WEST VIRGINIA
GEOLOGICAL SURVEY

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NATIVE BALSAM FIR TREE GROWING IN CANAAN VALLEY, TUCKER COUNTY.

WEST VIRGINIA GEOLOGICAL SURVEY

VOLUME FIVE

Forestry and Wood Industries

BY

A. B. BROOKS

I. C. WHITE, State Geologist

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LETTER OF TRANSMITTAL.

To His Excellency, Hon. William E. Glasscock, Governor of West Virginia, and President of the State Geological Survey Commission :

SIR: I have the honor to transmit herewith Volume V of the general series of Survey publications. This volume on Forestry and Wood Industries of the State has been prepared by Mr. A. B. Brooks, a practical woodsman who has given special attention to Forestry during his training at the State University. Mr. Brooks is at home in the forests, and knows the trees and their habits from long and intimate acquaintance. No subject except the mineral fuels is of equal importance to the future of our State. Every year the supply of available timber grows less. The accompanying map will show how small is the area of Virgin Forests yet remaining in our State, a mere fragment of what it was even within the recollection of the writer. Vast areas of our mountain regions unfitted for agriculture could be reforested at great profit to the State, if the matter were taken up systematically under proper forestry laws which minimize fires and encourage tree planting. Whether the State should acquire these cut-over and unproductive lands as is being done in our sister states of Pennsylvania and New York, and proceed to reforest the same, or whether such encouragement should be given to the private owners in the shape of reduced or nominal taxation as would encourage them to undertake systematic reforestation are questions that should engage the serious attention of our statesmen. At the present rate of exhaustion, 15 to 20 years will practically see the end of our virgin forests, and with annual forest fires sweeping through the cut-over areas, it will be a century or more before nature unassisted can reforest these areas and produce another crop of merchantable timber. The price of lumber to all the citizens of West Virginia must greatly advance with the disappearance of the present virgin forests, so that the question of reproducing other forests to replace this vanishing heritage is one that affects financially every citizen of the State.

Mr. Brooks has in these pages given a graphic account of the former timber wealth of the State, and its rapid disappearance though the combined attacks of fire, farmers, and saw mills, and has also given a summary of the forestry laws in our sister States showing how our neighboring commonwealths have attempted to deal with the question of future lumber supply, as well as with the all important question of protecting water sheds. The interesting story he has given shows for itself how well he has performed the allotted task. It is hoped that the perusal of this volume by the citizens of the State may lead to a more intelligent appreciation of the great potential value to all the people of a wise forest policy which shall lead to the rapid reforestation of millions of acres of our cut-over and burnt-over lands that are so happily adapted to forest growth, and but poorly fitted for agriculture.

Very respectfully,

I. C. WHITE,
State Geologist.

Morgantown, W. Va.
February 1st, 1911.

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A U T H O R ' S P R E F A C E .

The forestry policies of the Government or of any of the states have not come into existence suddenly, but have been developed slowly from small beginnings. The present highly specialized and effective service of the forestry organizations of the Federal and certain state governments has usually been preceded by fundamental investigations and by work which was more general in its scope.

The present volume on forestry is essentially preliminary. It is in no sense a report of completed work. On the contrary, it is intended to call attention to a long-neglected duty which the citizens of West Virginia owe to themselves and their posterity—the protection and wise utilization and improvement of the remnants of our forest lands. Much of that which is herein suggested is yet to be done. The timber producing capacity of our forests is pointed out in order to encourage owners to work for maximum yields; their utility is discussed for the purpose of stimulating a new desire which has taken hold of the people to prevent the total destruction of one of our most useful and indispensable natural possessions. Likewise, the nature and extent of destruction wrought by the various enemies of trees and wood are mentioned that they may be better understood and more surely controlled.

The chapters devoted to a discussion of the present condition of woodland in the State as a whole and that of each separate county are intended to supply such general information as will lead to definite efforts toward improvement, and to constitute an essential though imperfect basis for future work in detail. The map which accompanies this report represents graphically the location and extent of wooded areas.

The chapter on forestry in other states is included as a basis for comparison of methods employed and as a means of contrasting the work accomplished in different parts of the country.

It is hoped that the chapter containing a list of the native trees and shrubs of the State may be of use from a commercial standpoint, and that it may tend to induce some persons to make such a study of our exceedingly interesting flora as will add

greatly to the present imperfect knowledge of the occurrence and distribution of various forms of plant life.

The recommendations given at the end of the volume are purposely made brief to emphasize the importance of taking definite advanced steps; and it is earnestly desired that such measures as will meet present urgent demands may be adopted without undue delay.

The information given herein relative to conditions in West Virginia was largely obtained in the field during the summer, fall, and winter of 1910. The difficulty experienced in gathering accurate data over so wide a field was very great; and time would not permit the verification of considerable second-hand information. For this reason, in justice to himself, the writer must disclaim responsibility in part for slight errors which doubtless occur in several instances.

Numerous persons have freely assisted in the preparation of this report.

Lumbermen, timber cruisers, surveyors, and many others, contributed information regarding the location and character of timber-lands, the condition of original forests, history of the lumber industry, etc. The names of many of these are given in the body of the volume.

The illustrations herein are reproduced from photographs made by Fred E. Brooks, Associate Entomologist of the West Virginia Experiment Station, except such as are otherwise credited.

That part of Chapter Four which relates to fungi was read by Dr. John L. Sheld on, Professor of Botany and Bacteriology at the West Virginia University, and his private collection was used in preparing the list of destructive fungi.

During the collection and preparation of data for this report frequent and valuable suggestions were furnished by Dr. I. C. White, State Geologist.

The writer takes pleasure in acknowledging his indebtedness to all who have aided him in any way in the preparation of this volume.

A. B. BROOKS,
Forester.

Morgantown, West Virginia, February 1, 1911.

CHAPTER I.

INTRODUCTION.

The object of forestry is to discover and apply the methods according to which forests are most profitably managed. The principles of this science bear somewhat the same relation to the production of crops of trees that those of agriculture and horticulture bear to the growing of crops of grains and fruits; but its applications are broader. Forests not only produce wood for the building of houses, and ships, and cars, and for the manufacture of thousands of useful and indispensable wooden articles—they do more than this. They prevent the washing of soils from cultivated lands, where they are needed, into rivers and harbors where they hinder navigation; they hold the water of rains and melting snows and give it out gradually to the springs that regulate the flow of creeks and rivers; they furnish a place for recreation to hunters, to fishermen, to collectors, to students, and to thousands of persons who enter them in search of a restful influence which can be found in no other part of nature; they shelter and furnish homes for multitudes of beneficial mammals and birds; and they act as protectors from winds, as modifiers of climates, and as beautifiers of landscapes.

Forestry is not a new science. It was practiced in Switzerland and Germany and other European countries centuries before it was thought of in America. Some of the countries of Asia and Europe disregarded it. They did not prevent the destruction of their forests when they had the opportunity. When their forests were gone the soil became impoverished and the streams dried up. Then large areas had to be abandoned by every inhabitant, for the land no longer produced any food. Syria, China, Austria, Sicily, Denmark, France, and many other countries have suffered from such neglect. Some of these

have spent many millions of dollars in restoring their forests; others have lost territory that they can never regain. History has shown us that the countries which protect and utilize their forests become powerful and influential and prosperous; that those which destroy them become weak and degenerate.

The need of preserving the forests of this country was not apparent to many persons 200 years ago. The pioneer settlers of our Eastern states built their homes in what they considered an almost boundless wilderness. Trees were regarded by them, naturally, as obstacles in the way of improvement, for they were removed with great labor and could not be sold or given away. The openings first made were insignificant in comparison with the vast woodlands which surrounded them. But this was not long the case. As the population increased and settlements were extended from year to year, the small cornfields were widened into extensive farms; fires began to take their toll from the forests in the region of settlements; and the occupation of lumbering began. In the course of time the various agents of destruction, working together, produced a serious condition in the forests. The condition was not readily observed because the people had not been trained to expect trouble from such a source. The conception that the forest was boundless and inexhaustible had been transmitted from one generation to another until it had become fixed in the minds of the inhabitants as a firm belief. With this inherited handicap, therefore, the present generations were slow in believing even what reason taught them was true. When the Government and the states took up the work of forest conservation it was not approved by all classes of people. The reform necessary for protection involved a complete change from practices which had been followed during a long period of years in which habits had been formed and customs established. These had to be overcome. It became necessary to agitate the question and to carry on a campaign of education. The new measures proposed were taken up and published and repeated by the press and from the platform until they became familiar to all concerned and often until the reformers themselves were looked upon as overzealous fanatics. Men were appealed to through every channel of approach;—some through their business capacity, others

through their sense of honor and obligation, and others through their esthetic tastes. They were told that "The most imperative duty of America is to save the forests;" that "It is unpardonable for the nation or the states to permit any further cutting of timber save in accordance with a system which will provide that the next generation shall see the timber increased instead of diminished;" that "The most terrible condition now confronting our people is the failure to protect the great forest industries of our country;" that "A timber famine is one of the inevitable events of the near future;" and thousands of similar truths, repeated by men of highest position and influence.

There were some regions where conditions helped the people to see their danger and to believe the principles that were being advocated many years ago, so that it was possible for the Government and several of the states to begin and carry on their important work without disapproval. As one success after another has been achieved all have been made to see that forestry is no longer in its experimental stage under any condition; and that the results of intelligent and determined effort for the betterment of forest conditions are no longer problematic. The Forest Service is now regarded as one of the most helpful branches of the Department of Agriculture. Its work is important in nearly all sections of the United States. The Government Forests, scattered from Minnesota to California and containing 190 million acres or more, are administered by the Forest Service officials. It co-operates with states in forest investigations; it undertakes the study and solution of forestry problems which are beyond the power of individuals to handle without assistance; and it prepares and distributes a great volume of literature relating to every phase of forestry.

The actual achievement of objects by the Government and by states has given weight to all that has been said, and has hurried a widespread awakening. What the states are doing is told in Chapter VII of this report. It is sufficient to say that the states which have spent the largest sums and have laid the most solid foundations for their forest policies are the ones which have succeeded; and that there is not now the slightest

reason for offering an apology of any sort for the expenditure of enormous sums of money for the improvement of forest conditions, nor for the slight expenditure necessary in taking the important initial steps in that direction. On the contrary, those states which have not acted when they have known the truth have not measured up to their obligations.

In calling attention to the condition of West Virginia forests and to the necessity for a more economical use of them, we bring before the farmers, the manufacturers, the lumbermen, before business men, professional men, capitalists, laborers, and men of every trade and calling, a question in which they are all alike interested. In no state are the forests greater timber producers, and in no state do they occupy a more important position than in West Virginia. The non-agricultural lands lie on our mountains at the heads of the streams. The removal of forests from these lands would affect not only the citizens of this state but all who are influenced in any way by the flow of the Ohio river. The approximate figures given below will serve to show the situation briefly.

There once existed within the present limits of West Virginia an almost unbroken forest covering more than $15\frac{1}{2}$ million acres and containing 150 billion feet of timber. During the time which has elapsed, from the clearing of the first acre by civilized men to the present, the virgin forest area has been reduced to one-tenth its original size or to $1\frac{1}{2}$ million acres. In addition to this area there are extensive cut-over forests aggregating about 3 million acres; and 5 million acres of farmers' woodlots. The present forests, then, cover 60 per cent of the state and contain not less than 25 billion feet of standing timber. There are 83 mammoth band saw mills and about 900 portable saw mills operating within the state. These have a combined annual capacity of approximately $1\frac{1}{2}$ billion feet. Should all of them continue to operate as at present they would cut the timber of the state in a little over 16 years.

There are many reasons why the situation is not as hopeless as the figures above may suggest. The greatest of these reasons is found in the attitude of public officials, law-makers and common people whose knowledge of the value of the forests

SCENE ON THE LITTLE BLACKWATER RIVER.

and whose admiration of their beauty will not suffer them to be destroyed completely. Forest land owners are making a greater effort than ever before to protect their property from fire; and the Legislature has enacted a law to help them in the endeavor. Lumbermen, in some cases, are making extensive plantations in their cut-over forests; and others are ready to follow their example when they see that the danger from fire is lessened and are encouraged by more favorable laws of taxation. Farmers in many sections are making inquiries concerning the management of their woodlots, and are everywhere deploring useless waste of timber and are calling for better care of our forests.

CHAPTER II.

WEST VIRGINIA AS A TIMBER PRODUCING STATE.

Location and Area.

West Virginia was separated from Virginia during the Civil war and was admitted to the Union as a state on June 20, 1863. As originally constituted it was divided into 48 counties. Berkeley and Jefferson came in after a period of litigation in 1866. Five counties—Grant, Mineral, Lincoln, Summers, and Mingo—were organized between 1866 and 1895.

The boundaries of the state are extremely irregular. Beginning at a point on the Potomac river a short distance below Harpers Ferry the line follows the south bank of the Potomac and its North Branch to the Fairfax Stone set at the head of the stream; thence almost due north to the Mason and Dixon Line; thence west with this line to the southwest corner of Pennsylvania; thence north to low water mark on the northwest bank of the Ohio river. From here the line turns to the southwest and follows the right bank of Ohio river for 256 miles to the mouth of Big Sandy river; thence up the Big Sandy and its Tug Fork to the western end of McDowell county, a short distance above the northeast corner of Kentucky; thence with the watershed separating the Tug and Levisa Forks of Big Sandy to the southernmost point of the state; thence it turns to the east and northeast, crosses the head of Dry Fork of Tug river, and follows Horsepen creek and Big Stone ridge to the Mercer line; thence southeast across the Bluestone basin to the crest of East River mountain; thence with this mountain and across New river to the crest of Peters mountain. Here the line turns northeast and follows the crests of Peters and Potts mountains and the main ridge of the Alleghanies to the

southwestern corner of Pendleton county; thence it turns southeast across the Potomac basin to the crest of Shenandoah mountain, which it follows for some distance northeastward; thence southeast to the crest of North mountain; thence with this mountain and its foothills to the Morgan county line; thence by a straight line running southeast across Back creek, Opequon creek, and the Shenandoah river, to the crest of Blue Ridge mountains; thence with this mountain crest to the beginning. The line thus described is about 1,170 miles in length.

The state is situated between 37 degrees 6 minutes and 40 degrees 38 minutes north latitude, and between 40 minutes and 5 degrees 35 minutes longitude west from Washington. Ohio and Pennsylvania bound it on the north, Pennsylvania, Maryland, and Virginia on the east, Virginia and Kentucky on the south, and Kentucky and Ohio on the west.

The area of West Virginia is usually given at 24,715 square miles. The area, as determined by the original calculations of the United States Geological Survey,—including 135 square miles of water surface—is 24,780 square miles. Later and more careful calculations of the areas of several of the counties have reduced these figures to 24,643 square miles, or 15,771,520 acres. Exact figures will not be obtainable until the re-survey of the state has been completed.

The greatest air line distance across the state in any direction is 274 miles from Harpers Ferry to Kenova. The distance from the northern extremity of Hancock county to the most southern point in the state is 245 miles.

Topography.

As the topography of each separate county is described in another part of this report, it will be necessary here to describe that of the state as a whole, only in a general way and to add a few interesting facts regarding elevations, etc.

The greater part of West Virginia lies in the Ohio river drainage basin between the Alleghany mountains on the east and the Ohio river on the west. The average elevation of the crest line of the mountains is about 4,000 feet; that of the river is about 600 feet. This large, westward-sloping area is a northeast continuation of the Cumberland plateau, or the

high table-land from which rise the Cumberland mountains. In all places in West Virginia it is deeply dissected and its resemblance to a plateau can be recognized only by obtaining a broad view from some elevated ground. The portion of the state lying east of the Alleghany Front descends more rapidly with the Potomac basin to the valley of the Shenandoah. On both sides of the Alleghany crest—particularly on the east side—there is a succession of parallel mountain ridges which lessen in elevation toward the east and west. We have, then, the plateau region sloping down more or less gradually from the top of the mountains to the Ohio river, and the more abrupt slope descending by broken parallel mountains to the lowlands of the eastern panhandle. This general view has given some authors authority to speak of the topographic features of the state as simple. The claim of other authors that it is complex will be generally accepted by those who have visited most sections of the state.

A clearer idea of the surface configuration can be obtained by dividing the state into three sections which may be called (1) the Ohio river section, (2) the mountain section, and (3) the Potomac section.

The Ohio river section embraces about 30 of the hilly counties lying along and back from the Ohio river. It ranges in elevation from 500 feet at the mouth of Big Sandy river to 1,500 feet, or more, on top of some of the high hills which lie nearest the mountains. The 1,000-foot contour line crosses the Dry Fork of Big Sandy river at the mouth of Crane creek, and the Tug Fork at the mouth of Dry Branch in McDowell county; it crosses the Great Kanawha near Sewell station in Fayette county, the Gauley at Wood's Ferry, and the Elk at the Braxton-Webster line. The bed of the Little Kanawha river is below 1,000 feet up to the mouth of Gladys creek in the southern end of Lewis county. From this point the course of the 1,000-foot line is irregular up to the Preston county corner of Pennsylvania, whence it crosses Greene and Washington counties and re-enters the state 225 feet above the Monongahela river level in Monongalia county. It crosses the Cheat river at the mouth of Sandy creek in Preston county, the Tygarts Valley

6 miles above Grafton, and the West Fork at Weston. It is thus seen that a large percentage of the Ohio river section lies below 1,000 feet. The bottom lands are wide in most places along the 256 miles of the Ohio river, which borders this section on the west, and along the Great Kanawha up to a point some distance above Charleston. The bottoms are narrower along the Little Kanawha, the Monongahela, the Big Sandy, the Guyandot, the Elk, and so on, somewhat in proportion to the size of the stream.

“If we begin in the eastern part of Monongalia county at 1,500 feet and trace a level line southward it will pass a little east of Grafton, east of Philippi, east of Buckhannon, along the Braxton-Webster line, west of Fayetteville, and east of Oceana, to the most eastern point of Kentucky.” The line here described may be said to mark the beginning of the mountain section or the place where the hilly region ends and where the mountain region of the state begins; though the one passes almost imperceptibly into the other. Along this line—sometimes called a “line of rapids”—are to be found the “roughs” of the Guyandot in Wyoming county, the falls of Great Kanawha in Fayette county, Valley Falls in Taylor county, and numerous other falls and rapids of other streams. As a rule the portions of the streams above this line are too rapid to admit of navigation, and in many of them even the successful rafting of logs is impossible. The upward slope of the surface from the 1,500-foot level is with the tops of thousands of mountains arranged irregularly and deeply carved throughout the great Back Alleghany region, and with the long, undulating crests of the ridges which begin with Flat Top mountain and Laurel ridge and end at the elevated crest of the Alleghanies. Eastward from this crest there is greater uniformity, the mountains trending northeast and southwest with considerable regularity and lessening in elevation with each successive ridge. The 1,500-foot level, which may be taken as the eastern line of the mountain section, is again reached in Grant county. The mountain section, as here described, includes the counties of Preston, Tucker, Pendleton, Randolph, Webster, Pocahontas, Greenbrier, Monroe, Summers, Mercer, and McDowell, with parts of Wyoming, Raleigh, Fayette, Nicholas, Upshur, Barbour,

Taylor, Monongalia, Grant and Mineral counties. This section reaches an elevation of 4,860 feet on the summit of Spruce Knob in Pendleton county.

The Potomac section includes the counties of Jefferson, Berkeley, Morgan, Hampshire, Hardy, and parts of Grant and Mineral. Portions of the 4 western counties of this group, especially, are prominently ridged, but the valleys are wide and the whole region has a climate and an appearance differing from the Trans-Alleghany highlands and from the cold, mountainous regions of Grant and Pendleton. The 1,000-foot level extends up the North Branch of Potomac to Bloomington above Piedmont and up the South Branch to the Forks of the river above Petersburg in Grant county. On the extreme east this level is near the summit of the Blue Ridge mountains.

The highest mountain in the state is Spruce knob in Pendleton county, 4,860 feet above tide; the lowest land is found on the Potomac river a short distance below Harpers Ferry, Jefferson county, 260 feet above tide.

The highest county in the state is Pocahontas with an average elevation of about 3,000 feet.

Area in W. Va. from	500 to 1,000 ft. elevation,	7,763 sq. mi.
" " " "	1,000 to 1,500 " "	6,000 "
" " " "	1,500 to 2,000 " "	4,200 "
" " " "	2,000 to 3,000 " "	5,280 "
" " " "	3,000 to 4,000 " "	1,200 "
" " " over	4,000 " "	200 "

The average elevations of the highest Appalachian states above tide are as follows:

West Virginia	1,500 feet
Pennsylvania	1,100 feet
Vermont	1,000 feet
New Hampshire.....	1,000 feet
New York.....	900 feet
Ohio	850 feet
Virginia	850 feet

The drainage of that part of the state which lies east of the Alleghany mountains reaches the Atlantic ocean through the Potomac and James rivers. The chief tributaries of the Potomac, named in order up-stream from Harpers Ferry, are Shenandoah

river, Opequon creek, Back creek, Cacapon river, Little Cacapon river, South Branch of Potomac river, Patterson creek, and New creek. The streams named all flow northeast in the valleys between the Alleghany and Blue Ridge mountains. A small area in the eastern part of Monroe county is drained by the headwaters of Dunlap and Potts creeks, tributaries of the James river.

The drainage of that part of the state on the west of the mountains reaches the Gulf of Mexico through the Ohio and the Mississippi. The largest tributaries of the Ohio—some of which are direct and others indirect—are Big Sandy river, Twelvepole creek, Guyandot river, Mud river, and the Great Kanawha, with its Pocatalico, Coal, Elk, Gauley, Greenbrier, New, and Bluestone river tributaries draining the southern part of the state. North of these there are Little Kanawha river, Middle Island creek, Fishing creek, and Fish creek, all direct tributaries of the Ohio; and the Monongahela, with its Cheat, West Fork, Tygarts Valley, and other tributaries flowing north to Pittsburg to form—with the Alleghany—the Ohio river. A line drawn from the eastern point of Tyler county to the southern point of Randolph and from there to the northern end of Pocahontas, separates the headwaters of the Cheat, the Tygarts Valley, the Middle Fork, the Buckhannon, the West Fork, and other northward-flowing streams from the Greenbrier, the Gauley, the Elk, the Little Kanawha, and other rivers which flow west and south.

The rivers of the state, including the Ohio, the Great Kanawha, the Big Sandy, the Little Kanawha, and the Monongahela as the principal ones, are navigable for a distance in the aggregate of about 750 miles.

There are no natural lakes or other bodies of still water of any considerable size, though there is evidence that several of these once existed at the places now occupied by our mountain glades.

Below are the names of the 38 principal rivers of the state with the altitudes of their fountain heads or of the points where they enter the state, the altitudes of the points where they leave the state or empty into other streams, and the total fall of each. Those which are marked with a star (*) rise outside of West Virginia:

<i>Name of River.</i>	<i>Rises or crosses line</i>	<i>Leaves or empties</i>	<i>Total fall in W. Va.</i>
Big Coal (Marsh Fork)	2,500 ft.	565 ft.	1,935 ft.
Big Sandy (Dry Fork)*	1,600 ft.	500 ft.	1,100 ft.
Birch	2,500 ft.	700 ft.	1,800 ft.
Blackwater	3,700 ft.	1,700 ft.	2,000 ft.
Bluestone*	2,300 ft.	1,390 ft.	910 ft.
Buckhannon	3,400 ft.	1,300 ft.	2,100 ft.
Cacapon	2,000 ft.	420 ft.	1,580 ft.
Cheat (Shavers Fk.)	4,600 ft.	800 ft.	3,800 ft.
Cherry	4,000 ft.	1,900 ft.	2,100 ft.
Cranberry	4,400 ft.	2,000 ft.	2,400 ft.
Dry Fork of Cheat	3,900 ft.	1,700 ft.	2,200 ft.
East	2,800 ft.	1,600 ft.	1,200 ft.
Elk (Old Field Fk.)	4,500 ft.	575 ft.	3,925 ft.
Gauley	4,400 ft.	620 ft.	3,780 ft.
Glady Fork	3,500 ft.	1,950 ft.	1,550 ft.
Great Kanawha (New)*	1,500 ft.	515 ft.	985 ft.
Greenbrier (East Fk.)	3,700 ft.	1,300 ft.	2,400 ft.
Guyandot	2,700 ft.	505 ft.	2,195 ft.
Holly	3,000 ft.	1,000 ft.	2,000 ft.
Hughes (South Fk.)	1,100 ft.	600 ft.	500 ft.
Laurel Fork of Cheat	3,800 ft.	2,200 ft.	1,600 ft.
Little Coal (Pond Fk.)	2,500 ft.	600 ft.	1,900 ft.
Little Cacapon	1,700 ft.	520 ft.	1,180 ft.
Little Kanawha	2,800 ft.	600 ft.	2,200 ft.
Meadow	3,000 ft.	1,100 ft.	1,900 ft.
Monongahela (West Fk.)	1,500 ft.	800 ft.	700 ft.
Middle Fork	3,300 ft.	1,500 ft.	1,800 ft.
Mud	1,000 ft.	550 ft.	450 ft.
Ohio*	700 ft.	500 ft.	200 ft.
Piney	3,000 ft.	1,100 ft.	1,900 ft.
Pocatalico	1,000 ft.	550 ft.	450 ft.
Potomac (North Br.)	3,200 ft.	260 ft.	2,940 ft.
Shavers Fork	4,600 ft.	1,650 ft.	2,950 ft.
Shenandoah*	350 ft.	260 ft.	90 ft.
Stony	4,000 ft.	2,000 ft.	2,000 ft.
Tygarts Valley	3,300 ft.	880 ft.	2,420 ft.
South Branch Potomac	2,400 ft.	560 ft.	1,840 ft.
Williams	4,400 ft.	2,100 ft.	2,300 ft.

CHARACTERISTIC VIEW IN WEST VIRGINIA SPRUCE BELT, WEBSTER COUNTY.

The State as a Natural Forest Region.

The great range in altitude of 4,600 feet, the variety of soils, including the rich alluvial soils of river bottoms, the numerous clays of hills and plateaus, the cool, sandy loams of coves and north hillsides, the dry sands of mountain ridges, the shales of the northeastern counties, and the deep, wet, vegetable soils of upland glades, are favorable to the existence of many kinds of trees. These, together with the various exposures—the sunny hillsides, the sheltered coves, the shady banks of mountain streams, the bleak summits of mountains, the rocky canons, and the low river valleys—as well as the humidity of the region and other favorable natural features and conditions, constitute West Virginia a remarkable forest area. The range of altitude, mentioned above, is the equivalent of at least 15 degrees of latitude. This means that the state has a climate suitable for the existence of the great diversity of life—every plant, every animal, every tree—that thrives from the southern border of Virginia to beyond the Canadian border. There are three well-defined life zones, designated as Carolinian, Transition, and Canadian, to be found within the state.

The Carolinian zone, or more properly the Carolinian faunal area of the Upper Austral zone, has been in general thus described:

“The Carolinian faunal area occupies the larger part of the Middle States, except the mountains, covering southeastern South Dakota, eastern Nebraska, Kansas, and part of Oklahoma; nearly the whole of Iowa, Missouri, Illinois, Indiana, Ohio, Maryland, and Delaware; more than half of West Virginia, Kentucky, Tennessee, and New Jersey, and large areas in Georgia, Alabama, the Carolinas, Virginia, Pennsylvania, New York, Michigan, and southern Ontario. On the Atlantic coast it reaches from near the mouth of Chesapeake Bay to southern Connecticut, and sends narrow arms up the valleys of the Connecticut and Hudson rivers. A little farther west another slender arm is sent northward, following the east shore of Lake Michigan, nearly or quite to Grand Traverse Bay. * * * *

“Counting from the north, the Carolinian area is that in

which the sassafras, tulip tree, hackberry, sycamore, sweet gum, rose magnolia, red bud, persimmon, and short-leaf pine first make their appearance together with the opossum, gray fox, fox squirrel, cardinal bird, Carolina wren, tufted tit, gnatcatcher, summer tanager, and yellow-breasted chat. Chestnuts, hickory-nuts, hazelnuts, and walnuts grow wild in abundance. The area is of great agricultural importance.”*

This zone covers the western half of the state, or, in other words, most of the Ohio river section and much of the Potomac section in the east. Among its common trees are several species of oaks, including white oak, black oak, shingle oak, spanish oak, yellow oak, mossy cup oak, pin oak, and others, the yellow poplar, the sweet gum, the box elder, the persimmon, the red bud, the silver maple, the sweet buckeye, the pawpaw, the silver bell, and the yellow pine.

Within this zone are found the principal agricultural lands of West Virginia and, for this reason, a large percentage of the forest has been removed in many sections to give place to the growing of grains, vegetables and fruits. Except in a few localities where the hills are thin and unfit for cultivation the growing of extensive forests is impossible and should not be recommended. There are, however, several acres of rough and steep land on almost every farm throughout this whole agricultural area where the products from well-kept woodlots would far exceed in value any other crop. These woodlots would be of inestimable value as protectors of soils and streams as well.

Several counties, or portions of counties, including parts of Preston, Barbour, Upshur, Webster, and others, lie in the humid or Alleghanian faunal area of the Transition life zone. As its name implies there is an overlapping in this zone of species from the regions above and below it, and there are few really distinctive animals or plants. “In the Alleghanian faunal area the chestnut, walnut, oaks, and hickories of the south meet and overlap the beech, birch, hemlock, and sugar maple of the north. * * * * * Several native nuts, of which the beechnut, butter-nut, chestnut, hazelnut, hickorynut, and walnut are most important, grow wild in this belt. Of these the chestnut, hickory-

*Life Zones and Crop Zones of the United States. C. Hart Merriam.

nut, and walnut come in from the south (Carolinian area) and do not extend much beyond the southern or warmer parts of the Alleghanian area."

This zone, like that which lies below it, is well adapted to agriculture in most places and has been occupied for many years by agricultural people. There is much rough and unproductive land here, also, along the stream channels and on the hillsides, where woodlots should be allowed to remain permanently and should be attended and made more profitable than they are at present.

The Canadian life zone embraces, in West Virginia, large areas on mountains and plateaus above the 3,000-foot level, in Tucker, Grant, Pendleton, Randolph, Webster, Pocahontas, and Greenbrier counties. The typical forest trees of this zone are the cone-bearers, such as red spruce, hemlock and yellow birch; and the animal life consists of such species as the varying hare, the star-nosed mole, the veery, and the Canadian warbler.

Farming is here not generally successful. Grazing and fruit-growing are profitable in some sections and some varieties of vegetables can be grown. It has been pointed out that "labor spent in attempting to grow wheat or corn is not only wasted, but this labor hastens the destruction of soil, which should be protected by every means possible."

Many of the rivers of the state rise in this high region and are largely dependent upon the forests for their regular flow of water. Unfortunately, these forests which are of greatest value to the state are most readily demolished—mature trees, young growth, and even the soil itself—by lumbermen and by the fires which follow their operations.

The Original Forests.

What the favorable conditions for the growth of forests would naturally produce they did produce in West Virginia. "When white men first came into the state it was all forest except a few cliffs and rocky peaks, and two or three old fields where Indians had probably cultivated corn."* To the small

*Report W. Va. Conservation Commission, p. 18.

treeless areas mentioned above may be added an area of 100 acres or more of open glades in Pocahontas county, two or three of smaller size in Webster, one in Tucker, and others in Preston, Nicholas, Greenbrier, Mercer, Randolph, and Raleigh. But these were as almost nothing in comparison with the 15½ million acres or more of forest. No one knows how long this forest had been in existence nor just how much timber it contained. It had reached a state of equilibrium. "The growth was neither increasing nor diminishing but was at a standstill. The young growth coming on and the old trees dying and falling, balanced each other." Marked changes, such as the succession of certain species in certain areas, took place not by years but by centuries. Northern species had been swept down in the flow of ice or had been distributed by other natural agencies along the cold summits of the mountains; others had crept from the south and spread themselves along the lowlands; and others had entered from the plains of the West or from the Atlantic coast on the east.

The changes that have been brought about in the forests which were thus established in the state, through the introduction and toleration of destructive forces, are spoken of in subsequent chapters.

CHAPTER III.

THE UTILITY OF FORESTS.

The utility of forests from every standpoint has become so apparent to almost everybody, their useful products and their beneficial influence have become so familiar, that the whole matter might almost be passed without comment so far as imparting information to the reading public is concerned. It is possible, however, that some persons, even in this day, may not have considered just how many indispensable things and how many luxuries must be credited as coming, either directly or indirectly, from this source.

Forests are maintained, in general, for two purposes, namely, for their products and for their influence. That is, they have a direct value in that they supply wood and many minor commercial products and furnish lucrative employment to men; and they have an indirect value in that they protect water-courses and soils, influence climate, improve the health and the ethics of the people, etc. Under the two main heads here suggested are grouped a number of facts regarding forest resources and forest influences.

THE DIRECT VALUE OF FORESTS.

Wood a Necessity.

It is said that civilization is inconceivable without an abundance of wood. Whether this statement is absolutely true or not, it is near enough the truth to be extremely interesting, particularly in a day when all the evidence points to a near-at-hand timber shortage. The subject of a timber famine is usually dismissed by the unthinking person with the remark that when the timber is gone we can use something in its place. It is true that substitutes for wood are being used in many cases, but it

is safe to say that nothing has ever been found or ever will be found that can take its place for every purpose. With all the efforts that are being made to discover satisfactory substitutes, and in spite of the present extensive use of cement, bricks, and metals, the consumption of wood in England, where practically all the lumber is imported, is increasing at the rate of 5 per cent per annum, and in the United States and France at the rate of 10 per cent per annum.

Judging from the amount of wood consumed in the United States it is a greater necessity here than in any other civilized country. Our annual wood consumption is not far from 23 billion cubic feet. This is more than 250 cubic feet per capita. Some authorities place it at 100 cubic feet above this. But even at the smaller figure, this country easily stands at the head of the list. Germany, with its magnificent and well-tended forests, manages to get along with about 63 cubic feet per capita annually; and some other countries with much less than this. But no country has been able to do without it entirely.

West Virginia comes in for her full share of extravagance in the use of wood, and would feel most keenly the effects of a shortage. There is enough lumber sawed in the state each year to supply every resident man, woman and child with a thousand feet, or enough to build a board walk 200 feet wide around the 1,170 miles of the state's boundary line, with plenty to spare. If we add to this the enormous amounts consumed as fuel, and cut for poles, posts, fence-rails, cross-ties, staves, tan-bark, mine timbers, pulp wood, etc., for which we have no definite record, together with all that is wasted in lumber operations, and all that is burned by forest fires, we can safely state that West Virginia can make no claim for great economy at present, and we can begin to see that wood must be one of our most indispensable commodities.

Many of the commonest and most necessary things are most easily forgotten and least appreciated. We think of air and water when we are deprived of them. Wood has been almost as common as air or water and it has been used as if it were just as inexhaustible. Now, when the supply begins to wane, we can

understand better than ever before to what extent we are dependent upon it.

More than half of all our dwellings, churches and schoolhouses are built of wood, and in the other half wood is used as an essential part of the structure. Inside fixtures, such as shelving, wardrobes, etc., as well as all manner of furniture and other articles found in houses, including tables, chairs, beds, stands, desks, dressers, dining room and kitchen furniture, musical instruments, etc., are made of wood. Many people still use it for fuel.

Outside of buildings wood is no less a necessity. Railroad companies use it for cars, for cross-ties, for trestles, and for telegraph poles; telephone companies use it for poles, for brackets, and for many other purposes; mine operators use it for props, and ties, and headers; and oil and gas companies use it for derricks.

There is hardly a useful article in the manufacture of which wood is not employed or does not enter in, and hardly an occupation which can exist without it. Farmers need it in cultivating their ground, in harvesting, threshing, and marketing their grain; fruit-growers ship their products in wooden barrels, carriers and baskets; and manufacturers ship their wares in wooden barrels, crates, and boxes.

The bark of some trees is used in tanning leather, and large quantities of wood are used in the manufacture of paper. Wood alcohol, vinegar, acetates, and creosote, as well as maple sugar and many minor by-products are derived from wood. It would be next to impossible, indeed, to enumerate even the common uses of wood.

Forest Industries.

"The lumber industry now ranks fourth among the manufacturing enterprises in the United States, and represents an invested capital of about \$611,000,000 and an annual outlay of over \$100,000,000 in wages. It affords through its three great branches—the logging industry, the saw mill industry, and the planing mill industry—a means of livelihood to considerably over a million persons."*

*"Influence of Forestry upon the Lumber Industry"—Overton W. Price.

In West Virginia there are 14,000 men, earning about \$9,000,000 a year, engaged in logging and operating the band saw mills alone. Add to this 5,000 men who work on smaller operations, 5,000 in planing mills and other wood-working establishments, and 2,000 more in tanneries, pulp mills, chemical factories, etc., and we have a total of 26,000 men earning approximately \$16,000,000 a year. Beside these there is a large number of men, such as carpenters, salesmen, jobbers and others, who are indirectly furnished with employment through the lumber industry. These approximate figures and general statements are not included for the purpose of justifying the present abnormal development of our forests, but to call attention to the direct utility of forests as a means of supplying employment. In order to show the possibility of an extensive, indestructive, and perpetual lumber industry in this state we quote from report of the West Virginia Conservation Commission as follows:

“It is of interest to know how much timber West Virginia can grow, year by year, if its forests are properly cared for, and the vacant spaces are put to work as they should be. Take it for granted that 8,000,000 acres in the state will be kept permanently in productive forests. It can be figured out with a fair degree of accuracy how much timber will grow on an acre, and how much the yearly growth will be. The same rule does not hold everywhere. The growth depends on climate, soil, kinds of trees, and the care given them. In some of the finest Japanese forests the yearly growth is as much as 80 cubic feet per acre. In some of the neglected and fire-wasted woods of West Virginia it is not one-tenth that much. In the vigorous hardwood forests of this state the annual increment may be as much as 50 or 60 cubic feet, but in choice localities only. The state’s 8,000,000 acres, if guarded from fire, and well cared for in all ways, ought to yield 25 cubic feet of timber yearly for each acre. The estimate is conservative. That would provide for a yearly harvest, from the whole state of 1,600,000,000 feet, board measure. At \$20 a thousand feet, the gross income from lumber sales would be 32 million dollars a year. That would not be the rake-off of several years growth at one time, as at present, with nothing for

SOFTWOOD BAND SAW MILL OF BABCOCK LUMBER & BOOM COMPANY AT DAVIS, TUCKER COUNTY. This mill has cut over 400 million feet of spruce and hemlock during the last 20 years.

many succeeding years, but it would come in every year, and as time went on the yield would increase rather than diminish."

THE INDIRECT VALUE OF FORESTS.

The forest in its effect upon water supply, upon the character of soils, and upon climate, and in its relation to animal life, to sanitation and to recreation, is often made secondary to its value as a wood-producer and as a place for employment. In a broad sense, however, its influence may be more valuable than its products.

The Forest in Its Relation to Water Supply and Distribution.

Many volumes have been written to show the relation of forests to water supply. The question is a most important one in West Virginia, as it is in all mountainous and hilly regions where the water which falls may become highly useful or highly destructive according to the manner of its distribution within and without the state.

It is not known that more water falls in the course of a year in the form of rain, snow, and hail, upon forest regions than on the same area after the forests have been removed. Tests which have been made for the purpose of determining this have proven almost nothing. They have failed principally for two reasons, one that the rain gauges, although placed near together, have often furnished widely differing records due to uneven rainfall, varying winds, etc., and the other that it has been impossible to select two areas for the tests which were in every way equal except for their covering. It is a common belief among men of wide experience that rain falls more frequently and in greater volume in forest regions than away from them and, until it can be proven otherwise, this belief, which is supported by reason, will not be abandoned.

But whether rainfall and snowfall are affected by forests or not, it is well known that the distribution of water after it has reached the earth is so affected; and in this all persons are most greatly interested. We include here under the 6 following

heads a clear and able discussion of this whole subject as applied to conditions in West Virginia, from The Report of the West Virginia Conservation Commission:

"The Forest's Influence Over Floods and Droughts."

"Forests exercise a considerable influence over the behavior of rivers. This influence is not the same in all climates and countries. Each river system must be studied by itself, for deduction under one set of conditions may not hold true under another. Generally speaking a woodland soil absorbs more water than naked ground. The decaying leaves, the roots and stems, and the more porous nature of the upper layers of the forest soil, take up the rain and melting snow, and hold it for a time, permitting it to filter away slowly and enter the streams gradually. Sudden rushes of water down steep slopes after a rain are thus hindered, and the streams rise more slowly, flow more regularly, and seldom reach excessively low stages. When the same has been laid bare and packed by its own weight and under the unobstructed beating of rain drops, its surface hardens, its porosity is lessened, and it sheds water like a roof. The streams catch it quickly and floods follow. That is the difference between a forested and a treeless region. A country well cultivated, and producing farm crops, may have a soil almost or quite as effective in preventing storm water from flowing too quickly to the streams. The dangerous region is the one with steep, bare slopes. The West Virginia mountains would, if denuded, be a constant menace to all the lower valleys. Floods surpassing everything known in this region heretofore would be sure to follow. On the other hand, streams would speedily become dry after the rains had ceased.

"Public opinion has long held that the floods are increasing in number, not only in West Virginia but in other regions where rapid deforestation has been going on, but only recently were figures compiled showing just what is taking place in this state. Records of river stages and rainfall have been kept daily during many years, at numerous points, by the United States Geological Survey, the War Department, and the Weather Bureau. A

compilation of results shows a very disquieting state of affairs in West Virginia. Floods in the Ohio at Wheeling have increased 28 per cent in number in 26 years; Potomac floods at Harpers Ferry have increased 36 per cent in 18 years; the Monongahela floods, at Greensboro, Pennsylvania, show an increase of 73 per cent in 24 years; and at Charleston an increase of 83 per cent is shown by the Kanawha in 20 years.

“The increase in low water periods, for the same time, follows: Ohio river 39 per cent; Potomac 40 per cent; Monongahela 36 per cent; and Kanawha about the same as the Monongahela.

“The actual quantity of water discharged by the Potomac per year is 8 per cent more than 12 years ago; and for the Ohio at Wheeling, the quantity is 13 per cent greater.

“The average rainfall for the whole state of West Virginia seems to be about $2\frac{1}{2}$ per cent less than it was 8 years ago. This does not necessarily imply that the decrease will be permanent or that it will continue. It is well known that rainfall varies greatly. It sometimes increases during a term of years, then declines, and again increases. The cycle of change seems to be about 35 years; but that matter needs additional proof before it should be accepted as settled.

“The increase of the total discharge of West Virginia rivers, in spite of diminishing rainfall and a greater fluctuation than formerly in the periods of high and low water, is due solely, so far as available data can be interpreted, to the deforestation of the mountains. There is no reason to doubt that a continuation of the timber cutting and burning will increase the fluctuation of the streams, if, indeed, it does not permanently reduce the rainfall which is by no means improbable.

“Water Resources.”

✓ “The average annual rainfall in West Virginia, including melted snow, is about 40 inches. The amount is 2,322,295,810,000 cubic feet, enough to fill a reservoir of 16 square miles and one mile deep. The mass of water is disposed of in two ways. Part of it flows away by the rivers, and part of it evaporates before it reaches the large watercourses. The part which goes out by

the rivers is about two-fifths of the whole precipitation, and in a year amounts to a sheet of water 16 inches deep over the entire surface of the state, or approximately 921,842,176,000 cubic feet. The portion which evaporates would equal a sheet of water 24 inches deep over the whole state.

“The water which goes off as vapor renders plant growth possible. Part of it is taken in by the roots and after being used by the plant for various purposes, is evaporated through the leaves. But it is the water which gets into rivers that counts for navigation, water-power, and other purposes. The theoretical horsepower possible of development from the streams of West Virginia exceeds two million. One-half of this should be set aside as not available in practice. In order to utilize the other remaining one million horsepower it would be necessary to develop all the streams, construct reservoirs on the mountains to collect floods, and provide means of obtaining a steady flow all the time. One million horsepower would go a long way toward meeting all the state’s needs in that line. The following table shows the amount of power used in West Virginia for the years given:

<i>Year.</i>	<i>Steam, horsepower</i>	<i>Water, horsepower</i>	<i>Total.</i>
1870.....	17,176	10,195	27,331
1880.....	28,456	9,454	37,910
1890.....	44,680	10,552	55,457
1900.....	95,595	10,273	108,566

For the purpose of comparison, a similar table for the United States is given:

<i>Year</i>	<i>Steam, horsepower.</i>	<i>Water, horsepower.</i>	<i>Total.</i>
1870.....	1,215,711	1,130,431	2,346,142
1880.....	2,185,458	1,225,379	3,410,837
1890.....	4,662,029	1,263,343	5,954,655
1900.....	8,742,416	1,727,258	11,300,080

“Railroads are not included in these tables. It is important to note that in 30 years, both in West Virginia and in the whole

United States, the use of steam increased from 500 to 700 per cent, while the use of waterpower remained almost the same for the whole time. The building of railroads made coal cheap and plentiful and it was more convenient to use it than to develop waterpower. Besides, in recent years only has it been found practicable to carry waterpower long distances by electricity. Formerly it was necessary to locate the power plants near the place where the power was to be used, and that generally made waterpower unavailable. It is now practicable to transport power long distances by wire, and this fact ought to open the way to the development of waterpower in remote and rugged regions which was impossible a few years ago. Power might be profitably carried by electricity from any point in West Virginia to any other point. Water thus used is a resource that can never be exhausted. It cannot be used up so long as rains fall and rivers flow. West Virginia has a very liberal share of this resource. Its money value cannot be estimated except at so much per horsepower. Taking that at \$20 a year, the full development would pay 6 per cent on a capitalization of \$330,000,000.

“The impounding of water in enormous reservoirs by building dams across valleys high in the mountains would not be an experiment. Work of a like kind is being carried on in different parts of the country, especially in the west where the water is made available both for irrigation and for power. Some of the dams rank with the world's greatest engineering feats, and they make possible the development of resources which have lain idle in all past time. Reservoirs are being built of sufficient capacity to store the entire flow of a river for many months. West Virginia has many excellent sites for storage reservoirs, some being 2,000 or 3,000 feet in elevation, others lower. The development of this resource, from the nature of the case, will take a long time. Power will be produced faster than it can be used.

“The construction of systems of dams in the mountain valleys would serve other useful purposes than the development of waterpower. The storing of a large part of the storm water would lessen floods and lower rivers, and much of the

usual damage from high waters might be avoided. Extremely low water might be prevented likewise by gradually draining the stored water into the streams in dry weather. The flow of rivers provided with large reservoirs can be regulated as rivers are which flow from and to lakes.

✓ "It should be borne in mind, however, that dams and reservoirs without forests would not be worth much. The soil on the steep slopes must be kept covered with vegetation or it will wash into the reservoirs and fill them. Again, the importance of speedy action to protect the forest is seen. Almost every proposed development goes back to and depends upon the forest, and unless the woods are cared for, nearly every other resource becomes unavailable."

"West Virginia's River Commerce."

"The ability of the streams of West Virginia to carry commerce is one of the state's most valuable resources. The road to market is the path to prosperity; and the easier and better the road the greater the prosperity. Wealth locked up is no better than poverty. Free exchange of commodities is the life and blood of business growth and national development.

"The United States Government has improved the West Virginia rivers and made them navigable, but the water and the commerce come from this state. It is for that reason to West Virginia's interest to provide water to fill the channels and freight to laden the barges.

"The total extent of navigable water in West Virginia is 748½ miles, according to the figures compiled by the National Bureau of Commerce and Labor. A table showing the mileage of each stream follows:

Monongahela	33	miles.
Ohio	285	"
Great Kanawha	90	"
Little Kanawha	120	"
Guyandotte	50	"
Big Sandy and tributaries	170½	"

Total 748½ miles

"Some of this mileage can scarcely apply to both going up as well as down, but is calculated on the ability of the streams to carry rafts or boats in time of medium flood stages. The Monongahela is considered only from Fairmont to the Pennsylvania line; the Big Sandy, its whole length, and the Ohio along the state border.

"The Federal Government has spent large sums improving West Virginia rivers or those receiving their principal supply of water from the mountains of West Virginia. The expenditures from 1790 to 1907 have been as follows:

Big Sandy and tributaries.....	1,445,425 32
Guyandotte	22,500 00
Great Kanawha	4,730,108 02
New	112,000 00
Gauley	15,000 00
Elk	35,000 00
Little Kanawha	488,844 38
Monongahela, its whole length.....	6,794,827 40
Ohio, its whole length.....	24,485,261 26
Buckhannon	5,500 00
Cheat	13,000 00
Total	38,147,466 39

"The remarkable point in these figures is that approximately one-twelfth of the money spent by the Government, from 1790 to 1907, for the improvement of the rivers and the harbors of the whole country, has been spent upon rivers depending in whole or in part upon West Virginia for their water. Cut off or greatly reduce the flow from the West Virginia plateau region and every one of those rivers would immediately feel the effect, and would become nearly or quite dry. Without water from West Virginia, the Ohio river would dwindle to a stream practically worthless for carrying commerce. As a freight carrier, the Monongahela would be a thing of the past, although it is now one of the largest carriers of freight on the continent. No other territory of five times its size exercises the influence

upon the inland navigation of the United States that is exerted by the West Virginia mountain region.

“It is not in man’s power to cut off or lessen to any great extent the total quantity of water flowing year by year from the West Virginia mountains into the streams, but it is within his power to largely control the manner in which the water is furnished. By keeping the mountains forested, a steady supply will be available; but if the woods are destroyed, the water will go down as destructive floods when rain has fallen, and it will as quickly disappear when rains cease—too much at one time, and not enough at another. It is within man’s power to protect navigable channels from another danger—that of filling with gravel and mud washed from the land. To accomplish this, the mountains should be kept well covered with woods.

“The commerce on West Virginia rivers, or those depending very largely upon this state for water, is shown in the following table, the figures being for 1906:

Big Sandy	148,623 tons
Great Kanawha	1,613,889 tons
Little Kanawha	106,510 tons
Monongahela	11,447,444 tons
Ohio	13,163,656 tons
<hr/>	
Total	26,480,122 tons

“This is more than one-fifth of the total river commerce of the United States. There are 282 navigable streams, and the five named above carry 20 per cent of the freight. Little of it would be carried without the water which flows from the mountains of West Virginia. For that reason, this state is of supreme importance to the nation’s inland water commerce. A greater tonnage originates on the banks of the Monongahela, and is carried by it, than on any other river of the Western Hemisphere. A few rivers carry more, but much of it is furnished by tributary streams or comes from the sea. There are, however, only four rivers in the United States which actually carry more than the Monongahela, and two of these, the Ohio

LOGS DRIFTING ON THE MONONGAHELA RIVER AT MORGANTOWN, ESCAPED FROM BROKEN BOOM AT GRAFTON, JULY, 1896.
Photo by W. E. Rumsey.

and the Mississippi, receive much of their tonnage from the Monongahela, and the other two, the Delaware and the Hudson, receive from the sea much of theirs.

“The navigability of West Virginia streams ought to be maintained and further improved. The care of navigable rivers is a function of the United States Government, and it usually does not ask or receive aid from the states. But West Virginia is so peculiarly and so fortunately situated that the advisability of joining hands with the Federal Government to promote certain works would be worthy of careful consideration in case the Government should invite such co-operation and express a willingness to follow certain lines. One such measure would be the protection of the high mountain forests, and another, the building of storage reservoirs, previously referred to in this report. If the Government should take up this work, it would do it for the purpose of improving the navigation of streams which carry interstate commerce, and not to promote forestry, or develop water powers, or to assist one state alone, although these things would result as incidentals to the general purpose.

“The Federal Government cannot now take up the work because Congress has not enacted laws authorizing it, neither has the Legislature of West Virginia passed the necessary act giving its consent to the purchase of land in the state by the Government for that purpose. The proposed act for the purchase of land in the Appalachian region for National Forests, failed to pass Congress. So far as West Virginia is concerned, the state ought to give its consent to the purchase of land by the United States in the high mountains for forestry purposes. If the care of these wide forested areas falls entirely upon the people of West Virginia, it will be a heavy burden—but it cannot be evaded. If the Government will do part, the state ought, at least, to give its consent.

“The construction of storage reservoirs in the mountains of West Virginia can scarcely be said to be under serious consideration by the Federal Government at present; but the feasibility of the project, and its bearing on the navigation of rivers, have been discussed in different Government departments, and action at some time is probable. If such reservoirs are built they will

be on the headwaters of the Monongahela, the Cheat, the Kanawha and its tributaries, the Big Sandy, and probably the head streams of the Potomac. If the Government does this, it will consider it a national work; but West Virginia would derive much more benefit than any other state, and it could well afford to assist in a substantial manner, if asked by the Government to do so. Free rights of way and reservoir sites would be a small price to pay for the enormous value such improvements would be to the people of the state. Local encouragement often goes a long way toward securing help from the Government."

"Irrigation."

"Irrigation—the artificial watering of crops—is a form of development to which the people of West Virginia have given little or no thought. It is not a matter of as much importance here as it is in some other parts of the country and world, because in West Virginia rains are usually sufficient to produce some sort of crop. Nevertheless, there are thousands of acres in the valleys of this state where irrigation would greatly increase the yield. Water in ample quantity is nearly always available at much less expense than is usual with those who practice irrigation elsewhere. It probably would not pay to irrigate grain and the coarser crops; but it would pay in many cases to resort to that method of farming where the land is occupied by truck gardens, berries and fruits. When agriculture becomes more intensive in this state, as it will and as it ought, irrigation will play an important part in the highest development of our soil resources.

"The opinion is more or less prevalent that irrigation is useful in arid regions only. This is erroneous. Flowers and lawns need water between showers, and they suffer if they do not get it. Gardens and orchards often suffer from thirst which might be satisfied from neighboring streams which run to waste.

"Many instances might be sighted to show that irrigation brings excellent results in countries which have considerable rain the year round. Northern Italy is a case to the point. Its climate resembles West Virginia's except that it is not quite so

cold in winter. The rainfall is nearly the same. Irrigation has there produced development which would be impossible without it.

“The artificial watering of land need not be looked for in West Virginia until farmers and gardeners see that it will pay. The state might, without much cost, investigate the matter by conducting irrigation experiments. This might be done by the Experiment Station, and no special legislation would be necessary, further than to make an appropriation for the purpose. The appropriation need not be large, but the experiments should extend through a number of years to make sure of the value of results.

“Municipal Water Supply.”

“The health of the people is a most valuable asset. It should be given high place in the list of resources on which a state's prosperity depends. It may not be possible to measure it by dollars, but it has a money value. It has been claimed that every person that dies before his time means a loss of \$10,000 to the community. The correctness of the estimate might be questioned by some, but no one will deny that human life and health, aside from all sentimental considerations, is worth looking after. The individual may protect himself the best he can, but some things he cannot do, the state can. Few lives are absolutely worthless, and sickness always lays a burden on somebody or on the community. The health of the most obscure person is a matter for public concern; and much more so is the health of those who contribute to the country's welfare and prosperity. The struggle for existence is hard enough and progress is slow enough when conditions are as favorable as they can be made.

“The difficulty of protecting the health of the people of West Virginia increases from year to year. Effort seems to slack as difficulty grows. The waters in the streams become more impure, and the inquiries after remedies do not appear vigorous or widespread. In some cases the West Virginian uses water which a Chinaman would not touch without boiling it first. This

is not meant as a criticism of corporations and companies which own municipal water works. They seem to be doing about as well as they can under the circumstances, but the circumstances are against them. The fault lies nearer to the door of the whole people than to any particular doors that might be pointed out. If rivers are allowed to become so dirty that no treatment less heroic than "destructive distillation" can purify them, it is too much to expect individuals or companies to do the work. The remedy must begin at the beginning and not at the ending. The pollution ought to be kept out of the rivers, and then it would not need to be taken out. What is needed is prevention rather than cure.

"The natural watercourses were once pure in all parts of West Virginia. Their drainage basins were covered with forests and farms, and the water which fed the streams was clean. Many of these streams are sewers now. Their valleys are thickly settled, their banks lined with towns and manufacturing places, mines and mills, and the offal of the land goes directly into the streams. Under present methods it can go no where else.

"The trouble really begins at the tops of the mountains, where the cutting of timber has bared the ground, caused the drying up of springs once pure and perennial, and substituted surface drainage over the hard and packed soil. This has polluted the various sources of the rivers. Lower down are the mines and their sulphur drainage, camps on the hillsides with seldom an underground sewer. Further on are tanneries, pulp mills, saw mills, factories, and larger towns, all emptying their waste and sewerage into the watercourses with no attempt at purification. The water supply of many towns is pumped from rivers which carry this burden of dangerous and offensive impurities. Towns with better water supplies are fortunate. Filtering plants are doing a great deal. In fact, in many instances, they virtually stand between the people and death; but science has not yet been able to devise a filter that will take out all the germs.

"Impure running streams are the highways along which disease germs travel. The typhoid bacteria remain alive from

6 to 10 days in water of ordinary temperature. That affords them time to move from the source to the mouth of any West Virginia stream. Typhoid is only one of many diseases which enter homes by way of the water spigots. Contamination from a single cholera patient on the Elbe river in Germany in 1892 infected 17,020 persons of whom 8,605 died. In 1903 the Experiment Station at Morgantown published a report on rural water supply with analyses by Prof. C. D. Howard. A single item in that report will suffice to indicate the condition of some of the water then drawn from natural streams. On June 19th, when the Monongahela was as pure as it could be expected to be at any time, it was found that a single gallon of water contained enough bacteria to supply one healthy specimen to every man, woman and child in West Virginia, and 300,000 left over. Three days later when a shower had washed a fresh supply into the river, a gallon held enough to give one bacterium to every person in the United States and the British Isles.

“There is no reason to suppose that the Monongahela was worse than some other rivers of the state, and they are all probably much worse now than they were then. No improvement is possible as long as they remain the open channels through which the country's sewage is carried on its mission of pollution.

“The opinion which is somewhat prevalent that running streams purify themselves has no fact for its basis. It is true that sunshine, if hot enough, may kill many of the germs as they pass over the shoals, but beyond that, running water is more dangerous than still water, because it keeps the germs from settling to the bottom, and as long as they remain alive they are an active menace. Deep pools in rivers do more to purify the water than is done by all the intervening riffles and shoals. The settling reservoir at Washington, D. C., precipitates to the bottom 85 per cent of the impurities that come in with the Potomac water. Disease germs are more often products of land than of the rivers, and unless they are washed into the stream they are not apt to get in.

“Germs which are capable of producing malignant diseases, such as fever, diphtheria and others, are not the only dangers

lurking in the river. Impurities of another kind may do much injury, the acids and other chemicals for instances. According to press reports, steamers on the Monongahela late this season could not use the water from some of the pools without ruining their boilers. The water of Cheat river must have been worse, judging from the current reports that it put locomotives out of commission and that it took the hair off the legs of cattle that stood in it in fly time, and was fatal when they drank it. Conditions must be very bad when a river will tan the skin of a living cow and kill her when she slakes her thirst. It is believed by persons who have looked into the matter that scarcely a living fish remains in Cheat river between its forks and its mouth.

“In the old countries, as well as in this, some of the cities use their sewage on farms and thus put to good use that which was formerly a standing menace. The city of Berlin spent \$3,000,000 for land and \$10,000,000 to lead the sewers to it, and is able to clear \$60,000 a year on the investment. The waste is used to fertilize the land. Some progressive cities and towns are following a similar plan in this country. Among them are Brockton and Farmingham, Massachusetts, Bristol, Connecticut, Plainfield, New Jersey, Altoona and Wayne, Pennsylvania, Pullman, Illinois, Hastings, Nebraska, Colorado Springs, Colorado, Salt Lake City, Utah, Helena, Montana, Phonix, Arizona, Fresno, Los Angeles, Pasadena, Santa Rosa and Redding, California.

“This Commission is impressed with the importance of cleansing and keeping pure the rivers of West Virginia, though a degree of excellence such as the waters possessed in pioneer days can never again be attained. Rivers in other countries more thickly settled than this state are maintained in comparative purity. What others successfully do, West Virginia ought not hesitate to undertake. It is, however, no small undertaking. This region is increasing in population and adding to and enlarging its manufacturing plants. The hills are steep and the valleys narrow. Level tracts of land large enough for sewage disposal are often hard to find within reach of towns. The opening of a new mine or the establishment of a lumber plant may lead to the building of a town in a year or two.

Scientific sewerage and sewage disposal will find great difficulty in keeping pace with development in a state like this where so many resources are forcing their way to market."

"Removal of Soil Through Deforestation."

"When the ground is laid bare on the steep slopes, rains wash the soil away. It is sometimes worn down over its whole surface, as may be seen in old clay fields on hillsides; or gullies may form, as is often the case where soils are sandy. In either instance the loss is serious. Every rain carries down a load of silt or sand, and the rivers carry it toward the sea or drop it in their own channels where it forms bars, islands, and shoals. In West Virginia the erosion has not yet progressed far, but agencies are at work, and rapid denudation may be looked for in the near future. In the Appalachian region south of Pennsylvania it has been estimated that the soil from 100 square miles goes into the rivers every year, from the native hills. The soil is gone forever—worse than that, for it is not only lost to agriculture which sorely needs it, but it fills navigable channels which must be dredged at great cost. Much of the hundreds of millions of dollars which the Government has spent dredging rivers has gone to remove silt washed in from fields which ought never to have been cleared, and from deforested mountains.

"West Virginia can attack this waste in its infancy. It should be borne in mind that every yard of soil that gets into the streams is lost for all time, because it takes ten thousand years for enough rock to decompose to form a foot of soil. The people of West Virginia should profit by the fate of Dalmatia which let its forests be destroyed and its soil washed away. In some districts of that region the wretched people pound rock into sand with hammers and make little plots of ground for gardens, some of them scarcely longer than bed quilts. Care of woods once abundant would have prevented the irreparable loss in that country, and it will prevent it in West Virginia."

The Forest in Its Relation to Health.

Supplementary to the statements regarding pure water in relation to the health of the people—as quoted under a preceding head—some observations in general should be made regarding the sanitary influence of forests.

It is well known that—other things being equal—the general state of health of persons living in the open country, and especially in moderately high altitudes, and in close proximity to forests, is far above that of persons living in towns and cities. There are numerous individual cases, however, which seem to contradict this statement. For example, whole families who live under what would appear at first to be ideal health conditions, are often composed of mere wrecks of beings whose appearance betokens misery and ill health. If the causes for their condition are sought out they will usually be found on the interior and not due to outside influences. It is a notable fact, as many persons can attest, that good sanitary conditions in the homes of these unhealthy families are totally lacking; and that the cooks are unable to prepare even plain bread, meat and vegetables so that they can be eaten and digested with any degree of ease, to say nothing of pleasure. It is safe to say that, on the whole, the members of intelligent rural families have before them the possibility of longer and happier lives than any other class of people. Their good state of health is due in part to more wholesome exercise, to plainer food, and to more regular habits, and in part to purer air and water and to a more tranquil state of mind.

The air in towns and cities is filled with dust, and smoke, and poisonous gases. Moreover, the winds which sweep up the streets often carry countless numbers of pathogenic, or disease-producing, microbes into the air to spread infectious diseases among the people. The pure, ozone-filled air of wooded mountains is free from all such contaminations. The bacteria which produce diseases, such as fevers, diphtheria, and tuberculosis, are never present in the soil, the water, or the air of virgin forests.

The influence of surroundings, such as forest regions fur-

CAMP OF COLLECTING PARTY AT CRANBERRY GLADES, POCAHONTAS COUNTY, JULY, 1909.

nish, upon the state of mind is important from the standpoint of health. As a rule those persons who worry least live the longest and the amount of worry often depends on the surroundings as much as on the disposition of people. Those who work in offices, in stores, in studies, in factories, or in any place where they are thrown constantly into social, business, or professional relations with men, are more apt to have their peace of mind disturbed than those whose associations are with the more unoffending and less imperfect forms of life to be found in the open fields and forests.

Some of the states which have extensive forest reservations are finding them most valuable places for the location of sanitariums. In Pennsylvania a large area within the state forest reserve has been set aside for the use of the Department of Health. A report from "Camp Sanitorium" in this forest, states that about 75 per cent of the tubercular patients who have come in the past five years to the camp for treatment were discharged as cured or the disease arrested. The Legislature of that state has recently made large appropriations to aid in carrying on and extending this important work for the conservation of human life.

It is reasonable to suppose that sufferers from diseases of the throat and lungs who make long and fatiguing journeys from West Virginia to the mountains of the west and south could find as great relief, with less inconvenience, in our own mountain highlands if suitable accommodations could be provided.

Recreation.

Forests furnish the most popular and the most satisfactory places for recreation; and, during the warmer months, are visited by thousands of campers, sight-seers, hunters, fishermen and collectors. The national forests are fast becoming "playgrounds" for the people. During the last year half a million people sought recreation in these forests of the west and north; and a recent publication of the Forest Service states that the time seems not far distant when a million people will annually visit them for this purpose. People find well-kept forests more desirable places for recreation than those which are not.

Hunting and Fishing.

Some persons prefer the recreation found in hunting and fishing to any other. The 1,000 visitors to the national forests of Alaska in 1909 all went for this purpose. Hunting, fishing and trapping are among the finest forms of recreation. They furnish a mental excitement which diverts the thoughts completely from previous occupations, and takes the follower of game or the fisherman into the regions farthest removed from the influences which disturb his rest.

The large number of hunter's licenses issued from the County Clerks' offices and the numerous fishing and hunting permits granted by owners of forest land in West Virginia during the past two seasons, are evidences that the people of West Virginia are lovers of these sports. It is a lamentable fact, however, that the game has been so greatly reduced by careless and unlawful hunting and by forest fires, and that the fish have been killed by the pollution and drying up of streams to such an extent that these innocent sports have lost much of their former attraction.

The economic side of the forests of West Virginia as places of recreation is set forth in the report before quoted from as follows:

"A country's natural scenery may have a good deal more than an esthetic value. It may be worth money, and from a business standpoint its care and improvement is frequently of great importance. Fifty million dollars go into Switzerland every year to pay the board and traveling expenses of foreigners who journey there for pleasure and recreation. The money thus brought into the country constitutes a large part of the income of the people. Nature gave fine scenery and pleasing summer climate to Switzerland, and the natives have built the best and most picturesque roads in Europe to make travel easy and exhilarating. Excellent hotels offer attractive accommodations. People go there to spend their money, and depart with the feeling that their money was well spent. Scenery and resorts pay in that country.

"The people of Maine have found ways to make money out of their woods, lakes, rivers and summer hotels. Fishermen and

hunters who have plenty of money to spend go by thousands to Maine to spend it. They are willing to pay well, and the thrifty Yankees see to it that their guests get their money's worth. That brings the guest back year after year. Game is protected and is plentiful. Streams abound in fish because dynamiting and other destructive modes of killing are not permitted. The woods are in good condition because fires are not permitted to burn unopposed. The people of Maine find their scenery, resorts, hunting and fishing an investment which pays big dividends.

"West Virginia has not, up to the present time, done much with its scenery except to mar it, mutilate it, and burn it up. Except in the case of mineral springs, practically nothing has been done in this state to make scenery attractive or to bring it to the attention of the outside world. West Virginia may never rival Switzerland, but it can equal Maine. The summer climate is glorious among its high mountains and elevated valleys. A series of summer hotels from 3,000 to 4,000 feet above the sea might stretch across the state, following the Alleghany and parallel ranges of mountains.

"Adequate highways connecting these resorts, and others for side trips to hunting and fishing grounds, with the surrounding forests cared for, and the innumerable mountain streams clear and clean would attract to West Virginia many thousand wealthy tourists who now hardly know the state by name and who never think of visiting it, except to rush across it on the limited express trains of trunk railroads.

"A good many things must be done before West Virginia will take its due rank as a resort for tourists, health seekers, and sight seers. It must first protect its woods and make them attractive. It must clean its streams and stock them with fish, and make and enforce civilized laws for the protection of the fish. It must stop the senseless slaughter of birds and game. It must build roads that can be traveled with speed and safety by modern vehicles. In building these roads the value of scenery must be considered in regions where scenery is attractive.

"The steps necessary to the carrying out of any one of these recommendations are many, expensive, and difficult. No

one should suppose that it is possible to do such things by simply resolving that they ought to be done. The immediate duty is to make a beginning and to make it in the right way and in the proper direction. Then build upon that beginning as it becomes possible to do so. Check forest fires first; lessen the pollution of streams; put all new roads on the best grades, and when old ones are changed, put them on proper grades also; make it so dangerous for fish dynamiters and game destroyers to ply their trade that they will migrate. Follow these beginnings with constructive work; stock streams anew with fish; the forests with game and birds; build roads as circumstances will allow; and take pains to let the outside world know that West Virginia is in the scenery and resort business.

“If the time shall come when immense storage reservoirs occupy a number of the elevated valleys among the mountains of West Virginia they will constitute an important factor in the development of the state’s scenic resources. They will add more than almost anything else can add to the enjoyment of persons who visit the mountains, as well as to the people who live there. To all intents and purposes they will be high mountain lakes, suited to sail, launch, and canoe. They will cover hundreds, and in some cases, perhaps thousands of acres, and abound in fish and fowl. The reservoirs are not yet built, of course. They may not be built for a long time; but it is reasonably safe to count on them as one of the most attractive features of our mountain scenery in years to come.”

The Forest in Its Relation to Climate.

Just what the influence of forests is upon climate has not been fully worked out. To a certain extent, however, there need be no tests made with thermometers, barometers, and other instruments, to convince us that trees and forests have at least a local effect in modifying climatic conditions. All who have worked on hot, sunny days in open fields, or traveled sunny roads know the luxury of shade and that the heat of the sun’s rays is broken by trees, without being told or having it proven to them by scientific tests.

The effect upon climate of an individual tree is, of course, not appreciable; but when trees stand together and form dense forests which cover large areas their combined effect is readily seen. When rains fall on bare ground the water quickly runs off or is evaporated and within a short time after it falls, if the sun shines and the wind blows, all signs of it may have disappeared. In the forest it is not so. The water there is caught by the living and the decaying vegetation which prevent its rapid escape into streams. The trees lessen evaporation by breaking the rays of the sun and by retarding the velocity of winds. We have in the forest, then, a damp, cool atmosphere which is not subject to as rapid changes in temperature and humidity as that on the outside. This great volume of cool air surrounding the mass of green leaves of trees and weeds of the woods, acts as an equalizer of temperature. The soft winds which come out of woodlands during hot, dry days carry the cooler air out into the fields. The air which is held under the canopy of tree tops remains more uniform in temperature, as has been said, and on frosty nights has the effect of warming the air for a considerable distance in open areas. In lessening the extremes of temperature in early spring and late fall and in checking evaporation from cultivated lands the forest exercises two of its most important functions for the farmer.

It is the common testimony of the older inhabitants of West Virginia that, as the country has been cleared up, there has been a corresponding lengthening of the warmer seasons; that in localities where crops of corn would not ripen in former years they now mature in ample time to be harvested; that winters are shorter and more changeable; and that both floods and drouths occur more frequently.

The Forest in Its Relation to Animal Life.

Mammals, birds and insects make up an interesting and important part of the life of every forest. Some of them are beneficial, some are injurious.

As for the mammals, they do not greatly affect the character of woodlands although they are frequently important agents

in the distribution of nut-bearing trees. The moles and shrews are insectivorous and may be of considerable benefit to forests in destroying the larvae that infest nuts often to such an extent that none of them will germinate. The injury done by various mammals in gnawing and scratching the bark from young trees in the forest, and in breaking their branches, is negligible. The mammals, however, have a great value aside from their direct relation to forests—either as enemies or friends—as interesting objects for observation and study and for their valuable food and fur. The forest as a hiding place and home for mammals, then, is the most important consideration in this connection.

The value of birds—particularly migratory birds—is forcibly brought out in the quotation given below :

“We know that trees are subject to many injuries by reason of the undue multiplication of the animals that feed upon them. The foliage is devoured by insects and other animals; the fruit and seeds by insects, birds, and squirrels; the twigs are killed by borers or girdlers; the bark is eaten by mice, hares, squirrels, or porcupines; the trunks are attacked by wood-borers, the roots have insect enemies; even the very life blood, the sap, is sucked out by aphids. When we consider well the fecundity, voracity, and the consequent great possibilities for mischief possessed by their enemies, we wonder that trees survive at all. Still, trees spring up and grow apace. In a wooded country a few years of neglect of field and pasture suffices to clothe them with a growth of bushes and saplings, and in time a woodlot succeeds the cleared land. That trees are able thus to spring up and grow to maturity without man’s care is sufficient evidence that they are protected by their natural friends from the too injurious inroads of their natural enemies. Among these friends birds hold a high place.

“It is generally believed that there are few birds in the deep woods. Travelers have often remarked the scarcity of birds in the forest. It is true that usually there are fewer birds, both in numbers of species and individuals, in most northern forests than in more open or cultivated lands. This is particularly true of coniferous forests, for such woods harbor fewer

insects than deciduous forests, and so furnish a more meager food supply for the birds. Those birds that live and breed in the deep woods, however, are especially fitted to destroy the tree's enemies.

"This care of the trees is kept up throughout the year by the ebb and flow of the tide of bird life. In the chill days of March and early April, when sunshine and shadow fleck the lingering snow, in silent, leafless woods and along swollen streams, the lusty Fox Sparrow searches for seeds and for dormant insects, which only await the warmer sun of April or May to emerge from their hiding places and attack the trees. This sparrow and its companions, the Tree Sparrow and the Junco, soon pass on to the north, making way for the White-throats and Thrushes, which continue the good work, to be followed in their turn by other Thrushes and Towhees. Birds are not plentiful in the woods in early April, but nevertheless diligent Titmice, Woodpeckers, Jays, Nuthatches, and Kinglets are there and at work. In the warm days of May, when nature has awakened from her long winter sleep, when the little, light green oak leaves are just opening, when the bright young birch leaves decorate, but do not hide the twigs; when every leaflet vies with the early flowers in beauty, and every branch upholds its grateful offering; when insects which were dormant during the earlier days of the year become active, and their swarming offspring appear on bud and leaf—then the south wind brings the migratory host of birds which winter near the equator. Unnoticed by men, they sweep through the woods, they encompass the trees; flight after flight passes along on its way to the north, all resting daily in the woods and gleaning insects ere they go. No one who has not watched these beautiful birds hour after hour and day after day, and who has not listened to their multitudinous notes, as, night after night, they have passed overhead, can realize the numbers that sweep through the woods in the spring and fall migrations."*

It should be said, also, that a large number of resident birds keep up the fight against insects all the year round.

*From "Useful Birds and their Protection" by Edward H. Forbush.

Among the most important—from this standpoint—of those that spend the winter with us are the Downy, Hairy, and Red-bellied Woodpeckers, the White-breasted Nuthatch, the Carolina Chickadee, the Carolina Wren and the Song Sparrow.

The birds, like the mammals, or even more than they, have a very great value apart from their economic relation to forests; and the protection of forests as a nesting place for birds appeals to nearly all people.

The Forest in Its Relation to the Character of the People.

That there has been a great change in the character of the people—especially rural people within the past 100 years—or even in the past 50 years, all will admit. That the changes have always been from worse to better is not so easily agreed upon.

There have doubtless been not a few but a very great number of things which have brought about the changes; but certainly among them, as one of the chief, must be placed the circumstances that have grown out of the rapid development of our natural resources. During a comparatively few years nearly the whole population which originally earned its living from the ground has been pushed out from places of seclusion into a whirl of modern industry. When the railroads and the saw mills came in they brought with them a different class of people whose manners and language were readily adopted by the younger people. Thousands of young men were induced to enter mines, factories and logging camps where they were thrown into intimate association with a rough, drifting, foreign element. It is a frequent and just complaint of farmers in our own state that their sons have left the farms at a time when they were most needed and have taken up other lines of work in lumbering and mining sections and in the towns; that the neglected farms have grown up in briars; that the young men have become wholly dissatisfied with the work in which they once took an interest; and that a spirit of selfishness and cool-headed business has taken the place of the hospitality that once prevailed.

NEST OF VEERY, FOUND ON MOSS-COVERED LOG SPANNING BIG RUN, PENDLETON COUNTY. This bird is one of the sweetest singers of northern forests and rarely nests as far south as West Virginia.

The industries mentioned have frequently reduced regions which abounded in beautiful forest scenery into unattractive and ugly wastes of land. This has had an effect, and will continue to have an effect, upon the character of the inhabitants. A certain amount of development of natural resources of any country or any state must be expected and should be desired; but unrestricted industries should not be permitted to disfigure and ruin the appearance of the regions of their operations beyond all hope of repair. J. H. McFarland, President of the American Civic Association, declares that "The true glory of the United States must rest and has rested upon a deeper foundation than that of her purely material resources. It is the love of country that lights and keeps glowing the holy fire of patriotism. And this love is excited, primarily, by the beauty of the country." The devastated, fire-blighted regions of our state which have been abandoned in past years to the greed of careless exploiters, could not possibly awaken in any one the slightest flicker of patriotism or admiration or any of the finer feelings. There are no "books in running brooks" which are foul with the pollution of mines and mills, and there are no "sermons in stones" that have been laid bare by forest fires. "The tree has ever been the symbol of life, strength, beauty, and of rest, and the eye of man cannot continue to look day after day, upon these stately God-given queens of nature without their beauty being reflected in his life, making him a healthier, happier and a better man, and their destruction means not only the removal of one of our most desirable natural resources, from a practical and utilitarian standpoint, but from the viewpoint of health, morality, spirituality, and beauty, their loss would be without remedy."

As long as the beauty and grandeur of primitive forest scenery is preserved it will have a powerful influence in shaping the character of people. All men are imitators to a certain degree, whether or not they are conscious of it or desire it, and become more or less like the persons or even the inanimate things with which they associate or are surrounded. The great forest which surrounded the homes of the pioneers left an indelible mark on their characters. It affected every act of their

lives. Its influence was manifested in their manners and customs and conversation. It made men more thoughtful and less talkative and superficial; it furnished the inspiration for many of their great works of prose and poetry; and it breathed into them a spirit of freedom and independence.

Every city has its parks which were made and are kept up largely for their artistic beauty. No one should underestimate the value of woodlands which are maintained for their esthetic effects. Those whose lives must be largely spent on paved streets between walls of buildings find a complete and refreshing change in the shaded parks and are benefitted to the extent of their power to appreciate such surroundings. Natural forests, where there is no touch of the artificial, have a greater effect upon character; and what the parks are in a small way the virgin forests are in a much larger way.

Many persons do not know the forest nor understand its meaning. It has been said that no one can really know the forest without feeling the gentle influence of one of the kindest and strongest parts of nature. Neither those persons who regard it as a collection of standing timber which can be measured and sawed into lumber, nor those who look upon it as a place overgrown with thickets of thorns and populated with dangerous and repulsive reptiles, insects, and other animals, nor yet those who claim to admire it from a distance and speak of it in terms of false sentiment, have really known it. To know the forest it is requisite that one should live in it, eat and sleep in it, drink water from its springs, gather fruits from its vines and trees, climb its mountains, follow its trails, and bathe in its streams; that one should know something of the creatures that live in it; and that one should imbibe its spirit.

Upon some the forest has a fascinating effect—an influence that cannot be expressed in words, but which is capable of driving out every frivolous thought and stirring every deep emotion. Those persons will know what this inexpressible influence is who have sat alone upon some mossy boulder or fallen tree trunk in a remote forest, or have awakened at the dead of night and watched the shadows that were cast by the light of a low-flickering camp fire and listened to the weird, human-like

calls of the barred owl, to the rustle of the leaves which were stirred by some night-prowling animal, and to that most melancholy but most inspiring music that is made by a gentle wind playing among the branches of trees. There are those who feel that our forests are something more than a "business proposition" and who deplore their destruction as much for their influence as for their economic value.

CHAPTER IV.

THE DESTRUCTIVE AGENTS OF FORESTS.

When forests once become established over certain areas they continue as a rule, under natural conditions, without much change from year to year. There are, of course, spasmodic outbreaks of insects and other animal enemies of trees, brought on by some unusual occurrence, and there are wind storms and hail storms which throw the trees and injure their foliage, and there are occasional fires set by lightning; but, on the whole, as the forests are renewed, the old trees dying off and the young ones springing up to take their places, there is but little apparent change. The natural variation in the general character of forests occurs not by years or decades but by centuries and ages.

In an undisturbed state the forest and all its forms of life, both animal and vegetable, are held in an almost perfect balance by natural laws. Almost every plant and animal which reaches maturity comes up through an uncertain early life, taking chances with thousands of its kind, and continues to live in danger to the end. Each species is restricted within certain bounds. When it overreaches them its special requirements for food, heat, light and moisture act as a check. When it increases abnormally it creates favorable conditions for the multiplication of its natural enemies. The enemies of one plant or animal have, in turn, their own enemies, and so on indefinitely. There is, therefore, a continual balancing and adjusting of conditions and species, which results from the operation of the law above referred to.

When men take hold and begin to clear away the trees, reducing one species and providing for the increase of another, the whole well-regulated system is thrown out of order. Plants spread out of their places and become weeds; harmless mammals become pests; and injurious insects multiply and destroy crops.

Men themselves, then, not only become direct destructive agents, by clearing land, by cutting down the trees for their lumber, and by setting out fires, but in so doing they become indirectly responsible for injuries done by fungi, insects, and other destroying agents.

CLEARINGS.

All land cannot be used for the same purpose. Some will produce one crop and some another. Land that is adapted to the growing of corn may not be good wheat land; and that which will produce peaches may not produce vegetables. It is certain that a large quantity of land in West Virginia will not grow successfully any of the ordinary farm and garden crops. It is fortunate, however, that practically every acre that is unfit for other crops will produce trees of a valuable sort, or was capable at one time of producing them. It is the part of land owners to discover the most profitable use to which their lands can be devoted and then to put into actual practice what they have discovered. Anything short of this is mistreatment of the land and a reflection on the intelligence of its owner. If an area is most profitable for the growing of apples or grapes then it should be used for those purposes; if it is more profitable for growing grain, or truck, or grass than for any other crop, then it is clear what use should be made of it; and it is no less true that if land is most valuable as a producer of forest products and as a protector of soils and streams, it should be kept in woods and as carefully tended and protected as if it were in corn.

It can truthfully be stated that a great many acres have been cultivated by the farmers of West Virginia that should never have been cleared. Numerous farms with from 30 to 100 acres can easily be found which do not contain a half dozen acres of land suitable for the growing of cultivated crops or for grazing. In such cases the farmers are not excusable for their destruction of timber although the motive may have been good. Those who have tried to cultivate such land have had hard work to live and their lives have been a burden to them. There is enough rich and easily tilled land in West Virginia to pro-

duce all that is needed at home of grains, fruits and vegetables, and much besides, provided it is intelligently farmed.

It is not to be regretted that the good agricultural lands have been cleared. The state could never have had an existence without such improvement. The fertile land, it is true, contained the finest timber in the largest quantities, but much of it was cleared in an early day when logs and lumber could not be sold at any price. Their owners would have been glad of a chance to give them away. The destruction of timber under such circumstances cannot fairly be considered as a waste. "The farmer needed the land and no one wanted the timber." Room had to be made for buildings and the growing of farm crops or settlement would, of course, have been impossible. After the pioneer had selected a building site the next thing in order was to cut down trees; and every acre that was added to the opening meant the felling of thousands of feet of timber. A little of this timber only could be used. Selected logs were used for the walls of the house; others were split into punch-ions and boards for floor and roof; and some were used for fuel, for fencing, and for other domestic purposes. All the rest was rolled into heaps and burned.

Just how much timber has been destroyed by the farmers of the state will never be known, and it is certain that we would be little better off if exact data regarding this were obtainable. In the light of the present high prices of lumber, however, the subject of this early destruction becomes an interesting one. There are persons in almost every community who can refer to a time easily within their recollection when walnut and poplar trees, which would now be worth hundreds of dollars, were used for making fences or were burned and their ashes scattered to enrich the land.

On the supposition that the forests of West Virginia 120 years ago contained 150 billion feet of timber, and that an equal amount had been added by growth since that time, the Report of the West Virginia Conservation Commission gives the following approximate figures to show how much timber remained in 1908 and what had become of the balance:

<i>Items.</i>	<i>Feet Board Measure.</i>
Timber used for fence rails in 120 years.....	4,275,000,000
Farm timber other than fencing, prior to 1880..	1,000,000,000
Construction of wooden houses in towns prior to 1880.....	500,000,000
Fuel in 120 years.....	10,000,000,000
Quantity now in forests.....	30,000,000,000
Lumber cut since 1879.....	15,419,500,000
Quantity wasted.....	238,805,500,000
Total	300,000,000,000

Only one item, the lumber cut since 1879 is from the records. The others are given approximately, as has been stated.

FOREST FIRES.

The forest has, perhaps, no worse enemy than fire. The losses from this cause are complete and far-reaching. Mature timber is burned in large quantities; the young and promising undergrowth is consumed; standing trees are made subject to attack by insects and fungi; the animal life of the woods is destroyed; the beauty of landscapes is marred; lives and property of all kinds are endangered; streams are dried up; and often the very soil itself is consumed.

The work of preventing and controlling forest fires forms the chief work of those who have the care of forests in charge. The Government incurs great expense in its efforts to stamp out this curse from the National Forests in the west; every state is confronted with the problem of its control; and all lumber companies, coal companies, and other owners of wooded lands must sustain frequent and serious losses from this cause.

"The fire has destroyed billions of feet of timber in West Virginia. The loss has increased as forests have decreased, and for apparent reasons. There seems to have been little loss in the early years of settlement. Travelers and writers of that time who were familiar with the country seldom mention fire; and there is little evidence to be found in the condition of the woods to show that fires did much damage. Old "burns"—that

means tracts of timber killed by fire—were few and small fifty years ago. Early chronicles occasionally speak of tracts on which timber was thrown by wind, but they are so uniformly silent as to fire that the conclusion is logical that forest conflagrations were rare. It is natural that they should be, for settlements were few and far apart, and fires seldom start except near improvements. Lightning has been known to start fire, but not often in a climate like West Virginia. It is highly probable that the almost unbroken woods of former times were damper than the fragmentary forests of today, and fire would burn more slowly then. It is not known to a certainty that rain was more abundant, but it is probable that between a more copious precipitation and the unbroken shade which hindered the drying process, the average dampness of the woods was much more pronounced than at present.

“The wholesale destruction by fire of the softwood forests (cone-bearing trees) began about the time of the civil war. The largest single burn is that which extends along the summit and sides of the Alleghany mountain, nearly unbroken, from the head of the Greenbrier river through Pendleton, Randolph, Grant and Tucker counties. The opening was begun by a fire which spread from the camp of confederate scouts on the Roaring Plains, of Randolph county. It has been enlarging ever since. Many destructive and spectacular conflagrations have occurred in the region, the most formidable being that which swept the eastern side of Alleghany mountain on the headwaters of Big creek in Pendleton county. Eye witnesses have stated that the flames overtopped the tallest pines and advanced ten miles an hour.

“Apparently, the pine forests have suffered most from fire, but in reality the damage to the hardwoods (broad-leaf trees) has been more in the aggregate, because covering much more country. The undergrowth is often destroyed, and this kills the forest which would be productive a century hence. A bad pine-wood fire may kill old and young, all at once, while in a hardwood forest one must look forward a hundred years to see the full injury—perhaps a thousand years would not be

FIRE-KILLED TIMBER ON MOUNTAIN SLOPE NEAR HEAD OF BUCKHANNON RIVER.

time enough to show it all where the humus of the soil has been burned out.

“The manner in which fire destroys the foundation on which a forest grows is apparent from an examination of changes in the soil on the Alleghany summit and neighboring ranges where the woods have ceased to exist, and that one case is typical of many, and in a lesser degree of all. Over much of that territory the foundation on which the forest stood was a mass of broken and split rocks, and beneath that the solid rock. Trees had found an anchorage for their roots, and for centuries the decaying needles and leaves had been falling into and filling the cavities among the stones. Mosses and lichens had grown and decayed. Each season added a little to the soil, and the accumulation of organic substances, with the mat of living moss, covered the underlying rocks to a depth of from one to three feet. This mass of vegetable matter, with the fragments of broken rocks beneath, was a soil in process of formation—a new soil just coming into existence. Had the process gone on a sufficient length of time, a deep, agricultural soil would probably have been the result, though ages might be required to do the work. The opinion has been expressed by Chamberlain that ten thousand years may be required to form one foot of mineral soil. A thing so valuable, and so slow in making, ought not be carelessly destroyed.

“In the case of the mountain tracts alluded to, the process of soil building was cut short by fire. The work of centuries was undone in a few days, and the moss and vegetable matter covering the rocks were consumed. The trees quickly died and were thrown by the wind, becoming food for future fires which completed the destruction. What little mineral soil there was, was washed into deep cavities by rain, and large tracts became treeless, and almost without soil. That is their condition now. Reforestation will be slow and difficult, for the whole process of soil building must be gone over again in some places.

“Fortunately, the area of excessive denudation is small in comparison with the whole state. It lies chiefly on the high, stony mountains. But fires have done immense damage over wide regions lower down. The hardwoods (broad-leaf trees)

occupy the principal part of the state, and fires run through them at intervals. There is usually a deep, mineral soil, and fire does not get down to the rock as it often does on the mountain tops. But it injures the soil. The vegetable matter, which furnishes plant food, is burned out. The seedlings and sprouts are killed. The mature trees may seem to escape unharmed, but they seldom do. Insects and fungi enter through the injured bark, and decay begins. A profuse crop of sprouts usually succeeds a fire among hardwoods, and the sprouts might become trees if let alone; but other fires follow. At length the mature timber disappears—by natural decay or lumber operations—and a jungle of worthless scrub brush is apt to be all that remains.

“Such is a familiar sight in many parts of West Virginia. It is due to repeated fires which not only kill the young growth but burn out the soil’s fertility.”

Forest Fire Statistics.

“During the fall of 1908 more complete data regarding forest fires in the state were compiled than ever before. It was done by the United States Forest Service as a part of the general work along that line all over the country. Though more complete than any similar statistics for West Virginia, there is reason to believe that in many particulars all the facts were not ascertained.

“The first serious fire occurred August 28, and from that time there was no cessation for three months. Every county in the state was visited by fire, but in some instances only a few acres were burned. The total number of fires reported was 710; the number of men called out to fight was 5821; the cost to the county treasuries, so far as reported, was \$646; the expense incurred in fighting fire by individuals and companies was \$89,100; the area burned was 1,703,850 acres; the standing timber burned was 943,515,000 feet, board measure, worth \$2,903,500. The lumber, tan-bark, and improvements burned were valued at \$490,175; the injury to undergrowth and soil was placed at \$1,703,850, and the loss from forest fires in the

state made the grand total of \$5,097,825. More than one-tenth of the whole surface of the state was burned over, and one-fifth of the forest area. Three per cent of the estimated standing timber in West Virginia was destroyed, including the small as well as the large; and the amount burned was two-thirds as much as the cut of all the mills in the state in 1907.

“As to the origin of fires, 71 per cent were from locomotives, 20 per cent from saw mills and campers, 3 per cent set to improve the range for live stock, 2 per cent incendiary, and 4 per cent from other causes.”*

The forest fire statistics, as collected by J. A. Viquesney, Forest, Game and Fish Warden of West Virginia, for 1909, are as follows:

Number of fires	70.
Number acres burned over	94,322.
Value of timber destroyed	\$107,053.10.
Amount spent in fighting fires.....	1,305.76.

A comparison of the losses by fire in the two years, as given above, will show to what extent the recently-enacted fire laws have proven valuable even before the system provided for has been thoroughly organized. It should be stated, however, that the season of 1908 was exceptionally dry and favorable in every way for the spread of forest fires.

Prevention and Control of Forest Fires.

Fire in forests cannot be controlled absolutely. Even the areas that are guarded best sometimes suffer. The appalling losses in the National and other forests of the Northwest during the present season have shown that too much vigilance is impossible.

Forest fires are of three different classes according to the places where they burn. Surface fires run over the ground, burning the leaves, brush, and all manner of litter; ground fires burn more slowly, eating their way through the humus-

*Report of West Virginia Conservation Commission.

filled soil itself; and crown fires burn through the treetops. Crown fires are confined entirely to softwood forests, and hence have occurred in West Virginia only along the mountains where there were pure stands of spruce, hemlock and other trees of that character. The destructive effects of such fires have already been referred to. In most cases the crown fires have started from surface fires, and these have often been followed in our high mountains by fires that burned the soil. Practically all the fires in the state have been those that burned the litter on the surface.

The means of preventing and extinguishing fires are many and varied. It is better, of course, to prevent a fire than to extinguish it, for even small and seemingly harmless fires do much indirect damage to mature trees and often kill the young seedlings. The best policy, then, is to see that the common causes of fires are reduced to the minimum by every possible means. If sparks from locomotives and saw mills are allowed to scatter broadcast, if persons who travel through the woods, carelessly or maliciously setting fire to it, are allowed to go unpunished, and if no effort is made to lessen the amount of dangerous, inflammable litter in exposed places, then all the fire-fighting force that can be mustered may not be able to keep down losses from this cause. If the people of West Virginia will stand by the law which is already enacted for the suppression of fires they will be suppressed; for all the citizens of any state working in co-operation can make sure that the common causes of fires are eliminated.

But no state has been able to reach all the fires in time to stop them before they were under headway. A few states, recognizing the value of promptness, have established and equipped lookout stations in order that forest fires may be discovered and extinguished before they have spread into dangerous proportions. It has been found out that guards are as necessary in forests as night watchmen are about greatly exposed buildings. The commoner means of fighting fires that are under way are by back-firing and by clearing strips of ground of all inflammable materials in advance of the fires. Water and

chemicals are sometimes employed. Fire lines are frequently kept up as barriers, and roads, trails, and streams are used as places of attack.

THE LUMBER INDUSTRY.

Types of Saw Mills.

There have been three general types of saw mills used in West Virginia. These are the sash, or up-and-down, mill, operated by water-power; the portable mill, using a circular saw and operated by steam; and the stationary band saw mill. All of these have had various modifications. The "muley saw" was only slightly different from the ordinary sash saw, but with a faster stroke. Portable saw mills of almost every description have been used—some with heavy machinery and a capacity of from 10 to 15 thousand feet per day, and some with parts so light that they could be hauled over the steepest mountain roads. The band mills are provided with one, two, or even three band saws; some have double-cut bands, some have pony saws, some have re-saws, others gang saws, and so on.

A rude, hand-operated device known as a whip saw, was used in an early day before and with the sash saw. The contrivance is thus described in Kercheval's History of the Valley of Virginia:

"The whip saw was about the length of the common mill saw (referring to the sash saw used in water mills) with a handle at each end transversely fixed to it. The timber intended to be sawed was first squared with the broad axe, and then raised on a scaffold six or seven feet high. Two able-bodied men then took hold of the saw, one standing on top of the log and the other under it." The author of this history adds further on—"The labor was excessively fatiguing, and about 100 feet of plank or scantling was considered a good day's work for two hands."

These saws have long gone out of use in most parts of West Virginia. It is stated, however, that they have been employed to some extent in the sparsely settled districts of our southern counties within the last five years.

Progress of the Lumber Industry.

It is not known when or where the first saw mill was built and operated in West Virginia. It is probable, however, that there were a few built by the early settlers who occupied the valleys of the Potomac river and its tributaries prior to the year 1755. No records have been examined that confirm or deny this statement, but it is reasonably safe to say that there were a dozen rude water mills in the territory now occupied by Jefferson, Berkeley, Morgan, Hampshire, Hardy, Grant and Pendleton counties as early as 1775, and that the number had increased to five or six times as many by the year 1800. There may have been more at each date. A record dated in the year 1810 states that there were about 50 saw mills running in Berkeley county alone at that time.

