

THE HARVARD FOREST AT PETERSHAM

BY RICHARD T. FISHER, DIRECTOR OF THE FOREST



A Remnant of the Forest Found by the First Settlers of the Town
Two Hundred Years Ago.

THE Harvard Forest, situated at Petersham, Mass., contains about 2,000 acres of wooded land. It was acquired by the University in 1907 through the generosity of John S. Ames, '01. The Forest is used as a laboratory for forest research and the training of advanced students in the operation of timberlands.

On the organized forests of Europe it has been customary to revise the figures upon which the management is based once

in ten years. This period having now elapsed since work began at Petersham, it is timely to make a summary not only of results in respect to accomplishments on the Harvard Forest itself, but also as regards research and the professional progress of graduates.

When the Forest was first taken in hand, in 1909, no specific working-plan report was drawn up; but such measurements and computations were made as were



Wood Road in Slab City Tract.

necessary for management on the basis of a sustained, and as far as possible, increasing yield. The prime object was, and is, to build up a model producing-forest, embodying all the processes of growing and harvesting timber, and maintaining the maximum amount of woodland unimpaired. Thus the aim has been to cut yearly no more than the calculated annual increment of the whole tract, and to increase that return by reforesting vacant places, improving the rate and quality of growth in inferior young stands, and reproducing the cut-over areas with new crops. In pursuance of these purposes, 80 acres of blank land have been planted; 120 acres of mixed young growth have

been made productive by improvement cutting; and 90 per cent. of all areas from which mature timber has been cut have been satisfactorily reforested, mainly by natural seeding. The effect of those operations upon the growing stock is shown by the following comparative figures:

VOLUME OF STAND.		
Date	Saw Timber	Firewood
1909	10,500,000 bd. ft.	(Not estimated)
1919	11,500,000 bd. ft.	14,500 cds.
ANNUAL INCREMENT.		
Date	Saw Timber	Firewood
1909	250,000 bd. ft.	(Not computed)
1919	380,000 bd. ft.	511 cds.

This table shows that in the first ten years of operation the total standing timber (not considering cordwood) has in-

creased by 1,000,000 board feet, and the increment (or return on this amount of forest capital) has been augmented by 130,000 board feet. The increase in the volume of saw timber is mainly due to a considerable tract of young woods having reached merchantable size which were not included in the first estimate; while the improvement in increment is mostly accounted for by absolute enlargement of forested area.

Financially, the Forest has been self-supporting. A loan of \$4,000 for initial operating expenses has been repaid, equipment, including horses, motor trucks, machinery, tools, etc., has been bought and maintained, and the upkeep of the dormitory and headquarters building has been met. A small surplus also has recently been available for experimental work and permanent improvements in the Forest. A great many expenses have to be provided for that are not properly chargeable to the woods operations; if these are deducted, the average net income would be from \$2,000 to \$3,000 a year.

As regards contributions to the knowledge of forestry, the Harvard Forest is beginning

clearly to show the fruits of that continuity of experience which is essential to sound conclusions. Aside from a number of investigations of special problems, the results of many of which have already been published, the chief aim has been to find out by actual test the most effective and practical means of renewing a forest crop. Until such a method is defined and proved, for each region of similar forest conditions, the adoption of forestry by private owners cannot be looked for. Ten years of experimental work in Petersham have produced a scheme of cuttings that is successful and reasonable in cost; and the Federal Forest Service, now making a special effort to stimulate forestry among timberland owners, has asked for a statement of methods and results in use on the Harvard Forest. This material will shortly be published under the title "The Management of Second Growth White Pine in Central New England". An appendix at the end of this report contains the titles of all publications made by students or instructors in forestry since 1906.

Investigative work now being conducted by students at the Forest relates to the



In 1861 a Pasture; Now a Pine Forest Sixty Years Old.



A Pond in the Harvard Forest.



Swift River.

following problems: The yield of second growth hardwood timber; the results of forest planting in New England; the life history of a destructive snout beetle, *Hyllobius pales*. A fourth student is specializing in city forestry, and two more from the Business School are to study the operation of portable mills. In all of these studies much of the material hitherto unused has accumulated incidentally to the recorded operations on the Forest.

The progress of former students in their professional work has shown not only the value of an organized forest as a training ground, but also the added importance of the research which has now replaced the general course. The distribution of employment among the graduates indicates the result of the special emphasis which has been placed upon the use of the Forest as a laboratory. Nearly half of these graduates are in the service of lumber companies or in consulting work; the rest are employed by the United States Forest Service, State Departments, Forest Schools, and City Governments. Of the Harvard foresters who enlisted for service in the Forestry regiments in France, nearly all were detailed to the important Department of Acquisition, which located the logging operations in advance for the saw mills. Those men who have taken the specialized work of the last three years have all obtained notably better paid and more responsible positions at the start than did the graduates under the old plan. At the beginning of 1918, men who got their training at Petersham were collectively in charge of approximately five million acres of lumber land in the United States.

