planted in a slit with a spade. During the unusually severe winter of 1917-18, most of the catalpa were completely killed. In some cases, weak sprouts appeared the following year. The dead catalpa were clearcut during the summer of 1921.

Such a narrow strip of land should have been replanted with a more tolerant species than Douglas fir. The stand is now almost 100% black cherry from natural seeding.

Species: White pine Lot: I-4  
 Planted: Spring 1907 1.26 acres  
 Soil: Fox sandy loam  
 Previous land use: Farm land

## PLANTATION ESTABLISHMENT:

Stock: 2-0  
 Seed source: Unknown  
 Site preparation: Scalped spots  
 Planting method: Center hole with grub hoe  
 Spacing: 4 x 4  
 Initial survival %: 0.32

## CULTURAL HISTORY:

Replanting: 1912, 2-0 ponderosa pine  
 Thinning : Five times (winter 1938, 1943, 1948, 1953, and 1958). To relieve pruned crop trees of competition.  
 Pruning : Larger white pines and spruces to 17 feet in 1935.

## DAMAGE:

Same as for other white pine stands in Block I.

## MEASUREMENT (per acre basis)

Year	<u>Before Cutting</u>			
	1958			
Species or treatment	W. Pine	Nor. Spruce	Pond. Pine	All
Age	52	54	47	
No. trees	282	15	5	302
Basal area	186.0	6.6	2.0	194.6
Ht. dom. trees	68'	---	---	----
Av. DBH	11.0"	9.0"	8.7"	----
Merch.cu.ft. (3" min. top-peeled)				
Bt.ft. 5" min. Top Int. 1/4"				720,200
Year	<u>After Cutting</u>			
	1958			
Species or treatment	W. Pine.	Nor. Spruce	Pond. Pine	All
Age	52	54	47	
No. trees	228	6.3	2.3	236.6
Basal area	164.0	2.6	1.2	167.8
Ht. dom. trees	68'	---	---	----
Av. DBH	11.5	8.7	9.8	----
Merch.cu.ft. (3" min. top-peeled)				
Bd.ft. 5" min. Top Int. 1/4" ---		-----	-----	18,150

5,800 bd. ft. per acre has been removed in thinnings.

DISCUSSION: This area was originally planted with sugar maple and beech in 1905, but the venture was almost a complete failure. The replanting with 2-0 Norway spruce stock the next year was also a failure, although a few trees have survived. The present stand dates largely from the 1907 white pine planting, as the ponderosa pine planted in 1912 were largely overtopped and killed.

1961

S Species: Ponderosa Pine Lot No. I-5  
 Planted: Spring 1908 0.76 acres  
 Soil : Fox sandy loam  
 Previous land use: Forest nursery, 1904-1908 in part.

## PLANTATION ESTABLISHMENT

Stock: 2-0  
 Seed source: Unknown  
 Site preparation: Scalped spots  
 Planting method: Center hole with grub hoe  
 Spacing: 6 x 6  
 Initial survival percentage: 88

## CULTURAL HISTORY

Replanting: 1918, 2-2 ponderosa pine

Thinning : Five times, winters of 1939, 1943, 1948, 1953, 1958.

Pruning : 120 per acre to 17 feet, 1936.

DAMAGE: All the injuries have been mechanical. The hail storm of 1916 broke off many terminal shoots of the current season's growth. Ice broke 19 trees in 1938 and two in January, 1949.

## MEASUREMENT (Per acre basis)

Year	1960
Species or treatment	--
Age	52
No. trees	176
Basal area	82.0
Ht. dom. trees	68'
Av. DBH	9" +
Merch. cu. ft. (3" min. Top-peeled)	
Bd. ft. 5" min. top Int. 1/4"	6,700

## DISCUSSION

In 1908, most of the nursery stock was removed, but a number of rows of hardwood stock along the east edge of the lot were left. The survivors of those trees are still there. Scattered through the present plantation are some red oak, Norway spruce, and Scotch pine that were left in the nursery. On the slope below the nursery, a group of red cedar and another group of Ailanthus had been planted prior to 1908.

Ailanthus seedlings are abundant in the southeast portion of the area. American elm has seeded in from trees in the swamp to the south. Some of these were cut to prevent injury to the pines.

Species: Austrian, Scotch, and ponderosa pine s. 1961  
 Planted: Spring, 1906 Lot: I-6  
 Soil : Fox sandy loam 0.62 acres  
 Previous land use: Farm land

#### PLANTATION ESTABLISHMENT

Stock: 2-0  
 Seed source: Unknown  
 Site preparation: Scalped spots  
 Planting: Center hole with grub hoe  
 Initial survival %: irr. 3-4 ft.  
 95

#### CULTURAL HISTORY

Thinning: Nine times at 5-year intervals from 1919 through 1958.  
 Early thinnings were rather light to minimize windfall.

#### DAMAGE:

During the winter of 1911, some trees were girdled by mice and died the next year. The hail storm of 1916 caused some damage to terminal shoots. The heavy wind of 1919 tipped some Austrian and Scotch pines. Twelve Scotch pines had their tops broken out by ice in 1922. In 1949, three Austrian pines were tipped by wind. Many ponderosa pines have been bent to the ground in the early years by heavy snow. The cutting of these has opened the stand excessively.

#### MEASUREMENT (per acre basis)

Year	1960			
	Scotch pine	Pond.pine	Aust.pine	All
Species or treatment				
Age	55	55	55	55
No. trees	27	29	70	126
Basal area	21.6	20.0	43.4	85
Ht. dom trees	79'	66'	74'	---
Av. DBH	12"	11"	11"	---
Merch. cu. ft. (3" min. top-peeled)				
bd. ft. 5" min. top Int. 1/4"	2,450	1,450	4,300	8,200

#### DISCUSSION:

The three pines were planted in pure blocks with an irregular spacing that was intended to give the stands a more natural appearance. Small groups of a few trees each of a number of other species had been planted previously, mostly around the outside edge of the area.

A rather dense cover of shrubs and herbaceous plants has become established.



Species: Scotch pine - Catalpa Lot: I-7  
 Planted: Spring 1908-1904 0.92 acres  
 Soil : Fox sandy loam - slope north of Third Sister Lake  
 Previous land use: Farm land

#### PLANTATION ESTABLISHMENT

Stock: 1-0  
 Seed source: Unknown  
 Site preparation: Scalped spots  
 Planting method: Center hole with grub hoe  
 Spacing: 4 x 4  
 Initial survival % : 85

#### CULTURAL HISTORY:

Replanting: Spring 1908, 2-0 Scotch pine was planted between the rows of catalpa. Initial survival percentage, 93.

Thinning: Seven times at 5-year intervals from 1927.

#### DAMAGE:

Hail, snow, and ice have damaged the pine a number of times. Terminal shoots were broken and deformed by hail in 1916. In 1922, 33 trees had the tops broken off by ice. In 1938, 25 more were smashed.

#### MEASUREMENT (per acre basis)

	Before	After
Year	1957	1957
Species or treatment	Sc. Pine	Sc. Pine
Age	50	50
No. trees	274	
Basal area	157.0	141.0
Ht. dom. trees	61'	61'
Av. DBH	10.3"	10.5"
Merch. cu. ft. (3" min. top-peeled)		"
Bd. ft. 5" min. top Int. 1/4"	17,800	16,200

5,000 bd. ft. per acre removed in thinnings.

#### DISCUSSION

Most of this lot lies on a rather abrupt south slope above the shore of the lake, and was subject to erosion during the years it was in farm crops. The soil at the top is, therefore, less fertile and less moist than that near the bottom. This condition has produced great variation in the rate of growth of the catalpa. Near the bottom of the slope, it has been very good, but toward the top, it has been suppressed by the Scotch pine.

Other hardwoods, notably black cherry, and various shrubs and herbs have invaded the area in abundance. This lot is now primarily a Scotch pine stand.

