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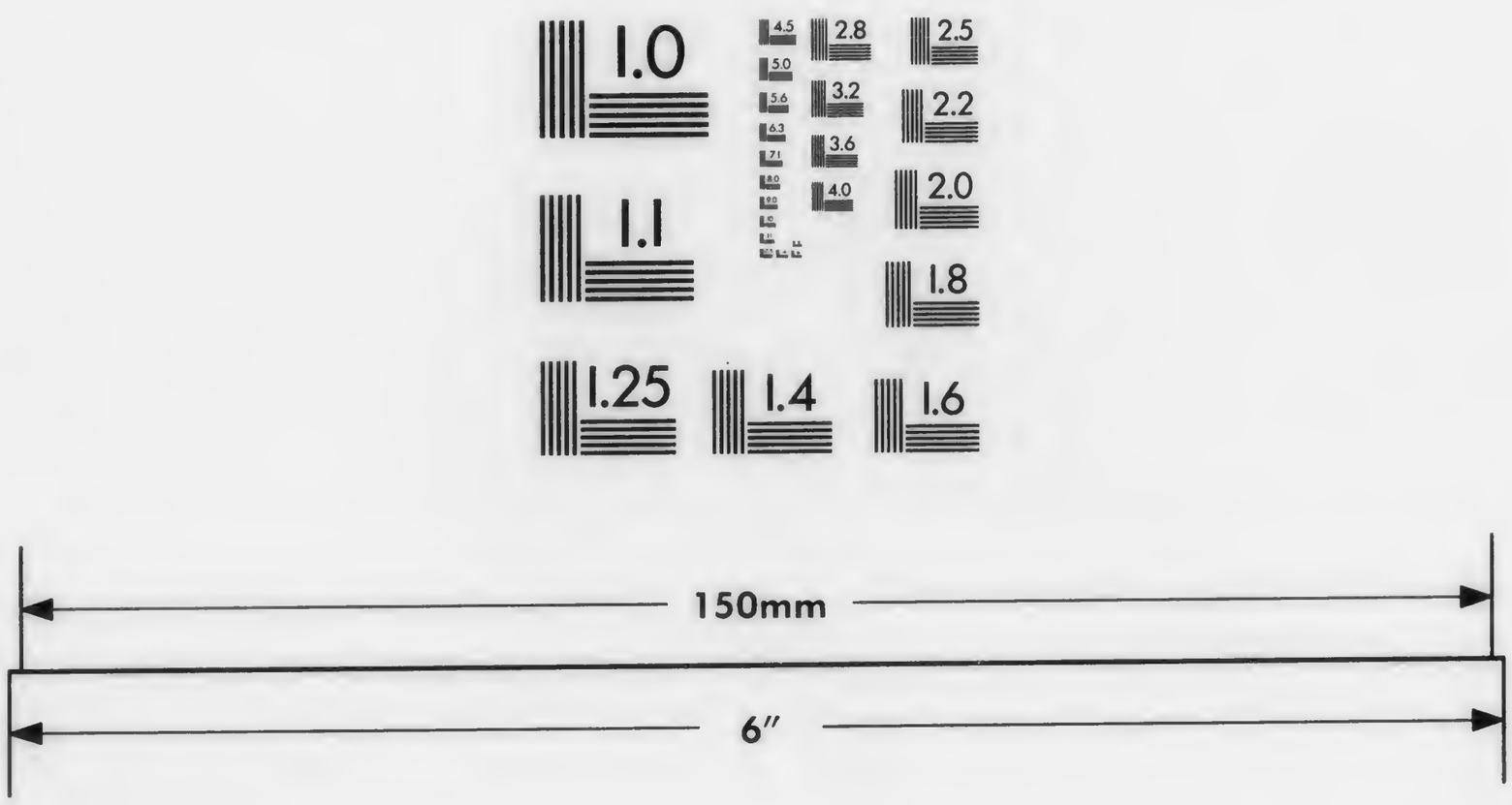

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PENNSYLVANIA LAWS

RELATING TO THE

Bulletin 1

DEPARTMENT OF FORESTRY,

FORESTRY RESERVATIONS, TIMBER LANDS, ROADSIDE TREES, &C.

PUBLISHED BY THE DEPARTMENT OF FORESTRY.

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PENNSYLVANIA LAWS RELATING TO FORESTRY, &C.

Title VIII. Offenses Against Real Property, and Malicious Mischief.

Section 140. If any person shall wilfully set on fire, or cause to be set on fire, any woods, lands, or marshes within this Commonwealth, so as thereby to occasion loss, damage or injury to any other person, he or she shall be guilty of a misdemeanor, and on conviction, be sentenced to pay a fine not exceeding one hundred dollars, and to undergo an imprisonment not exceeding twelve months.

Section 152. If any person shall cut down or fell any timber tree or trees, knowing the same to be growing or standing upon the lands of another person, without the consent of the owner, or if any person shall purchase or receive any timber tree or trees, knowing the same to have been cut or removed from the lands of another, without the consent of the owner thereof, or who shall purchase or receive any planks, boards, staves, shingles or other lumber made from such timber tree or trees, so as aforesaid cut or removed, knowing the same to have been so made, the person so offending shall be guilty of a misdemeanor, and being thereof convicted, shall be sentenced to pay such fine, not exceeding one thousand dollars, or to such imprisonment, not exceeding one year, as the court in their discretion, may think proper to impose.

Section 153. If any person shall knowingly and maliciously cut, fell, alter or remove any certain bounded tree, or other allowed land mark, to the wrong of his neighbor, or any other person, he shall be guilty of a misdemeanor, and on conviction, be sentenced to pay a fine not exceeding five hundred dollars, and to undergo an imprisonment not exceeding one year.

Approved—March 31st, A. D. 1860. WM. F. PACKER.

AN ACT

To prevent the firing of mountain and other wild lands in the county of Union.

Whereas, There being certain mountain and other wild lands in the county of Union which are fired from year to year, thereby destroying the young timber and causing the land to be worthless for the purpose of timber: And whereas, Should such young timber not be destroyed it would add to the value of the land, in the course of twenty years, from fifty to one hundred dollars per acre, thus increasing the wealth of the county thousands of dollars, therefore

Section 1. Be it enacted, etc., That any person or persons who shall intentionally set fire said lands shall forfeit and pay a sum not exceeding five hundred dollars nor less than fifty dollars, or shall be confined in the county prison for a term not exceeding one year nor less than thirty days, or both, at the discretion of the court, on conviction at any of the courts of this Commonwealth; one-half of said fine to be paid to the person or persons who make the information and the other half to be paid into the county treasury.

Approved—The 9th day of April, A. D. 1869.

JOHN W. GEARY.

The act of June 2, 1870 (P. L. 1316), extends the provisions of this act to the counties of Schuylkill, Lehigh, Berks, Lycoming, Centre, Snyder and Luzerne.

The act of May 19, 1871 (P. L. 950), exempts Lycoming county from the provisions of this act.

AN ACT

To prevent tenants in common of timber lands from cutting or removing trees without the consent of all of their co-tenants.

Section 1. Be it enacted, &c., That from and after this date it shall be unlawful for any owner or owners of any undivided interest in timber land within this Commonwealth, to cut or to remove, or to cause to be cut or removed, from the said land, any timber trees, without first obtaining the written consent of all co-tenants in said premises.

Section 2. That no sale of any timber cut or removed from such un-

divided lands, before or without such consent, shall pass any title thereto; and the parties injured shall have every remedy in law and equity for the recovery of the said timber trees, and of all square timber, boards, lumber, ties, shingles and other articles whatsoever manufactured therefrom; and also for the recovery of damages for the cutting or removing of the same, which they now have against an entire stranger to the title.

Section 3. Upon the violation of the provisions of the first section of this act, it shall be lawful for any of the parties in interest to sue out a writ of estrepement, to prevent any further cutting thereon, or the removal of any timber then already cut, or both; which said writ shall be of force until the interests of the parties shall be set out in severality, or the writs dissolved by the court, or the action of partition in refernce to said land finally ended; and the said writ of estrepement shall be obtained by affidavit, and allowed in the same manner and with like proceedings as to its service and dissolution as are now by law allowed and authorized in cases of estrepement issued pending actions of ejectment for real estate.

Approved—May 4th, A. D. 1869.

JOHN W. GEARY.

AN ACT

To prevent the burning of the woods in any of the counties of this Commonwealth.

Section 1. Be it enacted, &c., That any person or persons who shall wantonly and wilfully kindle any fire on the lands of another, so as to set on fire any wood lands, barrens or moors, within the limits of this Commonwealth, shall be guilty of a misdemeanor, and on conviction thereof shall be sentenced to pay a fine not exceeding three hundred dollars, and undergo an imprisonment not exceeding twelve months, or either or both, at the discretion of the court; and prosecutions for such offenses may be commenced at any time within two years from the commission thereof.

Section 2. Upon the conviction of any person or persons for any of the offenses aforesaid, the commissioners of the county in which such conviction is had, shall pay to the prosecutor in every such case the sum of fifty dollars out of the county treasury as a reward for the apprehension and conviction of the offender, and the defendant or defendants shall pay the same, with the costs as in other cases, into

the hands of the sheriff for the use of the county, and nothing herein contained shall prevent the prosecutor from being a competent witness in the prosecution aforesaid.

Approved—The 11th day of June, A. D. 1879.

HENRY M. HOYT.

AN ACT

Requiring the several assessors of this Commonwealth to make return of timber lands.

Section 1. Be it enacted, &c., That it shall be the duty of the several assessors of this Commonwealth, in their return of real estate to the commissioners of the proper county, at the next triennial assessment, and at each triennial assessment thereafter, to make return of all the timber land in their proper district by specifying in separate columns, how many acres each tract contains of cleared land, and how many in timber.

Approved—The 13th day of June, A. D. 1883.

ROBERT E. PATTISON.

AN ACT

For the encouragement of forest culture, and providing penalties for the injury and destruction of forests.

Section 1. Be it enacted, &c., That in consideration of the public benefit to be derived from the planting and cultivation of forest or timber trees, the owner or owners of any land in this Commonwealth planted with forest or timber trees in number not less than twelve hundred to the acre, shall on making due proof thereof, be entitled to receive annually from the commissioners of their respective counties, during the period that the said trees are maintained in sound condition upon the said land, the following sums of money:

For a period of ten years after the land has been so planted a sum equal to ninety per centum of all the taxes annually assessed and paid upon the said land, or so much of the ninety per centum as shall not exceed the sum of forty-five cents per acre.

For a second period of ten years, a sum equal to eighty per centum of the said taxes, or so much of the eighty per centum as shall not exceed the sum of forty cents per acre.

For a third and final period of ten years, a sum equal to fifty per centum of the said taxes, or so much of the said fifty per centum as shall not exceed the sum of twenty-five cents per acre.

Provided, That it shall be lawful for the owner or owners of the said land, after the same has been so planted for at least ten years, to thin out and reduce the number of trees growing thereon to not less than six hundred to the acre, so long as no portion of the said land shall be absolutely cleared of the said trees;

And provided also, That the benefits of this act shall not be extended to nurserymen or others growing trees for sale for future planting.

*Section 2. The owner or owners of forest or timber land in this Commonwealth, which has been cleared of merchantable timber, who shall at any period after the said land has been so cleared, and who shall maintain upon the said land young forest or timber trees in sound condition, in number at least twelve hundred to the acre, shall, on making due proof thereof, be entitled to receive annually from the commissioners of their respective counties the sums of money mentioned in the first section of this act: Provided, That the first period of ten years shall be counted from the time that the said land has been cleared of merchantable timber, and, that after the said first period of ten years, the number of trees upon the said land may be reduced as in the first section is provided.

Section 3. Any person or persons who shall wilfully or carelessly cut bark from, or otherwise cut, burn or injure any tree, plant, shrub or sprout planted, growing or being on any land in this Commonwealth, without the consent of the owner or owners thereof first had, obtained, or who without such consent, shall kindle, or cause to be kindled, a fire on any forest or timber land in this Commonwealth, or who shall carry into or over any forest or timber land any lighted candle, lamp or torch, or other fire, without having the same secured in a lantern or other closed vessel, or who shall discharge or set off fire works of any kind on said land or among the trees thereon, or who shall wilfully or carelessly burn or fire upon his or their own land, or that of others, any tree, brush, stubble or other combustible material whereby fire shall be communicated to the leaves, brush or timber upon any forest or timber lands belonging to other parties, shall be subject to a penalty †not exceeding one hundred dollars for each offense committed, with costs of suit: Provided, That if the defendant or defendants neglect or refuse to pay at once the penalty imposed and costs, or shall not enter sufficient bail for the payment of the same within ten days, he or they shall be committed to the common jail of said county for a period of not less than one day for each dollar of the penalty imposed: And pro-

*Act of March 22d, 1901, amended this section as it appears here.
†Act of May 14th, 1891, amends by providing this penalty of $100 instead of $50.

vided, When the penalty imposed is above five dollars, the defendant or defendants may enter into a recognizance, with good security, to answer said complaint on a charge of misdemeanor, before the court of quarter sessions of the peace of the county in which the offense is committed, which court, on conviction of the defendant or defendants of the offense so charged and failure to pay the penalty imposed by this act, with costs, shall commit said defendant or defendants to the common jail of the county for a period of not less than one day for each dollar of penalty imposed.

Section 4. Any justice of the peace or alderman, upon information or complaint made before him by the affidavit of one or more persons of the violation of this act, by any person or persons shall issue his warrant to any constable or police officer to cause such person or persons to be arrested and brought before the said justice of the peace or alderman, who shall hear and determine the guilt or innocence of the person or persons so charged, who, if convicted of the said offense, shall be sentenced to pay the penalty aforesaid.

Section 5. The commissioners of each county shall, within one month after the passage of this act, cause the same to be published one or more times, in one newspaper of general circulation in their respective counties.

Approved—The 1st day of June, A. D. 1887.

JAMES A. BEAVER.

AN ACT

Providing for the recovery of damage to trees along the public highways, by telegraph, telephone and electric light companies.

Section 1. Be it enacted, &c., That from and after the passage of this act, it shall be lawful, whenever any telegraph, telephone or electric light company shall have erected its poles and lines along any turnpike, public road, street, lane, alley or highway in this Commonwealth, for the owner or owners of land adjoining said turnpike or public road, who may claim to be damaged by the erection or maintenance of said lines by reason of the cutting of trees, whether planted in the said turnpike, public road, street, lane, alley or highway, or on enclosed or unenclosed land adjoining the same, to petition the court of common pleas of the county in which said damage shall be alleged to have been committed, whereupon the said court shall appoint three impartial men, citizens of the county in which said damages shall be alleged, as viewers, who shall, after having been duly sworn or affirmed to the faithful performance of their

duties, assess the damages done, if any, to the petitioner, and shall report the same to the court, at the first week of the next regular term thereof after the said appointment, which report shall, upon its presentation as aforesaid, be confirmed nisi; and if no appeal be entered to the same on or before ten days from the Saturday of the week in which the same is presented, it shall then be confirmed absolutely and judgment entered by the prothonotary of the said court upon the same against the said company.

Section 2. The compensation of the viewers provided for by the first section of this act shall be the same as is now provided for road viewers, and shall be paid by the defendant company, where damages are awarded, otherwise by the petitioner: Provided, That the provisions of this act shall not apply to the police patrol or fire department telegraph lines.

Section 3. All laws in so far as they conflict with this act are hereby repealed.

Approved—The 2d day of June, A. D. 1891.

ROBERT E. PATTISON.

AN ACT

Authorizing the purchase by the Commonwealth of unseated lands for the non-payment of taxes for the purpose of creating a State Forest Reservation.

Section 1. Be it enacted, &c., That from and after the first day of January, A. D. 1898, whenever any unseated lands within this Commonwealth shall, under existing laws, become liable to sale by the respective county treasurers or the county commissioners for non-payment of taxes, it shall be the duty of such treasurers and commissioners to publish a notice once a week for six successive weeks in at least two newspapers of general circulation within the county in which the lands lie, and if two newspapers be not published in said county, then in one newspaper in or nearest to the same, which notice shall contain the names of the owners when known, the warrant numbers, names of warrantees when known, the number of acres contained in each tract, the township in which the same is located, and the sums due upon each tract for taxes; and further to mail to the Secretary of Agriculture and the Commissioner of Forestry each, ten copies of such printed advertisement immediately upon the publication thereof.

Section 2. It shall be the duty of the Commissioner of Forestry to

inquire into and examine the location and character of unseated lands advertised by the respective county treasurers and the county commissioners of this Commonwealth for sale for the non-payment of taxes, and if in his judgment the same are so located and are of such a character as to make them desirable for the Commonwealth for the purpose of creating and maintaining a Forestry Reservation, he shall have power, at his discretion, to purchase any such lands for and in behalf of the Commonwealth at such tax sales, subject to the right of redemption under existing laws: Provided however, That the bid made and the price paid for said lands, shall in no case exceed the amount of taxes for the non-payment of which the same are being sold, and the costs. For all purchases so made in behalf of the Commonwealth, the Auditor General shall draw his warrant upon the State Treasurer to the order of the county treasurer, upon certificate filed by the Commissioner of Forestry with the said Auditor General: Provided further, That the Commissioner of Forestry shall have power to purchase unseated lands other than such as are advertised for sale for the non-payment of taxes, upon such terms and conditions as may be agreed upon with the owners of such land: Provided, That such purchase shall be approved by the Governor and the Board of Property, consisting of the Attorney General, Secretary of the Commonwealth and Secretary of Internal Affairs. And provided further, That in no case shall the price paid for such unseated land exceed the assessed value of the same. For all purchases so made in behalf of the Commonwealth the Auditor General shall draw his warrant upon the State Treasurer to the order of the grantor, upon certificate filed by the Commissioner of Forestry, with approval as aforesaid: Provided, That in no case shall the amount paid for any tract of land purchased under the provisions of this act exceed the sum of five dollars per acre.*

Section 3. In the event of redemption of said lands, the redemption money paid shall be remitted to the State Treasurer by the county treasurer, with a statement describing the tract of land so redeemed.

Section 4. The title to all lands so purchased, and not redeemed after the expiration of the time limited for redemption, shall be taken as vested in the Commonwealth to the same extent, and with like effect as though such purchase had been made by an individual at such sale, and the county treasurer shall certify to the Secretary of Agriculture, lists of all lands purchased in behalf of the Commonwealth and not redeemed within the time limited for such redemption, with a description of each tract as required by section one of this act, and thereafter such lands shall not be subject to further

*Section 2, as amended by act of April 28, A. D. 1899.

taxation while the same are owned by the Commonwealth. It shall be the duty of the Secretary of Agriculture to keep a record in a book, to be especially provided for that purpose, of all the lands so acquired by the Commonwealth, with full description of each tract, the character of the same, the date of purchase, the price paid, when the title became absolute, or if redeemed, the date of redemption.

Section 5. The lands so acquired by the Commonwealth shall be under the control and management of the Department of Agriculture, but assigned to the care of the Division of Forestry, and shall become part of a forestry reservation system, having in view the preservation of the water supply at the sources of the rivers of the State, and for the protection of the people of the Commonwealth and their property from destructive floods.

Section 6. All acts and parts of acts inconsistent herewith are hereby repealed.

Approved—The 30th day of March, A. D. 1897.

DANIEL H. HASTINGS.

AN ACT

Making constables of townships ex-officio fire wardens for the extinction of forest fires, and for reporting to the court of quarter sessions violations of the laws for the protection of forests from fire, prescribing the duties of such fire wardens and their punishment for failure to perform the same, and empowering them to require, under penalty, the assistance of other persons in the extinction of such fires.

Section 1. Be it enacted, &c.. That on and after the first day of Janaury, A. D. 1898, the constables of the various townships of the Commonwealth shall be ex-officio fire wardens, whose duty it shall be, when fire is discovered in the forests within their respective townships, immediately to take such measures as are necessary for its extinction, and to this end to have authority to call upon any person or persons within their respective townships for assistance; the said fire wardens to receive fifteen (15) cents per hour, and the persons so assisting twelve (12) cents per hour, as compensation for their services; the expense thereof shall be paid, one-half out of the treasury of the respective county, and the remaining half of said expense shall be paid by the State Treasurer into the treasury of said county, out of moneys not otherwise appropriated, upon warrant from the Auditor General, but no such warrant shall be drawn

until the respective county commissioners shall have first furnished, under oath or affirmation, to the Auditor General, a written itemized statement of such expense, and until the same is approved by the Auditor General: Provided, That no county shall be liable to pay for this purpose, in any one year, an amount exceeding five hundred dollars.

Section 2. Any person who being called upon by the fire warden of his township to furnish assistance in extinguishing forest fires, as provided in section one, shall, without reasonable cause, refuse to render such assistance, upon conviction thereof shall pay a fine not exceeding ten dollars, or undergo imprisonment not exceeding thirty days, or both, at the discretion of the court.

Section 3. The fire wardens of each township throughout the Commonwealth shall, in the first week of each term of the court of quarter sessions of their respective counties, make returns to said court, under oath or affirmation, of all violations occurring within their respective townships, which may come or be brought to their notice, of any of the provisions of any law now enacted, or hereafter to be enacted, for the purpose of protecting forests from fire, and it shall be the special duty of the judge of said court to see these returns are faithfully made; and on failure of any fire warden to comply with this provision, or if it be found upon examination or inquiry by said court that any fire warden has either wilfully or negligently omitted to report all such violation occurring within his township, or having failed to perform his duty as set forth in section one of this act, such fire warden or constable shall be deemed guilty of wilfully or negligently making a false return, or neglect of duty, and the court shall suspend him from office and direct the district attorney to indict and try him, and if found guilty, he shall be fined in a sum not exceeding fifty dollars, and undergo an imprisonment not exceeding three months, both or either, at the discretion of the court.

Section 4. The term forest herein used shall not, for the purposes of this bill, be held to include an area of timber land or brush land of less than fifty acres in extent, unless such said area shall, by proximity to other timber land, be liable to convey fire to an area of brush land or timber land containing at least fifty acres.

Approved—The 30th day of March, A. D. 1897.

DANIEL H. HASTINGS.

AN ACT

To authorize constables and other peace officers, without first procuring a warrant, to arrest persons reasonably suspected by them of offending against the laws protecting timber lands.

Section 1. Be it enacted, &c., That if any person or persons shall be detected by any constable or other peace officer, in the act of trespassing upon any forest or timber land within this Commonwealth, under such circumstances as to warrant the reasonable suspicion that such person or persons have committed, are committing, or are about to commit, some offence or offences against any of the laws now enacted or hereafter to be enacted for the protection of forests and timber land, such constable or other peace officer shall have authority at once, without first procuring a warrant therefor, to arrest on view such person or persons, with like effect as though such warrant had first been procured.

Section 2. That all acts or parts of acts inconsistent herewith be and the same are hereby repealed.

Approved—The 29th day of April, A. D. 1897.

DANIEL H. HASTINGS.

AN ACT

To secure State Forestry Reservations, and providing for the expenses thereof.

Section 1. Be it enacted, &c., That a commission, to be composed of the Commissioner of Forestry, the chairman of the State Board of Health, the Deputy Secretary of Internal Affairs, and two other persons, one of whom shall be a lawyer or conveyancer of at least ten years professional experience and the other one a practical surveyor, to be appointed by the Governor, be hereby created.

Section 2. The said Commission shall, after examination, locate and report to the Governor, or to the Legislature if it be in session, the following forestry reservations:

(1). One of not less than forty thousand acres upon waters which drain mainly into the Delaware river.

(2). One of not less than forty thousand acres upon waters which drain mainly in the Susquehanna river.

(3). One or not less than forty thousand acres upon waters which drain mainly into the Ohio river:

Provided, That each of these reservations shall be in one continuous area so far as the same is practicable.

Section 3. That the lands selected shall be of a character better suited to the growth of trees than to mining or agriculture, and that at least fifty per centum of the area of each reservation shall have an average altitude of not less than six hundred feet above the level of the sea.

Section 4. That the said commission shall have full power to take by right of eminent domain and condemn the lands it has selected for the purposes aforesaid as State reservations for the use and behoof of the Commonwealth, and wherever it shall be necessary to have a recourse to a jury to assess the damages for any property to be taken as aforesaid, the said jury shall consist of such number and shall proceed and their award shall be reviewed and enforced in the same manner as now provided by law for the taking of land for the opening of roads in the respective counties in which said property is situated. And all the lands acquired by the State for public reservations by the action of said Commission shall be paid for by the State Treasurer, upon a warrant drawn by the Auditor General of the Commonwealth, after approval by the Governor.

Section 5. The Commissioners appointed under this act shall serve without compensation, except so far as the officials designated hereby are compensated by the continuance of their salaries as such officials while serving as Commissioners, but the necessary expenses of travel and all other necessary expenses incurred under the provisions of this act shall be paid by the State Treasurer, on the warrant of the Auditor General, after due certification.

Section 6. Provided, That nothing herein contained shall authorize the taking, for the purpose of this act, of any land held by any corporation created for the purpose of the preservation of forests.

Approved—The 25th day of May, A. D. 1897.

DANIEL H. HASTINGS.

[The provisions of the above act have mainly become inoperative by the passage of the act of February 25, 1901.]

AN ACT

To amend the first section of an act, entitled "An act to protect timber lands from fire," approved the second day of June, A. D. 1870, providing for a penalty in case of the failure of county commissioners to comply with the terms of said act, after demand made upon them by the Commissioner of Forestry, and providing for the Commonwealth bearing part of the expenses incurred under said act.

Section 1. Be it enacted, &c., That the first section of the act, entitled "An act to protect timber lands from fire," approved the 2d day of June, A. D. 1870, which reads as follows,:

"Section 1. That it shall be the duty of the commissioners of the several counties of this Commonwealth to appoint persons under oath, whose duty it shall be to ferret out and bring to punishment all persons who either wilfully or otherwise cause the burning of timber lands, and to take measures to have such fires extinguished where it can be done; the expenses thereof to be paid out of the county treasury, the unseated land tax to be the first applied to such expenses," shall be and the same is hereby amended to read as follows:

Section 1. That it shall be the duty of the commissioners of the several counties of this Commonwealth to appoint persons, under oath, whose duty it shall be to ferret out and bring to punishment all persons or corporations who either wilfully or otherwise cause the burning of timber lands within their respective counties, and to take measures to have such fires extinguished where it can be done; and on failure of the commissioners of any county, after demand made upon them by the Commissioner of Forestry of this Commonwealth, to comply with this provision, they shall be deemed guilty of a misdemeanor in office, and upon conviction thereof shall be fined in a sum not exceeding one hundred dollars, or suffer an imprisonment not exceeding two years, or both, at the discretion of the court. The expense incurred in the employment of the persons contemplated by this act, on and after the first day of January, A. D. 1898, shall be paid, one-half out of the treasury of the respective county, and the remaining half of said expense shall be paid by the State Treasurer upon warrant from the Auditor General; but no such warrant shall be drawn until the commissioners of the proper county shall have first furnished, under oath or affirmation, to the Auditor General, a written itemized statement of such expense, and until the same is approved by the Auditor General: Provided, That

in no case shall the expense to the Commonwealth growing out of this act exceed five hundred dollars for a single county in any one year.

Approved—The 15th day of July, A. D. 1897.

DANIEL H. HASTINGS.

AN ACT

Making constables of townships and boroughs ex-officio fire, game and fish wardens, prescribing their power and duties, fixing their fees as wardens, and prescribing their punishment for failure to perform their duties.

Section 1. Be it enacted, &c., That from and after the passage of the act the constables of the various wards, boroughs and townships of the Commonwealth shall be ex-officio fire, game and fish wardens.

Section 2. It shall be the duty of said fire, game and fish wardens to enforce all statutes of this State now in force, or that may hereafter be enacted, for the protection of forests and timber lands from fire, and for the protection and propagation of game, game birds, game mammals, song and insectivorous birds, and fish, and said constables or wardens shall have authority to arrest without warrant any person or persons caught by them in the act of violating any of the aforesaid laws for the protection of forests and timber lands, game, and food and game fish, and take such person or persons forthwith before a justice of the peace or other magistrate having jurisdiction, who shall proceed without delay to hear, try and determine the matter. Such arrests may be also made on Sunday, in which case the person or persons arrested shall be taken before the proper officer, and proceeded against as soon as may be on a week day following the arrest.

Section 3. Said constables or wardens shall have power without warrant to search and examine any boat, conveyance, vehicle, fish box, fish basket, game bag or game coat, or other receptacle for game or fish, when they have good reason to believe that any of the laws for the protection of forests and timber lands, game and fish, have been violated; and the said constables shall at any time seize and take possession of any and all birds, animals or fish, which have been caught, taken or killed at any time, in a manner or for a purpose, or had in possession or under control, have been shipped or are about to be shipped, contrary to any of the laws of this State. Any court having jurisdiction of the offense, upon receiving proof of probable

cause for believing in the concealment of any bird, animal or fish, caught, taken, killed, had in possession, under control or shipped, or about to be shipped, contrary to law, shall issue a search warrant and cause a search to be made in any place, and to that end may, after demand and refusal, cause any building, enclosure or car to be entered, and any apartment, chest, box, locker, crate, basket or package, to be broken open and the contents thereof examined by said constable. All birds, animals or fish, or nets, or fishing appliance, or apparatus, seized by any constable or warden, shall be disposed of in such manner as may be directed by the court before whom the offense is tried, and such constable or warden shall not be liable for damages on account of any such search, examination or seizure, or the destruction of any nets or fishing apparatus of any kind in accordance with the provision of this act.

Section 4. Any constable or warden, upon the arrest and prosecution of any offender to conviction under the provisions of this act, shall, in addition to the fees to which he may be entitled under existing laws, be paid for his services the sum of ten dollars on a warrant drawn by the county commissioners on the county treasurer, one-half of which shall be paid out of the treasury of the respective county, and the remaining half of said reward shall be paid by the State Treasurer into the treasury of said county, out of moneys not otherwise appropriated, upon warrant from the Auditor General, but no such warrant shall be drawn until the respective county commissioners shall have first furnished, under oath, to the Auditor General, a written itemized statement of such expense, and until the same is approved by the Auditor General: Provided, That no county shall be liable to pay for this purpose in any one year an amount exceeding five hundred dollars.

Section 5. Each of said constables or wardens shall, for the purpose of this act, have concurrent jurisdiction throughout his own proper county; and they shall in the first week in each term of the court of quarter sessions of their respective counties make special returns to said court, under oath, of all violations occurring in their respective townships, or which may come or be brought to their notice, of any of the provisions of any law now in force, or that may hereafter be enacted, for the protection of forests and timber lands, game and fish; and it shall be the duty of the judge of said court to see that such returns are faithfully made, and any constable or warden wilfully neglecting or refusing to make such returns, or to prosecute any offense under said laws of which he shall have personal knowledge, or of which he shall have notice in writing by any citizen, giving the name of the offender together with the names of the witnesses, shall be guilty of a misdemeanor, and upon conviction

thereof be sentenced to pay a fine of fifty dollars, or to undergo an imprisonment in the county jail of two months, both or either, at the discretion of the court.

Section 6. All sections, provisos, acts, or parts of acts inconsistent with this act, or any section of it, are hereby repealed.

Approved—The 22d day of March, A. D. 1899.

WILLIAM A. STONE.

AN ACT

To establish a Department of Forestry, to provide for its proper administration, to regulate the acquisition of land for the Commonwealth, and to provide for the control, protection and maintenance of Forestry Reservations by the Department of Forestry.

Section 1. Be it enacted, &c., That there be and is hereby established a Department of Forestry, to consist of the Commissioner of Forestry and four other citizens of the Commonwealth, who together shall constitute the State Forestry Reservation Commission; each of whom shall be appointed and commissioned by the Governor, by and with the advice and consent of the Senate; the Commissioner of Forestry for a term of four years, two of the said citizens for a term of two years, and two of said citizens for a term of four years; and thereafter all appointments shall be made by the Governor, by and with the advice and consent of the Senate, for a term of four years. The persons so appointed, before entering upon the discharge of their duties shall each take and subscribe to the oath of office prescribed by article seven of the Constitution of Pennsylvania. The Commissioner of Forestry and the Forestry Reservation Commission, so appointed, shall be clothed with all the powers heretofore conferred by law respectively upon the Commissioner of Forestry and the Forestry Reservation Commission, so far as the same are consistent with the provisions of this act, and in addition shall have full power, by and with the consent of the Governor, to purchase any suitable lands in any county of the Commonwealth that in the judgment of said Commission the State should possess for forest preservation: Provided, That in no case shall the amount paid for any tract of land, purchased under the provisions of this act, exceed the sum of five dollars per acre. Said commission shall also have full power to manage and control all the lands which it may purchase under the provisions of this act, as well as those that have heretofore been purchased and which are now owned by the State under existing laws. Said Commission is also empowered to estab-

lish such rules and regulations with reference to control, management and protection of forestry reservations, and all lands that may be acquired under the provisions of this act, as in its judgment will conserve the interests of the Commonwealth; and whereever it shall appear that the welfare of the Commonwealth, with reference to reforestation and the betterment of State Reservations, will be advanced by selling or disposing of any of the timber on forestry lands, the Commission is hereby empowered to sell such timber on terms most advantageous to the State; and said Commission is hereby empowered to make and execute contracts or leases, in the name of the Commonwealth, for the mining or removal of any valuable minerals that may be found in said forestry reservations, whenever it shall appear to the satisfaction of the Commission that it would be for the best interests of the State to make such disposition of said minerals; and provided, that such contracts or leases shall also be approved by the Governor of the Commonwealth after the proposed said contracts or leases shall have been duly advertised in at least three newspapers published nearest the reservation designated, for one month, in advance of said contract or lease, and the contracts or leases shall be awarded to the highest bidder, and he or they shall have given such bond as the commission shall designate for the performance of his or their part of the contract, and the said bond shall have been approved by the court of the county wherein the contracts or leases are made: Provided, however, that when, by virtue of leases or contracts for removal of minerals and sale of timber from any lands purchased by the State for Forestry Reservations, there comes a net revenue to the State, one-half of said net revenue derived from lands situate in any township shall be paid by the State Treasurer to the treasurer of such township, for application to township purposes and reduction of local tax levies in such township: Provided, That there shall not be paid to any one township, during any year, more than twice the amount of taxes that would be received by such township from said lands if they were owned by individuals.

Section 2. Any person or persons who shall kindle fires upon any of the forestry reservations of this Commonwealth, except in accordance with such rules and regulations as may be prescribed by the Forestry Reservation Commission, or who shall cut or remove any timber whatever, or who shall do or cause to be done any act that will damage forest lands or timber belonging to this Commonwealth, shall be guilty of a misdemeanor, and upon conviction thereof be subject to a penalty of not less than one hundred dollars nor more than five hundred dollars for each offence committed, with costs of suit, which penalty and costs of suit shall be collected in the same manner as is now provided by existing laws

for like offences committed on forest lands belonging to individuals; all fines and penalties when collected to be paid to the Commissioner of Forestry, who is hereby directed to pay the same over to the State Treasury; provided, that if the defendant or defendants neglect or refuse to pay at once the penalty and costs imposed, he or they shall be committed to the common jail of the county wherein the offence was committed until such penalty and costs are paid.

Section 3. That the Commissioner of Forestry shall be the president and executive officer of the Forestry Reservation Commission, and also Superintendent of the State Forestry Reservations, and shall have immediate control and management, under the direction of the Forestry Reservation Commission, of all forest lands already acquired or which may hereafter be acquired by the Commonwealth, but the power so conferred upon said Commissioner of Forestry shall not extend to the enforcement of the laws relating to public health or the protection of fish and game. It shall be the duty of the Commissioner of Forestry to encourage and promote the development of forestry, and to obtain and publish information respecting the extent and condition of forest lands in the State, and to execute all rules and regulations adopted by the Forestry Reservation Commission for the enforcement of all laws designated for the protection of forests from fire and depredation; and he is hereby empowered to employ such detective service, and such legal or other services, as may be necessary for the protection of the forestry reservations owned by the Commonwealth and for the apprehension and punishment of persons who may violate any of the forestry reservation laws or any of the rules and regulations, which, under the powers herein given, may be adopted by the Forestry Reservation Commission: Provided, That the services so employed and the expenses that may thereby be incurred shall be approved by said Forestry Reservation Commission and the Governor of the Commonwealth.

Section 4. The Commissioner of Forestry shall receive a salary of three thousand dollars per annum, and in addition thereto shall be reimbursed for all necessary expenses of travel which may be incurred in the discharge of the duties of his office; and the other members of the Forestry Reservation Commission shall serve without salary, but shall be reimbursed for all necessary expenses incurred by them in the performance of the duties of their office.

Section 5. The Commissioner of Forestry shall have an office at the State Capitol, and it shall be the duty of the Board of Commissioners of Public Grounds and Buildings to provide, from time to

time, the necessary rooms, furniture, apparatus and supplies, for the use of the Department of Forestry created under the provisions of this act.

Section 6. All moneys appropriated by the General Assembly in the general appropriation act of 1899 for the Division of Forestry of the State Department of Agriculture, as for salaries or contingent fund, which may remain unexpended at the time of the approval of this act, shall be transferred to and be vested in the Department of Forestry, hereby created; and the clerk of the Commissioner of Forestry, hitherto appointed under the law creating the Department of Agriculture, shall be transferred from the Department of Agriculture to the Department of Forestry, on the same salary that he now receives.

Section 7. The purchase money for lands acquired and all expenses that may be incurred, except the salaries of the Commissioner of Forestry and his clerk, shall be paid by the State Treasurer out of any moneys in the Treasury not otherwise appropriated, on warrant of the Auditor General, upon vouchers duly approved by resolution of the Forestry Reservation Commission and the Governor of the Commonwealth.

Section 8. The title of all lands acquired by the Commonwealth for forestry reservations shall be taken in the name of the Commonwealth and shall be held by the Commissioner of Forestry, and such lands shall not be subject to warrant, survey or patent, under the laws of the Commonwealth authorizing the conveyance of vacant or unappropriated lands, and all such forestry reservation lands shall be exempt from taxation from the time of their acquisition. In all cases where lands have been purchased, or may hereafter be purchased by the Forestry Reservation Commission for forest reservations, where there are public roads, regularly established, running into or through said lands, the Commissioner of Forestry, under such rules and regulations as the Forestry Reservation Commission is hereby authorized to adopt, may expend a sum not exceeding twenty-five dollars per mile in each year for the maintenance, repair or extension of any such roads, and on roads bordering on reservations one-half of this rate per mile may be expended. All expenses that may thus be incurred shall be subject to the approval of the Forestry Reservation Commission and the Governor of the Commonwealth, and shall be paid in the same manner as other expenses are provided for in this act.

Section 9. The Commissioner of Forestry shall receive the moneys to which the State may be entitled by virtue of the sale of any timber, or by virtue of any leases or contracts relating to the disposition of minerals, as hereinbefore provided, and he shall immediately

pay the same over to the State Treasurer as a part of the revenue of the Commonwealth. The said Commissioner of Forestry shall give his bond to the Commonwealth, with two sureties, to be approved by the Governor, in the sum of ten thousand dollars, for the faithful discharge of the duties imposed by this act and for the proper accounting of any moneys to the Commonwealth that may come into his hands by virtue of his position as Commissioner of Forestry.

Section 10. That all acts or parts of acts inconsistent with the provisions of this act be and the same are hereby repealed.

Approved—The 25th day of February, A. D. 1901.

WILLIAM A. STONE.

AN ACT

To encourage the preservation of forests by providing for a rebate of certain taxes levied thereon.

Section 1. Be it enacted, &c., That in consideration of the public benefit to be derived from the retention of forest or timber trees, the owner or owners of land in this Commonwealth, having on it forest or timber trees averaging not less than fifty trees to the acre, each of said trees to measure at least eight inches in diameter at a height of six feet above the surface of the ground, with no portion of the said land absolutely cleared of the said trees, shall, upon filing with the county treasurer of their respective counties and with the tax collectors of their respective townships or districts an affidavit made by said owner or owners, or by some one in his, her or their behalf, setting forth the number of acres of timber land within the requirements of this act, be entitled to receive annually, during the period that the said trees are maintained in good condition upon the said land, a rebate equal to eighty per centum of all taxes, local and county, annually assessed and paid upon said land, or so much of the eighty per centum as shall not exceed in all the sum of forty-five cents per acre, the said rebate to be deducted from said taxes, pro rata, and receipted for by the respective tax collectors or county treasurers: Provided, however, That no one property owner shall be entitled to receive said rebate on more than fifty acres.

Section 2. All acts or parts of acts inconsistent herewith are hereby repealed.

Approved—The 11th day of April, A. D. 1901.

WILLIAM A. STONE.

AN ACT

For the better protection of timber lands against fire, and providing for the expenses of the same, and directing what shall be done with the fines collected and costs paid.