Those who left the settlements on the Potomac and other settlements in the east and north to take up lands and establish homes west of the Alleghanies had doubtless become familiar with the water saw mill and knew its value, but many of them journeyed such a distance that it was not possible for them to take anything so cumbersome as machinery of this kind. As soon as roads could be cut through the wilderness, however, among the first things to be hauled over them were the clumsy irons of these mills, which were taken farther west, year after year, until they reached the Ohio river. We find that there was a flourishing colony established on the Monongahela river as early as 1758; that there was a settlement containing 5,000 people on the Ohio river near Wheeling in 1769; that colonies were established at Parkersburg in 1773, and at Point Pleasant in 1776. During the decade between 1770 and 1780 settlements were begun in a number of places along the Cheat river in Preston and Tucker counties; along the Tygarts Valley river in Randolph; along the Monongahela and its West Fork and Tygarts Valley tributaries in the whole region now embraced by the counties of Monongalia, Marion, Taylor, Harrison, Barbour, Lewis and Upshur. During the same period, or slightly earlier in some cases, settlements were established on the Greenbrier river in Pocahontas and Greenbrier counties, and in the

plateau and valley lands of Monroe county. Saw mills were brought to the settlements nearest the mountains first, but the dates given above are only a little in advance of the saw mills in any case. In fact, if we were to continue as above, to trace the progressive settlements step by step, from the very first up to the year 1880, we would have a reasonably accurate history of the progress of these mills.

The first saw mill west of the mountains is said to have been built near the town of St. George in Tucker county by John Minear in the year 1776. This was a sash saw mill and stood on Mill run, a small tributary of Cheat river.

The Gazetteer of Virginia and the District of Columbia, written by Joseph Martin, contains one of the first available lists of saw mills in what is now West Virginia. According to this there were 40 or more water saw mills running in 1835. These were distributed among the counties as follows:

Jackson	8 mills.
Pendleton	1 mill.
Randolph	1 mill.
Wood	2 mills.
Brooke	several mills.
Fayette	2 mills.
Greenbrier	5 mills.
Hampshire	9 mills.
Harrison	6 mills.
Jefferson	2 mills.

It is stated in The West Virginia Hand Book and Immigrants' Guide (J. H. Diss Debar, 1870) that "As late as 1860 $\frac{7}{8}$ of the lumber consumed in the state and exported, was manufactured by water-power."

The most extensive sash saw mill operations in the state were conducted on Middle Island creek in Pleasants, Tyler and Doddridge counties. Further mention is made of these operations, under the counties mentioned, in Chapter Six.

In one sense this old-time industry was of more actual benefit to the citizens of the state than that carried on with modern

mills more recently. The mills were easily set up and kept in running order. Power cost nothing except the labor of building dams and races and keeping them in repair. The lumber sawed was used to the last foot and nothing was wasted. Only the good, mature trees were cut, and all the young growth was left undisturbed.

We know as little of the first portable saw mills as we do of the first water-power mills. Full history at this time would be impossible. Local historians, with one or two exceptions, have remained silent regarding this industry, and all that can now be learned must be laboriously obtained from a few imperfect records and from the older citizens of the state who engaged in the lumber industry many years ago.

According to Martin's list there were 15 steam saw mills in operation in the counties that now constitute West Virginia in 1835. These he gives as follows:

Brooke	1 mill.
Jefferson	1 mill.
Kanawha	2 mills.
Mason	1 mill.
Monroe	1 mill.
Monongalia	6 mills.
Ohio	2 mills.
Wood	1 mill.

The increase in number of portable mills was not rapid during the first 30 or 40 years after their introduction. A few experiments were sufficient to show that the industry was not profitable in cases where the mills and lumber had to be hauled long distances on wagons. For this reason most of the early steam mills were built within easy reach of streams which afforded an outlet for their products.

With the coming of railroads, however, mills of this kind began to multiply rapidly. The new towns that grew up along these roads required a large amount of rough lumber for the hastily built houses, and it was usually possible to locate mills near by. In 1870 J. H. Diss Debar wrote: "Along both

LOGS CUT ON RIGHT-OF-WAY FOR LUMBER RAILROAD. First Step in Removing a Forest.

branches of the Baltimore and Ohio railroad, from twenty to thirty first class mills are cutting on an average 3,000 feet of lumber per day." And so it was along practically all other railroads as they were built from time to time. A few came at first and these were soon followed by many others as mentioned in the quotation above. Just as the old water mills followed closely the first settlements, supplying the lumber for floors and ceiling in the log houses and for the construction of the first frame dwellings, so the portable mills followed the newer settlements as they were established along the lines of railroad.

Below are given dates of the opening of the principal railroads in West Virginia. These dates, as has been suggested, correspond in most cases with the beginning of active portable saw mill operations in the different localities:

BALTIMORE AND OHIO RAILROAD.

WINCHESTER & POTOMAC RAILROAD	Miles.	Date.
Harpers Ferry to Swimley, Va.,	20.21	1836

B. & O. MAIN LINE

Harpers Ferry to Wheeling,	248.25	Jan. 1, 1853
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BENWOOD BRIDGE

Benwood Jct. to low water mark on Ohio side,	1.41	
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PARKERSBURG BRANCH

Grafton to Parkersburg,	103.13	
Parkersburg Bridge,	.82	1857

WHEELING, PITTSBURG & BALTIMORE RAILROAD

West Alexander, Pa. to Wheeling, W. Va.,	14.41	1857
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WEST VIRGINIA & PITTSBURG RAILROAD

Clarksburg to Richwood	120.99	
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Pickens Branch,

McPelah Jct. to Pickens,	50.51	
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Sutton Branch,

Flatwoods to Sutton,	5.63	
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Total mileage W. Va. & Pittsburg R. R.,	177.13	1879
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OHIO RIVER RAILROAD

Benwood Jct. to west bank of Guyan-
dotte river, 207.82

{	Wheeling to Parkersburg 90 mis., ..	June 16, 1884	{
	Parkersburg to Point Pleasant 79 mis.,	Jan. 1, 1887	

HUNTINGTON AND BIG SANDY RAILROAD

West Bank of Guyandotte river to
Kenova, 10.92 1892

RAVENSWOOD, SPENCER & GLENVILLE RAILROAD

R. S. & G. Jct. to Spencer, 32.40 Jan. 4, 1892

RIPLEY & MILL CREEK VALLEY RAILROAD

Millwood Jct. to Ripley, 13.00 1888

PAW PAW RAILROAD

Bellview to Gray's Flats 7.30 1902

PATTERSON CREEK & POTOMAC RAILROAD

Patterson Creek to McKensie, 5.42 1903

HARDMAN BRANCH

Hardman, W. Va. to Coal Co.'s mines, 1.40 1901

RACCOON VALLEY BRANCH

Newburg to Austin	2.89	
Gorman Extension	.81.....	3.70 1908

BAKER BRANCH

Engle to Aulls, 4.13 1879

FROG HOLLOW BRANCH

Martinsburg to Standard Lime &
Stone Co.'s Quarries, 2.64 1887

CHERRY RUN & POTOMAC RAILROAD

Cherry Run to Berkeley Springs, ... 13.92 1903

BERKELEY SPRINGS & POTOMAC RAILROAD

Hancock to Berkeley Springs, 5.95 1888

SOUTH BRANCH RAILROAD

Green Spring to Romney, 16.10 Sept. 1, 1884

GRAFTON & BELINGTON RAILROAD

Grafton to Belington,	41.47	
Berryburg Br., Hackers		
Cr. Jct. to Berryburg,	4.66... 46.13	1884

FAIRMONT, MORGANTOWN & PITTSBURG RAILROAD

F. M. & P. Jct. to Morgantown.....	26.00	1886
Morgantown to Pa. State Line	7.83	1895

**POINT PLEASANT, BUCKHANNON & TYGARTS VALLEY
RAILROAD**

Tygart's Jct. to Buckhannon,	16.60	
Burnersville Br., Lemley Jct., to Century,	5.09	1904

MONONGAHELA RIVER RAILROAD

W. Va. & Pittsburg Jct. to Gaston Jct.,	30.24	Aug. 1, 1890
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WEST VIRGINIA SHORT LINE RAILROAD

Brooklyn Jct. to Short Line Jct., ...	58.00	
Pigott's Run Branch, Lumberport to. Sta. 64-65,	1.22	1900

CHESAPEAKE AND OHIO RAILROAD.

Date of opening.

MAIN LINE C. & O. RAILROAD

Allegheny to Huntington,	1873
Huntington to Big Sandy River,	1881

CABIN CREEK BRANCH

Cabin Creek Jct. to Acme,	1890
Extension to Lawson,	1906

LOUP CREEK BRANCH

Thurmond to McDonald,	1891
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GAULEY BRANCH

Gauley Jct. to Vaughan,	1892
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PINEY CREEK BRANCH

Prince to Raleigh,	1899
Extension to Lester,	1905
Extension to Sullivan,	1908

GUYANDOT BRANCH

Barboursville to Midkiff,	1900
Extension to Logan,	1904
Extension to Ethel,	1906

GREENBRIER DIVISION

Whitcomb to Cass,	1901
Extension to Durbin,	1902
Extension to Winterburn,	1905

PAINT CREEK BRANCH

Extension to Rattlesnake Draft,	1906
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COAL RIVER BRANCH

St. Albans to Madison,	1907
Extension to Clothier,	1909

NORFOLK AND WESTERN RAILROAD.

	Date of opening.
MAIN LINE OF N. & W. RAILROAD	
Completed to Charlestown, Jefferson Co.,	1879
Completed to Bluefield, Mercer Co.,	1883
WIDEMOUTH BRANCH	
Main Line to Wenonah	1904
TUG FORK BRANCH	
Completed to above Pageton,	1909
CLEAR FORK BRANCH	
In McDowell County,	April, 1905
DRY FORK BRANCH	
Completed to Cranebrake,	March, 1906
OHIO EXTENSION	
(Road including Welch, Williamson, Wayne and Ceredo.)	Nov. 1892
KENOVA AND BIG SANDY LINE	
Naugatuck to Kenova,	Dec. 1904

KANAWHA AND MICHIGAN RAILROAD.

	Date of opening.
MAIN LINE	
Point Pleasant to Charleston,	1882
Charleston to Gauley,	Aug. 1893

THE WESTERN MARYLAND RAILROAD.

	Date of opening.
MAIN LINE	
Piedmont to Davis,	1887
Extended to Parsons,	1889
Extended to Elkins,	1890
Extended to Belington,	1891
Extended to Huttonsville,	1898
Coal & Iron Branch,	
Elkins to Durbin,	Aug. 1903

COAL AND COKE RAILROAD.

	Date of opening.
MAIN LINE	
(Begun at Charleston, 1893.)	
Charleston to Clay,	Jan. 1897
Extended to Gassaway and Sago,	Sept. 1904
Branch to Coalton,	1903

VIRGINIAN RAILROAD.

	Date of opening.
MAIN LINE	
Deepwater to Robson,	1898
Robson to Princeton,	Sept. 24, 1908
Princeton to Virginia line,	Oct. 7, 1908

MORGANTOWN AND KINGWOOD RAILROAD.

	Date of opening.
MAIN LINE	
Opened for short distance out of Morgantown,	Sept. 20, 1899
Opened to Masontown,	Sept. 28, 1902
Opened to Kingwood,	Mar. 12, 1906
Completed to M. & K. Jct.,	July 8, 1907

The first band saw mills were built in West Virginia between the years 1880 and 1885. Deveraux Lumber Company's mill built at Charleston in 1881, was probably the first. Two years later J. R. Huffman, the inventor of the band saw, built two large mills at Charleston. The St. Lawrence Boom & Manufacturing Company erected a band mill at Ronceverte in 1884; and the Blackwater Boom & Lumber Company erected one at Davis in 1887. Others of the older mills were those of Hulings Lumber Company, at Hambleton; Gauley Lumber Company, at Camden-on-Gauley; Parkersburg Mill Company, at Parkersburg; and Pardee & Curtain Lumber Company, at Grafton.

The band saw mills in West Virginia have probably reached their maximum number and production. Thirty years ago there was not a mill of this type in the state. Now there are eighty-three. Thirty years hence they will be gone. The figures given below show the rapid development of the band saw industry and its no less rapid decline from this date.

<i>Date.</i>	<i>Number band saw mills in operation.</i>
1880	0
1885	4
1890	9
1895	13
1900	23
1905	46
1910	83

<i>Date.</i>	<i>Approximate number of band saw mills that will be running.</i>
1915	41
1920	23
1925	9
1930	5
1935	3
1940	0

There are three or four band saw mills being erected at this date, and it is probable that a few others will be built within the next 5 years. The number, however, will be small, as nearly all the large tracts of available timber are in the hands of operators.

The amount of timber cut in the various operations connected with the lumber industry could not be accurately estimated. The cut of saw mills during the past 30 years has been about 18 billion feet. It is not known how much was cut before that time, nor how much was rafted out in the log, nor how much was cut for hoop-poles, cross ties, tan-bark, pulp wood, poles, etc., but the quantity was very large.

Such facts in detail as have been learned regarding the various phases of the lumber industry in the state are given in the county discussions. A further inquiry into this subject would bring out many additional and interesting facts of commercial history.

DISEASES OF FOREST TREES AND WOOD-DE-STROYING FUNGI.

Extent and General Results of Disease.

The life of trees, like the life of animals, is shortened by disease. Some species resist disease more readily than others but not one has been found that is wholly free from it through all the stages of its life. Some trees, it would seem, are subject to many kinds of diseases. These are constantly struggling against conditions which interfere with their normal growth

so that they seldom reach maturity unscarred. Other species are less frequently attacked and may attain maturity in comparative perfect health. The extent to which trees are infected frequently varies with their age. Those that are young and vigorous are in little danger from fungi and insects that usually enter through broken limbs or wounded bark. The diseases which work upon the surface, however, sometimes find the most favorable conditions for their rapid growth in the tender foliage and twigs of seedlings. There comes a time in the life of every tree when growth practically ceases. It is then, when its vitality is low and its power to heal greatly reduced, that the tree is most powerless against disease; and it is after that time in most cases, that the increase in wood of timber trees is not sufficient to counterbalance the loss from various causes. Trees reach the inactive, mature stage at various ages according to the species and in spite of unfavorable climatic conditions or other adverse influences. Hence, it must not be concluded from a study of the natural enemies of the different kinds of trees that the variation in their length of life is caused entirely by the presence or absence of disease; for those with approximately the same susceptibility, in similar situations, and under the same environment, will react in case of infection in an entirely different manner, and with entirely different results. A white oak and a beech standing close together may be equally diseased but the former will probably outlive the latter by many years. The giant redwood of the Pacific coast having certain inherent powers of resistance to its enemies and by nature extremely long-lived, is able to stand at the end of three or four thousand years in a state of vigorous and healthy maturity. On the other hand, such trees as our cottonwoods, willows, and the wild red cherry, with fewer disease resisting properties and with shorter natural life, are old and ready to die at a hundred years.

Some Dangers Surrounding Trees Enumerated.

The health and life of trees are endangered almost constantly. First, there are the unfavorable natural conditions often surrounding them, including excessive or meager water

supply; insufficient and improper plant food; severe winter freezing and late spring frosts; wind storms; lightning; snow, sleet and hail; an excess or insufficiency of light; and crowding by other trees. Closely related to these are the unfavorable artificial conditions found in the regions of coke ovens, pulp mills, copper smelters and blast furnaces, all of which produce large quantities of smoke or sulphur gases. Second, there are the dangers from living organisms, such as the wounding of trees by deer, bears, and other forest inhabiting mammals; the gnawing of roots and carrying of disease germs by small burrowing quadrupeds; the ravages of innumerable insects; and the destructive work of fungi and bacteria and of parasitic flowering plants. The wonder is that trees can live at all, when we consider all these things, and especially when we reflect that they have no power to remove themselves from unhealthful situations and out of reach of infectious diseases, but must submit passively to whatever comes their way. A brief consideration of the structural protection which Nature has given trees will help us to understand how so many of them are able to survive in the face of great odds.

Protective Structure of Trees.

Every living tree, after it has reached a certain age, is made up of two distinct parts, namely, the dry, dark-colored heartwood and the living and growing sapwood, bark and leaves. Every part has its own peculiar protection. The heartwood, which extends through the trunk and larger limbs and roots, is effectually dead and now acts only as a support to the living parts which surround it. The heartwood of a few trees, such as the osage orange, the red cedar and others, is supposed to contain some chemical properties that are distasteful to insects and that resist the entrance of fungi; but in nearly all cases it has no power in itself to resist the elements of decay. Therefore, it is completely enclosed by living wood which is enabled, normally, to ward off many of its enemies. The living woody parts are partially protected by the thick bark of the trunk and limbs and by the exudation of gums and resins which occurs in many species. The wood of trees that are not resinous is said

GRADE FOR A LUMBER RAILROAD NEAR HEAD OF CRANBERRY RIVER.

to exude a resistant substance when exposed to the air. Bruises and broken limbs and roots are quickly healed over, especially in young and vigorous trees, and the natural place of entrance of many disease-producing organisms is thus closed. A resistant corky tissue is sometimes formed beneath the scars of tender growing parts and is also found about the lenticels, or breathing pores, in the bark. Leaves, the tenderest and most exposed growing parts of the tree, present several protective features. Leaves are structurally protected from excessive light and from the escape of too large quantities of water from their upper surfaces. A further protection is afforded them by the hardened epidermis or skin-like covering, and many leaves are protected, also, by a dense covering of hairs or spines. The seeds of trees are protected, in some cases, by spiny or bone-like coverings, as in the nuts of chestnut, hickory and walnut.

The Decay of Dead Wood.

From the ordinary commercial standpoint trees become useful only after they are cut down. When this is done the protection they have had in life is, of course, removed. Moreover, enemies of living wood now give place to a larger number of insects, fungi and bacteria that attack dead wood and quickly bring about its ruin and decay.

Conditions That Favor Decay.

Saplings felled and left upon the ground decay within a few months. This is especially true when the bark is not removed and when they are left in damp, shady places. Many wood-destroying fungi and insects prefer to work in young trees, and in the sap wood of older ones, thriving only where there is a large percentage of moisture. Just the conditions that favor the most rapid decay are afforded by leaving logs, sills, ties and other timbers upon the moist ground or in other places where thorough seasoning is not possible.

Conditions That Discourage Decay.

Sound wood, if properly treated or placed out of reach of the elements of decay, may be preserved almost indefinitely. The decay of wood is not the result of mere exposure to air as is the rusting of iron but is brought about by living organisms, such as insects, bacteria and fungi. Fungi and many bacteria in order to live must have not only food but also a proper amount of heat, moisture, light and air. Therefore, if all of these requirements, or any one of them is lacking, decay from these causes will be greatly lessened or made impossible. Thoroughly seasoned heartwood may have the food, the light, the air, and the heat, but as long as it lacks the required moisture it will not decay. Examples are numerous which illustrate the lasting properties of well-seasoned wood. The interior finish of buildings erected hundreds of years often remains in a perfect state of preservation. That which is exposed to the weather, as yellow poplar siding used on most of the frame houses in West Virginia, is frequently found to be worn thin by long exposure to winds and rain but yet with no sign of decay. Wood kept under the water or buried deep in the ground is preserved even more perfectly than that which is seasoned. In these cases the supply of air, or light, or heat, or of all of them, is not sufficient for the existence of organisms of decay. Furthermore, bacteria and the spores of fungi—many of which float for long distances through the air—are effectually prevented from coming in contact with the wood. Archaeologists have frequently uncovered wooden buildings, with wooden furniture and numerous smaller articles, that were used by the early European races. Many of these have been buried for thousands of years. A wooden boat, recently taken from a deep excavation in London, is said to have been left on the sandy shore of the Thames river before the invasion of England by the Romans in the year 43 A. D. A pleasure ship which was identified as belonging to the Roman Emperor, Tiberius, whose reign ended in 37 A. D., was unearthed not long ago in a well-preserved condition. Excavations in Greece, Italy, Switzerland, and in other countries have brought to light old buildings the

architecture of which has proven them to be of great age; and bridge piles, driven into the channels of European and Asiatic rivers thousands of years ago, are yet to be found.

It is not necessary, however, to go outside of West Virginia to find examples of remarkable wood preservation. A well driller in the Kanawha valley of Mason county is said to have found a solid sycamore log at a depth of 50 feet; and a sound hardwood log was drilled into at a somewhat greater depth in the Buckhannon river valley near Sago in Upshur county. Well-preserved bottom logs of mill dams built by the early settlers of the state are still to be found along many of our streams; and the sandy shores and channels of most of our rivers contain sunken logs and limbs that have been kept from decay for hundreds of years, perhaps, by the action of soil and water. An interesting example of seasoned wood preservation is seen in an idol-like wooden statue found in a cave in West Virginia and now on exhibition in the Capitol Annex at Charleston. When it was made is not known but we are justified by its appearance and all the known circumstances in believing it to be of great age.

Woods can be preserved, for a limited time at least, by the use of such preservatives as creosote, zinc chlorid, corrosive sublimate, and copper sulphate. Their action is to prevent the entrance of bacteria and fungi that produce decay. Another method employed is the painting or the applying of other waterproof substances to the outside of posts, poles and other exposed wood.

Conditions and Organisms That Induce Diseases of Trees and Decay of Wood.

Having noticed, generally, that the injury and death of trees and the decay of wood result, directly or indirectly, from unfavorable environmental conditions or from living organisms, that the destructive work of these natural agencies is either restricted by certain structural barriers in living wood and by the absence in dead wood of one or more of the requirements of organisms of decay, or that it is augmented in proportion to

the lack of resistance of living trees and the presence of water and other favorable conditions of dead wood, it becomes advantageous to consider separately some of the enemies of trees and wood enumerated under a foregoing head.

Water in Its Relation to Tree Diseases.

An immense quantity of water passes through every tree during the period of its growth. The water is drawn from the soil through the roots and passes out, or is transpired, from the leaves. In the summer months a large broad-leaved tree will transpire from 500 to 900 pounds, or we may say a barrel, of water daily. Coniferous trees transpire about one-tenth that amount. A small amount of water passes out through the bark and even in the winter months a large tree may lose from 10 to 15 pounds of water every day.

The water requirements of trees vary greatly, and their distribution is affected everywhere by the amount of moisture present in the soil. The water content of the soil that will suit the needs of one tree will be the death of another. The tree that thrives in swampy ground will die if planted upon a dry hill and *vice versa*. That is to say, either an excessive or a meager supply of water may produce a diseased condition according to the species of the tree. If the roots of the yellow poplar or the white oak are flooded with water they are unable to get the amount of oxygen they require and will soon show signs of bad health. The same is true to a less extent of many other trees that prefer a porous, airy soil. A group of dead oaks or poplars, killed by the comparatively small quantity of water which drains from a culvert, may frequently be seen along a forest road. On the other hand, swamp white oaks, sweet gums, and other trees that prefer wet ground will immediately show signs of disease when the water is drained from their roots.

Plant Food Supply in Its Relation to Tree Diseases.

It is just as impossible for a good crop of trees to grow in a shallow and poor soil as it is for a crop of corn or other agricultural crop to thrive on the most infertile land. One looks for

large trees in the rich soils of valleys and coves and in the deep humus-filled soils of north hillsides. The fertility of the soil itself can easily be judged by the kinds and sizes of the trees which it produces. Trees growing in poor soil are apt to have a starved and sickly appearance, and their weakened condition induces many kinds of disease.

Relation of Excessive Cold to Tree Diseases.

Severe winter freezing often kills the roots, twigs, and even the trunks of smaller trees, thereby producing a diseased condition. Cracks in the bark and wood caused in this way not only weaken the tree and injure the quality of the wood but permit, also, the entrance of insects and fungi. Late spring frosts may kill the leaves or injure them to such an extent that they are unable to perform their important work.

Diseases Induced by Storms.

Storms occurring during the summer months may injure trees by lightning, by wind and by hail. Injuries from the first cause are comparatively slight. It is not uncommon, however, for a dozen or more trees to be struck during one season in a forest of a few hundred acres, some of which will be only slightly damaged and others killed outright or almost completely demolished. High winds are always disastrous to forests. Scores of the finest trees are upturned by wind each year in every wooded locality, and many limbs are broken from the standing trees. Hail storms are less violent in this part of the country than in the West and Northwest. The tender spring foliage, however, is occasionally riddled by hail-stones in narrow belts of timberland. Winds in winter, when the trees have dropped their foliage, sweep harmlessly through the forests of hardwood; but the conifers are sometimes overthrown by winter as well as by summer winds. The principal losses in winter result from hanging snows and sleets that break the limbs and bear down and distort the trunks of the younger growth. Almost every limb was observed to be broken from thousands of trees growing on North Fork mountain in Pendleton county after the heavy sleet which fell

in February, 1910, and doubtless other regions suffered in the same way.

The breaking of limbs by winds, snows and sleet and the wounding of bark and wood by falling trees and by lightning result, indirectly, in a great loss from diseases of various kinds. Many species of wood-infesting insects and myriads of disease germs find a suitable place to enter at the scars of broken limbs and bark.

Effects of Insufficient Light.

The life of every tree in a forest is a constant struggle to get to the light. Some species demand more light than others, but all are dependent upon it to a greater or less degree. The trees that succeed in overtopping those that are intolerant of shade grow and reach maturity at the latter's expense. Disease is sure to follow a weakening of trees that have been overgrown and left in the shade; and so an insufficient supply of light causes a constant thinning out process to go on from year to year.

Injuries Due to Smoke and Gas.

The ill effects upon vegetation of the smoke and gas of coke ovens and paper pulp mills is readily seen in the immediate vicinities of these industries. Not only the grass and other small vegetation about the thousands of coke ovens in West Virginia are killed, but the leaves of all the trees surrounding them have a withered and sickly appearance. Cone-bearing trees, especially white pine and hemlock, are most easily killed from the causes here mentioned. Oaks, hickories, chestnut, and poplar, however, are all seriously affected and many others suffer disease and finally death after long exposure.

Effects of the Wounding of Trees by Mammals.

A number of forest-living mammals, such as bears, deer, and rabbits, injure live trees by chewing, scratching, or otherwise wounding the bark; and small, burrowing rodents occasionally

damage the roots of trees in the same manner. These injuries, like those caused by snow and ice, are important chiefly because of the channels which they open up for destructive insects and fungi.

Injuries by Forest Fires.

It should not be forgotten that one of the most serious effects of forest fires comes quietly and often unobserved, yet none the less surely, from the work of numerous species of fungi that are admitted to the wood of living and dead trees through the injured bark. Millions of forest trees in the State have been greatly damaged or rendered worthless by this secondary effect of fire.

Injuries by Insects.

Insects must be classed among the worst of the enemies of trees. They not only injure every part of living trees, but attack and destroy fallen trunks and manufactured wood products. The destructive work of forest insects is taken up more in detail under another head.

Injuries by Fungi.

The destructive work of fungi has already been referred to in a general way. The leaves, twigs, roots, bark and wood of living trees suffer from fungous diseases of many kinds. It has already been pointed out, also, that after trees are cut down their wood is in still greater danger from the fungi that produce decay unless it is rapidly and thoroughly seasoned or treated with some chemical preservative.

Fungi and Their Methods of Work.

The terms "fungous disease", "bacterial disease", and the like, would have been meaningless to the general reader in West Virginia twenty years ago; but since the development of scientific treatment of diseases of vegetables, grains, and fruits, this is no longer the case. Through farmers' institutes and agricul-

tural periodicals, through bulletins issued and practical demonstrations made by the Agricultural Experiment Stations, and through instruction in the State Universities and in the public schools, even the farmers that are the farthest removed from the centers of population have become more or less familiar with their crop diseases and the methods of controlling them. For the reasons given, therefore, a simple discussion of the fungous diseases of forest trees should be readily understood and fully appreciated by any readers into whose hands it may fall.

“Fungi are a class of low plants, possessing no coloring matter, which consist of fine threads called hyphæ, many hyphæ forming the mycelium. The mycelium grows in or upon dead or living organic matter, from which it extracts certain food substances. After a sufficient quantity has been absorbed, provided that conditions are favorable, fruiting bodies are formed which develop the spores. The fruiting bodies of the larger fungi found on trees are generally known as sporophores”.*

Many of the common fungi are parasites upon other living plants, called their *hosts*, and live entirely at the latter's expense. Others that derive their food materials from dead and decaying organic substances are known as saprophytes.

The large “brackets” or “punks”, referred to above as “sporophores”, are not themselves the fungi, but bear somewhat the same relation to the whole fungus plant that ordinary fruits and flowers bear to the trees and vines upon which they grow. In other words, when the fruiting part of a fungus appears, it is unmistakable evidence that the vegetative part of the fungus has reached an advanced stage in its life and has doubtless already worked great injury to its host.

Fungi do not produce true seeds but countless numbers of minute bodies (spores), which answer the same purpose as seeds, are scattered from their fruiting organs. When spores find a suitable lodgment they begin to grow, sending slender threads (hyphæ) or their feeding branches (haustoria) into living or dead tissues and continue to grow as described in the above quotation.

It is not considered advisable, if indeed it were possible, to

*“Fungous Diseases of Forest Trees”—H. Von Schrenk.

PLANT OF WARN LUMBER COMPANY, NEAR SEEBERT, POCAHONTAS COUNTY.

take up separately in this report the many species or even the many classes of parasitic and saprophytic fungi that live in trees and timbers and discuss their appearance, their work, etc. Instead, a few of them will be grouped according to their favorite feeding places and some of those that have been collected in West Virginia will be mentioned incidentally in that connection or listed near the end of this chapter.

Fungi That Injure the Leaves of Trees.

The most important of the fungi that are parasitic on the leaves of trees are the mildews, the rusts, and the leaf-spot fungi.

The whitish mycelium of mildews frequently covers the whole surface of leaves and tender twigs giving them a frosty appearance during the summer and fall. The food of the mildews is drawn from their hosts through short branches of the mycelium which penetrate the cell walls of the interior leaf tissues. Late in the year small, black fruiting bodies (perithecia) appear. These hold on to the leaf surfaces during the winter, and in the spring burst open and scatter their spores. The damage done by mildews to large trees is not often great; but to seedlings it may be more serious. In nurseries or in seedling plantations this fungus can be controlled by the use of powdered sulphur or some liquid fungicide such as Bordeaux mixture.

The leaves of deciduous trees suffer but little from rusts. Ash, poplar, birch, and willow-leaves are occasionally affected, and one stage of the cedar rust is found on service, hawthorn, and other trees belonging to the rose family. The familiar "cedar-apples" often found growing on red cedar trees in West Virginia are caused by this cedar rust which is injurious both to the cedar and, in another stage, to the hardwood trees last mentioned above. A rust (*Peridermium tsugae*) sometimes occurs here on the leaves of hemlock but does only slight damage. The European currant rust (*Cronartium ribicola*) has been introduced from European nurseries, in one of its stages, on white pine seedlings. This disease is very destructive to young trees and due care should be exercised by purchasers not to procure infected stock.

Rusts can sometimes be controlled by fungicides when it is

practicable to carry on spraying operations. Another method of control is to rake together and burn diseased leaves in the fall or early spring.

Leaf spots are caused by a large number of minute fungi belonging to several genera. The fungi producing leaf-spots may become troublesome here on such trees as silver maple, sugar maple, red maple, chestnut, walnut, hickory, pawpaw, witch hazel, and the buckeyes. A leaf-blight (*Gleosporium nervisequum* Sacc.) is commonly found on sycamores. A serious leaf-blight of white pine occurs from New Hampshire to North Carolina. The cause of this blight is not well understood but it is believed that fungi often found present are responsible in part.

Leaf-spots and leaf-blight may be controlled in the manner recommended for the control of rusts.

Fungi That Injure Bark.

The bark of trees is affected to some extent by nearly all the wood-destroying fungi in their advanced fruiting stage. There are, however, some fungous diseases which are distinctively bark-destroyers. Among these are the slime-fluxes which work in the inner bark of such trees as the white elm, the maples, the yellow birch, and the flowering dogwood. The bark which is sometimes killed by these diseases, in broad girdles extending around limbs and trunks of trees, is affected by various forms of algae, bacteria, and fungi. Special attention should be called to a serious bark disease which affects both chestnut and chinquapin trees. The disease is caused by a fungus known as *Diaporthe parasitica* Murr. It was first observed in the City of New York in 1904, at which time it had already damaged a large number of trees. Dr. W. A. Murrill, who first described the disease, estimates that it has caused a financial loss in New York City and vicinity of "between five and ten million dollars." Over 16,000 chestnut trees were killed in a single park on Long Island. So far the disease has spread to Rhode Island and Massachusetts on the north, and through New Jersey, Delaware, Pennsylvania, and Maryland to Virginia on the south. The most recent reports of the occurrence of this disease are from Boston, Massachusetts; Saratoga and Cooperstown, New York; Derry, Greensburg, and Kittanning

Point, Pennsylvania; Fontella, Virginia; and from Lewisburg, Greenbrier county, and Whetsell, Preston county, West Virginia.

The appearance and work of the chestnut bark disease are thus described: "The spores of this fungus, brought by some means from a previously diseased tree, enter the bark through wounds; possibly also in other ways. The leaves and green twigs are not directly affected. From the point of infection the fungus grows in all directions through the inner bark until the growth meets on the opposite side of the trunk or limb, which in this way is girdled. The wood is but little affected. Limbs with smooth bark attacked by the fungus soon show dead, discolored, sunken patches of bark covered more or less thickly with yellow, orange, or reddish-brown pustules of the fruiting fungus. In damp weather or in damp situations the spores are extended in the form of long irregular "horns" or strings, at first greenish to bright yellow in color, becoming darker with age. * * * * A (diseased) patch usually grows fast enough to girdle the branch or trunk that it is on during the first summer."*

The means recommended for the control of this disease are the cutting down and destroying of infected trees and rigid examination of nursery stock.

Fungi That Injure Roots.

There are several fungi that attack the roots of trees. Only one of these will be mentioned here. This is a gill-bearing fungus known as the honey mushroom. (*Armillaria mellea* (Vahl.) Quel.). Its presence is manifested in the affected tree by a "drying up of the top" and in its advanced stages by the honey-colored fruiting parts of the fungus which appear scattered over the ground near the base of infected trees.

Fungi That Injure the Wood of Living Trees.

Under this head comes a large number of destructive fungi which attack the wood of living trees. Some of these are truly parasitic and injure the growing sapwood; but by far the greater

*"The Present Status of the Chestnut Bark Disease"—Metcalf and Collins.

damage is done by saprophytic forms which find an entrance to the valuable heartwood. Nearly all of the destructive fungi of this class belong to the group known as pore fungi, most of which send out from the tree trunks the familiar sporophores, variously known in West Virginia as "brackets", "toadstools", "punks", "gnat-woods", or "puddicks". Heartwood of affected trees is rendered worthless by all the fungi of this class. The diseased wood becomes dry or wet, powdery or fibrous, light or dark-colored, according to the species of the attacking fungus. One of the most familiar examples under this head is the locust fungus (*Pyropolyporus robiniae* Murr.) which enters the wood of the tree through broken limbs or through the tunnels of the locust borer. Another, the false-tinder fungus (*Fomes igniarius* Gill.) is an enemy of many broad-leaved trees including beech, maples, yellow birch, walnuts, oaks, hickories, and willows. The sulphur polyporus (*Polyporus sulphureus* (Bull.) Fr.) is found on oaks, chestnut, locust, walnuts, and many other deciduous trees. Others are the soft-rot fungus (*Polyporus obtusus* Berk.) found growing in wood of oaks; and the heart-rot fungus (*Fomes nigricans* Fr.) of birches, willows, and aspens. Many others, described in various publications relating to this subject, may be found in the forests and woodlots of the State.

Fungi That Injure Dead Wood.

No estimate can be made of the immense damage to fallen trees and manufactured timbers caused by various species of saprophytic fungi. It has been pointed out that decay from these causes under favorable circumstances is rapid and certain, and that in order to preserve wood it is necessary at once to insure it against attack by seasoning or chemical treatment. According to some writers, the most widely distributed and most destructive of the wood-rotting fungi is the comparatively small and varicolored species (*Polystictus versicolor* (L.) Fr.) found growing singly or more often in dense masses on almost every kind of hardwood. A more conspicuous example of this class is the common sap-rotting fungus (*Elfvigia megaloma* (Lev.) Fr.), the large sporophores of which are seen growing on logs in damp

woods in almost every locality. Several others of this class are included in the list given below.

Studies of Fungi in West Virginia.

Observations by the writer on the extent of injury by fungi to forests and forest products in West Virginia have been of the most general nature. A glance at the conditions in the principal forest regions, however, has shown a percentage of injury from this cause almost beyond comprehension. The progress of destruction is found to be particularly alarming in the immense burnt-over areas found in nearly every part of the state, and in the cut-over forests where careless methods of lumbering have left tangled heaps of decaying tree-tops among the scarred and battered growth of young and inferior trees. It is evident on every hand that the highest possible development of destructive fungi and other disease-producing organisms has been encouraged in the forests of the state by every means common to a policy of carelessness and waste.

The principal studies and collections of West Virginia fungi have been made by Mr. L. W. Nuttall, formerly of Nuttallburg, Fayette county, and by Dr. John L. Sheldon, Professor of Botany and Bacteriology at the State University. The work of the former covered a period of several years, especially between 1893 and 1896, in which he collected extensively at odd times on the waters of the New river and its tributaries, furnishing most of the 980 fungi listed in Millspaugh and Nuttall's "Flora of West Virginia." A large private collection—from which the names and annotations given in the list below were taken—has been built up by Dr. Sheldon during his vacations from University work. This collection, which is available to the students in botany at the West Virginia University, has been brought together, not through any special encouragement from the outside but because of the great need of an herbarium at the chief educational institution of the state, and because of the special desirability of a collection of native plants as an aid in teaching systematic botany.

AN ANNOTATED LIST OF FUNGI DESTRUCTIVE TO
TREES AND WOOD.

(Collection of Dr. John L. Sheldon.)

Pore Fungi.

Bjerkandera adusta (Willd.) Karst.

On dead oak, Randall.

On willow, Moundsville.

Coriolus abietinus (Dicks.) Quel.

On red spruce, Cranberry Glades.

On hemlock, Lick Run.

On hemlock, Cooper's Rock, east of Morgantown.

Coriolus pubescens (Schum.) Murr.

On beech, French Creek. (Coll. F. E. Brooks.)

On beech, Morgantown. (Coll. C. P. Hartley.)

Coriolus versicolor (L.) Quel.

On black walnut, Morgantown.

On birch, Quarry run, near Morgantown.

On birch, Cranberry Glades.

On birch, Albright.

Coriolus prolificans (Fries) Murr.

On birch, Cranberry Glades.

On oak, Seebert.

On beech, Albright.

On wild plum, Morgantown.

Coriolus nigromarginatus (Schw.) Murr.

On yellow poplar, Oliver.

On dead wood, Cranberry Glades.

On birch, Lick Run.

Coriolellus sepium (Berk.) Murr.

On walnut, Morgantown.

Daedalea confragosa (Bolt.) Murr.

On birch, Lick run.

On oak, Star City.

On birch, Cranberry Glades.

Elfvigia megaloma (Lev.) Murr.

On dead wood, Lick run.

On sugar maple, Cranesville.

Fuscoporia viticola (Schw.) Murr.

On oak and locust, Morgantown.

- Fomes roseus** (Alb. & Schw.) Cooke.
On hemlock, Cranesville.
On red spruce, Cranberry Glades.
On living peach tree, Washington. (Coll. Hartley.)
- Fomes unguatus** (Schaeff.) Sacc.
On hemlock, Cranesville.
- Gloeoporus conchoides** Mont.
On decaying log, Sabraton.
On wild cherry, Mona.
On apple, Albright.
On dead wood, Ceredo.
- Ganoderma tsugae** Murr.
On hemlock, Tibbs run.
On hemlock, Sturgisson.
- Gloeophyllum hirsutum** (Schaeff.) Murr.
On scrub pine, Dellslow.
On spruce log (Alt. 4,000 ft.) Cranberry Mountain.
On ash, Ringgold.
- Gloeophyllum trabeum** (Pers.) Murr.
On sugar maple, Lick run.
On sugar maple, Morgantown.
- Grifola Berkeleyi** (Fr.) Murr.
On dead wood, Cranberry Mountain.
- Hapalopilus gilvus** (Schw.) Murr.
On beech, Morgantown.
On red maple, French Creek.
- Hapalopilus lichnoides** (Mont.) Murr.
On sugar maple, Albright.
- Hexagona alveolaris** (DC.) Murr.
On dead wood, Dorsey's Knob near Morgantown. (Coll. Hartley.)
- Inonotus perplexus** (Peck.) Murr.
On beech, Morgantown.
- Irpiciporus lacteus** (Fr.) Murr.
On oak, Lick run. (Coll. Hartley.)
On white walnut, Morgantown.
- Irpiciporus mollis**.
On sugar maple, Lick run.
- Phaeolus sistotremoides** (A. & S.) Murr.
On hemlock log, Cranberry Glades.
- Polyporus acularius**. (Batsch.) Fr.
On dead log, Star City. (Coll. Hartley.)

Polyporus fissus Berk.

On maple, Cranberry Glades.

Trametes robinophila Murr.

On locust (wounds), Morgantown.

Tyromyces chioneus (Fr.) Karst.

On maple, Sabraton.

On dead wood, French Creek. (Coll. F. E. Brooks.)

Pyropolyporus igniarius (L.) Murr.

On birch, Cranberry Glades.

On maple, Cranesville.

Pyropolyporus Robiniae Murr.

On living locust, Sturgisson.

On living locust, Elwell.

Pyropolyporus conchatus (Pers.) Murr.

On dead log, Morgantown.

Pycnopus cinnabrinus (Jacq.) Karst.

On dead wood, Cranberry Mountain.

On wild cherry, Reedsville.

On wild cherry, Morgantown.

On birch, Cranesville.

On oak, Morgantown.

Mildews.**Erysiphe polygoni.**

On yellow poplar, Morgantown.

Erysiphe aggregata.

On alder, Durbin.

Podosphaera oxyacanthae.

On wild cherry, Morgantown.

On hawthorn, Cranesville.

On hawthorn, Martinsburg.

Uncinula macrospora Peck.

On white elm, Ronceverte.

On white elm, Point Pleasant.

Uncinula geniculata.

On red mulberry, Morgantown.

Uncinula parvula Ck. & Peck.

On hackberry, Martinsburg.

Uncinula circinata Cooke & Peck.

On sugar maple, Morgantown.

Microsphaera Alni (DC.) Wint.

On birch, Cheat View.

On oak, Rohr.

BALSAM FIRS KILLED BY RECENT FOREST FIRES, TUCKER COUNTY.

Microsphaera grossulariae.

On common elder, Cranessville.

Miscellaneous.**Hydnum erinaceum.**

On locust.

Hymenochaete rubiginosa.

On locust, Morgantown.

On white oak, Terra Alta.

Hymenochaete tabacina.

On maple, Cranberry Glades.

Lentinus villosus.

On sugar maple, Lick run.

Lenzites betulina.

.....Lick run.

Schizophyllum alveum.

On maple, Cranberry Glades.

Stereum lobatum.

On beech, Albright.

On white oak, French Creek.

Stereum complicatum.

On beech, Albright.

On hemlock or spruce, Cranberry Glades.

Thelephora pedicellata.

On hawthorn, Durbin.

Anthostoma discincola (Schw.) Sacc.

On crab apple, Morgantown.

Caryospora putaminum (Schw.) DeN.

On hickorynut, Morgantown.

Daldinia concentrica (Bolt.) Ces. & DeN.

On birch, Cooper's Rock.

Diatrype virescens (Schw.) Cooke.

On oak, Morgantown.

Eutypella stellulata (Fr.) Ell.

On Ailanthus, Morgantown.

Glonium stellatum Muhl.

On black walnut, Albright.

On wood fence, Dellslow.

Gnomonia ulmea (Sacc.) Th.

On white elm, Ceredo.

- Gnomoniella fimbriata** (Pers.) Sacc.
On Carpinus, Durbin.
- Herpotrichia diffusa** (Schw.) E. & E.
On red mulberry, Marilla.
- Hypocrea Schweinitzii** (Fr.) Sacc.
On oak log, Lick run.
- Lophodermium Rhododendri** (Schw.) E.
On Rhododendron, Lick run.
- Melanconis tiliaceae** (Ell.) E. & E.
On basswood, Morgantown.
- Nectria episphaeria** (Tode.) Fr.
On beech, Morgantown.
- Nectria cinnabrina** (Tode.) Fr.
On sugar maple, Morgantown.
- Ophionectria scolecospora** Bref.
On white pine, near Morgantown.
- Physalospora ilicis** (Schw.) Sacc.
On holly, Morgantown.
- Plenonectria denigrata** Wint.
On honey locust, Morgantown.
- Plowrightia morbosa** (Schw.) Sacc.
On wild cherry, Cranberry Mountain.
- Rosellinia pulveracea**.
On hickory log, Uffington.
On sycamore, Marilla.
- Rhytisma acerinum** (Pers.) Fr.
On red maple, Rohr.
On sugar maple, Morgantown.
On red maple, Cheat Bridge.
- Rhytisma punctatum** (Pers.) Fr.
On mountain maple, Cheat Bridge.
- Rhytisma ilicis-canadensis** Schw.
On holly, Cranberry Glades.
- Valsaria exasperata** (Gerard) E. & E.
On white walnut, Morgantown.

Injuries to Trees by the Mistletoe.

The mistletoe (*Phoradendron flavescens*) is a semi-parasitic flowering shrub growing upon the limbs and trunks of elms, hackberries, sycamores, sweet gums, and other hardwood trees,

and distributed from the Pacific coast southward and eastward to New Jersey, southern Pennsylvania and southern Ohio. In West Virginia it is found, chiefly, on white elms along the lower Ohio and Great Kanawha rivers and other streams in the southern half of the state.

In some parts of its range—notably in Texas—the mistletoe is extremely troublesome; and wherever it grows the host from which the parasite draws the major portion of its living, suffers appreciably. The injuries are somewhat offset, however, by the high esteem in which this white-berried evergreen shrub is held for purposes of holiday decoration.

INSECTS THAT INJURE FORESTS AND FOREST PRODUCTS.

About twenty years ago the importance of the injury being done to forests by insects began to attract special attention in West Virginia. In 1891 and 1892 a destructive outbreak of the southern pine beetle, (*Dendroctonus frontalis* Zimm.) occurred throughout a considerable portion of the pine and spruce regions of the State. This outbreak was made the subject of an extended investigation by Dr. A. D. Hopkins, who was at that time entomologist to the West Virginia Agricultural Experiment Station. Later, many other species of insects destructive to forests were included in the investigation and the results of the studies were published as bulletins of the Experiment Station and in various scientific journals. Dr. Hopkins was one of the pioneer investigators of forest insect problems in this country and subsequently he became an authority on the subject whose writings have attracted world-wide attention.

From 1891 to 1902, or, for a period of about ten years, Dr. Hopkins, as entomologist to the Experiment Station, devoted a considerable part of his attention to original investigations of forest insects with special reference to the distribution, life histories, habits, natural enemies and methods of control of the more important species found in West Virginia. The numerous papers dealing with this subject which he published while he was employed in this State and other publications by him which followed after he removed from here to take charge of forest insect

investigations for the United States Department of Agriculture furnish valuable information in regard to practically all our species of forest insects that are of serious consequence. The writer in preparing this chapter has drawn freely from these publications as representing the best knowledge to be had on the subject.

Nature and Extent of Injury.

The damage done by forest insects, in the opinion of those who have investigated the subject most, is in excess of that done by forest fires. The destructive work of the two agents, however, is often reciprocal, the one agent assisting and furthering the destruction begun by the other. Thus it happens often that where insects have injured and killed forest trees fires will follow and burn the inflammable dead wood with great devastation. Likewise, timber injured or killed by fires invites many species of bark and wood boring insects which further the work of destruction. In both cases the injury from the burning is the more conspicuous and the fires are usually accredited with the major portion of the loss, when, in fact, the insects may be the more destructive agent of the two. The interrelations of forest insects and wood-destroying fungi are also frequently very marked. The burrows of insects in the wood afford suitable places for the fungi to begin their work of decay, and, transversely, trees injured primarily by fungi are attacked by insects and the progress of deterioration and decay hastened.

Insects injure forests by attacking the bark, wood and foliage of living trees causing their death or a more or less serious impairment of their health and of the quality of the lumber which they may produce. Standing diseased or dead trees and felled trees and logs are attacked by other species that bore through the wood and cause great loss. Manufactured lumber, both in the rough and finished, and tanbark are often injured. The seeds of various forest trees are attacked by other species and injured so that they will not germinate when planted thus interfering with both natural and artificial reforestation.

The following is a brief description of some of the more de-

structive insects that injure our different classes of forest trees and forest products.

Insects That Attack the Bark of Living Trees.

Among the most serious enemies of coniferous forests are the different species of beetles that in their adult and larval stages attack the inner bark of living trees excavating galleries for the reception of their eggs and for food. Beetles of this class belonging to the genus *Dendroctonus* have been notably destructive in West Virginia and in many sections of this and other countries, the genus being represented at present by 23 North American and one European species. The beetles of the different species are somewhat variable in size, ranging from 2 to 7 mm. in length. The color is brown, reddish-brown or black. The beetles have broad heads and the general form of the body is elongate, cylindrical and stout.

The beetles mine in the bark of their host trees for a distance of a foot or more and construct egg galleries. The larvae hatching from the eggs destroy the bark intervening between the burrows and galleries made by the adults thus girdling the trees and causing their speedy death.

As a result of conditions that favor their multiplication these beetles sometimes appear in swarms and attack living healthy trees over wide areas of country. Hopkins estimates that if the timber destroyed in the United States by this one group of insects during the past fifty years were living today its stumpage value would exceed \$1,000,000,000.

In 1891 and 1892 the southern pine beetle, (*Dendroctonus frontalis* (Zimm)) appeared in the spruce and pine regions of West Virginia and Virginia, and, to a less extent, in North Carolina, the District of Columbia, Maryland and Pennsylvania and killed a very large percentage of young and old trees on an area of over 75,000 square miles. The loss in West Virginia from this outbreak was great as nearly all the pine and spruce trees in thousands of acres of fine forest were killed while shade and ornamental pine trees within the infested areas suffered the same as those in the forests. In the Potomac basin

from 75 to 80 per cent of all the mature pines were killed. Previous to this killing of the trees very few destructive forest fires had occurred in this region but in 1895 fires raged in the dead timber and caused great loss. Since that time, as a more or less direct result of the insect outbreak, fires have been frequent and destructive.

The insects continued to multiply and spread for two seasons and just at the time when it seemed that all our spruce and pine forests were doomed natural conditions destroyed the beetles causing them to disappear as suddenly as they had come. Since 1893 no injury is known to have been done by this species within the state. In Virginia and other states further to the south it has continued to be more or less active and there is a remote possibility of future recurrences of devastating swarms in the forests of West Virginia.

The death of large areas of pine which history records as occurring in some of the southern states has no doubt resulted from the attacks of the southern pine beetle.

Several other bark beetles of this genus have been found by Hopkins in West Virginia but none of them is so destructive as the species just described. The Eastern Larch Beetle (*D. simplex* Lec.) has been found on the larch growing in the north-eastern part of the state and one specimen of the Alleghany Spruce Beetle (*D. punctatus* Lec.) was found by Hopkins in Randolph county. The Black Turpentine Beetle (*D. turbrans* Oliv.) was found on yellow and white pine at Kana-wha Station, W. Va. The Red Turpentine Beetle (*D. valens* Lec.) bred in great numbers in the trees injured by the southern pine beetle in 1891 and 1892 and did some damage to living pine and spruce trees in 1893 but was not notably injurious thereafter.

The Destructive Spruce Bark Beetle (*Polygraphus rufipennis* Kirby) is a small, black, elongate beetle that has caused considerable damage to spruce in this state. It occasionally attacks the bark of other trees but most of its injury is done to spruce, especially to trees that have been injured or have had their vitality impaired by other causes. In August, 1909, Hopkins observed this insect to be killing spruce timber on

Shavers mountain, in Randolph county. The Hickory Bark-borer (*Scolytus qudrispinosus* Say) is a destructive enemy of hickory in the region from Wisconsin to Vermont and south to Georgia. Its injuries, like the others, consist of mines and galleries made in the inner bark.

Insects That Injure the Wood of Living and Dead Trees.

One of the commonest forms of insect injury to wood consists of pinholes or wormholes that are revealed as the logs are sawed into lumber. Often a tree will have every appearance externally of being sound but when it is manufactured defects of this kind will be so abundant that a very large portion of the lumber can be graded only as culls. Hard and soft wood of all kinds are subject to these injuries and it is not infrequent for lumber to be reduced in value fully 50 per cent by their occurrence.

Several species of insects are responsible for these defects. The Oak Timber Worm (*Eupsalis minuta* Dru.) gains access to the heartwood of living trees through bruises in the bark, ax wounds or the bases of broken and dead limbs. From the place of entrance the burrows extend in every direction through the wood. Old oak trees are almost sure to contain more or less of the burrows of this insect and the loss is often enormous. The Chestnut Timber Worm (*Lymexylon sericeum* Harr.) attacks chestnut in a manner similar to the way in which the species last mentioned attacks oak. Defects in chestnut lumber caused by this species are perhaps even more abundant than are those in oak caused by the oak timber worm. Scarcely a chestnut tree of merchantable size can be found that has not been injured to some extent. Hopkins estimates that the reduction in value of the average chestnut lumber product due to this species is not far from 30 per cent.

Very large wormholes are frequently found in white oak and red oak and occasionally in other kinds of oak. These may occur at any place along the trunk of the tree but are perhaps most abundant about the bases of the limbs. Most of these large burrows are made by the larvae of large moths which are

known as carpenter moths. Injuries of this kind are common in the oaks of West Virginia.

Another class of defects which are somewhat distinct in appearance are the "grease spots" or "black holes" found in white oak, chestnut oak, beech, yellow poplar and other species of trees. These are caused by one of the so-called ambrosia beetles (*Corthylus columbianus* Hopk.) These defects are very abundant and are the cause of much loss especially in hardwoods.

The Locust Borer (*Cyrtene robiniae* Forst.) is a destructive enemy of yellow locust in West Virginia. Some sections of the state are comparatively exempt from the ravages of this species while in other sections injuries done are so great that it is almost useless to attempt to grow locust trees. Hopkins states that the locust timber on the Potomac waters is comparatively free from these insects but that they are plentiful on the Greenbrier river. They are abundant also in the central and western parts of the state and about Morgantown.

The adult locust borer is a very handsome yellow and black beetle that deposits its eggs on the bark of the host tree in the fall. At this season the beetles may be found also frequenting the blossoms of goldenrod. The larvae feed first in the bark and later extend their burrows into the solid wood. Their presence is always indicated by the sawdust-like borings which the larvae eject from their burrows.

Dying and dead pine wood is also attacked by ambrosia beetles and the sapwood seriously injured by the pinholes which the insects make. A fungous growth develops in these pinholes which stains the wood and hastens decay. Hardwood trees when about to die and when dead are attacked by a great variety of insects the most destructive of which are the round-headed borers, timber worms and ambrosia beetles. The promptness with which many of these insects enter the trees after they are killed and the rapidity with which they extend their burrows in every direction through the wood makes it important that trees killed by any agency should be manufactured as soon as possible after their death in order to sustain the minimum of loss.

Photo by A. D. Hopkins.
WHITE PINE KILLED IN 1892 BY SOUTHERN BARK BEETLE.

Miscellaneous Injuries to Forest Products.

Roundheaded borers, timber worms and ambrosia beetles cause serious damage to small round timbers of many kinds, especially when cut in the winter or spring and allowed to lie with the bark on. The same classes of insects attack pulpwood and cordwood of all kinds causing a loss, according to Hopkins, of from 10 to 100 per cent. Ambrosia beetles often do serious damage to oak and other hardwood planks when sawed and stacked in close piles. Handles and stock for wagons and farm implements are frequently injured by powder-post beetles often to the extent of being entirely ruined. These insects are especially troublesome in store houses where handles and other small timbers are kept.

Insects That Feed on the Foliage of Trees.

Up to the present time the forests of West Virginia have not been visited by such leaf-eating insects as the Gypsy moth and brown-tail moth which have wrought such havoc in some of the New England states. Several species of caterpillars that feed gregariously on the foliage of oak have from time to time been slightly injurious. Fall web-worms and canker worms have done some damage in certain parts of the state and the insects known as walking-sticks have been abundant for a few years and have done slight damage to the leaves of deciduous trees in Mineral county.

The Catalpa Sphynx Moth has for several years been destructive to catalpa foliage in Kanawha, Mason and Ritchie counties and probably in other southern and western sections of the state. The Catalpa Midge (*Cecidomyia catalpae*. Comst.) has injured the buds and foliage of catalpa in Upshur county.

The chrysomelid beetle, (*Monocesta coryli*) has for several years been very destructive to the foliage of elm trees in Greenbrier, Monroe and Berkeley counties. The Rose Chafer (*Macrodactylus subspinosus*) has frequently been complained of as injuring the foliage of black walnut, chestnut, ash and other forest trees. The injuries from this species have usually been confined to strips of country lying along the water courses

where there is a sandy soil in which the insects pass the larva stage. The Locust Leaf Beetle, (*Odontata dorsalis*) is a common enemy of yellow locust in the lower sections of the state. This insect in both its adult and larval stages feeds on the leaves of locust giving to them a dead appearance about mid-summer.

Insects That Injure Nuts.

The larvae of several species of beetles and moths feed on nuts frequently injuring them to such an extent that they are unfit for food and worthless for planting. Two species of snout beetles of the genus *Conotrachelus* attack the young nuts of hickory and walnut. The beetles pierce the husks of the nuts with their snouts and deposit eggs in the openings. The larvae that issue from the eggs feed on the young nuts causing them to drop by the time they are half grown. Several species of weevils of the genus *Balaninus* attack chestnuts, hickorynuts, hazelnuts and acorns as they approach maturity. These beetles use their long, slender snouts to make holes through the covering of the nuts in which to place their eggs. The larvae from the eggs feed on the nuts often devouring the entire meat and making them worthless for any use. In West Virginia, two species of these weevils attack chestnuts, one hickorynuts, one hazelnuts and at least six attack the different species of acorn. The common, fleshy, white grubs, or worms, found in nuts are the larvae of these weevils. Chestnuts are sometimes affected to the extent of from 50 to 75 per cent of the whole crop and acorns are even more seriously injured. Hazelnuts and hickorynuts suffer to a less extent.

How Losses Can Be Prevented.

In the way of suggestions for preventing loss from forest insects no better directions can be given than those laid down by Dr. Hopkins in Bulletin 58, Part V, Bureau of Entomology, U. S. Dept. Agr. We quote from page 93 of this publication.

“The results of extensive investigations and of practical

applications during recent years have demonstrated that some of the most destructive insect enemies of American forests and manufactured and utilized products can be controlled and serious damage prevented with little or no ultimate cost over that involved in good forest management and business methods.

"It is evident that if the information now available through publications of the Department of Agriculture and through direct correspondence with its experts is properly utilized in the future it will result in the prevention of the equivalent of at least 30 per cent of the estimated annual waste of forest resources that has been caused by insects within recent years and thus contribute greatly to the conservation of the forest resources. This can be accomplished as follows:

"(1) By the adoption or adjustment of certain requisite details in forest management, in lumbering and manufacturing operations, and in storing, transporting, and utilizing the products which, at the least expense, will bring about the necessary reduction of the injurious insects and unfavorable conditions for their future multiplication or destructive work.

"(2) By the adoption of policies of control, based upon expert technical knowledge or advice relating to the species, habits, life history, and natural enemies of the insects involved, and methods for their control, supplemented by expert knowledge or advice on the principles of technical and applied forestry in the proper management, care, and utilization of the forest and its resources and still further supplemented by practical knowledge and experience relating to local conditions and facilities favorable and unfavorable for successful application according to a given method or policy of control.

"(3) By reliance on technical advice furnished by recognized experts in forest entomology and forestry as a basis for success in practical application by the owner or forester.

"(4) By utilization of so-called matured timber, and especially dense or pure stands of such timber, thus removing one of the favorable conditions for rapid deterioration through attacks by wood-boring insects or death through the attacks of destructive bark-boring or defoliating insects.

“(5) By the utilization of a knowledge of the principles of natural control as a means of contributing to the efficiency of artificial control.

“(6) By prompt recognition of the first evidence of the work or destructive outbreaks of the principle insect depredators, by authentic identification of the species involved, and by prompt action in adopting the proper method or methods of control for the prevention of losses.

“It should be remembered that as a rule it is useless to attempt the extermination of an insect enemy of the forest or its products. It is only necessary to reduce and weaken its forces at least 75 per cent, so that it can not continue an aggressive invasion, but must occupy a defensive position against its own enemies and become dependent upon favorable conditions resulting from avoidable negligence and mismanagement by owners of the forests and the manufacturers of forest products.

“While beneficial insects, beneficial birds, and beneficial diseases exert a continuous and powerful influence toward the prevention of a more extensive waste of forest resources, it has been repeatedly demonstrated that they can not be depended upon always to prevent widespread devastation or otherwise to work for the best interests of the private or public owner by protecting the best trees and the best tree species.

“The best way to utilize the factors of natural control is to become their allies and assist in the reduction of the enemy, rather than to try to make them our allies through artificial introduction or dissemination.

“A large percentage of the waste caused by insects can be prevented by the utilization of infested material, and at the same time, without additional expense, this will contribute greatly to the control of insects which cause such waste and also prevent injuries and depredations in the future.

“Under past conditions the poor management or neglect of the average forest has contributed to the increase of depredations by forest insects.

“Under present conditions of better management of local

forests and of the more progressive manufacturing enterprises much is being accomplished toward the reduction of losses. In the average forest, and in the average business enterprise dealing with forest products, present conditions are little better than in the past. This is largely due to a lack of appreciation of the importance of the subject and failure to realize the opportunity and practicability of preventing a large percentage of the loss."

CHAPTER V.

PRESENT FOREST CONDITIONS.

Virgin Forest.

- 1835.—“West of the Alleghanies a large portion of the country must forever remain in its primitive forest.”—*Gazetteer of Virginia and the District of Columbia*, by Joseph Martin.
- 1870.—“At least 10,000,000 acres are still in all the vigor and freshness of original growth.”—*The West Virginia Hand Book and Immigrants' Guide*, by J. H. Diss Debar.
- 1876.—“Between 9,000,000 and 10,000,000 acres are in the original forest.”—*Resources of West Virginia*, by M. F. Maury and Wm. M. Fontaine.
- 1893.—“Nearly or quite one-half of the State is still uncleared, and by far the greater portion of the uncleared land is still in virgin forest.”—*The Mountain State*, by Geo. W. Summers.
- 1900.—“The wooded area of West Virginia is estimated at 18,400 square miles, or 73 per cent of the area of the State and most of this is occupied by timber of a merchantable size and quantity.”—*U. S. Census Report*, by Henry Gannett.

The virgin forest area in 1910 is slightly over 1½ million

acres. The table given below, the county discussions, and the map which accompanies this report show in what parts of the State the forest areas are distributed. The acreage of wooded and cleared areas is given approximately. No surveys were made for the purpose of obtaining the acreage or location of forest lands. Careful observations and numerous inquiries were made throughout the State, however, and the areas of virgin and cut-over forests, particularly, are not far wrong. The percentages of cleared land—from which the acreage of woodlots and cleared land is calculated—were obtained by consulting with a number of well-informed citizens in every county. It is probable that the figures obtained in this manner are inaccurate in some instances, but they are sufficient to show, in a general way at least, the regions which are occupied by farms and those which have remained in forest.

Table Showing Distribution of Forests in West Virginia.

County	Area (Acres)	Virgin Forest (Acres)	Cut-Over Forest (Acres)	Farmers' Woodlots (Acres)	Per Cent Cleared Land	Cleared Land (Acres)
Barbour	251,520	1,000	15,000	134,912	40	100,608
Berkeley	164,480	.....	8,000	16,672	85	139,808
Boone	327,680	10,500	200,000	68,028	15	49,152
Braxton	346,240	9,670	24,100	139,350	50	173,120
Brooke	62,080	.....	.....	9,312	85	52,768
Cabell	167,040	.....	.....	66,816	60	100,224
Calhoun	179,328	5,980	1,500	82,184	50	89,664
Clay	222,720	17,500	75,000	96,812	15	33,408
Doddridge	220,160	.....	.....	88,064	60	132,096
Fayette	496,000	53,000	190,000	178,600	15	74,400
Gilmer	234,880	13,200	1,700	102,540	50	117,440
Grant	309,120	57,000	63,400	110,440	25	73,280
Greenbrier	672,640	140,100	105,900	157,584	40	269,056
Hampshire	423,680	12,000	15,000	248,392	35	148,288
Hancock	55,040	.....	.....	8,256	85	46,784
Hardy	380,160	64,500	.....	201,612	30	114,048
Harrison	266,355	.....	.....	53,271	80	213,084
Jackson	300,985	.....	.....	75,246	75	225,739
Jefferson	136,320	.....	.....	27,264	80	109,056
Kanawha	558,080	8,800	81,000	300,856	30	167,424
Lewis	264,960	.....	.....	105,984	60	158,976
Lincoln	282,240	7,000	52,000	82,120	50	141,120
Logan	316,160	35,000	160,000	89,544	10	31,616
McDowell	430,720	15,000	400,000	2,798	3	13,922
Marion	201,882	.....	.....	30,282	85	171,599
Marshall	201,766	.....	.....	60,530	70	141,236
Mason	287,533	.....	.....	57,507	80	230,026
Mercer	279,680	18,700	5,000	158,092	35	97,888
Mineral	212,480	.....	7,000	120,488	40	84,992
Mingo	271,360	8,200	200,000	36,024	10	27,136
Monongalia	234,573	7,600	11,400	74,829	60	140,744
Monroe	296,960	29,900	14,600	163,372	30	89,088
Morgan	150,400	.....	25,000	50,200	50	75,200
Nicholas	442,240	130,500	112,600	44,356	35	154,784
Ohio	71,040	.....	.....	7,104	90	63,936
Pendleton	452,480	137,900	2,000	222,084	20	90,496
Pleasants	90,880	.....	.....	27,264	70	63,616
Pocahontas	549,120	212,950	138,780	87,566	20	109,824
Preston	429,440	30,000	58,000	169,664	40	171,776
Putnam	227,392	.....	4,500	109,196	50	113,696
Raleigh	358,400	117,600	112,500	74,540	15	53,760
Randolph	695,040	195,570	198,350	196,864	15	104,256
Ritchie	292,480	75	14,310	131,855	50	146,240
Roane	311,168	.....	4,800	88,552	70	217,818
Summers	235,520	3,800	7,800	141,488	35	82,432
Taylor	84,480	.....	.....	33,792	60	50,688
Tucker	281,600	56,800	130,400	52,160	15	42,240
Tyler	166,477	1,200	.....	48,743	70	116,534
Upshur	208,640	1,500	17,100	85,720	50	104,320
Wayne	348,800	3,600	80,000	55,920	60	209,280
Webster	377,600	122,000	133,000	65,960	15	56,640
Wetzel	230,701	2,000	12,800	77,480	60	138,420
Wirt	147,776	.....	6,000	38,333	70	103,443
Wood	228,480	.....	1,000	90,392	60	137,088
Wyoming	336,640	44,150	192,490	40,000	18	60,000
Totals	15,771,616	1,574,295	2,882,030	5,087,013		6,228,277

DESTRUCTION OF VEGETATION AND SOIL BY FIRES FOLLOWING LUMBER OPERATIONS, NEAR DAVIS, TUCKER COUNTY.

Estimates furnished by the owners of timberland show that there are approximately 190,000 acres of virgin forest containing from 20 to 90 per cent of spruce in Randolph, Pocahontas, Webster, Pendleton, Greenbrier, and Tucker counties, with a few outlying patches in Grant and Preston counties. The quantity of standing timber in the virgin spruce belt is estimated at $1\frac{1}{2}$ billion feet of spruce, 1 billion feet of hemlock, and $\frac{1}{2}$ billion feet of hardwoods, the principal of which are beech, birch and maple. Small areas of virgin white pine are still to be found in Mercer, Raleigh, Greenbrier, and Pendleton counties.

The forests of virgin hardwood contain not far from 12 billion feet of timber. The chief hardwoods, named approximately in the order of their abundance are as follows:

White Oak 30 per cent.

Other oaks—Chestnut Oak, Red Oak,

Black Oak, Scarlet Oak, etc..... 15 per cent.

Yellow Poplar 18 per cent.

Chestnut 12 per cent.

Maple—Sugar Maple, Red Maple... 5 per cent.

Beech 5 per cent.

Basswood 5 per cent.

Hickories

Ashes

Black Cherry

Cucumber

Buckeye

Locust

Walnut

Sycamore

White Elm

Others

..... 10 per cent.

Cut-over Forest.

The cut-over forests vary greatly, both as to kinds and quantity of timber, in the different sections of the State. As a rule, there is a fairly good reproduction of valuable species of trees in the hardwood regions. In some sections that were worked from 25 to 40 years ago, or longer, there is an excellent

stand of timber trees of a sufficient size for saw logs. Many of the tracts more recently cut over, however, have been worked down to a low limit and the remaining timber would estimate almost nothing. The cut-over forests of spruce and other softwoods have only a slight reproduction in most cases. There is a tendency in many softwood sections toward a natural replacement of the original species by locust and other hardwoods.

Farmers' Woodlots.

Almost every farmer in West Virginia has retained an area of wooded land on his farm from which he can draw for domestic purposes. The area of woodlots in some counties is very small, not exceeding 10 or 15 per cent. In others it is much above this—in some cases as much as 80 or 90 per cent. In a number of the hilly counties in the western half of the State, especially, the average woodlots are found to contain a scrubby growth of white oak, and other hardwoods, with but little timber that is valuable for lumber or even for railway ties or for poles. Other counties have a large percentage of woodlots with from 1,000 to 5,000 feet of merchantable timber per acre. Throughout the State there is a tendency toward neglect of woodlots, and thousands of acres of land in rough ravines and on hillsides that are now overgrown with worthless brush and briars could easily be made to yield profitable crops of locust and other valuable species of trees.

Burnt Areas.

There are fully 70,000 acres that are almost or quite destitute of trees lying along the west side of the Alleghanies and the nearby parallel ranges. About 20,000 acres of this is in Pendleton county and the remainder in Randolph, Tucker and Grant counties. In some places, as on the Roaring Plains in Randolph, on the summit of Spruce mountain in Pendleton, and in smaller areas on the summits of stony ridges in Tucker and Grant, the bare rocks are exposed and the existence of any vegetation other than lichens, mosses, and the like, is impossible. In most places, however, there is still enough soil remaining to sup-

ply suitable ground for a dense growth of ferns and wild grasses. Throughout the whole burnt region, particularly on the waters of Stony river in Grant, on the Blackwater Fork of Cheat, in Tucker, on Glady Fork of Cheat and on Gandy creek in Randolph, and on the headwaters of Greenbrier in Pocahontas, there are burns which have not yet suffered so seriously as the one first mentioned. These are on the road to complete destruction, however, and a few more fires will put them out of reach of easy help.

There seem to be four very well marked stages which appear in succession when fires run frequently through the forests of the West Virginia spruce belt and adjacent highlands. These may be designated as the "fire cherry" stage, the blackberry stage, the fern stage, and the bare ground stage. An examination of any region of comparatively recent lumber operations, immediately on the west of the Alleghany mountains, will show the four stages more or less perfectly. The reduction by fire in this region takes place, with numerous variations, as follows: It has been and is still the practice of the manufactures of spruce timber in this State to cut to a very low limit, leaving nothing but small saplings standing among the tangled heaps of treetops and brush from "haul roads." About the first or second year after lumbermen have abandoned their cut over lands fires are almost certain to burn through them, with the result that practically all the small and inferior trees left standing are killed. The first fires are usually followed by a dense growth of wild red cherries or "fire cherries," as they are commonly called. When these are killed blackberries frequently spring up and occupy the ground almost entirely until they are in turn killed in the same way. Thousands of acres of this stage can be seen along Glady Fork and Dry Fork of Cheat and on the head of the West Fork of Greenbrier. In the next stage a tall, branching species of fern—the bracken—often takes exclusive possession and, if the soil is not completely destroyed by fires, remains indefinitely. A good example of this stage can be seen along the headwaters of Big and Seneca creeks in Pendleton county and in the plateau region of Tucker county. The bare ground stage is found only in the areas where the vegetable soil has been entirely destroyed exposing the loose, broken

fragments of sandstone. In limestone areas bluegrass occupies the ground wherever it is made bare by fire or otherwise.

Planting.

In spite of the poor encouragement given by our laws to those who plant trees a few substantial plantations have been begun.

The Western Maryland Railroad Company planted 8 acres in hardy catalpas along their railroad east of Elkins in 1906; Geo. C. Craig & Son have planted a small area on the East Fork of the Greenbrier river with spruce, white pine, tamarack and locust; the West Virginia Pulp and Paper Company planted 25,000 spruce trees on Shavers Fork of Cheat in 1909, and 170,000 spruces and 2,000 yellow poplars in 1910. The E. I. du Pont de Nemours Powder Company has made partial arrangements for rather extensive plantations in Mercer, Harrison and Cabell counties, for the purpose, in part, of protecting their mills.

CHAPTER VI.

CONDITIONS BY COUNTIES.

Had all parts of West Virginia been as easily reached and settled as the valleys of the Shenandoah and Potomac rivers, on the east of the Alleghanies, or as the valleys and low hill areas along the Ohio, the Great Kanawha and other rivers on the west and south, the conditions in all sections would be more uniform, and a larger area than the county could be taken as a unit for study. Such, however, has not been the case. Large areas in the interior of the state, remote from navigable streams and from the main lines of travel, have been occupied and developed slowly; and many of the rough and unproductive mountainous sections have acted as complete barriers to settlement. Almost every conceivable condition and stage of development, therefore, will be observed in crossing the State from east to west. Some sections have been settled for more than 150 years, and a large percentage of the forest removed; others have been partially settled and improved in more recent years; and still others have remained to the present time in their wild, original state. A discussion of local conditions is intended to assist the owners of large and small tracts of woodland in making intelligent application of the recommendations contained in this report.

In the following discussions of past and present conditions in the 55 counties of the State the writer has depended for information on a hasty and, in some cases, slight examination of the forests, the streams, and the lumber operations in each county; on the facts gathered from hundreds of lumbermen, surveyors, county officials and other citizens in every part of the State; and on the facts regarding the subjects treated in the publications of state and county historians and others who are the authors of hand-books, reports and other literature.

The areas of Brooke, Calhoun, Hancock, Harrison, Jackson,

Marion, Marshall, Mason, Monongalia, Ohio, Putnam, Roane, Tyler, Wetzel and Wirt counties have been determined with accuracy. The others are only approximate.

BARBOUR COUNTY.

Location and Area.

Barbour county, formed from parts of Lewis, Harrison and Randolph, lies some distance northeast of the center of the state. Its area is 393 square miles or 251,520 acres.

Topography.

The surface of the county is hilly except where Laurel ridge, the last western ridge of the Alleghanies, forms an elevated and continuous mountain border on the east. As a whole, the area is less rugged than parts of Upshur, Randolph and Tucker counties on the south and east. The hillsides facing the streams in many sections are steep and rough, but back from these the hills are well rounded and smooth and admit of easy cultivation. The bottom lands along Tygarts Valley river are very narrow as compared with those farther up the stream in Randolph and with those of Cheat river in Tucker. There are areas of considerable extent, however, that are level, or almost level, lying on the ridges and uplands of Glade and Cove districts and in some sections farther west. The elevations of Barbour range from about 1,000 feet above tide at the point where Tygarts Valley river leaves the county, up to 3,075 feet where the eastern line crosses a high point on Laurel Hill about 3 miles directly east of the town of Belington.

Original Forest Conditions.

Almost the whole area was once covered with a dense growth of hardwoods. The region on the west, drained by Gnatty creek, Elk creek, and Brushy Fork, should be especially mentioned in this connection, for it is doubtful if any portion

of the State produced a heavier and a more excellent stand of timber. Here in the valleys of the streams and in the numerous rich coves the yellow poplar, sugar maple, oaks, hickories, black walnut, white ash, basswood, chestnut, cucumber, and many others, grew abundantly. All of Pleasant district, on the northwest, and the drainage basins of First and Second Big runs and Peeks run in Union district on the southwest were also noted for their hardwood forests. Eastward from the Tygarts Valley and Buckhannon rivers there are large areas which are less fertile than in the localities mentioned above, and in these the original forests contained fewer species and lighter stands of timber trees. The prevailing timber trees in the eastern part along Laurel ridge were chestnut, locust and chestnut oak on the ridges and flats, with poplars, ashes, cucumbers and others in the rich coves and with hemlock, birches and beech along the streams.

The Lumber Industry.

Some sections of the county have been settled for 140 years; and in these nearly all the timber of the original forests was destroyed in clearing the land for cultivation. Before the year 1860 most of the residences and out-buildings were made of logs. The small amount of lumber used in an early day was manufactured by hand-operated whip saws and by "up-and-down" water saw mills. There was an abundance of straight-grained yellow poplar, chestnut, red oak and black walnut timber for fence rails, shingles, boards and puncheons, without using the curly walnuts, knotty oaks and twisted chestnuts, which were all classed together and burned as worthless timber.

A few of the primitive mills which operated approximately between the years 1845 and 1875 were Shuttlesworth's mill near Peeltree, Hall's mill, Teter's mill and McCoy's mill, on Buckhannon river, Kittle's mill at Georgetown, Stout's mill on Tygarts Valley river and the Nicola mill at Moatsville. Some of these were at first run by water and later by steam. One of the first stationary steam saw and grist mills in the county was built about the year 1856 at Peeltree by John Maxwell. This mill sawed lumber for local use during a period of 30 or 40 years.

About the year 1883 a narrow gauge railroad was built from Grafton to Philippi and a few years later was widened to regular gauge and extended up the Tygarts Valley river to Belington. Immediately after the completion of this railroad portable saw mills were stationed, first along the line and later farther back, toward the heads of the streams. Since then there has been a continual operation of portable mills in all sections where merchantable timber could be found. The principal shipping points for lumber have been Moatsville, Belington, Philippi and Clements. There have been no band saw mills in the county. Considerable timber from along the river, however, was drifted out and manufactured about 25 years ago on Curtin's band mill at Grafton and later by G. C. Blatchley at the same place.

The Present Forest Conditions.

The only forest land of any consequence now remaining in the county lies in a belt from 1 to 3 miles wide extending along the western face of Laurel ridge on the east and adjoining Randolph and Tucker counties. There are a few small virgin areas in that section which contain in the aggregate about 1,000 acres, and approximately 12,000 acres of cut-over forest. There are about 3,000 acres of cut-over forest, also, lying in broken tracts along the Tygarts Valley and Middle Fork rivers from a short distance above Philippi to Clements.

The small areas of woodland throughout the county are principally connected with cleared farm land and contain only a small stand of merchantable timber.

BERKELEY COUNTY.

Location and Area.

Berkeley, the second oldest county in West Virginia, was formed in the year 1772 from a part of Frederick county. It lies in the Eastern Panhandle, between Jefferson county on the east, Morgan county on the west, Maryland on the north, and Virginia on the south. Its area is 257 square miles or 164,480 acres.

Photo by W. E. Rumsey

AN OPEN WOODLOT IN BERKELEY COUNTY.

Topography.

The eastern half of the county is a rich limestone area with an average elevation of about 500 feet. Here we find the last traces of the eastern foothills of the Alleghanies in West Virginia, forming low, smooth ridges many of which have been broken into rounded and elliptical elevations by the action of eastward-flowing streams. The western half of the county is rougher, having 2 well-defined mountain ridges and the eastern face of a third one. Little North Mountain extends through the county in a northeast and southwest direction, entering from Frederick county, Virginia, and terminating near the Potomac river. Its elevation is from 1,000 feet to 1,500 feet. An early historian speaks of this mountain as "remarkable on account of its rising immediately like a wall", and describes the summit as "beautifully undulated in all its parts". About 6 miles to the east of North mountain is Third hill, and 2 miles farther on is Sleepy Creek mountain the latter forming the natural boundary line between Berkeley and Morgan for some 15 miles. In a few places on this mountain the line crosses elevations of a little more than 1,800 feet.

The county is divided from Maryland by the Potomac river. Its longest tributaries in this area are Opequon creek on the east and Back creek flowing just west of Little North mountain. Meadow branch flows between Third hill and Sleepy Creek mountain passing around the northern end of the latter and flowing into Sleepy creek in Morgan county. Mill creek, Middle creek and Tuscarora creek are important branches of the Opequon, and Tilhance creek is the largest tributary of Back creek.

Original Forest Conditions.

There is little authority for making a definite statement in regard to the original forests of the county, for original conditions in most places have long ago passed away. This is particularly the case in the rich agricultural districts where the best of the timber must have grown. On some of the mountain ridges in the west, it is true, there are boundaries of woodland that

have not been so greatly disturbed; but the timber on these often consists of such species as chestnut oak, bear oak, pitch pine and scrub pine, and does not fairly represent the original forests in other sections. It can be gathered from the character of the small and somewhat isolated woodlots of the eastern sections, and from the records left by various writers on the resources of West Virginia, that there was once an enormous growth of oaks, poplars, hickories and other hardwoods in the fertile valley lands. Yellow pine is said to have been common on Back mountain and vicinity. Pitch pine and scrub pine, as well as chestnut oak and some other varieties, grew abundantly on thin, dry land.

The Lumber Industry.

Hon. C. J. Faulkner, writing of the industries in Berkeley county in 1810, gives the following information: "There are in this county upwards of 50 grist mills or merchants mills, as many saw mills, several fulling mills, an oil mill and a paper mill".

It is probable that within 25 years from the above date the number of saw mills in operation was much smaller. From Joseph Martin's list of the wood-working industries of 1835 we learn that there were "7 wagon makers, 1 chair maker and 3 tanners" at that time, but no mention is made of even a single saw mill.

After the days when the old, upright saw mills had ceased to flourish in the county, small portable mills were brought in and have been moved from place to place for 50 years, sawing out "sets" wherever a few score logs could be brought together. Four or 5 mills still run irregularly.

Much of the good white oak was cut for ship timber. The chestnut oak has been peeled for tan-bark and the trunks used for railroad ties.

A water-power mill at Tuscarora was built in 1809; and a water-power box factory has been operated on the Opequon for about 100 years.

The Auburn Wagon Company, of Martinsburg, uses about 2 million feet annually of oak, ash, hickory, pine, gum and poplar in the manufacture of vehicles of various kinds.

Present Forest Conditions.

Mr. Alexander Clohan, of Martinsburg, gives the following information regarding the present conditions in Berkeley county:

"The best tract of timber east of North mountain contains about 27 acres and lies a short distance west of Tabler station on the Cumberland Valley railroad. The woodlots belonging to the farmers throughout this section are fairly good but about half of the land owners have none at all.

"Following down the Opequon we find the pine hill lands lying between Berkeley and Jefferson. Most of the pine here is "Bull" pine and scrub pine and is not valuable commercially except for boxes etc."

"There is more timber and a much greater percentage of woodland from the middle of the county westward. The west side of North mountain is covered with fairly good timber, consisting of hickory, pine, chestnut, chestnut oak, black oak and others. Lower down there are water maples, sycamores and others that usually grow with them. There is probably an area of about 1,000 acres in that section that has not been closely cut over. This is held in rather small tracts by different owners. There are about 10,000 acres of forest land on Back mountain and on Sleepy Creek mountain. The timber on this area is of little value except for staves and cross-ties.

"Gerardstown and Hedgesville districts are the roughest and most mountainous in the county. The other 5 districts are well improved, Arden and Opequon having perhaps 90 per cent of cleared land.

"Pine comes up almost spontaneously on abandoned land on the west side of North mountain, and on the east side locusts seem to predominate."

BOONE COUNTY.

Location and Area.

Boone county, formed from parts of Kanawha, Cabell and Logan, in 1847, lies in the southwestern part of the State. Its area is 512 square miles or 327,680 acres.

Topography.

The surface of the county, which is broken into irregular hills and long, elevated ridges, slopes from an elevation of about 600 feet at the point where Big Coal river leaves in the northern end, up to 3,500 feet along the southern border.

The principal streams are the Big and Little Coal rivers, both flowing through the county in a northwesterly direction and uniting a short distance beyond the county line. The right-hand tributaries of Big Coal are Bull creek, Lick creek, Short creek, Tony creek, Joe creek and White Oak creek; its left-hand tributaries are Fork creek, Brush creek, Drawdy creek and Laurel creek. Little Coal river is formed near Madison, the county seat, by the union of Pond and Spruce forks which drain the whole southern and southwestern part of the county. The principal tributaries of the Little Coal below Madison are Turtle creek, Lick creek, Rock creek, Camp creek, Hewitt creek and Horse creek. The headwaters of Mud river drain a small area in the western part of the county.

The larger streams flow slowly in most places, and between high hills that slope abruptly to the narrow valleys.

Original Forest Conditions.

The forests of Boone contained little timber except the hardwoods. There was a fringe of hemlocks along many of the streams, and toward the heads of Big and Little Coal rivers this species grew in considerable abundance. Pitch pines grew on ridges and southern faces in some parts.

The following statement in regard to the timber in the virgin forests of the county was written 17 years ago when "fully one half of the poplar timber" remained untouched and when "three fourths of all other kinds" were standing in their virgin state.

"The principal timber trees are poplar, walnut, oaks, ash, hickory, maple, beech, birch, lynn, pine, hemlock, cherry, chestnut and locust. Poplar and walnut timber is especially fine in Boone and trees of enormous size are often reported.

"A poplar tree was cut in 1889 on the waters of Big coal

river in Boone county, the dimensions of which are given by Maj. Thos. L. Broun, of Charleston, as follows: The tree measured eight feet and nine inches in diameter at the base, and the distance from the ground to the first limb was seventy-one feet. From the tree were cut six logs, each twelve feet in length, the diameters of which at the small ends were respectively seven feet, four inches; seven feet; six feet eight inches; six feet one inch; five feet nine inches, and five feet six inches.

“Wm. C. Reynolds, civil engineer, says: I found on West Fork near the head and over one thousand feet above the foot of the mountain, a walnut tree eight feet in diameter and tall enough to furnish half a dozen average length logs.”*

The Lumber Industry.

According to Mr. William Thompson, of Madison, “Up to the year 1830 no timber of any note had been taken out of the county. About this time, however, the people who lived along Little and Big Coal rivers began to cut the finest of the poplar for flat-boats which they constructed themselves and floated to St. Albans during freshets. From there the boats were towed by steam boats and distributed above at the various salt furnaces along the Great Kanawha. The whole flat-boat was made of poplar except the white oak boat pins. At first the boats were comparatively small and the gunwales were hewed and sawed by hand. The price then was from \$2 to \$3 a running foot. Later, when the flat-boats were made larger and were loaded with fencing plank and staves, the price was reduced to \$1 a foot. There were probably as many as 100 flat-boats built on the Little and Big Coal rivers each year for 40 years, or more.”

Beginning about the year 1855 the Coal River Navigation Company put in a system of locks and dams on the Big Coal River from its mouth at St. Albans to the village of Peytona 30 miles above. The river was thus made navigable for boats and barges, and large quantities of coal, logs, staves, tan bark, and hoop-poles were brought out of the county. During the Civil

* “The Mountain State”—Summers.

War navigation on the river was stopped, the dams were broken, and all improvements greatly damaged. After the war was over repairs were made and the system remained intact until about the year 1875.

Mr. Julian Hill, of Madison, states that the first steam saw mill in the county was put in operation at Peytona on the Big Coal river about 1840 and was known as the Van Horn mill. Before the completion of the Chesapeake and Ohio branch railroad to Madison in 1907, however, there had been but few steam saw mills in operation in the county and most of the timber cut had been manufactured on mills at St. Albans and other points outside. The Knight Lumber Company, at Sattes, and the Mohler Lumber Company, near St. Albans, are still floating not far from 13,000,000 feet of timber each year down the Coal river from Boone.

The largest operation located in the county has been that of Peytona Lumber Company, with a single band mill at Peytona on the Big Coal river. This plant was put in operation in 1905.

During the past 5 years small mills have literally flocked to the forests of the county made accessible by the building of the railroad. There are now not fewer than 40 mills sawing in different sections.

Since the railroad was extended from Madison to Clothier in 1909 a large band mill belonging to Boone Timber Company has been built just across the line in Logan county. This mill will be supplied in part by logs from Boone county.

Present Forest Conditions.

The county is covered largely with cut-over forests aggregating about 200,000 acres. Most of this forest land is owned by companies which are holding or operating it for coal or lumber. There are also approximately 10,500 acres of virgin forest land lying principally in four areas. Two virgin tracts lie wholly within the county, one near Peytona and another not far from the northern end of the county on waters of the Little Coal river. In the southern end a portion of a large virgin area

extends into the county from Logan, and on the west part of a 10,000 acre tract on the head of Mud river lies inside the Boone line.

At least four fifths of all the woodland still contains some merchantable timber, of which the leading kind is oak.

The farm land lies in almost continuous belts along the principal streams and in small scattered patches among the hills and mountains. Farms are more numerous in the northern than in the southern end. Much of the rough, hilly land is unfit for agriculture and the timber should be given the right of way.

The clearing of the narrow, sandy bottoms of the rivers has materially affected the character of their channels. It is stated by old residents of the county that both Big and Little Coal rivers were one third narrower 40 years ago than they are at present. Originally the water flowed over solid rock bottoms and at every turn there was a deep, clear pool of water with shallows above and below. Now the deep places are full of sand which has washed from cultivated fields and the stream channels have been widened by the falling in of unprotected banks.

BAXTON COUNTY.

Location and Area.

Braxton county was formed in 1836 from parts of Lewis, Kanawha and Nicholas. It is the central county of the State and has an area of 541 square miles or 346,240 acres.

Topography.

The surface of the county is rendered irregular by high hills and mountains and by narrow river valleys. The hilltops and mountaintops reach elevations ranging from about 1,000 feet in a small area in the north, to a little over 2,000 feet in the south along the Webster and Nicholas lines. The summits lie uniformly in nearly all sections at about 1,600 feet, being

greatly modified remnants of a plateau which has been worn away by the waters of the several rivers and the numerous smaller streams which have flowed through it.

The county now has portions of 5 rivers. Of these the Elk and the Little Kanawha are the largest, the former flowing through the county in a southwesterly direction and the latter flowing northwest through the northern end. The principal tributaries of the Elk are Big Birch river, Coon creek, Big and Little Buffalo creeks, Buckeye creek, Wolf creek, Stony creek, Mill creek and Laurel creek, emptying from the south, and Duck creek, Tate creek, Little Otter creek, Granny creek and Holly river, flowing in from the north. The chief tributaries of the Little Kanawha are the Right and Left Forks of Steer creek, and Cedar creek, flowing into Gilmer county on the northwest, and Oil creek, Salt Lick Fork, Knawls creek and Fall run, emptying into the river between Burnsville and Falls Mill.

Original Timber Conditions.

According to an early writer on the timber resources of the State, "All the varieties (of timber) common to the altitude and latitude of the county (Braxton) are found. Poplar and the various kinds of oak are the most plentiful, though there is an abundance of hickory, ash, maple and some walnut. The poplar of this county is remarkably fine, the rich soil having produced a very large growth and the trees reach enormous proportions. The oak timber is also very fine and in much demand."

Pitch pine grew in most sections on dry hills and hemlocks were commonly found thinly scattered along streams. J. I. Bender, of Burnsville, reports small areas of white pine near chapel post office on Steer creek, and a scattered growth of red cedar on Cedar creek and at the falls of Little Kanawha.

The Lumber Industry.

The Elk and the Little Kanawha rivers were the principal outlets for the timber of Braxton county before the building of the Baltimore and Ohio and the Coal and Coke railroads. As

LOCUST GROVE IN THE SHENANDOAH VALLEY NEAR MARTINSBURG

early as 1846, and perhaps several years earlier, there were many persons employed along Elk river in constructing flat-boats. These boats which were often 18 or 20 feet wide and from 75 to 120 feet long were largely made of yellow poplar. Many of the finest poplar trees growing close by, or within easy reach of the river were cut down, squared, pitted and sawed in two with whip saws for flat-boat gunwales. At the date mentioned above, and for several years thereafter, these boats were loaded with split staves and taken to the salt furnaces in the Great Kanawha valley. There the staves were sold to coopers who manufactured salt barrels, and the flat-boats were sold to salt producers for the transportation down the river of the large quantities of salt then being produced in that region. The boats usually sold at \$1 for each running foot. Some of the first timber to go out from the county was floated and rafted on the Elk and Little Kanawha rivers. This industry was carried on at first principally by the farmers or the owners of small boundaries of woodland and not by companies as in some other sections. The principal timbers rafted were poplar and black walnut. In later years lumber companies with mills at Charleston, Parkersburg, and other points bought stumpage high up on the Elk and the Little Kanawha and rafted out their logs.

One of the pioneer mills of central West Virginia was located at or near Bulltown on the Little Kanawha. It is probable that this mill was in operation more than a hundred years ago. Several primitive water saw mills were in operation 60 years ago along the larger streams. Two of these were Peeble's mill at the mouth of Holly river and Frame's mill at Frametown on the Elk. When the Richwood branch of the B. & O. railroad was built through the county and a branch extended to Sutton in 1892, a lively lumber industry was begun by portable saw mills and by larger stationary mills in the interior forests. Prior to the building of these roads there had been little sawing except by water-power mills.

Pardee and Curtin Lumber Company operated a band mill at Sutton from about 1892 to 1905. The logs for the mill were largely obtained in Holly district of Braxton and in Webster county.

T. M. Mitchell began to operate a circular mill on Wolf

creek in 1895 and cut a large quantity of good timber from the H. L. Robinson tract of 2,240 acres. Later the Mead and Speer Company operated a circular mill on the same tract cutting the largest remaining timber. The latter company ceased its operations on this tract in 1902. The West Virginia Pulp and Paper Company cut the pulp timber from an adjoining tract of 2,250 acres, beginning about the year 1898.

The Braxton Coal and Lumber Company established a band mill at Gillespie on Elk river in 1894 and operated it for 3 years.

The Holly Lumber Company had a band mill at Palmer from about 1895 to 1900. Most of the timber sawed by this company was from Webster county.

John Paulhamus and Son operated a band saw mill at Centralia and cut timber from a tract of 13,000 acres in Braxton and Webster. Their operation continued from about 1900 to 1906.

Smith Brothers were extensive operators of portable saw mills on the Elk and Little Kanawha divide between 1903 and 1907.

From 1894 to 1900 Henry Waggy with portable mills cut timber on a 12,000 acre tract on the head of Birch river in Braxton and Webster. His lumber was hauled on a tram road to the Baltimore and Ohio railroad.

J. H. Chapman and Peter Goble purchased 2,000 acres of timber land on Grannys creek near Sutton about the year 1894, and cut the timber from it with a circular mill located at Karl siding. Their operation continued for about 3 years.

The Interstate Cooperage Company has been operating from 1 to 5 stave mills in the Braxton county part of their large forest lands since 1906. The sawed stave industry in Braxton began with the operations of this company.

The Meed and Speer Company has been running a band mill at Jennings on Strange creek since 1904.

A score or more of portable saw mills are sawing irregularly throughout the county at the present time.

Present Forest Conditions.

Braxton county still has a few areas of virgin forest. These are located principally between the Elk river and the Gilmer and Calhoun lines several miles west of Sutton. Their combined area is about 9,670 acres. The 24,000 acres of cut-over forest land is located on both sides of the Elk and Holly rivers near the Webster line, on Strange creek and Birch river in the southern end, and about 5,000 acres adjoining the virgin areas above referred to.

The remainder of the county is divided up into small farms most of which contain only sufficient timber for ordinary domestic purposes.

BROOKE COUNTY.

Location and Area.

Brooke County, situated in the Northern Panhandle, was formed in 1797 from part of Ohio county. Its area is 97 square miles or 62,080 acres.

Topography.

The hills of the northern and central sections of the county are low and are comparatively well rounded and smooth. Long ridges lie between the numerous small streams which flow northward and southward into the larger creeks tributaries of the Ohio river. The hills of the southern half of the county, particularly those facing the Ohio river and those along Buffalo creek and its tributaries, are too steep in many places to admit of successful cultivation. The elevation ranges from 657 feet at the Ohio river to 1,377 feet at a point near the southern line.

The county fronts on the Ohio river which flows along its western border for a distance of not less than 16 miles. The largest creek in the county is Buffalo creek which enters near the southeastern corner from Washington county, Pennsylvania,

and flows northwestward in a tortuous course, emptying into the Ohio river at Wellsburg. In its passage through the county this stream has a fall of about 200 feet and presents every natural feature favorable to the development of its great water power. Cross creek in the central part and Harmon creek in the northern part of the county are two important tributaries of the Ohio river.

