

MAINE STATE LEGISLATURE

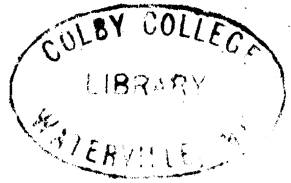
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PUBLIC DOCUMENTS OF MAINE

1911



BEING THE

ANNUAL REPORTS

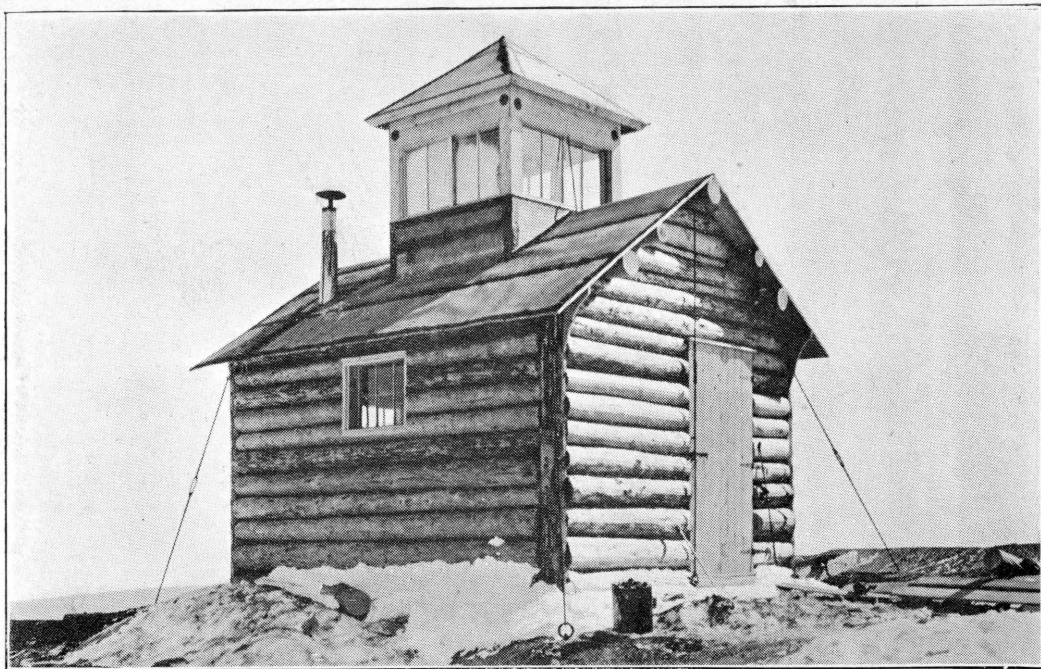
OF THE VARIOUS

DEPARTMENTS AND INSTITUTIONS

For the Year 1910.

VOLUME II.

AUGUSTA
KENNEBEC JOURNAL PRINT
1911



LOOKOUT STATION LOCATED ON BALD MT. SOMERSET COUNTY

EIGHTH REPORT

OF THE

FOREST COMMISSIONER

OF THE

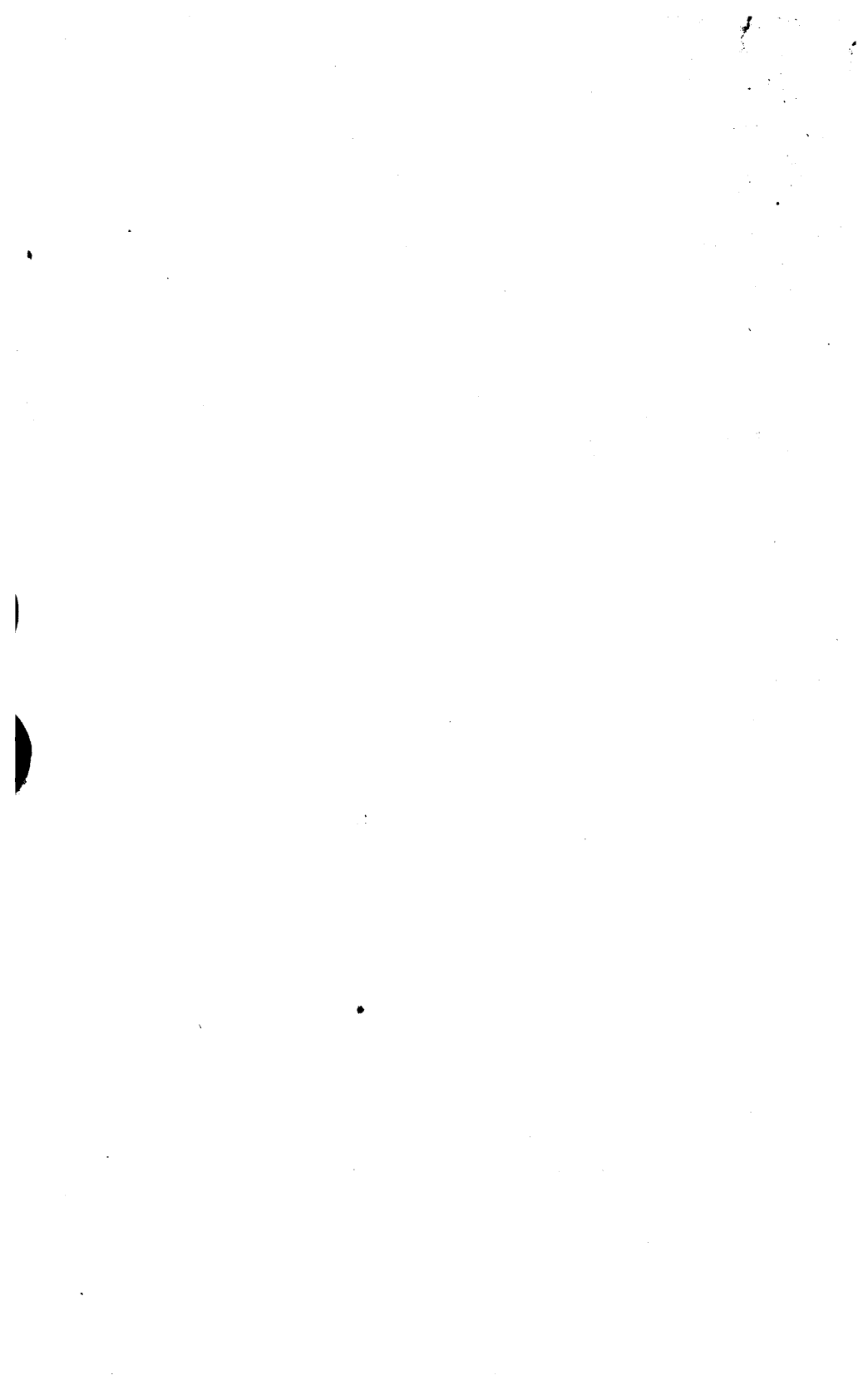
STATE OF MAINE

1910

AUGUSTA

KENNEBEC JOURNAL PRINT

1910



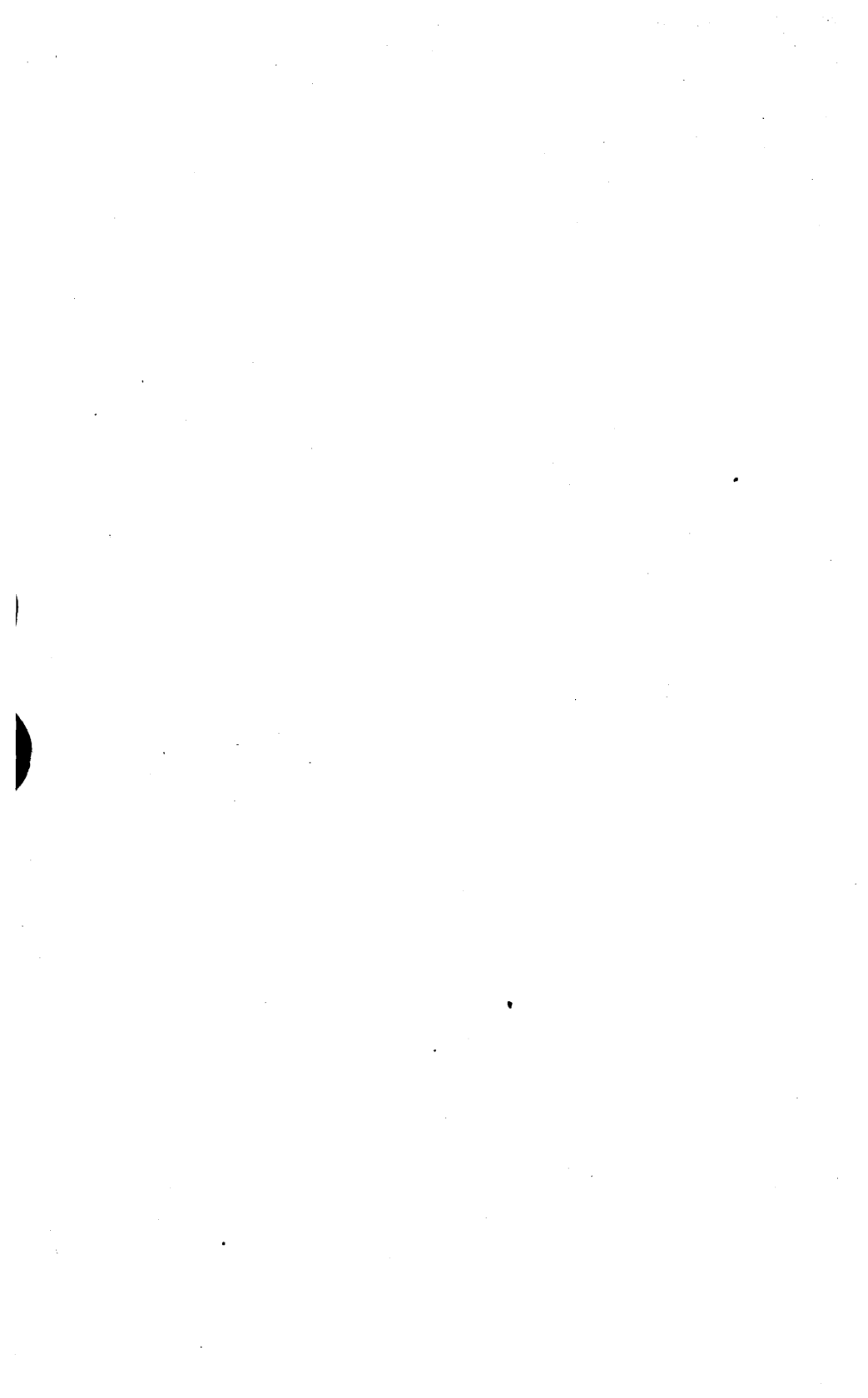
STATE OF MAINE.

To His Excellency, Bert M. Fernald, Governor of Maine:

I herewith submit my fifth report as Forest Commissioner for the years 1909 and 1910.

EDGAR E. RING,

Forest Commissioner.



REPORT OF THE FOREST COMMISSIONER.

It becomes my duty and privilege to prepare for those of this state interested in forestry matters my fifth biennial report. Since issuing the last report of this department no backward steps have been taken by Maine in dealing with its forestry problems and the state certainly ranks far in the lead in many matters pertaining to the preservation and care of its forests, one of its greatest resources.

In my report for the years 1907-08 I recommended that the system of fire protection so admirably started be continued, but for effective service and proper patrol of our waterways and thoroughfares, leading through our vast forests, there would be required at least \$50,000.

The suggestion was accepted by the principal land owners throughout the state, and right here I will say that it is only through the hearty cooperation of the timberland owners that the measure of success of the new fire law has been made possible.

Many discussions were entered into as how best bring about the desired result. It was admitted that it would be unjust to the other interests of the state to ask for an increased appropriation bearing directly upon all properties.

To overcome any charges of unfairness or disposition to put the burden otherwise than where it belonged and yet obtain the measure of protection that all felt was necessary, it was decided that the land owners should accept the whole burden of protection from forest fires.

To legally accomplish what had been decided upon was the next move, and consultations held between the land owners, their legal representatives and members of the Legislature, coupled with an agreement with the members of the committee on taxation, acting unanimously, there was enacted and incorporated the Maine Forestry District.

It includes all of the townships and plantations taxed wholly

as "wild land" and comprises a territory located in eight of the sixteen counties of the state, viz., Aroostook, Franklin, Hancock, Oxford, Penobscot, Piscataquis, Somerset and Washington, about 9,500,000 acres.

Assuming the entire cost of the carrying out the provisions of the act, thereby relieving the other taxable interests of the state of an appropriation of \$20,000 annually, the land owners decided to have included in the act a section fixing the annual tax rate of one and one-half mills on the dollar. The tax based upon the valuation as fixed by the board of assessors yielded annually for the years 1909-10 the sum of \$63,945.44.

That the new departure has been successful and all that was expected of it is borne out in the work accomplished and general satisfaction given, more of which will be told in detail in a chapter to follow.

As a further protection to our forests I recommended in 1908 the passage of a law authorizing the governor to issue a proclamation to prohibit hunters from entering the woods of the state during an extremely dry period. Such an act was passed by the Legislature of 1909, but fortunately the past two hunting seasons have been so free from long dry and dangerous periods that there has been no occasion to invoke the new law. This law works no hardship to the thousands of hunters and summer guests whom we invite to our state, and only in the interest of protection to our forests will it ever be enforced. Even the hunter or summer visitor will agree that it is a just law and will work a benefit to all whenever it becomes necessary to enforce its provisions.

It has been the aim of this department not only to publish such facts and figures as shall be of interest, but we have endeavored in each report to include one or more subjects of educational value to the young and those who are seeking knowledge of our forestry resources. Systematically we have taken up the several topics as space and time would allow.

The division of the state by its water systems has been extensively dealt with in former reports. Studies of the spruce and pine have been given and it is with much pleasure that this year through the courtesy of the United States Forest Service we are able to present studies of the white birch, probably the most valuable of our hard woods.

Along the educational line during the past two years this department has with the cooperation of the State Educational Department got out and distributed through the schools of the state two valuable pamphlets, the "Forest Trees of Maine" and "Selecting and Planting Trees."

For the "Forest Trees of Maine" there has been a large and constant demand which will very soon exhaust the edition. Possibly in order to meet the demands for this pamphlet it will be considered wise and money well spent to issue another edition, as it is being used more and more as a text book in the classes of botany and tree study in the common and high schools, as well as the academies of the state.

LAW CREATING MAINE FORESTRY DISTRICT.

The following law creating the Maine Forestry District was passed by the Legislature of 1909:

Section 1. An administrative district shall be and is hereby established and incorporated, to be known as the Maine Forestry District, and to include the following territory:

Township A, R. 2, W. E. L. S.; Hammond Plantation; C, R. 2, W. E. L. S.; D, R. 2, W. E. L. S.; E. Plantation; 3, R. 2, W. E. L. S.; Cox Patent; Glenwood Plantation; 3, R. 3, W. E. L. S.; 4, R. 3, W. E. L. S.; 7, R. 3, W. E. L. S.; 8, R. 3, W. E. L. S.; 9, R. 3, W. E. L. S.; 10, R. 3, W. E. L. S.; Stockholm Plantation; 17, R. 3, W. E. L. S.; 1, R. 4, W. E. L. S.; 2, R. 4, W. E. L. S.; 3, R. 4, W. E. L. S.; 7, R. 4, W. E. L. S.; 8, R. 4, W. E. L. S.; 9, R. 4, W. E. L. S.; 10, R. 4, W. E. L. S.; 11, R. 4, W. E. L. S.; Westmanland Plantation; 16, R. 4, W. E. L. S.; 17, R. 4, W. E. L. S.; A, R. 5, W. E. L. S.; 1, R. 5, W. E. L. S.; 7, R. 5, W. E. L. S.; 8, R. 5, W. E. L. S.; 9, R. 5, W. E. L. S.; 13, R. 5, W. E. L. S.; 14, R. 5, W. E. L. S.; 15, R. 5, W. E. L. S.; 16, R. 5, W. E. L. S.; 17, R. 5, W. E. L. S.; Oxbow Plantation; 10, R. 6, W. E. L. S.; Garfield Plantation; Nashville Plantation; 14, R. 6, W. E. L. S.; 15, R. 6, W. E. L. S.; 16, R. 6, W. E. L. S.; 9, R. 7, W. E. L. S.; 10, R. 7, W. E. L. S.; 11, R. 7, W. E. L. S.; 12, R. 7, W. E. L. S.; 13, R. 7, W. E. L. S.; 14, R. 7, W. E. L. S.; Winterville Plantation; 9, R. 8, W. E. L. S.; 10, R. 8, W. E. L. S.; 11, R. 8, W. E. L. S.; 12, R. 8, W. E. L. S.; 13, R. 8, W. E. L. S.; 14, R. 8, W. E. L. S.; 15, R. 8, W. E. L. S.; 16, R. 8, W. E. L. S.; 11, R. 9, W. E. L. S.; 12, R. 9, W. E. L. S.; 13, R. 9, W. E. L. S.; 14, R. 9, W. E. L. S.; 15, R. 9, W. E. L. S.; 16, R. 9, W. E. L. S.; 11, R. 10, W. E. L. S.; 12, R. 10, W. E. L. S.; 13, R. 10, W. E. L. S.; 14, R. 10, W. E. L. S.; 15, R. 10, W. E. L. S.; Allagash Plantation; 18, R. 10, W. E. L. S.; 11, R. 11, W. E. L. S.; 12, R. 11, W. E. L. S.; 13, R. 11, W. E. L. S.; 14, R. 11, W. E. L. S.; 15, R. 11, W. E. L. S.; 18, R. 11, W. E. L. S.; 19, R. 11, W. E. L. S.; 11, R. 12, W. E. L. S.; 12, R. 12, W. E. L. S.; 13, R. 12, W. E. L. S.; 14, R. 12, W. E. L. S.; 15, R. 12, W. E. L. S.; 16, R. 12, W. E. L. S.; 17, R. 12, W. E. L. S.; 18, R. 12, W. E. L. S.; 19, R. 12, W. E. L. S.; 20, R. 11 & 12, W. E. L. S.; 11, R. 13, W. E. L. S.; 12, R. 13, W. E. L. S.; 13, R. 13, W. E. L. S.; 14, R. 13, W. E. L. S.; 15, R. 13, W. E. L. S.; 16, R. 13, W. E. L. S.; 17, R. 13, W. E. L. S.; 18, R. 13, W. E. L. S.; 11, R. 14, W. E. L. S.; 12, R. 14, W. E. L. S.; 13, R. 14, W. E. L. S.; 14, R. 14, W. E. L. S.

E. L. S.; 15, R. 14, W. E. L. S.; 16, R. 14, W. E. L. S.; 17, R. 14, W. E. L. S.; 11, R. 15, W. E. L. S.; 12, R. 15, W. E. L. S.; 13, R. 15, W. E. L. S.; 14, R. 15, W. E. L. S.; 15, R. 15, W. E. L. S.; 11, R. 16, W. E. L. S.; 12, R. 16, W. E. L. S.; 13, R. 16, W. E. L. S.; 14, R. 16, W. E. L. S.; 11, R. 17, W. E. L. S.; 12, R. 17, W. E. L. S.; in Aroostook County.

Township No. 4, Washington Plantation; Sandy River Plantation; Rangeley Plantation; 4, R. 1, B. K. P., W. K. R.; 4, R. 2, B. K. P., W. K. R.; 4, R. 3, B. K. P., W. K. R.; D. R. 1; 1, R. 2, W. B. K. P.; Dallas Plantation; Coplin Plantation; Lang Plantation; 3, R. 3, W. B. K. P.; 3, R. 2, B. K. P., W. K. R.; 2, R. 4, W. B. K. P.; 3, R. 4, W. B. K. P.; 1, R. 5, W. B. K. P.; 2, R. 5, W. B. K. P.; 3, R. 5, W. B. K. P.; 1, R. 6, W. B. K. P.; 2, R. 6, W. B. K. P.; 3, R. 6, W. B. K. P.; 1, R. 7, W. B. K. P.; 2, R. 7, W. B. K. P.; 1, R. 8, W. B. K. P.; 2, R. 8, W. B. K. P.; Gore North of T. No. 2 and 3, R. 6, W. B. K. P.; No. 6 North of Weld; Gore North of T. 1, R. 8, W. B. K. P.; Township E; Perkins; in Franklin County.

Township No. 3, North Division; No. 4, North Division; Two Mile Strip North of No. 3, North Division; Strip North of No. 4, North Division; No. 7, South Division; No. 8 Plantation; No. 9, South Division; No. 10, South Division; No. 16, Middle Division; No. 21 Plantation; No. 22, Middle Division; No. 28, Middle Division; No. 32, Middle Division; No. 33 Plantation; No. 34, Middle Division; No. 35, Middle Division; No. 39, Middle Division; No. 40, Middle Division; No. 41, Middle Division; Butter Island; Eagle Island; Spruce Head Island; Bear Island; Beach Island; Hog Island; Bradbury's Island; Pond Island; Western Island; Little Spruce Island; Marshall's Island; Pickering's Island; in Hancock County.

Fryeburg Academy Grant; T. A. No. 1; Andover North Surplus; Andover West Surplus; T. C; C Surplus; 4, R. 1, W. B. K. P.; Magalloway Plantation; 4, R. 2, W. B. K. P.; Lincoln Plantation; 4, R. 3, W. B. K. P.; 5, R. 3, W. B. K. P.; 4, R. 4, W. B. K. P.; 5, R. 4, W. B. K. P.; 4, R. 5, W. B. K. P.; 4, R. 6, W. B. K. P.; 5, R. 5, W. B. K. P.; Batchelder's Grant; in Oxford County.

Township 3, R. 1, N. B. P. P.; Lakeville Plantation; 5, R. 1, N. B. P. P.; Webster Plantation; Drew Plantation; 1, R. 7, N. W. P.; 2, R. 8, N. W. P.; Seboeis Plantation; 2, R. 9, N. W. P.; 3, R. 9, N. W. P.; 1, R. 6, W. E. L. S.; 2, R. 6, W. E. L. S.; Stacyville Plantation; 6, R. 6, W. E. L. S.; 7, R. 6, W. E. L. S.; 8, R. 6, W. E. L. S.; A. R. 7, W. E. L. S.; 1, R. 7, W. E. L. S.; 2, R. 7, W. E. L. S.; 3, R. 7, W. E. L. S.; 4, R. 7, W. E. L. S.; 5, R. 7, W. E. L. S.; 6, R. 7, W. E. L. S.; 7, R. 7, W. E. L. S.; 8, R. 7, W. E. L. S.; Hopkins Academy Grant; 8, R. 8, W. E. L. S.; A. R. 8 & 9, W. E. L. S.; Veazie Gore; No. 3, Indian Purchase; No. 4, Indian Purchase; 1, R. 8, W. E. L. S.; 2, R. 8, W. E. L. S.; 3, R. 8, W. E. L. S.; 4, R. 8, W. E. L. S.; 5, R. 8, W. E. L. S.; 6, R. 8, W. E. L. S.; 7, R. 8, W. E. L. S.; No. 1, North Division; Grand Falls Plantation; in Penobscot County.

Lakeview Plantation; Barnard Plantation; 4, R. 9, N. W. P.; 5,

R. 9, N. W. P.; 6, R. 9, N. W. P.; 7, R. 9, N. W. P.; Elliottsville Plantation; 3, R. 5, B. K. P.; E. K. R.; 2, R. 6, B. K. P., E. K. R.; 1, R. 9, W. E. L. S.; 2, R. 9, W. E. L. S.; 3, R. 9, W. E. L. S.; 4, R. 9, W. E. L. S.; 5, R. 9, W. E. L. S.; 6, R. 9, W. E. L. S.; 7, R. 9, W. E. L. S.; 8, R. 9, W. E. L. S.; 9, R. 9, W. E. L. S.; 10, R. 9, W. E. L. S.; A, R. 10, W. E. L. S.; B, R. 10, W. E. L. S.; 1, R. 10, W. E. L. S.; 2, R. 10, W. E. L. S.; 3, R. 10, W. E. L. S.; 4, R. 10, W. E. L. S.; 5, R. 10, W. E. L. S.; 6, 10, W. E. L. S.; 7, R. 10, W. E. L. S.; 8, R. 10, W. E. L. S.; 9, R. 10, W. E. L. S.; 10, R. 10, W. E. L. S.; A, R. 11, W. E. L. S.; B, R. 11, W. E. L. S.; 1, R. 11, W. E. L. S.; 2, R. 11, W. E. L. S.; 3, R. 11, W. E. L. S.; 4, R. 11, W. E. L. S.; 5, R. 11, W. E. L. S.; 6, R. 11, W. E. L. S.; 7, R. 11, W. E. L. S.; 8, R. 11, W. E. L. S.; 9, R. 11, W. E. L. S.; 10, R. 11, W. E. L. S.; 7, R. 10, N. W. P.; 8, R. 10, N. W. P.; A, R. 12, W. E. L. S.; 1, R. 12, W. E. L. S.; 2, R. 12, W. E. L. S.; 3, R. 12, W. E. L. S.; 4, R. 12, W. E. L. S.; 5, R. 12, W. E. L. S.; 6, R. 12, W. E. L. S.; 7, R. 12, W. E. L. S.; 8, R. 12, W. E. L. S.; 9, R. 12, W. E. L. S.; 10, R. 12, W. E. L. S.; A, R. 13, W. E. L. S.; A 2, R. 13 & 14, W. E. L. S.; 1, R. 13, W. E. L. S.; 2, R. 13, W. E. L. S.; 3, R. 13, W. E. L. S.; 4, R. 13, W. E. L. S.; 5, R. 13, W. E. L. S.; 6, R. 13, W. E. L. S.; 7, R. 13, W. E. L. S.; 8, R. 13, W. E. L. S.; 9, R. 13, W. E. L. S.; 10, R. 13, W. E. L. S.; A, R. 14, W. E. L. S.; X, R. 14, W. E. L. S.; 3, R. 14 & 15, W. E. L. S.; 4, R. 14, W. E. L. S.; 5, R. 14, W. E. L. S.; 6, R. 14, W. E. L. S.; 7, R. 14, W. E. L. S.; 8, R. 14, W. E. L. S.; 9, R. 14, W. E. L. S.; 10, R. 14, W. E. L. S.; Sugar Island; Deer Island; Middlesex Canal; Day's Academy; 4, R. 15, W. E. L. S.; 5, R. 15, W. E. L. S.; 6, R. 15, W. E. L. S.; 7, R. 15, W. E. L. S.; 8, R. 15, W. E. L. S.; 9, R. 15, W. E. L. S.; 10, R. 15, W. E. L. S.; Moose Island; Kineo; Farm Island; Kingsbury Plantation; in Piscataquis County.