Species: Norway spruce Lot No: II -1a & 1b  
 Planted: Spring 1904 1.68 acres  
 Soil : Miami loam  
 Previous land use: Farm land

#### PLANTATION ESTABLISHMENT

Stock: 3-0  
 Seed source: Unknown  
 Site preparation: Plowed and harrowed  
 Planting method: Slit with spade  
 Spacing: 3 x 3 and 4-1/2 x 4-1/2  
 Initial survival %: 98

#### CULTURAL HISTORY

Replanting: Spring 1915. Mixture of Scotch, white and ponderosa pines planted on the most badly eroded slopes where the early growth of the spruce was very slow (1-2 inches per year).  
 Thinning : Eight times at 5-year intervals from 1923 through 1958. Plot in northeast corner was left unthinned (except for cutting of all Scotch pine in 1928) up to 1953). When dead trees were cut on this area, 1500 bd. feet per acre had been removed in thinnings.  
 Other : Locust were planted in gullies to check erosion. Later cut.

#### DAMAGE:

In 1908, some spruce were washed away in the gullies. In May 1915, the new shoots on many trees were killed by frost. The hail storm of 1916 damaged terminals in this stand. The glaze storms of 1922 and 1938, though, did no damage here. About 1923, some trees were heavily attacked by the spruce cone-gall without serious consequence. Many trees died from drought in 1932 and 1933, opening up the stand to an undesirable degree.

#### MEASUREMENT (per acre basis)

Year	Before 1958		After 1958		Before 1958		After 1958	
	H. Spruce		Scotch Pine		Wh. Pine		All	
Age	55		44		44		--	
No. trees	424	322	37	34	9	9	470	365
Basal area	119.5	102.0	20.2	19.0	5.6	5.6	145.3	126.6
Ht. dom. trees	66'	66'	--	--	--	--	---	---
Av. DBH	7.2"	7.6"	10.0	10.2	10.7"	10.7"	---	---
Merch. cu. ft. (3" min. top-peeled)	2790	2360	--	---	---	---	---	---
Bd. ft. 5" min. top Int. 1/4"	9080	8240	2140	2040	570	570	11790	10850

Data pertains to thinned area only. Based on sample plot 0.56 acres in area.

DISCUSSION. This area was originally divided into two sublots - 1-a, planted with a 3x3 ft. spacing; and 1-b, supposedly planted at 4-1/2 x 4-1/2 ft. Actually there was so little difference in the spacing that they were combined in 1918.

In June, 1916, one year after planting, many of the Scotch pine on the badly eroded slopes were higher than adjacent spruce. In the fall of 1918, the average heights were 4.1 for Scotch pine, 1.6 ft. for white pine, and 1.3 ft. for ponderosa. These spots are now dominated by Scotch pine together with a few white pine.

1961

Species: Red pine  
 Planted: Spring, 1923  
 Soil : Miami loam  
 Previous land use: Farm land. Old field.

Lot II-2  
 1.04 acres

## PLANTATION ESTABLISHMENT

Stock: 3-1  
 Seed source: Unknown  
 Site preparation: Scalped spots  
 Planting method: Center hole with grub hoe  
 Spacing: 4 x 6  
 Initial survival %: 90

## CULTURAL HISTORY

Thinning: Four thinnings at 5-year intervals from 1942 through 1957.

Pruning: To 7 ft. in 1937 and to 17 ft. on crop trees only in 1947.

DAMAGE: The European pine shoot moth has damaged the terminals of some of the shorter trees, particularly along the east edge of the stand. Most of the trees bear scars caused by Tympanis cankers. No trees have been killed by this fungus.

## MEASUREMENT (per acre basis)

Year	Before 1957	After 1957
Species or treatment	<u>thinning</u>	<u>thinning</u>
Age	35	
No. trees	812	620
Basal area	148.0	124.0
Ht. dom. trees	41'	41'
Av. DBH	5.8	6.0
Merch. cu. ft. (3" min. top-peeled)	2133	1840
Bd. ft. (5" min. Top Int. 1/4")	---	---

## DISCUSSION:

This lot was originally planted to catalpa in the spring of 1904. The 1-0 stock was planted at a 4x4 spacing. Survival was very high. Two years later, the trees were cut back just above ground level, because of an idea then prevalent that the best sprout would form a tree of better form and faster growth than the original seedling. Unfortunately, the sprouts were never thinned, and very crooked sprout clumps developed. On this old-field site, growth was slow. At the age of 15 years, the best sprout in each clump averaged 10.5 feet in height. The catalpa was clearcut in 1922. Sprouts have had to be cut back several times since.

In contrast to the catalpa, the red pine reached an average height of 16 feet at 15 years of age, and an average DBH of 2.9 inches compared to 1.3 inches for catalpa at the same age.

1961

Species: Scotch pine Lot II-3  
 Planted: Spring 1922 0.34 acres  
 Soil : Miami loam  
 Previous land use: Old field

## PLANTATION ESTABLISHMENT

Stock: 2-2  
 Seed source: Stock from Higgins Lake nursery  
 Site preparation: Scalped spots  
 Planting method: Center hole with grub hoe

## CULTURAL HISTORY

Thinning: Four times at 5-year intervals from 1942 through 1957.

Pruning : Better pines to 12 feet in 1935; 17 feet in 1942.

DAMAGE: No serious injuries.

MEASUREMENT (Per acre basis)	Before	After
Year	1957	1957
Species or treatment	Sc. pine	Sc. pine
Age	36	
No. trees	442	363
Basal area	127.0	114.0
Ht. dom. trees	49'	
Av. DBH	7.2"	7.6"
Merch. cu.ft. (3" min. Top-peeled)	----	----
Bd. ft. (5" min. Top Int. 1/4")	9670	9500

## DISCUSSION:

Originally planted to osage orange in spring of 1905, using 1-0 stock. The survival was good - about 80 per cent - but the average height at 15 years was only 6.3 feet, and most of the trees had very poor form. A few trees at the bottom of the slope at the south edge have grown quite well and were left standing when the rest of the area was clearcut in the fall of 1921.

The osage orange sprouted after cutting, but the sprouts grew too slowly to interfere with the pine that was planted the following spring.

1961

Species: Northern White cedar  
 Planted: Spring 1927, completed 1942  
 Soil : Rifle peat

Lot: around lake

## PLANTATION ESTABLISHMENT

Stock: 2-2  
 Seed source: Unknown  
 Site preparation: Scalped spots  
 Planting method: Hole with grub hoe  
 Spacing: 5 x 6  
 Initial survival %: 95

## CULTURAL HISTORY

Replanting: White cedar was planted around the lake wherever possible starting in 1927, finished in 1942.

## DAMAGE:

Some ice damage and girdling by mice during first year or two after planting.

## MEASUREMENTS (per acre basis)

Year	1952
Species or treatment	NWC
Age	26
No. grees	1425 trees, 2185 stems
Basal area	123.6
Height	24 (1948)
DBH	3.2
Merch. cu. ft	
Merch. bd. ft.	

## DISCUSSION:

The measurements apply to a fifth-acre sample plot in the strip of cedar planted along the south shore of the lake in 1927. A large percentage of the trees are multiple-stemmed, as a result of low forking.

1961

Species: Shagbark hickory Lot: III-2  
 Planted: Spring 1907 less than 0.1 acres  
 Soil : Miami loam  
 Previous land use: Farm land

## PLANTATION ESTABLISHMENT

Stock: seed  
 Seed source: local  
 Site preparation: scalped spots  
 Planting method: holes with grub hoe  
 Spacing: 4x4  
 Initial survival%: 84

## CULTURAL HISTORY

Replanting: Spring 1917 with 1-0 mockernut hickory

Other - Release cuttings in 1917, 1927, and 1947.

## DAMAGE:

Girdling by mice and rabbits during first few years. The hickory re-sprouted.