During the summer of 1919 an important piece of protective work was carried out on the Forest. In view of the possible spread of the White Pine Blister Rust, the Federal Government, the State Department of Agriculture, and the Harvard Forest coöperated to eradicate from the woods all currant and gooseberry plants which are the alternate hosts of the disease. A fund of \$2,000 was appropriated for the

work, \$1,000 from the Government, \$500 from the State, and \$500 from a donation on behalf of the Harvard Forest. The field work was in charge of C. C. Perry, M.F., 1914. At the close of the season the eradication had been completed over the whole of the Harvard land, which is thus reasonably insured against extensive infection.

A list of the publications of the teachers and students, past or present, connected with the Harvard Forest, is here given:

The Year in the Forestry Department—R. T. Fisher, *Harvard Graduates' Magazine*, Vol. 14, page 607, 1906.

Manual for Northern Woodsmen—Austin Cary, Harvard University Press, 1909, Revised Edition, 1918.

The Structure of the Wood in the Pineae—I. W. Bailey, *Botanical Gazette*, Vol. 48, pages 47-55, July, 1909.

Methods of Instruction in the Forest School—R. T. Fisher, *Forestry Quarterly*, Vol. 8, no. 1, March, 1910.

Notes on the Wood Structure of the Betulaceae and Fagaceae—I. W. Bailey, *Forestry Quarterly*, Vol. 8, no. 2, 1910.

Anatomical Characters in the Evolution of Pinus—I. W. Bailey, *American Naturalist*, 1910.

Oxidizing Enzymes and Their Relations to Sap Stain in Lumber—I. W. Bailey, *Botanical Gazette*, Vol. 50, no. 2, pages 142-147, August, 1910.

Reversionary Characters of Traumatic Oak Woods—I. W. Bailey, *Botanical Gazette*, Vol. 50, no. 5, pages 374-380, November, 1910.

An Account of Operations in the Harvard Forest, '08-09—R. T. Fisher, *Bulletin of the Harvard Forestry Club*, Vol. 1, 1911.

Trees and Other Woody Plants Found in the Harvard Forest—John G. Jack, *Bulletin of the Harvard Forestry Club*, Vol. 1, 1911.

Relation of Leaf-trace to Compound Rays in the Lower Dicotyledons—I. W. Bailey, *Annals of Botany*, Vol. XXV, no. 97, January, 1911.

Cretaceous Pityoxylon with Marginal Tracheides—I. W. Bailey, *Annals of Botany*, Vol. XXV, no. 98, April, 1911.

The Evolutionary History of the Foliar Ray—I. W. Bailey, *Annals of Botany*, Vol. XXVI, no. 103, July, 1912.

Forestry—R. T. Fisher, *Harvard Graduates' Magazine*, Vol. 21, page 680, 1912.

Trees in the Harvard Yard—R. T. Fisher, *Harvard Graduates' Magazine*, Vol. 22, page 725, 1913.

A Volume Table for Red Maple on the Harvard Forest—E. E. Carter, *Bulletin of the Harvard Forestry Club*, Vol. 2, 1913.

Notes on the Chestnut Bark Disease (*Diaporthe*



Wood Stacked After Improvement Cutting.

paracitica, Murrill) in Petersham, Massachusetts—J. Kittredge, Jr., *Bulletin of the Harvard Forestry Club*, Vol. 2, 1913.

The Preservative Treatment of Wood: I. The Validity of Certain Theories Concerning the Penetration of Gasses and Preservatives into Seasoned Wood. II. The Structure of the Pit Membranes in the Tracheids of Conifers and Their Relation to the Penetration of Gasses, Liquids, and Finely Divided Solids into Green and Seasoned Wood.—I. W. Bailey, *Forestry Quarterly*, Vol. II, March, 1913.

Influence of Shade and Other Factors on Plantations—George W. Kimball and E. E. Carter, *Forestry Quarterly*, Vol. II, June, 1913.

Investigations on the Phylogeny of the Angiosperms: 2. Anatomical Evidence of Reduction

in Certain of the Amentiferae, *Botanical Gazette*, Vol. LVIII, no. 1, July, 1914. 3. Nodal Anatomy and the Morphology of Stipules, *American Journal of Botany*, Vol. 1, 441-453, November, 1914. 4. The Origin and Dispersal of Herbacious Angiosperms, *Annals of Botany*, Vol. XXVIII, no. 112, October, 1914. 5. Foliar Evidence as to the Ancestry and Early Climatic Environment of the Angiosperms. (The above series by I. W. Bailey and Edmund W. Sinnott).

Graded Volume Tables for Vermont Hardwoods—I. W. Bailey and P. C. Heald, *Forestry Quarterly*, Vol. 12, no. 1, March, 1914.

Some Observations on the Variation in Length of Coniferous Fibers—H. B. Shepard and I. W. Bailey, *Proceedings of the Society of American Foresters*, Vol. 9, no. 4, 1914.

The Effect of the Structure of Wood upon Its Permeability. 1. The Tracheids of Coniferous Timber—I. W. Bailey, American R. R. Engineers Association, February, 1915.

The Evolution of Herbaceous Plants and Its Bearing on Certain Problems of Geology and Climatology—Edward W. Sinnott and I. W. Bailey, *Journal of Geology*, Vol. XXIII, no. 4, May-June, 1915.