Early Settlement and Timber Conditions.

Brooke, like all the other counties of the Ohio valley, was originally well timbered with many kinds of hardwoods, and like many of them, also, was early settled by farmers who destroyed the bulk of the best timber in their clearings. Settlement began at Charlestown (now Wellsburg) as early as 1772. Since that time almost every acre of tillable land has been devoted to the growing of some agricultural crop.

The Lumber Industry.

The excellent water power easily obtainable on the larger creeks encouraged the building at an early date of a number of combination grist and sash saw mills. These primitive mills ground the grain of the early settlers and saved a considerable quantity of choice lumber for domestic use. They have long since ceased to run but many of the names of the owners are still remembered by the oldest living inhabitants of the county. The names and locations of several of the mills are here given: William Briggs' mill was located on Buffalo creek one mile above its mouth at Wellsburg; Casner's mill, on Buffalo creek, two miles above Wellsburg; Richard Waugh's mill, on Buffalo creek, where Waugh's dam is now located; (James and David Waugh replaced the old mill at this place, about 1866, with a new sash mill which they subsequently changed to a "muley mill") Bowman's mill, located on Buffalo creek, five miles above its mouth; and Campbell's mill, on Buffalo creek at Bethany. This mill was owned by Bishop Campbell, the founder of Bethany College. Besides the mills named above, there were Sander's mill, Clark's mill, and Fowler's mill, on Cross creek,

Brown's mill and Jones' mill on Castleman creek, and Apple-gate's mill on Cummins run. The dates of operation of these several mills are not obtainable. It is certain, however, that some of them were built very early in the nineteenth century and that nearly all were operating in 1850. Some of them continued to run for several years after the close of the civil war.

Robert T. Moore had the only tan yard in the county. This he built at Charlestown (Wellsburg) about 1790 and continued to operate it for several years. The bark used in tanning was bought at a low price from the immediate vicinity.

Several coopers carried on their industry in a limited way in the county. Of these the principal were William McGee, who manufactured tight barrels, and William G. Howard, who manufactured flour barrels up to the year 1890.

The first steam saw mill in the county was Coen's stationary mill built in 1864. About 4 years later small portable saw mills began to come in. These have since sawed in all parts and have cut most of the timber remaining after the date of their introduction. As many as 8 or 10 portable mills were in operation at various times and 3 or 4 still saw irregularly.

The stave industry was carried on to some extent for 3 or 4 years. This began in the summer of 1890 when the first stave saw mill was brought in from Ohio. Two or three mills operated during the period mentioned.

Most of the black walnut in the county was shipped out in the log. John Virgin, who bought logs from 1885 to 1909, was the principal shipper.

Large numbers of white oak, black oak and red oak trees were used in the manufacture of shingles several years ago.

Within the last five years a great quantity of white oak has been shipped in the form of square timber.

° Present Timber Conditions.

The constant drain upon the timber of the county through a period of more than a hundred years has reduced the stand to almost nothing, from a commercial standpoint. About 10 per cent of the whole area is still in woodland of some kind. This occupies, chiefly, the rougher hillsides and ravines and is

held by the farmers for domestic use. In a very few cases the woodlots contain some valuable timber. Most of them, however, have been closely cut over and many acres are growing worthless trees.

CABELL COUNTY.

Location and Area.

Cabell county, formed from part of Kanawha in 1809, lies on the Ohio river in the southwestern part of the State. Its area is 261 square miles or 167,040 acres.

Topography.

The surface of the county is hilly, rising gradually toward the east from the Ohio river. The Ohio river valley here varies greatly in width. At Huntington it is a little over a mile wide. A short distance northeast of Guyandotte the hills slope almost to the river leaving a very narrow valley for nearly 3 miles. North of this the valley is half a mile wide for 3 miles, and then comes another 3 miles, or more, where the hillsides slope down almost to the water's edge. Northward from this the valley is wide to the Mason county line. Low water mark on the Ohio river at Huntington is 494 feet, and high water mark is 551 feet. Porter knob, on the divide between Guyandot and Mud rivers, rises to 1,252 feet.

The county is drained by the Ohio river and its tributaries. Its largest tributary is the Guyandot. Smaller tributaries, named from south to north, are Fourpole creek, Sevenmile creek, Ninemile creek and Guyan creek. The principal tributary of the Guyandot is Mud river emptying at Barboursville. The 3 rivers named have numerous small tributaries that drain every part of the county.

Original Forest Conditions.

The original forest has disappeared. Old residents state that there was once a very heavy growth of hardwoods, such as the oaks, yellow poplar, hickory, ash, cucumber, beech and ma-

ple, and a little yellow pine in the hills. The location of the county and the adaptibility of its soil for tree growth warrant such a statement.

Destruction of Timber by Early Settlers.

Much of the best timber was destroyed in the "clearings" of the early settlers who came in considerable numbers into the valley of the Ohio and its tributaries in the county as early as 1800. The best land, where the best timber grew, was taken first and all the valuable timber, except a small amount for domestic use, was rolled together in heaps and burned.

The Lumber Industry.

The first timber removed from the county for commercial purposes was rafted down the Ohio river. This industry began about 70 years ago. Rafting was not carried on, to any considerable extent, by large companies but chiefly by owners of small tracts of woodland. Many men were thus employed during the winter months. Timber sold at a low price then and nothing more was expected in return, by those who engaged in this winter occupation, than pay for their labor. The rafts of logs were sold to saw mill operators along the Ohio river, as far down as Cincinnati and Louisville, and to timber dealers. Among the latter were Vinson, Goble and Pritchard who bought rafts at the mouth of Guyandot river. It is said that the county furnished not less than 50 per cent of the white oak timber used in building steam boats from Huntington to Louisville. The timber thus used was rafted to mills outside the state and manufactured there.

There were but few saw mills before 1860. A small number of water-power and steam mills sawed for local use. In about 1870, however, near the time of the building of the Chesapeake and Ohio Railroad, several portable steam mills were put in operation. Some of these have continued to run, often with indifferent success, to the present time and have cut about all the timber that was not floated out at an earlier date. The principal shipping points have been Milton, Ona, Barboursville, Huntington and Guyandotte.

Three of the largest saw mill operators, during the early years of the industry, were Ensign Manufacturing Company, 1871, and The Lyons Stave Company, 1871, of Huntington, and Wilson and Lyons of Guyandotte.

The Present Timber Conditions.

There is no virgin or cut-over forest land left in the county, and nearly all the merchantable timber has been removed from the farmers' woodlots. The second growth has been cut over time after time and the cross-tie timber, even, is no longer to be found except in small quantities.

The woodlot area has been greatly reduced during the past few years to make room for the culture of tobacco and some of the upland has been cleared for apple orchards.

CALHOUN COUNTY.

Location and Area.

Calhoun county, formed in 1855 from part of Gilmer, has a position slightly northwest of the center of the State. Its area is 280.2 square miles or 179,328 acres.

Topography.

The average elevation of the county is about 1,000 feet. The lowest point is where the Little Kanawha river flows out at 720 feet elevation and the highest point is on the summit of Mule Knob, 1,550 feet elevation, in the southern end of the county. The slope of the hillsides is generally gradual but, in some sections, the faces are steep and difficult to cultivate. The only level land is found along the Little Kanawha river and its West Fork and smaller areas along the larger creeks.

The whole county is drained by the Little Kanawha river. The West Fork, with its Beech Fork and many smaller tributaries drains the southern half of the county, and the main river, with Leading creek, Yellow creek and Laurel creek as its

SPRUCE TREES GROWING ON BORDER OF BURNT LANDS ON SPRUCE MOUNTAIN. The form of the trees shows the effect of exposure to constant winds after the burning of the surrounding forest. Broad-leaved plants in the foreground are American White Hellebore.

larger northern tributaries, and with Steer creek, Sycamore creek and Pine run as its principal southern tributaries, drains the northern half.

The Original Forest.

It is asserted that a belt of land about 10 miles in width but with no definite boundary lines having timber of a very durable character extends from the Cumberland Mountains of Tennessee across West Virginia and into Pennsylvania a short distance west of Uniontown. The portion of this belt in West Virginia has the most durable white oak timber to be found within the State. Whether the outlines of this strip of land, which would cross the southern end of Calhoun, can be accurately traced or not, it is certain that white oak and other hardwoods with remarkable freedom from defects and with great durability are found in that section of the county. The principal timbers of the county, as a whole, were white, red and chestnut oak, yellow poplar, black walnut, shellbark and pignut hickory, chestnut, beech, sugar and red maple and yellow pine. There were smaller quantities of white ash, basswood, black cherry, sweet birch, sycamore, black gum, sweet buckeye, hemlock, white and pitch pine and red cedar. The yellow pine was chiefly found in the western half of the county, and the white pine was confined to two small areas, one of about 2,000 acres on Laurel creek and another of less extent on the right hand side of Little Kanawha river, 6 miles below the town of Grantsville. Scattered trees of white pine were found in other places.

The Early Lumber Industry.

Most of the timber not used and destroyed in the county by farmers has been taken out in rafts and barges on the Little Kanawha river. Rafting and drifting of logs has been going on for not less than 65 years. The first timber taken was yellow poplar. Later other hardwoods and yellow and white pine were rafted to Parkersburg and to other points lower down on the Ohio river. Some rafts went only as far as Elizabeth, in Wirt county, where they were sawed on the large mills of Burns

Brothers and Huffman and of D. M. Miller. In 1893, according to George W. Summers, author of "The Mountain State", most of the poplar had been cut for a distance of 2 miles back from the principal streams and the oak for a distance of 1 mile back. This author further states that fully one half of the county was, at that time, covered with original forest.

The time of the coming of the first water mills, of which there were several, cannot be definitely fixed. The first steam mill in the county was owned by Louis Shafer and began operation in 1866. Since then many portable mills—as many as 50 at some times—have sawed in various parts of the county. Lumber from these mills has been used locally or loaded in barges and towed down the river by the use of gasoline boats. Large numbers of cross-ties have been sawed on portable mills and rafted down to Owensport, at the terminus of the Little Kanawha Railroad, and to Parkersburg. In recent years Withers and Vandevender have cut staves and lumber in considerable quantities. Local mills have sawed most of the good hickory into two-inch stock for the Ohio Valley Bending Company at Parkersburg. No band mills have operated at any time within the county.

The Present Lumber Industry.

Nearly all the remaining timber in reach from the river has recently been purchased by the Parkersburg Mill Company and the Little Kanawha Log and Tie Company. Both of these Companies are engaged in rafting out logs. The number of small saw mills in operation now is about fifteen. Most of these have a small capacity and do not run regularly.

Present Forest Conditions.

All the virgin timber now remaining in the county is a boundary of 5,980 acres lying in the southeastern section, being part of an 18,000 acre tract which extends into Gilmer and Braxton counties. The timber on this area consists of the species mentioned under the head of "Original Forests" and is of most excellent quality. The cut-over forest land is confined to 2

small areas on Leading creek having a combined area of 1,500 acres. The rest of the county must be classed as farm land. The farmers' woodlots, of which there are about 80,000 acres, have a stand of 2,000 feet, or more, of such timbers as hickory, beech, maples, oaks and others.

CLAY COUNTY.

Location and Area.

Clay county came into existence in 1856, being formed in that year from parts of Braxton and Nicholas counties. It occupies a central position in the State and has an area of 348 square miles or 222,720 acres.

Topography.

The western half of the county has an average elevation of a little more than 1,000 feet, the stream beds lying from 100 feet to 250 feet below the 1,000 foot contour line and the hills rising to a height of 1,500 feet in many places. Eastward from the Elk river, which, at its lowest point in the county is 637 feet, the land rises gradually until it reaches an average elevation of a little less than 1,500 feet along the Nicholas county line. Pilot Knob, in the western part of the county, has an elevation of 1,650 feet and the highest land, 1,850 feet, is found near the head of Rockcamp Branch of Buffalo creek in the northeastern corner of the county. This is a county of hills lying, as it does, some distance to the west of that portion of the State to which the term mountains can properly be applied.

The Elk river, with Porters creek, Little and Big Sycamore creeks, Leatherwood creek and Buffalo creek, its principal tributaries from the east, and with Otter creek, its principal tributary from the west, drains all the county except an area of about 8 square miles lying along the northwestern boundary line. This irregular strip is drained by Walker and Stinson creeks of Little Kanawha river. Elk river winds in a south-

westerly direction for 50 miles through the county, falling about 100 feet in that distance. The stream is remarkable on account of its beauty and unusual state of preservation. Its water is kept constant and pure by the large coniferous and hardwood forests out from which it flows in Webster, Randolph and Pocahontas counties. The hillsides facing the river and its tributaries in Clay county are, for the most part, too rocky and steep for cultivation and so have remained in forest to the present time. In many places the hills rise abruptly from the water's edge and, in no place, are the bottoms wide enough to encourage extensive farming. These conditions, as well as those that exist at the river's head, have contributed to the preservation of the stream.

Former and Present Forest Conditions.

The former forest conditions in the county can be known by a study of the virgin areas yet remaining. A representative boundary of 15,000 acres was found to contain, approximately, 100 million feet, board measure, of the following species of timber:

Oak,—principally White Oak—.....	40	per cent.
Poplar	20	“ “
Beech	10	“ “
Hickory	5	“ “
Hemlock	5	“ “
Maples	5	“ “
Basswood	3	“ “
Cucumber	2	“ “
White Ash	2	“ “
Birch	2	“ “
Chestnut	3	“ “
Black Walnut.....	3	“ “
Black Gum		
Locust		
Buckeye, and others.....		

The only parts of the county which have not produced good timber in great abundance are the thin and rocky southern ex-

posures and the steep bluffs along the river and creeks. Hardwoods of various kinds predominate, the only softwood of much value being hemlock. This grows, principally, along the narrow bottoms and steep hillsides facing the larger streams. Pitch pine is found sparsely scattered over the county on dry ridges and high up on the river bluffs. A few red cedar trees grow along the river banks in the southern end of the county. Of other less valuable species, not mentioned here nor in the list above, there are the sycamore, white elm, river birch and the rare sweet gum, growing along the river, and smaller quantities of white walnut, black cherry, honey locust, slippery elm and others, scattered throughout the county. The timber on the virgin forest areas would estimate from 5,000 to 8,000 feet per acre, of the species listed above. That on the cut-over areas would estimate, on the average, about 1,000 feet per acre of such species as oak, beech, hickory, birch and buckeye. The farmer's woodlots, as a rule, are cut over but contain sufficient timber for domestic purposes. The approximate total stand of all kinds of timber in the county, including the less valuable species of cut-over and woodlot areas, is 250 million feet.

Virgin, Cut-over and Farm Areas.

An investigation of conditions in the county has given us the following classification of forest and farm land:

Virgin forest land.....	17,500 acres
Cut-over forest land.....	75,000 acres
Farm and woodlot land.....	130,220 acres

The principal boundary of virgin timber yet remaining is toward the head of Buffalo creek, being part of a tract which extends into Nicholas county. There are about 2,000 acres of virgin timber in the extreme southwestern part of the county, and 1 or 2 small tracts yet remaining in Otter district, west of the Elk river. The cut-over areas lie, principally, east and southeast of the Elk river and are greatly in excess of either the uncut forest or the farm lands in that section. On the west side, although not more than 25 per cent of the land has been cleared

for cultivation, the woodland is largely owned by the farmers. The most improved lands of the county are on Porters creek, Right Fork of Big Sycamore, and on the heads of O'Brien, Big Sandy and Big Otter creeks.

The Early Lumber Industry.

For the past 75 years, or more, the Elk river, which furnishes excellent rafting facilities, has carried many millions of feet of logs, lumber, cross-ties and staves from its adjacent forest lands in Clay, Braxton and Webster counties. Active rafting in Clay county did not begin, however, until about the close of the Civil War. The Charleston, Clendennin and Sutton Railroad (now Coal and Coke Railroad) reached the town of Clay in December, 1895, and was extended to Ivydale, 12 miles above, in 1900. During the 30 years which preceded the coming of the railroad the best timber had been stripped from all the land in the county fronting on the Elk river and the large creeks. In fact, the poplar had been cut for as many as 10 or 12 miles up the larger creeks and drifted out. All of the available walnut, also, went out from 1880 to 1885. The men who were in the rafting business, especially during the early years of that industry, took only the best of the most valuable species. This left considerable good timber on the easily accessible areas to be taken, with the large quantities on the more remote virgin lands, by the saw mills which became numerous after the building of the railroad. Before that time the few small circular mills which had found their way into the county and a water-power mill located at Serena on Big Sycamore creek, manufactured lumber in considerable quantities. The largest amounts cut during this period were by Samuel Stephenson, 1885-1895, who operated on Big and Little Sycamore creeks and elsewhere; the Chaney Lumber Company, 1890-1895, which cut over 10,000 acres on the head of Blue creek; John T. Moore, 1890-1898, who sawed at Clay Court House, on Camp creek, Big Laurel creek and at other points.

Later Lumber Operations.

The first large mill to be located in the county was erected at Porter in 1895. This mill has cut the timber from about 20,000 acres. E. L. Boggs has been operating a circular mill for the past 15 years in Otter district and has cut over about 5,000 acres. M. Hardman and Company purchased 5,000 acres on Standing Rock run and other streams and removed the timber from the same during the years from 1895 to 1900. The logs cut by this Company were splashed from the small streams into Elk river where they were rafted and run to Charleston. W. S. Lewis operated a stave and lumber saw mill from 1896 on Big Laurel, Big Otter and head of Big Sandy creeks, cutting over about 15,000 acres of virgin timber. C. L. Ritter Lumber Company began operating in 1899 and cut over about 26,000 acres in the 10 years following. The David S. Collins Company began operating at Elkhurst in 1899 and cut the timber on 10,000 acres. This company was succeeded by Elkhurst Planing Mill Company which completed the cutting on an additional 5,000 acre tract in 1906. Tidewater Oil Company operated on Big Otter creek from 1900 to 1906, cutting the timber from 28,000 acres. The Leatherwood Lumber Company began operating on Leatherwood creek in 1900 and cut the timber from a 1,300 acre tract of land owned by the Jacob Tome Institute and C. C. Lewis. Waggy and Gorrel have been cutting on Whetstone, Little Laurel and Spread Shoal creeks since 1900, taking the timber from about 5,000 acres. Mitchell and Good commenced operating about 1904 and have cut the timber from 3,000 acres of land drained by O'Brien creek. Shadle and Auchmuty began at Yankee Dam in 1906 and are engaged in removing the timber from 2,000 acres on Elk river and Blue Knob creek. Crescent Lumber Company has been in operation since 1907 and is engaged in cutting timber from a 10,000 acre tract. Of those who have manufactured staves in the county we may mention D. G. Courtney, who operated stave mills on Buffalo creek from 1904 to 1908, recutting about 10,000 acres which had been cut over, originally, by The C. L. Ritter Lumber Company, and Tidewater Oil Company which, also, has manufactured large numbers of staves in the county.

The cross-tie and stave industries have been carried on for the past 25 years and millions have been floated and shipped out.

The only large industry, practically, which has existed in Clay county—outside of farming—has been the lumber industry in its various phases.

By reference to the list of saw mills given in another part of this report it may be seen that there are 3 band mills and 16 circular mills in operation now in Clay county. These are reducing the stand of timber at the rate of about 50 million feet annually.

Forest fires, originating from hunters, ginseng diggers and the railroads, are of frequent occurrence throughout the dry months and burnt areas of considerable extent are becoming overgrown with sassafras, grape vines and other undesirable species of trees and shrubs.

In the judgment of those best acquainted with conditions in the county not less than 50 per cent of the land is absolutely unfit for agricultural purposes.

DODDRIDGE COUNTY.

Location and Area.

Doddridge county was formed in 1845 from parts of Harrison, Tyler, Ritchie and Lewis. It is separated from the Ohio river by Tyler county on the west and adjoined on its other sides by Wetzel, Harrison, Lewis, Gilmer and Ritchie. Its area is 344 square miles or 220,160 acres.

Topography.

The county's surface is hilly in all parts, very rough in some sections and smoother in others. There is but little level bottom land along the larger streams within the area.

About three fourths of the total area of the county is drained by Middle Island creek and its tributaries, the chief of

Photo by E. V. Brown.

LOG RAFTS ON ELK RIVER NEAR CHARLESTON.

which are McElroy creek, Arnold creek, Buckeye creek and Meathouse Fork. Portions of the southern part are drained by tributaries of Hughes river and of Leading creek.

Original Timber Conditions.

The timbers of the county were the oaks, hickories, walnuts, yellow poplar, white ash, and other hardwoods, all reaching a large size and attaining a high degree of excellence in the rich lands commonly found in all sections. There were small quantities of yellow and white pines, hemlock and red cedar.

The Lumber Industry.

The principal outlets for manufactured lumber have been the Baltimore and Ohio railroad since about 1857, and Middle Island creek and its larger tributaries.

Water saw mills on Middle Island creek and its branches were common until within recent years, cutting vast quantities of fine yellow poplar and some other timbers. About 90 per cent of the yellow poplar was sawed and rafted to a chair factory in Marietta, the rest going to Pittsburg.

Beginning with about 1880 oak timber was cut and much of it sold in Marietta and in Beverly and Malta on the Muskingum river in Ohio.

Much timber has been used in oil rigs thousands of which have been constructed in the county during the past 25 years.

Large numbers of staves and ties have been floated down Middle Island creek to St. Marys, the ties being sold largely to the Pennsylvania railroad and the staves to manufacturers of oil barrels in Baltimore.

The timber that has been taken "has gone down the water courses which liberally supply the county with transportation for timber, or has been hauled to the railroad over tram roads which are numerous and of considerable length, one of them being about twenty miles long, and over which vast quantities of timber have been hauled. In most places where the timber has been removed it has been taken, staves, ties, telegraph poles,

hoop poles, and tan bark, all going along with the saw timber and leaving the land cleared and ready for farming.”*

The Present Forest Conditions.

We have a record which says that from a fourth to a third of the timber of Doddridge had not been touched in 1893. At the present time practically all the woodland has been culled. The best timber is now found in West Union, Cove, Central and New Milton districts, where most of the land is held by a comparatively few private owners.

The woodlots belonging to farmers are very superior to those found in some sections of the state, there being a good second growth and in some cases a virgin stand of timber. It is probable that 65 per cent of the area has been cleared for cultivation and grazing purposes.

FAYETTE COUNTY.

Location and Area.

Fayette county, formed in 1831 from parts of Kanawha, Greenbrier, Nicholas and Logan, is situated about half way between the center and the southern border of the State. Its area is 775 square miles or 496,000 acres.

Topography.

This county, although it lies near the eastern side of the division of the Appalachian Province, having uniform and almost horizontal geologic strata, is, nevertheless, rendered somewhat irregular by erosion. Impressions of visitors to the county, who attempt to view it from the rough and narrow gorge of the New river alone, are apt to be far from correct. In order to gain a full comprehension of the surface formation it is necessary to ascend to higher ground. Here, it will be observed, the surface

* “The Mountain State”—Summers, p. 138.

stretches away with more or less regularity to the north and south of the meandering channel of the New river. In places, as about the head waters of Wolf creek and Laurel creek, the work of erosion has progressed but slowly and the rolling surface is strongly suggestive of the plateau which once existed there on a somewhat higher plane. Everywhere throughout the upland region numerous streams have cut their channels to varying depths. The summits of thousands of irregular hills thus formed lie more or less uniformly at an elevation of about 2,000 feet and here and there stand mountain peaks which rise in bold relief to a height of more than 1,000 feet above the surrounding country. Among the highest of these in the eastern part of the county are Ford Knob, Bee Lick Knob, and Big Sewell Knob, all reaching an elevation of over 3,000 feet, the latter ascending to 3,500 feet. The lowest land, 618 to 675 feet above tide, lies along the Gauley and the Great Kanawha rivers. The fertile bottoms and loamy coves of this lower section contrast sharply with the heavy clays found above the stratum of Sewell sandstone which outcrops at the "Hawk's Nest" and at other places along the New river.

The whole area of the county lies within the drainage basin of the Great Kanawha river which is formed by the confluence of the New and the Gauley. Southward from the Great Kanawha and the New rivers, which flow in a northwesterly direction through the center of the county, the principal streams are Powellton and Loop creeks, tributaries of the Great Kanawha river and Laurel, Wolf, Arbuckle and Dunloup creeks, tributaries of the New river. The northern half of the county is drained by Smithers creek, a tributary of the Great Kanawha; by the lower waters of Gauley and Meadow rivers, which are followed for nearly 50 miles by the northern boundary line; and by numerous small streams that flow southward into the New and northward into the Gauley and Meadow rivers.

The New River Gorge.

New river, which has its source on the high summits of the Blue Ridge in North Carolina, flows through Fayette county for a distance of about 50 miles. It enters the county from the south through a deep narrow channel at about 1,200 feet eleva-

tion. From this point, to where it joins the waters of the Gauley and flows on as the Great Kanawha, the stream is beset by falls and almost continuous rapids descending to an elevation of 650 feet at Gauley Bridge.

The wild beauty of this canon, known as the New River Gorge, with the clear water of the river flowing swiftly among scattered boulders at the base of its precipitous and rocky walls, has appealed to thousands of people, and has afforded ample justification for the efforts at description made by many prominent writers.

“Who having once seen, will ever forget the ‘Hawk’s Nest’ in Fayette County—often called ‘Marshall’s Pillar’—a frowning precipice said to be over twelve hundred feet high and overhanging New river. Imagine yourself standing upon its projecting point, a perpendicular rock, 1,292 feet from the valley below. Before you, as you look to the east, the New river is seen for the distance, perhaps, of several miles, winding or rather rushing, tumbling and foaming through the towering cliffs which environ it. Sweeping by this lofty promontory on which you stand, it suddenly turns its course in a southwest direction, and presents in the whole distance several beautiful cascades which send to the listening ear the far off but lulling sound of their waters. The cliffs, themselves, judging by the horizontal and corresponding strata of rock on either side, seem to have been originally united but torn asunder by some strong convulsion of nature, in order to give free passage to the narrow but angry torrent which rolls majestically at their feet. The autumnal season gives to this imposing picture a magnificent and gorgeous drapery of which no man whose vision has been confined to lowland scenery can have the slightest conception.” *

“The cliffs of New river present for a distance of 20 miles a succession of sublime scenery rivaled in our country only by that of Niagara, between the falls and Queenstown.” **

The immense water power of the river is adequate to supply light, heat and facilities for travel to the present and the future population of the Great Kanawha Valley. Within a few years,

*Lewis's *Hand Book of West Virginia*, 1904, p. 13.

**Martin's *Gazetteer of Virginia and The District of Columbia*, 1835.

doubtless, these waters as yet but little used, will appeal as strongly to the commercial mind as they have in the past to the esthetic.

The Original Forests.

The topography of Fayette is such as to promote the growth of valuable forests. Originally the low and fertile lands of the Gauley and of that portion of the Great Kanawha within the county, were characterized by the abundance of yellow poplar, black and white walnut, white and red oaks, sweet buckeye, basswood, cucumber and white ash, as well as the less valuable sweet gum, sycamore, river birch, honey locust, and others. On the clays of the higher areas such species as maples, white oak and beech predominated, with fringes of hemlock along the water courses and with scattered clumps of pitch pine and scrub pine growing on dry ridges and along the sandstone outcrops.

The Lumber Industry.

Some of the best yellow poplar, black walnut and other timber growing along the Great Kanawha and the Gauley rivers was cut and rafted out about 50 years ago. The New river is too rapid for even the successful drifting of single logs and, as there was no other means of transportation then, the bulk of the timber in the interior remained until a later date. A large number of staves were cut in a wasteful manner on Laurel creek about 35 years ago and several small steam and water mills were in operation before that time. Two sash saw mills, at least, existed in the county as early as 1835. Timber cutting on a large scale for commercial use did not begin until about 1885. The industry has continued without interruption and at an increasing rate until the present day. The greater part of the timber so far taken has been sawed by portable stove and lumber mills located throughout the county. These have delivered their lumber over branch railroads, wooden tram roads and, by means of wagons, over country roads, to the various stations along the Chesapeake and Ohio railroad and, more recently, to Belva, Gauley Bridge and other stations on the Gauley branch.

Large requisitions have been made upon the timber by the

150, or more, coal companies operating within the county. The quantity of timber used in mining, through a long series of years, for posts, caps, headers, ties, tipples and buildings, is enormous. In the judgment of those men best acquainted with the present situation the time is near when the scarcity of both timber and water will become alarming if, indeed, it is not already so. A number of coal companies, however, are taking steps to preserve the remnant of less valuable but rapid-growing timbers still standing in the extensive cut-over forests. An enterprising company owning property on Loop creek has built an immense dam near the head of that stream and is catching the run-off water of early freshets for their use in mining operations.

The present lumber industry embraces the operations of 2 large band mills located within the county and a third located near the eastern line in Greenbrier county, together with the smaller operations of about 25 portable mills. These have a combined capacity of not less than 250,000 feet per day. The large mills are engaged in the removal of timber from the remaining virgin tracts and the small mills are cutting wherever a few thousand feet of timber can be brought together.

The Present Forest Conditions.

There is, perhaps, 10 per cent of cleared land in the county. The remaining 446,000 acres are in forest. Only about 53,000 acres, however, are yet in virgin growth. The balance is cut-over and woodlot forest owned by coal and lumber companies and by farmers. It is estimated that there is an average stand of about 2,500 feet per acre of the less valuable kinds of timber, such as black gum, beech, sugar and red maple, birch, etc. yet remaining on the cut-over and woodlot land, but that at least 80 per cent of the value of the original forest has been removed. Areas aggregating 200,000 acres, or more, of cut-over lands lie chiefly in the southern and western parts of the county and are largely owned by coal companies. The principal virgin forest areas lie in the region of Big Sewell mountain, in the eastern part of the county, and, farther north, along the Meadow river.

GILMER COUNTY.

Location and Area.

Gilmer county, formed in 1845 from parts of Lewis and Kanawha, lies in the third tier of counties east of the Ohio river and is a little northwest of the center of the State. Its area is 367 square miles or 234,880 acres.

Topography.

The surface of the county is hilly. In most parts the slopes are gentle and the crests of ridges and the hilltops are well rounded. At various places, however, the slopes are steep and rough giving the hills an uneven and angular appearance.

The lowest land is along the valley of the Little Kanawha river which falls about 50 feet in its course through the county, entering on the east at 750 feet and leaving on the west at 700 feet. The hills rise to a height of 1,000 feet, and over, throughout the county and in many places reach an altitude of 1,200 to 1,300 feet. Locust knob, in the eastern part near the Braxton county line, rises to 1,600 feet.

The Little Kanawha river traverses the county from east to west for a distance of 25 miles. All the other streams are its tributaries. Of these the larger ones are Steer creek, Grass run, Cedar creek and Duck creek, flowing in from the south, and Tanner creek, Sinking creek, Leading creek, Stewart creek and Sand Fork, flowing in from the north.

The Original Forest Conditions.

The county once had a superior hardwood forest. White oak, yellow poplar and black walnut were the most valuable of the predominant hardwoods. The white oak, especially, has been much sought after on account of its freedom from defects and its unusual durability. Chestnut, hickory, beech, basswood, white ash, sugar and red maple, red, black, chestnut and scarlet oak, locust and sycamore were other common hardwoods. White pine

is said to have grown on Tanner and Lynch creeks in the northern part of the county. Hemlock and pitch pine grew in small quantities throughout the county, the former along streams and in cool ravines, the latter on dry ridges. Red cedar grew in abundance on Cedar creek and in smaller quantities in other parts of the county.

The Lumber Industry.

Almost all the timber so far taken out of the county has been floated and rafted down the Little Kanawha river. Some has been sawed in recent years by portable mills and shipped on the Coal & Coke Railroad which touches the southeastern side of the county.

The earliest settlements were made near the towns of Glenville and Stumptown. All the lumber used about the premises of the early settlers was sawed by hand or on sash saw mills, about 7 of which were located at various points along the Little Kanawha and its tributaries. The first manufactured lumber shipped from the county was sawed on a sash saw mill near the mouth of Cedar creek. None of the primitive water saw mills have been running for 25 years.

Rafting was begun on the river as early as 1840. This industry was carried on, at first, by owners of timberland lying near the river and, to some extent, by other residents who cut timber without regard to the ownership—a common practice 60 years ago in many parts of West Virginia. Most of the rafts were disposed of at Parkersburg and Cincinnati. The first raft of logs taken out of the county was sold at Parkersburg for 25 dollars and 25 dollars' worth of goods. This raft was made up of choice yellow poplar and would now bring not less than \$750.00. Yellow poplar was the principal timber rafted before 1860. Since then several companies have bought large quantities of the heavier timbers, such as oak, beech and maple, and rafted them out with the poplar, cucumber and basswood. Some of the prominent operators along the river in more recent years were Wyant and Brannon, S. F. Whiting, Withers and Lorentz, and Withers and Vandevender. The chief floating done on the river at present is by the Little Kanawha Log and Tie Company,

HAULING LUMBER MANUFACTURED ON PORTABLE SAW MILLS.

which is handling from 600 to 800 rafts a year of saw timber and about 100,000 cross-ties. W. J. Holden and Lowther and Fleming, of Parkersburg have also been purchasing and rafting cross-ties from the county for several years.

Portable saw mills were brought to the county about 1865. Many of these have continued to run to the present time. They have sawed large numbers of cross-ties and considerable export oak and bill stock within reach of the railroad in the eastern end of the county. No band mills have operated in the county. Two of the prominent portable saw mill operators were John R. Bartlett and Benj. Allen.

The stave industry has not been extensive. A considerable quantity of split staves, however, has been hauled to the railroad and shipped, and Withers and Vandevender have been engaged for some time in sawing staves at several points in the county.

The Present Forest Conditions.

There are about 13,000 acres of excellent virgin forest lying in the southwestern part of the county on the waters of the Right Fork of Steer creek. All of this, except about 1,000 acres, is in the hands of operators who will probably manufacture the white oak found there into staves within the next few years. A tract of 1,700 acres in the northern end of the county comes under the head of cut-over forest. All the rest of the woodland is owned in small scattered boundaries by farmers. As a rule the farmers' woodlots have but little merchantable timber.

GRANT COUNTY.

Location and Area.

Grant county, formed in 1866 from a part of Hardy, lies south of Garrett county, Maryland, and of Mineral county; north of Pendleton, east of Tucker and west of Hardy. Its area is 483 square miles or 309,120 acres.

Topography.

The county is divided naturally in respect to its surface configuration, into two distinct and radically diverse areas. Approximately one fourth of the total area, lying northwest of the main Alleghany Front, is in the form of a high, rolling plateau. The elevation of this division is comparatively uniform, ranging from about 2,700 feet to 3,000 feet, except that the channels of the streams sink to a depth of 300 or 400 feet below the surrounding country as they approach the North Branch of the Potomac. Southeast of the Alleghany mountain crest the surface is broken into a number of elevated, parallel ridges similar in form and trend to those found in the adjacent counties of Pendleton, Hardy and Hampshire. The first and most important of the mountain ridges southeast of the Alleghany Front is New Creek mountain, extending through the length of the county into Mineral on the north and into Pendleton on the south, where it is known as North Fork mountain. New Creek mountain is abruptly broken from crest to base by at least 4 narrow gaps. The first of these on the south permits the passage of the North Fork of the Potomac; through the second and third, known respectively as Kline and Cosner Gaps, flow small tributaries of Lunice creek; and through Greenland Gap flows the North Fork of Patterson creek. East of this mountain is the broad, hilly basin of Lunice and Patterson creeks; and east of this rises Patterson Creek mountain, the natural dividing line of Grant and Hardy counties.

Westward from the Alleghany crest the drainage is through Buffalo creek, Difficult creek, Abram creek, and other smaller streams, and through the long, slow-flowing Stony river, to the North Branch of the Potomac which separates this county and Maryland from the Fairfax Stone to the Mineral line. The principal stream of the eastern part of the county is the South Branch which enters on the south from Pendleton and passes out between the high walls of Petersburg Gap. The chief tributaries here of the South Branch are the North Fork, emptying a few miles above Petersburg, the county seat; and Mill creek and Lunice creek, emptying just above the Hardy county line. Patterson creek, tributary of North Branch, drains all the north-eastern part of the county.

Original Timber Conditions.

On the Alleghany mountains red spruce and hemlock were the predominant timbers, originally, with a scattered growth of sugar maples, beeches, and other hardwoods. East of this, beginning abruptly along the upper margin of the Alleghany escarpment, the growth was of many varieties of hardwoods, liberally intermixed with the pines that were found throughout that region. White oak and chestnut oak were the most valuable hardwoods, and yellow pine was the leading softwood of the eastern part of the county.

The Lumber Industry.

The lumber operations in Grant county have been confined, chiefly, to the mountainous, northwestern section which was made accessible by the building of the Western Maryland railroad along the North Branch in 1887. Since that time the bulk of the timber has been taken from the top of the Alleghanies to supply the large mills located at Wallman, Maryland, and at Bayard, Wilson, Dobbin, Henry, Wilsonia and Fairfax, West Virginia, and to supply smaller mills scattered here and there in the region lying back from the railroad. All the large band mills in the county have ceased to run except the plant at Dobbin owned by the Parsons Pulp and Lumber Company.

Not much has been done in the lumber industry east of the Alleghanies. The sawing by small water and steam mills, through all the years of settlement and up to the present time, has been for the purpose, principally, of supplying lumber for local uses. An exception to this was the floating and hauling out of walnut, poplar and pine logs about 20 years ago, and the cutting for many years of chestnut oak timber for tan bark. Much bark has been used by the local tanneries at Moorefield and New Creek and at Petersburg before the burning of the plant at that place in 1904. The loss of timber in the bark industry has been considerable, probably one half of the chestnut oak cut being wasted. The chestnut oak timber in the Maysville, Greenland and Williamsport sections has been largely utilized for lumber and

ties after the bark was removed. Northward from the three towns mentioned above bark, ties, and lumber, to considerable extent, is being removed and hauled on wagons to Keyser.

Present Conditions.

Roughly speaking, there are 57,000 acres of virgin timberland and 63,000 acres of cut-over timberland now remaining in Grant county. In addition to these areas, which are held in large boundaries, the farmers own woodlots of various sizes aggregating not less than 100,000 acres. The main boundaries of virgin timberland lie toward the eastern and southern parts of the county along the Alleghanies and New Creek mountain south of Maysville, and on the mountains which separate the several tributaries of the South Branch. Smaller areas in other sections are to be found the chief of which lies on the western face of Patterson Creek mountain.

In answer to an inquiry concerning the present forest conditions in the county Mr. E. L. Judy of Petersburg, made the following statements:

“There is but little of the original growth of timber remaining on top of the mountain, nearly all having been cut over to some extent. The virgin part of the mountain is owned, largely, by operators who are now engaged in removing the timber. A few farmers, living north of a line running from Bayard to Pigeon Roost, have small, virgin woodlots within their farms. South of this line there are but few farms. Much of the cut-over forest there has timber worth marketing today and a few mills are still in operation. The principal timbers now on the mountain are the hardwoods, such as sugar maple, beech, birch, and the poorer grades of white oak, red oak, and chestnut oak. These were left as unprofitable timber when the spruces and hemlocks were taken from the area some years ago.

“The southern half of the eastern slope of the Alleghanies contains an almost virgin growth of hardwoods, mostly chestnut oaks, as yet but little cut; while the northern half, from the Maysville section, is largely the same kind of timber but culled to some extent in later years.

“That part of the county east of Martin and Maysville to

the foothills of Patterson Creek mountain, and extending as far south as Petersburg is largely in farms. Patterson creek mountain, from the Mineral county line to Petersburg Gap is very well timbered in hardwood but with a number of farm openings.

"The Cave Mountain and Smoke Hole sections have a virgin growth of hardwoods, principally the oaks, with a little pine, poplar and walnut. The Middle mountain, particularly the southern end, has a fairly good stand of chestnut oak and other timbers. The South Fork mountain has considerable virgin oak. The North and South Mill creek sections are largely improved as is also the South Branch valley from the mouth of North Fork toward Moorefield."

The pine forests that were visited in this county by the bark beetles in 1891 and 1892 have not recovered from the injuries received in those years and in subsequent years by destructive forest fires that raged in the dead timber. The young pines that are growing up in some sections are either the comparatively worthless scrub pines or inferior trees of the more valuable species. Conditions in limited areas, however, give promise of a reasonably good stand of softwoods.

Since the recent extension of a branch of the Baltimore and Ohio railroad to Petersburg from Romney, in Hampshire county, there has been an active interest manifested in fruit raising; and doubtless many acres of the hitherto uncleared hill land will be set in apple and peach trees within the next decade. An active lumber industry, also, is likely to follow the building of the railroad.

GREENBRIER COUNTY.

Location and Area.

Greenbrier, next to the largest county in West Virginia, was formed in 1777 from parts of Montgomery and Botetourt counties. It is situated in the southeastern part of the State, bordering on the Virginia line, and has an area of 1,051 square miles or 672,640 acres.

Topography.

The eastern line of the county follows the main range of the Alleghany mountains and all the area lying east of the Greenbrier river is exceedingly mountainous except in the valleys of the creeks. Westward from the Greenbrier there is a rich plateau region lying high above the channel of the river and covering much of the central, southern and western parts of the county south of a west line from Falling Springs. The eastern part of the plateau is undulating but not hilly, and the southern and western parts are traversed by low ridges and furrowed by numerous streams. North of the plateau region the surface is broken into hundreds of high mountain peaks and ridges, many of which reach an elevation of over 4,000 feet.

The Greenbrier river, which flows south at the western base of the Alleghany mountains, is the principal stream of the county. Its largest eastern tributaries are Howards creek and Anthonys creek. The streams that flow into it from the west are very small and far between except in the extreme southern end where Muddy creek drains an area west of Muddy Creek mountains. Several creeks in the center of the limestone plateau disappear into subterranean caverns. The western and northern mountainous sections are drained by Meadow and Cherry rivers, both tributaries of the Gauley.

Original Forest Conditions.

The county may be divided into 3 districts according to the kinds of timber which each produced in greatest abundance. First, in the mountainous section on the east of Greenbrier river, white pine was the most valuable species. It grew in this county most abundantly on Anthonys creek and its tributaries. The following description of the white pine growing in Greenbrier and Pocahontas is given by Mr. Cecil Clay, former president of the St. Lawrence Boom and Manufacturing Company of Ronceverte:

“There are several hundred million feet of good white pine lumber in this district. The white pine growing as it does here at an altitude of 2000 to 2500 feet, has a climate about like that of lower Pennsylvania and has much likeness to Susquehanna

pine. Where the white pine grows it takes the ground to itself, and but little of other timber is found with it. It grows in several localities through the valley (Greenbrier). On Deer and Sitlington creeks are 100,000,000 feet; on Knapps creek and branches another 100,000,000 feet; and Spice, Laurel, and Davys runs, with Anthonys creek, and some outlying patches, would yield a third 100,000,000 feet. This pine timber is perhaps a little heavier than the Pennsylvania pine, but is soft and smooth to work. It is generally a sound, red-knot timber, with remarkably thin sapwood, often averaging not over half an inch in a lot of 1000 logs. As much as 40,000 feet can sometimes be cut on an acre." *

The timber of the limestone plateau, before referred to, was distinct from that on the east and north. Mr. W. A. Mastin, of White Sulphur Springs, describes the limestone area and its timber as follows:

"The eastern boundary line of the principal limestone area is, of course, the Greenbrier river as far down as Caldwell. Here the river turns more to the west passing out through the limestone and leaving an area of considerable size on its east and south. The western boundary line of the area begins at Alderson, passes up Muddy creek, by the way of Blue Sulphur Springs crosses the divide to Sinking creek and continues on in that direction toward Trout Valley.

"The limestone section produced excellent timber, free from insect injuries and defects of every kind. It was nearly all hardwood, such as white oak, red oak, poplar, black walnut, hickory, and some wild cherry."

The third district lies in the mountainous sections of the north and northwest, and is characterized by such species as spruce, hemlock, yellow birch, and others that thrive at high altitudes. Even here, however, hardwoods predominate below an altitude of 3,000 feet and sometimes higher up than this. Following is a list of trees and the number of each kind growing on 1,000 acres on the head of Cherry river in this county. Locusts,

*"Resources of West Virginia"—Maury and Fontaine.

hickories and black walnuts with a diameter over 10 inches, and all others over 18 inches were counted.*

White oak	132
Chestnut oak	889
Hickory	86
Chestnut	1513
White maple	3258
Sugar maple	7291
Locust	4
Beech	1965
Birches	1120
Gum	104
Cherry	349
White walnut	1
Poplar	529
Linden	1014
Cucumber	937
Ash	576
Hemlock	2303
Yew pine (Spruce).....	34
<hr/>	
Total	22264

The Lumber Industry.

Most of the limestone area, where the best hardwoods grew, was settled and the timber destroyed in the process of clearing the land for cultivation before it could be sold for profit and in a day when timber was considered inexhaustible and of little value. A little of it was utilized for building and fencing purposes and for fuel.

Small water-power saw mills were located here and there in an early day. After these came the portable steam saw mills. The latter were not common until the Chesapeake and Ohio Railroad was extended westward from White Sulphur Springs about the year 1873. After that time many of these mills were located near the line. The principal shipping points for lumber were

*"Resources of West Virginia"—Maury and Fontaine.

LUXURIANT GROWTH OF VEGETATION ON YEW MOUNTAINS, GREENBRIER COUNTY.

White Sulphur Springs, Caldwell and Ronceverte. When the Chesapeake and Ohio railroad was built up the Greenbrier river a similar industry was begun all along the line. When available sites for the small mills became scarce near the railroad many of them moved back into the interior where they are still engaged in sawing for small owners and hauling the lumber on wagons to the railroad.

The first large band saw operation in the county was that of the St. Lawrence Boom and Manufacturing Company. This company came to Ronceverte in 1882 and erected a circular mill. In 1884 this was replaced by a double band mill which continued to operate until 1910. During 24 years the mill cut 433,000,000 feet of white pine from Greenbrier and Pocahontas counties. After 1902 the white pine supply began to fall off and considerable hemlock and hardwood timber was sawed. This company erected a single band mill at Shryock on Anthonys creek in 1909 which it is now operating.

Some of the large operators that have completed their work were the Henderson Lumber Company, with a band mill at the mouth of Anthonys creek; the Clear Creek Lumber Company, and the Kittanning Lumber Company, both with large circular mills in the Greenbrier section.

Among the present extensive operators, some of which have cut over vast forest areas, may be mentioned the Cherry River Boom and Lumber Company, located at Richwood in Nicholas county; the Fenwick Lumber Company at Fenwick, Nicholas county, and the Neola Lumber Company at Neola, all band mill operations. Donaldson Lumber Company and Kendall-Deter Lumber Company are operating large circular mills near Anthony on the Greenbrier river.

Much of the fine walnut timber was destroyed. That which remained until after the coming of the railroads was eagerly sought after and even the stumps throughout the Greenbrier valley were bought and removed.

Chestnut oak timber once grew in abundance in the county and furnished material for an active tan-bark industry which has lasted through a long period of years.

Present Forest Conditions.

The forests that remain in the county lie in an irregular semicircle on the north, east and west of the rich and highly improved limestone lands of the central plateau region. There are now approximately 140,000 acres of virgin forest and 105,000 acres of cut-over forest. The largest areas of both virgin and cut-over forests lie on the waters of Meadow and Cherry rivers in the north and northwest and on the western slope of the Alleghany mountains east of the Greenbrier river.

Most of the land now in forest is unfit for agriculture and will be vastly more profitable to the citizens of this and other counties if left in its present condition, or preferably in a condition that will result from a careful protection of the forests against fires and wasteful methods of lumbering.

HAMPSHIRE COUNTY.

Location and Area.

Hampshire, the oldest county in West Virginia, was formed in 1754. At that time the outlines of the area were not definitely defined but included most of the South Branch valley and an indefinite boundary to the west. The area was reduced in 1785 by the formation of Hardy county, which then included Grant and a portion of Pendleton; in 1820 when Morgan county was formed; and again in 1866 by the formation of Mineral county. Hampshire touches Morgan county on the northeast, Maryland on the north, Virginia on the east and is bounded on the south west and north by Hardy and Mineral counties. Its area is 662 square miles or 423,680 acres.

Topography.

The principal mountains of the county are Mill Creek mountain, South Branch mountain, Short mountain, Sandy Ridge, Great North mountain and Cacapon mountain. The main trend

of the mountains is northeast and southwest; but in many places streams of water have so disfigured them that they are no longer in the form of continuous ridges but are broken into a succession of oblong and irregular elevations. The topography of Hampshire has been described thus:

“While the county is hilly or mountainous, it yet has no mountains equalling in height and ruggedness those of some of the counties west, particularly Grant, Pendleton, Pocahontas, Greenbrier, Webster and Randolph. The most elevated point in Hampshire county is 3,100 feet above the sea. The lowest point is the bed of Capon river where it flows across the line from Hampshire into Morgan 510 feet. The county, therefore, has a vertical range of 2,590 feet. Every point in Hampshire lies somewhere between these two extremes. The average elevation is probably not far from 1,200 feet. It is a prominent feature of the mountains of this county that they have few peaks which rise sharply above the surrounding ranges. This is because the mountains of Hampshire county are very old, geologically considered, and peaks which may once have existed have been worn down till they now rise little above the ridges, and appear as broad, rounded domes.”*

About 2 miles east of Greenspring Station the North and South Branches flow together and form the Potomac river, which flows for several miles along the northern border of the county. The principal streams flowing northeast through the county, and named from west to east, are the South Branch, the Little Cacapon, the North river and the Cacapon river.

The Original Timber Conditions.

Despite the fact that the county was settled at an early date, most of the timber cut before the building of the branch railroad from the main line to Romney in 1884, was destroyed by fire or used for domestic purposes. For this reason much practically virgin timber was standing 30 years ago, and several of the less valuable virgin tracts have been preserved to the present day. The men who remember the undisturbed forests of the valleys and fertile hills speak of them as “excellent tim-

*“History of Hampshire County”—Maxwell and Swisher.

berlands, containing large numbers of such trees as the oaks, walnuts, elms, hickories, maples and pines". The principal softwood was yellow pine, though this did not grow in pure stands, generally. White pine was often found but was said to be of an inferior quality. Scrub pine was abundant, especially in poor, gravelly soils; and the other two indigenous pines, as well as red cedar and hemlock, grew in small numbers locally.

Early Settlements and the Lumber Industry.

George Washington speaks of "a great company of people, men, women, and children who followed us through the woods" when he was surveying in the South Branch valley in the spring of 1748. The "people" referred to—who all spoke "dutch"—were Germans who had settled this region at that early date in considerable numbers. That is, settlement began in this county over 150 years ago. For the first 100 years, at least, there was little timber cut for commercial purposes; but vast quantities were necessarily destroyed by fire during this period and much was used for various purposes about the pioneers' homes. Mr. I. H. C. Pancake, of Romney, states that in an early day there was no general shipment of lumber out of the county and that most of the lumber for home use was sawed on the old-time water saw mills, several of which were located on the streams at various points. In 1835 there were 9 of these water saw mills, 1 cabinet maker's shop, 2 wagon maker's shops, 2 chair-making establishments and 3 tan yards in Hampshire county. The principal lumber sawed on the water mills was yellow pine and a little yellow poplar and other of the softer woods.

A limited shipment of lumber from the northern end of the county followed the building of the main Baltimore and Ohio railroad, and before that time there had been some floating done on the South Branch and the Great Cacapon.

From the year 1875 to 1885 considerable lumber was sawed in the vicinity of Romney and traded to merchants for goods. Good yellow pine was valued at \$9.00 a thousand feet. A part of this lumber was disposed of to lumber dealers and the rest stacked near the stores and sold in small or large quantities to

the local citizens as they needed it. The merchants also took large numbers of white oak shingles "for trade".

An active lumber industry, in which portable saw mills figured prominently, began with the building of the branch railroad before mentioned. Lumber from the portable mills was hauled in wagons and shipped from Romney and other stations on the branch or main line railroads. For the last 25 years there has been a constant drain upon the remaining forests, and the extensive virgin areas have been reduced to comparatively small and isolated tracts. There are a few active lumber operations at present in the county. Most of the owners of saw mills, however, run their mills irregularly through the winter and in the fall use their engines for threshing grain.

Two firms located at Romney still ship large numbers of cross-ties, but the trade in lumber has fallen off during recent years.

The Present Forest Conditions.

The virgin forests of the county, which aggregate about 12,000 acres, lie principally toward the southern end and are situated upon the mountains. A virgin forest of considerable extent still remains upon the eastern face of South Branch mountain a few miles south of Romney; and there are other large tracts on the northern end of Short mountain, and on Great North mountain near the Virginia line. The cut-over forests, aggregating about 15,000 acres, are in Bloomery district in the northern end, on the western face of South Branch mountain, and in smaller areas throughout the mountainous parts of the county.

Probably one-third of all the land is cleared. Romney district is largely improved; Mill Creek, Springfield, and Gore districts have scattered improvements; Sherman and Capon districts have numerous improvements at the bases of the mountains, the farmers' woodlots often extending from their cleared lands to the summits of the wooded mountains. Bloomery district in the northeastern end, is roughest and least improved. There are, perhaps, 50,000 acres of non-agricultural land in the county covered with a growth of scrubby timber. It should be

stated, however, that much land considered almost worthless in the past has been found in recent years to be well adapted to fruit-growing.

The trees most commonly found on the dry, wooded hills at present are scrub pine, chestnut oak, scarlet oak, scrub oak, and black oak. With these grow scattered locusts, pitch pines, table mountain pines and a few chestnuts. The lower lands now produce such timbers as white ash, black and white walnuts, white and slippery elms, cucumber, basswood, sugar maple, and many others.

HANCOCK COUNTY.

Location and Area.

Hancock, the most northern and the smallest county of the State, was divided from Brooke in 1848. Its area is 86 square miles or 55,040 acres.

Topography.

The surface of the county is hilly but smooth and well adapted to farming and fruit growing. The least elevation is 666 feet at the Ohio river and the greatest is 1,337 feet at the summit of a high hill near Chester in the northern end.

The Ohio river and its tributaries, of which the chief are Kings creek and Tomlinson creek, furnish ample drainage for the county.

Early Timber Conditions.

The excellent hardwoods of this county were white oak, black walnut, locust, hickory, cherry and sugar maple. There were good stands, also, in the original forests of beech, white elm, sycamore, basswood, and many others usually associated with these species. There were scattered trees of white pine and hemlock and a few red cedars.

The Lumber Industry.

A limited number of water power saw mills once operated in the county but the quantity of lumber manufactured on these was not large. The timber not cut by farmers in an early day, and not destroyed in the tan yard and hoop pole industries, has largely been sawed by small portable saw mills. These began to operate about 35 years ago and 3 or 4 mills are still in operation.

The stave industry has taken considerable of the choice white oak, once so abundant in the forests of the county. Three stave mills are now operating in a small way.

Present Timber Conditions.

Farmers own all the woodland that remains in the county. Perhaps not less than 80 per cent of the land has been cleared. A few of the woodlot areas contain valuable timber but, in nearly all cases, it has been closely cut, leaving only the small and imperfect trees.

HARDY COUNTY.

Location and Area.

Hardy county was formed from part of Hampshire county in the year 1786. It is the second county on the border south of the eastern panhandle. Its area is 594 square miles or 380,160 acres.

Topography.

The surface of the county is similar to that of Hampshire, being a succession of parallel mountain ridges and river valleys. On the west, followed by the Hardy-Grant boundary line, is Patterson Creek Mountain with an elevation of 3,000 feet in some places. East of this, and near the center of the county, are South mountain, Branch mountain, Short mountain and Big ridge. The line which separates the county from Shen-

andoah and Frederick counties, Virginia, on the east, follows North mountain for many miles at an elevation of about 3,000 feet. In some places the higher ridges are broken by eastward and westward flowing streams and the foot-hills or lesser ridges, some of which rise only a few hundred feet above the valleys, are everywhere interrupted in this way.

The principal rivers of the county are the South Branch of the Potomac, with its South Fork or Moorefield tributary, and the Lost river. The former enters the area from Grant county through the picturesque Petersburg Gap. From the place where it emerges from the gap the river flows through a broad and fertile valley, past Moorefield the county seat, where the volume of water is doubled by its confluence with the South Fork. From this place it flows on in the same northeasterly direction through a still wider and more fertile valley to the mouth of Mud Lick run. Here the valley comes to a sudden end, the steep slopes of Mill Creek mountain on the west and those of a lower, narrower ridge on the east descending to the very water's edge and forming for a distance of about 7 miles a deep and symmetrical canon, known as the "Trough." The Lost river flows several miles northwestward and parallel with the southeastern line of the county. A short distance above the town of Wardensville the river disappears under a hill, reappearing a mile or more below. Below this underground or "lost" portion of the channel, which gives the upper course of the stream its name, the river is known as Cacapon or Great Cacapon through the counties of Hampshire and Morgan. The North river, a large tributary of the Cacapon, rises in the northern end of Hardy county.

Original Timber Conditions.

As a whole, the county was not heavily timbered. The principal valleys and the rich mountain coves, however, once contained a dense stand of oaks, hickories, walnuts, ash, basswood, and many other hardwoods. The timber has been removed from nearly all the bottom lands but a few remaining virgin woodlots furnish evidence of the superiority of the valley timbers. Up to about 1891 the county contained a considerable quantity

STACKING TANBARK AT ROMNEY, HAMPSHIRE COUNTY.

of good pine. White oak and chestnut oak were the leading timbers, both growing abundantly, the former in nearly all sections and the latter on dry ridges and exposed mountain faces. The stand of timber per acre on the remaining virgin tracts varies from about 500 feet to 5,000 feet. A stand of timber far in excess of this once occupied the rich lands that have been cleared for agricultural purposes.

The original forests of the county, as indicated by the large virgin areas still to be found on some of the mountains and in the farmers' woodlots, were preeminently forests of oak. The 12 species of oaks named below were observed during a 2 hour's drive near Moorefield on September 10th, 1909:

- Red Oak (*Quercus rubra*).
- Pin Oak (*Quercus palustris*).
- Scarlet Oak (*Quercus coccinea*).
- Black Oak (*Quercus velutina*).
- Scrub Oak (*Quercus nana*).
- Shingle Oak (*Quercus imbricaria*).
- White Oak (*Quercus alba*).
- Post Oak (*Quercus minor*).
- Mossy-cup Oak (*Quercus macrocarpa*).
- Swamp White Oak (*Quercus platanooides*).
- Chestnut Oak (*Quercus Prinus*).
- Yellow Oak (*Quercus acuminata*).

Another species, the Black Jack Oak (*Quercus Marilandica*) is reported by Dr. C. F. Millspaugh from the same locality.

The Lumber Industry.

The lumber business in this area which, until within the present year has been far removed from railroads and other means of rapid transportation, is not comparable with the enormous industry which exists in many other parts of West Virginia. Naturally, there never have been any large mills in the county, and all the sawing, so far, has been done by the old-fashioned upright water saw mills and by small portable steam mills which were hauled in on wagons and by traction engines. The first steam saw mill was brought in by F. B. Welton and

placed just below the Petersburg Gap in the southwest end of the county. About a dozen saw mills are now in operation.

The cross-tie industry has taken out, it is said, about 70,000 ties a year for the past 10 years. Most of these have been rafted down the South Branch to Romney and shipped from there by rail.

Much of the good walnut has been hauled out on wagons and exported in the log.

On the east side of the county some good pine timber was hauled to Virginia for building purposes several years ago.

According to Martin's "Gazetteer of Virginia and the District of Columbia", there were 2 tan yards, 2 wagon makers and 1 chair maker in Hardy county (then embracing Grant) in 1835. A large quantity of excellent chestnut oak has been wasted at the early tan yards and the larger tanneries of more recent years. According to Mr. C. B. Welton, of Moorefield, the trunks of the thousands of chestnut oak trees that were peeled in the early days and up to about 5 years ago by the owners of the larger tanneries in Virginia and at Lost City and Moorefield, were left on the ground to decay.

Shingles and locust posts were often traded to merchants for goods during the period of early settlement.

The Present Forest Conditions.

Hardy county still contains about 64,000 acres of virgin woodland. This lies principally on both sides of the South Fork of the Potomac in the southeast and in scattered boundaries of various sizes along the principal mountains, as seen from the map which accompanies this report. Outside of this there is a large acreage of inferior woodland upon the low, sandy ridges lying back from the river bottoms. On these areas are to be found a more or less dense stand of scrub pine, "jack" oak, and others of little commercial value. There are many small areas from which the best timber has been taken, but these are owned by farmers and hence are not classed as cut-over land.

In some localities where the mature pine timber was killed by insects about 18 years ago there is a slight reproduction of softwoods, such as yellow pine, white pine, pitch pine, scrub

pine, and table mountain pine, and in many places an excellent stand of young locusts, oaks, chestnuts, ashes, poplars and others.

Perhaps not more than 25 per cent of the whole county is cleared for cultivation and grazing purposes. Moorefield district, including the best of the South Branch valley, is the most improved section; and South Fork district, embracing much of the mountain woodland on the southeast, is the roughest and least improved.

HARRISON COUNTY.

Location and Area.

Harrison county, formed in 1784 from part of Monongalia, lies in the north-central part of the State. Its area is 416.18 square miles or 266,355.2 acres.

Topography.

The hills of most sections of the county are comparatively low and smooth. There are valleys of considerable extent along the West Fork river from Clarksburg to the Barbour line and along Simpson creek, Elk creek and Tenmile creek.

West Fork river, the principal stream of the county, flows northward, passing a little east of the center. Its larger tributaries from the east are Shinns run, Simpson creek, Elk creek, Browns creek, Lost creek, Duck creek and Hackers creek. Those flowing in from the west are Bingamon creek, Jones creek, Tenmile creek, Lambert run, Coburn creek, Sycamore creek, Buffalo creek, Isaacs creek and Two Lick creek. The whole area is drained by the streams named above, with their tributaries, except that Booths creek and Coons run, tributaries also of the West Fork, drain a small area in the northeast.

Original Timber Conditions.

It is difficult now to find any more than a trace of the original forests. The quality of timber in small isolated areas, however, together with the unusual fertility of the soil and other

favorable natural conditions, justify us in asserting that no county in the State had a larger and more uniform boundary of superior hardwoods. Nearly every species of hardwood common to central West Virginia grew here but those which should be especially mentioned were yellow poplar, white oak, red oak, black walnut, hickory, white ash and sugar maple. There were no softwoods of any consequence.

The Lumber Industry.

The rich and easily cultivated lands of Harrison county invited settlement and the clearing of large areas before the timber had a commercial value. The removal of timber from farms in all sections has made an extensive lumber industry,—such as has been carried on in other parts of the State—an impossibility. There were saw mills, it is true, operating along several of the streams in an early day; but these were of the usual primitive type and manufactured lumber in small amounts for domestic use only. An early writer, speaking of the industries in Harrison county, informs us that there were 6 saw mills running in the year 1835.

Poplar, oak, and some other timbers have been floated out on the West Fork river, going to Pittsburg, Brownsville, Rices Landing, Beaver and other points along the Monongahela and Ohio rivers.

Most of the timber not destroyed by the settlers has been sawed by portable mills which have moved from place to place during the last 40 or 50 years. As a rule the operations have been most numerous and active in the localities made accessible by the building of railroads. According to Haymond's "History of Harrison County" published in 1909, the principal railroads of the county were completed as follows:

Baltimore and Ohio railroad to Clarksburg in 1856.

Monongah railroad in 1889.

West Virginia and Pittsburg railroad in 1879.

Short Line railroad in 1901.

Present Forest Conditions.

About 80 per cent of the county has been cleared and is now in a good state of cultivation. The remainder of the area is in woodlots ranging in size from 1 or 2 acres up to 100 acres or more. Woodland is more plentiful on the western edge of the county than in other sections. Mr. R. T. Lowndes, of Clarksburg, mentions a broken tract of about 2,000 acres of culled forest lying on Indian run, a tributary of Tennile creek in the western part of the county.

JACKSON COUNTY.

Location and Area.

Jackson county lies on the Ohio river between Mason on the southwest and Wood on the north. It was formed from parts of Kanawha, Wood and Mason counties in 1831. Area, 470.29 square miles or 300,985.6 acres.

Topography.

Like other counties lying along the Ohio river Jackson has a surface diversified with hills and valleys. In most parts the hills are low and smooth, admitting of easy cultivation. The steepest and roughest land is found on the hillsides facing the Ohio river at several places, and along some of the streams, particularly the headwaters of the Right and Left forks of Sandy creek, the several headwaters of Mill creek, and the Middle fork of Pocatalico river. The Ohio river valley averages a mile in width from Millwood northward for about 5 miles and about the same width for nearly 3 miles in the vicinity of Ravenswood. To the north and south of the wide valleys named, and for a short distance between them, the hills descend abruptly to the water's edge, except that from Murrayville southward for about 5 miles there is a narrow valley widening at Muses Bottom to nearly half a mile. Both Mill creek and Sandy creek have bottoms of a width varying from a few rods toward their heads to almost a mile at a few points along their lower courses.

The drainage is principally through Mill creek, Sandy creek, Little Sandy creek, and through numerous smaller streams and the tributaries of Pond creek to the Ohio river, which forms the irregular western boundary of the county for about 30 miles. An area of considerable extent in the south is drained by the Middle and Left forks of the Pocatalico river.

Original Timber Conditions.

Jackson county once had an immense amount of fine white oak, yellow pine, yellow poplar, chestnut, black walnut, red oak, black oak, chestnut oak, beech and hickory, with smaller amounts of white elm, sugar maple, red maple, basswood, white ash, sycamore, white walnut, hemlock, white pine, black gum and others usually found with them. Yellow pine grew on sandy hills and south exposures in nearly all parts of the county but more abundantly toward the northeast.

The Lumber Industry.

By the year 1830 there was a store and blacksmith shop at Ripley, the present county seat, and several settlements had been made along the Ohio river and at other places inland. It is hardly necessary to mention that here, as elsewhere, some of the best timber was destroyed by the early settlers who needed the use of the land more than they needed the timber. The small amount of lumber used in the construction of rude dwellings and outbuildings was sawed by hand or on upright or sash saw mills run by water power. As early as 1835 there were 5 combination grist and sash saw mills on Mill creek and probably others on Sandy creek. These sawed for domestic use and some lumber from them was rafted to the Ohio river and there sold to dealers.

Extensive floating has been carried on along Mill creek, Sandy creek and Pocatalico river. Logs floated by private owners and by companies were caught in booms at the mouths of the 3 streams named above. Here they were rafted and taken to Cincinnati and other cities along the Ohio. Cole and Crane of Cincinnati were the principal rafters and took out an enormous quantity of poplar, oak and yellow pine from about 1880

to 1897. According to Mr. B. F. Armstrong, of Ripley, steam saw mills were brought to the interior of the county about the year 1870. At least 1 steam saw mill was in operation in the river valley in 1847. Between 1870 and the completion of the Ripley branch of the Baltimore and Ohio railroad in 1888 the steam saw milling consisted largely in the cutting of cross-ties. These were floated on the creeks and caught in the booms at their mouths. After the extension of the branch railroads up Mill creek to Ripley, at the date given above, and up Sandy creek 4 years later, many portable saw mills were put in operation and the lumber manufactured by them shipped from Ripley, Evans, and other stations. The several saw mills now in operation saw cross-ties and a little lumber in the winter and thresh grain in the summer and fall. No band mills have operated at any time in the county.

The cross-tie industry has been extensive for 20 years, and many were cut before that time. About 75,000 ties were cut in the county in 1909. In 1908, 150,000 were cut, and not fewer than half a million went out during some single years preceding this.

Much of the good white oak was manufactured into split, bucked and sawed staves. The staves were floated or hauled to the Ohio river and there were sold to the coopers of Parkersburg and other cities. It is stated that as many as 75 teams could often be seen in a day hauling staves on the Ravenswood road. The staves were hauled from far in the interior and frequently 2 or 3 days were required to make the trip. Merchants frequently bought staves and shingles, paying for them with goods or cash.

Boatbuilding has been the leading industry at Murrayville since the year 1837. An historical sketch which appeared in the *Jackson Herald* of February 4, 1910, is interesting not only in outlining the progress of this early enterprise, but also in throwing light on the primitive methods of lumber manufacture in that locality 70 years ago:

"In the fall of 1837, Elijah Murray and Capt. Wm. Hicks bought the land now occupied as the boat yard, and comprising the upper part of the town, for the purpose of carrying on the business of boat building, and in the spring of 1838 commenced

operations. Mr. Murray, from whom the town derived its name, and who acted as foreman in the business, remained about two years, but becoming financially embarrassed, sold out and removed to some point below. The business was then carried on by Capt. Wm. Hicks, John Roberts and R. W. Skillenger. * * *

* * * * * During the year 1847 the steam saw mill was erected by James F. Scott, John Roberts and R. W. Skillenger, who continued the business of boat building. Many were the disadvantages under which boat building was carried on during the first eight or ten years. There was no saw mill in the country, and the lumber was procured by the soul killing method, commonly called "whip sawing." Among these old pioneer "whip sawyers" we find the names of Samuel Swain, Joseph Grim, Samuel Craig, Samuel Pearson, Eli Powell, George Caster, Jacob Brinkerstaff, Damon Springer, Samuel White, and two men from Mill Creek, John Tall and J. Thomas, commonly known as the "Red men from the East." Among the pioneer ship carpenters we find the names of R. W. Skillenger, John M. Whealdon, Benj. Ollom, Jerry Ollom, John Bell, Thomas Bell, Frank Bell, Adam Parker, Thomas Fry, and many others. R. W. Skillenger became foreman in the yard in the year 1840, and occupied the position until the spring of 1884, making his term of service about forty years. * * * * *

"Following is a list of the steam boats built at Murrayville, in the order as they were built, and the names of the parties for whom they were built:"

NAMES OF BOATS.

PARTIES FOR WHOM BUILT.

Amazon	Capt. Louderbeck
Miami	Capt. Greene
Gen. Scott.....	Capt. Dobbins
Scioto Valley.....	Capt. Hicks
Ohio Valley.....	Davis & Smith
Oneida.....	Davis & Smith
Congress.....	Capt. Hicks
Importer.....	Capt. Johnson
Lancet.....	Capt. Hicks
Fort Wayne.....	Capt. Hicks
Louis Phillip.....	Rogers & Co.
Scioto.....	Davis & Smith

A SHADED LIMESTONE ROAD IN THE SHENANDOAH VALLEY, JEFFERSON COUNTY.

A. N. Johnson.....	Capt. Bennett
Beacon.....	Capt. Shaw
Car of Commerce.....	Davis & Smith
Audubon.....	Martin & Anchutz
Yuba.....	Capt. R. Hill
David Gibson.....	Capt. McKinley
City Bell.....	Capt. Hicks
Bayou Bell.....	Capt. Walker
Shelby.....	Capt. Bishop
Ham Howell.....	Capt. Robb
Reuben White.....	Capt. Shelby
Free Stone.....	Garrett & Co.
Chatahula.....	Capt. Walker
Emperor.....	Capt. Reno
Glide.....	Capt. Anderson
Revenue.....	Capt. Booth
St. John.....	List & Co.
R. R. Hudson.....	Capt. Russell
Quick Step.....	Capt. Smith
Oriole.....	Capt. Dowry
Hope.....	Capt. Davis
Ed. Hobbs.....	Capt. Hornbrook
R. W. Skillenger.....	Capt. Flesher
Prairie City.....	Capt. Flesher
H. Lindsay.....	Capt. Barrett
Moulton.....	Capt. Barrett
Irvin.....	Capt. White
Hudson.....	Capt. List
N. J. Roberts.....	Capt. Roberts
St. Lawrence.....	Capt. List
Sidney.....	Capt. List

“In addition to the steam boats, there has been a great number of barges and wharf boats built; among which, the great mammoth wharf boat at Cincinnati was built for Capt. McCoy. The business of boat building is still (1884) carried on by A. J. Flesher & Son.”

Present Forest Conditions.

All the land of the county—of which at least 80 per cent is cleared—is owned and occupied by farmers. The woodland is chiefly in scattered second growth woodlots. Some farmers, particularly those in Ripley and Washington districts, have areas of 75 to 300 acres of practically virgin forest. A few of those holding the larger areas of this kind are J. L. Starcher, 150 acres; J. H. G. Winters, 150 acres; L. D. Parsons, 250 acres; E. Thomas, 150 acres; G. W. Anderson, 100 acres; Alice Rogers, 300 acres. There are many smaller woodlots containing good timber, but those with second growth and inferior stands predominate.

JEFFERSON COUNTY.

Location and Area.

Jefferson county was formed from part of Berkeley in the year 1801. It is the easternmost county in West Virginia and is bounded on the north by Maryland, on the east and south by Virginia, and on the west by Berkeley county. The area is 213 square miles or 136,320 acres.

Topography.

This county lies in the valley of the Potomac and the Shenandoah rivers and has a rolling surface throughout its entire extent, except in the southeast where the Blue Ridge mountains rise abruptly from the east bank of the Shenandoah. The eastern line touches the highest point in the county and the lowest point in the state; namely, 1,600 feet on the Blue Ridge, and 260 feet a short distance below the junction of the Potomac and Shenandoah rivers.

The area is amply supplied with drainage by the Potomac and the Shenandoah rivers, the former flowing at the north, and the latter at the western base of the Blue Ridge on the east. Lucas run empties into the Potomac about 3 miles below Shepherdstown.

and Elk branch empties just above Harpers Ferry. The chief tributaries of the Shenandoah in the county, named from Harpers Ferry up-stream, are Flowing run, Cattail run, Evitt run, Bullskin run and Long Marsh run. Opequon creek and Rocky Marsh run form a part of the boundary line between Jefferson and Berkeley.

Original Timber Conditions.

The fertile limestone areas of the county once contained a superior stand of hardwoods. Of these the chief were probably white oak, red oak, hickory, poplar, ash, and black walnut. Others of the hill land were chestnut (on Blue Ridge) pitch pine, scrub pine, locust, chestnut oak and scarlet oak.

No definite data can now be collected regarding original conditions as the forests have long since been cleared away or stripped of their virgin growth.

The Lumber Industry.

Jefferson county has been settled for nearly 200 years. For more than 100 years, certainly, after the settlement of Shepherds-town (then Mecklenberg) in 1727, there could have been little or no commercial use made of the trees that were cut. When the Baltimore and Ohio railroad reached Harpers Ferry in December, 1834, however, the timber of the county began to have some marketable value, especially as it was of good quality and easily accessible from this terminus. From 1834 to the present the county has furnished a large amount of timber. Many of the young trees standing when the forests were first cut over reached a large size within a hundred years and were cut as a second crop.

Mr. J. Garland Hurst, of Harpers Ferry, says that water power saw mills were once common along the streams and sawed not only for domestic use but for commercial purposes as well. There is still one water-power saw mill in running order at Halltown on Flowing run. Steam saw mills have operated irregularly in the county for many years. Joseph Martin, an early writer on the resources of Virginia, lists 2 saw mills for

Jefferson county in 1835. One of these, located at Harpers Ferry, he asserts was "one of the most valuable mills in the United States."

There are 4 or 5 portable saw mills now in the county.

Present Forest Conditions.

At least 75 per cent of the whole county has been cleared. There are some small, pastured woodlots connected with the farms in the improved sections. The West Virginia side of the Blue Ridge mountains is largely covered with a growth of inferior hardwoods. There are areas of considerable extent also overgrown with scrub oaks and pines near the Berkeley county line.

KANAWHA COUNTY.

Location and Area.

The western portion of Virginia was once embraced by 5 counties, namely, Montgomery, Harrison, Monongalia, Ohio and Greenbrier. Kanawha county was formed from parts of Greenbrier and Montgomery in the year 1789. Its location is southwest of the center of the state, and its area is 872 square miles or 558,080 acres.

Topography.

The county has a varied surface, being mountainous in the east and south, hilly in other parts, with broad bottom lands along the Great Kanawha river. Mountain ridges have no regularity of trend or elevation, streams flow in almost every direction, and the whole area presents a varied topography difficult or impossible to describe accurately in detail. The lowest land is found where the Great Kanawha passes into Putnam county at 560 feet elevation. Little Gauley Mountains, in the eastern part, have an elevation of a little more than 1,500 feet; Big Knob, south of the town of Clendennin, rises to 1,487 feet;

Table Rock rises to 1,756 feet; and Johnson knob, in the southern end, reaches an elevation of 2,200 feet above the sea.

The Great Kanawha river flows in a northwest direction through the county for about 50 miles, passing a little south of the center. This is the principal stream and, with its tributaries, drains the entire area. The larger rivers and creeks which flow in from the north are Pocatalico river, Elk river, Campbell creek and Kelly creek. Those from the south are Coal river, Davis creek, Cabin creek and Paint creek. There are many others of smaller size, tributaries of the Kanawha and of the other rivers named above.

Original Timber Conditions.

Nearly all traces of the original forests have disappeared from the rich bottoms of the Great Kanawha and only here and there in the more remote sections can virgin conditions be found. For this reason, an examination of the area at the present day fails to reveal the nature of the original growth in the sections where the timber grew in greatest luxuriance.

Fortunately, writers have left a few paragraphs which mention incidentally some of the prevalent timbers of the Kanawha valley. In his "History of Kanawha County" Hon. Geo. W. Atkinson says:

"The Kanawha Valley was at one time literally covered and packed with the largest growths of nearly every variety of timber common to this latitude. Beech may be especially mentioned, which grew in great abundance in the low, flat portions of the entire valley. The heavy beech masts never failed to attract wild turkeys, pigeons, and bears, in numberless flocks and companies, every fall.

"The wide, level bottom on which Charleston now stands, was studded formerly with beech timber, and the pioneer hunters would come here every fall, from all the neighboring settlements, to kill their winter's bear meat. The bears would get so fat and lazy from eating beech mast, that they would hardly move out of the way of the hunter. * * * * *

During the summer of 1872 W. E. D. Scott visited the home of the late eminent naturalist William H. Edwards at

Coalburg and made collections and studies in company with Hon. William S. Edwards, the latter's son. In the "Story of a Bird Lover" Mr. Scott speaks of the region about Coalburg as follows:

"* * * * * The river is about a quarter of a mile wide, generally, winding in and out among the hills, which rise abruptly just back from the river, there being little bottom land. At the time I visited this region it was heavily timbered with a growth of poplar, beech, oak, and some chestnut, though beech was one of the most noticeable of the forest trees. Small streams flowed down at frequent intervals from the high hills above, which form a spur of the Allegheny Range. The elevations here can hardly be called mountains, as they attain a height of not more than seven hundred feet above the level of the river."

There is a tract of virgin forest lying on the waters of Kelly and Hughes creeks, containing 8,000 acres, on which a count of trees was recently made. This tract includes the poor land of hills, the steep bluffs of mountain streams, and the rich lands of coves and bottoms, and may be said to fairly represent the forests of considerable of the area. The kinds and numbers of trees are as follows:

Yellow poplar.....	9,831 trees.
Oaks	31,710 "
Beech	2,497 "
Maple, (red)	301 "
Chestnut	2,510 "
Pines	1,190 "
Basswood	671 "
Gum	509 "
Hickories	1,463 "
Ash	122 "
Birches	111 "
Sugar Maple	660 "
Black Walnut.....	62 "
Sycamore	5 "
Buckeye	3 "

The Lumber Industry:

A record of the part which the forests of Kanawha county have played in the activities of its residents, from the first settlement made by William Morris in 1774 to the present day, would require a volume. Important as were the products of the forests of the county, however, affecting the financial welfare, the occupation and the very character of almost every citizen, we find only here and there a brief reference to the reduction of the forests by early settlers or to the development of a later lumber industry in the papers and books that contain a record of the history of this region.

Much of the Kanawha valley was cleared and settled thickly before the timber had any considerable market value. In these days small quantities were used about the dwellings of the settlers but the amount was insignificant when compared with the enormous stand. One of the first uses made of timber, aside from that just mentioned, was in the manufacture of boxes, tubs and hogsheads in which large quantities of salt were sold from the furnaces above Charleston as early as the year 1808, and in the construction of log rafts and flat-boats on which the salt was taken down the river. Many of the receptacles and flat-boats, however, were made from timber outside the county.

Charleston has been the center of an enormous lumber industry for many years. A report of A. M. Scott, resident U. S. engineer in charge of the river at Charleston, shows the quantity of forest products that passed through Lock No. 6, four miles below Charleston, for the year ending June 30th, 1892, as follows:

Timber, 39,585,000 feet.

Tan-bark, 590 cords.

Railroad ties, 924,650.

Hoop-poles, 980,000.

Shingles, 2,750,000.

The report also shows that 44,400,000 feet of logs and lumber, 380,000 cross-ties, 1,405,000 oak staves and 240 cords of tan-bark came down Elk river during the same year.

Answering a recent inquiry concerning the past lumber

operations in the city of Charleston, Mr. Samuel Stephenson gives the following specific information:

"In regard to the early operations in Charleston, Kanawha county, I desire to say that there were a great many large mills located here at one time which have long since ceased operation.

"The Bibby mill was one of the oldest mills operated in this city. It was built a great many years ago and had a sash saw. Later a circular saw was put in its stead. This mill was operated until a few years ago.

"The Woodruffs owned and operated a mill from about 1872 to 1878. This was a large circular mill, capacity from 20,000 to 30,000 feet per day. The principal lumber manufactured and sawed at that time was walnut and poplar.

"Manley and Fraikill had a circular saw mill, capacity 15,000 to 20,000. They operated from 1874 to 1880; walnut being the principal timber manufactured.

"Behymer operated a circular saw mill from 1874 to 1882.

"In 1882 J. R. Huffman, the inventor of the band mill, built and operated two band mills within the city. One of these mills is still standing but doing no business.

"The Devereaux Lumber Company owned and operated a large band mill built about 1880 and run until 1904, when it was torn down and moved to Mississippi. This mill perhaps cut more timber than any other mill that operated in the city.

"Since the building of the Coal and Coke railroad up the Elk river most of the mills have quit business as their log supply could not easily be maintained.

"These are some of the oldest mills which operated extensively from 1875 to 1905. A great deal of timber which came out of the Elk river valley, from Kanawha county and from points farther up, was rafted and floated to Gallapoli and Cincinnati where it was manufactured. The dates given in regard to these early operations may be a little off, but in the main they are correct."

J. H. Diss Debar, Author of "The West Virginia Hand Book and Immigrant's Guide" published in 1870, speaks as follows of a company that operated in Charleston:

"A company of enterprising Pennsylvanians, with a capital of \$300,000 under the corporate style of "The Elk River Land,

CHIMNEY ROCK OVERLOOKING HARPERS FERRY AT BASE OF BLUE
RIDGE MOUNTAINS.

Improvement, Manufacturing and Boom Company" obtained a charter for the exclusive privilege of booming Elk river and its tributaries, as far up as the mouth of Holly river, and are now engaged in developing 80,000 acres of land in Webster and Braxton counties with saw mills, planing mills and business headquarters at Charleston.

"One of the first operations of this company was the shipping of 10,000 feet of black walnut plank."

The 5 band saw mills now operating in the county, except the one located on Kelly creek, are sawing timber which is obtained from other counties. A number of small lumber and stave mills are engaged in sawing in various parts of the county.

The Present Forest Conditions.

The largest forests of the county lie in the eastern end and along the southern border. There are about 8,800 acres remaining in virgin forest and 81,000 acres in cut-over forest.

Almost every acre of the Kanawha valley has been cleared, but in nearly all other parts of the county the area of woodland owned principally by farmers, approaches, equals or exceeds the area of cleared land. Jefferson, Union, Poca and Big Sandy districts have a large percentage of cleared lands, while Elk, Malden, Loudon, Washington and Cabin Creek districts have from 30 to 80 per cent of their area in timber, or in an unimproved condition. In the coal mining sections, especially, there are large areas overgrown with unprofitable thickets of stunted oaks, and with worthless species of shrubs and trees.

Mr. D. G. Courtney, a prominent lumberman of Charleston, estimates that the county has about one-tenth of its original timber left, and that approximately 60 per cent of this is oak, 20 per cent poplar, 18 per cent other deciduous trees, such as ash, basswood, chestnut, birch and walnut, and 2 per cent pines and hemlock.

LEWIS COUNTY.

Location and Area.

Lewis county, formed in the year 1816 from part of Harrison, is situated slightly north of the center of the State. Its area is 414 square miles or 264,960 acres.

Topography.

This county lies in what is often termed the high hilly section, occupying as it does a position intermediate between the Alleghany mountains and the low hilly region of the Ohio river. In nearly all sections the hills are steep and the ridges long and narrow. There are a few sections, as the smooth portions of Hackers Creek and Freemans Creek districts, where there are broad valleys and where the hills are rather rolling than rough. Sand Fork of Little Kanawha river leaves the county at an elevation of 770 feet; the West Fork river leaves at about 970 feet, and Hackers Creek leaves at a little less than 1,000 feet. Buckhannon mountain, Bald knob, Cochran knob, Pine knob, Rush knob and Sugar knob range in elevation from approximately 1,600 feet to 1,800 feet.

The largest stream of the county is West Fork river which rises in the southern end and flows northward, passing near the center of the county. Its largest right hand tributaries are Hackers creek, Stonecoal creek and Sand Fork. The principal left hand branches are Kincheloe creek, flowing between Lewis and Harrison, Freemans creek, Polk creek and Rush run. The headwaters of Oil creek, Sand Fork and Leading creek, tributaries of the Little Kanawha, drain a large territory in the southwest.

Original Timber Conditions.

The original forests of Lewis county were essentially hardwood. Hemlock was never plentiful as in some adjacent counties and other softwoods, such as pitch pine and red cedar, grew only in small scattered clumps. Yellow poplars, oaks, black walnuts, locusts, maples, hickories, beeches, and many other hardwoods

grew in every locality. In the fertile valleys of Hackers creek and West Fork river the stand of timber was once enormous, as indicated by a few remnants that still remain. The broad meadows of the bottom lands are almost everywhere adorned with magnificent specimens of such trees as black maple, white elm, sweet buckeye and white oak. Along the slow-flowing streams black willows, sycamores, box elders and many other water-loving trees grow in profusion. These individual trees and small areas of timberland furnish the most reliable and satisfactory information regarding the original forests.

The Lumber Industry.

More than half of the county was settled before timber could be sold for enough to justify the owners in getting it to market. The early settlements throughout the northern and eastern districts were supplied with such lumber as they needed by the water-power saw mills located along the streams of this region. That only the choice trees, such as soft yellow poplars and black walnuts were cut for this purpose, is shown by the clear and well preserved lumber in some of the old residences and out-buildings still to be found. All trees that were too large to be easily manufactured as well as all that were not within easy reach of some mill, were cut down and split into fence rails, boards, or punch-ions, or else rolled together in the clearings and burned.

There were large numbers of poplar logs floated on the West Fork river from about 1875 to 1890. This was before the time of an active industry at home and the logs were obtained at a low price. Mr. R. T. Lowndes, of Clarksburg, was the principal operator, during this period. He bought logs from the land owners along West Fork and its larger tributaries and floated them to Clarksburg where they were manufactured into lumber on his circular mills. W. E. Mick and Sons also floated logs within the same period.

There has never been a band saw mill in operation in the county. Portable stave and circular lumber mills have cut most of the timber not removed as described above. Almost every locality has had mills of the latter kind. The two districts which have been most thinly settled and in which the portable saw mill

industry has been most active are Collins Settlement and Courthouse, lying together in the southern and southwestern parts of the county. Most of the lumber from the small mills has been hauled to the railroad and shipped. It was not unusual for lumber to be hauled on wagons for a distance of 20 or 25 miles. Weston, Orlando, Roanoke, Arnold, and more recently, various stations along the Coal and Coke railroad, have been the shipping points for lumber. A private narrow gauge railroad, connecting Ireland with Walkersville on the Coal and Coke railroad, brings out the lumber from that section.

Among the most extensive operators of portable mills were S. Hinkle and Company, who carried on a lumber industry in Collins Settlement district for 20 years, and the Alton Lumber Company, which took out a large quantity of export oak. G. F. Stockert sawed about 33 million feet in 22 sets prior to the year 1888, when he moved his operations to Upshur county. During recent years from 15 to 20 small mills have been sawing irregularly.

Present Forest Conditions.

There are no extensive virgin or cut-over forests left in the county. Approximately 100,000 acres still remain in forest of some kind but all, or nearly all of this is in small woodlots connected with cleared lands. The farmers in most sections own sufficient timber for domestic use, and in some cases have reserved excellent stands of oak and other hardwoods.

LINCOLN COUNTY.

Location and Area.

Lincoln county was formed in 1867 from parts of Cabell, Putnam, Kanawha and Boone. It lies in the southwestern part of the state and is the southernmost of the second tier of counties east of the Ohio river. The area is 441 square miles or 282,240 acres.

Topography.

The surface of the county is uneven and hilly. There is a difference of only about 200 feet in the height of the hills in the eastern and western sections. Those in the west reach an elevation of 1,000 to 1,300 feet and the elevation of those in the east varies from 1,200 to 1,500 feet. The elevation of the Guyandot valley where the river leaves the county in the north-west is about 550 feet and that of the Coal river in the east is about 600 feet.

The county is well drained by Guyandot, Mud and Coal rivers. The Guyandot flows northward through the western part, the Mud river flows parallel with it through the center, and the Coal river flows northward along the eastern border. Each of these rivers has numerous small tributaries.

The Original Forests.

The leading timbers were yellow poplar, black walnut, white ash, black cherry, and white oak, red oak and chestnut oak. Other less valuable but plentiful timbers were beech, maples, hickories, birches, black gum, white elm, sycamore and others. There was a fairly good growth of hemlock in favorable localities throughout the county.

The Lumber Industry.

It may be stated that here, as in many of the other counties, there was a large but necessary destruction of fine timber in the clearings of the early settlers. The period of such destruction in Lincoln began about 1820 and lasted, approximately, for 50 years. The first farmers who occupied the northern and north-eastern sections of the county, principally along the water courses of Guyandot, Mud and Coal rivers, destroyed much valuable timber which could not be used for domestic purposes and which had no commercial value at that time and place. The poplars, walnuts and oaks grew to such a size that the early settlers found it difficult to clear their lands of them. The chief uses that could be made of timber in those days was

in the construction of log dwellings and outbuildings and for fencing. The first lumber was sawed with whip saws operated by hand. A little later a few water-power saw mills were built along the streams. One of these was operated by Charles Latin on the Mud river near the town of Hamlin, and another by David Porter 9 miles below.

In 1872 floating began on the Guyandot and Mud rivers. The first men to engage in this industry were Blankenship and Hoback who bought poplar timber near the Guyandot and Mud rivers. The trees that stood near enough were felled into the stream beds during the summer and fall, when the water was very low, and there cut into logs and left to await a freshet. Other logs were cut on the adjacent hillsides and hauled by oxen to the streams. Buying and floating was continued for about 30 years. Three of the most extensive operators are named below:

Prichard and Lewis, the largest floaters on the Guyandot, built dams on many of the tributaries of that river and "splashed" out the logs to the main stream. They operated from 1885 to 1895.

Alexander Henderson floated out large numbers of logs to the Ohio river during the years from 1895 to 1897.

Fulton Cummings rafted timber on the Mud river from 1890 to 1900.

It has been the custom of owners of small tracts of timberland for about 30 years, to raft their own timber to Guyandotte and Huntington where ready sale could be made to operators and timber dealers. The chief stave industry was conducted on the Mud river from 1880 to 1884. The methods employed were very wasteful as the best only of each tree cut was utilized.

Steam saw mills were introduced in 1880, being hauled in on wagons in that and succeeding years and placed at several of the more easily accessible points in the county. The lumber manufactured at first on these mills was rafted down the rivers and later was taken in boats. With the building of the railroads—the Guyandot Valley Branch in 1900 and the Coal River Branch in 1906—a large number of portable mills began opera-

tion. Many of these are still sawing. No stationary mills with great capacity have operated in the county.

The Present Forest Conditions.

The largest tract of virgin timber in the county lies on the head waters of Mud river along the Boone county line. A few miles farther north on the waters of Coal river there is another tract of smaller size. The 2 tracts, containing about 7,000 acres, comprise the virgin area in this county. The cut-over forests occupy an area of about 52,000 acres in the southern, south-central and eastern parts of the county. The best timber has been taken from the farmers' wood-lots but there is still left a good stand of small oaks, beeches, maples, birches, etc.

About 15 per cent of the county is unfit for agriculture. In recent years, however, a large number of acres of the rougher upland has been cleared for grazing purposes and for tobacco growing.

LOGAN COUNTY.

Location and Area.

Logan county, formed in 1824 from parts of Giles, Tazewell, Cabell and Kanawha, is situated in the southwestern part of the state. Its area is 494 square miles or 316,160 acres.

Topography.

The surface of the county presents many irregularities. Sharp ridges which extend in all directions alternate with the narrow valleys of numerous streams. The greatest elevations, ranging from 2,500 to 2,700 feet, are to be found near the eastern edge of the county where the boundary line crosses the southern end of Huff mountain, and farther north on the ridges which surround the Buffalo creek basin. Both the northern and southern boundary lines follow dividing ridges for long distances, and the hilly surface slopes downward to the Guyandot valley in the

center of the county. The Guyandot river enters the county from Mingo at about 700 feet elevation and crosses the line into Lincoln at 600 feet elevation. The channels of all the larger streams are below 1,000 feet. The 1,500 foot and 2,000 foot contour lines are not here continuous but are broken into a number of separate, irregular circles and ellipses surrounding the hill-tops and crests of narrow ridges.

Guyandot river flows northwestward through the center of Logan and, with Crawley creek, Island creek, Rich creek, Big Huff creek, Buffalo creek, Rum creek and Dingess run as its principal tributaries, drains almost the whole county. An area of about 25,000 acres in the northeastern part is drained by the head waters of Spruce fork of Little Coal river, and an area of less extent in the southwestern part is drained by the waters of Kiah creek, a tributary of the Left fork of Twelvepole.

The Original Forests.

The original hardwood forests of the county were equal in stand and quality to those of any other section of the state. It is doubtful, indeed, if black walnut trees of such unusual size and perfection could have been found anywhere else in West Virginia. J. M. Anderson cut a figured walnut which is said to have measured 7 feet in diameter and 80 feet to the first limb. It is stated that figured trees were common and that many were cut which equaled, or nearly equaled, in size the one mentioned above. The growth of yellow poplars, also, was almost phenomenal. A reliable citizens of Logan asserts that he saw and obtained measurements of a tree of this species 12 feet in diameter and with a long trunk which tapered evenly and moderately to the crown.

Below are given the approximate percentages of timber trees growing on two virgin tracts lying on opposite sides of the county.

PANORAMIC VIEW OF HOLDEN, LOGAN COUNTY. A model lumber and coal town equipped with hospital and club house, and with clean streets, grassy lawns, and many other convenient and attractive features.

The stand on a 13,000 acre tract on Buffalo creek is as follows:

Yellow Poplar	60 per cent.
White Ash	} 15 per cent.
Cucumber	
Basswood	} 25 per cent.
Oaks	
Hemlock	
Chestnut	
Hickory	
Beech and others	

The stand on a 13,000 acre tract on Guyandot river and Rich creek is as follows:

Oaks (principally White Oak).....	50 per cent.
Yellow Poplar	} 25 per cent.
Cucumber	
Basswood	} 25 per cent.
Hickory	
Chestnut	
Maples	
Beech	
Birch	} 25 per cent.
Locust	
Hemlock, and others,	

Hemlock, pitch pine and red cedar were the only softwoods. Cedars were not uncommon along the water courses and pitch pines were occasionally seen growing on dry ridges. Hemlock was more or less common in the stream channels of the eastern part of the county but rare in the western part.

The Early Lumber Industry.

Prior to the completion of the Guyandot Valley Branch of the Chesapeake and Ohio railroad to Logan in 1904, the Guyandot river furnished the only practicable means for the transportation of logs and manufactured lumber. Rafting was confined, through the early years of the county's existence, to a comparatively small industry carried on by the resident owners of land

adjacent to the river. The timber so removed was of the best quality, however, and not a few rafts were taken to the mouth of the river and there sold to operators or to timber dealers. The Little Kanawha Lumber Company of Portsmouth, Ohio, and The Yellow Poplar Lumber Company of Ironton, Ohio, were the first large companies to raft logs out of the county. The former company began in 1892 and rafted until 1899, taking thousands of rafts, principally of poplar, from Island creek and Dingess run and from various points along the Guyandot. The Yellow Poplar Lumber Company operated about the same time but not so extensively. C. Crane and Company of Cincinnati, Ohio, commenced rafting about 1896 and has continued to the present time, taking not less than 100,000,000 cubes of timber during the 14 years of operation.

