

The Harvard  
Forest.

M6  
H28  
2

Professor Townsend

THE HARVARD FOREST

That Harvard University is conducting a logging operation is rather a startling statement; it is true however. Owing to the generosity of Mr. John S. Ames, who graduated from the Harvard Forest School of Harvard University with the class of 1909, the Harvard forest was acquired late in 1907. Mr. James W. Brooks, who owned 1800 acres, cooperated by placing a low valuation upon this land. Contiguous owners, with holdings in the aggregate of between 200 and 300 acres, deeded these additional areas so that today the Harvard Forest comprises more than 2000 acres. It was through the courtesy of Mr. Richard T. Fisher, Chairman of the Division of Forestry, that the writer was enabled to visit this tract on January 21st and 22nd in order to study the silvical method of treatment.

According to the Official Register of Harvard University, "the forest lies on hilly country at an elevation varying from 800 to 1400 feet above seal level. It is divided into three distinct blocks of (about) 850, 550, and 600 acres, which are located respectively northeast, northwest, and southeast of the village.\* The northeast block covers the slopes and surrounding areas of Prospect Hill, the northwest block includes the basin of a small pond called Meadow Water, and the southeast block takes in about two miles of the narrow valley of the Swift River, with a pond and a small water power along its course.\* In the words of the  
 \* Petersham, Mass.

Official Register "the primary object in the possession of this forest as part of the equipment of the Division of Forestry, is its use as a field laboratory for the training of students in practical forestry." This forest is particularly valuable as a training ground for students because of the large and varied growing stock and excellent market for practically all species and all kinds of product; and because of the varied distribution of age classes. This facilitates the practice of intensive forestry. It is within two hours' ride of Cambridge and the offices in the Division of Forestry can therefore direct the administration by weekly visits, when not in residence at Petersham. Mr. Fisher feels that the school tract is the strongest single advantage of a professional school of forestry and the school is conducted at the forest from July 1st to December 1st, and from April 1st to June 10th.

#### EQUIPMENT AND EDUCATIONAL FACILITIES.

The Equipment includes buildings with bedrooms and recitation rooms; suitable storage space; "and complete set of logging and woods tools"; a team used in logging; portable buildings for wood crew, etc.

Plate I. Old "Colonial House" now used as overflow dormitory.

Such courses as follow can be conducted during the period of field work: identification of species; soil studies; general silvical studies including marking, planting, and nursery practice; forest management; surveying; engineering; and "forest operations" which includes the details of wood management and mill work.

SPECIES AND TYPES.

Among the more important species found on the tract are white pine, red spruce and hemlock, popple, paper birch and black birch, white oak, red oak, white ash, black cherry, and red maple. A complete list of the trees and other woody plants was given in the Bulletin of Harvard Forestry Club, Vol. I, 1911, 1911, compiled by Assistant Professor John G. Jack .

This list comprises 173 species of trees and woody plants; an unusual variety of species, although a few of them are exotics cultivated in local gardens. There are about 50 tree species on the Harvard Forest that grow to a diameter breast high of over six inches.

The main forest types are white pine (second growth) and mixed hardwoods, but there are a large number of temporary types or variations of the main types which present different problems of forest management. For example, there is pure white pine; white pine and scattering hardwoods; pitch pine; beech and hemlock; pure chestnut; red maple swales with elm, ash, and cherry; spruce swamps with hemlock or larch; old field white pine; pine and birch; mixed hardwoods; white pine and hemlock and other minor combinations of species.

#### THE STAND.

According to most recent estimates which are, however, approximate, there is at least twelve millions board feet on the 2000 acres; 9/10ths of this is white pine. The chief woods as regards yield are, besides white pine, chestnut, red maple, red oak, paper birch, white ash and some scattering black cherry which is surprisingly straight and clean holed. The forest is not a woodlot but a tract producing chiefly saw timber, 9/10ths of which is worth \$7.50 to \$8.00 on the stump; marketing of this timber presents many interesting problems.

IMPROVEMENTS.

The boundaries are either marked by stone walls or fences, or plainly blazed. There are iron pipes driven in the ground at all corners. During the time this tract was owned by Mr. Brooks, he laid out and graded some fifteen miles of roads and including county roads there are probably twenty miles of logging roads within the area. Many of the private roads, however, were poorly laid out but undoubtedly the engineering class will improve some of the grades and straighten the alignments.