## MEASUREMENTS (per acre basis)

Year	1917	1927	1947
Species or treatment	Hick.	Hick.	Hick.
Age	10	21	41
Height	2.6	8.7	
DBH			2.9

## DISCUSSION:

The hickory stand covers a part of lot 2 as laid out originally.

Black locust were cut back in 1917. In 1927 and 1947, various hardwoods (black locust, black cherry, and box elder), which completely overtopped the hickory, were cut back.

The maximum height of the hickory was 6.0 ft. in 1917 and 18.7 ft. in 1927. The maximum diameter was 7.1 inches in 1947.

This lot is now a mixed stand of Black Cherry, Black Locust, and Box Elder with Hickory in the minority. The area is being managed as a mixed forest and not primarily for hickory.

1961

Species: Scotch, ponderosa and Jap. red pines Lot: III-3  
 Planted: Spring, 1927  
 Soil : Miami loam  
 Previous land use: Russian mulberry plantation. Before 1906, farm land.

## PLANTATION ESTABLISHMENT:

Stock 2.2  
 Seed source: Japanese red pine from University of Tokyo professor.  
 Site preparation: Scalped spots  
 Planting method : Hole with grub hoe

## CULTURAL HISTORY:

Replanting: Spring of 1930 with 242 Scotch pine.

Thinning : Three times in 1948 - winter 1952-53, and winter 1957-58.

DAMAGE: During the first few years rabbits caused heavy damage, especially to the Scotch pine.

## MEASUREMENTS PER ACRE BASIS.

Year	1933 (fall)		
Species or treatment	SP	PP	JRP
Age	7	7	7
No. trees	1783 for all 3 species		
Height	7.1	9.0	6.1

## DISCUSSION:

Originally planted in spring of 1906 with 1-0 Russian ; mulberry. Growth was very slow, vigor appeared low, and the form of the trees was distinctly bushy and scrubby, except for those trees adjacent to a small stand of black locust at the north end.

In 1913 and 1915, late spring frosts killed the new shoots. In 1916, there was some killing of new leaves by frost. The first heavy crop of berries was borne in the same year.

In the fall of 1923, after 18 growing seasons, the height of the average tree was 8.6 feet. The mulberry were clearcut in the winter of 1926.

The three pines were planted in random mixture. The age of the ponderosa pine stock is unknown.

In the last decade, Scotch pine has outgrown the others and dominates most of the area. Japanese red pine has shown poor development and is very crooked.

Measurements on this lot were made in the winter of 1952-53 and were combined with Lots 4a and 4b on following page.



Species: Scotch pine Lot: III-4a & 4b  
 Planted: Spring 1924; 4a-4b 1926 #3-4a & 4b combined  
 Soil : Miami loam 1.6 acres  
 Previous land use: Farm land, since 1906 a box elder plantation.

#### PLANTATION ESTABLISHMENT

Stock: 2-2  
 Seed source: Unknown  
 Site preparation: Scalped spots  
 Planting method: Hole with grub hoe  
 Spacing: 6 x 6  
 Initial survival %: over 90

#### CULTURAL HISTORY

Replanting: Spring of 1924, 2-2 Scotch pine with some Japanese red pine and a few ponderosa pine. This planting replaced the remaining box elder. Plantation refilled, 1930, with 2-2 Scotch.  
 Thinning: Three times in 1948, winter of 1952-53, and winter of 1957-58.  
 Pruning : Better trees to 12 feet in 1935; 17 feet in 1942.

MEASUREMENT (per acre basis) Lots 3-4a and 4b combined 1.6 acres  
 Before After

Year	1957	
Species or treatment	All species	
Age	33 av.	
No. trees	380	340
Basal area	120.0	100.6
Ht. dom. trees	50'	
Av. DBH	7'8"	8.0" (Sc. Pine)
	5.9"	6.5" (J.R. Pine)
	7.3"	7.5" (P. Pine)
Merch. cu. ft. (3" min. top-peeled)	----	-----
Bd. ft. (5" min. top Int. 1/4")	9,900	8,900
1000 bd. ft. per acre removed in thinnings.		

#### DISCUSSION:

Originally planted with 1-0 box elder in spring of 1906. Spacing as 6x6 on Lot 4a and 4x4 on Lot 4b. The soil was plowed and harrowed before planting, and survival was excellent.

After a few years, marked differences in growth appeared in various parts of the stand. Along the west boundary of Lot 4b adjoining a stand of black locust, growth was vigorous and stand density was high. Farther to the east, beyond the influence of the locust, growth was poor, crowns were thin, color of foliage was poor, and the weakest trees suffered some mortality. Tree form throughout the stand was poor.

The poorest box elder areas were clearcut and planted to pine in 1924. The rest of the stand was converted in 1926.

Growth of the Scotch pine has been very good both in size and in form. A group planted in 1926 toward the northwest corner of Lot 4b is particularly straight.

1961

Species: Black locust Lot: III-5, 5a,5b,5c  
 Planted: Spring 1906 1.89 acres  
 Soil : Miami loam  
 Previous land use: Farm land

## PLANTATION ESTABLISHMENT

Stock 1.0  
 Seed source Unknown  
 Site preparation Plowed and harrowed  
 Planting method Slit with spade  
 Spacing Various  
 Initial survival %: c.95

## CULTURAL HISTORY

Replanting: South portion underplanted with Norway spruce and some sugar maple in spring of 1915. Rest of stand underplanted with Norway spruce in spring of 1917.

Thinning: Winter of 1914 on sample plot of --- acres. Crown method. Repeated in 1919 and 1924. Entire stand unthinned in 1939.

DAMAGE: Serious locust borer from damage from early years on. As a result many trees have been broken by wind. Since 1929, however, a marked decrease in damage has been noted. Sugar maple largely lost through repeated girdling by mice. Norway spruce badly damaged by large frost cracks. Many terminals cut by red squirrels in winter of 1927. In 1930 and 1931, spruce is gradually dying out all thru the stand.

## DISCUSSION:

Originally seeded to black walnut in spring of 1905. After area was replanted to black locust, many walnut germinated and persisted for many years until suppressed by the black locust.

The black locust was spaced 6x6 on Lot 5a on level ground at the top; 4-1/2 x 4-1/2 on Lot 5b on a west slope somewhat below 5a; and 3x3 on Lot 5c at bottom of the slope.

The spruce and maple were underplanted to control the dense growth of blackberries and black raspberries which appeared under the black locust.

The thinning experiment was discontinued in 1929 because the removal of dead and damaged trees from the unthinned plots had eliminated differences in density.

On some small, eroded areas that were planted with pure stands of black locust and not underplanted, the trees were so badly damaged by the black locust borer that they have been clearcut and the area replanted with other species.

These lots are not under management. The area is left in a natural or untouched condition as a study area for pathology.

1961

Species: Basswood Lot: III-6  
 Planted: Spring 1906 0.75 acres  
 Soil : Miami loam  
 Previous  
 land use: Farm land

## PLANTATION ESTABLISHED:

Stock: 1-0  
 Seed source: Unknown  
 Site preparation: Plowed and harrowed  
 Planting method: Slit with spade  
 Spacing: 4x4  
 Initial survival %: 85

## CULTURAL HISTORY

Replanting: Underplanted with sugar maple seed in 1942 (complete failure)  
 and with white pine in 1945.

## DAMAGE:

Girdling by mice when the trees were small resulted in the development of many clumps of sprouts. In addition, about one-tenth of the trees have developed basal sprouts without apparent injury. Defoliation was heavy during three of the first 15 years. A leaf gall was also present.

## MEASUREMENTS (per acre basis)

Year 1938  
 Species or treatment Basswood  
 Age 33  
 No. of trees 1553 (includes many sprouts)  
 Basal area 85.7  
 Height 38  
 DBH 3.2

## DISCUSSION:

This plantation has been, essentially, a failure. Growth has varied considerably in different parts of the stand, but has been generally poor. The trees are bushy in appearance.

