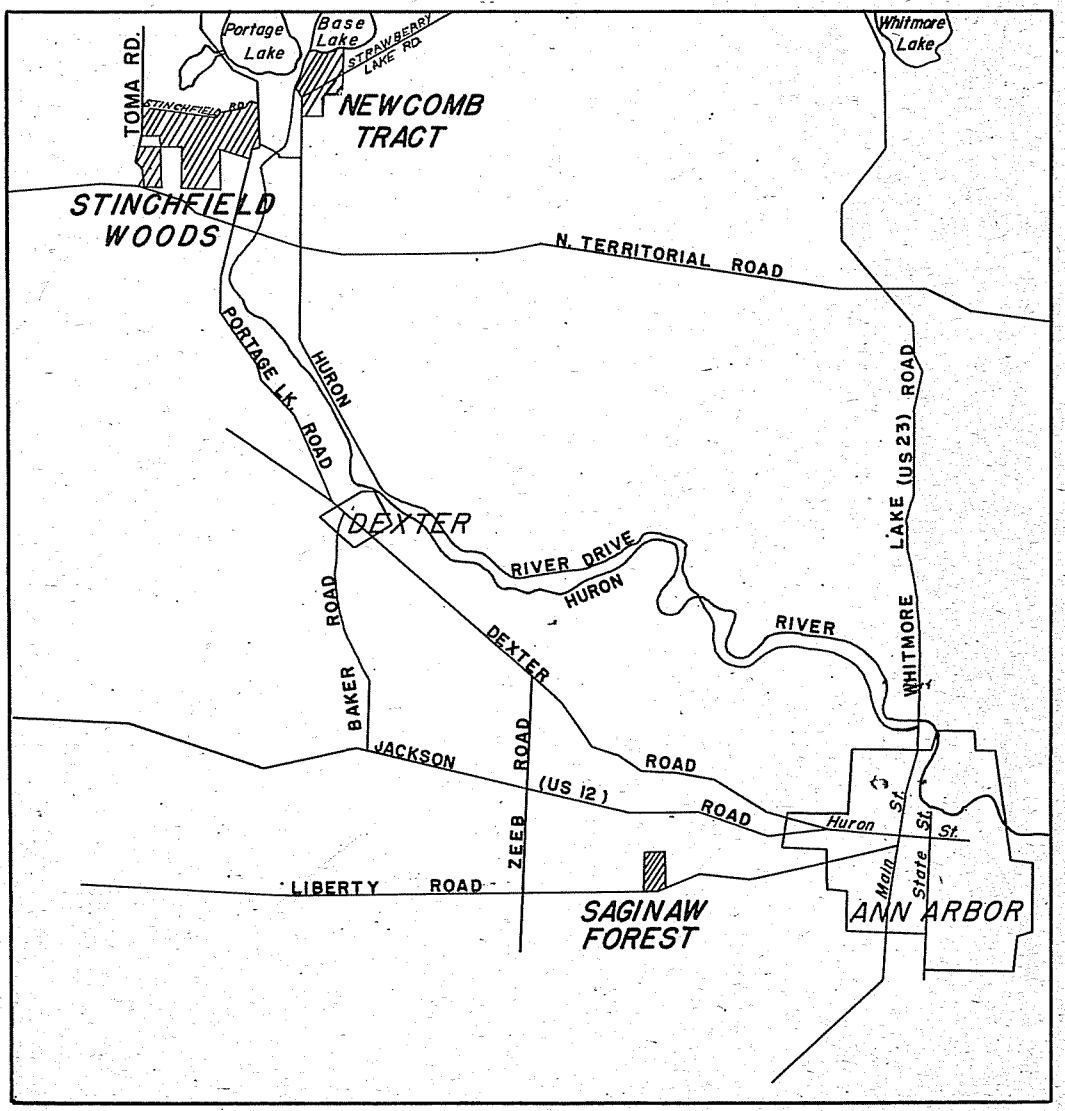
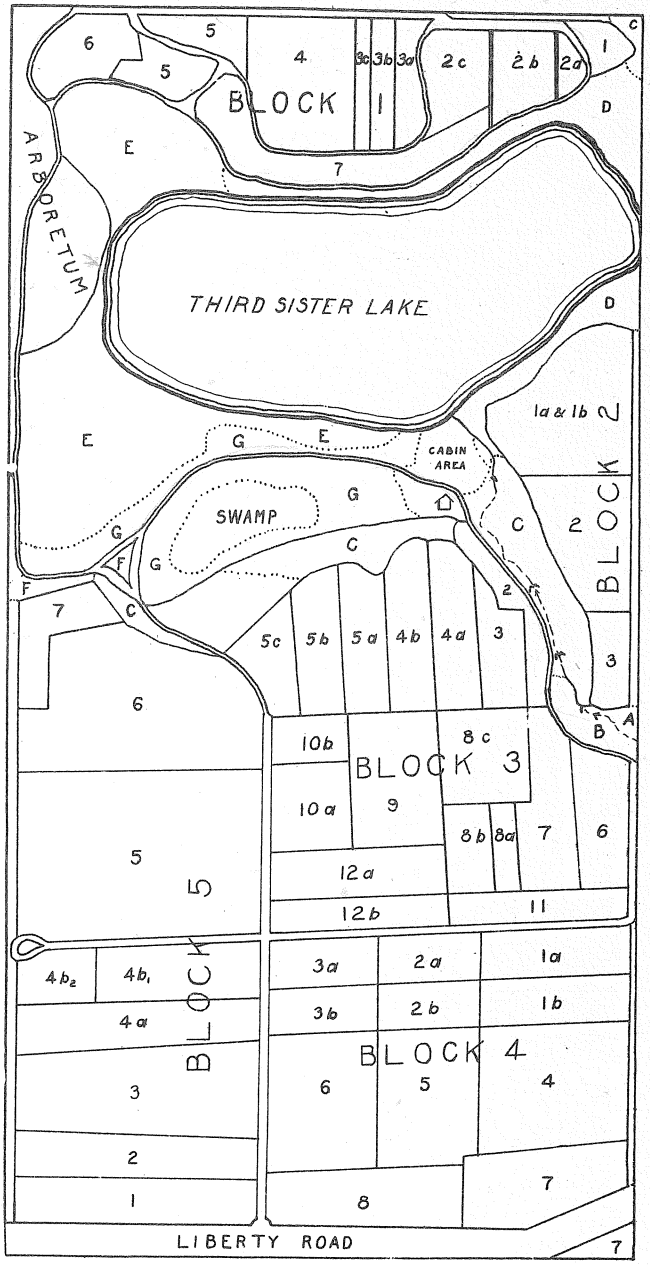
A GUIDE TO

SAGINAW FOREST



SCHOOL OF NATURAL RESOURCES
UNIVERSITY OF MICHIGAN
ANN ARBOR, MICHIGAN



SAGINAW FOREST

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Scale : 0 100 200 FT.

