Message from the President of the United States Transmitting ...

United States Dept. of Agriculture, United States Forest Service, United States Bureau of Forestry, Geological ...

MESSAGE

FROM THE

PRESIDENT OF THE UNITED STATES,

TRANSMITTING

A REPORT OF THE SECRETARY OF AGRICULTURE IN RELATION TO THE FORESTS, RIVERS, AND MOUNTAINS OF THE SOUTHERN APPALACHIAN REGION.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1902.

LETTER OF TRANSMITTAL.

To the Senate and House of Representatives:

I transmit herewith a report of the Secretary of Agriculture, prepared in collaboration with the Department of the Interior, upon the forests, rivers, and mountains of the Southern Appalachian region, and upon its agricultural situation as affected by them. The report of the Secretary presents the final results of an investigation authorized by the last Congress. Its conclusions point unmistakably, in the judgment of the Secretary and in my own, to the creation of a national forest reserve in certain parts of the Southern States. The facts ascertained and here presented deserve the careful consideration of the Congress; they have already received the full attention of the scientist and the lumberman. They set forth an economic need of prime importance to the welfare of the South, and hence to that of the nation as a whole, and they point to the necessity of protecting through wise use a mountain region whose influence flows far beyond its borders with the waters of the rivers to which it gives rise.

Among the elevations of the eastern half of the United States the Southern Appalachians are of paramount interest for geographic, hydrographic, and forest reasons, and, as a consequence, for economic reasons as well. These great mountains are old in the history of the continent which has grown up about them. The hard-wood forests were born on their slopes and have spread thence over the eastern half of the continent. More than once in the remote geologic past they have disappeared before the sea on the east, south, and west, and before the ice on the north; but here in this Southern Appalachian region they have lived on to the present day.

Under the varying conditions of soil, elevation, and climate many of the Appalachian tree species have developed. Hence it is that in this region occur that marvelous variety and richness of plant growth which have led our ablest business men and scientists to ask for its preservation by the Government for the advancement of science and for the instruction and pleasure of the people of our own and of future generations. And it is the concentration here of so many valuable species with such favorable conditions of growth which has led forest experts and lumbermen alike to assert that of all the continent this region is best suited to the purposes and plans of a national forest reserve in the hard-wood region.

The conclusions of the Secretary of Agriculture are summarized as follows in his report:

"1. The Southern Appalachian region embraces the highest peaks and largest mountain masses east of the Rockies. It is the great physiographic feature of the eastern half of the continent, and no such lofty mountains are covered with hard-wood forests in all North America.

"2. Upon these mountains descends the heaviest rainfall of the United States, except that of the North Pacific coast. It is often of extreme violence, as much as 8 inches having fallen in eleven hours, 31 inches in one month, and 105 inches in a year.

"3. The soil, once denuded of its forests and swept by torrential rains, rapidly loses first its humus, then its rich upper strata, and finally is washed in enormous volume into the streams, to bury such of the fertile lowlands as are not eroded by the floods, to obstruct the rivers, and to fill up the harbors on the coast. More good soil is now washed from these cleared mountain-side fields during a single heavy rain than during centuries under forest cover.

"4. The rivers which originate in the Southern Appalachians flow into or along the edges of every State from Ohio to the Gulf and from the Atlantic to the Mississippi. Along their courses are agricultural, water-power, and navigation interests whose preservation is absolutely essential to the well-being of the nation.

"5. The regulation of the flow of these rivers can be accomplished only by the conservation of the forests.

"6. These are the heaviest and most beautiful hard-wood forests of the continent. In them species from east and west, from north and south, mingle in a growth of unparalleled richness and variety. They contain many species of the first commercial value, and furnish important supplies which can not be obtained from any other region.

"7. For economic reasons the preservation of these forests is imperative. Their existence in good condition is essential to the prosperity of the lowlands through which their waters run. Maintained in productive condition they will supply indispensable materials, which must fail without them. Their management under practical and conservative forestry will sustain and increase the resources of this region and of the nation at large, will serve as an invaluable object lesson in the advantages and practicability of forest preservation by use, and will soon be self-supporting from the sale of timber.

"8. The agricultural resources of the Southern Appalachian region must be protected and preserved. To that end the preservation of the forests is an indispensable condition, which will lead not to the reduction but to the increase of the yield of agricultural products.

"9. The floods in these mountain-born streams, if this forest destruction continues, will increase in frequency and violence and in the extent of their damages, both within this region and across the bordering States. The extent of these damages, like those from the washing of the mountain fields and roads, can not be estimated with perfect accuracy, but during the present year alone the total has approximated $10,000,000, a sum sufficient to purchase the entire area recommended for the proposed reserve. But this loss can not be estimated in money value alone. Its continuance means the early destruction of conditions most valuable to the nation, and which neither skill nor wealth can restore.

"10. The preservation of the forests, of the streams, and of the agricultural interests here described can be successfully accomplished only by the purchase and creation of a national forest reserve. The States of the Southern Appalachian region own little or no land, and their revenues are inadequate to carry out this plan. Federal action is obviously necessary, is fully justified by reasons of public necessity, and may be expected to have most fortunate results."

With these conclusions I fully agree; and I heartily commend this measure to the favorable consideration of the Congress.

THEODORE ROOSEVELT.

WHITE HOUSE,
December 19, 1901.

CONTENTS.

ILLUSTRATIONS.

REPORT

ON THE

FORESTS AND FOREST CONDITIONS OF THE SOUTHERN APPALACHIAN MOUNTAIN REGION.

To the PRESIDENT:

An interest in practical forestry, notable and commendable, has grown up among the American people during the past few years. There is an evident determination that our country shall profit from its own and the experience of other countries by beginning the preservation of our forest remnants before it is altogether too late.

The most important practical outcome of this awakening has been the setting aside by the Government, out of the public domain, in the several Western States and Territories, of some 70,000 square miles of forest-covered lands about the mountains in these regions, to protect the streams and perpetuate the timber supplies. A more recent result is the movement, which has met with the general approval of business and scientific organizations and the unanimous support of the press, toward the preservation by the Government of the hard-wood forests on the slopes of the Southern Appalachian Mountains.

The proposal that the Government shall protect these Appalachian forests by purchasing the lands and making of them a great national forest reserve was first brought directly to the attention of Congress in January, 1900, when a memorial to that effect was presented by the Appalachian Mountain Club of New England and the Appalachian National Park Association of the South Atlantic States. In response to this memorial and in recognition of the importance of the movement, the act making the appropriation for the Department of Agriculture for the fiscal year ending June 30, 1901, provided that a "sum not to exceed $5,000 may, in the discretion of the Secretary of Agriculture, be used to investigate the forest conditions in the Southern Appalachian Mountain region of western North Carolina and adjacent States."

NATURE AND EXTENT OF THIS INVESTIGATION.

Acting under this authority I conducted such an investigation during the field season of 1900, and continued it again during the present year. The conclusions to which the results of this investigation have led me will be found at the end of this report (p. 38).

Departments of Agriculture and of the Interior cooperate in the investigation.

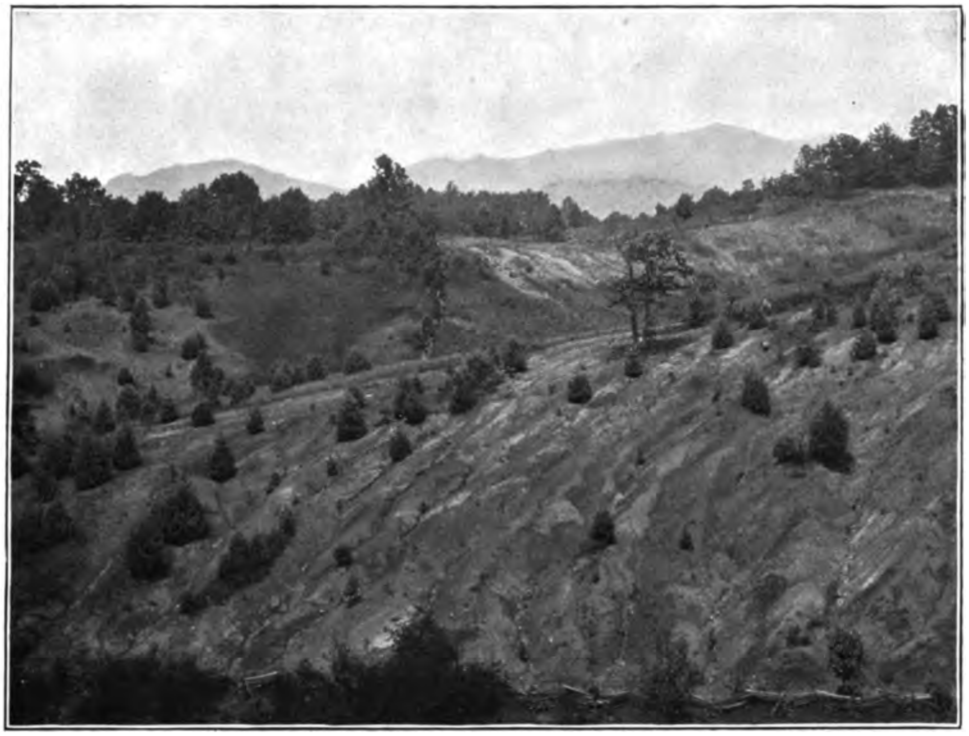
By the liberal cooperation of the Department of the Interior, through the United States Geological Survey, I was enabled to make these investigations much broader and more thorough than would otherwise have been possible. The Geological Survey, in timely recognition of the importance of this movement, has, during the past two years, studied the topographic features and the water supplies of the region in relation to its forest development, and has also cooperated in the examination of the forests themselves. The investigations along the several lines have been participated in by the best men available in the Government service. I have myself twice visited this region, and have seen at first hand the destruction of the forests and the consequent enormous damage by floods; have examined some of its largest mountain masses, and have climbed its highest peak. The conclusions reached from this personal experience, as well as from the extensive expert investigations just mentioned, will be found briefly summarized at another place in this report (p. 38).

Nature of the investigation.

The experts in charge of this work examined not only the forests and the general forest conditions as they exist to-day, but also the causes which have led up to these conditions and the possibility of improving them either with or without Government ownership and supervision. They studied the influences of the forests on the preservation of the streams and soils of these mountains and on the preservation of the water powers and the farm lands along these streams, both within the mountain areas and across the bordering lowlands. In particular the region was studied as to its relative adaptability to future development along the lines of practical forestry and practical agriculture.

Forest and agricultural conditions.

The forests were carefully mapped as to their distribution and density and the relative proportion of the forest-covered and cleared lands. The investigation also included a study of the general character and distribution of all the available species of trees and shrubs of the



(*A*) LAND EROSION ON THE CLEARED SLOPES OF THE SOUTHERN APPALACHIANS. (See pp. 26–28.)

These steep lands have been cleared, cultivated, abandoned, and ruined, all in a few years. Their reforestation will soon be impossible.

(*B*) FLOOD DESTRUCTION OF AN APPALACHIAN MOUNTAIN VALLEY. (See pp. 32, 130.)

The floods have washed away the farm and the home, leaving only the hillside barn. The aggregate damages from floods along these Southern Appalachian streams from April, 1901, to April, 1902, reached the large sum of $18,000,000.

(Photographed from a model by Howell.)

RELIEF MAP OF THE UNITED STATES, SHOWING BY INCLOSING WHITE LINES THE LOCATION OF THE NATIONAL FOREST RESERVES IN THE WEST AND THE REGION WITHIN WHICH IT IS PROPOSED TO LOCATE THE NATIONAL APPALACHIAN FOREST RESERVE, INCLUDING PORTIONS OF THE TWO VIRGINIAS, THE TWO CAROLINAS, GEORGIA, ALABAMA, AND TENNESSEE. (See p. 16.)

The black curving lines indicate the number of inches of rainfall in the regions they traverse. The dark shading also indicates a heavy rainfall, and the light shading indicates a light rainfall.

region, the stand of timber, the extent to which the timber has been and is now being cut or damaged by fire, the nature of the present holdings, and the prices at which these lands can be purchased. The agricultural investigation included the study of the cleared lands, methods of their clearing, the crops which they yield, and the extent to which these lands deteriorate by erosion and by the leaching out of their fertility both on the mountain slopes and in the valleys.

The officers of the Geological Survey meanwhile made a careful study of the quantity of water flowing out through the various streams having their sources in this region, and of the effect of forest clearings on the regularity of their flow at different seasons. Fifty-four regular stations were maintained, covering every large stream which rises in these mountains. These streams flow through West Virginia, Virginia, North Carolina, South Carolina, Georgia, Alabama, and Tennessee, and rank among the important rivers of the country. At each station daily records of stream heights were kept, and measurements of the volume of flow were made from time to time. In addition to this, more than 1,000 miscellaneous gagings were made on the tributaries of the James, Roanoke, Yadkin, Catawba, Broad, Savannah, Chattahoochee, Coosa, Hiwassee, Tennessee, French Broad, Nolichucky, Watauga, Holston, and New (Kanawha) rivers. (See Pl. XII).

Investigation of the streams.

A brief preliminary report embodying the more salient results of this investigation during the year 1900 was sent to Congress by the President in January, 1901. It was accompanied by a letter from President McKinley commendatory of the plan for an Appalachian forest reserve here suggested anew. The present report will be found to contain the results of the investigations carried on during the past two years, together with some conclusions based upon them. The general statement is followed by a series of supplemental papers, each containing a more detailed account of the results of the examinations and inquiries along some one single line.

Nature of this report.

The region examined during this investigation embraces that part of the Appalachian Mountain system which begins in southern Virginia and includes portions of that State, of southeastern West Virginia, western North Carolina, eastern Tennessee, northwestern South Carolina, and northern Georgia, and especially that portion of this region usually

The region examined.

designated as the Southern Appalachian Mountains. Its general character and relations can be more easily described and better understood after a brief discussion of the Appalachian region as a whole.

THE APPALACHIAN REGION.

The map accompanying this report (Pl. II) shows the Appalachian Mountain system extending along the eastern portion of the continent from New York to Alabama, for a distance of 1,000 miles, and having a maximum width approaching 150 miles. These Appalachians constitute, not a single ridge or chain, but a zone or belt of mountains, the maximum development of which is reached south-southwest of Washington. Along the southeastern front, the Blue Ridge Mountains in New Jersey and Pennsylvania are rather poorly defined, and reach an elevation in the latter State, at South Mountain, of about 2,000 feet. South-southwestward they become a more prominent and regular feature in the landscape, the highest peaks reaching an elevation of a little more than 4,000 feet in Virginia (see Pl. XII), and about 6,000 feet in North Carolina. Along the northwestern front of this belt the Allegheny Mountains, starting with the Catskills in New York, cross Pennsylvania and Maryland is a series of well-defined parallel ridges, with a general elevation of 2,000 feet. The maximum development of the Alleghenies, however, is reached along the line between Virginia, West Virginia, and Kentucky, where the elevations range from 3,000 feet to nearly 4,500 feet above the sea. Southward from this point they become less and less prominent, rising but little above the adjacent plateau surface.

Appalachian Mountains.

Between the Blue Ridge Mountains and the Alleghenies lies a great mountain valley, or succession of valleys, separated laterally by more or less subordinate ridges, parallel to the general mountain courses, and with their ends separated by low divides. This is called by the geographers the Great Appalachian Valley. The more or less separate valleys have local names, such as the Lehigh, Lebanon, and Cumberland valleys, in Pennsylvania; the Shenandoah, or Valley of Virginia (see Pl. III*a*), and the Valley of East Tennessee. (See Pl. LXV.) The floor of this great valley region has an elevation above the sea of from less than 500 to 800 feet in Pennsylvania, and thence, like the mountains, rises southward to its maximum elevation of about 1,700 feet in southwest Virginia. (Pl. III.)

Appalachian Valley.

(A) VALLEY OF VIRGINIA. (See p. 16.)

This is a part of the great Appalachian Valley lying west of the Southern Appalachian Mountains.

(B) PIEDMONT PLATEAU IN VIRGINIA. (See p. 17.)

This plateau region lies east and south of the Appalachian mountains from Virginia into Alabama.

THE SOUTHERN APPALACHIAN REGION.

This general Appalachian system is usually separated into its northern and southern divisions in southern Virginia by a line drawn nearly eastward from the most easterly point of Kentucky, and where the New or Kanawha River breaks across the Appalachian Valley and the Alleghenies. New River rises on the Blue Ridge in North Carolina, flows northward and then westward through the Ohio into the Mississippi drainage. It thus violates the rule established by the James, the Potomac, the Susquehanna, and the Delaware rivers, to the north, of rising about the Alleghenies and breaking eastward across the Blue Ridge into the Atlantic drainage; and it here establishes a new rule that controls the drainage of the larger mountain streams to the south, which, following its example, rise on the western slopes of the Blue Ridge and flow across the mountain region to the northwestward and into the Mississippi drainage through the Tennessee. To the southwest of this line which separates the two systems of drainage lie the Southern Appalachians.

Division between the northern and southern Appalachians.

Referring again to the maps (Pls. IV and XII), it will be seen that bordering these mountains on the east and south in Virginia, the Carolinas, Georgia, and Alabama, is a region which is termed by the geographers the Piedmont Plateau. From the base of the mountains, where it has an elevation of from 1,000 to 1,200 feet, the hilly, undulating surface of the plateau (see Pl. III *b*) slopes gently seaward for a distance of from 100 to 150 miles, to where these hills give place to the sandy plains of the coast region. This Piedmont Plateau represents the finest agricultural and manufacturing portions of these States. Across its surface wind the rivers, fed by mountain streams, whose waters furnish power for large and rapidly growing manufacturing interests, and whose bordering lands are among the most productive in the region. The future of these water powers and of these bordering lands depends upon the regularity of the mountain streams, and these in turn depend upon the preservation of the mountain forests.

The Piedmont Plateau.

To the west of these mountains lies the Valley of East Tennessee, which constitutes the southern portion of the great Appalachian Valley. It has an elevation of 1,700 feet in southwestern Virginia and 1,000 feet at Knox-

Valley of East Tennessee.

ville, from which point it extends southwestward across portions of Georgia and Alabama. Into and through this valley drains the larger portion of the water which leaves the mountain region. Along the upper reaches of these streams are numerous valuable water powers, and along their lower courses through the valley are some of the finest farming lands in Tennessee. To the west of this valley lie the southern remnants of the Allegheny Mountains and the better defined Cumberland Plateau.

Between this great valley on the west and the Piedmont Plateau on the east and south are the Southern Appalachian Mountains, with which this report has especially to deal.

THE SOUTHERN APPALACHIAN MOUNTAINS.

The accompanying maps (Pls. IV and XII), show that the Blue Ridge, as it crosses Virginia southward, increases and holds its prominence and its individuality. As it passes into North Carolina it enlarges both vertically and laterally, widening out into a complex zone or belt of mountains, with a maximum width of about 70 miles in western North Carolina and east Tennessee, and contracting again toward its southern end. These mountains show none of the regularity exhibited by the Northern Appalachians, but, on the other hand, are composed of massive ranges and cross ridges and more or less isolated mountains, often with rounded, dome-like tops (see Pl. VIII), in striking contrast with the sharp, regular, parallel, rocky ridges of the more northern Alleghenies.

The Blue Ridge and the Unaka Mountains.

Along the southeastern margin of this southern mountain belt is the Blue Ridge proper, which, as it crosses North Carolina, is a fairly well-defined mountain range, standing more than 3,000 feet above the sea and rising in four peaks to more than 5,000 feet, and in one—the Grandfather—to practically 6,000 feet. Bordering this region on the northwest is a mountain range—the Unakas—somewhat higher, and in its southern portion more massive, but less continuous, than the Blue Ridge; less continuous for the reason that its course is cut across by half a dozen rivers, which rise on the Blue Ridge on the east, flow across this intervening mountain region, and cut through the Unakas in wild, deep gorges. (See Pl. V.) Between these river gorges the segments of the Unakas are known by such local names as the Iron Mountains, Bald Mountains, and Great Smoky mountains. In southern

DOE RIVER GORGE, TENNESSEE. (See p. 18.)

The forests on the steep slopes of this beautiful gorge are being destroyed by the fire and the axe.

PLATE VI, PART 1.

Little Yellow Mountain. Roan Mountain.

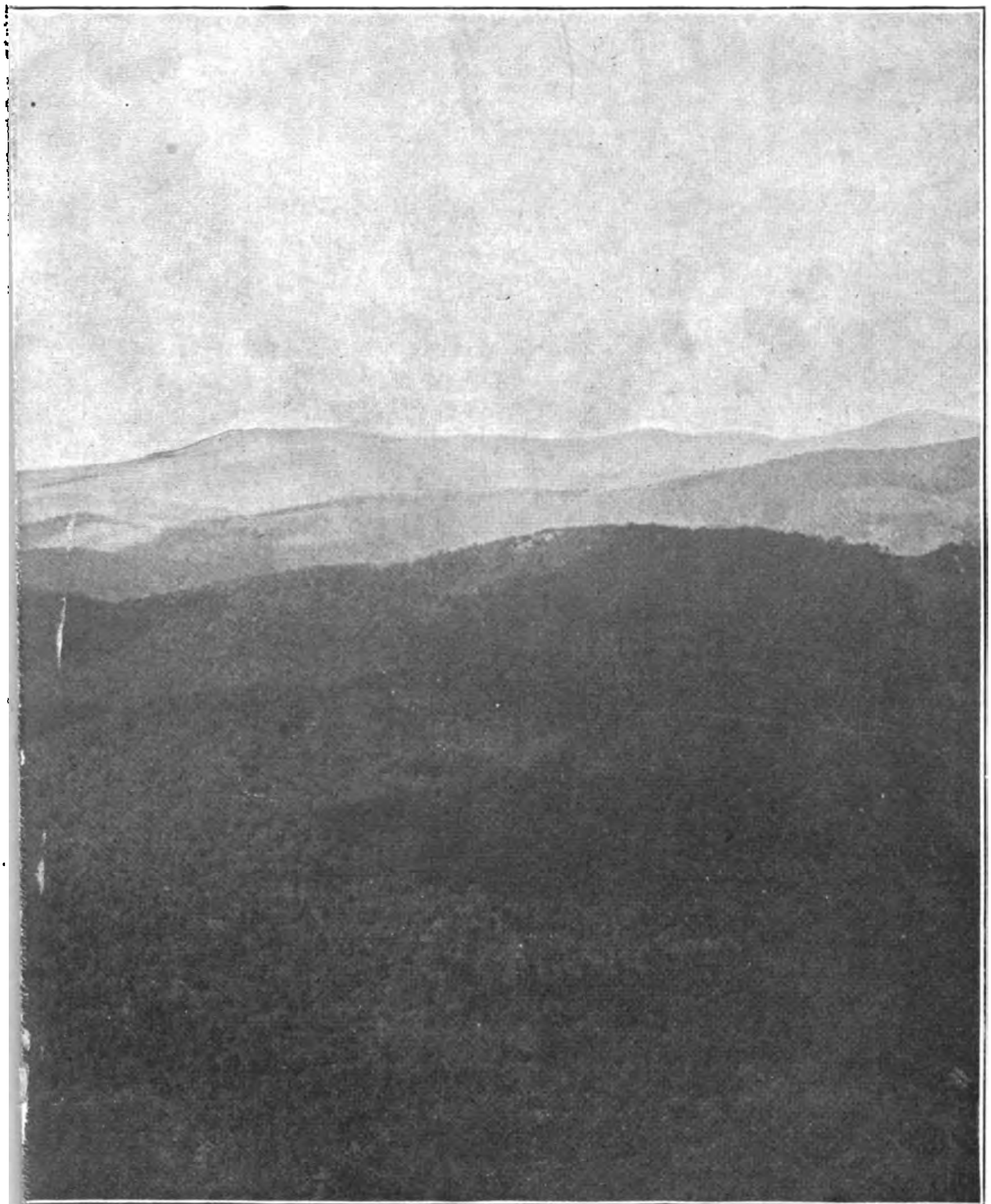
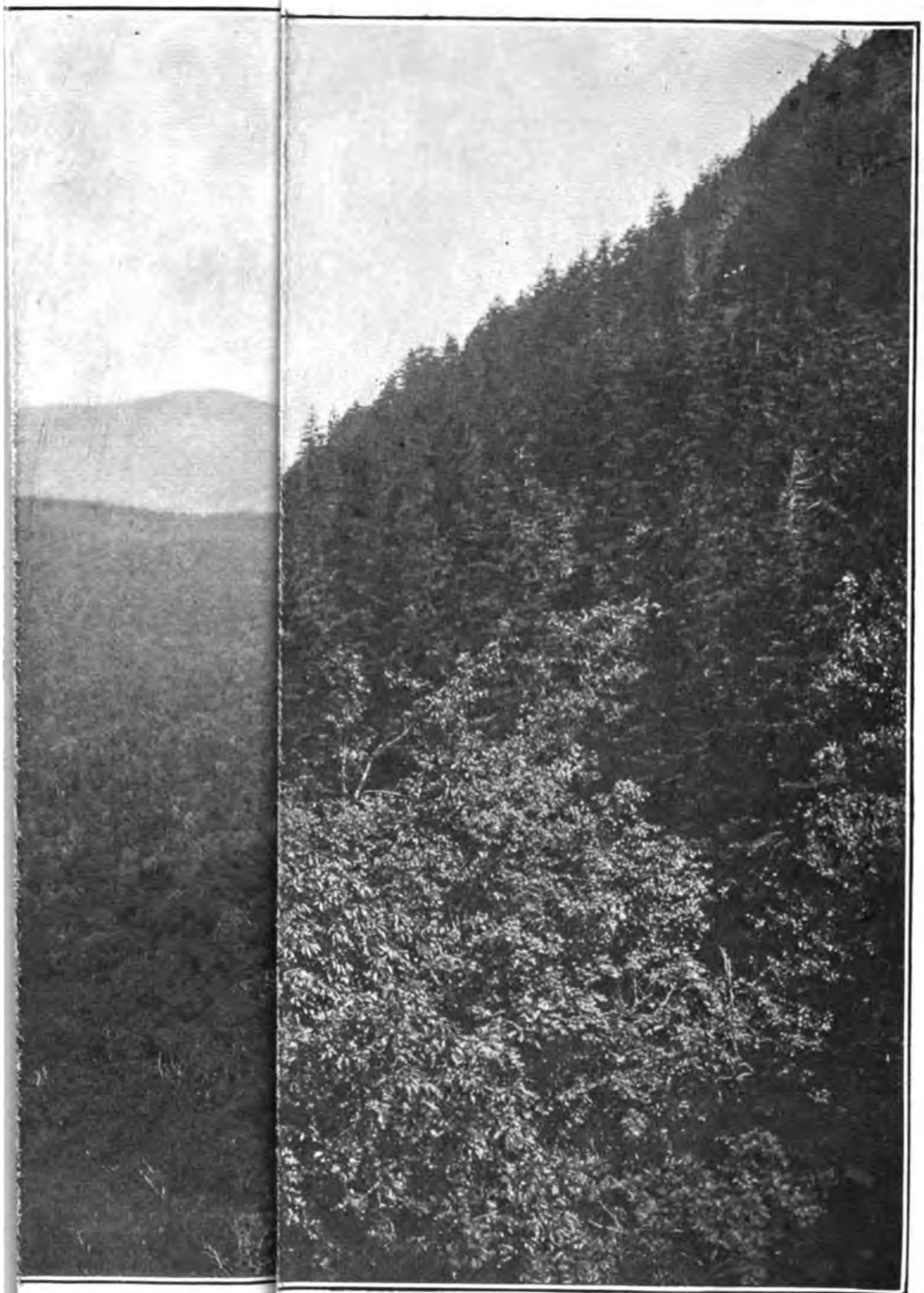


PLATE VI, PART 2.