No growth measurements have been taken since 1938.

1961

Species: Ponderosa pine Lot III-7  
 Planted: Spring 1938 0.73 acres  
 Soil : Miami loam  
 Previous land use: Farm land, American elm plantation 1906-1937.

## PLANTATION ESTABLISHMENT:

Stock 2-1  
 Seed source Unknown  
 Site preparation: Scalps  
 Planting method Planting bar  
 Spacing 6x6  
 Initial survival%

## DAMAGE:

The ponderosa pine was attacked rather severely by the European pine shoot moth.

## DISCUSSION:

Originally planted in spring of 1906 to 1-0 American elm, 4x4 feet spacing, wite plowed and harrowed, planting in slit with spade. Initial survival, 98 per cent.

Up to an age of about 10 years, the American elm was one of the best-looking of the hardwood plantations. Later, growth declined and many trees started to die at the top, finally dying completely. The stand condition was very poor by 1927.

By 1932, a heavy growth of gray dogwood, sumac, and raspberry had become established where the elm was on its way out. In the spring of 1933, sugar maple was underplanted. The elm had made normal vigorous growth, only at the north end, adjacent to the black locust and along the west edge where leaf litter was heavy. It suffered practically no girdling by mice. In 1933, there were 1760 elm per acre with a basal area of 71.5 sq. feet, a mean height of 19 feet, and a mean diameter of 2.7 inches.

By 1950, much sugar maple reproduction had become established. On the south end of the lot, where it is shaded by a stand of oak, the young maple is denser and taller than elsewhere.

By 1961, the stand has been largely taken over by Sugar Maple and Black Locust. The pine is being gradually forced out.

1961

Species: Sugar maple  
Soil: Miami loam  
Previous land use: Farm land

Lot: III - 8a and 8B  
0.69 acres

PLANTATION ESTABLISHMENT

Stock 1-0  
Seed source: unknown  
Site preparation: Plowed and harrowed  
Planting method: Slit with spade  
Spacing: 3 & 4 feet  
Initial survival %: 87

CULTURAL HISTORY

Replanting: Larger failed spots in 8b filled with 1-0 sugar maple in spring of 1919. These trees have been suppressed.

Thinning : Thinning plots established in south portion of each lot in 1921. North part left unthinned. Thinned lightly again in 1941 and 1946. Heavy thinning made in fall 1956.

DAMAGE: Mice damage in early years.

Measurement (per acre basis)	Thinned	Unthinned
Year	1961	1961
Species or treatment	none	none
Age	56	56
No. trees	355	970
Basal area	100	164
Ht. dom. trees	56'	55'
Av. dbh	7.2"	5.6" (due to large edge trees)
Merch. cu. ft. (3" min. top peeled)	-	-
Bd. ft. 5" min. top Int 1/4"	-	-

DISCUSSION:

While the growth of the maple has been slow compared to that of some of the other species, the trees have remained vigorous, and the stand has not deteriorated in the way that those of elm and black walnut have done. Because of the lack of wind protection along the west border, the leaf litter is blown away to the east from about two-thirds of Lot 8b, and the average growth on this lot is poorer than that on Lot 8a.

Thinning had been light from 1921 to 1956 because of the large amount of forking and the spreading crowns. The stand was given a heavy thinning excepting unthinned plot along north side.

1961

Species: Red pine Lot: III-8c  
 Planted: Spring 1921 0.90 acres  
 Soil : Miami loam  
 Previous land use: Farm land. White ash plantation 1906-1920.

## PLANTATION ESTABLISHMENT

Stock 2-2  
 Seed source Unknown  
 Site preparation Scalped spots  
 Planting method: Hole with grub hoe

## CULTURAL HISTORY

Thinning: 1942, 1952, and 1960.

Pruning : 7-12 feet in 1935. Extended to 17 feet in 1947.

## DAMAGE:

Heavy Tympanis canker infection. More recently, terminals of trees in the east portion of the stand have been killed back by European pine shoot moth. Pines adjacent to the black walnut have been dying for several years. Recently, pines have begun to die in parts of the stand that are well removed from the walnut. By 1958, the mortality rate was practically nil.

## MEASUREMENT:

Year	1960	
	Before cutting	After cutting
Species or treatment		
Age	39	39
No. trees	358	423
Basal area	128.0	105.0
Ht. dom. trees	50'	50'
Av. DBH	6.5"	6.7
Merch. cu.ft. (3" min. top-peeled)	1960	1640
Bd. ft. (5" min. top Int. 1/4")	----	----

## DISCUSSION:

Originally planted to white ash. The west half was planted in the spring of 1906 and the east half in the spring of 1908. Although survival was excellent, growth was only fair, as shown by an average height of 7.1 feet at the age of 12 years. By 1919, it was observed that an infestation of oyster shell scale had become very heavy. It had killed some ash and was spreading to other species in adjacent plantations. Because of this condition, the ash was clearcut and burned in the winter of 1920.

At present, there seems to be a sharp decrease in the height growth of the red pine. Perhaps this is related to the heavy soil which is not optimum for red pine.

1961

Species: Corsican Pine Lot: III-9  
 Planted: Spring 1930 1.30 acres  
 Soil : Miami loam  
 Previous land use: Farm land, white ash plantation  
 1906-1920; sugar maple & yellow poplar 1923-30.

#### PLANTATION ESTABLISHMENT

Stock: 2-0  
 Seed source: Unknown  
 Site preparation: Scalp  
 Planting method: Planting bar

#### CULTURAL HISTORY

Replanting: 1937, Corsican Pine.

Thinning : Light thinning made in fall, 1957

Pruning : Dead branches to 10 feet on larger pines in 1949.

Other : White ash sprouts cut back many times.

#### DAMAGE:

Heavy rabbit damage to sugar maple and yellow poplar in early years. Many Corsican pine trees also cut off by rabbits, especially along the east side of the stand. Quite a number of the pine recovered, however, by putting adventitious shoots.

#### DISCUSSION:

Originally planted to white ash in the spring of 1906. This was clear-cut and burned because of oyster-shell infection in the winter of 1920. Prior to clearcutting, however, a plot in the south end of Lot 9a was thinned in the spring of 1919 and a part of it underplanted to sugar maple.

The present stand is largely Corsican pine with some yellow poplar and sugar maple.



1961

Lot III-10a

0.76 Acres

Species: Red Oak  
Planted: Spring 1906  
Soil : Miami loam  
Previous land use: Farm land

PLANTATION ESTABLISHMENT

Stock:	1-0
Seed source:	Unknown but probably local
Site preparation:	Plowed and harrowed
Planting method:	Slit with spade
Spacing:	4x4
Initial survival %:	60

CULTURAL HISTORY

Replanting: Spring 1915

Thinning : Six times from winter of 1933 at 5-year intervals through 1958.

MEASUREMENTS (per acre basis)

Before cutting

Year	1961
Species or treatment	RO
Age	56
No. of trees	250
Basal area	114
Height	63'
D.b.h.	9.1"

DISCUSSION:

In understocked portions of the stand, the red oak have developed large crowns with heavy limbs, and will produce timber of poor quality.

1961

Lot: III-10b  
0.35 acres

Species: White oak  
Planted: Spring 1906  
Soil : Miami loam  
Previous land use : Farm land

PLANTATION ESTABLISHMENT

Stock:	1-0
Seed source:	Probably local
Site preparation:	Plowed and harrowed
Planting method:	Slit with spade
Spacing:	4x4
Initial survival%:	85

CULTURAL HISTORY

Thinning: Five at 5-year intervals, beginning in 1928 through 1948.