Block	Lot	Species	Stock	Date	Acres
1	1	Scotch Pine	2-0	Sp. '04	.24
	2a	Austrian Pine	2-0	"	.12
	2b	White Pine	2-0	"	.54
	2c	" "	2-0	"	.57
	3a	Douglas Fir	2-0	"	.37
		Western Y. Pine	2-0	Sp. '08	
	3b	Tulip Poplar	2-0	Sp. '04	.28
		White Pine		Sp. '08	
	3c	Douglas Fir	2-2	Sp. '21	.23
	4	White Pine	2-0	Sp. '04	1.63
	5	Western Y. Pine	2-0	Sp. '08	.95
	6	Scotch, Austrian + W. Y. Pine	2-0	Sp. '06	.61
	7	Scotch Pine	2-0	Sp. '08	.91
		Catalpa	1-0	Sp. '04	
2	1a+1b	Norway Spruce	3-0	Sp. '04	1.68
	2	Norway Pine	3-1	Sp. '23	1.04
	3	Scotch Pine	2-2	Sp. '22	.34
3	1	Black Locust	1-0	Sp. '04	.53
	2	Hickory	1-0	Sp. '07	
		Black Locust			
		Elm			
	3	Scotch Pine	2-2		
		Japanese Aed Pine	2-2	Sp. '27	.53
	4a	Scotch Pine	2-2	Sp. '26	.77
	4b	" "	2-2	Sp. '24	.64
		Japanese Red Pine	2-2	Sp. '25	
	5a-5b-5c	Black Locust	1-0	" '06	1.86
		Norway Spruce	2-2	" '15	
	6	Basswood	1-0	" '06	.75
	7	W. Yellow Pine	2-1	" '38	.85
	8a	Sugar Maple	1-0	" '06	.24
	8b	" "	1-0	" '06	.45
	8c	Norway Pine	2-2	" '21	.90
	9	Corsican Pine	2-0	" '30	1.30
	10a	Red Oak	1-0	" '06	.76
	10b	White Oak	1-0	"	.35
	11	Wh. + Burr Oak	Seed	"	.62
	12a	Bl. Walnut	1-0	"	.46
	12b	" "	Seed	Fall '06	.61
4	1a	Wh. Oak	Seed	Fall '06	.74
		Wh. Pine			
	1b	Chestnut	Seed	Fall '06	.74
		Wh. Pine			
	2a+2b	Red Oak	1-0	Sp. '08	1.02
		Scotch + Wh. Pine			
	3a+3b	Red Oak	Seed	Fall '06	
				Sp. '07	1.08
	4	Bl. Walnut	"	" '09	
		Pine-Oak	2-2		1.87
		Larch-Spruce	2-2		
	5	Red Oak	1-0	Sp. '07	1.45
	6	" "	Seed	"	1.54
	7	Nor. Spruce	2-2	" '14	1.03
	8	Red Oak	1-0	" '08	1.17
5	1	W. Y. Pine	2-0	Sp. '09	1.07
	2	" "	2-0	" '37	.97
	3	Nor. Spruce	3-0	Fall '11	2.21
	4a	Cottonwood	Cuttings	Sp. '12	1.05
	4b1	W. Y. Pine	2-1	" '15	1.00
	4b2	Nor. Pine	2-2	" '21	.37
	5	W. Y. Pine	2-0	" '09	4.04
	6	" "	2-0	" '12	2.76
		Filled Douglas Fir		" '18	
	7	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

REVISED AUG. '53

LA 172

THE SAGINAW FOREST, 1903-53

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 Authur 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.

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 difeerent 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 both 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. Average diameter is given as a measure which represents the arithmetic average of the diameters rather than the diameter of the tree of mean basal area. In the case of plantations I-2b and I-2c, however, the data apply to the stand after thinning and the mean diameter is that of the tree of mean basal area.

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

Yellow poplar	Liriodendron Tulipifera L.
Black cherry	Prunus serotina Ehrh.
Black locust	Robina Pseudo-Acacia L.
Ailanthus	Ailanthus altissima (Mill.) Swingle
Sugar maple	Acer saccharum Marsh.
Red maple	Acer rubrum L.
Silver maple	Acer saccharinum L.
Box elder	Acer Negundo L.
Basswood	Tilia americana L.
White ash	Fraxinus americana L.
Catalpa	Catalpa speciosa Warder

1953

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

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 8 times (1916, and at 5-year intervals from 1920 through 1950). One plot of 0.055 acres left unthinned.

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.

MEASUREMENTS (per acre basis)

Year	1950	1950	1950
Species or treatment	thinned	thinned	unthinned
Age	47	47	47
No. trees	305	264	618
Basal area	170.0	155.8	260.4
Height	66 (1945)		67 (1945)
d.b.h.	10.1	10.4	8.8
Merch. cu. ft.	3590	2900	5810
Merch. bd. ft.	18,000	16,800	24,400

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.

1953

Lot No. 1-2a

0.13 acres

Species: Austrian pine
Planted: Spring, 1904
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: Six 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 1922, 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)

Before Thinning

Year	1949	1949
Species or treatment	A Pine	W Pine
Age	46	46
No. trees	362	46
Basal area	169.2	29.3
Height	66 (1948)	--
d.b.h.	9.2	10.7
Merch. cu. ft.	3070	630
Merch. bd. ft.	13,100	2600

After Thinning

Species or treatment	A Pine	W Pine
Age	46	46
No. trees	276	39
Basal area	135.9	25.8
Height		
d.b.h.	9.5	11.0
Merch. cu. ft.	2500	550
Merch. bd. ft.	11,000	2300

Lot 1-2a (cont'd)

All Species

	Before	After
No. trees	409	315
Basal area	198.5	161.7
H eight		
d.b.h.		
Merch. cu. ft.	3700	3050
Merch. bd. ft.	15,700	13,300

DISCUSSION:

In 1949, the crown length was 32 percent of the total tree height. Natural pruning of the dominant trees had occurred to an average height of 45 feet.

The bole form of this stand is excellent, except for an occasional forked tree.

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. They have not equalled the growth of the dominant Austrian pine except along the edge of the stand.

1953

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:	3 x 3
Initial survival percent:	99

CULTURAL HISTORY

Thinning: Eight times at 5-year intervals from 1915 through 1950. 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 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.