ANDFATHER MOUNTAIN: TYPICA

Virginia the Unakas approach the Blue Ridge and practically merge with the latter into one irregular mountain range; southward, the two diverge. The Unaka range has 18 peaks rising above 5,000 feet, and 8 of these above 6,000 feet. The Roan, toward its northern end, Mount Guyot and Clingman's Dome, farther south in the Great Smoky Mountains, reach altitudes, respectively, of 6,313, 6,636, and 6,619 feet.

Southwest of the North Carolina line these bordering mountain chains lose both in elevation and regularity. In northern Georgia they break up into several minor ridges, diminishing in size as they extend southwestward, separated by widening, irregular valleys. Near Cartersville, Ga., between the two principal tributaries of the Coosa River, the Southern Appalachians merge into the Piedmont Plateau, with its low, isolated hills and ridges, remnants of former mountains. (See Pls. IX *a* and XLV.) They rise again, however, in eastern central Alabama into the short, irregular ridge of the Talladega Mountains, which reach an elevation of 2,500 feet. The slopes of these ridges in north Georgia are still largely forest covered and along them are the countless springs which, with notable constancy, feed the great rivers of that State and Alabama. The scenery of much of this region is exceedingly picturesque, and its attractiveness is increased by the many cascades and waterfalls along the courses of these mountain streams, such as Tallulah Falls (see Pl. XXVIII), with a descent of 335 feet, and the Dukes Creek, Minnehaha, and Ruby falls, with each a descent of nearly 300 feet in short distances.

Southern ends of the Appalachians.

Extending out from the two great irregular mountain borders, the Blue Ridge and the Unakas, into the elevated region between them, and connecting them in places, are a series of more or less interrupted cross ridges, which have altitudes comparable to, and in one case (the Black Mountains) greater than, those of either the Blue Ridge or the Unakas. And these interior ridges are separated by high, but deep and generally narrow, irregular valleys.

The cross ridges of mountains.

Standing on any of these elevated mountains, one may see stretching out in either of several directions an endless succession of mountain ridges and mountain peaks. A remarkable succession of these ridges and peaks is seen from the Grandfather Mountain, North Carolina, looking southwest, as shown in the accompanying panoramic view (Pl. VI). Hundreds of such vistas, from as many peaks, open out before the traveler through this region. In every direction the splendid hard-wood forests cover and protect the mountain slopes and the countless springs of water which flow from them as the sources of great rivers. There is but one discordant fact—the calamitous destruction of the forests on these mountain slopes.

Some of these ridges, like the Black Mountains, are short, but high and massive and terminate abruptly. Others are longer and lower and slope gradually down to the adjacent valley or rise from a lower gap to another still higher ridge. All are more or less irregular both in their courses and their elevation. Most of them have peaks rising from their tops; but not a few have fairly uniform crests. (See

Variety of peaks and ridges.

Pl. XVII.) Some of these peaks, like the Grandfather (Pl. VII), are sharp, rugged, and rocky; others, like the Roan or the "Balds" (Pl. VIII *a*), are rounded domes whose tops are covered only with grass and rhododendron, while still others, equally tall and massive, like the Blacks and the Great Smokies, are heavily forest covered to the summit. (See Pl. VIII *b*.)

The haziness of the atmosphere, which has found expression in the names "Blue Ridge" and "Smoky Mountain," often limits the distance of distinct vision, but it combines with the forest cover to soften the details and to render this Southern Appalachian landscape attractive beyond comparison. This succession of ridges and peaks, seen through it from an eminence, rising one above and beyond

Magnitude of these mountains.

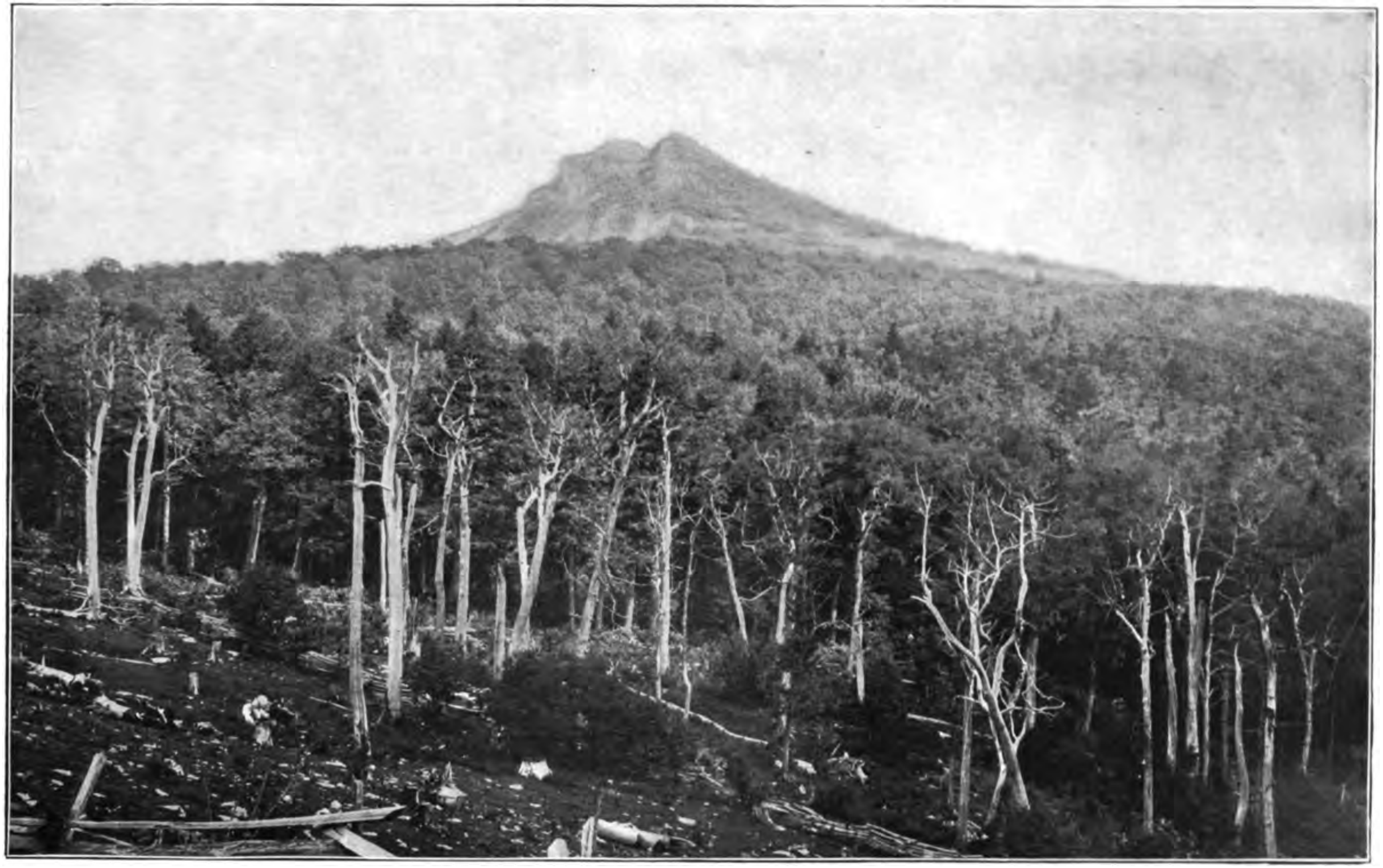
another for 50 or 100 miles or more, impresses upon the observer in a manner not to be forgotten the vastness of this region of mountains. It has 46 peaks, a mile or more apart, and 41 miles of dividing ridges, which rise above 6,000 feet; 288 additional peaks and 300 miles of divide rise more than 5,000 feet above the sea. These are not only the greatest masses of mountains east of the Rockies; they are the highest mountains covered with hard-wood forests in America.

Salient features.

This region, thus unique in its position, in its mountain features, in its forests, and in its climate, stands grandly out as the greatest physiographic feature in the eastern half of the continent. (See Pls. II and VI.)

Mountain valleys.

Between these groups of mountains and far below them, though still at an elevation of 2,000 feet or more above the sea, are the numerous narrow valleys of this region. They border the numberless streams and are generally more extensive nearer the sources of these streams, and

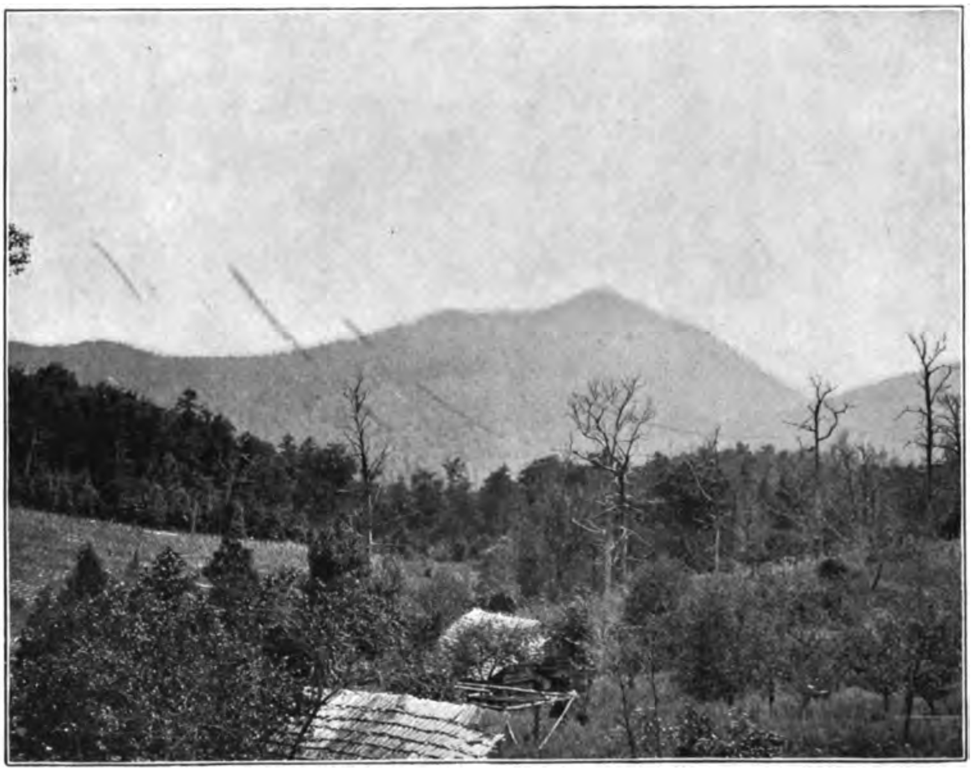


GRANDFATHER MOUNTAIN, THE HIGHEST POINT ON THE BLUE RIDGE, SHOWING SHARP, RUGGED PEAK, SURROUNDED BY HARD-WOOD FORESTS. (See pp. 20, 114.)

The forest in the foreground, which is being destroyed, has the hemlock spruce interspersed with oaks and other hard woods. About the higher peak (5,500 to 5,964 feet) the trees are mainly black spruce and balsam.

(A) "BALD" OF BIG YELLOW MOUNTAIN, MITCHELL COUNTY, N. C. (See pp. 18, 20.)

These bald mountain tops are covered with grass, the tree line often being fairly sharp. (See also Pl. XXIIa.)



(B) A COMMON TYPE OF SOUTHERN APPALACHIAN PEAK IN THE GREAT SMOKY MOUNTAINS. (See p. 20.)

hence nearer to the Blue Ridge than to the Unakas. (Pl. IX.) As a rule, they vary in width from a few hundred feet to as many yards. Some of the most notable of these valleys, reaching a width of 2 to 5 miles in places, are those on New River in Virginia, on the French Broad above Asheville, on the Tennessee River in southwestern North Carolina, and about the headwaters of the Coosa and other rivers in Georgia. As these streams approach and cut through the mountain borders of this region they run in deep gorges, the full width of which is often occupied by the streams. (See Pl. XXIX.)

The slopes of these mountains vary considerably in their steepness. The northwestern slopes of the Blue Ridge are usually gentle and in many places cleared. The southeastern slopes are generally much steeper and usually forest covered. In a few places these southeastern slopes are rocky and precipitous. Especially is this the case along the South Carolina border, as seen in Cæsars Head, Whiteside, and Table Rock mountains (see Pls. X, XI, and XLV), where the bare rock walls rise 600 to 1,000 feet in height. The slopes of the Unakas, like those of many of the interior ridges, are fairly steep on both sides, ranging generally from 20 to 50 degrees. About the interior ridges there is still greater variation. Some of the rocky faces are precipitous, while elsewhere the slopes are gentle, ranging from 5 to 20 degrees. But taking the mountains and the valleys together, the land surface with a slope of less than 10 degrees is not more than 10 per cent of the whole.

Steepness of the mountain slopes.

THE FORESTS.

It is the forest covering of these great mountain slopes—a covering that should never be removed—about which interest centers in the present investigation. The results of this examination during the past two years are given at length in a paper published as Appendix A (p. 41). They are stated separately for each of the larger river basins, following a somewhat general discussion of the forest conditions in the region as they exist to-day and of how the forests may be economically protected and improved under Government control.

Method and results of the examination.

These forests have been carefully studied and classified, and over much the larger portion of the area their density and distribution have been indicated on the excellent topographic maps furnished for this purpose by the Depart-

Forest maps.

ment of the Interior. The length of time required for engraving these detailed forest maps makes it impossible to issue them as a part of the present report, but copies of them in manuscript form are meanwhile available for examination at the Department of Agriculture and the Geological Survey. The distribution of these forests and the approximate relative proportion of the forest-covered and the cleared lands are indicated by the generalized map (Pl. XII). The scattered cleared fields on the mount slopes are so small that it is impossible to indicate them on a map of this scale, and hence only the larger clearings, mainly those along the valleys, are shown.

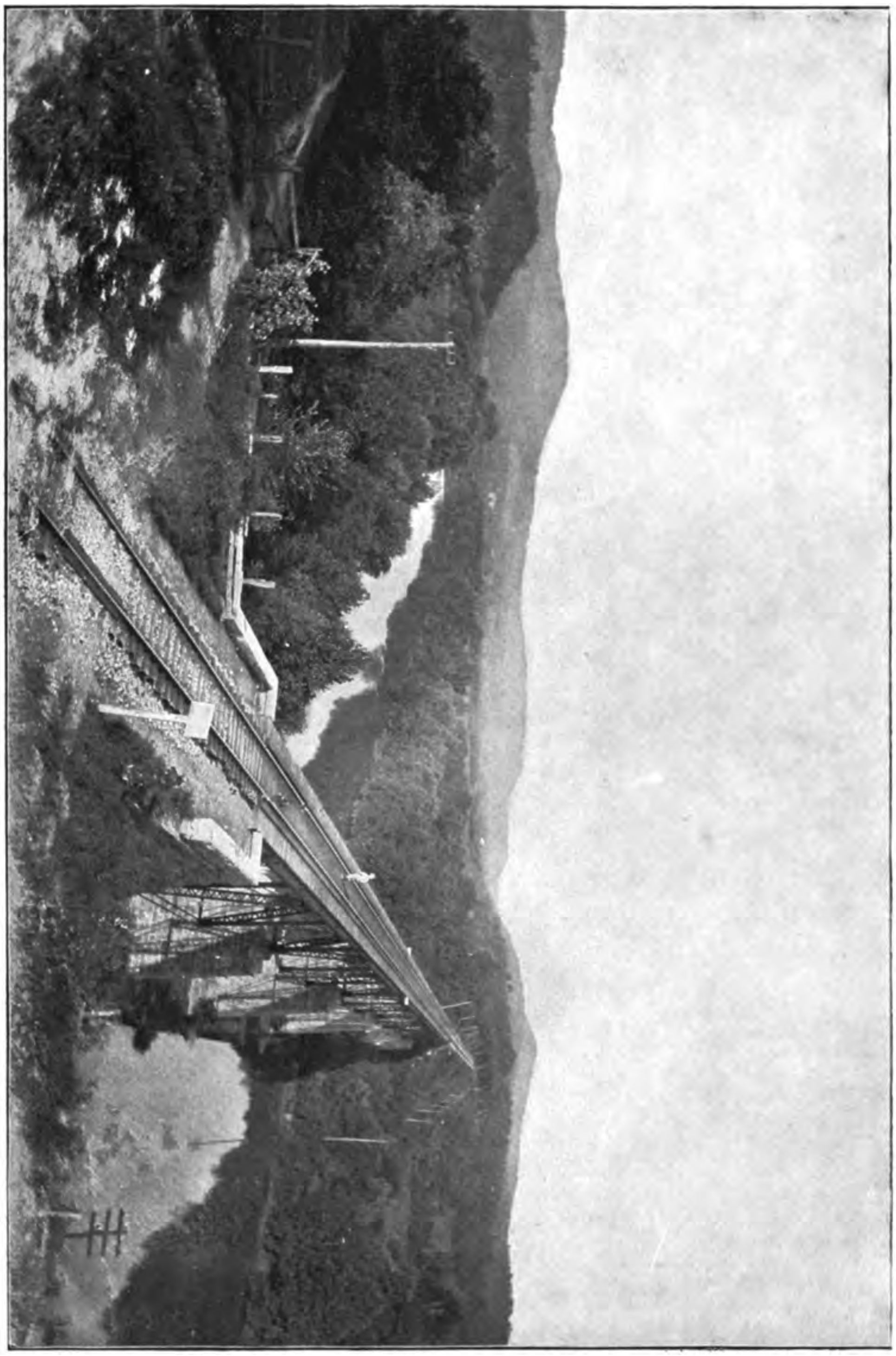
Considering the forests of the region as a whole, there is a striking uniformity about their general features, especially in the valleys and along the lower slopes, and yet everywhere there is variety. This fact is well illustrated by the list (on p. 93) of 137 species of trees and a still longer list of shrubs growing in this mountain region.

Variations in forests on southern and northern slopes.

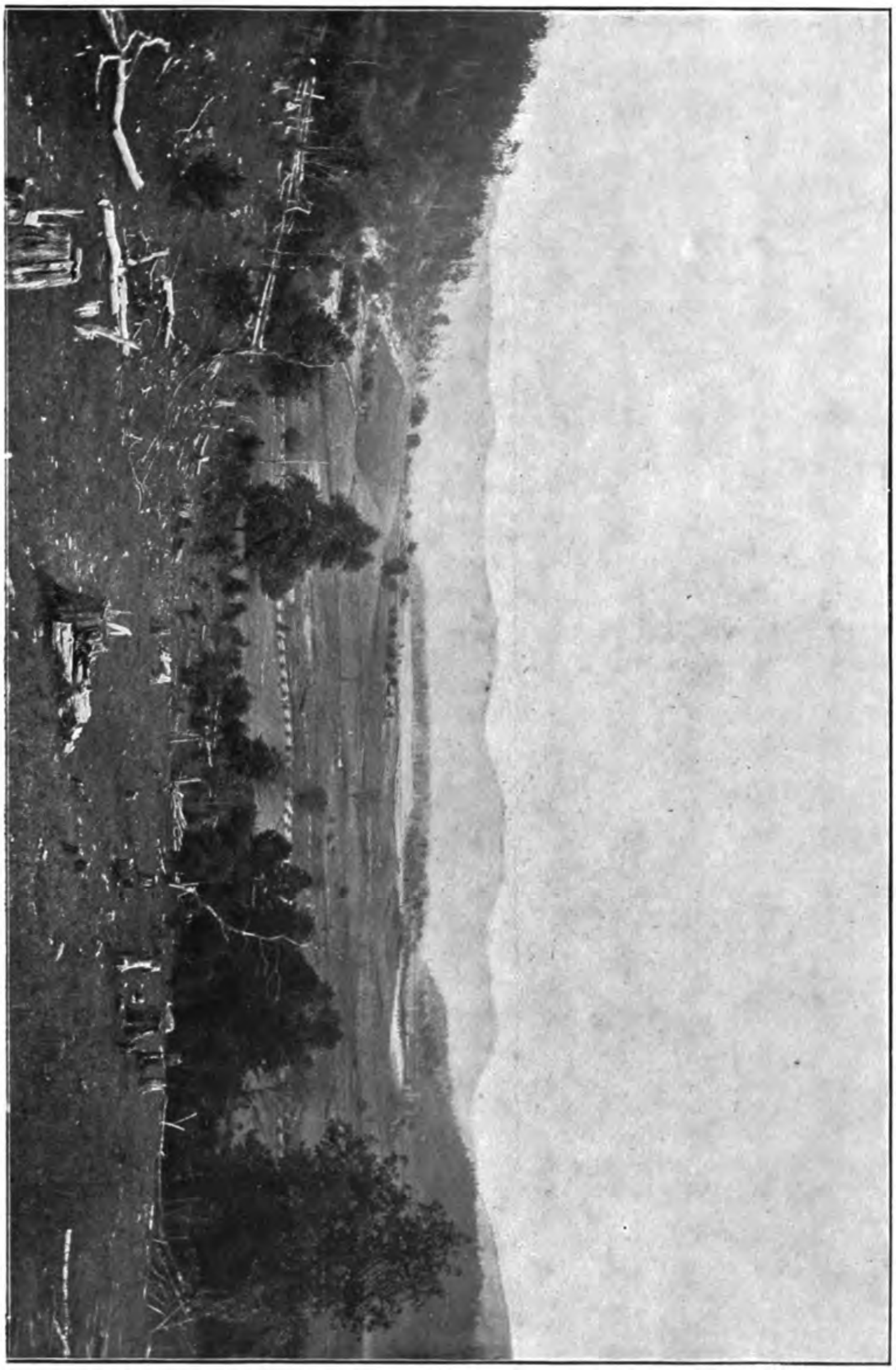
The forests on the southeasterly slopes are usually less striking, both in size of trees and density of growth, than those on the northwest, and they are usually more damaged by forest fires, because the slopes are steeper and are kept drier by their more direct exposure to the sun. The neighboring forests on the northern and western slopes and in the westerly facing coves exhibit a greater variety of vegetation, a denser growth, and finer specimens of individual trees, because they have not only greater moisture, but greater depth and fertility of soil. Both are protected by the humus which covers the surface and which contributes directly to the luxuriance of this growth. It is in such situations that we find the best examples of the superb hard-wood forests which abound in this region—the finest on the continent. (See Pl. XIII.)

Variations in forests due to elevation.