Section 1. Be it enacted, &c., That when the commissioners of any county or counties fail to "appoint persons under oath, whose duty it shall be to ferret out and bring to punishment all persons or corporations who either wilfully or otherwise cause the burning of timber lands," within their respective counties, as is provided for by the act of July 15th,1897, or when they have appointed inefficient persons to do the work aforesaid; the Commissioner of Forestry may, on the request of residents of a county in which such fires have been created, or on the request of the owner or owners of land which has been injured by the fires so created, appoint a detective or detectives, and employ an attorney or attorneys, to ferret out and bring to punishment, as aforesaid, those who cause the burning of timber lands; and all expenses incurred by the Commissioner of Forestry under the operation of this act shall be paid by the State Treasurer, on warrant drawn by the Auditor General, if the said bills shall be approved by the Governor and the Commissioner of Forestry; and all the fines collected shall be paid by the magistrate or by order of the court to the Commissioner of Forestry, and be paid by him to the Treasurer of the Commonwealth.

Section 2. When conviction is obtained, under the provisions of this act, of persons or corporations causing the burning of timber lands, then the Auditor General, on the request of the Commissioner of Forestry, may refuse to pay the State's share of the money due to the county for the services of the person or persons, appointed by the county commissioners, to ferret out and bring to punishment those who caused forest fires in the districts where such persons served as fire detectives, to make arrests and secure convictions, and for which conviction was obtained by the detectives appointed by the Commissioner of Forestry.

Approved—The 2d day of May, A. D. 1901.

WILLIAM A. STONE.

AN ACT

Authorizing boroughs of this Commonwealth to require the planting of shade-trees along the public streets thereof, by the owners of abutting property, in certain cases.

Section 1. Be it enacted, &c., That the burgess and council of any borough of this Commonwealth, upon the petition of a majority of the property owners upon any public street thereof, may by ordinance require the planting and replanting of suitable shade-trees along and upon either side of any such street, upon such alignment and at such points as may by such ordinance be designated, by the owner or owners of property abutting the street at the points designated; and on failure of any such owner or owners after reasonable notice, to comply with the terms of any such ordinances, the said authorities may cause such trees to be planted or replanted at the expense of the borough; and thereupon, in the name of the borough, collect such expense from the owner or owners in default, as debts of like amount are by law collectible: Provided, That the said authorities shall not require the planting or replanting of trees at any point or points which may interfere with the necessary or reasonable use of any street or abutting property, or interfere unreasonably with any business thereon conducted.

Approved—The 17th day of June, A. D. 1901.

WILLIAM A. STONE.

AN ACT

To encourage the planting of trees along the roadsides of this Commonwealth, and providing a penalty for killing, removing or injuring the same; what disposition is to be made of moneys collected as penalties, and for keeping a record, by the supervisor of roads or boards of supervisors of roads, of the trees so planted and upon which a tax abatement has been granted.

Section 1. Be it enacted, &c., That any person liable to road tax, who shall transplant to the side of the public highway on his own premises any fruit, shade or forest trees, of suitable size, shall be allowed by the supervisor of roads or boards of supervisors of roads, where roads run through or adjoin cultivated fields, in abatement

of his road tax, one dollar for every two trees set out; but no row of elms shall be placed nearer than seventy feet; no row of maples or other forest trees nearer than fifty feet, except locust and Carolina poplar, which may be set thirty feet apart, and except fruit trees, which may be set forty feet apart; and no allowance as before mentioned shall be made unless such trees shall have been set out the year previous to the demand for such abatement of tax, and are living and well protected from domestic animals at the time of such demand.

Section 2. Any fruit, shade or forest trees growing naturally by the side of the public highway, where said public highway runs through cultivated lands, shall be allowed for in the same manner and on the same conditions as in the preceding section.

Section 3. Any trees transplanted by the side of the public highway, as aforesaid, in the place of trees that have died, shall be allowed for in the same manner and on the same conditions as in the first section of this act.

Section 4. No person shall be allowed an abatement, as aforesaid, of more than one-quarter of his said annual road tax.

Section 5. Any person who shall cut down, kill or injure any living tree, planted or growing naturally as aforesaid, or who negligently or carelessly suffers a horse or other domestic animal, driven by or for him to injure any trees hereinbefore mentioned, upon conviction thereof shall be subject to a penalty of not less than one dollar, nor more than five dollars, with costs of suit, for each and every tree so cut down, killed, removed or injured: Provided, That if the defendant or defendants neglect or refuse to pay at once the penalty so imposed and costs, or shall not enter sufficient bail for the payment of the same within ten days, he or they shall be committed to the common jail of the county in which the offense was committed, for a period of not less than one day for each dollar of penalty imposed and costs: Provided, however, That the owner of the land upon which the trees are growing and upon which said abatement has been granted, may remove such trees, on condition that he will immediately plant and maintain another tree, or trees, in the place or places of those removed by him or refund to township said abatement, originally allowed for said tree or trees.

Section 6. All moneys collected as a penalty in accordance with section five of this act, shall be paid to the supervisors of roads or boards of supervisors of roads, and form part of the road fund of the township in which the offense was committed.

Section 7. It shall be the duty of the supervisor of roads or the boards of supervisors of roads to keep a permanent record, in a book especially prepared for that purpose, and which book shall be the

property of the township, of all trees upon which the said abatement, as hereinbefore mentioned, has been granted; and when any tree or trees have been removed, with or without the consent of the supervisors of roads or boards of supervisors of roads, the date thereof shall be distinctly entered in the said book.

Section 8. The act approved the second day of May, A. D. 1879, entitled "An act to encourage the planting of trees along the roadsides in this Commonwealth," is hereby repealed.

Approved—The 2d day of July, A. D. 1901.

WILLIAM A. STONE.

PROPAGATION

OF

FOREST TREES

HAVING COMMERCIAL VALUE

AND

ADAPTED TO PENNSYLVANIA.

By GEORGE H. WIRT, *Forester.*

Bulletin No. 2

PUBLISHED BY THE

PENNSYLVANIA DEPARTMENT OF FORESTRY.

1902.

WM. STANLEY RAY,
STATE PRINTER OF PENNSYLVANIA.
1902.

Department of Forestry,
Harrisburg, Pa., February 2, 1902.

The frequent demands made upon this office for information as to the best methods of propagating forest trees induced me to request Mr. Wirt, our State Forester, to prepare this bulletin upon the subject. I believe it will be timely and useful.

J. T. ROTHROCK,
Commissioner of Forestry.

LETTER OF TRANSMITTAL.

To Hon. J. T. Rothrock, Commissioner of Forestry:

Dear Sir: I have the honor to submit herewith the following notes on the "Propagation of Forest Trees Adapted to Pennsylvania."

Recognizing the needs of our farmers, I have endeavored to present in a brief and clear way such facts and methods as will bring reasonable success to the inexperienced planter, without making necessary any large expenditure of money. The nurseryman or the forester may find nothing new and may even take exception to many statements.

The botanical names of the trees and their order, for the greater part, is in accordance with Gray's "Manual of Botany," sixth edition. In addition I have added those given by Britton and Brown in their "Flora of North America and Canada," when differing from the nomenclature of Gray.

Very respectfully,

GEORGE H. WIRT,
Forester.

Harrisburg, Pa., February 1, 1902.

THE FOREST NURSERY.

Forestry work does not consist entirely of raising trees from seed and of planting them, although that is a very important part of it. Nor is all planting of trees forestry work. Forestry is a business and must be conducted on a financial basis. Planting individual trees is done mostly from an aesthetic standpoint and at a comparatively high expense. Planting for forestry purposes, under existing conditions, must be reduced to the least possible cost, but it must be understood that more may be lost in this operation from lack of care and attention to the young plants than by trying to save time and money along some other line of work. The methods of raising trees are as varied and as numerous as the trees themselves, the people who plant them and the localities in which they are planted. In other words, the conditions under which each planter has to work are so different that there can be no exact method laid down that will be applicable for all trees and all places. But there are certain laws of plant life in general, and facts in regard to particular trees that, being reinforced by observation of nature and by common sense, will undoubtedly lead to a measurable degree of success. For what follows there is no claim of originality. It is merely a sifted collection of notes taken from the most reliable sources at hand and from the observation of successful nursery work.

Nursery.

Location.—If many plants are to be raised and the planting is to extend over a number of years, a permanent nursery must be prepared. Its proximity to the house of the person in charge will afford the advantage of easy and quick accessibility. Time can be saved in going to and from it. A frequent inspection of its condition and requirements is more likely to occur, and work may be done at odd times. On the other hand, if the planting is to be done within one or two years the nursery might best be placed near the prospective plantation in order to save time in removing the young plants, and to decrease the danger of loss resulting from exposure of the roots to sun and wind. Less preparation is needed, perhaps, in this case, and less care, in some respects, but in either case the following hints are applicable.

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Aspect.—The land should have a very gradual slope, and face towards the northeast to give the best results. Good drainage will be obtained; the direct rays of the sun during the growing season are avoided and in spring there is more gradual thaw, a condition that is very desirable, for it is the sudden changes that affect plants most. Other slopes may be used of course, but protection from wind and from the sun must be provided for. As watering will often be necessary, a stream or a spring should be close at hand.

Soil.—The soil should be, preferably, a sandy loam of moderate moisture—neither too wet nor too dry. Heavy soil should be avoided. Whatever land is used, ought to be worked up thoroughly, to a depth of at least 1½ feet, in the fall and again in the spring. More especially should this be done on new land or on land that has not been worked for a long time. The top soil should be well and evenly fertilized. The more thoroughly the working is done the more oxygen for plant life there will be in the soil. The moisture will be better maintained. If the fertilizing is properly done, instead of raising seedlings with long, straggling roots, which cause more or less difficulty in transplanting, there will be produced strong plants with a compact system of root fibres, which is a better result for many reasons.

Beds.—The size of the nursery must be left entirely to the planter himself, but it may be a safe estimate to allow sixteen square feet of bed for every three hundred broad-leaved seedlings and for every six hundred conifers expected from a medium thickness of broadcast sowing.

If transplanting is to be done, fifteen to thirty square feet may be allowed for every one hundred conifers and thirty to sixty square feet for every one hundred broad-leaved seedlings. To prepare the beds stake out the paths or walks at right angles to each other. Shovel about six inches of soil from these and throw it on top of what will be the beds. These may be kept in better shape, then, if boards are placed around the sides, otherwise after each rain more or less soil is washed into the walks, often exposing the roots, or washing out entirely the plants along the edges. Long beds should be about four feet across so as to be worked easily from each side. Of course these are a saving in ground-space, but if there is much danger of damage from mice it is best to have small beds about five feet square. Or a ditch with perpendicular walls around the entire nursery will make it mouse-proof. For taprooted species of trees, such as oak, walnut, hickory, ash, etc., special beds might be made, so as to prevent the forming of long taproots, by placing on about a level with the walks a layer of boards or a very close layer of stones under the beds.

Moisture.—Moisture is one of the most necessary conditions of plant life, consequently the needs of the nursery in this direction

must be carefully attended to. Frequent working of the soil and weeding will make a fine, loose cover for the beds, preventing evaporation to a very great degree. If the soil becomes too dry, watering must be done. Very good results are obtained if the water is allowed to flow through the walks, and to reach the soil in the beds by capillarity. Another good method is to make small irrigation trenches on the beds, fill them and allow the water to soak into the ground. Sprinkling is likely to form a crust which will increase evaporation. After a rain the beds may be too moist. If so, proper conditions can be made by sprinkling some dry sand over the ground. Young seedlings are very likely, too, to have earth spattered over their stems. Especially is this so with conifers and they should be freed of this as soon as possible by running a stick gently over them.

Weeding.—The nursery beds should be kept clean of weeds at all times. If the seedlings have been planted in rows, or in the case of transplants, weeds may be kept out by small billets of wood or by a layer of moss, or of leaves placed between the rows. Weeding should not be done after the first of September at the latest.

Shade.—During the first season's growth, the young plants will be very sensitive and they should be given some protection from the sun. This can be done by making lath frames which will let through about half the sunlight, and by placing them from two to six feet above the beds. Or a frame may be made on which branches can be laid. Some prefer simply sticking conifer branches into the beds in such a way that they form a slight cover. Lath frames are, perhaps, the most convenient, for the shade ought to be removed on cloudy days and during gentle showers. These covers, as well as the billets to keep down weeds, will help to preserve the moisture in the beds.

Seeds.

Choice of Species.—In determining the species to be raised, it is well to observe what trees are growing in the locality, not only within wooded districts but also along fences and in fields. They will give an idea of the quality of the soil and of what may be expected in the future, although this is not always the case, for other better species may have been forced out by some cause. Find out when these trees will have a good crop of seeds and then have everything ready for work when it comes. Not all trees bear seeds every year, as in the case of some oaks and conifers the period varies from two to five years, or even longer. Nor do all seed years produce a full crop of good seeds, as in the case of the tulip-tree. Then some seeds ripen in early summer

even winter. From among these trees in the neighborhood, if they are the proper species, select the healthiest ones and gather their seeds as soon as ripe.

Time of Sowing.- Seeds of the poplars, soft maple, white elm, paper and river birch, and others maturing in summer should be sown at once. They lose their power of germination in a short time. Seeds of oaks, hickories, walnuts, conifers, and others which mature in fall may be sown at once. The freezing and thawing of winter will be beneficial to them, but the destruction by squirrels, mice, and birds that is likely to occur is sufficient reason for not planting until spring, if the seeds can be preserved properly. They should not be allowed to dry out before planting nor should they be exposed constantly to much moisture if they are to be kept for any length of time.

Thickness of Sowing.--By making tests, either by cutting seeds or by placing them between wet flannels in a warm room, so as to produce germination, or by some other method, the percentage of good seed is determined and from this the thickness of the sowing. It is very easy to sow too thick, and then the seedlings will be weak, but it is cheaper to thin out, and perhaps set the young plants in other ground, than to have to fill up blanks.

Depth of Sowing.—The difficulty, in too many cases, has been that instead of the seeds being planted, they are buried. As a general rule, for depth of cover, the diameter of the seed is sufficient, but if the ground is left very loose, or if there is danger from frost late in spring, a heavier covering should be given. It is well, after sowing, to roll the beds or to press the ground with a spade or a board. In fall sowing cover the beds with a layer of leaves. It will prevent the ground from heaving during the time of frost and in the spring will prevent the heavy rains from washing out the seeds. This may be done to advantage, too, after spring sowing. In both cases a careful watch must be kept and as soon as the seedlings appear the leaves should be raked off. Branches might then be spread thinly over them to keep the birds away, but these should not be left on too long so as to in any way interfere with the growth. Small seeds may be coated with red lead as a protection against birds.

Manner of Sowing.—As a usual thing the smaller seeds are sown broadcast in the nursery, especially those of the conifers, the ash, the birch, etc. The larger seeds, as those of the oaks, hickories, walnuts, etc., are usually sown in furrows, or rows, from six to twelve inches apart, on the nursery beds. The latter are often sown in rows where the plants will remain permanently. This may be advisable with with taprooted species. Broadcast sowing over a plantation is very expensive and is very seldom done.

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Transplanting.

Age of Plants.—Most plants after they have remained in the seed beds for one season, may be set out where they are to stand finally, especially broad-leaved ones. The spruces and firs grow very slowly during the first four or five years and may best be left two years in the seed bed, then transplanted to other nursery beds and allowed to remain there two or three years. Small and weak seedlings of other species should be treated in the same way. Frequent transplanting is recommended for all species, when especially large and strong plants are needed. In all cases before setting out finally, whether on good or poor land, the object should be to grow and to use only the strongest and best plants. They will be able to resist enemies and hardships and to recover from injuries much better than weak ones.

Time.—Transplanting can be done either in fall or in spring. If done in fall, it should be after the growth has ripened or ceased. During winter the dirt will have a chance to settle about the roots, and by spring the loss of root fibre will be partly made up. On the other hand, frost may lift the plants out of the ground or storms may loosen them. Then, too, they will be exposed to damage from animals at a time when food is scarce. In spring the work should be done as early as possible, at least before the new growth begins. Spring is preferable for conifers.

Distance.—The distance at which plants should be placed finally depends upon the species, the age and the object in view. If firewood is the only object then perhaps more wood will be formed per tree by giving as much room and light as possible to the tops. Even in this case it is a question whether close planting is not better financially, if small wood can be used or sold at all. Where it is the purpose to get the soil covered quickly, to raise straight stems clean from branches, either for poles or posts, or later for timber, close planting must be done. For plantations of considerable size, to plant at regular distances and to do it in a systematic way is at all times cheapest. Cultivation may be done more quickly and easily. Blanks may be easily found and filled, and later management is facilitated. Of course mere filling of gaps in existing forests can be done only in a very irregular method.

Roots.—There are numerous methods of planting, but, in all, the most important thing is to take care of the roots. Perhaps more failures could be traced to lack of care of them than to any other cause. They are very sensitive to sun and wind and should never be exposed long enough to become dried out. When the plants are removed from the nursery they should be taken from the beds as care-

fully as possible so that very few roots be broken. Wrap the roots in wet burlap or cover them with moist moss, or place them in thin mud. The plants may then be carried safely to the place of planting. If it is not done at once they should be "heeled in." In planting do not cramp the roots in any way and see that the growing ends are down, and not up. Place fine soil among the roots and pack it thoroughly. If sod has been taken out, turn it upside down on the ground close to the tree. Young plants are sensitive to being planted too deep and so should be no deeper than they were in the nursery. Of course with larger plants, when a great deal of dirt has been loosened, allowance must be made for some settling, but this will not be necessary if packing is well done. When larger roots have been broken or bruised they should be cut off smooth with a sharp knife. Planting can not be done too carefully.

Methods.—In loose and in sandy soil small plants may be set out quickly with the "dibble." This is simply a wooden peg or some iron instrument which will make a hole large enough to have the roots dropped into it. The hole should be made deeper than the roots are long. Place the plant in the hole as far as convenient and then raise it to the proper planting depth. In this way the roots will be in a natural position and not turned up, or to one side. The hole is closed by running the dibble into the ground near the hole and forcing the soil against the roots. This method may be used to good advantage within a forest to fill up blanks if the soil is deep enough.

The most common method, and that applicable under more conditions than any other, is planting in holes that have had to be dug in some manner, as with a spade or hoe. It is necessary for large plants. It is the best method for small plants in heavy soils and in stony places. In fact it may be used anywhere but in the very wet soils. It is well to have the holes dug in fall and allowed to lie open during the winter for spring planting. Humus, rich ground or manure may be used in planting, and if so, should be well placed among the roots, the poorer soil being placed on top. Each plant should be made firm.

On hillsides where a plow can be used terraces may be formed by laying rows of stones along the hill side, or if more time can be taken, by putting in stakes and placing small branches on the uphill side. Run a furrow above this in autumn and during winter the ground will be more or less broken up, facilitating spring planting a great deal. Where a plow can not be used on a slope the only resource is to dig holes just wherever possible and put in strong plants.

In wet soils, swamps or marshes, mound planting may best be used. This is very similar to hole planting, except that the plant is put into the ground thrown out of the hole instead of placing it in the hole itself as in the other cases. If sod has been lifted, split it and

place the plant in the crevice. Here, too, the ground must be thoroughly packed around the roots of the plant. When balls of dirt are taken out with the plants, holes must be dug somewhat larger than the size of the ball on the plant. When this is done the plants may be moved at any time of year and to any place. If the plants are crooked or branchy after planting, cut them off about an inch and a half above ground.

A few trees, such as willows and poplars, may be propagated by cuttings. It is recommended that the cuttings be gathered in fall from last year's shoots and buried during winter. They should be planted in spring while the ground is still moist. They will do well if not gathered till spring, but before the new growth begins, and planted at once. When planting leave one good bud above ground. The others may be rubbed off. Layers or root suckers may be used in a few instances but as a general rule, willows and poplars being an exception, it is better to raise trees from seed.

CUCUMBER TREE, MOUNTAIN MAGNOLIA.

Magnolia acuminata, L.

This tree is nowhere common in Pennsylvania. It is, however, a tree that is worthy of being cultivated because of the peculiar fitness of its wood for pump stocks, watering troughs, etc.

The fruit is a cylindrical mass resembling the cucumber, whence the tree's name. This becomes red in autumn and it is then time to watch for seeds, in order that they may be gathered as soon as ripe. About the last of September, or the first of October, when fully mature, scarlet seeds may be seen suspended from the fruit by delicate white threads. Owing to an oil in the pulp that encloses each seed they become rancid and lose their power of germination as soon as the pulp decays. They should be placed at once in water of 70 degrees to 80 degrees Fahrenheit and macerated for about a week, when the seeds can be thoroughly washed. These should then be fixed in a box in alternate layers of sand and seeds, and kept in a cellar where they will not freeze. As soon as the ground is warm in spring, about the middle of May, they may be sown in furrows from six to eight inches apart, on well prepared seed beds and covered lightly. If any fertilizing is done a small quantity of wood ashes or of bone dust is best. It is said that manure should not be used. The seedlings, after remaining in the seed beds for two years, should be ready for being set out where they are to remain. If intended for lawn planting they may be transplanted every two or three years until wanted.

The tree is found naturally in valleys or coves of mountainous regions, and along rocky streams, prefering deep, rich soil. To do well they must be planted in conditions as near as possible to those under which they do best naturally. Plant in rows from two to five feet apart and from eighteen to twenty-four inches in the row. Close planting will prevent early branching.

SWEET BAY, SWAMP SASSAFRAS, BEAVER TREE.

Magnolia glauca, L.

Magnolia Virginiana, L. See Britton & Brown, Vol. II, p. 48.

The tree never reaches a very great size in this State and is of very little importance except as an ornamental tree. Its flowers appearing in June and continuing for several weeks are very beautiful and fragrant. It prefers moist or swampy soils in a sheltered position. Propagation from seed is the same as that for the cucumber tree, but it may be easily propagated from layers which, it is said, require two years to root. It is frequently grafted upon a root of the cucumber tree and seems to grow better there than on its own roots.

UMBRELLA TREE, ELK WOOD.

Magnolia Umbrella, Lam.

Magnolia tripetala, L. See Britton & Brown, Vol. II, p. 48.

Very seldom found in Pennsylvania, nor does it attain a great size here. Professor Sargent says that it is hardy in cultivation as far north as New England. The branches are very irregular, with leaves at the ends giving the appearance of an umbrella. Large white flowers appear about May, making a very attractive tree. Its propagation is similar to that of the cucumber tree.

TULIP-TREE, TULIP POPLAR, YELLOW POPLAR.

Liriodendron Tulipifera, L.

The tulip-tree is one of the most magnificent of the forest trees and its wood is valuable for many purposes. It is a fairly rapid grower and as it is becoming very scarce its propagation should be encouraged.

The fruit has a cone like appearance, being made up of a number of scales, on a common axis, from which they fall during winter. Very few of these scales contain seeds and only about ten per cent. of the seeds formed are good. London said that the best cones are found on the higher branches of aged trees. In autumn, as the seeds mature, the fruit turns to a brownish color. The cones should be gathered in October after the first few scales have dropped. Drying them in an ordinary living room for a short time ought to be sufficient to free the seeds from the scales. The seeds may be sown broadcast, or in shallow furrows, in fall, or they may be kept in a dry room until spring. Roll the beds after giving the seeds a slight cover. Soft mold or wood and leaf ashes are good fertilizers for them. In summer do not allow the beds to become too dry and give the young plants some protection from the sun. The plants may remain in the seed beds for two years, to develop a good root system before being planted permanently, or if they are wanted for ornamental purposes they may be transplanted and left two or more years. After transplanting first time it is better to cut the stem off a couple of inches above the ground, allowing a new stem to be formed.

Rich soil of coves and of cool slopes is its preference. It is known to come up in old fields after an advance growth of sassafras or locust, or with locust. Seedlings are plentiful in the forest near old trees after a winter or spring fire has burned the layer of leaves on the ground. It may be set out as the cucumber tree, with locust or with walnut, or with both. Trees are said to be raised easily from cuttings.

BASSWOOD, AMERICAN LINDEN, LIME TREE, LIN.

Tilia Americana, L.

The linden has a one seeded fruit which when it is matured in September is hard, hairy, gray and about the size of a pea. They should be sown at once in the seed beds, or if kept over winter, should be stratified with moist sand in a box which can be placed in well drained ground. In either case a good percentage will come up the first year, but if they have been kept dry over winter they are likely to wait until the second year before germinating. They are very slow growers from the seed and will have to remain in the nursery for two, three, or four years, and perhaps more, before they will be large enough to set out permanently. They may be then planted with oak, sugar maple, white ash, etc. As with other trees, if the

plants are crooked, or too branchy, cut them off just above the ground and allow a shoot to form. More rapid growth is obtained from layers, so it is customary to cut off an old tree close to the ground, and when a number of shoots have come up, to throw dirt among them that they may take root for themselves. In one or two years they may be cut off and used as plants. Transplanting with balls of dirt is recommended. It prefers a moist situation but will grow on dry soil. As a shade tree it is probably not surpassed.

WHITE BASSWOOD.

Tilia heterophylla, Vent.

The white basswood is more of a mountain tree than the Tilia Americana. It is commonly found growing on the moist soil bordering mountain streams; however, it will thrive upon limestone soil, or dry, gravelly and sandy soil, if moderately rich. The wood of this tree is not unlike that of the other species of basswood and is sold as such. It can be propagated the same as the basswood above, either from seed or from cuttings, the latter being, perhaps, preferable.

AMERICAN HOLLY.

Ilex opaca, Ait.

While the holly, under favorable conditions, becomes a tree of good size, and is then valuable, it is not likely that, in this State at least, it will ever be raised for other than ornamental purposes. The fruit is a small red berry, maturing in autumn and remaining on the tree all winter. The berries may be gathered in December and at once macerated in water. After the seeds have been thoroughly washed, they should be spread on a cloth and dried, and then mixed with sand and kept dry until needed for sowing in spring. Sow in furrows ten to twelve inches apart. Cover seeds lightly with fine earth and roll it. A layer of leaves may then cover the bed which will perhaps hasten germination. The seeds are slow to germinate and may not come up until the second year. The plants should be carefully transplanted every two years until set out finally. It seems to prefer the edge of streams or swamps, under other trees, but it will grow on higher ground. It makes a close hedge and requires little care when once started. It is also propagated by cuttings.

OHIO BUCKEYE, FETID BUCKEYE.

Aesculus glabra, Willd.

The wood of this tree is used for pulp wood and for the manufacture of light wooden articles. Although there are other rapid growers, the wood of which is better in quality and may take the place of the buckeye, yet the facility with which it can be raised from seed together with its rapid growth may recommend it.

The fruit resembles the common horse-chestnut but is prickly when young. It matures in autumn and the seeds may be gathered from under the old tree after the first frost. They should be planted at once, either where they are to remain, say two or three feet apart each way, or they may be planted in seed beds, in rows eighteen to twenty-four inches apart and twelve to fourteen inches in the row. Cover a little more than the thickness of the seed, unless the beds are mulched. In one year the plants may be set out. They prefer moist soil, as along the banks of rivers, but will do well in soil that it is not exceedingly dry.

SWEET BUCKEYE.

Aesculus flava, Ait.

Aesculus octandra, Marsh. See Britton & Brown, Vol. II, p. 401.

The tree has a smooth fruit, has the same uses as the Ohio buckeye and may be propagated in the same manner. Either may be used as a shade tree, although the European horse-chestnut is superior and more frequently used for that purpose.

SUGAR MAPLE.

Acer saccharinum, Wang.

Acer Saccharum, Marsh. See Britton & Brown, Vol. II, p. 398.

In the Forestry Report for this State issued in 1895, it is stated that this is one of the largest and perhaps one of the commonest trees in the State. It is apparent therefore that conditions here are favorable to its growth. It is a valuable tree and will grow in almost any locality.

The seeds, in samaras or keys about an inch long, are matured in September. They may be picked from the tree, or a little later swept together under the tree, as they are usually very plentiful. They are very sensitive to being dried out and therefore should be sown at once. The rows should be about eight inches apart and the seeds six inches apart in the rows. A very light cover of earth is sufficient, but put a layer of leaves over the beds for the winter. The seeds may be kept over winter if stratified with sand just slightly moistened, then sown early in spring. During the first season the young plants will need shade. They may remain in the seed beds two years and then be set out permanently at three, four or five foot distances. Prune off any branches that may have formed. The sugar maple has been planted in pure plantations and also in mixture with white ash, walnut, oak, birch and others. It is among the best of the trees suitable for street planting.

What is known as black sugar maple is a variety of Acer saccharinum and is propagated in the same manner.

The striped maple (Acer Pennsylvanicum, L.), so called from the striped appearance of its bark, is of little importance except as an ornamental tree. Its seeds ripen in September and may be raised as the above. It is found in cool ravines and endures considerable shade.

SILVER MAPLE, WHITE OR SOFT MAPLE.

Acer dasycarpum, Ehrh.

Acer saccharinum, L. See Britton & Brown, Vol. II, p. 397.

This is perhaps the most rapid grower among the maples, and it is adapted to any soil, but it is of very little value. The keys are large, veiny and diverging. The seeds ripen early in summer, in May or June. They may be swept up under the trees and should be sown at once. If planted in moist beds and given a light cover of earth it will not be long before the young plants put in an appearance. Sow the seeds in rows about twelve inches apart and in distances of eight inches in the row. If started in good soil one year will be sufficient time in the nursery, but if in poor soil they will take two years to grow to a size suitable for planting. These plants are apt to branch young, so when planting, if they are branchy or crooked, cut them off just above the ground. The sprout that will be formed will make up for the growth that has been lost.

RED MAPLE, SWAMP MAPLE.

Acer rubrum, L.

The red maple is a more valuable tree than the soft maple and as it thrives in swamps (although not confined to them) which are rarely of any use, there is no reason why it should not be raised. The seeds ripen in May or June and perhaps can best be picked from the tree. They should be planted at once in moist soil, as with the soft maple. The first year they grow slowly and may have to remain in the seed bed two years. Pruning with these, too, may be necessary. Where the soil is good it makes a beautiful shade tree.

BOX ELDER, ASH-LEAVED MAPLE.

Negundo aceroides, Moench.

Acer Negundo, L. See Britton & Brown, Vol. II, p. 400.

In wooded sections of the country this tree is of little value, but in the plains it serves as a splendid "nurse tree" to other more useful species. It is a rapid grower and will thrive on any soil, hence, where a quick protection to the soil, or a quick shade is wanted, there is nothing better; for instance, for the protection of white pine seedlings on a dry southern slope. It is short lived and when planted with other trees affords an early return in the way of fire wood. The seeds are ripe in September and should be sown at once. In one year the seedlings can be planted out. With conifers, box elder may be planted in every other row at four foot distances, the rows being three feet apart. With broad leaved species every third row would be sufficient.

STAGHORN SUMACH.

Rhus typhina, L.

Rhus hirta, (L.) Sudw. See Britton & Brown, Vol. II, p. 386.

Mostly a shrub but at times reaches the dimensions of a small tree. The wood has a beautiful grain and will take a polish, making it suitable for panels, etc. The fruit (small, hard, strong seeds) is compacted into an irregular, brown or scarlet mass. The seeds mature

about October, after which they may be gathered and sown at once, or kept in a dry, cold place until spring. The sumach is found in thickets, both on the borders of streams and on dry hill sides; it seems to grow more rapidly, however, on the moist soil and usually produces there a stem more or less free of branches.

LOCUST TREE, BLACK LOCUST, YELLOW LOCUST.

Robinia Pseudacacia, L.

The locust has many qualities that recommend it to the tree planter. The foliage and blossoms make it suitable for a shade tree, especially along country roads. It is a rapid grower and can be reproduced easily from seeds or from root suckers. It will grow on any soil that is not wet, and, like all leguminous plants, it improves the soil on which it grows. Moreover the wood is strong and of great durability. Yellow locust wood is supposed to be more valuable than white locust wood, but both come from this species.

The fruit, a pod enclosing several seeds, is matured in September and may be gathered from the tree any time after that, for frequently they remain on the tree all winter. The seeds may be threshed out with a flail and cleansed by running them through a winnowing machine. Field mice are fond of them, consequently it is best to keep them for spring planting, which is easily done if they are kept in a cool, dry atmosphere. Before planting, put them into scalding water and remove them as soon as they swell up. Repeat the operation until all are ready, then plant at once in the seed bed, about six inches apart each way. The young plants may remain in the beds one or two years when they may be set out permanently at four foot distances. At first sight of the borer's work cut off the branch or the whole stem and burn it. If branchy when transplanted pruning will be necessary. It may be planted by itself or mixed with other species, as yellow poplar, catalpa, walnut, etc.

JUDAS TREE, RED BUD.

Cercis Canadensis, L.

Hardly more than a shrub. Its wood is seldom if ever used. In spring the bush is aflame with red flowers, making it worthy of a place on the lawn. The fruit is a legume, or pod, ripening in autumn

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These may be gathered and kept until spring, the seeds to be sown early. It does not seem to be particular as to soil and may be planted under other trees or shrubs. In growth it is fairly rapid.

KENTUCKY COFFEE TREE, COFFEE NUT.

Gymnocladus Canadensis, Lam.

Gymnocladus dioica, (L.) Koch. See Britton & Brown, Vol. II, p. 261.

Very similar to the locust in qualities and requirements. Like all other broad-leaved species it reaches its best development on moist, rich soil. The seeds mature in October and may be taken from the pods readily after a severe frost, or the pods may be gathered and macerated in warm water. Dry the seeds and treat as locust seeds. The growth is rapid, so close sowing is not necessary, neither is the tree so apt to branch as the locust.

HONEY-LOCUST.

Gleditschia triacanthos, L.

This tree as yet has very little value other than as an ornamental tree. It requires rich soil. The pods may be gathered in September or October and macerated in water until the seeds can be washed clean. They can be treated then as those of the locust and coffee tree. The taproot should be cut off before transplanting.

WILD CHERRY, WILD BLACK CHERRY.

Prunus serotina, Ehrh.

A neglected but valuable tree. It is a fairly rapid grower, not particular in regard to soil, and furnishes a fine wood for the manufacture of furniture. The fruit is matured in August. It can then be gathered from the tree and macerated in water until the stones can be cleaned. These may be sown at once, but it is well to preserve them until spring by mixing them with sand and placing the box either in a dry, cool cellar or in the ground where the stones can be

frozen. They must not be allowed to become moist. Sow in furrows six to eight inches apart and two or three inches in a furrow. They will be of sufficient size in two years to be moved safely. They may then be mixed with seedlings of ash, elm, oak, pine, spruce, etc., at four foot distances.

Prunus Pennsylvaniaca, L. fil., or the fire cherry, is of little value other than as a nurse tree to better and weaker species. It may be used as the box elder. Propagation is the same as for the black cherry. The fruit is ripe in July.

AMERICAN CRAB-APPLE.

Pyrus coronaria, L.

Malus coronaria, (L.) Mill. See Britton & Brown, Vol. II, p. 235.

The tree never reaches a very great size and its wood is of little value except for tool handles or turnery work. As an ornamental tree, however, it is worth some consideration. Its flowers are numerous, fragrant and of delicate tints. The fruit matures late in fall, when it may be gathered and macerated in water in order to obtain the seeds. Several years in the nursery may be required before the seedlings will be large enough to be planted out with safety. Pruning may be necessary in order to avoid a straggling form. It is usually found in rather moist soil.

MOUNTAIN ASH.

Pyrus Americana, DC.

Sorbus Americanus, Marsh. See Britton & Brown, Vol. II, p. 233.

Of no value other than as an ornamental tree. It grows both on highlands and on lowlands. The berry-like fruit grows in clusters and matures about October. The seeds may be obtained by maceration, and after being dried on a cloth should be kept in a dry, cool place for spring planting. Frequent transplanting before setting out permanently will no doubt secure the best results for ornamental use.

COCKSPUR THORN.

Crataegus Crus-galli, L.

Except for hedges the cockspur thorn is little used. It is occasionally found as a lawn tree because of its white flowers, which appear in June. The fruit matures in October. The seeds may be obtained by maceration and can be sown at once or kept for spring sowing.

JUNE BERRY, SHAD BUSH, SERVICE BERRY.

Amelanchier Canadensis, T. & G.

Another tree, more often a shrub, which is more ornamental than useful. It is among the first of our trees to bloom in spring and is very attractive because of its many white flowers. The fruit matures in June or July and is then edible. The seeds are obtained by maceration and should be sown at once. It has been found on soil varying from dry "barrens" to the wet borders of swamps.

GUM, SWEET-GUM, BILSTED.

Liquidambar Styraciflua, L.

A tree that grows to large size and furnishes a fine grained lumber suitable for veneer and interior finishing. The fruit, a ball with rough projections, matures in autumn, when the seeds drop out. They may be gathered in September or October and sown at once in the seed beds, either scattered thinly broadcast, or in furrows four to six inches apart. Give them a light cover of soil and as with other seeds sown in fall, spread leaves over the beds to protect them during the winter. Two years may be required to allow the seedlings to become of sufficient size to transplant. They may be set in almost any soil, but because of their tendency to branch set the plants not more than three feet apart each way. It presents a beautiful appearance in autumn and is suitable for a lawn tree.

DOGWOOD, FLOWERING DOGWOOD, BOXWOOD.

Cornus florida, L.

As the name implies the tree is conspicuous for its flowers. Its autumn colors are just as attractive, hence as an ornamental tree it is well worth consideration. In order to secure a straight trunk, and a regular shape, plant the young tree, then when it has a year to "root itself" fairly, cut the stem off (in spring or early summer) close to the ground. It will then produce several shoots. Select the one

you prefer and remove the rest. As this retained shoot grows and makes its branches, keep cutting off the lower ones until the stem is as high as you desire, after which it may be trusted to care for itself. It rarely attains great size but the wood is valuable for tool handles, mallets, etc., where it will undergo hard usage. As a forest tree it is scarcely better than a weed, permitting no other species to get a start beneath its shade. The fruit is a small, red berry maturing in September. The berries may be picked from the tree and macerated until the pulp can be removed from the seeds. Mix these with damp sand and place in well drained ground over winter. Plant early in spring. During summer protect from the hot sun. After two years the plants may be set out, either in the open or under the shade of other trees.

The alternate-leaved dogwood, having a "blue-black" berry, is of little value even as an ornamental tree.

TUPELO, PEPPERIDGE, BLACK OR SOUR GUM.

Nyssa sylvatica, Marsh.

Black gum, in favored localities, often grows to a large size. It prefers damp, rich soils but will grow in dry situations. It may be used for landscape work. The wood is hard to split and is used where such characteristic is needed. The fruit ripens in September and may be picked from the tree. Macerate in warm water until the seed or stone is clean. Mix with damp sand and place in ground well protected from moisture. In spring sow about two inches apart in rows. Keep the beds moist. In two years the plants may be moved and should be set two to three feet apart. They are, otherwise, likely to branch.

LAUREL, MOUNTAIN LAUREL, CALICO-BUSH.

Kalmia latifolia, L.

RHODODENDRON, ROSE-BAY, GREAT LAUREL.

Rhododendron maximun, L.

These two shrubs are of little value other than for ornamental use. They are comparatively easy to transplant from the woods. The young plants should be taken up in early spring with considerable dirt to the roots. After transplanting pack a thick layer of leaves about the foot of the shrub and keep them moist until a good growth is evident. Propagation from seed is said to be difficult and expensive. For planting in open grounds it is best to secure specimens which have grown in open grounds.

PERSIMMON.

Diospyros Virginiana, L.

This tree is more valuable for its fruit than for any other purpose. The heartwood, which takes almost a century to form, is very dark. The wood's "capacity for enduring friction is phenomenal." The fruit is mature in autumn and may be picked from the ground under the trees after several frosts. Remove the pulp from the seeds, mix them with moist sand and preserve in a cool cellar. Sow in rows in spring and, as with all slow growing species especially, cultivate well. In two years they may be removed from the seed bed. It grows on light, sandy soil or in bottom land. Occasionally it is found growing on high dry ground. In parts of the United States persimmon culture has become quite common and several improved varieties of the fruit are already produced.

WHITE ASH.

Fraxinus Americana, L.

A magnificent and valuable forest tree. Its wood is extensively used in the manufacture of furniture, wagons, farming implements and oars. It does not seem to be particular as to location, but if the wood of the more rapid growing trees is best, then moderately rich soil where the roots can get plenty of moisture is preferred, as along streams. The fruit is winged and matures in August or September. It should be sown broadcast at once in well raked beds. During the first summer provide shade for it and, if necessary, moisture. The seedlings may be removed when one year old. If the taproot has not been retarded it is better to cut it off than to run the risk of turning the growing end up when planting. It may be mixed with walnut, oak, maple, hickory, etc., at three or four foot distances.

The green ash and red ash are somewhat inferior to the white ash in respect to their timber qualities. If cultivated at all, they may be propagated in the same manner as the white ash.

BLACK ASH, HOOP ASH.

Fraxinus sambucifolia, Lam.

Fraxinus nigra, Marsh. See Britton & Brown, Vol. II, p. 602.