MEASUREMENTS (per acre basis)

	Thinning Plot		Control Plot
Year	1950	1950	1950
Treatment	unthinned	thinned	unthinned plot
Age	47	47	47
No. trees per A	540	403	925
Basal area	196.0	163.3	226.9
Height	65	65-	66
d.b.h.	8.1	8.6	6.7
Merch. cu. ft.	4260	3630	4520
Merch. bd. ft.	15,800	13,800	13,700

DISCUSSION:

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.

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 feet.

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 the 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. A scattered growth of small hardwood seedlings and some weeds have appeared in the thinned plot. White pine seedlings have appeared several times, lasting a part of the summer.

1953

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 :	6 x 6, $4\frac{1}{2}$ x $4\frac{1}{2}$ (south half)
Initial survival %:	96

CULTURAL HISTORY

Thinning: Seven times at 5-year intervals from 1920 through 1950. Thinned plot 0.212 acres. Unthinned plot 0.172 acres. Low method, Grade B, removing suppressed and many intermediates.

DAMAGE:

Same as adjacent white (I-2b)

MEASUREMENTS (per acre basis)

	Thinning plot		Control plot
Year	1950	1950	1950
Treatment	unthinned	thinned	unthinned
Age	47	47	47
No.trees per acre	552	476	605
Basal area	231.0	214.3	225.2
Height	66	66	68
D.b.h.	8.8	9.1	8.4
Merch. cu.ft.	4920	4590	4640
Merch.bd. ft.	19,480	18,450	17,900

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 hasexceeded that of the unthinned.

Weeds and small hardwoods are invading the south end of the stand where it borders a mixture of Scotch pine and catalpa.

1953

Species: Douglas fir
Planted: Spring, 1904
Soil : Fox sandy loam
Previous land use: Farm land

Lot No. I-3a
0.37 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: Six times at 5-year intervals from 1924 through 1949.

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.

MEASUREMENTS (Per acre basis)

	Before	After	Before	After	Before	After	Before	After Cutt'g
Year	1949		1949		1949		1949	1949
Species or treatment	DF	D.fir	PP	PPine	WP	WPine	All	All
Age	46	-	42		42			
No. trees	262	196	132	104	64	52	458	352
Basal area	55.5	47.4	27.6	23.9	18.8	17.3	101.9	88.6
Height (1948)	55		53					
d.b.h.	6.2	6.6	6.2	6.5	7.3	7.9		
Merch. cu. ft.	910	820	390	350	380	350	1680	1520
Merch. bd. ft.	1590	1560	640	640	1340	1280	3570	3480

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. As a result, many were badly bent by snow and ice and were subsequently cut. The present stand is therefore too open for good natural pruning. Large numbers of weeds, shrubs, and hardwood seedlings have become established. In 1948, the live-crown percentage of the dominants was 40, and is likely to become greater before the stand closes again.

1953

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 : Six 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.

MEASUREMENTS (per acre basis)

	Before	After	Before	After	Before	After Cutt'g
Year	1949		1949		1949	1949
Species or treatment	YP		WP		All	all
Age	46		42			
No. trees	118	78	400	292	518	370
Basal area	28.5	23.2	179.9	150.2	208.4	173.4
Height (1944)	60		59			
d.b.h.	6.6		9.1			
Merch. cu.ft.	560	450	3840	3290	4400	3740
Merch. bd. ft.	1950	1770	15600	13500	17550	15270

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. The live crown covers 43 percent of the total height of the dominants in the yellow poplar, and 37 percent in the white pine.

Yellow poplar seedlings have appeared in openings of the adjacent stand of Douglas fir and pine.

1953

Species: Douglas fir Lot No. I - 3c
Planted: Spring, 1921
Soil : Fox sandy loam 0.23 acres
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 percent. 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 species is badly suppressed and is being replaced with naturally seeded black cherry.

1953

Species: White pine
Planted: Spring 1907
Soil : Fox sandy loam
Previous land use: Farm land

Lot I - 4

1.63 acres

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: Three times (winter 1938, 1943, 1948). 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.

Before Cutting

Year 1948

Species or treatment	W. Pine	Nor. Spruce	P. Pine
Age	42	44	37
No. trees per acre	317	23	13
Basal area	139.7	5.4	2.5
d.b.h.	9.0	6.5	5.8
Height (dom trees)	52 (1944)		
Merch. cu. ft.	2840	110	23
Merch. bd. ft.	12,030	430	40

After Cutting

Before After

Year: 1948

Species or treatment:	W. Pine	Nor. Spruce	P. Pine	All species	
Age:	42	44	37		
No. trees per acre	215	18	9	353	272
Basal area	121.4	4.6	2.0	147.6	128.0
d.b.h.	9.5	6.7	6.1		
Height dom. trees					
Merch. cu. ft.	2520	95	18	2970	2633
Merch.bd. ft	11,820	400	40	12,500	11,260

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.

1953

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: Three times, winters of 1939, 1943, 1948.

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.

MEASUREMENTS (per acre basis)

	Before	After cutting
Year	1949	
Species or treatment	P.P.	
Age	41	
No. trees per acre	370	302
Basal area	97.6	85.2
Height	45 (1944)	
d.b.h.	6.9	
Merch. cu. ft.	1700	1540
Merch. bd. ft.	3900	3800

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.

1953

Species: Austrian, Scotch and ponderosa pines
Planted: Spring, 1906
Soil : Fox sandy loam
Previous land use: Farm land

Lot: I - 6
0.62 acres

PLANTATION ESTABLISHMENT

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

CULTURAL HISTORY

Thinning: Seven times at 5-year intervals from 1919 through 1949. 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.

MEASUREMENTS (per acre basis)

				Before	After Cutting
Year	1948	1948	1948	1948	
Species or treatment	AP	PP	SP	All	All
Age	43	43	43	43	
No. of trees				205	192
Basal area				139.2	118.4
Height	57(1944)	51(1944)	62 (1944)		
d.b.h.	8.2	8.1	10.2		
Merch.cu. ft.					
Merch. bd. ft.					

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.

1953
Lot: I - 7

Species: Scoteh pine - Catalpa 0.92 acres
Planted: Spring, 1908 - 1904
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 : Five times at 5-year intervals from 1927-1947.

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.

MEASUREMENTS (per acre basis)

	Before	After	Before	After	Before	After Cutting
Year	1952		1952		1952	1952
Species or treatment	Cat.		SP		All	All
Age	49		45			
No. trees	106	84	298	277	404	361
Basal area	51.7	43.9	156.0	145.2	207.7	189.1
Height						
d.b.h.	9.5		9.8			
Merch. cu. ft.			3040	2830		
Merch. bd. ft.			15,000	13,980		

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. A number of young white pine have also become established. This lot is now primarily a Scotch pine stand.