But the greatest variations in these mountain forests are observed in connection with the differences in elevation. Thus along the southern foothills of the Appalachians in Georgia one finds occasionally scattered colonies of the loblolly and long-leaf pines, trees which are characteristic of the South Atlantic and Gulf coast region, intermingling with the typical hard-wood forests of the Piedmont Plateau and of the lower mountain slopes. (See Pl. XIV.) At the eastern foot of the Blue Ridge, in North Carolina, the typical flora of the Piedmont Plateau abounds, and follows up the river gorges into the mountain valleys, where it associates with more characteristically Ap-

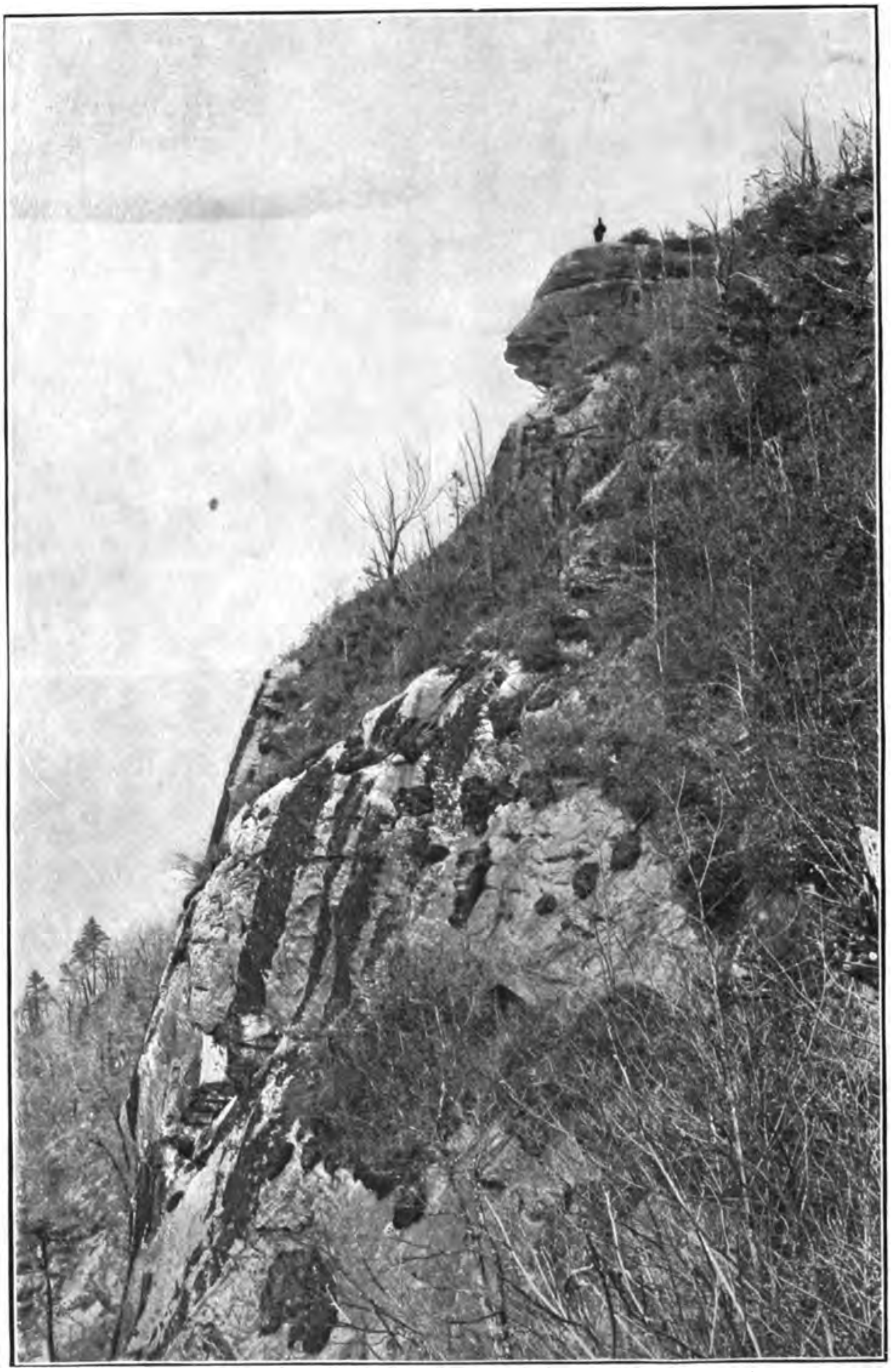


THE SOUTHERN END OF THE APPALACHIAN MOUNTAINS, NEAR CARTERSVILLE, GA., LOOKING NORTHEAST. (See p. 19.)



A MOUNTAIN VALLEY, LITTLE TENNESSEE RIVER, RABUN COUNTY, GA. (See p. 20.)

The mountains surrounding this fertile valley are forest covered, and the valley itself is not being washed away



(Photographed by Lindsay.)

CÆSARS HEAD, SOUTH CAROLINA. (See p. 21.)

The fires and the axe are destroying the forest growth on these steep, rocky mountain sides.

(Photographed by Scadin.)

WHITESIDE MOUNTAIN, SOUTHEAST PROFILE, NORTH CAROLINA. (See p. 21.)

palachian species. Thence up to the tops of the higher peaks there is a constant succession of changes—an intermingling and overlapping of the lower species with those which belong to greater elevations or more northern latitudes.

Thus in ascending any of the higher mountains, as Mount Mitchell, which, with its elevation of 6,711 feet, is the loftiest of them all, one may penetrate, in the rich and fertile coves about its base, a forest of oaks, hickories, maples, chestnuts, and tulip poplars, some of them large enough to be suggestive of the giant trees on the Pacific coast. (See Pl. XLIV.) Higher up one rides through forests of great hemlocks, chestnut oaks, beeches, and birches, and higher yet through groves of spruce and balsam. Covering the soil between these trees is a spongy mass of humus sometimes a foot and more in thickness, and over this in turn a luxuriant growth of shrubs and flowers and ferns. At last, as the top is reached, even the balsams become dwarfed, and there give place largely to clusters of rhododendron and patches of grass fringed with flowers, many of them such as are commonly seen about the hills and valleys of New England and southern Canada. Forests on Mount Mitchell.

In such an ascent one passes through, as it were, the changing of the seasons. Halfway up the slopes one may see, with fruit just ripening, the shrubs and plants the matured fruit of which was seen two or three weeks before on the Piedmont Plateau, 3,000 feet below; while 3,000 feet higher up the same species have now just opened wide their flowers. Fully a month divides the seasons above and below, separated by this nearly 6,000 feet of altitude. Seasons vary with elevation.

Remote from the railroads the forest on these mountains is generally unbroken from the tops of ridge and peak down to the brook in the valley below, and to-day it is in much the same condition as for centuries past. (See Pl. XVII.) In the more settled portions of the region, however, a different picture presents itself. Along the narrow mountain valleys are the cultivated fields about the settlements, where they ought to be. When the valleys were practically all cleared the increasing demands for lands to cultivate led to clearings successively higher and higher up the mountain slopes, with a pitch of 20 and 30 and even 40 degrees. From some of the peaks one may count these cleared mountain-side patches by the score. They have multiplied the more rapidly because their fer- General forest conditions. Unwise forest clearings for agriculture.

tility is short lived, limited to two, three, or five crops at most. They are cleared, cultivated, and abandoned in rapid succession. Out of twenty such cleared fields, perhaps two or three are in corn, planted between the recently girdled trees; one or two may be in grain; two or four in grass, and the remainder—more than half of them—in various stages of abandonment and ruin, perhaps even before the deadened trees have fallen to the ground. (See Pl. XVIII.)

Lumbering operations.

The lumberman attacked this forest several decades ago when he began to penetrate it in search of the rarer and more valuable trees, such as the walnut and cherry. Later, as the railroads entered the region to some extent, he added to his list of trees for cutting the mountain birch, locust, and tulip poplar, and successively other valuable species. During the past few years he has cut everything merchantable. He is now beginning to extend his operations to considerable distances beyond the main lines of transportation by the construction of tramways and even cheap, short railways. Meanwhile his search for the more valuable trees has extended in advance to most of the more remote mountain coves.

Damages from lumbering operations.

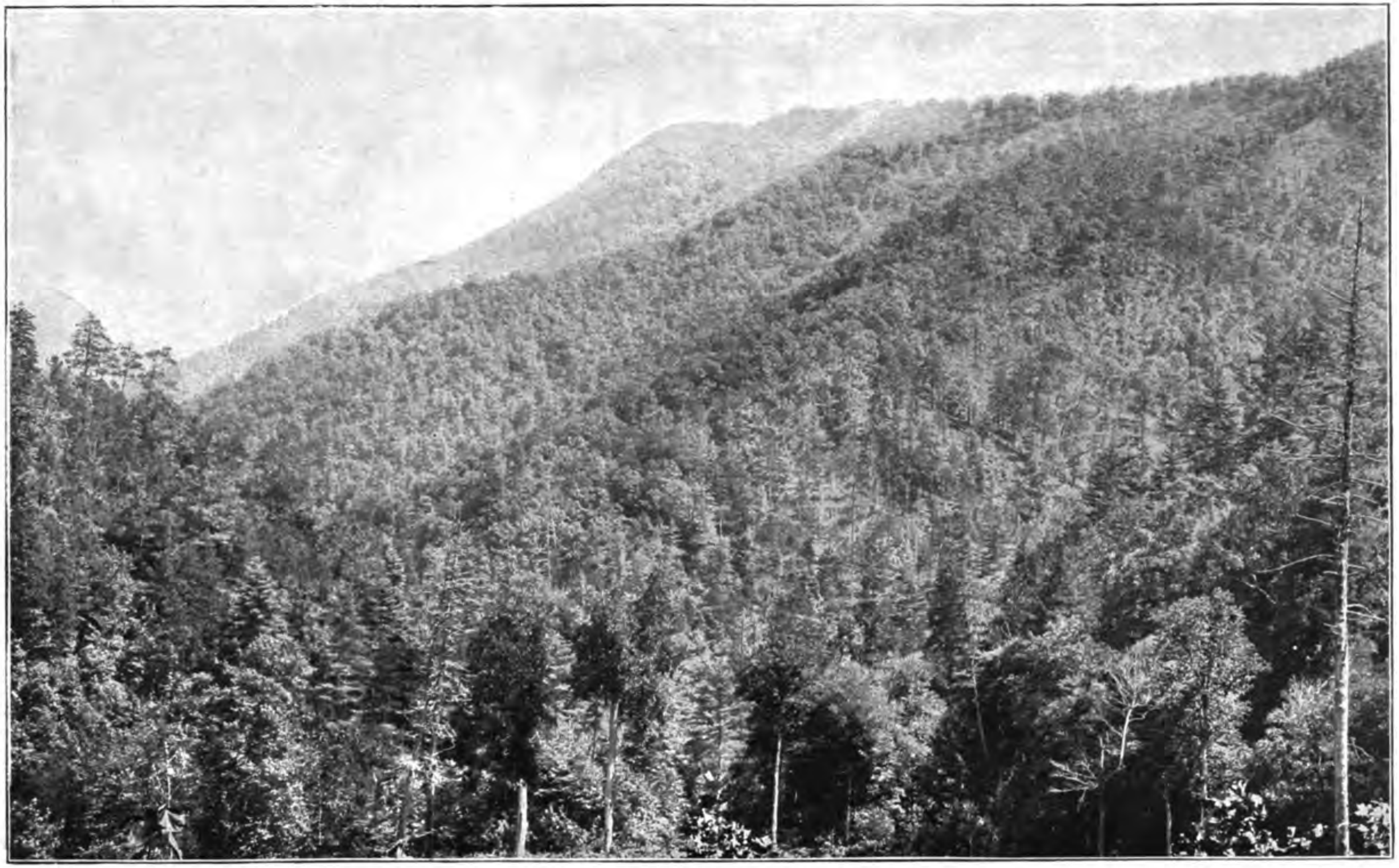
In these operations there has naturally been no thought for the future. Trees have been cut so as to fall along the line of least resistance regardless of what they crush. Their tops and branches, instead of being piled in such way and burned at such time as would do the least harm, are left scattered among the adjacent growth to burn when driest, and thus destroy or injure everything within reach. The home and permanent interests of the lumberman are generally in another State or region, and his interest in these mountains begins and ends with the hope of profit. There is, however, no evidence that the native lumberman has in the past exhibited any different spirit.

Destructive work of forest fires.

Forest fires have been one of the great curses of this country. From the days of Indian occupation down to the present time these Appalachian Mountain forests have been swept through by fires. Some of these have preceded the lumberman, others have accompanied him, and still others have followed in his wake, and the last have been far more destructive because of the tops and other rubbish which he has left behind him scattered among the remaining growth. (See Pl. L *b*). The aggregate damage from these fires is great. Over some limited areas they have entirely destroyed the forests. Everywhere on the south

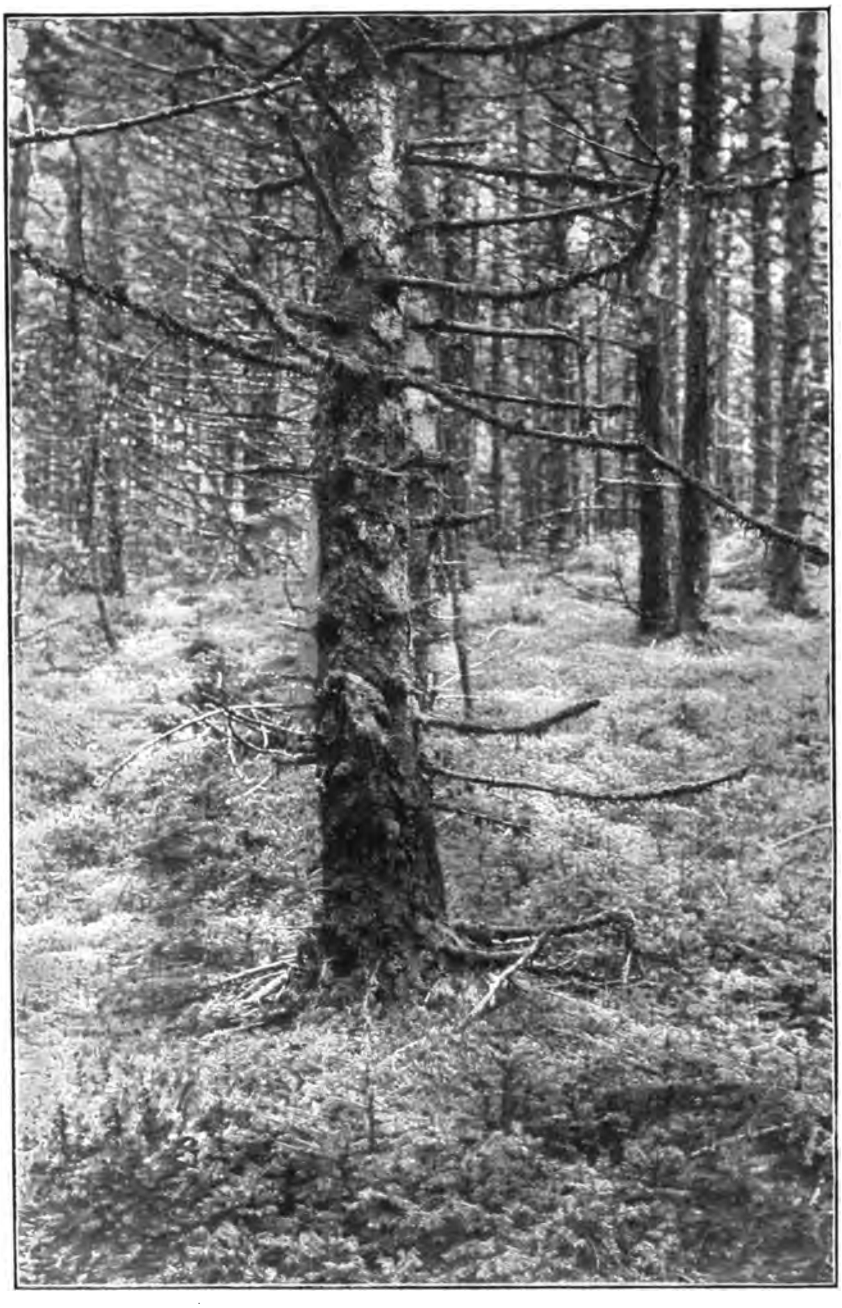
(Photographed by Scadin.)

AN ORIGINAL SOUTHERN APPALACHIAN MOUNTAIN FOREST, TRANSYLVANIA COUNTY, N. C. (See pp. 21-23, 45.)



MIXED HARD-WOOD AND PINE FOREST ON OCONALUFTY RIVER, SWAIN COUNTY, N. C. (See p. 22.)

On the lower mountain slopes and ridges the pines are often mixed with the hard woods. But whatever the nature of the trees, the frequent fires are destroying the undergrowth and humus and thinning out the trees, thus diminishing the commercial value of the forest, facilitating the erosion of the soil, and lessening its capacity for storing water.



SPRUCE FORESTS AT HIGH ELEVATIONS; ON WHITETOP MOUNTAIN, VIRGINIA. (See pp. 23, 47.)

Seedlings of this black spruce abound in the moss under the trees. These and the humus and the roots hold the soils and help store the rains.

ward slopes the damages have exceeded those on slopes toward the north or west. Trees have been burned near the roots, making their bases defective (see Pl. XLVII); the young growth has been burned down (see Pl. XLVI); the grasses and other wild forage plants have been temporarily exterminated, so that instead of pasturage being improved, as some have believed it would be, in the end it has been seriously damaged. This destruction of the humus has always resulted seriously both to the forests and to the soils. In some cases, where the forests covering the steep, rocky slopes were thin, the loss of the humus has resulted in the washing and leaching away of the soils to such an extent as to destroy the forests entirely; and in all cases where the humus is thus removed the work of land erosion among the trees goes on as surely as though the forest itself were gone, though of course the process is far less rapid. Furthermore, the storage of water (in soils from which this humus has been removed) is far less perfect than in the original perfect forest.

Injuries resulting from the burning of the humus.

The rapid rate at which these lumbering operations have extended during the past few years and the still more rapid rate at which they are being extended at the present time, considered in connection with the destructive work of the fires and the clearing for agriculture, indicates that within less than a decade every mountain cove will have been invaded and robbed of its finest timber, and the last of the remnants of these grand primeval Appalachian forests will have been destroyed. Hence the very possibility of securing a forest reserve such as now contemplated is a possibility of the present, not of the future. This great activity indicates, furthermore, in the most striking way possible, the growing anxiety as to the future supply of hard-wood timber. And indeed the time is now at hand when the great interests involved make it imperative that the Government take hold of this problem and inaugurate here in these great broad-leaved forests of the East a new conservative forest policy, as it is already doing for the pine forests of the West.

Imperative need of new forest policy.

FOREST CLEARING AND AGRICULTURE IN THE SOUTHERN APPALACHIANS.

Ordinary farming on these mountain slopes can not exist permanently and should never exist at all. As stated above, not more than 10 per cent of the land of this region has a surface slope of less than 10 degrees (approximately 2 feet in 10), while 24 per cent (see Pl. XII) of it has been cleared. In this region land with slopes exceeding this can not be successfully cultivated for any considerable time, because its surface is rapidly washed into the rivers below by the heavy rains, and the same agency rapidly leaches out and carries to the sea its more soluble and fertile ingredients. The valley lands have already been largely cleared, and the farmers are now following up the mountain slopes. In many cases their cleared patches have well nigh reached the mountain summits. This process is going on with greater rapidity, because each short-lived hillside field must soon be abandoned. The underbrush is destroyed, the trees are girdled, and for one, two, or three years such a field is planted in corn, then a year in grain, then one or two years in grass; then the grass gives place to weeds, and the weeds to gullies. (See Pls. XX and XXI.)

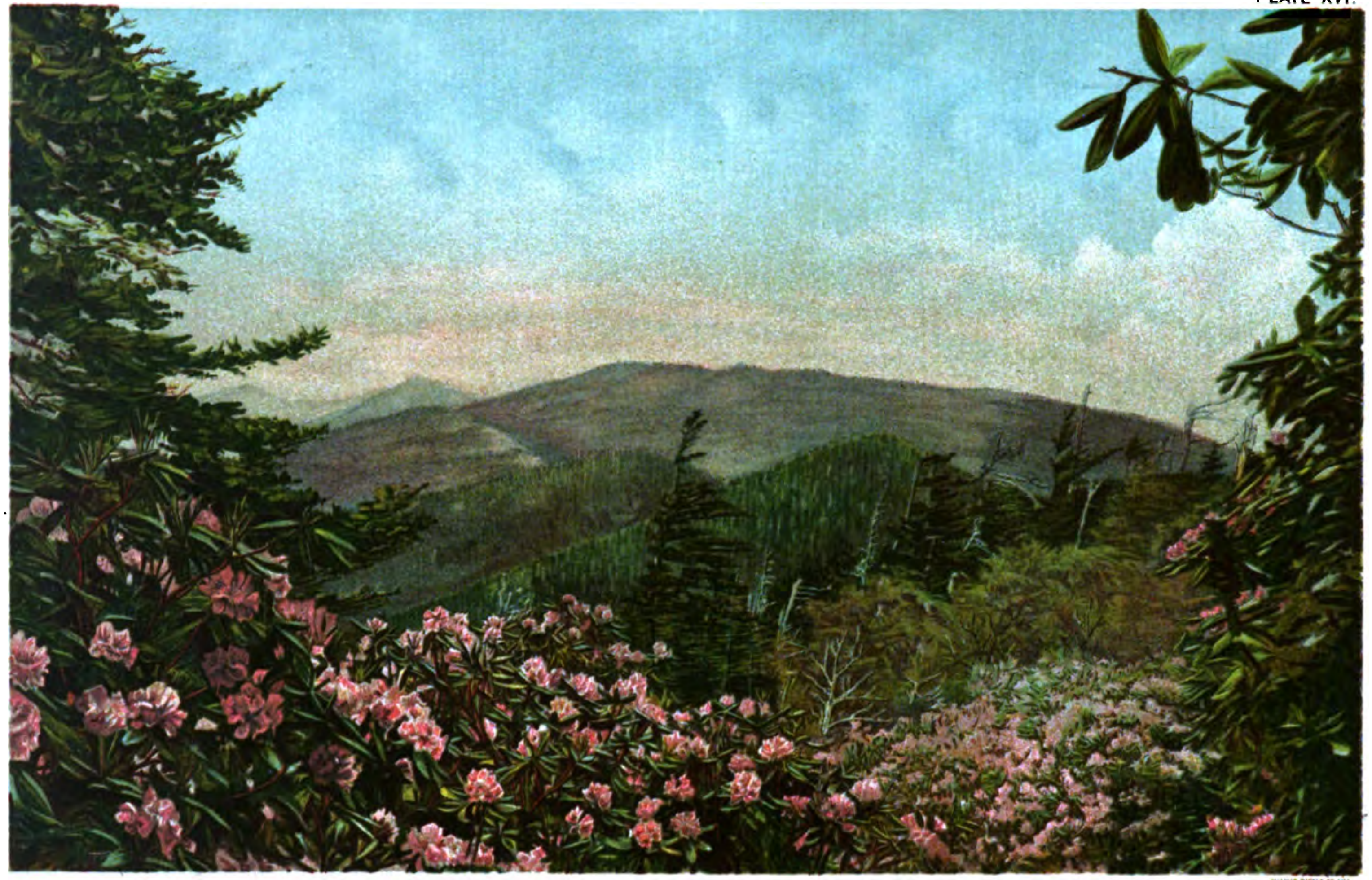
Agriculture on mountain slopes short lived in its benefits: permanent in the resulting injuries.

Such a field has usually passed through its cycle in five to ten years and another must be cleared to take its place. A forest which is the growth of several centuries perishes in less than a decade; a soil which is the accumulation of a thousand years has been cleared, cultivated, abandoned, and is on the downward road to the sea within less than a decade. Such is the brief life history of many thousands of small mountain fields in this Southern Appalachian region. But even the native farmer is beginning to realize that the clearing of these mountain slopes is producing floods that wash away the valley farms, and that the time must come when he will have successively cleared and destroyed all his available mountain land. (See Pl. XXXIV).

Some serious results from this forest clearing.

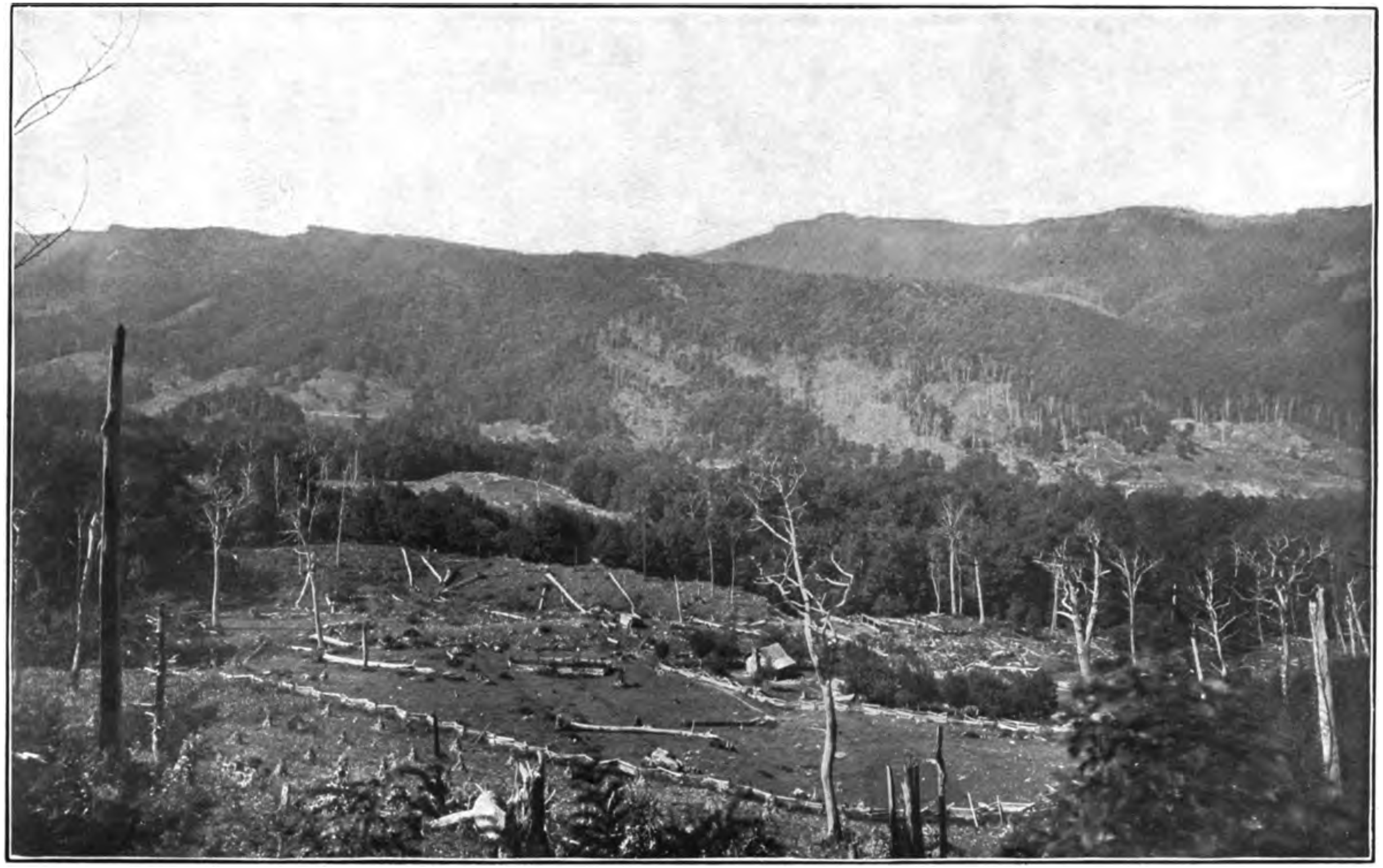
Fortunately the intelligence of the country is awakening to other and larger results that are following this policy. The soil thus removed may stop long enough on its way to the sea to silt up the streams as they cross the lowlands or may fill up the harbors as the streams reach the coast. Every acre of mountain slope thus cleared is a step in the more rapid destruction of the forests, of the soils, of the rivers, and of the "eternal mountains" themselves—the destruction of conditions which the combined wealth, intelligence, and time of man can not restore in a region which now possesses infinite possibilities for the benefit of the whole nation.