DAMAGE: In May 1915 the new shoots were killed back by a heavy frost. In December, 1926, a glaze storm deposited a heavy load of ice on these trees which still retained their dead leaves. All were badly bent, some almost double. As it was about two weeks before the ice melted, it was remarkable that the trees have straightened up as much as they have.

MEASUREMENTS (per acre basis)

Year	1961
Species or treatment	WO
Age	56
No. of trees	247
Basal area	100.0
Height	55'
D.B.H.	8.6"

DISCUSSION:

At the age of 38 years, the dominants of white oak were 10 feet shorter on the average than the adjacent red oak. At 43 years, the diameters of the white oak dominants averaged 1.1 inches less than those of the red oak dominants.

1961

Lot III-11  
0.62 acres

Species: White oak and bur oak  
Planted: Fall, 1906  
Soil : Miami loam  
Previous land use: Farm land

PLANTATION ESTABLISHMENT

Stock: seed  
Seed source: probably local  
Site preparation: Scalped spots  
Planting method: Seed spots with grub hoe  
Spacing: 5x5  
Initial survival %: 75

CULTURAL HISTORY:

Replanting: Spring of 1915 with 1-0 red oak

Thinning: Four times (1946, 1951, 1956 and 1961)

Other : Sprouts reduced to best stems, winter of 1931

DAMAGE: Repeated girdling of small trees by mice caused the development of many sprout clumps. Severe frost damage in May 1915,

Measurement (per acre basis)

All measurements after thinning

Year	All measurements after thinning			
	1961	1961	1961	1961
Species or treatment	W.O.	Bur.O	R.O.	All species
Age	55	55	47	-
No. trees	34	73	74	181
Basal area	9.0	30.0	43.0	82.0
Ht. dom trees	55'	55'	60'	-
Ave. dbh	7.0"	8.7"	10.3"	-
Merch.cu.ft. (3 min top peeled)		-----		
Bd. ft. 5" min. top Int. 1/4"		-----		

DISCUSSION:

The original planted was intended to be pure white oak, but careless seed collection resulted in the inclusion of many bur oak acorns.

The red oak has grown much more rapidly than the other species. As a result, many of the red oaks have crowded out neighboring white oaks, and have developed large heavy crowns.

1961

Species:	Black walnut	Lot: III-12a
Planted:	Spring 1906	0.92 acres
Soil :	Miami loam	
Previous land use:	Farm land	

## PLANTATION ESTABLISHMENT

Stock:	1-0
Site preparation:	Plowed and harrowed
Planting method:	Slit with spade
Spacing:	6x6; 5x5
Initial survival %:	50

## DAMAGE:

Mice damage was slight in early years. Killing of terminal shoots by winter cold and late frosts occurred several times.

## MEASUREMENTS (per acre basis)

Year	1934
Species or treatment:	BW
Age:	29
No. of trees	601
Basal area:	7.0
Height:	9
DBH:	1.5

## DISCUSSION:

The poor condition of the stand became evident in 1918, by which time height growth had decreased to about one or two inches per year. The crowns were bushy without a well-defined central stem. Later, dead branches began to appear in the crown, and some trees died back to the ground, sending up a few short-lived sprouts.

Periodic measurements were discontinued after 1934.

In local areas, growth has been much faster than in the rest of the stand.

1961

Species: Black walnut Lot: III-12b  
 Planted: Fall 1906 0.61 acres  
 Soil : Miami loam  
 Previous land use: Farm land

## PLANTATION ESTABLISHMENT:

Stock: Seed  
 Seed source: Probably local  
 Site preparation: Scalped spots  
 Planting method: Seed spots with grub hoe  
 Spacing: 5x5  
 Initial survival %: 85

## CULTURAL HISTORY

Replanting: Spring 1942, east half of the lot was underplanted with sugar maple. Black locust interplanted in spring of 1918.

Thinning: Four times at 5-year intervals (1939, 1944, 1949, 1954)

Other : Locust cut to release walnut.

## DAMAGE:

Locust virtually eliminated by rabbits after cutting. Sugar maple destroyed by rabbits after planting.

## MEASUREMENT (per acre basis)

Year	1959
Species or treatment	
Age	48
No. trees	233
Basal area	58.6
Ht. dom trees	54'
Av. DBH	6.8"
Merch. cu.ft. (3" min. top-peeled)	----
Bd.ft. (5" min. top. int. 1/4 ")	----

1961

Species: White oak Lot: IV-1a  
 Planted: Fall, 1906 0.74 acres  
 Soil : Miami loam  
 Previous land use: Farm land

## PLANTATION ESTABLISHMENT:

Stock: Seed  
 Seed source: Probably local  
 Site preparation: Scalped spots  
 Planting method: Seed spot with grub hoe  
 Spacing: 5x5  
 Initial survival%: 66

## CULTURAL HISTORY

Replanting: Spring of 1915 with red oak, white pine, ponderosa pine and a few European larch. Spring 1917, with Norway spruce. Spring of 1925 with Scotch pine.

Thinning: Five times (1939, 1944, 1949, 1954, and 1959)

## DAMAGE:

Most of the early loss of white oak was due to girdling by mice. The heavy frost of May 1915 killed the terminal shoots on the oak. Many white pine have been killed by a root rot.

## measurements (per acre basis)

Year	Before		After		Before		After		Larch
	1959		1959		1959		1959		
Species or treatment	White pine		N. spruce		Red oak				
Age	45		43		45				45
No. of trees	132	89	35	31	5.4	5.4			2.7
Basal area	60.0	43.8	7.0	5.0	2.8	2.8			1.0
Ht. Dom. trees	----	----	----	----	----	----			----
Av. DBH	9.0"	9.5"	6.0"	6.0"	9.7"	9.7"			8.5"
Merch.cu.ft. (3" top-peeled)	---	---	---	---	---	---			---
Bd.ft. 5"min. T, Int.1/4"	--	---	---	---	---	---			---

## MEASUREMENTS (per acre basis)

Year	Before		After		Before		After	
	1959		1959		1959		1959	
Species or treatment	W.Oak		Pond.Pine		All			
Age	53		45		----			
No. trees	209	174	6.7	4.0	390.8	306.1		
Basal area	28.0	51.7	1.3	0.9	130.1	105.8		
Ht. dom. trees	62'	62'	--	---	--	---		
Av. DBH	7.0"	7.5"	6.0"	6.5"	--	---		
Mer.cu.ft. (3" T, Pld)	---	---	---	---	---	---		
Bd.ft. 5"min. top Inv. 1/4"	--	---	---	---	--	---		

DISCUSSION. All of the species planted are now represented in the dominant crown class except for ponderosa pine.

Scotch pine eliminated from the stand by natural mortality and thinnings

Species: Red oak, wh. pine, ponderosa pine Lot: IV-1b  
 European larch, bl. walnut 0.74 acres  
 Planted: Spring 1915  
 Soil : Miami loam  
 Previous land use: Originally a chestnut plantation.  
 Before that, farmland.

#### CULTURAL HISTORY

Replanting: Spring, 1917, to Norway spruce. Spring, 1925 to Scotch pine.

Thinning : Four times (1944, 1949, 1954, and 1959)

#### DAMAGE:

Small numbers of white pine have died from root rot.

#### MEASUREMENTS (per acre basis)

Year	Before	After	Before	After	Before	After	Before	After
	1959	1959	1959	1959	1959	1959	1959	1959
Species or treatment	W. Pine		N. Spruce		Bl. Walnut		All	
Age	45		43		51			
No. of trees	85	74	105	100	50	49	<del>207</del> <sup>240</sup>	<del>201</del> <sup>223</sup>
Basal area	42.4	39.4	36.8	35.7	12.4	12.0	108.6	101.6
Ht. dom. trees	--	--	--	---	---	---	---	---
Av. DBH	9.5"	9.6"	8.0"	6.7"	6.7"			
Mer. cu. ft. (3" top- peeled)	---	---	---	---	---	---	---	---
Bd. ft. 5" min. top Int. 1/4"	---	---	---	---	---	---	---	---

#### DISCUSSION:

Originally planted in fall of 1906 to chestnut. Seed were planted in scalped spots with a grub hoe on a 6x6 foot spacing. Initial survival was 57 per cent. Winter-killing and mice were responsible for the loss of many trees in the early years and the development of clumps of sprouts.