The saw mill industry was very small before the building of the railroad. At the time of its completion, however, several portable mills were brought in and 2 or 3 large stationary mills. Most of these have continued to operate without intermission.

The Present Lumber Industry.

The only company still rafting extensively on the Guyandot is C. Crane and Company. The operations of this company will continue for a number of years.

The United States Coal and Oil Company has been operating a single band mill at Holden since 1904.

The Dimension Lumber Company has operated a band mill at Ethel for the past four years and has about completed the cutting on a large tract.

Boone Timber Company at Clothier on Spruce fork of Little Coal river has recently put a band mill in operation

Other saw mill operations in the county are few and small.

The Present Forest Conditions.

Logan county is divided into 3 magisterial districts,—Chapmansville, farthest north; Triadelphia, farthest south; and Logan in the middle. Chapmansville is a district of farms with about 5 per cent of the land owned by non-residents. In this dis-

trict, however, the land is rough and less than half cleared. About 70 per cent of Logan district is owned by non-residents and about 30 per cent of Triadelphia. The farm lands in the 2 districts last named are largely restricted to the narrow bottoms and the hillsides along the principal streams. About 10 per cent of the county is cleared and, altogether, 121,160 acres may be classed as farm and woodlot land. The remaining 195,000 acres are in forest. Of this 35,000 acres are in virgin forest and 160,000 acres are in cut-over forest. The principal virgin areas lie toward the eastern end of the county on Buffalo creek and on Rich creek and Guyandot river. Smaller tracts lie near the Mingo line and on the river a few miles north of the town of Logan. There is a stand of timber on these tracts of about 12,000 feet per acre of the species mentioned above under another head. The large areas of cut-over land, found through the central and eastern sections, contain, in some places, a good stand of the less valuable timbers. Much of the cut-over land on the northeast side of Guyandot river has a fair stand of excellent oak. This is particularly true of the territory south of Big Huff creek and between Big Huff and Buffalo creeks.

McDOWELL COUNTY.

Location and Area.

McDowell, formed in 1858 from a part of Tazewell, is the southernmost county in West Virginia. Its area is 673 square miles or 430,720 acres.

Topography.

The average elevation of McDowell is considerably below that of some of the counties, such as Pocahontas and Tucker which lie farther north along the Alleghany mountains. No one, however, who visits all of its parts or even crosses it from east to west over the Norfolk and Western railroad, will consider it improper to speak of the county as mountainous. The only part of the surface which lies below 1,000 feet is a narrow, branching

strip which borders the Tug Fork of Big Sandy river and its larger tributaries in the western part of the county. This low land enters from the west at an elevation of about 850 feet and extends up the main stream as far as Clear Fork, up Dry Fork to the mouth of Crane creek, up Panther and Bull creeks for a distance of about 2 miles and for shorter distances up the small tributaries that empty into the river below the mouth of Clear Fork. It is thus seen that almost the whole surface of the county lies above 1,000 feet. The elevation increases rapidly toward the east and large areas lie above 2,000 and 2,500 feet. At a point where the county's southern boundary line crosses the northern end of Sandy Ridge the elevation rises to 3,170 feet. The highest land is found, however, on the Great Flat Top mountain which rises to 3,300 feet in the extreme eastern part of the county.

The drainage basin of the upper Tug Fork of Big Sandy river, with Panther creek, Dry Fork, Clear Fork and Elkhorn creek as its principal tributaries, lies chiefly within McDowell county, a small part only extending into Tazewell county, Virginia. Elkhorn creek which rises in the eastern part of the county and Tug Fork, from the mouth of Elkhorn at Welch, to the Mingo line, both flow almost directly west and at a distance of from 2 to 6 miles south of Indian ridge. From this high ridge, which forms the natural boundary between McDowell and Wyoming counties, numerous short streams flow rapidly into Tug Fork and the Elkhorn. The southern tributaries of the river are longer and flow with a less rapid current.

Former Forest Conditions.

All sections of McDowell county once contained a large quantity of valuable timber except the very steep river bluffs and the more or less narrow strips of land lying on the sandy ridges. It may be said that yellow poplar and white oak were the predominant valuable hardwoods and that hemlock was the only softwood worthy of mention. There were many other hardwoods, however, that grew in merchantable quantities. Some of these were basswood, cucumber, white ash, black walnut, sugar maple, red oak, chestnut oak, black oak, chestnut, hickory, beech, locust and sweet buckeye. Percentages of the principal timber trees

standing on a 7,000 acre tract of virgin timber now remaining in the county are given approximately as follows:

Yellow Poplar	20 per cent.
White Oak	30 per cent.
Red Oak	} .10 per cent.
Chestnut Oak	
Black Oak	
Scarlet Oak	
Hemlock	20 per cent.
Basswood	} .5 per cent.
Cucumber	
White Ash	
Hickory	} 15 per cent.
Beech	
Chestnut	
Sugar Maple	
Red Maple	
Sweet Buckeye	
Sycamore.....	}
Birches and others.....	

Yellow poplar, white oak, red oak and some other hardwoods grew to an enormous size in the numerous narrow valleys and rich coves of McDowell county. A yellow poplar containing 12,500 feet of good lumber was cut on Longpole creek by Hamlet and Strother. The quality of several of the kinds of timber growing in this section of the state was unsurpassed. The sapwood was thin and the lumber clear and easily worked.

The Early Lumber Industry.

Comparatively little timber was destroyed in the "clearings" of the early settlers. The greater part of the county remains in forest even to the present day, the improvements being confined mainly within narrow limits along the principal water courses.

Before the completion of the Norfolk and Western railroad through the county in 1892, only a little timber had been cut ex-

cept in a limited way for domestic use. This was drifted down the Tug river and its lower tributaries which, at that time, furnished the only means of transportation. Very little had been taken even in this way east of the mouth of Clear Fork 14 miles below Welch. Yellow poplar which was rafted to Catlettsburg, Kentucky, and black walnut, cut in 1886, were the principal timbers removed in this way.

Later Lumber Operations.

Beginning about the year 1891 W. M. Ritter, with circular saw mills located on Shannon branch, Browns creek and at other points, removed timber from nearly all the land lying on the north side of the railroad from Welch to Hensley. A few years later he leased the large mill belonging to Panther Lumber Company then sawing timber from lands on Panther and Bull creeks. At the same time he bought the uncut timber belonging to the Company and an additional 50,000 acres lying on Panther creek and Dry Fork and began to operate under the firm name of The W. M. Ritter Lumber Company. In 1899 this company erected a large band mill at the mouth of Crane creek a tributary of Dry Fork and, in the following year, another on Beartown creek about 2 miles above. These 2 mills sawed the remaining timber from the 50,000 acre boundary known as the Lansburgh tract. The lumber from these mills was taken over the Company's private railroad which formed a junction with the Norfolk and Western railroad at the mouth of Dry Fork. The lumber railroad has since been acquired and extended to Berwind as a branch of the Norfolk and Western. W. M. Ritter, first with portable mills and later with the large stationary mills above referred to, has been the largest operator in the county.

C. L. Ritter Lumber Company operated a band mill at the mouth of Clear Fork of Tug river cutting most of the timber on that creek.

R. E. Wood Lumber Company, beginning in 1899 with a mill at Sandy Huff, cut the timber from the region up Sandy Huff creek.

The next large operation was that of Suddeth and Bailey Lumber Company. This company has sawed at Norwood, on Spice creek, on Jenny creek and at Shannon Branches.

Louis Carr, who operated first as Carr and McClure, later as Carr and Nunan, and still later as Norwood Lumber Company, cut timber from large tracts of land on Tug river and on Laurel creek, a northern tributary of Elkhorn.

Dr. W. R. Jaeger, as Jaeger and Brothers, 1892, operated a mill in Roderfield at the mouth of Spice creek. Only the choicest timber was taken by this company. That which remained was afterward sawed by Suddeth and Bailey Lumber Company and R. E. Wood Lumber Company.

The timber on 6,000 acres near Roderfield belonging to the McCormick estate was cut, principally, by R. E. Wood Lumber Company and by R. W. Higby.

The Longpole Lumber Company, Wyoming City, began in 1901 and cut over a tract lying on Fourpole, Longpole and Shortpole creeks.

The Carretta Lumber Company cut the timber on Barrenshe creek and Reedy Spring branch.

John R. McKinsey has been the principal manufacturer of staves. The stave industry in McDowell, however, has been of minor importance.

In addition to the larger lumber operations named above numerous small mills have been located at various points throughout the county. These have been prominent factors in the reduction of the original stand of timber.

Water saw mills, which have flourished in their day in many parts of the state, seem never to have found their way into McDowell county.

Present Forest Conditions.

There are perhaps not over 15,000 acres of cleared land in the county. Of this the native settlers, who occupy the narrow valleys of creeks and rivers, own less than one half. The balance is owned, principally, by coal companies. More than 95 per cent of the whole area must be classed as forest land. There yet remain about 15,000 acres of virgin timber land. This lies, principally, in 2 bodies, one of about 3,000 acres on the northwestern side of the Dry Fork of Tug and the other of about 12,000 acres on the opposite side of Dry Fork along the southern edge of the

county. The remaining 400,000 acres, or more, must be classed as cut-over forest.

The condition of the forest land varies considerably in the different localities. In many places, especially along the railroads and in the vicinity of large coal operations, the condition of the badly burned and cut-over land is not hopeful. In other sections, however, there is a sufficient stand of young trees of the species mentioned under the head of "Former Forest Conditions." Careful management of such areas will insure a profitable yield within a few years. The virgin timber land and the best of the cut-over land lies south of a line beginning at Bradshaw Station on the Dry Fork of Tug and running thence eastward to the Mercer county line by the way of Gary Station on the Tug river and the divide between the waters of Tug river and Elkhorn creek.

There are 87 coal companies in operation in the county with an average of 3 openings each. Practically all the timber land is owned by 3 or 4 of these companies. Large quantities of timber are required for mine props, mine ties, etc., and some of the large companies are purchasing their mine timbers from Virginia and Kentucky in order to conserve their own young growth.

MARION COUNTY.

Location and Area.

Marion county, formed in 1842 from parts of Monongalia and Harrison, is situated in the northern part of the state, being separated from Pennsylvania by Monongalia county and from Ohio by Wetzel county. Its area is 315.44 square miles or 201,881.6 acres.

Topography.

Like portions of Harrison and Taylor adjoining it on the south the surface of much of the county is roughened by low hills which are easily cultivated. Toward the heads of the streams, however, the hills become high and steep. The roughest portions are found in the western sections along the Wetzel

Photo by W. E. Ramsey.
VIRGIN SPRUCE FOREST NEAR HEAD OF NORTH FORK OF CHERRY RIVER.

line and in Winfield district in the east. The altitude of the county ranges from about 840 feet where the Monongahela river crosses the line in the northeast to a little over 2,000 feet in the extreme eastern corner.

The Tygarts Valley and West Fork rivers unite a short distance above Fairmont to form the Monongahela which flows northwestward into Monongalia county. The principal western tributaries of the Monongahela are Pawpaw creek and Buffalo creek, the latter with its Pyles and Davy Forks and other tributaries draining a large area in the center and west. Little creek and Prickett creek are the largest tributaries from the east. The tributaries of Tygarts Valley are small in this county. Booths creek, Coons creek, Tavebaugh creek and Little Bingamon creek are important tributaries of the West Fork.

Original Forest Conditions.

The forests of the county were hardwood and contained most excellent stands of poplar, oak, walnut, ash, maple, chestnut and others usually found growing with them. Softwoods were rarely found in any part of the county.

The Lumber Industry.

It is difficult at this late day to learn much in regard to the lumber industry in Marion county. The area has long been settled in most sections and the forest removed to give place to the cultivation of crops.

Early settlers depended on the water saw mills for their lumber until the steam saw mills were introduced 30 or 40 years ago. Since the introduction of these portable mills most of the timber of the county has been cut and shipped on the railroads from Fairmont, Mannington and Farmington. Less than a dozen portable mills are now in operation.

An immense quantity of timber was rafted down the Monongahela river in the form of hewed "steam-timber" and in the log during the period from about 1840 to 1890. During

that time it was the occupation of a number of lumbermen to buy logs in the interior and deliver them to other buyers at the river. Most of the rafts were taken to Pittsburg and other cities below.

Present Forest Conditions.

From 80 to 90 per cent of the county is cleared land. The woodland contains only a little good timber and is owned by farmers who hold it for domestic purposes in connection with their farms. In parts of Mannington and Lincoln districts, especially, there are woodlots of considerable size which contain valuable stands of hardwoods.

MARSHALL COUNTY.

Location and Area.

Marshall county, situated at the base of the Northern Panhandle, was formed in 1835 from part of Ohio county. Its area is 315.26 square miles or 201,766 acres.

Topography.

"This county has long been a rich agricultural area, especially north of an east and west line through the mouth of Fish Creek. South of this line, however, the hills are higher, steeper and rougher, and better adapted to grazing than to tillage."* The hillsides facing the streams throughout the county are rough and steep and the valleys mostly narrow. The elevation varies from 591 feet at the Ohio river to 1590 feet near the town of Rocklick in the eastern part.

The Ohio river flows at the western border of the county for about 28 miles. This stream with its main tributaries—Fish creek, Grave creek and Wheeling creek—furnishes abundant drainage.

*West Va. Geological Surv. Rep. of Marshall, Tyler, Wetzel Cos. p. 7.

Early Timber Conditions.

An annotated list of some of the principal timber trees of the county, by Mr. S. H. Bonar of Moundsville, is given below:

White Oak.—Abundant and of good quality.

Yellow Poplar.—Abundant and of good quality.

Chestnut Oak.—Plentiful on ridges.

White Ash.—Common.

Hickory.—Common.

Chestnut.—Common.

Beech.—Common.

Sugar Maple.—Common.

Locust.—Common.

Black Walnut.—Common.

Basswood.—Scattered growth.

Cherry.—Scattered growth.

Black Gum.—Scattered growth.

Red Oak.—Scattered growth.

White Walnut.—Scattered growth.

Red maple.—Scattered growth.

Hackberry.—Scattered growth.

Sweet Buckeye.—Scattered growth.

Ohio Buckeye.—Scattered growth.

Sycamore.—Common along streams.

White Ash.—Common along streams.

Hemlock.—Scattered growth in deep hollows and on sandy bluffs.

An area of virgin timber containing 1,250 acres was recently cut over which contained 12 million feet of choice oak and poplar. The tract produced, in addition to this, a large number of poles, bank props, etc. It is said that this tract was a fair representative of the best original forests of the county.

The Lumber Industry.

The lumber industry was begun in this county, as in others of this section of the state, by the introduction of sash saw mills, the larger creeks furnishing them with abundant water power. These mills ceased to run many years ago and

the names of their operators are not now easy to obtain. One of the last sash saw mills to survive was Lydick's mill at Glen Easton. This was supplied with steam power and continued to run until about 1876. At least 1 circular saw mill was run by water power. This was McCardle's mill on Upper Bowman run. After the more primitive mills came the portable steam saw mills. A few very small mills of this kind were running before 1876 but active operation did not begin until about that date. Portable mills became numerous at one time and most of the good timber that was standing at the time of their appearance has been sawed by them. No band mills have operated at any time in the county.

Barrels were furnished by local coopers to some of the grist mills several years ago. One of the last of these supplied Loudenslager's mill at Loudensville.

The tanneries of the county have all been small, and most of them operated at an early date. McConnell Brothers operated in Moundsville up to about the year 1900.

The lumber industry at present consists of the operations of about one dozen small saw mills scattered in different parts of the county. The various wood-working mills at Moundsville employ over 50 men in the manufacture of handles, grain cradles, boxes, barrels, excelsior and numerous planing mill products.

Present Timber Conditions.

There is no woodland in the county except small boundaries owned by the farmers. In the best parts the woodlots will not average more than 20 acres. According to those who are most familiar with conditions, about 60 per cent of the land is cleared and well cultivated; 20 per cent is in fairly well timbered woodlots; and 20 per cent is growing worthless trees and brush. Probably the best timbered tract now remaining contains about 60 acres and lies on Upper Bowman run in Meade district. The tract contains a fine stand of excellent white oaks. The timber on the last large virgin area was cut by Peerless Lumber Company between 1900 and 1904. This tract—known as the Goshorn tract—was situated on Maggoty run in Liberty district and contained about 1,250 acres.

MASON COUNTY.

Location and Area.

Mason county lies on the Ohio river south and west of Jackson and north of Cabell. It was formed in 1804 from part of Kanawha county. Its area is 449.27 square miles or 287,532.8 acres.

Topography.

The hills of the county are low and the slopes gentle, especially in the region embraced in the northwest by the Ohio and the Great Kanawha rivers. In the territory farthest back from the rivers the hills rise in some places to an elevation of a little more than 1,000 feet and the slopes are rough and steep. The bottoms of the Ohio and Great Kanawha rivers are wide in nearly all places in the county and comprise an area of over 50,000 acres.

The county is well drained by the Ohio and Great Kanawha rivers, the former separating it from Ohio on the north and west, and the latter flowing in a northwest course and emptying into the Ohio at Point Pleasant. The principal tributaries of the Ohio south of Point Pleasant are Guyan creek, Eighteenmile creek, Sixteenmile creek and Crab creek; those north of Point Pleasant are Oldtown creek, Mill creek, Tenmile creek, Sliding Hill creek, Broad creek and West creek. The principal tributaries of the Great Kanawha, named from its mouth to the Putnam county line, are Crooked creek, Threemile creek, Five-mile creek, Ninemile creek, Tenmile creek, Thirteenmile creek, Little Sixteenmile creek and Sixteenmile creek.

Original Timber Conditions.

The tree growth in the rich valleys of the two large rivers of the county, and the growth of all manner of plant life, was exceedingly luxuriant. According to Mr. John McCulloch, of Point Pleasant, grape vines often grew to such enormous size that some of them were split into rails for fencing; and the

poplars, oaks, black walnuts, wild cherries, hickories, and many others attained a size that was rarely reached in other parts of the state. The remarkable growth of timber in this region attracted the attention of early explorers. Christopher Gist, who was sent out from Virginia as an exploring agent of the Ohio Company, visited the Mason county area in 1751 and again in 1752. Under date of February 24th, 1751,—while encamped in the Ohio river valley some miles above the mouth of the Great Kanawha—this explorer made the following entry in his journal: “The bottoms about $1\frac{1}{2}$ miles wide, full of lofty timber.” On February 20th, 1752, he speaks of the Great Kanawha bottoms near the mouth of Thirteenmile creek, as “fine land” and as being “very rich.” Again on February 23rd, he refers to the Ohio river valley a few miles above Point Pleasant as “fine rich land, the bottoms about a mile wide.” It will be understood that the expressions “very rich”, and the like, carried with them the idea of good timber, for in the days of extensive forests, the trees furnished the best indication of the fertility of the soil.

On the 30th day of October, 1770, George Washington and party were at Letart Falls, on the Ohio river. He describes the appearance of the country as follows:

“* * *, We landed, and after getting a little distance from the river, we came, without resting, to a pretty lively kind of land, grown up with hickory and oak of different kinds, intermingled with walnut.”

On October 31st he says: “* * * I sent the canoe down about five miles, to the junction of the two rivers, that is, the Kanawha with the Ohio, and set out with a hunting party to view the land. * * * * *” Two days later the party encamped on the Great Kanawha at the mouth of Sixteenmile creek. At this place he wrote: “Some of our people went up the river four or five miles higher. * * * As you approach the hills, you come to a thin white oak land, and poor. The hills, as far as we could judge, were from half a mile to a mile from the river, poor and steep in the parts we saw, with pine growing on them. * * *”

On November 3rd, he says: “We set off down the river, on our return homewards, and encamped at the mouth. At

the beginning of the bottom, above the junction of the rivers, and at the mouth of the branch of the east side, I marked two maples, an elm, and a hoop-wood tree, as a corner of soldiers' land, if we can get it, intending to take all the bottom from hence to the rapids in the Great Bend in one survey. I also marked at the mouth of another run, lower down the west side, and at the lower end of the long bottom, an ash and hoop-wood tree, for the beginning of another of the soldiers' surveys, to extend up so as to include all the bottom in a body on the west side. In coming from our last encampment up the Kanawha, I endeavored to take the courses and distances of the river by my pocket compass, and by guessing. * * * November 4th: " * * * * * Just as we came to the hills, we met with a syacmore about sixty yards from the river, of a most extraordinary size; it measuring three feet from the ground, forty-five feet around, lacking two inches; and not fifty yards from it was another, thirty-one feet round. * * * * * " November 5th: " * * * * * The growth in most places, beech intermixed with walnut, but more especially with poplar, of which there are numbers very large. The land toward the upper end is a black oak, and very good. * * * * * "

Ten different kinds of trees are referred to in the above quotations from Washington's journal, and the two distinct types of land—the rich valley and the poor hill land,—are described according to the forest growth that each produced.

In answer to an inquiry concerning original timber conditions, etc., in Mason county, Hon. Virgil A. Lewis, State Historian and Archivist, gives the following interesting account:

"I remember something of the forest conditions in Mason county fifty years ago, that is to say, about the beginning of the Civil War. The entire county was a remarkable forest region. At that time there were "clearings" or "improvements" throughout all the hill country. Along the two rivers, Ohio and Great Kanawha, the county has a frontage of ninety-two miles; and it may be said that there are about ninety-two square miles of level bottom land. This was then, as now, the chief agricultural region of the county; but there were still magnificent forest preserves belonging to large estates along

both rivers. Over them grew gigantic poplars, walnuts, and wild cherries, with lofty hickories and with oaks of various kinds, including the famed Spanish oak, some of which were five feet in diameter. Over the whole region were forests of square miles in extent which had scarcely been reached by the woodsman's axe. Here grew the sugar maples in dense groves, and the spring of the year was the happy sugar-making time when thousands of pounds of maple sugar were made and shipped to various points. In the early days many hundreds of bird's-eye poplars (then called "cat-faced poplars") were felled and rolled into the streams to be floated away or put in heaps and burned in the "clearings" then being opened. Many of the finest trees were used in the building of "worm fences." The ordinary "rail cut" from which the rails were split was usually eleven feet in length. Oak and poplar, and even walnut trees were used for this purpose. I yet remember how readily the walnut "cuts" split and how many hundreds of panels of fence were built of this valuable wood.

"I have no doubt, if the present value of lumber should be placed upon the timber burned in the "clearings" in Mason county, on the hills, along the streams and on the bottoms, from the coming of the first white man in 1774 down to the year 1860, that it would aggregate many millions of dollars."

A two story house once built near the present town of Ashton was constructed, almost entirely, of walnut logs. The house was in a remarkably good state of preservation when it burned a few years ago.

The Lumber Industry.

The destruction of timber by early settlers is mentioned in the foregoing paragraphs. During the period when the forests were being opened there were here and there the old water-power saw mills, which manufactured lumber for flooring in the log houses. About the year 1860 the water power was replaced by steam power and a large number of mills—still using the upright saws—were put in operation in the hill sections. This now became a leading industry in the years immediately after the war. Circular saw mills were introduced

SECOND-GROWTH CHESTNUTS, MONOGALIA COUNTY. *Photo by A. D. Hopkins.*

soon after this and remained until the timber was practically exhausted. Most of the mills were small. At Point Pleasant and at some other places, however, there were larger operations. Comstock's mill operated at Point Pleasant in the sixties. This was succeeded by Benedict's mill, and this by Sehon's mill, the last to manufacture in quantities for shipment.

Much of the timber floated on the Ohio and Great Kanawha was manufactured on local stationary mills. Considerable good oak was rafted to Cincinnati and Louisville for ship building purposes, and some was used about the year 1860 by shipbuilders from Maine in the manufacture at Point Pleasant of several coasting vessels.

The present lumber industry consists of the work of two or three small portable saw mills, a planing mill or two, and the boat works at Point Pleasant.

Present Forest Conditions.

Perhaps the largest good tract of timber remaining in the county is on the Steinbergen farm near Point Pleasant. The tract contains 200 acres of practically virgin hardwood. A few farmers in different parts of the county have reserved and protected small boundaries of fairly good timber. In nearly all cases, however, the woodlots contain only a remnant of the original stand.

MERCER COUNTY.

Location and Area.

Mercer county was formed in 1837 from parts of Giles and Tazewell. It lies on the southern border of the state east of McDowell, Wyoming and Raleigh and south of Raleigh and Summers. Its area is 368 square miles or 135,520 acres.

Topography.

Nearly all the surface of the county lies above 2,000 feet, and not a little, above 2,500 and 3,000 feet. The southern boundary line follows the crest of East River mountain at an elevation

of about 3,500 feet for 25 miles. At one place in this distance the mountain rises to 4,109 feet, the highest point in the county. The west and northwest boundary line follows Flat Top mountain, the watershed separating Bluestone waters from those of Elkhorn creek and Guyandot river. The slope of the land, then, is toward the interior of the county and northeastward with the course of the principal streams. East river and Bluestone river cross the county line at about the same level, 1,500-feet, the two lowest points of land. The surface of most of the county is comparatively smooth.

Bluestone river and East river, both tributaries of the New, are the principal streams of the county. The former rises in Tazewell county, Virginia, and flows northeastward through the center of Mercer. The latter rises near Bluefield in the southern part of the county and flows in the same general direction at a distance of 1 to 3 miles northwest from the crest of East river mountain. Lick creek and Island creek, two small streams which empty into the New midway between the mouths of the two rivers named above, drain a small territory in the northeastern part of the county. The largest tributaries of East river are Fivemile and Twelvemile creeks. Those of Bluestone river are Mountain, Laurel, Camp, Wolf, Rich, Wide Mouth and Crane creeks flowing from the northwest, and Brush, Black Lick and Lorton Lick creeks from the southeast.

The Original Forests.

There is little left to show the character of the original forests of the southern half of the county. But, judging from the few isolated areas of virgin forest still left, and from the statements of old residents in that section, it is certain that the region once abounded in the choicest of hardwoods. The limestone land, especially, in East River and Beaver Pond districts, produced large numbers of excellent white oaks, yellow poplars and others, usually associated with them. On the high crests of East River mountain and on Stony and Red Oak ridges, such timbers as chestnut oak, small white oak, basswood and pitch pine predominated. The softwoods of the southern half

of the county were white and pitch pine and hemlock. These, however, have not grown there in large numbers.

The northern half of the county has produced not only the hardwoods common to this section of the state but large quantities of softwood as well. Of the softwoods white pine and hemlock have been the chief valuable species. The white pine belt lies along the southeastern side of Bluestone river from a point about 2 miles above Spanishburg to near the mouth of the river in Summers county. Northwestward from the Bluestone there is a scattered growth of white pine which joins the white pine area of Raleigh county. Below are given the approximate percentages of timbers growing on an 8,000 acre virgin tract in the white pine belt:

White Pine	60 per cent.
White Oak	25 per cent.
Hemlock	5 per cent.
Yellow Poplar	5 per cent.
Chestnut	} .. 5 per cent.
Hickory and others	

The Lumber Industry.

Most of the timber has been cut in the southern part of the county by a large number of portable mills. These began to operate about the year 1882 when the Norfolk and Western railroad was built, and have continued to the present. A few mills were running before that date but their small output was used for domestic purposes. As late as 1897 there were but 2 saw mills running in Rock district and not a stave had been cut along the Bluestone river. A little timber was taken from the northern end of the county by the William James Sons Company and sawed at Hinton about 1880; but active operations have continued for only the past 13 years. The L. B. Farley and the Beckwith stave mills, with the help of 2 or 3 smaller mills, have cut not fewer than 50,000,000 staves since 1897. The best of the white oak in Rock district, and some in Plymouth and Jumping Branch districts, has been manufactured into staves. The streams of the county will not admit of ex-

tensive rafting or drifting and, up to 1908, no lumber had been sawed for commercial purposes except by portable mills.

The cross-tie industry has been large during the past few years especially along the railroads.

Two shingle mills manufactured white pine shingles in Plymouth district from 1902 to 1908.

Estimating from the large number of saw and stave mills in the county, the remnant of timber will soon be cut. There are now 35 portable saw and stave mills and 1 band mill in operation. These have a combined capacity of about 230,000 feet per day or over 70 million feet per year. The company owning the band mill has a supply of white pine and other timbers that will last for about 12 years. Before the expiration of that time the smaller mills will have cut all the available timber scattered in other parts of the county.

The Present Forest Conditions.

There are 18,700 acres of virgin forest remaining in the county, and 5,000 acres of cut-over forest. This lies, almost entirely, in Jumping Branch, Plymouth and Rock districts on the waters of Bluestone river, Laurel creek, Rich creek, Wolf creek and Camp creek. There is but little in any other part of the county. The farmers of the southern districts have woodlots of considerable extent but with scarcely any merchantable timber. Those of the northern districts, in some cases, have a fairly good stand of valuable timber. The southern end of Rock district in the western part of the county is owned by coal companies which are already in need of more timber than their lands supply. Some companies, owning timber now large enough for mine ties, are making purchases from the outside in order that their own may grow to maturity.

MINERAL COUNTY.

Location and Area.

Mineral county, formed in 1866 from part of Hampshire, is situated in the eastern part of the state and is bounded on the west and north by Maryland, on the east by Hampshire

county, and on the south by Grant county. Its area is 332 square miles or 212,480 acres.

Topography.

The surface of Mineral is somewhat similar to that of Grant county, just south of it. In the west the main ridge of the Alleghanies traverses the county from northeast to southwest, with New Creek and Knobly mountains running parallel a few miles farther east. West of the crest of the Alleghanies is the plateau region, from 5 to 7 miles wide in the south and narrowing to a point farther north. The eastern half of the county is occupied by the low, rounded foothills of the Alleghanies and by the bottom lands lying within the drainage basin of Patterson creek. East of this the surface rises to the dividing ridge between Patterson creek and the South Branch which is followed by the Mineral-Hampshire boundary line. The range of elevation in the county is from 550 feet along the North Branch, from the mouth of Patterson creek to the Hampshire line, up to 3,327 feet at the summit of Pinnacle knob in the Alleghanies.

All the drainage is to the North Branch of the Potomac, which forms a very irregular line separating the county from Maryland on the northwest. The two important tributaries of this river in Mineral are Patterson creek, flowing through the eastern part, and New creek flowing between the Alleghany and New creek mountains and emptying at Keyser.

Original Forest Conditions.

The timber in this county did not differ materially from that of Grant and other adjacent counties. Hardwoods grew abundantly in the rich valley and cove lands and a mixed growth of hardwoods and softwoods could be found on the hills and mountains. Chestnut oak was very plentiful on low ridges, especially on Knobly mountains, growing in some places in almost pure stands or mixed with other hardwoods or with pitch, yellow and scrub pines.

The Lumber Industry.

Small, portable saw mills have cut practically all of the timber of the Patterson creek basin that has been removed up to the present time, excepting that which was destroyed by farmers during the period of early settlement. The timber of the mountainous sections escaped most of the destruction by early settlers. The large area of virgin forest in these sections was not entered by lumbermen to any extent until after the building of the Western Maryland railroad, in about 1885, along the North Branch of Potomac. After the forests of the western part of the county became accessible a great many large mills were put in operation. Some of these that have now gone were the Watson Company at Barnum, Hensch, Dromjold and Shull at Shaw, Billmyre at the mouth of Stony river, and the Whitmers at Emory. There were other large mills located at Atlantic, Harriman and other points, and numerous smaller ones were operated in the interior.

At present, there are about 20 saw mills running, many of which are small and saw irregularly. Traction engines, used in many of the smaller operations, are frequently put on the road for hauling lumber, cross-ties and tan-bark to the railroad.

Present Forest Conditions.

There are now no virgin forest areas in the county except those that are of very small size. The cut-over lands, scattered along the North Branch and on the mountain ridges, have a combined area of about 7,000 acres. The percentage of woodland in Welton, Cabin Creek and Frankfort districts is very low; but in Elk, New Creek and Piedmont, there is a high percentage of timberland, most of which has been closely culled and burned. Some of the best timber that now remains is to be found in the farmers' woodlots.

MINGO COUNTY.

Location and Area.

Mingo, the newest county of West Virginia, was formed from the southern end of Logan in 1895. Its position is along the southern border between McDowell on the southeast, and Wayne on the northwest. Area, 424 square miles or 271,360 acres.

Topography.

The lowest portion of the county is found along the Tug Fork of Big Sandy river which forms the southern boundary line for 60 miles. The elevation of the river is about 800 feet where it crosses the McDowell line and 575 feet at the southwest corner of the county. The northern, or northeastern, boundary line follows the Guyandot-Tug Fork watershed at an average elevation of a little less than 2,000 feet. From this long dividing ridge the land surface, broken by rough and irregular hills, slopes southwestward to the low land of Tug Fork, and, in the eastern end, to the Guyandot river. The highest point of land, 2,500 feet, is located near the head of Horsepen Fork, a tributary of the Guyandot.

All of Mingo county, except a part of Stafford district, in the eastern end, and a part of Harvey district in the northwestern end, lies on the southward slope of the Tug Fork drainage basin. The Guyandot river forms the eastern line for a distance of about 3 miles and then turns northward through the county in such a course as to leave about 10,000 acres on its eastern side. This river's principal tributaries here are Horsepen Fork, Brown's Fork and Leatherwood creek. The chief tributaries of the Tug Fork within, or partly within, the county are Jennie creek, Marrowbone creek, Pigeon creek and Mate creek. The Right and Left Forks of Twelvepole creek drain an area of considerable extent in the northwest.

The Original Forests.

That part of Logan county which is now Mingo was once heavily timbered with hardwoods. Just as in many other counties of the State white oak and yellow poplar were the most abundant of the valuable species. The less abundant valuable timber trees were black walnut, basswood, chestnut, red oak, black oak, chestnut oak, hickory, sugar and red maple, yellow and sweet birch, sycamore, sweet buckeye, white elm, slippery elm, hemlock, and others. Softwoods were not plentiful in any section. Hemlock grew sparingly along the streams and a few pitch pines on the dry ridges.

The Early Lumber Industry.

Much of the best timber had been taken from this area before it became Mingo county. The yellow poplar, black walnut and other timbers were rafted out on the Tug Fork and the Guyandot rivers. Large numbers of rafts were taken by the citizens to Catlettsburg and Ashland, Kentucky, and to Iron-ton, Ohio. The remainder was taken by lumbermen. The largest rafters have been The Yellow Poplar Lumber Company, Portsmouth, Ohio; The Little Kanawha Lumber Company, Ironton, Ohio; and C. Crane and Company, Cincinnati, Ohio. The first 2 companies named rafted logs and manufactured them on their mills from 1892 to 1899. C. Crane and Company began a little later and are still cutting timber taken from the southern counties on 3 band mills located in Cincinnati. During the past 30 years great numbers of logs have been rafted out of Pigeon creek to Catlettsburg by W. J. Williamson.

There were only a few saw mills in the county before the building of the Norfolk and Western Railroad. Since that time they have been numerous. The following were large operations:

Baker Lumber Company, with a band mill at Sad's Landing, sawed in 1895 and 1896.

Hutchinson Lumber and Manufacturing Company cut timber on Marrowbone and Laurel creeks from 1903 to 1907.

NATURAL REPRODUCTION OF YELLOW POPLAR IN CUT-OVER FOREST,
MONONGALIA COUNTY.

Photo by A. D. Hopkins.

The Present Lumber Industry.

The large operations at present are Prendergast Lumber Company, cutting with a band mill on Laurel creek, a tributary of Pigeon creek, and on Right Fork of Twelvepole creek, and J. S. Walker Lumber Company of Okeeffe. Besides these there are 7 smaller mills running.

The Present Forest Conditions.

There are, approximately, 8,200 acres of virgin forest in the county. Two thousand acres of this lies near the head of Brown's Fork of Guyandot, 1,500 acres lies on waters of Pigeon creek, and the remainder on waters of Twelvepole creek. The land owned and occupied by native settlers lies principally in narrow strips along the water courses. Not over 5 per cent of the land in the county is cleared and not over 35 or 40 per cent is held in fee by resident owners. There are about 200,000 acres of cut-over forest land owned by coal companies and other non-residents.

The virgin forest areas have a remarkably good stand of hardwoods, and a large percentage of the cut-over land has some merchantable timber left. None of the hickory, beech, birch and maple has been cut and in some sections, as on Marrowbone creek, Trace and Elk Forks of Pigeon creek, Left Fork of Twelvepole creek and in the region east of Guyandot river, there is a fair stand of medium and small white oaks, yellow poplars, and others, of the more valuable kinds of timber. It may be said of the forest land that 50 per cent has a varying stand of timber 18 inches and under; 25 per cent has a stand of 12 inches and under; 15 per cent has a stand of 20 inches and under; and 10 per cent has a stand of 24 inches and under. The cut-over areas will estimate about 2,000 feet per acre of all species.

Except in coal mining sections and in parts frequently visited by forest fires the cut-over lands are in prime condition and the young timber is making a rapid and healthy growth.

MONONGALIA COUNTY.

Location and Area.

Monongalia was formed from the District of West Augusta in the year 1776 and is the third oldest county in the State. It lies south of Pennsylvania, west of Preston county, north of Taylor and Marion, and east of Marion and Wetzel counties. Its area is 366.52 square miles or 234,572.8 acres.

Topography.

The surface configuration of the different parts of the county varies greatly. On the east the Cheat river flows at the bottom of a deep canon, in some places cut to a depth of 1,000 to 1,500 feet below the mountains on each side, and the whole region is rough and mountainous. The mountains lying on both sides of the Cheat river rise to elevations ranging from 1,500 feet up to 2,639 feet. Cheat View, a much visited mountain on the west side of the river, has an elevation of 2,212 feet; and 2 miles south of it a mountain rises to 2,290 feet. The smoothest land of the county is found in portions of Grant and Cass districts and the northern end of Clay district on the west side of the Monongahela, and in some sections of Clinton district on the east side. In Battelle district and also in portions of Clay district, in the western end of the county, the land is rougher. The bottom lands along the streams of the county are narrow except those of Dunkard creek below Pentress and those found in a very few places along the Monongahela river.

The whole county lies in the drainage basin of the Monongahela and Cheat rivers. Battelle and Clay districts and a small area in the northern end of Cass district are drained by the headwaters of Dunkard creek, a western tributary of the Monongahela. Other western tributaries of the Monongahela are Robinson run, Scott run, Dents run, and Indian creek. Its principal eastern tributaries are Cheat river, which empties at Point Marion in the edge of Pennsylvania, and West run, Deckers creek, Cobun creek and Booths creek. The tributa-

ries of the Cheat river in the county are very small, the largest being Morgan run and Quarry run which flow in from the mountains on the east.

Original Forest Conditions.

The original forests of the county were essentially hardwood, including almost every species common to the hilly part of the State. Oak, poplar, chestnut, beech, maple and walnut are listed by some as the principal timber trees. There were in addition to these, however, many others of considerable commercial importance. The wood specimens exhibited at the Centennial Exhibition in 1876 and furnished by Fairchild, Lawhead and Company and by Walter Mestrezat, of Morgantown, were cedar, white walnut, black walnut, white oak, sugar maple, hickory, poplar, locust, black cherry, white ash, linden and chestnut. Other common hardwoods were honey locust, sycamore, slippery elm, white elm, hackberry, sweet buckeye and red maple. Hemlock grew plentifully in some sections in the Cheat river basin and to some extent in the deep channels of Deckers creek and other tributaries on both sides of the Monongahela. Red cedar, scrub pine, pitch pine and white pine grew sparingly in some sections. Scrub pine still grows in pure stand on several acres near Dellslow on Deckers creek, and a few white pines are still growing near the mouth of Cobun creek.

The Lumber Industry.

Much of the best timber, particularly on the west side of the Monongahela river, was destroyed during the period of early settlement in the clearings made by farmers. The only lumber used by the pioneers was manufactured on water saw mills or by hand. All of the old saw mills have long ago been abandoned and their locations and owners in many cases have been forgotten. A list of the industries in existence in 1835 includes 6 saw mills, 10 cabinet shops, 2 chair shops, 4 wheelwright shops, 2 wagon-maker's shops and 2 tan yards. A list dated 1860 gives 7 saw mills and one of 1870 lists only 3 saw mills.

John Shisler commenced wagon-making in Morgantown as early as 1802; and 3 years later Kern's carriage shops were built. Fairchild, Lawhead and Company built extensive carriage works in 1851.

Robert P. Hennen and Edward Price were manufacturers of furniture, the former as early as 1840 and the latter some years after.

Before the railroads were built the Monongahela and Cheat rivers furnished the only practical means for the transportation of lumber and logs. The first logs that were cut and sold in the county were floated in rafts on the former river. It is not known in what year rafting began on the river nor who engaged at first in this industry. It is certain, however, that an enormous quantity of timber went out in this way. It is said that fleets of logs could be seen almost any time, especially during high water, for many years after the close of the Civil War. A number of the citizens of the county were interested 25 years ago in buying and selling logs that were delivered in rafts to Brownsville and other points below. Some of the men who engaged in rafting logs in later years were Geo. W. Johnson, Thornton Pickenpauh, John W. Corrothers, "Gus" Barker, Simon W. Boyers, and J. W. Holland. The three men last named have continued their work, to some extent, almost if not quite to the present time. John and Henry Sidwell and others ran logs on the Cheat river from the Beaver Hole at the Preston line and from other points below. Logs, both hewed and round, were often hauled for a distance of several miles on heavy trucks and rafted at the Monongahela river. Samuel T. Wiley, author of the "History of Monongalia County," states that "In 1876 it was estimated that \$50,000 worth of timber in logs was floated down the Monongahela river from Monongalia and Harrison counties."

Practically all the commercial sawing of lumber in the county has been done by portable steam saw mills. These came in about the year 1860, though a few were in operation before that time. With the building of the railroad in 1885 these mills became more numerous and have continued to operate in varying numbers to the present time.

The tan-bark peeled before the coming of the railroads was

used in local tanneries. Since then a large quantity has been hauled on wagons and shipped from Morgantown, Uffington, Little Falls, and other points on the Baltimore and Ohio and the Morgantown and Kingwood railroads. U. L. Griffith, T. Bennett, and Phillips and Lemmon have been among the leading buyers of tan-bark.

There has been a large cross-tie industry for many years. Hewed ties were first shipped on the river in barges; and in later years a great many have been hewed and sawed and hauled to the railroad from every part of the county.

Most of the best black walnut was bought and shipped in the log several years ago.

The Present Forest Conditions.

Areas of virgin forest aggregating about 7,600 acres still remain on the waters of Cheat river and Deckers creek in the eastern end of the county. The principal tract, containing approximately 5,000 acres, lies on the east of Cheat river and adjoins the forests of Preston county. Several hundred acres of virgin forest which is not heavily timbered lies on the steep faces of the Cheat river mountains, and areas of less extent lie on the hills on both sides of Deckers creek. The cut-over forests, containing about 11,000 acres, also lie in the same region.

The remainder of the county is divided up into farms which are partly cleared and partly wooded. As a rule the farmers' woodlots have but little timber.

MONROE COUNTY.

Location and Area.

Monroe county was formed in the year 1799 from a part of Greenbrier. It is situated on the southern border of the state and has an area of 464 square miles or 296,960 acres.

Topography.

The county is traversed by 4 parallel mountains running northeast and southwest. The principal one of these is Peters mountain—a long and symmetrical mountain ridge forming for many miles the natural boundary line between

Monroe county and Virginia. At one point toward the northern end of the county the line crosses from the summit of Peters mountain to the summit of Potts mountain, following the latter southward for some distance and again crossing to the former mountain. Just westward from Peters mountain, and separated from it by a narrow and fertile valley, is Gap mountain, extending from about 3 miles south of Gap Mills to a point in Virginia a short distance north of the county line. Middle mountain lies close on the west of Gap mountain and is about equal to it in length and elevation. The fourth of the parallel ridges is Cove mountain, a short southern extension of the main Alleghany range. Lesser ridges and mountain spurs in the eastern and northern parts of the county are known as Eads ridge, White Rock mountain, Kates mountain and Little mountain. Swopes Knobs, Wolf Creek mountain, and other more irregular elevations rise in the west-central and western sections.

Large areas in the northern, central and southern parts of the county are occupied by elevated and gently rolling plateaus. The smooth outlines of these rich and luxuriant limestone areas contrast sharply with the steep and stony mountain ridges on the east, and form numerous landscapes of unusual interest and beauty.

The Greenbrier river touches the northwestern corner of the county and the New river the southwestern corner, each forming the natural boundry line for a short distance. These two rivers receive all the waters of the county except that from a small area in the east. The largest tributary of the Greenbrier here is Second creek. Wolf creek, Kellys creek and Groomer creek are some of its smaller branches. Indian creek, Rich creek and Sinking Lick creek are the principal tributaries of the New. Potts creek, a tributary of the James river, flows northeast between Potts and Peters mountains; and Sweet Spring creek, Cove creek and Back creek, tributaries also of the James river through Dunlap creek, drain in part the three parallel valleys west of Peters mountain. Thus it is seen that the waters of Monroe county reach the Gulf of Mexico through the Great Kanawha, the Ohio and the Mississippi rivers, and the Atlantic ocean through the James river.

Original Timber Conditions.

The difference between the original tree growth of the mountains and that of the limestone uplands was as marked as the variation in the surface itself. The characteristic trees of the limestone areas were white oak, red oak, black oak, sugar maple, black walnut, shellbark hickory, wild cherry, poplar, basswood and cucumber; while those of the mountains which rise on the east were scrubby chestnut oak and pitch pine. Hardwoods grew exclusively on the northwestern faces of both Peters mountain and Potts mountain, but on their southeastern faces and on both sides of Gap mountain, Middle mountain and Cove mountain softwoods, such as pitch pines and a few white and scrub pines, grew in pure stands or mixed with various species of hardwoods. Hemlocks and the pines once formed a fringe around the hardwood forests of the limestone lands, and grew in considerable abundance along Second creek and other streams which descend to the Greenbrier and the New rivers.

A writer on the natural resources of West Virginia has said that "Monroe was never a well timbered county." This is true so far as the mountainous sections were concerned; but an examination of a number of practically virgin woodlots, scattered from Sinks Grove to Gap Mills, has shown that the statement would not have applied to the forests that once stood on the limestone areas. Mr. C. P. Lewis, the present county surveyor of Monroe, for many years familiar with every section of the county, asserts that there was once a very fine stand of timber growing on the extensive and fertile uplands, and that there are still some single acres of virgin forest owned by the farmers from which 25,000 feet of white oak could be cut.

The Lumber Industry.

In considering the destruction and utilization of the timber of the county we may divide the time into two periods: the first extending from the year 1750, the approximate date of the earliest settlement, to the year 1880; and the second extending from 1880 to the present. The first may be called a period of home consumption. The parts of the county settled

earliest were in the vicinities of Sweet Spring, Union and Second Creek. From these centers settlements spread in all directions, and before timber had become commercially valuable, a large proportion of it had been destroyed in the process of clearing the land. Small amounts of lumber were used in the early days in the construction of dwellings, out-buildings, fences, etc. This was manufactured chiefly by hand and by the rude water saw mills, several of which were located on Second creek and other streams of the county. According to Joseph Martin, author of the "Gazetteer of Virginia and the District of Columbia", there was one steam saw mill running in 1835. No extensive sawing was done by steam, however, until a much later date.

About the year 1870 buyers came in and took out black walnut, cherry and poplar logs from many sections, hauling them for shipment to Ronceverte, Fort Spring and Alderson on the Chesapeake and Ohio railroad. In later years large oaks also have been bought along with the other timbers mentioned.

Since 1880 there has been a more or less active commercial lumber industry in the county. There were but few saw mills in the county before 1890, however, and not a large number until after the year 1900. For the past 10 years there have been operations in almost every section, the 25 or 30 small portable mills cutting "sets" wherever a few thousand feet could be brought together. Lumber from these small mills has been hauled on wagons to various stations on the Chesapeake and Ohio, the Norfolk and Western and the Virginian railroads.

As a rule the farmers have conducted their part of the lumber industry in an economical manner, allowing the young and vigorous trees to be cut only from the land that they were soon to clear for cultivation. From the saw mill operator's standpoint the industry has been somewhat wasteful as, in addition to the usual waste of circular mills, they have not had the facilities for utilizing their valuable slabs and other so-called waste materials.

Among the larger operations that have cut timber in the county were the St. Lawrence Boom and Manufacturing Company, with a large band mill at Ronceverte and the Crimson

ELECTRIC WATER-POWER PLANT ON POTOMAC RIVER, MORGAN COUNTY. POWER USED IN MARTINSBURG 12 MILES DISTANT.

Springs Lumber company located some distance south of Union, in Monroe county.

A. Knabb and Company and others have carried on an extensive stave industry in several sections.

The Present Forest Conditions.

An area of nearly 30,000 acres of virgin forest still remains in the county. This includes a long, narrow belt of about 10,000 acres lying on the summit of Peters mountain; a large tract in the portion of the county east of Peters mountain, and several smaller areas scattered throughout other mountainous sections. The 14,600 acres of cut-over forests lie for the most part on the ridges west of Peters mountain. The character of the timbers growing in the different situations has been mentioned under another head, as has also the stand of trees remaining on some of the woodlots of the interior.

Mr. John L. Rowan and Prof. A. S. Johnston, of Union, Monroe county, approximate the area of cleared land at 35 per cent and state that the farmers' woodlots, particularly those in the limestone belt, are in a flourishing condition, having a stand of 3,000 to 4,000 feet of good hardwoods. Mr. W. A. Pedigo, formerly of the Crimson Springs Lumber Company, has recently estimated the present stand of timber in the county at 300 million feet.

Not far from 20 per cent of the land in Monroe county is absolutely unfit for cultivation. These non-agricultural areas are largely overgrown with undesirable species of trees and shrubs. The occupation of this land by locusts and other valuable and fast-growing species should be encouraged in every possible way.

MORGAN COUNTY.

Location and Area.

Morgan county was formed in 1820 from parts of Berkeley and Hampshire. It is located in the Eastern Panhandle and has an area of 235 square miles or 150,400 acres.

Topography.

The surface of the county is ridged with long, and not greatly elevated mountains, lying several miles eastward from the main crest of the Alleghanies and conforming, in general, to the trend of the Appalachian System. The principal mountains are named and described below: Sleepy Creek mountain forms the natural boundary between Morgan and Berkeley counties and has an elevation of 1,800 feet. This mountain extends unbroken for about 18 miles from the southeastern corner of the county. Cacapon mountain extends into the county from the south and terminates at the Potomac river a few miles below the mouth of the Great Cacapon. The greatest elevation of this mountain is 2,196 feet. Sidling mountain lies in the wetsern part of the county between the Potomac and Great Cacapon rivers. It has an average elevation of about 2,000 feet. Between the mountains named there are numerous ridges from 800 feet to 1,200 feet in height and all extending, like the former, in a northeast and southwest direction.

The Potomac river, which separates Morgan county from Maryland for a distance of about 50 miles, is the principal stream and receives all the drainage of this area. The principal tributaries of the Potomac here are the Great Cacapon river, which enters on the south from Hampshire county and flows at the western base of Cacapon mountain; Warm Spring run, which empties at Hancock Station, and Sleepy creek, which empties about 5 miles below.

Original Timber Conditions.

George Washington owned lands in Morgan county at Bath (now Berkeley Springs) and farther west near Orleans Crossroads. During an excursion to the "West" in 1784 Washington visited and "reviewed" his 200 acre tract at the latter place. The following entry in his journal under date of September 8th, gives us some facts concerning the original timber in that locality: "Set out about 7 o'clock with Doctr. (Craik) his son William, and my Nephew Bushrod Washington, who were to make the tour with us,—about ten I parted with them

at 15 Miles Creek, & recrossed the Potomac (having passed it abt. 3 Miles from the Springs before) to a tract of mine on the Virginia side which I find exceedingly Rich, & must be very valuable.—the lower end of the Land is rich white oak in places springey; and in the winter wet.—the upper part is exceedingly rich, and covered with walnut of considerable size many of them.”*

The kinds and the abundance of timber were usually mentioned in early days, to indicate the value of the soil; but it must be concluded that at least some value was placed by Washington on the timber itself, for he instructed “The Tenant not to remove any of the Walnut timber from the Land; or to split it into rails; as I should reserve that for my own use.—”

From his intimate acquaintance with the forests of the county for the past forty years Dr. William H. McCullough, of Sleepy Creek, is able to give the following list of trees with approximate percentages showing their former relative abundance:

Chestnut Oak	20 per cent.
White Oak	20 per cent.
Pines (including White, Pitch, Scrub, and Yellow Pine).....	10 per cent.
Black Oak	} 20 per cent.
Red Oak	
Chestnut	20 per cent.
Others, (including Sugar Maple, Red Maple, Locust, Hickory, White Ash, Cherry, Hemlock, Basswood, Black Gum, Black Walnut, Sycamore)	10 per cent.

The Lumber Industry and Timber Destruction.

The rich bottom and cove land of the county was sought after and occupied at an early date and much of the best timber destroyed before it had a merchantable value.

It cannot now be ascertained when the first water-power saw mills operated nor what were the names of their owners.

*“Washington and The West” p. 37.

It is stated that these primitive mills were once numerous along the larger tributaries of the Potomac and that large amounts of excellent lumber were manufactured to supply local demands. The first steam saw mill—at least in the northeastern part of the county—is said to have been put in operation near Cherry run by Louis Shipley in the year 1870. Soon after this date, it is certain, mills of this kind became numerous and have so remained to the present. At first, when prices were low, only the choicest lumber was manufactured and sold; later, when prices became high, only the more inferior timber remained. For this reason, therefore, the lumber industry has often proved unprofitable both to the original owner and to the manufacturer.

Waste has been everywhere in evidence. Bark from the chestnut oak timber—once so abundant on all the dry mountain ridges—was stripped off for local tanneries at Berkeley Springs, Pawpaw and other points, and the trunks left on the ground to decay; wasteful methods of lumber manufacture have been employed; a great number of young trees have been cut—especially during the last 15 years—for mine props, cross-ties, poles and pulp wood; and forest fires have prevailed in the wooded mountains during dry weather for more than a century.

Present Forest Conditions.

There are no virgin forests of any consequence now remaining in the county. The cut-over forests lie on the 3 principal mountains and comprise an area of about 25,000 acres. The timber on the cut-over areas is not good. The prevailing species are white oak, black oak and chestnut oak, with a scattered growth of other more or less stunted hardwoods, and with a few white, yellow and scrub pines.

The large number of healthy young locusts growing now in the county will be a valuable asset to all owners of woodland provided the trees are not seriously molested for a period of 20 years.

The wooded mountains—although producing but little timber and of an inferior grade—are, nevertheless, indispensable

factors in keeping up the water flow of the many streams throughout the whole region. The forest cover, for the purpose mentioned above, should be maintained and protected at all hazards. The water power capable of development is very great. An electric plant located at the Horseshoe Bend of the Great Cacapon river is now supplying light to the towns of Berkeley Springs, Hancock and Great Cacapon, and power to a number of sand plants near the town of Berkeley Springs.

The county is well adapted to fruit growing and considerable of the wooded hill land, almost worthless for the growing of other crops, is being profitably utilized for the culture of peaches.

Outside of the cut-over timber lands the farmers in the valleys have from 25 to 40 per cent of their farms in timber.

NICHOLAS COUNTY.

Location and Area.

Nicholas county, formed in 1818 from part of Greenbrier, lies a short distance directly south of the center of the state. Its area is 691 square miles or 442,240 acres.

Topography.

The whole county is well elevated and portions of it are decidedly mountainous. A belt of land lying along the northwest side of Gauley river and including the areas drained by Beaver creek, Muddlety creek and Peters creek contain many acres of comparatively smooth creek bottoms, glades and rolling uplands. Northwest of this belt the surface is somewhat rougher and the ridges higher. The portion of the county in the eastern end which is drained by the Cherry river contains the highest land. Much of the surface in this region lies above 2,500 feet and a little of it reaches an elevation of almost 4,000 feet.

Gauley river flows through the county from northeast to southwest. Its principal tributaries flowing in from the northwest are Twentymile creek, Peters creek, Muddlety creek and Beaver creek, named in order up stream. Its tributaries from

the southeast are Meadow river, Hominy creek, Cherry river, and Cranberry river. The waters which drain a narrow area of land along the Clay county line reach the Elk river through Leatherwood, Buffalo and other creeks; and those that drain a large area in the north reach the Elk through Birch river and Strange creek.

Original Forest Conditions.

In the hardwood forests of the county white oak, red oak, chestnut oak, yellow poplar, hickory, beech and maple were among the commonest species. With these grew nearly all other hardwoods common in the forests of central West Virginia. Black walnut was very abundant and of excellent quality in several localities. Hemlock was the principal softwood, being distributed generally over the county. Small areas of spruce grew in the high mountains in the extreme eastern corner.

The Lumber Industry.

The roughness of Gauley river prevented rafting, but thousands of poplar logs were drifted on the stream to mills located on the Great Kanawha. The first extensive drifting supplied logs to Thompson's circular saw mill situated near Kanawha Falls in Fayette county. J. R. Huffman, who had 2 band saw mills at Charleston, drifted poplar, walnut and basswood logs in large numbers from many points along the Gauley and some of its larger tributaries. Timber was bought at a very low price by both Thompson and Huffman and little care was taken to save all the logs that were cut. It is stated that thousands of feet of black walnut logs sank in transit on slow-flowing Muddlety creek and are now buried along its sandy channel. Hundreds of the finest poplar and walnut logs were also left to rot upon the banks and in the drift-heaps along Gauley river. A similar waste was permitted along Birch river and Strange creek, tributaries of the Elk. Dams were built on these streams and when the logs were "splashed" out or when they were drifted out during freshets many of them lodged upon the banks and were there allowed to remain.

There were a few water-power saw mills along the Gauley and other streams and a very few small portable mills in operation before the year 1885. Most of the timber that had been sold up to that time, however, had been taken from lands adjacent to the larger streams and drifted out, as above mentioned. The lumber from small mills operating in the interior of the county during the past 25 years has been hauled on wagons and tram-roads to Camden-on-Gauley and Richwood, on the Baltimore and Ohio railroad, and to Belva on the Chesapeake and Ohio. The names and approximate dates of a few portable saw mill operations are given below:

A. J. Aylor operated a portable mill in the vicinity of Craigsville from 1896 to 1902; L. C. Williams, from 1898 to 1905, on the waters of Gauley river; Geo. H. Alderson, 1893 to 1902, in many sections of the county; W. D. Huff, 1895 to 1908, numerous sets; Marple Bros., 1902 to 1908, on Cranberry river; T. W. Blankenship, 1898 to the present, on Beaver creek and Gauley river. The extensive operations of Arthur Brooks on Beaver creek should also be mentioned. Beside these there are many others that have operated in a small way and many others, also, that have recently begun to operate.

During the last few years the forests of the county have been made accessible by the building of railroads, and 11 huge band mills within the county and 2 or 3 on the outside are engaged in reducing the quantity of timber in Nicholas and adjoining counties at the rate of over 200 million feet a year. Three of these mills are located toward the southern end of the county—at Vaughan, Swiss, and at the mouth of Grassy creek; one is at Tioga in the northern end of the county; and the remainder are near the Baltimore and Ohio railroad between Allingdale station and Richwood. The operations of the Cherry River Boom and Lumber Company, with 2 mills in Nicholas and 1 in Webster, and of Pardee and Curtin Lumber Company, with 3 mills in Nicholas, are the largest in the state and are among the largest in the country. A writer on the resources of West Virginia said of Nicholas county 17 years ago, "A few mills are located in the county and some logs are taken out the Gauley to be sawed at other places but the timber supply is being almost imperceptibly reduced by this." If all the mills

that are now running in the county should remain in full operation for 7 years, and should cut all their timber from lands within the county and not from Webster, Greenbrier and Pocahontas, there would not be a timber tree standing in the year 1917.

Present Forest Conditions.

The 130,000 acres of virgin forest that still remain in the county lies principally in large boundaries to the southeast of the Gauley river and in the northern end of the county. A few smaller tracts are to be found in other sections. There are approximately 112,000 acres of cut-over forest land, the largest body of which lies on the waters of Cherry river in the eastern end. Other large areas are to be found along the western border and smaller areas on the north and south. As a whole the forests lie east of the Gauley river and in a broad belt along the western side with a large area of farm land lying between on the west of Gauley river.

About 70 per cent of the county is wooded. This includes, in addition to the areas of virgin and cut-over forests, about 50,000 acres of woodland owned in small boundaries by the farmers. As a rule the farmers' woodlots contain some fairly good timber.

OHIO COUNTY.

Location and Area.

Ohio county, situated in the middle of the Northern Panhandle, is one of the oldest counties of the State, being formed from the "District of West Augusta" in 1776. Its area, as determined by recent careful calculation, is 111 square miles or 71,040 acres.

Topography.

The county is everywhere hilly except the small areas of level bottom land along the Ohio river and Wheeling creek. For the most part, the hills are low and are smooth enough to

Photo by W. E. Rumsey.

VIRGIN FOREST OF SUGAR MAPLES, NICHOLAS COUNTY.

admit of easy cultivation. In some places, however, the hillsides are steep and rough. This is especially true of those that slope abruptly to the Ohio river and to the narrow bottoms of the larger creeks. The elevation of the land at the mouth of Short creek in the northwestern corner of the county is 668 feet. The lowest point is found at the Ohio river where it leaves the county on the south at an elevation of 610 feet. The hills rise in many places to a height of 1,100 to 1,300 feet and in the southeastern corner reach an elevation of 1,440 feet.

The Ohio river forms the western boundary of the county for about 12 miles and all the streams flow directly into it or into its larger tributaries. The principal tributary of the Ohio in this county is Wheeling creek, entering from Marshall county on the south and emptying at the city of Wheeling. Other smaller streams are Short creek, a direct tributary of the Ohio, and Little Wheeling creek, a tributary of Wheeling creek.

Early Timber Conditions.

According to Capt. Charles J. Rawling and Mr. William H. Irwin, of Wheeling, both early settlers in Ohio county, the valley of the Ohio river and of Wheeling creek and, in fact, all parts of the county were exceptionally well timbered with hardwoods of many kinds. The most abundant of these were white oak, chestnut oak, hickory, cherry, locust, ash, elm, poplar, beech, black walnut and sycamore. The principal softwood was red cedar which grew in scattered clumps throughout the county.

Early Settlements and the Lumber Industry.

Much of the best timber of the county was destroyed by early settlers in the process of clearing their land for cultivation. Settlement began at a very early date. Col. Ebenezer Zane, one of the three Zane brothers who settled at Wheeling in 1769, cleared a small boundary of land for corn in the Ohio Valley in 1771. During the period of early settlement timber had little or no commercial value and, for this reason, all that was cut down, except a small quantity used in the construction

of buildings, fences, etc., was rolled together in heaps and burned. It was under these conditions that numerous settlements were made in the valleys and on the fertile uplands where the choicest of the timber grew.

During the years of the early settlement of Ohio county the only lumber sawed was by means of hand-power whip saws and by water-power sash saws, several of which were located along the larger creeks. These have all ceased to run long ago and the names of most of the owners are forgotten. The old Hubbard mill, located at the mouth of Wheeling creek had a sash saw which was operated by steam-power. This mill was one of the pioneers among the larger operations. It is said that the mill cut a large quantity of white pine and other timber from the Allegheny river for about 18 years following its building in 1830.

Between the years 1835 and 1875 there were 4 wagon factories in operation in Wheeling. These were owned by Samuel Irwin, Busby and Little, Josiah Bodley and Thomas Moffett. The combined capacity of these factories was at least 1,000 wagons a year. Most of the vehicles manufactured were broad-tread southern wagons which were shipped on steam boats and barges to the sugar and cotton plantations of Mississippi, Louisiana and Arkansas. Busby and Little manufactured, in addition to the heavy wagons, a large number of ambulances and quartermaster's wagons for use during the Civil War. All the wagon makers named made use of locust for hubs, hickory for wheels and oak for frames. They obtained their wood entirely from the forests of Ohio county.

Ship-building was an important industry in Wheeling for several years. It is of much interest that the first steam boat—the *General Washington*—which made the round trip from the upper Ohio to New Orleans was built at Wheeling about the year 1813. This boat, and many others built later by Wilson, Dunlevy & Company and by others, were constructed of local timbers.

Following are the names of the tanners who have operated at Wheeling. The location given for some of them by streets and numbers is according to the present plan of the city: David Garden's tan yard, in operation from about 1825 to 1845; Mc-

Connell's tan yard, in operation from about 1825 to 1845; McClure's tan yard, corner of 4th and Main Streets, in operation from about 1825 to 1845; Wheat's tan yard, in operation in the 50ies; Vockler's tan yard, 22nd and Water Streets, in operation from 1850 to 1870; Berger and Huffman's tannery, corner Zane Ave. and Broadway, in operation from 1848 to 1870; J. G. Hoffman & Son's tannery, corner of 24th and Main Streets, in operation at present. Mention is made of the several tanneries that have operated within the county for the reason that most of the bark used by them was obtained from chestnut oak timber growing near at hand. In the early days the trees peeled for bark were left to rot on the ground.

The timber on Wheeling Hill was largely used for burning brick in Wheeling about sixty years ago.

Small steam saw mills, here as elsewhere, have operated in the past in nearly all sections of the county, sawing lumber and cross-ties.

Present Conditions.

The virgin forests of Ohio county are a thing of the past. As a rule, the farmers have reserved small boundaries of woodland for domestic use. These, however, occupy not more than one-tenth of the area, and most of them have been closely cut-over. If the worthless brush now growing on rough land throughout the county could be replaced by fast-growing and valuable species, such as locust, poplar, ash, and catalpa, great profit would result to the farmers within the next 25 years.

PENDLETON COUNTY.

Location and Area.

Pendleton county, formed in 1787 from parts of Rockingham, Augusta and Hardy, lies on the eastern border of the state. It is joined on the east and south by Rockingham, Augusta and Highland counties, of Virginia, on the north by Hardy and Grant, and on the west by Randolph and Pocahontas counties. Its area is 707 square miles or 452,480 acres.

Topography.

Spruce mountain, lying in the western part of the county,—and mentioned more particularly under another head—is the highest mountain in West Virginia, attaining near its southern extremity an elevation of 4,860 feet. From this mountain eastward there is a succession of high, parallel ridges or folds of the Alleghanies extending through the county from northeast to southwest. The loftiest and longest of these are North Fork mountain, in the center, and Shenandoah or Great North mountain on the east. Along the bases of these mountains are numerous lesser ridges and peaks, some of which are designated as follows: Timber ridge, Grassy mountain and Snowy mountain, in the North Fork basin; Cave mountain, Pretty ridge, Big mountain, Little mountain, Tract hill, Colletts mountain, Buffalo hills, Pond ridge, Lankey mountain, Easy mountain, Bible knob, Moser knob, Pickle mountain, Raleman mountain, Panther knob, Bobs mountain, Simmons mountain, and others, at the eastern base of North Fork mountain; Middle mountain, South Fork Mountain, Sweedlin hill, Long ridge, and Town mountain, scattered along the east side of the South Branch of the Potomac and on both sides of the South Fork.

Three swift-flowing rivers course toward the northeast through the county. The South Branch of the Potomac flows near the center and its North and South forks at about equal distances from it on the northwest and the southeast. These rivers are fed by many small streams and by cold springs that issue from the wooded mountains along their courses.

Original Forest Conditions.

With a vertical range in altitude of a little more than 3,500 feet this county becomes the natural home of a great variety of trees and shrubs and other plants. In the rich river valleys grew many hardwoods, such as the oaks, the maples, the walnuts and the yellow poplar; while on the cold summits of the highest mountains where the original conditions still exist only such species as can endure a Canadian climate find a congenial home. Among these are the red spruce, the mountain ash, the yellow

birch and the mountain maple. There is no indication at present that red spruce was abundant on any of the high ridges east of Spruce mountain, although the elevation would seem to favor its growth in many places. White pine was once common in the creek bottoms of the tributaries of the South Branch and the South Fork. A few groves of this tree still remaining in the river valleys indicate that it once may have grown in similar situations throughout the county. The other conifers were hemlock, yellow pine, pitch pine, jersey pine, table mountain pine, red cedar, and arbor vitae. Of these yellow pine was once abundant, growing principally on southern and eastern exposures. Yellow poplar has never grown generally in this area, but that it was once found in South Branch valley, at least to some extent, is evidenced by the fact that some of the old log houses built in Revolutionary times were constructed of this wood.

Timber Destruction and the Lumber Industry.

According to Mr. O. F. Morton, who is now preparing a history of Pendleton county, settlement began in the year 1747; and within 40 years from that date there was an almost continuous settlement along the three rivers, and a population of 2,000 people living in the valleys. The amount of good timber destroyed in the process of preparing the large areas of land for cultivation, both in the early days and in later years, has been enormous. The valleys and coves contained the best of the timber, and when these were cleared, the more inferior timbers of the less fertile mountain lands were left.

From 75 to 80 per cent of the mature pine timber of the county was killed by bark beetles about the years 1891 and 1892. This great destruction by insects furnished dry fuel for frequent and furious forest fires which raged in the mountains in 1895 and which have often occurred since that date.

The lumber industry here has been insignificant in comparison with that of the 2 counties adjoining on the west. The cause for this is found in the remoteness of the region from navigable streams and from railroads.

The old sash saw mills were once scattered along the larger

streams of the county but the exact number of these is not known and the date of the first operation is problematical. Joseph Martin, author of the "Gazetteer of Virginia and the District of Columbia," published in 1835, lists 1 saw mill and 2 tan yards for Pendleton county. It is probable, however, that 1835 is not the date of the beginning of saw mill operations. Three sash saw mills are still run at irregular intervals in the county. Small portable saw mills, numbering 2 or 3 in the seventies, and about 20 at present, have done most of the sawing so far. These mills, with a few exceptions only, are moved from place to place with traction engines. In the winter they saw for the farmers and in the summer and fall the engines are used to thresh their grain. A larger circular saw mill was operated on Big run of North Fork several years ago by the Parsons Pulp and Lumber Company. This company, with a large band mill at Horton, in Randolph county, has recently built lumber railroads across the divide between the waters of the Cheat and the Potomac and has already cut much of the spruce and other timber on Big run and on Seneca creek.

About 25 years ago Capt. J. H. Daugherty and Geo. W. and D. W. Eagle were all engaged in buying and shipping walnut lumber sawed on the small mills running on the South Branch in the vicinity of Upper Tract and on the North Fork above the mouth of Seneca creek. Most of this lumber was hauled on wagons to the railroad at Keyser, Mineral county, a distance of about 70 miles. The quality of the walnut lumber was good but much of it had to be classed as culls on account of its poor manufacture. Since 1905 most of the walnut timber that remained in the county has been bought and taken out in the log.

One of the chief uses made of white pine was for shingles, a large number of which were hauled in wagons to the Valley of Virginia and other places between the years 1860 and 1900.

The Present Forest Conditions.

In consequence of the limited lumber industry in the county most of the wooded area has remained to the present in a virgin state. Of the 140,000 acres, approximately, of tim-

berland, 138,000 acres are virgin and 2,000 acres are cut over. The virgin forests lie on the mountains in more or less continuous broad belts running from northeast to southwest, and in smaller boundaries scattered here and there. The cut-over forests are principally on the west of Spruce mountain. The sawing by small mills has been on lands that were soon to be "improved." This accounts for the absence of cut-over forests in the central and eastern sections. In addition to the above mentioned forest lands about 60 per cent of the farm land is growing well-timbered woodlots.

As stated under another head, many of the mature pines were killed in 1891 and 1892 by insects. In some localities where this destruction occurred there is a good reproduction of young pines; but in most cases, especially where the destruction of seed trees was complete, a young hardwood forest is growing up among the decaying pine logs. The appearance of hardwoods to succeed the conifers is not discouraging as the young trees are of valuable kinds. Locust, in particular, is abundant in places and is remarkably free from the enemies that disturb its growth in many other parts of the state.

From many standpoints the conditions in most sections of the county are ideal. The rich valleys produce abundant yields of vegetables, and fruits and grains, and the forest-covered mountains insure a constant flow of clear and unpolluted water. Over a large area in the western part, however, conditions are somewhat reversed. As a result of a disastrous forest fire which originated 50 years ago from a camp of scouts on the Roaring Plains, it is said, and of many subsequent fires, about 20,000 acres of mountain land are burned bare.

Spruce Knob.

The highest land in the state, 4,860 feet above tide, is found on a long, flat-topped ridge lying in the western part of Pendleton county and known as Spruce mountain. The crest of the mountain, for a little more than 10 miles, lies above 4,500 feet, and for half that distance, is 200 feet higher. Toward the southern end there is a gradual rise to the highest point. Spruce Knob, as this is called, is a misnomer for the reason that

the land here does not rise in the shape of a knob, being only slightly elevated above the general level of the ridge. The crest of the mountain varies in width from one-fourth to one-half mile and is everywhere strewn with seamed and broken fragments of sandstone.

The best view, in general, of the mountain can be obtained from the high watershed separating Gandy creek, a tributary of Cheat, from the waters of the Potomac; and from the summit of North Fork mountain on the east. As seen from the former mountain the western face appears not as a forest region, but as an area of open fields with scattered boundaries of dark green woodland. The sandstone boulders along the summit and the irregular outcrops farther down the mountain side are only faintly seen and the profuse growth of shrubbery is not discernable with the naked eye at that distance. Viewed from the other side, the deciduous forests, which cover the eastern face of the mountain give it a strikingly different appearance from the view obtained from the mountain on the west.

On closer examination it is found that thousands of acres, lying on the crest and on the side which faces toward the west, and in the region about the headwaters of Seneca creek and Big creek, are almost treeless and are thickly overgrown with ferns and wild grasses. In many places the lower vegetation has given way to tangled thickets of shrubs; and occasionally, in these open regions, a stunted spruce, or mountain ash, or other tree, has gained a foothold. This area was not always destitute of trees, but was covered a hundred years ago with a valuable forest of spruce. It is not, as has already been said, entirely without trees at the present day; for the fires which have swept over the mountain at frequent intervals for 50 years or more have left in the shady, moist depressions of the ridge, and in other protected spots, a remnant of the original growth. These few protected areas serve to show the character of the highest forests of the state and to hold the boreal forms of plant and animal life that find there the conditions under which they thrive.

The following annotated list of plants is copied from a memorandum made on the summit of Spruce Knob, June 18, 1908:

SUMMIT OF SPRUCE KNOB, PENDLETON COUNTY. The highest point in West Virginia, altitude 4,860 feet above the sea.

RED SPRUCE, *Picea rubens*.—The principal tree of the mountain. The dwarfed spruces growing among the rocks have limbs developed only on the leeward side, the lowest of which lie flat on the rocks and in many cases are longer than the trunks themselves.

WHITE PINE, *Pinus Strobus*.—Only 2 trees seen. These are not over 8 feet high and appear as if out of their range.

YELLOW BIRCH, *Betula lutea*.—Abundant, growing with the spruces on the highest wooded parts.

MOUNTAIN ASH, *Sorbus Americana*.—Frequent in open places. In full bloom.

WILD RED CHERRY, *Prunus Pennsylvanica*.—Thickets of young trees, mostly below the crest.

MOUNTAIN MAPLE, *Acer spicatum*.—An occasional small tree.

JUNEBERRY, *Amelanchier Canadensis*.—The few trees stunted and badly weatherbeaten.

DOTTED THORN, *Crataegus punctata*.—Three or 4 old trees standing a short distance south of the highest point. Still in bloom.

MOUNTAIN LAUREL, *Kalmia latifolia*.—Small clumps, mostly along the eastern edge of the summit.

ALLEGHANY MENZIESIA, *Menziesia pilosa*.—An abundant shrub of the heath family, from 1 to 3 feet tall, now covered with yellowish, bell-shaped flowers.

BLACK HUCKLEBERRY, *Gaylussacia resinosa*.—Plentiful, with flowers and green fruit.

WINTERGREEN, *Gaultheria procumbens*.—Abundant, and full of ripe berries of a very large size.

TRAILING ARBUTUS, *Epigae repens*.—Common, growing with the wintergreen.

MOUNTAIN CRANBERRY, *Oxycoccus erythrocarpus*.—Very abundant. Growing with Menziesia.

WILD HOLLY, *Ilicoides mucronata*.—A common, low shrub with long-stemmed, green berries.

MOUNTAIN HOLLY, *Ilex monticola*.—A few small bushes, in bloom.

BLACK CHOKEBERRY, *Aronia nigra*.—Common shrub near the summit.

FETID CURRANT, *Ribes prostratum*.—Reclining on rocks. Common.

DWARF CORNELL, *Cornus Canadensis*.—A small dogwood, not over 3 to 5 inches high. Full of pretty white blossoms.

RED RASPBERRY, *Rubus strigosus*.—Common on summit. More plentiful lower down.

WILD BLEEDING-HEART, *Bicuculla eximia*.—A delicate and beautiful red-flowered plant, growing in crevices of rocks on dryest part of the summit.

GREAT WILLOW-HERB, *Epilobium angustifolium*.—Not so common here as in burnings lower down.

PAINTED WAKE-ROBIN, *Trillium undulatum*.—A few in bloom in shady places.

CANADA MAY-FLOWER, *Unifolium Canadense*.—Common. In bloom.

YELLOW CLINTONIA, *Clintonia borealis*.—A very common plant, with lily-like yellow flowers.

PINK MOCCASIN-FLOWER, *Cypripedium acaule*.—Several in bloom.

ROUND-LEAVED ORCHID, *Lysias orbiculata*.—One plant found in shade of spruce trees near summit. Now in bud.

BRACKEN FERN, *Pteridium aquilinum*.—The most abundant plant of the region, covering thousands of acres of burnt lands.

CINNAMON FERN, *Osmunda cinnamomea*.—A few small areas overgrown with this fern.

POLYPODY, *Polypodium vulgare*.—On rocks. Not common.

GROUND PINE, *Lycopodium obscurum*.—Common.

RUNNING PINE, *Lycopodium clavatum*.—Abundant. Trailing over rocks.

GROUND PINE, *Lycopodium complanatum*.—A few found.

The list here given is far from complete but includes the majority of plants, from the club mosses up, which grow on the highest parts of Spruce mountain. A thorough search would reveal many additional and interesting flowering plants and a large number of cryptogams. A list of the numerous plants which grow in the wooded portions of the mountain might be given, but for lack of space this is not included.

The mammal and bird life of Spruce mountain is no less interesting than the plant life; and the region is as definitely characterized as Canadian by the one as by the other. Some of the representatives of the mammalian fauna found upon or in the vicinity of the mountain are the Black Bear, *Ursus americanus*, the Raccoon, *Procyon lotor*, the Red Fox, *Vulpes fulvus*, the Bay Lynx, *Lynx rufus*, the Varying Hare, *Lepus Americanus*, and the Red Squirrel, *Sciurus hudsonicus*. Among the smaller mammals are the Smoky Shrew, *Sorex fumeus*, the Star-nosed Mole, *Condylura cristata*, Cooper's Lemming, *Synaptomys*

cooperi, Red-backed Mouse, *Evotomys gapperi*, and the Canadian White-footed Mouse, *Peromyscus maniculatus nubiterræ*.

The birds are represented by such species as the Veery, *Hylocichla fuscescens*, the Olive-backed Thrush, *Hylocichla ustulata swainsonii*, the Golden-crowned Kinglet, *Regulus satrapa*, the Red-breasted Nuthatch, *Sitta canadensis*, the Winter Wren, *Nannus hiemalis*, the Magnolia Warbler, *Dendroica maculosa*, the Canadian Warbler, *Wilsonia Canadensis*, the Rose-breasted Grosbeak, *Zamelodia ludoviciana*, the Barred Owl, *Strix varia*, and the Red-tailed Hawk, *Buteo borealis*.

To the purchaser of coal or oil, to the farmer or even to the lumberman, Spruce mountain offers little or nothing. But to the lover of mountain air and mountain scenery, to the student of nature and the collector it offers much and possesses for these a peculiar interest and charm. To the former it is a barren upheaval of rocks, with but little soil and with less timber. To the latter it is a field for the study of a multitude of interesting forms of life and of geologic formations, and a place of unparalleled advantage from which to survey the long mountain ranges of the Alleghanies and the Blue Ridge. It is difficult, indeed, to imagine a region more bleak and unfruitful to some and at the same time more intensely fascinating to others. The mountain, however, has been robbed of half its glory by fire, and its great value cannot be realized until its forests have been restored.

PLEASANTS COUNTY.

Location and Area.

Pleasants, formed in 1851 from parts of Wood, Tyler and Ritchie, is a small, narrow county lying along the Ohio river on the western border of the state. It is surrounded by the 3 counties from which it was formed and by Washington county, Ohio. Its area is 142 square miles or 90,880 acres.

Topography.

The surface of Pleasants county can be described as hilly. The descent is from numerous elevations of 1,100 feet, 1,200 feet and a few of 1,300 feet, along the eastern side, down to an

elevation of about 575 feet, the average low water mark of this section of the Ohio river. The tops of the hills lie on a more or less level and uniform plane and the descent, mentioned above, is chiefly made along the river. In many places throughout the county the hillsides are steep and broken with narrow ravines. At several places the Ohio river valley is very narrow, the hills descending almost to the water's edge. This is particularly true for a distance of 2 or 3 miles just south of St. Marys and for an equal distance at Ravenrock 5 miles above. For the remaining distance the valley is from one-fourth to three-fourths of a mile in width.

The county has a frontage on the Ohio river of about 17 miles. The largest tributaries of this section of the river are Bull creek which forms the county's southern boundary line, Cow creek which empties 3 miles above, French creek which empties at Belmont, and Middle Island creek which empties at St. Marys. The largest tributaries of Middle Island creek in the county are McKim creek and Sugar creek. The general course of all the streams is westward and southwestward toward the Ohio.

The Original Forest Conditions.

Many years ago the rich valley of the Ohio river was occupied by farmers and by them was divested of its timber. For this reason an intelligent discussion of the early forest conditions of that section is hardly possible. It is true, however, that the whole valley was heavily forested with hardwoods such as yellow poplar, black walnut, oaks, hickories, maples, white ash, beech, black cherry, sycamore, white elm and many others. The softwoods, which grew in considerable quantities among the hills, were yellow pine, white pine and hemlock. As a whole the county has afforded an abundant supply of timber.

The Early Lumber Industry.

There was no market for the timber removed by the earliest settlers, and that which was not needed for buildings, fencing etc., was rolled together and burned. While some of the

best timber was destroyed in this way it cannot be regarded as a useless waste. In order to fit the land for cultivation the farmers were compelled to clear it of the forest growth which then had no apparent value to them save for domestic use.

The first timber marketed from the county was yellow poplar, oak and pine, rafted down the Ohio river and used for ship building at Cincinnati, St. Louis and other southern points.

The tan bark industry was one of the first that affected the timber of the interior. Thousands of cords of bark were peeled from the chestnut oaks, which grew on dry ridges throughout the hilly part of the county, and hauled on wagons to St. Marys. Here it was sold to merchants for cash or traded to them for goods. The merchants loaded the bark into barges and marketed most of it in St. Louis and Cincinnati. Two small tanneries at St. Marys, one built at an early date and another in 1871 were the only users of tan bark at home. Since the building of the Ohio River Division of the Baltimore and Ohio railroad in 1884 this method of handling tan bark has fallen into disuse and Pittsburg has become the chief market. It may be said that great waste accompanied this industry as no use was made of any part of the tree except its bark.

During the same period and as late as 1890 hickory and white oak hoop-poles were cut in great numbers. Some of these were used locally by the coopers at St. Marys and others were bought and shipped by merchants. Poles for slack hoops brought \$4.50 and those for tight hoops about \$7.50 per thousand.

The stave and lumber industry came next. The first staves to be taken were split staves. The choicest white oaks were felled and sawed into sections of the right length. These were then split into pieces of the proper thickness for 2 staves, known as "double stuff," and hauled in wagons and sold to merchants and coopers in St. Marys. During the period of an early oil development on Hotseneck creek, in about 1860, most of the staves obtainable were manufactured into barrels by local coopers and used for shipping crude oil. Later, when the oil refineries began the manufacture of barrels, the supply of staves went for this purpose to Parkersburg, Marietta and

Pittsburg. The first stave saw mills came into the county in 1880. In the following 15 years great numbers of staves were sawed and sold to contractors who shipped them to Pittsburg from St. Marys.

The first saw mills to operate in the county were sash saw mills run by water power. These began as early as 1830. The Sylvan mill, located on Middle Island creek about 6 miles above its mouth, was the principal mill in the county from about 1840 to 1880. During most of the year this mill ran day and night. The lumber which it manufactured was rafted to southern points along the Ohio river. Other mills of this kind were the Locke mill, the Lamp mill, the Gattrell mill, the Watson mill and the Seckman mill, all located on McKim creek a tributary of Middle Island.

Portable steam saw mills were brought in about 1870. Their coming marked the beginning of the greatest activity in the lumber industry. Companies bought timber and located mills in nearly all sections of the county. The most extensive operation was that of Jones and Haines. With a stationary mill at Jonestown on McKim creek and several portable mills at various points they employed a force of 100 to 150 men from 1875 to 1884. Cochran Brothers, with 1 mill in Pleasants county and 1 in Ritchie, removed about 3 million feet of timber from Cow creek. Hammet Brothers, also, cut timber in the same section. Capt. Martin Bachman and Nicholas Brothers were prominent operators on French creek.

The cross-tie industry was large from 1870 to 1895. The principal shipping point was St. Marys.

Black walnut, which was once common in rich coves and bottoms throughout the county, was largely taken out and exported to Europe during the "walnut boom" from 1870 to 1875.

There has been an enormous oil production in the county since 1860. The first territory was developed on Horseneck creek in that year and later developments began in 1889. No other one industry has drawn so heavily upon the supply of oaks and other hardwoods of the county. Oil well derricks of the earlier development were "boarded up" on all sides and

required several hundred feet of lumber in excess of the 11,200 feet now used in their construction.

The Present Lumber Industry.

The removal from this small county, through a period of 75 years or more, of hoop poles, tan bark, staves, shingles, cross-ties, lumber and logs, together with the clearing of the land by farmers, has practically exterminated the forests. The lumber industry is now reduced to the work of half a dozen small mills, which saw irregularly from place to place, and to the small operations of a few floating saw mills along the Ohio river.

The Present Forest Conditions.

Only the fragments of a forest now remain in the county. From 65 to 70 per cent of the whole area has been cleared for agricultural purposes. The largest tract of timber remaining is one of about 200 acres in Jefferson district. This has not been cut over because of its ownership by the infant heirs of an estate. As a rule the farmers' woodlots contain but little timber of any kind. In many cases even the cross-tie and pole timber are gone. Portions of numerous farms, especially in the oil fields, have become impoverished by long-continued cropping and are now overgrown with briars and brush.

It should be noted here that in some sections of the county there is a most promising growth of young trees of valuable kinds and that yellow locusts are beginning to occupy otherwise unprofitable ground in many places.

POCAHONTAS COUNTY.

Location and Area.

Pocahontas county was formed in the year 1821 from parts of Bath, Pendleton and Randolph. It lies on the eastern border of the state, the summit of the Alleghany mountains being the dividing line between the county and Virginia. Greenbrier bounds it on the south, Greenbrier, Webster and Randolph on the west, and Webster and Randolph bound it obliquely on the

VIEW IN THE LITTLE LEVELS OF POCAHONTAS COUNTY.

north. Its area, as given by the United State Geological Survey, is 858 square miles or 549,120 acres.

Topography.

"Although the highest mountain in the state is in Pendleton, the county of highest general elevation is Pocahontas. This county can hardly have an average elevation of less than 3,000 feet above the sea."* The eastern line follows the crest of the Alleghany mountains for a distance of more than 50 miles. Westward from this elevated border the surface descends by a succession of parallel ridges and stream channels to the valley of the Greenbrier river. Lying close to the western side of this river, and at an elevation of about 300 feet above it, are to be found in some places almost level areas of upland. Little Levels in the vicinity of Hillsboro is the principal one of these and, with its broad fields of grain and grass and with its border of wooded mountains, forms one of the most fertile and beautiful spots in West Virginia. The western side of the county is occupied by high mountains which are less regular in their trend than those on the east. The names and elevations of a few of the higher mountain peaks of the county are given below:

Bald knob	4,800 feet.
Spruce knob	4,750 feet.
Mace knob	4,700 feet.
Big Spruce knob	4,652 feet.
Bear mountain	4,600 feet.
Elleber ridge	4,600 feet.
Briery knob	4,534 feet.
Locust knob	4,392 feet.
Blue knob	4,368 feet.
Little Spruce knob	4,360 feet.
Gibson knob	4,360 feet.
Buck knob	4,356 feet.
Colaw knob	4,214 feet.
Bayards knob	4,150 feet.

*"West Virginia Agricultural Resources and Possibilities," p. 9.

Greenbrier river, the principal stream, rises in the high mountains in the north and flows southward passing slightly east of the center of the county. Its drainage basin includes about three-fourths of the whole area of the county. The larger eastern tributaries of the Greenbrier, named from south to north, are Joshua creek, Beaver creek, Knapps creek, Thorny creek, North fork, and East fork. These tributaries, with their numerous branches, drain all the area east of the Greenbrier river. Its principal western tributaries are Locust creek, Stamping creek, Swago creek, Stony creek, Laurel run, Clover creek and West fork. The streams which drain the western side of the county, named from south to north, are North Fork of Cherry river, Cranberry river, Williams river, tributaries of the Gauley; Old Field fork, Slaty fork, Big Springs fork, and Dry fork, tributaries of the Elk river; Tygarts Valley river, tributary of the Monongahela; and Shavers fork, tributary of the Cheat river. A small area on the west is drained by the heads of the North, Middle and South forks of the Gauley river. It is thus seen that no fewer than 8 rivers have their sources in the mountains of Pocahontas, making it an area of great importance from the standpoint of water protection and distribution.

The Original Timber Conditions.

The county has been and still remains, one of the most important timber regions of the state. Red spruce once covered the high mountains lying west of the Greenbrier river basin and a large area in the north drained by the headwaters of the Greenbrier and Shavers Fork of Cheat. With and near the spruce grew such other woods as hemlock, black cherry, yellow birch, sugar maple, beech and chestnut. On the lower grounds between the mountainous sections of the east and west grew most of the hardwoods common to central West Virginia. These included such species as yellow poplar, black walnut, white and red oaks, basswood, white ash, hickories and maples. East of the Greenbrier river, even on the highest elevations, spruce was not found to any extent south of the town of Greenbank. White pine was distributed in large areas along Deer creek, Sitlington creek, Knapps creek, and other eastern tributaries of the Green-

brier river. The original stand of white pine has been estimated by some at 600 million feet, and by others at 1 billion feet.

The Lumber Industry.

The facts given below regarding the early lumber industry in the county were obtained largely from data collected for this report by Hon. A. D. Williams, of Marlinton.

We do not know precisely when and where the first lumber was manufactured in Pocahontas county; but we are certain that the first sawing was done by the old-fashioned whip saw and that this was followed by the water mill, or "up-and-down" saw mill, as it was commonly known. After this the portable steam mills began to operate, and in later years the modern band saw mills. The development of machinery for the manufacture of lumber, as illustrated in this county, has been nothing short of marvelous; and the change from one method of sawing to another in each case has marked the beginning of an epoch in the lumber industry.

It seems that little has been written concerning the saw and its part in the industrial history of the county, important as this has been, and that many of the interesting facts connected with the early use of timber have been lost with the pioneers themselves. There are a few men yet living, however, whose memory covers the whole period of time in which the hand operated whip saw has given place, step by step, to the huge lumber plant of the present day. On information given by these men, and on the records left in the remains of the early dwellings, we must depend for the fragments of history given below—fragments which would be lost entirely to the next generation.

It is evident that the first dwellings were built without the use of any instrument for sawing, and that all the parts—the log walls, the board roofs, and the puncheon floors—were shaped with the axe, the adz, and the frow. An examination of the dwellings built a few years later shows that their floors were made of whip-sawed lumber. Among the dwellings yet standing, which have floors of this kind, is the home of Martha Dilley, widow of the late Andrew Dilley, son and occupant of the home of the pioneer Martin Dilley. The floors in this dwelling were

laid of pine lumber and by long usage the softer parts of the planks have worn away so that now every knot and resin spot stands up prominently. It cannot now be ascertained who did the whip sawing for this floor.

The first whip saw known to have been used in the vicinity of Marlinton was owned by the McCollums and "Lowey" McCollum was known as the sawyer. For years he and Alexander Lamb did the neighborhood sawing. At the death of Lawrence McCollum the saw was sold to Levi Waugh and by him to James Courtney, the pioneer of the Courtney family in Pocahontas. At the latter's sale it was sold to William Irvine of the Verdant Valley vicinity.

In the Back Alleghany region, which is that part of the county west of the Greenbrier river from Durbin south to a point some distance below Cass, William Cassell was the possessor of a whip saw that he used until near the year 1880. The last work done with this saw, of which any note was taken, was in sawing plank for the home of William Cassell Jr. built by D. B. McElwee and C. B. Swecker in 1877. The older Graggs of the same section owned and operated a whip saw about 100 years ago.

The Burners, Yeagers, and Arbogasts, of the "Upper Tract" were the owners and operators of a whip saw in the vicinity of Travelers Repose many years ago.

In the lower Pocahontas, or Hillsboro region, doubtless the first whip saw brought to the county was owned and used by Charles and Jacob Kennison who, with John McNeel, settled in the Levels in the year 1765. Charles Kennison was considered a good artisan in that day and the old pioneer house of John McNeel and the residence of the late Claybourn McNeil, of Buckeye, still stand as samples of his skillful work. Ezekiel and Fillden Boggs owned and operated a whip saw during the early days of settlement in the Levels section; and later another saw was procured by John and Frank Williams, who did considerable work in that neighborhood.

It is probable that the Cackleys at Millpoint (then Cackley Town), the Gibsons and Hannahs at Yelk, and the Bradshaws of Knapps creek, all owned whip saws in the early history of the

county; but no definite information regarding the time and the extent of their work has been obtained.

The last whip sawing in the county of any note, was done by Andrew Amos and Andrew Workman about the year 1880. The lumber was used by L. M. and Geo. W. McClintic for the construction of the Tea Creek Hunting House, at the mouth of Tea creek.

According to information obtained from Isaac McNeil and others, a water-power saw mill was built by the McNeels some years after their settlement in the southern end of the county in the year 1765. It is probable that Charles Kennison, who planned and worked on the fort in that section, helped to construct the first saw mill.

In 1778 Valentine Cackley settled at Millpoint and erected a grist mill, saw mill, and tilt or forging hammer. He also started a tannery, and in later years a store, making this the central place of business in lower Pocahontas for many years. Later the sons of Valentine Cackley, Valentine Jr. and Joseph, succeeded their father and erected another mill, Valentine taking the lower mill and Joseph the upper. Joseph Cackley afterward sold his mill to Sampson L. Matthews who operated it for several years. Only broken pieces of the old mills now remain.

Thomas Casebolt built and operated a sash saw mill on the headwaters of Locust creek about the beginning of the 19th century. Shortly after this Josiah Beard Sr. built a saw and grist mill on the same creek. Near this time, also, John H. Ruckman built a dam and erected a mill at the mouth of Stamping creek, a tributary of Greenbrier river.

About 1850 James F. Hill built a saw mill on Rush run between Jacox and Lobelia; and a little later the venerable Peter Hill, to whom we are indebted for considerable information, built a saw mill on Hills creek. Still a little later Morgan Anderson built a mill on Bruffeys creek, and about the same time Henry N. Clark erected another on Robins fork of Spring creek not far from the county line and the old Hudson-Martin corner.

Paul McNeel built and operated a saw mill on Spice run for many years. This successful operation was east of the river and

most of the timber cut was white pine which could be sawed easily and bought at a very low price.

Thomas McNeel settled on 300 acres of land on Swago creek about the year 1770. Here he built a grist mill, loom, and powder mill, which he ran by water power. After his death his son, Jonathan McNeel Sr. used the power for sawing lumber, weaving cloth, making powder and grinding grain.