PLATE XVI.



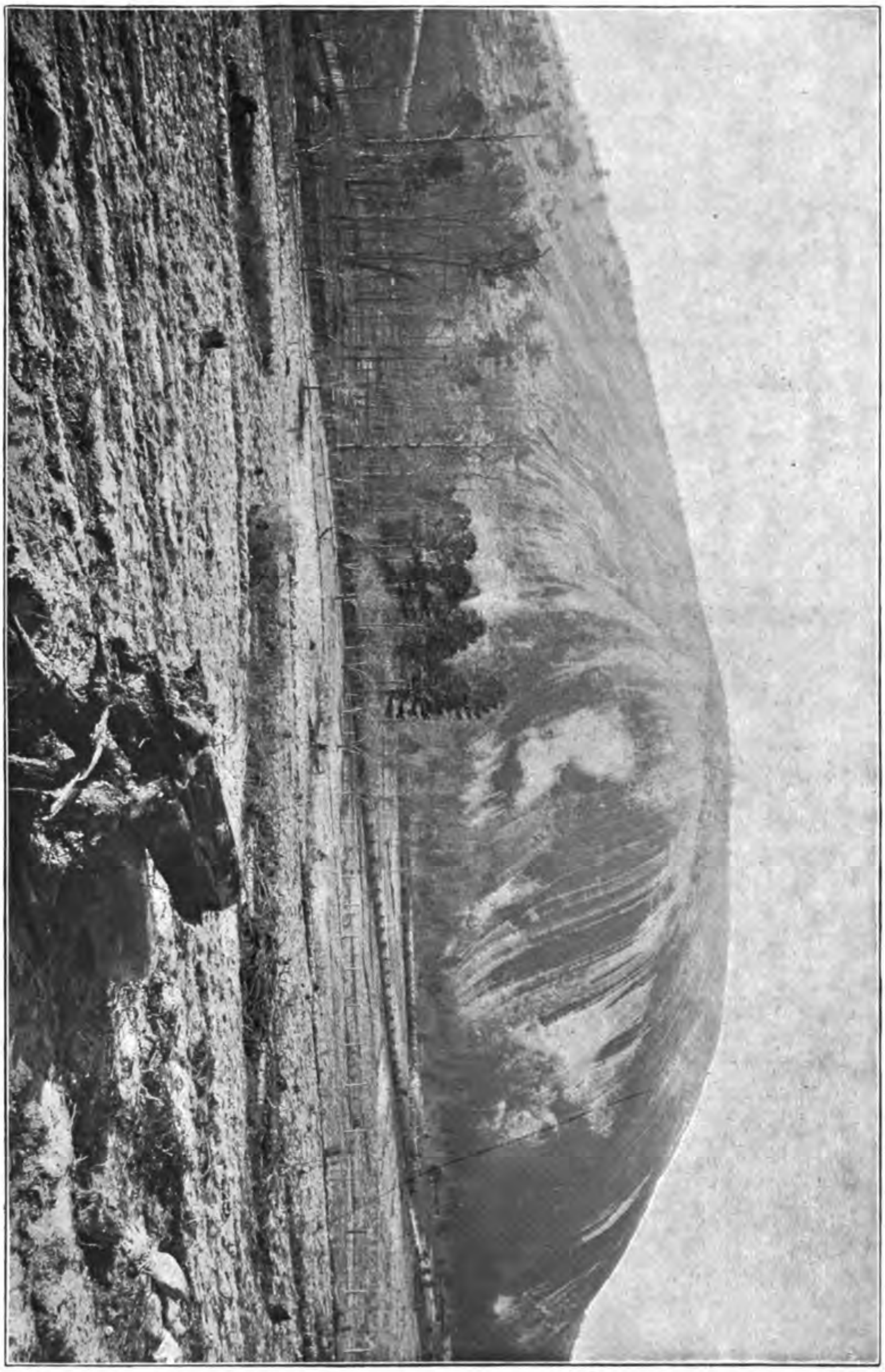
JULIUS BIEN & CO. N.Y.

IN COUNTY, N. C. (



FOREST CLEARINGS FOR FARMING ON THE SOUTHERN APPALACHIAN MOUNTAINS. (See pp. 26, 57.)

Already one-fourth of the total area of these mountain lands has been cleared; and additional areas are being cleared, cultivated, and abandoned in rapid succession, higher and higher up the mountain slopes.



STONE MOUNTAIN, NEAR ATLANTA, GA. (See p. 26.)

The ax and fire have removed the forest; and the heavy rains have removed the soil which once covered the larger part of this rocky knob.

(*A*) NEWLY CLEARED MOUNTAIN FIELD PLANTED IN CORN, RAPIDLY WASHING AWAY. (See pp. 26-28.)
These steep fields will be ruined and abandoned in less than a decade.

(*B*) RECENTLY CLEARED FIELD IMPOVERISHED AND ABANDONED. (See pp. 26-28.)
Such fields should be forever covered with forest.

Grass does not hold the soil on the mountain slopes.

In the cool climate of New England the native grasses form a dense sod which holds the hillside surfaces in place, so that even where the forests have been removed there is little erosion. In the Southern Appalachians, however, neither the grass, the legumes, nor the other forage plants have been able to prevent this land erosion, and their only safeguard for the future is the protection of the forests. Hundreds of these steep mountain fields where selected grasses were sown have been observed during the past few years, and the results, as indicating a means of permanently holding these soils, have been generally unsatisfactory. (See Pl. XXII.)

Washing of mountain lands.

This washing away of the cleared mountain fields does not always manifest itself in the formation of deep gullies. The majority of these fields have slopes so steep that the water in its downward course can not always move laterally to a sufficient degree for its concentration and the washing out of such gullies. Each drop of rain does its own work in battering and loosening the surface; and as it carries downward the particles of soil it has captured it is joined by only its closer neighbors. Hence frequently after a heavy rain the surface of such a field looks as though it might have been harrowed or even raked downward rather than plowed in larger furrows. From one of these cleared fields more soil is sometimes removed by a single heavy rain than during the preceding centuries while it was densely forest covered.

Washing away of valley lands.

But while the rains are removing the soils of the cleared mountain slopes the floods are removing the soils of the valley farms. This is notably the case in the valleys, where the bordering forests have been cleared to the largest extent. Year by year the channels of the streams are widening and encroaching upon the adjacent farms, and as the magnitude of the floods increases, these mountain streams, transformed into swollen torrents, leave their course and plow new channels across the fields. During the floods of the present year thousands of acres of the most productive valley lands in this mountain region have been damaged or destroyed by one or both of these processes. (See Pls. XXIII and XXIV.)

It is, then, exactly true that the making of farms on mountain slopes is destroying the farms in the valleys, and that unless stopped by some external influence this process will proceed more rapidly as the population of the

Result of present policy.

region increases. It is therefore only a question of time, to be measured not in centuries but in years, when, unless this policy is changed, there will be no forests in this region except on the small remnants—say 10 per cent of the whole—where the mountain slopes are too precipitous and rocky to make the cultivation of the lands possible, even by an Appalachian mountaineer and his hoe.

Policy under proposed Government management.

If, on the other hand, the policy now advocated is adopted, and all these steeper mountain slopes are incorporated into a forest reserve, owned and controlled by the Government, the valley lands will be protected from floods, and to the cultivation of these areas can be added that of the gentler slopes, the whole to be terraced and kept in a high state of cultivation by the native farmer, who will retain ownership then as now. (See Pls. IX *b* and XXIII *a*.)

Guiding principle in Government management.

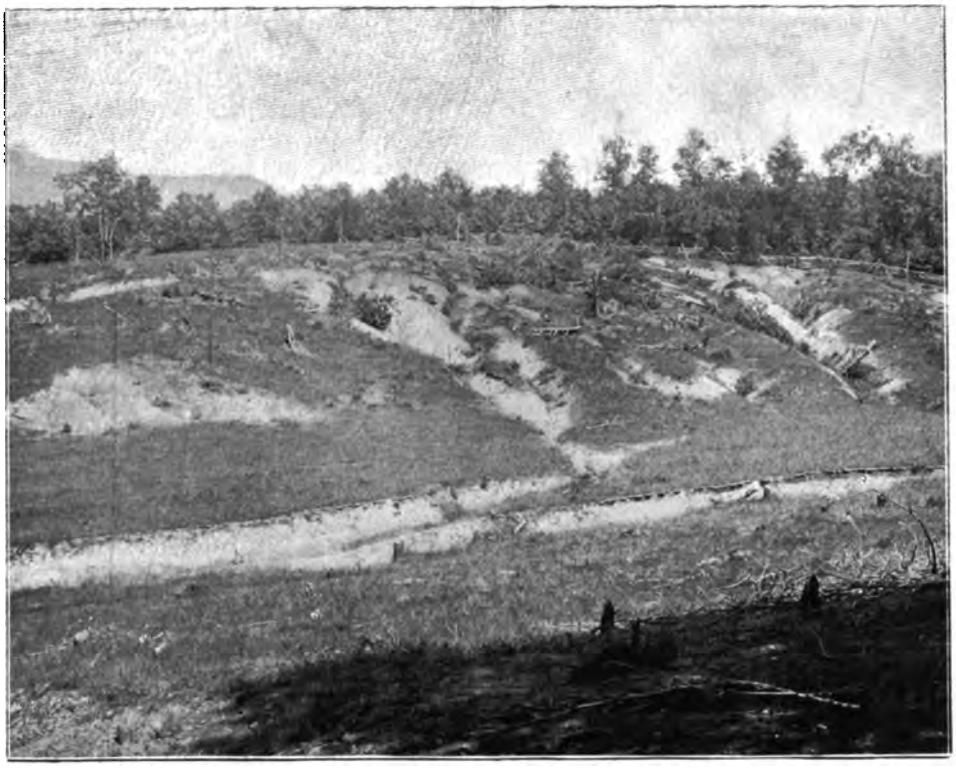
The guiding principle of the Government in the creation of this forest reserve should be to protect the farmer in his occupation and to insure the use of agricultural lands for agricultural purposes; but also, and primarily, to maintain forever the forest cover of these great and beautiful mountains, which can be perpetuated in no other way. Under such a system the agriculture of this region will be maintained on a permanently satisfactory basis. Under the present policy it is advancing to certain ruin.

FOREST CLEARINGS, THE RIVERS, AND FLOODS.

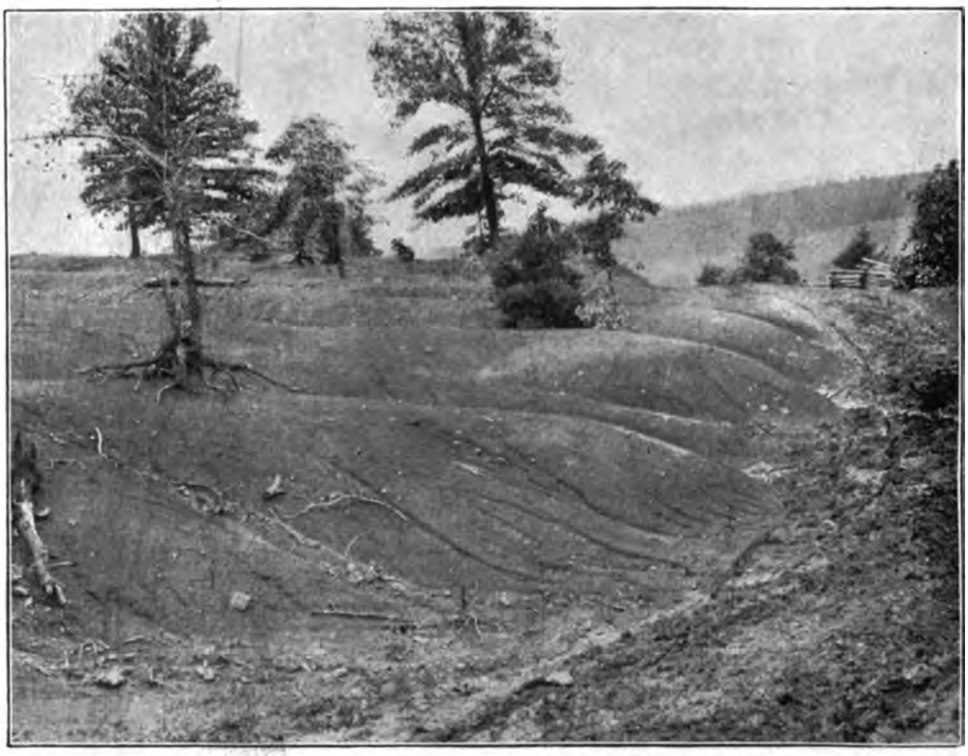
This region is the source of many rivers.

Probably no region in the United States is better watered or better drained than this; nor is there any other region which can boast of being the source of so many streams. (See Pl. XII.) From about its northern end the New River (Kanawha) flows northward and westward and becomes a prominent tributary of the Ohio; along its southeastern front the James, the Roanoke, the Yadkin, the Catawba, the Broad, and the Savannah reach the Atlantic; near its southern end the Chattahoochee and the Alabama flow directly into the Gulf of Mexico; along its western the Hiwassee, the Tuckaseegee, the French Broad, the Nolichucky, the Watauga, and the Holston drain westward through the Tennessee into the Mississippi.

Each of these greater rivers as it crosses the Coastal Plain region toward the sea is navigable for light-draft vessels. Each throughout its lower course is bordered by fertile agricultural lands, which in the past contributed largely to the nation's supply of corn, but during recent



(*A*) BADLY WASHED MOUNTAIN FIELD IN THE SOUTHERN APPALACHIAN REGION. (See pp. 26–28.)



(*B*) APPALACHIAN MOUNTAIN FIELD COMPLETELY RUINED BY EROSION. (See pp. 26–28.)

(*A*) WASHING OF GRASS-COVERED SOIL, TOP OF ROAN MOUNTAIN. (See p. 27.)

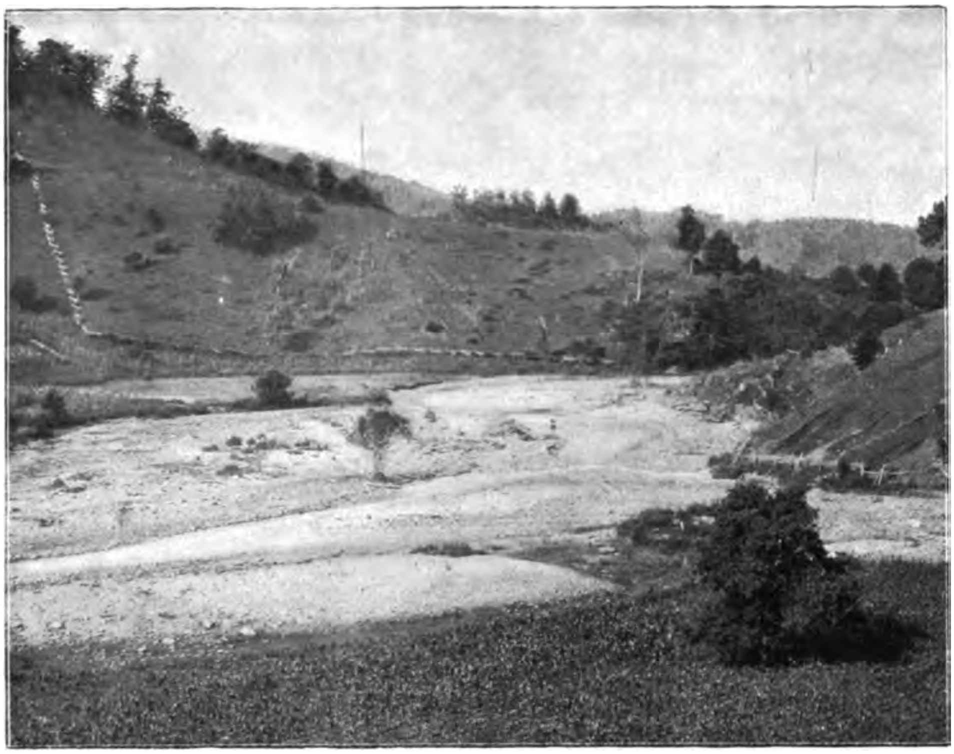
About the tops of these higher Southern mountains the grasses grow more vigorously than at lower levels; but even there the sod is not strong enough to prevent the washing away of the soil.

(*B*) WASHING OF AN ABANDONED PASTURE FIELD. (See p. 27.)

This is a good illustration of the process by which these mountain slopes are going to ruin.

(*A*) UNWASHED VALLEY LANDS SURROUNDED BY FOREST-COVERED MOUNTAINS. (See p. 27.)
(See, also, Pl. IX *b*, p. 21.)

(*B*) BADLY WASHED MOUNTAIN VALLEY LANDS, BAKERSVILLE, N. C. (See p. 27.)
The lower slopes of the mountains bordering this valley are largely cleared.



(A) VALLEY LANDS BADLY WASHED BY FLOODS. (See p. 27.)

These fertile valley lands in the Southern Appalachians will all be washed away in a few decades unless the forests on the mountain slopes are protected.

(B) VALLEY LANDS RUINED BY RECENT FLOODS AND ABANDONED. (See p. 27.)

As long as the forests remain on the mountain the valleys can be cultivated.

decades have begun to suffer seriously from river floods. Each one of these streams along its course through the mountains and across the hill country beyond by its water power is already a contributor to the manufacturing interests of the country (Pl. XXV), and with improvement in the electrical transmission of power the possibilities of manufacturing developments in this direction are increasing rapidly every year. The measurements and estimates recently made by the Government hydrographer show the aggregate available undeveloped water power on the streams rising in this region to be more than a million horsepower. On these streams water-power developments are constantly in progress, but their value in the future will diminish as the forests disappear.

Value of these mountain rivers crossing the lowlands for water power.

In the mountains themselves these streams have their sources at elevations from 3,000 to 6,000 feet, and before reaching a level of 2,000 feet many of them have reached considerable proportions. They subsequently flow across the mountain region for distances of from 20 to 50 miles before breaking through the border ranges onto the surrounding lowlands at elevations ranging from 1,000 to 1,200 feet. Along their courses stretches of smooth water are never long, and the descent is often accomplished by numerous rapids, cascades, and falls. (See Pl. XXVII; also Pls. LXX and LXXI.) Such cascades, with descent in short distances of from 10 to 50 feet, are abundant, while in some of the smaller tributaries beautiful falls of from 100 to 300 feet are to be found.

Beauty of the mountain streams.

I can not adequately describe the beauty and infinite variety of these mountain brooks and larger streams. Always clear, except immediately after the harder rains—for the forests hold back the soil—fed regularly from perpetual springs, they are among the important assets of the South.

No gorges in eastern America can equal in depth and wildness those carved across the Blue Ridge and the Unakas by these streams in making their way through the marginal ranges of the Southern Appalachians. About the headwaters of the Catawba, the Linville River, after flowing for some miles parallel with the Blue Ridge, at an elevation of 3,800 feet, rushes down its eastern slope with a fall of 1,000 feet in less than 3 miles, through a gorge 1,500 to 2,000 feet in depth, a dozen miles in length, and with wall so steep and bottom so narrow and rugged that few persons have succeeded in following its course.

The river gorges of the region.

(See Pl. LXXII.) Almost the same language might be used in describing the gorge cut by the Pigeon River across the Unaka Mountains southwest of Asheville; and there are a number of others cutting the Blue Ridge and Unakas at different points that are worthy of comparison with these. The same may be said of the gorges of the Tallulah and other streams in northern Georgia.

But notwithstanding the steepness of the slopes of these gorges, even where the descent is almost precipitous, they are forest-covered except where the trees and shrubs have been destroyed by fire and the soil has been removed by the storms. (See Pls. XXIX and XLII.)

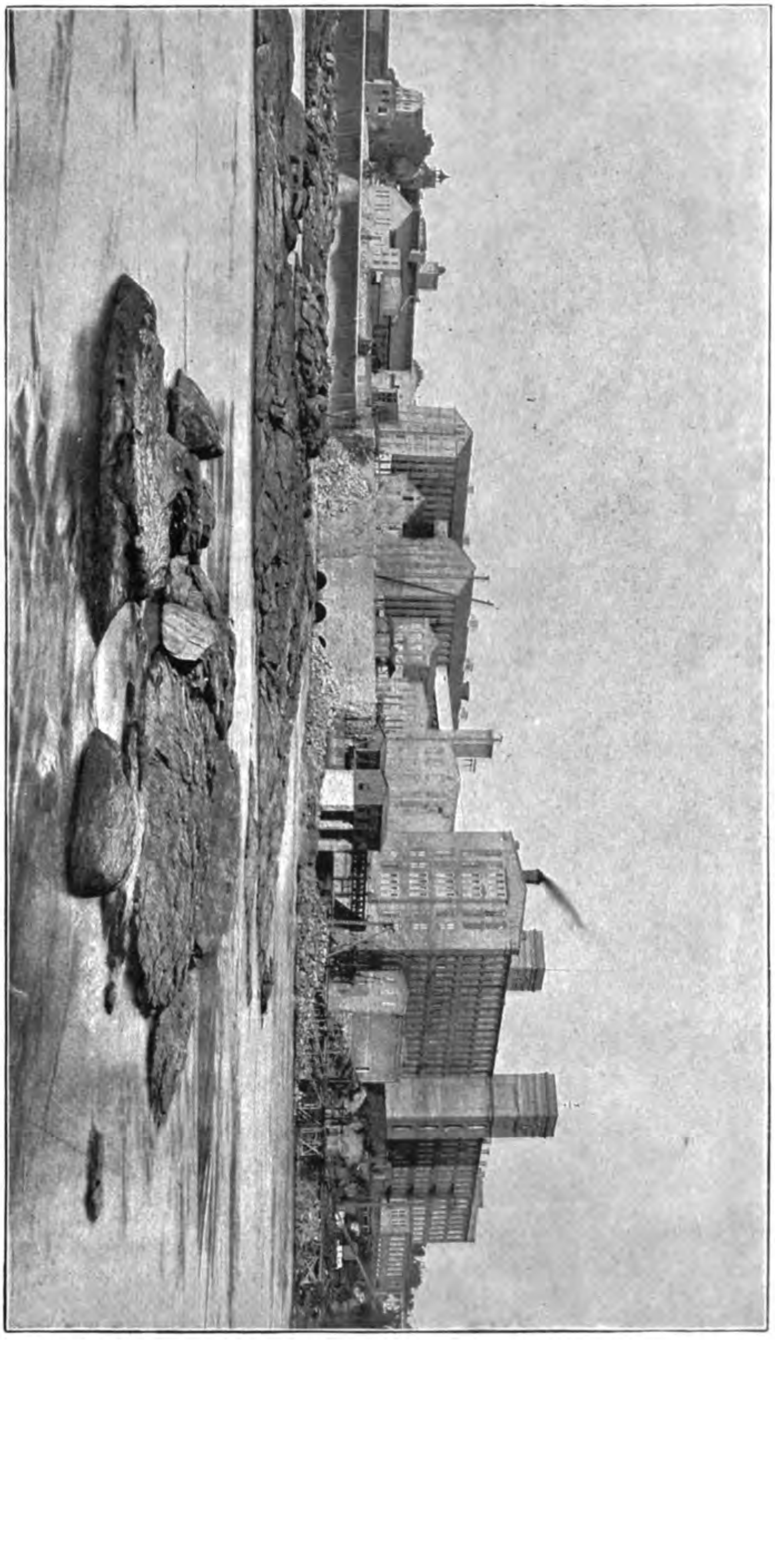
Irregularity of streams in regions largely cleared.

The perpetuation of the streams and the maintenance of their regular flow, so as to prevent floods and maintain their water powers, are among the prime objects of forest preservation in the Southern Appalachians. Nothing illustrates the need of this more fully than the fact that on the neighboring streams, lying wholly within the Piedmont plateau, where the forests have been cleared from areas aggregating from 60 to 80 per cent of the whole, floods are frequent and excessive. During the seasons of protracted drought some of the smaller streams almost disappear, and the use of water power along their course is either abandoned or largely supplemented by steam power.

To-day the larger valuable water powers in the South Atlantic region are mainly limited to the streams which have their sources among the Southern Appalachian Mountains; and the waters of these streams show a striking uniformity of flow as compared with the streams lying wholly within the adjacent lowland country, where forest clearing has been excessive. While the rainfall is somewhat greater in the mountain region, it is a question of the regularity rather than the volume of flow, and this depends upon the water storage. The soil in the one region is as deep as in the other, and the slopes being gentler in the low country, other things being equal, the water would soak into it the more easily. In the mountain region itself the flow of the streams along which proportionately large clearings have been made has become decidedly more irregular, and the flood damages have greatly exceeded those along other streams where the forests have not been disturbed. The problem resolves itself into one of a forest cover for the soil.