In 1934, the chestnut were 28 years old, and averaged 170 trees per acre with an average diameter of 2.3 inches and an average height of 20 feet. One tree had been killed by chestnut blight and the disease was spreading rapidly. By 1944, there were only three chestnut alive. These have since been killed.

Along the southern edge of the lot are some black walnut that were put in at the time that Lot 4 was seeded in 1909.



Species: Red Oak Lot: IV- 2a and 2b  
 Planted: Spring 1908 1.05 acres  
 Soil : Miami loam  
 Previous land use: Farm land

## PLANTATION ESTABLISHMENT

Stock: 1-0  
 Seed source: Local  
 Site preparation: Scalped spots  
 Planting methods: Center hole with grub hoe  
 Spacing: 2b - 6x6  
 2a - 5x5  
 Initial survival %: 85

## CULTURAL HISTORY:

Replanting: Spring 1915 to white pine and red oak  
 Spring 1925 to Scotch pine

Thinning : Seven times at 5-year intervals from 1929 through 1959.  
 Except for the last, thinnings have been light to encourage  
 natural pruning. The 1949 and 1959 treatment were heavier  
 to stimulate diameter growth.

DAMAGE: Early damage by mice.

## MEASUREMENTS (per acre basis)

Year	Before		After		Before		After	
	1959		1959		1959		1959	
Species or treatment	R. Oak		W. Pine		S. Pine		all	
Age	52		45		35			
No. of trees	161	139	87	66	12	12	260	217
Basal area	66.2	59.9	26.5	22.5	3.1	3.1	95.8	85.5
Ht. dom. trees	62'	62'	----	----	----	----	---	----
Av. DBH	8.6	8.9	7.7"	7.3"	6.9"	6.9"	---	----
Mer.cu.ft. (3" top-peeled)	---	----	----	----	---	----	---	----
Bd.ft. 5" min. top	---	----	----	----	---	----	---	----
Int. 1/4"	---	----	----	----	---	----	---	----

## DISCUSSION:

Most of the Scotch pine has been overtopped and either killed or cut in thinnings. The white pine, too, has been largely overtopped by the oak, but has persisted.

The crown length of the dominant oak in 1948 was 44 per cent of the total height of the tree.

Species: Red Oak 1961  
 Planted: Fall 1906 & spring 1907  
 Soil : Miami loam Lot: IV- 3a and 3b  
 Previous land use: Farm land

PLANTATION ESTABLISHMENT:

Stock: Seed  
 Seed source: Local  
 Site preparation: Scalped spots  
 Planting method: Seed spots with grub hoe  
 Spacing: 3a - 5x5  
 3b - 6x6  
 Initial survival %: 90

CULTURAL HISTORY

Thinning: Seven times at 5-year intervals from 1923 through 1958.  
 Thinnings were light the first 4 times and heavier in 1948 and 1958.

Other : Sprout clumps thinned to best sprout in 1923.

DAMAGE:

Girdling by mice resulted in many sprout clumps. For a few years around 1923, a Scolytid borer caused considerable damage to the wood. Some terminals have also been killed, apparently by a twig girdler - some evidence of oak borers.

MEASUREMENTS (per acre basis)	Before Cutting	After Cutting
	1958	
Year	1958	
Species or treatment	Red Oak	
Age	52	
No. of trees	268	231
Basal area	91.5	83.6
Ht. dom, trees	63' (53')	
Ave. DBH	7.9"	8.2"
Merch. cu.ft. (3" top-peeled)	---	---
Bd.ft. 5" min. top Int. 1/4"	---	---

DISCUSSION

Survival on these direct-seeded areas was better than on lots 2a and 2b where seedlings were planted. The seed was collected in the fall of 1906. Part of it was put in soon after collection in the left half of Lot 3a. The remainder was stored in a pit over winter and used the following spring on the east half of Lot 3a and on Lot 3b.

1961

Species: Black Walnut Lot: IV-4  
 Planted: Spring 1909 1.87 acres  
 Soil: Miami loam  
 Previous land use: Farm land

## PLANTATION ESTABLISHMENT

Stock: Seed  
 Seed source: Local  
 Site prepara'n: Scalped spots  
 Planting method: Seed spot with grub hoe  
 Spacing: 4x4  
 Initial survival%: 70

## CULTURAL HISTORY

Replanting: Fall, 1914, with a small number of elm and red, silver, and sugar maples. Spring 1915 with white pine, red oak, wh. oak and European larch. Spring 1917 with Norway spruce. Spring 1925 with Scotch pine.

Thinning: Four at 5-year intervals (1940, 1945, 1950, and 1955)

DAMAGE: Many of the coniferous trees have been killed by root rot, and by association with black walnut.

## MEASUREMENTS: (per acre basis)

Year	1955						Sc.	
Species or treatment	B. Walnut	R. Oak	W. Oak	Larch	W. Pine	N. Spruce	Pine	All
Age	46	40	40	40	40	40	30	
No. trees	194	27	15	2	17	37	27	319
Basal area	37.1	3.6	2.2	0.5	5.1	7.7	3.8	60.0
Ht. dom. trees							--	--
Av. DBH	5.9"	5.0"	6.1"	5.2"	7.5"	6.1"	5.0"	
Mer. cu. ft. (3" top-peeled)								
Bd. ft. 5" min. top								
Int. 1/4"								

All measurements given are after thinning.

DISCUSSION: Because of variation in soil conditions, the growth of the walnut has ranged from fairly good to very poor on different parts of the area. In the northwest corner of the lot, the walnut has made the best growth in a low area.

Of the maples planted in 1914, only six silver maple survive, and these live as large sprout clumps.

On the highest part of the lot in the southeast corner, the pine and spruce have grown well. The larches have remained healthy and have made fair growth. Most of the red oak have grown very slowly.

Some of the larger walnut bore fruit for the first time in 1930.

1961

Species: Red oak Lot: IV-5 and 6  
 Planted: Spring 1907 2.99 acres  
 Soil : Miami loam  
 Previous land use: Farm land

## PLANTATION ESTABLISHMENT

Stock: 1-0 and seed  
 Seed source: local  
 Site preparation: (5) plowed and harrowed; (6) scalped spots  
 Planting method : (5) slit with spade; (6) holes with grub hoe  
 Spacing: 6x6  
 Initial survival percentage: 80

## CULTURAL HISTORY

Thinning: Six at 5-year intervals from 1929 through 1954.

## DAMAGE:

Same as Lot 3. Evidence of oak borers.

## MEASUREMENTS (per acre basis)

Year	1959
Species or treatment:	R. oak
Age	52
No. of trees	213
Basal area	76.3
Ht. dom. trees	67'
Av. DBH	8.1"
Merch. cu. ft. (3" top-peeled)	---
Bd. ft. 5" min. top (Int. 1/4")	---

## DISCUSSION:

Lot 5 was planted with 1-0 stock while Lot 6 was direct seeded. Initial survival was 86 per cent for Lot 5 and 74 per cent for Lot 6. The better survival of the planted stock contrasts with the better survival of the direct-seeded stock in the Lot 2 and 3 comparison.

Species: Norway spruce 1961  
 Planted: Spring 1914 Lot: IV-7  
 Soil : Miami loam 1.03 acres  
 Previous land use: Formerly occupied by farm buildings and orchard.