STUMPAGE RATES.

The white pine is worth \$7.50 to \$8.00 on the stump, the hardwoods merchantable for saw timber perhaps \$4.00 and the cordwood from saplings too small to be sawn into lumber or from tops sells for 50 cents a cord standing.

MARKET.

There is an excellent market for all species except popple and red maple lumber. There is a considerable quantity of red maple on the tract which is considered more or less of a weed tree since ordinarily it can only be sold for cordwood. The demand for cordwood, however, exceeds the supply that at present can be cut, and no difficulty has been found in disposing of the white pine for boxes, boards, match

sash and blind stock, and "square edge." The box and match stock sells for from \$16 to \$18., one inch square edge for \$20., sash and blind stock for from \$25 to \$35. The chestnut sells as inch sidings for \$17., and as  $1\frac{1}{8}$  in. round edge for \$20. Selected ash, red oak, and cherry sells in small quantities at funny prices.

#### UTILIZATION.

On account of the excellent market it is possible to obtain exceedingly close utilization. The white pine stumps are cut from 4 to 6 in. high and in many cases appear to have been cut practically even with the ground. It is utilized to 4" in the tops and the rest of the tree, too small for manufacture, goes into cordwood which sells stacked at \$1.25 to \$1.35 per cord. The hardwoods cannot be utilized so closely for lumber chiefly on account of crooks, but the hardwood tops bring \$2.50 per cord stacked in the woods.

#### METHOD OF SALE.

It is rather surprising that Mr. Fisher has found it more profitable to do his own logging rather than to have it done by contract. The only material sold on the stump is a small quantity of cordwood taken out in cleanings. This is sold to local residents in what might be termed "neighborhood sales." In all operations trees are designated for cutting by marking although they are not stamped with any symbol to show whether they were officially marked or not. This is not

considered necessary because the officers in charge are so familiar with each tract that they can distinguish if the original marking has been materially departed from. The pine brush is burned at a cost of 15 to 25 cents per thousand. The hardwood brush is usually burned, particularly when it is cut with the pine but occasionally it is left in small piles where the fire danger is not considered great. Sales are made informally and no formal contract is required.

#### COST OF LOGGING.

The results of logging during the fiscal year of 1911 give the following average costs:- Sawing \$1.00 per M., drawing in and piling \$1.75, from the piles to rollway at portable mill 20 cents, sawing at mill by contract \$2.35, "sticking" 75 cents, hauling to the market \$2.25 (hardwoods hauling to market \$4.50). Since the thinnings are taken in connection with the final cuttings, no separate figures on the cost of logging have been secured. As an estimate, however, it is probably true that thinnings cost \$1.25 to fell and saw while the final cuttings cost but 85 cents. The average sale price for white pine for 1911 was \$17.50. The total cost of delivery according to the figures secured, amounted to \$8.30. In other words there was a net profit of \$9.20 per M. feet for white pine. The cordwood sales of white pine tops probably just about balance the cost of cutting and stacking. Even on the poorer quality hardwoods,

taking the total cost of delivery to be in the neighborhood of \$10.20, there would still be a net profit of \$3.30 and on the better quality hardwoods from \$9 to \$15 and up according to quality and species.

SYSTEMATIC RECORDS.

In order to keep accurate cost figures on all operations an interesting system of time sheets is maintained including cordwood tallies, individual time sheets and time sheets differentiating sawing, drawing in, cutting cordwood, burning slash, farm labor, nursery labor, and blanks for miscellaneous operations. These are summarized in a permanent ledger. Samples of these sheets follow:

HARVARD FOREST SCHOOL CORDWOOD  
TALLY.

Chopper F. Allen.

Season-Fall.  
Tract, Meadow Water

Date	Com part- ment	Hardwood		Softwood		Measured By	Date	Payments Amount	Made By
		cords	feet	Cords	feet				
10/28	3	4	6	1		R.T.F.	11/4	5.75	R.T.F.
11/14	3	2	7	3	3	"	11/14	6.25	"
11/29	3	3	3 $\frac{1}{8}$	4	3	"	11/29	7.45	"
12/7	3	2		2		A.H.W.	12/7	4.00	A.H.W.
12/8	3		3 $\frac{1}{8}$		1	"	12/8	56	No.47 E.E.C.