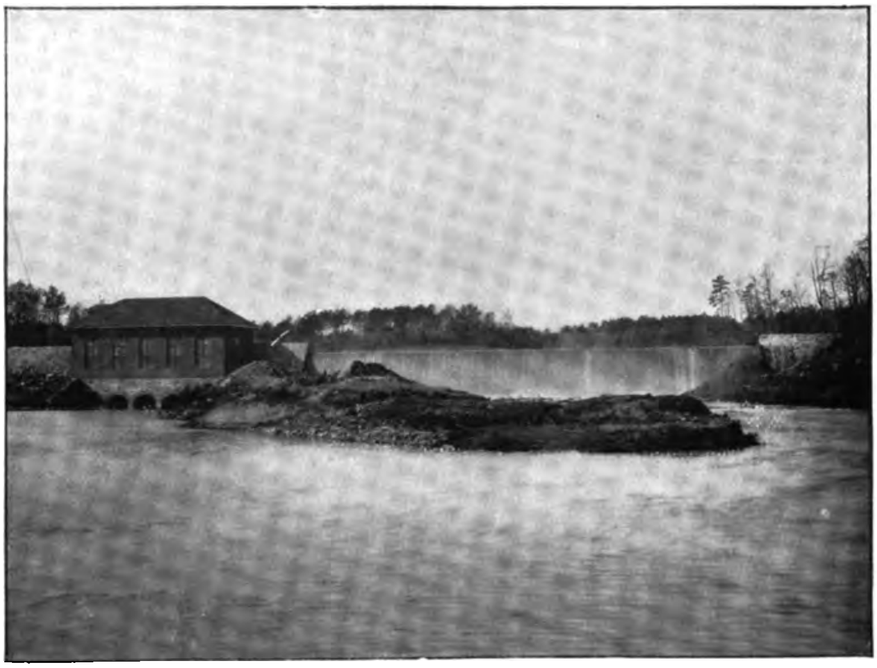
Forests regulate the flow of streams.

This is just what one would expect who has been, during a rainy season, in the heart of a mountain region where



WATER-POWER DEVELOPMENT AND COTTON MILLS AT COLUMBUS, GA., ON THE CHATTAHOOCHEE RIVER. (See pp. 29, 139-142.)

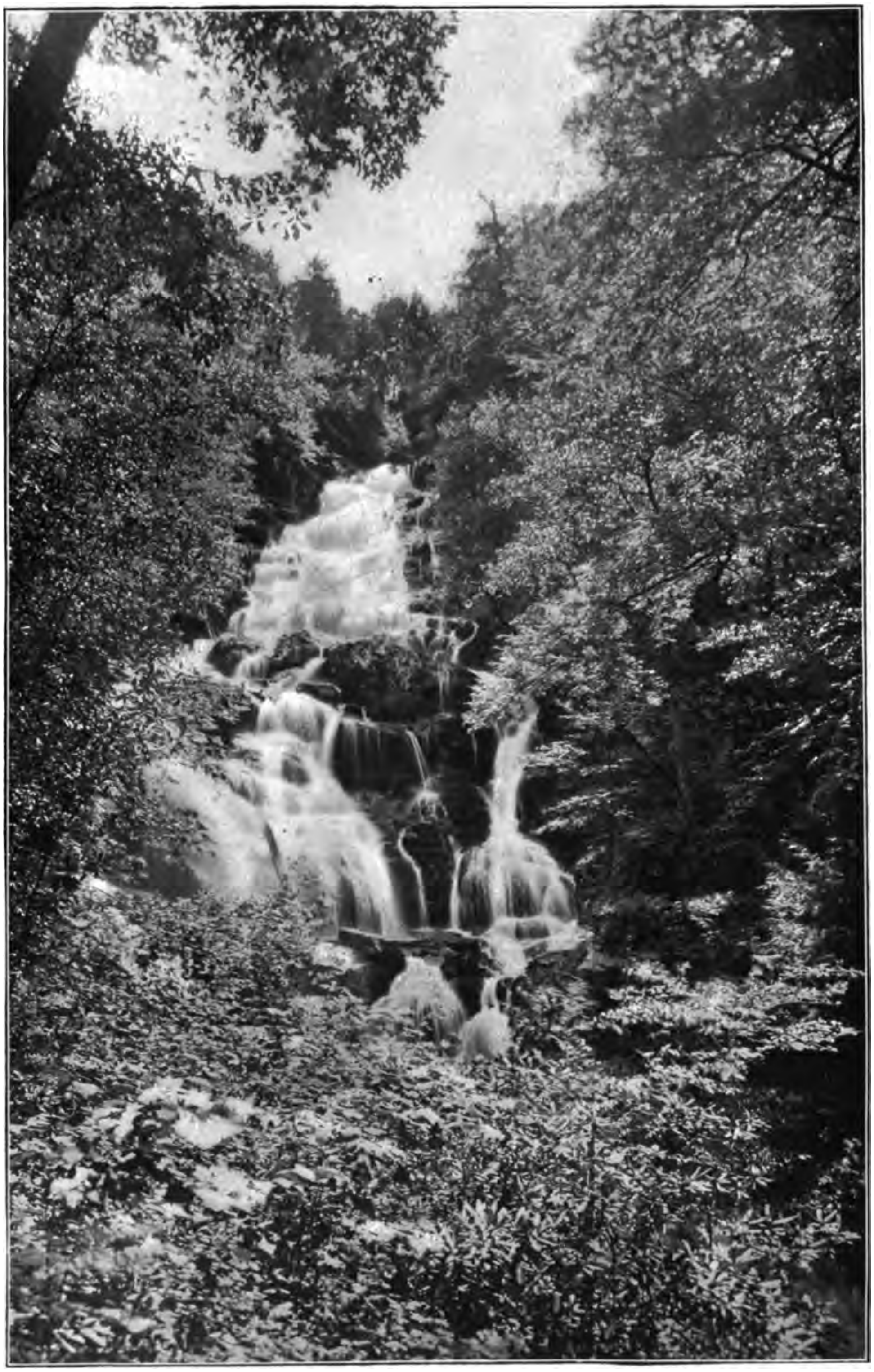
The sources of this and numerous other important rivers are within the limits of the proposed Appalachian forest reserve; and their value for water power and navigation can be perpetuated only through the preservation of these mountain forests.



(A) WATER POWER ON SALUDA RIVER, AT PELZER, S. C. (See pp. 29, 141.

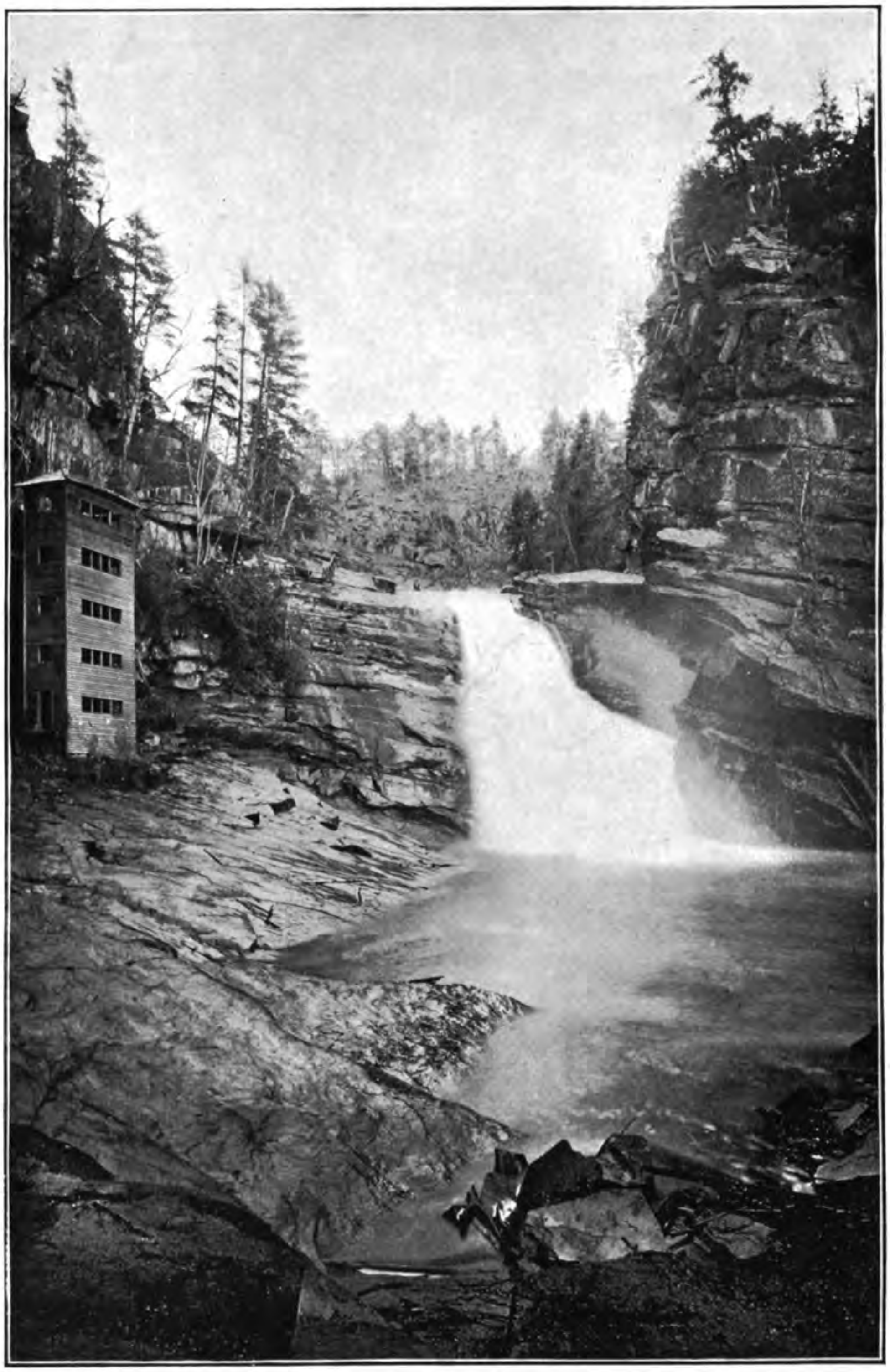
(B) WATER POWER ON BROAD RIVER, AT COLUMBIA, S. C. (See pp. 29, 141.)

These streams have their sources within the limits of the proposed Appalachian forest reserve: and the perpetuation of these valuable water powers depends on the preservation of these mountain forests.



CASCADES NEAR HEAD OF CATAWBA RIVER. (See pp. 29, 116.)

There are hundreds of cascades as beautiful as this in the Southern Appalachians. As long as these mountain forests are preserved these streams have a regular flow; united they furnish the water powers which operate the factories valued at increasing millions.



(Photographed by Hillers.)

TALLULAH FALLS, GEORGIA. (See pp. 19, 28, 139.)

There is here a succession of beautiful cascades which have within a short distance an aggregate descent of 335 feet.

the lands have not been cleared nor have forest fires destroyed the humus cover from their surface. The raindrops are battered to pieces and their force broken by the leaves and twigs of the trees, and when their spray reaches the ferns, the grass, and the flowers below, instead of running away down the surface slope it passes into the spongy humus, and thence into the soil and the crevices among the rocks below. As much of this supply as is not subsequently used by the growing plants emerges from this storehouse weeks or months later in numberless springs. (See Pl. XXXI.) The rain must be extremely abundant or long protracted to produce any excessive increase in the flow of the adjacent brooks.

Heavy rainfall renders forest cover necessary.

The rainfall in this Southern Appalachian region, as shown in Appendix D (p. 143), ranges from 60 inches for the year in Georgia to 71 inches in North Carolina. Heavy rainfalls during short periods are common. Even in an arid or semiarid region, where the rainfall for the year may be 10 inches or less, the absence of the forest cover results in a slow but sure removal of the soil from the mountain slopes. Much more in a region of heavy rainfall, like that of these southern mountains, when the forest cover has been destroyed, will the soil removal be certainly and rapidly accomplished.

Soil protection and water storage here are both forest problems.

In studying the streams of the more northern States it is seen that the numerous lakes and the deposits of sand and gravel spread over the hills and valleys of that region by the glaciers serve to store the water and to preserve the uniformity in the flow of the streams, and would accomplish much in this direction even were the forests in that region entirely removed. In this southern region the preservation of the soil and the streams is a task which the forests alone must accomplish, and to that end they must be effectively protected.

Proportion of cleared land in Appalachian region increasing.

The proportion of cleared and forest-covered land in each of the great river drainage basins of the region is given on page 69, and as will be seen there, this proportion, though generally small, varies considerably in the different basins. Taking the region as a whole, at the present time about 24 per cent of the area has been cleared. (See Pl. XII.) This proportion is an ever-increasing one—increasing the more swiftly for the reason that new fields are constantly being cleared and the abandoned fields are being eroded so rapidly that they are seldom reforested. (See Pl. XXI.)

Landslides indicating heavy rains in past and necessity of forest cover.

Here and there among the Southern Appalachians a landslide extending over an acre, or several acres, has started, bearing on its surface a section of the forest, but the larger trees below have blocked its course within a few feet or a few yards of its original position. (See Pl. XXXII.) The trees on its surface were tilted, but the subsequent upward bending of their tops shows that the slip took place ten, fifty, or more than one hundred years ago. The abundance of such evidence shows that these rain storms among the primeval forests have been both frequent and heavy, but during the centuries these densely forest-covered slopes have not lost their soils nor the soils their fertility, nor has a furrow been washed. Trees of four centuries stand to-day in the very bottom of shallow ravines and minor depressions (see Pl. XXXIII), eroded before these forests covered the mountains. Had these forests been removed a few of these great rains that started these landslides would have cleaned the mountain slope of its recently formed soil, and would have swept the valley below.

Erosion of the forest-covered mountains exceedingly slow.

The future will have its storms. Forests alone can protect mountains.

These mountains will continue to be the home of storms. Their heavy rains will continue to drench the slopes, if cleared of their forests, with increasing violence. Whether in the future these rains shall be caught by fern and grass and humus, and received by a deep, porous soil, to be given out as needed to the vegetation above and the perpetual springs below, or whether it shall rush down bare, rocky slopes to fill the gorges and carry destruction through the valleys beyond, depends upon whether or not these forests are preserved.

Damages from recent floods in this region.

The terribly destructive work of the heavy rains in washing away the farm lands on the mountain slopes and in the valleys of this region, especially where the clearings have been greatest, has already been described. It should be understood clearly, however, that the dangers from these floods are not limited to the region about the mountains. The floods from the May storm of the present year on the Blue Ridge, about the sources of the Catawba, swept the best of the farm lands along the course of that stream for upward of 200 miles, and cost the farmers more than a million and a half of dollars. An August storm in the same region added a loss of half a million more by further destruction on the Catawba lowlands. (See Pl. XXXIV.) Similarly, the same May floods swept the valleys of the Yadkin in North Carolina, the New (Kanawha) in Virginia and West Virginia, and the upper tribu-

FOREST-COVERED SLOPES OF LINVILLE GORGE SEEN FROM BYNUMS BLUFF.

If the forests on these steep slopes are once destroyed they can not be restored, as the soils will be quickly removed by the heavy rains.

FORESTS REGULATING THE FLOW OF STREAMS IN THE SOUTHERN APPALACHIAN MOUNTAINS.

(See pp. 29-31; 137-142.)

The leaves and branches above break the force of the raindrops; the shrubs, ferns, and humus below catch the water and pass it slowly downward into the soil and rock crevices; and from this great natural reservoir, weeks or even months later, this water emerges in the numberless springs about the lower mountain slopes, and feeds the great rivers that cross the hill country below.

(A) A SPRING ON SOUTHERN SLOPE OF MOUNT MITCHELL.

These perennial springs are fed by water stored in the forest-covered slopes of these mountains. They maintain the regular flow of the many mountain streams of this region.

(B) A MOUNTAIN BROOK IN THE SOUTHERN APPALACHIANS.

In the beautiful Sapphire country of North Carolina.

(A) LANDSLIDE STOPPED BY THE FOREST, NORTH SLOPE OF ROAN MOUNTAIN. (See p. 32.)

(B) SMALL LANDSLIDE AT A SPOT WHERE NO LARGE TREES WERE GROWING.

If it were not for this forest growth the soils on many steep mountain slopes, when saturated from heavy rains, would either slide down like avalanches, or be washed down by the rushing water.

taries of the Tennessee with resulting devastation, which, when added to that on the Catawba, sums up to more than $7,000,000 damage. Add to this the damages from floods on other streams rising in different parts of this region during the spring and summer, and the total this year approximates $10,000,000. (See Pls. XXXV and XXXVI.)

Such has been the story, on a smaller scale, of other similar but less violent floods about the sources of these mountain-born rivers during the past few years. If we are to continue the destruction of these mountain forests, this story will have to be repeated in successively larger editions in the future.

THE CLIMATE OF THE SOUTHERN APPALACHIANS.

As shown in the accompanying paper by Professor Henry, of the Weather Bureau (p. 143), the climate of the Southern Appalachian region possesses distinctive features of its own, although it partakes somewhat of the main features of the climatic zones both to the west and to the east. Its distinctive features, due to higher altitudes, are a lower temperature, both summer and winter, a drier atmosphere, and at the same time a greater rainfall and snowfall, and higher wind velocity. There are of course local variations in the climatic conditions of the region, owing to its extremely varied topography, but the limited number of stations where observations have been made in this region makes it impossible to discuss these local variations at the present time.

Temperatures in the region not extreme.

It is in temperature that we might expect the greatest variations, but, unfortunately, with the exception of a few months' observation on Mount Mitchell (elevation 6,711 feet), no observations are available at elevations greater than 4,000 feet. The highest temperature observed on Mount Mitchell during May, June, July, and August in 1873 was 72° in July; the lowest, 41° in June. At Highlands, N. C. (elevation 3,817 feet), the mean temperature of the summer is given by the Weather Bureau records as 65.7°, and the mean winter temperature as 35.4°. The extremes during a period of eight years (1893 to 1900) were 19° below zero in February and 86° above zero in June.

Rainfall heaviest in the Eastern States.

The rainfall along the southern slopes of the Blue Ridge is the heaviest in the United States, with the exception of that on the northern Pacific coast, ranging from 60 inches in northern Georgia to 71 inches in western North Carolina. The precipitation for the year 1898 in western North Carolina at Highlands was 105.24 inches; at Horse Cove, 99.97 inches; Flat Rock, 78.39 inches, and Linville, 71.05 inches. The rainfall in the warm seasons is often torrential, while in the spring and autumn the rains often continue over several days in succession. During May 21, 1901, the rainfall in twenty-four hours was, at Highlands, N. C., 4.03 inches; at Hendersonville, N. C., 4.91 inches; at Flat Rock, N. C., 6.12 inches; at Marion, N. C., 7.25 inches; and at Patterson, N. C., 8.3 inches. Near Roan Mountain, North Carolina, a rainfall of 8 inches in eleven hours has been recorded. In August of 1901 the total rainfall for the month at Highlands, N. C., was 30.74 inches.

Special climatic features.

The tables which accompany Professor Henry's paper show the temperatures, rainfall, and other weather conditions at practically all of the stations established within this region. They emphasize two facts of special importance in connection with the present discussion, namely, that the climate is such as to permit travel and lumbering operations in all portions of this region throughout the entire year, while the rainfall, being heavy in the aggregate and often excessive within short periods, renders it necessary to protect the forests in order to limit floods and prevent the washing away of the land.

HOW CAN THESE FORESTS BE PRESERVED?

Government control the only practical solution.

Having given what I believe to be a fair statement of the conditions existing in the Southern Appalachian region, and considered the danger growing out of the policy and practice now in force, I pass on to inquire through what agency these forests can be preserved. After careful consideration I am able to suggest but one way to solve the problem, and that is for the Federal Government to purchase these forest-covered mountain slopes and make them into a national forest reserve.

Protection of these forests beyond the agency of private individuals.

Certainly, the lumbermen and the native farmers, who are now pushing the destruction of these forests, can not be expected of themselves to bring about their preserva tion. Nor can the perpetuation of forest conditions, upon which depend so many national interests, be left to the caprice of private capital, which has no interest beyond the profits in the lumber industry. The restoration of forests already injured, and the reforesting of the steep

LARGE POPLAR TREE GROWING IN MOUNTAIN RAVINE, ON THE WEST SLOPE OF THE GREAT SMOKIES. (See p. 32.)

(*A*) SOIL REMOVED AND WHITE SAND SPREAD OVER THE SURFACE OF THE CATAWBA RIVER LOWLANDS. (See pp. 32, 130.)

The damages along this river from the floods of May and August, 1901, aggregated about $1,500,000.

(*B*) LAYER OF SAND SPREAD OVER THE FERTILE LOWLANDS BORDERING THE CATAWBA RIVER BY A FLOOD IN MAY, 1901. (See pp. 32, 130.)

(A) FLOOD DAMAGES ON ELKHORN CREEK, IN WEST VIRGINIA, JUNE, 1901.

The damages from floods along streams rising in this Southern Appalachian region, from April 30, to December 1, 1901, reached $10,000,000. Between December 1, 1901, and April 1, 1902, they reached $8,000,000 additional.

(*B*) DÉBRIS FROM FLOODS ON NOLICHUCKY RIVER, EAST TENNESSEE, MAY 21, 1901.

This débris consisting of the wreck of farmhouses, furniture, lumber yards, bridges, cattle, and probably several human bodies, covered 6 acres of fertile farm land near Erwin, Tenn.

(*A*) FLOOD DAMAGES TO RAILWAY ON DOE RIVER, TENNESSEE. (See pp. 32, 130.)

(*B*) FLOOD DAMAGES TO RAILWAY ON NOLICHUCKY RIVER, EAST TENNESSEE.

The flood damages here illustrated occurred in May, 1901. These and similar floods occurring during August and December, 1901, and January, February, and March, 1902, wrought damages to railroad property in and about this Southern Appalachian mountain region aggregating several million dollars.

mountain slopes already cleared, are here properly national functions, for their results will be national in importance and extent. Furthermore, it is perfectly safe to assert that any satisfactory protection and development of these forests for the objects here contemplated is wholly beyond the agency of private individuals; and such persons would have no direct interest whatever in the protection and perpetuation of water-power, agriculture, and navigation along the lower courses of the streams whose headwaters they control.

Ownership and control by the State not practicable.

Nor can the States within whose territory these lands now lie be expected to convert them into a forest reserve. The land is not owned by the States, but by private individuals. It is true that some of the wealthier States, like New York and Pennsylvania, are showing an intelligent and commendable interest in purchasing forest lands and establishing forest reserves for the protection of the sources of streams lying within their own boundaries and for the conservation of the forests. But the case is wholly different in the Southern Appalachian region. North Carolina can not, for example, fairly be expected to establish a forest reserve at great expense for the protection of streams which though rising within her borders lie mainly in other States. Nor could Alabama be expected to purchase lands in the State of Georgia for the protection of her great river which reaches the Gulf in Mobile Bay. Nor could West Virginia be expected to purchase lands in North Carolina for the protection of the sources of the Kanawha River, the largest lateral tributary of the Ohio.

Purchase of these forests too costly for the States, but the States willing for Federal control.

Furthermore, even were these States willing to enter upon such a plan, their financial condition is not such as to make the undertaking possible. The combined income for a year of all the States within whose borders these lands lie would hardly be sufficient for their purchase. As shown, however, in the Appendix (p. 172), each of the States within whose borders these mountain lands are located has by legislative act expressed its hearty approval of this measure and its willingness to cede the control of these lands to the Federal Government.

Protection of these forests a national problem.

This is a national problem. The people of a number of States are directly interested. The dangers growing out of the policy now in force are national in their character, as are also the benefits to be obtained by the policy now advised. This proposal for a national forest reserve has already been discussed and commended by our ablest men of science, by practical lumbermen, by the forestry associations, by many of the business organizations of the country, and by both the technical and the general press. I earnestly hope that it will meet with favorable action at the hands of Congress during its present session.

National forest reserves in the West.

Congress has wisely provided for the setting aside out of the public domain, and thus withdrawing from sale, many thousands of square miles of valuable forest lands, with a view to protecting the streams and perpetuating the timber supply about the mountains in our western States and Territories. (See Pl. II.) And while the measure now proposed involves a purchase instead of a withdrawal from sale of forest lands formerly purchased, the principle and purpose are the same. In both cases, even if judged simply as a question of finance, the Government's investment will ultimately prove a good one.

Policy recommended not a new one for the Government.

As further illustrating the fact that the proposed purchase will not be a new policy or precedent on the part of the Government, attention may be called to the numerous purchases of lands for military parks, and to the purchase from the Blackfoot Indians in 1896 of more than half a million acres of forest lands at a cost of $1,500,000, which area was subsequently added to the Flathead Forest Reserve in Montana.

Forest reserve more important than a park, but the two not antagonistic.

As I stated in my preliminary report of January last, the early movement for the purchase and control of a large area of forest land in the East by the Government chiefly contemplated a national park, but the idea of a national park is conservation, not use; that of a forest reserve is conservation by use, and I therefore recommend the establishment of a forest reserve instead of a park. If, however, the present proposal for the establishment of a national forest reserve is favorably acted upon by Congress, and at some future time it should prove desirable that some considerable portion of this region be set aside and opened up more especially for use as a national park, I can see in advance no objection whatever to the carrying out of such a plan.

CONDITIONS OF PURCHASE AND MANAGEMENT.

Cost of the mountain forest lands.

I stated in the preliminary report just referred to that lands in this region suitable for a forest reserve are now generally held in large bodies of from 50,000 to 100,000 acres, and that they can be purchased at prices ranging from $2 to $5 per acre. Further investigations during the present year confirm the correctness of this statement. There are also many additional tracts of forest lands ranging from 1,000 to 50,000 acres each that are for sale at reasonable prices. Within the present year a few tracts of from 10,000 to 30,000 acres sold at less than $2 per acre. Within the past decade the larger portion of this area could have been purchased in large tracts at prices ranging from $1 to $2 an acre; but in view of the growing demand for forest lands, prices have already advanced, and they may be expected to advance still more within the next few years.