Lexington Plantation; Pleasant Ridge Plantation; Highland Plantation; 1, R. 3, B. K. P., W. K. R.; 2, R. 3, B. K. P., W. K. R.; Dead River Plantation; Bigelow Plantation; 1, R. 4, B. K. P., W. K. R.; 2, R. 4, B. K. P., W. K. R.; 3, R. 4, B. K. P., W. K. R.; Flagstaff Plantation; West Forks Plantation; 2, R. 5, B. K. P., W. K. R.; 3, R. 5, B. K. P., W. K. R.; 4, R. 5, B. K. P., W. K. R.; 1, R. 6, B. K. P., W. K. R.; 2, R. 6, B. K. P., W. K. R.; 3, R. 6, B. K. P., W. K. R.; 4, R. 6, B. K. P., W. K. R.; 5, R. 6, B. K. P., W. K. R.; 1, R. 7, B. K. P., W. K. R.; 2, R. 7, B. K. P., W. K. R.; 3, R. 7, B. K. P., W. K. R.; 4, R. 7, B. K. P., W. K. R.; 5, R. 7, B. K. P., W. K. R.; 6, R. 7, B. K. P., W. K. R.; Gore North of Nos. 1, 2 & 3, R. 7, B. K. P., W. K. R.; Mayfield Plantation; 2, R. 3, B. K. P., E. K. R.; The Forks Plantation; 2, R. 4, B. K. P., E. K. R.; 1, R. 5, B. K. P., E. K. R.; 2, R. 5, B. K. P., E. K. R.; 1, R. 6, B. K. P., E. K. R.; 1, R. 1, N. B. K. P.; 2, R. 1, N. B. K. P.; 3, R. 1, N. B. K. P.; Jackman Plantation; 5, R. 1, N. B. K. P.; 6, R. 1, N. B. K. P.; 1, R. 2, N. B. K. P.; 2, R. 2, N. B. K. P.; 3, R. 2, N. B. K. P.; Moose River Plantation; Dennistown Plantation; 6, R. 2, N. B. K. P.;

Big W, N. B. K. P.; Little W, N. B. K. P.; 1, R. 3, N. B. K. P.; 2, R. 3, N. B. K. P.; 3, R. 3, N. B. K. P.; 4, R. 3, N. B. K. P.; 5, R. 3, N. B. K. P.; Seboomook; 1, R. 4, N. B. K. P.; 2, R. 4, N. B. K. P.; 3, R. 4, N. B. K. P.; 4, R. 4, N. B. K. P.; 5, R. 4, N. B. K. P.; 3, R. 5, N. B. K. P.; 4, R. 5, N. B. K. P.; 4, R. 16, W. E. L. S.; 5, R. 16, W. E. L. S.; 6, R. 16, W. E. L. S.; 7, R. 16, W. E. L. S.; 8, R. 16, W. E. L. S.; 9, R. 16, W. E. L. S.; 10, R. 16, W. E. L. S.; 4, R. 17, W. E. L. S.; 5, R. 17, W. E. L. S.; 6, R. 17, W. E. L. S.; 7, R. 17, W. E. L. S.; 8, R. 17, W. E. L. S.; 9, R. 17, W. E. L. S.; 10, R. 17, W. E. L. S.; 4, R. 18, W. E. L. S.; 5, R. 18, W. E. L. S.; 6, R. 18, W. E. L. S.; 7, R. 18, W. E. L. S.; 8, R. 18, W. E. L. S.; 9, R. 18, W. E. L. S.; 5, R. 19, W. E. L. S.; 6, R. 19, W. E. L. S.; 7, R. 19, W. E. L. S.; 8, R. 19, W. E. L. S.; 5, R. 20, W. E. L. S.; in Somerset County.

Township No. 18, East Division; No. 19, East Division; No. 26, East Division; No. 27, East Division; No. 18 Middle Division; No. 19, Middle Division; No. 24, Middle Division; No. 25, Middle Division; No. 29, Middle Division; No. 30, Middle Division; No. 31, Middle Division; No. 36, Middle Division; No. 37, Middle Division; No. 42 Middle Division; No. 43, Middle Division; No. 5, North Division; Strip North of No. 5, North Division; No. 6, North Division; Strip North of No. 6, North Division; No. 1, R. 1, Titcomb's Survey; Grand Lake Stream Plantation; 1, R. 2, Titcomb's Survey; 1, R. 3, Titcomb's Survey; 6, R. 1, N. B. P.; 7, R. 2, N. B. P. P.; 8, R. 3, N. B. P. P.; 10, R. 3, N. B. P. P.; 11, R. 3, N. B. P. P.; 8, R. 4, N. B. P. P.; Indian Township; Codyville Plantation; No. 14 Plantation; No. 21 Plantation; in Washington County.

Sect. 2. An annual tax is hereby assessed upon all the property in said district, including rights in public lots, to be used for the protection thereof. Said tax shall be due and payable at the date of the assessment of the State tax, in the years when the legislature is in session, and for other years it shall be due and payable in one year after the date of such assessment.

The rate of such tax is hereby fixed at one and one-half mills on the dollar. The valuation as determined by the board of State assessors, and set forth in the statement filed by them as provided by the Revised Statutes, chapter eight, section eleven, as amended, shall be the basis for the computation and apportionment of the tax hereby assessed until the next biennial equalization.

The tax hereby assessed shall be valid, and all remedies herein provided shall be in full force if said property is described with reasonable accuracy, whether the ownership thereof is correctly stated or not.

Sect. 3. The board of State assessors shall within thirty days after such tax is due, prepare and file with the treasurer of the State, a certificate setting forth the description of each lot, parcel or right subject to the tax hereby assessed, together with the tax computed at the rates hereby established.

Sect. 4. The treasurer of the State shall cause lists of the assess-

ments made hereby to be advertised for three weeks successively in the State paper, and in some newspapers, if any, in the county where the land lies, within three months after such tax is due. Such advertisement may be consolidated with the advertisement required by Revised Statutes Chapter 9, Section 42, as amended.

The said land shall be held to the State for the payment of the tax hereby assessed, with interest at twenty per cent. per annum, to commence six months after such tax is due as herein provided.

Sect. 5. Owners of lands so assessed and advertised may redeem them by paying to the treasurer of the State the tax with interest thereon, within one year from the time when such interest commences. Each owner may pay for his interest in any tract, whether in common or not, and upon filing with the State treasurer a certificate showing the number of acres, and describing the property on which he desires to pay the tax, and where the same is located, and paying the amount due, shall receive a certificate from the treasurer of the State, discharging the tax on the number of acres or interest upon which such payment is made.

Each part or interest of every such township or tract upon which the tax hereby imposed so advertised is not paid, with interest, within the time limited in this section for such redemption, shall be wholly forfeited to the State and vest therein free of any claim by any former owner.

Sect. 6. The tax assessed by authority of this act shall be held by the State treasurer as a fund to be used to protect from fire the forests situated upon and within the district hereby created, and to pay expenses incidental thereto and for no other purpose.

The State treasurer shall from such fund pay bills for this purpose and also expenses incurred in assessing, advertising and collecting said tax. Such payment shall be made immediately upon approval by the State forest commissioner and auditing by the State auditor.

Sect. 7. The forest commissioner shall take measures for the prevention, control and extinguishing of forest fires in said forestry districts, and to this end he shall establish such sub-forestry districts as he may deem necessary for effective protection against loss or damage by fire. He shall have authority to establish lookout stations connected by telephone, and to equip and maintain depots for necessary tools for the extinguishment of forest fires.

Sect. 8. The said commissioner shall appoint in and for each of said districts so established, a chief forest fire warden, and he shall also appoint within such districts such number of deputy forest fire wardens as in his judgment may be required to carry out the provisions of this act, assigning to each of the latter the territory over and within which he shall have jurisdiction. All chief and deputy forest fire wardens, so appointed, shall hold the office during the pleasure of said commissioner, be sworn to the faithful discharge of their duties by any officer authorized to administer oaths, and a certificate thereof shall be returned to the office of such commissioner.

Sect. 9. The said chief forest fire wardens, under the direction of said commissioner, shall have general supervision of their respective districts and of the deputy forest fire wardens therein. Each chief forest fire warden, when directed by the said commissioner, shall patrol the forests of his district for the purpose of searching out, extinguishing and guarding against forest fires. He shall investigate and gather evidence regarding the causes of forest fires, enforce all laws relating to forests and forest preservation, arrest all violators thereof, prosecute all offenses against the same, and in this connection shall have the same power to serve criminal processes against such offenders and shall be allowed the same fees as a sheriff, or his deputy, for like services, and shall have and enjoy the same right as a sheriff to require aid in executing the duties of his office. Said chief forest fire wardens shall perform such other duties, at such times, and under such rules and regulations, as the said commissioner may prescribe, and each shall receive as compensation three dollars for each and every day of actual service, with an allowance for expenses of travel and subsistence not to exceed two dollars daily for such period. The said commissioner may authorize the employment of suitable persons to assist said chief forest fire wardens in patrolling their respective districts and every person so employed shall be paid twenty cents for each hour of service so rendered by him and be provided with subsistence during such period. Deputy forest fire wardens shall perform such duties, at such times and under such rules and regulations, as the said commissioner, or the chief fire warden of the district, with the approval of said commissioner, may prescribe, and they shall receive as compensation two dollars and subsistence for each and every day of actual service.

Sect. 10. Whenever a fire occurs on, or is likely to do damage to forest lands within the district of any chief forest fire warden, he shall take immediate action to control and extinguish the same. If such fire occurs upon or is likely to do damage to forest lands within the territory of a deputy forest fire warden and the chief fire warden of the district is not present, then and in such case the deputy forest fire warden having jurisdiction of the territory shall forthwith proceed to control and extinguish the same, and he shall meanwhile, with all consistent dispatch, cause the said chief fire warden of the district to be notified of the occurrence of such fire. Until the arrival of the chief warden at the place of fire the deputy warden shall be in charge of the control and extinguishment of the same. For the purpose of controlling and extinguishing fires as aforesaid chief forest fire wardens, and deputy forest fire wardens when in charge of the control and extinguishment of forest fire or when so directed by the chief wardens, may summon to their assistance citizens of any county, and each person so summoned and assisting shall be paid fifteen cents for each hour of service rendered by him and be provided with subsistence during such service. Immediately after the extinguishment of a fire the deputy forest fire warden who for any time may have

been in charge of the same shall make return to the chief warden of the district of the expense thereof during the period of his being in charge including the names of the persons so summoned and assisting, with their postoffice addresses and the hours of labor actually performed by each under his direction. The return shall be made upon oath and the said chief warden is hereby authorized and empowered to administer such oath. Upon receipt of such return the said chief fire warden shall carefully examine and audit the same and he may direct the deputy to amend and correct any return found to be incomplete, incorrect or insufficient in form. If upon examination and auditing of said return, and investigation of the subject matter thereof said chief fire warden believes said return to be just and correct, he shall endorse his written approval thereon and forward the same so approved to said forest commissioner. The chief fire warden of every district burned by a forest fire shall, upon the extinguishment of such fire, promptly forward an extract and detailed statement of the expense, if any, which said chief fire warden may have incurred in connection with the extinguishment of such fire, to the said forest commissioner, who may confirm, reject or recommit either or both said approved return of said deputy or said detailed statement of said chief fire warden if justice so requires.

Sect. 11. All expenses incurred under the provisions of this act shall be paid from the funds raised and created by the tax hereby assessed.

Sect. 12. For the purpose of the better carrying out of the provisions of this act it is hereby provided that the chief clerk to the land agent shall be a deputy forest commissioner. The said deputy shall hold office during the pleasure of the forest commissioner and perform such duties as the latter may prescribe. For such services the said deputy forest commissioner shall receive annually the sum of five hundred dollars, to be paid from the funds provided under this act, in addition to the salary now provided for the clerk to the land agent. It is also hereby further provided that the forest commissioner shall receive from the funds provided under this act, the sum of five hundred dollars, in addition to the salary as now provided by law.

Sect. 13. So much of the funds raised by the tax hereby imposed and paid into the treasury as may be necessary to pay the claims, accounts and demands arising under the provisions of this act is hereby appropriated to pay the same, and the governor and council are hereby authorized to draw their warrants therefor at any time. Any balance remaining unpaid shall continue from year to year as a fund available for the purpose of this act.

Sect. 14. All acts and parts of acts which are inconsistent with this act are hereby repealed.

Sect. 15. This act shall take effect when approved.

LIST OF WARDENS HOLDING COMMISSIONS.

The following have been appointed either for general warden or patrol service and hold themselves in readiness at any and all times for duty when called upon. In choosing men their fitness as woodsmen and ability for general work has been the only consideration and in most cases we have found the men equal to whatever duty they have been assigned. Many applications come to this department for employment from all sections of the state, and even out of the state. Of course it has been our endeavor to select only the best, giving preference in all cases to Maine men.

The active wardens are:

AROOSTOOK WATERS.

CHIEF WARDENS.

- Geo. B. Dunn (Houlton), Maine Forestry district in Aroostook County.
S. C. Cummings (Haynesville), all of Maine Forestry District in Aroostook County from South line to North boundary of Township No. 9; also T. No. 7, R. 6 in Penobscot County.
William Sewall (Island Falls), T. 4, R. 3.
Harry E. Hasey (St. Francis), all of Maine Forestry District on St. John waters.
Cory A. Pooler, (Old Town), St. John waters in Maine Forestry District.
Fred C. Knowlen, (Guerette), Township 15, R. 4; 15, R. 5; 15, R. 16; 16, R. 3; 16, R. 4; 16, R. 5; 16, R. 6; 17, R. 3; 17, R. 4; 17, R. 5.
Ora Gilpatrick (Houlton), Stacyville Pl.; T, 1, R. 6; 2, R. 6.
J. B. Bartlett (Ashland), Maine Forestry District included in T. 8, 9, R. 5; 8, 10, R. 6; 8, 9, 10, 11, 12, R. 7, 8, 9, 10.
H. B. Buck (Bangor), Maine Forestry District in Aroostook County.
Wm. H. Hinckley (Bangor), Maine Forestry District on St. John waters.
Eugene H. Decker (Bangor), Maine Forestry District on St. John waters.

DEPUTY WARDENS.

- Frank McLean (Haymock), T. 6, R. 10.
M. A. Weston (Monarda), T. 1, R. 4; 2, R. 4; 1, R. 5; A, R. 5.

- Herbert Walker (Mapleton), T. 10, R. 3; 10, R. 4; 11, R. 4.
 Hazen Huson (Presque Isle), T. 10, R. 3; 10, R. 4; 11, R. 4.
 John A. Brown (Smyrna Mills), T. 7, R. 3; 7, R. 4.
 D. H. Moore (Houlton), East $\frac{1}{2}$ 8, R. 3; Hammond Pl.; T. 9, R. 3;
 8, R. 4; 7, R. 5; 8, R. 5; 7, R. 6; C; D; 7, R. 4.
 J. J. Niles (Houlton) East $\frac{1}{2}$ 8, R. 3; Hammond Pl.; T. 9, R. 3;
 8, R. 4; 7, R. 5; 8, R. 5; 7, R. 6; C; D; 7, R. 4.
 Miles D. Arbo (Oxbow), Townships Nos. 9, R. 11; 10, R. 11; 9, R.
 12; 10, R. 12; Oxbow Pl.
 John M. Brown (Eagle Lake), Townships Nos. 15, R. 5; 15, R. 6;
 16, R. 6.
 C. A. Trafton (Ashland), Garfield Pl.; T. 10, R. 6; 10, R. 7; 11, R. 7.
 Romuld Labbe (Wallagrass), T. 15, R. 8; 16, R. 8; 16, R. 7; 17,
 R. 7.
 Miles McNally (Ashland), Townships 11, R. 8; 12, R. 8; 11, R. 9; 12,
 R. 9; 11, R. 10.
 William McNally (Ashland), Townships 11, R. 8; 12, R. 8; 11, R.
 9; 12, R. 9; 11, R. 10.
 D. L. Cummings (Houlton), T. 16, R. 5; 17, R. 5.
 Chas. H. Shannon (Macwahoc), North Yarmouth Academy Grant.
 Alec Currier (Oxbow), Oxbow Pl.; T. 7, R. 8; 9, R. 8; 10, R. 8.
 Ralph E. Pineo (Chesuncook), Townships in vicinity of Eagle Lake,
 Piscataquis County.
 August Carlson (Nelson), T. 15, R. 4.
 William Libby (Oxbow), T. 8, R. 9; 9, R. 9; 10, R. 9.
 Cyrus Chase (Westfield), East $\frac{1}{2}$ No. 10, R. 3; E, R. 2.
 Wm. N. Carpenter (Houlton), Hammond Pl.; T. 7, R. 3.
 Samuel Ross (Monticello), T. C, R. 2; D, R. 2.
 W. C. Corliss (Burleigh), T. 7, R. 3; West $\frac{1}{2}$ 8, R. 3; 7, R. 4.
 George B. Moore (St. Croix), T. 9, R. 4; 8, R. 5; 9, R. 5.
 Joseph Greene (Linneus), Townships A, R. 2; 4, R. 3.
 Allen Quimby (Stockholm), Stockholm Plantation.
 Osgood F. Smith (Portage), T. 13, R. 5; 14, R. 6; 15, R. 6; 16, R.
 6; 12, R. 7; 13, R. 7; 14, R. 7; Nashville Pl.
 Harry G. Tingley (Island Falls), T. 3, R. 4, W. E. L. S.
 John Landers (Island Falls), T. 3, R. 4, W. E. L. S.
 John B. Bussell (Old Town), Maine Forestry District on Aroostook
 waters.
 Elmer E. Gilpatrick (Davidson), T. 1, R. 6; 2, R. 6.
 Leon Orcutt (Ashland), T. 11, R. 7; 12, R. 7; 13, R. 7; 11, R. 8.
 Frank McManus (Rockabema), T. 8, R. 5.
 Fred H. Stinson (Rockabema), T. 8, R. 5.
 Charles Peterson (Garfield), Garfield Pl.; T. 10, R. 6.
 C. F. Farrar (South Amity), Leavitt.
 E. G. Hunter (Hodgdon), T. A, R. 2.
 Fred Cyr (Winterville), Winterville Pl.; T. 14, R. 7; 14, R. 8; 15,
 R. 8.

- James H. Ruth (Linneus), T. 4, R. 3; A, R. 2; 3, R. 2; 3, R. 3; Glenwood Pl.
- George Moors (Griswold), East $\frac{1}{2}$ 8, R. 3; Hammond Pl.; T. 9, R. 3; 8, R. 4; 7, R. 5; 8, R. 5; 7, R. 6; C; D.
- Harry Wheeler (Portage), T. 13, R. 7.
- Mitchell Morin (Eagle Lake), T. 15, R. 5; 15, R. 6; 16, R. 6; 14, R. 6; 14, R. 7; 15, R. 7.
- Frank Currier (Oxbow), T. 8, R. 6; 9, R. 6; 10, R. 6.
- Frank W. Austin (Ft. Kent Mills), General Deputy Warden for Maine Forestry District on Aroostook waters.
- Harry Clark (Ashland), T. 10, R. 4; 11, R. 4.
- Thomas Lawler (Benedicta), T. 1, R. 6; 2, R. 6.
- Henry Reed (Danforth), Maine Forestry District in Aroostook County.
- Preston Burleigh (Houlton), Maine Forestry District in Aroostook County.
- Ellie Greenlaw (Masardis), T. 8, R. 3; 8, R. 4; 9, R. 4; 9, R. 5.
- Joseph Smart (Eagle Lake Mills), T. 15, R. 5; 15, R. 6; 16, R. 6; 14, R. 6; 14, R. 7; 15, R. 7.
- E. P. Knight (Macwahoc), T. A, R. 5; 1, R. 5; North Yarmouth; 2, R. 4.
- Frank C. Hinckley (Bangor), T. 11, R. 4; 17, R. 4.
- Walter Swett (Oxbow), T. 8, R. 6; 8, R. 7; 9, R. 6; 9, R. 7.
- St. John and Allagash waters, patrol: Thomas Gardner, Allagash; Archie C. Dore, Glenburn; Roy C. Storer, Carmel; Frank' H. Eales, Vanceboro; Frederick Woodman, Bangor; George Kelley, Allagash; George H. Jones, St. Francis; Roland S. Connors, St. Francis; Ross Miller, Levant; William H. Kelley, Allagash.
- St. John waters patrol; Frank Miller, Old Town; C. A. Batty, Orono; Alphonze Blanchette, Seven Islands; C. F. Doore, Foxcroft; Lewis K. Miller, Old Town; William M. Thompson, St. Pamphile; Guy S. Kohnson, Masardis; A. J. Preble, Old Town; Fred Berube, Fort Kent; E. H. Bigelow, Orono.
- Chamberlain and Eagle Lake patrol: Frederick Lancaster, Old Town; John Conway; C. P. Murphy, Old Town; S. D. Crocker, Old Town.
- Aroostook and Machias waters patrol: Miles E. Richardson, Levant; Maine Forestry District in Northern Aroostook.
Chas. P. McKenney, Enfield; George T. Holbrook, Vanceboro.
- Bert Drake (Stockholm) Stockholm Plantation.
- Scott Reid (Fort Kent) Maine Forestry District in Northern Aroostook.
- August F. Daigle (Soldier Pond) T. 16 R. 6; 17 R. 5.
- Claue L. Huston (Smyrna Mills) T. 6 R. 4; 6 R. 5; 7 R. 4; 7 R. 5.

HANCOCK COUNTY.

CHIEF WARDENS.

- H. T. Silsby (Aurora), all of Maine Forest Fire District in Hancock County.

DEPUTY WARDENS.

- M. B. Joy (North Hancock), Township No. 8.
 Fred S. Bunker (Franklin), Townships Nos. 7, 9, 10 and 16.
 A. B. Havey (East Sullivan), No. 7 and No. 10.
 W. H. Farnsworth (South Beddington), E. $\frac{1}{2}$ No. 28; E. $\frac{1}{2}$ No. 34.
 Henry French (Eastbrook), Township No. 16; South $\frac{1}{2}$ and East $\frac{1}{2}$ No. 22.
 Naham Jordan (Aurora), Townships Nos. 21; North $\frac{1}{2}$ No. 22; West $\frac{1}{2}$ No. 28.
 Ezra Williams (Great Pond), Townships Nos. 32; West $\frac{1}{2}$ No. 34; No. 33.
 John Baker (Bradley), Townships Nos. 39; 40; No. 2; North $\frac{1}{2}$ No. 34.
 Chas. Merritt (Deblois), East $\frac{1}{2}$ No. 22; East $\frac{1}{2}$ 16.
 H. H. Madden (Greenfield), No. 32.
 Howard Fletcher (Ellsworth Falls), Plantation No. 8.
 John R. Shuman (Great Pond), Number 33 Plantation.
 H. P. McReavey (Northfield), East part T. 35 and 41; No. 4.
 Rufus S. Page (Passadumkeag), West part T. 35 and 41.
 Hiram Corliss (Cherryfield), Lead Mt. town and surrounding territory.
 W. L. Robertson (Cherryfield), N. E. $\frac{1}{4}$ No. 10; S. E. $\frac{1}{4}$ No. 16.
 Albert E. Schoppie (Beddington), West $\frac{1}{2}$ Township No. 35; West $\frac{1}{2}$ Township 29.
 E. S. Tracy (Cherryfield), Townships 7, 9, 10 and 16.
 E. S. McCorison (Burlington), Grand Falls Pl.
 John O. Whitney (Ellsworth Falls), General Deputy for Maine Forestry Dist.
 Howard B. Moore (Ellsworth), General Deputy for Maine Forestry Dist.
 Madison Gordon (North Sullivan), T. 7, 8, 9, and 10.
 Fred A. Carver (Cape Rozier), all islands in Maine Forestry Dist. in Hancock County.

KENNEBEC WATERS.

CHIEF WARDENS.

- W. M. Shaw (Greenville), all unincorporated townships in Main Forestry District in Piscataquis County withing 20 miles of Moosehead Lake.
 Louis Oakes (Greenville Jct.), all unincorporated townships in Maine Forestry District within 20 miles of Moosehead Lake.
 E. P. Viles (Skowhegan), Kennebec waters.
 W. J. Lanigan (Waterville), Kennebec waters.
 Frank E. Haines (Deadwater), Mayfield Pl; Bald Mt.; Caratunk Pl.; West Forks Pl.; East Moxie; Moxie Gore; Cold Stream; Square Town; Indian Gore; Chase Stream.

Forest H. Colby (Bingham), Kennebec waters.
 F. H. Sterling (Caratunk), all unincorporated townships in Somerset County to the North line of Bingham's Kennebec Purchase.
 Blaine S. Viles (Augusta), Maine Forestry District.
 Peter Herbst (The Forks), Maine Forestry District on Kennebec waters.

DEPUTY WARDENS.

Albert McDaniles (Jackman), General Deputy Maine Forestry Dist. on Kennebec waters.
 E. A. Piper (Jackman), General Deputy Maine Forestry Dist. on Kennebec waters.
 William Haines (The Forks), General Deputy Maine Forestry Dist. on Kennebec waters.
 John Holden (Rockwood), General Deputy Maine Forestry Dist. on Kennebec waters.
 Wm. Chatfield (Flagstaff), General Deputy Maine Forestry Dist. on Kennebec waters.
 Alton B. Carl (Bingham), General Deputy Maine Forestry Dist. on Kennebec waters.
 Robie Howes (Bingham), General Deputy Maine Forestry Dist. on Kennebec waters.
 L. V. Standish (Waterville), General Deputy Maine Forestry Dist. on Kennebec waters.
 B. W. Page (Skowhegan), General Deputy Maine Forestry Dist. on Kennebec waters.
 Peter Larkin (Waterville), General Deputy Maine Forestry Dist. on Kennebec waters.
 F. B. Rowe (Bingham), General Deputy Maine Forestry Dist. on Kennebec waters.
 Lawrence P. Barney (Skinner), General Deputy Maine Forestry Dist. on Kennebec waters.
 O. W. Chase (north New Portland), Lexington Pl.; Highland Pl.
 Peter Liberty (Jackman), Moose River Valley in Maine Forestry Dist.
 Henry Kennedy (The Forks), Stoney Brook.
 Ralph Wing (Flagstaff), Patrol Dead River waters.
 Hugh Shaw (Greenville), Moosehead lake waters.
 E. G. Stevens (Lily Bay), Lily Bay; Blake Tract; Spencer Bay Tract; Day's Academy Tract.
 A. H. Woods (Askwith), Maine Forestry Dist. in Somerset County.
 A. R. Henderson (Kingfield), Jerusalem; Mt. Abraham; Crocker-town; Reddington.
 Arthur W. Lanigan (Waterville), Maine Forestry Dist. in Somerset and Piscataquis Counties.
 Henry Hudson (West Forks), T. 1, R. 5.
 Joseph Spaulding (Caratunk), East and West Moxie; Moxie Gore; Square Town.
 Roy L. Marston (Skowhegan), Kennebec waters.

- William Lockyer (Eustis), Jim Pond Town; Chain of Ponds; T. 4, R. 5; Kibbie.
- Alfred Fortier (Jackman), Thorndike; Holden; Attean; T. 4, R. 6; 5, R. 6; Dennistown; Sandy Bay.
- Frank Haggan (Holeb), Holeb; Forsythe; Lowelltown; T. 6, R. 7.
- C. S. Skinner (Lowelltown), Skinnertown; Lowelltown; T. 1, R. 7; 2, R. 7.
- M. P. Colbath (Northwest Carry), Big and Little W.; Seboomook; Soldiertown.
- W. H. Galusha (Greenville), Little and Big Squaw; Gore A, R. 2; Lily Bay; Sugar Lsland; Deer Island.
- A. J. Kennedy (Greenville), Spencer Bay; Blake; East Middlesex; Day's Academy Grant.
- C. A. Judkins (Kineo), Day's Academy Grant.
- Silas Nelson (Moosehead), Taunton & Raynham; Misery Gore.
- Charles Meservey (Roach River), T. 1, R. 12; A, R. 12; 1, R. 13; A, R. 13.
- G. W. Parks (Roach River), T. 1, R. 12; A, R. 12; 1, R. 13; A, R. 13; 1, R. 11; A, R. 11.
- Wm. P. Forsythe (Lake Moxie), West Forks Pl.; T. 2, R. 5; 2, R. 6; 1, R. 6.
- Frank Savage (Stratton), Bigelow Twp.; Coplin Pl.; Dead River Pl.
- J. K. Viles (North New Portland), West Eustis; T. 3, R. 5.
- Harry Pierce (Eustis), King; Bartlett; Pratt, T. 4, R. 5, B. K. P., W. K. R.
- E. Gilbert (Askwith), Misery; 10,000 acre tract; Misery Gore; Taunton & Raynham Strip; Brassua; Sandwich Academy.
- John Prince (Jackman), Long Pond Town; Thorndike and Holden.
- Ruel Holden (Jackman), Attean; No. 4 Twp.
- B. W. Adams, (Mayfield), Mayfield Pl.
- H. J. Lane (Bingham), Carry Town; Pierce Town.
- H. P. McKinney (Jackman), Townships 3, 4, 5, 6, R. 3, B. K. P., W. K. R.; Parlin Pond Twp.
- B. S. Whiting, (Shirley), Bald Mt. Twp.
- Frank J. Durgin (The Forks), T. 1, R. 5; 1, R. 6.
- Oliver Adams (The Forks), T. 1, R. 5; 1, R. 6.
- Henry Hodgdon (The Forks), T. 1, R. 5; 1, R. 6.
- F. L. Gipson (Lily Bay), Lily Bay Twp.; Gore A, R. 2.
- Paul York (Greenville Jct.), Kibbie; Appleton; Sandwich Academy; Misery; 10,000 acre tract.
- John B. Carville (Flagstaff), T. 3, R. 4.
- Fred Parent (Rockwood), Taunton & Raynham; Blue Ridge; Tomhegan; Rockwood Strip; Middlesex; Farm Island; Day's Academy Grant.
- Alva Berry (Eustis), Chain of Pond Twp.; Massachusetts Gore; Seven Ponds Twp.; Alder Stream.
- T. B. Snow (N. E. Carry), East and West Burbank.
- J. H. White (Eustis), T. 5, R. 6; 4, R. 6, B. K. P.; Somerset County; 1, R. 6, Franklin County.