A Botanical Index of Cretaceous and Tertiary Climates—I. W. Bailey and Edward W. Sinnott, *Science*, N. S. No. 1066, pages 831-834, June 4, 1915.

Sanio's Laws for the Variation in Size of Coniferous Tracheids—I. W. Bailey and H. B. Shepard, *Botanical Gazette*, Vol. 60, no. 1, July, 1915.

The Climatic Distribution of Certain Types of Angiosperm Leaves—I. W. Bailey and E. W. Sinnott, *American Journal of Botany*, Vol. 3, pages 24-39, January, 1916.

Some Unwritten Records of the Harvard Forest—R. T. Fisher, *Harvard Graduates' Magazine*, Vol. 25, page 191, 1916.

Hyllobius Pales as a Factor in the Reproduction of Conifers in New England—E. E. Carter, *Proceedings of the Society of American Foresters*, Vol. 11, no. 3, 1916.

Utilization and Round-edged Lumber—R. T. Fisher, *Proceedings of the Society of American Foresters*, Vol. 11, no. 4, October, 1916.

The Rôle of the Microscope in the Identification and Classification of the "Timbers of Commerce"—I. W. Bailey, *Journal of Forestry*, Vol. XV, no. 2, February, 1917.

Are Tetracentron, Trochodendron, and Drimys Specialized or Primitive Types?—W. P. Thompson and I. W. Bailey, *Memoirs of the N. Y. Botanical Garden* 6: 27-32, August, 1916.

The Structure of the Border Pits of the Conifers and Its Bearing upon the Tension Hypothesis of the Ascent of Sap in Plants—I. W. Bailey, *Botanical Gazette*, Vol. 62, no. 2, August, 1916.

The Significance of Certain Variations in the Anatomical Structure of Wood—R. P. Prichard and I. W. Bailey, *Forestry Quarterly*, Vol. 14, December, 1916.

The Yield of Volunteer Second Growth, as Affected by Improvement Cutting and Early Weeding—R. T. Fisher, *Journal of Forestry*, Vol. 16, May, 1918.

Size Variation in Tracheary Cells: 1. A Comparison Between the Secondary Xylems of the Vascular Cryptogams, Gymnosperms and Angiosperms—I. W. Bailey and W. W. Tupper, *Proceedings of the American Academy of Arts and Sciences*, Vol. 54, no. 3, 1918.

Additional Notes upon the Angiosperms Tetracentron, Trochodendron, and Drimys, in Which Vessels are Absent from the Wood—W. P. Thompson and I. W. Bailey, *Annals of Botany*, Vol. LXVII, no. 128, October, 1918.

Depressed Segments of Oak Stems—I. W. Bailey, *Botanical Gazette*, Vol. 67, no. 5, May, 1919.

Structure, Development, and Distribution of the So-called Rims or Bars of Sanio—I. W. Bailey, *Botanical Gazette*, Vol. 67, no. 6, June, 1919.

Phenomena of Cell Division in the Cambium of Arborescent Gymnosperms and Their Cytological Significance—I. W. Bailey, *Proceedings of the National Academy of Science*, Vol. 5, July, 1919.

The Use of Yield Tables in Predicting Growth—E. E. Carter, *Proceedings of the Society of American Foresters*, Vol. 9, 1914.

Notes on the Relation of Planting Methods to Survival—E. E. Carter, *Proceedings of the Society of American Foresters*, Vol. 10, 1915.

IN PREPARATION OR IN PRESS.

Management of Second Growth White Pine in Central New England—R. T. Fisher and E. I. Terry, to appear in the *Journal of Forestry*.

The Significance of the Cambium in the Study of Certain Physiological Problems—I. W. Bailey, to appear in the *Journal of General Physiology*.

The Formation of the Cell Plates in the Cambium of the Higher Plants—I. W. Bailey, to appear in the *Proceedings of the National Academy of Science*.

The Anatomy of the Myrmecoxenic Plants from the Belgian Congo, with Special Reference to Myrmecophytism—I. W. Bailey, to appear in the *Bulletin of the American Museum of Natural History*.

Some Relations Between Ants and Fungi—I. W. Bailey, to appear in the *Journal of Phytopathology*.

Studies on the Life History and Control of Hyllobius Pales—Henry B. Peirson.

Growth Study and Yield Tables for Second Growth Hardwoods in Central New England—J. Nelson Spaeth.

Forest Plantation in Massachusetts—Arthur Herbert Richardson.

Volume Table for Second Growth Chestnut.

Mill Tally Scale Rules for White Pine, Chestnut and Mixed Hardwoods.

Fundamental Factors in Determining the Mechanical Properties of Woods for Use in Airplanes. Prepared for the Bureau of Aircraft Production.

Specifications for Spruce Lumber Used in Aircraft Production. (Prepared as above.)

ELECTED TO THE NATIONAL ACADEMY

William Duane, Professor of Bio-Physics, E. P. Kohler, Abbott and James Lawrence Professor of Chemistry, and G. W. Pierce, Professor of Physics, were elected to membership in the National Academy of Sciences at the recent annual meeting of the Society in Washington.