The black ash, growing in wet and swampy soils, although capable of growing on dry soils, is used very much for hoops, basket weaving and interior finishing. Its seeds ripen several weeks later than those of the white ash but are treated in a like manner.

CATALPA, BEAN TREE, INDIAN BEAN, CIGAR TREE.

Catalpa bignonioides, Walt.

Catalpa Catalpa, (L.) Karst. See Britton & Brown, Vol. II, p. 199.

A tree to which a great deal of attention has been called of late. It is a rapid grower on almost any soil, producing, in a very short time, stems large enough for railroad ties or even telegraph or telephone poles. The fruit is a pod enclosing numerous small winged seeds. These pods remain on the trees during winter and may be gathered any time after October. Remove the seeds and keep in a cool, dry atmosphere until the ground can be worked in spring. Sow the seeds broadcast and cover with fine dirt. By the next spring the seedlings can be set out in rows. If by themselves, three or four foot squares will make proper distances for planting. They may be planted with locust, maple, ash, pine, etc. It has been recommended to plant them in alternate rows with field corn. This will afford some cultivation after the plants have been set out. White pine might then be set along the corn rows after one or two crops have been removed. If any damage comes to the young plant, cut it off at the ground, for as long as the root is healthy a sprout will soon come up which will probably produce a better tree than the seedling stems. This indeed, is the best way to secure a trunk long enough and straight enough for a telegraph pole. Cuttings may be used for propagation. The wood, whilst it resists decay in the ground, appears to lack strength sufficient for a good railroad tie.

WESTERN CATALPA.

Catalpa speciosa, Warder.

It is said that the wood of this species is more durable in contact with the ground than that of the Catalpa above mentioned. As a rule it produces straighter stems and is freer from branches. The growth is rapid in almost any soil, producing a good crop of telephone poles, etc., in twenty-five years, or less. It can be propagated as the above, either from seed, or from cuttings. Its value for railroad ties has been greatly overestimated.

SASSAFRAS.

Sassafras officinale, Nees.

Sassafras Sassafras, (L.) Karst. See Britton & Brown, Vol. II, p. 97.

Although a rapid grower, the tree will hardly be planted much in Pennsylvania because of its timber qualities. It is very frequently

found in old fields, preparing the soil for a more valuable species and acting as a nurse to it. As such it may be used to advantage. The fruit matures in September. The pulp must be washed from the stone, which should be planted at once in rich, moist soil. Two years will not be too long for the seedlings to remain under nursery care. After they have had a start in the plantation, yellow poplar, sugar maple, white pine and perhaps hemlock might be mixed with it in alternate rows. It sprouts readily and may be raised from suckers or from bits of root.

SLIPPERY ELM, RED ELM, MOOSE ELM.

Ulmus fulva, Michx.

A tree which is suitable to plant in wet locations, although it is sometimes found on the hillsides. By some the wood is said to be superior to that of the white elm. The fruit is mature in June. It may be gathered from under the tree and sown at once in the nursery beds. If they are dry, moisture should be applied to the beds artificially. Give protection during summer from the sun. If the moisture has been sufficient, the plants may be set out that fall, but it may be best to allow them to remain for another year. Fall transplanting is preferred. It may be mixed with beech, oak, ash, or sugar maple.

WHITE ELM, WATER ELM, AMERICAN ELM.

Ulmus Americana, L.

The white elm rivals the sugar maple in size. Its wood is very hard to split and is used where such resistance is necessary. It, too prefers moist, rich soil, but will grow in other situations. The fruit is mature in June and should be treated as that of the slippery elm. It may be mixed with birch, beech or maple.

HACKBERRY, SUGAR BERRY.

Celtis occidentalis, L.

Although this tree reaches a fair size, its wood is of no practical importance. The fruit is a small drupe, maturing in autumn. The

seeds may be obtained by maceration and should be sown in moderately moist beds at once. Two years are often required for the seeds to germinate. The young seedlings should have some protection from the sun for several seasons and their roots kept moist. They may be propagated by cuttings.

OSAGE ORANGE, BOW WOOD, BOIS d' ARC.

Maclura aurantiaca, Nutt.

Toxylon pomiferum, Raf. See Britton & Brown, Vol. I, p. 529.

Another valuable but neglected tree. It is a rapid grower, and not particular in choice of soil. Its wood has been found to be very valuable in the manufacture of wagon wheels, and has also been used with good success as railroad ties. The fruit matures in October but as it is frequently seedless, and as the tree is readily propagated from cuttings, it may be cheapest to use the latter method. If seeds are obtained after macerating the fruit, they should be kept in a cool, dry atmosphere and sown in spring. The tree is frequently used for hedges, when it needs considerable pruning. In plantations it should be planted closely. It is not a native of Pennsylvania, but is introduced from the southwest.

RED MULBERRY.

Morus rubra, L.

The fruit, resembling an elongated blackberry, is mature in July. It should be picked from the tree and macerated in water, the seeds cleaned and then kept in a cool, dry atmosphere until spring. Sow thinly over the beds and cover with fine dirt. Keep the beds moist and protect the young plants from the sun. After two seasons growth they can safely be placed in the plantation. They endure some shade so may be set among other trees. It prefers low, rich soils.

BUTTONWOOD, SYCAMORE.

Platanus occidentalis, L.

A rapid grower, often reaching a very large size, and not particular as to location. The wood, however, is of very little value, except in

the manufacture of tobacco boxes. The common "button balls" are made up of a number of seeds which mature about October. Sow them as soon as ripe, and cover lightly, or keep them dry over winter and plant early in spring. The seedlings may be planted when one year old.

BLACK WALNUT.

Juglans nigra, L.

A tree valuable both for its wood and its fruit. That it is almost exterminated in Pennsylvania is well known and yet it is a fairly rapid grower and readily propagated from seed. The nuts mature in fall and after a slight frost may be picked up from under the old trees in quantities. Where there is no serious danger from mice and squirrels the nuts may be planted at once (after slightly bruising the hull) in rows about a foot apart, and from four to six inches apart in the row, for they branch early. To prevent the taproot from becoming too long a close layer of stone may be laid before the nursery beds are formed, or the plants may be started in boxes about six inches deep, having holes in the bottom and sides to allow proper drainage. Transplant when one year old. To keep the nuts over winter, remove the "hull" and mix them with moist sand and bury in the ground. Plant as soon as taken up in the spring. If desired, the nuts can be planted at once where the tree is intended to remain. Locust, maple, beech, or catalpa could be mixed with it in the plantation. It might be raised with field corn.

The white walnut or butternut, having an oblong, pointed nut, may be raised in the same manner. It will grow on both high and low ground, whereas the black walnut rarely does well in a dry situation.

SHELL-BARK, SHAG-BARK HICKORY.

Carya alba, Nutt.

Hicoria ovata, (Mill.) Britton. See Britton & Brown, Vol. I, p. 485.

There are said to be nine species of hickory on the continent, but there are only three that are of any importance to us. The shagbark, so called from the appearance of its bark, prefers rich, damp soil and in such is a rapid grower. The fruit matures in October and may then be gathered from under the trees. They should be placed in moist sand and kept for spring planting. Because of the

taproot it may be best to plant at once permanently, and if possible raise some field crop with the young plants. Make furrows about three feet apart and drop the nuts about every half-foot. Weeds will have to be kept down. If raised in a nursery, care will have to be taken in transplanting, because of the long taproot. Cut off any bruised or broken roots.

WHITE-HEART HICKORY, HICKORY, KING NUT, MOCKER NUT.

Carya tomentosa, Nutt.

Hicoria alba, (L.) Britton. See Britton & Brown, Vol. I, p. 486.

The young shoots of this tree are hairy; the nut angular and pointed. It may be found more frequently and is perhaps the best of the family from the standpoint of forestry because of its choosing the poorer soils, although its slow growth is against it. It is raised as the shag-bark hickory.

PIG NUT, BROOM HICKORY, SWITCH BUD HICKORY.

Carya porcina, Nutt.

Hicoria glabra, (Mill.) Britton. See Britton & Brown, Vol. I, p. 487.

The bark is furrowed on older trees; the fruit is thin shelled. The wood rivals that of the shag-bark, said by some even to surpass it. It will grow both in high and low situations, but in Pennsylvania at least it prefers moist soil. It is also treated as the shag-bark hickory.

BIRCHES.

Betula, L.

Of the five birches commonly found in this State all are more or less valuable or worthy of cultivation. The fruit of the red or river birch and of the canoe birch matures in summer, about June. The small seeds should be removed from the cone-like fruit and sown broadcast at once in moist beds. Of course the plants must be

shaded, at least during the first season's growth. They had better remain in the seed beds for two years. The fruit of the three other birches, black, yellow and white, matures in fall. Their seeds should be kept in damp sand until spring. Sow as early as possible and keep the beds moist during the summer, also shade the plants. In one year these may be removed. Most of the birches will grow on poor soil and may be used as nurse trees for more valuable broad-leaved species. Conifers suffer from having their tender shoots whipped off in a strong wind by the action of the slender stems of these trees and consequently should not be planted with them.

SMOOTH ALDER.

Alnus serrulata, Willd.

Alnus rugosa, (Du Roi) K. Koch. See Britton & Brown, Vol. I, p. 512.

Seldom if ever more than a shrub, but of value, especially for holding soil on banks of streams. The seeds should be picked in October and sown broadcast at once on fresh, sandy soil and covered lightly. Roll the beds and give a covering of leaves for the winter. The seeds are frequently sown upon the snow. If seeds are preserved until spring, when they must be sown very early, keep them in damp sand and in a cold place. Shade the beds during the summer.

IRON WOOD, HOP-HORNBEAM.

Ostrya Virginica, Willd.

A slow growing tree of the poorer soils. It is usually found in the shade of oaks, maples and the larger trees. The fruit resembles the hop. It matures in September. The nut-like seeds should be sown at once and even then may not sprout until the year following. It may be used to plant up blanks, or open places on rocky slopes.

WATER BEECH, HORN BEAM.

Carpinus Caroliniana, Walt.

Usually nothing more than a shrub, though sometimes becoming a tree 25 feet high and a foot in diameter, growing along streams in rich soil. The wood, similar to that of iron wood, is used for levers and turnery work. The fruit matures in autumn and the nut-like seeds should be sown at once in moist, sandy soil. Usually they will not come up until the second year.

OAKS.

Quercus, L.

The oaks may be divided into two general classes, namely the white and the black oaks. The white oaks are those having leaves with round lobes, not being bristle-pointed. The acorns ripen in one year and are sweet to the taste. The black oaks are those the leaves of which have bristle-pointed lobes. The acorns mature in the second year and are bitter to the taste.

Of the first class there are in Pennsylvania, worthy of being cultivated, the following:

White Oak. Quercus alba, L.

Post Oak. Quercus stellata, Wang. Quercus minor, (Marsh.) Sarg. See Britton & Brown, Vol. I, p. 520.

Bur Oak. Quercus macrocarpa, Michx.

Swamp White Oak. Quercus bicolor, Willd. Quercus platanoides, (Lam.) Sudw. See Britton & Brown, Vol. I, p. 521.

Chestnut Oak. Quercus Prinus, L.

Yellow Oak. Quercus Muhlenbergii, Engelm. Quercus acuminata, (Michx.) Sarg. See Britton & Brown, Vol. I, p. 522.

Those of the black oaks are:

Red Oak. Quercus rubra, L.

Scarlet Oak. Quercus coccinea, Wang.

Black Oak. Quercus tinctoria, Bart[illegible]. Quercus velutina, Lam. See Britton & Brown, Vol. I, p. [illegible].

Pin Oak. Quercus palustris, Du Roi.

Spanish Oak. Quercus falcata, Michx. Quercus digitata, (Marsh.) Sudw. See Britton & Brown, Vol. I, p. 518.

All of the oaks will grow on poor soil, but since rapid growth of oak produces better wood the better part of soil allotted to forest should be given to them. The acorns mature in fall and may easily be gathered from under the old trees. Those of the black oak class may be sown at once, because of their bulkiness for keeping and because there is no danger from rodents. Those of the white oaks, while they lose their power of germination very soon, but because of the danger from rodents, should be kept until spring in damp sand and in a cool room, or buried with sand in a well drained place. The plants have long taproots and some suggest that the acorns be sown at once in the plantation where the seedlings are to remain. If so done, plough shallow furrows every three feet apart and drop the acorns at a distance of every two or three inches in the furrow. For

several years the seedlings may be cultivated as convenient. If sown in beds scatter from three to four hundred acorns on a bed four feet each way. In one year the plants may be removed and set one foot apart in rows three feet from each other.

CHESTNUT.

Castanea sativa, Mill., var. Americana, Watts. & Coult.

Castanea dentata, (Marsh.) Borkh. See Britton & Brown, Vol. I, p. 515.

In the Forestry Report issued by this State in 1895 the following reasons are given for the cultivation of chestnut:

"1. It will grow on almost any kind of soil, from a river flat to a mountain top, although it is not at its best on limestone soils.

"2. It grows with great rapidity.

"3. When cut it reproduces a valuable coppice growth in a few years.

"4. Its product, wood and fruit, will always be in demand.

"5. There will be an increasing demand for it in the future because of the tannin which it contains."

The fruit matures in October, being released from the burs by the first frost. The chestnuts may be sown at once, which is preferable, or they may be mixed in moist sand and buried until spring. Have the soil well prepared. Some sand mixed in the beds will be good. Shade the seedlings during summer. Set out as the oaks, in rows three feet apart and at a distance of one foot from each other in the row. Alternate rows may be set with white pine, or in order to afford cultivation corn might be planted in alternate rows.

BEECH.

Fagus ferruginea, Ait.

Fagus Americana, Sweet. See Britton & Brown, Vol. I, p. 514.

The beech is a tree which should be planted in soil where its roots can get plenty of moisture. The fruit is mature in October and may be gathered from under the old trees. Sow in furrows six inches

apart, the seeds touching each other in the furrows. Shade well. If possible sow the seeds broadcast within an open pine woods, after having raked off the needles. Cover the seeds lightly. The plants may be set out at from two to five years old. It endures shade and may be set under oak, pine, etc.

WILLOWS.

Salix, L.

All of the willows are so easily propagated from cuttings that it is not necessary to waste time by trying to raise them from seed. Last year's shoots can be cut and buried over winter. In spring take an iron bar and make a hole large enough for the cutting to go in. Leave one bud above ground and pack the soil firmly about the remaining part of the cutting.

ASPEN, QUAKING ASP.

Populus tremuloides, Michx.

The poplars are rapid growers. They are found usually along banks of streams, but also on higher ground. In the west the aspen is found coming up on land that has been cleared of other trees, either by "slashings" or by fires. There it prepares the soil for better species, as for instance white pine, and it protects the young plants. The fruit ripens in May or June. The seed is small and "cottony." It should be sown at once in a cool situation and covered lightly. When one or two years old set out in a plantation, as close as convenient. It may branch when young but permits pruning. It may be raised easily from cuttings.

COTTONWOOD, CAROLINA POPLAR.

Populus monilifera, Ait.

Populus deltoides, Marsh. See Britton & Brown, Vol. I, p. 493.

A tree whose wood is being extensively used for paper pulp. It is a rapid grower and adapts itself easily to almost any soil. The most vigorous growth, however, is found on rather moist soil. Thirty

cords of pulp wood to the acre, under average circumstances, might be expected after fifteen or twenty-five years. The tree is frequently found here as a shade tree. The seeds mature in July and should be sown at once. The seed beds should be kept moist. By the next fall seedlings could be set out in the plantation at four or five foot distances from each other. It will make a good nurse tree for white pine, if mixed with it. The quickest and cheapest method of propagation is from cuttings.

WHITE PINE.

Pinus Strobus, L.

It is not necessary to state the uses of this tree nor should it be necessary to state that it ought to be cultivated extensively. It is a rapid grower and prefers poor soil, yields early returns and is very valuable when mature—what more is wanted? The seeds mature in fall of second year and as soon as the cones become pitchy (in August or September) pick them and keep in ordinary living room or some other dry place during winter in bags or on a slat frame, having something to catch the seeds as they fall from the cones. Seventy-five degrees Fahrenheit is sufficient heat to open the cones that the seeds may drop out. Sow broadcast early in spring. Cover lightly and roll the beds. They must be protected from the sun in summer. If the beds become very wet sprinkle dry sand over them as soon as possible. "Damping off" is said to be prevented in this way. If one year old plants are not used in the plantation they had better be transplanted to nursery rows, the rows six inches apart and plants about two inches apart in the rows. During the winter cover with leaves and transplant in spring. Two year old plants may be used safely. If possible have some nurse tree two or three years in advance of the pine, or a rapid grower, set in alternate rows, or two rows of pine to one of the other. Three feet in the row is sufficient. It is worthy of a place as an ornamental tree.

PITCH PINE, YELLOW PINE, JACK PINE.

Pinus rigida, Miller.

This pine has needles in threes. The cones take two or three years to mature. They should be gathered and treated as white

pine. With all pines the seeds must be kept dry during the winter. The oil in them will preserve them so there is very little danger of their losing the power of germination for several years if they are not exposed to moisture. Sow the seeds broadcast in sandy beds in spring. Seedlings can be set out in spring when two years old. They are very sensitive to being transplanted so their roots should be carefully protected. It grows where the soil is extremely poor, but slowly.

SPRUCE PINE, YELLOW PINE.

Pinus mitis, Michx.

Pinus echinata, Mill. See Britton & Brown, Vol. I, p. 52.

Leaves usually in pairs. The cones are somewhat longer than those of the pitch pine but not so large in diameter, proportionally, They mature in one season. Formerly there was considerable yellow pine in this State but it has become very scarce. The tree reaches a large size and its wood is valuable. It is not hard to raise from seeds, which should be treated as those of the other pines. It is a fairly rapid grower and is adapted to dry, sandy soil and to poor slopes.

The red or Norway pine (Pinus resinosa) may be propagated as easily from seed as the other pines.

RED SPRUCE.

Picea nigra, var. rubra, Engelm.

Picea rubra, (Lamb.) Link. See Britton & Brown, Vol. I, p. 55.

A tree of the highest ridges and cool northern slopes. The cones are small and unusually plentiful. They may be gathered any time after October. By heating the cones some, the seeds will readily fall from the scales. They should be sown in early spring in soil somewhat sandy. Cover the seeds lightly and roll the beds. Shade the seedlings well and do not let the beds become too dry. The plants may be put in the plantation when two years old or they may be transplanted to nursery rows and set out when four years old. They have shallow roots and may be used on rocky slopes. In regular plantations three feet is the proper distance at which the plants should stand from each other.

BLACK SPRUCE.

Picea nigra, Link.

Picea mariana, (Mill.) B. S. P. See Britton & Brown, Vol. I, p. 55.

Somewhat smaller than the red spruce. It prefers "sphagnum-covered swamps." Propagation is same as for the red spruce.

HEMLOCK, HEMLOCK-SPRUCE.

Tsuga Canadensis, Carr.

The cones of the hemlock mature in one year. They are small and egg-shaped, drooping from little foot stalks when ripe. Gather in October. After the seeds have been removed from the cones, keep them in a dry, cool room until spring. Sow broadcast in well prepared beds. Rotten wood mixed with the soil will no doubt insure better success. Moisture and shade are necessary for the young plants. In two years they may be set out finally or transplanted and set out when four years old. While the tree is found in moist and cool places it seems to do well in other situations. The hemlock is, when young, perhaps the slowest grower of all our forest trees and will be the hardest to perpetuate as a forest tree.

BALSAM FIR, BALM OF GILEAD FIR.

Abies balsamea, Miller.

Frequently found in the northern and colder parts of the State. It makes a fairly rapid growth in well drained soil and can be used for planting along roads or walks. The cones may be gathered in autumn and dried slightly. The scales of the cones will have to be separated from the seeds. They can then be treated as those of the black spruce.

LARCH, TAMARACK, HACKMATACK.

Larix Americana, Michx.

Larix laricina, (Du Roi) Koch. See Britton & Brown, Vol. I, p. 54.

The tamarack is a northern tree and is found only in the cooler parts of the State. While it may be grown on dry soil it prefers and

is usually found in cool swamps. It is a valuable tree and is said to be raised easily from seeds. The small cones mature in September and may then be gathered from the trees. Drying the cones will release the seeds which may be kept in a cool dry place until spring. Sow thinly over the beds and press the seeds into the ground, giving them a slight cover. Protect well during summer. The next fall they may be easily planted out at about five foot distances. Their growth is fairly rapid.

ARBOR VITAE.

Thuya occidentalis. L.

A tree that is of more value perhaps as an ornament than as a tree for forestry purposes, in this State. The stems are used for poles and posts. The cones mature in September or October. It is grown easily from seeds if treated as the other conifers. Two years in the nursery beds is sufficient for the young plants. They may then be placed in the plantation. It occurs naturally, but sparingly in this State.

CEDAR, RED CEDAR, SAVIN.

Juniperus Virginiana. L.

Very common throughout the State, but never reaching a very large size. It is a slow grower. The fruit is a berry made up of several fleshy scales enclosing two or three seeds. The berries may be gathered in November. They should be macerated in warm water or put in strong lye made from wood ashes for several days until the seeds can be washed clean. Keep the seeds dry and cool and sow early in spring. Cover the beds with leaves as it is likely that the plants will not come up until the next year. They may be set out after two years, or transplanted when four or five years old. Set at three feet from each other. This tree is very valuable for fence posts.

PENNSYLVANIA

DEPARTMENT OF FORESTRY.

INSTRUCTIONS

TO

FOREST WARDENS.

Bulletin # 3

By I. C. WILLIAMS, Esq.,
of the Department of Forestry.

Published by direction of the Commissioner of Forestry.

WM. STANLEY RAY,
STATE PRINTER OF PENNSYLVANIA,
1903.

Pennsylvania Department of Forestry,
Harrisburg, Pa., August 1, 1903.

Sir: I have the honor to submit herewith for publication and distribution among those entitled thereto, what I have called "Instructions to Forest Wardens," prepared under your direction and at your request. It is intended to give those persons employed as care-takers, or wardens, upon the State lands held for Forestry Reservation purposes, such information as they will need with respect to the duties, rights, and liabilities imposed and conferred upon them by reason of the passage by the Legislature of the Act of March 11, 1903, P. L. 25.

No attempt whatever at technical discussion has been made. The matter has been condensed to the smallest compass thought advisable, with an endeavor to present it in plain narrative, easily comprehended by those not familiar with legal language or forms. It of necessity presents but a constricted view of the law relating to constables.

Very respectfully,

I. C. WILLIAMS.

Hon. J. T. ROTHROCK, M. D.

Commissioner of Forestry.

Instructions to Forest Wardens, who under the the Act of March 11, 1903, P. L. 25, are invested with Constabulary Powers.

Among the laws enacted by the General Assembly for the creation and protection of the Forest Reservations, the act of March 11, 1903 is important. The text of the act in full is as follows:

AN ACT

Conferring upon persons employed, under existing laws, by the Commissioner of Forestry, for the protection of State Forestry Reservations, after taking the proper oath of office, the same powers as are by law conferred upon constables and other peace officers; to arrest, without first procuring a warrant, persons reasonably suspected by them of offending against the laws protecting timber lands; also, conferring upon them similar powers for the enforcement of the laws and rules and regulations for the protection of the State Forestry Reservations, and for the protection of the game and fish contained therein; and further, conferring upon them power to convey said offenders into the proper legal custody, for punishment; this act to apply only to offences committed upon said reservations and lands adjacent thereto.

Section 1. Be it enacted, &c., That the persons employed under existing laws, by the Commissioner of Forestry, for the protection of State Forestry Reservations, shall, after taking the proper official oath before the clerk of the court of quarter sessions of any county of the Commonwealth, be vested with the same powers as are by existing laws conferred

upon constables and other peace officers: to arrest on view, without first procuring a warrant therefor, persons detected by them in the act of trespassing upon any forest or timber land within this Commonwealth, under such circumstances as to warrant the reasonable suspicion that such person or persons have committed, are committing, or are about to commit, some offence or offences against any of the laws now enacted or hereafter to be enacted for the protection of forests and timber lands. Such officers shall likewise be vested with similar powers of arrest, in the case of offences against the laws or the rules and regulations enacted or to be enacted for the protection of the State Forestry Reservations, or for the protection of the fish and game contained therein: Provided, That the above mentioned rules and regulations shall have been previously conspicuously posted upon the reservation. Said officers shall further be empowered, and it shall be their duty, immediately upon any such arrest, to take and convey the offender or offenders before a justice of the peace or other magistrate having jurisdiction, for hearing and trial, or other due process of law: Provided further, That this act shall extend only to the case of offences committed upon said Forestry Reservations and lands adjacent thereto; and the powers herein conferred upon said officers shall not be exercised beyond the limits thereof, except where necessary for the purpose of pursuing

and arresting such offenders, or of conveying them into the proper legal custody, for punishment, as aforesaid.

Section 2. All acts or parts of acts inconsistent herewith be and the same are hereby repealed.

Approved—The 11th day of March, A. D. 1903.

SAML. W. PENNYPACKER.

It will be observed that this act confers large discretionary powers as well as important duties upon persons employed by the State Forestry Reservation Commission, in the care of State lands held for Forest Reservation purposes. These persons, while not so designated by the act, are commonly known as Forest Wardens.

Before proceeding to a discussion of the duties and liabilities of Forest Wardens under this law, it may be desirable to consider in a brief manner the office of constable in general, his duties, his qualifications, and his liabilities under existing laws.

The office of constable is an ancient one. His title is derived from the fact that originally he was *Comes stabuli*, count of the stable, chief of the horse, of the ancient military barons and war lords of Europe. The con-

stable of France was a high officer of the crown, and the Lord High Constable of England was the commander-in-chief of the army, the keeper of the peace of the nation. He was also invested with judicial power and regularly held his court for the cognizance of such matters as were within his jurisdiction.

The constable of to-day is still a conservator of the peace within his county. He is the executive officer of a township, a ward, or a borough, but may exercise his authority throughout a county. He is required to execute civil process and every precept directed to him. A constable formerly held his office for a year, but now for three years. He must give a bond for not less than five hundred dollars nor for more than three thousand dollars, unless he is a free holder with unincumbered property of the value of one thousand dollars. The court of quarter sessions of any county may remove a constable from office if it appear upon petition that he is unfit and incompetent to discharge his official duties, or where he shall not have given the security required. He may command others to assist him in making arrests or executing writs, where assistance is needed.

In civil process, the service of a summons is

the most common duty of a constable. A summons is a writ signed, dated, and issued by a justice of the peace, directed to a constable, commanding him to give notice to a person named therein to appear at a certain time and place to answer a complaint. A summons is the method of beginning a civil suit or action at law, and all natural persons, except those exempt, and corporations may be made defendants and served therewith. To every summons there must be a return. This is the report of the constable as to the manner in which he has executed the writ. It must show the date and manner of service, be in writing, and be signed by him.

Certain actions are of the nature of both civil and criminal suits and are begun by *capias* instead of summons. In these cases the body of the defendant is taken, that is, he is placed under arrest. The person arrested must, without unnecessary delay, be taken before a magistrate for hearing, to be followed by a holding to bail, a commitment, or a discharge. The service of a summons or of a capias on Sunday is unlawful and void. The constable cannot break an outer door to make service of these writs at any time.

Certain persons are exempt from service of

process by reason of their position. They are ambassadors and public ministers of foreign countries and their employees; members of Congress and State legislators while in attendance upon their public duties; electors, that is, voters, attending elections, going to or returning therefrom; soldiers and militia men during term of service, unless for a debt in excess of $20.00 contracted before enlistment; parties to a suit, counsel and witnesses in attendance at court, or going to or returning therefrom; jurors, attorneys and agents in attendance upon court; and freeholders having unincumbered real estate to the value of two hundred and fifty dollars, are privileged from arrest.

A constable who has made an arrest on capias may take a bail bond for the appearance of the defendant, but he must take sufficient security else he will be liable to the plaintiff. In executing civil process a constable will have other duties to perform. They may consist of making an ordinary levy following a judgment obtained upon a summons, and a sale thereunder; making an attachment execution; the attachment of fraudulent debtors; against non-resident debtors; and domestic attachment; serving distress warrants in land-

lord and tenant cases; executing a writ of possession; making returns to court of unlicensed places where liquors are sold; the illegal sale of liquors by licensed persons; the sale or giving away of liquors on election day, or near militia encampments; attendance on election and the duties incident thereto.

A Forest Warden would probably never be called upon to exercise any of these duties and for that reason no further comment thereon is necessary.

In criminal cases, the duty of a constable is especially to preserve the peace, and make arrests for violation or breach thereof. He has power to imprison and break outer doors when necessary to prevent homicide, riot, or a dangerous breach of the peace. Every person is in morals bound to take notice of violations of law and make complaints thereon; but a constable is legally required to prevent crime and bring the perpetrators to justice.

An arrest is "the apprehending or restraining of one's person, in order to be forthcoming to answer an alleged or suspected crime." It is a literal seizing of the body and the holding of it in custody.

In making an arrest, more than mere words is necessary. It is not sufficient to say, "I

arrest you," or "you are my prisoner," or "I have a warrant for your arrest." But if the person so addressed submits and goes with the officer, the arrest is complete. If the defendant run away and escape without being touched by the constable, there is no arrest. The constable must, therefore, exercise some corporal taking or restraint. A slight restraint, a mere touching, is held to be sufficient. The constable should inform the person whom he takes that he arrests him; but when the arrest is made during the actual commission of an offense, this is not necessary. A constable may use violence in making an arrest but only such violence as is necessary. If the officer in attempting to arrest is resisted by the defendant, he may and must use all the force necessary to subdue his prisoner. If the offense committed or about to be committed is a felony, and the prisoner resists and escapes, the officer, after informing him of his order and intention, may shoot to compel him to stop. If the offense involved is a misdemeanor only, he has no right to shoot a person evading arrest.

Prisoners should be treated fairly and kindly after arrest, and only as much violence used as is necessary to restrain. It is usual and pro-

per to make a search of the person in order to find such evidences of guilt as may be suspected. Property thus taken from a prisoner must be turned over to the magistrate to await the final outcome of the case.

Since the distinction between felonies and misdemeanors affects the officer's power and manner of making arrests, every constable should clearly understand the difference between them. By felonies we understand those heinous and more serious crimes as contra-distinguished from the milder and more trivial kinds, which are called misdemeanors. Originally felonies were those offenses which were punished capitally or by imprisonment, and were accompanied by forfeiture of lands and goods; all others were misdemeanors. Originally, therefore, it was the kind of punishment meted out for an offense which determined whether it fell within one or the other class. This distinction has disappeared in America, and crimes are by express statutory enactment declared to be either felonies or misdemeanors, and the punishment prescribed thereby. No one would undertake to describe a felony or a misdemeanor by exact definition. They are known as such only by statutory enactment and simple enumeration.

The following are felonies: Murder, robbery, larceny, rape, burglary, arson, sodomy, buggery, counterfeiting, passing counterfeit money knowingly, assault and battery with intent to kill, or intent to kill by administering poison, or by stabbing, or other means; shooting or attempting to shoot a person; stabbing with intent to maim or disfigure; explosion of gunpowder or other explosive with intent to harm; or sending any such explosive or other dangerous thing, or throwing at a person any acid or corrosive substance, with like intent; administering chloroform or stupefying drugs in an attempt to commit a felony; procuring an abortion; breaking open by day or by night, with intent to commit a felony, any house, barn, stable, shop, etc.; attempting to wreck a railroad train, or to blow up a house with intent to destroy it or harm persons within.

It will be noticed that the intent is the determining feature of many of the above felonies.. No one can be supposed to be able to read the mind of another, to discover his intent; but it is a safe rule to follow that a person intends the consequences of his act, and when a constable has reasonable ground to suspect the intent of an act and acts accordingly, he will be protected, though mistaken. The

reasonable ground of suspicion should be clear.

The following acts are misdemeanors: The adulteration of goods, candy, liquors, etc., assault and battery with or without a weapon, bribery, corruptly influencing voters, selling votes, selling cigarettes to persons under sixteen years of age, compounding crimes, carrying concealed deadly weapons, conspiracy, cruelty to animals, disorderly conduct, keeping disorderly houses, disturbing public meetings, drunkenness, duelling, embezzlement, corruptly influencing jurors, escape from custody, aiding prisoners to escape, voluntarily or negligently permitting them to escape, carrying dangerous detonating explosives upon public conveyances, selling firearms to persons under sixteen years of age, the manufacture and sale of toy pistols, extortion, false pretense, forgery, fortune telling, gambling, fraudulent insolvency, lewdness, libels, conducting lotteries, malicious mischief and trespass, mayhem, dissemination of obscene literature, maintaining a nuisance, running an opium joint, perjury, prize fighting, profanity, riot, seduction, sending threatening letters, etc.

The offenses enumerated in the various acts of Assembly for the protection of forests and woodlands, and of which the forest wardens

have special cognizance by reason of the act of March 11, 1903, hereinbefore cited, are all misdemeanors.

Arrests are made in two ways, either with or without a warrant. A warrant is a writ, or an authority in writing, issued by a justice of the peace usually, directing and commanding a constable to take the body of the person named therein and bring him before the justice to answer a charge against him. The warrant should give the name and surname of the person to be arrested, or such description as will enable the officer to identify him; it should state the offense committed and be signed by the person issuing it. When executed, the warrant should be returned to the justice showing the manner of execution. When a constable receives a warrant he should proceed to execute it as soon as convenient and with reasonable secrecy. If he refuse to execute it. he is guilty of a misdemeanor. Where the official character of the officer is known to the person arrested, the warrant need not be shown nor need he give notice of his office, but he should state the reason of the arrest. A safe course to follow is to show the warrant if demanded. When arresting a stranger, the constable should either show his warrant or

give notice of his legal authority. A constable should never part with his warrant. If the person inspecting it keep it, the officer may use as much force as is necessary to retake it. A constable may arrest without a warrant any one attempting to commit a felony, or on a reasonable suspicion that a felony has been committed. He may likewise arrest without warrant for breach of the peace committed in his presence; otherwise a warrant must be procured, unless the breach of the peace was committed with intent to commit a felony.

A constable has no right to break open an outer door to execute civil process. Having a warrant for an arrest on the charge of treson, felony or breach of the peace he may break open an outer door to execute it. He has the same right to break open a door to arrest without a warrant, where the arrest is made on his own authority, that he has with a warrant. He should however demand admittance before breaking, as a matter of precaution.

Having made an arrest, a constable must conduct his prisoner before a magistrate for a hearing. The time within which this must be done is not governed by any precise rule. It has been decided that he cannot hold him three days while he is collecting evidence. If

the arrest is made at night, the hearing should be had the next day. If during the day, it should be held that day if the justice can be found before night. In the meantime the constable must keep his prisoner safely. He may confine him in a house, a lockup, or a jail, if one is convenient. If the person arrested be sick, the taking before the justice may be delayed until such time as he may be safely removed. A prisoner is in the custody of the constable until his hearing is concluded.

A warrant of arrest may be executed anywhere within the Commonwealth and the offender carried before the justice or other officer issuing the warrant. When an arrest is made without a warrant and the prisoner carried before the justice, the constable should then make an information giving the reason of the arrest, unless the prisoner waive a hearing and give bail for court.

The foregoing discussion covers in part only the duties of constables, but is believed to be sufficient for the purposes here intended. In case of doubt how to act, a warden will communicate at once with this Department.

It will be noticed that under the act of March 11, 1903, the duties of constables so conferred upon wardens are to be exercised only upon

the State Forestry Reservations or upon the adjacent or immediately adjoining lands. Such violations of law as will most probably come under their immediate official cognizance will be those having to do with trespassing and the inflicting of damage to timber. Under the statutes, these are wilfully setting on fire any woods, lands, or marshes belonging to the Commonwealth, cutting any timber therefrom, cutting or removing boundary trees and land marks, kindling fire on adjacent lands so as to communicate fire to State lands, cutting bark from, burning, or otherwise injuring trees, carrying any lighted candle, lamp, or torch, or other open fire into a forest, setting off fireworks within a forest; or any other act not herein specifically mentioned which will cause damage to forest lands or timber belonging to the Commonwealth.

Before proceeding to exercise his said office, a warden must go before the clerk of the court of quarter sessions of the proper county and take the official oath such as is taken by all constables. He is then invested with full authority under the act, so long as he remains in the employ of the Department of Forestry upon the State lands.

The act provides that arrests may be made in two classes of cases:

1. For those acts prohibited by existing laws now in force or hereafter to be enacted for the protection of forests and timber lands.

2. For violations of the rules and regulations made for the protection of the Reservations, or of the fish and game contained therein.

In the first case, arrests may be made immediately after taking the oath; in the second, the rules and regulations must have been previously conspicuously posted upon the Reservations. The act expressly provides that arrests shall be made for offenses committed upon the Reservations or upon lands adjacent; and that the power of arrest on view without warrant shall not be exercised beyond these limits, except for the pursuit of offenders and the taking of them after arrest into proper legal custody. If an offender be caught in the act, he may be arrested then and there. If the indentity of the warden is not known to the person arrested, it should be declared and the official badge exhibited. It is probable that occasionally felonies and other misdemeanors may be commited upon the Forest Reservations. A warden will in such cases be governed by what has been stated above

with respect to constables generally. A reasonable suspicion on the part of the warden that a trespasser is about to commit or has committed a violation of the law, without seeing him in the act, will entitle the officer to make an arrest without warrant; but the circumstances must be such, either from present appearance or from conduct on the part of the person suspected as would lead a reasonable person to suspect that an offense has been or is about to be committed, and by the person suspected. The offense and the person suspected must in some way be connected in the mind of the officer.

Having made an arrest, the warden should take his prisoner before the nearest justice of the peace, or at least the one most convenient to reach. No unusual haste is demanded and no unnecessary delay should intervene. The justice will then proceed to hear the evidence. The warden making the arrest is a competent witness and may testify to all facts within his own knowledge or which he learned upon inquiry. All witnesses having knowledge of the case in hand should be produced and if they refuse to come voluntarily, should be brought under subpoena. If a matter where summary conviction may be had, the justice will, if the

an arrest is attacked by his prospective prisoner or any of the latter's associates, he may and must use all possible force in resisting their attack and in his own defense. If it is necessary to take life in defense of one's own life, this is excusable homicide. It is not necessary that the person attacked should first submit to a beating or even worse injury before he acts in his own defense. He is not compelled to retreat as far as he is able before he opposes force with force; but may from the very outset resist and follow up his resistance until he has successfully driven off his assailant, or in the case of a warden, reduced him to subjection and arrest. This view of the law is expressly decided and upheld by the courts of Pennsylvania and by the Supreme Court of the United States. It remains further to say only that while acting in self defense, a warden should use as much deliberation and good judgment as the circumstances of the affair will permit and not follow up any advantage obtained by him, in inflicting grievous and unnecessary injury upon his prisoner.

Under the act of March 30, 1897, all constables are ex-officio fire wardens; and under the act of March 22, 1899, all constables are ex-officio fire, game, and fish wardens. While it

may or may not be a question whether the act of March 11, 1903 confers upon State Forest Wardens the powers contained in the two first mentioned acts, all wardens should be familiar with the provisions thereof and be prepared to report any violations thereof to the proper authorities and insist upon prosecutions in proper cases. Copies of the said acts above referred to and all the acts in force in the State on the subject of Forestry will be furnished each State employe upon Reservations. and the Commissioner of Forestry recommends that by continual study of the same, entire familiarity with their provisions may be acquired. After a reasonable time allowed for study, a regular drill and examination thereon is proposed to be held.

Wardens so invested with authority must use good judgment and employ the dictates of reason so far as it is in their power to do. They must not be needlessly officious nor oppressive in their acts; but while enforcing the laws must employ such sound discretion as will enable them to do their whole duty, preserve the dignity of their official positions, and at the same time, to the end that all citizens may be led to recognize the aims of this Department, advance the Forestry Idea so far as they may be able.

Commonwealth of Pennsylvania

DEPARTMENT OF FORESTRY

A REPORT

ON

THE CHESTNUT TREE BLIGHT

THE FUNGUS, DIAPORTHE PARASITICA, MURRILL

Bulletin # 4

By JOHN MICKLEBOROUGH, PH. D.

MAY, 1909

HARRISBURG:
C. E. AUGHINBAUGH, PRINTER TO THE STATE OF PENNSYLVANIA
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LETTER OF TRANSMITTAL.

Hon. Robert S. Conklin,
Commissioner of Forestry:

Sir: I have the honor to present my report on the deadly fungus, *Diaporthe parasitica,* that has caused the destruction of many chestnut trees within the borders of the State of Pennsylvania. The investigations have been carried on to ascertain the presence of this disease in the valleys of the Delaware and Susquehanna rivers. Accompanying the report of its geographical distribution is an account of its life history, its prolific propagation, the damage already done, and suggestions for remedial treatment.