- C. A. Spaulding (Caratunk), Pierce Pond Twp.
 Lewis G. Baker (Bingham), Bald Mt. Twp. and Spaulding Town.
 Eugene Clark (Caratunk), Sapling Town.
 Chas. F. Ham (Bingham), Chase Stream and Indian Town.
 Cyrus Hall (Bingham), East & West Moxie.
 Fred Henderson (Jackman), Thorndike; Alder Brook; Soldier Town;
 Moose River Pl; Long Pond Twp.
 Colin McRitchie (Holeb), Holeb; Forsythe; Gorham Grant; T. 6, R. 7.
 W. B. Small (Kingfield), Crockertown; Jerusalem; Mt. Abram.
 Albert Edgerley (Greenville), A, R. 13; A, R. 14; 1, R. 13; Gore A,
 R. 2; A, R. 12.
 Sylvere Gaudet (Rockwood), Taunton & Raynham; Blue Ridge;
 Tomhegan; Rockwood Strip; Middlesex; Farm Island.
 Ray Viles (Flagstaff), Bigelow Pl.; Coplin Pl.; Dead River Pl.;
 Flagstaff Pl.; Langtown; T. 2, R. 3; 3, R. 4 and any territory
 in vicinity of towns named.
 George Flanders (Mayfield), Mayfield Pl.; Kingsbury Pl.
 M. R. Hastings (Hastings), Batchelder Grant.
 M. J. Marr (Moosehead), T. 1, R. 6; 1, R. 7; 2, R. 7.
 Benj. DeWitt (Skinner), Kibbie; T. 1, R. 6, Franklin County.
 Chris Stewart (Caratunk), Bald Mt. Twp.; West Moxie and Moxie
 Gore.
 Daniel Burns (Lake Moxie), Chase Stream; Squaretown; Lower
 Cold Stream.
 J. C. Hutchinson (Bangor), General deputy warden.
 H. W. Maxfield (Bingham), Pleasant Ridge Pl.
 Elmer E. Tufts (Kingfield), Jerusalem; Mt. Abraham; Crockertown
 and Reddington.
 H. E. Harlow (Dead River), Bigelow Pl.; Dead River Pl.; Carrying
 Place; No. 3, R. 4, W. B. K. P.; Pierce Pond.
 William D. Snow (Skowhegan), Bowtown; Enchanted; Indian Pond
 Twp.; Squaretown.
 W. E. Hinds (Flagstaff), Flagstaff Pl; No. 3, R. 4, W. B. K. P.;
 No. 4, R. 5, W. B. K. P.; No. 3, R. 5, W. B. K. P.
 William Durgin (The Forks), West Forks Pl.; Cold Stream.
 John Comber (The Forks), The Forks Pl.; Bowtown.
 J. A. Durgin (The Forks), Bowtown.
 George E. King (Cupsuptic), T. 4, R. 2, W. B. K. P.
 W. F. Henderson (Gardiner), Bald Mt. Twp.; No. 4; Coplin Pl.;
 T. 1, R. 12; A, R. 12.
 James O'Brien (Lake Moxie), Moxie Gore; Square Town.
 W. E. Patterson (Girard), No. 4, R. 6; No. 3, R. 5, W. K. R.
 D. B. Durgin (The Forks), Upper Cold Stream; 10,000 acre tract.
 S. E. Andrews (Bingham), Pierce Pond Twp.; East Moxie.
 Thomas Willett (Mosquito), Bald Mt. and West Moxie Townships.
 James Hennessey (Mosquito), East and West Moxie and Bald Mt.
 Townships.
 E. I. Small (Jackman), Parlin Pond and No. 4 Townships.

William Chatfield (Flagstaff), Kennebec waters in Maine Forestry District.

J. S. Douglass (Bigelow), Crockertown; Jerusalem; Mt. Abraham.

Ira McDaniels (Moose River), Sandy Bay and Dennistown Townships.

OXFORD AND FRANKLIN.

CHIEF WARDENS.

Silas F. Peaslee (Upton), all unincorporated townships in Maine Forestry District on Androscoggin waters in Maine.

C. C. Murphy (Rangeley), all unincorporated townships in Maine Forestry District on Androscoggin waters in Maine.

DEPUTY WARDENS.

Rufus O. Dyer (Coplin), Lang Plantation.

Horace Bennett (Wilson's Mills), Lincoln Pl.; Townships Nos. 5, R. 3; 5, R. 4; 5, R. 5; Magalloway Pl.

Freeland D. Abbott (Houghton), Letter E.

Charles H. Adams (Rangeley), Dallas Pl.

Cyrus A. Compbell (Rangeley), East $\frac{1}{2}$ Dallas Pl.

William Tibbetts (Kennebago Lake), T. 3, R. 4.

Henry W. Dunn (Andover), North and West Andover surplus.

Stillman N. Littlehale (Bethel), Riley Township.

Temple E. Spaulding (Oquossoc), T. 4, R. 3, Oxford Co.; T. 2, R. 1; 3, R. 1; 3, R. 3, Franklin Co.

George E. Allen (Middle Dam), Letter C; T. 4, R. 1; 5 R. 1, Oxford County.

Percy Ripley (Wilson's Mills), Parmachene; Lynch & Parker towns.

Walter S. Hodges (West Phillips), No. 6, North of Weld. Jerry Lowell (Rangeley), Sandy River Pl.

A. L. Savage (Stratton), General Deputy Maine Forestry Dist. in Oxford and Franklin Counties.

Wm. True (Phillips), Dallas; Reddington.

Wm. Tibbetts (Rangeley), Maine Forestry Dist. in Oxford and Franklin Counties.

Harry Look (Rangeley), Maine Forestry Dist. in Oxford and Franklin Counties.

W. Leslie Hart (Wilson's Mills). T. 5. R. 1, 2, 3, 4, 5. W. B. K. P.; T. 4, R. 5 & 6.

A. Newall Dunham (Madrid), Letter E. and No. 6 North of Weld.

George E. King, Jr., (Bethel), T. 4 R. 3; 5 R. 3; 4 R. 4, W. B. K. P.

PENOBSCOT SYSTEMS.

CHIEF WARDENS.

John Appleton (Bangor), Maine Forestry District on Penobscot West Branch waters, north of Pemadumcook Lake.

- Eugene H. Smith (Norcross), Maine Forestry District in Penobscot West Branch region below head of Pemadumcook Lake, including Millinocket Lake; Cooper brook territory and lands adjoining.
- M. L. Woodman (Lagrange), Maine Forestry District south of Norcross in Penobscot and Piscataquis counties.
- J. A. Lobley (Mattawamkeag), all unincorporated townships in Maine Forestry District in Penobscot County, north of Mattawamkeag.
- S. C. Cummings (Haynesville), See Aroostook Chief Wardens.
- Fred A. Gilbert (Bangor), Maine Forestry District.
- John W. Hinch (Danforth), T. 1 R. 4; 2 R. 4; A. R. 5; 1 R. 5, Aroostook County. 7 R. 2; 8 R. 3; 8 R. 4 Washington County.
- N. C. Ayer (Bangor), Maine Forestry District, Penobscot and Piscataquis Counties.
- Chas. W. Bowers (Mattagamon), East Branch waters in Maine Forestry Dist.
- J. L. Chapman (Milo), East and West Bowdoin College Grant; T. 7, R. 9; Elliottsville Pl.; K. I. Works; T. 5, R. 9; A, R. 11; A, R. 12; B, R. 11.
- S. H. Boardman (Guilford), Maine Forestry Dist. in Piscataquis County.
- A. R. Billings (Brownville), along the right of way of C. P. Ry. and adjoining territory in Maine Forestry Dist.
- E. O. Grant (Patten), West Branch waters Cadana line to head Pemadumcook lake.

DEPUTY WARDENS.

- C. H. Randall (Roach River), T. 2, R. 10; A, R. 11; A, R. 12.
- Harry Bowers (Burlington), T. 3, B. P. P.; 3, R. 1, N. B. P. P.
- J. M. True (Lee), Township No. 3.
- George S. Ranney (Winn), Webster Pl.; Drew Pl.
- J. E. Smart, Jr. (Seboeis), Seboeis Pl.
- W. J. Curran (Patten), T. 6, R. 8; 6, R. 9; 5, R. 9; 7, R. 8.
- Fred Stinson (Rockabema), T. 7, R. 5; 7, R. 6; 8 R. 5; west half 7, R. 4.
- C. C. Garland (Debsconeag), T. 2, R. 9; 2, R. 10; 2, R. 11.
- Frank Tuck (Norcross), T. 1, R. 8; 1, R. 9; 1, R. 10.
- M. M. Tracy (Stacyville), Stacyville Pl.; T. 3, R. 7; 2, R. 6; 2, R. 7; 4, R. 7; 3, R. 8; 4, R. 8.
- E. F. Drew, (Onawa), Elliottsville Pl.; T. 7, R. 9; 8, R. 10; 7, R. 10, N. W. P.
- Earl S. Page (Burlington), T. No. 3.
- B. B. Bell (Wytopitlock), Reed Plantation.
- A. L. Green (K. I. Works), K. I. Works; B. R. 10; B. R. 11.
- John H. Rice (Bangor), A, R. 10; A, R. 11; 1, R. 10; 1, R. 11.
- S. A. Potter (Norcross), A, R. 10; A, R. 11; 1, R. 10; 1, R. 11.
- J. P. Mallett (East Winn), T. No. 3.
- Guy Butterfield (Drew), Drew Plantation.
- H. G. Robinson (Patten), T. 4, 5, 6, 7, 8, R. 7; 6, R. 6; 8, R. 8.
- Albert Ross (Chesuncook), T. 1. R. 9; 2, R. 10; 2, R. 11; 3, R. 11; 4, R. 11; 1, R. 12.

- Charles H. Collins (Norcross), T. 2, R. 10; 2, R. 11; 2, R. 12.
 Oscar Thomas (Lincoln), T. 4, R. 9.; 6, R. 9; S. W. $\frac{1}{4}$ 5, R. 9.
 Frank McElroy (Patten), T. 6, R. 9, Lookout Station.
 F. L. Robinson (Bragville), Stacyville Pl.
 Z. L. Harvey (Mattagamon), T. 5, R. 9; 7, R. 9; Piscataquis county;
 5, 6 & 7, R. 8; Penobscot County.
 Chas. Dacy (Norcross), 4 & 5, R. 10.
 R. J. Russell (Brownville), Bowerbank.
 John N. Jewett (Patten), Maine Forestry District.
 James Mack (Millinocket), T. A, and unincorporated part of T. 3, I. P.
 Frank Keegan (Wytotitlock), Glenwood Pl.; North Yarmouth; T.
 2, R. 4.
 N. W. McNaughton (Schoodic), T. 4, R. 9, N. W. P.
 E. H. Decker (Patten), T. 7, R. 13; 7, R. 12; 7, R. 14; 8, R. 11;
 8, R. 12; 8, R. 13; 8, R. 14; 10, R. 11 and 10, R. 12.
 Louis Ketchum (Norcross), 1, R. 11; 1, R. 12; 2, R. 11; 2, R. 12.
 George W. Coffin (Lee), T. 3, R. 1.
 John A. Tenney (Rockabema), T. 7, R. 6.
 Daniel A. Nelson (Kingman), T. 6, R. 3, N. B. P. P.
 Chas. Henderson (K. I. Works), General Deputy for Penobscot waters.
 Fred M. Smith (West Seboeis), Hopkins Academy; Long A; T. 2,
 R. 8; 2, R. 9; 4, R. 9.
 George R. Berry (Mattagamon, Care of Roberts Camp), T. 5, R. 10;
 6, R. 10; 5, R. 11; 6, R. 11.
 H. A. Hilton (Kingsbury), Kingsbury Plantation.
 Oscar Bickford (Kingsbury), Kingsbury Plantation.
 Frank Fortier (Orono), East Branch Patrol.
 Harry E. Fortier (Orono), East Branch Patrol.
 Joseph Patten (K. I. Works), T. 7, R. 9, N. W. P.
 A. E. Chadbourne (Millinocket), Long A Twp. and adjacent Territory.
 Fred M. Knowles (Boyd Lake), Hopkins Academy; T. 4, R. 9; Lake-
 view Pl.
 Henry Grover (Bangor), T. 4, R. 11; 4, R. 12.
 Harry Davis (Monson), Elliottsville Pl.; T. 7, R. 10; 8, R. 10; 7, R. 9.
 Thomas Griffin (Millinocket), T. 3, I. P.; 4, I. P.
 B. W. Howe (Patten), General Deputy for all of the Maine Forestry
 District North of West Branch Patrol.
 L. M. Tufts (Brownville), T. 4, R. 9; 5, R. 9, N. W. P.; B, R. 10, W.
 E. L. S.
 E. H. Doyle (Seboomook, Pittston Farm), General Deputy Maine For-
 estry District.
 H. L. McKechnie (Alton), Patrol East Branch of Penobscot.
 Frank A. Porter (Alton), Patrol East Branch of Penobscot.
 H. E. Preble (Millinocket), T. 3 & 4, I. P.
 Dick Gandreau (Old Town), Patrol East Branch of Penobscot.
 D. W. McDonald (Grindstone), General Deputy for Penobscot waters
 in Maine Forestry District.
 Albert LeBrun (Old Town), Patrol East Branch of Penobscot.

- West Branch Patrol: Charles Silsby, Argyle; H. B. Tice, Bangor; A. T. Porter, Canaan; Paul R. Brown, Hartland; Paul Bachelder, Bangor; Fred Morrison, Milford; G. W. Brown, East Bowdoinham; Fred White, Stillwater; R. L. Gray, Chesuncook; Geo. King, Norcross; E. B. Libby, Hartland; George Owens, Old Town; Thomas T. Dunn, Bangor; Edgar A. White, Orono; Louis April, St. Zacharie; Roscoe Emery, Hartland; Chas. Cavanaugh, Orono; Irving T. Brown, Comden; George Patten, Old Town; Newell Lyons, Old Town; Elec Rushall, Norcross; Leonard R. Hartell, Orono, William Owens, Old Town.
- P. P. Reed (Orono), Patrol on Passadumkeag waters.
- L. E. Houghton (Lee), Patrol on Passadumkeag waters.
- M. E. Priest (Milo), General Deputy, patrol on West Bowdoin College Grant.
- H. L. Perkins (Milo), Patrol Wilson Pond and Prong Ponds.
- J. W. Campbell (Charleston), Patrol T. A. R. 11 (Cooper Town).
- B. L. Jones (Garland), Patrol T. B. R. 11 (Big B).
- D. E. Huff (Danforth), T. 8 R. 3; 10 R. 3; 11 R. 3; 8 R. 4 N. B. P. P.; Codyville Plantation.

WASHINGTON COUNTY.

CHIEF WARDENS.

- Victor M. Smith (Northfield), Maine Forestry District on East Machias waters.
- Thos. O. Hill (Codyville), Maine Forestry District on St. Croix waters.
- Alfred K. Ames (Machias), Maine Forestry District on Matchais waters.

DEPUTY WARDENS.

- William Roberts (Northfield), T. 19 and 25.
- W. L. Hodgkins (Lambert Lake), Lambert Lake Plantation; Forest Dyer; T. 10, R. 3, 11, R. 3; N. B. P. P.
- George E. Andrews (Waite), Codyville Plantation; Kossuth; Dyer.
- W. B. Hoar (Grand Lake Stream), Grand Lake Stream Plantation; T. 6, N. D.; 6, R. 1, N. B. P. P.; T. 43 and No. 5.
- Waldo Mercier (Princeton), Indian Township; T. No. 7; 1, R. 1; 21; 26 and 27.
- John Graham (South Springfield), Townships No. 5, R. 1; No. 4, N. D.; No. 4, R. 1; Kossuth.
- L. F. Leighton (Epping), Townships Nos. 18, 19 and 25, M. D.
- L. C. Bridgham (Beddington), Townships Nos. 36, 37, 29, 40, 31, 24, 28 and 34, Hancock County.
- Fred Albee (Machais), Townships Nos. 24, 31, 36, 29, 37, 30.
- Gilmore Driscoll (Machias), Townships Nos. 24, 26, 27, 29, 30, 31, 36, 37.
- Orson E. Tuell (Dennysville), West $\frac{1}{2}$ No. 14 Plantation.
- John Greenlaw (Brookton) General Deputy.
- Frank Gray (Wesley), Townships Nos. 30, 31, 36, 37.

Thomas S. Smith (East Machias), East $\frac{1}{2}$ No. 14 Plantation.

John R. Sullivan (Whitneyville), Townships Nos. 42 and 43.

John Breen (Princeton), Grand Lake Stream Plantation; T. 6, N. D.;
6, R. 1, N. B. P. P; No. 5 and 43.

David Vance (Wesley), T. 18 and 19 E. D.

James Frost (Cooper), T. 18 and 19.

Frank O. Elsemore (East Machias), T. 18 and 19.

Thomas Brooks (Wesley), T. 26, 27, 30, 31, 36, 37, 24, 29, E. $\frac{1}{2}$ 35.

REVISED FIRE LAWS FOR TOWNS.

It was apparent to the members of the Legislature of 1909 that some changes were necessary in the law applying to the protection and prevention of forest fires in incorporated towns. Under the law existing previous to 1909 while the selectmen were the forest fire wardens of the town, there was lack of a penalty in the law which allowed for the shifting of responsibility from one member of the board to another.

Under the new law a town is liable for the negligence of its selectmen to give proper attention to forest fires within the borders of the town. In cities the responsibility is placed upon the chief engineers of the fire department.

Sections of the new law as amended follow :

'SEC. 52. The selectmen of towns shall be forest fire wardens therein, and the services of such selectmen acting as said fire wardens, shall be paid for at the same rate as is paid for their other official services. It shall be the duty of the fire wardens when a fire is discovered to take such measures as may be necessary for its control and extinguishment. For this purpose they shall have authority to call upon any person in the town for assistance, and such persons shall receive such compensation, not exceeding twenty cents per hour, as said selectmen may determine, the same to be paid by the town. But no town shall be holden to pay for extinguishing forest fires in any year an amount greater than two per cent upon its valuation for purposes of taxation. If any person so ordered to assist and not excused from said service by said forest fire wardens on account of sickness, disability, or some important business or engagement, shall neglect to comply with any such order he shall forfeit the sum of ten dollars, to be recovered in action of debt in the name and to the use of the town, by the treasurer thereof. If any person shall suffer damage from fire in consequence of the negligence or neglect of the selectmen of any town to perform the duties required by this act, such person shall have an action on the case to recover from the town where the fire occurs to the amount of his damages so sustained not to exceed two per cent of the valuation of said town. This act shall also apply to cities. The chief engineer of the fire department of cities shall be forest fire wardens and shall have the same powers and duties in carrying out the provisions of this act as selectmen of towns.'

SEC. 55. Whoever by himself, or by his servant, agent or guide, or as the servant, agent or guide of any other person, shall build a camp, cooking or other fire, or use an abandoned camp, in or adjacent to any woods in this state, shall, before leaving such fire, totally extinguish the same, and upon failure to do so such person shall be punished by a fine of fifty dollars, provided that such fires built upon the sea beach in such situation that they cannot spread into forest wood or cultivated lands or meadows, shall not be construed as prohibited by this section. One half of any fine imposed and collected under this section shall be paid to the complainant.

SEC. 56. Selectmen shall erect in a conspicuous place at the side of every highway, as they may deem proper, and suitable distances alongside the rivers and lakes of the state frequented by camping parties, tourists, hunters and fishermen, in their respective towns, notices in large letters to be furnished by the forest commissioner, substantially in the following form: "Camp fires must be totally extinguished before breaking camp, under penalty of not to exceed one month's imprisonment or one hundred dollars fine, or both as provided by law,, Forest Commissioner." The forest commissioner shall furnish owners of wood lands situated within this state, when called upon to do so, notices of similar tenor, to be posted at the expense of said owners upon their respective lands.

SEC. 58. Municipal officers in towns shall proceed immediately to a strict inquiry into the cause and origin of fires within wood lands, and in all cases where such fires are found to have originated from the unlawful act of any person, to cause the offender to be prosecuted without delay.

SEC. 59. The selectmen of towns in which a forest fire of more than one acre in extent has occurred, within a month shall report to the forest commissioner the extent of area burned over, to the best of their information, together with the probable amount of property destroyed, specifying the value of timber as near as may be, and the amount of cord wood, logs, bark or other forest products, fencing, bridges and buildings that have been burned. They shall also report the cause of these fires if they can be ascertained, and the measures employed and found effective in checking their progress. Blanks for the reports required in this act shall be furnished by said forest commissioner at the expense of the state.

ACT PROHIBITING THE USE OF FIREARMS IN DRY TIMES.

The following act authorizing the governor to issue a proclamation to prevent the use of firearms in the forests during a dangerously dry time, was passed by the Legislature in 1909:

Section 1. Whenever, during an open season for the hunting of any kind of game or game birds in this state, it shall appear to the governor that by reason of drought having in possession firearms in the forests is liable to cause forest fires, he may, by proclamation suspend the open season and make it a close season for such time as he may designate.

Section 2. During the time which shall by such proclamation be made a close season, all provisions of law covering and relating to the close season shall be in force, and a person violating a provision of the same shall be subject to the penalty therein prescribed. In case any person shall enter upon the wild lands of the state carrying or having in their possession any firearms, or any person shall shoot during the close season fixed by proclamation of the governor, as provided in the preceding section, any wild animal or bird for the hunting of which there is no close season otherwise provided by law, he shall be punished by a fine of one hundred dollars and costs.

Section 3. Such proclamation shall be published in such newspapers of the state and posted in such places and in such manner as the governor may order in writing. A copy of such proclamation and order, shall be filed with the secretary of state. A like attested copy shall be furnished to the forest commissioner, who shall attend to the posting and publication of the proclamation. All expense thereof and all the expense of enforcing the provisions of the proclamation shall be paid by said commissioner, after allowance by the state auditor, from any funds in the state treasury not otherwise appropriated.

Section 4. If after the issuing of the proclamation as provided in section one, by reason of rains or otherwise, the governor is satisfied that the occasion has passed for the issuance of the proclamation, he may annul it by another proclamation issued as provided in this act for the issuance of the first proclamation.

FOREST FIRES OF 1909.

The year 1909 marked the first season and trial of the Maine Forestry District. Under the provisions of the bill the appropriation for the work of prevention and extinguishment of forest fires amounted to about \$64,000, instead of \$20,000 which had heretofore been the limit of appropriation by the state.

This increased appropriation allowed for the employment of more patrols and the establishment of more lookout stations, resulting in a small loss from forest fires, the percentage being insignificant compared with the total wooded area of the state.

The selectmen of towns were also working under their new fire law and from all that could be learned this law stimulated the municipal officers to more carefully watch the woodlands in the towns, as the municipalities were made liable for negligence on the part of the selectmen.

In 1909 Aroostook County was marked as the "dry belt" of the state, resulting in many more fires. Considering the dryness of the season and the timbered area of the county, the damage was very small, being estimated at \$43,209, or about two-thirds of the loss in the whole state. The incorporated towns of Aroostook, which are wholly under the care of the selectmen, suffered a loss of 6,315 acres of timbered land at an estimated damage of \$15,890.

Oxford County, which is within the Maine Forestry District, was the most fortunate of any in the state, as there was not a single fire reported in either the wild land sections or in the incorporated towns.

Piscataquis County, with its nearly 2,000,000 acres of wild land, valued at nine and one-half millions of dollars, escaped with so nearly a clean slate that it is scarcely worth mentioning, the area burned over being only six acres, and that scattered over three townships. The estimated damage was only \$77. That constituted the whole loss to the timber interests of that county, as not a fire was reported from the incorporated towns in 1909.

Penobscot county, especially the northern part, came in next to Aroostook in the number of acres burned over, but only a little over 3000 acres of its 857,000 acres was touched, the estimated damage being about \$6500, which is small compared with the assessed value of the timber lands of the county of nearly three and a half millions of dollars.

Somerset county which in 1908 lost more than 50,000 acres by the ravages of the forest fires, escaped in 1909 with about 1500 acres burned over at an estimated damage of \$6890, which is light compared with the wild land acreage of 1,740,917 acres valued at nearly ten millions dollars.

Hancock county which has a little over a third of a million acres of wild land valued at \$1,190,283 had only 40 acres burned over at an estimated damage of \$100.

In Washington county one or two townships suffered quite badly but the total was only 2000 of the 658,000 acres of the county's wild land, on which the estimated damage was about \$6000 compared with the assessed valuation of over two millions dollars.

Franklin county with its 554,559 acres of wild land valued at about three and a quarter millions dollars got through the season of 1909 with a burned area of 600 acres on which the estimated damage was \$600.

The causes assigned for the fires of 1909, by the forest fire wardens on the part of the Maine Forestry District and the selectmen on the part of the incorporated towns are as follows: Clearing land, 37; railroads, 22; unknown, 68; river drivers, 5; campers and fishermen, 10; lightning, 2; trappers, 1; berry pickers, 2; surveyors, 1; school children, 1; smokers, 2; portable mill, 2; burning buildings, 2; blueberry burning, 1.

The tabulations follow:

Fires of 1909 on Incorporated Towns.

ANDROSCOGGIN COUNTY.

Town.	Date.	Acres.	Cause.	Damage.
Lisbon.....	May 7.....	10	Clearing land.	\$ 50
AROSTOOK COUNTY.				
Mapleton.....	May 15.....	35	Clearing land.....	250
Chapman.....	May 26.....	300	Clearing land.....	750
Mapleton.....	May 28.....	12	" "	20
Mapleton.....	May 30.....	188	" "	1000
Cyr.....	May 29.....	1280	Unknown.....	3000
Island Falls.....	May 29.....	40	Clearing land.....	120
Sherman.....	May 30.....	400	Unknown.....	400
Perham.....	June 1.....	1000	Clearing land.....	2500
Mapleton.....	June 2.....	150	Clearing land.....	1000
Island Falls.....	June 3.....	100	" "	250
Portage.....	June 3.....	180	Unknown.....	1000
Monticello.....	June 3.....	400	" "	800
Orient.....	June 3.....	10	" "	150
Chapman.....	June 5.....	400	Clearing land.....	1200
Snyrna.....	June 6.....	350	Unknown.....	1000
Mapleton.....	June 10.....	30	Clearing land.....	200
Castle Hill.....	June 10.....	20	" "	150
Blaine.....	June 11.....	200	" "	600
Haynesville.....	June 14.....	200	Unknown.....	600
Connor.....	June 1.....	600	" "	500
Connor.....	June 1.....	500	Fishermen.....	400
		6,315		\$15,890

2 Town Fires 1909.

CUMBERLAND COUNTY.

Standish.....	May 13.....	60	Unknown.....	\$300
Pownal.....	August 3.....	12	" "	100
North Yarmouth.....	August 4.....	6	" "	100
Durham.....	August 11.....	600	" "	3000
Gorham.....	August 11.....	200	" "	1500
Cumberland.....	August 25.....	1	" "	15
Scarboro.....	August 12.....	5	" "	100
		884		\$5,115

HANCOCK COUNTY.

Dedham.....	June 4.....	10	Unknown.....	\$45
Bluehill.....	June 9.....	100	" "	500
Bluehill.....	June 15.....	15	" "	60
		125		\$605

KNOX COUNTY.

Thomaston.....	May 13.....	35	Unknown.....	\$100
Warren.....	May 27.....	20	School children.....	100
Warren.....	July 1.....	30	Unknown.....	300
Warren.....	July 27.....	9	Railroad.....	50
Warren.....	August 3.....	15	" "	100
Warren.....	August 17.....	8	Cigar stub.....	40
		117		690

KENNEBEC COUNTY.

Towns.	Date.	Acres.	Cause.	Damage.
Pittston.....	April 12...	3	Portable mill.....	\$50
Winslow.....	May 28.....	45	Unknown.....	150
Winslow.....	August 12..	50	"	300
China.....	August 23..	3	Clearing land.....	10
		101		\$510

LINCOLN COUNTY.