A sash saw mill was operated by Mike Propps above the mouth of Stony creek during the early years of the last century. All that now remains of this mill is a remnant of the race and dam. Farther up the creek the early Duffields had a saw and grist mill which was erected by William Cochran and Alexander Lamb. The place is now marked by the combination flouring mill, shingle mill, and saw mill owned by Godfrey Geiger and operated by water-power.

On Big Spring fork where McLaughlin's mill stood, Robert Moore built and operated a saw and grist mill. Lieut. Beverly Waugh, who furnished much information regarding the early saw mills, remembers when but a small boy of seeing Amos Barlow with red oxen hauling lumber from this mill to the home of his father, the late Rev. John Waugh of Indian Draft, to pay for blacksmith work prior to the year 1840. In later years Rev. John Waugh built a dam and erected a saw mill in the Indian Draft near his home. In connection with his other work of sawing lumber, blacksmithing and farming, he wheeled the first wagon in the county. The wheels of this wagon, which was owned by Robert Gay, were made of solid blocks of wood bound with iron tires.

David Gibson built a grist and saw mill on the waters of Elk about the year 1840 and did the neighborhood sawing and grinding for a time.

Andrew Amos had a grist and saw mill farther down the Elk at Roaring run on the Hogsett place, and John Hannah, known as "Black John Hannah," operated a saw mill on Old Field fork of Elk.

One of the early saw and grist mills of the county was erected at Clover Lick by Jacob Warwick, a pioneer settler in that section. This mill stood on the farm now owned by the Hon. C. P. Dorr.

Farther up the west side of the Greenbrier river at Stony Bottom an old mill, known as the Galford mill, where Adam Geiger's grist mill now stands, did the sawing for the inhabitants of that section.

On Leatherbark creek there were 2 sash saw mills, one owned by Allen Galford near Cass and the other about 5 miles up the creek owned by James Cassell.

Hugh McLaughlin owned a water saw mill about 4 miles west of Durbin.

Down on the east side of Greenbrier river Robert Gay built a mill and sawed white pine on Beaver creek at the point where the Underwood mill now stands. McCombs also had a saw mill on this creek.

On the waters of Knapps creek John Bradshaw, a pioneer settler, built a saw mill just above Huntersville near the beginning of the last century, and about the year 1830 Geo. Craig erected a saw mill at the Gum Friel place. This mill, long known as the Barker and Friel mill, did good work and was run steadily for some time. Near Driscoll, James T. Lockridge owned a saw mill which was built by Peter Lightner some time before the year 1800. The lumber from this mill was hauled to the western part of the county. Some of the ceiling, weatherboarding and flooring, used by the late Alexander W. Sharp in building one of the first frame houses in the county, was sawed on this mill and hauled by oxen for a distance of 20 miles.

Washington Moore and Samuel Harper each had a saw and grist mill on Knapps creek. James Sharp built a saw mill in 1825 near Frost on what is now the Aaron Sharp farm; and about the same time Rev. James Wanless erected a mill on the John F. Wanless farm, and another on the Robert D. McCutcheon place about 1835. Logs used in the first M. P. church built in the county were squared on this mill. The mill at the place now known as Dilleys Mill, was erected by the pioneer, Henry Dilley, in 1830.

At Dunmore on Sitlington creek Jacob Warwick built some kind of a saw mill in the early pioneer period. Later Isaac Moore erected a mill, or rebuilt the Warwick mill, and operated it steadily for many years. During a part of the time this mill was kept running day and night in order to meet the demand

for lumber there. Still later the Pritchards put up another mill at Dunmore; and another located on Sitlington creek about 5 miles from Dunmore was owned by Lindy Taylor.

One of the first saw mills stood on Little Back creek, a branch of Deer creek, where Daniel Kerr, soon after he returned from the Revolution, settled and built the mill and blacksmith shop which made his place the center of trade in that region for a time. In the early days, also, Benjamin Arbogast or his descendants, erected a saw mill at Greenbank; and 2 miles above on Deer creek at what is now known as the Heavener mill there has been a mill for over 75 years. Four miles above Greenbank Robert Brown still operates the only sash saw mill known to be running in the county.

Over a hundred years ago John Yeager settled at Travelers Repose and he and some of his descendants had a mill near that place.

The first steam saw mill in the county was used during the Civil War by the Federal troops. According to Lieut. Waugh, the same mill was used in Upshur county.

The first steam saw mill to do regular work in the county was put in operation in 1873 at Mace on the Dry fork of Elk by Dan, John, and Jake Garber, who came from Augusta county, Virginia. The cherry lumber sawed at this place was hauled on wagons over Elk mountain and rafted down the Greenbrier river to Ronceverte.

About 1875 John Marshall, also from Augusta county, moved a steam saw mill into Lower Pocahontas where it was in operation for some time. This mill is remembered by Levi Waugh as it stood near the town of Buckeye covered with mud after the flood of 1877.

The first steam saw milling in the Dunmore section was done by a man by the name of Sherman.

In 1830 Albert L. Whitmore started a steam saw mill in the county, and in 1882 Capt. Lokin, John Peters and Pritchard began to operate a mill of the same kind at Clover Lick. Charles Callison located a steam saw mill in the Levels in 1885, and in the following year Uriah Bird, McClintic and Peters began another operation. After this James Gibson commenced a portable saw mill operation which he continued for many years.

LICHEN BEDS IN CRANBERRY GLADES.

Other operators who deserve mention in connection with the portable saw mill industry prior to the coming of the railroads, are J. N. White, Jiles Sharp, Andy Wooddell, S. M. Gay, Frank Dilley and N. S. Duffield.

Most of the valuable black walnut that grew on the lowlands of the county was cut and floated out on the Greenbrier during the decade from 1880 to 1890.

Considerable white pine was cut, not only by means of the whip saw and water saw mills¹ before mentioned, but for fence rails, shingles, puncheons, hewed frame timbers, and for all manner of wooden articles used about the homes of the early settlers. During a visit to the white pine region about Huntersville in the fall of 1909 Dr. A. D. Hopkins, of Washington, D. C., was informed that not less than 100 miles of worm fence had been built of white pine rails in that immediate vicinity.

The first white pine that was cut in large quantities for commercial purposes was floated out of the county in the early seventies by Col. Cecil Clay, who, in company with James Waugh, made an examination of the timber in the white pine belt during a trip up the Greenbrier in 1867. His work was done principally by negroes and oxen.

The *Greenbrier Independent* of March 11, 1871, gives an account of the incorporation of the Greenbrier River Boom, Lumber, Iron, Land, and Manufacturing Company, with James Caldwell, John A. Hunter, S. A. M. Syme, S. S. Thompson, R. P. Lake, S. C. Ludington, R. F. Dennis, Matthew Wallace, B. F. Harlow, and Jesse Bright, as members of the firm. The operations of this company followed the work of Col. Clay and continued until about the year 1882, when it was succeeded by the St. Lawrence Boom and Manufacturing Company, which at that time built its booms at Ronceverte. Much of the lumber was cut by Smith and Whiting and Whiting and Denny, and by Col. Dan. O'Connell, who afterward organized the Cumberland Lumber Company.

The Chesapeake and Ohio railroad reached the county in 1899, was extended up to Cass in 1901, to Durbin in 1902, and to Winterburn in 1905. The Coal and Iron railroad was extended from Elkins to Durbin in 1903. Before the building of these railroads only a small beginning had really been made in the

immense forests of the mountainous parts of the county; but with their coming began an active lumber industry which has continued to grow until today there are 14 huge band saw mills and about 26 circular saw mills in operation within the county. These, according to figures furnished by Mr. J. M. Paris, of Marlinton, have an approximate combined capacity of 350 million feet annually. Practically all the virgin forests of the county are in the hands of operators who have already made large openings and who are prepared to complete the cutting of all valuable timber within a comparatively few years.

The Present Forest Conditions.

There are about 212,000 acres of virgin forest and 138,000 acres of cut-over forest now remaining in the county.

The forests lie in an almost solid body along the western side of the county and in the northern end, and in large scattered tracts on the east of Greenbrier river. The most extensive virgin areas are to be found on the waters of Cherry, Cranberry, Williams, and Elk rivers in the region adjoining Webster and Randolph counties; on the west face of the Alleghany mountains north of the village of Frost; on both sides of the East fork of Greenbrier river in the region of Travelers Repose; and along the east side of Greenbrier river from Hosterman to the Greenbrier county line. Smaller tracts are scattered among the areas of cut-over forest in nearly all sections. The largest areas of farm land lie in a broad, irregular belt on the northwest side of the Greenbrier river from Clover Lick to Spice Run, and in the smooth uplands and valleys which lie between the mountain ranges on the east of Greenbrier river.

The white pine was nearly all cut and removed between the years 1882 and 1900. In the section about Huntersville, drained by tributaries of Knapps creek, there is a fairly good reproduction of young white pines; but in the region north of Dunmore fires have repeatedly burned over the ground destroying the seeds and seedlings; and the area which once contained a valuable forest of white pine is growing up in scrubby oaks, chestnuts, and other hardwoods. A few of the cut-over forest areas are in a good condition and others have been abandoned to the

fires which frequently rage along the Coal and Iron railroad and in other sections.

According to William T. Price, author of "Historical Sketches of Pocahontas County," "The climate of this county has passed through a great change in the past 80 or 90 years. It was once a rare thing for corn to ripen anywhere in the region, and in planting it was the intention merely to have soft corn for use in fattening beef or pork in case the mast failed." In these days, since a considerable area of land has been cleared and cultivated during a long period of time, fine crops of corn and other grains are matured in every farming community.

Cranberry Glades.

The high region covering the western part of Pocahontas county, drained by hundreds of clear mountain brooks that flow into the Cranberry, the Williams, the Gauley, and the Elk rivers, was once known as the "Wilderness" or the "Wilds of Pocahontas," a region until recently overgrown with a dense, undisturbed forest and abounding in game of many kinds. Here, in the midst of the "Wilderness" and on the border of the greatest forest remaining in the state, are the Cranberry Glades near the head of Cranberry river.

There is, in reality, only one glade, containing from 250 to 300 acres of deep, wet soil overgrown in some places with a thicket of shrubbery and in others carpeted with lichens, mosses, and sedges. Within the glade there are 5 open spaces the names and areas of which are given below:

Big Glade	56 acres.
Flag Glade	20 acres.
Long Glade	14 acres.
Round Glade	8 acres.
Little Glade	2 acres.

Each open area is separated from the others by winding and sluggish streams which are bordered by fringes of alder, hollies and other shrubs.

There is, perhaps, no area of equal extent in West Virginia which is of greater importance for its influence on water flow,

nor one more interesting to the student and collector on account of its varied forms of plant and animal life than this glady region lying at an elevation of 3,100 feet above the sea and surrounded by mountains which rise from 1,000 to 1,500 feet above it.

A few of the characteristic species of plants, mammals and birds collected by a party which visited the Glades in July, 1909, are named below:

Plants.

Red Spruce, *Picea rubens*. Abundant on margins of glades and on mountain summits.

Quaking Aspen, *Populus tremuloides*. Growing on margin of glades.

Mountain Ash, *Sorbus americana*. Common around glades.

Ground Hemlock, *Taxus canadensis*. Shrub growing abundantly in wet, shady places.

Northern Rattlesnake Plantain, *Epipactis repens* var. *ophioides*.

Collected by Dr. John L. Sheldon under a hemlock tree near the edge of the glades.

Rose Pogonia, *Pogonia ophioglossoides*. Common in sphagnum moss in open glades.

Horned Bladderwort, *Utricularia cornuta*. Found growing in Big Glade.

Round-leaved Sundew, *Drosera rotundifolia*. Common in open glades.

Sphagnum Moss, *Sphagnum Girgensohnii* Russ. This northern species was found growing with other Sphagnums in the glades and collected by Dr. Sheldon.

American Cranberry, *Vaccinium macrocarpon*. Common on edges of open glades.

Small Cranberry, *Vaccinium Oxycoccus*. Abundant over all the open glades. A peculiar "speckled" form of this berry was collected in Round and Flag glades.

Mammals.

Yellow-cheeked Meadow Mouse, *Microtus chrotorrhinus*. One specimen collected in July, 1909 on southern edge of glades by Fred E. Brooks. Not taken before south of the Adirondack mountains, New York.

Masked Shrew, *Sorex personatus*. Common in open glades and about their borders.

Smoky Shrew, *Sorex fumeus*. Less common.

Red-backed Mouse, *Eutamias gapperi*. Most abundant in wooded border of glades.

Birds.

Alder Flycatcher, *Empidonax traillii alnorum*. Collected on margin of Big Glade by Earle A. Brooks.

Swamp Sparrow, *Melospiza georgiana*. Seen in alder thickets.

Magnolia Warbler, *Dendroica maculosa*. Common.

Barred Owl, *Strix varia*. Abundant.

PRESTON COUNTY.

Location and Area.

Preston county was formed in 1818 from a part of Monongalia. It is separated from Pennsylvania on the north by a portion of the Mason and Dixon line, and from Maryland on the east by a line running north from the Fairfax Stone to the Pennsylvania line. Tucker, Barbour, Taylor and Monongalia join it on the south and west. Its area is 671 square miles or 429,440 acres.

Topography.

Most of the county is high and not a little of it may be classed as mountainous. The principal mountain ridge enters on the extreme southwest from Barbour county and passes about 3 miles west of Terra Alta. South of Cheat river this mountain is known as Laurel ridge and north of it as Briery mountain. Over most of the county the ridges have no regularity of form or trend. In many localities, particularly in the region north of Terra Alta, the surface spreads out into high, rolling uplands; and in nearly all sections the tops of hills and mountains are smooth and the slopes gentle. In some places, however, as in

the lower course of Cheat, the streams flow through deep canons with rugged and precipitous walls.

The Cheat river, which flows north and northwest dividing the county into two almost equal parts, is the principal stream. Its chief tributaries from the east are Big Sandy creek, Muddy creek, Roaring creek, Saltlick creek and Wolf creek. Those from the west are Bull run, Laurel run, Greens run, Morgan run, Lick run, Pringle run and Buffalo creek. A large area in the southwest is drained by the headwaters of Deckers creek, a tributary of the Monongahela emptying at Morgantown, and by Threefork and Sandy creeks emptying into Tygarts Valley, the former at Grafton, the latter about 8 miles above. Rhine creek, Snowy creek, Muddy creek and Saltblock run, all tributaries of the Youghiogheny, drain a belt of land on the east.

Original Timber Conditions.

Preston was once an immense forest containing practically all the common hardwoods on its lower lands, and areas of spruce, white pine and hemlock along its cold mountain streams and uplands. The spruce grew principally on Snowy creek, the head of Saltlick creek, and in the vicinity of Cranesville. White pine was found in limited quantities near Cranesville and on Threefork creek. Pitch pine was once common on Snaggy mountain east of Terra Alta. Chestnut, poplar, white oak, red oak, chestnut oak, ash and hickory may be mentioned as the principal hardwoods.

When the first settlers came into the Preston county area there were open glades scattered here and there in the wilderness that attracted their attention. There were the glades at Cranesville, at Reedsville and in the vicinity of Terra Alta, as well as those on Sandy creek and in several other places. Washington speaks of the Sandy creek glades as having a "pretty appearance, resembling cultivated fields and improved meadows at a distance." "Here fire, storm, heat or cold had brushed away the forests and laurel thickets, and in their place waved long grasses and wild flowers on the highland mountain summits. For scores of miles not a tree was to be seen save where little rivulets traced a course toward the Ohio or the Potomac.

These smiling meadows on the roof of the Alleghanies are not more popular with summer tourists to-day than with the large game-animals, the deer, elk and buffalo of a century ago. When the pioneers came the glades were the great pasture grounds for all who could reach them.”*

The above description was written of the glades in Alleghany and Garret counties, Maryland, and Preston county, West Virginia, but the “scores of miles” must refer to conditions outside the state as the open, grass-covered glades were comparatively small on the West Virginia side. Most of the glade land, in fact, was overgrown with shrubs and some of it with dense stands of trees. An example of this was the Pine Swamp located on the Maryland line near the town of Cranesville, which had a forest of spruce, white pine, hemlock, wild cherry and tamarack.

The Lumber Industry.

Although settlements were made at Bruceton, Reedsville, Kingwood and Aurora before the beginning of the 19th century, “the whole country,” says Major Orr, “was covered with timber in 1840 except the small farm openings of the scattered settlements.”

Here, as in other counties, the pioneers made use of the excellent water-power of the mountain streams for the manufacture of lumber on primitive saw mills, used almost exclusively for the first 50 or 75 years. The names and locations of a few of the old saw mills are given below:

Joseph Ringer’s mill, on tributary of Muddy creek of Cheat.

Zeller’s mill, near the mouth of Roaring creek.

Friend’s mill, on Daugherty creek.

Gandy’s mill, on Maple run.

Thos. Waters’ mill, on Raccoon creek.

David Fortney’s mill, on Threefork creek.

Henry Albright’s mill, on Muddy creek of Youghiogheny.

Browning’s mill, on Muddy creek of Youghiogheny.

Wakefield’s mill, on Muddy creek of Youghiogheny.

The first circular steam saw mill was brought to the county

*“Washington and the West”—p. 120.

by James Cain, who began to operate it about 2 miles south of Tunnelton in 1854; the second was put in operation in 1865 by Maj. U. N. Orr about 2 miles east of Newburg; and 2 years later the third was brought in and stationed near Austin by Martin L. Shaffer. Soon after this—beginning about 1870—portable steam mills began to scatter into all parts of the county.

A. A. Perry and Company operated a gang saw mill and stave factory at Rowlesburg from about 1870 to 1879. This mill was largely supplied with logs that were floated down the Cheat.

Hinkle and Company did an extensive business with a circular mill at Rowlesburg from 1885 to 1895.

The stave industry was begun at Independence in 1853, the next year after the Baltimore and Ohio railroad was completed to that station. A company of Philadelphia lumbermen bought a large number of excellent white oak trees in that section and used and wasted them in this industry. Nearly all the portable saw mills used their slabs and small timber in the manufacture of staves, in this way showing themselves less wasteful than many of the present operators.

The tan-bark industry has been carried on from 1876 to the present. Chestnut oaks have been peeled in almost every section and the bark hauled in wagons to the Baltimore and Ohio railroad.

There have been no operations larger than the gang saw operation at Rowlesburg; and practically all the timber cut in the county has been sawed on small portable mills, of which there are about 100 still in operation.

Present Forest Conditions.

There are scattered tracts of virgin timber in the county which aggregate about 30,000 acres. These lie almost entirely along the Cheat river and on Roaring creek, Big Sandy creek and Laurel run. The narrow belt of virgin timber lying along the steep bluffs of the Cheat and lower course of Big Sandy creek is not good in quality nor easily accessible. The tracts lying on land which is not so steep, however, contain excellent stands of timber. The cut-over forest lands, aggregating about

Photo by T. A. Morgan.

SCENE ON THE GREAT KANAWHA NEAR BUFFALO, PUTNAM COUNTY.

58,000 acres, are found in several widely scattered areas, some lying on the Cheat river near the Tucker line, some on Brushy and Briery mountains, and others on the heads of Muddy run and on the Cheat near to the Monongalia line.

Grains, vegetables and fruits are successfully grown in nearly all parts of the county and much of the remaining woodland will probably be cleared for agricultural purposes.

PUTNAM COUNTY.

Location and Area.

Putnam county, formed in 1848 from parts of Kanawha, Mason and Cabell, lies southwest of the center of the state and is separated from the Ohio river by Cabell and Mason counties. Its area is 355.3 square miles or 227,392 acres.

Topography.

The county is hilly throughout except in the broad bottoms of the Great Kanawha river and in the narrower bottoms of some of its tributaries and the tributaries of Mud river. A peculiar depression in the surface, known as Teays Valley, extends westward across the southern end of the county from the Great Kanawha river to the Mud river in Cabell county. This almost level belt of land, which contains from 3,000 to 5,000 acres, was doubtless once the channel of the Great Kanawha river. Before the ice age, it is said, the Great Kanawha and the Big Sandy formed a river which flowed northward through the Scioto valley and discharged its waters into the Great Lakes.

The Great Kanawha river flows northwestward passing not far from the center of the county. Its principal tributaries from the north are Eighteenmile creek, emptying at the Mason county line; Buffalo creek 4 miles below Winfield; Guano creek about 4 miles above Winfield; and Pocatalico river emptying about 4 miles below the Kanawha county line. The southern tributaries of the Kanawha river are Little Hurricane creek and Hurricane creek, emptying about $1\frac{1}{2}$ miles and 3 miles respectively below Winfield; and Twentymile creek emptying

about 2 miles above Buffalo. A comparatively small area on the south is drained by Trace Fork and other tributaries of the Mud river, and a small area on the west is drained by Eighteen-mile creek, a direct tributary of the Ohio.

Original Timber Conditions.

The timbers of the county were principally hardwoods, the oaks, yellow poplar and beech predominating. The principal softwoods were yellow pine and red cedar. There were small quantities of white and scrub pine and hemlock. Mr. Louis Barnhart, of Winfield, gives the names of 40 hardwoods that are commonly found in his section, and speaks of oak, yellow poplar and yellow pine as timbers that deserve special mention on account of their abundance and good quality. A yellow poplar, said to have been 10 feet in diameter and 80 feet to the first limb, once stood in the southern end of the county.

The Lumber Industry.

Much of the rich bottom land and portions of the hill country were cleared by the early settlers many years before the timber had any commercial value. Only a small percentage of the heavy stand of timber could be utilized for log houses, fences, etc. and so the rest was rolled together in heaps and burned just as it was in all other pioneer settlements. The only lumber manufactured during these early times was sawed by hand-operated whip saws or by primitive water saw mills. The latter, however, were not used to a great extent as in many other counties. Ventroux mill, which ran many years ago on Hurricane creek, was of this type.

About the first timber cut for commercial purposes was split into barrel and pipe staves by the owners of woodland and sold for cash or traded for goods at the various stores located at Buffalo, Redhouse, Winfield, Poca, and other points along the river. The merchants shipped most of the staves down the river in barges. This industry began before the Civil War and continued for 10 or 15 years. Later this grew into a large business. Buyers came in and bought and shipped staves from

all points along the river and in many sections in the interior. Staves that were bought in the hilly sections were often floated down the creeks and runs and were loaded with those from the valley in barges at the river. Most of the staves were sold to Poston Stave Company. Stewart, Morrison and Company, and other coopers, made a large number of salt barrels at Winfield, Poca and other places, during the days when the Kanawha river salt furnaces were flourishing.

An extensive sawed stave industry was carried on by D. G. Courtney of Charleston, approximately from 1885 to 1900, with mills at Raymond City. Large quantities of oak growing on Pocatalico river and its tributaries were manufactured by him into oil barrel, firkin, tub and beer keg staves and shipped to Holland, Austria and other European countries. He also manufactured lumber and cross-ties during the same period.

The cutting of cross-ties and hoop-poles began early and continued for many years. Merchants bought cross-ties, just as they did staves, and shipped them in barges or by rail. This practice is still kept up to some extent.

Much oak and poplar was cut and taken out in the log for ship timber between 1870 and 1900. Hanley Brothers were the chief purchasers of logs for this purpose.

The rafting of logs to Huntington, Iron-ton, Cincinnati and other points was an important feature of the lumber industry for many years. Black walnut was taken out, principally in the log, on the river and by rail.

Portable saw mills have been operating in the county for 40 years or more and have had a large share in the reduction of the timber stand in all sections. Much of the oak was sawed into export and car stock, the latter going principally to the car works at Huntington.

Merchants bought and shipped considerable tan bark 25 years ago and some was bought by other purchasers. A quantity of bark was sold also to a company which loaded it on a boat provided with machinery for grinding and pressing it into cakes of a convenient size and shape for shipment.

A few portable mills are still operating irregularly, some of which manufacture cross-ties and others lumber.

Two or three farmers along the river are keeping up groves of red cedar which produce profitable yields of excellent posts.

Present Forest Conditions.

Not far from half of the county is still wooded but there is but little good timber remaining. A few farmers have reserved small boundaries of good timber. Most of them, however, have disposed of even their young trees for cross-ties.

Farmers own all the forest land in the county except a broken tract of 24,000 acres lying above Winfield and fronting on the Great Kanawha river; a tract of 10,000 acres owned by Whitehouse heirs who have leased same to coal companies; and about 2,200 acres owned by a coal company on the south side of the river 2 miles from Winfield. Scattered improvements are found in many parts of the forest tracts mentioned above, and an area of only about 4,500 acres, lying northeast of Winfield can properly be classed as cut-over forest land.

RALEIGH COUNTY.

Location and Area.

Raleigh county, formed from part of Fayette in 1850, is bounded on the north by Fayette, on the east by Summers and Mercer, and on the south and west by Wyoming and Boone. Its area is 560 square miles or 358,400 acres.

Topography.

The land now included within the boundary lines of Raleigh was once part of a great inland plateau which has been modified, in many places beyond recognition, by the action of streams and other natural agencies. New river, which forms the northeast boundary of the county, has cut a winding channel through this plateau to a depth of more than 1,000 feet, and numerous tributaries of the Big Coal, the New and the Guyan-dot rivers have furrowed it deeply in all directions. An area of not less than 100,000 acres lying in the interior of the county

still bears some resemblance, however, to its original form. But even here the slow-flowing streams have left their marks, changing the once smooth and lofty plateau into a rolling upland.

The greatest elevations of the county are to be found along the mountains which border it on the south and west. Ivy Knob, on the southwest, rises to 3,693 feet, and in several places an elevation of 3,500 feet is reached along the Great Flat Top and White Oak mountains. Big Coal river leaves the county on the west at 900 feet, the lowest point; New river, in the north, leaves at 1,150 feet, and Guyandot river, in the south, at 1,600 feet.

New river, with Glade creek, Piney river and other smaller tributaries, drains the eastern third of the county. A smaller area on the north is drained by the head waters of Paint and Dunloup creeks, tributaries also of New river. Clear and Marsh Forks of Big Coal river drain the western side of the county, and Winding Gulf creek, Slab Fork and Tommy creek, tributaries of the Guyandot, drain a large area in the south. In the interior uplands are to be found the fountain heads of numerous small streams which wind sluggishly through glades and meadows and open woodlands. These finally unite their waters to form the creeks and rivers which descend through narrow, rocky gorges to the lower levels of the larger streams.

The Former Forest Conditions.

This county, with its greatly diversified surface, has been and is still the natural home of many species of valuable timber trees. White pine once grew in abundance on about 50,000 acres lying at an elevation of from 2,500 feet to 3,000 feet on the waters of Glade creek and Piney river. This area, with its extension into Mercer county, formed one of the three principal bodies of white pine to be found within the state. Outside of the white pine belt, hemlock is the only softwood growing in large quantities. Yellow poplar and the oaks, principally white oak, are the most abundant of the valuable hardwoods. Percentages of the principal timbers growing on two widely separated virgin tracts will show to what extent the quantity of species varies in the different localities. The timber on a 30,000

acre tract on the waters of Big Coal river stands, approximately, as follows:

Yellow Poplar	60 per cent.
White Oak	10 per cent.
Red Oak	} ..10 per cent
Black Oak	
Chestnut Oak	
Chestnut	} 20 per cent.
Maples	
White Ash	
Beech	
Hemlock	
Birch	
Sweet Buckeye	
Hickory and	}
others	

The percentages of species on an 18,000 acre tract on waters of Guyandot river are as follows:

Yellow Poplar	35 per cent.
White Oak	20 per cent.
Red Oak	} 15 per cent.
Black Oak	
Chestnut Oak	
Hemlock	10 per cent.
Chestnut	} . 20 per cent.
Beech	
Hickory	
Maples	
Sweet Buckeye	
Basswood	
Cucumber, and	
others	

The Early Lumber Industry.

Little can be said concerning the early cutting of lumber in Raleigh county. The first lumber, sawed by hand and on 3 or 4 rude water saw mills, was used by the comparatively few

early settlers for domestic purposes. Not until 10 years or more after the close of the Civil War were portable steam saw mills put into operation in the county. These, for a number of years, sawed but little. From about 1888, however, numerous mills of all sizes have been brought in. A few of these are named below:

Beatty Lumber Company, with a circular mill, cut white pine near Crow on Beaver creek and Glade creek and trammed it to the Chesapeake and Ohio railroad at the mouth of Glade creek.

Interstate Lumber Company, with circular mills, cut a large area on the head of Maple Meadow branch of Marsh Fork.

Marsh Lumber Company has operated several circular mills on Marsh Fork of Big Coal river, cutting over a large area in that section.

George Bair operated a circular mill on Piney river and on Marsh Fork waters.

J. B. Earwood has been cutting on Piney river near Beckley.

Raleigh Lumber Company, with a large band mill near Beckley, operated from 1898 to 1907. At that time the mill went into the hands of the W. M. Ritter Lumber Company which has since been running it.

The Blue Jay Lumber Company, with a band mill, has cut over a large area of white pine and hemlock on Piney river and on Beaver and Glade creeks.

The American Column and Lumber Company, with a band mill at Colcord, has been cutting on Clear Fork of Big Coal river.

The Bowman Lumber Company, with a band mill at St. Albans in Kanawha county, has been engaged in removing timber from a 60,000 acre tract in Raleigh and Boone counties.

Many of the owners of small mills who operated in the county several years ago met with only indifferent success and often failure. Mills were brought in and erected at great expense and the lumber frequently had to be hauled on wagons a distance of 20 or 25 miles to the railroad. To this excessive cost of manufacture and the lack of proper shipping facilities

are attributable, chiefly, the results to operators mentioned above.

The principal shipping points for lumber have been Prince, McDonald and Raleigh, at first, and later the various stations along the Virginian railroad, and Surveyor on the Chesapeake and Ohio railroad.

Most of the large streams of Raleigh are too rough and rapid for the rafting or drifting of logs. A few were drifted out, however, on the Coal river waters, 20 years ago or more and a few at the same time on the waters of Paint creek.

The Present Lumber Industry.

With the completion of the Virginian railroad through the county in 1907, and with the extension of the Chesapeake and Ohio branch to Lester in the same year, the lumber industry was greatly increased. These railroads, with another branch of the Chesapeake and Ohio now being built from Pemberton down the Winding Gulf branch of Guyandot river, have entered the chief timber belt of the county. A band mill erected at Maben in Wyoming county in 1907 and the one at St. Albans, mentioned above, are drawing their supply of logs from Raleigh county. These mills, including 3 band mills and numerous smaller mills now in operation, are making great inroads on the virgin forests. The combined capacity of all mills is not less than 60 million feet per year. If the cutting at this rate is continued for a few years the virgin areas will be cut over and the farmers' woodlots and the sparsely timbered areas ransacked for every valuable tree.

The Present Forest Conditions.

From the information obtainable in the short time allotted for investigation in this county, 117,600 acres are yet in virgin forest, 112,500 acres are cut-over forest and the remaining 128,300 acres are cleared and woodlot lands belonging to farmers and other small owners. The virgin lands lie chiefly on the head waters of Piney river and on the waters of Guyandot in the southern part of the county, and on the waters of Big Coal river

NATURAL BLUE GRASS SOD ON TURKEY BONE MOUNTAIN, RANDOLPH COUNTY.

in the western part. Smaller areas are found in other places. The cut-over lands lie chiefly in the eastern part of the county. Large tracts are to be found, however, in the south-central, western and northwestern sections.

All the white pine has been taken out except an area of about 2,000 acres on Piney river, now being vigorously cut, and a very small area lying near to Beckley, the county seat. The parts of the white pine belt not frequently visited by fire are restocking with a good stand of young trees. On most of this area, however, especially south of Piney river, recent fires have killed all the young white pines that had made a start.

Forest fires, in general, have been most destructive on Beaver and Glade creeks and Piney river and on Clear Fork of Big Coal river. These burnt areas have only a meager growth of valuable young trees. Other cut-over lands have from 1,000 to 2,000 feet of merchantable timber per acre and a fairly good stand of young hardwoods.

RANDOLPH COUNTY.

Location and Area.

"Randolph county was formed from Harrison in 1787 and included all the present county of Tucker, all of Barbour east of the river, all of Upshur east of Buckhannon river, and a considerable portion of Pocahontas and Webster. It lost territory in 1821 when Pocahontas was formed; again in 1843 when Barbour came into existence, and in 1851 it gave up some of its territory to Upshur, and five years later 350 square miles were cut off to form Tucker; and in 1860 Webster took a strip; and after all these losses Randolph still is the largest county in the state."* The county is located between the center and the eastern border of the state. Its area is 1,086 square miles or 695,040 acres.

*"History of Randolph County"—Maxwell.

Topography.

The eastern line of the county follows the crest of the Allegrany mountains. Westward from there the surface is ridged with several long, parallel mountains, the chief of which are Middle mountain, Shavers mountain, Cheat mountain, Rich mountain and Laurel ridge. The region west of Rich mountain is high and uneven, and throughout the whole area of the county mountain peaks rise to a great height. The names and elevations of some of the highest knobs and peaks are given below:

Snyder knob	4,730 feet.
High knob	4,710 feet.
Crouch knob	4,600 feet.
Barton knob	4,600 feet.
Green knob	4,600 feet.
Sharp knob	4,545 feet.
Tony Camp mountain	4,510 feet.
Cunningham knob	4,485 feet.
Brier Patch mountain	4,480 feet.
Roaring Plains	4,400 feet.
Ward knob	4,400 feet.
Yoakum knob	4,330 feet.
Bradshaw hill	4,320 feet.
Gregg knob	4,310 feet.
Elk mountain	4,300 feet.
Huttons knob	4,260 feet.
Bayards knob	4,150 feet.
Haines knob	4,130 feet.
Mingo knob	4,120 feet.
Bickle knob	4,020 feet.
Mast knob	4,000 feet.
Round knob	4,000 feet.
Chenoweth knob	3,870 feet.
Whitmans knob	3,800 feet.
Little Beech mountain	3,700 feet.
Shavers mountain	3,700 feet.
Blue knob	3,700 feet.

The level land of the county is found chiefly in the broad

bottoms of Tygarts Valley river from Valley Head to a point about 2 miles below Elkins, and along Leading creek. The bottoms of most of the creeks and rivers are very narrow. There are level or undulating uplands in several localities as Mingo Flats, near the head of Tygarts Valley river; Whitman Flats and Cranberry Flats, east of Rich mountain; and Roaring Plains, on the Alleghany mountains.

The largest streams of the county flow northeastward between the high mountain ridges named above. These, named in the order that one would cross them going from east to west, are Gandy creek, Dry Fork of Cheat, Laurel Fork of Cheat, Gladly Fork of Cheat, Shavers Fork of Cheat, Tygarts Valley, Middle Fork of Tygarts Valley, and the Left and Right Forks of Buckhannon. Space will not permit an enumeration of the large number of creeks and runs that are tributary to the rivers mentioned. An area of considerable extent in the southern end of the county is drained by the headwaters of Elk and Holly rivers. The several large forks of Cheat, as well as the Elk, the Middle Fork, the Buckhannon and the Holly, are clear, rapid-flowing streams, and all the rivers and their numerous tributaries have their sources in the forests of the high mountains. The Shavers Fork of Cheat enters Randolph at an altitude of 3,700 feet and leaves at 1,765 feet, making a fall in its course through the county of 1,935 feet. It is pointed out in Maxwell's History of Randolph County that the fall of the waters of this stream in Randolph county is 170 feet more than in its course of about 3,000 miles through the Monongahela, the Ohio and the Mississippi from the Randolph line to the Gulf of Mexico. The enormous power of the water in the county is almost beyond computation.

The Lumber Industry.

Although there were settlements in Randolph county as early as 1772, most of the forest land remained undisturbed for a hundred years thereafter. Outside of the valleys of Tygarts Valley river and of Leading creek the territory was slowly occupied, being mostly high, mountainous land and unfit for farming purposes.

The dwelling houses and out-buildings of all the pioneer settlers were constructed of logs for the first 50 years and only a few were built of sawed lumber for many years after that time. One or two water saw mills manufactured a meager supply of lumber for the farmers of the upper Tygarts Valley in an early day. According to Maxwell's "History of Randolph County," "The first saw mill in Mingo was built by Edward Woods and John Smiley at the Laurel Thicket, on H. C. Tolly's place near Valley Head, in 1822. The wagon which hauled the irons for the mill was the first that crossed the mountain to Mingo. It was driven by Augustus Woods, who cut the road as he came." This was one of the first saw mills in the county, and perhaps the only one for several years. Martin's list of 1835 gives 1 saw mill in Randolph county.

From about 1865 to 1895 there were a great many logs floated on the Cheat and Tygarts Valley rivers. The first timber sold in the county was taken out by water. Some of the best poplar, ash, cherry and black walnut went in this way. Pardee and Curtin Lumber Company of Grafton got a large percentage of the logs floated on the Tygarts Valley, and those floated on the Cheat went largely to Rowlesburg and Point Marion. Dewing and Sons sawed some of the first spruce that was cut in West Virginia on a large circular saw mill located at Point Marion. Col. A. H. Winchester, with headquarters at Cheat Bridge, superintended the cutting of timber on the company's extensive holdings on Shavers Fork from about 1888 to 1896. The logs made the long journey from almost the head to the mouth of Cheat river.

The steam saw mill industry began in the year 1878 when a portable mill was brought from Virginia and put in operation on Dry Fork of Cheat. Others soon followed this and by the year 1890 several were running in different parts of the county.

A more active industry followed the building of the railroads which made accessible the great coniferous and hardwood forests. The principal railroad lines were built approximately as follows:

From Parsons to Elkins.....	1889.
From Elkins to Beverly.....	1891.
From Beverly to Huttonsville.....	1898.
From Newlon to Pickens.....	1892.
From Roaring Cr. Jet. to Coalton.....	1903.
From Elkins to Durbin.....	1903.

Within the last 12 years the lumber industry has increased at an amazing rate. Huge band mills have taken the place of smaller operations in all the large forest areas and are now manufacturing lumber at the rate of a million feet a day. No fewer than 15 band mills located within the county and several on the outside, as well as a number of smaller portable saw mills, are cutting timber from the Randolph forests. Below are given the names of the band saw operations with the dates on which they began in the county:

Parsons Pulp and Lumber Co., Horton, on Gandy Creek..	1894
Holly Lumber Co., Pickens, on Buckhannon river.....	1900
Tygart River Lumber Co., Millcreek, on Mill creek.....	1902
Parsons Pulp & Lumber Co., Laneville, on Red creek.....	1905
J. M. Bemis & Son, Bemis, on Shavers Fork.....	1905
Glady Fork Lumber Co., Glady, on Glady Fork.....	1905
Wheeler Lumber Co., Glady, on Glady Fork.....	1905
Moore, Keppel & Co., Ellamore, on Middle Fork.....	1906
Elkins Pail & Lumber Co., Elkins, on Tygarts Valley....	1906
Brown & Hill, Montes, on Shavers Fork.....	1906
Raine-Andrews Lumber Co., Evenwood, on Glady Fork...	1906
Perley & Crockett Lumber Co., Jenningson, on Dry Fork..	1906
United Lumber Co., Hazelwood, on Dry Fork.....	1908
Wyoming Lumber Co., Laneville, on Red creek.....	1908
Laurel River Lumber Co., Jenningson, on Dry Fork.....	1909

A few of the large lumber companies which have already completed their operations in the county are given by Mr. C. W. Maxwell, of Elkins, as follows: Morribell Lumber Company, at Morribell, 1901 to 1908; Beulah Lumber Company, at Beulah, 1901 to 1908; McClure, Tyson & Irvin, at Glady, 1901 to 1909; J. B. Moore & Sons, at Gilman, 1901 to 1908; Mabie-McClure

Lumber Company, at Mabie, completed work in 1908; Himmelrick Lumber Company, at Coalton, 1895 to 1908; and Jennings-ton Lumber Company at Jennings-ton, sold to Laurel River Lumber Company in 1908.

No definite data have been collected regarding the cutting of ties, poles, staves, shingles, etc. in the county, nor of the cutting of the large number of chestnut oaks for tan-bark.

Present Forest Conditions.

There are probably not far from 125,000 acres of cleared land in the county. Of this approximately one-half lies along the bottoms and foot-hills of the Tygarts Valley river and Leading creek, and the other half in the region of Helvetia on the southwest, in the mountainous limestone region on Dry Fork of Cheat, and in small farms scattered throughout the area.

The great virgin forests—aggregating about 195,000 acres—lie principally on the Cheat waters east of the crest of Cheat mountain, and on the headwaters of Middle Fork river. It is said that about 85,000 acres of this contains spruce timber in varying quantities. Hemlock is found in abundance on almost every tract. There are almost 200,000 acres of cut-over forest land in the county. This lies in large and small areas throughout the forest region adjoining the lands which have not yet been cut over. In some sections, notably along Gandy creek and Glady Fork of Cheat, fire has killed the young growth that was left by the lumbermen and thousands of acres now contain nothing more valuable in the way of tree species than wild red cherries and yellow birches. In some places even these have been killed and a dense growth of blackberry briars and ferns have sprung up in their places. There is an area of large extent on the Roaring Plains, where the eastern line of the county follows the crest of Alleghany mountains, which is almost entirely without vegetation of any kind. The frequent fires in the region not only destroyed the trees and shrubs but the soil also.

Granting that there are 4 billion feet of timber yet standing in Randolph county (a high estimate) there are enough mills now at work to cut every foot of it inside of 15 years. Some

companies, however, own a sufficient quantity of timber to keep them operating a few years longer than that. According to information obtained from the lumber companies listed above only 5 of them will be operating in the county 10 years hence and these will be nearing the completion of their work. Almost every acre of virgin forest in the county is in the hands of operators or is likely to be within a very short time.

It is gratifying to note that at least one lumber company—the West Virginia Pulp and Paper Company—is making extensive plantations of spruce trees on its cut-over lands near the head of Shavers Fork of Cheat river.

RITCHIE COUNTY.

Location and Area.

Ritchie county, formed in the year 1843 from parts of Wood, Harrison and Lewis, lies northwest of the center of the State in the second tier of counties back from the Ohio river. Its area is 457 square miles or 292,480 acres.

Topography.

There are no high mountains and no broad valleys in the county. The whole area is uniformly hilly, the slopes being rough and steep in many places and in others smooth and less abrupt. At the point where Hughes river leaves the county on the southwest the elevation is 630 feet. King knob, 6 miles due south of Harrisville, rises to 1,200 feet.

Every acre of the county is drained by the North and South Forks of Hughes river and by Goose creek a tributary also of Hughes river. The North Fork rises in the extreme northern corner and flows southwestward through the county for about 50 miles. The larger of its 40 or more important creeks and runs, named from mouth to source, are Gillespie run, Addis run, Big run, Bonds creek, Rockcamp run, Lynncamp run and Bundle run. The South Fork of Hughes river enters the county from Doddridge and flows almost due west joining the North Fork near the southwestern corner of the county. Its principal

tributaries are Macfarlan creek, Indian creek, Slab creek and Whiteoak creek, flowing in from the north, and Bear run, Leatherbark creek, Grass run, Spruce creek, Bone creek and Otterslide creek, flowing in from the south. Goose creek flows south near the western edge of the county.

Original Timber Conditions.

Yellow poplar grew in all parts of the county, but not to as large a size as on some of the waters of the Little Kanawha river higher up. Wild cherry was plentiful near the forks of Hughes river and along many of the streams. Mr. John Cain, county surveyor of Ritchie, speaks of a wild cherry which had a clear trunk 83 feet in length and 30 inches in diameter near the ground. This tree grew on Gillespie run, a branch of North Fork. Basswood was found in abundance and of good quality at the bases of north hillsides in most sections. Yellow pine was common on ridges and flats. On low benches of hills and at the heads of coves the yellow pines grew to a large size. Oaks, including white oak, chestnut oak and black oak, were distributed over the whole county. Other common timber trees were beech, chestnut, hickory and walnut. There were scattered clumps of white pine here and there and fringes of hemlocks grew along the colder streams.

Christopher Gist, who passed with his exploring party down the North Fork of Hughes river in February, 1752, speaks of the land near Harrisville as "rich and well timbered with lofty Walnuts, Ash, Sugar trees, etc. but hilly in most places."

The Lumber Industry.

The 2 principal outlets for the timber of Ritchie county are Hughes river and the Baltimore and Ohio railroad.

Rafting and floating have progressed in the lower end of the county from about 1840 to the present. During the early years of water transportation all logs were rafted; but for 20 years or more logs have been floated loose and caught in booms. It is stated that most of the timber cut from all points 10 miles

NATURAL BED OF PAINTED TRILLIUMS ON BIG SUGAR CREEK, RANDOLPH COUNTY.

south from the main line of railroad has gone out on the water, principally in the log and not as sawed lumber.

Before the completion of the Baltimore and Ohio railroad through the county and to Parkersburg in 1857 there had been a lumber industry that supplied local demands only, except that a quantity of hoop-poles and tan bark had been hauled in wagons to St. Marys on the Ohio river, and that considerable rafting had been done on the lower water courses.

There were several water-power sash saw mills running in the county during its early settlement. Some of those on the North Fork of Hughes river were Malone's mill, near Harrisville, and Liggett's mill, Heaton's mill and McGregor's mill, at other points below. Besides these there were the 2 Wells mills and 4 others belonging to a man by the name of Preble. On the South Fork were the Hugil mill, the Nebbo mill, and the Sennett mill.

A more active lumber industry began with the building of the Baltimore and Ohio railroad, before referred to.

Large numbers of hewed and sawed ties were cut, all being taken by the Baltimore and Ohio railroad. Some of these were used in the construction of their line through the county and some were shipped east. In later years Pittsburg has become the principal market for cross-ties.

There has been an extensive split and sawed stave industry. A stave factory located at Pennsboro built a tramway to Harrisville which carried oak timber to their plant from a large area in the interior. Many staves have been shipped by various operators from Cairo, Petroleum, Cornwallis, Ellenboro and other stations along the railroad in the county. Joel Beckwith has been one of the most extensive operators in Ritchie, as well as in Wirt, Wood and Calhoun counties.

Portable saw mills were brought to the county soon after the railroad was built and began to saw lumber, cross-ties and staves. There were comparatively few operations, however, until after the year 1870. Since that date most of the timber that remained has been sawed on small mills.

A shingle factory at Pennsboro manufactured a large number of poplar and oak shingles.

Present Forest Conditions.

All of the forests remaining in the county have been culled except a few small boundaries, none of which contains more than 75 acres. The cut-over forests, aggregating about 14,000 acres, are in areas ranging in size from 100 acres to 5,000 acres and are scattered promiscuously throughout the southern and western sections.

In Grant and Murphy, the 2 districts embracing the western half of the county, the areas of farmers' woodlots are considerably in excess of their cleared lands: but in Clay and Union districts, the percentage of cleared land is much higher. Taken as a whole, about one-half of the county is still covered with woodland, most of which is owned by farmers and has but little valuable timber. In most sections, however, there is a good stand of hardwoods that have almost reached the cross-tie size.

ROANE COUNTY.

Location and Area.

Roane county was formed in 1856 from parts of Kanawha, Jackson, and Gilmer and is situated in the western part of the State near the base of the Alleghany Plateau. Its area is 486.2 square miles or 311,168 acres.

Topography.

The surface of the county is diversified by a succession of hills and narrow valleys. The elevation at the points where the several rivers and creeks flow from the county are as follows: Pocatalico river, 620 feet; Big Sandy creek, 620 feet; West Fork of Little Kanawha river, 620 feet; Right Fork of Sandy creek 640 feet; and Reedy creek, 670 feet. All the streams have a moderate fall through the county, flowing slowly at elevations varying from 620 feet to about 800 feet. Most of the summits of the hills and ridges rise to 1000 feet, and from that elevation up to 1,500 feet in some places near the southeastern border. In most sections of the county the slopes are gradual and the hilltops and ridges well-rounded and smooth.

The drainage system of the county is somewhat complex. All of the water finally reaches the Ohio river, however, some streams flowing directly into it and in other cases reaching it through the Little Kanawha and the Great Kanawha rivers. The northern half of the county is drained by the West Fork of the Little Kanawha river, by Spring creek and by Reedy creek, tributaries of the Little Kanawha, and by the headwaters of Sandy creek and Mill creek, which flow west into the Ohio river. The southern half is drained principally by Big Sandy creek and Little Sandy creek, tributaries of Elk river, and by Pocatalico river, a tributary of the Great Kanawha.

The Original Forest Conditions.

The principal timbers of the county were hardwoods. Those that deserve special mention on account of their abundance and good quality are white oak, yellow poplar, chestnut, hickory, black walnut and white ash. Other abundant species of less value were sugar and red maple and beech. There were smaller quantities of basswood, black oak, red oak, black gum, chestnut oak, black cherry, white elm, slippery elm, sycamore, and others. Pitch pine grew to some extent on dry hills, and there was a little yellow pine on the western side near the Jackson county line. Hemlock was rarely found.

The Lumber Industry.

The first timber taken from the county was drifted out on the Pocatalico river, on Spring creek, and on Reedy creek. The drifting logs were caught in booms which had been constructed near the mouths of the streams named. The logs from Spring and Reedy creeks were rafted on the Little Kanawha to Parkersburg, and those from Pocatalico river to Point Pleasant, Cincinnati and other points along the Ohio river. Some of the timber was sold in the tree to companies, but, in most cases, the logs were bought and branded after they had been cut in the winter by the landowners. During the spring freshets the logs were drifted to the mouths of the streams and delivered to the purchasing companies. The period of most active floating was

from 1878 to 1892. There were large numbers of cross-ties and split staves floated with the logs during the same period. Some of these were sold direct to companies and others went through the hands of local merchants.

There were a few small saw mills in operation as early as 1865. These sawed lumber almost exclusively for local use. An increase in the number of saw mills followed the completion of the Baltimore & Ohio Railroad to Spencer in 1892. Since that time most of the good timber of the county has been sawed and shipped out.

Several stave mills were put in operation about the time of the building of the railroad. The 3 most prominent operators were, J. W. Depew, who sawed on Reedy creek; Bert. England, who sawed on Spring creek; and Judge Lewis, who sawed on Sandy creek.

A part of the chestnut oak tan-bark peeled in the county was used at 3 small tan yards. The rest was shipped over the railroad.

There has been an extensive hoop-pole and cross-tie industry in the county for the last 30 years.

Much of the good oak was exported for ship-building purposes. In 1901 J. D. Seaman, operating on Reedy and Spring creeks, and Ball and Dudley on Pocatalico river, cut and shipped about 7,000 pieces of square oak.

Present Forest Conditions.

The county is nearly all owned by farmers. From 65 to 75 per cent of the land has been cleared for agricultural purposes. The farmers' woodlots which are remote from shipping points, especially in the southeastern section, have some good timber remaining. This is being rapidly cut for use in the oil fields of the county. Woodlots which are near to market have been stripped of almost everything except a few hoop-poles and inferior cross-ties.

There are 2 tracts, 1 in Smithfield district of a little less than 3,000 acres, and another in Spencer district of about 2,000 acres, that may be classed as cut-over forest.

There is no virgin forest except a few very small areas owned by farmers.

SUMMERS COUNTY.

Location and Area.

Summers county, formed from parts of Mercer, Monroe, Greenbrier, and Fayette counties, lies in the southeastern part of the State and is bounded on the north, east and south by the counties from which it was formed and by Raleigh on the west. Its area is 368 square miles or 235,520 acres.

Topography.

The mountainous surface of the county is deeply dissected by the channels of many swift-flowing streams. Wolf Creek mountain, White Oak mountain and Keeney mountain are the highest in the county. The first has an elevation of about 3,000 feet and the others rise from 500 to 700 feet higher. Forest Hill and Talcott districts contain the smoothest land and also, with Green Sulphur district, compose the richest agricultural section. Greenbrier, Jumping Branch and Pipestem districts are rough, but contain a large acreage of good grazing and tillable land.

New river courses through the center of the county, entering at its extreme southern corner and flowing out on the northwest. The Greenbrier river, flowing from the northeast, empties into the New at Hinton; and the Bluestone river, entering from Mercer, empties on the opposite side from the Greenbrier and about 4 miles above the latter's mouth.

Former Timber Conditions.

According to Mr. J. C. James, a pioneer lumberman, the county was not as well timbered, originally, as some of the other interior counties of the State. It is fair to state, however, that prior to the beginning of any lumber operations, and before the area was visited by even the pioneer lumbermen, a large per-

centage of the rich land, where the best timber grew, had been cleared and the trees destroyed. Following are some of the timber trees mentioned by the older residents of Summers county:

White oak—The principal timber.

Chestnut oak—Common on dry ridges.

Poplar—Not generally abundant but good on Madams creek and in some other localities.

Red oak—Common in rich ground.

Basswood—Common.

Buckeye—Common.

Walnut—Common.

Hickory—Common.

Ash—Common.

Cucumber—Not common.

Beech—Not common.

Birch—Not common.

Maples—Not common.

White pine—Small areas on Bluestone river.

Pitch pine—Occasionally seen on high ground.

Hemlock—Of good quality and common along streams.

The Lumber Industry.

The building of the Chesapeake and Ohio railroad through the county in 1872 marked the beginning of an active lumber industry. "Before that time," says Judge James H. Miller, of Hinton, "there had been no shipment of logs or sawed lumber—not even of walnut. All the trees that had been cut were either burned or made into fence rails etc. by the pioneer farmers, or else manufactured by the rudest methods then employed into rough boards for domestic use."

A large quantity of the best oak has been manufactured into split and sawed staves. Most of these have been sold to the Standard Oil Company through Theodore Astor, their purchasing agent. The sawed stave industry began about the year 1873. In those days large numbers of staves were hauled in wagons from the stave saw mills, working back from the railroad, and shipped from the various stations. The Doan Cooper-

age company manufactured staves for their own use for a few years. Three or four stave saw mills are still operating in a small way from place to place.

Portable saw mills came in with the railroad and have been numerous for 35 years. The Wm. James Sons Company has had a large circular mill at Hinton since 1877. This mill has cut an immense quantity of timber from the Bluestone and from others waters. The only other important operation at Hinton was that of J. P. Mills who operated a small mill there for about 10 years.

The Crosby-Beckley Lumber Company had a large circular saw mill on Lick creek, and mills at other points, about 12 years ago.

The walnut timber has been largely exported. Samuel Smith and C. A. Fredeking were two of the principal exporters, the former buying extensively in Green Sulphur district, and the latter buying from various localities and exporting to Germany.

The present lumber industry consists, principally, of 1 large band saw operation at Glenray—running since 1905—1 large circular saw operation at Hinton, and of about 30 small lumber and stave operations scattered throughout the county. The smaller mills run irregularly, sawing small sets for farmers.

Present Forest Conditions.

There are about 3,800 acres of virgin forest remaining in the county. This lies in scattered areas of a few hundred acres each, principally on the waters of Bluestone river, in the southern part, and between Lick creek and Meadow creek on the north. One virgin area on the Bluestone, containing 200 acres, has about 60 per cent of white pine. In all the others hardwoods of various kinds predominate.

The cut-over forest lands comprise an area of about 7,800 acres. The largest area contains 4,000 acres and lies on Greenbrier river waters in the eastern part of the county. The other cut-over lands are scattered, like the virgin areas, in the southwestern, western, and northern sections.

Most of the land is owned by farmers who have an average

of about 100 acres each. It is estimated that about 40 per cent of all the farm land has been cleared. The wooded portions of the farms have, in most cases, been stripped of the best timber. A few remain that are exceptions to the general rule.

The land unfit for agriculture is variously estimated at from 10 to 20 per cent.

TAYLOR COUNTY.

Location and Area.

Taylor, formed in 1844 from parts of Harrison, Barbour and Marion, is a small county joined on the north by Marion, on the east by Preston, on the south by Barbour, and on the west by Harrison. Its area is 132 square miles or 84,480 acres.

Topography.

Lying some distance west of the mountainous part of the state, Taylor county has an irregular, hilly surface. In large areas of Flemington, Courthouse, and Booths Creek districts, and smaller areas in other districts, the land is comparatively smooth and easily cultivated. The lower end of Booths Creek district and the parts of the county adjoining Preston are more uneven and the elevations are greater.

Tygarts Valley river flows northwest dividing the county into almost equal parts. Its chief tributary is Threefork creek, rising in Preston county and emptying at Grafton. Other smaller tributaries of the river are Lost run, Otter creek, Berkeley run and Pleasant creek, flowing in from the south, and Wiekwire run and Sandy creek, flowing in from the north.

Original Forest Conditions.

Most parts of the county have been occupied and improved by farmers for many years; and it is not possible to state definitely what timbers predominated in the original forests. We are safe in stating in a general way, however, that the area was well timbered with hardwoods of the kinds that are still found

OLD-FASHIONED WATERPOWER MILL, SUMMERS COUNTY.

throughout all the hill regions of the state. A well-informed resident of the county makes the claim that the best white oak timber in West Virginia once grew here. This claim is made, however, for almost every county in central, western and southern West Virginia and should be taken to indicate simply that this timber was plentiful and of good quality and large size. The softwoods found both east and west of this county were not common. A few hemlocks were scattered along the streams and an occasional clump of pitch pines grew on the high ridges.

The Lumber Industry.

The first commercial use of timber in this county, of which we have any knowledge, was for the production of charcoal used by the old iron furnaces in Taylor and Preston counties about the year 1800. Areas cut over for this purpose have grown up with a good stand of timber trees and many of them have been re-cut for lumber and cross-ties.

In the years following 1820, and before any saw mills were operating in the county, a large quantity of excellent white oak was taken out in the form of hewed ship timber. This was hauled to the Monongahela river and rafted to Pittsburg.

About the year 1869 A. F. Westerman built a large circular saw mill and stave plant 7 miles east of Grafton at the little town which still bears his name. This mill, which ran for 10 years or more, was among the first to manufacture lumber on a large scale in the county.

J. C. Painter & Brother operated from 2 to 5 circular mills for several years preceding 1905. This firm got out also a large number of split staves, most of which were exported to Europe.

Beginning about 1870 a large water power saw mill, known as Bradshaw's mill, was operated at Valley Falls. The supply of timber for this mill was obtained from the owners of small tracts of forest land in Taylor and Marion counties and was hauled to the mill on wooden tramways. In later years logs were floated on the Tygarts Valley river from points as high up as Philippi in Barbour county. After a successful operation of about 30 years the plant was leased to Theodore Bush, Bradshaw having been appointed as a purchasing agent of the Balti-

more and Ohio railroad. Bush continued to operate as his predecessor had done, getting his logs from lands high up on the Tygarts Valley river, until the mill was about worn out and the timber supply exhausted.

Capt. G. W. Curtin built a large band mill at Grafton and operated it for several years about 25 years ago. His supply of logs came chiefly from points on the Tygarts Valley river above the boundaries of Taylor county.

C. G. Blatchley operated a pump factory and planing mill for many years at Grafton.

Numerous portable saw mills have been operating in the county for 30 years. There are about 25 small mills still running irregularly—a sufficient number to cut every good tree left in this small county within the next 5 years.

The Present Forest Conditions.

Farmers own all the land of the county, and the forest land remaining is in scattered woodlots. In some sections at least 75 per cent of the land is cleared. This is true in the best agricultural areas adjoining Harrison and Barbour counties. In other sections the percentage of cleared land is much smaller, and here the farmers have reserved considerable good timber. Many woodlots, it is said, have 5,000 feet per acre of sound oak, hickory, and other timber, still standing on them.

TUCKER COUNTY.

Location and Area.

Tucker county, formed from part of Randolph in 1856, lies south of Preston, east of Barbour, and west of Grant county. Its area is 440 square miles or 281,600 acres.

Topography.

The whole area of the county is included within the boundary of that part of the Appalachian Province known as the Alleghany Highland and lies between the crests of Canaan and Alleghany mountains on the east and the northern portion of Laurel ridge on the west. Some 2 miles southward from the point on the Alleghanies where the eastern boundary line turns abruptly to the northwest and crosses the Stony river and Red

creek watershed to the crest of Canaan mountain, the county attains its greatest elevation, 4,300 feet. The lowest ground is found where the Cheat river leaves the county at an elevation of 1,469 feet. Between these two altitudes the downward slope of the land surface, toward the northwest from the Alleghanies and toward the northeast from the less elevated crest of Laurel ridge, is interrupted by numerous mountains and plateaus and by the deep channels of streams. The principal mountains within, or partly within, the county are the Alleghany, the Canaan, and the Brown mountains in the eastern part; Shavers mountain which extends into the county just west of Gladys Fork; Green mountain, partly enclosed by Otter creek, a tributary of Dry Fork; McGowans mountains, between Otter creek and Ellick run; Fork mountain, east of the lower part of Shavers Fork; Pheasant mountain and Laurel ridge on the west; Limestone mountain on the right of Cheat river where it leaves the county and Backbone mountain in the center. Some of the mountains named conform to the general trend of the Appalachian System and others break away at all angles and extend irregularly between numerous tributaries of the Cheat.

"Some miles beyond the Backbone, on the head branches of Cheat river, there is an elevated region of about one hundred thousand acres of land from time immemorial called the Land of Canaan."* The region here referred to is the southern end of an elevated plateau which lies in a broad belt westward from the crest of the Alleghanies through the counties of Tucker and Grant. This area, with an average elevation of about 3,000 feet, forms in the county the principal plateau region and is one of its most striking physical features.

The county is drained entirely by the waters of the Cheat river, the main stream of which flows through the west-central portion of the county in a north-easterly direction. Its principal tributaries are Clover run and Minear run, which empty into the river from opposite sides near the town of St. George; Horseshoe run, which empties into the river a short distance above the "Island"; Shavers Fork which, with Big Blackwater, forms the main stream at Parsons, the present county seat; Ellick run which empties into the river at Hambleton; Dry

* Maxwell's Hist. of Tucker Co. 1884, p. 168.

Fork which joins the Blackwater at Hendricks; and Otter creek and Gladly Fork, tributaries of Dry Fork. Blackwater is the only large tributary of the Cheat which rises, with all its branches, inside the boundaries of the county. The principal tributaries of this stream are the Little Blackwater, followed by the Western Maryland Railroad and emptying into the river about 1 mile below Douglas; Beaver creek, emptying at Davis; and, farther up, the smaller tributaries of its upper course. The Blackwater and its tributaries drain the entire area of the plateau which covers the eastern part of the county. Through this they flow sluggishly falling not more than 100 feet in a dozen miles. But, on reaching a point about 1 mile below the town of Davis, the river plunges over the southern rim of the plateau and, by a succession of picturesque cataracts and rapids, descends 1,350 feet in a distance of 10 miles. From the mouth of the Blackwater to the point where the Cheat river leaves the county its fall is about 250 feet. This descent is not made regularly but, in part, by a number of shoals occurring at irregular intervals.

The Original Timber Conditions.

The greatly diversified character of the Tucker county area, with its rich river bottoms, its lofty plateaus and mountains, together with its unusual range of altitude, fit it for the existence of a remarkable forest growth. "When the old pioneers first settled the bottom lands along the river, they found there the most gigantic oaks, hickories, walnut and other timbers."* The "other timbers" here mentioned would include such trees as the yellow poplar, basswood, white ash, sycamore, sweet buckeye, and the birches, maples and others usually associated with them. Hemlock, the most abundant timber of the county, grew in nearly all sections. White pine grew plentifully on Horseshoe run, Upper Dry run, Mill run and Clover run, as well as on the southern exposures along Haddix creek and on benches and faces of the Cheat river hills from Hendricks to St. George. It was found in greatest abundance on Horseshoe run, up which it extended for a distance of not less than 7 miles. The original stand of white pine in Tucker county was probably not far from 15 or 20 million feet. West of Backbone mountain the land was

* Maxwell's Hist. of Tucker Co., p. 139.

well timbered in sugar maple forming what were called the "Sugar Lands." Large areas of red spruce once existed in the county. These lay on the high mountains in the southern part and eastward from Backbone mountain, covering most of the higher land of the eastern half of the county. If we approximate the original stand of all timber at 5,000 feet to the acre the county must have contained almost a billion and a half feet. The principal species of timber trees of Tucker county are given below with percentages to show their relative abundance:

Hemlock	20	per cent.
Red Spruce	10	"
Yellow Poplar	10	"
Sugar Maple	10	"
Beech	12	"
White Oak	} ... 15	"
Red Oak		
Chestnut Oak		
Black Oak		
Scarlet Oak	} ... 2	"
Chestnut		
Hickory		
Sweet Birch		
Yellow Birch	} ... 1	"
White Ash		
Black Walnut		
Black Cherry		
Red Maple	} ... 4	"
Black Gum		
Basswood		
Cucumber		
Locust		
Sycamore		
Sweet Buckeye		
Slippery Elm		
White Walnut		
Black Ash	}	
Balsam Fir		

These percentages can be applied to the present stand except that the white pine has practically all been removed and the yellow poplar, red spruce, hemlock, and all the valuable oaks greatly reduced. This has had the effect of raising the percentages of the less valuable timbers such as beech, birch and maple.

Settlements and Farm Lands.

Probably the first white man to see the present territory of Tucker county was William Mayo in 1745. He was on the head of Little Blackwater in that year surveying lands of Lord Fairfax who owned a few thousand acres there. In 1762 Capt. James Parsons passed through the territory by way of the Horseshoe on his return from captivity by the Indians. This was believed to be one of the earliest visits to this section but, according to the latest research of Mr. Hu Maxwell, the Horseshoe was known and its strategic importance recognized in 1755. It is stated in Withers' "Border Warfare" that John and Samuel Pringle, deserters from the army at Fort Pitt, and John Simpson, a trapper, crossed the Cheat river at the Horseshoe in 1764. The first settler in the county was John Crouch in 1766 on the site of Parsons, the county seat. The next was Capt. James Parsons in 1769, in the Horseshoe, followed by Thomas Parsons in 1772. Soon after this colonies were established at various points along the Cheat. As late as 1840, however, there were few settlements except along the Cheat and in the narrow bottoms of the larger creeks toward the northern end of the county. From about 1860 until the present settlement by farmers of the tillable portions of the county has progressed more rapidly. The lands now occupied as farms lie, principally, in Licking and Clover districts in the northern part of the county, with narrow strips and irregular areas in St. George and Black Fork districts, and areas of considerable extent in Dry Fork district, along the Dry Fork of Cheat, and in the upper portion of Canaan Valley.

Much of the land so far cleared is productive and, in the lower sections especially, grains and vegetables of all kinds are grown. The limestone sections, particularly the upper end of Canaan Valley, produce excellent blue grass and such other crops as oats, buckwheat and potatoes. Other portions of the county

are yet to be reclaimed for farming purposes. Much of the county not yet improved lies at so great an elevation, however, that only a very limited number of farm products can be successfully raised. Fully 25 per cent of the county is non-agricultural. The position of the area is such as to give it great importance from the standpoint of water supply and for this reason, if for no other, certainly not less than from 35 to 50 per cent of it should be kept permanently in forest.

The Present Timber Conditions.

Of the unimproved part of the county, about 56,000 acres are still in virgin forest, and 130,000 acres are cut-over forest. The largest bodies of virgin timber lie along the Alleghanies, in the southeastern section, and between the Dry Fork and Blackwater Fork of Cheat. The balance is scattered in areas of from a few acres to 4,000 or 5,000 acres along the southern border and the right hand side of Shavers Fork, at the southern end of Backbone mountain, and, farther north, on the waters of Horse-shoe run. As a rule the cut-over lands are cleared of everything merchantable, except in the western side of the county, and are badly burned, as will be mentioned in the discussions of conditions prevailing in the vicinity of Davis.

The Land of Canaan.

The region before referred to as the Land of Canaan is deserving of special mention on account of the remarkable conditions that existed there, originally, and because of the great changes that have taken place since the beginning of its exploitation by lumbermen less than 30 years ago. The portion of this area now called Canaan, or Canaan Valley, is a high basin containing some 25,000 acres lying between Canaan mountain on the east, and Brown mountain, through which the Blackwater river has cut its way. Originally, that part of the plateau lying north of the Blackwater and stretching northwestward across Little Blackwater to the base of Backbone mountain, was called Canada to distinguish it from Canaan on the other side.

Harper's Magazine for December, 1853, (Vol. VIII, p. 18) contains a sketch in which this region is spoken of in the following somewhat exaggerated terms: "In Randolph County, Virginia, there is a tract of country containing from seven to nine hundred square miles, entirely uninhabited, and so inaccessible that it has rarely been penetrated even by the most adventurous. The settlers on its borders speak of it with dread, as an ill-omened region, filled with bears, panthers, impassable laurel brakes and dangerous precipices. Stories are told of hunters having ventured too far, becoming entangled, and perishing in its intricate labyrinths." The region is also described, in somewhat similar terms, in a volume called "The Blackwater Chronicle," (New York, 1853) which treats of a hunting trip to the locality in question, and a brief allusion to it will be found in "Picturesque America." (Vol. I, pp. 390, 391).

The recorded impressions of visitors who saw this region in its original, wild state, if slightly exaggerated, are suggestive at least of the denseness of the forests which covered it then. It is probable that nowhere in West Virginia, nor in the United States, according to Major Hotchkiss, an authority on the resources of the Virginias, did there exist a more luxuriant growth of spruce and hemlock than over a large part of this area. "The trees were as straight as an arrow and frequently rose to a height of 120 feet or more. In places their branches were so interwoven that they formed a thick, dark shade, which, in the summer season, was most delightful, but in winter, when the sombre branches were drooping with snow, the prospect was gloomy beyond description."

Disturbances in Canaan.

Canaan Valley and the surrounding plateau country remained practically undisturbed until 1863. That year a forest fire occurred which, with other "burnings" started by hunters, destroyed the spruce timber on a large area. In 1877 a storm swept a narrow path through the heart of the spruce belt, extending eastward from Dobbin Mansion for a distance of 6 or 8 miles. From this windfall other fires started and spread through the forest. The timber suffered in 1882 from a severe drouth.

CLUMP OF NATIVE SPRUCES IN FIELD OF BLUE GRASS, CANAAN VALLEY.

In 1883 the Southern Pine Beetle, (*Dendroctonus frontalis* Zimm.) began to infest the timber, killing thousands of trees during the decade which followed. In this same year the timber was cut on the West Virginia Central Railroad's right of way from Fairfax, in Grant county, to Davis, and the railroad completed to the latter point in 1885. This railroad furnished an outlet for the great quantity of timber and admitted numerous portable and stationary saw mills which have continued to operate to the present time. The timber where the town of Davis now stands was cut in 1885 and the large band saw mill, which has cut over 400 million feet of softwoods, was erected 2 years later.

Those who visited this locality prior to the introduction of these disturbing influences would hardly recognize it now. Dr. William C. Rives, an eminent naturalist of Washington, D. C., who made some field observations in the vicinity of Davis in 1891 and again in 1897, makes the following comment: "The destruction of timber which had already begun before the time of my first visit had progressed with startling rapidity, during the six years that had elapsed, and instead of the more or less unbroken sea of green tree tops formerly visible, the eye now rested upon a country disfigured by prostrate logs stripped of their bark, misshapen and unsightly stumps, and dead trees blackened and destroyed by fire. Railroads for getting out the timber had been forced into the heart of the woods. Saw mills, tanneries, pulp mills and lumber camps stand where the timid deer formerly came to slake its thirst and the ponderous and unwieldy bear found an unmolested abode. It is for the most part requisite to travel for many miles from the railroad to find a place to which the wood cutter has not yet penetrated."*

Lumbermen and Forest Fires.

Timber conditions have continued to grow steadily worse, not only in the locality referred to above, but in nearly all parts where timber has been cut. All that was left by lumbermen on large areas has been consumed, in many places down to the bare rocks, by the oft-recurring forest fires. Viewed from any high station in the vicinity of Davis or Thomas, the whole region,

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undisturbed a few years ago, presents a picture of desolation. Except for here and there a clump of spruces or hardwoods that have been protected from the fire by streams or marshes, and a fringe of balsam firs surrounding McDonald Glade, all the mature timber on the lower half of Canaan Valley is gone. The same condition exists, also, over broad belts on both sides of the railroad to the north of Thomas, and, to a great extent, on the cut-over mountains southward from the Cheat river. In many places "Fire Cherries" and yellow birches have sprung up, and occasionally more valuable species, but all these alike are soon killed by fire.

The Lumber Industry.

The lumber industry in Tucker county divides itself, naturally, into 3 periods. These are the period of sash saw mills, run by water power, the period of portable steam saw mills, and the period of large stationary mills. To some extent the first period overlapped the second, and the second continues with the third which, doubtless, it will outlive for many years.

Arnold Bonnifield built a sash saw mill on the Cheat river as early as 1830. This he ran continually for 35 years. The first lumber that went out of the county was from this mill and was used in the construction of the bridge where the Northwestern Turnpike crosses the Cheat river 6 miles above Rowlesburg. N. M. and Geo. M. Parsons operated a sash mill in the county at an early date, and a little later, we are told, "Mills of this kind became numerous all over the County." Rufus Maxwell built a mill known as a "muley-mill" in 1865. This was an improvement on the sash mills for the reason that it worked faster, giving about 300 strokes of the saw to the minute.

With the coming of the steam mills, shortly after the close of the Civil War, the lumber industry took on new life. The largest operator of this period was C. R. Macomber who surpassed all the others in the quantity of lumber sawed. His operations were in the white pine belt, principally, from 1874 to 1884. Other portable mills were Taylor's Mill on Shavers Fork, Howe's Mill and Sterling's Mill, as well as one on Black Fork and one in Canaan Valley. Rufus Maxwell, Abraham and

Daniel Dumire, George Auvil, David Closs and Rowlesburg Lumber and Iron Company all operated shingle mills in the white pine section on Cheat river. The greater part of the white pine in this section was manufactured into shingles by the 5 mills named. Joseph Davis operated a shook stave mill at St. George, rafting the staves on the river to Rowlesburg where they were marketed. During all the years of the first and second periods large numbers of logs were rafted down the Cheat river, some passing through from Randolph and others taken from Tucker. These were disposed of at different points on the river outside the county. Some were taken as far as Point Marion, Pennsylvania, and sawed on the mill of Marcus Hulings and later by Dewing and Sons. Others were manufactured into lumber by Geo. E. Hayes, Hinkle and Company, and others at Rowlesburg.

When the West Virginia Central Railroad (now Western Maryland Railroad) was extended into the county in 1885, it opened the great timber areas in the eastern and central sections. Numerous small mills came in and large stationary mills, some provided with circular saws and others with band saws, were located at various points along the road. Among the first of these were the mills at William and at Davis. The latter was built in 1887 and has operated under the following names: The Blackwater Boom and Lumber Company, 1887-1893; The Blackwater Lumber Company, 1893-1905; Thompson Lumber Company, 1905-1907; The Babcock Lumber and Boom Company, 1907 to the present. Another large band mill has been running at Hambleton since 1890; first, as The Hulings Lumber Company, later, as Welch Brothers Lumber Company, and still later, as the Otter Creek Boom and Lumber Company. A new field was opened up a few years ago by the building of the Dry Fork Railroad and its branch to Laneville. Several large mills have begun operations in this section of the county within the past few years.

TYLER COUNTY.

Location and Area.

Tyler county, formed in December, 1814, from Ohio county, is the second Ohio river county south of the northern Panhandle. Its area is 260.12 square miles or 166,477 acres.

Topography.

The topography of the region is thus described:

"The Marshall-Wetzel-Tyler area is a highly dissected plain or plateau of about 1350 to 1400 feet above sea level. The effect of water erosion has reduced this original plateau practically all to slope, the streams flowing in deeply cut "V" shaped valleys. Numerous hills and ridges ranging in elevation from 1400 feet to 1600 feet and capped with more resistant layers of sandstone and rock strata, remain as evidence of the original plateau.

"On the northwestern side of the area under discussion the Ohio river has cut a deep, narrow gorge in this old plateau from $\frac{1}{2}$ to 1 mile wide and 400 to 600 feet deep through the nearly parallel strata of sandstone, shales and limestone. The valley walls are usually steep, often almost perpendicular, but on reaching the summits the general surface is rolling except where trenched by creeks and runs. Hard layers of sandstone and limestone often cause inequalities in the surface, the softer portions being eroded away and steep bluffs formed.

"South of Middle Island creek and west of Middlebourne erosion seems to have progressed farther and the topography is much more gentle and smooth than in other portions of the Marshall-Wetzel-Tyler area."*

The report from which the above quotations are taken says further, referring particularly to the topography of Tyler county:

"The county has a range of elevation from 580 feet above tide, low water level of the Ohio river near Bens Run, to 1500

* W. Va. Geo. Surv. Rep. "Marshall-Wetzell-Tyler Counties"—p. 48.

feet above tide at the top of a high knob, on the Wetzel-Tyler line, 2 miles northeast of Alvy (Stringtown), in the extreme eastern part of the county, or a total range of 920 feet. Many residents of Tyler think a high knob, called "Owlshead", 2 miles northeast of the town of Wick, the highest in the county, but it lacks 75 to 80' of being as high as the knob referred to above, since the top of it is only about 1415' above tide.

"Tyler has a much smoother topography than Wetzel and is therefore better adapted to farming than the latter. The soil has become exhausted somewhat and the farms have been neglected over a great portion of the county since the development of the oil and gas industry 15 to 20 years ago. * * * * ."

The principal stream is the Ohio river along which the county fronts for about 14 miles. The tributaries of the Ohio for this distance are very short, draining a strip which averages not more than a mile in width. To the east of this low watershed all the streams flow directly away from the Ohio river to Middle Island creek or its larger tributaries.

Since Tyler county is drained almost entirely by Middle Island creek and its tributaries the following complete description of the stream is here given:

"Middle Island creek is said to be the longest stream not to bear the name river in the United States. The air line distance from its mouth at the Ohio river to its head in southeastern Doddridge county is slightly over 38 miles. The distance measured along the meanders of the stream is over 100 miles. The crookedest portion of the creek lies within Tyler county. The air line distance between the point where the creek enters Tyler county (63 miles above its mouth) is 12.8 miles. The same distance measured along the stream is 46 miles, or the ratio of total distance to air line distance is about 3.6.

"The entire area of Tyler county with the exception of a narrow belt along the river front, lies within the drainage basin of Middle Island creek. The area of its drainage basin within the limits of Tyler county is 246 square miles.

"From Middlebourne to the Ohio river, a distance of 39 miles, the total fall is only 60 feet or an average of about 1 foot and a half to the mile. This would indicate that the lower

course of the stream is fast approaching to the base level with the Ohio.

“Like Fishing creek its channel possesses many features of inherited maturity along with those of early youth. The stream in some instances meanders over 2 miles from its general course which is northwest until the latitude of Middlebourne is reached when it changes to southwest. This would seem to indicate that it flowed into the preglacial Marietta river. The famous “jug” of Middle Island creek is located about 2 miles above Middlebourne. Here the creek made a great bend or loop to the south 3.5 miles around same and came back within 50 feet of itself. Within recent years an attempt has been made to utilize the difference in level, about 10 feet between the two portions of the stream for water power by digging a cut across the low, narrow neck of the peninsula. Floods of course have greatly enlarged this cut and at the present time, when the water is low, the entire discharge flows through the new channel. The peninsula is now an island, and not many years in the future very little of the stream’s output, even in time of floods will go around this bend.

“At two other prominent points in Tyler county, Middle Island creek has made similar cut-offs, as evidenced by the old, well-marked channels at slightly higher elevations than the present stream level at the points in question. The first of these abandoned loops is located about one-half mile above Josephs Mills, and at the present time Little Camp Mistake run follows the old north channel of the last 0.8 of a mile of its course. The highest point of this old channel is barely 30 feet above the present level of the stream at the neck of the cut-off.

“The other abandoned loop which is also easily observed on the ground is found at the point where Middle Island crosses the Tyler-Pleasants boundary line. At this point the creek at one time made a great bend of almost a mile to the south. The old channel is plainly visible, the elevation of the highest point of which is about 690 feet above tide. The present level of the creek at the neck of the cut-off is about 610’ A. T.

“Many old terraces are found along the enclosing valley and its tributaries. These terraces no doubt owe their origin

to the same causes as for those on Fish and Fishing creeks and on the Ohio river.

"The tributaries of Middle Island in Tyler county are from the north; Point Pleasant, Indian and McElroy creeks, all three of which are fairly large streams, and Buffalo, Left Buffalo, Shriver, Gorrell, Muddy, Jefferson and Camp Mistake runs. Those putting in from the south in Tyler county are McKim, Sugar and Sancho creeks, and Gorrell, Jug, Pitts, Wheeler, Conaway, Purgatory, McGee, Big and Short runs."*

Original Timber Conditions.

The leading hardwoods of the county were white oak, yellow poplar and hickory. Residents of the county make the claim that the best white oak timber in the state once grew here; and if the areas of virgin timber that still remain uncut are fair representatives of the original forests then their claim cannot be greatly in error. Single acres—according to the word of experienced and reliable timber cruisers—are yet to be found that contain not fewer than 25,000 feet of choice hardwood, about 90 per cent of which is white oak. Other hardwoods commonly found were black oak, black and white walnut, sweet buckeye, basswood, white ash, black gum, sycamore, hackberry (called hoop-wood), sugar and red maples, beech, and chestnut. White elms are abundant also on low ground. An old tree of this species now standing on Middle Island creek has a horizontal expanse of limbs of 120 feet. A few slippery elms and cucumbers were to be found and a very few sweet birches grew on McElroy creek, a tributary of Middle Island. The softwoods were yellow pine, white pine, pitch pine, hemlock and red cedar. None of these were abundant except yellow pine which grew from the center of the county up Middle Island creek and its tributaries. The white pine was scattered along the bluffs and water courses in clumps throughout the hilly sections back from the Ohio river. It is said that an average of a thousand feet to the acre of yellow and white pine once grew in half of the county. According to that estimate there were over 83,000,000

*W. Va. Geo. Surv. county reports, "Marshall, Wetzel and Tyler counties," pp. 46-47.

feet, principally of yellow pine. There were a few red cedars near the water courses and hemlocks grew in narrow belts in the deeper hollows. Pitch pine was found only here and there on dry, sandy ridges.

The Lumber Industry.

Some of the early settlers in the county, especially those that bought land far back from the larger streams, destroyed most of their fine walnuts, poplars and other timbers by fire. Others, whose timber was easily accessible to the Ohio river, sold a part of it to lumbermen who were rafting logs to Cincinnati and other southern points. According to Mr. H. H. Furbee, of Middlebourne, between the years 1840 and 1880, 24 combination grist and sash saw mills were running on Middle Island creek in Tyler county. Some of these mills ran night and day in the winter. All sawed for southern markets. The bulk of the best yellow and white pine in the county was sawed on these water mills. Four sash saw mills are still operated irregularly.

In the summer of 1870 the first steam saw mill was brought in. Since that time portable mills have been operated in almost every section. Not more than half a dozen of these are running now.

In 1881 the first stave factory came into the county, operating first at Sisterville, later at Middlebourne and other points. Before the coming of the stave mills much timber was shipped out for staves, principally to Pittsburg, some of it hauled in wagons for part of the distance, some floated, and some taken in barges.

No band mills, or any large stationary mills, have ever been operated in the county.

The thousands of oil well derricks erected in the area have drawn heavily upon the timber supply.

The Present Forest Conditions.

There are a few small virgin timber tracts lying on Middle Island creek, McElroy creek and Indian creek, aggregating 1,200 acres. All the remaining woodland is owned in small boundaries by farmers. Many of the woodlots contain good

FALLS OF THE BLACKWATER, NEAR DAVIS.

second-growth hardwoods. Where the yellow and white pine once grew there are now only scattered trees of these species.

Great changes have taken place in the forests of the county within the last 20 years. In 1893 Geo. W. Summers, author of "The Mountain State" wrote of the timber in Tyler county as follows:

"Oak, poplar, hickory, chestnut, ash and walnut are the principal woods, though there is very little of the latter left now. The lands along the streams have all been pretty well cleared, but on the lands back from them and on the hills little has been cut." A little further on, however, this author adds: "Saw mills, stave mills and other wood working industries are numerous in the county and the forests are rapidly disappearing."

UPSHUR COUNTY.

Location and Area.

Upshur county, formed from parts of Randolph, Barbour and Lewis in the year 1851, is located slightly northeast of the center of the State. Its area is 326 square miles or 208,640 acres.

Topography.

The surface of the county varies greatly from north to south. The smoothest and lowest land lies north and west of a line running from Arlington, on the Little Kanawha river to Sago, and thence down the Buckhannon river to the Barbour county line. The smoothest and best agricultural land lies in Warren and Buckhannon districts in the northern and north-western parts of the county. The hills of that part of Warren district which borders on the Buckhannon river and those that are in the drainage basin of Pecks and Turkey runs are low, with well-rounded or flat tops. The hills of the northwestern side of the district, drained by Hackers creek, are steep and less rounded on top. Only a few of the Hackers creek hills rise above those on the other side but all appear much higher on account of the greater depth of the stream channels in that sec-

tion. Hackers creek flows out at 1,070 feet and the Buckhannon river at 1,380 feet, making a difference of 310 feet in the stream bed elevations on opposite sides of the district. The drainage basins of Finks run in Buckhannon district, that of portions of French creek with its Slab Camp fork and Bull run tributaries in Meade district, and that of Cow run of Banks district, are comparatively smooth. The principal bottom lands of the county lie along the Buckhannon river from a little above the town of Buckhannon to a distance of 6 or 7 miles below it. Narrower bottoms are found along Turkey run, Finks run, Brushy fork, Cutright run, French creek, Bull run, Slab Camp fork and Cow run. There are level or rolling uplands in the vicinities of Rock Cave, Frenchton, Hinkleville, and in several other localities on both sides of the Buckhannon river in Meade, Union and Washington districts.

Geologists speak of a plain which once included this region but which has now been elevated and tilted and furrowed by streams until it is almost beyond recognition. Remnants of it are found on the flat-topped hills and ridges which lessen in elevation from southeast to northwest.

The areas drained by the upper Buckhannon river, as well as those drained by the Middle Fork river on the east, and by the Right and Left Forks of Little Kanawha on the south, are principally high and rough. For several miles back from the Randolph and Webster county lines the summits of the Upshur hills rise from 2,000 to 2,500 feet, and in one place near Palace Valley they reach an elevation of about 3,100 feet.

The Buckhannon river flows north through the county keeping a little east of its center. Its descent is rapid from where it enters the area a short distance north of Arvondale station to the village of Hampton, four miles above Buckhannon. From this point it flows slowly for a distance of 7 or 8 miles. A short distance from where it leaves the county it again begins to flow rapidly toward the Tygarts Valley into which it empties some 8 or 9 miles below. The principal eastern tributaries of the Buckhannon are Left Fork, Panther Fork, Tenmile creek, and Sand run. Its largest western tributaries are Big run, French creek, Finks run, Turkey run and Pecks run. The Middle Fork of Tygarts Valley drains a belt of land

on the east of the county; the Little Kanawha a large area on the south, and the tributaries of the West Fork river drain small areas along the western side.

According to the following statement made by geologists of the United States Geological Survey, several small streams have been captured from the Buckhannon river and their waters turned into the Little Kanawha and the West Fork rivers:

"Instances of this capture of drainage may be observed in the headwaters of Stone Coal creek, west of Buckhannon. Glady Fork and Spruce Fork flow toward the Buckhannon river to a low, wide divide at the source of Brushy Fork, where they turn abruptly backward in a deep gorge and empty into the West Fork of Monongahela river. The drainage of Buckhannon river on the east side of the Divide has nearly cut down to its base-level of erosion, while that of the West Fork, on the west, is cutting rapidly and deeply into the soft shale and sandstone, and if conditions of erosion remain as at present for a long period of time, Stone Coal creek will doubtless cut back to Buckhannon river and divert its waters from their present course and lead them into West Fork. Other striking examples of diverted streams may be seen in the whole of the drainage of Little Kanawha river above Arlington. The headwater drainage of this river has persistently and rapidly cut northward, moving its watershed, and has captured the waters of Laurel, Cow, and Get Out runs, which originally belonged to French creek and flowed northward into Buckhannon river."

Original Forest Conditions. .

Yellow poplar, black walnut, white oak, red oak and chestnut may be named as some of the most valuable hardwoods of the county. Other common hardwoods were sugar and red maple, black birch, shellbark and pignut hickory, black gum, beech, chestnut oak, scarlet oak, black oak, white ash, locust, sycamore, and white walnut. Cucumber, basswood, and some others were distributed locally. Shingle oak grew along the Buckhannon river as far up as Hampton, and a very few trees of swamp white oak were to be found on the low lands in the vicinity of Lorentz, 4 miles west of Buckhannon.

- Hemlock once grew on the rough stony soil of Buckhannon river and its larger tributaries as far north as Sago; on nearly all the tributaries of the Right and Left Forks of the Little Kanawha in the southern end; and to some extent along the Middle Fork river. There were also narrow fringes of hemlocks along the tributaries of West Fork river which head in the county. No other softwoods—not even in small quantities—grew within the area.

The quality of poplar, black walnut and hemlock was good. White oak and chestnut were damaged to some extent by insects.

The Lumber Industry.

The destruction of timber by the pioneers of the county was enormous, as large settlements were begun and large openings made in the original forests many years before the establishment of a commercial lumber industry. It is of interest that the first white men who lived in the county made their home for two years in the hollow of a gigantic sycamore tree which grew near the mouth of Turkey run, a tributary of the Buckhannon river. These men were John and Samuel Pringle, deserters from the royal army at Fort Pitt during the French and Indian War. When the war was over they left the region for the settlements on the South Branch. In 1768 Samuel Pringle acted as guide for the first settlers who built their homes along the Buckhannon river and its larger branches not far from the town of Buckhannon. In 1772 others came from the same settlements and established homes farther up the river and on Hackers creek. Settlements were made at Sago in 1801, at French creek in 1816, at Queens in 1817, and by 1825 there were families living in every district.

Sawing for domestic use was begun over a hundred years ago. The first lumber was sawed with whip saws which were operated by hand. A few years later rude water-power saw mills were built along the creeks and rivers in several localities. The following list of sash saw mills with dates and locations is taken from Cutright's "History of Upshur County":

<i>Owners.</i>	<i>Date of building.</i>	<i>Location.</i>
John Strader & Henry Reger	1806	Spruce run.
John Jackson	1810	Buckhannon
Zedekiah Morgan &... }	1810	Sago.
Patrick Peebles		
Aaron Gould	1813	French Creek, (Meadville)
James Bunten	1825	Sago.
Elbridge and John Burr...	1832	French Creek.
Aaron Liggett	1853	Gladly Fork.
Chippis & Wamsley	1854	Grassy run.
Lewis	1874	Big Sand run.
Hinkle	1878	Big Sand run.

There were also B. W. Phillips' mill and Houghton's mill on Laurel Fork of French creek, Abram Crites' mill at Selbyville on the Buckhannon river, Pringle's mill at Alton on the Buckhannon river, Wilson's mill at Stillman on the Little Kanawha, Marshall Wingrove's mill on French creek, and several others.

It is probable that Abraham Hinkle operated the first steam saw mill on Cutrights run, a tributary of the Buckhannon river, in the year 1867. About ten years later W. F. Hollen built a mill of the same kind in Union district and operated it for a number of years.

The commercial lumber industry began with the building of the railroad to Buckhannon in 1883 and was greatly increased by its extension up the Buckhannon river a few years later. Since that time there has been an extensive industry throughout the whole Buckhannon river basin carried on by scores of large and small operators. A few of these are mentioned below:

Floyd Brown and William Mearns both operated mills on the waters of Little Kanawha, beginning about 1885. The former sawed at Stillman, Get Out run, and in other places in that region; the latter, with his sons, continued to operate for many years in the vicinity of Rock Cave and in other parts of the southern end. Fidler and Huff had a steam mill on Kanawha run as early as 1888. Fidler's mill on the Kanawha

river at Arlington should be mentioned also as one of the pioneer stationary operations.

A. G. Giffin began in the county by buying hickory. This he sawed and shipped to Pennsylvania. Later he cut poplar and other timber on his own mill and on several rented mills. Still later he acquired the plant built by the Buckhannon River Lumber Company at Buckhannon. Much lumber manufactured by himself and by others in the region was dressed on his planing mill located in Buckhannon. His operations covered the period from 1883 to 1891.

The Buckhannon River Lumber Company came in soon after the railroad was built to Buckhannon. This company operated a circular mill at Buckhannon and another at Ten-mile, and hired a third mill near the latter town. Many of the logs for the Buckhannon mill and the lumber from the Ten-mile mills were brought down the river on a tram-road. A large number of logs were brought down from lands high up on the Buckhannon river, some being floated and others hauled by the company's locomotive after the West Virginia and Pittsburg railroad was extended to Newlon in 1891. About the year 1892 the mill was sold to Winchester and Craddock, who soon after remodeled it, installing a band in place of the circular saw.

G. F. Stockert came to Upshur county from Lewis in 1888 and began operations with the Buckhannon River Lumber Company. Later he and his brothers sawed on Little Bush run, a tributary of French creek, and on Kanawha run a tributary of the Little Kanawha river. He also cut about 8,000,000 feet on Big run near the town of Alton. From there he went to Panther Fork where he erected a large circular mill. Here, from 1895 to 1900, he cut about 12,000,000 feet of fine timber from a tract of 3,600 acres and then sold out to Isherwood and Cody. Later he sawed near Alton and in other parts of the county. At present he is superintending operations on the Kanawha river near the town of Holly Grove.

Alexander Lumber Company, with a band mill at Alexander, cut timber from a large tract on the Left Fork of Buckhannon river between the years 1889 and 1894.

Col. Sellars operated a circular saw mill at Tenmile between 1889 and 1892.

Alton Lumber Company erected a portable mill at Alton in the spring of 1891 and cut the timber from 1,200 acres of land on Buckhannon river and Laurel Fork of French creek. This company, with offices in Buckhannon, is now engaged in the wholesale lumber business and is interested also in the manufacture of lumber in Randolph and Barbour counties.

Smoot Lumber Company operated a portable mill at Tenmile from about 1892 to 1898.

Fell and Stranahan sawed the timber from a tract of 600 acres near Tenmile between the years 1893 and 1895.

Isherwood and Cody sawed about 15,000,000 feet of lumber from their own lands on Panther Fork between 1900 and 1908.

Others who have operated portable mills are Crosby and Beckley Lumber Company on Big run, near Alton; Jenkins and Cochran near the village of Canaan; J. H. Grogg on French creek and other Buckhannon river tributaries; William Burner near the town of Sago; and Phillips Brothers on the Buckhannon river from Sago to Alton.

The 3 principal lines of steel railroad built in the county for hauling logs and lumber are the 17 mile line built up the Left Fork of Buckhannon river by the Alexander Lumber Company in 1890; the 15 mile line built by G. F. Stockert on Panther Fork and Middle Fork waters; and the recently constructed line from Frenchton to the Kanawha river in use by the Buchanan Lumber Company.

The principal operation now in the county is that of the Croft Lumber Company with a single band mill located at Alexander.

Not fewer than 30 small mills, with capacities ranging from 1,000 to 8,000 feet a day, are operating principally in the southern end of the county and along the Coal and Coke railroad in the central sections.

Present Forest Conditions.

There are 4 or 5 virgin forest areas, aggregating about 1,500 acres, still remaining in the southern end of the county, principally in the Kanawha river basin. Most of the

cut-over forest lands lie in the scattered tracts along the Buckhannon river south of Sago, and in the extreme southern end of the county along the Randolph and Webster lines. The largest areas are in the vicinity of Alton, on both sides of the Buckhannon river, and on the rough lands which slope to the Right and Left Forks of the Little Kanawha river near Cleveland. The total area of cut-over forest land is about 17,000 acres.

The remaining 190,000 acres, or more, of land in the county is owned by farmers. In Warren and Buckhannon districts in the northern end not less than 85 per cent of the land is cultivated or in grass. In the southern and eastern parts the percentage of cleared land is much lower. The farmers, as a rule, have woodlots that contain some merchantable timber and that are well stocked with a young growth of valuable species of hardwoods.

WAYNE COUNTY.

Location and Area.

Wayne county, which was formed in 1842 from part of Cabell, is situated in the extreme southwestern part of the state. Its area is 545 square miles or 348,800 acres.

Topography.

Lying as it does along the lower course of the Big Sandy river and for some distance along the Ohio, the county has a low elevation. The low land at the mouth of Big Sandy river lies at about 500 feet being next in elevation above the lowest point in the state at Harpers Ferry. The western half of the county lies below 1,000 feet except an occasional hilltop and crest of ridge. The surface of the eastern part of the county, excepting the channels of larger streams, lies above 1,000 feet. In a few places, as between the Right and Left Forks of Twelvepole creek and southward from the Right Fork, the ridges reach a height of 1,700 feet.