1953

Species: Norway spruce
Planted: Spring, 1904
Soil : Miami loam
Previous land use: Farm land

Lot No: II- 1a and 1b

1.68 acres

PLANTATION ESTABLISHMENT

Stock:	3-0
Seed source:	Unknown
Site preparation:	Plowed and harrowed
Planting method:	Slit with spade
Spacing:	3 x 3 and $4\frac{1}{2}$ x $4\frac{1}{2}$
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: Seven times at 5-year intervals from 1923 through 1953. Plot in northeast corner was left unthinned (except for cutting of all Scotch pine in 1928) up to 1953.

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.

MEASUREMENTS (per acre basis)

	Before thinning	After thinning	Before	After	Before	After
Year	1948					
Species or treatment	NS	NS	S.Pine	Sc.Pine	all	all
Age	45	45	34	34		
No. trees	800	638	39	35	839	673
Basal area	138.7	124.1	18.0	17.0	156.7	131.1
Height	51 (1944)	-				
d.b.h.	5.6	6.0	9.3	9.5		
Merch. cu. ft						

Data pertains to thinned area only. Based on sample plot 0.78 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 $4\frac{1}{2}$x$4\frac{1}{2}$ 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 ft. 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.

1953
Species: Red pine Lot II - 2
Planted: Spring, 1923
Soil: Miami loam 1.04 acres
Previous land use: Farm land. Old field.

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: Grade B low thinning, 1942. Crown thinning with crop trees marked by white paint, 1947, 1952.

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 ease edge of the stand. Most of the trees bear scars caused by Tympanis cankers. No trees have been killed by this fungus.

MEASUREMENTS (per acre basis)	Before	After cutting
Year	1952	1952
Species or treatment	RP	RP
Age	30	30
No. trees	1106	950
Basal area	158.4	140.4
Height	35 (1949)	
D.b.h.	5.1	5.2

DISCUSSION:

This lot was originally planted to catalpa in the spring of 1904. The 1-0 stock was planted at a 4 x 4 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.

1953

Species: Scotch pine
Planted: Spring, 1922
Soil : Miami loam
Previous land use: Old field

Lot. II-3

0.34 acres

PLANTATION ESTABLISHMENT

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

CULTURAL HISTORY

Thinning: Three times at 5-year intervals from 1942 through 1952.

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

DAMAGE; No serious injuries.

MEASUREMENTS (per acre basis)

	Before cutting	After cutting
Year	1952	1952
Species or treatment	SP	SP
Age	31	31
No. trees	532	458
Basal area	121.6	108.7
Height:	40 (1948)	
D.b.h.	6.5	6.6
Merch. cu. ft.	2160	1950
Merch.bd. ft.	5925	5675

DISCUSSION:

Originally planted to osage orange in spring of 1905, using 1-0 stock. The survival was good - about 80 percent - 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 fallof 1921.

The osage orange sprouted after cutting, but the sprouts grew too slowly to interfere with the pine that was planted the following spring. Many of these sprouts are still alive.

Species: Northern white cedar Lot: around lake
Planted: Spring, 1927, completed 1942.
Soil : Rifle peat

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: Wh. 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. trees	1425 trees, 2185 stems
Basal area	123.6
Height	24 (1948)
D.b.h.	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.

1953

Lot: III-2
less than 0.1 acres

Species: Shagbark hickory
Planted: Spring, 1907
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:	4 x 4
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 resprouted.

MEASUREMENTS (per acre basis)

Year	1917	1927	1947
Species or treatment	Hick.	Hick.	Hick.
Age	10	21	41
Height	2.6	8.7	
D.b.h.			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 inchesin 1947.

1953

Lot: III-3

Species: Scotch, ponderosa and Jap. red pines — 0.53 acres
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 Univ. of Tokyo professor
Site preparation:	Scalped spots
Planting method:	Hole with grub hoe.

CULTURAL HISTORY

Replanting: Spring of 1930 with 2-2 Scotch pine.

Thinning: 1948- winter 1952-53.

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 hasoutgrown 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.

1953

Species: Scotch pine
Planted: Spring, 1924
4a-4b 1926
Soil: Miami loam
Lot: III - 4a and 4b
1.41 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 1926, 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: 1948, b - winter of 1952-53.

Pruning: Better trees to 12 feet in 1935, 17' in 1942.

DAMAGE: Rabbits damaged many pine during first five years.

MEASUREMENTS

Year	1953
Species or treatment	thinned all species
Age	28 av.
No. of trees	560
Basal area	176.0
D.b.h.	Sp, 6.9"; J.R.P. 5.0"; PP 5.7"

DISCUSSION:

Originally planted with 1-0 box elder in spring of 1906. Spacing was 6 x 6 on Lot 4a and 4 x 4 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. The Japanese red pine averaged 37 ft. high in 1948 and 5.0 inches in diameter in 1953.

1953

Species: Black locust
Planted: Spring, 1906
Soil : Miami loam
Previous land use: farm land

Lot: III - 5, 5a, 5b, 5c.

1.89 acres

PLANTATION ESTABLISHMENT

Stock:	I.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. Some spruce killed by drought in 1930 and 1931.

MEASUREMENTS (per acre basis)

Year	1944	1944	1944
Species or treatment	BL	NS	All
Age	39	30	
No. of trees	199	513	712
Basal area	71.1	51.1	122.2
Height	61 (1948)		
D.b.h.	8.1	4.3	

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 6 x 6 on Lot 5a on level ground at the top; 4½ x 4½ on Lot 5b on a west slope somewhat below 5a; and 3 x 3 on Lot 5c at the 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.

1953

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

Lot: III-6

0.75 acres

PLANTATION ESTABLISHED:

Stock:	1-0
Seed source:	Unknown
Site preparation:	Plowed and harrowed
Planting method:	Slit with spade
Spacing:	4x4
Intial 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 washeavy 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
D.b.h.	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.

1953

Species: Ponderosa pine Lot: III-7
Planted: Spring 1938
Soil: Miami loam 0.73 acres
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:	6 x 6
Initial survival %:	

DAMAGE

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

DISCUSSION.

Originally planted in spring of 1906 to 1-0 American elm, 4 x 4 ft. spacing, site plowed and harrowed, planting in slit with spade. Initial survival, 98 percent.

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. ft., a mean height of 19 ft., 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.