Edgecomb.....	June 13....	5	Unknown.....	\$25
South Somerville.....	June 14....	25	"	200
Jefferson.....	June 17....	5	"	10
Edgecomb.....	June 16....	20	Burning building.....	100
Somerville.....	July 28....	30	Unknown.....	200
Somerville.....	August 5...	10	"	50
		95		\$585

OXFORD COUNTY.

Andover.....	May 20.....	20	Unknown.....	\$100
Fryeburg.....	May 26.....	400	"	500
Stoneham.....	August 9...	100	"	100
Paris.....	August 10..	30	"	100
Greenwood.....	August 15..	5	"	15
		555		\$815

4 Town Fires 1909.

PENOBSCOT COUNTY.

Holden.....	May 16.....	5	Clearing land.....	\$50
Holden.....	June 3.....	10	Railroad.....	70
Lagrange.....	June 11....	12	"	120
Hudson.....	June 12....	200	Clearing land.....	55
Winn.....	June 18....	150	"	305
Edingburg.....	August 2...	2	Unknown.....	50
Howland.....	August 14..	600	"	1000
Hudson.....	August 16..	25	"	10
		1004		\$1,660

SOMERSET COUNTY.

Norridgewock.....	July 31.....	10	Portable mill.....	\$25
Bolon.....	August 14..	2	Unknown.....	10
		12		\$35

SAGADAHOC COUNTY.

Phippsburg.....	April 12....	75	Clearing land.....	\$10
Topsham.....	August 2...	5	Railroad.....	25
West Bath.....	August 7...	20	Smokers.....	100
Topsham.....	August 8...	200	Unknown.....	1000
Woolwich.....	August 11..	100	Railroad.....	600
		400		\$1,735

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5 Town Fires 1909.
WALDO COUNTY.

Searsport.....	June 4.....	15	Clearing land.....	\$100
Islesboro.....	August 6...	4	Unknown.....	50
Searsport.....	August 15..	15	Clearing land.....	50
Palermo.....	August 23..	3	" "	10
Prospect.....	August 23..	10	Burning dwelling.....	10
		47		\$220

WASHINGTON COUNTY.

Cooper.....	May 24.....	35	Blueberry Burn.....	\$250
Charlotte.....	May 24.....	300	Unknown.....	600
East Machias.....	May 27.....	100	Clearing land.....	1000
Northfield.....	June 2.....	20	Unknown.....	70
Baring.....	June 3.....	800	Railroad.....	500
Charlotte.....	June 8.....	700	" "	700
Whitneyville.....	June 8.....	100	Clearing land.....	200
Talmadge.....	June 17....	75	" "	400
		2130		\$3,720

YORK COUNTY.

Lebanon.....	May 12.....	30	Railroad.....	\$150
Wells.....	May 12.....	75	" "	400
North Berwick.....	May 26.....	25	Clearing land.....	700
Kennebunkport.....	July 18....	2	Unknown.....	10
Kennebunkport.....	July 24....	2	Campers.....	10
Shapleigh.....	July 30....	5	Lightning.....	50
Acton.....	August 3...	10	Unknown.....	10
Kennebunkport.....	Oct. 9.....	1	" "	5
		150		\$1,835

SUMMARY OF 1909 FIRES.

Incorporated Towns.

County.	Acres.	Damage
Androscoggin	10	\$ 50
Aroostook	6,315	15,890
Cumberland	884	5,115
Hancock	125	605
Knox	117	690
Kennebec	101	510
Lincoln	95	585
Oxford	555	815
Penobscot	1,004	1,660
Somerset	12	35
Sagadahoc	400	1,785
Waldo	47	220
Washington	2,130	3,720
York	150	1,335
	<u>11,945</u>	<u>\$32,935</u>

Fires in 1909 on Unincorporated Townships.
AROGSTOOK COUNTY.

Township.	Date.	Acres.	Cause.	Damage.
16 R. 3	May 20	15	Clearing land.....	\$60
7 R. 3	" 23	7	Railroad.....	60
A. R. 7	" 24	175	".....	1,500
17 R. 7	" 28	50	Unknown.....	100
7 R. 3	" 30	14	".....	104
Westmanland	" 30	12	Clearing land.....	15
B. R. 2	June 2	150	".....	150
17 R. 5	" 2	10	".....	20
11 R. 4	" 2	12	".....	60
14 & 15 R. 6 & 7	" 3	4,900	".....	2,275
3 R. 4	" 3	350	Unknown.....	1,500
Forkstown	" 4	3,000	Clearing land.....	10,000
17 R. 4	" 4	20	".....	50
7 R. 3 & 4	" 4	900	Unknown.....	4,000
15 R. 10	" 4	6	Riverdrivers.....	25
11 R. 4	" 8	35	Unknown.....	175
17 R. 5	" 8	75	".....	400
13 R. 7	" 8	240	".....	1,200
Yarmouth	" 8	10	".....	30
17 R. 4	" 9	10	Clearing land.....	20
3 R. 4	" 9	1	Unknown.....	40
15 R. 3	" 9	6	".....	25
7 R. 3	" 14	8,000	".....	16,000
D. R. 2	" 17	1,650	Campers.....	5,400
		19,648		\$43,209
FRANKLIN COUNTY.				
Jim Pond	Sept. 3	3	Sportsmen.....	\$15
3 R. 1	August 5	600	Blueberry pickers.....	600
		603		\$615
HANCOCK COUNTY.				
No. 23	May 22	25	Unknown.....	\$25
No. 41	Sept. 3	15	Campers.....	75
		40		\$100
PISCATAQUIS COUNTY.				
Sq. Mt. Twp.....	August 1	1	Fishermen.....	\$15
Sq. Mt. Twp	" 15	1	Unknown.....	12
1 R. 10	" 15	4	Surveyors.....	50
		6		\$77
PENOBSCOT COUNTY.				
A. R. 7	May 24	60	Railroad.....	\$300
A. R. 7	June 3	1	Unknown.....	3
3 R. 3	" 4	30	Fishermen.....	50
Seboels	" 4	25	".....	10
2 R. 6	" 8	150	Railroad.....	1,200
5 & 6 R. 8	" 10	2,000	".....	4,000
No. 3 I. P	" 10	25	".....	50
5 R. 6	" 13	120	Riverdrivers.....	500
Seboels	" 14	1	Railroad.....	5
3 R. 1 N. B. P	" 14	5	Unknown.....	25
Long A. Twp	August 1	2	Railroad.....	10
8 R. 3 & 4	" 6	800	Berry pickers.....	400
T No. 6	" 24	1	Campers.....	5
		3,220		\$6,558

SOMERSET COUNTY.

Township.	Date.	Acres.	Cause.	Damage.
Taunton & Raynham.....	May 26	10	Railroad.....	\$30
Dennistown	" 26	400	Riverdrivers	50
Rockwood Strip	June 1	6	Clearing land.....	10
Comstock Twp.....	" 2	400	Riverdrivers	2,250
Holeb.....	" 3	2	Clearing land.....	10
Holeb.....	" 3	2	Railroad	50
Sandwich.....	" 4	800	"	500
Pittston.....	" 5	20	Unknown	200
Misery Notch.....	" 6	5	Railroad	75
Dennistown	" 8	2	Unknown	25
8 R. 4	" 8	100	"	500
3 & 4 R. 5	" 25	300	"	3,000
Jackman.....	" 27	1	Lightning	20
Attean.....	July 15	10	Unknown	100
Taunton & Raynham.....	August 2	2	Fishermen	10
Taunton & Raynham.....	August 15	1	Unknown	20
		1,561		\$6,890

WASHINGTON COUNTY.

Indian Twp.....	May 23	50	Unknown	\$200
No. 10.....	" 23	40	"	40
T. 80 & 31.....	June 3	1,200	Logdrivers.....	5,000
No. 8 E. D.....	" 6	400	Trappers	700
Indian Twp.....	" 8	5	Unknown	200
10 R. 3.....	" 10	300	Railroad	800
Hinckley.....	August 10	8	Unknown	10
No. 18 E. D.....	" 31	2	Clearing land.....	10
		2,005		6,285

SUMMARY OF 1909 FIRES.

Unincorporated Townships.

County.	Acres.	Damage.
Aroostook	19,648.....	\$48,209
Penobscot.....	3,220.....	6,558
Somerset.....	1,561.....	6,890
Washington	2,005.....	6,285
Franklin.....	608.....	615
Hancock.....	40.....	100
Piscataquis	6.....	77
	27,083	\$63,734

FOREST FIRES OF 1910.

The fire loss on the timber lands of the state in 1910 was comparatively small, the entire acreage burned over within the Maine Forestry District being only 267 acres of the 9,500,000 acres contained therein. The estimated damage was \$935 compared with the state valuation of \$41,279,390. Of this damage and loss 200 acres burned over by blueberry pickers was in Washington county, the estimated damage to the lot being \$500. Thus it is seen that this one fire included nearly all of the acreage burned over and one-half the entire loss. This number of fires, however, does not include the hundreds of small fires found and extinguished by the patrolmen, which had they been left to burn under the old system of no watchmen, might have amounted to many thousands of acres burned over and a loss running into large figures.

In the incorporated towns eighteen forest fires were reported to this department and of this number six reported no damage was done. In the remaining twelve 581 acres were burned over at an estimated loss of \$1,906.

The causes assigned to the several fires in the Forestry District and the incorporated towns were as follows: Clearing land, 11; unknown, 11; railroads, 5; campers, 3; lightning, 1; blueberry pickers, 1; hot ashes, 1; boy playing with fire 1.

The tabulations follow:

Fires on Unincorporated Townships.
AROOSTOOK TOWNSHIPS.

Townships.	Date.	Acres.	Cause.	Damage.
B. R. 2.....	May 22	1	Clearing land.....	\$10
11 R. 4.....	" 17	1	Locomotive.....	1
16 R. 6.....	" 17	7	Clearing land.....	70
16 R. 5.....	July 11	1	Unknown.....	20
16 R. 6.....	August 28	5	Unknown.....	40
15 R. 4.....	Sept 3	12	Clearing land.....	30
15 R. 6.....	August 31	6	Unknown.....	50
16 R. 6.....	" 30	1	Camp fire.....	30
14 R. 7.....	" 30	2	Camp fire.....	20
Westmanland.....	Sept. 12	12	Clearing land.....	36
7 R. 14.....	August 26	2	Campers.....	30
		50		\$337
HANCOCK COUNTY.				
No. 41.....	Sept. 2	1	Unknown.....	\$2
No. 41.....	Sept. 3	1	Unknown.....	12
		2		\$14
PENOBSCOT COUNTY.				
Stacyville.....	July 19	1	Unknown.....	\$15
SOMERSET COUNTY.				
4 R. 5.....	Apr. 17	10	Clearing land.....	\$2
Dennistown.....	July 28	3	Lightning.....	4
Jackman.....	Sept. 1	1	Locomotive.....	
		14		\$69
WASHINGTON COUNTY.				
No. 24.....	May 9	200	Blueberry pickers.....	\$500

Fires on Incorporated Towns.
ANDROSCOGGIN COUNTY.

Town.	Date.	Acres.	Cause.	Damage.
Lisbon.....	April 14	35	Locomotive.....	\$200
Wales.....	July 26	4	Unknown.....	50
		39		\$250
HANCOCK COUNTY.				
Southwest Harbor.....	April 14	15	Unknown.....	\$200
Sullivan.....	" 15	150	Hot ashes.....	400
Ellsworth.....	" 16	7	Clearing land.....	75
Ellsworth.....	" 16	8	Locomotive.....	6
Hancock.....	" 18	100	Clearing land.....	50
		280		\$781
KENNEBEC COUNTY.				
Wayne.....	July 4.....	5	Unknown.....	\$75
Pittston.....	August 7...	7	Boy.....	100
		12		\$175
KNOX COUNTY.				
Hope.....	April 15	50	Brush fires.....	\$50
South Thomaston.....	" 16	150	Locomotive.....	500
		\$200		\$550
PENOBSCOT COUNTY.				
Eddinburg.....	August 14	50	Unknown.....	\$200

SUMMARY OF 1910 FIRES.

Incorporated Towns.

County.	Acreage.	Damage.
Androscoggin.....	39.....	\$250
Hancock.....	280.....	731
Kennebec.....	12.....	175
Knox.....	200.....	550
Penobscot.....	50.....	200
	<hr/> 581	<hr/> \$1,906

Unincorporated Townships.

County.	Acreage.	Damage.
Aroostook.....	50.....	\$337
Hancock.....	2.....	14
Penobscot.....	1.....	15
Somerset.....	14.....	69
Washington.....	200.....	500
	<hr/> 267	<hr/> \$935

PATROL AND LOOKOUT SYSTEM.

One of the first things attempted and carried out under the conditions made possible by creating the Maine Forestry District, was the enlargement of the patrol and lookout systems.

Eight years ago when the first law was passed looking to the protection of Maine's forests a goodly number of fire wardens were appointed and so far as possible during the dry and dangerous periods the most exposed places were patrolled, but necessarily only a limited amount of such work could be done with an appropriation of only \$10,000, which had to be devoted to extinguishment as well as prevention.

Experience has taught all who have made a study of the protection of forests against fire that first in importance is the protection that can be gained by proper patrol. It has been the custom of the Forest Commissioner each spring to meet the land owners of the different sections of the state at some convenient and central point to talk over and plan the season's work. At the meeting held in 1909 after the passage of the Maine Forestry District act we made known our plans for extending the patrol system and such plans met with hearty approval of the land owners.

An efficient corps of chief wardens were appointed, men being selected who were recommended by the land owners as being thoroughly familiar with the territory assigned to their care. Under the chiefs were placed enough men to cover the most exposed sections and there was not a township of wild land that was not included in the routes of the patrolmen. The waterways and roads most frequently travelled by rivermen and sportsmen were particularly well looked after as were the townships lying along the railways.

Of the amount appropriated in 1909 there was used in the patrol system alone, including amounts paid the chief and deputy wardens the sum of \$31,131.79, making more than one-half of the entire amount expended in 1909 going directly for patrol

work and supervision of the same. In 1910 for the same class of service there has been expended up to Nov. 1, \$38,708.97.

Included in the work of patrol and constant watch for fires there has been posted by these men over 20,000 danger fire notices, printed largely in English, although when it seemed wise notices printed in French and Italian have been put up.

Close touch with the men employed has been made possible by weekly reports returned to the department by the regular patrolmen being required at the end of each week to file reports containing the following information: Townships patrolled; distance travelled each day; fires found, time of same and direction of the wind; locality in detail, how set; kind and quantity of timber burned; area of damage; method of fighting fire; remarks.

In case of fire of any proportion and causing the hiring of extra men the chief or deputy wardens in charge file reports containing the following facts: County and township in which fire occurred; time discovered and number of hours before it was entirely extinguished; direction of wind at the time; method employed in extinguishing same; cause of fire; area burned; estimated damage; names of men and hours employed and the total expense of extinguishing the fire; the report to be signed and sworn to by the warden in charge and approved by the chief warden of the section in which the fire occurred.

Set and fast rules to cover all cases cannot be made but as a reminder of what is expected of the wardens added to the good judgment of the men themselves the following instructions were given:

In making up their reports wardens should see that they are made in accordance with the law thus avoiding the inconvenience of having them returned for correction.

They should then be forwarded to the Chief Fire Warden of the district in which the fire occurs who will send them to the Forest Commissioner at Augusta when they will be promptly paid. No warden should neglect to send in every bill contracted at least once a month. All bills must be approved by the Chief Fire Warden in the district where the same is contracted. See that your bills are certified to be for a Justice in accordance with the law. Whenever it is necessary for you to pay out any money, be sure to take a receipt and enclose it with your report. This will be necessary if you expect to be reimbursed.

An important part of practical forestry is the prevention of fire. This cannot be accomplished successfully without a well organized force in which the duties of each individual are well defined and clearly un-

derstood. To this end the following instructions should receive careful attention.

It is the duty of the chief fire warden to see that the district fire wardens are fully supplied with printed notices containing the rules and regulations relating to the prevention of forest fires. Early in the season fire notices are sent to all wardens but more can be obtained at any time by writing to the Forest Commissioner. The district fire wardens should see that their respective districts are properly posted with these notices, putting them along each forest trail and location frequented by fishermen and hunting parties. During the dry season when fires are most likely to occur, especially in the spring before the trees are in leaf, the chief fire wardens and their deputies should keep a sharp lookout for any sign of fire and have everything in readiness so that when the smoke is seen there will be no unnecessary delay in reaching the spot. Fishermen, hunters and campers should always be cautioned whenever the opportunity offers, to be careful in the use of fire; to refrain from throwing lighted matches on the ground; and especially, to extinguish their camp fires completely before leaving them.

All violations of the law relating to building fires on the wild lands of the State should be carefully investigated, and when sufficient evidence is found the guilty parties should be arrested and the matter reported to the department at Augusta.

No instructions seem necessary here as to how the work at a forest fire should be conducted, for it is assumed that each fire warden has had ample experience in this respect. At the same time it may be well to remember that backfiring should not be resorted to until its necessity is plainly evident; and even then, the entire situation should first be carefully examined and well understood.

It should be remembered, also, that in controlling a woodland fire, one hour's work in the morning or late evening is worth six in the middle of the day. For this reason, if a fire is not extinguished at evening, the men should remain on the ground all night, and the fire wardens should make arrangements to send in food and blankets to the crew. If the men are allowed to leave a fire at evening and go back to their homes much valuable time is lost.

Especial pains should be taken to ascertain the cause of the fire, and the person or persons who started it. Too many reports are received in which the printed questions as to the origin of the fire are answered with the words "Cause unknown." If attended to promptly, there should be little trouble in ascertaining the point at which the fire started, and in most cases who started it. The facts then should be written out fully in the report, no matter whom it may concern. Each fire warden should discharge his duty fearlessly in this respect, without fear or favor. If the fire warden is unable to report definitely as to who the guilty parties were and their connection with it, he should give his opinion as to the cause and who were to blame in the matter.

In addition to answering fully the printed questions in the report the fire warden should furnish such further information as may not be conveyed in the preceding answers, and should take pains to include also everything that might relate directly or indirectly to the matter. After a fire occurs the chief fire warden should, as soon as possible, mail the report of the same to the Forest Commissioner, using the printed form furnished for this purpose.

Every effort should be made by the wardens to bring to justice any and all violators of the forest fire laws.

TOOLS FOR FIGHTING FIRE.

In the early years of our fire law the state wardens had no tools for fighting fires, except such as could be collected and pressed into service from the nearest community. This has all been changed in the past two years and there has been purchased and distributed in convenient localities in the fire district tools to the amount of about \$5000.

These tools are all branded with the stamp of the district and cared for in small camps or depots erected for that purpose, or are deposited in tool boxes built to hold several dozen axes, pails, shovels and mattocks, some 60 of these boxes being constructed under special order in 1910, at a cost of about \$6.00 per box and sent to various localities. These boxes are under lock and key, the keys being kept by the chief wardens and at accessible stations in case of need.

LOOKOUT STATIONS.

Next in importance to the patrol, are the lookout stations located on the highest elevations to obtain the widest view of the surrounding country. Of the few stations built by the timberland owners before the organization of the Forestry District, all of which have been taken over by the district, the number has been increased until there are now twenty-four stations fully equipped and form a valuable asset to the district and the work.

The expenses of these stations, including construction and equipment during the past two years has been \$14,664.49 and we consider this part of the system practically complete, although a few more stations may be deemed necessary. The location of the several stations are as follows:

LOCATION OF STATIONS.	CHIEF WARDENS.
Lead Mt. Twp. 28, Hancock Co.	H. T. Silsby, Aurora.
Pleasant Pond Mt., Caratunk	F. H. Sterling, Caratunk.
Attean Mountain, Attean Twp.	F. H. Colby, Bingham.
Tumble Down Mt., Twp. 5 R. 6 W. K. R.	E. P. Viles, Skowhegan.
Squaw Mt., Twp. 2 R. 6, B. K. P. E. K. R.	Lewis Oakes, Greenville.
Snow Mt., Twp. 2 R. 5, Franklin County	E. P. Viles, Skowhegan.
Mt. Bigelow, Bigelow Twp., Som- erset	E. P. Viles, Skowhegan.
White Cap Mt., Twp. 7 R. 10	J. L. Chapman, Milo.
Spencer Mt., Middlesex Grant.	John Appleton, Bangor.
Rocky Mt., Twp. 18 R. 12, W. E. L. S.	H. B. Buck, Bangor.
Trout Brook, Twp. 5 R. 9, W. E. L. S.	N. C. Ayer, Bangor.
Mt. Chase, Mt. Chase Twp.	S. C. Cummings, Haynesville.
Ragged Mt., Twp. A R. 9, W. E. L. S.	M. L. Woodman, Lagrange.
Mt. Kineo, Kineo Twp.	Lewis Oakes, Greenville.
Mt. Coburn, Twp. 3 R. 6, W. B. K. P.	F. H. Sterling, Caratunk.
Wesley Mt., Wesley	Alfred K. Ames, Machias.
Depot Mt., Twp. 13 R. 16 W. E. L. S.	H. B. Buck, Bangor.
Soper Mt., Twp. 8 R. 12, W. E. L. S.	H. B. Buck, Bangor.
Round Mt., Twp. T. 11 R. 8, W. E. L. S.	H. B. Buck, Bangor.
Aziscoos Mt., Lincoln Pl., Oxford County	S. F. Peaslee.
City Camps Twp. 4 R. 9, Piscata- quis	
Bald Mt., Twp. 2 R. 3, E. K. R.	F. H. Sterling.
Kibbe Mt., Twp. 1 R. 6.	L. P. Barney, Skinner.
Priestly Mt., Twp. 10 R. 12, W. E. L. S.	H. B. Buck, Bangor.

TELEPHONE LINES.

In connection with the lookout stations and patrol system many miles of telephone line have been constructed, bringing the remotest sections in quick communication with the chief wardens and localities from which men can be hastened to the scene of fire in case one is discovered. The value of these lookouts thus connected by telephone have been many times demon-

strated by the watchman communicating with a warden giving him the direction and almost exact location of a smoke from some small fire. One or two men sent out to investigate and put out the fire in its early stages accomplishes what hundreds or an army of men could not do after the fire has gained great headway and is being driven before high winds.

REPORTS FROM CHIEF WARDENS.

Something more in detail as to the exact amount of work accomplished is shown by extracts from the reports of wardens which follows:

The largest assignment to any one chief warden is that given to H. B. Buck of Bangor, who says in part in regard to the work performed under him in 1909:

"The territory covered by this patrol includes one hundred eleven townships, embracing an acreage of 2,591,663 acres valued by the state assessors at \$10,058,777. This territory was divided into six sections, viz., the Aroostook river watershed west of the Ashland branch of the Bangor & Aroostook railroad, and the Machias watershed; the watershed of the South Branch, Little South Branch and Boundary Branch of the St. John river; the watershed of Chemquassabamticook stream and lake, head waters of the Allagash system; the Allagash river watershed from its mouth to Churchill lake, the St. Francis river watershed in Maine, the Little Black river watershed in Maine, and the main St. John river watershed from the mouth of the St. Francis river to the mouth of Big Black river; the watershed of Churchill lake, the watershed of Eagle lake, the watershed of Chamberlain lake, and of the Allagash stream and lake; the watershed of the St. John river from the mouth of Big Black river to the Northwest Branch, the watershed of Big Black river in Maine, Depot stream and lake, and the Canadian Boundary adjoining Townships 15, R. 15, 14 R. 16, 13 R. 16, 12 R. 17, and 11 R. 17.

"The area patrolled, 2,291,553 acres, including the cost of maintaining four fire stations located within the territory was done at an expenses of \$10,456.47 or a very small fraction over four mills per acre.

"Outside of the many small fires which the patrolmen, notably on the Allagash river, have extinguished, but few fires have oc-

curred in this territory, five being reported as follows: On Township No. 15 Range 15, adjoining the Canadian Boundary. Started June 13, from fires left by river drivers coming from Big Black river drive. This fire burned over 75 or 80 acres, one-half of which was cleared land and the remainder a hardwood ridge. On Township No. 15 Range 13 in the S. W. $\frac{1}{4}$ a fire started June 9, from fire left by river drivers on Big Black river, burning over about eight acres of spruce, fir, cedar and hardwood growth at an estimated damage of \$25 or \$30.

"On Township No. 16 Range 10, Northeast corner fire started June 4 from a fire left burning by a driving crew on main St. John river, burning over about six acres of spruce, fir, cedar and hardwood growth, at an estimated damage of about \$25.

"Early before the patrols were put on a fire started by a driving crew burned over from 1500 to 2000 acres on Townships 9 R. 7, 9 R. 8, 8 R. 7 and 8. R. 8 on the Aroostook river. The last of May a fire started on Township No. 20, Range 11 & 12, bordering St. Francis river, supposedly from fires on the right of way of the Grand Trunk Pacific Ry. which follows close to the Canadian shore of the St. Francis river. The burned area was estimated at about 700 acres.

"So far as known the total burned area in 1909 within the patrolled district as above amounts to something under 2000 acres, or less than one-tenth per cent. of the total acreage.

"At the expense of the lumbermen and land owners the following telephone lines have been built during the past few years and are available for the use of the fire wardens: Line from St. Pamphile, P. Q., to Seven Islands, Maine, on the St. John river passing through Townships 14 Range 16 and 13 Range 16; thence from Seven Islands up the St. John river to St. John Lumber Co's. depot camp near the centre of Township No. 12, Range 15; thence across country to Jos. T Michaud's depot camp at Clayton lake in Township No. 11, Range 14. From Clayton lake Michaud has a line to the dam at the foot of Chemquassabamticook lake in Township No. 10, Range 15, and to his camps in Township No. 10, Range 15.

"He also has a line from Clayton lake following Chamquassabamticook stream to Long lake dam in Township No. 12, Range 13, and thence down the Allagash river to its mouth, where it connects with the line of the St. Francis Telephone Company

running to Fort Kent and there connects with the New England Telephone Co.

"There is also a line from Seven Islands in Township 13, Range 15, down the St. John river to the "Hunter Farm" in Township No. 14, Range 14. From Henderson's in Allagash Plantation our line runs to the Rocky Mountain fire station in Township 18, Range 12, a distance of about 12 miles. This line should be extended to the "Hunter Farm," a distance of some twenty miles, thus completing the circuit and greatly increase the efficiency of the patrol and lessen the number of patrolmen necessary on the St. John river.

"On the Machias river the Ashland Company has a telephone line to Machias dam at the foot of Machias lake, in Township No. 12, Range 8, from which point the state in 1909 built a line to Round Mountain fire station in Township No. 11, Range 8. There is a telephone line from Patten to Eagle lake, built by the Eastern Mfg. Co. From Haymock in Township No. 8, Range 11, the state in 1909 built a line to Soper Mountain fire station in Township No. 8, Range 12. Mr. N. C. Ayer of the Eastern Mfg. Co. was to extend his line from Township No. 9, Range 14 camps to the dam at the foot of Chamquassabamticook lake in Township No. 10, Range 15.

"While I believe that rivers travelled by sportsmen as much as is the Allagash river should be patrolled by men in canoes, yet I am of the opinion that much of the interior lands can be better covered by watchmen at lookout stations, at a much less expense."

Extracts from Mr. Buck's report to the department for work done in his territory in 1910 follow:

"The same territory was under my charge in 1910 as during the previous year and an efficient patrol was maintained throughout the season at a cost of 3.66 mills per acre.

"In this territory we now have five lookout stations, located as follows: Depot Mountain, Twp. 14 R. 16; Rocky Mountain, Twp. 18 R. 12; Soper Mountain, Twp. 8 R. 12; Round Mountain, T. 11 R. 8; Priestly Mountain, Twp. 10, R. 13.

"The stations on Depot Mountain, Soper Mountain and Round Mountain were built by the state in 1909. The station on Rocky Mountain was built by the land owners in 1907, before the Fire District was created. The station on Priestly Mountain was

built by the state in 1910 at a cost including 12 miles of telephone line, of \$582.97. The tower is 22 feet high, built on the highest bluff of the mountain and is constructed of twelve logs standing upright. The logs are framed with a platform on top 6 x 7 feet, with a "caboose" on the platform. There are four windows in the caboose so a view can be had in all directions. There is a living camp, 14 x 16 feet, built on the shore of Priestly lake. A living camp was also found necessary for Depot Mountain and was built at a small expense.