HARVARD FOREST SCHOOL

Rate \$2.00

Name A. Duro.

Summary from Time Sheet

Payments.

	From	To	Days	Amount	Date	Amount	Paid By
1911	10/11	10/14	4	\$ 8.00	10/14	\$8.00	E.E.C.
1911	10/17	10/21	2-4/9	4.89	10/23	4.89	R.T.F.
1912	12/30 etc.	1/ 6	6-7/9	13.56	1/5	13.50	

HARVARD FOREST SCHOOL

Time Sheet of  
A. Duro.

From 1/1 to 1/6  
Tract Meadow Water

Kind of Work	Comp Number	Hours by Days					Total Hours	Rate Amount
		M.	T.	W.	T.	F.		
	5					2		
Sawing	4 3	2						
Drawing in								
Cutting	5	9	9	2	8			
Corewood	4	5						
Burning Slash								
Farm Labor								
Nursery Labor								
Work on Bridge				7	1			
Sorting Lumber	3							
\$2.00 extra Given for Christmas								
Total Hours		9	9	9	7	9	52	
Equals						5-7/9 days at	\$2.00	\$11.56

MANAGEMENT.

Before the Harvard Corporation would agree to the purchase of this tract they wanted definite assurance that it would not be a source of expense to the University. In other words, Mr. Fisher agreed that it would be self-sustaining. The object of the management, therefore, has been (1st) to secure a reasonable return, (2nd) to cut first the timber that was mature and secure immediate regeneration and to make intermediate cuttings to improve the growing stock.

REGULATION.

There is at present no working plan, but it is expected that by 1914 a complete working plan will be drawn up. This lapse of seven years between the purchase of the tract and the completion of a formal working plan is accounted for by the fact that only student labor is used in the collection of data and it was desired to be very certain of local conditions and requirements before the management was committed to a definite line of action. At present the tract is mapped for topography, types and a portion for age classes. There is a rough growth table, volume table for white pine based on the mill run and more or less complete volume tables for chestnut and red maple are not being compiled. Tentatively, it is desired to manage the white pine and hardwoods on a rotation of about 60 years, but blocks of rapidly growing

pine will be reserved. The actual cut at present has been fixed roughly at 250,000 ft. of saw timber (chiefly pine) and 250 cords of wood. The data already collected for the complete working plan indicate that this cut may be greatly increased - possibly even doubled - with absolute safety.

#### FORESTATION.

Since there is considerable land either entirely bare or only covered with a scattered growth of gray birch, forestation has been started. About fifteen acres of white pine, two year old seedlings on the better sites and three year old transplants on the unfavorable sites, all spaced 6 X 6, have been put in.

During 1911 a good many of the white pine seedlings died during the drought and it was definitely determined that in similar exceptional seasons on the less favorable locations only transplants would succeed when planted in the open. Root competition from low brush did surprisingly little damage; in fact, the young trees succeeded better under huckleberry and other bushes than on bare ground. In the large openings the plantations will undoubtedly be successful, but in the small openings with a diameter of 50 to 100 ft., it is probable that the surrounding white pine wolf trees will suppress and damage a large proportion of the plantations.

In addition, there is a small area of Scotch pine spaced 6 X 6. It is planned to try out red pine, red oak, and Douglas fir. Were it not for the excellent reproduction of white ash and black cherry, it is probable that blanks would be planted to these valuable species.

### EXPERIMENTS

A number of experimental sample plots have been established to secure definite data on the different methods of treatment. For example, where the shelterwood system was tried in almost pure white pine, a quarter acre plot was not cut and nearby a quarter acre was measured to show the results of cutting both as to growth and reproduction. In a demonstration and experimental forest such as this, it would indeed be fortunate if even a greater number of sample plots could be established as rapidly as possible since there are few owners who can afford the time and expense to observe scientifically the results of the different methods of treatment. Possibly half acre or acre plots would give better results than quarter-acre.

### CUTTINGS.

The value of the Harvard forest as a demonstration of what can be done in practical forestry cannot be overestimated and private owners would profit by visiting this tract in order to make a careful study of the different

cuttings and the results. Within twenty or thirty years, when the results can be more accurately gauged, a tract such as this showing varying conditions, will undoubtedly do a great deal to encourage private owners to cut conservatively.