Titles to the lands satisfactory.

Within the past two decades the titles to many of the large tracts of land in this region have been much in dispute, and the efforts to adjust them involved tedious processes in court; but I am informed by competent judges that in practically all of these cases adjustments have finally been reached. Any appropriation for the purchase of these lands should provide ample time for the searching of titles, although no serious difficulty is anticipated from this source.

Forest reserve self-sustaining, and will ultimately yield a profit.

Referring again to my preliminary report, I may quote a statement which has been further confirmed by the results of the present year that "it is fully shown by the investigation that such a reserve would be self-supporting from the sale of timber under a wisely directed, conservative policy." In the case of many of the European forests under government supervision a net annual income is derived from the sale of timber and other forest products of from $1 to more than $5 per acre. I do not, of course, suppose that under the different conditions existing in this country a national forest reserve such as proposed would yield such a result, yet I confidently expect that the reserve now proposed in the Southern Appalachians will in the course of a few years be self-supporting, and that subsequently, as the hard-wood timber supplies in other portions of the country become more scarce, the lumbering operations will yield a considerable net return to the Government.

Its indirect benefits great.

Meanwhile, the establishment of such a reserve will remedy many of the evils now threatened in this region, and under the efficient management of the practical foresters now being trained in this Department its working will serve as a test and demonstration of the wisdom and success of practical forest operations on a large scale; and

Benefits of this forest reserve as an object lesson will be great.

this will encourage both individuals and States to adopt such methods of forest management on their own lands as will not only protect the forests in existence, but also restore them on lands which should never have been cleared.

Mineral developments not interfered with.

I am informed by the geologists who are familiar with this Southern Appalachian region that the development of its mineral deposits would neither interfere with nor be interfered with by the creation and proper handling of such a forest reserve.

Existing settlements not interfered with.

The settlements now existing within the limits of the proposed reserve would not be interfered with, nor would their existence there, nor their legitimate enlargement, interfere with the purposes to be accomplished in the establishment of the reserve.

Only general boundary now given.

It would not be wise at the present time to make public the exact location of lands which may be thought best adapted for incorporation in such a forest reserve, but the general boundaries of the region within which it is proposed to purchase these lands are indicated on the accompanying maps (see Pls. II, IV, and XII). I am of the opinion that the reserve should ultimately include not less than 4,000,000 acres.

CONCLUSIONS.

The results of these investigations of the forests and forest conditions of the Southern Appalachian region lead unmistakably to the following conclusions:

1. The Southern Appalachian region embraces the highest peaks and largest mountain masses east of the Rockies. It is the great physiographic feature of the eastern half of the continent, and no such lofty mountains are covered with hard-wood forests in all North America.

2. Upon these mountains descends the heaviest rainfall of the United States, except that of the North Pacific coast. It is often of extreme violence, as much as 8 inches having fallen in eleven hours, 31 inches in one month, and 105 inches in a year.

3. The soil, once denuded of its forests and swept by torrential rains, rapidly loses first its humus, then its rich upper strata, and finally is washed in enormous volume into the streams, to bury such of the fertile lowlands as are not eroded by the floods, to obstruct the rivers, and to fill up the harbors on the coast. More good soil is now washed from these cleared mountain-side fields during a single heavy rain than during centuries under forest cover.

4. The rivers which originate in the Southern Appalachians flow into or along the edges of every State from Ohio to the Gulf and from the Atlantic to the Mississippi. Along their courses are agricultural, water-power, and navigation interests whose preservation is absolutely essential to the well-being of the nation.

5. The regulation of the flow of these rivers can be accomplished only by the conservation of the forests.

6. These are the heaviest and most beautiful hard-wood forests of the continent. In them species from east and west, from north and south, mingle in a growth of unparalleled richness and variety. They contain many species of the first commercial value and furnish important supplies which can not be obtained from any other region.

7. For economic reasons the preservation of these forests is imperative. Their existence in good condition is essential to the prosperity of the lowlands through which their waters run. Maintained in productive condition they will supply indispensable materials which must fail without them. Their management under practical and conservative forestry will sustain and increase the resources of this region and of the nation at large, will serve as an invaluable object lesson in the advantages and practicability of forest preservation by use, and will soon be self-supporting from the sale of timber.

8. The agricultural resources of the Southern Appalachian region must be protected and preserved. To that end the preservation of the forests is an indispensable condition which will lead not to the reduction but to the increase of the yield of agricultural products.

9. The floods in these mountain-born streams, if this forest destruction continues, will increase in frequency and violence and in the extent of their damages, both within this region and across the bordering States. The extent of these damages, like those frcm the washing of the mountain fields and roads, can not be estimated with perfect accuracy, but during the present year alone the total has approximated $10,000,000, a sum sufficient to purchase the entire area recommended for the proposed reserve. But this loss can not be estimated in money value alone. Its continuance means the early destruction of conditions most valuable to the nation and which neither skill nor wealth can restore.

10. The preservation of the forests, of the streams, and of the agricultural interests here described can be success-

fully accomplished only by the purchase and creation of a national forest reserve. The States of the Southern Appalachian region own little or no land, and their revenues are inadequate to carry out this plan. Federal action is obviously necessary, is fully justified by reasons of public necessity, and may be expected to have most fortunate results.

JAMES WILSON,
Secretary of Agriculture.

DEPARTMENT OF AGRICULTURE,
Washington, D. C., December 16, 1901.

APPENDIX A.

FORESTS AND FOREST CONDITIONS IN THE SOUTHERN APPALACHIANS.

By H. B. Ayres and W. W. Ashe.

LUMBERING IN THE SOUTHERN APPALACHIANS.

By O. W. Price.

DESCRIPTION OF THE SOUTHERN APPALACHIAN FORESTS, BY RIVER BASINS.

By H. B. Ayres and W. W. Ashe.

TREES OF THE SOUTHERN APPALACHIANS.

By W. W. Ashe and H. B. Ayres.

LIST OF SHRUBS IN THE SOUTHERN APPALACHIANS.

By W. W. Ashe.

LETTER OF TRANSMITTAL.

UNITED STATES DEPARTMENT OF AGRICULTURE,
BUREAU OF FORESTRY,
Washington, D. C., December 18, 1901.

SIR: I have the honor to transmit herewith a report on the forests and forest conditions of the Southern Appalachians, including a description of them by mountain groups, an account of lumbering in the Southern Appalachians, and a description of their forests by river basins, together with an annotated account of the trees of the region and a list of the shrubs.

Very respectfully,

GIFFORD PINCHOT,
Forester.

The SECRETARY OF AGRICULTURE.

FORESTS AND FOREST CONDITIONS IN THE SOUTHERN APPALACHIANS.

By H. B. AYRES and W. W. ASHE.

The Southern Appalachian Mountains extend from Virginia southwestward into Alabama, and lie between the Piedmont Plateau on the southeast and the lowlands of East Tennessee on the northwest. That this is preeminently a region of mountains is well illustrated by the fact that the mountain slopes occupy 90 per cent of the total area; and probably the combined area of the valleys and gentler slopes (of less than 10 degrees—about 2 feet in 10) will not aggregate more than 15 per cent of the whole.

Entire mountain region originally forest covered.

Before the advent of man the entire region, save the tops of a few high mountains—the grassy "balds"—was covered with forest, mainly hard wood. (See Pl. XXXVII.) Then, as now, the forest varied as to density and vigor of growth, but a far larger portion of that existing then is resembled by the best of to-day on such tracts as are found in the most favored situations and have been protected from fire and severe culling.

Nature and extent of the clearings.

A total area of 5,400,000 acres has been examined in connection with this investigation, and of this 4,050,000 acres, or 75 per cent of the whole, are still in forest. Of this total area in forest about 7.4 per cent, or 303,000 acres, is still in primeval condition, i. e., has never been culled at all. The remainder of this wooded area has been culled to a varying extent. (See Pl. XXXVIII.) A limited portion of that near the railway lines has been robbed of nearly everything of commercial value, while the remote areas have had only the walnut, cherry, and figured woods cut. From the intervening areas, far the larger part of the whole, a varying proportion of the most valuable trees have been removed, but large amounts of commercial timber still remain. The clearing and culling of a century have made considerable inroads into these forests. The woodland connected with the farms has been largely culled and is in part covered with trees of second growth. In many places, where transportation facilities are available, the mills have gone into the heart of the mountain region and much of the choicest timber has been sawed there and hauled on wagons to the railroad. (See Pl. XXXIX.)

General character of the forests.

As to composition, generally speaking, it may be said that the forest below the 2,000-foot elevation consists of oaks, hickories, and pines; above that elevation are many hard woods, or hard woods associated with hemlock and white pine. Some spruce and balsam occur on the cold north slopes and around the tops of the larger and higher mountains.

DESCRIPTION OF THE FOREST AND FOREST CONDITIONS, BY MOUNTAIN GROUPS.

Subdivision of forest area.

For the sake of convenience in description the forest area may be subdivided as follows:

(1) The forests of the Blue Ridge.

(2) The forests of the White Top Mountain group.

(3) The forests of Roan, Grandfather, and Black mountains.

(4) The forests of the central interior mountain ridges.

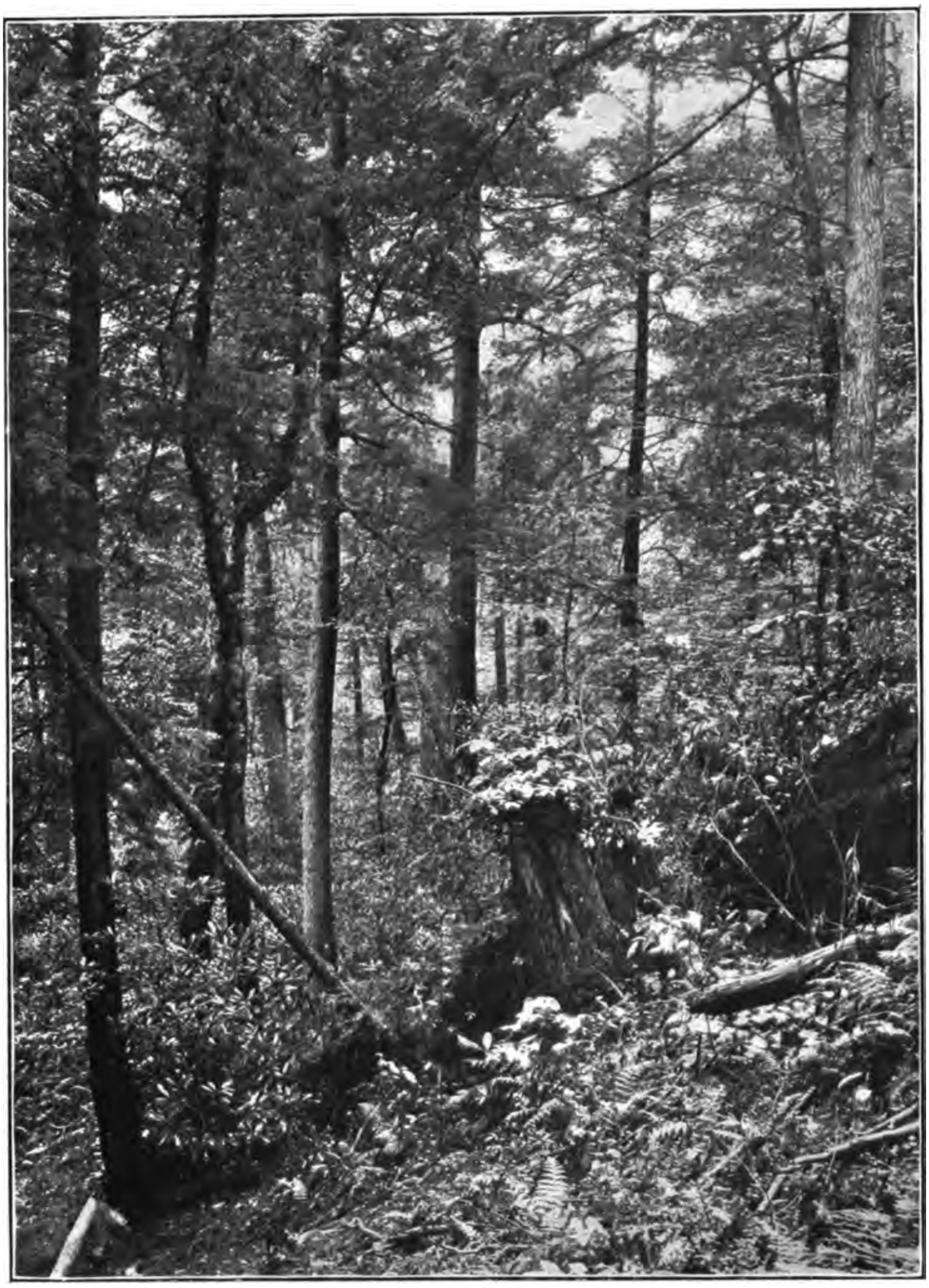
(5) The forests of the Great Smoky Mountains.

(6) The forests of the southern end of the Appalachians.

FORESTS OF THE BLUE RIDGE.

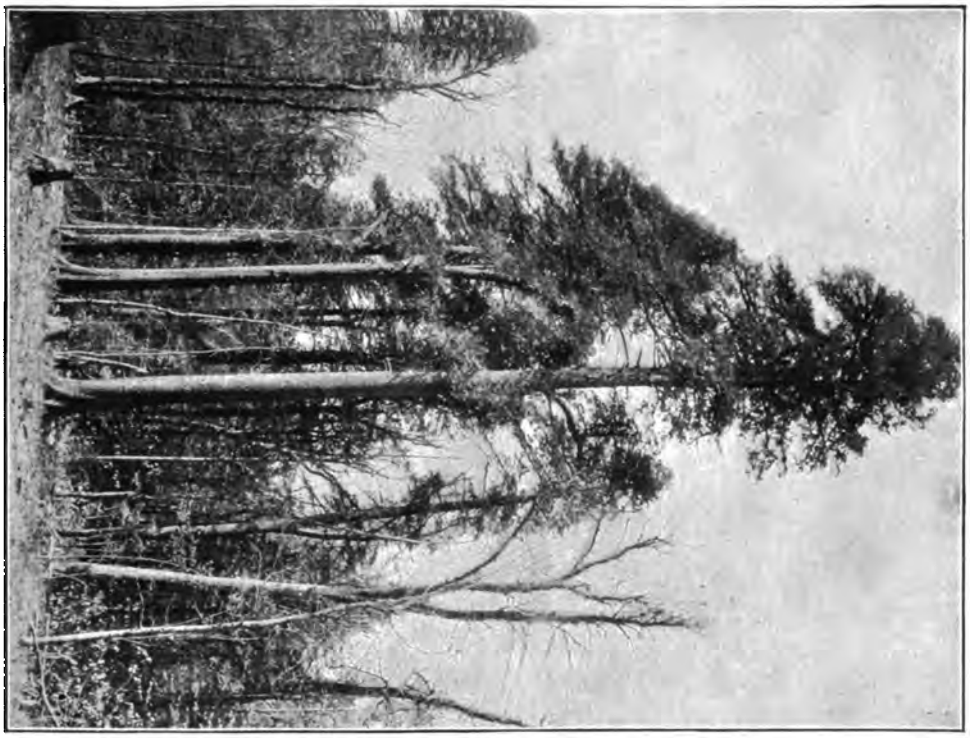
The Blue Ridge from Virginia to Georgia is, on the dryer slopes and crests, lightly timbered with small oaks, chestnut, and pines, while in the hollows mixed hard woods—oaks, chestnut, hickories, etc.—form heavy timber. The forests are on the ridges and steeper slopes. The narrow alluvial bottoms and often portions of the adjoining slopes have been cleared and are under cultivation or have been abandoned. But excepting these cleared valleys and hillsides, the forests are almost continuous from Virginia to Georgia.

While the hardwood forests have been culled along nearly the entire east slope, only the choicest trees of the lighter woods, among which are white pine, have been cut. (See Pl. XXXVIII *a*.) Before any of it was cut the white pine on the Linville River was probably the finest in the Southern mountains. A great part of this has been removed. It is being transported on a narrow-gauge railway via Cranberry to Johnson City. Mills at Hickory and



ORIGINAL FOREST, NORTHWEST SLOPE OF THE GREAT SMOKY MOUNTAINS. (See pp. 23, 45, 53.)

There are no lakes or glacial gravels in this Southern Appalachian region, such as abound in the Northern States. Here the forest and the soil alone must catch the heavy rains and regulate the flow of the streams. If the forests are destroyed the soils will be rapidly washed down into the river channels; and the terrible floods will destroy everything along the great river valleys. (See also pp. 56, 133.)



(*A*) SLIGHTLY CULLED MIXED FOREST, NEAR LINVILLE, N. C. (See p. 45.)

(*B*) WHITE-PINE FOREST EXCESSIVELY CULLED, SHADY VALLEY, TENNESSEE. (See p. 45.)

Lenoir are cutting the pine in the Johns River Valley. The other smaller bodies of white pine have been culled of their finest trees.

FOREST OF THE WHITE TOP MOUNTAIN REGION.

This region embraces the northwestern corner of North Carolina, the northeastern corner of Tennessee, and the adjacent portion of southwestern Virginia. In this portion of the Appalachians, the Unaka (here represented by Iron Mountain) and the Blue Ridge ranges approach nearer each other, and the intermediate land retains more of its original character as a plateau lying between the great Appalachian Valley, drained by the Tennessee River, on the northwest, and the Piedmont Plateau on the southeast. The White Top group comprises the mountains along the northern rim of the elevated mountain region.

Topographic features.

To the irregular mountain ridge which in this more northern region forms the boundary line between North Carolina and Tennessee, the name of Stone Mountain is applied. Here and there this ridge rises into peaks of prominence. On one of these, Pond Mountain, which has an elevation of 5,100 feet, the boundary lines between North Carolina, Tennessee, and Virginia corner. Another of these, White Top Mountain, some 5 miles to the northeast, and a far more massive and imposing mountain, rises to an elevation of 5,678 feet. Still another, Mount Rogers, on the Balsám Ridge, about 5 miles a little north of east from the White Top, rises to an elevation of 5,719 feet.

The general course of this Stone Mountain ridge is to the northeast as far as Mount Rogers and then continues eastward as Iron Mountain to New River Gap. Northwest of it, in Tennessee, is another less regular and less prominent ridge known as the Iron Mountains, reaching an elevation at intervals of from 3,000 to 4,000 feet; and 6 to 8 miles to the west of this latter, in Tennessee, is the Holston Mountain ridge, reaching a still higher elevation. These ridges are all approximately parallel, having in East Tennessee a general northeasterly course.

To the northwest of these mountains lies the broad, fertile valley of the South Holston; to the southeast is the more elevated valley of New River, broken into an endless series of steep, round-crested hills, mostly cleared, and producing well in both grass and grain. Broad agricultural valleys lie between the Iron and Stone mountains and between the Iron and the Holston mountains. There are many farms on the southeastern slope of the Stone Mountain, and its northwestern slope is dotted with clearings. Extensive clearings cover the southern foot hills of both White Top and the Balsam mountains. There is, however, in this group an almost unbroken forest, at least 6 miles in width, extending along the mountains from Elizabethton east to Mount Ewing, a distance of more than 60 miles.

Extensive mountain forests.

The portion of this forest to the southwest of Damascus covers the slopes of the Iron and Holston mountains and much of Shady Valley, between them. It is largely composed of hard wood, with which white pine and hemlock are associated. For 8 miles east of Damascus the forest covers both slopes of Iron Mountain. It has been slightly culled, but much burned. It is lightly timbered with oak, chestnut, hemlock, and some white pine. A large area lying east of White Top Mountain, on the upper slope of the Balsam Mountains, is heavily timbered with spruce (see Pl. XL) on and near the summits, while hard woods, with some hemlock intermixed, occupy the lower elevations. From the eastern end of the Balsam Mountains the Iron Mountain extends almost eastward to Mount Ewing, a distance of 40 miles. Its summit is dotted with a few farms and pastures, but the forest on the slopes is almost unbroken. It is lightly timbered with small oaks, chestnut, hickories, and black pine. The forest has been severely burned over large areas. A railroad has been built from Damascus southwestward through Shady Valley, and some of the finest white-pine timber in the United States is now being cut there. (See Pl. XXXVIII *b*.)

South of this large belt of forest are a few isolated mountains in the midst of the agricultural valley of New River which have their slopes well timbered. The largest of these are Phoenix, Three Top, and Elk mountains, which lie between the north and south forks of New River. Nearly 40,000 acres of this forest is unculled. There are six holdings of 10,000 to 50,000 acres each; the remainder is held in small areas of a few hundred acres. The farming region of both the New and Holston river valleys is dotted with wood lots sufficient to supply the needs of the resident population.

(A) HAULING LOGS TO THE MOUNTAIN SAWMILL. (See p. 46.)

(B) HAULING MOUNTAIN LUMBER TO THE RAILWAY STATION.

SPRUCE FOREST NEAR SUMMIT OF WHITE TOP MOUNTAIN, VIRGINIA. (See pp. 23, 48.)

Protected by a dense forest growth and covered by a dense growth of moss, flowers, and shrubs, the soils on the steep mountain slopes catch and store the heavy rains for use during dry seasons.

FORESTS OF ROAN, GRANDFATHER, AND THE BLACK MOUNTAINS.

Topographic and forest features.

Roan Mountain stands as a prominent figure in this group of four similar large, isolated mountain masses—Beech, Grandfather, Roan, and Black mountains—in a region which is largely devoted to agriculture. These mountains are alike in the general character of the forests on their slopes, and the agricultural lands about their foothills and intervening valleys. They are all heavily timbered, and, though much of their forest has been partially lumbered, only occasional choice trees have been cut, causing no break in the forest and little change in its condition. Mixed hardwoods form the dominant element, and associated with them are small areas of hemlock. Limited areas of spruce are found on or near their tops. Beech Mountain is the lowest of these four. It has few coniferous trees about it except hemlock and white pine on its northern slope, while large areas on the summits of Grandfather, Roan, Black, and Craggy mountains are occupied by spruce and balsam forests. These forests are virtually primeval, and trees of all sizes and ages are found intermingled, showing abundant reproduction and an undisturbed forest equilibrium. Along the drier portions of the summits and the ridges leading up to them, especially on the south slopes, fires have in some places done considerable damage. But areas entirely fire killed are small.

Forests and topographic features about Beech Mountain.

(1) The Beech Mountain group, including Sugar Mountain and other smaller peaks near it, lies between Watauga River and Banners Elk Creek and is the most northerly group. It has an area of about 70,000 acres (110 square miles), 20,000 acres (32 square miles) or about 30 per cent of which are cleared. It is the lowest of the four groups, having an altitude of only 5,522 feet. It is separated from Grandfather Mountain, which is about 15 miles southeast of its summit, by the valley of the Watauga River and from Roan Mountain, which is about the same distance to the southwest, by the valley of Elk Creek, which is partly cleared. Although the south slope of the mountain is steep, the soil is deep and mellow and grass farms extend nearly to the summit. There are also a few farms on the northern slopes.

The original forests of Beech Mountain are now largely confined to the deep hollows on the northern slopes. The greater part of them have been culled in degrees varying with their ease of access.

Forests and topographic features about the Grandfather Mountain.

(2) The Grandfather Mountain group, including Grandfather and Grandmother mountains, lies on the Blue Ridge, and is the highest point in that range, having an altitude of 5,964 feet. While it is situated on the Blue Ridge, its affinities, so far as its forests are concerned, are with the interior mountain areas and not with the eastern slope of the Blue Ridge.

The agricultural lands of this region lie to the north of the Grandfather along New and Watauga rivers, to the west in the valley of North Toe River, and on the low mountains and round hills, dotted with clearings, lying between the Grandfather and Roan groups. This mountain group contains an area of more than 100,000 acres, only a small portion of which is cleared. The cleared land is located chiefly among the headwaters of Linville and Watauga rivers.

The topography of the entire group is rough, with steep and often rocky slopes. Many of the farms are on land which is too steep for profitable agricultural use. The eastern and southern slopes of the mountains are lightly timbered. The western and northern slopes have been somewhat culled, but are still heavily wooded. A dense mixed forest covers the northern slope and extends across the valley of Boone Fork of Watauga River, which is yet uncleared for a distance of more than 5 miles from its head.

(3) The Roan Mountain group, including Roan Mountain, Yellow Mountain, and Spear Top, lies on the boundary line between North Carolina and Tennessee, between Doe and Toe rivers. It rises from a base of 2,000 feet to a height of 6,313 feet. The area of this group is about 120,000 acres, over one-fourth of which, or 35,000 acres, is cleared. The slopes are slightly more gentle than on any other of the large mountains, and are well wooded, though dotted with clearings. The entire wooded portion of this area is well timbered. The north slope, being nearest to the railroad, has been more culled, but some timber has also been cut on the south slopes at the heads of Big and Little Rock creeks.

Forests and topography about the Black Mountains and the Craggies.

(4) The Black Mountains, which lie just west of the Blue Ridge, a few miles north of where the latter range is crossed by the Southern Railway, are a series of short ridges. The most massive of these is that of Black Mountain proper, which diverges from the Blue Ridge and extends

northward 10 miles to a rather abrupt ending. The larger part of this ridge rises above 6,000 feet, and Mount Mitchell, the highest of half a dozen grand peaks, reaches an elevation of 6,711 feet. From near the southern end of the Blacks the Craggy Mountain ridge extends southwestward for a distance of nearly 10 miles, and from this same point the Yates Knob ridge extends northwestward in a less regular form toward the Unaka range. These mountains lie between Toe River on the north and the Swannanoa on the south. At the southern end of the Blacks they touch the Blue Ridge. They are from 15 to 30 miles south of Roan Mountain and 30 miles southwest of the Grandfather. The group has an area of more than 170,000 acres, about 20,000 acres of which are cleared. Forests cover nearly the entire area of the Craggy Mountains, though they are not so dense, nor so nearly in their original condition as are those on the Black Mountains, as more or less lumbering has been done along both the eastern and the western slopes. Some of these slopes, too, have suffered much from fire and are almost destitute of young trees and undergrowth. The densest and most primitive forests of the region lie on the west slope of the Black Mountains about the headwaters of Caney River. (See Pl. XIII.) Those on the east slope of the Blacks are much lighter and have suffered more from fires.