"In addition to the telephone lines enumerated in the report of the work for 1909, the following lines have been constructed during the season of 1910, more miles of line being built this season than was first contemplated for the reason that during the summer there were times that the patrolmen did not need to keep up the patrol and it was thought best to keep them at work on new telephone lines that were needed for the work. The expense of these lines in reality was only for the material, as these men were under pay for patrol work.

"Glazier Lake Line: This line connects with the main line at St. Francis, crosses the St. John river west of the mouth of St. Francis river and follows the St. Francis river on Twp. No. 18 R. 10, to the head of Glazier lake, where a box is located in a farm house in said township. This line is about 10.5 miles.

"Castonia Line: This line connects with the main line at Dickey, a postoffice in Allagash Plantation, at the mouth of Little Black river, and crosses the St. John river at this place and follows along the northerly side of the St. John river to a farm near the mouth of Tulandic stream in Twp. No. 16 R. 12, now occupied by Hilaire Castonguay, where a box is located. This line is about 17.5 miles in length.

"Musquacook Line: This line was first connected with the Allagash line at mouth of Musquacook stream and then run up Musquacook stream to Musquacook lakes, to the depot camp of W. H. Cunliffe's Sons', in Twp. No. 12, R. 11, a distance of about 13 miles. For the free use of this line in connection with lumbering and driving Messrs. Cunliffe's Sons furnished the labor for the construction, the state paying for the material.

"After this line was put in operation it was found that it loaded the Allagash line too much and the patrolmen, during wet periods, continued the line down the Allagash river a distance of three miles, and connected with a line previously built by

Messrs. W. H. Cunliffe's Sons. This line goes to Conlif's depot camp in N. E. part of Twp. No. 14, where a switch is installed and connection made with other points.

"Umsaskis Line: On the easterly shore of Umsaskis lake, in Twp. No. 11, R. 13, a summer sporting camp is maintained by Messrs. W. H. Cunliffe's Sons, in charge of George Kelley. Mr. Kelley was engaged to look after Umsaskis and Long lakes during the past season, where we had two patrolmen in 1909, and to put him in touch with Harry E. Hasey, Chief Warden, a telephone line was built from the camp, connecting with the Priestly mountain line at the head of Long lake. This line is about three miles.

"Aroostook Line: This line begins in Ox Bow, Twp. 9 R. 6, and follows the southerly side of Aroostook river to the fire warden's camp at the mouth of Mooseleuk stream in Twp. No. 8, R. 8. This line is about eleven miles and was built by patrolmen; the only expense being for material and team. Material enough is on hand to complete the line another season five miles farther up the river. There is also material enough on hand at Allagash to build twelve miles of telephone on the main St. John river, which can be done by the patrolmen in 1911 and thus complete the connection of the lower and upper St. John river watersheds.

"With the exception of the small camp fires extinguished by the patrolmen during the summer, we have had but three small fires in this large territory, one on T. 15 R. 15; one on T. 19 R. 11 and one on T. 7 R. 14, the expense of extinguishing the three being \$99.60."

M. L. Woodman of Lagrange, chief warden for the district, south of Norcross in Penobscot and Piscataquis counties, says in regard to construction and permanent work for 1909-10: "New lookout station was constructed on Ragged Mountain, completely equipped with instruments, cooking outfit, etc. Ten miles of new telephone have been built and thirty-five miles kept in first-class repair. The connections afforded by this telephone service are Long A; A Range 10; A Range 11; B Range 11; Indian Township and No. 1 Range 10. Trails have been spotted and marked between lakes and ponds, for a distance of 78 miles, varying in length from one mile to four and one-half. Tools and instruments are in first-class shape and the season closes with no fires of any importance."

Louis Oakes, of Greenville Junction, chief warden for all unincorporated townships in the Maine Forestry District, in Piscataquis county within 20 miles of Moosehead lake, reports: "In this territory during the season of 1909 there was built for permanent equipment, a telephone line from the Moosehead Telephone Company's central at Kineo Point, about one and one-half miles of line to the top of Kineo Mountain and a telephone instrument installed there.

"In the same territory during the season 1910, eighteen Maine Forestry tool boxes were distributed at all convenient points and fully equipped with the necessary fire fighting tools, also five portable telephone boxes for use of the patrolmen. On the Big Squaw and Kineo Mountain there has been built during the season of 1910 a lookout house for each mountain, situated near the top. The two station houses are equipped with stoves, etc., for use of men on the lookouts."

Forrest H. Colby, of Bingham, one of the chief wardens for the Kennebec waters reports: "In the Moose River Valley there have been no fires of any size, even along the Canadian Pacific Railway. Tool boxes and tools have been located at various stations, which would have been a great help in case of a fire of any size. Camp kits have been procured for the watchmen on Attean Mountain and two for the patrolmen along the line of the railroad. The telephone line from Jackman to the top of Attean Mt. has been put in first-class condition."

Frank H. Sterling, of Caratunk, chief warden for all unincorporated townships in Somerst County to the north line of Bingham's Kennebec Purchase, shows in this Kennebec Valley division, permanent camps built at Bald Mountain, Mt. Coburn and Pleasant Pond lookout stations. Eighteen miles of tree telephone were put in connecting Bald Mountain lookout station, Lake Moxie R. R. station, Lander's Siding, Baker's Siding, Pleasant Pond Mountain lookout station to Pleasant Pond. On this line ten telephone instruments were installed for the use of the wardens. This arrangement practically covers the whole of Somerset County, making it possible to call anyone that can be reached by public or private lines in the county. Fourteen miles of tree telephone were put up from Mt. Coburn to West Forks and by arrangements made for temporary use with H. P. McKenney gives the Forestry District free service of his line to Jackman, Attean and Spencer.

J. L. Chapman, of Milo, chief warden for the district including East and West Bowdoin College Grants; T. 7 R. 9; Elliottsville Plantation; Katahdin Iron Works; T. 5 R. 9; T. A R. 11; T. A R. 12; T. B R. 11, reports: "During the early part of the season of 1910 we repaired the telephone line from Roach River to the top of White Cap Mountain, where there is a lookout station. Later in the season the telephone line was repaired from Brownville to B Pond and up the East Branch of Pleasant river. The repairing of this East Branch line was great advantage to the forest fire district service as men upon patrol upon Townships A and B Range 11 had no means of communication except by messenger by the way of Katahdin Iron Works, and in case of fire, which should be beyond the control of the patrol men, they would be obliged to leave their work, making a trip to the Iron Works, a distance of fourteen or sixteen miles; therefore the benefit of the telephone line.

"The season of 1910 perhaps had its advantages and although we had no fires to contend with I feel that the men we have had upon patrol have worked to good advantage in creating a renewed interest with the campers and tenters of fishing parties and hunters. Many of these parties have flocked to the Maine woods during the season, and the men under my control have not had any difficulty whatever with any parties who have been in the woods. A mutual interest seems to be created from the new system which the department has been endeavoring to work out, an interest of mutual benefit to all.

"People who own sporting camps are realizing the advantages of keeping out the forest fires which are not only a menace to their camps and property, but are an injury to the beauty of the forest, aside from the danger to its wealth.

"One young man under my patrol on Wilson Pond relates how fishermen getting wet in their boat by a shower which came up during the afternoon, went ashore and built a fire against the side of a big pine log to dry out their clothing, and as the fishermen afterwards stated, they considered there would be no danger from the fire on account of its raining at the time of its being built, but four days afterward the ground was still burning, and the ground had burned beneath the top soil and spread over a large territory. The young man upon patrol had to cut out the burning sods, throwing them into the water, making openings through which he could pour water to extinguish the

fire burning underneath. This shows that perhaps during the dry season fishermen would not even endanger themselves enough to build a fire, only what they consider a wet period and thus be more neglectful of their duties in extinguishing. I have noticed that this holds true in many instances. I feel that this season of 1910 has brought about good results in many ways in the advancement of the protection of fires under the methods which you have advocated."

CO-OPERATION WITH NEW HAMPSHIRE.

Early in the season of 1910 through correspondence with Hon. E. C. Hirst, state forester of New Hampshire, a system of co-operation was entered into whereby Maine gets the benefit of the Kearsarge Mountain station, located in Chatham, N. H. This station can be reached by telephone through North Conway and it overlooks a considerable territory in Maine. Other stations overlooking Maine forests near the border are contemplated by New Hampshire. In return for this service the Maine Forestry District gives to the bordering state any information of fires discovered from the Aziscoos Mountain station, located in Lincoln Plantation, Oxford County, which has a view of quite a number of thousand acres of forests across the border line.

According to the agreement entered into between the foresters of the two states, when a New Hampshire lookout man discovers a fire in Maine he shall immediately telephone to the fire warden for the township where the fire is located, such telephone bills to be paid by the Maine department at the end of each month. Likewise when a Maine lookout man discovers a fire in New Hampshire he shall immediately telephone the fire warden nearest said location and for such telephone service New Hampshire department is to pay the bills at the end of each month.

FINANCIAL STATEMENT.

In the two years past, which is the first period since the incorporation of the Maine Forestry District, there has been available under the act, assessing a mill and a half on the valuation of the wild lands, the sum of \$63,945.44 for each year.

Of the amount expended the largest item is for patrolling, and that is as it should be, following the old maxim that an ounce of prevention is worth a pound of cure, as every dollar expended in patrolling and extinguishing the incipient fires found by such patrolmen, undoubtedly saves thousands of dollars of damage which would accrue if the small fires were swept into conflagrations.

The money expended for the construction and equipment of lookout stations and the purchase of tools for fighting fire, which for the two years has amounted to \$19,632.05, must be considered in the light of permanent improvement, as with proper care which the department is bound to give them, they will last for years. A few more stations may have to be constructed and more tools purchased before the district is fully equipped, but it is not expected there will be another period of two years when charges against these two accounts will be large.

In the matter of extinguishment of fires no estimate of the exact amount that will be required can be made and one year must necessarily differ from another as is shown by the record of the two seasons past. In 1909 the amount charged to extinguishing fires was \$10,944.80, while in 1910 the total expended under that head was only \$1,366.14.

The expenditure in detail will be found in the report of the State Auditor, but a summary of the two years is hereby given :

SUMMARY FOR 1909.

Patrolling Account.....	\$23,096 05
Cost of Lookout Stations and Telephone lines....	7,380 15
Watchmen on Lookout Stations.....	4,093 54
Expense Extinguishing Fires.....	10,944 80
Chief Fire Wardens.....	6,510 99
Deputy Fire Wardens.....	1,524 75
Tools and Supplies.....	2,163 25
Other Expenses	2,232 32
	<hr/>
Total	\$57,945 83

SUMMARY FOR 1910.

Patrolling Account.....	\$31,891 54
Cost of Lookout Stations and Telephone Lines....	7,284 34
Watchmen on Lookout Stations	5,411 83
Expense Extinguishing Fires.....	1,366 14
Chief Fire Wardens.....	6,119 03
Deputy Wardens.....	698 40
Tools and Supplies.....	2,804 31
Other Expenses.....	2,155 97
	<hr/>
*Total	\$57,731 56

Of the amounts expended in 1909 and 1910, \$19,632.05 was for permanent improvements. There will remain an unexpended balance for the two years of about \$12,000.00.

*The total for 1910 is as it existed Nov. 1, when this report was sent to the printer. The season's bills are practically all in and paid, although there may be a few small bills to pay before Dec. 31.

REPORT OF THE FORESTRY DEPARTMENT AT
THE UNIVERSITY OF MAINE TO THE
FOREST COMMISSIONER NOVEM-
BER 1, 1910.

We append herewith the report of Prof. John M. Briscoe, who has charge of the forestry department at the University of Maine. The maintenance of this department is taken from the \$2,500 appropriated for public instruction in forestry. This department is doing excellent work in instructing young men in practical forestry and I hope that ample appropriation will be made to continue the work and enable us to employ an assistant.

To the Hon. E. E. Ring,
Forest Commissioner,
Augusta, Maine.

Sir:—

THE PAST.

It gives me pleasure to present herewith a report on the status of the Forestry Department at the University of Maine.

Eight years ago, when the forestry course was first instituted at the University, there were only three other institutions in the United States offering instruction in forestry. Today more than twenty educational institutions offer more or less complete courses in the subject. These figures are given simply to show the general growth of the movement, and to emphasize the fact that in order to keep well up in the front ranks and to maintain the position and prestige which are the natural result of priority in the field, it is necessary to move forward. In other words, the equipment and the funds that were at one time sufficient are no longer adequate for the demands now made upon them, which have been increasing regularly and steadily from year to year. This has been occasioned both by the increased number of students taking this course, and also by the more advanced work

necessary to prepare these students properly for their future work in their chosen profession.

The objects of the course at the University of Maine are two-fold; first to promote forestry in the state, and second to prepare young men for the profession of forestry. The first is accomplished by means of lectures given at farmers' granges, clubs, and schools and also by correspondence. That the first object has been successful is evidenced by the increased interest shown by the increased correspondence and the greater demands for this kind of work. The second object is accomplished by means of a well regulated curriculum which provides for a thorough general education as well as training in the more technical branches of forestry proper. During the past year two of the men from this school passed the civil service examinations for the position of Forest Assistant, and were appointed to positions in the United States Forest Service at salaries of \$1,200 per annum.

This speaks well for the school, and for the training that they received during the time that Professor Tower was in charge of the courses for it is not unusual for men to pass this examination unless they have had either a year or two at some post-graduate forest school, or else have had some exceptional advantages in the way of practical field work. In this examination 20% of the total credit is given to "training and experience," and under this heading the school courses and the practical field work that the candidate has had are taken into consideration. This means, of course, that unless the school at which he has received his training is a first-class one in the eyes of the Forest Service, he does not get full credit for this part of his examination. This, in itself, is enough to make it clear to everyone that the standard of the school must be maintained.

Besides last year's graduates, there are now five other Maine forest school men in the government service, and there are many others employed throughout the state by lumber and paper companies and in private forestry work.

THE PRESENT.

The Maine forest school is now provided with excellent quarters in the new agricultural building. Besides the directors' office, there is a large, well lighted class room, two drawing rooms,

ERRATA.

In the third line of the second paragraph, page 59, the word
“unusual” should read usual.

an instrument room, a storage room, and room in the basement for timber testing which, however, has not yet been equipped with the necessary machinery, owing to lack of funds for the purpose.

The equipment in the way of instruments and implements is of the best quality, and is being added to as rapidly as the very limited funds available will permit. With the growth of the school, this must, of course, continually be increased.

The spirit of co-operation shown by the other departments of the University in which part of the curriculum is given is admirable. This is particularly true in the Biological and Engineering Departments where much of the fundamental work is given to the forestry students in order to prepare them for the more advanced forestry work.

The following students are now taking forestry courses:

Students whose major subject is forestry.....	31
Seniors	6
Juniors	6
Sophomores	4
Freshmen	15
Special students majoring in forestry.....	5
Students taking special forestry courses.....	4
	<hr/>
Total	40

This represents about 5% of the total enrollment at the University, and all of these students pay the regular tuition fees to the University, though no instruction in forestry proper is provided for by the University itself. This year, however, a field assistant was provided and paid by the University for assisting the professor of forestry during the fall semester with the field-work. There is available for this work only the special fund of \$2500 provided by the state legislature for public instruction in forestry, and so far, not even all of this fund has been for the work at the University. Other departments in the University with the same number of students have funds of from three to four times this amount to provide for instruction in their particular branches. Is it fair to the forestry students that they should have less instruction in the work of their chosen profession?

THE FUTURE.

Within the past decade tremendous strides have been made in the progress of forestry in the United States, and this in turn has placed an increased responsibility on the technically trained men. This will necessitate better preparation at the schools of forestry. The standard of the work at the University has been steadily and materially raised and as many additional subjects have been added to the curriculum as the existing circumstances would permit, yet our progress is not commensurate with the development of forestry nor with the higher standard of requirements which the work now demands.

In the curriculum itself, more field-work is needed, that is actual forestry work in the woods under the supervision of competent instructors. To accomplish this, more money is needed for it is impossible for one man to give the whole course at the University, attend to all correspondence, give outside lectures and make examinations, and at the same time conduct a field-party in the woods. We must have the practical work in the woods to make the department what it should be, and what all the good friends of forestry in this state would have it, if they could only be made to realize, in time, the exact conditions.

What we need at once is an annual appropriation of not less than \$5000 to put the work on the proper basis. Besides this we would like to have a permanent endowment fund for the forestry course started in this state. Most all of the forestry departments in other Universities have large permanent endowments, and there is no good reason, if the matter is taken up in the proper way, why this department should not have at least \$100,000 or more as a permanent fund, the interest from which could be used for the proper equipment and maintenance of a strictly first-class forest school such as would worthily represent the Pine Tree State.

There is no state in the Union that offers better natural facilities for such a school, and besides this, the vast amount of land that is, and for the most part always will be true forest land, makes it necessary that steps be taken in time to provide a body of technically trained men who will be able to satisfactorily solve the many problems that arise as to the proper utilization and management of "the Maine woods."

The forests of Maine have been the source of many millions

of the public and private wealth of the state, and under proper management, will continue to be for the generations yet to come. Does it not seem very fitting that some recognition should be taken of the fact, as well as some provision made now for the future welfare of the forests? And what better means could be found for perpetuating a worthy name than the establishing of an endowment for the conservation of these, our greatest natural but all too easily destroyed resources, "the woods and lakes of Maine?"

Respectfully submitted,

JOHN M. BRISCOE,

Professor of Forestry, U. of M.

THE CARE OF THE FARM WOODLOT.

BY PROFESSOR GORDON E. TOWER.

The woodlots of Maine form an important adjunct to the farm. The income which the farmer derives from the woodlot and the material it furnishes in the way of fuel, fence posts and building material for use on the farm greatly enhances the value of the farm. The general treatment which the woodlot has received has not led to its improvement or produced an increase of the total wood product, but on the other hand has resulted in a deterioration of our woodlands, so that today the wooded areas of the farms are not producing more than one-half or three-fourths as much wood as they are capable of growing. Many of the woodlots contain naturally a mixture of many different kinds of trees. When material was cut to supply a market demand, the best was taken, and even when fuel-wood was cut for home consumption the same practice has been followed as a rule. Such a culling process repeated again and again leaves the poor and worthless growth which frequently is of a decidedly inferior quality even for cordwood. Such growth encumbers the ground and seriously interferes with the production of a better crop of trees or may even prevent their starting at all.

No farsighted farmer will deliberately till his land in such a manner as to reduce the fertility of the soil to a point where it will produce only one-half or one-fourth of a crop and yet that is the condition into which the woodlot has been brought. Not only has its worth depreciated but the value of the farm as well. To convert the woodlot at this stage into tillable land is not an alternative because as a rule it occupies the poorest part of the farm; neither is it prudent to turn it into pasture land for the farm stock. Run-down land if properly treated and well cultivated can be made to yield better crops; so can the woodlot be improved and the wood which it will produce be increased in quantity and quality if it is given the proper treatment. To improve the woodlot and bring it into a condition to produce a larger and better crop, does not necessitate the introduction of

radical measures hard to execute, neither does it mean that all cutting shall cease. Simple methods easy of application will accomplish the purpose. Assuming that the growth has reached a size suitable to be cut and that the fire danger is duly guarded against, the condition of the woods can be improved by regulating the grazing and by proper thinnings.

The pasturing of the farm stock in the woods should be carefully regulated and if a young growth of trees is starting or if the owner wishes to have such growth start no stock whatever should be permitted to graze in them.

When any cutting is done care should be taken to thin out the undesirable growth and improve the composition of the stand. Instead of selecting the best trees and those which produce wood that splits easily, the crooked, rotting, scarred, and broken topped trees, those which are crowding the good trees or are overtopped by them, and those of poor quality should be taken as a general thing. It is rarely possible to remove all of the undesirable growth in the first thinning and the cuttings should be so planned as to make several rather light thinnings. By making repeated thinnings there is less danger of exposing the soil to the drying action of the sun and wind and this is an important point to be remembered with all thinnings, for when the soil becomes dried out too much the trees grow slower instead of faster. At times portions of the woodlot get into such a state as the result of unforeseen and uncontrollable circumstances that it makes more or less extensive cutting imperative. When such conditions arise as the result, for example, of windfall, the thing to do is to make the best of a bad situation and utilize the material in the best possible manner. In selecting the trees to be cut attention is given not only to the quality of the trees to be left but to their ability to properly shade the ground. With a species having naturally a very open top or crown like the birches and poplars, a much lighter thinning would have to be made than in a stand of beech or a mixed stand of hardwoods. The kind of trees in the woodlot makes a difference therefore in the number of trees to be removed. Although several factors must be taken into account in making thinnings for the improvement of the woodlot, it really comes down to the matter of exercising a little good judgment and the results attained will be well worth the effort.

The removal of all the trees is a method quite commonly practiced in our woodlots. When used in a hardwood growth, sprouts spring up from the cut stumps which very quickly form an effective cover for the protection of the soil. The trees should be felled with an ax, stumps cut 4 to 6 inches high, the top left smooth and slanting, to shed water and care taken not to injure the bark on the stump, if the best conditions are to be secured for the production and growth of sprouts. The area cut over should not be too large and can be made either a narrow strip, or several strips alternating with strips of standing trees and distributed over the whole area; or the cutting can be done in small patches or groups which are uniformly scattered over the woods.

The advantages of burning the brush left after the cutting, are (1) that the danger from fire is greatly lessened and (2) there is no refuse to interfere with young growth which might spring up. Brush burning is not recommended, however, unless care is exercised in doing it, otherwise more harm than good may result. Attention is necessary in piling the brush so that the fire will not injure the remaining trees and the burning must be done at a time when there is no danger of the fire getting beyond control.

Such lines of management for the improvement of the woodlot as have been briefly indicated, systematically and carefully carried out, will greatly improve the conditions for the growth of the trees. There will be an increased production of wood that in itself will repay for the added labor; besides the material obtained which in most cases will be sufficient to cover all expenditures of labor and money even if time is taken to burn the brush.

The improvement made in the University woodlot is cited as an example that such work pays for itself. The stand of timber in which the thinning was done covered an area of about 16 acres and consisted of a mixed growth of conifers and hardwoods. White pine was the predominating conifer, there being some hemlock, a little fir, and a few spruce and cedar trees. White and gray birch, soft maples and elm were the most abundant hardwoods. The estimated stand of the conifer before the thinning was done was 10,000 board feet per acre. One-half of the area was cut over one year and the remainder the next. The

first thinning was rather heavy because we wished to get some lumber for use on the farm; the next year a much lighter cutting was made. The two operations therefore differ considerably in the amount of material removed.

In marking the trees to be cut the white pine was the favorite species. All hardwoods were removed as far as possible in both operations. In the first operation the fir, spruce and hemlock were taken whenever they were not required to maintain the proper shading for the protection of the soil. Of the pine, only the very poorest and most defective were cut. The conifers were cut for lumber; the hardwoods were worked up into cordwood. The spring following the cutting the brush was piled and burned. In the second operation no trees were cut for lumber, only material for cordwood being taken. The piling and burning of the brush in this case was made a part of the operation, all the refuse being cleaned up as fast as the cutting was done.

The items of income and expenditure for each operation are given below, the computations being based upon the prices prevailing at Orono for cordwood, lumber and labor:

FIRST CUTTING.		SECOND CUTTING.	
RETURNS.		RETURNS.	
15,000 ft. lumber at \$25,	\$375	50 cds. wood at \$4,	\$200
62 cds. wood at \$4,	248		
	<hr/>		
	\$623		
EXPENSES.		EXPENSES.	
Marking trees at 75c. per acre,	\$ 6	Marking trees at 75c.,	\$ 6
Cutting logs,	28	Cutting and piling 50 cds. wood	
Yarding logs,	8	at \$2,	100
Hauling logs,	18	Piling and burning brush,	12
Cutting 62 cds. wood at \$1.50	93	Hauling,	25
Hauling 62 cds. wood at 50c.,	31		<hr/>
Piling and burning brush,	20		\$143
	<hr/>		
	\$204		

In the first cutting the total receipts were \$623, deducting the expenses leaves \$419 as returns from the woodlot or an average of \$52 per acre. Allowing a stumpage price of \$1 per cord for the wood and \$7 for the logs or lumber and deduct from the above figures leaves a net return of \$252, or an average of nearly \$32 per acre.

The second cutting gave less than one-third as much as the

first in the way of money returns, the value of the wood being \$200. Deducting expenses leaves a return of \$57.55, and allowing the same stumpage price of \$1 per cord gives a net return of \$7 after every expense has been deducted. In the improvement of the farm woodlot the labor would ordinarily be done by the farmer himself and would usually not be reckoned as an item of expense.

The second cutting was conducted entirely for the purpose of improving the woodlot. Being an improvement cutting, the total amount of material procured was very much less in comparison with that from the year previous yet enough wood was procured to more than pay for the cost of marking, cutting and hauling, piling and burning the brush, and still leave a small margin of profit even where the cutting and piling of the wood cost \$2 per cord as it did in this operation. The item of marking which was required on the University woodlot would not be necessary where one did his own cutting.

In addition to the pecuniary returns obtained from the woods, the conditions for growth of the remaining trees are far better than before the thinning was made and a greater volume production of wood will be secured than would have been possible with previous conditions and better financial return from the woods can therefore be obtained in the future. Then, too, there is about 8,000 feet board measure per acre of pine remaining in the woods that is worth about \$80 an acre where it is.

BENJAMIN C. JORDAN FUND.

At the session of the Legislature of 1909 Benjamin C. Jordan, of Alfred, who for many years has been interested in conserving the timber lands of Maine, presented to the members the unique proposition of giving to the state the sum of \$1,000.00. The conditions of said gift are set forth in the following proposition, signed by Mr. Jordan:

I would like to give to the State of Maine, to be its property forever, one thousand dollars, on condition that in consideration of said gift the state shall, once in 18 years, offer five prizes to be called the Jordan Forestry Prizes, as follows:

\$500.00 1st prize
\$250.00 2d "
\$125.00 3d "
\$100.00 4th "
\$25.00 5th "

Said prizes to be offered now by the State for the five best lots of young forest growth in the State and awarded by the State Forest Commissioner subject to the approval of the Governor, January 1st, 1927, and once in 18 years afterward forever, after a careful examination of all lots competing in accordance with the following rules:

Rule 1. Each lot shall consist of one parcel of not less than ten acres in somewhat regular shape and shall be accurately surveyed and plotted.

Rule 2. The majority of said trees shall not be less than ten feet nor more than thirty feet high and not less than ten nor more than thirty years old when the prize is awarded.

Rule 3. Said forest may consist of any of the following kinds of trees, but other circumstances and conditions being equal, preference shall be given in the following order: White Pine, White Oak, Hickory, Chestnut, Hachmatack, White Ash, Yellow Oak, Red Oak, Bass, Hemlock, Spruce, Norway Pine, Pitch Pine, Cedar, Fir, Poplar, Birch, Maple, Beech and Elm.

Rule 4. All competitors for the prizes shall file in the office of the State Forest Commissioner, their intention to compete, together with a correct and definite survey and plan of the lot, ten or more years before each award, and when such notice has been filed, said lot shall be eligible although the ownership may have changed.

Rule 5. Myself and my heirs shall have the same right as others to compete for the prizes.

Rule 6. In awarding prizes, other circumstances being equal, the following conditions shall be considered in the order named:

(a) Right number of trees per acre. (b) Even distribution over whole lot. (c) Health and thriftiness of trees. (d) Adaptation of the varieties of trees to the soil in which they stand. (e) Uniformity of size of trees. (f) Size of trees. (g) Size of the lot.

BENJAMIN C. JORDAN.

Alfred, Maine, January 14, 1909.

In accepting the offer the Legislature passed the following resolve:

Resolved, That the offer of Benjamin C. Jordan, of Alfred, Maine, giving to the State of Maine, one thousand dollars, to be known as the Jordan fund, conditions of which are herewith annexed, be hereby accepted, and the conditions of which shall be carried out by the State Forest Commissioner.

The \$1000.00 was deposited with the state treasurer by Mr. Jordan, as required during the year 1909, but up to this date no applications have been filed with the department by anyone wishing to compete for the prizes offered.