Accurate records are kept at the cost of the different operations. The main cuttings are as follows:-

50 year old white pine cut in 1911; thinned to stimulate growth; utilize portion of the timber. Here 6000 ft. were cut and 29000 left standing. The stand is carefully kept "dark" to prevent weeds and hardwoods coming in which would make future regeneration more difficult.

Groups of wolf pine with thrifty pine saplings and groups of over-mature hardwoods cut in 1911; a general improvement cutting by which the wolf pine are removed and the groups of over-mature hardwoods cut clear with the object of securing natural regeneration of white pine with more valuable species of hardwoods. The clear cutting covers a quarter to half acre areas and it is probable that some of the less desirable hardwood sprouts and seedlings must be cut back.

Hardwood swales cut in 1911; these were cut clean because the ground was already well reproduced to ash, black cherry, oak, chestnut and maple. Probably some pine re-

production will come in from neighboring stands. A few large, over-mature elms, for example, had to be left because they were not merchantable for lumber, and too costly to be split into cordwood. A few small, straight hardwood poles were left, but these will probably be removed within the next year.

Pure white pine, 45 years old, cut in 1911; thinned by the removal of 10,000 ft. per acre, 35,000 being left standing.

Pl. II

50 year old white pine after thinning. The brush has been burned.

30 year old white pine under grey birch, (popple and red maple, cut in 1909; the hardwoods were removed and the pine occasionally thinned with the object of liberating and improving the stand of pine. This cost \$2.25 per cord to cut and was only worth \$1.50 a cord stacked in the woods. About 10 cds. per acre were removed; a costly operation, although probably the expense can be reduced to \$2. or \$3. per acre in future operations and the value of the stand enormously increased.

Pl. III

30 yr. old white pine and birch before and after a cleaning.

Patch of chestnut and maple surrounded by pine, cut in 1910-11. Here the hardwoods were practically cut clean with the expectation that if the pine seedlings come in from surrounding pine stands, the less desirable hardwood sprouts would be cut back with a scythe to liberate the pine. On this area the damage to ash, oak and maple sprouts by deer was quite noticeable.

A stand of pine 60 years old mixed with 25% hardwoods, chiefly red maple, cut in 1908-09. Here 3-7/10th acres were cut clean in a good seed year. At the end of June following the cut 8 ft. sample plots showed 5-20 pine seedlings on each area, but after two dry years probably at least 50% of the pine died on the hummocks and on the south side of hummocks although there is still excellent pine reproduction at the southeast corner of the opening, within 50 ft. of the edge of the cutting. Probably better results would have been secured if the area cut had been in the form of a strip not exceeding 100 ft. in width although Mr. Fisher feels that the results would have been entirely successful had it not been for the subsequent drought.

60 year old white pine growing slowly with a scattering of oak, maple, and popple; pine somewhat affected by red rot;

cut in 1908; This cutting was a seed felling by the regular shelterwood method and removed practically all hardwoods and enough of the pine to admit light after reproduction. 1908 was a good seed year. 7000 to 9000 ft. per acre were removed and 21000 to 27000 ft. were left standing. The felling has resulted in excellent reproduction over much of the area. A similar felling in the same stand made in 1910 (seed year 1911), results of which will not show until the summer of 1912.

Pl. IV.

Before and after a seed felling by the shelterwood system; the white pine is almost pure and 60 years old.

Pure white pine sixty years old with hardwoods in gullies, cut in 1910-11. Here a strip was clear cut 50 to 100 feet, in width at right angles to the prevailing wind with the object of securing pine reproduction mixed with more valuable hardwoods. The bordering pine stands were thinned and a few selected pines were left in the openings where the distance to seed trees was over 75 feet.

60 year old chestnut with an understory of poles comprised of pine, hardwoods, etc., cut in 1912. Here a removal cutting was made, all the mature chestnut and mischapen damaged young stuff was cut. Fully 50% of the stand was taken. The remaining stand is comprised of a lot of splendid poles which should develop rapidly.

Plate VI  
Pure, even-aged white pine 35 years old.

1

Plate VII.  
50 yr. old white pine after thinning.

Near the headquarters the supply of cordwood required for heating purposes was secured by cutting out wolf hardwoods from a rather scrubby stand of white pine 30 to 40 years old, cut in 1908-12; removal cuttings of the wolf hardwoods with the object of improving the stand of white pine and leaving desirable hardwood poles.