1953

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 ft.
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 but not in 1931 or 1951. Crown method.

DAMAGE: Mice damage in early years.

MEASUREMENTS (per acre basis)

Year	1951	1951
Species or treatment	thinned	unthinned
Age	46	46
No. of trees	561	1425
Basal area	109.1	143.0
Height	52	49
D.b.h.	6.0	4.4

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 has been light since 1921 because of the large amount of forking and the spreading crowns. The quality of the boles has been lowered by considerable crook.

1953

Species: Red pine
Planted: Spring 1921
Soil : Miami loam
Previous land use: Farm land. White ash plantation 1906-1920.

Lot III-8c

0.71 acres

PLANTATION ESTABLISHMENT

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

CULTURAL HISTORY

Thinning: 1942 and 1952

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

MEASUREMENTS (per acre basis)

		Before cutting	After cutting
Year	1942	1952	1952
Species or treatment	RP	RP	RP
Age	21	31	31
Number of trees	1015	675	610
Basal area	125.0	121.2	109.9
Height	35 (1937)		
D.b.h.	4.7	5.8	5.8
Merch. cu. ft	1170	1670	1520
Merch. bd. ft.	1230	3400	3200

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.

1953

Species: Corsigan Pine Lot: III-9
Planted: Spring, 1930
Soil : Miami loam 1.30 acres
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, Corsigan pine.

Pruning: Dead branches to 10 ft. 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 clearcut 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.

1953

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

Lot: III-10a

0.76 Acres

PLANTATION ESTABLISHMENT

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

CULTURAL HISTORY

Replanting: Spring, 1915

Thinning: Four times from winter of 1933 at 5-year intervals through 1948 .

MEASUREMENTS (per acre basis)	Before cutting	After cutting
Year	1948	1948
Species or treatment	RO	RO
Age	43	43
No. of trees	417	314
Basal area	99.3	83.3
Height	54 (1943)	
D.b.h.	6.6	7.0
Merch. cu. ft.	2050	1700

DISCUSSION:

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

1953

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

Lot: III-10b
0.35 acres

PLANTATION ESTABLISHMENT

Stock:	1-0
Seed source:	Probably local
Site preparation:	Plowed and harrowed
Planting method:	Slit with spade
Spacing:	4 x 4
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 asmuch as they have.

MEASUREMENTS (per acre basis)	Before cutting	After cutting
Year	1948	1948
Species or treatment	WO	WO
Age	43	43
No. of trees	623	386
Basal area	103.4	74.7
Height	44 (1943)	
D.B.H.	5.5	6.0
Merch. cu. ft.	2040	1540

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.

1953

Species: White oak and bur oak Lot: III - 11
Planted: Fall, 1906 0.62 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:	5 x 5
Initial survival %:	75

CULTURAL HISTORY

Replanting: Spring of 1915 with 1-0 red oak

Thinning : Twice (1946 and 1951)

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.

MEASUREMENTS (per acre basis)

Year	1951	1951	1951	Before Cutting 1951	After Cutting 1951
Species or treatment	WO	BurO	RO	All	All
Age	45	45	37		
No. of trees	105	142	103	350	319
Basal area	15.1	29.8	34.5	79.4	75.7
Height	48(1949)	44(1949)	56(1949)		
D.b.h.	5.1	6.2	7.8		

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 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.

In 1948 the crown length - total height percentage of dominants was 46 percent for red oak, 33 for white and 38 for bur oak.

1953

Species: Black walnut
Planted: Spring, 1906
Soil : Miami loam
Previous land use: Farm land

Lot: III-12a

0.92 acres

Plantation Establishment:

Stock:	1-0
Site preparation:	Plowed and harrowed
Planting method:	Slit with spade
Spacing:	6 x 6; 5 x 5
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
D.B .H.	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.

1953

Species: Black walnut
Planted: Fall, 1906
Soil: Miami loam
Previous land use: Farm land

Lot: III-12b

0.61 acres

PLANTATION ESTABLISHMENT

Stock:	Seed
Seed source:.	Probably local
Site preparation:	Scalped spots
Planting method :	Seed spots with grub hoe
Spacing :	5 x 5
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 : Three times at 5-year intervals (1939, 1944, 1949)
Other : Locust cut to release walnut.

DAMAGE:

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

MEASUREMENTS (per acre basis)

	Before Cutting	After Cutting	Before Cutting	After Cutting
Year	1949		1949	
Species or treatment	West half		East half	
Age	43		43	
No. of trees	758	476	367	248
Basal area	79.7	64.6	54.6	44.0
Height			44(1948)	
D.b.h.	4.4	5.0	5.2	5.7

DISCUSSION

Despite the virtual loss of the locust after cutting back, the average size of the walnut on this part of the lot is at present larger than that of the trees on the west half.

1953

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

Lot: IV-1a
0.74 acres

PLANTATION ESTABLISHMENT

Stock:	Seed
Seed source:	Probably local
Site preparation:	Scalped spots
Planting method:	Seed spot with grub hoe
Spacing:	5 x 5
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 : Three times (1939, 1944, 1949).

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	*1949	*1949	*1949	*1949	After cutting
Species or treatment	WOak	W Pine	N Spruce	All	
Age	43	35	33		
No. of trees	298	246	62	606	490
Basal area	49.1	72.0	7.2	128.3	114.2
Height	48 (1949)				
D.b.h.	5.5	7.3	4.6		

* before cutting

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

1953

Species: Red oak, white pine, ponderosa pine, European larch, Bl. walnut.
Lot: IV - 1b
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: Two times (1944, 1949)

DAMAGE: Small numbers of white pine have died from root rot.

MEASUREMENTS:

Year	*1949	*1949	*1949	*1950 All species on lot	After cutting all species on lot
Species or treatment	NS	WP	B Walnut		
Age	33	35	41		
No. of trees	161	166	89	527	418
Basal area	28.7	53.2	10.0	106.1	95.9
D.b.h.	5.7	7.7	4.5		

* Before cutting

DISCUSSION: Originally planted in fall of 1906 to chestnut. Seed were planted in scalped spots with a grub hoe on a 6x6 ft. spacing. Initial survival was 57 percent. 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.

1953

Species: Red Oak
Planted: Spring, 1908
Soil : Miami loam
Previous land use: Farm land

Lot; IV - 2a and 2b
1.02 acres

PLANTATION ESTABLISHMENT

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

CULTURAL HISTORY

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

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

DAMAGE: Early damage by mice.