CONCLUSION

The proper conservation of our forests is a subject for deep thought and the exercise of our best judgment. Up to recent years forest fires were allowed to burn until extinguished by rain or the winter snows. As a result a large percentage of our forests have at some time or another been burned over, entailing a loss almost incalculable. The ground in most of our forests is covered with leaves, sometimes to considerable depth, in various stages of decomposition, and camp fires built upon this ground are particularly dangerous, as the soil burns and it is difficult to extinguish the fire. Ground fires have been known to burn for months and defy all efforts to extinguish until there was a heavy fall of snow. Such fires will sometimes travel beneath the surface for considerable distances and break out in fresh places several days after one thinks it has been entirely subdued.

The recent destructive fires which have occurred in the primeval forests of Washington, Minnesota and Montana, destroying many millions of property and hundreds of human lives, demonstrate the necessity of a thorough system of fire protection in our own state. Maine contains upwards of 10,000,000 acres of wild land, intersected in every direction by railroads, its forests teeming with game, hunted by thousands of sportsmen, the ground practically covered with litter and refuse left from logging operations, all of which combine to make the dangerous conditions necessary for a conflagration, which under favorable conditions would exceed that of any fire in the West.

The forest fire law enacted by the last Legislature was a long step toward the conservation of our forests by protecting them from fire. We know the principles of the law are correct because we have tried them out. The necessity of patrol is so generally admitted that it hardly needs mentioning. Putting out fires already started is better than letting them burn, but, as the real foundation of a protective system, it is about like

lowering the lifeboat after the ship has struck. Patrol is better than fighting, because the incipient spark or camp fire can be extinguished before it becomes a forest fire that has to be fought. One patrolman can stop a hundred incipient fires cheaper than one hundred men can stop one large fire.

Results in forest protection are most truly measured, not by the number of fires extinguished but by the absence of fire at all.

Another feature of the new law is that the small assessment upon the land owners makes it cooperative. Just as the individual cannot maintain a properly organized and equipped fire department to look after his city property as well alone as through joining with the community, neither can he do so in protecting forest property. If one patrolman can cover the land of several owners, it is unwise for each to hire a man. If a fire starts and threatens several tracts, it is better to share the expense of putting it out. The sale value of timberland in any region is increased by public knowledge that those interested there unite in supporting progressive protective methods.

Again this law has been the means of compelling the non-resident owner, the small owner who is unable to employ anyone alone, and the non-progressive owners who would otherwise do nothing, to contribute their share towards the general cost, and the public take far more kindly to the enforcement of fire laws by the state than to similar activity on the part of the individual owner, against whom a prejudice might exist.

Our forest wealth is mainly community wealth. All the owner can get out of them is the stumpage value. The people get everything else. On every acre of forest destroyed by fire the citizens of the state who are not land owners bear at least 75 per cent. of the direct loss and sustain serious injury to their future safety and profits.

The care of our forests involves greater responsibility than is ordinarily realized, and this work cannot be too thoroughly performed.

EDGAR E. RING,
Forest Commissioner.

MAINE'S WHITE BIRCH.

Of the hardwood industries in Maine the white or paper birch is fast forging to the front. Entering as it does into the manufacture of the millions of spools used by the largest makers of thread in the world, and into the hundreds of novelties, it makes a class by itself. The cutting and manufacture of this wood has made many a small hamlet of this state a prosperous community.

It is also encouraging to know that the demand will always be good and the continual growth of this species of wood promises to equal the demand for many years to come.

Considering the importance of this wood and that a special study has been made of it by S. T. Dana of the United States Forest Service, we have obtained special permission of the department to include the result of his research in this report.

IMPORTANCE OF PAPER BIRCH.

Although paper birch (*Betula papyrifera*) does not rank with the most important hardwoods, it is, nevertheless, a valuable species in the Northeast, and particularly in Maine. In this State it stands second in amount of annual cut of hardwoods, and is exceeded only by the aspens. It is used almost exclusively by a number of woodworking industries, and no satisfactory substitute for it has yet been found in the manufacture of certain articles. From the point of view of the forester also it is a particularly interesting tree, because it grows mainly on burned-over areas, and the present extensive stands of it are due to past fires. This characteristic of occupying burned-over tracts it shares with "popple," with which it is frequently associated. Both species are, in a way, the pioneers of the forest; they occupy the ground only for a short while and prepare the way for the permanent forest type natural to the locality. Yet in spite of the value of paper birch from both an economic and a silvicultural point of view, very little has been published concerning it.

ANNUAL CUT.

The annual cut of paper birch in the Northeast averages about 80,000 cords, or approximately 32,000,000 board feet. The cut has increased but little in recent years, and it is probable that it will not greatly increase. The wood supplies small mills for the most part, and many of them use no other species; even the largest mills seldom use more than 10,000 or 12,000 cords per year. A number of woodworking industries of the Northeast use practically nothing but paper birch, and several others use it almost exclusively. It is made into spools, shoe pegs, shoe shanks, toothpicks, dowels, various wood novelties, and a wide variety of miscellaneous articles.

SPOOL INDUSTRY.

The spool industry is by far the most important of the industries dependent upon paper birch. It uses annually about 43,000 cords, or more than half of the total cut of birch. Spool mills are located throughout the birch region, but the industry may be said to center in the valleys of the Piscataquis and Penobscot rivers in central Maine, where the largest mills are located, and where the birch is used almost entirely for this purpose. For spool manufacture the wood must be sound and free from red heart, coarse knots, mildew, stain, or pith. This means, of course, that only the best of the birch can be utilized and that there is a large waste caused by these defects. This waste is used mainly for fuel, while the slabs and edgings are frequently sold for cord wood to supply city markets, and bring from \$3 to \$4.50 per cord on the cars.

The various steps involved in the manufacture of the spools from the round log to the finished product are, briefly, as follows: The green logs are brought to the mill during the fall or winter in 4-foot lengths and are first sawed lengthwise into bars, or "squares." These bars are made 4 feet long whenever possible and are square in cross section, of various sizes, depending on the size of the spool desired. The bars must all be sawed out before the 1st of June, preferably before the 1st of May, in order to prevent staining. Round logs with the bark on begin to stain as soon as warm weather sets in, usually about the middle of May. By the middle of June 3-foot bolts are usually stained throughout their entire length, and by the 1st

of August 4-foot bolts are entirely stained. Soon after this white streaks begin to appear in the wood and it loses its strength. Whole stems left in the woods stain for only 2 or 3 feet at both ends, but the rest of the material is not so clean and white as when winter-sawed during the first season. Best results are obtained by sawing the wood while it is frozen.

With clear, white birch of the best quality, practically free from large knots and red heart, 2 cords of round logs yield a thousand board feet of spool bars. With the ordinary run of material, however, it takes from $2\frac{1}{2}$ to 3 cords to make a thousand feet of bars. Exceptionally poor material, practically culls, has been known to run 6 cords to the thousand feet of bars. The sawing of the logs into such small bars makes much sawdust waste, and half a cord of sawdust has actually come from a single cord of bolts.

Immediately after sawing, the green bars are stacked in open piles out of doors, but under cover. The air has free access to them, and they usually season for several months. When it is desired to use them, they are put into a dry kiln to complete the seasoning. It is essential that seasoning should be thorough, since the slightest change in the size of the spool after manufacture makes it impossible for the delicately adjusted machines now in use in the cotton mills to wind the thread upon it.

The manufacture of the kiln-dried bars into spools differs slightly in various mills, though the general process is the same. The bars are first cut into short pieces the exact length of the spool desired, and these are then put through a lathe which turns out the spools; in many cases these spool machines are entirely automatic. The best of them work with great speed and accuracy and turn out spools at the rate of one a second.

At this stage the spools are still rough and must be smoothed off so that the thread may not be cut and broken in winding. This smoothing is done by rolling the spools about for half an hour or more, together with several balls of wax or paraffin, in a large, hollow cylinder. This is the general process by which the ordinary sewing spools are made, and they are then sorted, culled, and shipped.

The very large spools, however, must be made in three pieces. A cylindrical piece several inches long and threaded at each end serves as the body of the spool, and the heads are cylindrical

disks which are screwed on to the body piece and glued. The spool is then completed by being turned on a lathe and is smoothed and polished with sandpaper. The largest of these three-piece spools hold 12,000 yards of thread, and between them and the smallest ones, that hold only 20 yards, there is every possible gradation in size and shape.

Many substitutes for paper birch have been tried in the manufacture of spools, but so far none has proved wholly successful. Pulp is used to some extent, particularly with large spools, which have also been made with a body of pine and with pulp heads. Sawdust consolidated by hydraulic pressure has been tried, but it is very heavy and is unsatisfactory in other respects. Other woods have been tried, but all have been found wanting as compared with paper birch; they are too hard, or too soft, or do not turn well. Yellow birch is the only species which has met with any favor. It is now used to some extent by a number of mills and there is no distinction on the market between the spools from the two species. Yellow birch is considerably the harder of the two woods, and to get the best results the method of manufacture must differ slightly from that for paper birch. This fact is not always appreciated by the mill men and probably accounts for much of the prejudice they have against yellow birch. When properly handled it seems to give good results, particularly the second-growth material, locally known as "silver birch." The southern hardwoods have not been tried extensively as yet, and it is possible that such species as black gum, red gum, and yellow poplar may prove to be fairly satisfactory substitutes.

SHOE PEG AND SHOE SHANK INDUSTRY.

The next most important use for paper birch after the spool industry is for the manufacture of shoe pegs and shoe shanks. This industry, which uses about 11,000 cords of paper birch annually, is confined entirely to the northeastern United States and, except for a small amount of yellow birch, uses paper birch exclusively.

Shoe pegs are made in two distinct ways. The more usual method is to cut the bolts into small blocks, which are in turn split up into pegs. The other method is to cut the bolts into peg "ribbons." These are manufactured at only two places in

this country—or probably in the world, for that matter—at Conway, N. H., and Brownville, Me. The round bolts are first cut into short pieces, usually $25\frac{1}{2}$ inches long, and the bark peeled from them. The peeled bolts are then put into a machine which revolves them against a series of sharp knives, which cut off veneers of the width and thickness of the pegs. These veneers are in the form of long, narrow ribbons, and are cut under considerable pressure so that much of the sap is forced out of them. They are next run through a machine which puts one sharp edge on the ribbons, and finally through a third machine which heats, compresses, and toughens them. They are shipped in the ribbon form and are cut into pegs with an automatic machine when used by the cobbler. A marked difference between this process and that used in making spools is that in this case the wood is seasoned when the article is turned out rather than before. In the manufacture of peg ribbons, even more than in the manufacture of spools, it is imperative that only the very best wood be used. Red heart has to be entirely discarded, knots unfit the wood for use, and the bolts must be of fairly good size. Consequently peg wood frequently costs \$15 per cord at the mill, while spool wood usually costs only \$5 or \$6.

Shoe shanks, which are used in the insteps of some shoes between the heel and the broad part of the sole, are usually manufactured in connection with shoe pegs. They also require fairly clear, white wood, but not necessarily of so high a quality as for shoe pegs. They are first cut from the peeled bolts as veneers, which are later cut by an automatic machine into finished shanks of various sizes. These are neither polished nor seasoned and are shipped loose in large sacks.

OTHER INDUSTRIES.

The greater part of the toothpicks used in this country are manufactured in the Northeast, and, with the exception of a few hundred cords of poplar and maple used for this purpose, are there made entirely from paper birch. Approximately 3,000 cords of birch are consumed annually in their manufacture. The stock from which they are made must be free from knots and red heart, straight, and preferably over 9 inches in diameter. In other words, only the very highest grade material can be used. This material is usually selected from stock which is being cut

for other purposes, and sells for from \$15 to \$25 per cord at the mill. The logs are first cut into 2-foot bolts, peeled, steamed slightly to take out the frost, and then run through a veneer machine, which cuts off a thin veneer the length and thickness of the toothpick. From these veneers the toothpicks are automatically cut, thoroughly dried, and sometimes polished.

Dowels, toys and novelties, and various miscellaneous articles, such as clothespins, hairpin boxes, bobbins, and shuttles, consume annually about 23,000 cords of paper birch. These industries all differ considerably from those previously described in that they use considerable quantities of other woods than paper birch. Chief among these are yellow birch, sugar maple, and beech. These articles can also in many cases be made of an inferior grade of birch. A small per cent of red heart is usually allowed in most dowels, and cheap toys and novelties are not infrequently made entirely from red heart and knotty wood which could not be used for any other purpose. This fact is sometimes taken advantage of by combining spool and novelty mills, so that the novelty mill can be largely supplied by the waste from the spool mill.

PRINCIPAL MARKETS.

The principal market for paper birch and its products is in this country, although there is some export business. The spools are mainly manufactured near the source of the timber supply and are then shipped to the thread mills in various parts of the country, chiefly to Rhode Island, Connecticut, New Jersey, and, to some extent, to California.

The shipment of spool bars to Scotland is, however, an important part of the trade and these shipments now amount annually to about 4,000,000 board feet. Scotland has always been a heavy consumer of birch for spools, and when the immediately available supply of European birch (*Betula albo*) began to fail, the manufacturers turned to this country to supply their demands. The first shipment of bars abroad was made to Scotland in 1882 from Bangor, Me., and since then shipments have continued, but with considerable fluctuation. The largest shipments were made in the latter part of the nineties and in one year ran as high as 13,000,000 board feet. Recently they have been decreasing until they now amount to only 3,000,000 or

4,000,000 board feet annually. This falling off is due to two causes: First, manufacturers abroad do not pay high enough prices to attract small dealers into the business; and, second, large tracts of European birch in Finland and the Scandinavian countries are now becoming available. This European white birch, while not of such high quality as the paper birch of this country, can, nevertheless, be used for spools and is cheaper because of its nearness and because of the lower wage scale in those countries.

Other paper birch products are mainly manufactured near the source of supply and are marketed, for the most part, in this country. Shoe pegs, and to a lesser extent shoe shanks, are, however, sent in considerable quantities to Germany, to Japan, and to other countries. Quite recently shipments of toothpicks have been made to England, France, and Germany. In all, the manufactured equivalent of about 12,000 cords of paper birch, or approximately one-seventh of the total cut, is exported annually.

DISTRIBUTION OF PAPER BIRCH.

BOTANICAL RANGE.

Paper birch is one of the most widely distributed trees of North America. It was formerly thought to be transcontinental in range, but the western forms are now divided into two distinct, although closely related, species. Of these *Betula alaskana* grows in Alaska, and *Betula occidentalis* in southwestern British Columbia and northwestern Washington.

Paper birch proper extends from Maine and Labrador northward almost to the Arctic Circle and westward to the Rocky Mountains and the valley of the Mackenzie River in British Columbia. It is decidedly a tree of the north and has been found as far as latitude 65° N., a point nearly as far north as is reached by any broadleaf tree of North America. In the United States it is found only along the northern border, and its southern limits are Long Island, northern Pennsylvania, central Michigan, central Iowa, and northern Nebraska. Its western limits are as yet imperfectly defined. In the southern part of its range it is small and comparatively rare, and never attains the commercial importance that it does farther north, where it is more at home.

COMMERCIAL RANGE.

In spite of its wide range paper birch is, in most places, not an abundant tree. It is scattered through forests of other trees and pure stands of any size are rare. In the United States the only extensive stands are in the Lake States and in northeastern New England. In the Lake States there are several belts of it on burned-over areas, but these stands are not, as a rule, fully stocked. The birch is short, branchy, and usually of poor quality for anything except fuel. Minnesota contains the largest and best stands in this region, and there are localities where this birch, now considered worthless, might be utilized to good advantage. Northern New England, on the other hand, has extensive stands, some of them practically pure, in which the birch is of excellent quality. New England is, therefore, the only part of the United States in which paper birch is at present of commercial importance, and it is there one of the most valuable hardwoods in the forest.

The distribution of the birch in commercial quantities through this region is shown on the map (fig. 1). This does not indicate that the birch is not found outside of the areas marked. It grows throughout all three of these States, and occasionally in sufficient quantities to be cut in southern Vermont and New Hampshire and in other parts of Maine. The map simply shows in a general way what may be called the paper birch region of the Northeast—that is, the region in which it occurs extensively over large areas. Not all of the area is covered exclusively with paper birch. Other species are found everywhere, and there are tracts in which the birch is entirely wanting. To eliminate these tracts and to show exactly where the birch is predominant is impossible in a map of this character, so that only the general outlines of the birch region are shown. Much of the timber in this region is already of sufficient size to be merchantable, but young growth is also found in many places.

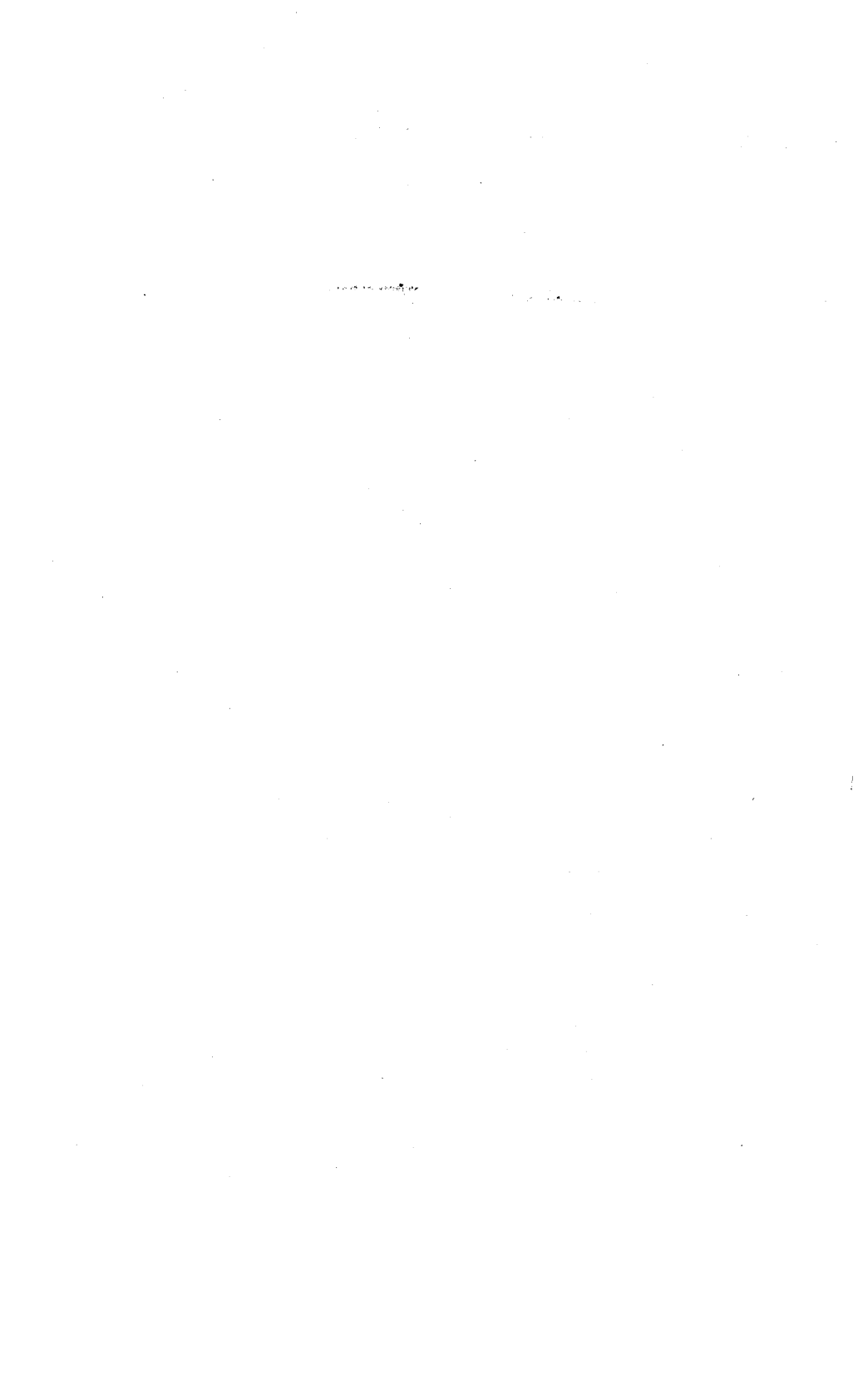
Maine is plainly the paper birch State of the country. Vermont has about 300,000 acres of birch land in the north central part of the State, New Hampshire has approximately 570,000 acres in the northeastern part, while Maine has over 5,500,000 acres extending in a broad belt directly across the central part of the State.

EFFECT OF FIRES AND CLEARINGS.

The abundance of paper birch throughout this entire region is due to fires, and in many cases the boundaries of the region correspond exactly with the boundaries of these fires. So intimate is this relation between paper birch and cleared or burned-over areas that it is fairly safe to assume that areas containing a good stand of birch have either been burned or previously cultivated. The reverse, however, is not always true; burned areas are not always occupied by paper birch. Aspen is equally quick to seize upon them, white pine is more or less characteristic of such situations, and still other species may occupy them, though less frequently. Paper birch readily occupies burned or cleared areas, because its seeds are produced abundantly each year and are easily carried to great distances by the wind, so that they are always on hand to restock open areas. The bare mineral soil exposed by burns offers an ideal germinating bed, and the full light gives the young seedlings an excellent chance to develop without danger of being shaded out.

The greatest fire known in Maine occurred in October, 1825. This is generally called the "Mirimichi fire," although it was quite distinct from the famous fire of that name which occurred in New Brunswick the same year. It covered in the neighborhood of 1,300 square miles, and burned over practically all of the area shown on the map from Monson and Abbott East to the Penobscot River. This area now contains some of the heaviest and best stands of birch in the State. The irregular detached section to the north is the result of two fires. The upper part was burned over in 1837, and the lower at some time between this and the great conflagration of 1825. This section, too, contains many excellent stands of birch which are now yielding valuable lumber.

East of the Penobscot River is a large area in Hancock and Washington counties, shown by vertical lines on the map, which is intermediate in character, and its inclusion in the birch region might be questioned. This land has practically all been burned over, parts of it several times. In places it is still barren, while in other places there is good second growth composed of a mixture of many species. Paper birch grows throughout the area, but not so generally in the pure stands that are characteristic of it on other burns to the west. Here the white, or gray birch





ONE OF THE SPOOL MILLS OF PERKINS, DANFORTH & CO. THIS COMPANY
MANUFACTURES 5,000,000 FEET PER YEAR

(*Betula populifolia*), so plentiful in southern Maine and along the whole New England coast, but practically lacking in the rest of the birch region, is abundant. Included within this territory is a tract surrounding Grand Lake which contains good stands of mature paper birch, and should undoubtedly be classed with the region west of the Penobscot.

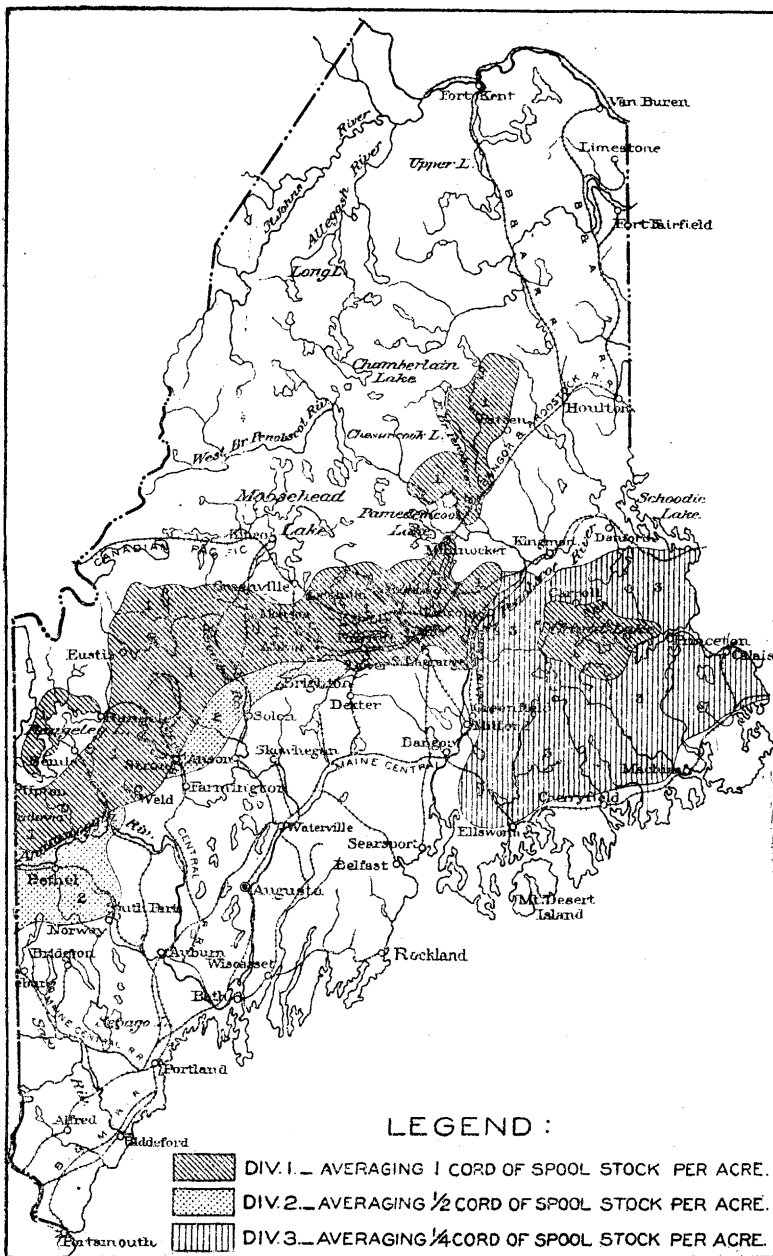
In western Maine the bounds of the different fires are not so well marked, but a large part of the territory was probably burned over about 1825. The best stands here are to the south and east of the Rangeley Lakes, where they fully equal those in central Maine. Along the line of the Grand Trunk Railroad in the neighborhood of Bryants Pond, Lockes Mills, and Bethel, the birch has been cut very heavily for many years; the original supply has been almost exhausted, but there is now more or less second growth available.

In New Hampshire and Vermont fires have also been responsible for the creation of paper birch tracts, but not to such an extent as in Maine. The stands are more scattered and the yield, as a rule, not so heavy. Much of the timber is already mature, but there is also much young growth.

TYPES.

Paper birch stands may be divided according to their composition into two general classes—pure and mixed.

Pure stands are not so abundant as mixed, but they are of greater commercial importance. These stands vary in extent from a few to several hundred acres, and contain from 75 to 90 per cent of birch. The principal species found in mixture in such stands are the two aspens, often with an understory of spruce and balsam. These stands are generally even-aged, and have a fairly uniform crown cover. There are usually a few large-crowned, sprawly individuals which obtained an advantage at the outset and have developed abnormally, and also a few badly crowded, suppressed, and dying individuals; but the main stand consists of trees of approximately the same degree of development with rather narrow, medium-sized crowns. In mature stands the crown cover is not continuous, but is more or less open and broken in places, owing to the intolerance of the birch. This enables such tolerant species as spruce and balsam, which are able to start under the light shade cast by the birch,



to develop more rapidly and eventually to establish themselves as the permanent forest type.

In mixture paper birch occurs in three quite distinct ways—with aspen, with other hardwoods, and with conifers. Mixed stands of birch and aspen closely resemble pure birch stands in general character and appearance. The two species may be present in practically equal numbers, or one or the other may slightly predominate. There is the same even-aged, even-crowned character of the pure birch stand, except that the aspen often shows larger and taller individuals than the birch. The stands begin to break up at about the same age and to deteriorate in much the same way.

When paper birch is mixed with other hardwoods its principal associates are yellow birch, sugar maple, and beech. These stands differ considerably from pure birch stands. They are often irregular and not even-aged, and evidently start as a more or less open mixed stand in which paper birch is prominent. Then more tolerant species gradually come in and fill up the blanks, so that the stand assumes somewhat the character of a virgin forest with various age classes present. Paper birch in such stands usually develops a spreading crown, a large diameter, a knotty bole, and a comparatively short merchantable length. The tree is likely, however, to have a large proportion of clear, white sapwood and to remain sound longer than when in pure stand. Stands of this character, when the birch has once been cut or has died out, usually revert to the mixed hardwoods type.