The Ohio river which forms the northern boundary line

OPEN DECIDUOUS WOODS, UPSHUR COUNTY.

for about 6 miles, the Big Sandy river, with its Tug Fork, which forms the southern boundary line for 50 miles, together with Twelvepole creek, a large tributary of the Ohio, constitute the drainage system of the county. Twelvepole creek flows northward through the center of the county. Its principal tributaries are the Right and Left Forks which flow together near the town of Wayne, Buffalo creek and Beech creek which empty several miles below. Most of the numerous streams that empty into the Big Sandy and Tug Fork are small. Whites creek, Isom creek and Hurricane creek are the largest tributaries of the former, and Mill creek, Lost creek and Jennie creek the largest of the latter.

The Original Forests.

The virgin forests have practically disappeared from Wayne, making it difficult to determine from present conditions the character of the original areas. There is, however, an authentic timber record of a large tract on the Right Fork of Twelvepole which may be taken as typical of the virgin forests of the county.* The trees that were measured on this 12,263 acre tract were those above 18 inches in diameter 4 feet from the ground, with the exception of locusts, hickories and black walnuts which were measured from a diameter of 10 inches and upward. The varieties and numbers of commercial timber trees growing on the tract at that time are as follows:

White Oaks	24,760
Chestnut Oaks	38,848
Hickories	21,298
Black Oaks	8,528
Yellow Poplars	12,450
Basswoods	2,328
Chestnuts	7,681
Locusts	1,996
White Maples (Red Maples)	1,583
Sugar Maples	450
Birches	1,344

*Summer's "West Virginia," 1893, p. 31.

Black Gums	1,044
Black Walnuts	393
Red Oaks	943
Cucumbers	240
Ashes	271
Buckeyes	28
Sycamores	13
Pines, (probably Pitch Pines).....	3,472
Hemlocks	903

Whole number of trees.....128,567

There was but little hemlock on the Big Sandy and on the lower half of Twelvepole and none on the Ohio river. There was a scattered growth of pitch and jersey pine and red cedar. Cedars grew, and are still growing, most abundantly in 2 belts of land which extend across the county from east to west, 1 about 2 miles wide passing through the center, and another about 1 mile wide 7 miles north of this.

The Lumber Industry.

The timber of the county has been cut first, by the early settlers who used a little and destroyed much; second, by farmers and lumbermen who drifted and rafted logs on the Big Sandy river and on Twelvepole creek; and third, by operators of saw mills in the county. A large number of logs were cut by the owners of small tracts of land and rafted to the Ohio river where they were bought by lumber companies and taken in fleets to southern points. In later years C. Crane and Company, of Cincinnati, and other companies, bought stumpage along the streams and rafted out their logs.

From 1875 to 1884 many split staves were cut and delivered to the banks of the streams to Oxley Stave Company of Cincinnati, and to Dixon and Barr. These companies drifted the staves to the mouth of Twelvepole where they were caught in a boon and loaded into barges. Much of the best oak in the county was used and much was wasted in the stave industry.

The pioneer saw mill operators were the Smiths who came

from Virginia about 1832 and built water power mills along Twelvepole creek. A part of the lumber manufactured by them was used locally and a part floated in "stacks" down the Twelvepole. Saw mills were few and of small capacity until the building of the railroads.

C. W. Ferguson has operated a circular and planing mill, known as "Elmwood Mill," for many years on Twelvepole creek near the town of Wayne. Most of the lumber used in constructing the buildings of Wayne, the present county seat, was sawed on this mill.

Among the larger companies that have operated in the county are Prendergast Lumber Company which cut timber from East Fork of Twelvepole and from tributaries of Tug Fork; Al. Cline Lumber Company which cut timber on Tug Fork waters; and Parsons Lumber Company which cut poplar into cigar box stock and thin ceiling at Ceredo.

McComas, Bowen and Company operated mills in various sections of the county cutting the best of the hickory for handle stock.

The cross-tie industry has been large since the coming of the first portable mills.

The timber has been cut to such an extent that the lumber industry is no longer large. Rafting still continues, in a small way, along the Tug Fork and the Twelvepole. About 18 portable mills are sawing from place to place.

The Present Forest Conditions.

The timberland is in Lincoln and Grant districts in the southeastern part of the county. In these 2 districts fully one-half of the surface is owned by non-residents, the other half, or less, being owned and occupied by farmers. There are about 3,600 acres of virgin forest scattered in small tracts throughout the central and southeastern sections, and 80,000 acres of cut-over forest. The whole northwestern end of the county is owned by farmers.

The cut-over forest land still has from 25 to 40 per cent of the original timber, and the farmers' woodlots, especially in the southeast, contain a good stand of the less valuable hardwoods.

WEBSTER COUNTY.

Location and Area.

Webster county was formed in 1860 from parts of Nicholas, Braxton and Randolph. It is situated slightly southeast of the center of the state. Area 590 square miles or 377,600 acres.

Topography.

This county is one of the highest and roughest portions of West Virginia. In the southeastern half of the county the lofty ridges of the Yew mountains rise to elevations ranging from 3,000 feet to 4,300 feet. The lowest land is found at the points where the Little Kanawha and the Elk rivers leave the county at an elevation of about 1,000 feet. The Gauley river leaves at 2,000 feet elevation and the Cranberry crosses the southwestern line into Nicholas at about 2,200 feet. The smoothest areas are found about the Welch Glades near Cowen, on Strouds creek and Big Ditch run north of Camden-on-Gauley, in the vicinity of Wayneville, and at Hackers Valley on the Holly river. In some sections, also, there are high, flat areas on the mountain tops. This is especially true of the mountain separating Elk and Gauley rivers in the region south and southwest of Webster Springs.

The general course of all the larger streams is toward the northwest. By following the line which bounds the county obliquely on the west, a person would cross the following streams, named in order from north to south: Little Kanawha river, Left and Right Forks of Holly river, Elk river, Laurel creek, heads of Little and Big Birch rivers, Strouds creek, Gauley river and Cranberry river. The principal tributaries of the Little Kanawha in the county are the Right Fork and Buffalo run; those of the Back Fork of Holly are Laurel Fork, Hodam creek and Old Lick creek; and those of the Right Fork of Holly are Grassy creek, Desert Fork and Laurel Fork. Elk river's chief tributaries are Laurel creek, which rises in the Welch Glades; Back Fork, emptying at Webster Springs, and Leatherwood and Bergoo creeks, flowing in from the high moun-

tains to the south. Gauley river is formed in the spruce forests of the eastern part of the county by the running together of North, South and Middle Forks. Its chief tributary here, however, is Williams river, a large, swift-flowing stream which empties about 6 miles above the town of Camden-on-Gauley. Other smaller tributaries are Big Ditch run, Turkey creek and Straight creek. The Cranberry river, which empties into the Gauley in Nicholas county, flows for about 14 miles through the southern part of the county.

Original Forest Conditions.

In view of the fact that a large area in the county is still covered with virgin forests the usual discussion under this head is included under "Present Forest Conditions."

The Lumber Industry.

Webster is comparatively a new county. When it was formed in 1860 there was a population of only 1,776 persons; and with the exception of small, scattered openings made by these earliest settlers, the whole area was an unbroken forest at that time. For many years after the formation of the county, settlement and the clearing up of woodland was slow. In fact, as late as 1892 when the Gauley branch of the Baltimore and Ohio railroad was completed to Camden-on-Gauley, not less than nine-tenths of the county was covered with virgin forests. From this it will be seen that the destruction of timber in the clearings of early settlers was comparatively insignificant in this county.

Before the building of the railroad, above referred to, the vast forests were accessible only through the channels of the large rivers which course through the county. It may be stated that floating of poplar logs began on the Webster part of Elk river approximately 40 years ago, and on the Gauley river about 10 years later. Mr. Walter Hollister, of Cowen, states that the first extensive floating on the Elk river was carried on by the Woodruffs between the years 1870 and 1880. This company cut poplar timber near the river from a point some dis-

tance above Webster Springs to the western line and floated them to its mill at Charleston. The Woodruffs were succeeded by Smith and Gillighan and they, in turn, were succeeded by the Moulton Lumber Company, both of which continued the floating of poplar logs.

J. R. Huffman, with band mills at Charleston, floated logs from Webster on the Elk and Gauley rivers for several years following 1880.

From 1892 to 1905 a large number of logs were floated on the Elk to supply the band mill of Pardee and Curtin Lumber Company at Sutton in Braxton county.

About 20 years ago Burns Brothers and Huffman, with logger's headquarters at Cleveland, cut and floated an immense quantity of valuable poplar and other timber from the Back Fork of Little Kanawha. The logs were taken to their mill at Elizabeth in Wirt county.

Almost at the beginning of the saw milling in the county a large band mill was hauled on wagons from Kanawha Falls in Fayette county up the Gauley river a distance of 50 miles or more and stationed at Camden-on-Gauley. The expense of moving the heavy machinery in this way was very great and the enterprise proved less profitable than it would have done under more favorable circumstances. After running for several years the plant went into the hands of the Baltimore and Ohio railroad company. Recently this company disposed of it to the Cherry River Boom and Lumber Company.

Two band saw mills that operated in the county about 15 years ago were the Hardwood Lumber Company and the Webster Lumber Company, both located on Laurel creek between Cowen and Centralia.

For the past 18 or 20 years a number of portable mills have been cutting lumber along the railroads and throughout the northern and western sections. The Smoot Lumber Company, of Cowen, has led in this phase of the lumber industry for several years.

The timber of the county is now being rapidly cut by 4 band mills and by about 15 smaller mills located at different points. Large areas in the mountainous sections are being en-

tered, also, by companies with large band mills at Curtin, Richmond and other points in Nicholas county.

Present Forest Conditions.

A belt of mountain land averaging 10 miles in width and 25 miles in length and including the southeastern third of the county is still in virgin forest, except that the best poplar has been removed from an area of about 15,000 acres lying on the south side of Williams river and its Middle Fork, and from 8,000 acres on the north side of Gauley river. Outside of this belt there are virgin forests on the headwaters of Holly river in the northeast and on the Elk river between Webster Springs and the Braxton line, making in all an area of about 122,000 acres. The cut-over forests—aggregating about 133,000 acres—lie in nearly all sections, but are most extensive in the region drained by the several tributaries of the Holly river, and along the northwestern side of the county. Extensive areas are also found on the Gauley and Williams rivers and on the Elk river west of Webster Springs. Of the remaining 122,600 acres, about one-third is cleared and the balance is in culled woodlots.

The variety of timber trees growing in the forests of Webster county is very great. All along the southeastern side there is a belt of red spruce which varies in width from 2 to 6 miles. The irregular northwest boundary line of the spruce belt crosses Bergoo and Leatherwood creeks of Elk, the Gauley river below its three forks, Williams river near the mouth of Little Beechy run, and the Cranberry river north of Hanging Rock. Such trees as hemlock, sugar maple, beech, yellow birch and wild cherry are frequently found growing with the spruce or in almost pure stands on lower ridges and mountainsides. Westward from the spruce belt are the valuable forests of yellow poplar, cherry, maple, basswood, chestnut, and other hardwoods. An experienced timber cruiser gives the following list of timber trees growing on a 20,000 acre tract on Elk river:

Yellow Poplar	25 per cent.
Chestnut	25 per cent.
Oaks	12 per cent.

Sugar Maple	13 per cent.
Basswood	5 per cent.
Spruce	5 per cent.
Hemlock	5 per cent.
Others (including beech, birch, ash, cherry)	10 per cent.

In other sections the percentage of some species named above would be low and that of others high according to elevation of the tract, etc.

Most of the area in Webster county now occupied by virgin and cut-over forests should always remain as forest land. There are at least three good reasons why this is so: First, the land is not in any sense agricultural; second, it is capable of producing, naturally, an abundant and profitable yield of timber; and third, the region is of pre-eminent value for its effect upon the flow of waters which finally reach the Ohio river through the Elk, the Gauley and the Great Kanawha.

In the glady regions near Cowen truck-growing will doubtless become very profitable, and there are many sections throughout the northwestern half of the county where fruit and the ordinary farm crops can be successfully grown. The agricultural areas are small, however, and the county must protect and encourage the growth of its forests as the principal source of wealth.

WETZEL COUNTY.

Location and Area.

Wetzel county is separated from Greene county, Pennsylvania, and from Marshall county on the north by a portion of the historic Mason and Dixon line and a westward extension of the same to the Ohio river; on the east the Monongahela-Ohio river watershed forms the natural boundary line; on the south the line follows the southern edge of the Fishing creek drainage basin; and on the west it follows the western bank of the Ohio river. In 1846 Wetzel was cut off from the northern end of Tyler county and the boundaries given it then have remained unchanged. Its area is 360.47 square miles or 230,701 acres.

VIEW ON CRANBERRY RIVER, WEBSTER COUNTY.

Topography.

A description of the surface of this area is included under a similar head in the discussion of Tyler county. The lowest point, 588 feet, is at the Ohio river in the southwestern corner of the county, and the highest, 1,650 feet, at the summit of Honsocket knob in the opposite corner. The hills in most parts are very rough and steep.

Wetzel fronts on the Ohio river for about 13 miles. The largest tributary of this river in the county is Fishing creek, the whole basin of which lies within the area and drains 220 square miles. The remaining area of 140 square miles is drained by Fish creek, which flows northwest into Marshall county, and by several small creeks and runs.

Original Forest Conditions.

Yellow poplar, oaks, walnuts, and other hardwoods, reached the same degree of excellence here that they did in the other counties of the Ohio river valley. Yellow poplar was abundant in the rich land of the creek bottoms. A tree of this species 7 feet in diameter once stood on Nettle run south of Jacksonburg. White pine was found on Piney Fork, Brush run, and State Road run, all southern tributaries of Fishing creek. Yellow pine grew locally in the southern part of the county, principally on the ridges at the head of Piney Fork of Fishing creek. Hickories, birches, and chestnuts were not common except in a few localities.

The Lumber Industry.

Following is a statement made by Mr. S. I. Robinson, of New Martinsville, an old resident surveyor and lumberman:

"It may be said that the lumber industry really began about the year 1844; that is, 2 years before the county of Wetzel was cut off from Tyler. Before that time there was a demand for a limited amount of lumber at home, and a little trafficking in lumber was done here and there along the Ohio river; but in a majority of cases the trees that were cut down were split into

fence rails, boards for roofing, flooring, etc., or more often rolled together and burned. What sawing was done was by hand or by water saw mills of a primitive type. After this floating began. The bulk of the timber has been floated down Fishing creek.

"Portable steam saw mills have been in operation since the Civil War, and a few before that time. About 5,000 acres were cut over on Doolin run, just east of New Martinsville, by Caswell & Neuzem between 1860 and 1868. They hauled their fine poplar and oak to New Martinsville and shipped it in barges. The excellent poplar once growing on Buffalo and on Nettle run was sawed by small mills, hauled to the mouth of Buffalo and from there rafted down Fishing creek.

"There were no large mills on Fish creek, but several small mills cut lumber which was hauled to Littleton and shipped. A great deal of lumber was cut on the North Fork of Fishing creek by local mills and hauled in wagons to Mannington, Marion county, and shipped on the B. & O. railroad. The best of the timber on several thousand acres on Arches Fork, Morgan run, Tenmile, and other branches of the main South Fork of Fishing creek, was also cut by local mills and hauled to Mannington. The timber on 1,600 acres lying on Upper run was sawed by D. H. Cox, of New Martinsville, and by a Pittsburg operator.

"Much stave timber was cut along the Ohio river and the smaller streams and taken in barges to Pittsburg. About the year 1870 the Pittsburg Stave Company built a factory at New Martinsville. There they operated for 5 or 6 years, shipping rough and dressed staves to Pittsburg, and using some for the manufacture of barrels in their own plant. A barge would carry 60,000 rough staves or 100,000 that were dressed."

Mr. Robinson, from whom the above quotations are given, was himself an extensive shipper of staves. Many of his staves were shipped to the Phoenix Brewery of Pittsburg, to Gibson's distillery on the Monongahela, and to the Freeport distillery on the Allegheny river, 28 miles above Pittsburg. He also manufactured and hauled a large number of poplar shingles. In the process of manufacture trees were cut into blocks 4½ feet in length, and floated down the creeks to New Martinsville. Here the "bolts" were sawed in two, steamed, and cut into

shingles. Mr. Robinson states that 13 cords of "bolts" were cut from a single poplar tree.

Most of the white pine was cut into timbers 6 by 12 inches in thickness and from 25 to 60 feet in length to be used as gun-wales for coal barges built at New Martinsville and other points.

At present there are several large circular saw mill operations along the Short Line railroad and several smaller ones in other sections of the county. Of these the principal ones are Paulhamus & Moon, with a mill at Bane station, cutting from a tract on Arches Fork and head of Buffalo Fork of Fishing creek; Federal Lumber Company, of Jacksonburg, cutting from the John Mills tract on Buffalo run and Piney Fork with 5 circular mills; J. M. Hastings Lumber Company, of Jacksonburg, cutting from lands lying to the north and east of Jacksonburg. It is probable that the companies named will all have completed their operations here within a year after the publication of this report, and at least one of them, before that time.

The Present Forest Conditions.

There are about 2,000 acres of virgin forest remaining in the southern end of the county. The timbers on these forest lands are yellow poplar, white oak, chestnut oak, red oak, and others of less value. The cut-over forests contain about 12,800 acres and lie also toward the southern end. The largest tracts are situated between the southern line of the county and Fishing creek, above the mouth of Piney Fork.

Magnolia, Proctor, Center, and Church districts contain the best agricultural land; and Proctor and Center, in particular, contain areas of considerable extent that are fairly smooth. Clay district, in the northeastern corner, is not as well improved as those named above. Grant and Greene districts, in the southern end, are chiefly rough, non-agricultural areas although perhaps 30 per cent of the land has been cleared.

Taken as a whole, about 60 per cent of the county has been cleared. Since the development of an extensive oil and gas industry, however, many farms have been neglected and have become overgrown with brush and briers.

WIRT COUNTY.

Location and Area.

Wirt county, formed in 1848 from parts of Wood and Jackson, lies near the center of the second tier of counties back from the Ohio river. Its area is 230.9 square miles or 147,776 acres.

Topography.

The surface of the county is uneven with valleys and low hills. The principal valley is that of the Little Kanawha river which lies at an elevation varying from 650 feet at its upper end to about 600 feet at all points below the town of Palestine. The only other valley of importance is that of the Hughes river in the northwestern part of the county. Small areas on tops of the hills, some distance back from the principal streams, are over 1,000 feet in elevation. A few hills in the southeastern and eastern parts rise to 1,200 feet and the summit of a single knob on the divide between Little Kanawha river and Standingstone creek has an elevation of 1,325 feet.

The drainage of this territory is effected by the Little Kanawha river which traverses the county from southeast to northwest. Its principal tributary is Hughes river. Other smaller tributaries are Lee creek, Reedy creek, Standingstone creek, Tucker creek, Spring creek and Straight creek. The West Fork of Little Kanawha flows through the eastern part of the county for a short distance emptying into the main river at Creston near the Calhoun county line.

The Original Timber Conditions.

Wirt county, especially that part north of the Little Kanawha river, was originally well timbered. The growth consisted largely of the species named below and approximately in the proportion indicated:

White Oak	35 per cent.
Yellow Poplar	25 per cent.
Chestnut Oak	10 per cent.
Yellow Pine	10 per cent.
Beech	5 per cent.
Hickory	5 per cent.
Chestnut	} 10 per cent.
Red Oak	
Black Oak	
White Ash	
Basswood	
Cucumber	
Sycamore	
White Elm	
Black Walnut	
White Walnut	
Birch	}
Locust	
White Pine	
Hemlock	

The Lumber Industry.

Previous to 1873 no timber had been removed from the interior of the county. Owners of woodland lying adjacent to the river, however, had been engaged for a number of years in cutting yellow poplar, yellow pine and other valuable timbers and rafting the logs to Parkersburg where they were sold to operators there and through dealers to other operators along the Ohio river. The Parkersburg Mill Company has drawn upon the supply of timber along the Little Kanawha since 1854, taking the very best trees at a low price in the earlier years of their operation. Other operators who bought rafts from Wirt county were C. Crane & Company and Geo. Rettig of Cincinnati; J. R. Timms, West Fork Lumber Company; Geo. Crawford, Marietta Chair Company; D. M. Miller and, later, Burns Brothers and Huffman, and McCoy Lumber Company at Elizabeth. The mills of the companies and individuals named above were supplied

with logs from Braxton, Gilmer, Roane, Calhoun and Wirt counties.

McConaughey & Company began the purchase of timber and staves in 1873, being the only recognized company at that time which made regular purchases of both these commodities. Their operation extended also into Gilmer, Calhoun and Roane counties. This company operated 2 stave mills and purchased large numbers of split staves from the residents of the county. These were sold in Pittsburg, Cincinnati and in Indiana. During the same years the Company bought timber of all kinds that could be disposed of to C. Crane & Company, Geo. Rettig, Burns Brothers & Huffman, Geo. Crawford and the Marietta Chair Company, operators along the Little Kanawha and Ohio rivers.

From 1877 to 1900 McConaughey & Company dealt extensively in cross-ties, taking up the first that were branded on the Little Kanawha river above the "pools," and handling in some single years from 100,000 to 200,000. Since 1885 Withers & Vandevender, the Little Kanawha Log and Tie Company, D. M. Miller, and others, have been large purchasers of cross-ties in the county.

Parkersburg was long the chief market place for timber of all kinds that came down the Little Kanawha; but, after the building of the dams on this river, Burning Springs and Creston became the headquarters for timber dealers. All timber was delivered by the residents of this section and by purchasing companies into the pools at one of these points.

D. M. Miller and McConaughey & Company have handled most of the square oak. This was shipped to Canada and to Baltimore, and exported from there to England.

The largest mills that operated in the county were Burns Brothers and Huffman's band mill, McCoy Lumber Company's circular and gang saw mill, and the West Virginia Bung Company's mill, all located at Elizabeth. The first 2 mills named began to operate about 1880, cutting logs that were rafted from above on the river.

The yellow pine which grew near the river was sawed largely by the Parkersburg Mill Company which cut, of all kinds, from 400 to 600 rafts, annually, each raft of oak and pine con-

taining about 1,500 cubes and of yellow poplar about 2,000 cubes.

A large number of logs, ties and staves have sunken to the bottom of the Little Kanawha river in transit from all points between Elizabeth and Burnsville.

The Present Forest Conditions.

Approximately 25 per cent of the county still remains in woods. This, however, except about 6,000 acres in Burning Spring district belonging to oil companies, is owned in small boundaries as farmers' woodlots. The small quantity of merchantable timber left standing is being taken out by portable saw mills of which there are about 16 now in operation in the county.

WOOD COUNTY.

Location and Area.

Wood county, situated on the Ohio river, was formed in 1799 from part of Harrison. Since its formation Jackson, Ritchie, Wirt, and Pleasants, the four West Virginia counties which adjoin it, have been formed in part from the original territory. Its area is 357 square miles or 228,480 acres.

Topography.

There are no special surface features which differentiate the Wood county area from that of the Ohio river counties already described. The acreage of bottom land is relatively greater in this county, however, than in some of the adjacent ones, owing to the long frontage on the Ohio river and to the passage through of the broad-valleyed Little Kanawha.

The Ohio river flows at the western edge of the county for a distance of about 40 miles, and the Little Kanawha river flows northwest for half that distance, through the central section, emptying into the Ohio at Parkersburg. Some of the smaller tributaries of the Ohio river are Pond creek, Lee creek, and Island creek, emptying south of Parkersburg; and Pond run,

Big run and Bull creek, emptying farther north. The principal tributaries of the Little Kanawha, named from its mouth to the Wirt county line, are Neal run, Tygart creek, and Slate creek, flowing in from the south, and Worthington creek, Stillwell creek, and Walker creek, flowing in from the north.

Original Timber Conditions.

The white oak and other hardwoods of the Ohio and Little Kanawha river valleys grew in great abundance and were of excellent quality in this county. Yellow pine, and other softwoods in smaller quantities, such as hemlock, white pine, and pitch pine, grew locally through the hilly sections.

The Lumber Industry.

Parkersburg has been, and is still, the center of a lively lumber industry. This fact is due to the city's situation at the mouth of the Little Kanawha river—the natural outlet and transportation channel for the vast forests of white oak and other hardwoods that once grew within its basin. Rafts of logs have been common on the river for 50 years, or more, and Parkersburg has been the headquarters for the buyers of logs, and lumber, and cross-ties, cut in the counties which are drained by this stream.

Many mills have operated in the county during the last 75 years. Most of them have moved out and their names have been forgotten; but a few remain to the present day, the larger of which are engaged in sawing from lands bought up and held for their timber, and the smaller in sawing cross-ties and lumber from the smaller and more inferior trees.

One mill in particular should be mentioned in this connection, namely, the plant of the Parkersburg Mill Company. According to Mr. Daniel Gould, one of the original partners in the Parkersburg Mill Company, the mill had its beginning as early as 1825 when a sash saw mill was built and operated near the present site. Who owned the original mill is not known. In 1853, however, Daniel Gould became a partner with William B. Caswell, who had moved from Massachusetts to Parkersburg

Photo by A. D. Hopkins.

PASTURED WOODLOT IN MONONGALIA COUNTY.

some years before that time, and who had come into possession of the old mill. Shortly after the partnership was formed the mill burned down but was rebuilt immediately. A circular saw was then substituted for the upright saw, and planing, grist and other machinery added. Several years later the mill was remodeled and improved, a band saw being installed with the circular saw at that time. Fire destroyed the plant again in 1907. Again it was rebuilt, and stands today as one of the best hardwood mills in West Virginia. The mill is equipped for handling logs from 50 to 80 feet in length, and orders for oak and other hardwood timbers of practically every dimension are filled. The quantity of timber taken from the waters of the Little Kanawha river by this company during the past 50 years is almost beyond computation. A stock of 5 million feet, or over, is kept in storage at the mill and in the company's booms up the river.

Some of the rafters who have operated extensively in the past, or are still operating, are C. Crane & Company, of Cincinnati, McConaughey & Company, D. M. Miller, Withers & Vandevender, and many other local operators.

The principal lumber industry at the present time is the manufacture of hardwood lumber by the Parkersburg Mill Company, and other smaller mills at Parkersburg, and by the Nicolette Lumber Company at Nicolette, on the B. & O. railroad. A few small portable mills are still operating irregularly in various parts of the county.

The cross-tie industry has been large, and even in 1909 there were about 20,000 ties cut and sold in the area. This, however, cannot long continue at this rate unless better protection and care be given the woodland which remains.

The Present Forest Conditions.

Farmers own all the woodland of the county as woodlots connected with their cleared land. Some have retained a limited amount of good timber, but, for the most part, the cross-tie and pole timber, even, has been taken off. The numerous wood-manufacturing establishments in Parkersburg, such as furniture factories, chair factories, planing mills, etc., are draw-

ing their supply of rough material, largely, from points far removed from this once finely timbered region.

WYOMING COUNTY.

Location and Area.

Wyoming county, formed in 1850 from Logan county, has an area of 526 square miles or 336,640 acres. It lies north of McDowell, the southernmost county of West Virginia, and is joined on its other sides by the counties of Mingo, Logan, Boone, Raleigh and Mercer.

Topography.

The 1,000 foot contour line extends into the county for a short distance, only, along the low ground where the Guyandot river flows out. From this point the upward slope of the land surface is toward the east and northeast where the dividing ridges which separate the waters of the Guyandot from those of the Great Kanawha rise to an elevation of 3,000 feet or more. The northern boundary line of the county crosses Ivy knob at 3,693 feet. Although this county lies within the Alleghany Plateau and derives its name from an Indian term signifying a plain, the surface is so deeply dissected and broken in all directions that it bears but little resemblance either to a plateau or to a plain.

The Guyandot river drains the whole area of the county. Its principal tributaries are Clear fork, with its Toney and Laurel branches, Indian and Pinnacle creeks which drain the southern part, and Big Huff creek which drains the northwestern corner of the county. Above the "Roughs" at the southern end of Huff mountain the Guyandot flows between narrow banks and with a moderate fall. Clear fork has wider bottoms and flows less swiftly than the main stream.

Former Timber Conditions.

Poplar, oak, hemlock and chestnut once grew in great abundance in Wyoming county. Besides these there were smaller quantities of ash, basswood, black walnut, cucumber, maple,

hickory, beech, birch, locust, buckeye, black gum, sycamore, wild cherry, pitch pine, and others of less value. The excellent quality of poplar, hemlock, cucumber, basswood and walnut should be mentioned. The quantity of black walnut was not large, but on Clear fork and Big Huff creek, it grew in considerable abundance and was often figured. The oaks, white oak, red oak, black oak, chestnut oak and scarlet oak, were abundant, particularly white oak, but were more or less inferior in quality.

The Lumber Industry.

Except for a little rafting on the lower waters of the Guyandot no timber was taken out before 1890. All that was manufactured on whip saws and small mills prior to that date was used for domestic purposes. All the logs and lumber so far taken out have been floated down the Guyandot river, hauled on wagons to the Norfolk and Western railroad in McDowell county, or shipped over the Virginian railroad which has recently tapped the extensive forests in the eastern end of the county.

Floating on the Guyandot.

Extensive floating began about 18 years ago and is still carried on. The Little Kanawha Lumber Company floated poplar, ash, cucumber and basswood logs and manufactured them into lumber on their mill at Portsmouth, Ohio. This company operated for about 7 years. The Yellow Poplar Lumber Company also floated timber of the same kinds and manufactured it at Coal Grove, Ohio. H. Gordon floated poplar, ash, cucumber, basswood and black walnut logs to Huntington, West Virginia, and manufactured them there. The Ohio Falls Car Company floated poplar timber to their works at Jeffersonville, Indiana. M. Goble floated poplar, also, and sold it on the market. All these companies and individuals named above began floating about the year 1892 and ceased operations from 1896 to 1899. C. Crane and Company, Cincinnati, Ohio, commenced floating on the Guyandot and its larger tributaries in 1896 but did not operate actively until 4 years later. Since then

the company has handled the bulk of the timber which has gone out. Probably not less than 30 million cubes of poplar, oak, hemlock, ash, cucumber, chestnut, and a small quantity of black walnut and basswood have been rafted to Cincinnati from Wyoming county and sawed by this company on its 3 band mills located in that city. Other smaller operators were S. H. Nigh who floated small black walnut logs to Catlettsburg, Kentucky, in 1900, Jefferson Gill who floated poplar and ash to be manufactured by the Freedman Lumber Company at New Richmond, Ohio, and Newman and Spanner who have floated poplar, ash and cucumber to Ironton, Ohio.

Saw Mills.

Large quantities of timber have been taken out by saw mill companies. R. E. Wood Lumber Company, 1898-1906, sawed at Hanover on Little Huff creek, taking the timber from about 5,000 acres. The lumber from this mill was hauled across the mountains to the Norfolk and Western railroad. Crosby and Beckley Lumber Company, 1898-1902, operated 2 mills, one on Indian creek, another on Pinnacle creek, cutting the timber from about 5,000 acres. E. H. Suddeth Lumber Company, in operation since 1902, has cut over 4,000 acres. Keys-Fannin Lumber Company, at Herndon on the Virginian railroad, has operated a band mill since 1904. The W. M. Ritter Lumber Company, with a band mill at Maben on the Virginian railroad, is cutting timber from a large virgin tract lying in Wyoming and Raleigh counties. A number of small mills, also, have been sawing for the past few years at various points. The black walnut was taken out of the county, principally, on wagons to the Norfolk and Western railroad from 1895 to 1900. There are now in operation in the county 2 band mills and 19 circular mills. These have a combined capacity of about 45 million feet annually. If we estimate the present stand of timber at 800 million feet, the mills that are now in the county, if kept running at the present rate, will cut every foot of it in 18 years.

The probabilities are, however, that at least some merchantable timber will be standing in the county 18 years hence. Within 10 years the virgin areas will be cut over. Then the

large mills will move on to other fields, probably outside the state, leaving the cutting of the balance to smaller operators as the lumber is needed or sold by coal companies and other owners. Doubtless some areas of good timber will be maintained by those who are now conservative cutters and by others who will be shown by the stress of circumstances the necessity for careful preservation of young, growing timber. Floating will be kept up on the Guyandot but to what extent it is difficult to say.

The Present Forest Conditions.

Wyoming county now contains:

44,150 acres Virgin Forest,
192,490 acres Cut-over Forest,
100,000 acres Farm Land.

The greater part of the virgin forest land lies in the eastern part of the county along the Raleigh boundary line. About a dozen isolated areas of different sizes are scattered through the interior. Practically all the virgin area is in the hands of operators and will be cut over within the space of a few years. More than half of the whole area of the county must be classed as cut-over forest land. This, in many places, still contains a fair percentage of the original stand of timber for the reason, in part, that some of the largest floaters have established a 16-inch cutting limit. The 100,000 acres of farm land lies, principally, in more or less narrow strips along the principal water courses. The largest and best farming section is along the Clear Fork of Guyandot. There are about 60,000 acres of land under cultivation and in grass.

CHAPTER VII.

FORESTRY IN THE STATES.

The brief discussions below outline the forestry policies and the progress in forestry in 20 states, including most of those which have been for the longest time prominently and successfully connected with this work. It will be observed that, while there is considerable apparent diversity of method employed by the different states, there is, nevertheless, great uniformity of aim and purpose. All are waging war on fires as the most destructive enemy of forests; all are working for greater economy in the cutting and utilization of timber trees; all are carrying on an educational campaign through the circulation of literature and through public instruction; and nearly all are seeking to become, or have already become, the owners of non-agricultural lands within their borders to be managed as state forest reservations. Some states, such as West Virginia and Tennessee, have practically the whole problem of the future care of their forests before them; others, such as Pennsylvania and New York, have long ago solved the problem for themselves by establishing a system of forestry on a broad basis and by the acquisition of immense areas of forest land to be held and used for the perpetual good of all the citizens of the commonwealths.

Other states besides the twenty which deserve special mention for their activity in forestry work are Massachusetts, Minnesota, and Oregon. The states of Rhode Island, Tennessee, Georgia, Mississippi, Louisiana, Virginia, and Montana have also taken steps, either through some state organization or in co-operation with the Government Forest Service, to preserve their forests.

A list of states classified according to the official bodies directing their forestry work, and a list of state forest officers are included at the end of this chapter.

ALABAMA.

The forestry work in Alabama has been done through the State Commission of Forestry consisting of the Governor, as chairman, and 5 other members, and through the Commission in co-operation with the United States Forest Service.

The following quotation from a report of John H. Wallace, Jr., State Game and Fish Commissioner and Secretary of the State Commission of Forestry, will serve to show in some measure the condition of Alabama forests and the work undertaken for their protection:

"In conformity with the plan outlined by the State Commission of Forestry, bulletins have been issued directing the attention of the people to the economic value of the forests of Alabama. Although circumscribed in action by the very limited appropriation made by the legislature, still such labors as we have been able to prosecute have been fruitful of most excellent results. To a large extent the reckless destruction of useful timber trees has been checked, the annual burning of forests has been discouraged, and many inquiries have been made by the people with a view of engaging in the art of timber culture. * * * * *

"It should be most gratifying to the State Commission of Forestry to know that the Department of Agriculture at Washington classes the statute that brought us into official existence, as pre-eminently superior to any law ever enacted in the United States for the preservation and protection of the forests. The State Commission of Forestry should continue to disseminate useful information among the people, that will awaken them to an active interest in the preservation of their woodlands.

"Within a decade practically every vestage of the remaining virgin forests of Alabama will have been cut away, hence the problem which will confront the people of the state is the care of their second growth growing timber which in time, if properly treated, will develop into commercial trees. * * * * *

"The work of saving the forests of Alabama from complete obliteration, which has been begun so favorably, should be vigorously pushed, even into the remotest sections of the state, for upon the preservation of the trees depends the health, the

happiness, the well-being of the people. The destruction of the forests will bring floods and droughts; scarcity of timber and lumber for building purposes will impose hardships unrivaled in their direful effects; and even now wood for fuel in some sections of Alabama is becoming alarmingly scarce. * * *

The law creating the Commission of Forestry, approved by the Governor Nov. 30, 1907, provides among other things:

- 1—That it is the duty of the Commission to inquire into the condition of forests in the state and report on the same, and to recommend desirable legislation in reference to forestry.
- 2—That the Governor is authorized, upon recommendation of the Commission, to accept gifts of land to the state to be held and administered as state forest reserves.
- 3—That when the owner or owners of any land which has been denuded of trees, or any other land the assessed value of which shall not at the time of application exceed the sum of five dollars per acre, shall contract in writing with the Commission of Forestry to plant or grow upon the said land suitable and useful timber trees in such manner as they shall prescribe to protect the said land from fire and to maintain the trees so planted or grown upon it in a live and thrifty condition for a period of ten years and to cut or to remove from said land within that time, no tree or trees except as permitted in said contract; it shall be lawful for the state tax commission and they are hereby authorized, upon the recommendation of the Commission of Forestry, to exempt such land from taxation for the period of ten years next thereafter in which the said land is to be so maintained.
- 4—That the County Game and Fish Wardens already provided for by existing laws, be and are hereby declared and designated, Forest Wardens, whose duty it shall be to enforce the forest laws of the state and to carry out the provisions of this and other acts relating to forest preservation.

VIEW ALONG MOUNTAIN STREAM, TUCKER COUNTY.

5—That the malicious setting of fire to the woods shall be a misdemeanor punishable by a fine of \$25 to \$200 or imprisonment for 30 days to 1 year, or both.

6—That all monies received from fines, etc., shall be placed to the credit of the Forest Reserve Fund.

Experts of the Government Forest Service have made a preliminary survey of the forest resources of Alabama and have published the results, accompanied with recommendations for the state's future forestry policy.

CALIFORNIA.

Active forestry work in California began with the creation in 1905 of a State Board of Forestry and the appointment in the same year of a State Forester. The duties of the State Forester are briefly outlined under the following heads:

1—Appointment of 2 assistant foresters.

2—Acting as Secretary of State Board of Forestry.

3—Execution of all matters pertaining to forestry in the state.

4—Charge of all firewardens in the state's employ.

5—Control of the protection and improvement of state parks and forests.

6—Collection of data relative to forest destruction and forest conditions.

7—Taking such action as is necessary to prevent and extinguish brush and grass fires.

8—Co-operation with land owners—individuals, counties, towns and corporations—for management and protection of woodland.

9—Publication of literature to advance forestry in the state.

10—Reporting annually to the Governor on progress of work and making recommendations for improvement of forestry system.

In his review of forestry work done in California, both in his first and second reports, G. B. Lull, State Forester, points out that the problem of protecting the extensive forests from fire has engaged the principal efforts of the State Board of Forestry. In this work the Board co-operates with the Government

Forest Service which has in charge the 25 *million acres of Government forest in the state*. The forest fire laws are said to be particularly satisfactory.

Wm. C. Hodge, Deputy Forester, states in a recent letter that a large field of work, which is constantly increasing, is the giving advice and assistance to tree planters.

The principal plantations are of the various species of *Eucalyptus*—an exotic from Australia, introduced about 50 years ago. There have already been several thousand acres of the 100 or more species of this genus planted in the state. The Blue Gum, *Eucalyptus globulus*, is most successfully grown in many sections. This fast-growing and hardy tree often attains a diameter of 20 inches and a height of 125 feet in 15 years.

CONNECTICUT.

The forest policy of the state of Connecticut comprises the following:

- 1—Efficient protection of forest lands from fire by means of town forest fire warden service.
- 2—Ownership by the state of reserves as direct object lessons in forestry.
- 3—Scientific experiments and investigation in forest planting and forest management.
- 4—Co-operative assistance of private owners in the planting of forests and the management of woodland.
- 5—Educational work by addresses before clubs, associations, granges, etc.

Active work has been conducted in the state since 1901 when a forester was appointed in the Connecticut Agricultural Experiment Station. Subsequently he became by legislative act the State Forester and State Forest Fire Warden.

The laws of Connecticut intended to prevent and to regulate forest fires seem to have been unsatisfactory from early in the 19th century to the revision of 1902, and were in many instances practically a dead letter. In order to check the constantly increasing damage by fire to the young forests the offices of Town and District Fire Warden were created at the January session of the General Assembly of 1903. The forest

fire laws were added to and amended during the session of 1907 and again in 1909. The operation of the law so far has tended toward more efficient control of forest fires and promises to reduce to the minimum losses resulting from this cause.

The State has acquired by purchase forest reserves in 3 counties, Tolland, Hartford and Middlesex, aggregating about 1,360 acres. In answer to an inquiry directed to Mr. Samuel N. Spring, State Forester and State Forest Fire Warden, he makes the following reply: "*It is the purpose to establish a reserve in each county of the state that there may be good sized blocks of forest in each county that are handled under the principles of forestry to demonstrate the value of this work to the private owner.*" The law originally provided that not more than \$2.50 per acre should be paid for this land. This was subsequently changed to a maximum price of \$4.00 an acre. The largest body of land acquired by the state is 1,066 acres in the Town of Portland, Middlesex County, at an average cost of less than \$2.00 an acre." The land generally acquired has been recently cut-over forest of young growth, so that profitable returns are not yet obtainable. In the Middlesex forest there are, however, some lots containing timber 25 to 30 years old in which experimental thinnings have been made and the products disposed of profitably. The state forest in Simsbury, Hartford County, consists of purely waste, brush-covered land which prior to being acquired by the state was annually burned over. Since it was taken by the state no fires have occurred. In order to bring the several forest reserves into a state of the greatest possible productivity the state is dependent, first, on protection from fire by a well-equipped and well-paid fire warden service; second, on aid to natural reproduction by occasional "improvement thinnings;" and third, on the planting of valuable species of trees on unoccupied lands.

In making thinnings the trees that are especially favored in Connecticut are chestnut, white pine, oak, hickory and white ash. Those that are usually removed are gray birch, red cedar, ironwood, sassafras, and some others.

• *Planting of trees, principally white pine, is being carried on by the state, by water companies and by private land owners.* The principal plantations by private owners have been made

since 1906 when the Experiment Station undertook to find seedlings for planters at reasonable prices. During 2 recent years private owners planted 350,000 trees; water companies and similar concerns planted 200,000 trees; and the state planted 85,000 trees, making a total planted for forestry purposes in Connecticut of 635,000 trees.

The Experiment Station since 1901 has been conducting experiments in forest planting at Rainbow, Connecticut, and within 2 years has acquired 4 acres of 30-year-old white pine which had been established by seed sowing. On this latter tract experiments in thinning were conducted in the spring of 1909. The trees on these experiment plots will be measured periodically and further thinnings made as required, the whole being conducted as a scientific experiment in the handling of white pine forests. The accumulated results of this experiment and the work at Rainbow are published from time to time.

Upon application private owners throughout the state are given assistance in the planting of forests and the management of woodland. The expenses of travel and the subsistence of the Forester while engaged on the work are borne by the private owner. The result of this work has been the undertaking by many water companies and by private land owners of definite forest work, as indicated above.

So far as there is opportunity the Forester spreads the knowledge of forestry by means of addresses before associations, granges and other public meetings.

DELAWARE.

During the 1909 session of the Legislature of the state of Delaware a law was passed entitled, "An Act to Establish a State Board of Forestry." This Board is to consist of 5 members: the Governor, the Secretary of State, President of the State Board of Agriculture, Director of the Experiment Station, and the Forester of Delaware College, who is to act as secretary of the Forestry Board. Under the law the Forester is to have charge of all forestry matters in the state. Among the particular duties prescribed are:

- 1—Growing and distribution of shade tree nursery stock.
- 2—Supervision of state forest lands.
- 3—Formulation of a policy for control of forest fires and recommendation of fire wardens for appointment by the Governor.

In actual practice, but little action has been taken in compliance with the provisions of the new law. The passage of the law, however, is a step in the direction of conservation and makes possible the operation of an effective forestry system.

INDIANA.

The forestry work of Indiana is in charge of a State Board of Forestry created by an act of the General Assembly approved on March 1st, 1901. The secretary of the Board is state forester and as such devotes his time exclusively to forestry matters. A sufficient amount is appropriated to cover salary and traveling expenses of the secretary and the salary of a clerk employed in his office at Indianapolis.

The work of the Board is varied, including among other things, co-operation in forestry work with individuals and corporations; management of the state forest reservation; advice through correspondence and personal visits to owners of woodland; collection and publication of information relative to general forestry conditions in the state.

An act of the Assembly authorizing the State Board of Forestry to purchase 2,000 acres for "*a state forest reservation, laboratory of forestry demonstration and state nursery*" was passed in 1903. Under authority of this act the Board purchased a suitable tract in Clark county and at once placed the same under scientific management. A number of plantings have been made on the reservation for the purpose of demonstrating to the farmers and other planters of the state the value of a careful observance of soil adaptation, pruning, cultivation, rate of growth, spacing, and insect enemies of each species of tree, and for the purpose, also, of determining the most valuable trees and the best methods of propagation to be used in Indiana. Tests have been made, or are now under way, of such species as ash, poplar, oak, hickory, black walnut, white elm,

locust, osage orange and catalpa. Every precaution is taken to avoid forest fires in the reservation. Several fire roads are maintained and a fire lane surrounding the whole tract has recently been made. As a further safeguard against fire no smoking or hunting is allowed at any time of the year. A telephone is kept up for the purpose, in part, of giving alarm in case of fire.

Persons responsible for the destruction of property in any part of the state caused by forest fires, carelessly or accidentally set, are made liable under the law to a fine not exceeding \$50, for each offense and for full damages sustained by the owners. Road supervisors are fire wardens and are empowered to summon all necessary help for the purpose of extinguishing fires within their jurisdiction.

There are no extensive forest areas in the state. Practically all the woodland is in the form of small woodlots. These, in many cases, have been closely pastured and are in poor condition for the production of wood.

The following extract taken from the Ninth Annual Report of the Board of Forestry sets forth the policy that is to be insisted on:

“The problem of the future of the forests of Indiana is merely the problem of securing the proper handling and care of the woodlots and small timbered areas held by individual owners. If such areas are wisely handled and conservatively lumbered there is no reason why they should not for years yield a steady and increasing income and at the same time show a steady and marked increase in quality and value. In other words, the problem of the future timber supply in the state is very largely a problem of education. * * * * * The real peril lies in the fact that the process of education is a very slow one and that existing timber areas may be greatly reduced in value or completely destroyed before a knowledge of the better methods has become common property.”

Rapid progress has been made in recent years in creating a sentiment favorable to better methods of handling woodland. Considerable time is given to the teaching of forestry in the public schools. The press has been active in promoting fores-

try; and an educational campaign through the preparation and distribution of press bulletins, by correspondence and by various other means, is being conducted by the secretary of the State Forestry Board.

KANSAS.

Important forestry investigations have been conducted by the Kansas State Agricultural College since the early days of its existence, and, prior to 1909, most of the work done was accomplished through this agency. Naturally, the problem in central and western Kansas has been the reforestation of prairies. Forest tree plantings have been made at various times from 1874 to 1909. These have been under scientific observation and have made possible such studies by the State Agricultural College as rate of growth of various species; methods of propagation; the value of various species for windbreaks, commercial plantations, and as ornamental trees; the causes of success and failure of artificial forests; investigation of the value and distribution of native species, etc.

In 1887 the legislature established 2 State Forestry Stations, one near Ogallah in Trego County, another near Dodge City in Ford County. Both stations are situated on elevated prairie land such as predominates in the western third of Kansas. The chief work of the stations has been the growing of forest tree seedlings and distributing them to the citizens of the state. Although the work at these places was neglected during some periods large numbers of trees were grown and distributed. Species of trees grown for distribution and for demonstration planting at Ogallah and Dodge City stations include the following: red cedar, austrian pine, scotch pine, green ash, black locust, honey locust, osage orange, black walnut, hackberry, coffee bean, russian mulberry, ailanthus, russian olive, cottonwood and catalpas.

According to Prof. Albert Dickens, former State Forester, "The forestry work that has been done in central and western Kansas in the past quarter century has resulted in a large number of good tree plantations, many poor ones and some total failures." Further on in his "Report of Conditions in Central

and Western Kansas" Prof. Dickens asserts: "Since the prairie fires have been restricted and the fuel need of the settlers supplied by the coal miner and freight car, the area of natural timber has increased at a most gratifying rate. Thirty years ago the Arkansas west of Hutchinson, and its tributaries from the south, were practically devoid of trees. Today there are many acres that are under forest conditions and the forest area is increasing."

The conclusion is reached in this report that fires have had much to do in the formation of treeless regions and that if proper attention is given to soil preparation, selection of species, and condition of tree when set, plantations will be successful in nearly all locations.

A Division of Forestry under direction of the Board of Regents of the Kansas State Agricultural College was established by Act of Legislature in March, 1910. The new law provides for a State Forester, Assistant Forester and Assistants in charge of the forestry stations at Dodge City and Ogallah. The State Forester's duties are prescribed in the following sections of the law:

"SECTION 1. For the promotion of forestry in Kansas there shall be established in the Kansas State Agricultural College, under direction of the board of regents, a division of forestry. The board of regents of the Kansas State Agricultural College shall appoint a state forester who shall have general supervision of all experimental and demonstration work in forestry conducted by the Experiment Station. He shall promote practical forestry in every possible way, compile and disseminate information relative to forestry, and publish the results of such work through bulletins, press notices, and in such other ways as may be most practicable to reach the public, and by lecturing before farmer's institutes, associations and other organizations interested in forestry.

"SEC. 2. The state forester shall employ, under direction of the board of regents of the Kansas State Agricultural College, such assistants, who shall be practical foresters, laborers and clerks, and shall purchase necessary office furniture and equipment as may be needed to carry into effect the purpose of this act.

VIEW IN BIG GLADE, HEAD OF CRANBERRY RIVER.

"SEC. 3. The State forester shall, upon request, co-operate with towns, counties, corporations and individuals in preparing planting plans and plans for the protection, management and replacement of trees, wood lots and timber tracts under an agreement that the person obtaining such assistance shall pay the field expenses of such work."

Appointments under the law have already been made. A forest policy, prepared and submitted by the State Forester, has been approved by the board of regents and work of the new organization is under way. According to the proposed forest policy "The projects requiring immediate attention come under 2 classes: First, State work which includes the nursery and planting operations at the Dodge City, Ogallah and Hays stations; second, all kinds of cooperative work."

Nursery work at the Dodge City and Ogallah stations is to be abandoned and the free distribution of forest tree seedlings eliminated. About twenty acres will be set aside, however, at the Hays Branch Station for nursery purposes. The new nursery will be developed for the purpose of growing trees suitable for conditions in western Kansas. The plantations at the Dodge City and Ogallah Stations and all cooperative plantations will be supplied with nursery stock from the Hays Branch at cost of production. The old stations will be devoted, in part, to demonstration plantings and to experiments in crop-growing with a system of windbreaks.

The forestry division has planned to carry on extensive co-operative work with individual land owners in all parts of the state. *According to these plans from 4 to 6 demonstration plantations, each containing not less than 5 acres, are to be established in every county in western Kansas.*

In a communication from Prof. C. A. Scott, the recently appointed State Forester of Kansas, the statement is made, "In addition to the purely forestry work in the state, *we are laying considerable emphasis on park forestry, and at the present time have several applications from towns throughout the state for park plans.* Mr. Jansen, my assistant, is an expert landscape gardner and this end of the work is being turned over to him."

KENTUCKY.

The Kentucky State Board of Agriculture, Forestry and Immigration and the United States Forest Service have been conducting for the past 3 years a co-operative study and survey of the forests of the state. For this purpose \$2,000 may be used out of the annual appropriations by the Board, and this amount is duplicated by the Forest Service.

So far, a careful investigation has been made by expert forest examiners covering more than half of the total area of the state and carefully prepared maps and reports have been published to show the prevailing conditions found.

The result of this study, it is expected, will be the inauguration of a complete forest policy as recommended by the Forest Service. This will include the appointment of a State Board of Forestry; the employment of a State Forester; the enactment of efficient forest fire laws; the appointment of forest fire wardens; and the acquirement and administration of state forest reservations.

MAINE.

The Forest Commission of Maine is devoting its principal energies to the prevention and control of fires in the state's vast forest areas. The forest fire laws are executed by a large number of chief and deputy fire wardens who are under direction of the forest commissioner. A feature of the law that has been eminently successful gives the forest commissioner "authority to establish lookout stations connected by telephone, and to equip and maintain depots for the necessary tools for the extinguishment of forest fires."

In a letter addressed to the state forester of New York and dated January 6th, 1909, Mr. Edgar E. Ring, Land Agent and Forest Commissioner of Maine, writes of the lookout stations as follows: "We have in this state nine lookout stations located on high points of land, in which men are stationed during the summer season to watch for forest fires."

"They are a great success and we expect to establish a number more the coming season. They are connected by tele-

phone to the nearest firewarden and are equipped with a range finder, compass, strong field glasses, and a plan of the surrounding country, drawn to a careful scale. With these instruments our wardens have located fires accurately 30 miles distant, notified the wardens and had them extinguished before making any great headway.

"In my opinion one man located at a station will do more effectual work in discovering and locating fires than a hundred would patrolling."

MARYLAND.

Practical forestry work began in Maryland with a co-operative study of forest conditions in 7 counties made by the state and the Federal Division of Forestry from 1900 to 1905. Aside from the value in itself of this study it served to show the need for additional investigation by the state.

In 1906 a State Board of Forestry was created which, during the four years of its existence, has *taken the lead in developing and carrying on an original system of forest study and forest mapping*. Eighteen of the 23 counties have been studied and surveyed and a mass of valuable information gathered from almost every quarter. The Board has issued 2 general reports, the second including preliminary discussions by the State Forester of Forests and Forest Management for 2 counties.

The success of forestry in Maryland has resulted, in large measure, from an awakened public sentiment stimulated and encouraged by the efficient efforts of a State Forester and his co-workers. About one-half of the Forester's time is devoted to county studies, as outlined below. Among his other duties are lectures on forestry delivered at the State Agricultural College and before Farmer's Institutes during the winter months; practical assistance to owners in the management of woodlands; supervision of 4 forest reserves comprising an area of 1957 acres; examination of farmers' woodlots and preparation of planting plans; dissemination of a knowledge of the principles of forestry through correspondence and personal interviews;

control of forest fires; preparation of forestry leaflets and other matter for publication.

The system of field study, referred to above, is briefly outlined as follows: Three or 4 men are assigned to work in as many adjoining counties, each working separately but under supervision first, of the State Forester, who has general charge of field and office work, and second, under an experienced field chief who devotes his time among the field assistants. The assistants traverse all the principal roads with horse and buggy (or on horseback in very rough sections) and each is further equipped with mounted and folded county map, a rule for scaling distances, an odometer for checking short distances, an angle mirror, a pair of calipers, a height measure, and a 50-foot metallic tape. With this equipment and a little experience the assistants are enabled to classify rapidly and with fair accuracy the kinds and stand of timber on wooded areas. Two main divisions of timber are considered separately,—the hardwoods and the conifers. Both hardwoods and softwoods are divided into the merchantable class, the culled class and the sapling class. The merchantable hardwoods are subdivided into 3 divisions according to the stand per acre, and the same is done in the case of culled hardwoods. In order to obtain a basis for the calculation of timber stands and as a means of checking up ocular estimates a large number of sample plots, each containing one-tenth of an acre, are selected in wooded areas representing the various classes to be studied and careful estimates made of the quantity of timber, etc. The field chief, in addition to his work of assisting in taking the sample plots and overseeing the field work, collects such other data as will be valuable in the preparation of detailed county reports. Frequent reports are made to the main office where the State Forester is preparing maps for publication, tabulating data for county reports, and calculating timber stands on sample plots.

Only 2 colors are used on the forest maps,—red for hardwoods and green for conifers. By means of solid colors and horizontal and oblique lines, it is possible to represent a great variety of types and classes. The cost of the field study has not exceeded 54 cents per square mile.

Below is a statement showing the progress of forestry in

Maryland prepared for this report by Mr. F. W. Besley, State Forester:

- 1900-1905—Study of forest conditions by the State Geological Survey in co-operation with the federal Division of Forestry. Conditions in **seven counties** studied and reports published by State Geological Survey for five of these, viz., Alleghany, Garrett, Cecil, Calvert and St. Mary's. Publication of a forest map of Worcester County.
- 1906—An Act of the Assembly creating a **State Board of Forestry** and enacting forest laws. F. W. Besley appointed State Forester.
- 1907—A forest survey of the state begun by the **State Board of Forestry**. *Four tracts of woodland comprising 1957 acres given to the state for Forest Reserves*. Publication of first report by Board of Forestry.
- 1908—Appointment of a **State Conservation Commission**.
- 1909—Second report of the **State Board of Forestry** published. Publication of a report of the Maryland Conservation Commission, including a chapter on Forest Reserves. Creation of a **State Conservation Bureau**.

MICHIGAN.

The question of forestry began to be agitated in Michigan about 25 years ago by the State Horticultural Society. Fruit growers in the southern part of the state became alarmed on account of the ill effects to their industry produced by the removal of the forest and began to work with special reference to windbreaks and the preservation of a reasonable amount of forest land in the interest of conditions that would promote horticulture.

The first definite action along forestry lines was the creation of the Forestry Commission in 1899. Two of the three members which composed the Commission were appointed by the Governor and the third was the Commissioner of the state

land office who was secretary of the Commission by virtue of his office. The Commission was given authority to appoint a Forest Warden at a salary of \$1,000 a year.

The organization at once planned to manage the immense holdings of state lands, the planting of trees on the western border to check the movement of the lake shore sands, the awakening of an interest in the protection of southern watersheds, and the solution of questions arising from conditions in the great non-agricultural region on the north. Also, more conservative methods of lumbering were urged, a study of the development of water power was made, farmers and orchardists were instructed in the management of woodlots, nurseries were established, and the people were further enlightened by means of discussions through the press and from the platform.

In 1903 about 35,000 acres of state lands in 3 townships were set aside as a permanent forest reserve and an appropriation of \$7,500 per year was made for its care. The same act provided, further, that all lands to which the state should acquire title within the 3 townships should become a part of the reserve. Lands subsequently added increased the area of the reserve in these districts to 42,000 acres.

The supervision of the state reserve fell largely into the hands of the Commission's Forest Warden, Prof. Filibert Roth, of the University of Michigan.

In 1909 the Legislature created what is known as the Public Domain Commission and transferred all authority vested in the Forestry Commission to this body. According to the creating act, "Said Commission shall have power and jurisdiction over and have the management, control and disposition according to law of the public lands, forest reserve and forest interests, of all the interests of the state in connection with stream protection and control, forest fires protection and all matters within the jurisdiction, custody and control of the Michigan Forestry Commission and all the authority and discretion vested in them by law are hereby transferred to and vested in the Public Domain Commission."

Since the organization of the Public Domain Commission the state has withdrawn for forestry purposes 210,000 acres

additional. *This, with the Agricultural College reserve, makes a total of about 312,000 acres of state lands reserved for forestry purposes in Michigan.*

The wanton destruction of much of the vast White Pine forest of Michigan should be taken as a warning by those states which themselves have not suffered a similar loss. Prof. Roth in the "Forest Reserve Manual," asserts that "Michigan cut in one year over 3,600 million feet of White Pine alone," and adds, "The forests of this state supplied the people of our country clear to Texas with this choice material and at the same time called into existence the great wood working industries which have built up our towns and our railways." A little further on he says, "Today the State of Michigan imports lumber; the lumberyard of nearly every town in the state carries Yellow Pine and Cypress from the South and shingles and other materials from the Pacific coast. * * * * * And all this great waste of money for high priced lumber without any good cause, for Michigan has lands in plenty where a good forest growth would supply its people with all it needs and more beside, if only fire and vandal were restricted and thus nature assisted instead of opposed by man."

On the other hand, the energy with which many of the leading men of Michigan have undertaken the work of reclamation of their denuded forest lands, and the helpful attitude assumed by the common citizens of the state, have brought about a condition that may well be held up as an example for other states to follow. Under the direction of the competent members of the Public Domain Commission and the skillful work of the no less competent executives, an excellent system of forestry has been developed and put in operation.

NEW HAMPSHIRE.

Previous to May, 1909, the principal forestry work in New Hampshire was conducted by the state and the Government Forest Service in co-operation. The published results of the co-operative study began with a report on forest conditions in the White Mountains in 1903. This was followed in 1905 by a

report on forest conditions in southern New Hampshire and in 1907 by a report on forest taxation.

At the date first mentioned above a new law went into effect which provides for a Forestry Commission, a State Forester, and a complete fire warden service.

The Forestry Commission is composed of 3 members who serve for 3 years each without compensation. Their chief prescribed duty is the appointment of a state forester who shall serve at the will of the commission at a salary to be fixed by them under a given limit.

The forester's work is outlined under the following heads:

1—Educational lectures on forestry delivered at farmers' institutes and similar meetings in the state.

2—Execution of all matters pertaining to forestry within the jurisdiction of the state.

3—Serving without additional compensation as State Forest Fire warden. (In this capacity the Forester has the power of appointment and removal of fire wardens and the execution of all laws to prevent and extinguish forest fires.)

4—Co-operation with counties, towns, corporations and individuals in the preparation of plans for the management of woodland.

5—Preparation of a biennial report to the Governor.

The state has a number of forestry laws that have been tried and found successful. Some of these are mentioned below:

Portable steam mills must be provided with suitable spark arresters.

Railroads are made responsible for all damages to property caused by fire from any locomotive or engine on their roads.

Shade tree wardens are appointed by mayors and selectmen to care for ornamental and shade trees growing in parks and along public highways.

Owners of forest tree plantations having not less than twelve hundred trees to the acre are entitled to a rebate of ninety, eighty and fifty per cent of their assessed value for the first, second and third periods of ten years respectively.

SPRUCE BARK CAMP IN FOREST NEAR HEAD OF CRANBERRY RIVER.

The state owns about 600 acres of woodland used for parks and 1,000 acres of forest land is owned by state institutions. There has been no planting of forest trees except by individuals. Many small areas of waste land have been planted by land owners and private planting is increasing rapidly throughout the state. The state owns no forest tree nursery at present but an appropriation for this purpose will be made in the near future. The Forest Commission and State Forester have started a private nursery on a small scale. Two commercial forest nurseries are being operated in the state.

In answer to an inquiry concerning forest fires in New Hampshire Mr. E. C. Hirst, State Forester, replied in part as follows:

"Our law providing for local fire wardens is working admirably in most towns. In the mountain towns we generally appoint an employe of some lumber company.

"I am sending you an account of a meeting we had with the lumbermen in New Hampshire. At this meeting they subscribed \$4,000 to be used in establishing lookout stations* for the control of forest fires."

NEW JERSEY.

The state of New Jersey has 2,000,000 acres, or 46 per cent, of its whole area in woodland. This comprises a large body of pine land of approximately 1,500,000 acres in the southern part of the state, smaller bodies of rough mountain land covered chiefly with hardwoods in the northwestern part, and scattered woodlands between.

As a result of forest fires and reckless exploitation by lumbermen the forest growth is inferior but has been slowly improving since about 1890 when it was in its lowest condition.

At various times between 1794 and 1902 laws were passed looking to the prevention of forest fires, but owing to the defects common to most laws of that character nothing practical came of them.

For the last 20 years the State Geological Survey has

*See discussion of forestry in Maine, page 334.

gathered and published a mass of information relative to the forests, and has urged in every practicable way a more conservative use of them. But in the face of all efforts to conserve there was an appalling annual loss occasioned by forest fires.

In 1905 Governor Stokes in his inaugural address called attention to the situation and was instrumental in securing the passage of an act by which the Forest Commission was created. In the following year a new law dealing with forest fires was enacted. With the establishment of the Forest Commission began an era of active work in forestry. This work has been and is still chiefly directed toward the suppression of forest fires, for, it is believed by those who have the matter in charge, that forest management, tree planting, or silviculture, of any form will find little justification, or hope of adoption, so long as the forest fires are uncontrolled.

In 1907 a State Forester was engaged. His work comes chiefly under the following heads:

- 1—Execution and development of forest fire laws.
- 2—Administration of State Forest Reserves and the care of an arboreum at New Brunswick.
- 3—Experimental planting.
- 4—Lectures before improvement societies, shade tree commissions and other civic bodies.
- 5—Advice to private owners, through correspondence and in the field, as to the management of woodlots, methods of planting, combatting diseases of trees, etc.

New Jersey has acquired about 14,000 acres of land for State Reserves which are being administered as demonstration areas, or object lessons in forestry.

About 200 fire wardens are in regular service, all appointed by the governing bodies of the townships or other municipalities, and all paid salaries in addition to liberal compensation for services in fighting fires. Mr. Alfred Gaskill, Forester and Secretary of the New Jersey Forest Park Reservation Commission, states in a recent communication: "We are well satisfied that the policy of paying a small salary, or retainer, to each fire warden though it be but \$20 or \$10 a year is a good one,

since after 2 years' experience we find the men *more interested in the work, and much more capable of control.*"

It will be observed from the foregoing that most of the forestry laws, so far enacted, are in reference to the control of forest fires. Some of these are mentioned in the "Fifth Annual Report of the Forest Park Reservation Commission of New Jersey" (1909) as follows:

"The minimum rate of pay for fighting fire is found to be a good feature of the law. Helpers when fighting fire are allowed \$1 for five hours, *or less*, and twenty-five cents per hour thereafter. A man who gets as much for half an hour's work as for five hours will be apt to hurry and try hard to put out a fire before it becomes serious.

"A permit must be obtained before any fire can legally be made within 200 feet of a forest at any time of year. It has been necessary to limit these permits to seven days but fire wardens are authorized to issue renewals, to send them by mail, and in every way to hamper trustworthy citizens as little as possible. If a man is known to be careless a permit may be withheld until the warden thinks it safe for him to burn, or it may be denied altogether."

The last effort of the Forest Commission has been directed toward the control of railroad fires through the construction of wide fire lines along every railroad which traverses woodland. The railroad fire lines are described thus: "What are regarded as the essential features are the bared strip, ordinarily ten feet wide, and the thinning, not total removal, of the forest between the bared strip and the roadbed. The bared strip located 100 feet from the nearest rail is intended to be an automatic fire check. From its whole length and width every bit of vegetation and inflammable matter is to be removed and the mineral soil exposed and so maintained. Between this strip and the roadbed the ground is simply cleared of grass, brush, &c., by mowing or burning, or both, and the trees, where they form thickets, thinned out. The intention is to leave all trees that are three inches in diameter and not less than six feet apart.

"A fire line like this is supposed to work thus: If sparks are thrown from a locomotive stack, the foliage of the trees

may so retard its fall that its fire is lost. If a spark is not so killed, and reaches the ground alive, it is almost sure to fall inside the bared strip. There it finds little to burn, but if some grass or dried leaves are ignited the fire can gain little force or headway before it reaches the bared strip. Under ideal conditions, even with considerable wind, a small fire would rarely cross the ten feet of bare ground, but must go out for want of fuel. In practice some fires will find opportunity to cross, yet with reasonable vigilance on the part of the section men and fire wardens the number that escape need be few.

“The whole work of constructing fire lines is to be done by the railroads, and at their expense, within the next five years. But though only one-fifth of the total is cut each year, all that may have been cleared must be recut or reburned at least once each year to maintain its effectiveness.”

NEW YORK.

- 1883—An act of Legislature prohibiting further sale of land owned by the state in ten Adirondack counties. Appointment by State Comptroller of a committee to investigate conditions in Adirondack state lands.
- 1885—Report of the investigating committee recommending the establishment of a Forest Commission. Appointment of a Forest Commission by the Governor.
- 1886-1889—Organization by the Forest Commission of a fire protecting force. Determining boundaries of parcels of land aggregating 715,267 acres. Enforcement of the law against trespassers.
- 1890—Appropriation of \$25,000 for the purchase of 16,320 additional acres in the Adirondack Mountains.
- 1891—Promotion of Col. Wm. F. Fox to the position of Superintendent of Forests.
- 1892—Establishment of the Adirondack Park by Act of Legislature. Inauguration of a plan for producing revenue from forest preserves by leasing camp sites.
- 1893—Reorganization of Forest Commission. Publication

of "Land Grants and Land Patents of Northern New York" by Col. Wm. F. Fox. Passage of a law permitting the sale of spruce and tamarack over twelve inches in diameter in any part of forest preserves.

1894—A Constitutional provision in the new Constitution prohibiting the cutting and removal of **any trees** on state land.

1895—Consolidation of Forest Commission and The Fish and Game Commission under the name of "Fisheries, Game and Forest Commission." Legislative act making it a misdemeanor to set fires to clean land during certain dangerous periods.

1897—Organization of a Forest Preserve Board and purchase of two million dollars worth of land for an Adirondack Park.

1901—Consolidation of Fisheries, Game and Forest Commission and Forest Preserves Board under name of Forest, Fish and Game Commission,—the present organization. Improvement of forest fire law by creating the office of Chief Firewarden.

The above brief outline, omits much that was important in the institution and carrying on of the several lines of forestry work from 1883 to the beginning of the present century, and purports to indicate in a general way, *only*, the policy pursued during this period. It will serve to show, however, the foresight and good business judgment of the promoters of forestry in New York which have proven of inestimable value to every citizen of the Commonwealth in securing the acquisition of large forest preserves and in establishing a practical and extensive system of forestry.

A good beginning at an early date prepared the state for the promptest action at the time of the recent awakening. All the lines of work carried forward during the last decade cannot be discussed here. The work of the Forestry Department is included, principally, under the following heads:

- 1—Administration and protection of 1,588,874 acres of state forest reserves situated in 12 Adirondack and 4 Catskill counties.
- 2—The protection from fire of all land in the Adirondacks and Catskills without regard to ownership.
- 3—Gathering and tabulating statistics from a large number of saw mills.
- 4—Reforestation of state lands.
- 5—Management of forest tree nurseries.
- 6—Experiment work in cooperation with Government Forest Service.

An area of about 6,000 acres has been planted with forest trees including such species as White Pine, Scotch Pine, Norway Spruce, Bull Pine and European Larch.

Five nurseries having a combined area of about 31 acres supply large numbers of trees for state land and cooperative forest plantations. These, however, are inadequate to meet the demands. Hon. James S. Whipple, Forest, Fish and Game Commissioner, declares, "We are not growing one twenty-fifth as many trees as we ought." He recommends that at least \$100,000 be spent each year in this particular work and that at least 30 million trees should be furnished annually to the people of the state at a price lower than cost.

During the last session of the New York Legislature important changes were made in the laws relating to the state's forest possessions. The particular features of the amended law of most importance are summarized in commissioner Whipple's Fifteenth Annual Report as follows:

“First—Those which provide for the cutting off of limbs from the tops of coniferous trees when felled, that they and the tops may lie flat down on the ground, gather and retain moisture and soon rot.

Second—For a paid fire patrol.

Third—For the construction of observation stations on mountain tops, and telephone lines through the forest connecting up the stations.

Fourth—That the state pay, in the first instance, all of the expenses of fire fighting, half to be rebated by the towns where fires occur.

Fifth—Providing that railroad companies pay the whole expense of patrolling their rights of way.

Sixth—That daily, weekly and monthly reports be made to the department of fires on matters relative thereto.

Seventh—Making town supervisors part of the fire fighting force.”

NORTH CAROLINA.

A study of the material resources of North Carolina was taken up as early as 1823; and the subject of Forestry has been before the citizens of that state for 40 years.

The following brief abstract of a sketch prepared for this report in March, 1910, by Mr. J. S. Holmes, Forester for North Carolina Geological and Economic Survey, will show the progress of work to the last date given above:

1823—An Act of the Assembly authorizing the Board of Agriculture to pay expenses of “geological excursions” for a period of years. Work in charge of Prof. Denison Olmsted.

1825—Removal of Prof. Olmsted to Yale and appointment of Dr. Elisha Mitchel to succeed him.

1852—Appointment of Dr. E. Emmons as State Geologist.

1860—Publication by the Natural History Survey of North Carolina of a report on the “Woody Plants of North Carolina” prepared by Dr. M. A. Curtis.

1866—Appointment of Dr. W. C. Kerr as State Geologist.

1867—Publication of the “Indigenous and Naturalized Plants of North Carolina” by Dr. M. A. Curtis.

1870—Dr. Kerr’s first general report to the Legislature.

In this report he says, “The time has come to begin the work of repairing the mischief and waste of our predecessors and our own by planting our old fields with seeds of future forests and fortunes.”

1891—Establishment of the North Carolina Geological Survey and appointment of Prof. Joseph A. Holmes as State Geologist.

The expressed object of the Survey was "the thorough examination of the nature and extent of the mineral and timber resources of the State."

1892—Publication of Prof. Holmes's first Biennial Report. In this report he says: "It will be the policy of the survey to publish from time to time in the future special bulletins on the management and preservation of the forests of the state, in order that the people who own these forests may be able while disposing of their supplies of timber now available to do so under such conditions as will best protect the young trees and shrubs from injury by the lumbermen and from the still more common and destructive injuries from the forest fires and stock; and thus perpetuate the forest wealth of the State."

1892—Appointment of W. W. Ashe as Assistant, in charge of timber investigations.

1894—Publication of Bulletin 5, entitled "The Forests, Forest Lands and Forest Products of Eastern North Carolina" by W. W. Ashe.

1895—Publication of Bulletin 7, "Forest Fires, their Destructive Work, Causes and Prevention" by W. W. Ashe.

1897—Publication of Bulletin 6, including "The Timber Trees of North Carolina" by Gifford Pinchot, then Forester for the Biltmore Estate, and "The Forests of North Carolina" by W. W. Ashe.

1897—Publication of the first Economic Paper, "The Possibility of a Maple Sugar Industry in North Carolina" by W. W. Ashe.

1898—Co-operative study begun of the silvicultural characters and growth of loblolly pine in North Carolina, by the Forestry Division of the United States Department of Agriculture and the State of North Carolina.

WATERFALL ALONG THE WESTERN MARYLAND RAILROAD NEAR DOUGLAS,
TUCKER COUNTY.

- 1898—Organization of the North Carolina Forestry Association.
- 1900—A study begun in cooperation with the Bureau of Forestry and the United States Geological Survey looking to the possible establishment of a national park, or forest reserve, in that region.
- 1905—Publication by the United States Geological Survey of Professional Paper No. 37, "The Southern Appalachian Forests." This report, in part, was based on cooperative investigations made in North Carolina.
- 1905—Publication of the biennial report of the State Geologist which embodied the result of several year's cooperative study of the comparative value of the swamp lands of the eastern part of the state for forests and for agriculture.
- 1905—Creation by the State Legislature of the North Carolina Geological and Economic Survey and appointment of Dr. Joseph Hyde Pratt as State Geologist. The objects of the Survey, as stated in the Act creating it, include, "examination of the mineral, forest, fish and other natural resources of the state." The paragraph relating to the forests states that "an examination and classification of the soils, the forests, and other physical features of the state shall be made, with special bearing upon the occupation of the people."
- 1907—An agreement made between the State Board of Education and the Survey whereby the Forestry Division was to investigate the boundaries and general condition of swamp lands belonging to the Board.
- 1908—A report by Mr. J. F. Bond of the United States Forest Service, on the suitability for reforestation of the North Carolina Banks, included in the State Geologist's biennial report.
- 1908—Appointment of W. W. Ashe as Forester of the North Carolina Geological and Economic Survey.
- Educational work, which was begun many years

before by the State Geological Survey, was taken up vigorously in 1908 by the Forester. It consisted chiefly in lecturing and writing of press bulletins.

1909—Resignation of Mr. Ashe and appointment in his place of J. S. Holmes as Forester.

A report of an examination into the present forest conditions of western North Carolina made by the State Forester in cooperation with the United States Forest Service is in preparation.

A study of forest fires in the state for the year 1909 was made in cooperation with the United States Forest Service. A report is now in preparation.

The State cooperated with the office of Wood Utilization of the United States Forest Service in making a study of the wood-using industries of North Carolina.

Under the energetic administration of Dr. Pratt there have been established 3 divisions under the direct supervision of the State Geologist, viz: the Highway Division, in charge of W. L. Spoon, Highway Engineer; the Fisheries Division, under Theodore S. Meekins, Fish Commissioner; and the Forestry Division, now in charge of J. S. Holmes, Forester.

It is planned to continue a careful study of forest conditions of the state until all the counties are covered. At the rate the work progressed in 1909 it is estimated that this will require about 4 more seasons' work. The Survey will then be in possession of information that will enable it to recommend a definite and advanced forest policy for the State.

It is planned, further, to conduct a vigorous campaign of education, both through the press and by lectures at Farmers' Institutes and other public meetings.

The next Legislature will be asked to enact improved and progressive forest laws.

OHIO.

Ohio is essentially an agricultural state. It has but a small percentage of non-agricultural land. A few thousand acres of rough land on the south and east are held by coal companies. The remainder of the state is divided into small farms averaging less than 100 acres each. A large proportion of this farm land

has been cleared for cultivation but, as a rule, each farmer has preserved a small boundary of woodland.

The branch of forestry work, therefore, which has received most attention in Ohio is the improvement of the farmers' woodlots. The 2 forestry publications, issued from the Ohio Agricultural Experiment Station before the establishment of a department of forestry in that institution, explain methods of growing profitably for farm use such species of trees as catalpas, osage orange, mulberry and yellow locust. In 1906 this important work for the farmer was taken up vigorously by the first forester of the Experiment Station, and has been made a prominent feature in all forestry work. Several hundred farmers are cooperating with the Forestry Department of the Station in the management of their woodlots, and the number interested in this is increasing each year.

Cooperation in forestry work with public institutions, also, is being successfully carried on. According to the third annual report of the forester 4 state, 1 county, 1 municipal, 2 educational and 2 charitable institutions are cooperating with the state. Nurseries have been established at 3 of the institutions where about 300,000 tree seedlings have been grown for planting purposes. Other institutions throughout the state have expressed a desire to establish forest plantations for parks and to be used in the protection of water supplies.

Other lines of work being pursued are a study of natural forest conditions by counties; experiments to obtain data relative to rate of tree growth and the conditions favoring the growth of various species; a study of problems peculiar to the rough hill lands; experiments with certain trees in the construction of windbreaks; a study of methods of prevention and control of forest fires.

The outline below, prepared for this report by Mr. Edmund Seerest, Forester of the Ohio Agricultural Experiment Station, shows the beginning of interest in forestry and its progress in Ohio through a period of more than 50 years.

“1853—Publications on Forestry, through the Western Horticultural Review, by Dr. John A. Warder of Cincinnati, Ohio.

1873—Appointment of Dr. Warder as commissioner to Vienna to report upon the products of the forests as shown at the International Exposition.

1883—Organization of the Ohio Forestry Association.

Efforts of the State Forestry Association to secure Forestry Experiment Stations.

Efforts to secure legislation authorizing the appointment of a state forester.

1885—An Act of the Assembly establishing a State Forestry Bureau consisting of three members.

Prof. Adolph Lewe elected secretary of the Forestry Bureau with authority to make forestry investigations.

First annual report of the Forestry Bureau by Prof. Lewe.

1903—Organization of the Ohio Forestry Society.

1904—Publication of Bulletin 149 of the Ohio Agricultural Experiment Station on the "Hardy Catalpa as a Farm Crop", by W. J. Green.

1905—Publication of Bulletin 158 by Ohio Agricultural Experiment Station on "Forestry Investigations" conducted by J. W. Green and C. W. Waid.

1906—Repeal of the act establishing the State Forestry Bureau. An Act to establish at the Ohio Agricultural Experiment Station a forestry department. Appointment of W. J. Green as Forester and Edmund Secrest as Assistant Forester of the Experiment Station.

1907—Publication of the first annual report of the forester of the Experiment Station by W. J. Green.

1908—Publication of the second annual report of the forester of the Experiment Station by W. J. Green.

Publication of Bulletin 189, of the Experiment Station, "Forestry Suggestions" by W. J. Green and Edmund Secrest.

Publication of Bulletin 190, of the Experiment Station, "Evergreens, their Culture and Uses", W. J. Green and W. E. Bontrager.

1909—Publication of Bulletin 204, of the Experiment Station on "Forest Conditions in Ohio" by W. J. Green and Edmund Secrest.

Third annual report of the forester of the Experiment Station by W. J. Green and Edmund Secrest.

1910—Appointment of Edmund Secrest as Forester of the Experiment Station.

Publication of a report on the "Durability of Post Timbers," Bulletin of the Experiment Station, by W. J. Green and J. J. Crumley."

PENNSYLVANIA.

The Commonwealth of Pennsylvania is the owner at present of 920,000 acres of land for forest reserves. The management and protection of this large forest area is the principal work of 40 scientifically trained foresters and over 100 rangers.

Robert S. Conklin, Commissioner of Forestry and President of the State Forestry Reservation Commission, who prepared for this report the chronological statement of the status of forestry in Pennsylvania as given below, states that "*the work of protecting and developing the forests in the state is going forward with great rapidity.*"

Forestry in Pennsylvania.

1681—Sec. XVIII William Penn's Charter of Rights: "In clearing the ground care shall be taken to leave one acre of trees for every five acres cleared; especially to preserve the Oak and Mulberries for silk and shipping."

1700—Act against felling trees on another man's land without permission.

1735—Act to prevent damages from firing woods.

1785—Publication of "Arbustrum Americanum" by Humphry Marshall.

1794—Second act against firing woods. Others followed in 1860, '69, '70, '79, etc. Act against cutting timber trees or firing woods.

- 1851—Act incorporating the Pennsylvania Agricultural Society.
- 1855—Death of Andre Michaux, leaving a legacy of \$12,000 to American Philosophical Society in Philadelphia for Forestry instruction.
- 1863—Publication of "The Earth as Influenced by Human Action" by Geo. P. Marsh.
- 1870—Michaux legacy became available. Dr. J. T. Rothrock, Dean of the Botanical Department of the University of Pennsylvania, appointed Michaux lecturer on "Forestry."
Act making it the duty of the county commissioners to appoint persons under oath to bring to justice persons who set fire to forests.
Collection of forest data for the ninth census.
- 1873-1874—Attention of the Legislature called to the forestry question in the annual message of Gov. Hartmanft.
- 1876—Act establishing the state board of agriculture, "To investigate subjects relating to improvements in the Agriculture in the State."
Forest exhibit at Centennial Exposition at Philadelphia.
- 1877—Organization of the State Board of Agriculture. May meeting devoted largely to forestry questions. Papers published in report of State Board of Agriculture for 1877.
Secretary of State Board of Agriculture asks for better fire laws, refers to rebate laws of other states, calls attention to the great cost of wood fences and unnecessary waste connected with them.
- 1878—Pennsylvania State Agricultural Society resolves to bring to attention of Legislature a law rebating the road tax for planting trees along highways. (N. Y. act of 1867 referred to.)
- 1879—Act to encourage planting trees along roadsides.
Act authorizing the county commissioners to pay \$50

to prosecutor in successful suit against an individual for setting fire to the woods.

Forestry meeting in main Centennial building in Philadelphia.

Address by Dr. George May Powell, Chairman of American Forest Committee and Secretary of International Forest Council.

Secretary of Board of Agriculture recommends exemption of taxes "on lands planted with certain kinds of forest trees, for a certain time after planting, and at the expiration of this time the lands be not increased in valuation for taxable purposes by reason of trees thus planted."

He also suggests the appointment of a commission to investigate forestry matters and report such legislation as may be needed.

1880—Data for tenth census. *First real awakening to the forest resources of the state.*

1883—Act directing assessors to return all timber land.

1886—Organization of Pennsylvania Forestry Association.

1887—Rebate of taxes on plantations of forest trees for 30 years (1897).

Appointment by Governor of Commission to investigate the forest conditions in the state. First observance of Arbor Day.

1891—Act providing for the payment of damages for injuries done to trees along public highways by telephone, telegraph, and electric light companies.

1893—Appointment of commission to examine into and report upon forestry conditions in the state.

1895—Division of Forestry created in new Department of Agriculture and Dr. J. T. Rothrock appointed commissioner of Forestry.

Report of Committee published as Vol. 2 of report of Secretary of Agriculture in 1895.

1897—Act making constables ex-officio fire wardens.

Act empowering constables to make arrests without warrant upon sight, in case of violation of forest laws.

- Act authorizing purchase of unseated lands at tax sale for the purpose of creating a state forest reservation.
- Act to provide reservation of 40,000 acres at headwaters of each of three main rivers of the State.
- 1898—Report of Commissioner of Forestry for 1897 as Vol. 2 of the Report of Secretary of Agriculture for 1897.
- 1901—Establishment of Department of Forestry and Forest Reserve Commission. Appointment of a State Forester.
- 1902—Establishment of a forest nursery and planting of first trees by Department.
- 1903—Establishment of State Forest Academy at Mont Alto.
Appointment of a Deputy Commissioner of Forestry.
Report of Department of Forestry for 1901-2.
- 1905—Act making fixed charge on lands to compensate for loss of taxes.
Conferring on municipalities right to use water from State forests.
Report of Department of Forestry for 1903-4.
- 1906—Report of Department of Forestry for 1905-6.
First class of foresters graduated from the Forest Academy.
- 1907—General Shade Tree Act.
- 1908—Report of Department of Forestry for 1907.
First convention of Pennsylvania Foresters.
- 1909—Act to protect trees growing by the roadside.
Act authorizing the Department of Forestry to grow and sell forest tree seedlings at cost.
Act establishing municipal forests. (First law of the kind in the United States.)
State Inspection and report on chestnut blight.
New forest fire warden law.

VERMONT.

The outline given below, prepared by Mr. Austin F. Hawes, State Forester of Vermont, mentions some of the steps which led to the creation of the Board of Agriculture and Forestry.

BALSAM FIRS ON MARGIN OF McDONALD GLADE, TUCKER COUNTY.

It is stated also in the introduction to "Forest Fires in Vermont," published in December, 1909, that "The establishment of the Vermont Forest Service by the Legislature of 1908 was no doubt partially due to the serious forest fires of that fall; as the forest fire law itself had followed the disastrous fire of the spring of 1903."

Progress of Forestry in Vermont.

"Establishment of a Forestry Association in Vermont.

Creation of office of Forestry Commissioner.

1905—Establishment of State Nursery and annual appropriation of \$500 per annum for same.

1906—Publication of Bulletin No. 2, "An Address by Dr. B. E. Fernow."

Publication of Bulletin No. 120, "Planting White Pine in Vermont" by Prof. L. R. Jones.

1907—Publication of Bulletin No. 127, "State Nursery for Forest Seedlings" by Prof. L. R. Jones.

Publication of Bulletin No. 3, "An Address by Prof. J. W. Toumey of Yale Forestry School.

1908—An act abolishing the Board of Agriculture and creating a Board of Agriculture and Forestry.

1909—Appointment of Austin F. Hawes as State Forester. Field study of forest fires and publication of "Forest Fires of Vermont."

Purchase of "L. R. Jones state forest," Plainfield, Vermont.

Acquirement of Downer State Forest, Sharon, Vermont, by gift of Mr. Charles Downer.

Publication of Vermont Forestry Cards Nos. 1-6.

Bulletin No. 139 of the Vermont Agricultural Experiment Station outlines some of the more important duties of the State Forester as follows:

"Inasmuch as the first step toward the practice of forestry must be the *reduction of forest fires* to a minimum, the most important duty of the state forester is to increase the efficiency of

the warden service and inaugurate any other measures necessary for the doing away with these fires. A study of the fires which occur in the state will be necessary before recommendations along these lines can be made.

"The next in importance to the prevention of forest fires, is the *education of land owners* so that they may carry out forestry principles on their own land. As already pointed out, the example furnished by the state forests will be the most effective means of bringing this about.

"Investigations and experiments will be made by this office to *obtain accurate information about the various forestry problems* of the state, and the results will be published from time to time. In the meantime the state forester will be glad to meet granges and other organizations and to *explain the purposes and results of forestry methods*. He is prepared to *give illustrated lectures* when desired. * * * * * *Correspondence* is especially invited on all forestry topics.

" * * * * * The state already has a well established nursery. This will be enlarged at once, with the hope of supplying in a few years a large amount of material. In the meantime the aim of the office will be rather to furnish small orders to a large number, so that every land owner may become interested by the time a large supply is available."

WASHINGTON.

Encouraged by the results obtained through scientific management of the National forests on the Pacific slope, and awakened to the need for protection through the depletion of their own forests by lumbermen and by fires, several of the states in the "far west" have established departments of forestry and have become leaders in forest conservation. Among the foremost of these is the state of Washington, with a State Board of Forest Commissioners, a State Fire Warden and Forester, and an army of deputy fire wardens, scattered throughout the state.

The forestry laws enacted in 1905 outline the duties of the Board of Forest Commissioners as follows: "The state board of forest commissioners shall supervise all matters of state forest

protection as provided for in this act; it shall have full power to appoint a state fire warden and forester, deputy fire wardens and forest rangers; to make such rules and regulations for the prevention, control and suppression of forest fires as is deemed necessary; to regulate and control the official acts of the state fire warden and forester, deputy fire wardens and forest rangers, and to have power to remove at will any of these officials; it shall be the duty of said board to collect information regarding the timberlands owned by the state, through investigation made by the state fire warden and forester, deputy fire wardens and forest rangers, regarding the conditions of the timber lands belonging to the state, reporting any damage caused by forest fires and any illegal cutting or trespass upon the state timber and report promptly such information to the state land commissioner.”

The chief work of the State Fire Warden and Forester is summarized under the following heads:

- 1—Clerical work as Secretary of State Board of Forest Commissioners.
- 2—Supervision of forest fire service, including,—
 - (a)—Massing and direct charge of fire fighting force in times of special danger.
 - (b)—Investigation of origin of forest fires.
 - (c)—Prosecution of violators of forest fire laws.
 - (d)—Preparation of abstract of forest fire law for public distribution.
 - (e)—Notification of county clerks of the appointment and names of deputy fire wardens.
 - (f)—Furnishing notices printed on cloth for posting calling attention to dangers from forest fires.
 - (g)—Preparation of printed forms for deputies.
 - (h)—Inspection and auditing of bills of salary and expenses of deputy fire wardens.
- 3—Enforcement of all laws for the preservation of the forests of the state.
- 4—Preparation of maps of each of the counties containing timber tracts showing state lands therein.
- 5—Study of the kinds, acreage and value of timbers.

6—Estimation of the yearly cut of timber in the state.

7—Annual report to Board of Forest Commissioners.

In a letter dated June 30, 1910, Mr. J. R. Welty, State Fire Warden and Forester of Washington, among other things says:

“We have a State Board of Forestry Commissioners, composed of the State Land Commissioner, ex-officio member, also four electors of the State appointed by the Governor.

“Our forestry work consists principally in protecting the forests from fires. Our department has not gone into the reforestation of lands as yet; but I am taking up this subject with the State Board of Forest Commissioners with that object in view.

“There is organized in the state, the Washington Forest Fire Association, with offices at Seattle, Washington, and the Inland Forest Fire Association, with headquarters at Spokane, Washington: They are composed of timber owners throughout the state, and their object is to protect the timber from fires.

“The National Government has a well organized force for the protection of the National Forests in the State.

“Our department works harmoniously with these organizations, and commissions their patrolmen and rangers, as Forest Rangers at large, to serve without pay. It gives them power to make arrests for violations of the Forest Protection Law. This practically gives us one of the largest and best forces for the protection of the forests of any of the states.”

WEST VIRGINIA.

The citizens of the State of West Virginia remained inactive on the subject of forestry until the forests of the greater part of the state had been stripped of their timber and until the opportunity to save a remnant of the virgin timberland was all but gone.

The history of the awakening of the people of the State to the alarming condition resulting from a depletion of the forests and to a lively interest in their protection dates back only about 4 years. Since that time much has been accomplished. The most important steps are taken up in order below:

1906—Preparation and publication of a pamphlet entitled "The Needs of Forest Protection in West Virginia and Suggestions for a Forest Law" by Hu Maxwell. In this pamphlet Mr. Maxwell called attention to the great value of West Virginia forests—for their timber and for their influence on erosion and water flow, to their destruction by fire and by careless lumbering methods, and to the lack of concerted action to prevent the great waste. A contrast was drawn between the lack of interest in West Virginia and the intense interest in such states as California, Pennsylvania and New York, all of which had spent already many thousands of dollars for the purpose of protecting and restoring their forests. The law proposed in this pamphlet was submitted as a bill before the Legislature of 1907 but failed of passage.

1908—Appointment by Gov. Wm. M. O. Dawson of a Conservation Commission consisting of Hu Maxwell, Chairman, James H. Stewart, Secretary and Neil Robinson, a third member.

The appointment of this commission was one of the direct results of the Conference of Governors of the United States which was called for May 13-15, 1908 by President Roosevelt.

The major part of the report of this Commission, which was prepared and published in the fall of 1908, is devoted to a discussion of the forest resources of the state and to recommendations regarding the policy which should be inaugurated for their protection. Statements made in this valuable and timely publication are freely quoted in other parts of the present report.

Establishment of a Chair of Forestry as a department of the College of Agriculture of the West Virginia University, and the election of A. W. Nolan as Professor of Forestry.

The courses in forestry have proven to be among the most popular offered in the State University in re-

cent years; and the number of young men and women who enroll for this work is increasing with every term.

Organization of the West Virginia Forestry Association.

On January 24, 1908, 45 persons, representing 23 counties of the state, met in the Y. M. C. A. room of the West Virginia University in response to a call issued by Pomona Grange No. 2, and elected Prof. T. C. Atkeson, Dean of the Agricultural College as permanent chairman, and Prof. A. W. Nolan as permanent secretary of the Association.

Publication of a Report on Forestry issued as a quarterly report of the State Board of Agriculture, June 30 1908.

1909—Enactment by the Legislature of a Forest, Game and Fish Law and appointment by the Governor of J. A. Viquesney as Forest, Game and Fish Warden.

The appointment of the chief deputies and a large number of deputies has been made and the law has been in full operation for over a year.

Appropriation by the Legislature of \$5,000 (Chap. 84, Sec. 51, Acts of 1909) for the preparation and publication of the present report on forest conditions in West Virginia.

WISCONSIN.

The state of Wisconsin has *forest reserve lands* in 9 counties aggregating *over 250,000 acres*.

For the purpose of directing the management and protection of the vast forests held by the state, and those held by corporations and by individuals, there has been created in Wisconsin by legislative enactment a State Board of Forestry, "consisting of the president of the state university, the director of the state geological survey, the dean of the state agricultural department, the attorney general, and one other member appointed by the governor."

Among the important prescribed duties of the Board are the appointment of a state forester; the acceptance on behalf of

the state of "any grant of land within the state, which shall become a part of the state reserve"; the examination of "points of interest in the state" as to their desirability as public parks; etc. etc.

The state forester " * * * * shall act as secretary of the state board of forestry. He shall, under the supervision of the state board of forestry, execute all matters pertaining to forestry within the jurisdiction of the state; direct the management of the state forest reserve; collect data relative to forest destruction and conditions; take such action as is authorized by law to prevent and extinguish forest fires and to prevent forest trespass; cooperate in forestry as provided under section 5 of this act; advance as he may deem wise, by issuing of publications and by lectures, the cause of forestry within the state;" etc. It may be said, without quoting further, that there is practically no line of legitimate and helpful forestry work that is not liberally delegated by law to the state forester and to his helpers.

The law provides, also, for a well-salaried assistant state forester and for a complete forest fire warden and trespass agent service.

The following outline, prepared for this report by Mr. Edward M. Griffith, present state forester of Wisconsin, shows some of the steps in the progress of forestry in that state, particularly the building up of the state forest reserve during the years from 1903 to 1909:

"1903—Enactment of first forestry law placing some 40,000 acres of state lands in the forest reserves.

State forester to appoint town fire wardens.

1904—Examination of 40,000 acre tract and also of other state lands suitable for forest reserve purposes.

Organization of fire warden system.

1905—Enactment of present forestry law, placing all state lands in northern Wisconsin, (some 200,000 acres) within the forest reserves. Law provides for sale by State Board of Forestry of scattered and agricultural lands, proceeds to constitute "Forest Reserve Fund" to be used for purchasing forest reserve lands, and for their protection and improvement.

Appointment assistant state forester.

1906—Selection of timber cruisers and work started of examining and appraising lands to be sold and purchased.

1907—Enactment of law granting additional appropriation of \$10,000 per annum for purchase of forest reserve lands.

State Board of Forestry given control of water reservoirs in northern part of state used for power purposes by private companies.