MEASUREMENTS: (per acre basis)

Year	*1949	*1949	*1949	*1949	After thin. 1949
Species or treatment	RO	WP	SP	All	All
Age	42	35	25		
No. of trees	255	227	70	552	434
Basal area	60.6	46.2	6.7	113.5	91.0
Height	57 (1949)				
d.b.h.	6.8	5.5	4.0		

* before thinning

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 percent of the total height of the tree.

Species: Red oak
Planted: Fall 1906 and spring 1907
Soil: Miami loam
Previous land use: Farm land

Lot: IV- 3a and 3b
1.08 acres

PLANTATION ESTABLISHMENT:

Stock:	Seed
Seed source:	Local
Site preparation:	Scalped spots
Planting method:	Seed spots with grub hoe
Spacing: 3a - 5 x 5 3b - 6 x 6	
Initial Survival %¼	90

CULTURAL HISTORY

Thinning: Five times at 5-year intervals from 1928 through 1948. Thinnings were light the first 4 times and heavier in 1948.

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.

MEASUREMENTS (per acre basis)

		After cutting
Year	1948	1948
Species or treatment	R Oak	R Oak
Age	42	42
No. of trees	439	352
Basal area	87.9	69.0
Height	51 (1943)	
D.b.h.	6.0	
Merch. cu. ft.	1940	1500

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.

1953

Species: Black walnut
Planted: Spring 1909
Soil : Miami loam
Previous land use: Farm land

Lot: IV - 4
1.87 acres

PLANTATION ESTABLISHMENT

Stock:	Seed
Seed source:	Local
Site preparation:	Scalped spots
Planting method:	Seed spot with grub hoe
Spacing :	4 x 4
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: Three at five-year intervals (1940, 1945, 1950).

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

MEASUREMENTS (per acre basis)

Year	1952	1952	1952	1952	1952	1952
Species or treatment	BW	WO	RO	WP	SP	NS
Age	42	37	37	37	27	35
No. of trees	328	26	34	31	81	51
Basal area	37.8	2.8	3.9	7.6	7.8	8.9
D.b.h.	4.6	4.4	4.6	6.7	4.2	5.6

All measurements given are before 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.

1953

Species: Red oak
Planted: Spring, 1907
Soil: Miami loam
Previous land use: Farm land

Lot: IV - 5 and 6

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: 6 x 6
Initial survival percentage: 80

CULTURAL HISTORY
Thinning: Five at 5-year intervals from 1929 through 1949

DAMAGE: Same as lot 3

MEASUREMENTS (per acre basis)

	Before cutting	After cutting
Year	1949	
Species or treatment	RO	R oak
Age	43	43
No. of trees	367	257
Basal area	77.4	65.0
D.b.h.	6.2	
Merch. cu. ft.	1630	

Note: Lots 5-6-8= 1530 cu.ft. per acre before cutting and 1200 cu.ft. per A after cutting.

DISCUSSION:
Lot 5 was planted with 1-0 stock while lot 6 was direct seeded. Initial survival was86 percent for Lot 5 and 74 percent 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.

1953

Species: Norway spruce Lot: IV - 7
Planted: Spring, 1914
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 :	Twice (1946 and 1951)
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.

MEASUREMENTS (per acre basis)

	Before cutting	After cutting
Year	1951	1952
Species or treatment	NS	NS
Age	38	38
Number	660	580
Basal area	143.5	130.9
Height	50 (1948)	
D.b.h.	6.3	6.5

DISCUSSION:

A heavy grass cover buried some of the young spruce and caused early openings in the stand. Practically all the Scotch pine that were planted in 1925 have died.

The green crown averages 62 percent of the total tree height.

1953

Species: Red Oak
Planted: Spring, 1908
Soil : Miami loam
Previous land use: Farm land

Lot: IV - 8
1.17 acres

PLANTATION ESTABLISHMENT

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

CULTURAL HISTORY

Thinning: Four 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)

	Before cutting	After cutting
Year	1949	1949
Species or treatment	RO	RO
Age	42	42
No. of trees	251	178
Basal area	46.5	36.5
D.B.H.	5.8	6.1

Merch. cu. ft. See Lots 5 and 6 for cu. ft. volume.

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.

1953

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

Lot: V-1
1.07 acres

Plantation establishment:

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

CULTURAL HISTORY

Thinning: East half in 1935. Entire stand in 1940, 1945, and 1950

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.

MEASUREMENTS (per acre basis)

	Before cutting	After cutting
Year	1950	1950
Species or treatment	PP	PPine
Age	42	42
No. of trees	591	444
Basal area	191.6	160.7
Height	47 (1945)	
D.b.h.	7.7	8.2
Merch. cu. ft.	2600	2300
Merch.bd. ft.	8200	7400

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.

1953

Lot: V-2

Species: Ponderosa pine
Planted: Spring, 1937
Soil : Miami loam
Previous land use: Planted to white oak and black locust in 1911.

PLANTATION ESTABLISHMENT

Stock:	2-0
Seed source:	Unknown
Site preparation:	Scalped spots
Planting method:	Slit with planting iron
Spacing :	6 x 6
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.

1953

Species: Norway spruce
Planted: Fall 1911
Soil : Miami loam
Previous land use: Farm land

Lot: V-3
2.21 acres

PLANTATION ESTABLISHMENT

Stock:	3-0, some 2-0
Seed source:	Unknown
Site preparation:	Plowed and harrowed
Planting method:	Slit with spade
Spacing :	5 x 5
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. South plot left unthinned.

Pruning: None

DAMAGE: Spruce gall aphid 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	Before 1950	After thinning 1950	1950
Species or treatment	thinned	thinned	unthinned
Age	39	39	39
No. of trees	738	678	550
Basal area	144.9	146.2	124.8
Height	59	58	
D.b.h.	6.0	6.3	6.4
Merch. cu. ft.	2600	2800	2300

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.

1953

Species: White pine
Planted: Spring, 1939
Soil : Miami loam
Lot: V-4a
1.05 acres
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:
Other : Cottonwood clearcut in 1947 to release pine.

DAMAGE:

MEASUREMENTS (per acre basis)

DISCUSSION:

Originally plowed and harrowed in fallof 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 percent. 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.

1953

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

Lot: V-4b
0.92 acres

PLANTATION ESTABLISHMENT

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

CULTURAL HISTORY

Thinning: Three times (1941, 1946, 1951)
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.