Mixed stands of paper birch and conifers, usually spruce and balsam, have still a different character. In these the birch and conifers usually take possession of the ground at the same time, although the conifers may be a few years later in making their appearance. The birch, however, makes a very much more rapid height growth in early youth and soon overtops the conifers, so that the stand has the appearance of a two-storied forest, the birch occupying the upper story, with plenty of space and light in which to develop. The spruce and balsam are tolerant and thrive under the relatively light shade. Their growth is more persistent and well-maintained than that of the birch, and in time they overtake it. The exact age at which they do this varies considerably, but as a rule the conifers catch up with

the birch enough to make a closed stand in from forty to sixty years. The birch is then crowded from the sides, prunes itself well, and develops a clear bole with good merchantable length. As a result, the best developed trees with the best quality of wood are often found in mixture with spruce and balsam. It is sometimes claimed that there is more red heart in birches grown in mixtures of this kind, but this seems to depend more on the character of the soil than on the mixture. Upon the removal of the birch there results a pure coniferous type.

STAND PER ACRE.

The stand of paper birch varies very greatly in different places, and under different conditions, from almost nothing up to 40 or 50 cords per acre. Even experienced woodsmen are likely to overestimate the average stand. Actual figures of the cut of spool stock, which may be taken as a fair representation of the merchantable material, from two good birch towns in Maine are, respectively, 58,175 cords from 18,000 acres, or an average of 3.2 cords per acre; and 39,905 cords from 10,000 acres, or nearly 4 cords per acre. The northwest corner of the second town, where the birch was exceptionally thick, yielded 16,500 cords from 3,000 acres, or an average of 5.5 cords per acre. Still another town, which was considered rather poor but still good enough to cut, yielded only 3,303 cords from 6,000 acres, or an average of 0.55 cord per acre. All the material may not have been completely utilized in these cases, but it was approximately so, since the towns were cut over with considerable care.

Actual cuts and careful estimates show that the average stand in what are ordinarily considered good birch towns is about 2 cords of spoolwood material per acre. Individual acres may, of course, run very much higher than this, and single exceptional acres may run as high as 40 or 50 cords. Areas of a few hundred acres may average as high as 12 or 15 cords of spool stock per acre. Still other areas, even within the birch region, contain no paper birch whatever. It is, therefore, fair to assume that within the better portion of the birch region (marked 1 on the map) the stand will average 1 cord per acre; in the intermediate portion (marked 2 on the map), one-half cord per acre; and in the poorer portion (marked 3 on the map), one-

quarter cord per acre. All these figures refer to the quantity of spool stock and not to the total amount of solid wood per acre, which would probably overrun these figures by about 20 per cent, and, therefore, give a considerably larger stand. Most of the birch stands, however, are now so remote from the market and the difficulties of transportation are so great that it is impracticable to utilize this additional 20 per cent, which, if more accessible, would be valuable for fuel.

THE PAPER BIRCH SUPPLY.

No attempt has ever been made to secure an accurate estimate of the total amount of paper birch in the Northeast. The birch is so widely and irregularly scattered over a large area that this would be a very difficult undertaking. At the same time, it is possible to estimate roughly the present supply, how long it will last, and what will be the source of future supplies. In the three divisions shown on the map (fig. 1), as already explained, division 1 is assumed to contain 1 cord per acre of merchantable material; division 2, one-half cord per acre; and division 3, one-quarter cord per acre. The application of average figures to so large an area is not wholly satisfactory, but it is the best method that can be used under the circumstances, and the resulting estimate is at least conservative. If these average figures are multiplied by the total area of each division the result gives a total stand of approximately 4,000,000 cords of merchantable paper birch.

Even with an assumed annual consumption of 100,000 cords, as against the present actual average of 80,000 cords, there is now standing a sufficient supply of birch to last for forty years. This, of course, does not take into consideration the increase through growth of existing stands, or through young growth which will mature during that period. On the other hand, much of the supply is not at present accessible, and a considerable part of it is also deteriorating because of old age. Taking everything into consideration, however, it is certain that users of paper birch will not feel the pinch of a shortage so early as will the users of many others of our important trees.

BOTANICAL AND SILVICAL CHARACTERISTICS.

GENERAL APPEARANCE.

Mature paper birch may be readily recognized by its creamy white bark, which separates readily into thin, papery layers. Small twigs, and the stems of young trees up to an inch or two in diameter, have a brownish bark, usually tinged with orange, while near the ground on old trees the bark often becomes dark, blackish, and broken into thick, closely appressed scales. The bark not infrequently resembles that of the white birch, but can be distinguished from it not only by its greater whiteness and scaliness, but also by the fact that white birch has at the base of the limbs dark, triangular patches which paper birch does not have. Intermediate forms occasionally occur in which the bark resembles that of both species. Such specimens are sometimes looked upon by woodsmen as hybrids. They appear, however, to be merely variations from the type, due to different conditions of site and growth, and can be readily classified by their leaves and other characteristics.

Forest-grown paper birch has a long, clear bole with a narrow crown occupying usually a little less than half the length of the tree. The twigs are fine and delicate and the foliage very light and open. The open-grown tree is usually shorter with a much shorter bole and a much larger, better developed crown.

LEAVES, FLOWERS, AND FRUIT.

The leaves of paper birch are ovate, irregularly serrate, with short, broad points which distinguish them at once from the very long-pointed leaves of the white birch. The winter buds are dark chestnut brown, ovate, acute, and about one-fourth inch long. They help to distinguish the tree from white birch, since they and the twigs on which they grow are slightly hairy, while in white birch they are smooth.

The birches are all monœcious, having the staminate and pistillate flowers on the same tree. The staminate flowers occur in long catkins, or aments, which are visible during the winter and elongate and bloom in early spring. The pistillate flowers occur in much shorter aments and are not visible during the winter. They form a cone-like fruit, or strobile, on the scales of which are borne the seeds. These are very small and light,

equipped with thin, membranous wings, which are much broader than the seed itself, so that the seed is easily carried long distances by the wind.

WOOD.

The wood is of medium weight, fairly hard, strong, and tough, of close grain and uniform texture. Green wood contains considerable sap and is rather heavy and hard to handle. When seasoned, however, it becomes fairly light and has a specific gravity of 0.59 and a weight of 37 pounds per cubic foot. The wood is usually straight-grained, although cross-grained individuals occasionally occur, particularly on exposed north slopes. It varies more or less in toughness and its character in this respect can frequently be judged from the appearance of the bark. Dark-colored, close-barked trees are apt to have a tough, stringy wood, while those with a very white, papery bark scaling off in large plates are apt to have a smooth, easily worked wood. The wood is not durable and decays quickly in contact with the soil. The bark lasts much longer, and logs are not infrequently found which appear at first sight to be perfectly sound, but which are really a mass of decayed punk inside of the sound bark.

The character of the wood unfits it for certain uses. It is too hard and heavy for ordinary construction timber, is too soft for hardwood lumber, and is not striking enough in appearance to be popular for furniture or interior finish. It is too perishable to be fit for ties, posts, fence rails, or other uses in the open. In the Lake States it has nevertheless been used to some extent as ties for logging railroads, where these were not expected to last more than two or three years, and then left in the ground to rot. It is possible that preservative treatment may open a new field for its use, but without such treatment its utilization in the open must be very limited. It is a little used for the manufacture of paper pulp and is fairly satisfactory, but will hardly be much used for this purpose because of its comparative scarcity and of the difficulties of transportation.

On the other hand, the even grain and uniform texture of the wood, its ability to hold its shape after seasoning, the ease with which it turns on the lathe, and the smooth, clean surface which it presents particularly adapt it to a number of wood-working industries where accuracy and nicety of finish are

required, such as the manufacture of spools, shoe pegs, shoe shanks, dowels, toothpicks, and various wood novelties.

A serious defect in the wood is that known as "red heart," which materially reduces the quality, strength, and value of the wood and renders it unfit for spool, shoe peg, or toothpick stock; its presence in large quantities means heavy loss. Red heart is not a disease and is not present in very young trees. It is simply the natural heart-wood formed with advancing age, and is therefore certain to come in all trees. The age at which it makes its appearance varies greatly. Locality is one of the chief influences. In favorable localities seedlings under 5 or 6 inches in diameter and less than 40 or 50 years old seldom show any red heart. In unfavorable localities and in sprouts it may appear much earlier. With trees over 5 inches in diameter it averages slightly over 6 per cent of the volume of the tree. It does not seem to vary with any set rule, however, and aside from age it is often difficult to determine the exact causes

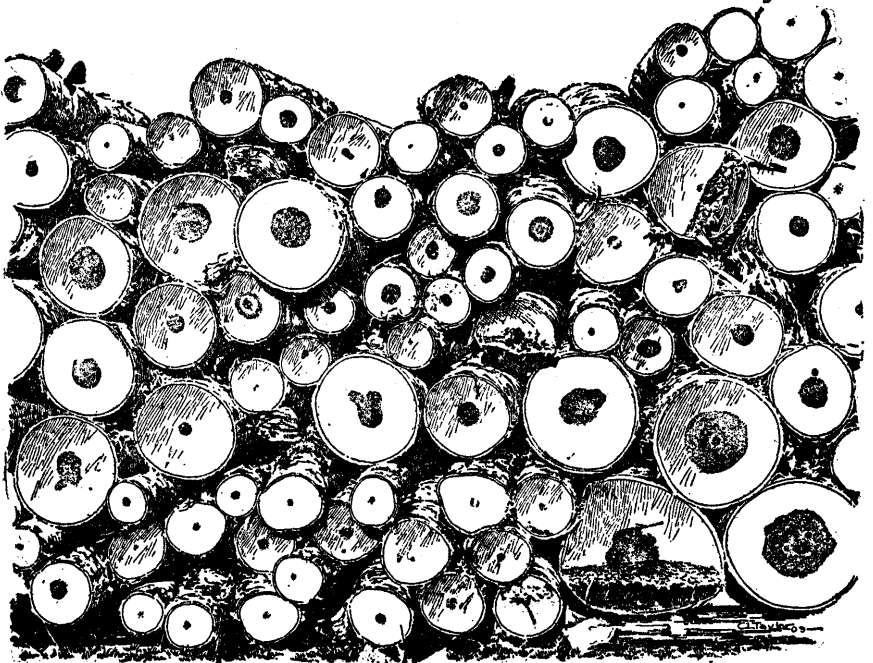


FIG. 2.—Stack of 4-foot bolts of paper birch for spool stock, showing variation in size of red heart and in size of bolts, 4 to 18 inches in diameter. Piscataquis County, Maine.

which produce it. When it first appears it usually increases in diameter at about the same rate that the tree is growing, but later spreads more rapidly and encroaches on the white sapwood. Mature trees usually show from 2 to 4 inches of sapwood outside of the heartwood. The heartwood has the same general shape as the tree itself and decreases in diameter from the base up in about the same proportion as the bole, so that there is none in the upper part of the tree.

When the heart first appears it is sound and may remain so for many years or may decay very soon, depending on the locality and the general health of the tree. In an average stand, at maturity, perhaps 10 or 15 per cent of the trees are affected by heart rot, but as soon as the stand becomes overmature the proportion increases very rapidly.

SOIL, MOISTURE, AND LIGHT REQUIREMENTS.

Paper birch is not particularly exacting in respect to its demands upon soil and moisture. It prefers a fairly deep, loose, well-drained, sandy loam, and attains its best development on soils of this character. It is not likely to grow on dry, sandy barrens or in submerged swamps, but is found in practically all situations intermediate between these two extremes. In the White Mountains it is abundant on the thin-soiled rocky slopes above 3,000 feet. This is not, however, because it prefers such situations, but because it is able to grow there while many other trees are not. On Mount Washington it has been found at an elevation of 5,700 feet as a prostrate shrub.

In its light requirements paper birch is much more exacting. It is one of the most intolerant species of the Northeast, and in this respect is exceeded among the broadleaf trees with which it associates only by the aspens. Young seedlings will grow under very light shade but will not survive under a crown cover as dense as that usually found in virgin forests. Saplings and poles when shaded from the side will sometimes struggle along for a while as poorly developed, suppressed individuals but must have absolutely free crowns in order to thrive. Suppressed trees do not recover after being released from suppression, as do spruce and balsam.

GROWTH.

Paper birch is commonly considered a very rapid grower. To some extent this reputation is deserved, though the tree's growth throughout life is not so rapid as is often supposed. It makes a quick start in early youth and shoots up more quickly than most of the species with which it grows, and in this way attracts attention. After the first five or ten years it also makes a good diameter growth, but the rate begins to fall off when the tree is about 30 years old, and gradually decreases until in old age it is almost negligible. Perhaps another reason for the prevalent notion that paper birch is such a rapid grower is the fact that much smaller specimens can be utilized than with other trees lumbered in the region, such as spruce, pine, balsam, and hemlock.

In any consideration of growth a distinction must be made between seedlings and sprouts, and the locality must also be taken into consideration. Table 1 shows the growth of both seedlings and sprouts in height and in diameter, while Table 2 shows their volume growth. The figures for the seedlings are based on 50 full stem analyses of trees growing in low, rocky ground near the shore of Hardy Pond in Piscataquis County, Me. Those for the sprouts are based on 30 full stem analyses of trees growing on a very rocky, rather thin-soiled hillside in Carroll County, N. H. Both localities are of the second quality

TABLE 1.—*Height and diameter growth of paper birch.*

Age.	Height.		Diameter breast-high.	
	Seedlings.	Sprouts.	Seedlings.	Sprouts.
<i>Years.</i>	<i>Feet.</i>	<i>Feet.</i>	<i>Inches.</i>	<i>Inches.</i>
5	5	10	0.2	0.7
10	13	19	1.1	1.8
15	22	28	2.2	2.9
20	30	36	3.4	4.0
25	37	43	4.4	4.9
30	44	49	5.3	5.6
35	49	55	6.1	6.3
40	54	60	6.8	6.9
45	58	65	7.5	7.5
50	62	70	8.0	7.9
55	65	74	8.5	8.4
60	68	78	8.9	8.8
65	71	82	9.3	.....
70	74	.....	9.7	.....
75	76	.....	10.0	.....
80	78	.....	10.2	.....
85	80	.....	.....	.....
90	81	.....	.....	.....

TABLE 2.—Volume growth of paper birch.

Age.	Total stem volume.		Annual rate of growth.*		Volume, N. H. rule.	
	Seedlings.	Sprouts.	Seedlings.	Sprouts.	Seedlings.	Sprouts.
<i>Years.</i>	<i>Cu. ft.</i>	<i>Cu. ft.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Bd. ft.</i>	<i>Bd. ft.</i>
20	.....	1.8	.....	14.0	.....	.....
25	2.3	3.2	11.0	9.0	.....	13
30	3.6	4.6	7.9	6.3	16	19
35	5.2	6.1	6.3	5.0	22	26
40	6.9	7.7	5.2	4.3	29	34
45	8.6	9.5	4.3	3.8	37	43
50	10.5	11.4	3.6	3.4	46	52
55	12.3	13.5	3.0	3.0	55	61
60	14.1	15.5	2.5	2.7	64	71
65	16.0	.....	2.1	.....	73	.....
70	17.7	.....	1.8	.....	82	.....
75	19.3	.....	1.5	.....	90	.....
80	20.7	.....	1.3	.....	97	.....

* The rate of growth given in this table was determined by dividing the increase in volume during the different five-year periods by the volume at the beginning and at the end of the period and by averaging the results obtained to find the rate of growth at the middle of the period. This gave the rate of growth for the five-year period, which was divided by 5 for the annual rate of growth. These values were then plotted on cross-section paper and smoothed out by means of a curve.

and represent very well average conditions. These figures should, therefore, give a good idea of the average rate of growth of paper birch throughout Maine and New Hampshire.

It is evident from these tables that the height growth of the sprouts is more rapid throughout life than the height growth of the seedlings. The difference between the two is relatively greater in early youth, but absolutely is about constant.

The difference in diameter growth is not so constant. Up to 45 years of age the sprouts have a greater diameter than the seedlings, at 45 the diameter is the same, while after that the seedlings have the greater diameter. In other words, while the sprouts make a greater diameter growth at first, this rate is not maintained, and the seedlings gradually overtake and pass them.

In volume the sprouts surpass the seedlings throughout life. The difference is not great at any point, and averages only a little more than 1 cubic foot. It is enough, however, to indicate that the encouragement of second growth sprout stands may often be advantageous, particularly for short rotations and when large-sized material is not specially desired. The decrease in rate of growth of both seedlings and sprouts with advancing age is partly counterbalanced by the better quality of the wood, which, on account of its freedom from knots, is much more valuable than the earlier growth. After 55 years of age, how-

ever, the rate of growth falls below 3 per cent, so that further growth of the stand is hardly profitable in spite of the increased value of the wood. With very old trees averaging about 20 inches in diameter the annual rate of growth is only 1 per cent.

Paper birch is a comparatively short-lived tree. It matures early and goes to pieces rapidly thereafter. This characteristic varies according to local conditions, and trees on good soils live longer than those unfavorably situated. In general, seedling paper birch is mature at from 70 to 85 years, and seldom lives more than 150 or 200 years. Sprouts are much shorter-lived and usually mature at from 50 to 60 years, and live only from 70 to 90 years. In pure stands birch matures and decays earlier than when in mixture with other hardwoods or with conifers.

SUSCEPTIBILITY TO INJURY.

By far the worst enemy of paper birch is fire. Young seedlings and saplings are destroyed by light ground fires, while even older trees with their thin and highly inflammable bark may be seriously injured or even killed. Severe fires are almost sure to destroy the entire stand.

Although paper birch is not deep-rooted it is nevertheless comparatively free from windfall. This is probably due chiefly to two causes: The root system, although relatively shallow, has a considerable lateral extent and affords good support to the tree; and the slender twigs and branches bend readily before the wind, and therefore offer but little resistance to it.

Living trees are sometimes attacked by a flat-headed bark borer (*Agrilus anxius*), and by the birch bark beetle (*Xylococcus betulæ*), and are defoliated by several kinds of caterpillars. A number of species of beetles destroy the wood of felled trees.

Fungi are a secondary enemy. Live trees are occasionally attacked by *Fomes igniarius* and one or two other shelf fungi, but these attacks are not serious. Dead trees, on the other hand, are attacked at once by *Polyporus betulinus* and other fungi, and decay very rapidly.

In many places deer play havoc with young birch. They are fond of browsing on the winter buds and tender new shoots and not infrequently destroy enough young sprouts and seedlings to interfere seriously with reproduction.

Among the minor enemies of the birch are the sapsuckers,

which occasionally bore holes into it. This injury is not very widespread, however, and is rendered less serious from the fact that it is usually confined to the upper part of nearly mature trees. Old trees are seldom injured by frost or drought. Young sprouts, especially those which start in midsummer, may be killed back by early fall frosts, but only the tips are injured, and the plants seldom killed. The collection of birch bark for cups, baskets, and other fancy and ornamental articles is responsible for the death of many trees. Careless collectors frequently girdle trees in the neighborhood of summer resorts, and many dead trees can be found standing as a memorial to their work. A little care in taking only small sections of the outer bark might prevent much of this injury.

REPRODUCTION.

By Seed.

Paper birch is a prolific seeder. There are no definite seed years as with many other species, and a considerable amount of seed is borne each year. Individual trees may not bear equally heavy crops year after year, but when one has a light crop, another may have a good one, so that the amount of seed produced annually is fairly constant. The germinating per cent is not very high. A sample count showed the fertility by inspection to be 68 per cent. A germination test, even in the greenhouse, would probably give a much lower figure than this, and under natural conditions the proportion of seeds which succeed in germinating would undoubtedly be still further reduced. The best seed is produced in greatest amount by full-crowned trees similar to those found in the open.

The seeds are very light. A sample count of seeds collected in Maine in 1905 showed that there are more than 38,000 seeds to one ounce. This lightness coupled with their wings enables them to be carried readily to great distances by the wind. This accounts for the exceedingly wide distribution of the birch and for its sudden appearance in dense stands on burned or cut-over areas even when there is not a single seed tree in the immediate vicinity. The seeds are not, as is sometimes mistakenly assumed, already in the ground, but are blown in by the wind, which is by far the most important factor in their distribution.

The best germinating bed is a bare mineral soil. A heavy ground cover of leaves, duff, sod, or other material checks the

reproduction and in many cases prevents it altogether, since the root system of the young seedlings is decidedly shallow and weak and can not force its way through any thick covering into the mineral soil, so that the tiny rootlet dries up and dies. The shallowness of the root system indicates that the soil must be fairly moist to afford a good germinating bed. Bare mineral soil, capable of holding at least a moderate amount of water, usually characterizes burned-over areas, and this, with the absence of overhead shade, explains the abundant and satisfactory reproduction on old burns.

By Sprouts.

Up to a certain age paper birch reproduces itself as readily by sprouts as by seed. The stumps send up from the root collar vigorous shoots, which may a rapid growth during their first few years. Sample counts of 1-year-old sprouts from stumps of 40 to 50 year old trees in New Hampshire showed an average of 46 sprouts per stump, with an average height of slightly over 2 feet. Most of these are soon killed off in the struggle for existence, and usually only from 2 to 4 survive to reach maturity. The old stump decays in a few years, but the sprout origin of the trees may be recognized from the way in which they stand in small clumps. Mature or nearly mature birches do not sprout so freely nor so vigorously as when younger, and in old age probably lose their sprouting capacity altogether. This loss in vigor ordinarily begins at from fifty to sixty years. Consequently, if satisfactory sprout reproduction is desired, the trees should be cut not later than this. The same stump will not produce sprouts for any great length of time, since it eventually becomes exhausted.

As a rule birch stands are composed either entirely of seedlings or entirely of sprouts. Occasionally, however, the two forms are found together in practically even-aged stands. In such cases it is probable that the stand was originally composed of seedlings, but early in life was burned over. Some of the trees may have escaped destruction, while those that were burned sent up one or more sprouts. These seedling sprouts, except for the fact that they often occur in groups, have all the characteristics of seedlings and may be so treated.

MANAGEMENT.

METHODS OF LUMBERING.

In typical lumbering operations in paper birch, cutting begins the latter part of September or in October, after the growing season. Except in a few instances cutting is never done in summer, owing to the danger of sap staining. The trees are practically always felled with the ax, seldom with a saw. The stumps are usually $1\frac{1}{2}$ or 2 feet high. For spoolwood and similar material a diameter limit of 6 inches, breasthigh, is often adopted, and wherever possible the tops are utilized to a diameter of 4 or 5 inches. For fuel, all trees over 3 inches are taken, and the tops are utilized down to 2 inches.

After the tree has been felled the method of handling varies in different localities. Sometimes the men work separately, each man taking a given area and doing all the work on that area himself. He chops down the trees, saws them into 4-foot bolts with a buck saw, marks out and clears a road as he goes, and finally piles the bolts into stacked cords along the road. These are of regular size, 8 feet long and 4 feet wide, but are made 4 feet 4 inches high to allow for the shrinking and settling of the green wood. When the men work individually in this way they are paid by the cord, usually \$1.50. Under average conditions an ordinary worker will put up $1\frac{1}{2}$ to $2\frac{1}{2}$ cords per day, and an exceptionally good man 3 or even 4 cords. Under particularly favorable circumstances a record of 5 or 6 cords per day has been maintained for several days. This method of working is particularly adapted to dense stands of small trees.

Perhaps the more common method is by crews, in which each man is given a definite part of the work to do. One man does all the chopping, others all the sawing, and still others attend to the piling. The sawyers usually work in pairs and use a large crosscut saw, although they are also provided with individual buck saws for the smaller logs. One chopper is able to fell enough trees to keep four sawyers busy. After the trees have been cut into 4-foot bolts these are removed on low sleds, managed by a "sled tender," and then piled. No attempt is made to have the piles contain an even number of cords, and their exact contents are not known until they are measured by the scaler. Their size and location are determined wholly by con-

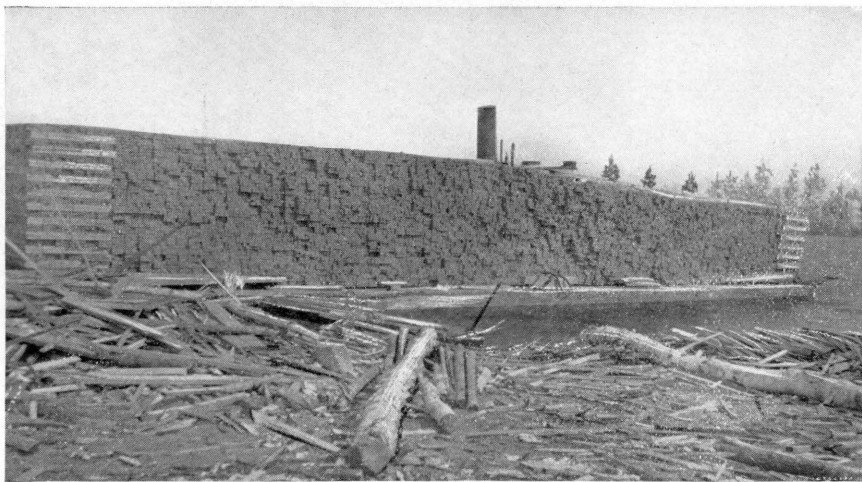
venience in making and afterwards removing them. With this method the men are paid by the day or month, and there is not so heavy a cut per man as when the men work alone. It seldom exceeds $1\frac{1}{2}$ or 2 cords per day. This method is particularly adapted to stands where the logs are too large for one man to handle and where the birch is so scattered that one man could not work to advantage by himself.

A modification of the crew method is to remove the tree stems to the place where they are to be piled before cutting them into bolts. One man does all the chopping, but as soon as the trees are felled and their tops cut off they are dragged, or "twitched," to the piles and there cut into bolts by a saw crew. This is "sawing at the yard" in contrast to "sawing at the stump." It saves two handlings of the bolts, but it makes the logs very gritty as they are dragged through the dirt, with subsequent serious wear and tear on the saws at the mill.

Still another modification of the crew method is to have crews of only two or three men, in which each takes his turn at the chopping, sawing, and piling.

The wood is usually scaled and sold by the stacked cord. A stack 8 feet long, 4 feet wide, and 4 feet high is scaled as 1 cord without regard to its actual solid contents. Theoretically a cord contains 128 cubic feet, but because of the numerous air spaces the average solid content of a stacked cord of paper birch spool stock is approximately 96 cubic feet, though this varies considerably with different-sized bolts. The best way to scale birch, therefore, is not by the stacked cord, but by the cubic foot. This may be done in two ways: By measuring each stick and finding its solid contents from a table giving the contents in cubic feet of sticks of different diameters; or by estimating the average size of the sticks and obtaining the solid contents from a table giving the average contents of stacks composed of different-sized bolts (as Table 8, on page).

In some localities the wood is first scaled in cubic feet by the New Hampshire log rule, and this figure is then reduced to cords by considering 128 cubic feet as equal to 1 cord. The cubic foot given in the New Hampshire rule is merely an arbitrary standard and is not the true cubic foot. It is equal to the contents of a log 16 inches in diameter and 1 foot long, or actually 1.4 cubic feet. Consequently 128 of these so-called cubic feet really contain 179 cubic feet. But since 96 cubic



52,000 FEET OF SPOOL BARS LOADED ON SKOW TO BE TRANSFERRED
TO RAILROAD STATION FOR SHIPMENT

feet make a stacked cord, a cord scaled by the New Hampshire rule is equivalent to 1.9 stacked cords. This explains why considerably higher prices are often obtained for birch bought by the New Hampshire rule than by the stacked cord.

Occasionally paper birch is cut into boards, to be later ripped up and manufactured into bobbins and shuttles. In this case it is scaled by the thousand feet, board measure, New Hampshire rule.

Birch stumpage varies from \$0.75 to \$2 per cord, according to its quality and location. The average price is about \$1.50 per cord.

After the bolts have been cut and stacked along the logging roads, the final step in the lumbering operations is to get them to the mill. This is done on sleds when the ground is covered with snow. Sometimes only a few main roads are used, with no branches, and the bolts are all carried from their original piles and stacked along these main roads. The more usual way, however, is to pile them near where they are cut and have numerous branch roads leading to these piles. Cutting is continued until the deep snow interferes seriously with the work, when the rest of the winter is devoted to hauling. The hauling is usually done with horses and sleds. Steam log haulers are used to some extent and give good results, particularly when long hauls are necessary. Spool-bar mills are often set up near the source of supply and the bars taken from there to the spool mill. This obviates unnecessary hauling of waste in the bolts. When a railroad runs near the source of supply it is made use of; and since paper birch is heavy and difficult to handle, it is probable that the exploitation of the more remote and inaccessible areas will depend largely on the development of railroad logging.