FORESTS OF THE CENTRAL INTERIOR MOUNTAIN RIDGES.

Topography.

The Balsam Mountains make up the longest of the cross ridges in the Southern Appalachians, extending from Mount Guyot, the highest of the Unakas, on the Tennessee line, in a general southeasterly course to Mount Toxaway (Hogback) on the Blue Ridge, near the South Carolina line, a distance of 40 miles. They reach their highest point in Richland Balsam — 6,540 feet

Northeast of and less prominent than the Balsams are the Newfound Mountains, which form another and shorter cross ridge, extending from Mount Pisgah northward to the Unakas. South of the Balsams, the Cowee and Nantahala mountains each form short cross ridges, rising to less than 5,500 feet, which extend from the Blue Ridge on the Georgia State line northwesterly to the Great Smokies of the Unaka Range.

Agriculture.

These cross ridges are in their general features all much alike, with frequent steep rocky slopes and sharp crests. There is very little land on them suited to agriculture, except in the narrow valleys and coves. (See Pl. XLIII.) The soils are generally thin and light, in some places sandy, rarely clayey. These mountains, however, are surrounded by agricultural valleys, except near the northwest ends of the Balsam and Newfound mountains, where these join the Unakas. The forests on the northwestern portion of the Balsam Mountains are really a continuation of those of the Great Smokies, and resemble them in the species represented and in the general forest conditions.

General forest conditions.

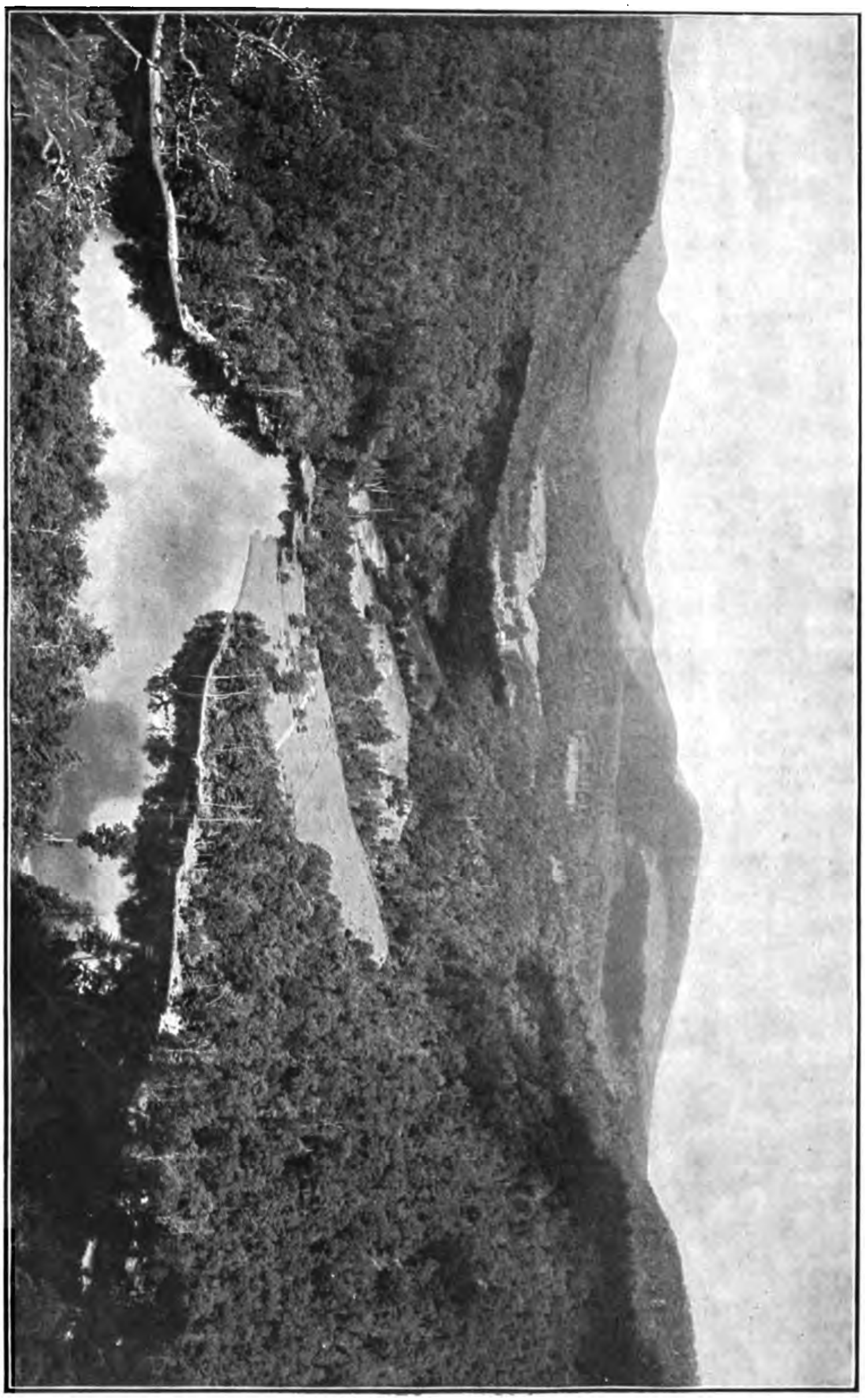
The forests on the east side of the Balsams and on the Newfound, Cowee, and Nantahala mountains are much alike, but the Balsam Mountains are much more heavily wooded than the others, especially on their northern slopes, and have more of the softer woods, like linn, buckeye, and ash. The southern slopes of all are lightly wooded and have been injured by fire to some extent, so that in places the forest is open and young timber trees are scant. Much of the best timber has been culled from the Newfound and Nantahala mountains. The larger part of the forest land on the eastern spur of the Balsams (about Mount Pisgah) is under forest protection.

Forests about the Newfound Mountains.

The forests of the Newfound Mountains are formed of hard woods, largely oak and chestnut, associated with white pine. As they lie nearer the main line of the Southern Railway, and on account of the topography were easily lumbered, they have been more culled than those of the other cross chains. Some general lumbering has been done on Wolf and Shut-in creeks, and an attempt has been made to remove all the merchantable timber from some large tracts. At most, however, it amounts to only severe culling. The forests of the Cowee and Nantahala mountains are very much alike. They consist of hard woods, in which oak, chestnut, hickory, and maple form the largest element. There is almost an entire absence of coniferous growth, the hemlock, which is associated with the hard woods elsewhere, being almost wanting here. Much culling has been done in the forests at the north ends of these mountains, where they are nearer the Murphy branch of the Southern Railway.

Forests about the Balsam Mountains.

The Balsam Mountains are more heavily timbered than the other cross ridges. On both northern and southern slopes there are deep, cool hollows, or coves, with fertile soil, producing vigorous growth, and as there has been very little culling these forests are very nearly primeval. They consist of typical Southern Appalachian harp

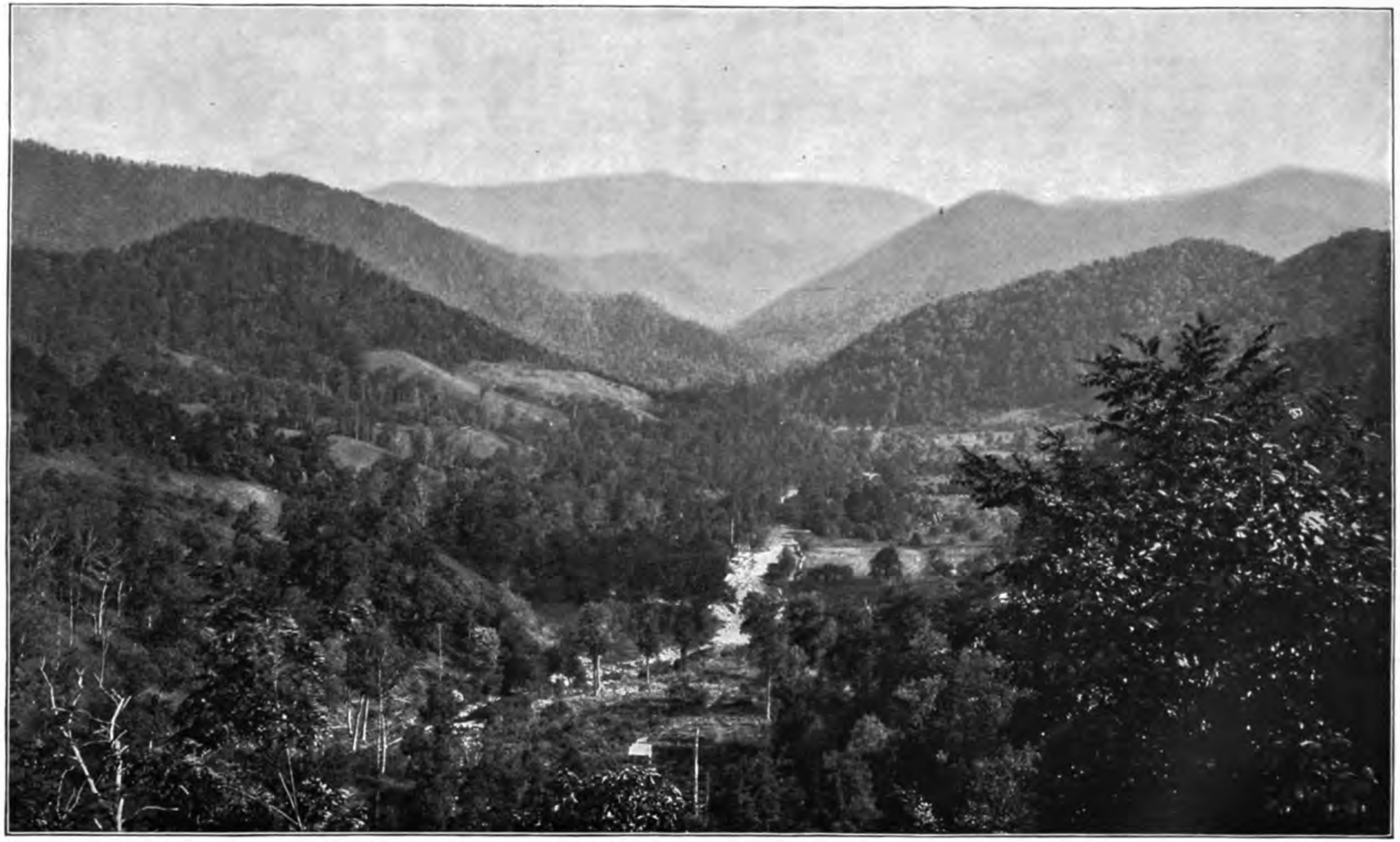


(Photographed by Scadin.)

FORESTS ON THE SOUTHERN SLOPES OF THE BLUE RIDGE, ABOUT MOUNT TOXAWAY, IN THE SAPPHIRE COUNTRY, WESTERN NORTH CAROLINA. (See pp. 51, 52.)

FORESTS ON THE SLOPES OF NANTAHALA GORGE, WESTERN NORTH CAROLINA. (See p. 53.)

The soil on these slopes is thin and would be quickly removed by the rains if the forests were destroyed.



FORESTS AND CLEARINGS ABOUT THE SOUTHEASTERN SLOPES OF THE GREAT SMOKY MOUNTAINS, BETWEEN CROSS RIDGES. (See p. 53.)
The clearings are small Indian farms on the Oconalufty River.

woods, associated with hemlock and spruce. On the northern slopes the softer of the hard woods form the dominant element, as linn, ash, buckeye, and yellow poplar, while the proportion of oak and chestnut is smaller. The hemlock is associated with these in the deep hollows, while spruce crowns the summits of the northern slopes. On the southern slope oak and chestnut form the larger proportion of the timber, and there are less of the lighter woods and of hemlock and almost no spruce. The eastern, or French Broad River slope about Mount Pisgah, is lightly timbered with oak and chestnut and has been much damaged by fire. At present, however, it is under forest protection, and a vigorous young growth is springing up. Railroads are now being built into the forests on both the north and south slopes in order to exploit the timber.

The almost precipitous walls of the beautiful Nantahala Gorge, nearly 2,000 feet deep, are forest covered throughout their entire extent. (See Pl. XLII.)

FORESTS OF THE GREAT SMOKY MOUNTAINS.

Topography and forest conditions.

This segment of the Unakas is the largest mountain mass in the Southern Appalachians, and it contains the largest area of continuous forest (see Pl. XVII), with the smallest number of clearings. It includes the Smoky Mountains from the Big Pigeon River on the northeast to McDaniel Bald on the southwest, and that part of the Balsam Mountains which lies west of Soco Gap, with their numerous spurs and subsidiary ridges. The region is rough and rugged on both north and south slopes, and rises from a low valley level of about 1,500 feet at the larger streams to more than 6,000 feet along the crests of the highest mountains. The wooded area begins on the western foothills of the Smoky Mountains in Tennessee, covers the northwestern and southeastern slopes of the Great Smokies (see Pl. XLIII) and the slopes of the Cataloochee Mountain.

The broad agricultural valleys of East Tennessee lie against these mountains on the northwest, but elsewhere they are surrounded by a rough country of lower mountains, with narrow, intervening agricultural valleys. Less than 10 per cent of this area is cleared. The clearings are few and small, and lie chiefly some miles distant from the crest of the ridge.

Nature and extent of the forests.

The forests are chiefly of hard woods, with a large amount of coniferous growth around the higher summits and in the deep, cool hollows. On the drier slopes, and especially on the south sides, oak and chestnut form the greater part of the timber, with some black and yellow pine on the ridges. The timber in the hollows is more varied and the stand is heavier, poplar, birch, linn, and buckeye being associated with the oak and chestnut. The finest and largest bodies of spruce in the Southern Appalachians occur here, along the crest of the ridge and the north slope of both the Cataloochee and Smoky mountains. There are about 20,000 acres of spruce and nearly as much hemlock. There is no spruce on the Smoky Mountains southwest of Silers Meadow.

The forests of the north slope of the Smoky Mountains have been much culled and injured by burning and pasturage. There is yet a great deal of fine timber, however. Fires have also done much injury on the south slope, especially to hard woods, and the growth is often very open on account of the suppression of young trees by burning for a great number of years. The valleys of Cataloochee and Big Creeks are heavily timbered, though they have been culled to some extent, and the ridges have often been burned. A railroad is now being built up Big Pigeon River in order to exploit the timber on these streams. A railroad is also under construction up Oconalufty River to remove a part of the timber from the east prong of that stream.

FORESTS OF THE SOUTHERN END OF THE APPALACHIANS.

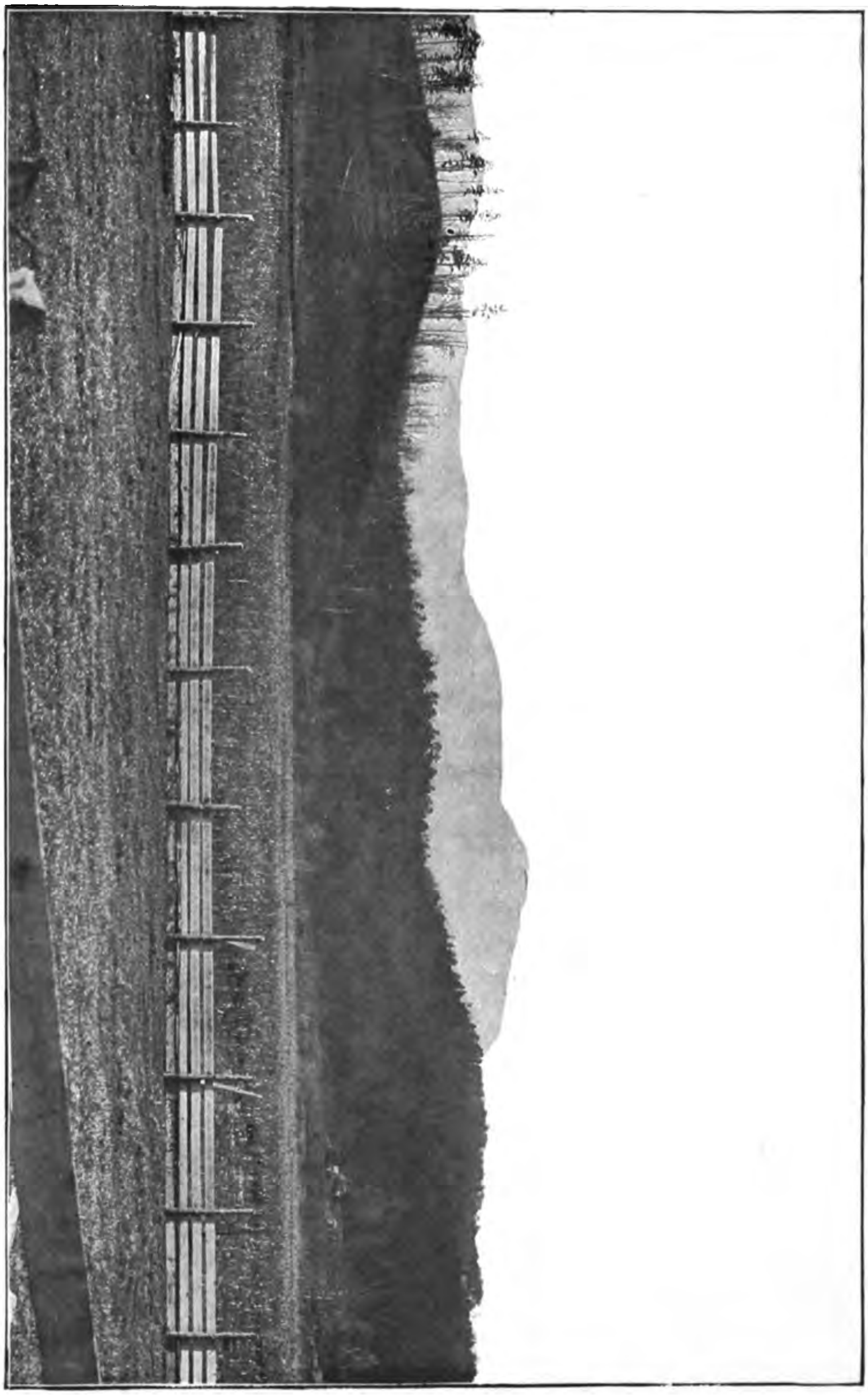
Topography.

South of the Nantahala cross ridge the Appalachian Mountains no longer consist of two well-defined parallel ranges with prominent cross ridges, but break up into a number of small, low mountains, or small ridges, with broad, alluvial valleys or low hills between them, or in some places there are a series of low ridges which are separated by deep, narrow, gorge-like valleys. In northwestern Georgia their identity is entirely lost, and they pass into the hills of the Piedmont Plateau. While only a few of these mountains have an altitude of more than 4,500 feet, the topography is rough, as the stream level is much lower than it is further northeastward, not being more than 1,000 feet. The resisting character of the rock—quartzite, sandstones, and slates—which forms these mountains, which have eroded into sharp-pointed ridges with deep, narrow intervening val-

In Haywood County, N. C.

In East Tennessee.

BIG CHESTNUT TREES, FROM THE BASE OF THE GREAT SMOKY MOUNTAINS. (See pp. 23, 54.)



FORESTS ON THE SOUTHERN APPALACHIAN MOUNTAINS: TABLE ROCK, SOUTH CAROLINA.

leys, has added to the ruggedness of the region and its picturesqueness. Some of the largest of these mountains are the Blue, Flat Top, Shooting Creek, and Valley River mountains.

Forest conditions.

The northern slopes and hollows are often well wooded with hard woods, chiefly with oaks, chestnut, maples, and hickories. The southern slopes are lightly wooded with oaks, hickories, and black and yellow pines, which also form the forests on the spurs and foothills. In very many places the forest is open and thin, and many trees are defective. The undergrowth is often dense, consisting of numerous sprouts from young trees which have been killed by fires, and many shrubs which grow in the partial shade of the thin forest cover. In other places there is almost no underwood and no young growth. Repeated fires have injured much of the timber on the southern slopes and greatly impaired the general forest condition. These fires are far more frequent and severe than in the hard-wood forests northward, on account of the dryer climate and soil and the large amount of inflammable pine, and the resultant injury to the timber is more evident. On account of the thin, dry soil the trees are smaller and less vigorous than farther north, and the constant destruction of the humus by the fires still further lessens their growth and keeps them small. The soils of the mountains are generally thin and sandy and not at all productive agriculturally. In many places they are very rocky, so that tillage would be impossible. The altitude is too low for grass. About three-fourths of the area is at present in forest. Some of it is second growth, but only a small part of it is such. There are occasional clearings, however, around the base of the mountains and in the hollows. Lumbering has been in progress in many places and some of the choicest timber has been removed, especially along and near the Marietta and North Georgia Railroad.

CHANGES IN FOREST CONDITIONS OF THE SOUTHERN APPALACHIANS.

The three agencies that have wrought changes in the forests of the Southern Appalachians are the fires, the lumbermen, and the clearer of lands for farming purposes.

Injury by forest fires.

Fire has come as an oft-repeated scourge since the days of early Indian occupation.

Extent and nature of their damages.

More than 78,000 acres of the region examined have recently been so severely burned as to kill the greater portion of the timber, but the greater aggregate damage has been done by lighter fires creeping through the woods year after year, scorching the butts and roots of timber trees, destroying seedlings and forage plants, consuming forest litter and humus, and reducing that thatch of leaves which breaks the fall of raindrops. Evidence of such fires is found over approximately 4,500,000 acres, or 80 per cent of the entire area. (See Pl. XLVI.)

The effect of forest fires is seldom appreciated, especially in this region, where so few timber trees are killed. The killing of mature timber trees is, in fact, from the nation's point of view, the least damage of all; for were only the mature trees killed a dozen saplings would stand ready to fill the place of each, but the fires affect the saplings much more than the large, thick-barked trees, and, too, where spring fires are habitual seedlings can not grow, as they are killed when very small. A forest under such conditions can not reproduce itself. The timber trees die out and are replaced by brush that sprouts from the roots. One who studies these effects can see everywhere the damage by fire in dead trees, scorched butts, hollow trees, dead saplings and seedlings, in clumps of sprouts from roots of fire-killed trees, in the openings, the half-forested land, and in the annual weeds that occupy the burned areas, nature using their humble efforts to cover the nakedness of the misused land.

Reproduction prevented.

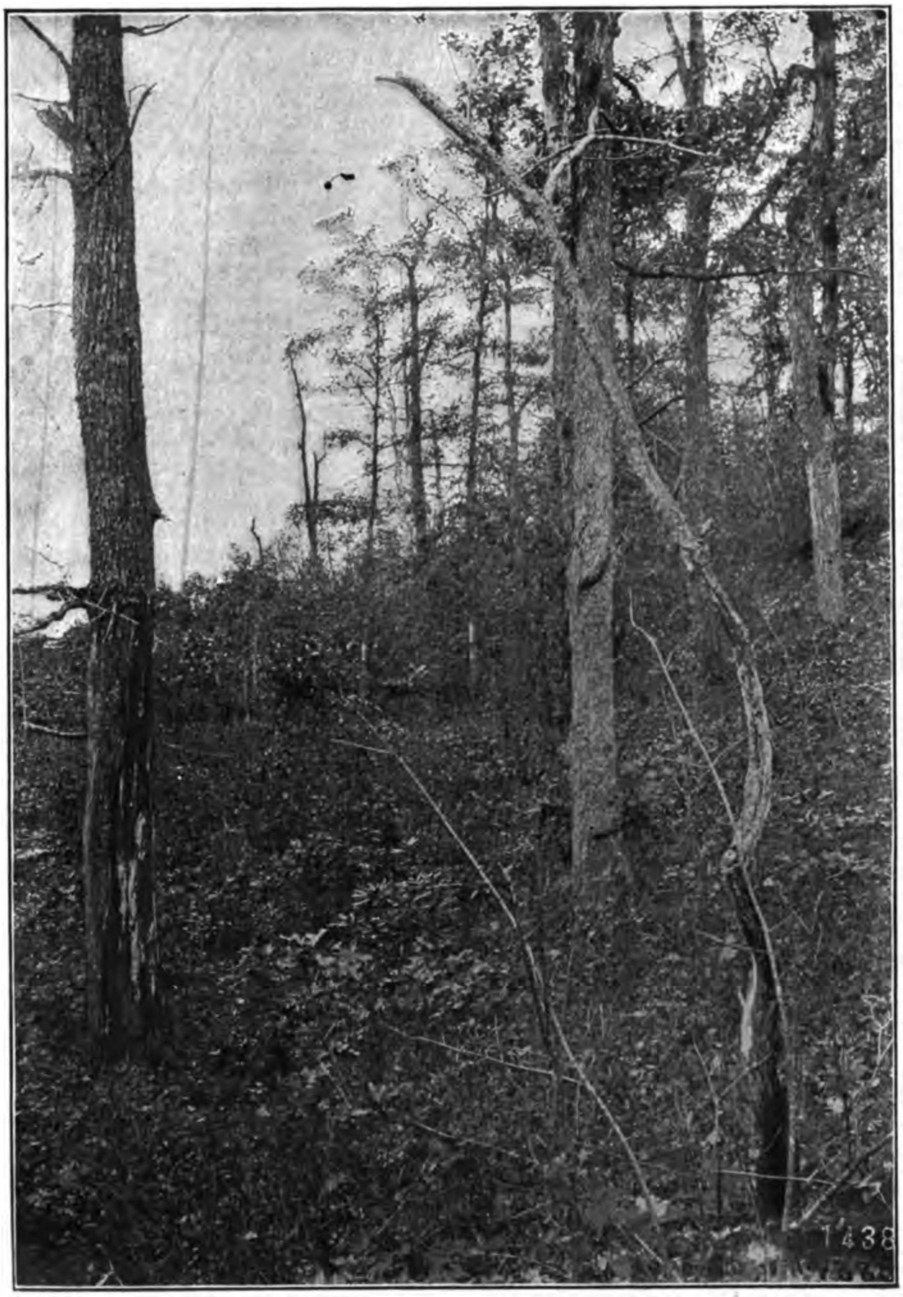
Fires increase violence of floods.