Thanking you and your associates for many courtesies, I have the honor to be,

Most respectfully yours,

JOHN MICKLEBOROUGH, Ph. D.

THE CHESTNUT TREE BLIGHT.

BY JOHN MICKLEBOROUGH, PH. D.

The devastation produced by the chestnut tree fungus, *Diaporthe parasitica,* is arousing the attention of State authorities and deeply concerns the owners of woodland, also the owners of chestnut groves and chestnut orchards. Nothing more serious has ever appeared in the forests of this country than the destructive work of this parasite. Its presence is known by the writer from personal examinations to extend from near the northern boundary of Maryland, through south eastern Pennsylvania, across New Jersey and New York. The line of inspection covers a distance of nearly two hundred and fifty miles. On Long Island the disease has spread for fifty or sixty miles with great rapidity, and is most prevalent and its ravages the most deadly.

In December, 1908, I was invited by Dr. Jane Baker, the physician in charge of Chester County Insane Hospital, to speak before an Educational Conference at Embreeville, Pa. On this visit several infested chestnut trees were found. The disease was not prevalent.

The inspection of forests to ascertain the presence of the blight, under the direction of the Department of Forestry, began March 29th, 1909. The counties first to receive attention were, Dauphin, Lebanon, Berks (west), Cumberland, and Franklin. This is a rich agricultural section of the State lying between South Mountain and North Mountain or the Blue Ridge. The Lebanon and Cumberland valleys are a limestone formation and very few chestnut trees are to be found until the mountain slopes are reached where the chestnut growth is abundant. A careful inspection of the forests was made on each side of the Susquehanna where the river cuts through the Blue Ridge to the north of Harrisburg, and at Middletown where it wends its way beyond the broken ridges of South Mountain. An examination of chestnut forests was made at Wernersville in Berks County, and as far west as Mont Alto in Franklin. Examinations were made along South Mountain at Hunters Run, Mt. Holly Springs, and farther south at Idaville. *The Chestnut tree blight was not found to the north and west of South Mountain.* It becomes an interesting question whether the valley from twelve to twenty miles or more in width between North and South Mountains may not act as an effective barrier to the progress of the disease into the interior of the State. At Mont Alto, the State Forestry Academy was visited. This institution is doing most excellent work. The instructors are able and practical men, and the students are enthusiastic lovers of nature.

The value of having trained men in the service of the Department can not be too highly estimated. The next region of the State to be inspected was to the south and east of South Mountain. From the city of Lancaster three trips were made by trolley, first to Ephrata, second to Quarryville, and the third to Gap. At each of these places the blight was found. Specimens of bark were taken from trees six and eight inches in diameter. Infected sprouts or coppice about stumps were obtained. Under the microscope spores of the deadly fungus in uncountable millions were shown. The disease was most prevalent at Gap. Ephrata in Lancaster is south of South Mountain and is only twelve miles from Wernersville in Berks county where the forests of South Mountain furnished no evidence of the disease.

At Gap, Mr. Levi Wise has a chestnut grove of one hundred trees, consisting of Paragon and Spanish grafts. A distinction is made between a chestnut grove and a chestnut orchard. When the stock is a native chestnut and the scion for grafting is a foreign variety or species, such as Paragon, Spanish, Japanese, Numbo, Ridgely, Alpha, etc., it is termed a grove. When young seedlings are set out in rows, whether grafted or not, it is called an orchard. The blight had invaded Mr. Wise's grove. Infected spots were found on the native stock and also on grafts. The following note was made at the time of the inspection: "The Paragon and Spanish grafts are unusually healthy considering the number of infected native trees in the immediate vicinity." On these trips in Lancaster county it was my good fortune and very great pleasure to have the company of Deputy Commissioner of Forestry, Mr. Irvin C. Williams. It was decided at once to make an Experiment Station at Gap and to plant twenty-five Japanese chestnut trees and to start with one hundred grafts of the same species. Surrounded by natural woodland in which the disease is quite prevalent, here was an opportunity to test the immunity or resisting power of three foreign chestnut growths side by side.

Through the generosity of Mr. Isaac Hicks, a nurseryman at Westbury, Long Island, twenty-five Japanese chestnut trees were donated for the experiment and all the Japanese scions that could be used. Three of these Japanese trees will probably bear this year, and all should begin to bear next year. Mr. Wise had made one hundred new grafts this season, using Paragon scions on native stocks. Within half a mile of Mr. Wise's grove there is another small grove of Paragons on the property of Mr. Thomas J. Bitzer. Seven of the Japanese trees were given to Mr. Bitzer. During the past winter, the writer has had in his laboratory specimens of bark and limbs and sprouts of native chestnut, Paragon and Japanese, all infected. And yet from the examination of hundreds of trees of each kind,

and nine chestnut groves in widely separated localities it is firmly believed these chestnut groves and orchards may be protected from the ravages of this fungus growth.

Since the blight was found at three places on the east side of Lancaster county, an inspection was made at two points on the western border. At Martic Forge, or Marticville, the blight was found on native chestnut trees in the immediate vicinity of, and in the grove of the Paragon Nut Co. The grove contains nearly four hundred acres. About two hundred infected trees had been removed from the grove. The wood was on a pile at the woodshed. Many of the sticks on the wood pile were infested with living spores. The blight is a bark disease and when a tree is felled the bark should be burned at once. When the bark has been removed, the wood may be used for various purposes. The bark on the stump should be burned for two or three inches below the surface of the ground. Spores will be developed and propagated many months after the tree has been cut down. Specimens of infected bark have been kept in sealed test tubes for more than nine months and on examination the spores were alive and as active as on the day when selected for the experiment. Martic Forge is thirteen miles directly south of the city of Lancaster and about four from the Susquehanna river. The next inspection was made at Marietta, located on the Susquehanna and about sixteen miles directly west of Lancaster. At this place Mr. John G. Engle has a grove of one hundred and twenty-five trees, chiefly Paragon. His grove is in excellent condition. There was no evidence of the blight and no indications that it has ever existed on his property. The grafting which had been done by him several years ago is as perfect in the union between scions and stocks as can well be obtained. Infected trees on other property were found at Marietta. Specimens of bark and branches showing the disease were taken from native growth and also from Paragon grafts from two small groves in the vicinity which had been seriously infected. In Lancaster County the disease was found at three places on the eastern border and at two places on the west. In Adams county, at Gettysburg, there is no chestnut growth to speak of, but in the northern part of the county at Idaville the forests are chiefly chestnut and oak. This village is on the south side of South Mountain. Much care was exercised in the inspection at this place and hundreds of trees on several lots were examined. No evidence could be obtained of the presence of the disease at Idaville.

The next county to receive attention was Montgomery. Specimens showing the infection were obtained from the trees on the campus of Haverford College. Three estates near Haverford were examined. The chestnut was the prevailing tree in this portion of the State. In

one case all the chestnut trees had been carefully treated by cutting off all dead limbs and each wound covered with tar or paint. All the trees, several hundred in number, on the estate of Mr. Harold Pierce were in a fine healthy condition. On two other estates, dead trees had been felled during the winter, but in one instance the pile of cordwood contained abundant evidence that the fungus parasite had done its deadly work, and in the other all the wood and brush had been burned, but an examination of the bark on the stump revealed the fact of the existence here of enough living spores to infect all the trees of the neighborhood, should they find a lodgment on their favorite hosts, the chestnut trees.

The next trip was to follow up the valley of the Susquehanna to the north of Harrisburg. At Sunbury in Northumberland county, the North Branch and the West Branch unite to form the Susquehanna river. At this point the forests for a distance of ten miles, along the river and its two main branches, were examined. The chestnut growth was not so abundant as along the slopes of South Mountain. No evidence could be obtained of the presence of the blight. A side trip was taken up the Shamokin valley. This gave an opportunity to examine the Paragon grove of Mr. C. K. Sober, situated about twelve miles in a direct line from Sunbury. This famous grove contains about four hundred acres and all the trees bearing fruit. Here is a demonstration that waste mountain land, on which the native chestnut grows, may be redeemed and become a profitable investment. One year Mr. Sober had two thousand bushels of Paragon chestnuts to sell. And since the selling price has ranged from $5 to $12 per bushel, one can estimate the income from this source. In his nursery, he had approximately three hundred thousand seedlings and about one hundred thousand of these were to be grafted in the spring of 1909. In large banks or mounds of sand there were one hundred bushels of nuts which would be planted early in May. The object on all trips was primarily to inspect the natural woodland. The native growth of chestnut on Herndon Knob was examined and also the opposite ridge two miles away across the valley. There was no sign of the blight in Shamokin valley nor in any other portion of Northumberland county that was visited.

At Sunbury an inspection was made to the east and south of the Susquehanna, and at Bloomsburg it was to the north or on the opposite side of the river. No sign of the blight could be found in Columbia county. With Mr. S. C. Creasy a drive was taken to Millville, twelve miles from Bloomsburg on the Susquehanna. The chestnut trees are very abundant in certain parts of Columbia county. Mr. Creasy is well informed on all subjects pertaining to forestry in

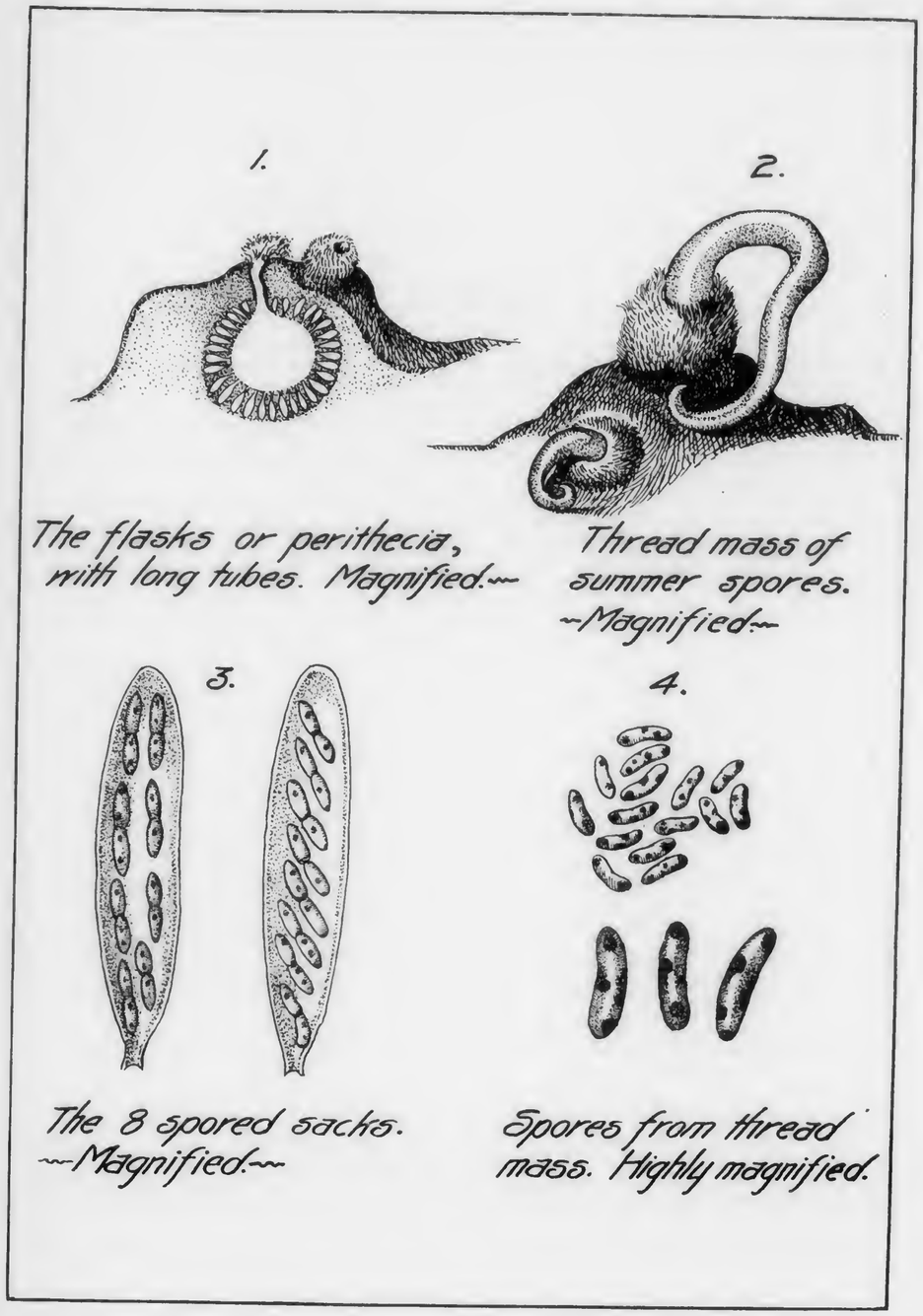
its practical bearing and his company was a great delight. The next stop was made at Wilkes-Barre. In company with Mr. J. E. Patterson a trip was taken to Glen Summit Springs, about nine miles south of Wilkes-Barre. In these trips frequent stops were made and a dozen or more investigations were undertaken. Luzerne county did not furnish a single specimen that gave any indication of the presence of the blight.

At Scranton on the Lackawanna river, a tributary of the Susquehanna, there is little or no chestnut growth. Valuable information was obtained from Mr. T. J. Snowden, a lumber dealer, as to the character of what little forest growth remains in that part of the State. In his lumber yard there were four hundred chestnut posts from six to eight feet in length. These had been cut at Hawley near the border of Pike county. Having been recently cut, the bark which was on the posts would have given evidence of the disease had it existed. There was no sign of the blight on any of these posts.

The next stop was made at Carbondale in the northeasterly part of Lackawanna county. Here as at Scranton, the lack of forests in general, and especially of chestnut trees, precluded an extended investigation. Going eastward over the divide between the Lackawanna river and the Lackawaxen creek or in a broader sense over the highland which separates the watershed of the Susquehanna from that of the Delaware river, the work was taken up at Honesdale. No chestnut growth could be found within ten miles of Honesdale, was the information received from Mr. Kreitner of that town. Since the writer had found the blight at Milford on the Delaware, in Pike county it became an important question to ascertain if it had spread westward and been carried into the upper portions of the Susquehanna valley. The disease exists at Milford and farther north to within three miles of Matamoras, Pa., opposite Port Jervis, N. Y. With Mr. E. T. Riviere of Milford, infected trees were found to the west and again to the south of Milford. Specimens of the blight were taken about one mile from the Camp of the Yale Summer School of Forestry on the estate of Mr. Gifford Pinchot, Chief of the U. S. Forest Service.

To sum up for the Susquehanna valley. The chestnut tree blight was *not found* north of South Mountain. It was found in several localities south of South Mountain along the Susquehanna and on the watershed lying to the east of the river.

In the Delaware valley infected chestnut trees were found at Embreeville in Chester County, on the Brandywine, a tributary of the Delaware river; at Haverford in Montgomery county; at Trenton, N. J., and across the river at Morrisville in Bucks county; near Easton in Northampton county; and at Milford and Matamoras in Pike county. Nowhere in Pennsylvania has the blight become so virulent



and malignant as in New York, especially on Long Island. In the winter of 1908, over eleven hundred chestnut trees were felled in Prospect Park in Brooklyn, N. Y. Many of them were dead and the others so infected that removal was the best course to pursue. Forest Park, is another large park in Brooklyn. It contains 536 acres of which about 350 acres are natural woodland. The Park Commissioner reports fifteen thousand or more chestnut trees in Forest Park. At this date, May, 1909, these trees are standing, but greater havoc from blight or insect pest on forest trees has probably never been excelled in deadly malignity. The disease is so prevalent, that it is proposed to cut every chestnut tree in the Park. On many estates on Long Island similar conditions exist.

THE LIFE HISTORY OF THE BLIGHT.

Neither insect pests nor blights can be dealt with successfully until the life history is known. It is almost useless to strike at one of these supposed antagonists in the dark. Is it much better to know your antagonist, where it lives, and how and when it is propagated. As to the chestnut blight, its general appearance should be known at different stages of growth and for each season of the year. Does it have the same appearance in the resting stage of winter as in the rapidly growing condition of summer?

The first scientific description of the chestnut blight was given in 1906 by Dr. Wm. A. Murrill of the Bronx Botanical Garden, New York City. After a year or more of study and experiment the fungus was proved to be a new species. It belongs to the class known as the sac-fungi and to the genus Diaporthe of which more than one hundred species are known to science. The scientific name of this blight is *Diaporthe parasitica.*

Many of the fungi derive their nourishment from decayed vegetation. Such are the common brackets or shelves on stumps and logs and are properly called saprophytes. Other saprophytes live on decayed animal matter. When one looks at a puff-ball, mushroom, or bracket on a log, it is the fruiting body of the fungus that is under observation. Besides this there are hundreds of fine threads a yard or more in length penetrating the mould or decayed log. These threads or mycelia take up the nourishment and produce the fruiting body. Some fungi, however, derive their nourishment from *living* plants or animals, and are consequently called parasites. Ringworm that attacks man is a fungus parasite, *Trichophyton tonsurans.* The deadly chestnut blight is also a fungus parasite. The ringworm burrows beneath the skin and the chestnut blight lives in the bark and derives nourishment from the new cells of the cambium. The other hundred or more species of Diaporthe live, as a general rule,

on decayed wood and do not attack the living. They are saprophytes and not parasites. This distinction should be kept in mind.

The saprophytes are found on *dead* limbs and trunks of the locust, mountain maple, hickory, ironwood, ash, chestnut, basswood, elm, walnut, oak, red maple, beech, willow, sassafras, golden rod, aster, and many other plants. After a forest fire many forms of saprophytes may be found on the *dead* limbs and trunks of various trees.

What are fungi? They are plants produced by spores and in this respect differ from seed-bearing plants. The ferns and the mosses are also spore plants and are higher in the scale of plant life than the fungi. The fungi include the moulds on bread, cheese, and preserved fruits; mildews, as the downy mildew causing the rot of the Irish potato; rusts on wheat; black-knot on the plum and cherry; mushrooms, edible and poisonous; yeasts; puff balls, etc.

The total number of plants of all kinds known to science is about two hundred thousand species. There are about fifty thousand species of fungi, and of this number about fifteen thousand belong to the sac-fungi (Ascomycetes). The sac-fungi are a very destructive form of fungus growth and produce a number of diseases on account of the fact that many of the species have the parasitic habit. In this division of fungi, there are the leaf-curl of the peach; the black-knot of the plum and cherry; many of the powdery mildews; the large morels, prized for food; the yeast plant, known to makers of bread and beer; the green mould on cheese, as well as the deadly chestnut blight. After the chestnut trees or sprouts have been killed by the blight, numerous other fungi will attack the dead wood. These must not be charged with the destruction of the tree or sapling. These are the scavengers that come to feed upon the dead and are known as saprophytes. Between thirty and forty different species of fungi are known to attack dead chestnut limbs, stumps, and logs.

PROPAGATION OF THE CHESTNUT BLIGHT.

The Diaporthe parasitica is propagated by at least two kinds of microscopic spores. One kind of spore is developed in minute sacs. Each sac contains eight spores and nature fills each tiny sac with the eight spores as uniformily as one finds four legs on a dog and two on a bird. These are sometimes called the winter spores. These spore-sacs are developed in minute flasks resembling carafes or long necked water bottles and are formed abundantly in the autumn. In this way the fungus tides over the winter. Another kind of spore more minute than the winter spore may be found in thread like masses in early spring and during the summer. These are called summer spores, or conidial spores. Conidial is derived from the Greek word meaning dust. Sometimes the thread mass or spores is more than half an inch in length. Such a thread will furnish millions of spores.

These two kinds of spores are different in origin but the same in power in producing the young plant. For the benefit of the microscopist it may be well to state, the winter or sac spores are sexual spores and the conidial or summer spores are non-sexual. It would take from five to six hundred of the tiny sacs placed end to end to measure one inch and about three thousand of the sac spores end to end to measure an inch, and of the minute summer spores eight to nine thousand. Both kinds of spores are produced by countless millions. A section of a limb twelve inches in length and one inch in diameter will furnish an ample supply of spores to infect all the chestnut trees in a county. The minute spores are carried by the wind, on the feathers of birds and the fur of squirrels, and find a lodgment where the bark is abraded and especially in the fork of the limbs or more tender branches. The spore immediately sprouts, and procures its nourishment from the new wood or cambium layer. These newly formed wood cells have very thin delicate walls and are full of sap. Thus the cambium furnishes the parasite with ample nourishment. The walls of the new wood cells are broken down by the growing parasite and the bark begins to change color from a healthy olive green on twigs and slender branches to a reddish brick color, and the parasite shows a tendency to girdle the limb or trunk. As soon as the girdle is complete, all nourishment is cut off from the parts beyond the infected portion. The result is the same whether the girdling is done with an axe, a saw, or by a parasite. Large trees are girdled and killed in two or three years. During the summer of 1908 many branches of chestnut trees showed signs of decay and the green leaves of spring withered long before the frosts of autumn had touched the foliage. So far we have spoken only of the growing fungus. Its work during this stage is carried on in and beneath the bark. It is technically speaking a hypophloeous disease. The next stage is known as the fruiting period. As the fungus grows it finally matures and develops the fruiting body, or rather fruiting bodies. Its growth is now outward, through the pores in the bark. In old trees the fruiting or spore producing bodies are in the long crevices or fissures of the bark. A piece of a limb kept in the laboratory where the changes in the weather will not affect it, will soon be thickly beset with small yellow pustules, resembling little yellow cushions of velvet. These are fruiting bodies of this parasite. Running through the pustule are some dark lines. These are the necks of the flasks or perithecia at the base of the pustule and are situated just beneath the outer layer of the bark. These flasks are lined with the eight-spored sacs. In early spring and during the summer the thread masses consisting of the summer or conidial spores will be found. These threads are dissolved and washed away by the rain and the spores are blown about by the wind. These developments

may be seen best on specimens in the laboratory. A common fruit jar, in which is placed a four or six inch piece of an infected limb, will, in thirty-six or forty-eight hours show signs of the fruiting bodies. First put the stick into water for two or three minutes then transfer it to the jar in which there is less than half an inch of water. The jar is closed and kept at summer temperature. A warm cellar is most convenient, since the fungus grows in the dark as well as it does in the light. In this way the writer has had an abundant supply during the past winter of fruiting pustules on limbs of the native chestnut, Castanea dentata; on the Japanese chestnut, Castanea crenata; and on the Paragon, which is probably a variety of the Spanish or sweet chestnut, Castanea vesca. From these specimens the two kinds of spores were at hand during the entire winter.

Foreign chestnut trees sometimes attain an immense size, and are quite common in the south of Europe, in Spain, Italy, Switzerland, and Germany. The fruit or nut which is two or three times the size the American nut is much used as an article of food. The large kernel is frequently ground into meal and is used to thicken soups, and even bread is made of the chestnut flour. The largest foreign chestnut tree is on the slope of Mt. Etna, in Sicily, and has a circumference of 190 feet, and is known as the "Castagno di cento cavalli," the chestnut of one hundred horses.

There is no lack of opportunity for spores to find an entrance beneath the bark of a chestnut tree, large or small. The wood is brittle and the storms of winter leave many broken twigs and limbs. The small boys and older nut gatherers have clubbed the trees and left many a scar. Insect borers and woodpeckers have made openings in the bark in many places. The forks of the branches seem to be favorite places for the lodgment of spores. In a young tree ten or more points of infection have been observed at the break of the bark in the forks of the limbs.

The propagation is readily carried on wherever there is a supply of spores. The transportation and ready access to the cambium wood cells are well provided. On Long Island an isolated tree, more than a mile distant from any chestnut growth was infected.

IMMUNITY OF OTHER TREES.

All the other forest trees seem to be immune. There are fungus growths of the saprophytic type on all forest trees. Abundant spores of another species of fungus were found upon the branches of several oak trees. The trouble was limited to the under side of the branches, and there was no tendency on the part of the fungus to invade the new cells of the cambium or to girdle the branch. An examination of

THE CHESTNUT BLIGHT AS FULLY DEVELOPED BY INCUBATION.
(From a Color Photograph.)

the locality revealed the fact that it had been swept by fire a year or more ago and the under side of the limbs had been injured. The fungus was merely doing scavenger work, and living upon decayed vegetable tissue. Many times questions have been asked about the horse chestnut, AEsculus hippocastanum. The common horse chestnut or buckeye is a near relative of the maple and is quite unlike the oak, chestnut, and beech, belonging to the same natural order, Cupuliferae, from the fruit being contained in a cup or burr. Another question,—is the chestnut oak immune? It is just as immune as any other oak. Up to this date the writer has not found the deadly chestnut fungus on the chestnut oak, sometimes called rock oak, or Quercus Prinus, L. Hundreds of the chestnut oaks have been examined and although growing side by side with diseased chestnut trees, no case of an infected oak has been discovered.

The variety of chestnut called the Paragon, is quite susceptible to the disease. While the Japanese variety or species is not immune, it is certainly more resistant than the native or the Paragon. In one locality eleven Japanese chestnut trees were in a perfectly healthy condition and bore abundance of fruit in the summer of 1908, although in the immediate vicinity there were many native trees all badly infected. Within one hundred yards of these eleven trees there was a Paragon infected in several different places. In a nursery of twelve or fifteen hundred young Japanese chestnut trees, there were many young native chestnut seedlings from five to ten feet in height. It was almost impossible to find a native tree free from the infection. On the other hand many of the Japanese were immune, yet on an extended examination some five or six of the Japanese were infected, and under hothouse treatment developed a rich supply of spores. Evidently an orchard of Japanese or Paragon chestnut trees can be made profitable and the trees kept in a healthy condition with reasonable care.

ESTIMATED VALUE OF PROPERTY DESTROYED.

The statistics furnished by the United States government show that for the year 1907 over 600,000,000 board feet of chestnut lumber were cut. Valued at $17 per 1,000 the total value would be about $10,000,000 for one year. Besides, there were over $3,000,000 for chestnut cross-ties. Much timber is used in the mines, and also for fence posts and telegraph and telephone poles, and by cabinet makers. The tanneries also use many cords of chestnut wood. The market value of the nuts is no inconsiderable item. In 1908 it would appear, the output of all kinds from the chestnut forests of the United States would aggregate $22,000,000. Should the chestnut blight become as prevalent and virulent as on Long Island, and advance as

rapidly over the country as it has moved eastward on the Island, it is only a matter of a few years when this source of income will be reduced many millions per annum.

The number of chestnut trees on an acre of natural woodland has been counted in New York, New Jersey, and in Pennsylvania. In some counts there were from forty to fifty chestnut trees to the acre disregarding any tree under two or three inches in diameter. In Somerset and Morris counties, N. J., an average of thirty chestnut trees to the acre would be a low estimate for many pieces of woodland. The damage already done by the chestnut blight in the States of New York, Pennsylvania, and New Jersey would not be less than $12,000,000; and when the special value from location on lawns and the aesthetic value in landscape features are considered, two or three millions could be added to this estimate.

REMEDIAL TREATMENT.

Let us notice the conditions in the life history of the chestnut blight. It is a vegetable growth and in its development, the threads penetrate the delicate cells of the newly forming cambium. Summer spores are produced from early spring to late autumn. On the approach of winter, the winter spores are developed in sacs and the sacs line the flasks or perithecia, and in this way tide over the severest cold in the resting stage.

In the case of a large tree, if it is infected at several points it would be advisable to cut it down at once. All the branches and the loose bark should be burnt. The wood may be used for various purposes. If allowed to stand, it furnishes millions of spores, and the wood is greatly injured on acount of the attack of saprophytic fungi of various kinds and also certain insect pests. Young trees are destroyed in one or two years after becoming infected. The girdling process is soon accomplished and the cutting and burning of such growth is recommended. First, all undergrowth about the chestnut trees should be removed. An examination of the trunk will soon reveal the healthy or living condition of the new wood beneath the bark. If the layer beneath the bark is destroyed, the extent of injury up and down and around the trunk can be ascertained. If only a limited area has been destroyed, the dead portion, bark and dead wood should be cut away and the wound covered with tar. If only a few limbs are attacked, their removal should not be delayed, if the tree is considered worth treatment. Cover all wounds with tar. The two discouraging features about any treatment arise, first from the difficulty of finding all infected spots on a large tree, and second, many owners of woodland will not give attention to the matter.

A few neglected trees will supply enough spores to infect all the

trees for miles around. When the spore has found a lodgment in the layer of new growing cells beneath the bark, only the greatest care will prevent the growth and maturity of the fungus. No forest tree develops sprouts or coppice more abundantly than the chestnut, unless it is the basswood. If the tree is much infected almost invariably the blight will be found on the coppice about its base. A chestnut stump will aid the investigation, for it is sure to be surrounded with an ample supply of sprouts. The bark of an old tree has deep crevices or fissures. In these fissures in the bark of old trees the fruiting bodies are found. If the layer beneath the bark is dead, the deepest part of the fissure should be examined for rows of little red tubercles. Here is where the microscopist finds the sacs with their eight spores, as well as masses of summer spores. By tapping on the thick bark with a hammer, the muffled sound will indicate where the bark is dead. If the area is small it can be cut away and the place tarred.

Many suggestions have been made about injecting some chemical that would enter into the circulation and destroy the fungus. So far nothing of practical value in this line has been accomplished. There are fungicides but if used in sufficient strength to kill the growing fungus, the treatment is about as injurious to the tree as is the disease. Trees kept free from undergrowth and frequently inspected and by cutting as soon as the infection is observed, may be saved and kept in a healthy condition. Chestnut groves and orchards may be protected by careful inspection and prompt treatment. If a tree is badly infected its removal is advised. All bark should be burned at once. The bark of the stump well down into the ground must not be forgotten.

While spraying hundreds of forest trees is out of the question, yet grafted trees in groves or orchards may be benefited by spraying, and a limited number of young chestnut trees on a lawn may be so treated. In the Zoological Bulletin, Oct. 1, 1907, page 190, Prof. H. A. Surface says of the Lime-Sulphur Wash; "It is a fungicide as well as an insecticide and cleans up many of the disease germs, such as those causing leaf curl, leaf spots, rusts, mildews, apple scab, and other diseases of leaves or fruits." The Bulletin of March 1, 1909, contains all necessary information on spraying. Many spores may be washed away, but this infection is protected because it grows beneath the bark and is scarcely touched by spraying.

Trees have been treated by using cotton saturated with Bordeaux mixture. Small bunches of raw cotton saturated with Bordeaux and wrapped in burlap have been tied in the forks of the limbs. To be effective, it would be necessary to treat every fork of the limbs and twigs in this manner and also abraded bark on any part of the tree.

Whether the blight will spread inland must remain a problem for

further investigation. At present it appears to be following the coast. On woodland in several localities in Pennsylvania its existence can be shown, yet it can not at present be considered a discouraging menace. On the other hand should the disease spread from tree to tree as is now the case in certain localities in New York and New Jersey, every available measure should be adopted to prevent the propagation of spores by cutting the trees and burning all infected bark.

#6

Commonwealth of Pennsylvania

Bulletin #5

VOCABULARY

OF

FOREST TERMS

SILVICULTURE,
FOREST PROTECTION, FOREST UTILIZATION

FOUND IN

SCHWAPPACH'S "FORSTWISSENSCHAFT"

COMPILED BY
WM. A. A. REINHARDT, A. B.

STATE FOREST ACADEMY, MONT ALTO, PA.
1909

HARRISBURG:
C. E. Aughinbaugh, Printer to the State of Pennsylvania
1909

Abblättern—peeling off.
Abbrennen—burning off.
Abflutung—flooding off.
abgängig—hypermature.
Abhauen—cutting.
Abhieb—cutting off.
Ableger—layer.
Absatz—sale.
Abschluss—closing off.
Abschürfen—scurfing, scraping.
Abschwächung—weakening.
Abschwemmung—flooding off.
Abstand—distance apart.
Abstellung—removal.
Abstrich—knocking down, abating auction sale.
Abstufung—gradation.
Abtriebsschlag—final felling.
Afterraupe—larva of hymenoptera.
Ahorn—maple.
Akazie—acacia.
Akkordverkauf—agreement sale.
Alterstufung—age gradation.
Altholzalter—age of old wood, old age.
anbauen—cultivate.
anfallen—fell, cut down.
anfertigen—arrange, fix.
angehend—young.
angemessen—suitable.
Anhalt—halt, limit, indication.
Anhaltspunkt—halting-place.
Anpassungsvermögen—adaptability.
Antrieb—inducement.
Anzucht—raising, rearing.
Arbeitsbedarf—labor supply.
=*kraft*—labor strength.
=*verdienst*—remunerative employment.
Arsenikweizen—arsenic wheat.
Aspe—aspen.
Ast—branch.
=*streu*—litter of branches.
=*stummel*—snag.
Ästung—lopping.
Ätzkalk—quick lime.
Aufarbeitung—working up.
=*forstung*—afforestation.
=*frieren*—frost lifting.
=*hieb*—clearing, cutting up.
=*lodern*—kindling.
=*platzen*—bursting.
aufstapeln—to pile up.
Aufstrich—rising auction sale.
=*treibung*—swelling.
=*trieb*—driving in.
Auge—bud.
Ausfrieren—frost-lifting.
ausgiebig—abundant.

Aushagerung—impoverishment.
=*hieb*—extraction, cutting out.
auskesseln—to kettle out.
=*klengen*—to cone, husk.
Ausläuterung—cleaning, clearing.
=*roden*—uprooting.
=*rupfen*—tearing out.
=*scheidung*—removal, separation.
Ausschlag—shoot, sprout.
=*schlagsfähigkeit*— ability to sprout.
=*wühlen*—uprooting.
=*zugshauung*—extraction of old trees from young woods.
austrocknend—dessicating.
Auwaldung—forest on land liable to inundation.

B.

Ballenkamp—ball-plant nursery.
ballenlos—unballed.
Ballenpflanze—ball-plant.
Band—band.
Bankskiefer—Pinus Banksiana.
Baumfrucht—tree fruit.
=*schule*—nursery.
bedrängen—crowd.
Beeinträchtigung—injury.
Beerkraut—bilberry.
Behandlung—treatment.
Beherbergung—sheltering.
beherrscht—dominated.
Beimischung—admixture.
Belaubung—foliage.
Benutzung—utilization.
Benützungsweise—manner of utilization.
Berechtigungsgrenze—proscriptive boundary.
Bergahorn—mountain maple.
=*erle*—mountain alder.
Berufs-und Gewerbezählung—Census of Trades and Occupations.
Besamung—seeding
Beschaffenheit—constitution.
Beschirmung—shelter.
Beschneidung—pruning.
Besenpfriem—common broom.
Besichtigung—surveying.
Bestand—stand, crop.
bestandbildend—forming stands.

Bestandesanlage—formation of woods.
=*begründung*—foundation of stands.
=*erziehung*— tending of the crop.
=*loch*— gap in stand.
=*material*—crop material.
=*pflege*—tending of woods.
=*schluss*— crowded stand.
=*schutzholz*—stand shelter wood.
Bestellung—tillage, cultivation.
Betrag—amount
Betrieb—management, system, practice, operation.
Betriebsart—method of management, silvicultural system.
Bezüge—fees.
Biegsamkeit—flexibility.
Biegungsfestigkeit—transverse strength.
Bindigkeit—compactness.
Bindung—binding.
Binnenland—inland.
Binse—rush.
Birke—birch.
Birschpfad—shooting (stalking) path.
Blattwespe—saw-fly.
Blaubeere—bilberry.
=*werden*—becoming blue.
Blockverkauf—block sale, sale of standing trees by area.
Blumentopf—flower pot.
Blutmehl—dried blood.
Boden—soil.
=*decke*—soil cover.
=*feuer*—surface fire, ground fire.
=*flora*—soil flora.
=*pflege*— preservation of fertility.
=*schicht*—soil layer.
=*schutzholz*— soil shelter wood.
=*streu*—soil litter.
=*überzug*—soil cover.
=*vorbearbeiting*— preliminary working of soil.
Bohrkäfer—boring beetle, borer.
Bordelaise Brühe—Bordeaux mixture.
borkig—barky, scabbed.
Böschung—slope.
Brandschaden—fire damages, injurious fire.
=*stiften*—icendiarism.
Breitsaat—broadcast sowing.
Bremse—brake.
Brennholz—fuel wood.
=*kraft*—heating power.

Brombeere—blackberry, brambleberry.
Bruch—swamp, bog.
Buche—beech.
Buchenkotyledonenpilz—beech seedling fungus.
Buchenspinner—beech moth.
Buchweizen—buckwheat.
Büschelpflanzung—multiple plantink.
Buschwald—brush wood.

D.

Dampfpflug—steam plow.
Daseinskampf—struggle for existence.
Dauer—durability, permanence.
dauernd—permanently.
Derbholz—wood over 7 cm. wide at the smaller end.
dichtgelagert—compact.
Dickung—thicket.
Doppelpflügen—double plowing.
Douglasfichte—Douglas spruce.
Drahtgeflecht—wire work.
Drainröhre—drain-pipe, draining-tile.
Drehwuchs—twisted growth.
Dreiecksverband—triangular planting.
Drillmashchine—drill machine.
Druckfestigkeit—resistance to crushing.
Düngung—manuring, fertilizing.
Dunkelschlag—seed cutting.
Durchfallast—loose knot.
Durchforstung—thinning.
Durchforstungsbetrieb—thinning system.
durchführbar—practicable.
Durchwurzelung—spreading of roots.
dürftig—poorly, spare.

E.

Edelkastanie—sweet chestnut.
Eggen—harrowing.
Eibe—yew.

Eiche—oak.
Eichel—acorn.
Eichenschälwaldung—oak coppice wood for bark.
=*wickler*—oak leaf roller, oak tortrix.
Eigentumsgrenze—ownership boundary.
Einfriedigung—fencing.
=*griff*—attack.
=*halten*—adherence, retention.
=*legung*—beggining, start.
=*schlag*—yield from felling.
=*stufen*—dibbling.
einschlagen—to heel in.
Einzelbaum—individual tree.
=*bruch*—individual break.
=*mischung*—mixture by single individuals.
Einzelpflanzung—planting by single individuals.
=*reihe*—single row.
einzelständig—isolated.
Elementarereigniss—elemental occurrence.
Engerling—cockchafer grub.
Entwässerung—drainage.
Entwicklung—development.
Erdbahn—dirt road.
=*feuer*—ground fire.
=*grube*—earth pit.
=*weg*—dirt road.
Erhaltung—support, retention.
Erhebung—elevation.
Erlös—proceeds.
Ernährungsprozess—process of nutrition.
Erwerbender—laborer, wage-earner.
Erzeugnis—product.
Erzeugung—production.
Erziehung—rearing, raising.
Esche—ash.

F.

Fahrlässigkeit—negligence.
Fallrichtung—direction of fall.
Fällungszeit—season of felling.
Fangbaum—trap tree.
=*knüppel*—trap billet.
=*rinde*—trap bark.
Farnkraut—fern.
Faschine—fascine, faggot-hurdle.

Fasernlauf—course of fibres.
Fasertorf—fibrous peat.
Faulbaum—alder-buckthorn.
=*stellen*—rotting.
fäulniswidrig—rot-resisting.
Fegen—rubbing.
Fehlen—failure.
Fehler—defect, fault.
fehlerhaft—defective, faulty.
Fehlmast—fail mast, failure.
Feldmaus—field mouse.
Femelschlagbetrieb—selection system.
Festigkeit—hardness.
Festlegung—determination.
festtreten—stomp fast.
festwalzen—roll fast.
Feuchtigkeit—moisture.
Feuchtigkeitsgehalt—humidity.
Feuergestell—fire line.
=*mantel*—fire belt.
Fichte—Norway spruce.
Finke—finch.
flächenweise—by areas, spotwise.
flachgründig—shallow.
=*wurzelnd*—shallow-rooted.
Floss—raft.
Flugfeuer—flying fire.
Flugjahr—swarm year.
=*sand*—drift-sand.
fm=*Festmeter*—solid, cubic meter.
Forstbenutzung—forest utilization.
Forstdiebstahl—forest theft.
=*frevel*—forest offence.
=*gartenbetrieb*—nursery practice.
=*politik*—forest policy.
=*polizeiübertretung*—forest offence.
=*produkt*—forest product.
=*recht*—forest law.
=*schutz*—forest protection.
=*strafgesetzgebung*—legislation of forest penal laws.
=*technologie*—forest technology.
=*unkraut*—forest weeds.
=*verwaltung*—forest administration.
=*wirtschaft*—forest management.
=*wissenschaft*—forestry.
frevelhaft—mischievous, malicious.
Frostleiste—frost-rib.
=*riss*—frost-fissure.
Fruchtbau—crop cultivation.
=*beisaat*—additional crop sowing.
=*träger*—fruit-bearer.
Frühjahrsaat—spring sowing.
Füllerde—filling earth.