A marked variation from the usual method of operation is in the few cases where the logs are driven or rafted to the mill. When this is done the logs are never cut into bolts in the woods, but the whole stem is put into the water. Contrary to common belief, green paper birch will float for a while, and it is sometimes put into the water in this condition. But, since seasoned wood is lighter, it is usually first seasoned to some extent. An effective method is to cut the trees in summer and leave the tops on. The leaves continue to transpire moisture for a while, with the result that a large quantity is removed from the tree

at once and the wood is left in a comparatively seasoned condition. The tops may then be cut off and the stem put into the water immediately. Another method is to remove the tops at once and then let the logs stay in the woods for about a year to season. This method is probably not so effective, since birch seasons very slowly when left with the bark on. If cut in summer the logs are also likely to stain badly, at least at the ends.

It is generally thought by lumbermen that paper birch can be successfully driven short distances and remain in the water two or three weeks, but that after that it becomes waterlogged and sinks. Logs have been rafted 40 miles, however, and have remained in the water fifty or sixty days, with results good enough to warrant the drive. The amount lost depends not only on the seasoning of the wood but also on the weather conditions. Even the lightest birch floats low in the water, and during heavy winds is likely to work its way under the boom and escape. While the average loss under good weather conditions may perhaps be 10 per cent, this loss may easily be doubled by a severe storm.

Mill men differ decidedly in their opinions as to the wisdom of attempting to drive paper birch. Some think it inadvisable under any conditions; others think that under certain conditions it pays well for short distances; while still others believe in attempting long drives. Some think that driving injures the quality of the wood; others think not, and the question has not yet been studied enough to lead to any hard and fast conclusions. The one great advantage of driving over hauling is its cheapness. For distances up to 20 miles it should give good results, provided the wood is properly handled before it is put into the water. Driving is often valuable in making stands accessible which are now too remote to be lumbered in the ordinary way. In time it may be supplanted by log haulers or railroads, but at present it is a valuable method under certain conditions.

POSSIBLE IMPROVEMENTS.

Although the present methods of lumbering paper birch are, on the whole very good and generally economical, there are a few ways in which they could be improved and more complete utilization secured. First of all, stumps should be cut lower and the trees should be felled with a saw instead of an ax.

Paper birch is usually not a large tree, and the base is seldom very swell-butted, so that stumps could, in most cases, very readily be cut to a height of 1 foot; this would gain from half a foot to a foot of good material. In chopping, another half foot or more is wasted in the scarf, and could be saved by substituting sawing for chopping. The saving in the butt log through both of these means would average about 5 per cent in the largest and best part of the bole, and would also mean that frequently another bolt could be secured from the top.

A further saving could in many cases be effected in the top itself. For spool stock this should be utilized down to a diameter of 4 inches, except where numerous branches make this obviously impossible. In some cases this is already done, but in many others a large part of the top is wasted because there is a fork, or one or two large branches, above which there is still merchantable material. Not infrequently a tree forks about halfway up, and the good material above can be utilized simply by cutting out the crotch. The saving effected would vary greatly, from about 5 to more than 50 per cent, but would probably average about 20 per cent. Large branches which are now sometimes rejected could be made use of in the same way.

Whether that portion of the top which remains after the merchantable spool stock has been taken out should be used for fuel depends chiefly upon the locality. When the cutting is near a railroad or settlement it can be so used, but when it is more or less remote this is impracticable, and the tops must simply be left upon the ground. The whole question is simply one of dollars and cents—will it pay?

The cutting of young trees for fuel down to 3 inches in diameter is a distinctly bad practice. Such trees are usually growing rapidly and much greater returns can be obtained if they are left until they attain sufficient size for spoolwood, and cut to a minimum diameter of 6 inches. The tops can then be utilized for fuel and will probably yield nearly as much as the entire tree if it had been cut when only 3 inches in diameter. Immature, healthy trees should not be cut to a diameter of less than 6 inches for any purpose.

In connection with the utilization of material now wasted, the question arises whether the tops and the waste produced at the mill, such as slabs, edgings, and heart, could not be used for the manufacture of wood alcohol, acetic acid, and charcoal.

There is no doubt that these products could be made from paper birch, but it is doubtful whether, under present conditions, their manufacture would prove profitable. Except under peculiarly favorable circumstances the handling of the tops is rather expensive, there is not a large amount of waste at the mill which could be utilized, and the cost of marketing the charcoal would, in many cases, be about as much as it would bring.

A more practicable form of saving lies in the direction of the more complete utilization of sound red heart. This is already used to some extent for the cheaper grades of spools and for novelties, and could doubtless be used in this way still more widely.

SYSTEMS OF MANAGEMENT.

The point to emphasize in the management of paper birch, whether pure or mixed, is that the type is preeminently a temporary one. It is the connecting link between the original permanent type of the virgin forest and the similar type which will take its place when natural conditions, now disturbed by fire or clearing, are restored. This means that a birch stand can not be replaced by a birch stand indefinitely except by planting, or, possibly, by burning over the area to bring about those conditions which first brought it into existence. This point should constantly be borne in mind, since it has an important influence on the method of cutting to be employed.

There are three distinct systems of cutting which are applicable to birch stands under different conditions: 1. Cutting to a diameter limit to utilize the young growth to the best advantage. 2. Clean cutting of pure stands to secure sprout reproduction. 3. Complete removal of birch from mixed or changing types to give way to species which are more valuable or better adapted to the locality.

1. Cutting to a diameter limit is applicable to middle-aged, pure stands, usually more or less even aged, but which show considerable variation in diameters. The object of the cutting is to free the smaller trees, which would otherwise soon be suppressed and killed out, and to leave them for a second cut ten or twenty years later. There is no intention of securing reproduction, the aim being rather to utilize the present stand to the best possible advantage. Cuttings of this sort should be made when the stand is from 40 to 50 years old, and should

remove the larger trees to a diameter of 7 or 8 inches. Hard and fast rules, however, are seldom applicable, and the diameter limit should be flexible; that is, trees above the limit should be left or trees below the limit removed, as circumstances prescribe.

This method is not applicable to mature or overmature stands, even when these show a wide variation in diameters. In such cases the smaller trees are not younger, but are simply suppressed, poorly developed, and usually unthrifty trees of the same age as the rest of the stand. Opening up the stand would not materially increase their rate of growth, and the chances are that they would deteriorate or die before the next cutting. Such a stand should be cut clean and all of the merchantable material utilized.

2. Clean cutting to secure reproduction is applicable in pure, middle-aged stands, in which the trees are nearly all of the same size and in which there is no lower story of other species. Such stands usually have a considerable undergrowth of shrubs and weeds which would interfere with the growth of seedlings, but through which the more vigorous sprouts are able to shoot up and establish a new stand. This second growth may not be as good as the original, but if the system is carefully carried out a sufficiently heavy stand to warrant a second cut is practically assured.

The cutting should be done when the trees are from 50 to 60 years old, at which age they have an average diameter of 8 or 9 inches. After this age, the sprouting capacity is feeble or entirely lacking and the reproduction scanty. Also, the rate of growth is then too slow to warrant holding the stand longer, and the amount of heartwood increases rapidly.

The resulting sprout stands may be managed by the clean-cutting system in the same way. Owing to their shorter life, however, the cutting should take place when the trees are about 40 or 50 years old, with an average diameter of 7 or 8 inches. The method can not be continued indefinitely, however, and a second, or under most favorable circumstances a third, crop is all that can be hoped for, owing to the exhaustion of the birch stumps and the encroachment of other species.

The shape and size of the cuttings are immaterial, and since sprout reproduction is depended on, the leaving of seed trees is unnecessary. There will always be trees enough near by to

furnish seed for such seedlings as are able to establish themselves.

3. In all other cases the complete removal of the birch, with no provision for reproduction or a second cut, is advisable. The object is to utilize all of the birch already on the ground and at the same time to restore the type natural to the locality. This method is obviously the one to use in mixed stands of birch and conifers or birch and other hardwoods, where there is no hope of securing birch reproduction, and where the object is to favor the other trees by getting rid of the birch altogether. It is particularly advisable in the white pine belt. The same system of cutting, with the same object, is applicable to pure birch stands which are overmature or in which there is already a second story of other species ready to occupy the ground as soon as the birch is removed. In neither case can satisfactory reproduction be looked for. Overmature stands should be cut at once and younger stands at the time they will yield the greatest amount of wood of the best quality.

The best method of disposing of the debris left after lumbering in birch stands is to lop the larger branches of the tops so that they and the main trunk will come into contact with the ground. In the moist woods of the Northeast the danger of fire starting in old tops is not very great where ordinary precautions are taken, so that it is unnecessary to pile and burn them. Moreover, birch rots very quickly in contact with the soil, and these old tops and brush help to improve the humous conditions of the forest. Whether the scattering and burning of the tops as they lie on the ground might sometimes be advisable as a silvicultural measure is an open question. This method would destroy the ground cover, expose the bare mineral soil, and bring about the very conditions which first produced the birch stand. It would, therefore, be reasonable to expect a fair reproduction on such land again, particularly if natural means were supplemented by the broadcast sowing of a small amount of seed. On the other hand, this burning would in most cases destroy large numbers of seedlings of other species which had already established themselves, and would delay the ultimate occupation of the land by the natural type best suited to it. Furthermore, great care would have to be exercised to see that the fire did not escape into the surrounding forest with disastrous results. On the whole, scattering and burning of

the brush seems unwise at present, or at least until paper birch is much scarcer and dearer than it is now.

VOLUME AND YIELD TABLES.

The accompanying tables show the average volume of paper birch trees. The figures can not be applied to individual trees, which often vary from 10 to 15 per cent from the average, but applied to a large number of trees will give accurate estimates. The diameters given are outside the bark. The figures are from trees in central Maine and eastern New Hampshire, localities which are representative of the paper birch region. All board feet are by the New Hampshire log rule.

Table 3 shows the total volume of trees of different diameters and heights in cubic feet. Table 4 shows the merchantable volume of trees of different diameters and heights in both cubic feet and board feet by the New Hampshire rule. Table 5 shows the merchantable volume of trees of different diameters and merchantable lengths in both cubic feet and board feet. All of these tables can be applied to either seedling or sprout growth. With trees of the same diameter average sprouts have greater height and, therefore, greater volume than average seedlings. But when they do happen to have the same diameter and also the same height, then their volume is the same. In other words, the shape of the stem is the same for both seedlings and sprouts, provided they have the same height and diameter. If the volume tables were based on diameter alone, separate tables would have to be made for seedlings and sprouts, but when both diameter and height are used in the classification they can be grouped together in one table, as is done in this case.

TABLE 3.—Total stem volumes of paper birch, based on measurements of 443 trees.

Diameter breast-high.	Height of tree.				
	50 feet.	60 feet.	70 feet.	80 feet.	90 feet.
	Volume.				
<i>Inches.</i>	<i>Cu. ft.</i>	<i>Cu. ft.</i>	<i>Cu. ft.</i>	<i>Cu. ft.</i>	<i>Cu. ft.</i>
4	2.5	3.0	.....	.....	.....
5	3.7	4.3	4.8	.....	.....
6	5.2	5.9	6.7	7.8	.....
7	6.8	7.8	9.0	10.4	12.2
8	8.9	10.2	11.5	13.3	15.3
9	11.2	12.8	14.5	16.5	18.8
10	14.0	15.9	18.0	20.4	22.8
11	17.2	19.5	21.8	24.6	27.5
12	20.0	23.4	26.3	29.5	33.0
13	.....	23.0	31.5	35.3	33.6
14	.....	33.0	37.3	42.1	47.4
15	.....	33.9	44.0	49.7	55.8
16	.....	.....	51.0	57.5	60.0

TABLE 4. Merchantable volumes of paper birch, by diameter and height, based on measurements of 445 trees.

Diameter breast-high.	Height of trees.										Diameter inside bark of top.
	50 feet.		60 feet.		70 feet.		80 feet.		90 feet.		
	Volume.										
<i>Inches</i>	<i>Cu. ft.</i>	<i>Bd. ft.</i>	<i>Cu. ft.</i>	<i>Bd. ft.</i>	<i>Cu. ft.</i>	<i>Bd. ft.</i>	<i>Cu. ft.</i>	<i>Bd. ft.</i>	<i>Cu. ft.</i>	<i>Bd. ft.</i>	<i>Inches.</i>
5	2.7	16	3.2	19	3.7	23	.....	.....	.....	.....	3.3
6	3.3	22	4.6	26	5.4	30	6.2	35	.....	.....	3.7
7	5.2	28	6.3	34	7.3	40	8.5	46	9.6	.....	4.2
8	6.8	33	8.2	45	9.5	52	11.0	60	12.4	.....	4.5
9	8.7	43	10.4	57	12.2	67	14.0	76	15.5	.....	4.8
10	10.9	61	13.0	72	15.2	85	17.4	95	19.3	.....	5.1
11	13.4	73	16.0	88	18.8	104	21.4	117	24.0	.....	5.3
12	16.3	88	19.5	103	22.8	124	26.1	141	29.3	.....	5.5
13	19.8	106	23.3	127	27.3	148	31.3	169	35.0	.....	5.6
14	.....	.....	27.7	150	32.3	176	37.0	201	41.5	.....	5.8
15	.....	.....	32.5	177	37.8	207	43.2	236	48.5	.....	5.9
16	.....	.....	.....	206	43.8	242	50.0	276	56.3	.....	6.0
17	.....	.....	.....	.....	50.3	240	58.0	320	64.9	.....	6.1
18	.....	.....	.....	.....	57.4	320	.....	366	.....	.....	6.1

TABLE 5.—*Merchantable volumes of paper birch, by diameter and merchantable length, based on measurements of 396 trees.*

Diameter breast high.		Merchantable length.													
		12 feet.		16 feet.		20 feet.		24 feet.		28 feet.		32 feet.		36 feet.	
		Volume.													
<i>Inches.</i>	<i>C.ft.</i>	<i>B.ft.</i>	<i>C.ft.</i>	<i>B.ft.</i>	<i>C.ft.</i>	<i>B.ft.</i>	<i>C.ft.</i>	<i>B.ft.</i>	<i>C.ft.</i>	<i>B.ft.</i>	<i>C.ft.</i>	<i>B.ft.</i>	<i>C.ft.</i>	<i>B.ft.</i>	
5	1.7	7	2.0	10	2.3	13	2.6	15	2.9	15	3.2	21	.....	.....
6	2.4	12	2.9	16	3.4	19	3.9	22	4.3	25	4.8	23	5.4	31	
7	3.3	17	3.9	21	4.6	25	5.3	29	5.9	33	6.5	37	7.2	41	
8	4.2	23	5.2	23	6.0	32	6.8	37	7.6	42	8.4	47	9.2	52	
9	5.3	29	6.6	34	7.5	40	8.5	46	9.5	51	10.5	57	11.4	64	
10	.....	35	8.1	41	9.2	48	10.3	55	11.5	61	12.7	68	13.8	76
11	.....	.....	.....	49	11.0	56	12.2	64	13.5	71	15.0	80	16.4	89
12	.....	.....	.....	.....	.....	.....	.....	73	15.7	82	17.5	92	19.2	103
13	.....	.....	.....	.....	.....	.....	.....	.....	.....	20.1	105	118	22.7	120
14	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	27.0	138

Diameter breast high.		Merchantable length.											
		40 feet.		44 feet.		48 feet.		52 feet.		56 feet.		60 feet.	
		Volume.											
<i>Inches.</i>	<i>C. ft.</i>	<i>B. ft.</i>	<i>C. ft.</i>	<i>B. ft.</i>	<i>C. ft.</i>	<i>B. ft.</i>	<i>C. ft.</i>	<i>B. ft.</i>	<i>C. ft.</i>	<i>B. ft.</i>	<i>C. ft.</i>	<i>B. ft.</i>	
5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
6	5.8	35	6.3	.....	7.0	.....	.....	.....	.....	.....	.....	.....
7	7.9	45	8.4	.....	9.3	53	9.9	57	.....	.....	.....	.....
8	10.0	57	10.8	62	11.6	67	12.4	72	13.2	76	14.0	80	
9	12.3	69	13.3	75	14.2	81	15.2	86	16.1	92	17.1	98	
10	14.9	83	16.0	91	17.2	97	18.4	104	19.4	111	20.6	119	
11	17.8	97	19.3	107	20.7	115	22.2	124	23.6	134	25.2	142	
12	21.0	114	23.0	125	24.8	137	26.7	148	28.6	160	30.6	168	
13	24.9	133	27.4	146	29.8	160	32.3	174	34.9	187	37.5	200	
14	30.0	154	33.0	170	35.9	185	39.1	201	41.5	.....	.....	.....

An interesting feature of these tables is the rather high volume shown by paper birch, as compared with many other species. This is due to the fact that it has a bole which is more or less cylindrical in shape, with a small taper. This is clearly shown in Table 6. The bole is usually straight and free from branches for from 40 to 50 feet from the ground; above this there are numerous limbs and the taper is quite rapid. Table 7 shows the taper of the stump at 1-foot intervals from the ground and furnishes a means of determining the breastheight diameter of trees of different stump heights.

TABLE 6.—Diameters of paper birch at 5-foot intervals above the ground, based on measurements of 354 trees.

60-FOOT CLASS.

Diameter breasthigh	Height above ground.							
	5 feet.	10 feet.	15 feet.	20 feet.	25 feet.	30 feet.	35 feet.	40 feet.
	Diameter outside bark.							
<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>
6	6.0	5.7	5.4	5.0	4.6	4.2	3.8	3.4
7	7.0	6.7	6.3	5.9	5.5	5.0	4.5	3.9
8	8.0	7.6	7.2	6.8	6.2	5.6	5.0	4.3
9	9.0	8.5	8.1	7.6	7.0	6.3	5.5	4.7
10	10.0	9.5	8.9	8.4	7.7	7.0	6.1	5.2
11	10.9	10.4	9.8	9.2	8.5	7.7	6.8	5.7
12	11.9	11.3	10.6	10.0	9.3	8.4	7.5	6.4
13	12.9	12.2	11.5	10.8	10.0	9.2	8.2	7.1

70-FOOT CLASS.

Diam- eter breast- high.	Height above ground.									
	5 feet.	10 feet.	15 feet.	20 feet.	25 feet.	30 feet.	35 feet.	40 feet.	45 feet.	50 feet.
	Diameter outside bark.									
<i>In.</i>	<i>In.</i>	<i>In.</i>	<i>In.</i>	<i>In.</i>	<i>In.</i>	<i>In.</i>	<i>In.</i>	<i>In.</i>	<i>In.</i>	<i>In.</i>
6	6.0	5.9	5.7	5.4	5.1	4.6	4.3	3.9	3.5	3.1
7	7.0	6.7	6.5	6.1	5.8	5.3	5.0	4.5	4.0	3.5
8	8.0	7.6	7.3	6.9	6.5	6.0	5.5	5.1	4.5	3.9
9	8.9	8.5	8.1	7.7	7.2	6.7	6.2	5.7	5.0	4.3
10	9.9	9.4	9.0	8.5	8.0	7.4	6.9	6.2	5.5	4.7
11	10.9	10.3	9.9	9.3	8.8	8.2	7.5	6.8	6.0	5.1
12	11.9	11.3	10.8	10.2	9.6	8.9	8.2	7.5	6.5	5.5
13	12.9	12.2	11.7	11.1	10.5	9.7	9.0	8.1	7.1	5.9
14	13.9	13.2	12.6	12.0	11.3	10.6	9.7	8.8	7.6	6.4

80-FOOT CLASS.

Diameter breasthigh.	Height above ground.											
	5 feet.	10 feet.	14 feet.	20 feet.	25 feet.	30 feet.	35 feet.	40 feet.	45 feet.	50 feet.	55 feet.	60 feet.
	Diameter outside bark.											
<i>Inches.</i>	<i>In.</i>	<i>In.</i>	<i>In.</i>	<i>In.</i>	<i>In.</i>	<i>In.</i>	<i>In.</i>	<i>In.</i>	<i>In.</i>	<i>In.</i>	<i>In.</i>	<i>In.</i>
7	7.0	6.8	6.6	6.4	6.2	5.9	5.6	5.2	4.7	4.1	3.5	2.9
8	8.0	7.7	7.4	7.2	6.9	6.5	6.1	5.7	5.2	4.6	3.9	3.3
9	8.9	8.6	8.3	8.0	7.6	7.1	6.7	6.3	5.7	5.1	4.4	3.7
10	9.9	9.5	9.2	8.8	8.3	7.8	7.3	6.9	6.3	5.6	4.8	4.0
11	10.9	10.5	10.1	9.6	9.2	8.6	8.1	7.5	6.9	6.1	5.3	4.4
12	11.9	11.4	11.0	10.5	10.0	9.4	8.8	8.2	7.5	6.7	5.7	4.8
13	12.9	12.4	11.9	11.4	10.9	10.3	9.7	8.9	8.1	7.2	6.2	5.1
14	13.9	13.3	12.8	12.3	11.8	11.2	10.5	9.6	8.8	7.8	6.7	5.5

TABLE 7.—Diameters of paper birch at 1-foot intervals above the ground below breastheight, based on measurements of 300 trees.

Diameter breast- high.	Height from ground.			
	1 foot.	2 feet.	3 feet.	4 feet.
	Diameter outside bark.			
<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>
3	3.5	3.2	3.1	3.0
4	4.8	4.3	4.1	4.0
5	6.0	5.5	5.2	5.1
6	7.2	6.6	6.2	6.1
7	8.4	7.7	7.3	7.1
8	9.9	8.9	8.3	8.1
9	11.4	10.0	9.4	9.2
10	12.8	11.2	10.4	10.2
11	14.1	12.3	11.5	11.2
12	15.4	13.4	12.6	12.3
13	16.6	14.5	13.6	13.3
14	17.8	15.5	14.7	14.3
15	18.9	16.6	15.7	15.3
16	20.1	17.6	16.8	16.3

The amount of solid wood in a stacked cord is influenced by many factors, such as form, diameter, and length of sticks, and method of stacking. Table 8 is based on measurements of 16 half-cord stacks of unseasoned paper birch spoolwood bolts in the round and shows the influence of diameter on the solid contents of the stack. The measurements show the high average of 96 cubic feet per cord for spoolwood bolts averaging from 5 to 12 inches in diameter, which indicates very clearly that most birch bolts are smooth and straight. Ninety-six cubic feet may therefore be assumed as equivalent to one cord and, with modification depending on the average size of the sticks, used as a converting factor in changing volumes from one measure into the other.

The proportion of sap and heartwood varies more or less irregularly with bolts of different sizes. While the larger bolts contain absolutely more heart than the smaller ones, they may not contain any more relatively. The measurements show the average per cent of heart to be 6.9 per cent, and of sapwood 82.7 per cent. In spite of the fact that birch bark is relatively thin, it averages as high as 10.4 per cent of the total volume, and does not show any regular variation with changes in the size of the sticks.

The fuel wood is small, knotty, often quite crooked, and does not pack closely. Measurements of two half-cord stacks showed the high average of 274 sticks per cord, with the correspondingly small average solid contents of only 65.5 cubic feet per cord.

TABLE 8.—*Solid contents per stacked cord for paper birch spoolwood bolts of different diameters, in the round.*

Average diameter of stick.	Sticks. per cord.	Solid wood per cord.
<i>Inches.</i>	<i>Number.</i>	<i>Cu. ft.</i>
5	185	82.0
6	106	86.7
7	85	91.4
8	69	96.0
9	57	100.0
10	47	102.3
11	39	104.6
12	32	105.2

Table 9 shows the yield of pure paper birch stands at different ages and in different situations. The best situations are designated as quality 1, the medium situations as quality 2, and the poorest situations as quality 3. Figures are given only for qualities 1 and 2. The situations in which birch is found throughout the region probably average slightly better than quality 2. The yields given were obtained by a field party under R. L. Marston, of the Forest Service, from 46 sample plots of different ages, all of which contained at least 40 per cent birch and had a density of over 50 per cent. Where the plots contained other species in mixture the figures were reduced to correspond to a pure (100 per cent) birch stand. Hence the table applies only to pure birch stands of average density (83 per cent in quality 1, and 75 per cent in quality 2). For a mixed stand containing, for example, 60 per cent of birch, a corresponding reduction would have to be made in the yield.

TABLE 9.—Yield per acre of pure paper birch stands of average density.

QUALITY 1.						
Age.	Average diameter breast-high.	Average height.	Total yield.		Annual rate of growth.	Yield of trees 6 inches and over in per cent of total yield.
Years.	Inches.	Feet.	Cu. ft.	Cords.	Per cent.	Per cent.
15	2.3	24	710	7.4	9.0	.....
20	3.4	33	1,020	10.6	6.2	4
25	4.5	41	1,340	14.0	5.1	27
30	5.6	48	1,700	17.7	4.5	46
35	6.4	54	2,090	21.8	3.9	63
40	7.2	58	2,520	26.2	3.3	75
45	7.8	62	2,950	30.7	2.7	85
50	8.4	65	3,340	34.8	2.1	91
55	8.8	68	3,660	38.1	1.5	96
60	9.2	70	3,940	41.0	1.0	98
65	9.6	72	4,190	43.6	.7	100
70	10.0	74	4,450	46.4	.6	100

QUALITY 2.						
15	1.8	21	410	4.3	8.0	.....
20	2.6	23	590	6.0	6.2	.....
25	3.4	34	770	8.0	5.6	18
30	4.3	40	1,010	10.5	5.0	35
35	5.0	45	1,290	13.4	4.4	50
40	5.7	49	1,580	16.5	3.9	63
45	6.3	53	1,890	19.7	3.4	73
50	6.8	56	2,220	23.1	2.9	82
55	7.2	59	2,530	26.4	2.4	89
60	7.6	61	2,810	29.3	1.9	94
65	7.9	64	3,060	31.8	1.6	97
70	8.2	66	3,300	34.4	1.4	100

Although the total stem volume is given in Table 9, the lowest measurement taken in the sample trees was at 4½ feet, and the disregard of butt swelling makes the yield conservative. The yield in cubic feet was reduced to cords by dividing by 96, as previously explained. To reduce the total yield to merchantable volume the figures given would have to be reduced in general from 20 per cent to 30 per cent. The annual rate of growth in volume for the whole stand, as shown in Table 9, is less than the rate of growth of individual trees shown in Table 2. This is largely due to the fact that in measuring the individual trees the very smallest were not included, while in measuring the stand even the smallest, suppressed trees were measured whether they were merchantable or not. After twenty years of age the rate of growth in quality 1 stands is less than that in quality 2, although their actual volume growth continues to be considerably greater. This is due to their quicker growth in early youth and to their greater volume at all ages throughout the life of the stand.

These measurements were all taken in unmanaged stands just as they occurred in the forest, and show what may be expected from natural birch stands. Where the stands are near settlements and easily accessible, the yield can be increased by thinnings, which not only utilize the smaller and less desirable trees but also increase the growth of those that remain.

OUTLOOK FOR FUTURE SUPPLIES.

Forest conditions and forest policies are now changing so rapidly that it is difficult to predict what conditions will prevail many years in the future. In the case of paper birch, however, it seems fairly certain that for a good many years the supply will not be exhausted. There are extensive areas of mature birch which should be cut as soon as possible, and there are also considerable stands of young material of various ages which will later be available. Future supplies will be brought from greater and greater distances and from places now inaccessible, as better transportation facilities and an increase in the value of birch eventually bring them to market. These future supplies will undoubtedly come largely from Maine and New Hampshire. The Lake States, particularly Minnesota, may in time furnish a small supply, but the bulk of the material will still come from the Northeast.

Whether the supply of paper birch will last indefinitely is a much more difficult question. As already stated, paper birch represents a distinctly transitory forest type, and the present stands are bound to be replaced, in time, by the types natural to the locality. Fires and clearings give birch a chance to re-occupy old areas and seize upon new ones, but with the prevention of forest fires and the more permanent occupancy of agricultural lands these factors will be less influential in the future. Extensive stands of paper birch may, therefore, tend to become scarcer and scarcer, but it is very doubtful whether they will ever disappear altogether. Clearings of one sort or another will enable it to get a footing, and the passing of the paper birch is too remote a contingency to be accurately foretold.

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