Approximately 4,000 acres land purchased. Grant of 4,500 acres of land to State Board of Forestry by Nebagamon Lumber Company.

1908—Work of examining lands to be sold and purchased continued.

U. S. Government grants 20,000 acres of land to Wisconsin for addition to state forest reserves.

1909—Work of examining lands to be sold and purchased continued.

Purchase of approximately 22,000 acres of land."

Classified List of States Showing the Official Bodies Which Direct Their Forestry Operations.

California	State Board of Forestry
Delaware	State Board of Forestry
Indiana	State Board of Forestry
Maryland	State Board of Forestry
Massachusetts	State Board of Forestry
Oregon	State Board of Forestry
Wisconsin	State Board of Forestry
New Jersey	State Board of Forest Park Reservation Commissioners
Washington	State Board of Forest Commissioners
Minnesota	State Forestry Board
Montana	State Forestry Board
Michigan	State Forestry Commission
Louisiana	State Forestry Commission and Commission of Natural Resources
New Hampshire	Forestry Commission

NATURAL BLUE GRASS SOD ON CRANBERRY MOUNTAIN, POCAHONTAS COUNTY. Land cleared by hacking and grazing.

Maine	Commission of Forestry
Rhode Island	Commission of Forestry
Pennsylvania	Department of Forestry
Ohio	Department of Forestry in Agricultural Experiment Station
Connecticut	Agricultural Experiment Station
Tennessee	Department of Game, Fish and Forestry
Vermont	State Board of Agriculture and Forestry
Kentucky	State Board of Agriculture, Forestry and Immigration
New York	Forest, Fish and Game Commission
Kansas	Division of Forestry, State Agricultural College
North Carolina	State Geological and Economic Survey
West Virginia	Forest, Game and Fish Warden reports to Governor.

List of State Forest Officers.

Alabama,	John H. Wallace Jr.,	Commissioner, Dept. of Montgomery,	Game and Fish.
California,	G. B. Lull,	Sacramento,	State Forester.
Connecticut,	S. N. Spring,	New Haven,	Forester, Agr. Experi- ment Sta.
Delaware,	Prof. H. Hayward,	Newark,	Director Agr. Experi- ment Sta.
Georgia,	Alfred Akerman,	Athens	Sec'y. State Forest As- sociation.
Hawaii,	R. S. Hosmer,	Honolulu,	Supt. of Forestry.
Indiana,	C. C. Deam,	Indianapolis,	Sec'y. State Board of Forestry.
Kansas,	C. A. Scott,	Manhattan,	State Forester.
Kentucky,	M. C. Rankin,	Frankfort,	Chairman, State Bd. of Agr., Forestry and Immigration.

Louisiana,	F. J. Grace, Baton Rouge,	State Forest Commis- sioner.
Maine,	E. E. Ring, Augusta,	State Forest Commis- sioner.
Maryland,	W. F. Besley, Baltimore,	State Forester.
Massachusetts,	F. W. Raine, Boston,	State Forester.
Michigan,	A. C. Carton, Lansing,	Sec'y. Forest Commis- sion.
Minnesota,	Gen. C. C. Andrews, St. Paul,	Forestry Commissioner.
New Hampshire,	E. C. Hirst, Concord,	State Forester.
New Jersey,	A. Gaskill, Trenton,	Sec'y. and Forester of Forest Park Reserva- tion Commission.
New York,	C. R. Pettis, Albany,	State Forester.
North Carolina,	J. S. Holmes, Chapel Hill,	Forester, State Geo. and Economic Survey.
Ohio,	Edmund Secrest, Wooster,	Forester, Dept. of For- estry, Agr. Experi- ment Sta.
Oregon,	J. W. Baker, Cottage Grove	Forest, Fish and Game Warden.
Pennsylvania,	R. S. Conklin, Harrisburg,	Commissioner of For- estry.
Rhode Island,	J. B. Mowry, Chepachet,	Commissioner of For- estry.
Vermont,	A. F. Hawes, Burlington,	State Forester.
Washington,	R. W. Condon, Port Gamble	Chairman, State Bd. of Forest Commissioners
West Virginia,	J. A. Viquesney, Belington,	Forest, Game and Fish Warden.
Wisconsin,	E. M. Griffith, Madison,	State Forester.

CHAPTER VIII.

THE NATIVE TREES OF WEST VIRGINIA.

It has already been pointed out in a preceding chapter that West Virginia is favorably located for the growth of forests, "being in that favored belt of temperature between about 37 degrees and 41 degrees north latitude." The geographic position, the topography, and the elevation of the State are such that a very large percentage, indeed, of the species of trees that are indigenous to the northern states east of the Rocky Mountains and as far south as the southern border of Virginia find extensive areas of adaptability for their healthy existence. The Alleghany mountain region admits several species of cone-bearing trees that belong, primarily, to southern Canada and the states of the extreme northeast; the low, fertile Potomac valleys provide suitable places for many of the trees of the Atlantic coast region; and the large westward-sloping, trans-Appalachian portion of the State, with its numerous low valleys and hills, meets the requirements of many of the trees that belong to the sub-tropical and middle western regions of the United States.

The list which follows does not include all the native trees of West Virginia and does not give the complete distribution in the State of many of them. It has been the object to keep on safe ground, giving the names of only such species as have been definitely determined, and mentioning the localities where it is certain they are to be found. A more careful examination will add a score or more of trees to the list as well as many new stations in the distribution of some of those given. A number of additional species of Hawthorns (*Crataegus*) were collected, but, owing to the present confusion of this genus resulting from widely differing interpretation by specialists and probably from the hybridization of nearly related trees, they could not be

referred—without complete sets of flowers, mature leaves and fruits—to the proper species. Other trees which are of especial interest on account of the difficulty in some cases of their determination and the consequent uncertainty of their occurrence or distribution in the State, are the Basswoods, the Willows, the Poplars, and the Ashes.

PINUS STROBUS, L. White Pine.

Geographic Distribution.

Newfoundland to Manitoba, through the northern states to Pennsylvania, Illinois, and Iowa, and along the Alleghany Mountains to eastern Kentucky and Tennessee and northern Georgia, forming nearly pure forests on sandy drift soils, or more often in small groves scattered in forests of deciduous-leaved trees on fertile, well-drained soils, also on the banks of streams, river flats, or rarely in swamps. *

Distribution in West Virginia.—Grew originally in abundance (1) on the east side of Greenbrier river in Pocahontas and Greenbrier counties, chiefly on Knapps creek, Deer creek, Sitlington creek, and Anthonys creek; (2) on heads of Piney river and Glade creek in Raleigh county; (3) on Bluestone river in Mercer county; (4) on Horseshoe run and adjacent tributaries of the Cheat river in Tucker county.

Distributed at present as follows:

Calhoun: Laurel creek, and on Little Kanawha river below Grantsville.

Gilmer: a few scattered trees in northern end.

Hampshire: scattered among other conifers.

Hardy: scattered growth.

Jackson: few trees.

Mineral: infrequent.

Pendleton: in creek bottoms. Small areas. Once common on South Branch and South Fork of Potomac. Killed by beetles in 1892.

* The geographic distribution of all species of trees named in this report is according to "Manual of the Trees of North America" by Charles S. Sargent.

Pocahontas: scattered trees and young groves on Knapps, Deer, and Sitlington creeks, and on other eastern tributaries of the Greenbrier river.

Preston: distributed in eastern and northern sections. Few trees in pine swamp near Cranesville.

Raleigh: on Piney river and Glade creek. Two small virgin areas still remain. Cut-over forests badly burned in most places.

Ritchie: Harrisville, Smithville and other stations. Growing with yellow pine and deciduous trees.

Summers: small number of trees near the mouth of Blue-stone river and at other stations on south and east.

Tucker: few trees on Cheat waters in vicinity of St. George.

Tyler: sparse growth.

Wetzel: few trees.

Wirt: infrequent.

Wood.—Soft, straight-grained, easily worked, light, not strong.

Uses.—Valuable wood for interior finish, for fixtures, shelving, cupboards, etc. Used frequently for shingles, for boxes, barrels and tanks, for numerous cabinet shop articles, and for excelsior and pattern making. Much of the white pine growing in the counties back from the Ohio river was cut for ship timber.

PINUS RIGIDA, Mill. Pitch Pine. "Bull Pine". "Rosin-tree."

Geographic Distribution.

Sandy plains and dry gravelly uplands, or less frequently cold deep swamps; valley of St. Johns river in New Brunswick to the northern shores of Lake Ontario, southward in the Atlantic states to northern Georgia; crossing the Alleghany Mountains to their western foothills in West Virginia, Kentucky, and Tennessee; very abundant on the Atlantic coast south of Massachusetts Bay; often forming extensive forests in southern New Jersey.

Distribution in West Virginia.—Found locally on dry hills in the following counties: Boone, Braxton, Clay, Doddridge, Fayette, Gilmer, Grant, Hampshire, Hardy, Jefferson, Kanawha, Logan, Mercer, Monroe, Mingo, McDowell, Nich-

olas, Preston, Pocahontas, Randolph, Roane, Summers, Tyler, Wayne, and Wyoming. Reported from Greenbrier by Millspaugh. In Webster it is rare, being found on the divide between Gauley and Williams rivers at altitude 3,500 feet, on "Tater knob" on Holly river, and in a few other places. It is not frequently found in McDowell and Wyoming.

Wood.—Coarse-grained, brittle, light, reddish, very durable. Resin-filled knots are frequently found in deciduous woods which have been exposed to the weather for hundreds of years.

Uses.—Wood excellent for fuel. Used also for charcoal, interior finish for houses, for furniture, for bridge timber, boxes and crates. Tar is often made from this wood. An area on Snaggy mountain, near Terra Alta, Preston county, was used for this purpose. Not an important timber tree in West Virginia.

PINUS ECHINATA, Mill. Yellow Pine. Short-leaved Pine.

Geographic Distribution.

Staten Island, New York, to north Florida and to West Virginia and eastern Tennessee, and through the Gulf states to eastern Louisiana and southern Missouri to eastern Texas; most abundant and of its largest size west of the Mississippi river.

Distribution in West Virginia.—Sparsely distributed in the following counties lying back from the Ohio river, and on the east of the Alleghany mountains.

Calhoun: common near Grantsville.

Doddridge: very few trees.

Grant: east of Alleghanies.

Hampshire: on dry soils with other softwoods.

Hardy: scattered growth.

Jackson: once abundant, now scattered thickly in some parts of Washington district.

Mason: few trees in hilly section.

Mercer: distributed in northern and western parts.

Mineral: few trees.

Pendleton: scattered on mountain faces and in coves.

Putnam: few on hills.

Ritchie: once plentiful, now infrequent.

Tyler: once plentiful, now infrequent.

Wetzel: head of Piney Fork, few.

Wirt: distributed along the hills on both sides of the Little Kanawha.

Wood: only a few trees.

Wood.—Hard, heavy, coarse-grained, yellowish.

Uses.— A valuable timber tree, now nearly exhausted. Wood used for house finish, boxes, crates and barrels, farming implements, and furniture. Cut in Tyler, Jackson, and other Ohio river counties for masts, spars, and other timbers for ships.

PINUS VIRGINIANA, Mill. Jersey Pine. Scrub Pine.

Geographic Distribution.

Long Island, New York, southward generally near the coast to the valley of the Savannah river, Georgia, to northeastern Alabama and through eastern and middle Tennessee and Kentucky to southern Indiana; usually small in the Atlantic states and only on light sandy soil, spreading rapidly over exhausted fields; attaining its largest size west of the Alleghany mountains on the low hills of southern Indiana.

Distribution in West Virginia.—

Barbour: a few scattered trees along Tygarts Valley river.

Berkeley: abundant on poor hills.

Boone: few trees on hills near Madison.

Fayette: clumps at Kanawha Falls.

Grant: common east of mountains.

Hampshire: abundant. The prevailing softwood.

Hardy: common on sandy hills.

Jefferson: found in sandy soils in western part.

Kanawha: few on hills.

Logan: found on hill near Logan Court House.

Mercer: trees found at Spanishburg.

Monongalia: several acres of pure stand near Dellslow, on Deckers creek.

Pocahontas: few on Knapps creek.

Randolph: on hillsides above Huttonsville.

Ritchie: few with other softwoods.

Wayne: few trees found near Wayne Court House.

Wyoming: infrequent.

Wood.—Soft, light, brittle, coarse-grained, decays slowly when placed in contact with the soil.

Uses.—Of little value as a timber tree. Wood used for boxes, crates, fencing, ties, and fuel.

PINUS PUNGENS, Michx. Table Mountain Pine. Hickory Pine.

Geographic Distribution.

Dry gravelly slopes and ridges of the Appalachian mountains from Pennsylvania to North Carolina and eastern Tennessee, sometimes ascending to elevations of 3,000 feet, with isolated outlying stations in Virginia, eastern Pennsylvania, and western New Jersey; often forming toward the southern limits of its range pure forests of considerable extent.

Distribution in West Virginia.—Found scattered sparingly with other kinds of softwoods in Grant, Hampshire, Hardy, and Pendleton. Reported by Millspaugh from Kanawha and Mineral.

Wood.—Coarse-grained, brittle, light.

Uses.—Not valuable for lumber, used for fuel and charcoal.

LARIX AMERICANA, Michx. Tamarack. Larch.

Geographic Distribution.

At the north often on well-drained uplands, southward in cold deep swamps which it often clothes with forests of closely crowded trees, from Labrador to the Arctic Circle, ranging west of the Rocky Mountains to latitude 65 degrees and 35 minutes north, and southward through Canada and the northern states to northern Pennsylvania and Preston county, West Virginia, northern Indiana and Illinois, and central Minnesota, and along the eastern foothills of the Rocky Mountains to about latitude 53 degrees; very abundant in the interior of Labrador, where it is the largest tree; common along the margins of the barren lands stretching beyond the sub-Arctic forest to the shores of the Arctic sea; attaining its largest size north of Lake Winnipeg on low benches which it occasionally covers with open forests; rare and local toward the southern limits of its range.

Photo by Ray V. Hennen.
RED SPRUCE ALONG RAILROAD OF WYOMING LUMBER COMPANY, HEAD OF
FLATROCK RUN OF RED CREEK, RANDOLPH COUNTY,
ABOVE 4,000 FEET ELEVATION.

Distribution in West Virginia.—Preston county, Cranesville swamp at Maryland line. Few scattered trees, none over 15 inches in diameter.

Wood.—Hard, heavy, very durable, brownish.

Uses.—Too rare at present to be of value in West Virginia.

Wood used for interior finish, telephone poles, cross-ties, fence posts, ship-building, and for many other purposes. Planted as an ornamental tree.

PICEA RUBENS, Sarg. Red Spruce.

Geographic Distribution.

Well-drained uplands and mountain slopes, often forming a large part of extensive forests, from Prince Edward Island and the valley of the St. Lawrence southward to the coast of Massachusetts, along the interior hilly part of New England and New York, and the Alleghany Mountains to the high peaks of North Carolina.

Distribution in West Virginia.—Confined to high mountains and plateaus. Grows at elevations varying from about 2,500 feet, in a few instances, up to 4,000 feet and over in the following counties:

Randolph—on south and east—	approximately,	80,000	acres
Pocahontas—on north and west—	“	70,000	“
Webster—on east—	“	10,000	“
Tucker	}	“	30,000
Pendleton			
Greenbrier			

Total..... 190,000 acres

A few scattered trees and groves are still to be found in Grant and Preston counties, and in the cut-over lands adjacent to the present uncut areas.

According to Col. E. Hutton, whose estimate was published in Bulletin No. 17, of the West Virginia Agricultural Experiment Station (Dr. A. D. Hopkins, 1891) the area

of spruce in West Virginia was 469,000 acres distributed as follows:

Randolph	140,500	acres
Pocahontas	220,000	"
Tucker	50,000	"
Mineral	25,000	"
Greenbrier	33,500	"

In 1895 the area of standing spruce was estimated at 225,000 acres.

Wood.—Light, soft, pale, not strong, more durable than hemlock when exposed to the weather.

Uses.—A very valuable timber tree. Wood used largely in construction of houses, interior finish, fixtures, musical instruments, furniture, aeroplanes, and wood pulp. Tree often planted in high elevations in yards and lawns.

MAP SHOWING PRESENT DISTRIBUTION OF RED SPRUCE IN WEST VIRGINIA.

TSUGA CANADENSIS, Carr. Hemlock.*Geographic Distribution.*

Scattered through upland forests and often covering the northern slopes of rocky ridges and the steep rocky banks of narrow river gorges from Nova Scotia to eastern Minnesota, and southward through the northern states to New Castle county, Delaware, southern Michigan, southwestern Wisconsin, and along the Appalachian mountains to northwestern Alabama; most abundant and frequently an important element of the forests in New England, northern New York, and western Pennsylvania; attaining its largest size near streams on the slopes of the high mountains of North Carolina and Tennessee.

Distribution in West Virginia.—A common timber tree. Grows in nearly all parts of the State. Confined to a few deep ravines in the hilly regions east of the Ohio river in Wayne, Cabell, Mason, Jackson, Wood, Pleasants, Tyler, Wetzel, and the Northern Panhandle counties. Rare in Barbour, Harrison, Mingo, Gilmer, Wirt, Roane, Putnam, Taylor, Jefferson, Berkeley, and Morgan. Most abundant in Randolph, Webster, Tucker, Pocahontas, Nicholas, Raleigh, Clay, Mercer, Greenbrier, and the southern end of Upshur.

Wood.—Medium soft, light, coarse-grained, brittle, hard to work, quickly decaying when exposed to the weather.

Uses.—Lumber used largely for rough construction, floors, boxes, crates, barrel heads, and staves. Bark used in tanning leather. Tree planted for shade and ornamental hedges.

ABIES FASERI, Poir. Balsam Fir. She Balsam. "Blister Pine."

Geographic Distribution.

Appalachian Mountains from southwestern Virginia to western North Carolina and eastern Tennessee, often forming forests of considerable extent at elevations between 4,000 feet and 6,000 feet above the sea level.

Distribution in West Virginia.—Growing now in only three known localities, viz:

Randolph: near Cheat Bridge, with red spruce in and around a small swampy area drained by Blister run, a tributary of Shavers Fork of Cheat river.

Pocahontas: a few trees scattered along the East Fork of Greenbrier river near its head, about 2 miles south of Big Sinks. A swamp containing about 40 acres was overgrown with this species until recently when the trees were nearly all cut down to improve the pasture.

Tucker: head of Blackwater Fork of Cheat river, sparsely distributed over a high basin known as Canaan Valley. Now chiefly confined to the margin of McDonald Glade where it forms a dense thicket. Said to have once grown one mile north of the town of Thomas. This handsome evergreen, which is at home on the mountains of some of the southern states, reaches the northern limit of its range at the Tucker county station.

Wood.—Light, soft, coarse-grained.

Uses.—Not commercially important in West Virginia. Occasionally sawed into lumber. Wood used for poles, posts, etc., in some sections, and mixed with spruce for pulpwood. Resinous liquid often collected from "blisters" on the bark and used as a medicine. Planted locally in yards and lawns as an ornamental tree.

THUYA OCCIDENTALIS, L. White Cedar. Arbor-vitae.

Geographic Distribution.

Frequently forming nearly impenetrable forests on swampy ground or often occupying the rocky banks of streams, from Nova Scotia and New Brunswick, northwestward to the mouth of the Saskatchewan, and southward through the northern states to southern New Hampshire central Massachusetts and New York, northern Pennsylvania, central Michigan, northern Illinois, and central Minnesota, and along the high Alleghany mountains to southern Virginia and northeastern Tennessee; very common at the north, less abundant and of smaller size southward; on the southern Alleghany mountains only at high elevations.

Distribution in West Virginia.—Rare. Collected on the North Fork of South Branch of Potomac between Circleville and mouth of Seneca in Pendleton county. Said to grow also on South Branch and on the South Fork of the Potomac. Reported by Millspaugh from Mineral and Grant counties.

Wood.—Soft, brittle, light, very durable.

Uses.—Valuable for posts, ties, poles, etc., but too rare in West Virginia to be of great commercial or domestic value.

JUNIPERUS VIRGINIANA L. Red Cedar. Savin.

Geographic Distribution.

Dry gravelly slopes and rocky ridges, often immediately on the sea coast, from southern Nova Scotia and New Brunswick to the coast of Georgia, the interior of southern Alabama and Mississippi, and westward to the valley of the lower Ottawa river, eastern Dakota, eastern Nebraska and Kansas, the Indian Territory and eastern Texas, not ascending the mountains of New England and New York nor the high southern Alleghanies; in middle Kentucky and Tennessee, and northern Alabama and Mississippi, covering great areas of low rolling limestone hills with nearly pure forests of small bushy trees.

Distribution in West Virginia.—Not plentiful. Rarely found in Randolph, Tucker, Upshur, Pocahontas, Webster, Barbour, Harrison, Taylor, Lewis and in the mountainous parts of Nicholas, Greenbrier, Grant, Preston, and Monongalia. A scattered growth throughout the whole western and southern hilly sections and east of the Alleghanies. Rather plentiful in Gilmer, Calhoun, Putnam and Hampshire.

Wood.—Close-grained, soft, light, dark reddish, easily worked, very durable.

Uses.—Wood used for interior finish, lining of wardrobes, chests, etc., for posts and poles, and for pails, tubs, and shingles.

JUGLANS CINEREA, L. Butternut. "White Walnut."

Geographic Distribution.

Rich moist soil near the banks of streams and on low rocky hills, southern New Brunswick and the valley of the St. Lawrence river in Ontario to eastern Dakota, southeastern Nebraska, central Kansas, northern Arkansas, and Delaware, and on the Appalachian mountains to northern Georgia and northern Alabama; most abundant and of its largest size northward.

Distribution in West Virginia.—A common tree. Found throughout the State except on highest mountains and in a few small areas south and west, especially in Jackson, Putnam, Mingo, and Wyoming. Thrives at higher altitudes than Black Walnut, reaching 3,000 feet, or over, in its distribution along cold mountain streams in Randolph and adjacent counties.

Wood.—Light, soft, coarse-grained, light brown, durable.

Uses.—Less valuable than black walnut. Wood used for interior finish for houses, for posts, etc. Bears edible nuts.

JUGLANS NIGRA, L. Black Walnut.

Geographic Distribution.

Rich bottom lands and fertile hillsides, western Massachusetts to southern Ontario, southern Michigan and Minnesota, central and northern Nebraska, eastern Kansas, and southward to western Florida, central Alabama and Mississippi, and the valley of the San Antonio river, Texas; most abundant in the regions west of the Alleghany Mountains, and of its largest size on the western slopes of the high mountains of North Carolina and Tennessee, and on the fertile river bottom lands of southern Illinois and Indiana, southwestern Arkansas, and the Indian Territory; largely destroyed for its valuable timber, and now rare.

Distribution in West Virginia.—Still found in scattered growth in rich coves, valleys, and hillsides in every county. Not found at high altitudes.

Wood.—Heavy, dark brown, hard, coarse-grained, durable heartwood.

Uses.—A very valuable timber tree. Wood used for furniture of all kinds, veneering, musical instruments, wainscot, gun stocks, and for many other purposes. Produces large quantities of edible nuts.

HICORIA MINIMA, Britt. Bitternut. Swamp Hickory.

Geographic Distribution.

Low wet woods near the borders of streams and swamps or high rolling uplands often remote from streams, southern Maine to Ontario, central Michigan and Minnesota, southeastern Ne-

braska eastern Kansas and Indian Territory, and southward to northwestern Florida, northern Alabama, and eastern Texas; one of the largest and commonest hickory trees of southern New England, and abundant in all the central states east and west of the Appalachian mountains; growing to its largest size on the bottom lands of the lower Ohio basin; the common hickory of Iowa, Nebraska, and Kansas.

Distribution in West Virginia.—Infrequent. Found in rather small numbers in the following counties:

Boone: near Madison, on Pond Fork of Little Coal river.

Grant: near Gorman, on North Branch of Potomac.

Hampshire: near Romney.

Hardy: near Moorefield.

Jefferson: near Harpers Ferry.

Monongalia: near Morgantown.

Pocahontas: Cranberry Glades.

Tucker: near Hendricks.

Tyler: on Middle Island creek.

Reported by Millspaugh from Greenbrier county.

Wood.—Hard, close-grained, heavy, tough, light brown.

Uses.—Wood used for fuel, handles, hoops, etc. Fruit bitter.

HICORIA OVATA, Britt. Shellbark Hickory. Shagbark Hickory.

Geographic Distribution.

Low hills or near streams and swamps, in rich deep moderately moist soil from southern Maine to the valley of the St. Lawrence river near Montreal, southwestward along the northern shores of Lake Erie and Ontario to southern Michigan, central Minnesota, southeastern Nebraska, southward to Pennsylvania and Delaware and along the Appalachian mountains to western Florida, northern Alabama and Mississippi, and westward to central Kansas, the Indian Territory and eastern Texas; most common and of its largest size on the western slopes of the southern Allegheny mountains and in the basin of the lower Ohio river.

Distribution in West Virginia.—A common tree. Found in all parts of the State except on high mountains. Reported as not plentiful in Wetzel, Roane, Jackson, and Summers.

Wood.—Heavy, hard, strong, tough, close-grained, flexible, light in color.

Uses.—Very valuable wood. Used for agricultural implements, handles of various kinds, baskets, vehicles, and fuel. Produces delicious nuts.

**HICORIA LACINIOSA, Sarg. Big Shellbark. Bottom
Shellbark.**

Geographic Distribution.

Rich deep bottom-lands usually inundated during several weeks of the year from Iowa to southeastern Nebraska, through Missouri and Arkansas, eastern Kansas and the eastern portion of the Indian Territory, through southern Illinois and Indiana to East Tennessee, southern Michigan, western and central New York, eastern Pennsylvania and middle North Carolina; rare and local east of the Alleghany mountains and comparatively rare in Arkansas, Kansas and the Indian Territory; one of the commonest trees of the great river swamps of central Missouri and the lower Ohio basin.

Distribution in West Virginia.—Rare. Found in Ohio river bottoms near Point Pleasant, in Mason county, and near Parkersburg, in Wood county. Probably grows at many points along the Ohio river. Reported by Millspaugh from Ice's Ferry on Cheat river, near Morgantown.

Wood.—Similar to that of the last species of hickory described above.

Uses.—Not commercially important in West Virginia on account of the scarcity of the tree. Wood used as in other species of this genus.

HICORIA ALBA, Britt. Mockernut. Big Bud Hickory.

Geographic Distribution.

Southern Ontario southward to Cape Canaveral and the shores of Tampa Bay, Florida, and westward to eastern Kansas, the Indian Territory and eastern Texas; comparatively rare at the north, growing on ridges and less frequently on alluvial river bottoms; the most abundant and generally distributed of the hickory trees of the south, attaining its largest size in the basin of the lower Ohio river and in Missouri and Arkansas; the only hickory in the southern maritime pine-belt, growing in great abundance on low sandy hummocks close to the shores of bays and estuaries along the coast of the south Atlantic and Gulf states.

TYPICAL VIEW IN THE OPEN PART OF CRANBERRY GLADES.

Distribution in West Virginia.—Found near Morgantown, Monongalia county, and in Hampshire, near Romney.

Reported by Millspaugh as frequent.

Wood.—Similar to that of Shellbark Hickory.

Uses.—Same as Shellbark and Pignut.

HICORIA GLABRA, Britt. Pignut.

Geographic Distribution.

Dry ridges and hillsides, southern Maine to southern Ontario, and southward to the shores of the Indian river and Peace creek, Florida, southern Alabama and Mississippi, and through southern Michigan, to southeastern Nebraska, Missouri, eastern Kansas, Arkansas, the Indian Territory, and Texas; most common in Missouri and Arkansas; of its largest size in the basin of the lower Ohio river; ranging farther south in Florida than other hickories, and, with the exception of the Pecan, farther to the southwest in Texas.

Distribution in West Virginia.—A common tree. Grows in every county in the State, but not frequent at high altitudes.

Wood.—Similar to that of other hickories.

Uses.—Same as in the preceding species of hickory.

POPULUS TREMULOIDES, Michx. Aspen. Quaking Asp.

Geographic Distribution.

Southern Labrador to the southern shores of Hudson's Bay and northwesterly to the mouth of Mackenzie river and the valley of the Yukon river, Alaska, through the northern states to mountains of Pennsylvania, northeastern Missouri and northwestern Nebraska, and through all the mountain regions of the west, often ascending to elevations of 10,000 ft. above the level of the sea, to the sierras of central California, northern Arizona and New Mexico, the high mountain ranges of Chihuahua and to Mt. San Pedro Martir in Lower California; in the east common and generally distributed usually in moist sandy soil and gravelly hillsides; bordering the midcontinental prairie region with a wide belt, and growing with its greatest vigor and to its largest size on the western margin of the Atlantic forest north of the 49th degree; farther to the northwest forming with the Birch and the Spruce the forests of high ridges; in the west and southwest on the high slopes of mountains and along the banks of streams; most valuable in the power of its seeds to germinate quickly in soil made fertile by fire and of its seedlings to grow quickly in exposed situations; now widely spread over vast areas on the slopes of the Rocky Mountains swept by fire of their former covering of coniferous trees.

Distribution in West Virginia.—Infrequent. Found in the following counties:

Randolph: a few trees at Gladys, on Gladys Fork of Cheat river.

Pocahontas: at Dunlevie, on the Greenbrier, and at Cranberry Glades.

Grant: summit of Alleghany mountains.

Tucker: high plateau near Davis.

Preston: near Cranesville.

Upshur: on French creek.

Reported by Millspaugh from Calhoun, Gilmer, Monongalia, Mason, Summers, and Wirt.

Wood.—Soft, light, brownish.

Uses.—Not valuable for its wood.

POPULUS GRANDIDENTATA, Michx. Poplar.

Geographic Distribution.

Rich moist sandy soil near the borders of swamps and streams; Nova Scotia, through New Brunswick, southern Quebec and Ontario to northern Minnesota, southward through the northern states to northern Delaware, southern Indiana and Illinois, northeastern and central Iowa, and along the Alleghany mountains to North Carolina, and westward to central Kentucky and Tennessee.

Distribution in West Virginia.—Not common. Found in the following localities:

Webster: on Elk mountain.

Randolph: Horton, Gandy creek.

Tucker: near Davis.

Monongalia: on Deckers creek.

Tyler: near Middlebourne.

Reported by Millspaugh from Ohio and Preston.

Wood.—Light, brownish, thin white sapwood.

Uses.—Not commercially important. Wood used for minor domestic purposes in West Virginia.

POPULUS DELTOIDES, Marsh. Cottonwood.*Geographic Distribution.*

Banks of streams, often forming extensive open groves; Province of Quebec and the shores of Lake Champlain, through western New England and New York, Pennsylvania west of the Alleghany mountains, and the Atlantic states south of the Potomac river to western Florida, and westward to the base of the Rocky mountains, from southern Alberta to northern New Mexico. * * * Comparatively rare and of smaller size in the east and in the coast region of the south Atlantic and east Gulf states, and the largest and one of the most abundant trees along the streams between the Appalachian and the Rocky Mountains, making their course over the midcontinental plateau to the extreme limit of tree-growth, and growing to its largest size as far west as the 100th meridian.

Distribution in West Virginia.—Infrequent. Found on the South Branch of Potomac near Romney, Hampshire county; and near Petersburg on the South Branch and on Lunice creek, in Grant county.

Wood.—Brownish, with white sapwood, difficult to season.

Uses.—Not now important in West Virginia. Wood used for various purposes, including interior finish, boxes, furniture, cooperage, and wagon beds. Frequently planted as a shade tree.

SALIX NIGRA, Marsh. Black Willow.*Geographic Distribution.*

Low moist alluvial banks of streams and lakes; southern New Brunswick and the northern shores of Lake Huron and Superior to southern Florida, and to eastern Dakota, Nebraska, Kansas and the Indian Territory; through western Texas, southern New Mexico and Arizona, and southward in Mexico; along the western foothills of the Sierra Nevada, and northward in western California to the valley of the Sacramento river and the eastern base of the Coast Range in Caloosa county; the largest and most conspicuous willow of eastern North America; most abundant in the basin of the Mississippi river, and of its largest size in southern Indiana and Illinois and in the valley of the lower Colorado river in Texas; rare in California.

Distribution in West Virginia.—An abundant tree along streams throughout the State. Most common in the lower counties but found to some extent in almost every locality.

Wood.—Soft, light, not durable.

Uses.—Of greatest value in West Virginia in preventing the falling in of banks. Wood of little commercial value.

(Variety *falcata*, Torr., with scythe-shaped leaves, was collected at Morgantown, along the Monongahela, and at Weston, along the West Fork.)

CARPINUS CAROLINIANA, Walt. Hornbeam. Blue Beech.
"Water Beech."

Geographic Distribution.

Borders of streams and swamps, generally in deep rich moist soil; southern and western Quebec to the northern shores of Georgian Bay, southward to Cape Malabar and the shores of Tampa Bay, Florida, and westward to northern Minnesota, eastern Nebraska and Kansas, the Indian Territory, and eastern Texas; reappearing on the mountains of southern Mexico and Central America; common in the eastern and central states, most abundant and of its largest size on the western slopes of the southern Alleghany mountains and in southern Arkansas and Texas.

Distribution in West Virginia.—A small abundant tree, distributed along streams and in moist ground throughout the State.

Wood.—Close-grained, heavy, light-colored.

Uses.—Of no commercial value. Sometimes used for levers, wedges, and for other minor domestic purposes.

OSTRYA VIRGINIANA, K. Koch. Hop Hornbeam. Ironwood.

Geographic Distribution.

Dry gravelly slopes and ridges often in the shade of oaks and other large trees; Island of Cape Breton and the shores of the Bay of Chaleur, through the valley of the St. Lawrence river, and along the northern shores of Lake Huron to western Ontario, northern Minnesota, the Black Hills of Dakota, eastern and northern Nebraska, eastern Kansas and southward to northern Florida and eastern Texas; most abundant and of its largest size in southern Arkansas and Texas.

Distribution in West Virginia.—Small tree. Frequent in thinly scattered growth throughout the State.

Wood.—Very hard, close-grained, heavy, durable.

Uses.—Valuable for posts, tool handles, and for various domestic uses. Found in such small quantities as to render it of little importance.

BETULA LENTA, L. Cherry Birch. Black Birch.

Geographic Distribution.

Rich uplands from Newfoundland and the valley of the Saguenay river to northwestern Ontario, and central Iowa, and southward to Delaware, southern Indiana and Illinois, and along the Alleghany mountains to western Florida, central Kentucky and Tennessee; a common forest tree at the north, and of its largest size on the western slopes of the southern Appalachian mountains.

Distribution in West Virginia.—A common tree in the high hilly and mountainous counties of Randolph, Tucker, Upshur, Braxton, Webster, Pocahontas, Nicholas, Clay, Kanawha, Fayette, Greenbrier, Raleigh, Mercer, and Monroe. South and west of this group of counties the species becomes less frequent being found only occasionally on rock cliffs in the low hills of the first and second tiers of counties east of the Ohio river and along the Big Sandy waters from Wayne to McDowell. Scattered through the counties east of the mountains. Almost entirely disappearing over large areas in northern Upshur and Lewis, western Barbour, in Harrison, Taylor and Marion, western Monongalia, in the limestone plateaus of Greenbrier and Monroe, and in several smaller areas here and there.

Wood.—Close-grained, hard, reddish, resembling black cherry.

Uses.—Valuable. Wood used principally for furniture and interior finish. Sometimes employed in the manufacture of vehicles, cars, boxes and crates. Excellent as fuel. A flavor used in medicine is distilled from the wood, and the fermented sap is sold as birch beer.

BETULA LUTEA, Michx. Yellow Birch. Gray Birch.

Geographic Distribution.

Moist uplands, in rich soil, and one of the largest deciduous-leaved trees of northeastern America; Newfoundland and along the northern shores of the Gulf of St. Lawrence to the valley of Rainy river, and southward to northern Delaware and northern

Minnesota, and along the Allegheny mountains to the highest peaks of North Carolina and Tennessee; very abundant and of its largest size in the eastern provinces of Canada and in northern New York and New England; small and rare in southern New England and southward.

Distribution in West Virginia.—Frequent in the mountains.

Grows with other hardwoods, but more often with spruce and hemlock, reaching the highest elevations above the sea from Grant and Tucker along the Alleghanies, and parallel lesser ranges, to Mercer and McDowell. Infrequent in the low hilly half of the State and in the eastern panhandle. This species prefers the highest parts of mountains where elevations are from 3,500 feet to 4,500 feet, and over, but is usually found in cool, damp ravines on the outposts of its range.

Wood.—Very strong, close-grained, hard, lighter in color than that of the preceding species.

Uses.—Valuable for furniture, interior finish, wagon hubs, agricultural implements, and boxes of various kinds.

BETULA NIGRA, L. Red Birch. River Birch.

Geographic Distribution.

Banks of streams, ponds, and swamps, in deep rich soil often inundated for several weeks at a time; northeastern Massachusetts, Long Island, New York, southward to western Florida through the region east of the Alleghany mountains except in the immediate neighborhood of the coast, through the Gulf states to the valley of the Trinity river, Texas, and through the Mississippi valley to the Indian Territory, eastern Kansas, the bottom-lands of the Missouri river in eastern Nebraska, central Minnesota, southern Wisconsin, and Ohio; the only semi-aquatic species and the only species ripening its seed in the spring or early summer; attaining its largest size in the damp semi-tropical lowlands of Florida, Louisiana, and Texas, and the only birch tree of such warm regions.

Distribution in West Virginia.—Closely confined to borders of streams. Found along the following rivers:

Williams: a few clumps for 5 miles up from its mouth in Webster.

Gauley: from near the mouth of Williams river to Kanawha Falls.

Greenbrier: from Hosterman, in Pocahontas, to Hinton, in Summers.

New: from 2 miles above Hinton to its junction with the Gauley.

Great Kanawha: scattered along its whole course, originally.

Little Coal: from above Madison to its mouth.

Elk: from Webster county through Braxton, Clay, and Kanawha.

Guyandot: from in Wyoming county to its mouth.

Twelvepole: in Wayne.

Big Sandy: plentiful.

Little Kanawha: in Wood and Wirt.

Potomac: from above Keyser to Harpers Ferry.

Was not found growing along the banks of the Ohio river itself.

Wood.—Medium hard, light, close-grained, pale.

Uses.—Of no commercial value in West Virginia. Used in some cases for furniture and woodenware.

FAGUS AMERICANA, Sweet. Beech.

Geographic Distribution.

Rich uplands and mountain slopes, often forming nearly pure forests, and southward on the bottom-lands of streams and the margins of swamps; valley of the Restigouche river, the northern shores of Lake Huron and northern Wisconsin, southward to western Florida, and through southern Illinois and south-eastern Missouri to the valley of the Trinity river, Texas; one of the most widely distributed trees of eastern North America; of its largest size in the forests on intervalle lands in the basin of the lower Ohio river, and on the slopes of the southern Alleghany mountains.

Distribution in West Virginia.—Abundant in many parts of the State; found to some extent in every county. Most plentiful, originally, in the valley of the Great Kanawha river. Infrequent in the counties of the eastern panhandle, and in Summers, Mercer, McDowell, and Wyoming.

Wood.—Tough, hard, close-grained, light red, not durable in contact with the ground.

Uses.—Wood used for furniture, broom handles, clothes pins, and numerous small wooden articles.

By-products, charcoal, wood alcohol, acetate of lime.

CASTANEA DENTATA, Borkh. Chestnut.

Geographic Distribution.

Southern Maine to the valley of the Winooski river, Vermont, and southern Ontario, along the southern shores of Lake Ontario to southern Michigan, southward to Delaware and south-eastern Indiana, and along the Alleghany mountains to central Alabama and Mississippi, and to central Kentucky and Tennessee; very common on the glacial drift of the northern states and, except at the north, mostly confined to the Appalachian hills; attaining its largest size in western North Carolina and eastern Tennessee.

Distribution in West Virginia.—Frequent throughout the State; most abundant and of largest size through the high hilly and mountainous sections, including portions of Preston, Barbour, Upshur, Randolph, Braxton, Webster, Pocahontas, Nicholas, and a few adjacent counties. Infrequent except on dry ridges east of the Alleghany mountains, and also along the Ohio river.

Wood.—Soft, light, coarse-grained, not strong, durable in contact with the ground, light brown.

Uses.—Cheap furniture, interior finish, telephone and telegraph poles, fence posts, rails, shingles, boxes, crates, etc.

Valued on account of its nuts.

CASTANEA PUMILA, Mill. Chinquapin.

Geographic Distribution.

Dry sandy ridges, rich hillsides and the borders of swamps; southern Pennsylvania to northern Florida and the valley of the Naches river, Texas; usually shrubby in the region east of the Alleghany mountains; arborescent west of the Mississippi river; most abundant and of its largest size in southern Arkansas and eastern Texas.

Distribution in West Virginia.—Not widely distributed.

Mercer: found in several localities.

Wyoming: occurs frequently.

Photo by A. D. Hopkins.
TYPICAL CHESTNUT OAKS, MONONGALIA COUNTY.

Summers: common.

Logan: rare.

Boone: few trees on Pond Fork of Little Coal river. Trees with straight trunks 3 or 4 inches in diameter.

Fayette: found at Fayetteville.

Reported from Wayne, Monroe, Mingo, (rare) Braxton (rare), Gilmer (rare), Greenbrier, Pendleton, Grant, and Nicholas (rare).

Wood.—Coarse-grained, hard, light, brownish.

Uses.—Wood of no commercial value in West Virginia. Nuts often sold in market of southern towns.

QUERCUS RUBRA, L. Red Oak.

Geographic Distribution.

Nova Scotia and southern New Brunswick through Quebec to the northern shores of Lake Huron and to Lake Namekagon, southward to middle Tennessee and Virginia, and along the high Appalachian mountains to northern Georgia, and westward to eastern Nebraska and central Kansas; rare and of small size toward the northern limits of its range; abundant in southern Nova Scotia, Quebec and Ontario; one of the largest and most common trees of the forests of the northern states, and of its largest size in the region north of the Ohio river, less common and usually of smaller size southward.

Distribution in West Virginia.—Found throughout the State. Most frequent and of largest size in the high hilly and mountainous sections. Grows at higher elevations than the other native oaks. Rather infrequent, of smaller size, and poorer in quality in the low counties along the Ohio river and in the eastern part of the State.

Wood.—Hard, heavy, medium close-grained, reddish brown.

Uses.—One of the valuable timber trees. Chief use of wood is for furniture and interior finish for houses.

QUERCUS PALUSTRIS, Muench. Pin Oak. Swamp Spanish Oak.

Geographic Distribution.

Borders of swamps and river-bottoms in deep moist rich soil; valley of the Connecticut river in western Massachusetts to southern Missouri, and southward to the valley of the lower Potomac river, Virginia, central Kentucky, southwestern Ten-

nessee, northern Arkansas, and eastern borders of the Indian Territory; rare and of small size in New England; exceedingly common on the coast plain south of the Hudson river; of its largest size and very abundant on the bottom-lands of the streams of the lower Ohio basin.

Distribution in West Virginia.—Infrequent in most sections.

Mercer: plentiful near Princeton.

Hardy: few trees near Moorefield.

Reported by Millspaugh from Stumptown, Monongalia county.

Wood.—Heavy, coarse-grained, light-colored.

Uses.—Not important as a timber tree in West Virginia. Wood used for construction, boards, posts, rails, and staves.

QUERCUS COCCINEA, Moench. Scarlet Oak. "Pin Oak."

Geographic Distribution.

Light and dry usually sandy soil; valley of the Androscoggin river, Maine, through southern New Hampshire and Vermont and central New York to southern Ontario, westward through central Michigan and Minnesota to southeastern Nebraska, and southward to the District of Columbia and northern Illinois, and along the Alleghany mountains to North Carolina; very abundant in the coast region from Massachusetts Bay to southern New Jersey; less common in the interior, growing on dry gravelly uplands, and on the prairies skirting the western margins of the eastern forest.

Distribution in West Virginia.—Grows on dry hills throughout the State. Not found in the higher mountains.

Wood.—Hard, heavy, coarse-grained, light brown.

Uses.—Wood used for furniture, interior finish, cross-ties, staves, and fuel.

QUERCUS VELUTINA, Lam. Black Oak. Yellow-bark Oak.

Geographic Distribution.

Dry gravelly uplands and ridges; coast of southern Maine to northern Vermont, southern and western Ontario and central Minnesota, and southward to northern Florida, southern Alabama and Mississippi, southeastern Nebraska, eastern Kansas, the Indian Territory and eastern Texas; one of the commonest oaks on the gravelly drift of southern New England and the middle states; often forming a large part of the forest growth

in the foothill regions of the southern Appalachian mountains; abundant in all parts of the Mississippi basin, and of its largest size in the valley of the lower Ohio river; the common species of the black oak group reaching the south-Atlantic and Gulf coast, and here generally scattered on dry ridges through the maritime pine belt.

Distribution in West Virginia.—Distributed generally over the State. Abundant in scrubby growth on hills over the southern half of the State, where it is usually known as "Black Jack."

Wood.—Hard, strong, coarse-grained, reddish brown.

Uses.—Wood used for interior finish, boards, staves, ties, etc. Of less value as a timber tree than some of the other oaks.

QUERCUS NANA, Sarg. Bear Oak. Scrub Oak. "Jack Oak."

Geographic Distribution.

Dry sandy barrens and rocky hillsides; coast of eastern Maine southward through eastern and southern New England to eastern Pennsylvania and along the Alleghany mountains to southern Virginia, and westward to the shores of Lake George and the valley of the Hudson river; common in eastern and southern New England, in the pine barrens of New Jersey, and in eastern Pennsylvania.

Distribution in West Virginia.—Principally east of the Alleghanies and the southern mountainous counties.

Hampshire: abundant.

Hardy: found frequently.

Grant: common east of the Alleghany crest and found as far west as Mount Storm.

Monroe: frequent on dry ridges.

Summers: common in some localities on hills.

Reported from Pocahontas and Greenbrier.

Uses.—Of no commercial value; used occasionally for domestic purposes.

QUERCUS PAGODÆFOLIA, Ashe. Swamp Spanish Oak.

Geographic Distribution.

Rich bottom-lands and the alluvial banks of streams; southwestern Virginia to northern Florida, and through the Gulf states and Arkansas to southern Missouri, western Tennessee

and Kentucky, and southern Illinois and Indiana; most abundant and one of the largest and most valuable timber trees in the river swamps of the Yazoo basin, Mississippi, and of eastern Kansas.

Distribution in West Virginia.—Rare.

Kanawha county: a few trees found on north side of Kanawha river at Charleston.

Wood.—Hard, heavy, light reddish brown.

Uses.—A valuable timber tree in regions where it grows in greater abundance. Wood used for same purposes as that of white oak.

QUERCUS IMBRICARIA, Michx. Shingle Oak. Laurel Oak.

Geographic Distribution.

Rich uplands and the fertile bottom lands of rivers; Lehigh county, Pennsylvania, westward through southern Michigan and Wisconsin to northern Missouri and northeastern Kansas, southward to the District of Columbia, and along the Alleghany mountains to northern Georgia and Alabama, middle Tennessee and northern Arkansas; comparatively rare in the east; one of the most abundant oaks of the lower Ohio basin; probably growing to its largest size in southern Indiana and Illinois.

Distribution in West Virginia.—Infrequent. Found growing along streams in the following counties:

Barbour: near Belington on Tygarts Valley river.

Grant: on Lunice creek.

Hardy: few trees near Moorefield on South Branch of Potomac.

Mason: frequent along the Ohio river.

Monongalia: common near Morgantown on Monongahela river.

Upshur: along Buckhannon river from Hampton down, and on Cutrights run.

Wood.—Hard, heavy, coarse-grained, light brown.

Uses.—Not valuable as a timber tree in West Virginia. Wood used for interior finish, furniture, boards, and fuel.

QUERCUS ALBA, L. White Oak.*Geographic Distribution.*

Sandy plains and gravelly ridges, rich uplands, intervalles, and moist bottom-lands, sometimes forming nearly pure forests; southern Maine to southwestern Quebec, westward through southern Ontario, the lower peninsula of Michigan, and southern Minnesota to southeastern Nebraska and eastern Kansas, and southward to northern Florida and the valley of the Brazos river, Texas; most abundant and of its largest size on the western slopes of the southern Alleghany mountains, and on the bottom-lands of the lower Ohio basin.

Distribution in West Virginia.—One of the most widely distributed timber trees of the State. Found in every county and in almost every wooded locality except those of the highest elevations. Growing to the largest size and producing the clearest and most easily worked wood in the Great Kanawha valley and southward, and in the fertile valley of the Ohio. Of smaller size but with tougher wood in the north-central counties, including Gilmer, Calhoun, Braxton, Doddridge, Harrison, Barbour, and others, and in the limestone areas of Greenbrier and Monroe.

Wood.—Hard, close-grained, heavy, light-colored, durable.

Uses.—Very valuable. Wood used for furniture, interior finish, staves, boards, cross-ties, vehicles, ship-building, and for many other purposes.

QUERCUS MINOR, Sarg. Post Oak. Iron Oak.*Geographic Distribution.*

Cape Cod and islands of southern Massachusetts, Rhode Island and Long Island, New York, to northern Florida and southern Alabama and Mississippi, and from New York westward to Missouri, eastern Kansas, the Indian Territory and Texas; most abundant and of its largest size on dry gravelly uplands in the Mississippi basin; the common oak of central Texas on limestone hills and sandy plains; usually shrubby and rare and local in southern Massachusetts; more abundant southward from the coast of the south Atlantic and the eastern Gulf states to the lower slopes of the Appalachian mountains.

Distribution in West Virginia.—Not abundant in any locality nor widely distributed in the State. Found as follows:
Braxton: on dry banks along Elk river near Sutton.

Calhoun: frequent near Grantsville.

Fayette: near Fayetteville.

Grant: on Lunice creek.

Hampshire: few trees near Romney.

Hardy: common near Moorefield.

Kanawha: common near Charleston.

Lewis: few trees near Weston.

McDowell: few trees on ridge north of Welch.

Mercer: common near Princeton.

Wood.—Heavy, hard, close-grained, durable.

Uses.—Valuable for posts, interior finish of houses, furniture, boards, cross-ties, staves, and vehicles.

QUERCUS MACROCARPA, Michx. Burr Oak. Mossy Cup Oak.

Geographic Distribution.

Low rich bottom-lands and intervalles or rarely in the northwest on low dry hills; Nova Scotia and New Brunswick westward through the valley of the St. Lawrence river to Ontario, and along the northern shores of Lake Huron to southern Manitoba, southward to the valley of the Penobscot river, Maine, to the shores of Lake Champlain, Vermont, western Massachusetts, Lancaster county, Pennsylvania, central Tennessee, the Indian Territory and the valley of the Nueces river, Texas, westward to the eastern foothills of the Rocky Mountains, Montana, western Nebraska and central Kansas; attaining its largest size in southern Indiana and Illinois; the common oak of the "oak openings" of western Minnesota, and in all the basin of the Red River of the North, ranging farther to the northwest than the other oaks of eastern America; common and generally distributed in Nebraska, and of a large size in canons or on river bottoms in the extreme western part of the state; the most generally distributed oak of Kansas, growing to large size in all the eastern part of the state.

Distribution in West Virginia.—Rare.

Hardy: one tree near head of Mudlick run along Romney and Moorefield turnpike.

Grant: few trees on Lunice creek.

Reported from Long Reach, Tyler county, by Millsbaugh.

Uses.—A valuable timber tree in some states, but too rare in West Virginia to be of any commercial importance. Wood used for same purposes as that of white oak.

QUERCUS PLATANOIDES, Sudw. Swamp White Oak.*Geographic Distribution.*

Borders of streams and swamps in moist fertile soil; southern Maine to northern Vermont and southwestern Quebec, westward through Ontario and the southern peninsula of Michigan to southeastern Iowa and western Missouri, and southward to the District of Columbia, northern Kentucky and Arkansas, and along the Appalachian mountains to northern Georgia; widely scattered, usually in small groves but nowhere very abundant; most common and of its largest size in western New York and northern Ohio.

Distribution in West Virginia.—Infrequent. Found so far only in the localities named below:

Grant: few trees along Lunice creek.

Hardy: scattered along the South Branch near Moorefield. Pocahontas: few trees near Marlinton.

Randolph: infrequent along the Tygarts Valley near Huttonsville.

Upshur: rare near Lorentz.

Wood.—Heavy, hard, tough, light brown.

Uses.—Valuable for interior finish, boat-building, cross-ties, staves, fencing, and fuel.

QUERCUS PRINUS, L. Chestnut Oak. Rock Chestnut Oak.*Geographic Distribution.*

Hillsides and high rocky banks of streams in rich and deep or sometimes sterile soil; coast of southern Maine, the Blue Hills of eastern Massachusetts, southward to Delaware and the District of Columbia, and along the Appalachians to northern Georgia and Alabama, westward to the shores of Lake Champlain and the valley of the Genesee river, New York, the northern shores of Lake Erie, and to central Kentucky and Tennessee; rare and local in New England and Ontario; abundant on the banks of the lower Hudson river and on the Appalachian hills from southern New York to Alabama; most common and of its largest size on the lower slopes of the mountains of the Carolinas and Tennessee, here often forming a large part of the forest.

Distribution in West Virginia.—Common in all parts of the State except on the high mountains and plateaus.

Abundant on the dry ridges of Pendleton, Grant, Hardy,

Hampshire, and Morgan, but scarcely less abundant in numerous other sections.

Wood.—Heavy, hard, close-grained, light brown, durable.

Uses.—Valuable for cross-ties, interior finish, fencing, fuel, staves, etc. Bark used extensively for tanning leather.

QUERCUS ACUMINATA, Sarg. Yellow Oak.

Geographic Distribution.

Gardner's Island, Lake Champlain, western Massachusetts and Connecticut, and near the city of Newburg, New York, westward through southern Ontario to southeastern Nebraska and eastern Kansas, southward in the Atlantic states to the District of Columbia and the valley of the upper Potomac river, and west of the Alleghany mountains to central Alabama and Mississippi, through Arkansas and northern Louisiana, to the eastern borders of the Indian Territory and to the valley of the Nueces river and the Guadalupe mountains, Texas; rare and comparatively local in the Atlantic states, usually on limestone soil; very abundant in the Mississippi basin, growing on limestone ridges, dry flinty hills, or deep rich bottom-lands and the rocky banks of streams; of its largest size on the lower Wabash river and its tributaries in southern Indiana and Illinois.

Distribution in West Virginia.—Infrequent. Found in the following counties:

Boone: few trees near Madison on Little Coal river.

Doddridge: several trees on Middle Island creek a short distance below West Union.

Fayette: at Kanawha Falls.

Grant: probably more common near Petersburg than in any other part of the State.

Hardy: few trees on Mudlick run.

Kanawha: near St. Albans.

Monongalia: few trees near Morgantown.

Summers: on New river above Hinton.

Webster: on Elk river 2 miles above Webster Springs.

Wood.—Very strong, heavy, durable, close-grained, light-colored.

Uses.—Fencing, vehicles, staves, interior finish, and cross-ties.

Too rare in West Virginia to be of commercial importance.

TYPICAL WHITE ELM TREE DEVELOPED WITHOUT CROWDING, JEFFERSON COUNTY.

ULMUS AMERICANA, L. White Elm.*Geographic Distribution.*

River bottom-lands, intervalles, low rich hills, and the banks of streams; southern Newfoundland to the northern shores of Lake Superior and the eastern base of the Rocky Mountains, southward to Cape Canaveral and the shores of Peace creek, Florida, westward to the Black hills, Dakota, western Nebraska, western Kansas, the Indian Territory, and the valley of the Rio Concho, Texas; very common northward, less abundant and of smaller size southward; abundant on the banks of streams flowing through the midcontinental plateau.

Distribution in West Virginia.—Common in most parts of the State. Rare in some parts of Upshur, Webster, Randolph, Tucker, Pocahontas, Nicholas, Greenbrier, and other mountainous counties. Confined to low land.

Wood.—Heavy, strong, tough, medium coarse-grained, light brown.

Uses.—Valuable chiefly for wagon hubs, boat-building, cooperage, boxes, and furniture.

Planted extensively as a shade tree.

ULMUS FULVA, Michx. Slippery Elm. Red Elm.*Geographic Distribution.*

Banks of streams and low rich rocky hillsides in deep fertile soil; comparatively common from the valley of the St. Lawrence river through Ontario to North Dakota, eastern Nebraska, and northern and western Kansas, and southward to western Florida, central Alabama and Mississippi, and the valley of the San Antonio river, Texas.

Distribution in West Virginia.—Distributed locally. Found in the following counties:

Barbour, Braxton, Clay, Fayette, Grant, Mingo, Monongalia, Pocahontas, Putnam, Roane, Tyler, Upshur, and Wetzel. Not found at high elevations.

Wood.—Hard, heavy, close-grained, durable, dark brown.

Uses.—Wood used in wheels, agricultural implements, handles, fencing, ties, poles, etc. Inner bark used as a medicine.

CELTIS OCCIDENTALIS, L. Hackberry. Sugarberry.
"Hoop Ash."

Geographic Distribution.

Valley of the St. Lawrence river near Montreal, westward to southern Ontario, and in the United States from the shores of Massachusetts Bay to northwestern Nebraska, North Dakota, southern Idaho, eastern Washington and Oregon, western Washington, Nevada, New Mexico, and southward to the shores of Bay Biscayne and Cape Romano, Florida, and to Missouri and eastern Texas; rare east of the Hudson river, more abundant in western New York and the middle states, and of its largest size on the rich bottom-lands of the lower Ohio basin; growing usually in rich moist soil and often, especially in the east, on dry gravelly or rocky hillsides; west of the Rocky Mountains, a small tree or shrub rarely 30 feet high, with thick rigid scabrous reticulate leaves, exceedingly rare and only on the banks of streams.

Distribution in West Virginia.—Found as follows:

Boone: few trees at Madison.

Braxton: near Burnsville.

Grant: on Lunice creek.

Hampshire: near Romney.

Hardy: common at Moorefield.

Jefferson: near Harpers Ferry.

Kanawha: near Charleston.

Logan: at Logan Court House.

Monongalia: common near Morgantown.

Tyler: near Middlebourne (large trees).

Upshur: northern end (rare).

Reported by Millspaugh from Fayette and Jackson.

Wood.—Soft, coarse-grained, not strong, light yellow.

Uses.—Fencing, cheap furniture, agricultural implements, coo-
perage, boxes, and rough construction.

MORUS RUBRA, L. Red Mulberry.

Geographic Distribution.

Intervales in rich soil and on low hills; western Massachusetts, Connecticut, and Long Island to southern Ontario and central Michigan, southeastern Nebraska, eastern Kansas, and southward to the shores of Bay Biscayne and Cape Romano, Florida, and to the valley of the Colorado river, Texas; most

abundant and of its largest size in the basin of the lower Ohio river and on the foothills of the southern Appalachian mountains.

Distribution in West Virginia.—Frequent throughout the State; found in scattered growth in every county, but nowhere abundant.

Wood.—Light, soft, medium close-grained, very durable, light orange.

Uses.—Especially valuable for fence posts. Used sometimes for handles, cooperage, and agricultural implements. Often left standing or planted for shade and for the edible berries.

MAGNOLIA ACUMINATA, L. Cucumber-tree. Mountain Magnolia.

Geographic Distribution.

Low mountain slopes and rocky banks of streams; western New York, westward through southern Ontario to southern Illinois, and southward along the Appalachian mountains to southern Alabama, central Kentucky and Tennessee and northeastern Mississippi, and in northeastern, southern and southwestern Arkansas; rare at the north; most abundant and of its largest size in the narrow valleys at the base of the high mountains of the Carolinas and Tennessee.

Distribution in West Virginia.—Scattered among other hard woods throughout the State. Most plentiful in the narrow rich valleys and slopes of the mountainous and high hilly sections.

Wood.—Light, soft, durable, light yellow.

Uses.—Valuable wood for interior finish, kitchen furniture, shelving, pumps, and pulp.

MAGNOLIA TRIPETALA, L. Umbrella-tree. Elkwood. "Wahoo."

Geographic Distribution.

Deep rather moist rich soil along the banks of mountain streams and the margins of swamps, and widely distributed in the Appalachian mountain region, but nowhere very common; valley of the Susquehanna river, Pennsylvania, to southern Al-

abama, middle Kentucky and Tennessee, northern Mississippi, and in central and southwestern Arkansas, extending in the south Atlantic states nearly to the coast; of its largest size in the valleys along the western slopes of the Great Smoky mountains in Tennessee.

Distribution in West Virginia.—Found as follows:

Boone: near Madison.

Braxton: on Elk river.

Fayette: on New river.

Kanawha: near Charleston.

Logan: common on Island creek.

McDowell: frequent along Tug Fork.

Mingo: common.

Nicholas: near Curtin.

Randolph: Middle Fork and Buckhannon rivers.

Raleigh: near Beckley.

Upshur: Sago and Selbyville.

Webster: Holly river.

Wyoming: frequent.

Wood.—Light, soft, close-grained, not durable.

Uses.—A small tree of no commercial value here.

MAGNOLIA FRASERI, Walt. Mountain Magnolia. Long-leaved Cucumber-tree.

Geographic Distribution.

Valleys of the streams of the southern Appalachian mountains from southwestern Virginia to northern Georgia and Alabama, eastern Tennessee and northern Mississippi; probably most abundant and of its largest size on the upper waters of the Savannah river in South Carolina.

Distribution in West Virginia.—Infrequent. Scattered through the mountainous parts of Clay, Nicholas, Pocahontas, Randolph, Upshur, and Webster. Found growing at elevation 3,500 feet on head of North Fork of Cherry river in Pocahontas.

Reported by Millspaugh from Summers and Mercer.

Wood.—Light, soft, close-grained, not durable.

Uses.—Small tree, used only for minor domestic purposes.

LIRIODENDRON TULIPIFERA, L. Yellow Poplar.
Tulip-tree.

Geographic Distribution.

Deep rich moist soil on the intervalles of streams or on mountain slopes; Rhode Island to southwestern Vermont, and westward to the southern shores of Lake Michigan, southward to northern Florida, southern Alabama and Mississippi, and in southeastern Missouri and northeastern Arkansas; most abundant and of its largest size in the valleys of the lower Ohio basin, and on the lower slopes of the high mountains of North Carolina and Tennessee.

Distribution in West Virginia.—A common timber tree in nearly all parts of the State. Most plentiful and largest on the waters of Great Kanawha and southward. Once abundant throughout the whole western and central sections below the spruce belt. Least abundant in Pendleton and other counties drained by the Potomac waters.

Wood.—Soft, light, easily worked, not strong, durable heartwood, light yellow.

Uses.—A very valuable tree. Wood used for building purposes, furniture, veneer, shingles, fencing, pulp, and for many other purposes.

ASIMINA TRILOBA, Dunal. Pawpaw.

Geographic Distribution.

Deep rich moist soil; western New Jersey to the northern shores of Lake Ontario, and eastern central Pennsylvania, westward to southern Michigan, eastern Nebraska, eastern Kansas, and southward to middle Florida, and to the valley of the Sabine river, Texas; comparatively rare in the region adjacent to the Atlantic seaboard; very common in the Mississippi valley, forming the thick forest undergrowth on rich bottom-lands, or thickets many acres in extent.

Distribution in West Virginia.—Common. Scattered groves throughout the State. Rather infrequent in the mountainous counties and absent from the spruce belt, and adjacent highlands.

Wood.—Soft, light, weak, coarse-grained, light yellow.

Uses.—Of little value for its wood. Groves of trees often preserved for the luscious and wholesome fruit.

SASSAFRAS SASSAFRAS, Karst. Sassafras.*Geographic Distribution.*

Usually in rich sandy well-drained soil, southern Maine and eastern Massachusetts, through southern Vermont, southern Ontario, central Michigan, and southeastern Iowa to eastern Kansas and the Indian Territory, and southward to central Florida and the valley of the Brazos river, Texas; in the south Atlantic and Gulf states often taking possession of abandoned fields.

Distribution in West Virginia.—Abundant, usually on thin dry land. Distributed throughout the State except at high altitudes.

Wood.—Soft, brittle, coarse-grained, durable, dull yellow.

Uses.—Not valuable. Occasionally used for minor purposes. Oil of sassafras distilled from bark and roots.

LIQUIDAMBAR STYRACIFLUA, L. Sweet Gum. Bilsted.*Geographic Distribution.*

Fairfield county, Connecticut, to southeastern Missouri, southward to Cape Canaveral and the shores of Tampa Bay, Florida, and through Arkansas and Indian Territory to the valley of the Trinity river, Texas, reappearing on the mountains of central and southern Mexico and on the highlands of Guatemala; in the maritime region of the south Atlantic states and in the basin of the lower Mississippi river one of the most common trees of the forest, covering rich river-bottom lands usually inundated every year; in the northern and middle states on the borders of swamps and low wet swales; at the north rarely more than 60 to 70 feet tall, with a trunk usually not more than 2 feet in diameter.

Distribution in West Virginia.—A rare tree. Distributed principally along streams in the following counties:

Clay: common along Elk river from a short distance above Clay to the Kanawha county line.

Fayette: large trees found at Sewell station.

Kanawha: plentiful along north side of Kanawha river at Charleston and frequent along the Great Kanawha and Elk above Charleston.

Mingo: scattered trees along Tug Fork of Big Sandy a few miles above Williamson.

Nicholas: on Peters creek up 10 miles from its mouth; on Laurel creek; on Otter creek; on Twentymile creek, through Grant and Jefferson districts; and on Gauley river below the mouth of Peters creek.

Reported from Summers on New and Greenbrier rivers; Roane, on Pocatalico river; Jackson, on Mill creek; Gilmer, near Glenville; and Cabell, near Huntington.

Wood.—Heavy, hard, close-grained, reddish brown.

Uses.—Not commercially important in West Virginia. Wood used for boxes, house finish, etc.

HAMAMELIS VIRGINIANA, L. Witch Hazel.

Geographic Distribution.

Nova Scotia, New Brunswick, and the valley of the St. Lawrence river to southern Ontario, Wisconsin and eastern Nebraska, and southward to northern Florida and eastern Texas, growing usually on the borders of the forest in low rich soil or on the rocky banks of streams; of its largest size and probably only arborescent on the slopes of the high Alleghany mountains in North and South Carolina and Tennessee.

Distribution in West Virginia.—Small abundant tree, found throughout the State.

Wood.—Heavy, very hard, close-grained.

Uses.—Infrequently used for any purpose in West Virginia. Bark sometimes used as a medicine.

PLATANUS OCCIDENTALIS, L. Sycamore. Buttonwood.

Geographic Distribution.

Borders of streams and lakes on rich bottom-lands; southeastern New Hampshire, northern Vermont and the northern shores of Lake Ontario, westward to eastern Nebraska and Kansas, and southward to northern Florida, central Alabama and Mississippi, and the valley of the Brazos river, and through Texas to the valley of the Devil's river, everywhere common, but most abundant and of its largest size on the bottom-lands of streams in the basin of the lower Ohio and Mississippi.

Distribution in West Virginia.—Common throughout the State along nearly all streams below 3,000 feet elevation.

Wood.—Hard, close-grained, light-colored.

Uses.—Now considered valuable. Wood used for interior finish, butcher blocks, furniture, tobacco boxes, etc.

MALUS CORONARIA, Mill. Crab Apple. Fragrant Crab.

Geographic Distribution.

Rich rather moist soil in forest glades, often forming wide thickets; less commonly on dry limestone hills; valley of the Humber river, Ontario, westward along the northern shores of Lake Erie, and southward through western New York and Pennsylvania to the District of Columbia, and along the Alleghany mountains to central Alabama, and westward to northern Missouri.

Distribution in West Virginia.—A common tree in most sections.

Rare in Boone, Logan, Mingo, and other counties of the southwest. Abundant through the high hilly regions in the central and northern parts of the State.

Several trees found growing near Morgantown, Monongalia county, and near Terra Alta, Preston county, have larger, lighter-colored blossoms, larger and more rounded leaves, and more glossy fruits.

Uses.—The hard, close-grained wood sometimes used for tool handles, mallets, etc. Tree prized for its fragrant blossoms.

SORBUS AMERICANA, Marsh. Mountain Ash.

Geographic Distribution.

Borders of swamps and rocky hillsides; Newfoundland to Manitoba and southward through the maritime provinces of Canada, Quebec and Ontario, the elevated portions of the north-eastern United States and the region of the Great Lakes to the high mountains of Virginia and North Carolina; probably of its largest size on the northern shores of Lake Huron and Superior; in the United States, except in New England; more often a shrub than a tree; on the Alleghany mountains usually low, with narrower leaflets and smaller fruit than northward.

Distribution in West Virginia.—Confined to high glades and mountains. Found at the following points:

Pendleton: Spruce knob and vicinity.

Pocahontas: Cranberry Glades.

Preston: Pine swamp near Cranesville.

POTOMAC RIVER BELOW HARPERS FERRY. The Willows and Button Bushes in the lower left hand corner are growing on the lowest point of land in the State, altitude 260 feet above the sea.

Randolph: Osceola and Cheat Bridge.

Tucker: near Davis.

Reported from Grant county.

Wood.—Soft, light, not strong, pale lemon.

Uses.—Not valuable for timber. Wood used only occasionally for domestic purposes. Fruit sometimes used in preparing home-made medicines.

**AMELANCHIER CANADENSIS, T. & G. Shad Bush.
Service Berry.**

Geographic Distribution.

Upland woods in rich soil; Newfoundland, through the maritime provinces of Canada, and westward along the shores of the Great Lakes, ranging southward to northern Florida and westward to Minnesota, eastern Nebraska, eastern Kansas, and southern Arkansas.

Distribution in West Virginia.—Frequent throughout the State. Most plentiful in damp rich soils in the mountainous and high hilly sections. Least abundant in the low hill country back from the Ohio river.

Wood.—Heavy, very hard, close-grained, brownish.

Uses.—Wood occasionally used for tool handles and other small articles. Tree prized for its edible berries.

CRATÆGUS CRUS-GALLI, L. Cockspur Thorn.

Geographic Distribution.

Usually on the slopes of low hills in rich soils; valley of the St. Lawrence river near Montreal, southward to Delaware and along the Appalachian foothills to North Carolina, and westward through western New York and Pennsylvania to southern Michigan.

Distribution in West Virginia.—One of the commonest hawthorns. Found in abundance in Jefferson, Berkeley, Hampshire, Hardy, Upshur, Randolph, Webster, Monongalia, and Kanawha.

CRATÆGUS PUNCTATA, Jacq. Large-fruited Thorn.*Geographic Distribution.*

Rich hillsides; valley of the Chateaugay river, Quebec, to the valley of the Detroit river, Ontario, southward through western New England, and along the Appalachian mountains to northern Georgia, ascending in North Carolina and Tennessee nearly 6000 feet above the sea, westward through New York and Ohio to southern Michigan and Illinois.

Distribution in West Virginia.—Found as follows:

Tucker: abundant in Canaan valley.

Pocahontas: plentiful at Durbin and Cass.

Randolph: covering wide areas in almost pure growth on Bickle knob.

Wetzel: near Jacksonburg.

Webster: on Elk river near Addison.

CRATÆGUS CORDATA, Ait. Washington Thorn.*Geographic Distribution.*

Banks of streams in rich soil; valley of the upper Potomac river, Virginia, southward in the foothill region of the Appalachian mountains to northern Georgia and Alabama, and westward through middle Tennessee and Kentucky to the valley of the lower Wabash river, Illinois, Osage, Missouri, and south-eastern Missouri to northwestern Arkansas; nowhere common.

Distribution in West Virginia.—Found at St. Albans, Kanawha county. Reported from Ronceverte, Greenbrier county.**PRUNUS AMERICANA, Marsh. Wild Plum.***Geographic Distribution.*

In the middle and northern states in rich soil, growing along the borders of streams and swamps, and often forming thickets of considerable extent; in the south Atlantic often in river swamps; west of the Mississippi river on bottom-lands and dry limestone uplands; middle and northern New Jersey, and central New York to Nebraska; the valley of the upper Missouri river in Montana, the eastern slopes of the Rocky Mountains of Colorado, and southward to the Chattahoochee region of western Florida, the valley of the Rio Grande in southern New Mexico, and the mountains of northern New Mexico; most abundant and of its largest size in southern Arkansas and eastern Texas.

Distribution in West Virginia.—Borders of streams and glades.

Thinly scattered over the State.

Wood.—Heavy, close-grained, dark.

Uses.—Wood very rarely used. Fruit often eaten raw or cooked.

PRUNUS PENNSYLVANICA, L. Wild Red Cherry.
“Bird Cherry.” “Fire Cherry.”

Geographic Distribution.

Newfoundland to the shores of Hudson's Bay, and westward in British America to the eastern slopes of the Coast Range of British Columbia in the valley of the Frazer river, and southward through the northern states to Pennsylvania, central Michigan, northern Illinois, central Iowa, and to the high mountains of North Carolina and Tennessee and on the eastern slopes of the Rocky mountains of Colorado; common in all the forest regions of the extreme northern states, growing in moist rather rich soils; often occupying to the exclusion of other trees large areas cleared by fire of the original forest covering; common and attaining its largest size on the western slopes of the Big Smoky mountains in Tennessee.

Distribution in West Virginia.—Frequent in burnt lands at high elevations. Less common on lower ground. Found in Grant, Pendleton, Preston, Monongalia, Tucker, Randolph, Upshur, Webster, Pocahontas, Nicholas, and Greenbrier.

Wood.—Light, soft, close-grained, not durable.

Uses.—Wood of little value. Profitable as a covering for burnt lands.

PRUNUS SEROTINA, Ehrh. Wild Black Cherry.

Geographic Distribution.

Nova Scotia westward through the Canadian provinces to the northern shore of Lake Superior and southward through the eastern states to the shores of Matanzas Inlet and Tampa Bay, Florida, and westward to Dakota, eastern Nebraska and Kansas, the Indian Territory and eastern Texas; on the mountain ranges of western Texas, southern New Mexico and Arizona, and southward to Columbia and Peru; in the United States usually in rich moist soil; once very abundant in the Appalachian region, reaching its greatest size on the slopes of the high Allegany mountains from West Virginia to Georgia and Alabama; sometimes on low sandy soil, and often in New Eng-

land on rocky cliffs within reach of the spray of the ocean; not common in the coast region of the southern states; in the southwest only in the bottoms of mountain canons at elevations of 5,000 feet to 7,000 feet above the level of the sea.

Distribution in West Virginia.—A common timber tree in the mountains. Once grew in great abundance in rich plateaus and mountain coves and valleys in parts of Tucker, Randolph, Barbour, Upshur, Webster, Nicholas, Pocahontas, Greenbrier, and Monroe. Less plentiful and of smaller size in the hilly counties south of the Great Kanawha, throughout the whole western third of the State, and on the eastern side of the Alleghanies.

Wood.—Light, strong, hard, close-grained, reddish.

Uses.—Valuable for interior finish and furniture.

CERCIS CANADENSIS, L. Redbud. Judas-tree.

Geographic Distribution.

Borders of streams and rich bottom-lands, forming, especially west of the Alleghany mountains, an abundant undergrowth to the forest; valley of the Delaware river, New Jersey, southward to the shores of Tampa Bay and to northern Alabama and Mississippi, and westward to southern Ontario, eastern Nebraska, the eastern borders of the Indian Territory, Louisiana, and the valley of the Brazos, Texas; and on the Sierra Madre of Nuevo Leon; common and of its largest size in southwestern Arkansas, the Indian Territory and eastern Texas, and in early spring a conspicuous feature of the landscape.

Distribution in West Virginia.—Common in most parts of the State, forming thickets along borders of fields and banks of streams. Listed in the following counties:

Boone, Braxton, Clay, Fayette, Grant, Hampshire, Jefferson, Kanawha, Lewis, Logan, Mingo, Monongalia, Putnam, Randolph, Tyler, Upshur (rare), Wetzel, Webster, and Wyoming.

Wood.—Heavy, hard, weak, close-grained, reddish.

Uses.—Seldom used for any purpose.

GLEDITSIA TRIACANTHOS, L. Honey Locust.*Geographic Distribution.*

Borders of streams and intervale lands, in moist fertile soil, usually growing singly or occasionally covering almost exclusively considerable areas; less commonly on dry sterile gravelly hills; western slope of the Alleghany mountains of Pennsylvania, westward to Ontario and Michigan to southeastern Minnesota, eastern Nebraska and Kansas, and the Indian Territory, and southward to northern Alabama and Mississippi and to the valley of the Brazos river, Texas; attaining its largest size in the valleys of small streams in southern Indiana and Illinois; now often naturalized in the region east of the Alleghany mountains.

Distribution in West Virginia.—Rather infrequent, along streams on both sides of the Alleghanies. Found on the Bluestone at Spanishburg, Mercer county; on the New river at Hinton, Summers county; on the Great Kanawha at Kanawha Falls, Fayette county; at Charleston on the Kanawha river, Kanawha county; on the Kanawha river near Winfield, Putnam county; on the Little Coal river, near Madison, Boone county; on the Elk, near Clay, Clay county; near Webster Springs, Webster county; on the Little Kanawha, at a number of places from Glenville, Gilmer county, to its mouth; on the Monongahela river near Morgantown, Monongalia county; and on the South Branch of Potomac near Romney, Hampshire county. Frequently found also along Middle Island creek, Fish creek, Fishing creek and other tributaries of the Ohio.

Wood.—Hard, strong, coarse-grained, reddish, very durable.

Uses.—Valuable for posts, cross-ties, hubs and spokes, and fuel.

ROBINIA PSEUDACACIA, L. Locust. Acacia. Yellow Locust.*Geographic Distribution.*

Slopes of the Appalachian mountains, Pennsylvania, to northern Georgia; now widely naturalized in most of the territory of the United States east of the Rocky Mountains, and perhaps indigenous as a low shrub in northeastern and western Arkansas and in the Indian Territory; nowhere common; in the Appalachian forest growing singly or in small groups; most abundant and of its largest size on the western slopes of the Alleghanies of West Virginia; often spreading by underground stems into broad thickets of small and often sunted trees.

Distribution in West Virginia.—Widely distributed. Frequent in every county, growing from the lowest elevations up to 3,500 feet and over.

Wood.—Heavy, very hard, strong, durable, brownish with pale yellow sapwood.

Uses.—Very valuable for fence posts, ties, buggy hubs, pins, and bridge and ship timbers.

The locust must be looked upon as an exceedingly valuable tree in West Virginia. It springs up in burnt lands, and cut-over areas, and in almost every locality where room is made for it to grow it thrives regardless of soils or exposures. Like other legumes it enriches the soil by adding nitrogen wherever it stands and it is a rapid grower, reaching a merchantable size within 25 years or less.

RHUS HIRTA, Sudw. Staghorn Sumach.

Geographic Distribution.

Usually on uplands in good soil, or less commonly on sterile gravelly banks and on the borders of streams and swamps; New Brunswick, through the valley of the St. Lawrence river to southern Ontario and Minnesota, and southward through the northern states and along the Alleghany mountains to northern Georgia and to central Alabama and Mississippi; more abundant on the Atlantic seaboard than in the region west of the Appalachian mountains.

Distribution in West Virginia.—A small tree. Common throughout the State, and reaching higher altitudes than the smaller shrubby species of this genus.

ILEX OPACA, Ait. Holly.

Geographic Distribution.

Coasts of Massachusetts, in the city of Quincy, southward generally near the coast to the shores of Mosquito Inlet and Charlotte Harbor, Florida, valley of the Mississippi river from southern Indiana to the Gulf of Mexico, and through Missouri, Arkansas, and Louisiana to eastern Texas; rare and of small size east of the Hudson river and rare in the Alleghany mountain region and the country immediately west of it; most abundant and of its largest size on the bottom-lands of the

streams of southern Arkansas and eastern Texas; at the north in dry rather gravelly soil often on margins of oak woods, southward on the borders of swampy river bottoms in rich humid soil.

Distribution in West Virginia:

Boone: near Madison.

Braxton: near Sutton.

Fayette: Kanawha Falls and Fayetteville.

Logan: common near Logan.

Mingo: near Williamson.

McDowell: common.

Nicholas: at Richwood and Curtin.

Randolph: Roaring creek.

Upshur: waters of Buckhannon river, common.

Webster: on Elk river.

Wyoming: few.

Rare east of the mountains and sparsely distributed through the low hilly counties along the Ohio river.

Wood.—Light, close-grained, nearly white.

Uses.—Wood used to a slight extent in cabinet making and interior finish. Branches and berries used for Christmas decoration.

ACER SPICATUM, Lam. Mountain Maple.

Geographic Distribution.

Moist rocky hillsides usually in the shade of other trees, and really aborescent only on the western slopes of the high mountains of Tennessee and North Carolina; valley of the lower St. Lawrence river to northern Minnesota and the Saskatchewan, and southward to the northern slopes and along the Appalachian mountains to northern Georgia.

Distribution in West Virginia.—Found in Braxton, Grant, Pocahontas, Monongalia, Preston, Pendleton, Randolph, Tucker, Upshur, and Webster. Grows from elevations of 850 feet in Monongalia to 4,800 feet in Pendleton.

Wood.—Light, soft, close-grained.

Uses.—Not used except for a few ordinary domestic purposes.

ACER PENNSYLVANICUM, L. Striped Maple. Moosewood.*Geographic Distribution.*

Usually in the shade of other trees, often forming in northern New England a large part of their shrubby undergrowth; shores of Ha-Ha Bay, Quebec, westward along the shores of Lake Ontario and the islands of Lake Huron to northeastern Minnesota, and southward through the Atlantic states and along the Appalachian mountains to northern Georgia; common in the north Atlantic states, especially in the interior and elevated regions; of its largest size on the slopes of the Big Smoky mountains, Tennessee, and of the Blue Ridge in South and North Carolina.

Distribution in West Virginia.—Found with the foregoing species (*Acer spicatum*) but usually more abundant and in more shady situations.

Wood.—Light, soft, coarse-grained. Not often used.

ACER SACCHARUM, Marsh. Sugar Maple. Rock Maple.*Geographic Distribution.*

From southern Newfoundland to northern Georgia and western Florida, and west to Minnesota, eastern Nebraska, eastern Kansas, and eastern Texas. Most abundant in Minnesota, Wisconsin, Michigan, New York, and Maine, and on the Appalachian slopes. In the northern pine belt the principal forest tree forming often 25 to 75 per cent of the total stand. Associated species are beech, yellow birch, white pine, red pine, white spruce, red spruce, balsam fir, white birch, and red maple. Farther south it is found in mixture with nearly all the hardwoods. (Forest Service Circular 95.)

Distribution in West Virginia.—Found in every county. Superior on the elevated flats and in the rich coves along the Alleghanies from Tucker to Greenbrier and Monroe. Abundant in the high hilly sections just west of the mountains.

Wood.—Strong, hard, heavy, close-grained, reddish.

Uses.—Valuable for interior finish and furniture. This is the principal tree from which sap is taken for sugar making.

STUNTED RED SPRUCE GROWTH NEAR SUMMIT OF SPRUCE KNOB. The tree in the center of the picture is the most elevated natural object in West Virginia.

ACER NIGRUM, Michx. Black Maple.*Geographic Distribution.*

Valley of the St. Lawrence river in the neighborhood of Montreal, southward to the valley of the Cold river, New Hampshire, through western Vermont, and westward through northern New York, Ontario, and the southern peninsula of Michigan, Indiana, Illinois, and Iowa, to northeastern South Dakota, western Missouri, eastern Kansas, and southward through western New York and Pennsylvania to southwestern Virginia and Kentucky; comparatively rare near Montreal and in Vermont, more abundant farther west, almost entirely replaced by *Acer saccharum* in Iowa, and the only sugar maple of South Dakota.

Distribution in West Virginia.—Less common and usually on lower and more moist land than sugar maple. Found as follows:

Lewis: plentiful along the West Fork river at Weston.

Monongalia: common near Morgantown.

Tyler: on Middle Island creek near Middlebourne.

Webster: few trees on Elk river above Webster Springs.

Wetzel: near Jacksonburg.

Uses.—Wood similar to and used for the same purpose as the foregoing species—*A. saccharum*.

ACER SACCHARINUM, L. Silver Maple. Soft Maple.*Geographic Distribution.*

Sandy banks of streams; valley of the St. John's river, New Brunswick, to southern Ontario, southward to western Florida, and westward to eastern Dakota and Nebraska, the valley of the Blue river, Kansas, and the Indian Territory; rare in the immediate neighborhood of the Atlantic coast and on the high Appalachian mountains; of its largest size on the banks of the lower Ohio and its tributaries.

Distribution in West Virginia.—Closely confined to the borders of the larger streams at low elevations. Found on the South Branch of Potomac from a point between Moorefield and Petersburg to its mouth near Green Spring station; on the Potomac and its North Branch from Harpers Ferry to a point some distance above Keyser; on the New river at Hinton; on the Great Kanawha at Kanawha Falls,

Charleston and Winfield; on the Elk from Turner station to Charleston; on the Little Coal at Madison; on the Tug Fork of Big Sandy at Williamson; on the Little Kanawaa near Elizabeth; on the Monongahela at Morgantown; and on the Ohio at Wheeling, Parkersburg, Point Pleasant, and other points.

Wood.—Hard, rather brittle, easily worked, close-grained, brownish.

Uses.—Wood used for flooring, boxes, crates, and for numerous small household articles. Tree often planted for shade and ornament.

ACER RUBRUM, L. Red Maple. Scarlet Maple.

Geographic Distribution.

Borders of streams, low wet swamps, and rarely on hillsides; latitude 49 degrees north in Quebec and Ontario, southward to the Indian and Caloosa rivers, Florida and westward to western Wisconsin, western Iowa, and the valley of the Trinity river, Texas; one of the most common and generally distributed trees of eastern North America; most abundant in the south, especially in the valley of the Mississippi river, and of its largest size in the river swamps of the lower Ohio and its larger tributaries; at the north often covering low wet swamps almost to the exclusion of other trees.

Distribution in West Virginia.—Occurs in all parts of the State.

Not frequent in the counties east of the Alleghany mountains.

Wood.—Medium heavy, close-grained, soft, light brown.

Uses.—Furniture, chairs, gun stocks, woodenware.

ACER NEGUNDO, L. Box Elder. Ash-leaved Maple.

Geographic Distribution.

Banks of streams and lakes and the borders of swamps; western Vermont and central New York, southward to northern Florida and westward to the eastern slope of the Rocky Mountains, and to Utah, New Mexico, and eastern Arizona; rare east of the Appalachian mountains; most common in the Mississippi basin, and of its largest size in the valley of the lower Ohio river.

Distribution in West Virginia.—Confined to banks of streams.

Not widely distributed. Found as follows:

Boone: few trees along Big and Little Coal rivers.

Braxton: on Little Kanawha river at Burnsville.

Doddridge: common along Middle Island creek.

Fayette: common at Kanawha Falls.

Lewis: plentiful on West Fork at Weston.

Monongalia: plentiful on Monongahela at Morgantown.

Tyler: on Middle Island creek near Middlebourne.

Wood.—Light, close-grained, soft, nearly white.

Uses.—Wood used for cheap furniture, woodenware and pulp.

Often planted for shade.

ÆSCULUS GLABRA, Willd. Ohio Buckeye. Fetid Buckeye.

Geographic Distribution.

River-bottoms and the banks of streams in rich moist soil; western slopes of the Alleghany mountains, Pennsylvania to northern Alabama, and westward to southern Iowa, central Kansas, Indian Territory, southern Nebraska and eastern Kansas; nowhere abundant; most common and of its largest size in the valley of the Tennessee river in Tennessee and northern Alabama.

Distribution in West Virginia.—Not frequent. Found along the

Ohio river near Wheeling, Ohio county. Reported by Millspaugh from Wirt, Gilmer, and Monongalia, and as common along the Ohio river.

Wood.—Light, soft, close-grained, nearly white.

Uses.—Not commercially valuable in West Virginia. Wood used in some states for woodenware, paper pulp, and occasionally sawed into lumber.

ÆSCULUS OCTANDRA, Marsh. Sweet Buckeye.

Geographic Distribution.

Rich soil of river-bottoms and moist mountain slopes, Allegheny county, Pennsylvania, and southward along the mountains to the neighborhood of Augusta, Georgia, and northern Alabama, and westward to southern Iowa, the Indian Territory and western Texas; most common and of its largest size on the high mountains of Tennessee and North Carolina.

Distribution in West Virginia.—Found in Barbour, Boone, Braxton, Calhoun, Doddridge, Fayette, Kanawha, Lewis, Logan, Marshall, Mingo, Monongalia, Monroe, Pocahontas, Putnam, Ritchie, Summers, Tyler, Upshur, Webster, and Wyoming.

Variety, *hybrida*, Sarg. occurs more frequently than any other.

Wood.—Light, soft, close-grained, weak, nearly white.

Uses.—Wood used as in the preceding species of this genus.

TILIA AMERICANA, L. Linden. Bass Wood

Geographic Distribution.

Rich often moist soil, formerly often in mostly pure forests; northern New Brunswick to the eastern shores of Lake Superior, and northwestward to the southern shores of Lake Winnipeg and the valley of the Assiniboine river, and south in the United States to Virginia, along the Appalachian mountains to Georgia and Alabama, and to eastern Dakota, eastern Kansas, Nebraska, the Indian Territory, and Texas; more common northward than southward, and of its largest size on the bottom-lands of the tributaries of the lower Ohio river.

Distribution in West Virginia.—Found at Cranberry Glades, Pocahontas county. Probably occurs with the following species, but less frequently, in many parts of the State.

Wood.—Light, soft, light brown.

Uses.—Woodenware, pulpwood, cheap furniture, excelsior, etc.

TILIA HETEROPHYLLA, Vent. Linden. Bee-tree.

Geographic Distribution.

Rich wooded slopes in moist soil or near the banks of streams; often on limestone; near Ithaca, New York, southward along the Appalachian mountains to northern Alabama, and westward to middle Tennessee, Kentucky, and southern Indiana and Illinois; most abundant and of its largest size on the high mountains of North Carolina and Tennessee.

Distribution in West Virginia.—A common tree in Upshur, Randolph, Tucker, Hampshire, Hardy, Grant, Braxton, Lewis, Webster, Nicholas, Roane, Fayette, Kanawha, Gilmer, Monongalia, Marshall, and in several other counties.

Uses.—Wood similar to and used for the same as that of the preceding species.

ARALIA SPINOSA, L. Hercules' Club.

Geographic Distribution.

Deep moist soil in the neighborhood of streams; western slope of the Alleghany mountains, Pennsylvania, to southern Indiana and southeastern Missouri, and southward to northern Florida, western Louisiana and eastern Texas; probably of its largest size on the foothills of the Big Smoky mountains in Tennessee.

Distribution in West Virginia.—Common, often on dry burnt lands, west of the mountains. Found in the following counties: Fayette, Marshall, Monongalia, Nicholas, Randolph, Tucker, Upshur, and Webster.

Uses.—Of little commercial value. Bark, roots, and berries sometimes used in medicine.

NYSSA SYLVATICA, Marsh. Tupelo. Pepperidge. "Black Gum."

Geographic Distribution.

Borders of swamps in wet imperfectly drained soil, and southward often on high wooded mountain slopes; valley of the Kennebec river, Maine, to southern Ontario, central Michigan, and southeastern Missouri, and southward to the shores of Kissimmee river and Tampa Bay, Florida, and to the valley of the Brazos river, Texas; of its largest size on the southern Appalachian mountains.

Distribution in West Virginia.—A common tree throughout the State. Least frequent in the high mountains and in the counties east of the Alleghanies.

Wood.—Heavy, tough, medium coarse-grained, light yellow.

Uses.—Wood used for wheel hubs, ladders, mallets, wagon beds, piles, and rough flooring.

CORNUS FLORIDA, L. Flowering Dogwood.*Geographic Distribution.*

Usually under the shade of taller trees in rich well-drained soil; eastern Massachusetts to southern Ontario and southern Kansas, and southward to central Florida and the valley of the Brazos river, Texas; and on the mountains of northern Mexico; comparatively rare at the north; one of the commonest and most generally distributed inhabitants of the deciduous-leaved forests of the middle and southern states, ranging from the coast nearly to the summits of the high Alleghany mountains.

Distribution in West Virginia.—Frequent in all parts of the State.

Wood.—Heavy, close-grained, hard, brownish.

Uses.—Valuable for domestic purposes. Used for gluts, levers, handles, etc.

CORNUS ALTERNIFOLIA, L. Alternate-leaved Dogwood.*Geographic Distribution.*

Rich woodlands, the margins of the forest, and on the borders of streams and swamps, in moist well-drained soil; New Brunswick and Nova Scotia, westward along the valley of the St. Lawrence river to the northern shores of Lake Superior and to Minnesota, and southward through the northern states and along the Alleghany mountains to northern Georgia and Alabama.

Distribution in West Virginia.—Found along the Alleghany mountains and westward throughout the State. Infrequent on the east.

Uses.—Used only occasionally for minor domestic purposes.

OXYDENDRUM ARBOREUM, DC. Sorrel-tree. Sour Wood. "Sour Gum."*Geographic Distribution.*

Well-drained gravelly soil on ridges rising above the banks of streams; southern Pennsylvania to southern Indiana and middle Tennessee, and southward to the coast of Virginia and along the Alleghany mountains to western Florida, the shores of Mobile Bay, and through the elevated regions of the Gulf states to western Louisiana; of its largest size on the western slopes of the Big Smoky mountains, Tennessee.

Distribution in West Virginia.—A small tree found frequently in all sections west of the Alleghany mountains. Rare in the eastern counties.

Uses.—The hard, heavy, close-grained wood is sometimes used for handles, bean poles, and for other minor domestic purposes.

DIOSPYROS VIRGINIANA, L. Persimmon.

Geographic Distribution.

Light sandy well-drained soil, or in the Mississippi basin sometimes on the deep rich river-bottoms; Lighthouse Point, New Haven, Connecticut, southward to the banks of Caloosa river and the shores of Bay Biscayne, Florida, southern Alabama and Mississippi, and from southern Ohio to southeastern Iowa, southern Missouri, Arkansas, Louisiana, eastern Kansas, the Indian Territory, and the valley of the Colorado river, Texas; very common in the south Atlantic and Gulf states, often covering with shrubby growth by means of its stoloniferous roots abandoned fields, and springing up by the sides of roads and fences.

Distribution in West Virginia.—Frequent on low lands throughout the State. Probably most abundant in the valleys of the several larger tributaries of the Potomac.

Uses.—The heavy, strong, dark wood infrequently used. Manufactured in some states into plane stocks, shoe lasts, and other small articles. Fruit edible in late fall and winter.

MOHRODENDRON CAROLINUM, Britt. Silver Bell Tree.

Geographic Distribution.

Rich wooded slopes and banks of streams; mountains of West Virginia to southern Illinois, and southward to middle Florida, central Alabama and Mississippi, and through Arkansas to western Louisiana and eastern Texas; most abundant in the elevated Appalachian region, and of its largest size on the western slopes of the high mountains of North Carolina and Tennessee.

Distribution in West Virginia.—Rare. Grows plentifully along the Great Kanawha and New rivers from the eastern end of Kanawha county through Fayette and into Summers county, reaching in West Virginia the northern limit of

its distribution. Farther south the tree grows to a large size (3 feet), but in this State none were observed more than 8 inches in diameter.

FRAXINUS NIGRA, Marsh. Black Ash.

Geographic Distribution.

Deep cold swamps and the low banks of streams and lakes; southern Newfoundland and the northern shores of the Gulf of St. Lawrence to Lake Winnipeg, and southward to New Castle county, Delaware, the mountains of Virginia, southern Illinois, central Missouri, and southwestern Arkansas.

Distribution in West Virginia.—Infrequent. Growing in damp ground. Found at the following places:

Fayette: one or two trees near Kanawha Falls.

Preston: few trees in glade at Cranesville.

Tucker: rather common in Canaan Valley.

Reported by Millsbaugh from Randolph, Webster, Summers, Monongalia, and Wirt counties.

Wood.—Soft, coarse-grained, durable.

Uses.—Wood used for interior finish, furniture, cooperage, and baskets.

FRAXINUS AMERICANA, L. White Ash.

Geographic Distribution.