#### PLANTATION ESTABLISHMENT

Stock: 2-2, some 2-1  
 Seed source: Unknown  
 Site preparation: Scalped spots  
 Planting method: Hole with grub hoe  
 Spacing : 6 x 6  
 Initial survival %: 93

#### CULTURAL HISTORY

Replanting: Norway spruce in 1917 and 1922. Scotch pine in 1925

Thinning : Three times - 1946, 1951, and 1956.

Pruning : To 17 feet in 1945

#### DAMAGE:

In May of 1915 and 1921, the new shoots were killed by frost.  
 Drought was responsible for the death of some of the spruce along the east boundary in 1931. Some dominant trees died during the summer of 1960.  
 Reason unknown.

#### MEASUREMENTS (per acre basis)

Year	Before cutting	After cutting
		1956
Species or treatment		N. spruce
Age		43
No. of trees	572	454
Basal area	168.2	146.9
Ht. dom. trees	60'	60'
Av. DBH	7.3"	7.7"
Merch. cu. ft. (3" top-peeled)	3800	3350
Bd. ft. 5" min. top Int. 1/4"	13,360	12,370

1900 bd. ft. per acre has been removed in thinnings.

Species:	Red Oak	Lot: IV-8
Planted:	Spring 1908	1.17 acres
Soil :	Miami loam	
Previous land use:	Farm land	

#### PLANTATION ESTABLISHMENT

Stock:	1-0
Seed source:	Local
Site preparation:	Plowed and harrowed
Planting method :	Slit with spade
Spacing:	6x6
Initial survival %:	86

#### CULTURAL HISTORY

Thinning: Five times at 5-year intervals from 1934 to 1949

Other : Clumps reduced to best sprout in 1923

#### DAMAGE:

Similar to that of other red oak plantations in Block IV.

#### MEASUREMENTS (per acre basis)

Year	1959
Species or treatment	R. Oak
Age	52
No. of trees	258
Basal area	74.5
Ht. dom. trees	67"
Av. DBH	7.3"
Merch cu.ft. (3" top-peeled)	---
Bd. ft. 5" min. top	
Int. 1/4"	---

Measurements apply only to that part of lot in Red Oak.

#### DISCUSSION:

The east end of this lot is flooded several times a year by run-off during storms from a field south of Liberty Road, and was not planted in 1908. In the fall of 1911, a part of it was planted with American elm and box elder. More elm was planted in the fall of 1914 and the spring of 1918. A small number of sycamore were planted in 1918, but none survived.

Species: Ponderosa pine Lot: V-1  
 Planted: Spring 1909 1.07 acres  
 Soil : Miami loam  
 Previous land use: Farm land

#### PLANTATION ESTABLISHMENT

Stock: 2-0  
 Seed source: Higgins Lake Nursery - source unknown  
 Site preparation: Scalped spots  
 Planting method: Hole with grub hoe  
 Spacing: 6x6  
 Initial survival %: 91

#### CULTURAL HISTORY

Thinning: East half in 1935. Entire stand in 1940, 1945, 1950, 1953, 1958, and spring of 1961.

Pruning : To 12 feet on west half of lot in 1935, carried to 17 feet in 1936. On east half, trees pruned to 17 feet in 1951.

#### DAMAGE:

Mice girdled a small number of trees when they were small. A few trees have been bent from time to time by ice and heavy snow. A spot near the west end of the stand including 15 trees was badly damaged by glaze in the winter of 1949-50. Severe ice damage again in February 1961.

#### MEASUREMENT (per acre basis)

Year	Before Cutting	After cutting
	March, 1961	
Species or treatment	Pond. Pine	Pone. Pine
Age	52	52
No. trees	270	220
Basal area	117.9	100.5
Ht. dom. trees	58'	58'
Ave. DBH	8.9"	9.1"
Merch. cu.ft. (3" top-peeled)	----	---
Bd. ft. 5" min. top Int. 1/4"	9,500	8,275

#### DISCUSSION:

The stock used in this plantation had evidently developed in very dense seed beds, as the trees had small crowns and slender stems. In view of this fact, the high survival was rather surprising.

4,500 bd. ft. (Int. 1/4" rule) has been removed from this lot. In April, 1961, 2-0 red oak seedlings were planted in the large opening caused by the ice damages. Seed source, Newcomb tract, Stinchfield Woods.

Species: Ponderosa pine Lot V-2  
 Planted: Spring 1937  
 Soil : Miami loam  
 Previous land use: Planted to wh. oak and bl. locust in 1911.

#### PLANTATION ESTABLISHMENT

Stock 2-0  
 Seed source: Unknown  
 Site preparation: Scalped spots  
 Planting method: Slit with planting iron  
 Spacing: 6x6  
 Initial survival %: 70

#### DISCUSSION:

Planted in fall of 1911 with white oak (3-0 stock with long roots that were pruned severely) and black locust. Much of the locust was girdled by mice but 192 survived to 1917. Nearly all were girdled by borers in the dry years of the thirties.

In the fall of 1914, parallel strips of four furrows each were plowed across the lot in an east-west direction. These were harrowed the following spring when red oak acorns were sown thickly in shallow drills made in the center by hoes. Germination and survival was excellent but rabbits and mice eliminated most of the oak by 1923.

In 1932, the black locust was underplanted with white spruce which died in the drought.

At present, there is one 11-inch red oak from the direct seeding operation, one 6-inch white oak from the 1911 planting, and a number of sprouts of red oak and black locust, mostly along the edge of the spruce in Lot 3.

The area is now a mixed hardwood-pine stand. Black cherry, Norway, and sugar maple plus the oaks mentioned above have crowded out most of the pine.



Species: Norway spruce Lot: V-3  
 Planted: Fall 1911 2.21 acres  
 Soil : Miami loam  
 Previous land use: Farm land

## PLANTATION ESTABLISHMENT

Stock: 3-0, some 2-0  
 Seed source: Unknown  
 Site preparation: Plowed and harrowed  
 Planting method: Slit with spade  
 Spacing: 5x5  
 Initial survival %: 84

## CULTURAL HISTORY

Replanting: 1914, 1915, and 1917 in dry spots where trees died every summer for several years.

Thinning: Two half-acre plots with isolation strips laid out in 1935. North plot thinned in 1940, 1945, and 1950, five times during those years. South plot left unthinned.

Pruning : None.

DAMAGE: Spruce gall has infested the stand since at least 1925 but has not done any serious damage. During the first winter, all needles were killed on crowns that projected above the snow, and many trees were frost-heaved the following spring.

## MEASUREMENTS (per acre basis)

Year	1960		1960	
	Before	After	Before	After Ice Damage
Species or treatment	Thinned		Unthinned	
Age	49		49	49 "
No. of trees	348	296	432	422
Basal area	138.0	120.7	150.7	148.2
Ht. dom. trees	76'		76'	76.0
Av. DBH	8.5"	8.9"	8.0"	8.0"
Merch. cu.ft. (3" top-peeled)	3627	3208	3827	3757
Bd.ft. 5" min. top				
Int. 1/4"	15,180	13,940	14,980	13,720

## DISCUSSION:

The thinned plot was more heavily stocked than the unthinned plot at the time of establishment in 1935. Only after the 1950 thinning did the thinned plot fall below the unthinned plot in number of trees.

A considerable number of dominant trees died during the summer of 1960 - cause undetermined. Severe ice damage in February, 1961. Salvage cut made of 1,390 bd. ft., 6,780 bd. ft., Int. 1/4" rule, has been cut from this lot. Approximately 10 per cent of this was salvage from the unthinned area.

1961

Species: White pine Lot: V-4a  
 Planted: Spring 1939 1.05 acres  
 Soil : Miami loam  
 Previous land use: Farm land, planted to cottonwood in 1912

## PLANTATION ESTABLISHMENT

Stock: 2-2  
 Seed source: Unknown  
 Site preparation: Scalped spots  
 Planting method : Slit with planting iron  
 Spacing : 8 x 10  
 Initial survival %: c.90

## CULTURAL HISTORY

Replanting:  
 Thinning :  
 Pruning : To 8 feet in fall, 1957 - to 12 feet in fall, 1960.  
 Other : Cottonwood clearcut in 1947 to release pine.