Gasse—lane.
Gassenbruch—lane-break.
Gebrechen—imperfection.
Gefälle—fall.
Gegenfeuer—back-fire.
Gegenmassregel—preventive measure.
Gehölz—wood.
Geissblatt—honeysuckle, woodbine.
Gelände—land, soil.
Gerte—sapling.
Gerbstoffgehalt—tannin content.
Gertenholz—sapling wood.
Gesamtheit—sum total.
=*zuwachs*—total increment.
geschoben—shifted.
Gesteinstrümmer—rock particles.
Gestell—see *"Feuergestell."*
Gestör—raft section.
Gesträuch—shrubbery.
Gewerb—occupation, practice.
Gewerbetreibender—mechanic.
geworfen—warped.
Graben—ditch.
Grabenstreif—ditch-strip.
Grasflur—meadow.
=*narbe*—grass-car, thin cover of grass.
Grenzbeschreibung—description of boundaries.
=*gebiet*—border region.
=*stange*—boundary pole.
=*zeichen*—boundary mark.
=*zug*—boundary line.
Grobhacken—coarse hoeing.
=*rinde*—coarse bark.
grobschollig—coarse (clods).
Grubenholz—mining timber.
Grundbau—foundation.
=*bestand*—ground cover.
=*satz*—principle.
Gründigkeit—depth of soil.
grundsätzlich—fundamentally.
Gründüngung—mulching.
Gruppenwirtschaft—group system.

H.

Hackelhacke—pronged hoe.
Hackstreif—hoed strip.
=*streu*—cutting-litter.
Hackwaldbetrieb—system of field crops and oak coppice.

Hainbuche—hornbeam.
Halbfabrikat—incompletely manufactured article.
=*lode*—small transplant (21-50 cm.)
Hallimasch—honey fungus.
Harke—rake.
Harz—resin.
=*erguss*— exudation of resin.
=*rüsselkäfer*— resin weevil.
Hasel—hazel.
Haubarkeit—exploitation.
Haubarkeitsbestand—mature stand.
Hauptberuf—chief occupation.
=*holzart*—chief species.
=*nutzung*—principal yield.
Hautflügler—hymenopterous insect.
Hegereiser—see "*Lassreitel.*"
Heide—heath.
=*kraut*— common heather.
Heidelbeere—bilberry.
Heideplagge—heath sod.
heimisch—native.
Heister—high plant, small tree.
Heizungszweck—heating purpose.
Hemmung—hindrance.
Herbstsaat—fall sowing.
herrschend— predominating, dominant.
Hexenbesen—witches' broom.
Hiebsergebnis—felling yield.
=*zug*—felling series.
Himmelsrichtung—cardinal point, direction.
hintanhalten—hold in check, prevent.
Hippe—billhook.
Hochbestand—high stand.
=*durchforstung*—high thinning, thinning of dominant trunks.
Hochwaldbetrieb—high forest system.
hochwertig—highly valuable.
Höhenentwicklung—height development.
=*rücken*—ridge.
Holz—wood.
=*art*—tree species.
=*bahn*—wood road.
=*bedarf*—demand for wood.
=*bestand*—standing crop, tree stand.
=*ertrag*—wood yield.
=*gewächs*—wood growth.
=*masse*—wood volume.
=*nutzung*—wood yield.
=*riese*—wood slide.
=*sortiment*—wood assortment.

Holzzucht—wood growing.
holzverarbeitend—wood-working.
Hornast—horny knot.
horstweise—groupwise.
Hügelpflanzung—mound planting.
humifiziert—humified.
humos—humous.
Humusschicht—layer of humus.
Hürdengattern—rails (fence), railings.

J.

Jahresring—annual ring.
Jäten—weeding.
Joch—length of rail.
Johanniskraut—St. John's wort.

K.

Käfer—beetle.
Kahlabtrieb—clear-cutting.
=*fläche*—cleared area.
=*frass*—an eating bare.
=*schlag*—clear-felling.
Kalkboden—calcareous soil.
=*milch*—milk of lime.
Kamp—enclosure.
Karabiden—Carabidae.
Keilspaten—wedge-spade.
Keimbett—germinating bed.
=*kraft*—germinating power.
=*ling*—young seedling.
=*probe*—test of germination.
=*ruhe*—arrest of germination.
keimfähig—fertile.
Keimung—germination.
Kerbe—notch.
Kern (roter)—heartwood.
Kernriss—heart-shake, heart-fissure.
=*wuchs*—seed-growth.
Kiefer—pine.
Kiefernbaumschwamm—pine-tree fungus.
=*eule*—pine owlet-moth.
=*markkäfer*—pine beetle.
=*reisig*—pine brushwood.

Kiefernrüsselkäfer—pine weevil.
=*schüttepilz*—pine-needle-shedding fungus.
=*spanner*— pine loper moth.
=*spinner*—pine moth.
=*triebwickler*—pine-shoot tortrix.
Kienzopf—top of foxy tree.
Kiesdecke—gravel surface.
Klapppflanzung—cleft planting.
Klause—lock.
Kleinpflanze—small plant.
Klenganstalt—coning establishment.
Klima—climate.
klimatisch—climatic.
Kloben—split billet.
Knochenmehl—ground bone, bone dust.
Knollenbildung—formation of knobs (tubercles.)
Knüppel—round billet.
konsolenförmig—bracket-shaped.
köpfen—to pollard, to top.
Kopfholzbetrieb—pollarding.
Kraftmaschine—power machine.
kränkelnd—sickly.
Krebs—canker.
Krone—crown.
Kronenfeuer—crown-fire.
=*schirm*—leaf canopy.
=*schluss*—compact crown.
Krümelung—crumliness, coarseness (of soil).
Krummholzkiefer—mountain pine.
Kulturbetrieb—culture system.
=*fläche*—culture area.
=*methode*— method of culture.
=*weide*—cultivated willow.
Kümmern—starvation.
künstlich—artificially.
Kurzhacken—fine hoeing.

L.

Lage—location, position.
Landwirtschaft—agriculture.
Langholzflösserei—log rafting.
Langnutzholz—logs.
Längstrieb—leading shoot.
Lärche—*larch*.
Lärchenminiermotte—larch miner moth.
=*pilz*—larch fungus.

Larve—larva.
Lassreitel—standard.
Laubdach—leaf canopy.
=*holz*—broad-leaved tree.
Lauffeuer—running fire.
=*käfer*—ground beetle.
Läuterungshieb—cleaning.
Lawsonscypresse— Lawson's cypress.
lediglich—merely.
Lehmboden—loamy soil.
Leitergang—ladder, side gallery.
lichtbedürftig—light-demanding, intolerant.
Lichtbedürfnis—demand for light.
=*einfall*—light entrance.
=*genuss*—amount of light.
=*schlag*—light felling.
=*standszuwachs*—open stand increment.
Lichtung—heavy thinning.
Lichtungshieb—light felling, heavy thinning.
lichtstellen—to provide light, to interrupt the leaf canopy.
Lichtwuchsbetrieb—open stand system.
Linde—linden.
Löchersaat—sowing in holes.
=*wirtschaft*—group system of regeneration.
Lochpflanzung—planting in holes.
locker—loose.
Lockerung—loosening.
Lode—sprout, medium-sized transplant.
Lohlöffel—barking spoon, barking iron.
Lohporling—Polyporus Vaporarius.
Los—lot.
Loshieb—severance cutting.
=*spülen*—washing away.
Lottbaum—timber carriage, go-devil.
lückig—gaping.
lufttrocken—air-dry.
Lupine—lupine.

M.

Mächtigkeit—thickness.
Maikäfer—cockchafer, May-bug.
Mannbarkeit—ability to bear fruit.
männlich—staminate (blossoms).
Markstrahl—medullary ray.
Maserwuchs—curly growth.

Massenbruch—mass-break.
=*erzeugung*—volume production.
=*vermehrung*—increase in numbers.
=*zuwachs*—volume increment.
massgebend sein—be the measure (for).
Massregel—rule, measure.
Mast—mast.
Mäuseplage—mouse plague.
Meeresspiegel—sea level.
Meistgebot—highest bidding.
Mennig—red lead, minium.
Minderung—diminution.
Mischbestand—mixed stand.
=*holzarten*—mixed species.
Missbildung—defective formation.
Mitfruchtbau—simultaneous crop cultivation.
Mitteldurchmesser—mean diameter.
=*rippe*—midrib.
=*temperatur*—mean temperature.
=*wald*—coppice with standards.
Mollmaus—mould mouse, vole.
Moment—fact, force.
Moorerde—moor soil.
Mulde—depression.
Mure—landslide.

N.

Nachbesserung—later improvement.
=*hieb*—secondary felling.
=*lassen*—abatement.
=*teil*—residual part, superfluous part.
nachhaltig—in a sustained manner.
Nadelholz—conifer
Nagetier—rodent.
Nährstoff—nutritive material.
naturgemäss—natural, in accordance with nature.
Naturverjüngung—natural regeneration.
Nebenberuf—subsidiary occupation.
=*nutzung*—minor produce.

Neigungsgrad—degree of slope.
Nesterbruch—nest-break, clump-break.
Nichtderbholz—wood not included under "Derbholz."
Niederdurchforstung—low thinning, thinning suppressed trees.
=*schlagsmenge*—amount of precipitation.
Niederwaldbetrieb — coppice system.
Nonne—nun, nun-moth.
Notjahr—year of scarcity.
Nutzbarkeit—service, utility.
Nutzen—utility.
Nutzholz—timber.
nutzholztüchtig—of good timber.
Nutzrinde—timber bark.
=*wert*—yield value, utility value.

O.

Obenaufpflanzung—planting above surface.
Oberförsterei—forest district.
=*holz*—overwood.
=*ständer*—standard (reserved) tree.
Ochsenblut—ox-blood.
Odung—waste, barren land.
Orkan—hurricane.
örtlich—local.
ortsangesessen—local.
Ortstein—hardpan.

P.

Pachtertrag—lease.
Pappel—poplar.
=*plantage*—poplar plantation.
Peitschen—whipping.
Pflanzenabfall—plant offal, vegetable remains.
Pflanzgarten—nursery.
=*holz*—planting peg.
=*kamp*—transplant nursery.
Pflasterstrasse—paved road.
Pilz—mushroom, fungus.

Pilzerkrankung—fungus disease.
Planieren—leveling.
planmässig—systematic.
Plänterbetrieb—selection system.
=*wald*—selection wood.
Plattensaat—spot sowing.
Platz—square.
Polyporusart—species of Polyporus.
Preisselbeere—red whortleberry.
Presstorf—pressed peat.
Prozentsatz—percentage growth.
Prügel—round billet.
Puppenräuber—ground beetle, (pupa robber).

Q.

Quadratverband—planting in squares.
Quebrachoholz—quebracho wood.
Quellen—swelling.
Querschnitt—cross section.

R.

Rabattenpflanzung—sowing on ridges.
Rabattierung—bordering.
Raff=und Leseholz—fallen dead wood.
Rajolen—trench plowing.
Rajolstreif—trench strip.
Randbesamung—border seeding.
raschwüchsig—rapidly growing.
Raschwüchsigkeit—rapidity of growth.
Raubfliege—fly of prey.
=*insekt*—insect of prey.
=*wirtschaft*—robber management.
Raummeter—stacked cubic measure, stacks.
Räumung—removal.
Raupenleim—insect paste
Rebpfahl—vine pole.
Rechstreu—litter of dead leaves or needles.

Rechtsanspruch—legal claim.
Regenguss—heavy downpour.
Rehstand—deer stock.
=*wild*—roe deer.
Reife—maturity.
Reihe—row.
Reihenverband—planting in rows.
rein—pure, unmixed.
Reinigungshieb—cleaning cutting.
Reisig—brushwood, faggot wood.
Rentabilität—rentability.
Revier—district.
Riesen—sliding.
Riesweg—slide.
Rille—rill.
Rillendrücker—rill-board.
=*zieher*—rill-marker.
Rinde—bark.
Rindenbrand—bark burning.
=*gewebe*—bark tissue.
Rindviehmist—cow dung.
Ringschäle—ring shake.
Rinne—gutter.
roden—clear.
Rodung—clearing.
Roggen—rye.
Rohsortiment—rough assortment.
Rotbuche—redbeech.
=*erle*—red alder.
=*fäule*—red rot.
=*wild*—red deer.
Rötelmaus—bank vole.
Rotte—gang, band.
rücken—transport, remove.
Rückerlohn—transportation wage.
Ruckwagen—sledge.
Rückweg—slideway.
Rundholz—log.
Rüsselkäfer—weevil.
Rütteln—shaking.

S.

Saat—sowing.
=*kamp*—seed nursery.
Säelatte—sowing lath.
Saftzeit—sap time.
=*zersetzung*— decomposition of sap.
Sägmühlenbetrieb—saw mill practice.
Sähorn—sowing horn.
=*maschine*—sowing machine.
Samen—seed.
=*beschaffung*— procuring seed.
=*ertragsfähigkeit*—ability to bear seed.

Samenhandlung—seed establishment.
=*schlag*—seeding felling.
Sämerei—seeds.
Sandboden—sandy soil.
Särücksack—sowing sack for the back.
Saumschlag—strip felling.
Schaft—bole, trunk.
schälen—peel.
schattenertragend—shade enduring, tolerant.
Schattengitter—shade screen.
=*holz*—tolerant tree.
Scheide—sheath.
Scheiter—split billet.
Schichtnutzholz—stacked timber.
Schienenweg—railway.
Schilf—reed.
Schirmbestand—shelter wood.
=*schlag*—shelter wood felling.
schirmförmig—umbrella-shaped.
=*frei*—free of canopy.
Schlag—felling area.
=*fläche*—cut-over area.
=*führung*—arrangement of fellings.
Schlagruhe—period of rest from cutting.
Schleifholz—pulp wood.
=*weg*—road slide, slideway.
Schlittweg—sled road.
Schlucht—ravine, gully.
Schlupfwespe—ichneumon fly.
schmalspurig—narrow gauge.
schmarotzend—parasitic.
Schmarotzer—parasite.
schnabelförmig—beak-shaped, rostrate.
Schneebruch—snow-break.
=*druckgefahr*— danger of snow pressure.
Schneidelstreu—litter from lopping.
Schneisennetz—network of lanes.
Schnittprobe—cutting test.
Schönheitswaldung—beauty forest.
Schonung—closed wood.
Schule—transplant nursery.
Schulkamp—transplant nursery.
Schuppen—spade.
Schutzbedürfnis—demand for shelter.
=*streifen*—protective strip.
=*waldung*— protective forest.
Schwarzerle—black alder.
=*wild*—wild boar.
Schweinedünger—swine dung.
=*eintrieb*—pannage.
=*mast*—swine mast.
Schwerpunkt—important point.

Schwinden—shrinking.
Senkholz—sunken wood.
Setzreis—cutting.
=*stange*—slip.
Sickergraben—lateral trench.
Sitchafichte—Sitka spruce.
Sonnenbestrahlung—sunlight.
Spaltbarkeit—cleavability, fissibility.
=*pflanzung*—notch planting.
Spannkette—drag-chain, trigger.
spätblühend—late-blooming.
Spaten—spade.
Specktorf—rich peat.
sperrig—with wide-spreading branches.
Spiegelrinde—silver bark.
Sprengmast—quarter mast.
=*schraube*—blasting screw.
Spriegelzaun—tilt fence.
sprungweise—abrupt.
Spurweite—gauge.
Staatsgewalt—executive power.
Stamm—stem, trunk.
=*abschnitt*—trunk section.
=*achse*—stem axis.
=*feuer*—trunk fire.
=*teil*—part of trunk.
Stand—stand.
=*ort*—locality.
Stange—pole, stem, stalk.
Stangenholzalter—age of pole wood.
=*ort*—pole wood, locality containing pole wood.
Starklode—large transplant.
Stauwerk—water-stowing works (locks, dams, etc.)
stechen—to spade.
Steckling—cutting.
Stecksaat—dibbling.
Steig—path.
Steinbahn—stone road.
stellenweise—in places, spotwise.
Sticktorf—spaded peat.
Stock—stump.
=*holz*—stump wood.
Stoff—material.
Stoss—stack.
Strafgesetzbuch—penal code.
Strauch—shrub.
=*weide*—shrubby willow.
=*werk*—brushwood.
Streichtorf—molded peat.
=*rippe*—wooden runner.
Streifen—strip.
=*saat*—strip sowing.
Streu—litter.
=*decke*—litter cover.
=*ertrag*—litter yield.
=*nutzung*—removal of litter.

Strychninweizen—strychnine wheat.
Stücklohn—piece wage.
=*zahl*—number.
stufig—graduated, sturdy.
Stummel—snag, stump.
Stummeln—lopping.
Stummelpflanze—stump plant.
Stundung—delay granted in payments, respite, grace.
Stürzen—pitching.

T.

Tagwurzel—shallow root.
Taxe—rate, price.
Teer—tar, pitch.
=*öl*—tar oil.
=*schwelerei*—distillation of tar, production of tar from stumps.
Teeren—tarring.
Tenne—floor, barn-floor.
Terrain—ground, country.
Terrassieren—terracing.
Thomasschlacke—Thomas slag.
tiefgründig—deep (soil).
=*rissig*—deep-fissured.
=*wurzelnd*—deep-rooted.
Tiergattung—animal species.
tierisch—animal.
Tonboden—clay soil
Torf—turf, peat.
=*brei*—peat pulp.
=*mull*—peat mould.
=*stich*—spading of peat.
Tränkung—saturation, absorption.
Tränkungsfähigkeit—power of absorption.
Traubenkirsche—bird cherry.
Trieb—shoot.
Triften—floating.
Triftweg—passage for cattle, grazing path.
Trockenfäule—dry rot.
=*gewicht*—dry weight.
=*torf*—dry turf.
Turnus—rotation.

übererden—covering with earth.
=*halter*—reserved standard.
=*schwemmung*—flood.
=*sieben*—sieving over.
=*wallungsrand*—edge of wound.
Ulme—elm.
Umbruch—breaking up.
umgraben—dig up.
Umhacken—hoeing.
umklappen—flap over.
Umlichtung—opening out.
umschippen—shovel about.
umstechen—spade about.
Umtrieb—rotation.
Umtriebszeit—time of rotation.
Umwehrung—surrounding protection.
ungleichaltrig—uneven-aged.
Unkrautdecke—cover of weeds.
=*streu*—weed litter.
=*wuchs*—weed growth.
Unland—waste land.
Unterbau—under planting.
=*grundpflug*—subsoil plow.
=*holz*—underwood.
unverschult—untransplanted.
üppig—luxuriant.
Urbarmachung—cultivation.
Urwald—virgin wood.

V.

Vegetationsruhe—arrest of growth.
Verangerung—overgrowth of weeds.
Verarbeitung—working up.
Verband—arrangement.
Verbreitungsgebiet—region of distribution.
Verbuchung—entering into books, book-keeping.
Verdämmung—suppression.
Verdunstung—evaporation.
Verfahren—procedure, process.
Verfilzung—matting.
Verjüngung—regeneration.
Verkaufseinheit—selling unit.
verkittet—cemented.
Verkohlung—charcoaling, charring.
Verpflanzung—transplanting.
verpuppen—to change into a pupa.
verschulen—transplant.
Verschulungsbeet—transplant bed.

verschwindend—negligible.
Versteigerung—auction.
versuchsweise—experimentally.
Vertilgungsmassregel—measure for extermination.
Verunkrautung—overgrowth of weeds.
Verwendungsweise—manner of use.
Verwittern—decomposition.
Verwitterung—weathering.
Verwitterungsboden—disintegrated soil.
Verziehung—distortion.
Verzollung—paying (estimating) of customs.
Vogelbeere—mountain ash.
volkwirtschaftlich—economic.
Vollsaat—full sowing.
Vorarbeit—preliminary work.
Voraussetzung—presumption, condition.
Vorbereitungshieb—preparatory cutting.
Vorbeugungsmassregel—preventive measure.
Vorfruchtbau—preliminary crop cultivation.
Vornutzung—yield of thinnings.
Vorschrift—direction.
Vorsprung—projection, start.
vorwiegend—preponderating.
Vorwuchs—advance growth.
Vorwuchshorst—group advanced in growth.

W.

Wachsraum—growing space.
Wachstumsbedingung— condition of growth.
Wachstumsenergie— energy of growth.
Wadel—felling time.
Wald—wood.
=*anlage*—forest plantation.
=*bahn*—forest railway.
=*bau*—silviculture.
Waldbehandlung—forest treatment.
=*besitz*—forest property.
=*boden*—forest soil.
=*brand*—forest fire.
=*feldbau*—forest and field cultivation, combination of field crops with high forest.

Waldflora—forest flora.
=*grund*—forest soil.
=*hammer*—range hammer.
=*mantel*—shelter belt.
=*pflug*—forest plow.
=*rebe*—clematis.
=*teufel*—forest devil.
=*weide*—forest pasture.
waldtrocken—forest-dried.
Waldung—woodland.
Walnuss—walnut.
Wanderkamp—temporary nursery.
Wassergehalt—water content.
=*reservoir*—water reservoir.
=*wirtschaft*—water management.
Wegbauten—road construction.
=*planum*—road surface.
Wegenetz—network of roads.
Weichholz—soft wood.
Weide—pasture.
=*vieh*—cattle.
Weidenheger—willow culture.
=*hegerbetrieb*— willow culture.
=*korb*—willow basket.
=*röschen*—willow herb.
Weisserle—white alder.
=*esche*—white ash.
Weisstanne—silver fir.
=*tannenpilz*—silver fir fungus.
Welle—faggot.
Werfen—warping.
Werg—tow.
Werterzeugung—value production.
Weymuthskiefer—white pine.
widerrechtlich—illegal.
Widerstandsfähigkeit—power of resistance.
Wiesenanlage—meadow cultivation.
Wildbach—torrent.
=*garten*—game preserve.
=*park*—game park.
Wildlingspflanze—forest seedling plant.
Wimmerwuchs—wavy growth.
Windbruch—wind- break.
=*mantel*—wind-belt.
=*wurf*—wind-warping.
Wipfelbruch—top-break.
=*feuer*—top (crown) fire.
Wirbelwind—whirlwind.
wirtschaftlich—scientific, economic.
Wirtschaftswald—managed wood.
Wollappen—woolen cloth.
Wühlratte—vole, burrowing rat.

Wundhacken—hoeing up.
=*haltung*—keeping (the soil) in a turned-up condition.
=*pflügen*—plowing up.
Wurzel—root.
=*faser*—root fibril.
=*schwamm*—root fungus.
Wurzeltorf—rooty peat.
=*verbreitung*—root distribution.
=*vermögen*—rooting power.
wurzellos—rootless.
Wüste—waste land, desert.

Z.

zähe—tough.
zerfallen—decompose.
Zersetzung—decomposition.
Zersetzungserscheinung—decomposition phenomenon.
Ziehhacke—draw-hook.
Zirbelkiefer—Cembran pine.
Zopfdurchmesser—top diameter, smallest diamter.
Zuchtpflanze—cultivated plant.
Zufuhr—addition.
Zukunftsstamm—future trunk.
zuwachskräftig—vigorously growing.
Zwischennutzung—intermediate yield.
=*stufe*—intermediate stage (or step.)

#6

Commonwealth of Pennsylvania

DEPARTMENT OF FORESTRY.

PROCEEDINGS OF THE FIRST CONVENTION OF PENNSYLVANIA FORESTERS,

HELD AT HARRISBURG, PA., MARCH 4, 5, 6, 1908.

HARRISBURG:
C. E. AUGHINBAUGH, PRINTER TO THE STATE OF PENNSYLVANIA
1910

THE PENNSYLVANIA DEPARTMENT OF FORESTRY.

THE STATE FORESTRY RESERVATION COMMISSION.

Robert S. Conklin, President.
Dr. J. T. Rothrock, Secretary.
Miss Mira L. Dock.
John Fulton.
S. B. Elliott.

THE OFFICE OF THE COMMISSIONER OF FORESTRY.

Robert S. Conklin, Commissioner of Forestry.
Irvin C. Williams, Esq., Deputy Commissioner of Forestry.
A. E. Strode, Clerk.
George W. Howard, Clerk.

THE STATE FOREST ACADEMY, MONT ALTO, PA.

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George H. Wirt, Director.
J. P. Wentling, Assistant Director.
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Ralph E. Brock, Class of 1906, Forester.
William L. Byers, Class of 1906, Forester.
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Paul H. Mulford, Class of 1907, Forester.
John L. Witherow, Class of 1907, Forester.

TABLE OF CONTENTS.

Beginning with September, 1906, the first class of foresters from the State Forest Academy went into the field, and the second class followed September, 1907. For the purpose of comparing ideas and notes on their work and enabling them to have an interchange of thought, it was deemed advisable to bring them together during the early part of the following year for discussion of forestal topics and the reading of such papers on pertinent subjects as the men in the field might wish to present or hear discussed. Accordingly, on February 11th, 1908, the Commissioner of Forestry issued a call for the first convention of Pennsylvania foresters to meet at the Department in the new Capitol at Harrisburg on March 4th, 5th, and 6th, ensuing.

In the meantime, the wishes of the men were learned with respect to what subjects they wished to hear discussed, the program of exercises was prepared, and the meeting duly convened at the Department, Wednesday morning, March 4, 1908.

The Commissioner of Forestry presided at the meetings, and at intervals the other members of the State Forestry Reservation Commission, all of whom were present, were called upon to preside.

The papers presented by the young foresters are hereinafter contained and show that the men were interested in their work and desirous of learning whatever will assist them to bring better results. The discussions after the reading of each paper were participated in freely by all present.

The regular meeting of the Commission was held on Friday morning, March 6th, at which the foresters were present and saw how the business of the Department is conducted. During the sessions, at the invitation of the Governor, a visit was paid to the Executive Department where Governor Stuart in a short address welcomed the foresters and gave them some good advice with respect to their conduct both as men and officials. The Convention adjourned finally on Friday, March 6th, and the feeling of those who participated was that it was not only a successful meeting, but that much valuable instruction had been imparted which would be of permanent use to them in the forestal work of the future.

THE IMPORTANCE OF SURVEYS.

JOHN E. AVERY, *Forester.*

Surveying is the art of making such measurements as will determine the positions of points on the surface of the earth, so that a map of any portion of that surface may be drawn and its contents calculated. A survey of all forest lands or reserves of this Commonwealth is exceedingly important. Most of the State's reserve lines have not been run or retraced for years. Often the blazed trees have been cut, or have been destroyed by fire, or blown down. It takes a good surveyor with an instrument to follow them. Therefore, the lines should be run or retraced, plainly blazed, and blazes painted. Corners should be distinctly marked. The lines could be made more visible by cutting an open path and by posting notices at frequent intervals. This would show conclusively the lands of the State to all persons. The neighbor who intentionally or unintentionally gets over the line a little, and very often quite a distance, taking timber that does not belong to him, will not take the chance of crossing a well marked or well established line. Therefore, stealing of timber ceases almost immediately. There are but few cases of timber stealing on the reserves where lines have been retraced and visibly marked.

What can the wardens do, not knowing the lines? Absolutely nothing. They cannot properly patrol the land, and they are not sure of alleged trespassers being on State lands. One of the wardens reported to me several weeks ago that a party was chopping wood either on the reserve or very close to the line, but he was not sure and did not know what to do. He had asked this person where the line is and he could not show him, but said he was on his own land. In such a case, what are we to do? Finally we got a man living in the same community, one who claimed to know almost every line in the woods, to go with us. He put us on a line which had been run years ago and which he said was the State land line. Are we to rely upon the judgment of such persons, and will not work of this kind leave a loop-hole for timber thieves to plunder from the State lands? In a community like the one I have just cited every person seems to be related to every other or else they are bosom friends. What one knows all know. If they once find out that we do not know or are not sure where our lines are, they will cut without the least hesitancy and think all the while they are taking what belongs to them; for in a wooded country, and I think especially in Pike county, there are many men who do not think it a crime to go on his neighbor's tract

and relieve him of some of his timber. I know of a man who was not a native of the county being driven off his own land at the point of a gun by a timber thief. The owner knew he had land, but did not know the exact location until he had his lines run.

If the lines of the reserves were surveyed, blazed, and posted, it would not only be a benefit to the persons in charge, but also to the public and to the sportsmen. The sportsman or hunter, probably not accustomed to the distance travelled, may find himself crossing a State line, opened, blazed, and posted. He is safe to the extent that he is not trespassing on lands of an individual or lands owned by a hunting club, and is not liable to arrest and fine of ten dollars or ten days in prison for trespassing, and have his game taken away from him; but he does know that he is on a State Forest Reserve, free for all to hunt or fish, provided he complies with the rules of the Forest Reservation Commission.

If our reserves were surveyed and the boundary lines cut open, we could have the lands under a better system of patrol. The wardens could cover more of the reserve in one day than they can now in two. As most of the lines are at present they are delayed by tramping through underbrush. Again, the cut lines would serve as wagon roads for getting out timber in the future, or as fire lanes, along which back-fires could be set whenever a fire is headed toward the reserve. We would thus protect the reserve from its most deadly enemy, and save hundreds of dollars for the Commonwealth.

From a forester's point of view, he cannot make a forest working plan until he knows what he has. Here again a survey is very necessary. Not only the outside lines should be run, but township roads, railroads, creeks, bluffs, and other obstacles should be located. Lines between localities having different jurisdiction, as county and township boundaries, interior tracts, lands upon which any rights are reserved, or any individual property, should be accurately located. The forester cannot divide his reserve into compartments which should have natural boundaries, as streams, crests of ridges, swamps, and valleys, because they are permanent, until he has a topographical survey which will show the various undulations and inequalities on the reserve.

In conclusion, without a survey, the forester is continually handicapped, because

1st. The wardens are unable to do their duty for the simple reason that they are not positive as to location of lines and have to depend upon the honesty of neighbors.

2d. It is not fair to the public, as the State Forest Reserves are open for recreation purposes to the people of the Commonwealth.

3d. It is most important for a forester to have a map of his reserve. He can do scarcely anything without a map from which to make his calculations and working plans.

FERTILIZERS FOR RENEWING NURSERY SOILS.

RALPH E. BROCK, *Forester.*

In discussing the subject "The Best Method of Renewing Nursery Soil," I have endeavored to include the two methods most generally followed in best agricultural practice, that is, the one in which there is application of commercial or other fertilizers, and the other, green manuring. The latter is preferable for supplying essential plant foods, because of its cheapness, reliability, and mostly because it involves few or no experiments to determine the plant foods, or the amounts that are most needful.

But laying aside the methods of fertilizing, there is nothing that brings the soil up to "dot," so much as thorough tillage, bringing out the old adage from which we get the word manoeuvre or manure, "he who tills the soil, manures it." From this tillage or working of the soil, the texture is improved, and in heavy or clay soils its absorptive value is increased. Of course tillage alone will not suffice. Composting or fertilizing must be relied upon to aid. From this source we obtain the needed materials, nitrogen, potash, and phosphoric acid.

Supply of Nitrogen.

There are two ways of supplying this essential plant food to the soil, the one by the application of nitrates, and the other by the practice of green manures, the latter of which is preferable, especially if the soil is poor. Where the nursery is of sufficient size to keep a portion of it (one-fifth) unused, this method is very suitable. To restore this portion is to begin early in the spring, sowing Canada field pea, seeded deeply at the rate of two bushels and one-half per acre, giving the soil a top dressing of 300 pounds of acid phosphate and 120 pounds muriate of potash. This crop should be ploughed under during the latter part of June and the land sown in cow peas. Plow this under in September and then sow rye. Give the land now a top dressing of 350 pounds Thomas meal, 2,650 pounds slaked lime, and 900 pounds kainit. This method will give the area one year in good nitrogen catch crops, and will improve the texture of the soil considerably, making a loose soil more binding and retentive of moisture or a clayey soil more open, porous, and absorptive. Also, it would insure nitrogen for years to come, the soil being thoroughly inoculated and also possessing a supply of potash and phosphoric acid.

The Supply of Potash.

The most available supply of potash and the one from which the least trouble can be expected, is in the use of unleached hard wood ashes especially on a soil that is clayey and wet. I have found ashes alone a splendid fertilizer at Mont Alto. Professor Johnson suggests 30 pounds of freshly burned shell lime, 10 pounds of bone meal and 8 pounds kainit a good substitute for wood ashes. This formula is equal to 100 pounds of wood ashes. The ingredients can be bought at the rate of $4.40 per ton; hence, it is decidedly cheaper and has no weed seed.

Phosphoric Acid.

Bone-meal containing three per cent. nitrogen and twenty per cent. phosphoric acid, and kainit containing the same amount of phosphoric acid, besides many other valuable plant essentials in small amounts, are the two best sources of phosphoric acid to be had at a reasonable price.

Formulae for mixing fertilizers and composts are as follows:

Composts.

Substitute for wood ash equal to 100 pounds, 30 pounds freshly burnt shell lime, 10 pounds bone meal, and 5 pounds kainit.

Thomas-meal, 16 per cent. citrates, 350 lbs.
Slack lime, 2,650 lbs.
Cornallite, 900 lbs.
Mix well together with fine turf, scatter over ground in late fall or winter, and work well in early spring.

Two measures of well rotted wood, two measures of well rotted horse manure, one measure of liquid manure. Keep in covered place until used. Even quantities of chip dirt and well rotted dung well mixed, to which wood ashes and lime have been added. Keep two years.

Ground bone, 300 lbs.
Bone black super phos., 300 lbs. (Fall).
Muriate of potash, 400 lbs.
Nitrate of soda, 89 lbs. (Spring).

Von Schroeder's:
Kainit, 520 lbs.
Super phosphate, 60 lbs.
Whale Guano, 320 lbs.

A good reliable fertilizer for general purposes, is:
Mixture of 30 pounds hen manure, 10 pounds sawdust, 16 pounds acid phosphate, 8 pounds kainit.

This will carry about 1.25 per cent. nitrogen, 4.5 per cent. phosphoric acid, and 2 per cent. potash, which used at the rate of two tons per acre would furnish 50 pounds nitrogen, 185 pounds phosphoric acid, and 80 pounds potash.

Substitute for Barn Manure.

Dissolve one bushel salt in enough water to slack five or six bushels lime. The best method for preparing for composting is one bushel of this lime to one load of swamp muck, though three bushels to five loads is a very good manure. Mix well.

In laying up the heap let layers of muck and lime be thin so that decomposition will be more rapid and complete. Sprinkle salt water on the lime as heat goes up.

When lime cannot be obtained, use three or four bushels of unleached ashes to one cord muck. Turn in a month or six weeks.

Home-made Guano.

Save all fowl manure from sun and rain under cover. Spread a layer of dry swamp muck and dump fowl manure on top of it. Beat into a fine powder with back of spade, add hard wood ash and plaster paris to make following proportions:

Dried muck, 4 bushels.
Fowl manure, 2 bushels.
Ashes, 1 bushel.
Plaster paris, 1½ bushels. Mix well.

A little before planting moisten with water or liquid manure. Mix with soil when planting.

While home mixing of fertilizers is less expensive than prepared fertilizers, care must be exercised in the selection of the needed constituents for two reasons; first, when certain materials are mixed chemical changes take place in which a valuable material is lost, as when lime and barn-yard manure are mixed, ammonia is given off; and second, a change to a less available form occurs as, when lime and super phosphate are mixed, the phosphoric acid is rendered less soluble; also, when potash salts and Thomas meal are mixed the product is apt to cake and becomes hard to distribute evenly. For this reason a German expert lays down the rule that lime and sulphate of ammonia; lime and super phosphate, lime and Thomas slag; lime and barn-yard manure; lime and nitrogenous guano, should never be mixed. Nitrate of soda and Thomas meal; nitrate of soda and lime; potash salts and lime; and potash salts and Thomas meal, should never be mixed. Kainit and lime; and kainit and Thomas meal, should never be mixed unless used at once.

No seed should be sown until several weeks after fertilizers have been sown, and where kainit is to be used in mixture, that is, in connection with a highly nitrogenous product, all but the nitrogenous product should be sown the fall before. Concerning lime and nitrate of soda I add the following, especially concerning the nitrate of soda.

A tree is a slow growing plant and soluble salts, as nitrate of soda, leach away before they can be assimilated by the plant. Regarding lime, except as a mechanical ingredient in compost heaps, no conclusive results have been found, except in the case of three hard woods. Cherry, linden, and American elm appeared to be benefitted.

My experience has been that all conifers suffer from the use of lime. Even from the use of diluted Bordeaux mixture as a fungicide in the endeavor to check "damping off" the coniferous plant suffered.

BROADCAST SOWING vs. DRILL PLANTING.

RALPH E. BROCK, *Forester.*

In the raising of seedlings for commercial purposes, the idea of importance is to raise the greatest number of even sized, vigorous, and thrifty seedlings on the smallest possible area at the least expense.

Whether this can best be accomplished by sowing the seed broadcast or in drills, depends largely upon the character of the soil in the germinating beds, the moisture conditions of the locality surrounding, as influencing the amount of soil moisture in these beds, the species to be raised and the character of the location in which they are to be finally planted. Broadcast seeding is most practicable where the land has been under a system of thorough tillage for several years, in which weeds have been effectually subdued, the water table raised by successful cultivation, and where the drainage conditions are such that excessive moisture easily and quickly passes away. These conditions would most likely be found in soil that varies from a sand to a sandy loam, and where the surface water of the higher ground surrounding the nursery site is drained away from the beds naturally or artificialy. Drill planting is successful under a wider range of conditions, the four to six inch space between the drills renders weeding less difficult, permits cultivation at all times, and, in times of drought, where there is no adequate water system at hand, allows one to break the soil to facilitate capillary attraction of water from the sub-soil. Again, billets of wood may be laid between the rows of seed-

lings, in a measure, keeping down weeds, preserving moisture and lessening the quantity of leaves needed to cover the beds in the fall.

In beds that have been sown broadcast, the raising of even-sized seedlings excepting by chance is nearly impossible. The seedlings on the edges of the beds are larger, more vigorous and possess a more healthy color, than the dense masses near the centre of the beds. From broadcast sowing it is possible to secure a larger number of seedlings per bed, but the beds present an uneven appearance. The north and east ends of the bed have seedlings several times larger than those of the centre, and those on the south side are likely to be dwarfs and possess a less healthy color, though this may have been caused by exterior conditions. Where the seed had been sown in drills these conditions do not exist to such great degree.

It has been said that broadcast sowing chokes out weeds, but in this State our sowing season is in the latter part of April, after plant life has started. Even if we soak the seed, germination does not take place for three weeks. During this time the weeds have a good start, and from this time on a proportionately larger number of young seedlings are pulled out by weeding in broadcast sown beds than from those sown in drills. For this reason alone one would think that broadcast sowing would be inadvisable except in old beds where weeds have been greatly subdued. The cost of this method of sowing is so large as against drill sowing, except as above, that it would be inadvisable.

The cost of making a bed 100 feet by 4 feet averages one dollar, and the cost of the seed $14.40, making an initial cost of $15.40, not counting the cost of sowing and weeding. Ideally, allowing one seedling per square inch, this bed should give fifty-seven thousand six hundred seedlings, over half of which would be lost in weeding, and from damping off and other causes. In clayey soil after a heavy rain with bright sun following, the soil would bake and nothing could be done. If a drought should follow under these conditions, as it generally does, the soil could not be loosened artificially. In drill planting the baking of the soil can be remedied, and the initial cost of a bed 100 feet by 4 feet is seven dollars and forty cents. There would also be from fifteen to twenty thousand plants with a greater likelihood of surviving. For this illustration two dollars are allowed as the cost of white pine seed per pound, using one and eight-tenths pounds per hundred feet broadcast and eight-tenths of a pound in drills. Of course drill sowing will increase the bed surface needed, but not necessarily increase the cost of working the nursery. More beds could be weeded per day; the time gained could be applied to cultivation, and in the end labor would be saved, more thrifty and vigorous seedlings would be produced suitable for planting both in brush and cleared land, and be more satisfactory to the nurseryman who raises them.

FOREST PROTECTION.

WILLIAM L. BYERS, *Forester.*

In considering forest management, among the first things should be the establishment of an efficient protection from fire, insects, and atmospheric influences. The most important of these in our case is protection from fire. Any reason for an economic forest policy implies forest protection as the first step to be taken. The object of forestry would be defeated without protection. The planting and tending of forests are useless and a direct loss without protection. The management of a reserve will otherwise certainly prove a failure. It is possible to do lumbering on only a few portions of the different reserves at this time; but if these lands be protected from fire for a period of from twenty-five to forty years, we will then be able to cut a crop of timber from the greater portion of the reserves. The first protective measure should be the demarkation of the reserve boundaries. This survey should be done by competent surveyors. In this manner all disputes as to ownership of land will be settled. Without a survey some people will advance claims as owners of land, and thus have an excuse for trespass upon State forests. In the survey of land, nothing but stone corners should be made wherever possible, as they are not so easily destroyed as posts and trees.