Common in rich rather moist soil on low hills, and in the neighborhood of streams; Nova Scotia, New Brunswick, and southern Ontario to northern Minnesota, southward to northern Florida, central Alabama and Mississippi, and westward to eastern Nebraska and Kansas, the Indian Territory, and the valley of the Trinity river, Texas; of its largest size on the bottom-lands of the basin of the lower Ohio river; southward and west of the Mississippi river less common and of smaller size.

Distribution in West Virginia.—Found throughout the State but infrequent in some of the counties bordering the Ohio river in the northwest and in the eastern Panhandle.

Wood.—Heavy, strong, close-grained, light-colored.

Uses.—A valuable wood for interior finish, furniture, agricultural machinery, handles, vehicles, etc.

UNDISTURBED WOODS ON A TRIBUTARY OF THE BLACKWATER RIVER.

FRAXINUS PENNSYLVANICA, var. LANCEOLATA.
Sarg. Green Ash.

Geographic Distribution.

Banks of streams; shore of lake Champlain through the Appalachian region to western Florida, and west to the valley of the Saskatchewan, the valley of the Colorado river, Texas, the eastern range of the Rocky Mountains, the Wasatch Range, Utah, and the mountains of eastern and northern Arizona, comparatively rare east of the Alleghany mountains; most abundant in the Mississippi basin, often covering the banks of streams flowing east from the Rocky mountains, and westward only in elevated canons; in the region east of the Mississippi river appearing distinct, but westward connected with the red ash by intermediate forms, equally referable to either tree.

Distribution in West Virginia.—Frequent. Found in Upshur, Randolph, Kanawha, Putnam, and several other counties West of the Alleghanies. Infrequent in the east.

CHIONANTHUS VIRGINICA, L. Fringe-tree. Old Man's
Beard.

Geographic Distribution.

Banks of streams in moist soil; Lancaster and Chester counties, southern Pennsylvania, to the shores of Tampa Bay, Florida, and through the Gulf states to southern Arkansas and the valley of the Brazos river, Texas.

Distribution in West Virginia.—Rare. Found near Peterstown, Monroe county. Said to grow sparingly in Summers, Clay, and Putnam counties.

Reported by Millsbaugh from Jackson, Fayette, and Monongalia.

• *Wood.*—Hard, heavy, close-grained, light brown.

Uses.—Bark used sometimes in medicine. Often planted as a shade tree.

VIBURNUM LENTAGO, L. Sheepberry. Nannyberry.

Geographic Distribution.

Rocky hillsides, along the borders of forests, or near the banks of streams and the margins of swamps, in moist soil; valley of the Riviere du Loup, province of Quebec, to Saskatchewan, and southward through the northern states to

southern Indiana, and along the Alleghany mountains to northern Georgia, and to eastern Kansas and Nebraska, South Dakota and the Big Horn Mountains to Wyoming; in northern New England frequently springing up in fence-rows and along the margins of roadsides.

Distribution in West Virginia.—Infrequent. Found only in the two following counties:

Tucker: in Canaan Valley.

Grant: on Abram creek.

Reported by Millspaugh from Point mountain, Randolph county.

VIBURNUM PRUNIFOLIUM, L. Black Haw. Stag Bush.

Geographic Distribution.

Dry rocky hillsides, and fence-rows and the sides of roads; Fairfield county, Connecticut, and the valley of the lower Hudson river, New York, southward along the Alleghanies to northern Georgia, and westward to southern Missouri.

Distribution in West Virginia.—A common small tree. Found in Fayette, Gilmer, Grant, Hampshire, Lewis, Mingo, Monongalia, Summers, Tyler, Upshur, Webster, and Wetzel counties. Doubtless occurs in most of the other counties.

LIST OF NATIVE SHRUBS AND SHRUBBY VINES.

Taxus canadensis, Marsh. American Yew. Ground Hemlock.

A rare red-berried evergreen. Randolph: Gladys; Poca-hontas: Cranberry Glades and Winterburn; Grant: Greenland Gap; Preston: Cranesville; Raleigh: Piney river.

Salix cordata, Muhl. Heart-leaved Willow.

Monongalia: Aarons run, near Morgantown.

Salix sericea, Marsh. Silky Willow.

Monongalia: Deckers creek.

Myrica asplenifolia, L. Sweet Fern.

Hampshire. Cacapon creek. Rare.

Corylus americana, Walt. Hazelnut.

A common shrub.

Corylus rostrata, Ait. Beaked Hazelnut.

Pocahontas: Cranberry mountain; Mercer: Bluestone river; Hampshire: Little Cacapon.

Alnus rugosa, (Du Roi) Spreng. Smooth Alder.

Abundant along streams.

Alnus incana, (L.) Moench. Hoary Alder (?). Rare. Pocahontas: Cranberry Glades.

Pyrularia pubera, Michx. Oil-nut, Buffalo-nut. "Colic-nut."

Common in many sections.

Phoradendron flavescens, (Pursh) Nutt. American Mistletoe.

Evergreen parasite. On trees along southern rivers.

Aristolochia macrophylla, Lam. Pipe Vine. Dutchman's Pipe.

Woody vine. Frequent in rich mountain forests.

Zanthorhiza apiifolia, L'Her. Shrub Yellow-root.

Small shrub on banks of streams. Upshur: near Buckhannon; Webster: on Gauley river near Bolair.

Berberis Canadensis, Mill. American Barberry.

Southern part of the State. Mercer: near Spanishburg.

Benzoin aestivale, (L.) Nees. Spice-bush. Benjamin-bush.

Abundant shrub.

Hydrangea arborescens, L. Wild Hydrangea.

Abundant throughout the State.

Ribes Cynosbati, L. Prickly Gooseberry.

Common in rocky woods.

Ribes rotundifolium, Michx. Eastern Wild Gooseberry.

Pendleton: Spruce mountain.

Ribes prostratum, L'Her. Fetid Currant.

Rare. Pendleton: Spruce knob.

Physocarpus opulifolius, (L.) Maxim. Nine-bark.

Common shrub.

Spiraea salicifolia, L. Meadow-sweet.

Pocahontas: Cranberry Glades; Randolph: Elkins.

Spiraea tomentosa, L. Hard-hack, Steeple-bush.

Infrequent. Randolph: Elkins; Pocahontas: Seebert.

Pyrus melanocarpa, (Michx.) Willd. Black Chokeberry.

Frequent, in many sections.

Amelanchier oligocarpa, (Michx.) Roem. (?) Oblong-fruited
Juneberry.

Rare. Pocahontas: Cranberry Glades.

Rosa carolina, L. Swamp Rose.

Common in marshy places.

Rosa humilis, Marsh. Low or Pasture Rose.

Frequent in dry fields.

Prunus Virginiana, L. Choke Cherry.

Rare. Pocahontas: Cranberry Glades.

Zanthoxylum americanum, Mill. Northern Prickly Ash.

Monongalia: Lick run.

Rhus copallina, L. Dwarf Sumach.

Frequent.

Rhus vernix, L. Poison Dogwood. Poison Sumach.

Rare. Randolph: near Elkins; Webster: near Cowen.

Rhus glabra, L. Smooth Sumach.

Common throughout the State.

Rhus canadensis, Marsh. Fragrant Sumach.

Infrequent. Hampshire: Little Cacapon.

Rhus Toxicodendron var. *radicans*, L. Torr. Poison Ivy, Poison
Oak.

Abundant throughout the State.

Ilex monticola, Gray. Large-leaved Holly.

A rather common shrub.

Ilex verticillata, Gray. Black Alder. Winterberry.

Abundant in low grounds along rivers and in glades.

Nemopanthus mucronata, (L.) Trel. Wild or Mountain Holly.

Rare. Pendleton: Spruce knob; Preston: Cranesville;
Pocahontas: head of Greenbrier river.

Evonymus atropurpureus, Jacq. Burning Bush, Wahoo.

Boone: near Madison; Monongalia: near Morgantown, Up-
shur: near Buckhannon.

Evonymus americanus, L. Strawberry Bush.

A common shrub.

Celastrus scandens, L. Waxwork. Climbing Bitter-sweet.

Frequent along streams and on dry hills.

Staphylea triloba, L. American Bladder Nut.

Not common. Monongalia: near Morgantown; Wayne: near Wayne; Lewis: near Weston; Greenbrier: near Ronceverte.

Rhamnus lanceolata, Pursh. Lance-leaved Buckthorn.

Rare. Hampshire: Little Cacapon.

Rhamnus alnifolia, L'Her. Dwarf Alder.

Rare. Pocahontas: head east Fork of Greenbrier river.

Ceanothus americanus, L. New Jersey Tea.

Common on dry gravelly ground.

Vitis labrusca, L. Northern Fox Grape.

Infrequent. Upshur: French creek; Monroe: Sinks Grove.

Vitis aestivalis, Michx. Summer Grape. Frost Grape.

Abundant in most sections.

Vitis cordifolia, Michx. Chicken Grape. Pigeon Grape.

A common grape.

Hypericum prolificum, L. Shrubby St. John's-wort.

Plentiful in glady regions.

Hypericum densiflorum, Pursh. St. John's-wort. Glades.

Dirca palustris, L. Leatherwood. Wicopy.

Infrequent. Webster: near Webster Springs; Randolph: Tygarts Valley river near Valley Head; Pocahontas: on Greenbrier river.

Cornus canadensis, L. Dwarf Cornel. Bunchberry.

A small shrubby plant. Rare. Pendleton: summit Spruce knob; Randolph: near Osceola.

Cornus Amomum, Mill. Silky Cornel. Kinnikinnik.

Frequent along streams.

Cornus paniculata, L'Her. Panicle Dogwood.

Rare. Grant: on Abram creek.

Rhododendron maximum, L. Great Laurel. Rose Bay.

An abundant shrub, growing in thickets in many parts of the State.

Rhododendron viscosum (L.) Torr. Clammy Azalea. White Swamp Honeysuckle.

Frequent along mountain streams.

Rhododendron canescens (Michx.) G. Don. Mountain Azalea.

Rare. Pendleton: summit Spruce knob.

Rhododendron nudiflorum, (L.) Torr. Purple Azalea. Pinxter Flower.

Abundant in many sections.

Rhododendron calendulaceum, (Michx.) Torr. Flame Azalea.

Common in many sections.

Menziesia pilosa, (Michx.) Pers. Alleghany Menziesia.

Not common. Pendleton: Spruce knob; Randolph: Point mountain.

Kalmia latifolia, L. Mountain Laurel. "Ivy."

Abundant in thickets.

Andromeda glaucophylla, Link. (?) Bog Rosemary.

Rare. Pocahontas: Cranberry Glades. Plants not in bloom or fruit when collected.

Andromeda floribunda, Pursh. Mountain Fetter-bush.

Infrequent. Pocahontas: Greenbank. (Col. G. L. Swank.)

Lyonia ligustrina, (L.) DC. Male Berry.

Not common. Upshur: near Buckhannon; Webster: near Cowen.

Gaylussacia baccata, (Wang.) C. Koch. Black Huckleberry.

Abundant throughout the State.

Vaccinium staminium, L. Deerberry. Squaw Huckleberry. "Buckberry".

Abundant on dry ground.

Vaccinium Pennsylvanicum var. *nigrum*, Wood. Low Black Blueberry.

Common in many localities. Pendleton: Spruce mountain; Monongalia: near Morgantown.

Vaccinium canadense, Kalm. Sour-top. Velvet-leaf Blueberry.

Rare. Tucker: Canaan Valley; Preston: Cranesville.

Vaccinium vacillans, Kalm. Late Low Blueberry.

An abundant species.

Vaccinium corymbosum, L. High or Swamp Blueberry.

Common in some localities.

Vaccinium erythrocarpum, Michx. Southern Mountain Cranberry.

Rare. Pendleton: summit Spruce knob; Randolph: Shavers Mt.

Vaccinium Oxycoccus, L. Small Cranberry.

In glades. Pocahontas and Tucker.

Vaccinium macrocarpon. Ait. Large or American Cranberry.

In glades. Pocahontas and Webster.

Cephalanthus occidentalis, L. Button Bush.

Found in Greenbrier, Hampshire, Jefferson, Monongalia,
and Wetzel. Doubless occurs in many other sections.

Diervilla Lonicera, Mill. Bush Honeysuckle.

Rare. Pendleton: Spruce mountain.

Lonicera canadensis, Marsh. American Fly Honeysuckle.

Rare. Pendleton: Spruce knob.

Viburnum alnifolium, Marsh. Hobble-bush. Moosewood. "Hobble-rod."

Abundant in mountain regions.

Virburnum Opulus var. *Americanum*, (Mill.) Ait. Cranberry-tree. High Bush Cranberry. Infrequent. Tucker: Canaan Valley.

Viburnum acerifolium, L. Dockmackie. Arrow-wood.

A common shrub.

Virburnum dentatum, L. Arrow-wood.

Infrequent. Pocahontas: Cranberry Glades; Randolph: near Elkins.

Viburnum cassinoides, L. Withe-rod. Wild Raisin.

Not common. Webster: Gauley river; Pendleton: Big Run; Monongalia: Deckers creek.

Sambucus canadensis, L. Common Elder.

Abundant throughout the State.

Sambucus racemosa, L. Red-berried Elder.

Frequent in rocky woods.

Additional Trees Listed in "Flora of West Virginia," Bulletin No. 24, West Va. Agricultural Experiment Station, by Dr. C. F. Millspaugh.

Pinus Taeda, L. Loblolly Pine. Wood, Mineral, Hampshire, Hardy.

Abies balsamea, Mill. Balsam Fir. Randolph.

Juniperus communis, L. Juniper. Wood, Mineral, Fayette.

Hicoria microcarpa, (Nutt.) Britt. Small-fruited Hickory. Fayette.

Populus monilifera, Ait. Cottonwood. Ohio, Mason.

Salix amygdaloides, And. Peach-leaved Willow. Fayette.

Salix discolor, Muhl. Shining Willow. Ohio.

Betula populifolia, Marsh. White Birch. Gilmer, Randolph.

Ulmus racemosa, Thomas. Corky Elm. Monroe, Greenbrier.

Pyrus angustifolia, Ait. Narrow-leaved Crab. Preston, Webster, Nicholas.

Rhamnus Caroliniana, Walt. Indian Cherry. McDowell.

Crataegus apiifolia, Michx. (*C. Marshallii*, Eggleston) Thorn. Mercer.

Crataegus coccinea, L. Thorn. Various stations.

Crataegus mollis, (T. & G.) Sarg. Thorn. Mercer.

Crataegus tomentosa, L. Thorn. Various stations.

Gymnocladus dioicus, (L.) Koch. Kentucky Coffee Tree. Randolph, Webster.

Aesculus Pavia, L. Red Buckeye. McDowell.

Additional Shrubs Listed in Millspaugh's "Flora of West Virginia."

Robinia hispida, L. Bristly or Rose Acacia. Monongalia, Preston, Summers.

Spiraea betulaeifolia, Pall. Birch-leaved Meadow-sweet. Webster, Hardy.

Spiraea Virginiana, Britt. West Virginia Meadow-sweet. Monongalia.

Cornus circinata, L'Her. Round-leaved Dogwood. Upshur.

Ptelea trifoliata, L. Water-ash. Hop-tree. Jefferson, Hancock, Brooke, Summers.

Ilex mollis, Gray. Holly. Fayette.

Rhamnus Caroliniana, Walt. Indian Cherry. McDowell.

Vitis riparia, Michx. Grape. Randolph, Summers, Jefferson.

Vitis rupestris, Scheele. Sand Grape. Fayette.

Vitis rotundifolia, Michx. Muscadine. Randolph, Fayette, Summers.

PULP MILL AT DAVIS, TUCKER COUNTY.

Butneria florida, (L) Kear. Randolph, Webster, Fayette, Summers.

Butneria laevigatus (Willd.) McDowell.

Kalmia angustifolia, L. Sheep Laurel. Lamb-kill. Calhoun, Upshur, Randolph, Nicholas, Hardy.

Rhododendron arborescens, Torr. Smooth Azalea. Fayette, Webster.

Rhododendron Catawbiense, Michx. Lilac-colored Laurel. Pendleton, Fayette, Greenbrier, Summers.

Clethra acuminata, Michx. White Alder. Fayette.

Tecoma radicans, (L.) Juss. Trumpet-creeper. Monongalia, Marion, Fayette, etc.

Salix humilis, Marsh. Prairie Willow. Webster, Preston.

CHAPTER IX.

WOOD MANUFACTURING INDUSTRIES.

Reports obtained from about one-half of the wood-working establishments in West Virginia furnish the only data available at present for the general information herein given; and inasmuch as many of the reports were incomplete and for the reason that some of the largest concerns in the State could not be heard from nor visited, the estimates given will be valuable chiefly in showing the approximate extent of the several departments of this industry and in paving the way, in some degree, for a more careful future study. The average prices of the various kinds of lumber given cannot be relied on in many cases as this item was generally omitted by the reporting firms. The percentages of the different kinds of wood produced within and without the State must be omitted entirely for want of accurate information. It can safely be stated, however, that at least 75 per cent of all manufactured woods come from the forests of West Virginia.

The quantity of rough lumber converted into finished products by the West Virginia wood-working mills each year is probably not far from 330 million feet, board measure. The 28 kinds of wood named in the following table, with the approximate quantity manufactured of each, include all that were reported, though many others doubtless should have been included. It was not possible to separate the different species of oaks, maples, birches, ashes, and hickories, and under the head of yellow pine are included at least two other nearly related species of pines which grow in the states farther south.

Table No. I.—Kinds and Quantity of Wood Manufactured.

Kind of Wood.	Approximate number board feet manufactured.
Oak	95,775,000
Poplar	65,390,000
Hemlock	45,080,000
Spruce	32,600,000
Chestnut	17,880,000
Yellow pine	13,910,000
Beech	12,021,000
Maple	10,604,000
Hickory	8,420,000
White pine	8,250,000
Birch	7,375,000
Basswood	7,090,000
White elm	3,700,000
Ash	2,288,000
Red gum	1,950,000
Cypress	505,000
Cherry	455,000
Black gum	301,000
Buckeye	240,000
Cucumber	200,000
Black walnut	179,500
Locust	100,000
Scrub pine	90,000
Sycamore	80,000
Butternut	52,000
Cedar	30,000
Willow	25,000
Mahogany	6,500
Total	334,597,000

Industries.

The wood-working industries are grouped for convenience under the following heads, viz: (1) Interior and Exterior Finish and Fixtures, (2) Furniture, (3) Vehicles and Vehicle Stock, (4) Handles, (5) Mine and Log Cars, (6) Boxes, Crates and Cooperage, and (7) Miscellaneous.

Interior and Exterior Finish and Fixtures.

The industries included under the head of Interior and Exterior Finish and Fixtures number almost 200, and manufacture each year approximately 240 million feet of the finished materials that are used in the construction of houses. These materials include flooring, ceiling, siding, mouldings, stair work, columns,

doors, sash, frames, cornice, office, store and bank fixtures, etc. A very large quantity of finishing materials, already dressed, is shipped in from other states and sold to consumers in West Virginia. The table below does not include any materials manufactured outside of the State.

Table No. 2.—Kinds, Quantity, and Price of Lumber Used in Interior and Exterior Finish and Fixtures.

Kind of Wood.	Approximate Number of feet B. M. manufactured annually.	Approximate average price per 1000 ft. B. M. at factory.
Oak	80,000,000	\$28.00
Yellow poplar	54,000,000	32.00
Hemlock	38,000,000	16.00
Spruce	26,000,000	20.00
Chestnut	12,000,000	26.00
Maple	6,000,000	22.00
Beech	5,100,000	20.00
White Pine	6,000,000	31.00
Birch	3,500,000	31.00
Yellow pine	2,500,000	27.00
Ash	2,000,000	28.00
Basswood	3,500,000	33.00
Cherry	450,000	60.00
Hickory	250,000	38.00
Cucumber	200,000	25.00
Buckeye	200,000	.....
Black walnut	100,000	85.00
Sycamore	80,000	.....
Black gum	80,000	.....
Cedar	30,000	.....
Cypress	5,000	.....
Mahogany	5,000	150.00
Total	240,000,000	

Furniture.

According to reports received from 10 manufacturers, there are 13 species used and a quantity of a little more than 8½ million feet of lumber made annually into furniture of various kinds. Kitchen, dining room, bed room, parlor, and office furniture, as well as church and school house furniture are included in the list of manufactured articles.

Table No. 3.—Kinds, Quantity, and Price of Lumber Used in Furniture Manufacture.

Kind of Wood.	Approximate Number of feet B. M. manufactured annually.	Approximate average price per 1000 ft. B. M. at factory.
Oak	7,000,000	\$35.00
Poplar	800,000	34.00
Maple	350,000	20.00
Chestnut	230,000	19.00
Yellow pine	160,000	.....
Birch	75,000	22.00
Beech	21,000	24.00
Black gum	16,000	.....
Ash	8,000	25.00
Cherry	5,000	.....
Black walnut	4,500	30.00
Butternut	2,000	25.00
Mahogany	1,500	165.00
Total	8,673,000	

Vehicles and Vehicle Stock.

Six kinds of wood are reported from 10 establishments that manufacture vehicles or parts of vehicles. The table below shows that 5 million feet of lumber are used annually in this way. Hickory, used for spokes and rims leads in quantity; oak for running gear comes next, and birch for hubs next. The relatively large quantity of birch is manufactured into hubs by a single factory at Richwood, Nicholas county. Farm and team wagons, trucks, drays, dump carts, dumping wagons, fruit and dairy wagons, hickory fellows and spokes for heavy wagons, buggies and automobiles, and hubs for all manner of vehicles are reported.

Table No. 4.—Kinds, Quantity and Price of Lumber Used in the Manufacture of Vehicles and Vehicle Stock.

Kind of Wood.	Approximate Number of feet B. M. manufactured annually.	Approximate average price per 1000 ft. B. M. at factory.
Hickory	2,125,000	\$30.00
Oak	1,325,000	25.00
Birch	1,100,000	15.00
Black gum	200,000	35.00
Ash	100,000	30.00
Yellow pine	150,000	20.00
Total	5,000,000	

Handles.

Several large factories are engaged in the manufacture of hickory, maple, beech, and birch into handles of many kinds. These include handles for axes, sledges, picks, hammers, cant hooks, brooms, etc. One company employs about 100 hands and uses annually from 6 to 8 thousand cords of hickory. The number of establishments reporting is 6 and the quantity of wood used annually, as shown below, is 9,540,000 feet.

Table No. 5.—Kinds, Quantity, and Price of Lumber Used in the Manufacture of Handles.

Kind of Wood.	Approximate Number of feet B. M. manufactured annually.	Approximate average price per 1000 ft. B. M. at factory.
Hickory	6,040,000	\$20.00
Maple	1,500,000	12.00
Beech	1,500,000	12.00
Birch	500,000	12.00
Total	9,540,000	

Mine and Log Cars.

Six reporting companies are engaged in the manufacture of mine and log cars. The three woods used are yellow pine, oak and ash; and the reported amount is 5,855,000 feet. The 3 million feet or over of yellow pine is used in the construction of standard gauge cars by a single company in Huntington.

Table No. 6.—Kinds, Quantity and Price of Lumber Used in the Manufacture of Mine and Log Cars.

Kind of Wood.	Approximate Number of feet B. M. manufactured annually.	Approximate average price per 1000 ft. B. M. at factory.
Yellow pine	3,250,000	\$24.00
Oak	2,600,000	21.00
Ash	5,000	22.00
Total	5,855,000	

Boxes, Crates and Cooperage.

The 48 million feet used annually in making boxes, crates and barrels, as given below, may be far from the correct figure as a large number of establishments that manufacture these articles were not heard from and the estimate based on the reports received is approximate. Great care must necessarily be exercised in making a complete study under this head for the reason that some companies complete the manufacture of articles from the log to the finished product, some manufacture only the shooks which are sold to users within or outside the State, and others—as in the case of a number of glass factories—buy the shooks from various sources and complete the manufacture. Fourteen species are reported, and probably nearly as many more are used to some extent.

Table No. 7.—Kinds, Quantity and Price of Lumber Used in the Manufacture of Boxes, Crates and Cooperage.

Kind of Wood.	Approximate Number of feet B. M. manufactured annually.	Approximate average price per 1000 ft. B. M. at factory.
Yellow pine	7,000,000	\$16.00
Oak	3,500,000	11.00
Poplar	4,300,000	19.00
Hemlock	5,400,000	12.00
Spruce	6,000,000	.....
Chestnut	5,500,000	13.00
White elm	3,700,000	.....
Beech	2,800,000	.....
Basswood	2,300,000	.....
Birch	2,100,000	.....
Maple	2,000,000	.....
White pine	1,900,000	18.00
Scrub pine	90,000	.....
Total	48,290,000	

Miscellaneous.

Under the head of miscellaneous are included a number of wood-working industries which, in a more thorough study, might be classified into several groups according to the similarity of their manufactured products. The table below shows that over 17 million feet of lumber is used in the manufacture of the wood en articles named.

Table No. 8.—Miscellaneous Wooden Articles and the Kinds and Quantity of Lumber Used in Their Manufacture.

Manufactured Article.	Kind of Wood.	Approximate No. of ft. B. M. Manufactured An.
Veneer	Poplar	2,800,000
	Oak	200,000
	Walnut	75,000
Excelsior	Basswood	485,000
	White walnut	50,000
	Poplar	40,000
	Buckeye	40,000
	Willow	25,000
Pins and Brackets	Locust	100,000
	Ash	75,000
Grain Cradles	Maple	5,000
	Hickory	5,000
Bungs and Plugs	Poplar	2,850,000
	White pine	100,000
	Oak	50,000
Oil and Gas well Rigs	Hemlock	580,000
	Oak	200,000
	Pine	600,000
	Maple	23,000
	Cypress	500,000
Tanks	White pine	250,000
	Yellow pine	100,000
Wheelbarrows, Patterns, Flasks, Cants, Arms, Drill- ing Machines, Sand Reels, etc.	Hemlock	800,000
	Oak	400,000
	Yellow pine	100,000
	Spruce	50,000
	White pine	50,000
	Maple	25,000
	Black gum	5,000
Wood fiber	Basswood	5,000
	Maple	800
Violins	Spruce	200
	Beech	2,600,000
Clothespins	Maple	600,000
Butter trays	Basswood	600,000
Picture Frames	Oak	300,000
	Red gum	250,000
	Poplar	200,000
	Yellow pine	50,000
	Chestnut	50,000
	Poplar	100,000
	Basswood	100,000
Pails, Buckets, Tubs	Ash	50,000
	Birch	150,000
	Maple	100,000
	Poplar	300,000
	Basswood	100,000
	Spruce	500,000
	Hemlock	300,000
Refrigerators	Oak	200,000
	Chestnut	100,000
Total.....		17,239,000

PULP WOOD AT DAVIS, TUCKER COUNTY.

List of Wooden Articles Manufactured in West Virginia.

Acid tanks	Dairy wagons	Porch swings
Adz handles	Dining tables	Pottery crates
Automobile spokes	Doors	Preserve boxes
Axe handles	Drays	Pulpits
Balusters	Dressers	Pumps
Barrels	Drilling machines	Refrigerators
Barrel staves	Drug boxes	Rockers
Barrel heads	Dry goods boxes	Rollers
Barrel hoops	Dump carts	Sand reels
Bar fixtures	Excelsior	Sash
Base boards	Flasks	School seats
Bedsteads	Flooring	Shelving
Beer boxes	Fruit wagons	Ship pins
Blinds	Grain cradles	Shook
Boats	Hammer handles	Sideboards
Bungs	Hatchet handles	Siding
Broom handles	Insulator pins	Sledge handles
Butter trays	Ketchup buckets	Stair work
Cabinets	Kitchen cupboards	Store fixtures
Candy buckets	Lard tubs	Tin plate boxes
Cants	Lantern boxes	Trucks
Canthook handles	Lattice	Violins
Carriage rims	Log cars	Wagon bodies
Carriage hubs	Mantels	Wagon hubs
Casing	Mine cars	Wagon spokes
Cases	Mouldings	Wainscoting
Ceiling	Office fixtures	Wardrobes
Chairs	Office desks	Washstands
Church pulpits	Patterns	Water tanks
Church seats	Packing boxes	Wheelbarrows
Clay cars	Pickets	Window frames
Clothespins	Pickhandles	Window glass boxes
Coal cars	Picture frames	Wood fiber
Cocoanut pails	Plugs	Whip handles
Cornice	Pop boxes	
Crates	Porch columns	

LIST OF WOOD-MANUFACTURING ESTABLISHMENTS.

Interior and Exterior Finish and Fixtures.

Belington Planing Mill Co.....	Belington,	Barbour Co.
J. W. Ware.....	Belington,	Barbour Co.
H. P. Thorn.....	Martinsburg,	Berkeley Co.
Lee M. Bender.....	Martinsburg,	Berkeley Co.
Danville Improvement Co.....	Danville,	Boone Co.
Howell & Lewis.....	Madison,	Boone Co.
Gassaway Lumber Co.....	Gassaway,	Braxton Co.
Davis & Tucker.....	Sutton,	Braxton Co.
Central Lumber & Planing Mill Co....	Burnsville,	Braxton Co.
Bickerstaff & Coleman.....	Wellsburg,	Brooke Co.
Sliger Bros.....	Huntington,	Cabell Co.

T. W. Wilson.....	Guyandotte,	Cabell Co.
Samuel Beswick Planing Mill Co.....	Huntington,	Cabell Co.
The D. L. Morrow Planing Mill Co.....	Huntington,	Cabell Co.
C. M. Callaway Lumber Co.....	Huntington,	Cabell Co.
Ackerman Lumber Co.....	Huntington,	Cabell Co.
Licking River Lumber Co.....	Huntington,	Cabell Co.
Thornburg Manufacturing Co.....	Huntington,	Cabell Co.
S. M. Ward.....	Grantsville,	Calhoun Co.
Huffman Mill Co.....	Grantsville,	Calhoun Co.
W. H. Jackson.....	Big Springs,	Calhoun Co.
Tracy Poling & Brothers.....	Russett,	Calhoun Co.
C. Wigner.....	Grantsville,	Calhoun Co.
Morton Bros.....	Lizemore,	Clay Co.
Elkhurst Planing Mill Co.....	Yankeedam,	Clay Co.
Samuel Thomas.....	Clay,	Clay Co.
West Union Lumber Co.....	West Union,	Doddridge Co.
Smithburg Lumber Co.....	Smithton,	Doddridge Co.
Sewell Lumber Co.....	Landisburg,	Fayette Co.
Hogg Lumber Co.....	Glenjean,	Fayette Co.
Stewart Colliery Co.....	Stewart,	Fayette Co.
Geo. Fling.....	Roseville,	Gilmer Co.
Noah L. Wells.....	Glenville,	Gilmer Co.
Glenville Planing Mill Co.....	Glenville,	Gilmer Co.
Karl Hardman & Bro.....	Tannerville,	Gilmer Co.
John West & Son.....	Rosedale,	Gilmer Co.
Jennings Stalnaker.....	Letter Gap,	Gilmer Co.
Homer Woofter.....	Newberne,	Gilmer Co.
Cool & Co.....	Cedarville,	Gilmer Co.
A. N. Bailey.....	Cedarville,	Gilmer Co.
Parsons Pulp & Lumber Co.....	Dobbin,	Grant Co.
A. A. Price.....	Argo,	Greenbrier Co.
St. Lawrence Boom & Mfg. Co.....	Ronceverte,	Greenbrier Co.
Ronceverte Lumber Co.....	Ronceverte,	Greenbrier Co.
Jones Bros.....	Meadow Bluff	Greenbrier Co.
A. H. Lusher.....	Grassy Mead's,	Greenbrier Co.
A. E. Huddleston.....	White Sul. Spg	Greenbrier Co.
Nelson White.....	Organ Cave,	Greenbrier Co.
Clower Bros.....	Moorefield,	Hardy Co.
Wm. Barney.....	Wardensville,	Hardy Co.
Geo. B. Hulver.....	McCauley,	Hardy Co.
Snider Bros.....	Mathias,	Hardy Co.
Richard Construction Co.....	Clarksburg,	Harrison Co.
Clarksburg Lumber & Planing Mill Co.....	Clarksburg,	Harrison Co.
Parr Lumber Co.....	Clarksburg,	Harrison Co.
H. C. Progler & Son.....	Ripley,	Jackson Co.
T. J. Sayre.....	Evans,	Jackson Co.
Wm. Phillips Sons.....	Charleston,	Jefferson Co.
American Column & Lumber Co.....	St. Albans,	Kanawha Co.
Mohler Lumber Co.....	Lock Seven,	Kanawha Co.
The Charleston Lumber Co.....	Charleston,	Kanawha Co.
Kanawha Planing Mill Co.....	Charleston,	Kanawha Co.
F. Lory & Sons.....	Charleston,	Kanawha Co.
Morgan Lumber Co.....	Charleston,	Kanawha Co.
John F. Blessing.....	Charleston,	Kanawha Co.
Weston Lumber Co.....	Weston,	Lewis Co.
The Sun Lumber Co.....	Weston,	Lewis Co.
The Simmons Planing Mill Co.....	Weston,	Lewis Co.
East Weston Planing Mill Co.....	Weston,	Lewis Co.

Davis Lumber Co.....	Jane Lew,	Lewis Co.
B. Johnson & Son.....	Leet,	Lincoln Co.
W. W. Baker.....	Hamlin,	Lincoln Co.
W. F. Black & Son.....	Myra,	Lincoln Co.
Dry Fork Planing Mill Co.....	War,	McDowell Co.
United States Coal & Coke Co.....	Gary,	McDowell Co.
Marion Planing Mill Co.....	Fairmont,	Marion Co.
Dickerson Building Supply Co.....	Fairmont,	Marion Co.
J. A. Hess & Co.....	Rivesville,	Marion Co.
D. O. Haines & Co.....	Amos,	Marion Co.
Jos. Duitch.....	Farmington,	Marion Co.
Gatts & Gray Lumber Co.....	Moundsville,	Marshall Co.
Herman Hess.....	Moundsville,	Marshall Co.
F. T. Moore.....	Moundsville,	Marshall Co.
Point Pleasant Planing Mill Co.....	Heights,	Mason Co.
Bluestone Land & Lumber Co.....	Gardner,	Mercer Co.
The Princeton Brick & Lumber Co....	Princeton,	Mercer Co.
E. C. Epling.....	Flat Top,	Mercer Co.
L. B. Farley.....	Spanishburg,	Mercer Co.
L. A. Foley.....	Giatto,	Mercer Co.
Virginia Supply Co.....	Princeton,	Mercer Co.
V. M. Greyson.....	Antioch,	Mineral Co.
W. A. Liller.....	Keyser,	Mineral Co.
Prendergast Lumber Co.....	Rapp,	Mingo Co.
W. A. Harris Lumber Co.....	Williamson,	Mingo Co.
Matewan Planing Mill Co.....	Matewan,	Mingo Co.
Mont Steel.....	Williamson,	Mingo Co.
Athens Lumber Co.....	Morgantown,	Monongalia Co
General Wood-working Co.....	Morgantown,	Monongalia Co
Ross T. Shriver.....	Morgantown,	Monongalia Co
E. M. Davis.....	Union,	Monroe Co.
John A. Campbell.....	Union,	Monroe Co.
Robert Arnett.....	Lillydale,	Monroe Co.
Frank N. Mann.....	Alderson,	Monroe Co.
A. W. Thomas.....	Peterstown,	Monroe Co.
Anderson Smith.....	Lillydale,	Monroe Co.
J. S. Broyles.....	Wikel,	Monroe Co.
Preston Ballard.....	Hunters Spg.	Monroe Co.
John C. Miller.....	Red Sul. Spg.	Monroe Co.
Humphreys & Humphreys.....	Cashmere,	Monroe Co.
Skaggs & Dunn.....	Cashmere,	Monroe Co.
William Crossfield.....	Berkeley Spg.	Morgan Co.
Raymond Hunter.....	Berkeley Spg.	Morgan Co.
Cherry River Boom & Lumber Co.....	Richwood,	Nicholas Co.
E. R. McCutcheon.....	Gilboa,	Nicholas Co.
Jacob Moses.....	Pool,	Nicholas Co.
McClung & Jones.....	Mt. Lookout	Nicholas Co.
Daniel Brock.....	Summersville,	Nicholas Co.
Henry Campbell.....	Summersville,	Nicholas Co.
The W. W. Wood Co.....	Wheeling,	Ohio Co.
J. W. Betz & Sons Co.....	Wheeling,	Ohio Co.
Wilson Mill & Lumber Co.....	Wheeling,	Ohio Co.
A. C. Fisher & Son.....	Wheeling,	Ohio Co.
Shoepfner & Sons.....	Wheeling,	Ohio Co.
Klieves Lumber Co.....	Wheeling,	Ohio Co.
C. E. Lee.....	Franklin,	Pendleton Co.
Riggs & Hissom.....	St. Mary's,	Pleasants Co.
Pocahontas Lumber Co.....	Burner,	Pocahontas Co.

Flint, Erving & Stoner.....	Dunlevie,	Pocahontas Co
James Freeland.....	Terra Alta,	Preston Co.
Allen Forman.....	Amboy,	Preston Co.
Fike Bros.....	Egion,	Preston Co.
John D. Evans.....	Clifton Mills,	Preston Co.
Bruceton Milling Co.....	Bruceton Mills,	Preston Co.
J. M. Crane & Co.....	Kingwood,	Preston Co.
Geo. Miller.....	Tunnelton,	Preston Co.
Allinder & Raynes.....	Buffalo,	Putnam Co.
Blue Jay Lumber Co.....	Blue Jay,	Raleigh Co.
J. A. Lilly.....	Glen Morgan,	Raleigh Co.
Beckley Planing Mill Co.....	Beckley,	Raleigh Co.
C. M. Callaway.....	Beckley,	Raleigh Co.
H. H. Harper.....	Harper,	Raleigh Co.
Elkins Pail & Lumber Co.....	Elkins,	Randolph Co.
Tygart River Lumber Co.....	Millcreek,	Randolph Co.
Glady Fork Lumber Co.....	Glady,	Randolph Co.
Parsons Pulp & Lumber Co.....	Horton,	Randolph Co.
Elkins Planing Mill Co.....	Elkins,	Randolph Co.
R. W. Bishop.....	Elkins,	Randolph Co.
Star Lumber Co.....	Pennsboro,	Ritchie Co.
Pennsboro Mfg. Co.....	Pennsboro,	Ritchie Co.
H. M. Arnett & Son.....	Spencer,	Roane Co.
William Huddleson.....	Spencer,	Roane Co.
Rice & Greek.....	Reedy,	Roane Co.
Walter Bays.....	Walnut Grove	Roane Co.
J. H. Parker.....	Kester,	Roane Co.
F. H. Jones.....	Walton,	Roane Co.
H. S. McCulty.....	Gandeeville,	Roane Co.
W. W. Ogden.....	Newton,	Roane Co.
The Wm. James Sons Co.....	Hinton,	Summers Co.
J. A. Graham.....	New Richm'd.	Summers Co.
Grafton Lumber Co.....	Grafton,	Taylor Co.
Grafton Wood-working Co.....	Grafton,	Taylor Co.
J. L. Magill.....	Grafton,	Taylor Co.
Babcock Lumber & Boom Co.....	Davis,	Tucker Co.
Otter Creek Boom & Lumber Co.....	Hambleton,	Tucker Co.
E. A. Nester.....	Hovatter,	Tucker Co.
Parsons Lumber & Planing Mill Co....	Parsons,	Tucker Co.
McCoy & Alexander.....	Sistersville,	Tyler Co.
W. H. Huth & Son.....	Middlebourne,	Tyler Co.
Ralph Sweeney.....	Shirley,	Tyler Co.
Leo Brown.....	Frenchton,	Upshur Co
H. Fidler.....	Arlington,	Upshur Co
E. C. Queen.....	Rock Cave,	Upshur Co
William Rexroad.....	Newlonton,	Upshur Co
Wm. Grosseup.....	Buckhannon,	Upshur Co
H. B. Morgan & Sons Planing Mill Co.	Buckhannon,	Upshur Co
D. G. Watkins & Son.....	Buckhannon,	Upshur Co
L. B. Ferguson.....	Wayne,	Wayne Co.
J. E. Newman.....	Lavelette,	Wayne Co.
Kenova Poplar Co.....	Kenova,	Wayne Co.
Cherry River Boom & Lumber Co.....	Camden-on-	Webster Co.
	Gauley,	
J. F. Darnell.....	Freeport,	Wirt Co.
G. W. Righter.....	Sanoma,	Wirt Co.
A. Buck.....	Creston,	Wirt Co.
Kirchner & Co.....	Elizabeth,	Wirt Co.

Badger Bros.....	Elizabeth,	Wirt Co.
Parkersburg Mill Co.....	Parkersburg,	Wood Co.
Citizens Lumber Co.....	Parkersburg,	Wood Co.
Radeker Lumber Co.....	Parkersburg,	Wood Co.
Warren Myers	Parkersburg,	Wood Co.
West Virginia Mantel Co.....	Parkersburg,	Wood Co.
W. M. Ritter Lumber Co.....	Maben,	Wyoming Co.
Keys-Fannin Lumber Co.....	Herndon,	Wyoming Co.
G. E. Lambert.....	Pineville,	Wyoming Co.
J. S. Lambert.....	Key Rock,	Wyoming Co.

Furniture.

Penn Table Co.....	Huntington,	Cabell Co.
Nicholson-Kendle Furniture Co.....	Huntington,	Cabell Co.
Empire Furniture Co.....	Huntington,	Cabell Co.
Drawley Furniture Co.....	Charleston,	Kanawha Co.
Ohio Valley Furniture Co.....	Charleston,	Kanawha Co.
West Virginia School Furniture Co....	Logan,	Logan Co.
Richardson Furniture Co.....	Keyser,	Mineral Co.
Shoepfner & Sons.....	Wheeling,	Ohio Co.
Novelty Lumber Mfg. Co.....	Marlinton,	Pocahontas Co.
The Pennsboro Furniture Co.....	Pennsboro,	Ritchie Co.
Star Lumber Co.....	Pennsboro,	Ritchie Co.
Bentley & Gerwig Furniture Co.....	Parkersburg,	Wood Co.

Vehicles and Vehicle Stock.

Auburn Wagon Co.....	Martinsburg,	Berkeley Co.
James Fidler.....	Burnsville,	Braxton Co.
J. F. Haury Bending Co.....	Huntington,	Cabell Co.
Samuel Thomas.....	Clay,	Clay Co.
J. F. Brown & Bro.....	Ronceverte,	Greenbrier Co.
Conker & Guill.....	Charleston,	Kanawha Co.
The H. G. Sherwood Co.....	Richwood,	Nicholas Co.
S. P. Priest & Son.....	Franklin,	Pendleton Co.
Three States Mfg. Co.....	Kenova,	Wayne Co.
Ohio Valley Bending Co.....	Parkersburg,	Wood Co.

Handles.

Huntington Handle Co.....	Huntington,	Cabell Co.
J. F. Brown & Bro.....	Ronceverte,	Greenbrier Co.
Kelly Axe Mfg. Co.....	Charleston,	Kanawha Co.
Schmick Handle & Lumber Co.....	William,	Tucker Co.
Waitman T. Linger.....	Sago,	Upshur Co.
The Parkersburg Mill Co.....	Parkersburg,	Wood Co.
A. Buck	Creston,	Wirt Co.

Mine and Log Cars.

American Car & Foundry Co.....	Huntington,	Cabell Co.
The Davis-Price Foundry & Mach. Co..	New Cumb'l'd.	Hancock Co.
The Marquet Coal Co.....	New Cumb'l'd.	Hancock Co.
Kanawha Mine Car Co.....	Charleston,	Kanawha Co.
Fairmont Mining Machinery Co.....	Fairmont,	Marion Co.
Helmick Foundry Machine Co.....	Fairmont,	Marion Co.

Boxes, Box Shook, Crates and Cooperage.

Berkeley Cooperage Co.....	Martinsburg,	Berkeley Co.
Beader Box Mfg. Co.....	Huntington,	Cabell Co.
Lang & Crist Box & Lumber Co.....	Clarksburg,	Harrison Co.
Baker Limestone Co.....	Bakerton,	Jefferson Co.
W. Higgs.....	Charlestown,	Jefferson Co.
J. U. Graham.....	Charleston,	Kanawha Co.
The Weston Lumber Co.....	Weston,	Lewis Co.
Fairmont Bottle Co.....	Fairmont,	Marion Co.
The Grief Brothers Co.....	Moundsville,	Marshall Co.
T. F. McDermott Box Co.....	Moundsville,	Marshall Co.
W. W. McConnell Estate.....	Wheeling,	Ohio Co.
Pocahontas Lumber Co.....	Marlinton,	Pocahontas Co.
Allen Forman.....	Amboy,	Preston Co.
Blue Jay Lumber Co.....	Blue Jay,	Raleigh Co.
Glady Fork Lumber Co.....	Glady,	Randolph Co.
Babcock Lumber & Boom Co.....	Davis,	Tucker Co.
Kenova Box Co.....	Kenova,	Wayne Co.
Kenova Poplar Mfg. Co.....	Kenova,	Wayne Co.
The Parkersburg Mill Co.....	Parkersburg,	Wood Co.

Miscellaneous.

Burnsville Veneer Mills.....	Burnsville,	Braxton Co.
The Central Veneer Co.....	Huntington,	Cabell Co.
D. E. Abbott & Co.....	Huntington,	Cabell Co.
Huntington Chair Co.....	Huntington,	Cabell Co.
Central City Bung Co.....	Huntington,	Cabell Co.
The Davis-Price Foundry & Mach. Co..	New Cumb'l'd.	Hancock Co.
American Column & Lumber Co.....	St. Albans,	Kanawha Co.
Fairmont Wall Plaster Co.....	Fairmont,	Marion Co.
H. S. Rudy.....	Fairmont,	Marion Co.
Fairmont Mining Machinery Co.....	Fairmont,	Marion Co.
J. A. Schwob Co.....	Moundsville,	Marshall Co.
Moundsville Excelsior Works.....	Moundsville,	Marshall Co.
Kanawha Dock Co.....	Pt. Pleasant,	Mason Co.
Dodge Clothespin Co.....	Richwood,	Nicholas Co.
Buena Vista Harwood Co.....	Stony Bottom,	Pocahontas Co.
Elkins Pail & Lumber Co.....	Elkins,	Randolph Co.
Star Lumber Co.....	Pennsboro,	Ritchie Co.
Grafton Wood-working Co.....	Grafton,	Taylor Co.
Schmick Handle & Lumber Co.....	William,	Tucker Co.
Waitman T. Linger.....	Sago,	Upshur Co.
Three States Mfg. Co.....	Kenova,	Wayne Co.
The Parkersburg Mill Co.....	Parkersburg,	Wood Co.
The Parkersburg Chair Co.....	Parkersburg,	Wood Co.
The Parkersburg Rig & Reel Co.....	Parkersburg,	Wood Co.
Oil Well Supply Co.....	Parkersburg,	Wood Co.

LIST OF OPERATING SAW MILLS.

BARBOUR COUNTY.

J. H. Felton & Brothers, Arden.....	Circular saw.
Ed. England, Philippi.....	"
Frank Wolf, Philippi.....	"
C. C. Wolf, Philippi.....	"
Joseph Sandridge, Belington.....	"
E. R. Dyer, Philippi.....	"
Kelly & Baker, Philippi.....	"
J. W. Shaw, Philippi.....	"
Noah Parks, Philippi.....	"
John Fallon, Volga.....	"
C. F. Wolf, Philippi.....	"
Upton Mitchell, Arden.....	"
S. M. Ball, Philippi.....	"

BERKELEY COUNTY.

Cal. Hebeling, Martinsburg.....	Circular saw.
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BOONE COUNTY.

Peytona Lumber Co., Peytona.....	Band saw.
Leatherwood Lumber Co., Hill.....	Band saw.
E. E. Alcorn, Peytona.....	Circular saw.
Sear & Stevenson, Harless.....	"
J. M. & J. S. Hill, Lora.....	"
C. S. Rollison, Hill.....	"
James Haas, Hill.....	"
New Jersey Lumber Co., Danville.....	"
Nicholas Brothers, Danville.....	"
Elmer Harless, Andrew.....	"
Samuel Holsted, Foster.....	"
A. J. Miller & Brother, Foster.....	"
Benjamin Sturgal, Andrew.....	"
Greely Isaac, Hill.....	"
Jones Lumber Co., Danville.....	"
Board Lumber Co., Danville.....	"
Chambers & Tony, Danville.....	"
Melrose & Hatfield, Danville.....	"
Walter McKinney, Danville.....	"
Adams & Goff, Turtle Creek.....	"
Alex. Markham & Bro., Greenvew.....	"
G. W. Hill, Danville.....	"
J. D. Dowell, Havana.....	"
Bruffy & Damewood, Hewett.....	"
Hagar & Aleshire, Hewett.....	"
I. G. Stollings, Clothier.....	"
Bias & Bias, Clothier.....	"
Benjamin Price, Uneeda.....	"
John F. Blessing, Cobb.....	"
J. W. Cart, Peytona.....	"
Lew, Baier, Peytona.....	"
E. E. Alcorn, Peytona.....	"
D. G. Courtney, Charleston.....	Circular saw and stave mill.
Danville Improvement Co., Danville.....	Circular saw and planer.

BRAXTON COUNTY.

Mead & Speer Co., Jennings.....	Band saw.
Birch Boom & Lumber Co., Glendon....	Circular saw.
Fisher-Berry Lumber Co., Flatwoods....	"
G. P. Gillespie, Palmer.....	"
Diggings & Holden, Centralia.....	"
Smoot Lumber Co., Levi.....	"
R. M. Combs, Sutton.....	"
L. F. Davis, Sutton.....	"
Pioneer Pole & Shaft Co., Orlando.....	"
Waggy & Harden Lumber Co., Sutton...	"
A. J. Rawson, Rosedale.....	Circular saw and stave mill.
Interstate Cooperage Co., Gassaway....	Stave mill.
D. S. Engle & Son, Home.....	"
D. M. Wolf, Belfont.....	"
Boggs Stave & Lumber Co., Wire Bridge.	Circular saw and stave mill

BROOKE COUNTY.

Berdine & Sons, Wellsburg.....	Circular saw.
McGinnis & Mozingo, Wellsburg.....	"
Hervey Brothers, Wellsburg.....	"
Pfister Brothers, Wellsburg.....	Saw and grist mill.

CABELL COUNTY.

Ameri'n. Car & Foundry Co., Huntington.	Circular saw.
Wilson Brothers, Guyandotte.....	"
Sliger Brothers, Huntington.....	"
T. W. Wilson, Guyandotte.....	"

CALHOUN COUNTY.

Melville Westfall, White Pine.....	Circular saw.
Geo. Kerby, Ayers.....	"
Benj. B. Shimer, Freed.....	"
Hicks & Queen, Grantsville.....	"
W. F. Plant, Grantsville.....	"
B. B. Ferrell, Big Bend.....	"
Al. Kimble, Grantsville.....	"
Jarvis & Hicks, Oka.....	"
Hicks & King, Douglas.....	"
S. M. Ward, Grantsville.....	Circular saw and planer.
Huffman Mill Co., Grantsville.....	" "
W. H. Jackson, Big Springs.....	" "
Tracy Poling & Brothers, Russett.....	" "

TANNERY OF J. G. HOFFMANN & SONS COMPANY AT GORMANIA, GRANT COUNTY.
Photo by A. D. Hopkins.

CLAY COUNTY.

Crescent Lumber Co., Cressmont.....	Band saw.
Clay Lumber Co., Porter.....	Band saw.
Groves Creek Lumber Co., Ira.....	Circular saw.
James and L. J. Reed, Cosmoga.....	"
Geo. H. Seagraves & Co., Eldorado.....	"
Ezekiel Holcomb, Serena.....	"
Grant P. Morton, Lizemore.....	"
Morton Brothers, Lizemore.....	"
Marcellus Hardman, Nebo.....	"
E. F. Sirk, Ira.....	"
David Eagle, Valley Fork.....	"
Waggy & Gorrell, Whetstone.....	"
Kimbell Brothers, Ivydale.....	"
Charles Young, Douglas.....	"
Shadle & Auchmuty, Yankee Dam.....	"
R. W. Morton, Crosby.....	"
Newton Nicholas, Clay.....	"
L. D. Mullins, Clay.....	"

DODDRIDGE COUNTY.

Charley Smith, West Union.....	Circular saw.
Herbert Davis, West Union.....	"
W. T. Perine, West Union.....	"
Albert Strickling, West Union.....	"
S. Ford, Center Point.....	"
R. T. McGowan, Blandville.....	"
J. M. Cox, Market.....	"
Roy Piggott, Central Station.....	"

FAYETTE COUNTY.

The J. W. Mahan Lumber Co., Mahan....	Band saw.
Sewell Lumber Co., Landisburg.....	Band saw.
Charleston Lumber Co., Belva.....	Circular saw.
Rule & Rule, Deitz.....	"
W. C. Mohr, Victor.....	"
John A. Wilson, Kanawha Falls.....	"
J. W. Campbell, Divide.....	"
J. W. Amick, Dempsey.....	"
J. A. Roberts, Page.....	"
J. W. Montgomery, Kanawha Falls.....	"
G. Vincel, Dixie.....	"
Mankins Lumber Co., Oak Hill.....	"
J. M. Arthur, Beckwith.....	"
H. J. Withrow, Gatewood.....	"
J. H. Nickell, Graydon.....	"
Holliday Brothers, Edmond.....	"
Burgess Brothers, Fayetteville.....	"
G. W. Fleshman & Son, Danese.....	"
R. S. Aldrich, Corliss.....	Circular saw and stave mill.
Hogg Lumber Co., Glenjean.....	Circular saw and planer.
Stewart Colliery Co., Stewart.....	Circular saw and planer.

GILMER COUNTY.

H. G. Hardman & Son, Lockney.....	Circular saw.
John Burke, Cedarville.....	"
Lee Rhoads, Cedarville.....	"
Harvey Frashure, Truebada.....	"
Benjamin Allen, Sand Fork.....	"
John Ralston, Tannerville.....	"
Ira Young, Letter Gap.....	"
Allen Bailey, Cedarville.....	"
Karl Hardman & Brother, Tannerville...	"
Johnson Westfall, Dekalb.....	"
A. S. Westfall & Son, Letter Gap.....	"
F. R. Bell, Normantown.....	"
Boggs Brothers, Perkins.....	"
Davis Brothers, Coxes Mills.....	"
Frank Davis, DeKalb.....	"
George Fling, Roseville.....	Circular saw and planer.

GRANT COUNTY.

Parsons Pulp & Lumber Co., Dobbin....	Band saw.
Turner & Watts, Petersburg.....	Circular saw.
Mongold, Reel & Co., Petersburg.....	"
H. F. Brubeck, Petersburg.....	"
A. W. Sites, Masonville.....	"
Sites & Veach, Dorcas.....	"

GREENBRIER COUNTY.

St. Lawrence Boom & Mfg. Co., Ronceverte	Band saw.
St. Lawrence Boom & Mfg. Co., Shryock	"
Neola Lumber Co., Neola.....	"
Meadow River Lumber Co., Meadow Ck..	"
J. W. Callison, Farmdale.....	Circular saw.
E. E. Crane, Crawley.....	"
J. A. & E. L. Wyatt, Williamsburg.....	"
J. B. Deitz, Keiffer.....	"
L. D. Blake, Trout.....	"
L. A. McClung, Rupert.....	"
C. L. McClung, McClung.....	"
C. E. McClung, McClung.....	"
A. A. Price, Argo.....	Circular saw and planer.
Jones Brothers, Meadow Bluff.....	Circular saw and planer.
Pillsbury Brothers, Russellville.....	Stave saw.
M. L. Kirschner, Alderson.....	Circular saw.
I. L. Bivens, Blue Sulphur.....	"
Floyd Bennett, Smoot.....	"
Bert. Hudsonpillar, Dawson.....	"
W. A. Hedrick, Fort Spring.....	"
J. E. Hunter, Fort Spring.....	"
A. L. Davis, Alderson.....	"
Donaldson Lumber Co., Anthony.....	"
Kendall-Deter Lumber Co., Anthony.....	"
J. C. Moorehead, Tuckahoe.....	"

HAMPSHIRE COUNTY

James A. Hannas, Three Churches.....	Circular saw.
C. E. Wolford, Augusta.....	"
Stephen Hannas, Shanks.....	"
I. N. Baker & Co., Romney.....	"
T. F. Martin, Romney.....	"
Alex. Everett, Romney.....	"
W. J. Powell, Romney.....	"
James F. Smith, Hoy.....	"

HANCOCK COUNTY.

Edward Anderson, Hollidays Cove.....	Circular saw.
John A. Martin, New Cumberland.....	Circular saw.
Paul Stewart, New Cumberland.....	Circular saw and stave mill.
Thomas Geible, Chester.....	Stave saw.
Talbot Brothers, Chester.....	"
Hendershot & Hoy, Chester.....	"

HARDY COUNTY.

Wm. Conrad, Wardensville.....	Circular saw.
R. C. Anderson, Wardensville.....	"
H. D. Reed, McCauley.....	"
James Teets, Baker.....	"
George Grady, Lost River.....	"
B. H. Cullers, Mathias.....	"
Roy Welton, Moorefield.....	"
J. H. Rogers, Moorefield.....	"
Milton Vetter, Moorefield.....	"

HARRISON COUNTY.

A. D. Mitchell, Clarksburg.....	Circular saw.
Garrison & Barnes, Clarksburg.....	"
Geo. W. Webb, Wallace.....	"
J. L. Ferren, Mt. Clare.....	"
William Miller, Shinnston.....	"
B. F. Odell, Watt.....	"

JACKSON COUNTY.

Daniel Sayre, Angerona.....	Circular saw.
W. L. Sayre, Goldtown.....	"
G. W. Anderson, Alpin.....	"
Elda Hyre, Shatto.....	"
Benjamin Hunt, Angerona.....	"
McIntyre Brothers, Angerona.....	"
Rhodes & Tolley, Bell Grove.....	"
J. R. Cunningham, Bell Grove.....	"
J. R. Kester & Son, Ravenswood.....	"
D. W. Carney, Ripley.....	"
Ross Mill Co., Millwood.....	"

JEFFERSON COUNTY.

Thos. C. Frazier, Charlestown.....	Circular saw.
Charles Kidwiller, Bakerton.....	"
D. B. Shoemaker, Ripon.....	"
W. S. Martin, Shepherdstown.....	Stationary mill.

KANAWHA COUNTY.

Amer. Column & Lumber Co., St. Albans.	Band saw.
D. G. Courtney, Charleston.....	"
Bowman Lumber Co., St. Albans.....	"
Knight Lumber Co., Sattes.....	"
Mohler Lumber Co., Lock Seven.....	"
Robert Dawson, Angel.....	Circular saw.
Watson & Gillespie, Rome.....	"
J. D. Powell, Green View.....	"
A. W. Moses, Racine.....	"
Steinbeck & Osborne, Blakely.....	"
The Charleston Lumber Co., Charleston..	Circular saw and planer.
Ferrell & Coleman, Standard.....	Circular saw.

LEWIS COUNTY.

W. E. Mick & Sons, Ireland.....	Circular saw.
W. W. Smith, Jane Lew.....	"
W. P. Shock, Duffy.....	"
S. B. Byrd, Weston.....	"
J. W. Marsh, Weston.....	"
Lloyd Woofter, Alum Bridge.....	"
H. Holsberry, Gaston.....	"
Lewis Morrison, Berlin.....	"
Hall, Robinson & White, Freemansburg..	"
Simmons & Gum, Churchville.....	"
Moore & Mick, Crawford.....	"
Harry Alfred, Weston.....	"
Wm. Burr, Weston.....	"

LINCOLN COUNTY.

Linville & Lovejoy, Bernie.....	Circular saw.
S. V. Mullins, Mud.....	"
Hager, Duty & Mullins, Bulger.....	"
C. W. Dement, Allen.....	"
Josh. Sawyer, Branchland.....	"
J. W. Adkins, Minerva.....	"
H. H. Saunders, Cuzzie.....	"
A. W. Ramey, Wewanta.....	"
Sherman Maiden, Rector.....	"
Steel Bros., Rector.....	"
Rudolph Roy, Leet.....	"
Frank Burton, Ranger.....	"
Balas Bros., Sarah.....	"
Granville Curry, Portersville.....	"
Neal Bros., Sod.....	"
Wm. Browning, Hamlin.....	"
Mohler Lumber Co., McCorkle.....	"

Geo. McCormick, McCorkle.....	Circular saw.	
Floyd Justice, Train.....	"	
A. W. Young, Train.....	"	
Chas. Musgrave, Tornado.....	"	
E. M. Escue, Tango.....	"	
James Pauley, Garrettsbend.....	"	
Barger Lumber Co., Garrettsbend.....	"	
W. W. Wallace, Culloden.....	"	
Bias Bros., Sweetland.....	"	
Frank Eden, Myra.....	"	
E. P. Bell, Milton.....	"	
Yance. Hill, Garrettsbend.....	"	
Albert Oxley, Amy.....	"	
Mart Egnor, Sugartree.....	Circular saw and grist.	
Lee Green, Garrettsbend.....	"	"
J. L. Carper, Griffithsville.....	"	"
Joe Young, Easy.....	"	"
T. A. Griffith, Snowden.....	"	"
W. N. Griffith, Snowden.....	"	"
P. M. McGhee, Nye.....	"	"
Roll. Tackett, Garrettsbend.....	"	"
Ned Davis, Woodville.....	"	"
Moss Baker, Branchland.....	"	"
Hurston Clay, Branchland.....	"	"
R. B. Hayzlette, Branchland.....	"	"
Harry Hayes, Branchland.....	"	"
Messenger & Co., Sheridan.....	"	"
Chas. Hunter, West Hamlin.....	"	"
A. R. Sansom, Bulger.....	"	"
B. Johnson & Son, Leet.....	Circular saw and planer.	
W. W. Baker, Hamlin.....	"	"
W. F. Black & Son, Myra.....	"	"

LOGAN COUNTY.

The Dimension Lumber Co., Ethel.....	Band saw.	
The United States Coal & Oil Co., Holden.....	"	
Boone Timber Co., Clothier.....	"	
R. E. Lee, Logan.....	Circular saw.	
Henry Lawson, Hughey.....	"	
Sanders Brothers, Lake.....	"	
E. J. Hellard, Halcyon.....	"	
Mullins & Chapman, Big Creek.....	"	

McDOWELL COUNTY.

The W. M. Ritter Lumber Co., Avondale.....	Band saw.	
Suddeth & Bailey Johnson Lumber Co., Welch.....	Circular saw.	
Forest City Lumber Co., War.....	"	
R. E. Wood Lumber Co., Rift.....	"	
Big Sandy Lumber Co., Big Sandy.....	"	
W. G. Morgan Lumber Co., Hallsville.....	"	
A. T. Lusk, Antler.....	"	
Canada Day Lumber Co., Bradshaw.....	"	
United States Coal & Coke Co., Gary.....	"	
Page Coal & Coke Co.,.....	"	
Upland Coal & Coke Co., Upland.....	"	
Pulaski Iron Co., North Fork.....	"	

MARION COUNTY.

Swisher & Michaels, Rivesville.....	Circular saw.
James Criss, Mannington.....	"
Ernest Lemley, Granttown.....	"
H. H. Lemley, Fairmont.....	"
G. W. Wright, Worthington.....	"
H. R. Martin, Farmington.....	"

MARSHALL COUNTY.

R. T. Wetzel, Glen Easton.....	Circular saw.
Jackson Brothers, Howard.....	"
Samuel Arnold, Graysville.....	"
Jackson Wise, Rosbys Rock.....	"
Kinsey Huggans, Moundsville.....	"
Crawford & Long, Belton.....	"
Charles Aston, Moundsville.....	"
Charles Lydick, Moundsville.....	"

MASON COUNTY.

J. H. Selby, Santown.....	Circular saw.
T. W. Morrison, Pt. Pleasant.....	"

MERCER COUNTY.

Bluestone Land & Lumber Co., Gardner..	Band saw.
Carr Lumber Co., Giatto.....	Circular saw.
Johnson Lilly, Princeton.....	"
W. D. Huffman, Lashmeet.....	"
Scott Cook, Lashmeet.....	"
J. R. Caldwell, Kegley.....	"
Noah Payne, Matoka.....	"
W. J. Lyon, Spanishburg.....	"
B. I. Snyder, Pride.....	"
Nichols & Oxley, Athens.....	"
W. L. G. McKinsey, Athens.....	"
M. F. Ellison, Pride.....	"
John Perdue, Giatto.....	"
J. A. Vest, Rock.....	"
Wilson Snyder, Rock.....	"
Jacob Walker, Flat Top.....	"
C. W. Fielder, Kegley.....	"
Kinzer & Kinzer, Matoka.....	"
Canaday Shrewsbury, Lashmeet.....	"
Marion Foley, Matoka.....	"
J. W. Wyatt, Spanisburg.....	"
Wm. Bruce, Hatcher.....	"
Wm. Ayers, Oakvale.....	"
G. G. Thomas, Willowton.....	"
B. P. White, Princeton.....	"
Davis & Campbell, Willowton.....	"
N. A. Boggess, Athens.....	"
L. E. White, Hatcher.....	"

MINERAL COUNTY.

F. H. Lense & Bros., Alaska.....	Circular saw.
Adam Spencer, Alaska.....	"
Geo. Ward, Alaska.....	"
John Sneathen & Sons, Alaska.....	"
Baker Ward, Knobley.....	"
Labon Riley, Alaska.....	"
Geo. Wagoner, Alaska.....	"
Wm. Wagoner & Bros., Alaska.....	"
Seymour Whip, Burlington.....	"
Perry Biser, Headsville.....	"
Joe Leatherman, Headsville.....	"
John Gurdner, Elk Garden.....	"
W. E. Welch, Antioch.....	"
V. S. Welch, Antioch.....	"
Edward Rawlings, Antioch.....	"
Wilber Welch, Antioch.....	"

MINGO COUNTY.

Prendergast Lumber Company, Rapp....	Band saw.
J. S. Walker Lumber Company, Okeeffe..	Band saw.
Davis Lumber Company, Lindsey.....	Circular saw.
F. M. Massie, Matewan.....	"
Guy White, Williamson.....	"
Boothe & Talbot, Merrimac.....	"
H. Bazzell, Buttercup.....	"
John W. Riley, Williamson.....	"
T. J. Martin & Company, Kermit.....	"
Zat Ellis, Gilbert.....	"
Cain Scott, Chataroy.....	"
Williamson Coal & Coke Co., Williamson.	"
W. A. Harris Lumber Co., Williamson...	Circular saw and planer.

MONONGALIA COUNTY.

L. S. Birch, Charlotte.....	Circular saw.
Brookout & Duff, Dellslow.....	"
J. A. Conley, Morgantown.....	"
Chas. E. Cox, St. Leo.....	"
John F. Cress, Rohr.....	"
John H. Davis, Smithfield, Pa.....	"
A. F. Fleming, Morgantown.....	"
Dennis Fox, Mt. Morris.....	"
Uriah L. Griffith, Morgantown.....	"
Thos. Jackson & Sons, Little Falls.....	"
Lester Karns, Independence.....	"
W. L. Keck, Amos.....	"
D. E. & T. Lemley, Cassville.....	"
W. C. Ley, Morgantown.....	"
J. S. Matheson, Hagans.....	"
Lemley Martin, Mt. Morris.....	"
P. W. Moore, Amos.....	"
Voigt McClure, Pentress.....	"
James S. McClure, Morgantown.....	"
Earl Pixler, Morgantown.....	"
Geo. M. Thorn, Independence.....	"
Tri-State Lumber Co., Sturgisson.....	"
A. J. Walker, Morgantown.....	"
Watson Bros., Independence.....	"

MONROE COUNTY.

Crimson Springs Lumber Co., Crimson S.	Circular saw.
Persinger Brothers, Union.....	"
B. P. Beamer, Pickaway.....	"
Neal & McGuire, Gap Mills.....	"
Potts Valley Lumber Co., Waiteville....	"
Vance & Lucas, Waiteville.....	"
A. J. Young, Pickaway.....	"
Cook Brothers, Sinks Grove.....	"
J. W. Owens, Chalybeate, Va.....	"
W. F. Lockhart, Chalybeate, Va.....	"
A. W. Williams, Gap Mills.....	"
J. T. G. Miller, Sinks Grove.....	"
H. Willis & Son, Rock Camp.....	"
Charles Daugherty, Cashmere.....	"
George Lewis, Waiteville.....	"
Doss & Bradley, Waiteville.....	"
Geo. T. Kesler, Greenville.....	"
Broyles & Broyles, Lindside.....	"
Clarence Symns, Lindside.....	"
James Comer & Co., Wikel.....	"
J. M. Warren, Lindside.....	"
H. B. Spangler, Peterstown.....	"
Terry & Shue, Peterstown.....	"
E. A. Smith, Peterstown.....	"
James Rice, Peterstown.....	"
W. W. Dunn, Peterstown.....	"
The Hickory Handle Co., Kellyville....	"
Martin Brothers, Orchard.....	"
E. M. Davis, Union.....	Circular saw and planer.
John A. Campbell, Union.....	" "
Robert Arnett, Lillydale.....	" "
Mann & Mann, Wikel.....	Stave saw.
A. Knabb & Co., Peterstown.....	Stave saw.

MORGAN COUNTY.

Joseph Miller's Sons, Berkeley Springs..	Circular saw.
Michaels Brothers, Berkeley Springs....	"
Samuel Gantt, Cherry Run.....	"
Jacob Files, Cherry Run.....	"
Harry McBee, Berkeley Springs.....	"
Leonard Yost, Berkeley Springs.....	"
Frances Unger, Oakland.....	"
Norval Dick, Ungers Store.....	"
Newton Unger, Ungers Store.....	"
J. B. Newbraugh, Stotlers Cross Roads..	"
Preston Newbraugh, Stotlers Cross Rds..	"
West. Shirley, Berkeley Springs.....	"
Price T. Noland, Great Cacapon.....	"
A. C. Spring, Great Cacapon.....	"
John Spriggs, Magnolia.....	"
E. E. Dawson, Berkeley Springs.....	"
Perry McCool, Paw Paw.....	"
Newton Michael, Berkeley Springs.....	"
Charles Spriggs, Berkeley Springs.....	"
Scott Davison, Ungers Store.....	"
Lutterell Brothers, Ungers Store.....	"
Wm. Shade, Ungers Store.....	"

WOODLAND JUMPING MOUSE. An interesting little mammal occasionally found in the dense spruce forests of our higher mountains.

NICHOLAS COUNTY.

Cherry River Boom & Lumber Co.,		
Richwood	2	Band saw mills.
Pardee & Curtin Lumber Co., Curtin....	3	Band saw mills.
Fenwick Lumber Co., Fenwick.....		Band saw mills.
The Weston Lumber Co., Allington....		"
Tioga Lumber Co., Tioga.....		"
Flynn Lumber Co., Swiss.....		"
West Virginia Timber Co., Vaughan....		"
Woodbine Lumber Co., Woodbine.....		"
Thornhill Lumber Co., Cranberry.....		Circular saw.
Joseph Hill, Lockwood.....		"
Joseph Cavendish, Summersville.....		"
Thos. McCutcheon, Gad.....		"
C. W. Carnifax, Hookersville.....		"
David Pletcher, Delphi.....		"
Morris Brothers Conrad.....		"
Jettus Mollohan, Birch River.....		"
Crawford & Ervin, Hookersville.....		"
C. H. Smoot, Craigsville.....		"
E. R. McCutcheon, Gilboa.....		Circular saw and planer.
Jacob Moses, Pool.....		" "
McClung & Jones, Mt. Lookout.....		" "
Daniel Brock, Summersville.....		" "
Henry Campbell, Summersville.....		" "

OHIO COUNTY.

John Taggart, West Alexander, Pa.....Circular saw.

PENDLETON COUNTY.

G. J. Sponaugle, Franklin.....		Circular saw.
Henry Harper & Co. Circleville.....		"
Mitchell Brothers, Sugar Grove.....		"
A. D. Simmons, Riverton.....		"
T. A. Hively, Brandywine.....		"
Fulst & Propst, Mitchell.....		"
Bland Brothers, Riverton.....		"
John & Isaac Harman, Kline.....		"
L. W. Dunkle, Deer Run.....		"
Waggy Brothers, Mitchell.....		"
Charles Day, Fort Seybert.....		"
Hoover & Rexroad, Mitchell.....		"
C. B. Simmons, Ruddle.....		"
W. H. Rexroad & Co., Brandywine.....		"
Amby Harper & Son, Cave.....		"
I. D. Hammer, Franklin.....		Sash saw.
B. S. Hammer, Franklin.....		"
Isaac Propst, Moyer.....		"
A. R. Lough, Kline.....		"

PLEASANTS COUNTY.

Dunn & McTaggart, Schultz.....	Circular saw.
Locke & Simonton, Adlai.....	"
W. L. Locke, Finch.....	"
F. P. Locke, Crisp.....	"
Cox & Butler, Crisp.....	"
M. E. Kidder, Lytton.....	"

POCAHONTAS COUNTY.

Wildell Lumber Co., Wildell.....	Band saw.
Gilfillan, Neil & Co., May.....	"
Pocahontas Lumber Co., Burner.....	"
Newell Brothers Lumber Co., Braucher..	"
P. L. & W. F. Brown, Madeline.....	"
Geo. Craig & Son, Winterburn.....	"
Flint, Erving & Stoner, Dunlevie.....	"
Brushy Run Lumber Co., Boyer.....	"
West Virginia Spruce Lumber Co., Cass.	"
Deer Creek Lumber Co., Cass.....	"
Campbell Lumber Co., Marlinton.....	"
Tomb Lumber Co., Watoga.....	"
Warn Lumber Co., Millpoint.....	"
John Raine Lumber Co., Millpoint.....	"
Sweet, Lilly Lumber Co., Braucher.....	Circular saw.
A. G. Miller & Brother, Braucher.....	"
Bartow Lumber Co., Bartow.....	"
W. W. Whitehill, Durbin.....	"
H. J. Wilmoth & Sons, Boyer.....	"
H. J. Wilmoth & Sons, Hosterman.....	"
A. G. Miller & Brother, Cass.....	"
Beuna Vista Hardwood Lumber Co., Stony Bottom.....	"
H. E. Nixon, Dunmore.....	"
DeRan Lumber Co., Clover Lick.....	"
W. W. Dempsey, Big Run.....	"
Harter Brothers, Harter.....	"
Brown, Depp & Swanson, Marlinton.....	"
Marlinton Lumber Co., Marlinton.....	"
Limestone Lumber Co., Marlinton.....	"
N. S. Duffield, Onoto.....	"
Ira Irvin, Warwick.....	"
W. H. Shearer, Onoto.....	"
Withrow McClintic, Buckeye.....	"
David Barnes, Buckeye.....	"
H. M. Lockridge, Huntersville.....	"
H. A. Slear, Millpoint.....	"
Deer Creek Lumber Co., Millpoint.....	"
Smith & Payne, Seebert.....	"
Kidd, Kirby & Lilly, Beard.....	"
Hazelwood Lumber Co., Dunmore.....	"

PRESTON COUNTY.

Wm. Riley, Cranesville.....	Circular saw.
Tri-State Lumber Co., Sutherland.....	"
Kingwood Lumber Co., Caddell.....	"
Gibson Lumber Co., Masontown.....	"
Fort Pitt Lumber Co., Whetsell.....	"

E. Vansickel, Albright.....	Circular saw.
Geo. Hayes, Rowlesburg.....	"
Tanner Brothers, Kingwood.....	"
Felix Wolf, Kingwood.....	"
E. W. Britton, Newburg.....	"
L. H. Goff, Kingwood.....	"
Borgman & Korte, Howesville.....	"
Geo. N. DeWitt, Kingwood.....	"
J. V. Gibson, Tunnelton.....	"
Ridgway Brothers, Kingwood.....	"
T. P. Weaver, Howesville.....	"
W. B. Williams, Tunnelton.....	"
E. S. Brown, Reedsville.....	"
J. E. Cress, Masontown.....	"
S. P. Lyons, Masontown.....	"
Thos. M. Ohara, Reedsville.....	"
I. N. Roby, Masontown.....	"
H. F. Shaffer, Masontown.....	"
Thos. N. Tanner, Reedsville.....	"
J. A. Bucy, Independence.....	"
I. A. J. Cox, Independence.....	"
C. A. Danks, Newburg.....	"
Wm. A. Danks, Independence.....	"
W. R. Demoss, Newburg.....	"
Wm. H. Hebb, Newburg.....	"
John L. Holmes, Independence.....	"
Lucas & Demoss, Newburg.....	"
B. F. Sapp, Independence.....	"
Baylor & Watts, Newburg.....	"
Wm. H. Cool, Tunnelton.....	"
Stanton Demoss, Newburg.....	"
Geo. A. Funk, Tunnelton.....	"
O. L. Harvey, Newburg.....	"
S. A. Price, Rowlesburg.....	"
M. M. Ridenour, Tunnelton.....	"
Geo. W. Shaver, Rowlesburg.....	"
Geo. E. Sidwell, Newburg.....	"
Frank Tenney, Rowlesburg.....	"
C. F. Smouse, Cumberland, Md.....	"
Forman Brothers, Valley Point.....	"
Tanner & Shaffer, Valley Point.....	"
Miller & Otto, Albright.....	"
Homer Tichenell, Albright.....	"
O. F. & O. S. Walls, Pisgah.....	"
P. V. Nedrow, Summerfield.....	"
Bearbower Brothers, Glade Farms.....	"
J. B. McCormick, Egton.....	"
J. R. & B. F. Teets, Aurora.....	"
Roy C. Lantz, Egton.....	"
E. J. & D. A. Sell, Horseshoe Run.....	"
F. Mertin's Sons, Cumberland, Md.....	"
Katharine Watkins, Aurora.....	"
Noah Snyder, Aurora.....	"
Henline, Brother & Son, Aurora.....	"
D. W. Sanders, Rowlesburg.....	"
Ira C. Stemple, Amblersburg.....	"
Preston Nine, Egton.....	"
Fort Pitt Lumber Co., Moreland.....	"

Ramsey & Steele, Albright.....	Circular saw.
Charles H. Freeland, Terra Alta.....	"
Geo. Freeland, Terra Alta.....	"
Perley DeBerry, Terra Alta.....	"
J. W. & J. A. Fauber, Caddell.....	"
C. W. Mason & Son, Aurora.....	"
Wm. A. Knotts, Aurora.....	"
Peter F. Spiker, Eglon.....	"
Lloyd Dawson, Eglon.....	"
J. I. Zinn, Reedsville.....	"
Chester Beatty, Caddell.....	"
Gus. Barker, Kingwood.....	"
Elmer Martin, Albright.....	"
O. F. Farquer, Rowlesburg.....	"
Elzy Brothers, Amboy.....	"
Hallie Wolf, Tunnelton.....	"
H. B. Wilhelm, Terra Alta.....	Sash saw.
A. Knabb & Co., Clifton Mills.....	Stave mill.
James Freeland, Terra Alta.....	Circular saw and planer.
Allen Forman, Amboy.....	Circular saw, shingle mill and planer.
Fike Brothers, Eglon.....	Circular saw and planer.
John D. Evans, Clifton Mills.....	" "
Bruceton Milling Co., Bruceton Mills....	" "

PUTNAM COUNTY.

J. P. Rhodes, Winfield.....	Circular saw.
Dr. C. McGill, Red House.....	"
Geo. Fowler, Red House.....	"
Robert Coleman, Liberty.....	"
John & Lewis Carney, Poca.....	"
Homer Thornton, Buffalo.....	"
Gates Brothers, Buffalo.....	"
Daniel Sayre, Buffalo.....	"
W. H. Jeffries, Extra.....	"

RALEIGH COUNTY.

Blue Jay Lumber Co., Blue Jay.....	Band saw mill.
W. M. Ritter Lumber Co., Dugout.....	Band saw mill.
American Column & Lumber Co., Colcord.....	Band saw mill.
Geo. W. Bair, Beckley.....	Circular saw.
J. B. Earwood, Beckley.....	"
George French, Harper.....	"
A. Daniel, Harper.....	"
Harper & Wingrove, Sweeneyburg.....	"
James Shumate, Dameron.....	Circular saw and stave mill.

RANDOLPH COUNTY.

Moore-Keppel Lumber Co., Ellamore....	Band saw.
Holly Lumber Co., Pickens.....	"
Elkins Pail & Lumber Co., Elkins.....	"
Tygart River Lumber Co., Mill Creek....	"
Brown & Hill, Montes.....	"
J. M. Bemis & Sons, Bemis.....	"

Glady Fork Lumber Co., Glady.....	Band saw.
Wheeler Lumber Co., Glady.....	"
Raine-Andrews Lumber Co., Evenwood..	"
Laurel River Lumber Co., Jenningsston..	"
Perley & Crockett Lumber Co., Jenningsston	"
United Lumber Co., Hazelwood.....	"
Parsons Pulp & Lumber Co., Horton....	"
Parsons Pulp & Lumber Co., Laneville..	"
McClure, Tyson & Irvin, Glady.....	"
Wyoming Lumber Co., Kerstetter.....	"
Hench, Dromjold & Shull, Mill Creek...	Circular saw.
Woodrow Lumber Co., Woodrow.....	"
Koontz, Phillips & Stam, Gladwin.....	"
D. E. Lutz, Elkins.....	"
Keystone Mfg. Co., Elkins.....	"
Smith Lumber Co., Elkins.....	"
Curry-Bitner Lumber Co., Mabie.....	"
H. J. Poe, Elkins.....	"
R. M. McMillan, Elkins.....	"
Deahl Lumber Co., Elkins.....	"
W. H. Mabie, Mabie.....	"
W. M. Heil, Mabie.....	"
B. R. Slagle & Sons, Mabie.....	"
Roaring Creek Lumber Co., Kingsville..	"
H Markley, Kingsville.....	"

RITCHIE COUNTY.

C. L. Ferguson, Pullman.....	Circular saw.
C. E. Fleming, Harrisville.....	"
D. B. Cunningham, Pennsboro.....	"
J. A. Veach, Pennsboro.....	"
Grant Stewart, Highland.....	"
Sinnott & Cowen, Washburn.....	"
J. A. Zinn, Harrisville.....	"

ROANE COUNTY

John Starcher, Linden.....	Circular saw
V. A. Ledsom, Bright.....	"
J. H. Parker, Kester.....	"
W. V. Carper, Kester.....	"
Tolly Mill Co., Walton.....	"
Wm. Swiney, Walton.....	"
S. J. Drake, Newton	"
Thos. Smith, Uler.....	"
J. M. Dye, Latch.....	"
James Dawson, Spencer.....	"
John Blosser, Reedy.....	"
Preston Short, Pasco.....	"
Peter Millhone, Penile.....	"
Irvin Snodgrass, Reedy.....	"
Samuel Conley, Pasco.....	"
Thomas Drake, Looneyville.....	"
C. A. Goff, Spencer.....	"
V. A. Ledsom, Bright.....	"
H. H. Miller, Looneyville.....	"
Carter Oil Co., Richardson.....	"

SUMMERS COUNTY.

Commonwealth Lumber Co., Glenray....	Band saw.
H. Guinn & Son, Green Sulphur Springs..	Circular saw.
Z. V. Burks, Bell Point.....	"
J. J. Vest, Farley.....	"
Scott Brothers, Talcott.....	"
E. P. Vandal, Elton.....	"
John Bowland, Brooks.....	"
Indian Mill Supply Co., Indian Mills....	"
David Welder, Marie.....	"
D. G. Ballengee, Clayton.....	"
Jackson Grimmer, Lowell.....	"
Thomas Ballengee, Ballengee.....	"
Taylor & Wood, Forest Hill.....	"
Charles Sanders, Forest Hill.....	"
E. H. Harris, Hinton.....	"
Hinton-Belva Realty Co., Bell Point....	"
C. B. Burks, Tophet.....	"
Eskeu & Petrey, Tophet.....	"
Walker & Wood, Tophet.....	"
J. H. Helms, Brooklyn.....	"
Lilly Lumber Co., New Richmond.....	"
Houchin & McClung, Jumping Branch..	"
Bluestone Lumber Co., Lilly.....	Circular saw and stave mill.
Jordan Taylor, Forest Hill.....	" "
E. W. Spangler, Indian Mills.....	" "
The Wm. James Sons Co., Hinton.....	Circular saw and planer.

TAYLOR COUNTY.

Bush Lumber Co., Grafton.....	Circular saw and stave mill.
M. E. Bush, Grafton.....	" "
Watson & Watson, Independence.....	" "
Dilworth & Brother, Astor.....	" "
Reynolds & Morrow, Flemington.....	Circular saw.
Knight & Barker, Simpson.....	"
G. W. Shafer, Webster.....	"
C. J. Tucker & Bro., Webster.....	"
Brown & Goodwin, Grafton.....	"
T. F. Henry, Boothsville.....	"
Keener & Co., Grafton.....	"
I. W. McDaniel, Grafton.....	"
T. O. Jacobs, Grafton.....	"
R. S. Rogers, Grafton.....	"
DeMoss-Travis Lumber Co., Thornton...	"
J. W. Baylor, Thornton.....	"
J. C. Shroyer, Thornton.....	"
J. A. Poe & Brother, Grafton.....	"
Watts & Evans, Newburg.....	"
G. M. Thorn & Brother, Independence...	"
J. B. Kerns, Independence.....	"
Geo. W. Mays, Thornton.....	"
A. B. Current, Thornton.....	"
J. W. DeMoss & Son, Thornton.....	"

TUCKER COUNTY.

Babcock Lumber & Boom Co., Davis....	2 Band saw mills.
Otter Creek Boom & Lumber Co.,....	
Hambleton	Band saw.
Elk Lick Lumber Co., Hambleton.....	"
R. Chaffey, William.....	"
Demp-Bell Lumber Co., Hendricks.....	"
S. D. Sherrick Lumber Co., Henricks....	"
Clover Run Lumber Co., Parsons.....	Circular saw.
Scott Lumber Co., Red Creek.....	"
E. A. Nestor, Hovatter.....	Circular saw and planer.

TYLER COUNTY.

Ed. Sanders, Sistersville.....	Circular saw.
E. Curry, Middlebourne.....	"
G. D. Dalison, Middlebourne.....	"
Vernon Delo, Alma.....	"
Ralph Sweeney, Shirley.....	Circular saw and planer.
W. H. Huth & Son, Middlebourne.....	"
J. H. Pierpont, Next.....	Water mill.

UPSHUR COUNTY.

Croft Lumber Company, Alexander....	Band saw.
Buchanan Lumber Company, Frenchton..	Circular saw.
E. G. Wilson, Kanawha Head.....	"
Henry McQuain, Rock Cave.....	"
R. G. Smith & Brother, Frenchton.....	"
Hawker Lumber Company, Buckhannon..	"
J. Alkire, Canaan.....	"
Weston Lumber Company, Indian Camp..	"
A. W. Tenney & Son, Tenmile.....	"
David Woody, Selbyville.....	"
I. A. Stalnaker, Buckhannon.....	"
W. O. Grim, Queens.....	"
G. F. Stockert & Son, Buckhannon.....	"
Stockert & Bailey, Holly Grove.....	"
Pittsburg-Kanawha Lumber Company,	"
Buckhannon	"
Kirke Tillett, Hall.....	"
Wellington Thomas, Canaan.....	"
Phillips Brothers, Selbyville.....	"
Wyatt Gregory, Canaan.....	"
Charles Hollen, Queens.....	"
W. F. Hollen, Queens.....	"
E. N. Phillips, Tallmansville.....	"
Alonzo Cutright, Queens.....	"
Parley Zickefoose, Hemlock.....	"
Benton Queen, Newlonton.....	"
Mountain State Lumber Co., Tenmile...	"
C. E. Hiner, Buckhannon.....	"
Leo Brown, Frenchton.....	Circular saw and planer.
H. Fidler, Arlington.....	Circular saw and planer.
C. E. Queen, Rock Cave.....	Circular saw and planer.

WAYNE COUNTY.

Al. Cline & Co., Jennie.....	Circular saw.
G. W. Workman, Echo.....	"
D. H. Hanshaw, Crum.....	"
W. C. Crum, Crum.....	"
C. D. Williamson, Crum.....	"
D. Reed, Pharaoh.....	"
John Workman, Echo.....	"
J. R. Freiner, East Lynn.....	"
M. A. Kreig, Kiahsville.....	"
Matt. Napier, East Lynn.....	"
Stratton & Dameron, Centerville.....	"
Ramey & Sanders, Nestlow.....	"
Enoch Childers, Booton.....	"
Frank Fry, Stiltner.....	"
C. W. Thompson, Echo.....	"
L. B. Ferguson, Wayne.....	Circular saw and planer.
J. E. Newman Lavelette.....	Circular saw and planer.

WEBSTER COUNTY.

Cherry River Boom & Lumber Co.,	Band saw.
Camden-on-Gauley	
Mayton Lumber Co., Hackers Valley....	"
Belle-Mead Lumber Co., Addison.....	"
Smoot Lumber Co., Cowen.....	"
New Dominion Lumber Co., Diana.....	Circular saw.
Webster Springs Lumber Co., Addison..	"
James Elbon, Addison.....	"
J. P. White, Addison.....	"
Payne Brothers, Bolair.....	"
Chipps Lumber Co., Haynes.....	"
Lee Gad, Marcus.....	"
Hollister & Detamore, Cowen.....	"
Charles Cunningham, Upper Glade.....	"
Anis Boggs, Boggs.....	"
John Doddrell, Cowen.....	"
J. W. Mills, Cowen.....	"
Samp. Hamrick, Samp.....	Water power saw mill.

WETZEL COUNTY.

W. T. Francis, Smithfield.....	Circular saw.
Henry Fisher, Smithfield.....	"
J. L. Brown, Burchfield.....	"
Robinson Improvement Co., Smithfield..	"
John M. Hart, Hastings.....	"
Jesse Snider, Lowman.....	"
Paulhamus & Moon, Smithfield.....	"
Koonts & Phillips, New Martinsville....	"
Clark & Harris, Jacksonburg.....	"
Wm. Wyatt, Jacksonburg.....	"
Hunt & Harker, Hundred.....	"
Wm. Marshall & Co., Littleton.....	"
J. C. Briggs, New Martinsville.....	"

WIRT COUNTY.

W. M. & J. G. Merrill, Creston.....	Circular saw.
Alvin Ahart, Evelyn.....	"
J. M. Lee, Palestine.....	"
T. J. Lee, Palestine.....	"
A. B. Huffman, Palestine.....	"
Ernest Morrison, Elizabeth.....	"
W. H. Carpenter, Newark.....	"
Samuel Smith, Burning Springs.....	"
John Foutty, Newark.....	"
Bert Sheppard, Palestine.....	"
M. L. Righter, Sanoma.....	"
J. F. Darnell, Freeport.....	Circular saw and planer.
G. W. Righter, Sanoma.....	Circular saw and planer.

WOOD COUNTY.

Parkersburg Mill Co., Parkersburg.....	Band saw.
Alex. Cochran, Belleville.....	Circular saw.
H. D. Dye, Roosevelt.....	"
Kirks Mill Co., Parkersburg.....	"
Nicollette Lumber Co., Nicollette.....	"
Wilson & Sons, Parkersburg.....	"

WYOMING COUNTY.

The W. M. Ritter Lumber Co., Maben....	Band saw.
Keys-Fannin Lumber Co., Herndon.....	Band saw.
E. H. Suddeth Lumber Co., Woosley....	Circular saw.
T. H. Lambert, Pineville.....	"
Silas Goode, Saulsville.....	"
Wm. Stewart, Jesse.....	"
D. C. Brooks, Trent.....	"
Miles Burgess, Swope.....	"
Henry Cline, Baileyville.....	"
W. S. Toler, Sun Hill.....	"
L. A. Walker, Sun Hill.....	"
T. S. Morgan, Guyan.....	"
M. P. McGraw, McGraws.....	"
A. R. Wittenberg, Pineville.....	"
T. E. Rutherford, Pineville.....	"
James Cozort, Rock View.....	"
Lemuel Goode, Newfound.....	"
W. G. Lambert, Mullins.....	"
Powell, Lusk & Sons, Herndon.....	"
J. F. Fisher, Oceana.....	"
C. A. Hambrick, Oceana.....	"
G. E. Lambert, Pineville.....	Circular saw and planer.
J. S. Lambert, Key Rock.....	Circular saw and planer.

CHAPTER X.

RECOMMENDATIONS.

The preceding chapters of this report set forth the present condition of the West Virginia forests; suggest some of the ways in which they are useful and reasons for their preservation; and point out some of the ways in which they are being needlessly injured and destroyed. It is evident that a knowledge of these things, and even a much more thorough acquaintance with conditions than can be gained from these pages, will benefit no one unless it is productive of better laws for the protection of our forests and of better methods for their more conservative management. With this purpose in view, therefore, the following recommendations are made:

Forestry Laws Recommended.

It is recommended that a law be enacted providing for the appointment of a state forester and prescribing his duties from the list below.

- 1.—Carrying on an educational campaign throughout the State, by preparing and distributing printed matter, by speaking at farmers' and teachers' institutes and other public meetings, and by cooperating with instructors in forestry at the State University.
- 2.—Advising private land owners in reference to better management of woodlots and timber tracts.
- 3.—Executing laws for the control of forest fires.
- 4.—Examination of lands belonging to the State, or that may become the property of the State, for the purpose of determining whether such lands should be retained for forestry purposes.
- 5.—Collecting information regarding forests, forest trees, and forest products, and making a study of the industries carried on by saw mills and other wood-working establishments.
- 6.—Preparation of a biennial report.

It is suggested that the state forester should be appointed by and should act at the will of some existing board or of a forestry board or commission to be created by law. (See list of governing boards in other states near the end of Chapter VII.)

It is recommended that the Forest, Game and Fish Laws of 1909 be amended so as to take the execution of that part of the law relating to the suppression of forest fires from among the duties of the Forest, Game and Fish Warden and transfer the same to the duties of a state forester.

In order to encourage the planting of land in forest trees, it is recommended that a law be enacted exempting from taxation for a period of years such lands as may be planted according to carefully prepared specifications, or a law providing for a scale of rebates on lands so planted. (Connecticut, New Hampshire, and other states, have made satisfactory tests of the laws proposed.)

It is recommended that West Virginia give its consent, by the enactment of law, to the acquisition by the United States Government by purchase or gift or condemnation according to law such non-agricultural lands within the mountainous region of the State as may be needed in the establishment of a National Forest.

It is recommended that the Governor of West Virginia be empowered by law to accept in the name of the State any gifts of land suitable for forestry purposes.

Suggestions to Private Land Owners.

To the owners of cut-over forest lands the course marked out in the following communication from the West Virginia Pulp and Paper Company, dated August 24th, 1910, is hereby highly recommended:

“ * * * * We planted on our lands on Shavers Fork of Cheat river about 170,000 young spruces and 1,000 or 2,000 poplars this year. Last year we planted about 25,000 spruce seedlings and our judgment is that about 80 per cent of them are growing. Of course at the present time we cannot tell much about the latest planting in spruce because of the excessive un-

dergrowth completely covering the small trees, but we have reason to expect that at least a large proportion of them will grow this year as did last.

“We are very greatly interested in the reproduction of forests on our property and it is our present intention to do everything in our power in the future to save and propagate the timber. We are leaving all the small timber under about 10 inches at the stump and that portion which we have cut over is rapidly reproducing itself. Our planting is confined to locations where there has either been some fire or on which there was no stand of spruce. We confidently believe that if the fire can be kept out of the old slashings that our property will reproduce itself rapidly and that by the time we have lumbered over it, it will be possible to go over it again, and while of course we will not be able to secure the quantity of large lumber, we can make the crops perpetual for pulp.”

In sections where planting is not necessary it is recommended that at least some effort be made on the part of owners to encourage the natural reproduction of valuable species of trees. The most effective means to this end is the prevention of forest fires—a work impossible for the State without the energetic cooperation of railroads, lumber companies and others. A good stand and growth of desirable young trees can be encouraged further by leaving a sufficient number of seed trees and by clearing away brush and undesirable species of shrubs and trees.

Within a comparatively few years the many thousands of acres of rough woodlot land belonging to farmers must be looked to as one of the principal sources of timber in the State. It is suggested, therefore, that such areas in connection with farms as are now overgrown with worthless vegetation be made to grow locusts, chestnuts, or other fast-growing trees suited to the various localities.

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