## DAMAGE:

## MEASUREMENTS (per acre basis)

## DISCUSSION:

Originally plowed and harrowed in fall of 1911 and planted with cottonwood plantings in spring of 1912. Since a previous attempt to grow cottonwood from cuttings of part of Lot 4b had failed, long cuttings were rooted in the nursery and then were planted in holes that were from 18 to 24 inches deep. Spacing was 10 x 10 feet and survival about 80 per cent. During the dry year of 1933, the trees on the east portion of the lot, which is underlain by gravel, died at the top and continued to deteriorate thereafter. In 1938, all cottonwoods on this end of the lot were cut and the area has since been used as a woodyard. At this time, there were 208 trees per acre totalling 55.1 square feet per acre and with an average diameter of 6.9 inches. The average height of all trees at 20 years was 42 feet.

The following spring, white pine was planted under the cottonwood that remained, as it was beginning to show symptoms of decadence.

There is a small amount of Norway spruce reproduction, especially near the edge of Lot 3.

1961

Lot V-4b  
0.92 acres

Species: Ponderosa pine  
Planted: Spring, 1915  
Soil : Miami loam  
Previous land use: Farm land

PLANTATION ESTABLISHMENT

Stock: 2-1  
Seed source: Unknown  
Site preparation: Plowed in fall, harrowed in spring  
Planting method: Hole with grub hoe  
Spacing: 6x6  
Initial survival%: 90

CULTURAL HISTORY:

Thinning: Five times (1941, 1946, 1951, 1956 and 1961)  
Pruning : To 12 feet in 1935 and to 17 feet in 1946.  
Other : Dead ragweed removed from pine in spring of 1917.

DAMAGE: Mice and ragweed suppression reduced survival to 66 percent, by 1921.

Measurement (per acre basis)	Before cutting	After cutting
Year	1961	--
Species or treatment	P.P.	P.P.
Age	47	47
No. trees	304	243
Basal area	123.5	105.0
Ht. dom. trees	58'	58;'
Av. db.h.	8.6"	8.9" *
Merch. cu.ft. (3" min.top peeled)	-	---
B.Dt. (5" min.top Int. 1/4")	9,600	8,500

2500 bd. ft. per acre has been removed in thinnings.

1961

Lot V - 4b2

0.45 acres

Species : Red pine  
 Planted: Spring 1919  
 Soil : Miami loam  
 Previous land use: Farm land. A catalpa plantation in 1915,

PLANTATION ESTABLISHMENT

Stock: 2-2  
 Seed source: Unknown  
 Site preparation: Scalped spots  
 Planting method: Hole with grub hoe  
 Spacing: 5x5  
 Initial survival %: 90

CULTURAL HISTORY

Replanting: Spring of 1921 with 2-2 red pine  
 Thinning : Six times at 5-year intervals from 1936 through 1961  
 Pruning : To 12 feet in 1936 and to 17 feet in 1946  
 Other : All live catalpa cut in summer of 1926

DAMAGE: Heavy Tympanis canker by 1931. About 30 percent of pine killed by June bug larvae in summer of 1919 - the only case of damage by this insect in the Saginaw Forest.

Measurement (per acre basis)	Before thinning	After thinning
Year	1961	1961
Species or Treatment	R. Pine	R. Pine
Age	43	43
No. trees	490	380
Basal area	152.5	127.1
Ht. dom. trees	53'	53'
Av. dbh	7.5"	7.8"
Merch. cu.ft. (3" min. top-peeled)	2460.0	2100.0
Bd. ft. (5" min. top Int. 1/4")	9,700	8,750

Discussion: Originally planted in spring of 1915 with 1-0 catalpa from cold-resistant tree on the northeast corner of Packard and Hill Streets in Ann Arbor. Progeny were frozen back during first two winters.

Lot: V-5  
4.04 acres

Species: Ponderosa pine  
Planted: Spring 1909  
Soil : Miami loam  
Previous land use: Farm land

PLANTATION ESTABLISHMENT

Stock: 2-0  
Seed source: Unknown  
Site preparation: Scalped spots  
Planting method: Hole with grub hoe  
Spacing: 6x6  
Initial survival % 62

CULTURAL HISTORY

Replanting: Spring 1918 with 2-2 ponderosa pine.

Thinning : Two one-acre plots with isolation strips laid out in fall of 1935. In 1940, the southern plot was thinned. The entire stand was thinned in 1945, 1950 and 1955 except for the unthinned plot and the isolation strip around it. In 1950 the one-acre plots were reduced to 1/2 acre.

Pruning: On all the lot outside the two plots, 400 per acre pruned to 17 feet in 1936. No pruning in either plot.

Measurement (per acre basis)	After thinning	
	Thinned	Unthinned
Year	1961	
Species or treatment	Thinned	Unthinned
Age	52	52
No. trees	112	458
Basal area	94.0	167.4
Ht. dom. trees	62'	64'
Av. dbh	9.5"	8.2"
Merch. cub.ft. (3" min. top peeled)	---	---
Bd. ft. 5" min. top Int. 1/4"	8,170	12,180

DISCUSSION:

Severe damage by ice in Feb. 1961, requiring a salvage cut. 11,000 bd. ft. has been cut from this lot.

1961

Lot V-6  
2.76 acres

Species: Ponderosa pine  
 Planted: Spring 1912  
 Soil : Miami loam  
 Previous land use: Farmland

## PLANTATION ESTABLISHMENT

Stock: 2-0  
 Seed source: Unknown. Stock bought from D. Hill  
 Nursery Cp.  
 Site preparation: Plowed and harrowed.  
 Planting method: Slit with spade  
 Spacing: 5x5  
 Initial survival % 25

## CULTURAL HISTORY

Replanting: October 1914 with sugar maple and silver maple.  
 Spring 1915 with 2-1 ponderosa pine, and Douglas fir (2-2 and 2-2-2). Spring of 1918 with 2-2 Douglas fir and ponderosa pine.

Thinning : Four times at 5-year intervals from 1941 through 1956. All measurements confined on a one-acre permanent sample plot. In 1956 the one-acre plot was changed to 1/2 acre.

Pruning : To 17 feet on 250 trees per acre in 1936.

DAMAGE; Mice damage to Douglas fir in 1921.

Measurement (per acre basis)	Before thinning	After thinning
Year	1961	1961
Species or treatment	P,P	P.P.
Age	50	50
No. trees	294	236
Basal area	127.6	110.2
Ht. dom trees	58'	58'
Av. dbh	8.9"	9.3"
Merch. cu. ft. (3" min. top peeled)	-	-
Bd. ft. 5" min. top Int. 1/4"	10,000	9,120

## DISCUSSION:

Although most of the Douglas fir are still alive, they have been heavily suppressed. The few that are in the dominant canopy are vigorous and of good size.

The early mortality is attributed to drying-out of the stock during shipment.

7500 bd. ft, Int. 1/4" rule, has been removed in thinnings.

1961

Species: Norway spruce Lot: V-7  
Planted: Spring 1932 0.64 acres  
Soil : Miami loam  
Previous land use: Bl. locust planted 1904. Farmland before that.

## PLANTATION ESTABLISHMENT

Initial survival%: Good

## CULTURAL HISTORY

Replanting:  
Thinning :  
Pruning :  
Other : Hardwoods, largely black cherry, cut back in 1936.

## DISCUSSION:

Originally planted in spring 1904, to 1-0 black locust with 97 per cent survival. The locust successfully checked gully erosion on the slope, but was itself badly hit by the locust borer. Dead and heavily damaged trees were cut and burned in 1914 and 1921.

The area is now covered by an irregular stand, with spruce, locust sprouts, small saplings of other hardwoods, and shrubs.