The next step should be the making of a good system of roads, trails, and fire lanes, which should completely cover the reserve. They will furnish safe and effective places from which to fight fire, and they will also make the reserve accessible in case of fire. If it is possible, a good system of roads and trails should be made in preference to the making of fire lanes. Fire lanes should be made only where the grade is to heavy for a road and where it is necessary for one or the other to be used.

There should be an efficient force of rangers, about one for every 5,000 acres of land, and in some cases, one for 3,000 acres, and, during fire season, there should be appionted wherever it is found necessary an assistant ranger. These rangers should be trustworthy and not be appointed for political reasons. They should be required to learn their districts, all roads, trails, streams, and note any improvements that may be needed. They should patrol their districts thoroughly, and learn the needs and habits of the people who frequent their ranges. There should be a tower on every reserve, located on the highest point, from which may be had a view over most of the reserve.

During fire season there should be one man in this tower at all times. He should be provided with a good pair of field glasses, a complete map of the reserve, showing the roads and streams, and should also have telephone connection with the officer in charge of the reserve, or the nearest ranger. There should be placed on the reserve at different points, small tool houses or chests, fitted with a lock and keys, and each man empoyed on the reserve should have a key. These chests should contain shovels, rakes, picks, and one or two torches for use in back-firing. One of these outfits would not cost over ten dollars. They should be placed along roads, so as to be easily accessible in case of necessity.

With a private individual, forest protection is a question of profit and loss; but with the State, whose purpose in obtaining this land is to perpetuate the forest supplies and preserve the water supply of the State, it is its duty to protect, even if it does not pay. By affording protection, the land will bring the results for which it was bought. It pays to protect forested land in Germany, and there is no reason why it will not pay to do so in this country. Protection from fire would be greatly benefitted by having the law of June 12, 1907, P. L. 527, apply to all timber lands.

In case of attacks by insects, one way in which they may be stopped is by introducing into the forest insectivorous birds. Trap trees may also be resorted to. It is seldom that insects will attack healthy trees. Therefore, having a healthy stand of trees, is, in most cases, a protection against insects. Against atmospheric influences, a change of species will in some cases stop wind-falls. The attention of campers should be called to the loss that results from forest fires, often caused by carelessness. It is necessary to educate the people so that they will be more careful with the use of fire in the forest. The slashing of cut-over lands should be burned at a season of the year when there is no danger from fire being communicated to surrounding forests. In the planting of old fields, it would be well to leave an open strip around the planting area, to be kept free of all inflammable material as a protection to the young seedlings from fire. Seedling transplants should be carefully watched for any attack by insects. From November, 1903, until March, 1908, or a period of 52 months, the cost of protecting the Bedford county reserve, consisting of about 9,000 acres, outside of the regular ranger's salary, was $374.48, $7.20 per month, or $0.0096 per acre per year. This includes the opening of fire lanes, the repair of a road a distance of three miles, and the employing of an assistant ranger during several of the fire seasons, and a surveyor for a few days.

NECESSITY FOR ADVANCING IMPROVEMENT WORK.

ROBERT G. CONKLIN, *Forester.*

The lands which the State owns are commonly called forest lands, but this is a comprehensive term. These lands may be divided, according to the character of growth, into six types, as follows:

Type A. *Mature Growth Areas.* Lands on which there is a growth to maturity, which will only depreciate in value by being allowed to stand.

Type B. *Normally Stocked Areas.* These are the lands which contain an average stock of young growth, being neither greatly over-stocked nor greatly under-stocked. This does not mean that they contain a normal growing stock.

Type C. *Over-stocked Areas.* These are the lands on which there is a good young growth of various species, but which stands too thick for proper growth. There may be a few cases of lands which are over-stocked with old growth, but they are few.

Type D. *Under-stocked Areas.* These are the lands on which there are not sufficient trees to form a forest canopy to protect the soil. On these areas there is very often considerable young growth of little value.

Type E. *Barrens.* These are not lands entirely without growth, as the name might indicate, but are lands which contain nothing more valuable than scrub-oak or fire-cherry. Hundreds of acres of this type of land are to be found in all parts of the State, and Pike county has a large area.

Type F. *Open Fields.* This, perhaps, needs no explanation, as they are just what their name implies. They are found on almost all of the reserves, but not in large areas.

This classification is not intended to be taken as a standard, but is intended merely as a rough classification for the purpose of this paper.

To give here a lengthy picture of the conditions existing in many parts of the State where fire has followed the lumber man, and only the stumps are left, is not necessary. We have all seen them and know what they are. Likewise we are familiar with the other types of land as given above, so a picture of them is not necessary.

We are given the work of making something of these lands. What we make out of them depends on the success we have in keeping out fires, and the improvement work put upon them.

This improvement work is mainly directed toward the correction of bad conditions, as stated in the types above, and may be said to consist of three operations, improvement cuttings, thinnings, and plantation work.

There is a distinction to be made between improvement cuttings and thinnings.

An improvement cutting is the first cutting made on a new area, with the purpose of bringing the growing stock as near the normal as possible, by removing dead, dying, and valueless species. *A thinning* is one of the cuttings made at regular intervals during a rotation, to reduce the growing stock to the normal. This distinction is used by the Federal Forest Service, and has been sanctioned by various authorities.

While our systems of protection embrace all of the lands we own, our improvement work is directed mainly towards the lands of types C and F, the over-stocked areas, and the open fields. In one case, on the Mont Alto Division of the South Mountain reserve, a tract which came under type A has been improved, but this is the only one of that class.

All of our lands demand more or less immediate attention, and I shall attempt to show why this attention should be given them; that is, show the necessity for advancing improvement work on the reserves.

First, we will consider it from the point of silvicultural reason. This reason applies more closely to lands of the over-stocked type than to any of the others. On these areas we find conditions which are the very reverse of good. The trees are crowded together, their boles are thin and spindly, and their crowns small and sparse.

Every quality of soil has a definite amount of nourishment available for plant use, and no more. Consequently when an area contains more trees than the soil contains nourishment to sustain, we find the conditions stated above. And this is what we find on lands of type C. There is insufficient nourishment for the stock, consequently the trees are retarded in their development and what growth there is, is generally of an inferior quality. These conditions are opposed to the best silvicultural development standards, and the longer they are allowed to remain so, the worse they will become. Now, go in there, remove the smaller and less valuable trees, and make available for the remaining stock the food which the removed trees used, and also the space for the spreading of their crowns. The remaining stock will advance rapidly, their crowns will spread out, and the diameter and height increment will increase. If enough trees are removed, the boles of the small spindly trees will increase more rapidly in diameter. If carrying out this improvement work means the advantages here

stated, does not neglect of the work mean a corresponding loss? Every year the work is omitted means a year lost to the trees' development, and in the aggregate this is a great loss.

On the Mont Alto division of the South Mountain reserve, on the point of Pine Mountain, along the public road to the Consumptive Camp, there was made in the year 1904, an improvement cutting, covering a number of acres. The worthless and stunted trees were removed, cut into cord wood, and sold. Here we can see, in one phase, the silvicultural value of the work. Before this work was done there were a few white pine seedlings growing here. Their tops were of a sickly yellowish color, and the seedlings were not making their best growth. Since the cutting was made there is the greatest difference to be seen in these seedlings. Their tops are of a deep rich green, and they are growing very fast. And in addition, there are great numbers of all kinds of young seedlings coming on. These will soon fill the blanks left by the removal of the worthless and dead trees. To obtain the best returns and development on all these lands, they must be managed so as to bring the growing stock as near normal as may be done, and as soon as possible.

The economic and financial side of this question is somewhat closely allied with the silvicultural side, for on the attainment of the best silvicultural development depends the highest financial return. While the carrying on of this work now does not mean large financial return at the present time, there are economic reasons why it should be done at once.

One thing is sure: The carrying on of this work at present does not mean any increase in the cost of the work, but may mean a somewhat lower rate. The cutting and removal of small soft saplings is certainly cheaper than the removal of the larger harder poles, not only in the cutting but in the handling. Does not forest economy demand that work of this kind be done when it can be done with the least cost?

And then there is another phase. The removal of the stunted, diseased, and dying valueless trees means there is so much more nourishment available for the remaining trees. As stated above, this produces higher development both as to wood quality and quantity. Better development means greater financial return.

Take an area capable of producing two cords per acre per annum under the over-stocked conditions. The improvement of these lands will mean an increase of perhaps one cord per acre per year bringing the total up to three cords per acre per year. At the common rate for cord wood this means an increase in value of $2.00 per acre per year. Should this work be put off for 10 years, it would mean a loss of 10 cords per acre at a value of about $20.00 in the value of the woods. Will it not be better, financially, to do this work now when the cost is the lowest, and secure this increase in value?

Another economic reason for doing this work now is to prevent loss by reason of waste in the woods. This applies to two classes of lands, those on which there is no stock of any value or of very small value, and those on which there is a great quantity of timber, the removal of which is a help, both by benefitting the remainder and by a financial return.

Take those referred to first, which includes the open fields and the barrens. In the open fields and barrens we have a dead investment, *i. e.,* one which calls for expense, protection and taxes, but which produces no return. This is wasteful, but it cannot be remedied at once. In three counties, Adams, Franklin, and Huntingdon, we have taken steps to put these lands into the paying class. White pine and other seedlings have been planted on the open fields.

And again in the open fields we have another source of waste. On these places we encounter two great soil enemies, leaching and erosion. Rains beat down on the soil and what goes into the ground takes with it some of the soil fertility while that which runs off carries away the soil bodily. Trees are natural soil fixers and hence they are the things to use here.

So for every year these lands, the open fields and barrens, are left in their present state there is a loss through lack of return and payment of expenses, through loss of soil and soil fertility.

On hundreds of acres of State land, the ground is occupied by a mixture of valuable and valueless species. By the removal of the latter so much greater area will be available for the use of the former. On the Mont Alto Division on the top of the mountain, along the public road to the Sanatorium, there was a stand in which oaks of no value and aspen occupied much of the area. Under the direction of the forester, during the fall of 1904, these were removed, and now a good growth of oaks and chestnut is occupying the ground and filling the blanks.

As for the second mentioned lands, where the logs and tops are strewn around and dead and dying standing trees occupy the ground, the question has three phases. First, unless this stuff is utilized immediately it will be impossible to derive from it any revenue, for it will become rotten and worm eaten. Second, this stuff is occupying ground which should be supporting good young growth. Third, areas like this are fire traps. Fire starts easily here and once started burns fiercely, destroying everything in its path.

So improving areas like this will do three things; produce a definite financial return, give the young growth a chance, and destroy fire traps. On the Mont Alto division, Pondtown tract, there were 40 or 50 acres of dead poles. It had been a growth of oak and chestnut of 4 to 10 inches in diameter, but fire killed it all. This stuff was

cut by the people of the vicinity, and hauled away. The Department received $0.50 per cord on the stump. Here the young sprouts are again taking hold and making a good start.

On lands of type A, where we have the mature and over-mature stuff, the question of the immediate advancement of this work hinges on the fact that these lands have ceased to increase in value by reason of any wood increment; but are either at a standstill or are going back. Just as soon as stock ceases to increase in value it is ripe for cutting, and where it has started to go back or depreciate in value it should be cut at once. Why not reap the crop while it will give us the highest returns, and give the second growth the advantage of that much start?

Again we have to go to the Mont Alto division for an example of this phase. On the Guilford tract near Pondtown there was a mature stand of oak and chestnut. Under the supervision of a forester this was cut off. It yielded the State about $1,400.00 clear profit. And here the sprouts are already starting, although this was cut over only during the spring and summer of 1907.

On the Caledonia division of the same reserve there are several stands which are about ready for cutting, and should be cut within the next few years. But so long as a stand is not really going back, it will perhaps be better to expend all our efforts upon those areas which are in greater need of improvement.

The financial side has this to be said in its favor, that by deriving a return from the lands we will be meeting the popular demand for some visible sign of what this business will amount to.

There is still another phase to this subject, which, while it may not appeal very strongly to the forester, has a decided hold on the minds of the people. This is the aesthetic value of the forests. One of the popular ideas of forestry is that we are working toward the creation and maintenance of forests as parks and outing places for the people. As we are to a greater or less extent working for the interests of the people, we should recognize this public demand so far as is compatible with the best interests of the forest.

When we come to look at the two extremes of forest land, and scrub oak barrens of Pike county or the stripped hillsides of Tioga county on one hand; and the cathedral pines of Mont Alto or the hard-wood grove on the road between Caledonia and the Sanatorium on the other, we will all agree that there is a great deal of good in the idea of developing the aesthetic beauty of the forests. There is a necessity at this time to get the work before the public. We must show that we are doing something real. Where will we find anything so likely to attract attention as the fact that an agency has been at work removing some of the eye-sores which exist along the public roads? A well regulated forest, without a tangle of old logs and

greenbriars littering the floor, means more to the people than all the explanation about silvicultural development and economic use of the soil, and they will appreciate any effort we may make along this line.

Almost all of the operations so far carried out have been along the routes of public travel. Here the people see and appreciate the fact that something is being done. So with the necessity of getting the public's attention. Since the people will appreciate the development of natural beauty, do you not think this another reason for the advancement of improvement work?

And now will this work pay? There is an idea somewhat prevalent among the people that the real object of improvement work is the immediate return to be derived from the sale of material. That this idea is erroneous we all know. The real value of improvement work lies in the increased value of the remaining stock. In many cases improvement work can be made to pay for itself and in some cases to yield a profit. But where the need for advancing the work is great, it would be better to do it at a small immediate loss than to neglect it and lose the increase in value of the stock. As for plantation work it will more than pay for itself in the future.

Most of the states are taking up work in forestry, Pennsylvania perhaps in the lead. She has gone into it deeper and more business like than any of the others. There is still a lot of criticism and abuse by people who do not know anything of the subject.

On our work will depend the disarming of these critics and their change to friendliness. As before stated, most of the criticism is on the ground that there is nothing of any value resulting from the work. By advancing improvement work as rapidly as possible and showing by actual results that there is something being done, we will make and hold them friends.

While we all concede that improvement work is a necessity, we must not forget the need for another phase of the work, perhaps as important. I refer to protection. All improvement will count for nothing if we are to have it destroyed by fire. Every year thousands of acres are burned over. What will it benefit us if our work is to be obliterated within a year or two? While paying, therefore, all possible attention to the work of improving the lands, let us see that lands and work are properly protected.

A SYSTEM OF FOREST BOOK-KEEPING.

ROBERT G. CONKLIN, *Forester.*

In working out a system of book-keeping for a reserve, there is one thought to be kept constantly before you, simplicity. Where a forester has to do his own book-keeping, a complicated system will increase his work two-fold. Book-keeping will generally be done in the evenings after the day's reserve work is over, and a complicated system will needlessly increase his labors.

The conditions under which we must work are, perhaps, unlike any others where book-keeping is done. Each reserve is like a department in a big manufacturing concern, and yet different; for while a department of manufacturing has only one operation to deal with, here we have as many different operations as there are compartments or cutting areas in the reservation.

All our expenses are returned to a central office, and paid by moneys from there. Likewise all receipts go into the same office, but are paid from there into a different fund.

To work out a system of book-keeping which will be simple, yet applicable to the conditions under which we must work, will take time and experience. I am not an expert accountant, nor have I had an extensive experience in book-keeping. Consequently I do not set up any recommendations I may make as the best, but simply as recommendations.

In modern business practice, the card index system is rapidly taking an important part. Business forms of various kinds simplify matters, and system plays an important part.

On the Mont Alto division, there is in use a system of book-keeping which combines the use of books, blank forms, and cards under a somewhat elaborate system. This system of book-keeping is good and I thoroughly approve it, as it is clear and practical. There the conditions differ very much from the conditions on the reserves generally, for there are school accounts and reserve accounts which intermingle somewhat. But it is too complicated and elaborate for use on a reserve where conditions are simpler and the forester has to do his own book-keeping.

At Mont Alto they use the day-book, cash book, and ledger; a card index system, and a system of time-sheets and reports. The system of time-sheets and reports is good, and as it is, perhaps, as simple

and effective as could be devised, it will be suitable for use on all reserves; but as for the books and cards, I believe them too cumbrous and require too much work to be valuable on reserves.

At the Asaph Nursery I tried to devise a system, which, while simple, would fill all requirements. Of course, here conditions were much different from those found on a reserve, for we had only one operation to take care of. Other operations such as surveys and road work, were simply charged to the Department. Here only two books were used in connection with the system of time sheets, a journal and a ledger. In the journal everything was charged as used, except labor, which was entered only at the end of each week or the last day of the month. In the ledger the work was divided into such accounts as operation, protection, grounds and buildings, equipment, etc. The real stock account was headed "Pennsylvania Department of Forestry," and all goods and checks received were credited to this account. All expenditures made for outside reserve work, but paid from the nursery, were debited to this account. At the end of the season the inventories of equipment, protection, and seedlings, were debited to this account and the account balanced. This system is faulty without a doubt, but having had no previous experience and needing it immediately it was the best that could be evolved at the time.

When I submitted this question for the Convention I had not expected to be assigned it as a subject, but had expected to get some information from the Department as to their wishes in this matter. So far as I know there has never been any statement made to the foresters as to how they wanted the accounts kept. Are we to keep a simple record of expenses and receipts, and allow the profits and losses to be determined for each reserve as a whole, or by compartments, at the Department? Or are we to keep a more elaborate system of accounts so that we can determine at a glance whether the operations on each compartment, or on the reserve as a whole, are being carried on at a profit or a loss? So far, I have been going on the supposition that the second case is the one under which we are working.

There is one thing which should be kept in mind though, and that is that all operations, expenses, and receipts, for each compartment should be kept separate. Whether this will mean simply a separate account in the ledger or a separate ledger for each compartment, depends on the viewpoint. Suppose we use one ledger. In this ledger each compartment or operation should have a separate account, and different accounts such as pole wood, lumber, shingle wood, etc., should be kept.

The use of a loose leaf ledger will, perhaps, be better than this for at the end of each year the leaves of the various compartments could be separated and filed, each under its own head.

By keeping these separate accounts or books, each compartment will be made a separate investment.

But this is, perhaps, too elaborate, for it will require that each compartment have its own rangers; that the forester and his assistant will have to keep record of their time so as to charge it to the compartments they have worked on; and that will mean perhaps too many accounts.*

I believe the best way would be to have someone whose business it is to solve such problems work out a simple but comprehensive system of book-keeping for reserve use.

I do have a few recommendations to make:

First: Let the system be as simple and comprehensive as possible. Nothing causes so much trouble and worry as mistakes in book-keeping, due to ignorance of the system used.

Second: Use wherever possible blank forms which indicate clearly what is required.

Third: Keep the accounts of each range or compartment separate, so that a glance will suffice to show whether the operations have been carried on at a loss or gain.

Fourth: Keep separate accounts, if possible, for the various classes of products.

Fifth: Keep a general account which will show the status of the business of the entire reserve at once.

There is still another point which I wish to place before this convention, and that is the value of an accurate and minute record of the daily progress of the work on each reserve. The use of a separate record book for each compartment would very likely be much better, but perhaps it would entail too much work. The best way may be to use what may be called a Year Book. Each book would be divided into the same number of parts as there are compartments in the reserve and the complete record of the operations on the compartments entered in the part of the book allotted to it. By the use of a separate leaf book waste in paper could be eliminated, and the sheets used could be removed from the cover at the end of the year and filed under their proper head. This would not only be cheap but would reduce bulkiness in the record.

But whatever is done, one thing must be remembered: A full and complete record of all transactions both in book-keeping and records, should be kept on each reserve. The sooner a practical system is worked out and put into use, the better it will be for all parties and interests concerned.

*At present the conditions on each reserve differ from those on every other. With the instruction in forest book-keeping received at the Academy, each forester is expected to keep the best accounts under the circumstances, determining for himself largely what are his needs. After work on new reserves has been reduced to a system, uniform accounts will be required.
Commissioner of Forestry.

FOREST NURSERIES AND NURSERY WORK.

W. H. KRAFT, *Forester.*

The ever increasing demand for desirable timber trees brings to our mind the mission of Forest Nurseries, which is to supply seedlings of the most desirable species, in large quantities, at a nominal cost, to be used in reforesting waste and burned over lands.

These forest nurseries are being established by individuals, railroad, and lumber companies, state and national governments, for their own use, and professional nurseymen for the sale of desirable seedlings of the timber species for forest planting. This method is used to overcome the uncertain and slow natural regeneration of our most desirable species of timber trees.

The forest nurseries I will deal with mostly are the ones now established and operated under the direction of the Pennsylvania Forest Reservation Commission.

These nurseries, of which there are three principal ones at the present time are so situated in different parts of the State, that seedlings from them may be supplied to the different reserves without long or expensive shipment.

The one situated at Mont Alto, Franklin county, was established in the spring of 1902, and with which most of you are familiar from our forestry reports. One is situate at Greenwood, Huntingdon county, established in the fall of 1906. The other is situate near Asaph, Tioga county, established in the spring of 1907. Of the nursery at Greenwood, of which I now have charge, I wish to state as follows:

This nursery contains about two and one-half acres, is situate on a northwest slope in an old field, which was under cultivation for farm crops until the nursery was established thereon. The site is an ideal one for the raising of coniferous seedlings. The soil is of a shaly character and is protected on the west by a strip of woodland, which breaks the force of the prevailing westerly winds.

In the fall of 1906, Forester W. L. Byers, had this site plowed, manured, and cleared of stones. He also prepared the soil and planted in nursery rows two feet apart, one and one-half bushels of white oak acorns, one-quarter bushel of pignut hickory, one pound of black locust, which he gathered in the locality nearby. He also prepared twenty nine seed beds 4 x 70 feet, for the planting of white pine seed the following spring. In the spring of 1907, I was placed in charge of this nursery, but owing to the unfavorable weather and a late season I was unable to advance the work begun the fall before,

until the last week in April. With what help that could be procured at that time, the seed beds were prepared and there were planted 75 lbs. of white pine in drills six inches apart, sowing a few beds broadcast as an experiment only; 5 lbs. Scotch pine, 5 lbs. European larch, 10 lbs. white ash, 3 lbs. cucumber, 40 lbs. shellbark hickory, 40 lbs. bitternut hickory, all sowed in drills six inches apart.

The seed beds are raised about four inches above the path, are 4 x 70 feet, and run east and west giving them the benefit of the shifting light throughout the day. All the seeds above mentioned were procured by the Commissioner from professional seedsmen, and were sent me too late to make test for germination. Owing to the ground remaining cold and damp until in June, the germination of all the seeds was retarded, none making any appearance until late in June and in July. The conifers showed almost a perfect germination, also the white ash. The cucumber was evidently worthless, as none of it germinated. The hickories were so badly ravished by the pine squirrels that very few were left to germinate. At the present time I am unable to give the exact number of seedlings in the nursery as no inventory was taken in the fall of 1907 owing to insufficient help. Taking an inventory in the fall requires another in the spring to account for loss by severe winter or heavy spring frosts. With proper appliances, such as screens to shade the beds, and an available water supply in case of drought for watering beds and seedlings, I think this nursery when fairly started will produce from five to eight hundred thousand seedlings a year. This will depend largely on the age of the seedling to be used in the planting operations, as more two year old seedlings can be procured than those transplanted. The age at which the seedlings may be used will depend largely on the location of the plantation; two year old seedlings being satisfactory for plantations in old fields and ground which are easily prepared for planting; but where there is a heavy growth of brush or briars, four year old transplants are more advisable. The additional cost of these transplants will be about $2.50 per thousand.

Other work done at Greenwood in connection with the nursery was the making of a black walnut plantation in an old field containing about four and one-half acres. This was planted in the fall of 1906 by Forester Byers, about 30 bushels of walnuts being used and planted four by four feet. The nuts were greatly destroyed by the squirrels during the winter. What seed germinated made a thrifty growth, in the fall of 1907 ranging from six to twelve inches in height. The blanks were filled in in the fall of 1907 with nuts, nineteen bushels being used for the purpose.

The year 1907 having been a fairly good white pine seed year, one hundred and fourteen bushels of white pine cones were gathered by

boys of this locality, for which I paid thirty cents per bushel. While these cones when dried did not turn out as large a quantity of seed per bushel as some foresters estimate, from 114 bushels of cones I cleaned 77 lbs. of seed, ready for planting, averaging one pound of seed to not quite every bushel and a half of cones. Counting total cost of building screens on which to dry the cones, trays to catch the seed, and cost of cones, the price per pound was about $0.59. Allowing that these screens and trays will last five years instead of one, the cost would be reduced nearly one third.

The crop of other desirable seeds in this region, excepting walnuts, was a total failure in the year 1907.

The cost of labor in our nurseries and upon reserves could be reduced considerably, I think, if the question of hiring labor could be better adjusted than at present. Men are now employed only during the busy season of the year. This is unsatisfactory, as a man acquanted with the character of the work will do considerably more than one who is not. Therefore, steady, industrious men, who are quick to learn the work, are unwilling to be employed at a low wage for a few months only in the year. When men can obtain work at a higher wage even if it require their being away from home a great part of the time, they will seek such work. On account of the increased cost of living a man is unable to provide for a family on an average of eight months' work a year with 16 to 18 days per month, working only 145 to 150 days per year out of a possible 300 working days. Many of these men could be retained by giving them every possible day's work the weather permits. This could be done in opening necessary fire lanes, repairing roads, making improvement cuttings, and doing other work. Thus by employing a regular force, considerable more work could be done on the reserve with a smaller force than in the present way, and it would keep desirable labor in and about the reserve.

DIVIDING THE RESERVES.

LEWIS E. STALEY, *Forester.*

The subject of dividing the reserves into ranges, blocks, compartments, and sub-compartments is, without doubt, one which requires much forethought and a careful study of actual conditions found in the forest. Not alone must we be well acquainted with present conditions, but past conditions should be known in so far as they are

of value in the future management of the area to be treated. If the reserves were to be divided into their several divisions at short intervals, say every five or ten years, the subject would be quite different; but since when once divided they are divided for all time excepting for small changes, we should have nothing short of a complete past and present record. A division of the forest depends largely upon the kind of management to which the reserve will be subjected: that is, do the conditions of the forest require an intensive management, or are they such that warrant only an extensive management?

These conditions can only be actually known by a complete survey. Until recently, the boundaries of lands owned by the Commonwealth were not well located. The method of this complete survey depends largely on the value of the forest as represented by the returns. Generally speaking, all main lines such as boundaries, all public roads, all streams, meadows, farms, and anything else that may be of a permanent nature should be surveyed and accurately marked. As these data, so procured, will form all skeleton maps for future management of the entire area, they should be carried out in the minutest detail and to the greatest degree of accuracy. Nothing should be left undone that might be of value in determining what lines to follow for the future.

Considering conditions as we have them on the reserves today, each reserve may be well divided under the following general heads, viz:

1st. Ranges,
2nd. Ranges into Blocks,
3rd. Blocks into Compartments,
4th. Compartments into sub-compartments.

By a range is understood such an area as may be conveniently covered by one man called a ranger. In the division of a reserve of twenty thousand acres or more there are two conditions which must be considered: The situation and the intensity of management.

In the case of scattered blocks, or in hilly country such as we have to deal with, the ranges may comprise a smaller area than if the blocks are consolidated or situate on level ground. In forests which yield a small return, as is the case with ours at present, the ranges may be large. Where the returns are large it pays to make the ranges small in order to facilitate a more intense management of the area. The boundaries of ranges should in all cases conform to some very conspicuous topographical features. If for some reason no well defined ridge can be had, some permanent fixture as a public road may be well suited to mark the boundary. In rare instances either of these may make the range too small or too large. Then the only method would be to designate the boundary by an opened line. It

might happen that this line between the ranges may be well located for a fire lane and under these conditions would serve for both boundary line and fire protection.

Each range may again be divided into smaller divisions called blocks. These may or may not be of value other than reducing the area into workable sizes. If it should be convenient to divide the range into blocks by natural boundaries, very good; if not, it may be no detriment to the range. On large ranges this division into blocks may aid in designating any particular part of the range.

Again blocks are divided into compartments. Compartments are sometimes called the sylvicultural unit because they form the unit of work. The whole of this division is effected by using in addition to the outer boundary lines, interior natural lines, as creeks and smaller water courses; or some geographic unit, as a basin formed by two hills, the entire flat on top of a hill, or, in some cases, from the top of a hill to a ravine.

The boundaries of compartments may be made to coincide with the conditions of growth. For instance, a compartment may be composed of a pure stand of pine, of chestnut, or of some other species. Age conditions and, in some cases, public roads may conveniently form compartment boundaries; but it is best to have some geographical feature form boundaries when convenient. This will do away with the possibility of the lines ever being changed,—something that must be guarded against.

The size of the compartments as well as of other divisions depends on the intensity of management, the extent of danger from fire, and the size of the former division.

When there is necessity for dividing compartments these divisions are known as sub-compartments. Such sub-divisions should be avoided as much as possible because of the additional expense incurred in their management. When a compartment is composed of an area of large trees and an area of small trees each area may be called a sub-compartment, but as soon as there areas can be thrown together without much distinction of age classes it should be worked as one compartment.

Among the advantages to be gained by dividing the reserves are the following:

Each ranger knows exactly the area which he is to cover or patrol.

In case of operations a record can be kept and the exact location designated.

The best management can be effected by striving toward the ideal forest, and this is most easily accomplished by a systematic division of the forest into workable units.

A REGULARLY EMPLOYED LABOR FORCE.

LEWIS E. STALEY, *Forester.*

The necessity of a regular force of laborers is becoming more apparent as forestry advances. Not alone in forestry has this necessity manifested itself, but in all business operations one of the first things to be considered is men,—a regular force of laborers—men that can be depended upon at all times.

How can good results be accomplished if the men that are doing the work are careless and unconcerned? If good results are to be accomplished in forestry as in any other business, the men must be more or less trained for the work they are to do. They must have practice, and this can only be obtained by having them employed regularly.

Some one may make the statement that men are plentiful, that men can be picked up at any time. Of course to a very great extent this is true at present, but is it not also true that such men as are available at any time of the year, are in many cases men that cannot be depended upon? You have them one day and the next day they are gone. They have some excuse, your work does not suit them, or perhaps the wages are too little.

Why does the State train its own foresters? It is simply because the Commission has found it to be the most advantageous way in which to fit men for the work. Men who are trained along certain lines can undoubtedly work to better advantage than those who may be picked up at any time. The same rule may be applied to laborers. They may not be so well adapted to the work in the beginning, but in most cases, woodsmen, in particular, can in short time do the work as it must be done.

A very good example of a regularly employed force of laborers is the section gang of a railroad. These companies have a certain amount of work which must be done just as the forester has on each reserve. Could not these railroad companies depend on picking up men as the occasion demanded? Is it not true that the "section" labor is almost at an end as soon as the rough weather sets in, and yet the majority of the gang are retained the entire year? There is something at all times to employ them if it is only to make a surplus of handles for their tools. The retaining of these men, in my opinion, is simply because the railroad companies have found it to be to their

advantage to stick closely to their experienced workmen. The companies have so distributed their labor over the entire year that men are needed at all times.

The same idea with reference to distributing labor over the entire year could be used to advantage in forestry. While it is true there is certain forestry work, such as nursery work and fire patrol, which requires prompt action, there is a great deal of labor of other kinds which can be distributed over the greater part of the year just as it must be done when laborers cannot be had.

In forestry nearly every kind of labor must be done with the greatest care. Ordinary laborers in many cases are not capable of accomplishing the best results. For instance, take a man into the forest to do improvement work who has never swung an axe more than to split wood on his own wood pile; while he may be one of the best of workmen, he knows nothing about handling an axe, nothing about felling trees, cannot cut stumps as they should be cut, and in general knows little about the woods and the requirements of the work. But he is willing and always ready to do what is asked of him in his way of working. This man will soon realize how improvement work must be done, and in a short time can do fairly well. If men of this kind could be employed regularly, they undoubtedly would work to better advantage than if picked up at leisure.

Not alone in improvement work would a regularly employed force of laborers be a great advantage, but on reserves where nurseries have been established they could be available for the rush season of the year. In the early spring when nursery work must be pushed, when most planting must be done, and, as a rule when men are scarce, these regular men could be used to great advantage. By experience they would soon learn how nursery work must be done and in case of the absence of the forester in charge they could go ahead and cause no delay which so often is the case where the forester has charge of work other than that of the nursery.

Again in the spring and fall fire seasons there is always necessity for placing extra fire wardens on most of the reserves. The ranger in most cases has to patrol at least from five to seven thousand acres of mountainous country which, of course, is entirely too great. He may be in one region and fire be burning in another for several hours before he discovers it. Instead of taking some laborer not suited to the position, as in many cases the forester is compelled to do, one of these regular men could be available for each range at any time; and in case of rain or damp weather there is always plenty of other work for them, such as opening roads, fire lanes, repainting boundary lines, and numerous other small jobs that otherwise must be done.

The salary of these men would necessarily vary according to the standard of the locality. In localities where lumbering is carried on

and where manufacturing establishments are near at hand a larger salary would be required. Under conditions as we have them on the Mont Alto reserve, $30.00 per month would be a reasonable salary to begin, with the chance of a raise as proficiency in the work is reached. These men would soon realize the importance of the work and once being interested they would undoubtedly work to the advantage of the State.

Next, the value of these men could hardly be estimated in case of fire. While this may not be true on the Mont Alto reserve where the Academy students are ready in a few minutes to respond to any fire call, yet on reserves other than this one, and where men are scarce, truly great results could be accomplished with these regular men. They would be ready at any time and cause no delay in getting to the fire, something that may aid in checking disastrous fires.

As a summary, where nurseries have been established on the reserves, the regularly employed force of men could greatly aid in getting the work through. After the rush season of nursery work they could be used to advantage in improvement cutting, thinnings, opening fire lanes and trails, and in any surveying that might be done; and last but not least they would be at all times ready for fire service which, in case of scarcity of men, would alone more than repay the salaries paid them by the State.

IMPROVEMENT OF THE RANGER SERVICE.

B. FRANK HEINTZLEMAN, *Forester.*

As the State forest reserves are placed in charge of foresters the more intense system under which they are managed demands that some improvements be made in the ranger service to aid in putting the system into effect. The ranger has an important part to perform in the management of the State reserves.

The first thing to discuss when considering improvements along this line is the duties of rangers. When a forester has charge of a large reserve, 20,000 or 25,000 acres, upon which much work has to be done, it is not possible for him to look after the details. He should plan and direct how it is to be done. The ranger should then be able to take charge of what does not require direct supervision of the forester, and carry it forward according to orders. Such work includes improvement cuttings, building roads, cutting fire lanes, burning brush, and the like.

For all work to be done on the respective ranges, they should under direction of the forester, employ the help needed and keep the time sheets. They should have the right to dispose of fire-killed timber in the way prescribed by the forester. Some rangers, especially those on reserves which are not yet supplied with foresters, seem to think that patroling is the one thing required of them; that if a certain amount of time is spent riding or walking over the reserve they have done their full duty. Instead of patroling being their whole duty it should be but a small part of it. The other part should consist in keeping roads in a passable condition, in opening the trails where necessary to make any part of the reserve accessible, in keeping springs well cleaned and paths opened leading to them, and in doing any other work directed by the Department.

The rangers should traverse that part of the reserve boundary along their ranges, at least once a month. Under the present method used by some rangers, of patroling only the roads nearest the lines, adjoining owners might cut over them for a long while and the rangers not be aware of it. Rangers should be encouraged to operate small nurseries in connection with their work and should be supplied with the necessary material for planting and instructions concerning the raising of seedlings. There are many half days when a ranger would otherwise be doing nothing that his time might profitably be spent in a nursery. The seedlings raised could be used to plant the many small blanks found in almost all forests.

All rangers should give their entire time to work on the reserves, and should not be engaged in an additional occupation, as farming or lumbering. No one can farm and care for a large area of forest land at the same time. He will either have to slight one or the other, and in most cases it will be the forest. Foresters should try to get their rangers interested in the work. Until the men are interested it will always be somewhat retarded and of a poor quality. Probably one of the best ways to arouse interest is for the forester to explain to them his plans of work for the coming month or the coming year. Explain why such work is necessary and ask their views concerning the manner of performing it. State to them the financial results of past operations. Men like to know what returns their labor is yielding.

The placing of rangers in charge of men employed on the reserves should help stimulate interest, for a man is always interested in a piece of work if he knows he is the one held responsible for the manner in which it is done. Copies of all reports, bulletins and circulars issued by the Department should be forwarded to them, so that they can gain a clear idea of exactly what the State is doing and wishes to do on its reserves.

At the present time some men hold positions as forest rangers who who are scarcely able to read and write. As long as the duties of

rangers include only patroling and watching, these men do very well; but as the reserves are now beginning to be managed more intensely, a ranger should be a man of at least sufficient intelligence to be able to make reports on work done, to keep the time of laborers, and conduct the sale of wood.

Again, some of the present rangers are too old to be of much service to the Department. These men were often appointed when the land was purchased, no doubt because of their familiarity with the lines of the tracts. In this, it is true, they are often superior to younger men, but as the boundaries of the reserves are now being carefully located by surveys and men are being put in charge of the reserves who know how to determine the position of a line when the question arises, the need of their services in this direction is diminishing yearly. Because of their age they do not spend the amount of time on the reserves that they should, and they are not able to perform well severe labor, which often has to be done under trying conditions, such as fighting fire. Therefore, if the maximum age of men appointed was about 45 years, and then only those considered who are physically able to do hard labor, the reserves would show the result of the change in a short time. When a ranger is to be appointed, other conditions being equal, a man should be chosen who lives nearest to the reserve. One living three or four miles from his reserve cannot give good service with this distance to traverse to reach his work. If dwelling houses found on the reserves are to be used as houses for rangers and their families, they should be kept in repair. If it is necessary to erect buildings for this purpose, comfortable cabins should be built as the kind of men we like to occupy them is not the kind that is satisfied with anything.

All rangers should be sworn forest officers. When a man is under oath to see that the law is obeyed there is no inclination to leave wrongs unrighted. The ranger service might be greatly improved by the payment of a salary of about $45 per month, every man receiving the same amount. Very efficient men could be secured at such a salary. Even at the present salaries which as a rule are lower, some very capable men who are often making a great deal more than the rangers, figuring on a per day basis, inquire as to the prospects of getting a position, being attracted by the regular all-the-year-round employment. Much good might be accomplished by having the rangers make out their reports according to a regular system, showing the kind of work at which they were employed each day of the month, and the number of hours per day. The latter would prevent men from spending two or three hours on the reserve and recording it as the work of a full day. They should be allowed to be absent from the reserve a definite number of days per month. If they wish to be absent more days than the required number, the permission of the forester or of the Department ought first to be obtained.

A SYSTEM OF FOREST PROTECTION.

JAMES E. McNEAL, *Forester.*

Considering the short time which Forestry has been practiced in this State, and the condition of our land at present, the primary and most essential thing with which we have to deal is the protection of forests from damaging agencies.

Dr. J. T. Rothrock, in an article printed in the 1897 Report of the Division of Forestry, has written,—

"The one central point among existing conditions is that there is no use in attempting to save what forests we have, or to restore them upon ground from which they have been removed, until a reasonable protection against fire is assured. Neither the State nor the individual can hope for success until a thorough, radical change has been effected."

Fire protection, together with protection from other damaging agencies, precedes all benefits which we can receive, either directly or indirectly from our forests, and should be dealt with accordingly We should not only fight the danger after it has made its appearance, but should take measures for the prevention of all dangers to the forests. These dangers are numerous, and may, in a way, be divided into three classes:

1. Dangers from human agencies.
2. Dangers from organic agencies.
3. Dangers from inorganic agencies.

Under the first class, or dangers from human agencies, fire is certainly the greatest and most dreaded. Its source may be in so small a thing as a match, carelessly thrown aside by a smoker, but whose damage may be almost beyond computation, depending upon the condition of the weather, the efficiency of a protective system, or the nearness of a rain.

In calculating the amount of damage done by fire to forest land, usually only the destruction of good trees is taken into consideration, but indirectly the forest expectation value is seriously affected and the productive capacity of the soil lessened. Through the agency of fire the drain on our forests has been almost beyond belief, and although there have been large areas cut over, the amount of land burned over, in many places greatly exceeds it. This may be illustrated by a case in Oregon, where, during the past fifty years, there have been nearly 1,000,000 acres more land burned over than cut over.

Another case in which fire has done inestimable damage, occurred in New Brunswick in 1825, when there occurred what is known as the Miramichi fire, which, in nine hours, destroyed a belt of forest eighty miles long and twenty-five miles wide. More than 2,500,000 acres were burned over and nearly every living thing was swept from its path, 160 persons and nearly 1,000 head of stock perished. A number of towns were destroyed and 590 buildings burned.

Fires of this type are seemingly of the past, greatly due to laws and regulations governing the burning of brush, the awakening of the people to the importance and necessity of our forests, and the good work of Federal and State authorities. In our own State, statistics show a marked decrease in loss from forest fires. In 1902 the loss was $620,573, in 1903 it was $241,240, in 1904, $135,873, and in 1905 it was reduced to $63,951, which is less than 1-9 of the loss four years before. It does not follow, however, that the loss will decrease annually, and until there is a good system of protection established, we may look for very heavy losses.