MEASUREMENTS (Per acre basis)	Before cutting	After cutting
Year	1951	1951
Species or treatment	PP	P Pine
Age	37	37
No. of trees	571	442
Basal area	139.5	120.3
Height	47 (1949)	
D.b.h.	6.7	7.1
Merch. cu. ft.	2400	1900
Merch. bd. ft.	4600	4530

1953

Lot: V - $4b_2$

Species: Red pine
Planted: Spring, 1919
Soil: Miami loam
0.45 acres
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:	5 x 5
Initial survival %	90

CULTURAL HISTORY

Replanting:	Spring of 1921 with 2-2 red pine
Thinning:	Four times at 5-year intervals from 1936 through 1951
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.

MEASUREMENTS (per acre basis)

	Before cutting	After cutting
Year	1951	1951
Species or treatment	RP	RPine
Age	33	33
No. of trees	888	736
Basal area	160.2	133.3
Height	44 (1949)	
D.b.h.	5.7	6.0
Merch. cu. ft.	2100	1850
Merch. bd. ft.	3170	2950

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.

1953

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

Lot: V - 5
4.04 acres

PLANTATION ESTABLISHMENT

Stock:	2-0
Seed source:	Unknown
Site preparation:	Scalped spots
Planting method:	Hole with grub hoe
Spacing:	6 x 6
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 and 1950 except for the unthinned plot and the isolation strip around it.

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

MEASUREMENTS (per acre basis)

	Before thinning	After thinning	
Year	1950	1950	1950
Species or treatment	Thinned	Thinned	Unthinned
Age	42	42	42
No. of trees	473	358	561
Basal area	141.5	120.4	155.1
Height	48 (1945)		48 (1945)
D.b.h.	7.4		7.1
Merch. cu. ft.	2400	2100	2600
Merch. bd. ft.	7960	6380	6560

DISCUSSION

By 1940, much natural reproduction of black cherry had become established in the eastern part of the lot. Few of the 1918 trees were able to survive competition.

1953

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

Lot: V-6
2.76 acres

PLANTATION ESTABLISHMENT

Stock:	2-0
Seed source:	Unknown. Stock bought from D. Hill Nursery Co.
Site preparation:	Plowed and harrowed.
Planting method:	Slit with spade
Spacing:	5 x 5
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: Three times at 5-year intervals from 1941 through 1951. All measurements confined on a one-acre permanent sample plot.

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

DAMAGE: Mice damage to Douglas fir in 1921.

MEASUREMENTS (per acre basis)

			All species	
			Before cut.	After cut.
Year	1951	1951	1951	1951
Species or treatment	PP	DF	all	all
Age	40	37		
No. of trees	496	77	573	451
Basal area	145.7	9.4	155.1	133.3
Height				
D.b.h.	7.3	4.7		
Merch. cu. ft.	2460	120	2580	2300
Merch. bd. ft.	7060		7060	6690

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.

1953

Species: Norway spruce Lot: V-7
Planted: Spring, 1932 0.64 acres
Soil : Miami loam
Previous land use: Black 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 percent 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.

SUMMARY OF STATISTICS ON SAGINAW FOREST PLANTATIONS.

Block No.	Lot No.	Species	Age Years	No. of trees per A	Ave. DBH inches	Ave. Ht. of dominants	B.A. per A. sq.ft.	Periodic annual dia. growth inches	Per. Ann B.A. growth sq.ft	Volume cu.ft.	Per A bd.ft.	Spacing figure
I	2a	Austrian Pine (only)	46	362	9.2	65.8 [1]	169.2	0.15	4.717	3070	13,100	14.3
I	4	White Pine	42	317	9.0	52.3 [2]	139.7	0.16	3.827	2840	12,030	15.6
I	5	Ponderosa Pine	41	370	6.9	45.0 [3]	97.6	0.14	2.676	1700	3,900	18.9
I	6	Austrian Pine	43		8.2	56.7 [4]	25.3	0.18				
I	6	Ponderosa Pine	43		8.1	51.0 [4]	89.8	0.18	3.161			19.5
I	6	Scotch Pine	43		10.2	61.7 [4]	24.0	0.24				
II	1	Norway Spruce	45	800	5.6	51.0 [5]	138.7	0.14	6.657			15.8
II	2	Red Pine	30	1106	5.1	35.4 [6]	158.4	0.02	1.24			14.7
II	3	Scotch Pine	31	532	6.5	40.2 [6]	121.6	0.16	3.2	2160	5,925	28.2
III	4b.	Japanese Red Pine	28		5.0	37.3 [15]						
III	6	Basswood	33	1553	3.2	38.0	85.7	0.06				20.4
III	7	White Elm	27	1760	2.7	19.4 [7]	71.5	0.08				22.0
III	SP 7	No. White Cedar	26	1425	3.2	24.5 [16]	123.6	0.06	7.2			
III	8c	Red pine	32	714	5.8	35.0 [8]	129.0	0.08	1.5			16.1
III	10a	Red Oak	43	417	6.6	54.3 [4]	99.3	0.12	3.9	2048		18.6
III	10b	Wh. Oak	43	623	5.5	44.4 [4]	103.4	0.08	2.0			18.2
III	12a	Bl. Walnut	29	601	11.5	8.7 [7]	7.0					68.1

Summary of Statistics on Saginaw Forest Plantations, continued

Block No.	Lot No.	Species	Age Years	No. of trees per A	Ave. dbh in.	Ave.Ht. of dominants	B.A. per A sq.ft.	Periodic annual dia.growth inches	per Ann B.A. growth sq.ft.	Volume cu.ft.	Per A. bd.ft.	Spacing figure
III	12b W ½	Bl.Walnut	43	758	4.4		79.7	0.12	3.2			20.6
III	12b E ½	Bl.Walnut	43	367	5.2	44.5 [9]	54.6	0.12	1.4			25.1
IV	3a W ½	Red Oak	42	463	6.0	51.4 [2]	91.8	0.10	3.1	1967		19.4
IV	3a E ½	Red Oak	42	415	6.4	55.0 [2]	94.0	0.10	3.2	1990		19.2
IV	3b	Red Oak	42	439	5.7	48.0 [2]	77.9	0.10	3.2	1650		21.0
IV	5	Red Oak	43	396	6.3		84.6	0.10	2.3	1792		20.0
IV	6	Red Oak	43	339	6.1		70.1	0.10	2.1	1468		22.3
IV	7	Nor.Spruce	38	660	6.3	50.2[10]	143.5	0.16	3.8			15.5
IV	8	Red Oak	42	251	5.8		46.5	0.16	2.0			
V	1	Pond.Pine	42	591	7.7	47.0 [2]	191.6	0.10	2.4	2600	8200	13.4
V	4a	Cottonwood	25	208	6.9	42.0[11]	55.1	0.24				25.1
V	4b 1	Pond.Pine	37	571	6.7	46.8[10]	139.5	0.12	3.6	2400	4600	15.6
V	4b 2	Red Pine	33	888	5.7	43.7[12]	160.2	0.10	2.4			14.7