The reserve of white pine for a longer rotation will give interesting figures on the production of this species in second growth. A few specimens of the original "punkin" pine stand will also be retained. There is a general effort to get rid of the mature chestnut on account of the chestnut disease which has appeared. The chief

features of the management are intimate personal touch and careful marking. For example in one patch quite a number of red maple had been retained temporarily to shade a dry spot in the endeavor to induce natural regeneration of pine from the surrounding stand. There has been some pine windfall on the windy edges of openings, especially where the openings have been large, but probably less than 1000 ft. have been wind thrown. Another feature of Mr. Fisher's management is his care of the black cherry with the object of increasing this valuable species. It reminds one of the management seen abroad where the Oberforster knows the location of a great many of his more valuable specimens and watches them as they develop. It will be a valuable demonstration to see just how much it will cost to cut back the undesirable sprout or seedling growth which appears in some of these openings. A feature of this cutting back will be the splendid straight suckers that can be secured by cutting back even with the ground a mis-shapen seedling.

As may be judged from the preceding account of the main cuttings, no definite, iron-clad rule has been followed; the methods being varied in order to fit silvical conditions, to form rough experiments.

### MILLING AND SELLING

The milling is being done by contract and ordinarily the cost is \$2.00 a thousand. The marketing of the material brings up a number of practical problems. For example, if Mr. Fisher has a lot of small white pine logs, say under 12 in., shall he sell them to a match factory at \$18.00 for 2-1/8 planks or shall he sell them to a box factory at \$17.00 as 1 1/4 boards. A study at the mill, for example, will show him that a 6 in. log, 12 ft. long will saw out 8 ft. in 2-1/8 stuff and 11 ft. if sawn into 1 1/4 the difference being due in the 2-1/8 board. Moreover, he knows by experience that no payment is made for the extra 1/8th, while the extra 1/4 in. in thickness is scaled. Such practical problems as these are constantly arising and give the students excellent training.

### PROTECTION

There is little likelihood of trespass and the tract is so situated that the slightest smoke is at once seen and reported to the officer in charge. Since prompt action can be taken when fires start, no attempts have been made to establish costly fire lines and there is little danger of a crown fire except under most extraordinary conditions and then only in your coniferous growth.

GAME

There are ducks, deer, foxes, rabbits and partridges on the tract and the management allows hunting by local residents in order to promote good feeling; the damage by deer, particularly to ash seedlings, is quite noticeable and probably hunting will therefore be encouraged.

Plate VIII.  
Mill and Mill Yard.

NET RETURNS

At present the 250,000 bd. ft. cut annually, is sold to net well over \$7.50 per thousand, or \$1875, and the hardwood and pine cordwood for \$300 additional, making roughly a net return of \$2175. While this land will

probably not be taxed since it is part of the equipment for teaching forestry, yet the tract is assessed at \$60,000. The present yield, therefor, amounts to about 3.6 percent on this low valuation; the tract could be sold for \$80,000 quite readily. Yet it must be borne in mind that the cutting is nowhere near the normal yield. For example, suppose 1800 acres of the 2000 were producing to its full capacity on a 60 year rotation. This would mean an annual cut of 30 acres which surely should yield at least 30000 ft. per acre. If this netted only \$10 per thousand and it will certainly net more than this, perhaps double, by the time the forest is at its full producing capacity, you would have a net annual revenue of from \$9,000 to \$18,000.

#### SUGGESTIONS.

It would be interesting to see the effect of somewhat heavier thinnings in the pure pine 35- to 40 years old, perhaps removing one or two thousand feet per acre additional, or fifteen percent of the present stand as against ten or twelve percent. Of course, there is danger in admitting too much light and thus encouraging undergrowth which would hinder reproduction when the seed felling is made. More sample plots will be established; ( and it is hoped larger ones) since training in experimental work is part of

the curriculum of the school. One would expect at least a preliminary working plan, but the drawing up of such a plan has been delayed for entirely practical reasons and it is doubtful if the management has suffered. Perhaps some of the openings have been too large, but it must be remembered that a large opening possesses a distinct value from an experimental standpoint which more than offsets the small loss through lack of pine reproduction which may result. Whether it would be better to adopt an eighty or hundred year rotation for the pine can only be determined when more complete yield-<sup>tables</sup>~~data~~ are available.