The loss due to trespass is comparatively small and may be guarded against, to a great extent, by having good ranger service, by making all boundary lines conspicuous, and by placing warning notices through the tract.

Protection from organic agencies, i. e., from insect and fungus attacks, is very difficult and entails much study and experiment. The loss by reason of this agency is not nearly so great as that by reason of fire, but we must guard against it, nevertheless. This may be accomplished to some extent, by removing all breeding places, as dead or dying trees, and slashings.

Under dangers from inorganic origin we have "wind-falls" which, although they do not occur frequently, are often accompanied by very heavy losses. On September 30th, 1896, a destructive "wind-fall" occurred in Sullivan, Wyoming, and Luzerne counties, and although there is no exact estimate of the damage done, it is probable that not less than 200,000,000 feet were destroyed, covering an area of from 10,000 to 15,000 acres. This danger may be partly overcome by using proper methods of cutting, which should always be done under direction of a forester.

In establishing an effective system of forest protection it is necessary to do away with the cause of destruction. One of the most essential things is good fire and trespass laws. Penalties should be so severe that malicious people will be afraid to violate these laws, and careless people will be more careful.

It should be the duty of rangers, from the point of forest protection, to patrol the woods in order to guard against fire and trespassers, and to keep all fire lanes, or roads and trails used as fire lanes, free from

inflammable material. They should have some knowledge of harmful insects and fungi, in order that attacks may be promptly reported to the proper authority and effective measures taken to check them.

During fire seasons, there should be men employed to patrol the woods, if there are not enough rangers to do it properly. There should be one man to not more than 5,000 acres. "Look-out" stations, with telephone connection when possible, should be built on points commanding a good view of the surrounding country. There should be a man stationed at each of these stations while there is danger of fire. With the aid of field glasses he would locate fires as nearly as possible, and report them so that men might be sent out promptly. If a system of telephone lines were established, one can readily see that help could be had soon after the fire started and in many cases could be controlled, with little damage. A system of telephone lines has been successfully operated in the state of Maine, and in 1904 reports from one telephone are said to have saved many thousands of dollars.

All lumbering contracts should obligate the careful burning of slashing, whether on state land or private land adjoining other forest land. Although lumbermen do not meet such demands favorably, on account of the expense, experiments show a very small cost. In pine regions the slash has been piled and burned at the rate of less than 25 cents per M. B. F. logs scaled, and in some cases it has been as low as 15 cents. In California experiments have been made in which the slashing was burned as the lumbermen left it, by burning small areas at a time, in a way that the fire can be controlled at all times. This has been done successfully and at a small cost.

Many advantages are derived from the burning of slashing, among which are clear ground for better reproduction, destruction of so-called "fire-traps," breeding places for insects and fungi, and easier means of travel through the woods.

There should be on all large tracts, a network of roads and trails in order to confine fires to areas as small as possible. When cutting fire lanes it is advisable to cut them in places where there are likely to be permanent roads in the future, which will be used as fire lanes. All fire lanes should be kept free from inflammable material and should be opened up annually, soon after the growth stops and before the fall fire season begins. When there are railroads through forest land there should be a strip burned on either side of the tracks and kept free from inflammable material during the time there is danger from fire.

Protection from trespass through ignorance may be established by cutting a clean and distinct path along all boundary lines. This path should be made conspicuous by marking line trees with a special blaze and posting warning notices. Warning notices should also be

placed along frequently traveled roads and paths through the interior of the tract. All corners should be solidly built of stone which will not be greatly affected by the elements. In order that corners will be conspicuous they should be built of material which is not found in the immediate vicinity.

Although an effective system of forest protection will be expensive and will run into a good sized sum of money, it is better to establish it as soon as possible than to have losses, every year, that will in a comparatively short time exceed the cost of an adequate system of protection for many years. This may be illustrated by a case in the Adirondack Mountains where, in 1903, fires involving a loss of $3,500 entailed an additional expense of $175,000 for fire fighting alone. If this amount had been used in carrying out a system of protection during the dangerous months the great loss would have been averted, and protection afforded for many years.

MANAGEMENT OF FOREST LANDS UNDER PRESENT FOREST CONDITIONS.

JAMES E. McNEAL, *Forester.*

Under various circumstances a forest may yield its best return in wood, bark, or other forest products, in money, or interest on the capital which it represents, but which ever of these ways of using a forest is chosen in any given case, the fundamental idea of forestry is that of making the forest yield the best service possible at present and in such a way that its usefulness in the future will not be diminished, but rather increased. A forest well managed under practical methods will yield a return in at least one of the ways just mentioned; but before it will be in condition to render the best service, there are four things which a forest must have.

These are,—

1. Protection, especially against fire and thieves; for without such protection no investment is secure and the most skillful management is of little effect.
2. A strong and abundant reproduction. Without this a forest will speedily die out.
3. A regular supply of mature trees to be cut.
4. The proper amount of growing space for each tree, in order that all trees may grow to the best advantage.

The first requirement in the management of any property is that its condition be known and recorded. Hence, in placing a tract of forest land under management a survey is necessary. The object of such a survey is to have maps showing,

1. Outside boundaries.
2. Roads, rivers, railroads, and other means of transportation.
3. Lines between different localities having different laws, or which come under different jurisdiction, as county and township lines. Interior tracts of forest land, and land upon which any rights are reserved.
4. Contour lines and configuration.
5. Differences of soil. Whether agricultural, forest, or unproductive.
6. Fire lanes.
7. Cleared land within the tract.
8. Types of forest.
9. Any special land marks which may be noted.

In connection with these maps there should be a general description of forest, climatic, and surrounding conditions, of possible dangers, of market and labor conditions, and of means of transportation.

After this work has been done and one knows the condition of the forest, a division may be made into lots and aggregation of lots into ranges. In Pennsylvania, where most of the State forest land is in mountainous districts, division lines should follow the configuration of the soil. Difference of soil or character of growth within lots gives rise to sublots.

A valuation survey should then be made, ascertaining amounts of standing timber, rate of growth on various sites, and determining capability of production and future yield in material and money.

All these preparations should be made before a plan of management is determined. After one knows what can be expected from the forest, general plans should be made for all time, and special plans for a period of from ten to twenty years. The length of rotation should be determined and amounts to be cut should be designated, stating lots to be cut, with view of obtaining favorable distribution of age classes. Thinnings should be made, and methods determined to be used in felling and culture.

DISPOSAL OF FIRE-KILLED TIMBER.

PAUL H. MULFORD, *Forester.*

A fire running through a forest often assumes proportions that cause great damage to the roots of trees, burning the humus and ground floor, often burning the roots themselves, thus leaving the

trees with few supports to withstand heavy winds. They are blown down and become a prey to fires which pass over that land again. Or the fire may burn away the bark of a tree, girdling it and leaving it standing a prey to injurious insects which are thus invited to and fostered in starting a breeding colony in these dying trees. Finally, finding no living tissue to feed upon, these insects go at once to the broken branch, or scarred trunk of a living tree, and proceed to start their work of destruction.

These two types of fire-killed trees we have to deal with largely on the reserves in this State. A method to dispose of them must be found. Standing or lying, they are a detriment to young growth, both by crowding and because of fire menace.

In the work of the U. S. Forest Service, it has been proved by many strength tests that fire-killed timber, for instance white pine, or fir, (Cir. No. 113, U. S. F. S.) is about twice as strong as green white fir; and that it is 9-10 as strong as kilndried timber where it has received the same treatment.

So there should be no hesitation in offering fire-killed timber as second-class lumber, and also as timber ready for preservative process. As the moisture has evaporated, there is no watery sap to act as a mechanical barrier to the entrance of the preservative. Green or unseasoned timber must be piled for several weeks before it is in proper condition for treatment, else it has to be subjected to several processes to season it artificially. Artificial seasoning is expensive and is liable to reduce the strength of the timber; therefore, sound fire-killed timber is really more valuable for preservative purposes than green. The dead timber being perfectly seasoned is more easily handled and cheaper to ship. Making the larger material salable for mining timbers, railroad ties, telephone poles, dimension stuff, and posts, which have a ready sale in our State, results in a double economy, the prevention of waste, and the saving of more valuable material for better uses.

The principal defect of fire-killed timber is check. This appears soon after the death of the tree, and apparently does not increase later. To prevent decay on the surface, fire-killed timber should be barked soon after it is killed. If the bark has been left on, the sapwood will be found somewhat decayed. Most of the conifers, and some hardwoods, will last a long time, if not lying flat on the ground.

In the west, especially in Colorado, where the mines of one city alone, Leadville, (Cir. No. 113, U. S. F. S) use each month 350 M.ft. B. M. of fire-killed timber for mine props, fire-killed timber is decidedly preferred to green timber because it is perfectly seasoned and light In Denver, fire-killed timber has been used for a number of years for boxes and crates with excellent results, being odorless and not liable to shrink or warp.

Pennsylvania with it many mines and factories using great quantities of mine timber, boxes, pails, and baskets, in their operation, should be impressed with the value of this class of material, and thus create a market for large quantities of fire-killed timber.

On a part of the Stone Reserve, an area of about 3½ acres, lie 25 M. ft. B. M. of fallen timber killed by fire. It stood for about two years only to be wind swept, and having no root system to hold it, fell. This is in a place six to eight miles from a railroad, and accessible only by a very poor trail road. One man made an offer to pay $1.00 per M. feet for all logs sawed mill measure, 50 cents per M. for shingles, 50 cents per M. for lath, and 30 cents per M. for fence posts. This prospective buyer says "that by taking all fire-killed and down timber, there is still left a good profit at these rates." Another, a boss logger, not wishing to make a bid says "$12.00 per M. can be safely paid for all the better stuff, and fire wood or charcoal be made of the inferior material."

Confining this subject to our own State, we must first realize that each reserve because of its geographical and geological position would be governed by its own peculiar conditions. The money consideration in the disposal of fire-killed timber in one case could hardly be used as an example for every other. However, having in mind the idea of advanced forestry, and the thought that fire-killed timber is a great detriment to growing trees, seedlings, and necessary undergrowth, as well as to the cause of forestry, its removal is warranted at an expense equal to its revenue. Personally, I believe that its removal is warranted at a cost in excess of its return value. Such a deficit is to be regarded a good investment on account of the improved conditions obtained in the then cleared and growing forest.

Again, with a careful system thoroughly thought out for each reserve and operated under good management, there will eventually be a return of revenue far above the expense, and plus this, give a clean forest, a practical object lesson in applied forestry, an opportunity to train unskilled labor, as well as create a force of local workers, breed a friendly instead of a hostile feeling to the cause of forestry, and last, but far from least, leave a general result that "He who runs may read."

Each reserve, with an idea of profit from fire-killed timber, must first cater to the need of its local market, and then create a market for the remainder of the product, the idea being to make the former bear the expense, and from the latter, the fragments, receive the clear gain or profits of the operation.

At my station, the Stone Reserve in Tioga county, from personal observation and information received from loggers, lumbermen, and local residents, it is believed the amount of fire-killed fallen timber warrants the erection of a model plant for the manufacture of lumber,

boxwood, paving blocks, crate wood, lath, shingles, baled shavings and sawdust, poles, fence posts, stakes, fire logs, cordwood, wood distillation, charcoal, wood ashes for lye and compost, acid wood butts, and pulp wood. All of these could be marketed in a local or foreign market at a profit on the total production.

Having three streams of sufficient volume to generate electrical power to operate such a plant, also to supply power to operate a pumping and watering system for the five acre nursery of the reserve, the installation of such a system would not be amiss.

Certain kinds of fire-killed timber can be disposed of to local buyers, as in the cases already mentioned, and some cordwood could be sold to those making their homes nearby, and at no cost of labor or material to the Department; but such sales will be slowly made, and the period to exhaust the thousands of cords of stove wood and the many thousands board feet of lumber in log form will be long, after which the real cleaning up must be done by the State. Until this is done the reserve is open to fire, being practically without trails or fire lanes, at the present time. With a plant as mentioned, or any other of value, and an organized working force fully equipped, the question of the disposal of local fire-killed timber will be quickly solved, leaving a benefit in wages, a better sentiment toward forestry, and a lasting benefit in the impression of its advantages.

Thus briefly are outlined my ideas of the very important question of the "Disposal of Fire-Killed Timber," on the Stone Reserve, a matter on which I have had too little time to go into minute detail. After careful consideration it is believed each acre of State land having such timber, can be successfully handled, leaving to the State a money profit and an improved acreage for reforestation. Of the opportunity afforded by the danger of fire-killed timber to improve the ranger service, its relation to the question of roads, fire lanes, and trails, and a regularly employed labor force, cannot be entered upon at this time. That fire-killed timber has a bearing on all these matters is well understood by those who have given the subject consideration.

Finally, with a sales division of the Forestry Department organized to study and ascertain the needs of every portion of this State or nearby states, many or all of these products and by-products of the reserves could be disposed of to advantage with permanent benefit to the Department of Forestry.

ROADS, FIRELANES, AND TRAILS ON THE RESERVES.

JOHN L. WITHEROW, *Forester.*

Of all the branches of forestry, one that certainly deserves and requires our attention at present, is a system of forest roads, firelanes, and trails. Without these, forestry would be theoretical only.

A few reasons why:

1. They make reserves accessible and the removal of products possible.
2. They aid in the suppression of forest fires and insect depredations.
3. They may be made comparatively permanent.

A reserve road system should be laid out only after a careful study of the topography and market conditions of the reserve. It should not be built all at one time but rather developed gradually, and always fast enough to meet the demands of the increasing intensity of management.

An ideal road would be one which is perfectly level longitudinally, solid, smooth, and without curves, but we can only conceive of that just as we can an "Ideal Forest." In proportion to the number of these qualities that are lacking, so much less useful is that road.

The roads of a reserve should always be divided into two classes, main roads and minor roads.

Main roads should lead to the interior of the reserve and should be at least 16 feet wide, have a grade of five per cent. of less, and be made of stone.

Minor roads need not be so well built. They will connect main roads and also reach out from them into short valleys.

The old roads that we find on the reserve today were made for the purpose of removing forest products. On many of them travel was only one way, the empty wagons reaching the top by some other road much longer and less steep. On such roads the grade is so great that today they may be more properly called trails. They were laid out and built by men who knew little or nothing of engineering, but simply began and continued their work until their desired point was reached. Many of these roads are the best the locality would afford. Others should not be followed in our road building.

In all cases the route for a road should be surveyed in order to accomplish the best results from a given sum of money. Time spent on the survey must always mean both time and money saved on the construction of the road.

Not until a road is reduced to a five per cent. grade can it be called a good road, on account of the extra time and energy required for moving a load on it, and the great expense for maintenance.

It is the opinion of most men of authority, that the road that avoids the grade and is ten times longer, is the better road.

In laying out a road the survey should not be depended upon as the only guide. By every road the largest area possible should be made accessible.

Side drainage is as necessary, if not more so, on forest roads, as it is on roads running through cleared country, owing to the retentive nature of most forest soil. When building or repairing roads the camp should be moved as often as necessary to keep with the work. A working force of less than four men is unprofitable.

In our road building operations in Fulton county last year, we wanted a fair road up through a narrow valley seven miles long to serve both as a road and firelane in case of fire.

There was a road for three miles that was built over a hundred years ago for hauling out charcoal. We used it most of the distance except where grades could be avoided or the road straightened. A space seven feet wide was cut clear of everything on both sides for four miles. After this had been done, it was gone over, all rocks above the ground were removed, water turned off and holes filled up. This was done for $18.00 per mile for labor. After it was completed we could drive from one end to the other in fifty-five minutes.

There are perhaps no other branches of forestry, unless it be protection or survey, on which money spent at present, would give as quick returns or equal results as on forest roads, provided they are built in the proper places, and not at too great an expense.

To open up good roads from the interior of a reserve out to settled country, and where they are not needed, would be wasting money, beside being a temptation to trespass. After roads have been built it is comparatively easy to calculate the money saved by considering the difference in cost of marketing forest products, or it may be represented by an increased stumpage value. At present we are taking out about 500 railroad ties in Perry county at a profit of at least twenty-three cents on each. Had it not been for a road running to market, the timber probably would have rotted on the ground, the distance being so great as to prevent the building of a road at present.

No forest road should ever be made less than eight feet wide. A narrower road will admit of only one track and a narrow space at each side for the water to collect.

The transverse slope of a narrow road should be one-half inch to a foot. On a wide road of, say twenty feet, this may be increased for if water has to run a distance of ten feet with a fall of five inches

it will run to the sides of the road very slowly. Steepness is the worst quality a road can have, as all other bad ones may result from it.

Water breaks are necessary on hills to turn off water. The should be made straight across the road, rather than diagonally, for when so made they are liable to break the couplings of heavy wagons.

It has been found by experience that stone roads built of three layers of stone of different sizes, prove most durable. The road bed should be level, solid, and free from roots and decayed wood. The largest stones are laid or thrown on it. On these a thin layer of smaller stones is put to fill up low places and to make it solid. The last layer should be fine dust and stones from a stone crusher. It should be of stones that contain cement such as lime stones. Such a road as this may be sprinkled and rolled or left for a year to settle before using.

A few facts worth remembering when building roads.

1. It is cheaper, quicker, and easier to remove large rocks by explosives than by hand.
2. Plenty of all kinds of tools, kept in good condition, lessens the cost of labor.
3. The laborers should never be left without instructions where to work. They will always find the wrong road.
4. A lazy man on the working crew is dear at any price.
5. Be boss yourself unless your advisors are more experienced.

All public roads on a reserve should be in charge of the Department of Forestry. The location of many of these will often be such that they should be main reserve roads. They cannot be so if township officers have the authority to repair them in any way they see fit.

Not until the annual two cent road tax is taken off forest reserves, and all the roads on the reserves built and maintained by the Department will it be satisfactory, to our side at least.

Firelanes.

Firelanes will serve only for the suppression of fires and diseases, and as boundaries of forest divisions.

They will likely always be necessary in Pennsylvania. The problems that interest us most are their cost, location, and width.

The expense of cutting firelanes will, in some cases, be reduced by the sale of the trees cut. Where old roads can be cut out and used for firelanes, the cost will be from $10.00 to $20.00 per mile. When made separate from roads they take up a large area from which no revenues can be had, and require frequent cleaning with money produced by the forest.

The width of firelanes will depend upon the species and its height through which the lane is cut, also the density of the stand and number of roads nearby. Their width in Pennsylvania will probably range from 10 to 25 feet.

Before laying out or cutting a system of firelanes on a reserve the general direction of winds should be noted, as the opening caused by some lanes may produce windfalls with certain species if the edge of the forest is directly exposed to the strong winds of the locality.

Sharp curves in narrow lanes will allow fire to cross. They should be avoided if possible.

For several years after being made they will have a tendency to grow shut. This they will lose as soon as the strength of the roots is exhausted. Firelanes should be of as uniform widths as possible and brush cut in the lane should not be piled up along the edges or pushed in between bushes, but should be thrown back over the brush, where it will decay sooner and not be blown back into the lane by every strong wind.

The entire boundary of all reserves should be a firelane of sufficient width to prevent fires from crossing. Reserve boundaries are often on the summit of mountains where growth is not dense or soil valuable for tree growth. These will allow lanes to be wider than elsewhere without any great loss of the working area of the reserve.

Most forest roads should also serve as a firelane by being cleared of all growth on each side, as far back as is necessary to make the whole opening of the proper width for a lane.

There are many reasons why firelanes should be made in connection with roads.

1. The expense for making and cleaning is less.
2. Floor space is saved allowing a larger working area which results in a higher normal yield.
3. The number of lanes that must be cut through the forest apart from roads will be fewer.
4. Travel will keep the road free from inflammable material.

Trails.

Trails may be necessary in many places on the reserve.

They should connect roads, or roads and streams, or may run from the nearest roads to fire towers. They take up little space and can be made and kept up at a small expense.

The loss that may be prevented by time saved on one trip over them in case of fire may be more than the original cost of such a trail.

They should be made sufficiently good to allow a horse to be led or ride quickly either way, or for water to be carried by a pack-saddle horse if they are in use on the reserve.

The only expense for maintenance will be for keeping off water.

Where a trail has been cut out in the middle by water, it usually retards travel so much that it is easier through the woods than on the trail. Their width and grade will vary as to their usefulness.

The necessity for roads, firelanes, and trails is so great that if they are neglected, Pennsylvania will fail to receive early revenues from her forests.

#7

December 1912

Commonwealth of Pennsylvania.

Department of Forestry.

FORESTER'S MANUAL.

PART I.

GENERAL INSTRUCTIONS

OUTLINE FOR ANNUAL REPORT

INSTRUCTIONS UPON FORMS

HARRISBURG:
C. E. AUGHINBAUGH, PRINTER TO THE STATE OF PENNSYLVANIA.
1912

TABLE OF CONTENTS.

GENERAL INSTRUCTIONS.

1. The business of the Department is increasing rapidly,and time must be saved in every possible way. Uniformity in terms used, in statements of expenses, and in various kinds of reports is absolutely necessary. Brevity and conciseness can best be obtained by tabulated data, and with this idea in view many of the forms have been evolved. Some have been taken almost without change from the records of forest management abroad, but in most cases time-tested forms have been used as the basis and such changes made as were necessary to make them of most value to the Department.

2. In many cases details will have to be given on separate sheets or on the back of forms dealing with the particular subject which needs to be set forth at greater length than is called for in the form itself.

3. The Department of Forestry uses a great many kinds of forms, a few of which do not concern the foresters or rangers in the field. Each forester should have a supply of all necessary forms on hand.

4. Each forester should be sure to place his name and the date in the right hand corner, at the top of each form or sheet used. No paper should be filed or sent from a forester's office without being dated and signed.

5. Careful attention should be given as to what each form is and to the instructions for using it. Many times the business of the Department is burdened or delayed by reason of the fact that forms must be returned with repeated instructions for correction.

6. Fill out proper report form as soon as each operation is finished and file it.

7. Use one form sheet for each operation, to be kept as part of reserve file. For report to Department in some cases one sheet may be used as a summary.

8. Keep a duplicate of each report.

9. Tabulate as much material as possible.

10. Always include cost of rangers' and foresters' time in the cost of any operation.

11. On forms upon which financial statements are made, as voucher, receipt, pay roll, etc., no erasures are permitted. If errors are made, new forms must be filled up.

12. The terms "miscellaneous items," "incidentals," and similar ones must not be used.

13. Neatness in all cases is required, and proper English is insisted upon.

14. The work in which the Department is engaged is for the benefit of the whole people of Pennsylvania. Money appropriated by the Legislature is taken from the people's money in the Treasury. Every citizen, therefore, has a direct interest in the work.

(a) Every forester must keep his records in such shape that he may be able, on a moment's notice, to turn to any item of operation

or expense and give what information may be desired, either by an official of the State or by a citizen.

(b) All records and operations must be open to inspection.

15. Make notes as to improvement of forms or outline and submit the same with your annual report.

16. If in doubt concerning anything, write immediately to the Department for information and assistance.

17. Order all forms by number.

18. Forms have been made uniform as to size, either 8½ x 7 or 8½ x 14 inches.

(a) One fold is sufficient in the case of the small size.

(b) To fold the large size

1—When the heading is across the 8½ inch side, take the form at the bottom of the sheet in right hand and fold in half to the top, and then fold in half again in similar direction. Any backing may now be placed on the upper surface of the fold at the left end.

2—When the heading is across the 14 inch side, take the left edge of the form and fold over to the right, and then fold in half again in similar direction. A backing may now be placed upon the form, at the top, as it lies folded.

19. All report material not written on forms must be on paper of the same size as the forms, viz., 8½ x 14 inches, or on regulation typewriter size, viz., 8½ x 13 inches.

20. The following definitions shall prevail in the service:

(a) A reserve is a large contiguous tract of State land.

(b) A division is that portion of a reserve under the direction of a forester or assistant forester.

(c) A range is that portion of a division under the protection of a ranger.

(d) A block consists of a number of adjoining compartments, as for example, those within a certain watershed, or covering a certain mountain, and may be designated by the name of the stream, or mountain, or by some local historic name.

(e) A compartment shall be considered as the smallest unit of management.

1—The boundaries should be either natural features or roads and trails.

2—The area should not exceed 300 acres, and wherever possible should average much less. Uniformity in area is desirable.

(f) A sub-compartment is the area occupied by a growth of more or less even age, a pure stand, or an area exhibiting a distinct soil quality, etc.

1—A sub-compartment may be permanent or temporary.

2—There should be as few as possible.

OUTLINE FOR ANNUAL REPORT OF FORESTER.

The forester's report for each year must be submitted to the Department on or before January 10th of the succeeding year, and must conform to this outline. In the year preceding a legislative session a preliminary report must be submitted covering the main features of the outline, and must be in the Department by the 15th of November.

Deal with each item in the outline each year. Where desired information is lacking or does not exist, a statement to this effect must be made, e. g., if there have been no fires upon the reserves, say "No fires this year." When necessary, incorporate the material of the previous report. As the forester becomes more familiar with his reserve he will be able to change his statements to what is more nearly correct. As surveys progress, areas, ages, volumes, etc., will be definitely known.

1. Name of reserve, if named, and situation by counties; also subdivisions when definitely determined. See Form 37.

(a) Each year should add something to the historic record of the reserve, and whenever items of interest are obtained records should be made at once. Historic record must be revised in report of years ending in 0.

(b) A report of the following features is to be made at the end of the first full year that a forester has been on his reserve, and revised thereafter in years ending in 5.

1—Geologic characteristics, naming group or groups of rocks showing on surface, character of soil, and whether surface is of glacial deposit.

2—General topography of reserve, stating whether plateau, hilly, or mountainous, and naming approximately the proportion of each.

3—Local climatic conditions.

2. Forest Staff:

(a) Rangers.

(b) Other regular employes.

(c) Statements concerning them.

3. Status of boundary survey,—completed or not; condition of boundary line,—brushed, painted, and posted or not; statements or suggestions concerning the same; corners.

4. Interior or exterior tracts,—difficulties or advantages arising therefrom; tracts State should own and why; information of value relative to possible purchase.

5. Areas: (Tabulate and revise from year to year as the reserve is more familiarly known. Always give previous year's estimates and indicate any areas actually surveyed.) Submit whenever possible a map of the reserve showing these areas. See Forms 37, 38, 39.

(a) Total area added by years; virgin forest, if any.

(b) Area covered with mature or hypermature forests, and approximately the volume according to material it would produce; species, market conditions, and proposed meth-

ods of operations in detail, including methods of regeneration.

(c) Area covered with stands having a density of 50 per cent. or over. Divide this area into two classes:
1—Number of acres not in need of improvement.
2—Number of acres in need of improvement.
State approximately the amount of wood product which may be removed, noting form and species and possible present markets.
State conditions under which operations may be made profitable.
State what must be done to bring the stands to normal density.

(d) Area with scattered trees from a density of 10 per cent. up to stands having a density of 50 per cent.; species, and amount of material which should be removed, market conditions, etc.
State what must be done to bring the stands to normal density.

(e) Area, not included in above, covered with brush or weed growth, as scrub oak, bracken, briars, huckleberry bushes, etc.
State proportion of this area which will be naturally reforested by a growth of valuable species if protected from fire and grazing: Reforesting of remaining portion; amount of fire killed timber.

(f) Area of open ground where seed or seedlings may be planted now with little or no difficulty, as old fields, mill sites, severely burned areas, etc.

(g) Area covered with rocks, where no cutting ought to be done, or where no regeneration can be expected.

(h) Area covered with water;—lakes, dams, ponds, and streams.

(i) Area used for roads and trails.

(j) Area used for fire lanes.

(k) Summarize areas from above where reforesting by planting is not justified at present rate of cost.

6. Springs and Streams:
(a) Locate all springs on map.
(b) State whether springs are cleaned, made accessible, or posted (named).
(c) Data with reference to flow of springs. Continuous or not; unusual flow or drying up, and probable cause of same, whether due to climatic conditions, humus conditions, drainage, or other cause.
(d) Condition of streams generally.
1—Regularity of flow.
2—Contamination.
(a) Possibility.
(b) Prevention.

7. Buildings and repairs:
(a) Condition of all buildings on reserve.
(b) Need of repairs or new buildings.
(c) Fences.

(d) Telephone lines existing on or near the reserve; service, expense, need of extension, etc.
(e) Other conditions necessary for comfort and efficiency of personnel of the service.

8. Roads. See Form 36.
(a) Distinguish carefully between extension and improvement as indicated at head of form.
(b) Blasting, brushing, rebrushing, bridging, etc., should also be kept separately.
(c) Improvements should be specified on the reports and cost reported on a basis per 100 feet of total length, not simply upon the distance covered by the improvements.
(d) Outline of road system as planned to date, or map of the same. This can be made only after a careful consideration of markets and of configuration of reserve.

9. Easements:
(a) Rights of way.
1—Conditions relating to all such rights.
2—Good or bad features.
(b) Other easements.
(An easement is a right to exercise a privilege adversely to the owner of the title.)

10. Leases:
(a) Revenues, and material removed.
(b) Benefits or detriments.

11. Minerals and other valuable products.

12. Seed Collection:
(a) Date.
(b) Species.
(c) Amount.
(d) Cost per unit of measure to time of planting or shipment.
(e) Quality.
(f) Amount to be used by self.

13. Plantations: See Forms 33, 34, 35.
(a) Date on each form should be the date on which plantation is made.
(b) Planting Summary (Form 34).
1—Make separate statements of seeds planted in nursery and of those placed in plantations.
2—Must correspond with the totals of plantation reports.
3—Indicate with red ink, seed and plants collected, raised and planted on your own reserve.
(c) Measurement of past plantations must be revised and kept to date. See Form 35.
(d) Area (total) planted to date with seeds and with seedlings.
(e) Amount (total) of seeds and number of seedlings by species planted to date on reserve (not in nursery).

14. Nurseries:
(a) Date established and area at time of establishment.
(b) Area in current year.
(c) Inventory of seedlings by species and age.
(d) Number of seedlings available for spring planting, giving species, age, and cost per thousand.

(e) Number of seedlings shipped to individuals during year.
1.—To foresters or rangers for reserve planting, giving name, place to which shipped, number of each species according to age, and price per thousand.
2—To private individuals, giving name, address, species, age, number, and price per thousand.
3—Number used on own reserve.
(f) Amount of seed planted in nursery. See Form 34.
(g) Statements concerning temporary or permanent improvements and general nursery conditions and work.

15. Sample Plots, Experimental Plantations, etc.:
(a) When established.
(b) Name.
(c) Location.
(d) Area.
(e) Object of development.
(f) Measurements past and present. (Tabulate all data).

16. Labor Conditions:
(a) Wages per day or per hour per man.
(b) Wages per day or per hour for teams, with and without drivers, etc.
(c) Reasons for high or low wages.
(d) Scarcity and quality of labor, and cause for same.

17. Improvement Cuttings: See Forms 13, 31, 32.
(a) Conditions existing previously.
(b) Conditions subsequently and benefits expected.
(c) Conditions of improvement cuttings of previous years.

18. Market Conditions:
(a) Needs of the district.
1—Specifications.
2—Species.
3—Quantities used per year.
4—Prices.
(b) Transportation facilities.
(c) Railroad rates.
(d) Possibilities with reference to the reserve in detail in accordance with present market conditions.

19. Data with reference to growth. See Forms 35, 39, 40, 41, 42.

20. Erosion.

21. Insect or fungus attacks.

22. Forest Fires: See Forms 17, 19, 49.
(a) Statements not covered by forms.
(b) Observatory stations.
(c) Fire wardens and their work.

23. Trespass and fines:
(a) Violations of forest, fish, and game laws, or reserve rules reported and disposition of cases.

24. Outing and Recreation:
(a) Camps and campers.
1—Number.
2—Matter with reference to their conduct.
3—Hunting:
(a) Number of deer killed on or in the neighborhood of the reserve.

(b) Other game.
4—Fish and fishing.
(b) List of camp sites by common name and location.
(c) Other uses of reserve for outing and recreation.

25. Inventory: (Use separate sheets.)
(a) All tools on reserve, condition, and value.
(b) All other property belonging to Commonwealth:
1—Books.
2—Instruments.
3—Stock.
4—Implements.
5—Other material not before enumerated.

26. Summary of Accounts of the year. See Forms 30, 31.

27. Summary of suggestions.

28. Budget for succeeding year:
(a) Labor proposed and estimated expense in detail.
1. Road Work:
(a) New roads, Name Length.
(b) Old roads to be repaired or brushed. Length.
(c) New fire lanes Length
(d) Old fire lanes to be brushed, miles
(e) New trails to be cut.
(f) Estimated cost of (a) $.....
(g) Estimated cost of (b) $.....
(h) Estimated cost of (c) $.....
(i) Estimated cost of (d) $.....
(j) Estimated cost of (e) $.....
Total estimated cost, $.....
2. Improvement Cuttings:
(a) Estimated area to be improved, ...acres.
(b) Estimated amount of material to be derived from improvement cutting.
(c) Estimated value of product so obtained, $.....
(d) Estimated cost of suggested improvement work, $.....
3. Repairs to buildings:
(a) Cost of such recommended repairs, $.....
4. Other suggested improvements:
(a) Probable cost, $.....
(b) Seeds and seedlings required:
1. Seedlings needed for planting during the year.
Species Quantity Spring or Fall.
2. Estimated area in acres to be covered by the above planting.
3. Quantity of tree seeds needed for planting in experimental plots or nurseries.
Species Quantity
(a) Estimated cost of planting, $.....
(c) New or altered equipment.
1. Estimated cost, $.....
(d) Other items of expense.

INSTRUCTIONS UPON FORMS.

1 and 2.

Vouchers for expenses paid from appropriation to Department for contingent expenses. They are used only in the office of the Department.

3 and 4.

Vouchers for all Reserve Expenses.

1. Vouchers will be made up in the Department.

2. Statements for vouchers must be submitted in detail by letter, setting forth bill, by name and amount, as

Pay roll, ...	$150 67
John Jones, ...	11 00
John Smith, ...	6 77

3. Railroad fare must be indicated in this manner:

Jan. 14. To railroad fare, Harrisburg to Summerville, P. R. R., 250 miles (mileage), ...	$5 00
To railroad fare, Summerville to Clarion, P. S. & C. R. R., 16 miles (ticket), ...	65
16. To railroad fare, Clarion to Summerville, P. S. & C. R. R., 16 miles (ticket), ...	65
To railroad fare, Summerville to Harrisburg, P. R. R., 250 miles (mileage), ...	5 00
20. To railroad fare, Harrisburg to Lebanon and return, P. & R. R. R. (ticket), ...	1 05

Mileage books should be used whenever possible.

No receipt need be taken.

Pullman fare checks will be accepted as receipts.

4. Trolley fare must be indicated:

Jan. 24. Trolley fare, Mt. Pleasant to Greensburg, ...	$0 20

No receipt need be taken.

5. Livery or automobile hire should always be accounted for by receipt (Form 7) or by receipted bill on liveryman's bill head, the latter preferred.

The entry on the receipt or bill should be:

Horse and buggy, Muncy to Eagles Mere and return, 20 miles, ...	$3 00
Or, Double team, and driver, Milford, to Blooming Grove, 21 miles, ...	8 00
Or, Automobile, Renovo to Crossfork and return, 30 miles, ...	9 00

6. Express and freight charges must be accounted for by submitting receipts on the respective company's receipt form.

7. Telephone charges should be entered according to date and places between which the telephone was used.

8. Charges for single meals obtained at restaurants, or on dining cars enroute, must be noted as follows:

Jan. 14. To dinner enroute, P. R. R. diner 4447, ...	$0 90

No receipt need be taken.

9. Hotel charges should always be accounted for by receipt (Form 7) or receipted bill on hotel bill head.

10. Do not fail to itemize fully each expenditure for which no itemized receipt has been taken. The terms "incidentals," "miscellaneous," and the like, are not to be used.

11. In the case of surveys, hauling and boarding may be placed on pay roll (see Form 27) together with service. Separate receipts must be furnished for all other expenses incurred in the survey.

12. All expenses other than for traveling, those incident thereto, and for surveying, amounting to more than ten dollars require a separate voucher, in which case there must be submitted a receipted, itemized bill, on individual bill head, or on Form 7, which will be attached to a voucher with the following entry:

Jan. 17. To amount paid as per receipted bill attached hereto, ...	$15 85

The voucher must be signed by the individual furnishing the supplies.

13. Pay rolls, receipts and receipted bills of all kinds must be stamped "Received-Correct-Approved," and countersigned by the forester on the line provided for signature under the above words. This, of course, implies that each item has been received and approved and the charges found to be correct.

14. Where any expense is accounted for by the piece, pound, yard, bushel, hundred, etc., the entry should be as follows:

12 Meals, at 20 cents, ...	$2 40
15 lbs. butter at 30 cents, ...	4 50
2 dozen lanterns at $2.00, ...	4 00

15. Copies of all bills, receipts, payrolls, etc., must be kept in office of each forester, and properly filed.

16. Whenever possible, pay expenses by check, indicating clearly on the stub the items for which the check is drawn.

17. No person in the employ of the Department has any authority or legal right to sign another person's name for any purpose whatever. The person who is to receive the money must sign his own name and if unable to do so, must make his mark in the usual way. The mark must be accompanied by the signature of a witness.

The form of signature is as follows:

John X his mark Smith. Witness: Charles Brown.

18. The general rule of fully itemized bills prevails, and every employe must take notice. Follow the practice of getting, whenever possible, bills itemized on the printed bill heads of the person to whom the money is paid.

19. Be sure to forward all bills and receipts with the voucher to which they are to be attached.

20. All bills, receipts, pay rolls and vouchers should be forwarded

to the office not later than Tuesday previous to Commission meeting, which is on the first Friday of each month.

5 and 6.

Forest Academy Vouchers.

Used only for Academy expenses.

7.

Receipt.

1. Take receipts on this form for all expenditures possible, other than those for which receipted bills are obtained.
2. No receipt need be taken for trolley fare, railroad fare, telephone and telegraph charges, single meals at restaurants or on dining car enroute, cab or hack hire.
3. Itemize each expenditure fully.
4. Pay expenses by check whenever possible.
5. Always begin receipt by name of place where the expenditure is made and follow with date of payment.
6. If receipts are taken for lodging or meals, indicate by date; if for more than self, indicate number of men, e. g.,

Aug. 1, 1911, Supper and lodging for 7 men at 25 cents, ...	$3 50
Aug. 2, 1911, Breakfast and dinner for 7 men at 25 cents, ...	3 50
Aug. 3, 1911, Dinner for 2 men at 35 cents, ..	70
Aug. 3, 1911, Feed for two horses, ...	50

7. For further information, see instructions under Forms 3 and 4.
8. Be sure to stamp "Received-Correct-Approved" and countersign.
9. Date upon which material is furnished or service rendered should always be given.
10. Postage stamps must be receipted for by postmaster.

8.

This form is used only by the Commissioner of Forestry, and is for the payment of the annual charge against the forest reserves for school purposes.

9.

This form is used only by the Commissioner of Forestry, and is for the payment of the annual charge against the forest reserves for road purposes.

10.

This form is used by the Commissioner of Forestry to accept or refuse title, for the Commonwealth, to vacant land, for which application has been filed with the Secretary of Internal Affairs, notification of which has been made to the Department in accordance with Act of May 3, 1909.

11.

Land Offer.

This form is given to individuals desiring to sell land to the State. A copy of the offer is made on a similar form and sent to a forester

or inspector with instructions to examine the land previous to purchase. The report of the examiner is written upon the back of the form and returned by him to the Department. This report should state,

1. Whether or not the land offered is the land shown, if it is possible so to determine.
2. Whether it adjoins State land.
3. Character of the growth, species present, and relative percentage of total stand; age, height, diameter, density, quality of trees.
4. Soil.
5. Roads.
6. Streams.
7. Distance from market.
8. Other data.

Then should follow an estimate of the tract's worth, judging by past purchases in the same neighborhood.

12.

Contract for Purchase of Land.

Used only by the Commissioner of Forestry.

13.

Timber Cut.

1. This form is sent to those who do any wood cutting or sawing from the stump.
2. Each forester should report his cut on this form, as well as upon Form 31, so that it may be added into the total cut of the State.
3. Each forester should do all he can toward helping the Department to obtain information of this kind. Whenever he sees or hears of any individuals doing cutting of any kind, the names and addresses should be forwarded to the Commissioner of Forestry.

14.

Tabulation of Timber Cut.

Used only in the Office of the Department.

15.

Forest Fire Report.

1. For instructions concerning this form, see the form itself.
2. Each forester should keep a copy of each report made. Form 19 may be made up, to a large extent, with the aid of these reports.

16.

Bill for Extinction of Forest Fire.