Mixed Stands

Block No.	Lot No.	Species	Age Y ears	No.of trees per A	Ave. dbh in.	Ave.Ht. of dominants	B.A. per A sq. ft.	Periodic annual dia.growth inches	Per ann. B.A. growth Sq.ft.	Volume cu.ft.	Per A. bd.ft.	Spacing figure
I	3a	Douglas Fir	46	262	6.2	55.1	55.5	0.08	2.5	910	1590	
		Pon. Pine	42	132	6.2	52.9 [13]	27.6	0.14	0.8	390	640)	
		White Pine	42	64	7.3				0.4	380	1340)	18.3
I	3b	Yel.Poplar	46	118	6.6	60.2 [13]	28.5	0.10	0.8	560	1950)	12.8
		White Pine	42	400	9.1	58.7 [2]	179.9	0.14	5.1	3840	15600)	
I	7	Catalpa	49	106	9.5	53.7 [1]	51.7				)	12.8
		Sc. Pine	45	298	9.8		156.0			3558	16916)	
III	5a	Bl.Locust	39	167	8.6	57.6[14]	67.0	0.12			)	17.3
		Nor.Spruce	30	415	4.5		45.9	0.16			)	
III	5b	Bl.Locust	39	215	8.1		76.5	0.14			)	15.6
		Nor.Spruce	30	700	4.0		62.4	0.16			)	
III	5c	Bl.Locust	39	214	7.7	61.2[14]	69.8	0.22			)	17.4
		Nor.Spruce	30	423	4.4		45.1	0.18			)	
III	11	White Oak	45	105	5.1	47.5[14]	15.1				)	24.8
		Bur Oak	45	142	6.2	43.8[14]	29.8				)	
		Red Oak	37	103	7.8	56.1[10]	34.5				)	
IV	1a	White Oak	43	298	5.5	48.1 [9]	49.1	0.10	1.1		)	
		White Pine	35	246	7.3		72.0	0.08	1.2		)	16.7
		Nor.Spruce	33	62	4.6		7.2	0.16	0.3		)	
IV	1b	Chestnut	28	170	2.3	20.4 [7]	4.9				)	
		Nor.Spruce	33	161	5.7		28.7	0.14	0.8		)	
		White Pine	35	166	7.7		53.2	0.10	-0.2		)	19.2
		Walnut	41	89	4.5		10.0	0.12	0.3		)	

Mixed Stands (continued)

Block No.	Lot No.	Species	Age Yrs.	No. of trees Per A	Ave. dbh in.	Ave. H t. of dominants	B.F. per A sq.ft.	Periodic annual dia.growth inches	Per ann. B.A. growth sq.ft.	Volume cu. ft.	Per A. bd.ft.	Spacing figure
IV	2a	Red Oak	42	345	6.3	57.4[13]	74.0	0.12	2.8	1556	)	17.7
		Wh.Pine	35	289	4.8		36.8	0.06	0.6	580	)	
IV	2b	Red oak	42	165	7.2		46.2	0.14	1.4	918	)	
		Sc.Pine	25	111	4.0		9.6	0.14	0.0	111	)	-20.6
		Wh.Pine	35	165	6.2		35.0	0.12	0.8	664	)	
IV	4	Bl.Walnut	42	328	4.6		37.8	0.14	1.6		)	
		Wh.Oak	37	26	4.4		2.8	0.08	0.2		)	
		Red Oak	37	34	4.6		3.9	0.16	0.2		)	22.7
		Wh.Pine	37	31	6.7		7.6	0.20	-0.6		)	
		Sc.Pine	27	81	4.2		7.8	0.08	0.2		)	
		Nor.Spruce	35	51	5.6		8.9	0.14	0.0		)	
V	6	Pond.Pine	40	496	7.3		145.7	0.10	4.1	2268	8465)	14.9
		Doug.Fir	37	77	4.7		9.4	0.14	0.4	120	)	
						Experimental Thinning Plots						
I	1c thinned	Sc. Pine	47	305	10.1	65.5[9]	170.0	0.12	2.5	3570	18048	14.2
I	1 control	" "	47	618	8.8	67.3[9]	260.4	0.12	2.0	5811	24418	11.4
I	2b thinned	Wh.Pine	47	566	8.1	64.3[1]	196.0	0.08	3.4	4260	15800	13.0
I	2b control	" "	47	847	6.7	56.8[1]	226.9	0.12	-1.5	4520	13700	12.8
I	2c thinned	" "	47	552	8.8	58.6[9]	231.0	0.10	4.1	4920	19480	12.1
I	2c control	" "	47	605	8.3		225.1	0.14	1.6	4640	17900	12.3
III	8a thinned	Sug.Maple	46	583	6.2	54.0[14]	122.6	0.16	5.8			16.7
III	8a control	" "	46	1714	4.1	50.7[14]	157.0	0.12	5.6			14.7

Experimental Thinning Plots, cont'd.

Block No.	Lot No.	Species	Age Yrs.	No.of trees per A	Ave dbh in.	Ave.Ht. of dominants	B.A. per A sq.ft.	Periodic annual dia.growth inches	Per ann. B.A. growth sq.ft.	Volume cu.ft.	Per A. bd.ft.	Spacing figure
III	8b thinned	Sug.Maple	46	539	5.7	49.6[14]	95.5	0.12	4.1			18.9
III	control	" "	46	1136	4.6	48.1[14]	129.0	0.16	4.5			16.1
V	3 thinned	Nor.Spruce	39	238	6.0	59.0	144.9	0.14	4.4			15.4
	control	" "	39	678	6.3	57.7	146.2	0.20	3.0			15.2
V	5 thinned	Pond.Pine	42	473	7.4	48.1 [2]	141.5	0.12	3.3	2400	7960	15.6
	5 control	" "	42	561	7.1	48.8 [2]	155.1	0.12	1.9	2600	6560	14.9

1 At 45 years
2 At 37 "
3 At 36 "
4 At 38 "
5 At 40 "
6 At 26 "
7 Ave. of all trees
8 At 27 yrs.
9 At 42 years
10 At 34 "
11 Ave. of all trees of 20 years
12 At 30 years
13 At 41 "
14 At 43 "
15 At 23 "
16 At 22 "

* Cubic foot volumes include peeled wood to 3" top d.i.b. except for red oak which is to 5" top d.i.b.

Board foot volumes include all wood to 5" top diameter by International 1/4" rule.