1. For instructions, see the form itself.
2. It is important that these bills be forwarded as soon as possible after the fire has occurred.
3. A copy of each fire bill must be attached to the duplicate fire report, Form 15, and filed.

17.

Fire Loss.

1. These forms are sent out each year by the Department in order to get data on loss by forest fires.

2. Foresters should fill out one of these blanks each year for the loss on the reserve of which he has charge.

3. The statements made should be carefully figured out before being set down. The loss may be made up of actual property destroyed, whether trees are standing or not, young trees not yet marketable, humus and soil. Any special features making the forest particularly desirable should be capitalized if the forest is destroyed.

18.

Tabulation of Fire Loss.

Used only in Office of the Department.

19.

Summary of Fires.

1. This form is to be incorporated as a part of each forester's annual report.

2. The record of each fire should be made as soon as possible after the fire has occurred.

3. All fires at which the forester or any of his men assisted in extinction, should be reported on this form. Small fires as well as large ones must be reported.

4. In reporting damage, it is better to indicate the character of the damage rather than the value. As in the case of Form 17, reference should be made to extent of damage done to young and old trees, stating whether they have been killed, badly or slightly damaged, the species most affected, etc. Especial mention should be made of damage done to any regeneration which may have been present.

5. In reporting damage to forest floor, it should be stated whether merely the surface leaves, or a part or the whole of the humus has been destroyed; also something as to the condition of the live cover of the floor before and after the fire. Sometimes damage to the soil itself may be noted.

6. Damage to game, or birds, or other features making the forest particularly attractive should be noted.

7. It will be of great interest to keep records of the time of day when fires come to the attention of the forestry officials and the time of day at which they have been extinguished. If patrol is necessary after extinction, a note should indicate the fact, and the time elapsed before everything was considered safe.

8. Total cost of extinction should include the value of the time spent by forestry officials and employees, and expenses. If individuals assist who are not paid by the Department or from the appropriation for Extinction of Forest Fires, an effort should be made to learn what time and expense they have had and make proper report on this form.

9. Be sure the cause is known before recording it. Do not guess at it. If it is unknown, enter it as such.

20.

State Forest Reserve Rules.

1. Each forester should see that his reserve is well posted with these cloth notices.

2. They should be placed along all roads, especially near where the line of the reserve crosses a road and where roads fork or cross, at the mouth of streams, along streams, and near camp sites.

3. When notices fade or are removed for any reason, see that new ones are posted.

4. Be careful not to place the notices on trees which are likely to become valuable timber trees. Try to find old, defective trees, or trees of little value.

5. Become thoroughly familiar with these rules.

21.

Application for Camp Permit.

1. The important thing about the application is that each individual most subscribe to the rules and regulations of the reserve. After the application has been properly filled and received at the Department of Forestry, if there is no objection to the individuals, or if there is no previous application for the same camp site, a permit will be granted.

22.

Camp Permit.

1. These permits must be had before any one may camp over night upon a reserve. A copy of each permit is sent to the forester in charge of the reserve upon which the camp is to be located. If any one is found to camp upon a reserve without a permit from the Department, he is liable to fine or imprisonment, or both. (See Act of May 5, 1911.)

2. Every effort should be made by the members of the forest service to keep the Department informed as to the desirability or non-desirability of granting a permit to any one of the community or to any individual having improperly or illegally conducted himself upon the reserve.

3. Each forester should report to the Department all cases in which campers fail to notify him previous to locating their camp.

4. Under no circumstance must a forest official charge or collect any remuneration for rendering assistance in the location of a camp.

5. In case of campers locating upon a reserve, where there is every reason to believe that they are ignorant of the regulations, leniency should be shown. Have each one sign an application blank and forward it with explanatory letter at once to the Department and permit will be returned to forester.

23.

Surveyors Daily Notes.

1. Notes of final running are to be entered in ink each day on this form.

2. Sketches are to be made on right hand side of sheet.
3. Sheets are to be sent to the Department weekly.
4. Enter final courses and distances only.

24.

Daily Record.

1. The object of this report is that the Department may keep closely in touch with the work being done on the reserves.

2. For the foresters, they are of inestimable value in that at the end of each month the work of all rangers, and foresters as well, may be properly classified and charged to the proper accounts.

3. With these ideas in view, this report should become a diary of each man in the service. The exact location and character of work done should be set forth in detail for each day, as well as the amount of time in hours spent at each operation; also in red ink the account or accounts to which each days work is charged. No one should hesitate to tell exactly where he has been and what he has been doing.

4. The time of foresters and rangers costs value to the State, and consequently should be accounted for just as other expenses must be, and the time spent at each operation, or kind of service, should be charged against that operation or service at a rate per hour, determined by dividing the salary per month by 250, which rate shall be known as the "service" rate.

5. When each operation, other than distinctly administrative duties, has been properly charged for time given it at the "service" rate, the sum of the items should be taken; the difference between the forester's monthly salary and this sum should be charged to general administration. In case the sum of the items amounts to more than the monthly salary, the difference may be credited in the general administration account.

6. It must not be assumed that 250 hours is the amount of time which a forester or ranger is expected to work, no more or no less. That number has been chosen to determine the rate per hour to be charged against operations simply as a matter of convenience and uniformity. Men in the forest service do not work overtime; they are in the service of the State from the time they enter its employ until they leave it.

7. In the case of the ranger's time, each operation is charged properly and the difference between salary and the sum of separate items is charged to general protection account. If the sum of operation charges is greater than the salary, the difference may be placed to the credit of protection account.

8. Operations should be charged for rangers' and foresters' time in the same manner as charges for other time. If the forester would have to pay for time to and from the operation, in case a man were employed to do the work performed, then the time occupied by forester or ranger in getting to and from the operation should be charged against it. Otherwise an operation should be charged only for time actually spent at it. Time in transit may be omitted in reports and consequently will be made up in charge to administration or protection.

9. Absence from the reserve should be indicated by "Absent on leave." If on Department or reserve work the nature of the work should be indicated.

10. This form has to do only with the time of foresters and rangers and not with expenses of any other nature. Therefore, in the space for account charges, foresters will enter on their reports only the proper charges, determined from the report of their own time. In the proper space on each ranger's report, foresters will enter only such charges as arise from the particular ranger's time.

11. After the forester has received a ranger's report in duplicate he should examine it and if found to be satisfactory to him, he should stamp it with the "Received-Correct-Approved" stamp and countersign it under the ranger's signature. All assistance necessary should be given to the ranger so that he may make his reports in proper form.

12. Each day's record should be written in the evening of that day. Happenings will occur and observations will be made that, if not recorded at once, may be forgotten and entirely lost. When daily entries are impossible the record should be made at the first opportunity.

13. Promptness in forwarding to foresters and to the Department is expected. All reports must reach the Department by the evening of the fifth (5th) of each month. For each day of delay thereafter one dollar ($1.00) will be deducted from the forester's or ranger's salary check. A record will be kept of all delinquencies during the calendar year, and deductions will be made from the February pay check. Foresters must not hold other reports because of a delinquent ranger, but should send within the time limit what is on hand. Foresters must see that their rangers are not delinquent, as they will be charged with the penalty in the first instance. Penalties may be removed from foresters and charged to rangers only on presentation of proper evidence.

14. Duplicate copies should always be filed in the reserve office.

25.

Time Sheet.

1. This form was adopted because it has been used successfully by large corporations desiring a record of labor in detail. It suits the needs of reserve records. However, Form 26 may be used in its stead.

2. The name of the month is to be entered after the words "Month of." Beneath the days of the week, "Monday," "Tuesday," etc., should be entered the date in figures, as

Monday	Tuesday	
25	26	etc.

3. The forester, ranger or foreman who keeps the time should enter each new name in the proper column at the time the man begins work.

4. Each day's work of each individual should be designated in such a way that there can be no possible doubt as to the operation or compartment against which a charge must be made.

5. Uniformity and clearness of terms is necessary.

6. Each day's record should be made at the end of the day.

7. Totals should be carefully checked and entered at the end of the week.

8. Transfers are made from this form to Form 26.

9. After everything has been properly transferred and the amounts checked, the form should be filed.

10. Do not file until you are sure every entry is correct and that transfers have been made correctly.

26.

Labor Account.

1. This form was devised with the idea of using it as a summary sheet.

2. The heading will appear when filled, as follows:

Labor for the month of March, 1911.

Account Crooker's Run Road.

3. At the end of each week, the time sheets (Form 25) are carefully gone over, and when labor has bee ndone on Crooker's Run Road, the name of the individual is transferred, and the number of hours entered under the proper date. The rate paid is entered under its proper column.

4. Do not overload the reserve files, but at the same time, remember that crowding entries is unnecessary and should never be done.

5. Subdivisions of an account may be indicated upon one sheet, as for example, in the account above, there may be "Clearing Right of Way," "Dynamiting," "Grading," etc.

6. Two distinct accounts should never appear on the same sheet. However, a continuation of the account for another month may be satisfactory.

7. When a month's work has been properly distributed, the totals of all account sheets should agree with the totals of the time sheets for the respective month.

8. All totals should be carefully checked before making up the pay roll (Form 27).

9. All accounts for the month should be closed on Saturday previous to the Commission meeting so that the pay roll may be made up and forwarded to the Department with other bills of expense, in plenty of time for consideration on the following Friday.

10. Totals of each sheet, or of each sub-division of an account, should be transferred to the ledger account and so indicated in column marked "ledger folio."

(a) The above system necessitates, in many cases, a duplication of names, and for this reason a sheet has been used by some foresters for each employe. Form 25 is eliminated. The different kinds of labor are indicated in the column provided for names.

(b) The advantages of this method of use is that if the rates of wages differ with different work, they may be recorded without crowding any figures. Further, the total of each sheet may be transferred directly to the pay roll, whereas in the other method each individual's time must be collected from a number of sheets.

(c) On the other hand, unless it is desired to enter the value of each man's labor in the respective ledger accounts, and to which there can be no objection, these items must be collected from the various sheets and entered as a total for the month.

11. Either method may be adopted, but when once adopted, should

be adhered to in its entirety. If it is found to be more convenient to use the other method, a change may be made, but the change must be complete.

27.

Pay Roll.

1. The pay roll is to be forwarded to the Department as soon as possible after the closing of each month. It must be done not later than the Tuesday preceding the first Friday in each month.

2. No pay roll should be forwarded until the forester has verified its figures and found them to be correct.

3. Enter each man's name when he is first employed during the month, and he should sign his name in the column headed "Received payment" at the same time. If this idea is carried out, the forester will not be delayed at the end of the month in hunting his men for their signatures.

4. With reference to signatures, see item 22 under Forms 3 and 4.

5. Do not allow any person to receipt the pay roll for the amount due another.

6. Do not neglect to stamp the pay roll "Received-Correct-Approved" and countersign.

7. Never use ¼ hours on pay roll. Allow time to the nearest half hour only. Good judgment will determine when to give or take, and yet not be unjust to the employe or to the Commonwealth.

8. When the rate for labor is above the ordinary rate per hour for day labor, always indicate after the man's name the kind of labor which calls for the extraordinary rate, as for example, James Smith (Carpenter).

9. In case of surveys, pay for service, hauling and boarding should go on pay roll at rate per hour, or rate per meal. Total number of meals furnished entire crew each day must be entered per day in same manner as number of hours worked by each man. Receipts must be furnished for all other expenses incurred in the survey.

28 and 29.

Department Bill Heads.

1. It is good business practice to give a receipted bill for all material sold for which money has been received.

2. While all State business is expected to be a cash business, there will be transactions in which some time will elapse between the purchase of material and the payment for it. In such cases a statement, on either of these forms, should be sent at the end of each month to the individual still owing the Commonwealth.

3. When payment is made, receipt the bill as follows:

Received payment 10/12/12.

(Signed) William H. Kraft, Forester.

4. Do not use this form as a bill head for any individual.

30.

Statement of Finances.

1. This form should be filled out and forwarded to the Department at the end of each month. The heading will then be:

Statement for November, 1912.

2. It shows all the accounts of operations, or accounts by compartments which the forester has opened in his ledger.

3. A new account will have entries first, either in the receipt or in the expense column or in both.

(a) If expenses exceed receipts, the difference is placed in Dr. column immediately following expense column, and is a debit balance.

(b) If receipts exceed expenses, the difference is entered in the Cr. column at the extreme right of the form, and is a credit balance.

4. For the succeeding month the form will appear:

(a) Statement for December, 1912.
Balances of November.

(b) The debit or credit balances will be placed in the proper column under "Balances for November."

(c) New receipts or expenses will be entered in place.

(d) Receipts are considered as a credit item. Expenses become a debit item. Add receipts to credit balance and expenses to debit balance; subtract the two amounts, and the difference is placed in the Dr. or Cr. column according as to whether the debit or credit amount is the larger. As for example: An account at the end of November shows a debit balance of $50.49; during December, receipts to the amount of $18.50 were collected from the sale of material produced by the operation and there was an additional expense of $5.37. The December balance is determined by adding $5.37 to $50.49, which amounts to $55.86, and subtracting $18.30, leaving $37.56. Since the debit side of the account is the larger, this is a debit balance and must be entered in the debit column.

5. If expenses are paid, or material furnished directly from the Department, such expenses should be entered in red ink after the proper accounts, as a separate entry.

6. If, upon authority from the Department, money received from sale of material is used to defray all or part of any expenditure, such expense should be entered in red ink, also, but as a separate entry and enclosed in parenthesis.

7. The total of all black ink entries in the expense column should equal the total of all checks received from the Department for the month's expenses.

8. When any money from receipts is forwarded to the Department, a note and explanation should be entered on the month's statement.

9. This form will be used to present a summary statement of finances to be included in annual reports of foresters. (See Item 25 of Outline.)

(a) In this case the heading will be as follows:

Statement for the Year 1912.

(b) The balances existing at the end of the previous year will be inserted in the first two columns; the total receipts and expenses for the current year will be inserted in their proper columns and the final balances should be the same as those for December.

(c) All expenses during the year paid, or material furnished, directly by the Department, should be entered in red ink.

(d) Money paid from receipts on reserve should likewise be entered separately in red ink and inclosed in parenthesis.

(e) The total of all money forwarded to the Department should be indicated, as well as the balance of receipts on hand.

31.

Forest Products.

1. In order to determine the development and possibility of the forest it is necessary to keep an accurate record of yields according to species and products.

2. The only safe basis for computation is that of solid cubic feet of wood, exclusive of bark. If bark is sold with or without wood, a separate statement of quantity and price should be given. The individual forester is the only one who can determine this volume. He knows the number and quantities of various products and can readily determine the factor for reduction to cubic feet. No fast rule of thumb can be laid down for this purpose.

3. Exact measurements should be taken whenever possible and experiments made from time to time in order to determine the factor for a particular kind or quality of produce. The results of such experiments and exact details thereof should be carefully recorded and kept on file.

4. Prices given should be those of various sizes, classes, and qualities of material when ready to be removed from the reserve.

5. Data should be kept in each operation so that the forester may easily determine the stumpage value of various species and sizes of trees when made into various products. It is only in this way that it will become possible to determine the most satisfactory rotation and species for various localities and conditions.

6. If more than one species has been cut on one compartment enter the amounts cut of each species on separate lines, in the four columns provided for species, and make separate distribution into product columns for each amount.

7. Bark may be entered in "By-product" column but mark it as such. Other by-produtcs might be tree seed, charcoal, or anything, other than wood, that may be derived from the trees of the reserve.

32.

Financial Receipts.

1. The acreage to be given in the second column is that which can be used for wood production.

2. The third column calls for cubic feet and means solid cubic feet of wood, exclusive of bark.

3. If bark, alone or with wood, is sold by weight, some statement should be made to this effect and quantity given.

4. "Gross receipts" means the total value received for a product.

5. "Net receipts" means the receipts from a product after deductions have been made for expenses connected with the manufacture and sale of the product.

6. If material is sold on the stump and no charges except for super-

vision are made, the receipts would be entered as gross receipts and the charges for supervision, so marked, should be entered in column for cost of harvesting.

7. Minerals are usually sold on lease and consequently may be entered directly in net receipts column.

33.

Plantation Report.

1. For reserve record, one report sheet should be made for each plantation, as soon as the plantation has been made.

2. Each plantation on a reserve should be numbered consecutively and the record filed accordingly.

3. The location of the plantation should be definitely set forth.

4. Be accurate as to area planted. Make a survey when possible. The area to be entered in second column is the number of acres within the compartment which can be used for wood production.

5. Always describe in detail the method of making the plantation. If seed be used, indicate whether spot, strip, or broadcast sowing.

6. Give planting distance.

7. Specify for each plantation, age, species of plants used, or species of seeds.

8. Give data concerning soil conditions, condition of growth present, etc.

9. Describe the preparation of the soil, if any, fencing, or other protection necessary.

10. Give detail account of expenses connected with making the plantation, including forester's and ranger's time, as well as the items of expense indicated on the form.

11. In summing up total expense and determining cost per acre, make sure the figures are correct before placing them on the form.

12. For annual report to Department, one sheet may be used for several plantations.

13. If two or more species have been planted in mixture or if each species is planted on a small area, the areas adjoining each other, one plantation record is sufficient. If, however, large contiguous areas are planted pure with different species, it will be better to make a plantation record for each area and species.

34.

Annual Planting Report.

1. This form is intended as a summary of seeds and seedlings planted on reserves.

2. The figures on this form must correspond with the totals of Plantation Records for the year.

3. Seeds collected and planted on the same reserve should be indicated in red ink so as to distinguish such from seed furnished by another forester or purchased by the Department.

4. Seedlings raised and planted on the same reserve should be indicated in red ink so as to distinguish them from seedlings furnished by other nurseries.

5. Do not place on this form the amount of seed collected but not

planted on the reserve. Such a statement should appear elsewhere in the Annual Report (Item 12 of Outline).

6. Be sure to distinguish and place in the proper columns seeds planted in a nursery and those planted in permanent plantation.

7. If seeds or seedlings, the botanical names of which are not found in the list on the form, are planted, indicate the proper name in the blank spaces. The nomenclature of Gray's New Manual of Botany, Seventh Edition, is to be used.

8. Any plant raised from a seed is a seedling. The age of a seedling is determined by the number of growing seasons through which it has passed. A seedling having completed its first season of growth is designated as "a one year old seedling," irrespective of when the seed was sown. It remains a one year old seedling until the second season's growth begins, when it may be said to be in its second summer, but it does not become a two year old seedling until the second season's growth is completed.

Even though seedlings may have a new season's growth started in the spring when they are planted or transplanted, they are still designated by their age of the previous winter.

9. The age of transplants is determined by the number of growing seasons through which they have passed.

A seedling transplanted at the end of the first season's growth or at the beginning of the second and remaining in the transplant bed throughout the second season of growth, is two years old and may be designated as a two-year old transplant, or represented by the figures 1-1.

A seedling two years old, transplanted at the end of the second season's growth or at the beginning of the third and remaining in the transplant bed throughout the third and fourth seasons of growth, is four years old and may be designated as a four year old transplant, two years transplanted, or represented by the figures, 2-2.

35.

Plantation Growth Record.

It is absolutely necessary that the Department of Forestry collect uniform data with reference to the growth of trees in artificial plantations, upon which may be based future sylvicultural and financial plans. This form will serve for such purpose.

1. One sheet should be used for each plantation or for each species in the plantation.

2. This record sheet should be related to Form 33 by entering upon it the consecutive number of the plantation which it concerns.

3. Cross out "Seeds" or "Seedlings," according to what was used in making the plantation.

4. "Age of Seedlings" refers to the age of the plants when they were set in plantation.

5. In planting seeds, there may be spot, strip, or broadcast method of sowing, and various details connected with each. In planting seedlings, there may be hole, mound, split sod, and various other methods and details connected therewith. These details should be set forth either on the back of this sheet or on Form 33.

6. The second column, "Age of Trees," should give the age of the trees from seed.

7. During the first ten years of a plantation, height growth may be measured annually or biennially.

8. From the tenth year, measurements of both height and diameter may be taken at five year intervals, preferably when the trees are 10, 15, 20, 25, and so on, years of age.

9. Measurements should be made during the resting period of growth.

10. Diameter measurements should be made at the same height, and at approximately the same temperature. (Breast height is four and one-half feet above ground.)

11. Height growth should be given in feet and tenths of feet; diameter growth should be given in inches and tenths of inches; volume growth should be given in cubic feet and to three decimals.

12. Maximum current height growth is the greatest growth in height of any one tree during the season of growth just passed.

13. The average current height growth is determined by adding the lengths of the past year's shoots of all the trees in the plantation and dividing the sum thus obtained by the number of trees.

14. The mean annual height growth of a plantation is determined by adding the total heights of all trees in the plantation and dividing the sum by the number of trees to obtain the average height at the time of measurement. This average must then be divided by the number of years the trees are old.

15. The mean annual diameter growth is determined by adding the sectional areas of all trees in the plantations, as found from diameter measurements, and dividing the sum by the number of trees in the plantation. The result will be the average sectional area at the time of measurement. From this may be found the average diameter. The average diameter is then divided by the number of years the trees are old to obtain the mean annual diameter growth.

16. Having the average height and diameter of the trees in a plantation at any time, the volume of such a tree is determined by finding a tree of such size and making careful volume measurements of it. The volume of such a tree, called the "mean sample tree," multiplied by the number of trees in the plantation, will give the volume of the whole plantation. (See Graves' Mensuration, pp. 228 and 229.) This volume divided by the number of years the trees are old will give the mean annual volume growth.

17. When material is removed, the date should be given.

18. Explanation of Crown Classes:

Predominant—When the crown of the tree is partially or wholly above the general level of the top of the canopy.

Dominant—When the crown has light from above and very little from the side, being one of those making up the more or less even canopy height.

Intermediate—When the crown has no light from side and only a small amount from the top.

Suppressed—When the crown receives no light from top or side and the tree is in a weakened condition by reason of insufficient light.

36.

Roads, Trails and Fire Lanes.

1. A road shall be considered as a way of travel wide enough for the use of wagons, having been so used or to be used, and is supposed to be made bare of growth for at least 6 feet, especially if it is to be a part of the permanent road system.

2. A trail shall be considered as a narrow way for foot travel, or for horse-back riding, and is supposed to be made bare for from one to three feet.

3. A fire lane shall be considered as a way cleared through brush or forest, where a road or trail would never likely be built, and from which the brush and loose debris are removed. The width may be from 4 to 20 feet, of which at least one foot should be made bare.

4. When a road or trail has been laid out and the right of way cleared of brush only, it should not be reported as a fire lane.

5. A trail may, at some time, become a road, or a road, by discontinued use, may become a trail. Either or both may be abandoned.

6. Any changes in conditions should be noted, and reasons for them given.

7. Brush may be removed from either side of a road or trail to any distance permitted, but not change the character of the way. The brush removal should extend no farther than is necessary. Bare soil is better than great width of open space.

8. Distinguish carefully between extension and improvement.

(a) Extension refers to an entirely new road, trail or fire lane, where none has existed previously.

(b) Improvement refers to work done upon old roads or trails now existing, or upon new roads after having been considered completed and repairs become necessary.

9. Each road, trail, or fire lane should be designated definitely and its termini definitely determined from time to time.

10. Grading refers to the establishment of the general grade of a road or trail, as indicated by its rise or fall in length and includes the cost of survey.

11. Ditching refers to the accomplishment of good drainage by ditches on inside of road, cross-drains or sub-drainage.

12. Surfacing refers to rounding up the road after it has been graded and ditched, either with earth, gravel, stone or other material necessary to complete the work and make a finished road.

13. The cost of extension should be indicated by the rate per 100 feet of distance extended.

14. All improvements and repairs should be reported on the basis of cost per 100 feet of total length of road.

15. Notice that the column headed "Length" is under "extension" and in it should be placed the length of extension of new road, trail, or fire lane, and not the total length of the road. The latter may be indicated in small figures in the column headed "Roads, Trails, or Fire Lanes."

16. In summary to Department in Annual Report, use one sheet for roads, one for trails and one for fire lanes.

17. Brushed boundary lines should be so indicated and not classed as fire lanes, although they may be reported upon this form as well as under item 3 of report outline.

18. All roads, trails, streams, and open boundary lines are fire lanes in effect but should not be reported as such.

37.

Descriptions of Compartments.

Forms 37, 38 and 39 are very important as a basis of future forest management. It is not expected that exact data can be recorded upon them at present, but an effort should be made to cover the whole reserve and make proper entries on these forms, recording everything as far as possible at present. From time to time proper revisions may be made. In no case should the preliminary sheets be destroyed.

1. It should be remembered that the compartment is the smallest unit of management, should be bounded by geographic features, roads, or trails, as far as possible, and should not exceed 300 acres.

2. For the time being, warrants may be used in place of compartments, if their locations are definitely known.

3. A "blank" is a portion of the timber producing area, having no trees or but a few, hence necessitating a complete restocking. It does not include any areas not intended for wood production. In some cases the latter areas may have a thin stocking which may give a small return from time to time.

4. Under "Sylvicultural System" may be given any past history with reference to the growth.

5. "Quality of Locality" may be indicated by Roman numbers.

6. "Quality of Growing Stock" may be indicated by decimals and should comprehend density and condition of trees.

7. Under "Remarks" may be stated something descriptive of present conditions and of suggested future treatment.

8. Do not be afraid to use paper in giving details.

38.

Table of Areas.

This form is self explanatory and requires only a careful estimate or survey of areas.

39.

Tables of Qualities of Locality.

By "Quality of Locality" is meant the yield capacity as expressed by the quantity of produce which can be derived from the locality.

1. Under "Species and Sylvicultural System" should be noted conditions at present.

2. The following table shall determine the quality class.

I. (Best) Areas capable of producing per acre per annum 100 solid cubic feet of wood or more.

II. Areas capable of producing over 75 and less than 100 solid cubic feet of wood.

III. Areas capable of producing over 50 and less than 75 solid cubic feet of wood.

IV. Areas capable of producing over 30 and less than 50 solid cubic feet of wood.

V. (Poorest) Areas capable of producing over 10 and less than 30 solid cubic feet of wood.

3. Remarks should cover any matters which will set forth present conditions in any clearer light.

40.

Valuation Survey.

There are many methods of making a valuation survey, but this form is adapted to most of them.

1. Each sheet should be dated on the day the notes are entered.

2. "Locality" refers to quality of locality.

3. "Area" refers to the area which is being worked, as either the total area or the unit or area.

4. "Number" is that of the sheet covering the area indicated.

5. Calipering should be done carefully, paying attention to

(a) Position of calipers. They should be at right angle to the axis of the tree.

(b) Uniform height of measurement should be maintained.

(c) Swellings, knots, vines, etc., should be avoided.

(d) Average diameter should be read.

6. Except in case of very exact work, diameters may be entered in two-inch classes.

41.

Tree Analysis.

"The measurement of a felled tree to determine its growth is called a tree analysis." H. S. Graves.

1. Date should be entered, the day the analysis is made.

2. "Type" refers to type of tree, as predominant, dominant, or suppressed, etc.

3. "Locality" refers to quality of locality.

4. "Height of Cross Section" refers to the number of feet above ground at which the annual rings are counted and measured.

5. To determine the age of the tree, determine the number of years required for the tree to reach the height of the cross section, by examination of small seedlings or sprouts in the neighborhood; e. g., if the tree is cut at one foot from the ground and is a white pine, it may have required five years to reach that height. Then count the number of rings from centre to bark; add five for the total age.

6. If the cross section is one foot above ground and it took five years to reach that height, the radius at one foot when five years old was 0. At ten years the radius was the distance from centre to outside of the 5th annual ring; at 15 years the distance from centre to tenth annual ring, and so on.

7. Suppose the tree is 87 years old and the cross-section is 40 feet high. We determine first where the annual ring laid on in the 80th year of growth is by counting seven rings from the bark. The radius at 80 years at this height is the distance from centre to the outside of the ring, outside of which there are still seven rings.

Counting ten rings toward the center determines the annual deposit of wood made in the 70th year of the tree's life, and so on.

There may be a number of rings from the place of last measurement to center, say, 8. It would mean, if in all there were 25 rings on the cross-section, that it required 62 years to reach a height of 40 feet; in other words, 87 minus 25 equals 62.

8. "Diameter B. H." refers to diameter at $4\frac{1}{2}$ feet above ground, outside of bark.

9. "Merchantable Length" refers to the total length of stem that might possibly be used, if taken to the lowest diameter which can be utilized in any market.

10. When analysis is made for accurate results, the tree should be cut into sections not longer than four feet.

(a) The tree must be cut off as close to the ground as possible.

(b) The next cut must be at exactly two feet above stump cut.

(c) The last two cuts must be made two feet apart.

(d) In computing volume the portion of the tree above the last cut must be considered as a cone.

11. The name of the person making the analysis must be on each sheet.

42.

Tree Volume.

This sheet is to be used for recording the final figures in working up tree volume from data on Form 41.

1. Date should be the day upon which the calculations are made.

2. "Species," "No. of Tree," "Type," and "Locality," should correspond with the entries on Form 41, from which the necessary data are taken.

3. "Type" again refers to type of trees.

4. "Locality" refers to quality of locality.

5. The first computation will be to calculate the volume of the whole tree, including bark (branch wood may or may not have been considered in the analysis).

(a) The stump will be regarded as a cylinder.

(b) Each log shall be regarded as a truncate paraboloid the volume of which equals one-half the sum of the sectional area of top plus the sectional area of the base, multiplied by the length. Represented in formula $V = \frac{S+s}{2} \times L$

(c) What is left above the last log is considered as a cone.

6. The second computation is to find the volume of the whole tree without bark.

7. The next computations are for the volume of the tree, without bark, at specific ages, as seventy, sixty, fifty, forty years, and so on.

8. In the case of special analysis as under item 10, Form 41, the second cross-section is regarded as the sectional area in the middle of a four foot truncated paraboloid, the volume of which is found by multiplying the sectional area in the middle by the length, which in each instance in this case is 4. Refer to Vol. III Schlich's Manual of Forestry, 3rd Edition, page 30.

43.

Application for Examination for Admission to the State Forest Academy.

This form must be used by all who desire to take the examinations. They may be had by writing to the Department.

44.

Academy Contract—Major.

To be entered into by those who receive appointments to the Academy as students, and who are past their majority.

45.

Academy Contract—Minor.

Same as above, except to be entered into by those who have not yet reached their majority.

46.

Academy Bond.

To be entered into by all who receive appointments as students at the State Forest Academy.

47.

Nursery Certificate Shipping Tag.

1. One of these shipping tags, with the certificate properly filled up, must be attached to each package of seedlings sent from any of the inspected nurseries. This is required by law.

2. Do not use this form for the address card when it must be attached to a box. Use an ordinary plain shipping tag.

48.

Application for Forest Tree Seedlings.

This form will be sent from the Department to all private individuals (not to foresters on reserves) who desire seedlings from the Department nurseries.

49.

Lightning Report.

1. This form is to be filled up by foresters, rangers, and any other observers the forester may be able to interest in the work.

2. Definite areas will have to be designated where two observers might be likely to make duplications.

50.

Nursery Operation Sheet.

The purpose of this form is that the forester may tabulate nursery expenses, so as to be able better to determine the cost of raising seedlings of various ages and species.

51.

Nursery Shipment Card (green).

1. The nurseryman must fill up this card at the same time as Form 52, and send it to the individual to whom seedlings are shipped as

soon as shipment is made. (In case of private individual, card is sent to Commissioner of Forestry.)

2. The forester receiving seedlings will retain this card, and as the seedlings are planted make note of their number, size, and quality upon the back of the form.

3. If seedlings are received in the fall and some have to be heeled in over winter for any reason, a statement concerning the matter should also be placed on the back of this form.

4. If any seedlings have been lost or destroyed, a statement should be made giving whatever information is available.

5. As soon as the shipment is checked by forester receiving it and the proper memoranda made upon the back of the form, it must be sent to the Commissioner of Forestry.

6. Nurserymen should call the attention of express agents to the fact that seedlings have a special low rate.

52.

Receipt for Nursery Stock (yellow).

1. One of these cards must be filled up by the nurseryman for each shipment and sent to the individual to whom the seedlings are sent together with Form 51. (In the case of private individuals both forms for each shipment must be forwarded promptly to the Commissioner of Forestry, who will then notify the person to whom seedlings have been sent.)

2. After seedlings have been received and checked carefully, the forester will place his signature upon the card, and upon the back of it note whether the shipment was correct, condition in which seedlings were received, general condition and quality of seedlings, and any other information of value to the nurseryman. Then the card must be returned promptly to the nurseryman from whom it was received.

18. All roads, trails, streams, and open boundary lines are fire lanes in effect but should not be reported as such.

37.

Descriptions of Compartments.

Forms 37, 38 and 39 are very important as a basis of future forest management. It is not expected that exact data can be recorded upon them at present, but an effort should be made to cover the whole reserve and make proper entries on these forms, recording everything as far as possible at present. From time to time proper revisions may be made. In no case should the preliminary sheets be destroyed.

1. It should be remembered that the compartment is the smallest unit of management, should be bounded by geographic features, roads, or trails, as far as possible, and should not exceed 300 acres.

2. For the time being, warrants may be used in place of compartments, if their locations are definitely known.

3. A "blank" is a portion of the timber producing area, having no trees or but a few, hence necessitating a complete restocking. It does not include any areas not intended for wood production. In some cases the latter areas may have a thin stocking which may give a small return from time to time.

4. Under "Sylvicultural System" may be given any past history with reference to the growth.

5. "Quality of Locality" may be indicated by Roman numbers.

6. "Quality of Growing Stock" may be indicated by decimals and should comprehend density and condition of trees.

7. Under "Remarks" may be stated something descriptive of present conditions and of suggested future treatment.

8. Do not be afraid to use paper in giving details.

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Table of Areas.

This form is self explanatory and requires only a careful estimate or survey of areas.

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Tables of Qualities of Locality.

By "Quality of Locality" is meant the yield capacity as expressed by the quantity of produce which can be derived from the locality.

1. Under "Species and Sylvicultural System" should be noted conditions at present.

2. The following table shall determine the quality class.

I. (Best) Areas capable of producing per acre per annum 100 solid cubic feet of wood or more.

II. Areas capable of producing over 75 and less than 100 solid cubic feet of wood.

III. Areas capable of producing over 50 and less than 75 solid cubic feet of wood.

IV. Areas capable of producing over 30 and less than 50 solid cubic feet of wood.

V. (Poorest) Areas capable of producing over 10 and less than 30 solid cubic feet of wood.

3. Remarks should cover any matters which will set forth present conditions in any clearer light.

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Valuation Survey.

There are many methods of making a valuation survey, but this form is adapted to most of them.

1. Each sheet should be dated on the day the notes are entered.

2. "Locality" refers to quality of locality.

3. "Area" refers to the area which is being worked, as either the total area or the unit or area.

4. "Number" is that of the sheet covering the area indicated.

5. Calipering should be done carefully, paying attention to

(a) Position of calipers. They should be at right angle to the axis of the tree.

(b) Uniform height of measurement should be maintained.

(c) Swellings, knots, vines, etc., should be avoided.

(d) Average diameter should be read.

6. Except in case of very exact work, diameters may be entered in two-inch classes.

41.

Tree Analysis.

"The measurement of a felled tree to determine its growth is called a tree analysis." H. S. Graves.

1. Date should be entered, the day the analysis is made.

2. "Type" refers to type of tree, as predominant, dominant, or suppressed, etc.

3. "Locality" refers to quality of locality.

4. "Height of Cross Section" refers to the number of feet above ground at which the annual rings are counted and measured.

5. To determine the age of the tree, determine the number of years required for the tree to reach the height of the cross section, by examination of small seedlings or sprouts in the neighborhood; e. g., if the tree is cut at one foot from the ground and is a white pine, it may have required five years to reach that height. Then count the number of rings from centre to bark; add five for the total age.

6. If the cross section is one foot above ground and it took five years to reach that height, the radius at one foot when five years old was 0. At ten years the radius was the distance from centre to outside of the 5th annual ring; at 15 years the distance from centre to tenth annual ring, and so on.

7. Suppose the tree is 87 years old and the cross-section is 40 feet high. We determine first where the annual ring laid on in the 80th year of growth is by counting seven rings from the bark. The radius at 80 years at this height is the distance from centre to the outside of the ring, outside of which there are still seven rings.

Counting ten rings toward the center determines the annual deposit of wood made in the 70th year of the tree's life, and so on.

There may be a number of rings from the place of last measurement to center, say, 8. It would mean, if in all there were 25 rings on the cross-section, that it required 62 years to reach a height of 40 feet; in other words, 87 minus 25 equals 62.

8. "Diameter B. H." refers to diameter at 4½ feet above ground, outside of bark.

9. "Merchantable Length" refers to the total length of stem that might possibly be used, if taken to the lowest diameter which can be utilized in any market.

10. When analysis is made for accurate results, the tree should be cut into sections not longer than four feet.

(a) The tree must be cut off as close to the ground as possible.

(b) The next cut must be at exactly two feet above stump cut.

(c) The last two cuts must be made two feet apart.

(d) In computing volume the portion of the tree above the last cut must be considered as a cone.

11. The name of the person making the analysis must be on each sheet.

42.

Tree Volume.

This sheet is to be used for recording the final figures in working up tree volume from data on Form 41.

1. Date should be the day upon which the calculations are made.

2. "Species," "No. of Tree," "Type," and "Locality," should correspond with the entries on Form 41, from which the necessary data are taken.

3. "Type" again refers to type of trees.

4. "Locality" refers to quality of locality.

5. The first computation will be to calculate the volume of the whole tree, including bark (branch wood may or may not have been considered in the analysis).

(a) The stump will be regarded as a cylinder.

(b) Each log shall be regarded as a truncate paraboloid the volume of which equals one-half the sum of the sectional area of top plus the sectional area of the base, multiplied by the length. Represented in formula $V = \frac{S+s}{2} \times L$

(c) What is left above the last log is considered as a cone.

6. The second computation is to find the volume of the whole tree without bark.

7. The next computations are for the volume of the tree, without bark, at specific ages, as seventy, sixty, fifty, forty years, and so on.

8. In the case of special analysis as under item 10, Form 41, the second cross-section is regarded as the sectional area in the middle of a four foot truncated paraboloid, the volume of which is found by multiplying the sectional area in the middle by the length, which in each instance in this case is 4. Refer to Vol. III Schlich's Manual of Forestry, 3rd Edition, page 30.

43.

Application for Examination for Admission to the State Forest Academy.

This form must be used by all who desire to take the examinations. They may be had by writing to the Department.

44.

Academy Contract—Major.

To be entered into by those who receive appointments to the Acaemy as students, and who are past their majority.

45.

Academy Contract—Minor.

Same as above, except to be entered into by those who have not yet reached their majority.

46.

Academy Bond.

To be entered into by all who receive appointments as students at the State Forest Academy.

47.

Nursery Certificate Shipping Tag.

1. One of these shipping tags, with the certificate properly filled up, must be attached to each package of seedlings sent from any of the inspected nurseries. This is required by law.

2. Do not use this form for the address card when it must be attached to a box. Use an ordinary plain shipping tag.

48.

Application for Forest Tree Seedlings.

This form will be sent from the Department to all private individuals (not to foresters on reserves) who desire seedlings from the Department nurseries.

49.

Lightning Report.

1. This form is to be filled up by foresters, rangers, and any other observers the forester may be able to interest in the work.

2. Definite areas will have to be designated where two observers might be likely to make duplications.

50.

Nursery Operation Sheet.

The purpose of this form is that the forester may tabulate nursery expenses, so as to be able better to determine the cost of raising seedlings of various ages and species.

51.

Nursery Shipment Card (green).

1. The nurseryman must fill up this card at the same time as Form 52, and send it to the individual to whom seedlings are shipped as

soon as shipment is made. (In case of private individual, card is sent to Commissioner of Forestry.)

2. The forester receiving seedlings will retain this card, and as the seedlings are planted make note of their number, size, and quality upon the back of the form.

3. If seedlings are received in the fall and some have to be heeled in over winter for any reason, a statement concerning the matter should also be placed on the back of this form.

4. If any seedlings have been lost or destroyed, a statement should be made giving whatever information is available.

5. As soon as the shipment is checked by forester receiving it and the proper memoranda made upon the back of the form, it must be sent to the Commissioner of Forestry.

6. Nurserymen should call the attention of express agents to the fact that seedlings have a special low rate.

52.

Receipt for Nursery Stock (yellow).

1. One of these cards must be filled up by the nurseryman for each shipment and sent to the individual to whom the seedlings are sent together with Form 51. (In the case of private individuals both forms for each shipment must be forwarded promptly to the Commissioner of Forestry, who will then notify the person to whom seedlings have been sent.)

2. After seedlings have been received and checked carefully, the forester will place his signature upon the card, and upon the back of it note whether the shipment was correct, condition in which seedlings were received, general condition and quality of seedlings, and any other information of value to the nurseryman. Then the card must be returned promptly to the nurseryman from whom it was received.

END OF NUMBER.