The damage by fire causing a loss of the earth cover does not end with erosion, for it also prevents water from penetrating and being stored in the earth. The roots of trees penetrate deeply into the subsoil, and as they decay leave a network of underground water pipes. The mulch of forest leaves encourages numerous ground-boring worms and beetles that keep the soil of an unburned forest porous, not only favoring the absorption of water, but also retarding the capillary rise of moisture to the surface and its loss by evaporation. The mosses and humus of a well-conditioned forest form wet blankets, often a foot thick, the function of which is so evident that it need not be explained here. The dissipation of the chemical elements of plant food into the atmosphere by fire and the rapid leaching away of the slight residue contained in the ashes is another injurious effect of the forest fires.

Fires impoverish the soil.

Fires in this region best prevented by Government supervision.

The experience of the older countries should serve us sufficiently to prevent our making a similar mistake of policy concerning our mountain lands. That the same



DAMAGES FROM FOREST FIRES IN THE SOUTHERN APPALACHIANS. (See pp. 24, 55.)

The fires do incalculable damage to the forests on the slopes of these mountains, injuring and often killing both the trees and the undergrowth.

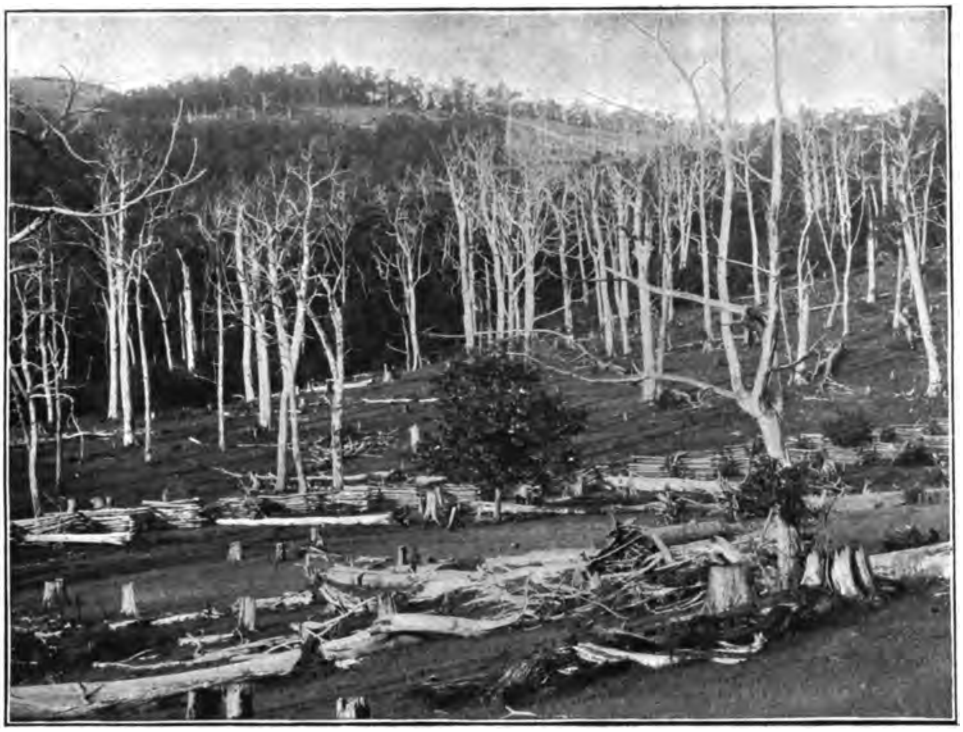
(*A*) BASE OF PINE TREE BURNED BY FOREST FIRES. (See pp. 24, 55.)

(*B*) SPROUTS FROM BASE OF AN OAK KILLED BY FOREST FIRES.

(*A*) GRANITE KNOB FROM WHICH THE FOREST, AND LATER THE SOIL, HAS BEEN LARGELY REMOVED.
(See pp. 25, 26, 56, 133, and Pl. XIX.)

(*B*) HUMUS AND UNDERGROWTH DESTROYED BY FIRE; SOIL BEING WASHED FROM ROCK BY RAIN.

When the fires destroy the undergrowth and the humus the soil loses its spongy covering, and the water from the heavy rains rushes down to the streams and causes floods, instead of being stored in the soil for dry-season supply. (See pp. 25, 56, 133.)



(*A*) DESTRUCTION OF FOREST ON MOUNTAIN RIDGES FOR PASTURING PURPOSES. (See pp. 26, 57-59.)

(*B*) CORN PLANTED BETWEEN GIRDLED TREES ON APPALACHIAN MOUNTAIN RIDGES. (See pp. 26, 57-59.)

Many of these steep mountain fields are "cleared," cultivated, badly washed, and abandoned, all within less than a decade, and before the girdled trees have fallen to the ground.

effects follow the careless policy of burning mountain land in this country as in Europe is proved by the already desolate condition of large areas in the Rocky Mountains and the plainly legible signs of the coming consequences in the Appalachian region.

The effect of lumbering.

The lumberman has been increasing his activities at a somewhat rapid rate, and he is yearly going farther into the forests. The damages he causes come not so much from the trees he cuts in culling the forest as from the additional trees and seedlings of valuable species which he destroys in his lumbering operations, and the greater destruction from forest fires which follow him, fed by the tops and other brush he leaves scattered through the forest. By his irregular cutting, reducing forest conditions, he renders impracticable the inauguration of economic, conservative forest management.

The effect of clearing steep mountain sides.

Following in the wake of the fire and the lumbering, and surpassing them both in the completeness and permanency of the damage done, is the man who clears for ordinary agricultural purposes mountain lands which should forever remain in forest. The clearing of lands in this region for agricultural purposes has progressed slowly but steadily during the past century as the population increased, until at the present time there are 1,200,000 acres (24 per cent) cleared out of a total of 5,400,000 acres examined. (See Pl. XII.) When it is considered that the settlement of this region has been in progress for more than a century the extent of the area devoted to agriculture is small. The reason for this is found in the unprofitableness of cultivating lands with such steep slopes. The cleared lands are mostly limited to the alluvial bottoms along the streams, the rounded valley hills, the lower mountain spurs, and the lower slopes of the larger mountains themselves below 4,000 feet elevation.

Percentage of land already cleared.

In some localities, especially in the region around Roan Mountain and on the Blue Ridge north of Gillespie Gap, there are large areas of cleared land at an elevation of from 3,500 to 5,000 feet; but these are mostly grass farms, are not subject to continuous tillage, as are the corn lands below, and hence do not deteriorate so rapidly. Some of the slopes that are cultivated are very steep—from 30 to 40 degrees—some of them too steep even for the mountain steer and bull-tongue plow, and must be cultivated entirely by hand.

The staple grain produced throughout this region is corn, which yields more heavily than small grain and is more easily managed on the steep slopes. On clearing the land for cultivation the standing trees are girdled to kill them, so that neither their shade nor their growing roots will injure the crops. Some of the trees thus killed are used for fencing and fuel, but the greater number of them fall in a few years and are then rolled into heaps and burned. Corn or buckwheat is usually grown on these newly cleared fields, between the girdled trees during the first season (see Pl. XLIX.) Following this corn may be planted one or two years more; then small grain, either wheat, rye, or oats, for one or two years; then grass for a few years; then follow worthless weeds, and then the gullies. When first cleared most of this mountain-side land is covered with a layer of humus several inches thick, and the soil below is black and porous, owing to the large percentage of vegetable matter it contains; but on cultivation and exposure to the sun and washing rains this organic matter is rapidly dissipated. In this process most of the soil is washed away; the remainder shrinks and consolidates, thus losing much of its power to absorb water rapidly, and loses its fertility by the continued eroding and dissolving action of the rains.

Method of clearing.

The process of erosion.

Hence these cleared mountain lands have a short-lived usefulness, and new clearings are made to replace the fields which from year to year are abandoned because they cease to be productive. A few years of cultivation for fields on these steeper mountain slopes usually brings them to the end of their usefulness for agricultural purposes. This may be followed by a few years of pasturage, and then come abandonment and ruin. (See Pls. I, XX, and XXI.) Over the eroded foothills, along the eastern base of the Blue Ridge and western base of the Unakas, young pines may slowly cover again the eroded surface of the mountain slope, but over the more elevated portion of the Appalachian Mountain region the erosion, whether it be in gullies, visible for miles, or in the more common form in which the whole surface moves downward, is so rapid that the hard-wood forests, slower to reproduce, do not readily regain their footing, and hence the work of land destruction continues.

Early abandonment and ruin of these cleared mountain slopes.

The limited alluvial or bottom lands in this region being the most productive and easiest cultivated, were naturally the first to be cleared, and these are now nearly all in cultivation; but with an increasing population the demand for additional fields to cultivate has led to the clearing of these mountain-side patches successively higher up the slopes, until now the area of these clearings considerably exceeds the area of the bottom lands. This process has gone on the more rapidly because of the rapidity with which these steep lands have been worn out and abandoned. There are yet many places where the gentler slopes might perhaps be cleared to meet the agricultural demands of the region, but unquestionably the steeper areas already cleared should be at once reforested in order to prevent their early ruin. All lands in this region remaining cleared for farming purposes should be kept in the highest state of cultivation, and those of even the gentler slopes should be carefully terraced, and as far as possible kept in grass or orchards.

Fields now abandoned should be reforested.

The effect of exposing mountain lands to the full power of rain, running water, and frost is not generally appreciated. The greater part of our population lives on level land and does not see how the hills erode, and even in the hills nearly all the people go indoors when it rains and therefore do not half understand what is going on. In the dashing, cutting rains of these mountains the earth of freshly burned or freshly plowed land melts away like sugar. The streams from such lands are often more than half earth and the amount of best soil thus eroded every year is enormous.

A remedy suggested

The individual owners are to a great extent helpless in preventing these unwise cuttings, clearings, and forest fires. Some of them can care for their own lands, but they can not, owing to their small holdings and small incomes, regulate the policy which controls adjacent areas. Only cooperation on a great scale, such as Government ownership could provide, can stop these forest fires, check this reckless clearing, and preserve these resources to the best advantage.

The two great needs of this mountain region are:

1. The use of the land for the purpose to which it is best adapted, which would require the keeping of 80 to 90 per cent of it in forest, while the cleared land should be kept in the highest state of cultivation for farm products.

2. Efficient and cheap transportation for the forest products.

LUMBERING IN THE SOUTHERN APPALACHIANS NOW AND UNDER GOVERNMENT OWNERSHIP AND SUPERVISION.

By Overton W. Price.

The protection of the headwaters of important streams in order to prevent floods and perpetuate water powers, the preservation of a great natural health resort and of important agricultural resources, are perhaps the most valuable results that would follow the creation and management of the proposed Appalachian Forest Reserve. The application of practical forestry in this region by the Federal Government would bear fruit also in the maintenance of a sustained supply of hard-wood timber, in the production of a steady and increasing income therefrom, and in providing a forcible object lesson to show the advantages of careful and conservative forest management.

Present methods of lumbering and their results.

Lumbering is one of the principal industries of the Southern Appalachians. The agricultural resources of the region must remain limited because of its ruggedness and the low percentage of arable land. Its development as a grazing country is hampered by the lack of winter forage and the temporary life of the grass covering in the lower slopes. Its main resource of the future will be its hard-wood forests, upon whose maintenance depends very largely the best and most permanent development of western North Carolina and eastern Tennessee. The existing supply of merchantable timber has already been seriously reduced, while repeated fires and unregulated grazing have in many localities greatly impaired the quality and health of the forest, as well as the chance of its successful reproduction. Although there is still enough wood left to fill the local demand, the cost of logging it is constantly growing with the increasing distance between the market and the source of supply. Around each settlement there is a rapidly widening area which has been stripped of all merchantable timber under methods which too often render it practically valueless for the production of a second crop. In many localities serious harm has already been done, which only time and care can remove. A continuance of such methods will within the near future destroy this great natural resource of the Southern Appalachians—the lumbering of its valuable hard woods to supply a steady and growing demand.

APPLICATION OF CONSERVATIVE FOREST METHODS TO THIS REGION BY THE GOVERNMENT PRACTICABLE AND PROFITABLE.

The application of practical forestry to the proposed reserve would not only preserve the productive capacity of the forest within its boundaries, but it would also provide a proof of the results of conservative forest management which would be of value in inducing private owners of forest land in this region to adopt the same measures. There is no surer or quicker way of convincing the lumberman of the Southern Appalachians that conservative lumbering pays better than ordinary lumbering than by an experiment on the ground, based upon a thorough study and effectively carried out.

Government management would yield a profit.

The question of direct returns from the proposed reserve is, from the point of view of the Federal Government, a secondary one. Its highest benefit will lie in those indirect returns which are of so vital an importance to the best development of this region and its resources. However, that the forests of the Southern Appalachians can under systematic and conservative measures be made to yield a profit from their management is certain. Although local stumpage values are not sufficiently good to warrant the application of an elaborate system of forest management, they are high enough to make conservative lumbering a sound business measure. The pecuniary advantage of practical forestry depends naturally upon whether it offers better returns than those to be had from ordinary lumbering. Since it reduces present profits slightly in order to insure a second crop of timber upon the lumbered area, its superiority from a business point of view rests upon the safety and value of the second crop. Serious danger from fires, a poor market, excessive difficulties to overcome in logging, or any other adverse condition which seriously impairs stumpage values, may render the probable future returns from a forest insufficient to justify conservative measures in lumbering it.

(*A*) WASTE IN SAWING AT A SMALL MILL IN THE SOUTHERN APPALACHIAN MOUNTAINS. (See p. 63.)

(*B*) TOPS LEFT AMONG THE TREES IN LOGGING. (See pp. 24, 57.)

These feed the forest fires so effectively that they sometimes destroy everything in their path.

(*A*) SAWING LARGE TIMBER AT A SMALL MILL IN THE MOUNTAIN FOREST. (See pp. 62-64.)

(*B*) BINDING POPLAR LUMBER FOR EXPORT, FROM THE GREAT SMOKY MOUNTAINS.

Not only is there no unfavorable condition in the Southern Appalachians which is sufficient to render practical forestry inadvisable as a business measure, but the opportunity offered for good returns from careful and conservative forest management is a peculiarly favorable one. The forest contains valuable timber trees, which not only command a high price at present, but are rapidly increasing in value for the lack of satisfactory substitutes, notably in the case of Black Walnut, Cherry, Hickory, Yellow Poplar, and White Oak. The transport of timber presents some difficulties, as in all mountain countries. These are, however, seldom sufficient to impair seriously the profits from lumbering. Effective protection from fire is practicable without prohibitive expense, while in its rate of growth, readiness of reproduction, and responsiveness to good treatment the forest offers silvicultural opportunities which are seldom excelled in this country.

Conditions in this region favorable for conservative forestry.

SOME EVILS OF THE PRESENT SYSTEM OF LUMBERING.

Practical forestry in the Southern Appalachians must comprise those modifications of the present methods of lumbering which will not only insure a fair profit upon present operations, but will preserve the productive capacity of the forest and provide for the desired reproduction of the timber trees. Unnecessary damage to the forest and total lack of provision for a future crop is characteristic of the lumbering now carried on in this region. Logging operations have generally shown an inexcusable slovenliness, as foreign to good lumbering as to practical forestry.

A clean lumber job is seldom seen. There is great waste of good timber through poor judgment in gauging the log lengths and in cutting stumps much higher than is necessary. Butting off unsound portions of trees is not always done; trees not wholly perfect are sometimes left to rot where they fall. Care is seldom taken to throw trees where they will do the least harm to themselves and to others, and in consequence lodged and smashed trees are very common. Overlooked sound trees are also numerous.

Wasteful methods followed.

However, criticism of lumbering in the Southern Appalachians must take into consideration the circumstances which led to it. Almost all of the work has been done by the farmers of the region in order to supply their fuel and other household material and to add to the poor living afforded them by their farms. These men are often hampered by lack of capital, are generally wanting in the knowledge requisite to good lumbering, and have had always to contend with the difficulty of obtaining expert loggers to carry out the work. Nevertheless, the nearness of large bodies of merchantable timber, among which are valuable kinds, such as Cherry, Black Walnut, Hickory, and Yellow Poplar, has usually made a fair profit possible under even the most thriftless logging methods. This desultory cutting has been going on for years, and although the individual efforts have been small, they have removed the merchantable timber from the larger portion of the accessible forests.

RECENT LUMBERING METHODS MORE PROFITABLE, BUT ALSO DESTRUCTIVE.

When the waning supplies of timber in the North and East some fifteen years ago forced the loggers of those regions to the South, the application of skillful and systematic methods of lumbering began in the Southern Appalachians. The newcomers, through the investment of commensurate capital in logging outfits, the thorough repair and extension of logging roads, and the generally businesslike mode of attack characteristic of the trained lumberman, have reaped a profit from their operations entirely impossible under the slipshod, desultory lumbering methods of the settler.

Nature of the damages.

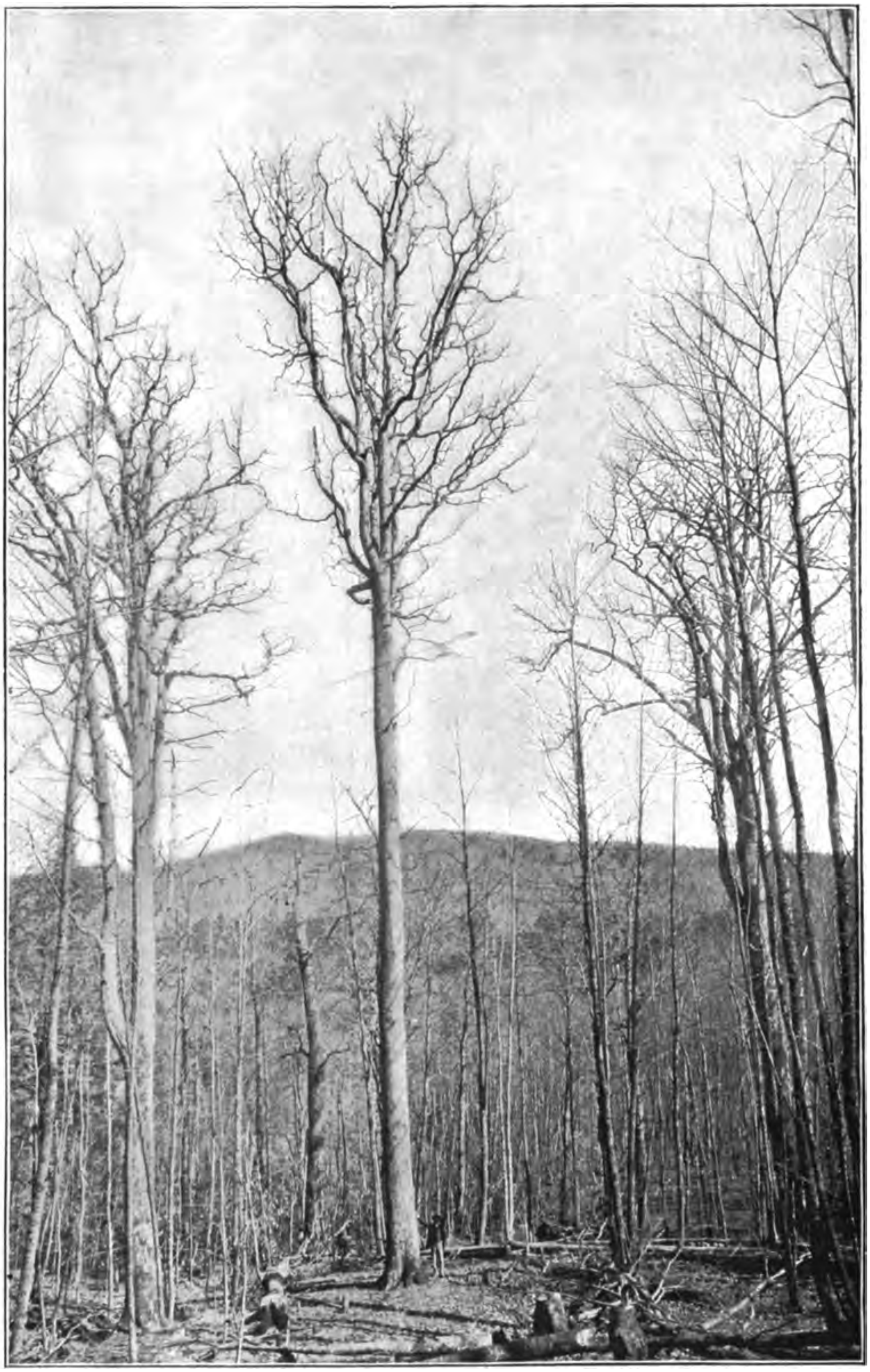
The harm done to the forest in both cases is very great in proportion to the quantity of lumber cut. This is due largely to the size of the trees and the fact that little care is taken in the fellings. The damage to young growth is increased by the absence of snow and by the fact that trees are often cut when they are in full leaf.

The breaking down and wounding of seedlings and young trees by the snaking of logs to the roadside or the river is in some degree unavoidable; but the damage is often much in excess of what is necessary. (See Pl. LIII.) There are often, however, many more snakeways, or skidways, than are necessary, and the application of a little system in laying them out would save time and young growth on a lumber job. On the higher and steeper slopes it is often the habit—and one which can not be criticized too strongly, except in those rare cases where it is absolutely necessary on account of the gradient—to roll the logs from top to

TIMBER NEAR MOUNT ROGERS, VIRGINIA, WHICH SHOULD HAVE BEEN CULLED LONG AGO.
(See pp. 64-67.)

Under every system of forest management the mature timber should be cut and used. Otherwise it interferes with the proper development of the younger growth; and when it decays and falls it may feed fires so as to destroy the forest.

UNNECESSARY FOREST DESTRUCTION ALONG THE SNAKING TRAIL. (See p. 64.)



REPRODUCTION OF HARD-WOOD FOREST IN THE SOUTHERN APPALACHIANS. (See pp. 67, 68.)

The large trees have supplied the seeds from which the smaller ones have grown.

bottom, merely starting them with the canthook. A 16-foot log, 3 feet or more in diameter, can gain momentum enough in this way to smash even fair-sized trees in its path, and when it passes through dense young growth it leaves a track like that of a miniature tornado. The practice is in line with others to be observed in the Southern Appalachians, such as the common habit, for example, of leaving to rot the "deadened" trees which stand over clearings. There are cases in which these clearings have been inclosed with fences built of rails split from prime black walnut, with no other excuse than that the walnut happened to be within easier reach than either oak or pine.

Under such methods, in which there is not only an absolute lack of provision for a future crop but often a marked absence of that forethought, skill, and aversion to waste which go to make clean lumbering, most of the logged-over areas in the southern Appalachians are only saved from entire destruction of the standing trees by the generally scattered distribution of the merchantable timber.

OBJECTS AND POLICY OF FOREST MANAGEMENT UNDER GOVERNMENT OWNERSHIP.

In the application of conservative forest management to that portion of the forests of the Southern Appalachians included within the proposed reserve, the first aim should be to protect them from fire. The safety of the forest from fire must form the foundation of any system of practical forestry which is to be permanently successful. Fire has done and continues to do enormous damage in this region. The chief cause lies not in malice or in carelessness of campers or of lumbermen, but in the ancient local practice of burning over the forest in the autumn, under the belief that better pasturage is thus obtained the following year.

Protection against forest fires.

The fires are started by the settlers upon the area which is to serve as a sheep or cattle range the following season, and are permitted to burn unchecked. The result is that, except where confined by roads, streams, or clearings, they often spread from the wood lots of the foothills, in which they are set, to the forests of the higher mountains, there to burn unmolested until rain, snow, or lack of inflammable material puts them out.

The hard-wood forests of the Southern Appalachians are by no means so inflammable as the coniferous forests of the North and West. Forest fires in this region are seldom more than ground fires, and only under the influence of exceedingly high winds in a dry season become uncontrollable. With an active and adequate force of rangers and a thorough system of trails, the protection of the proposed reserve would be practicable. The good results of its preservation from fire would be twofold. In addition to the evident benefits of efficient fire protection upon the forest would be the forcible example provided to prove that the forest untouched by fire yields in the long run better and more plentiful pasturage than if it be annually burned over. The modification of present methods of grazing in the Southern Appalachians, like the modification of present lumbering methods, will follow proof of its advantages much more rapidly than it would follow propaganda. The one is no less important to the best development of this region than the other. The advantages of both could in no way be better established than by their practical illustration in the proposed reserve.

The mountain forests of the Southern Appalachians are silviculturally the most complex in the United States. They contain many kinds of trees, varying widely in habit and also in merchantable value, and the forest type is constantly changing with the differences in elevation, gradient, and soil. Their best management is difficult, because the lack of uniformity in the forest renders it necessary constantly to vary the severity of the cutting and to discriminate in the kinds of trees which are cut, instead of following only those general rules which suffice where there are fewer species represented and the forest conforms more closely to a single type.

IMPROVEMENT IN GENERAL FOREST POLICY NECESSARY.

Improvement in method of lumbering.

In order to reproduce these forests successfully and to minimize the damage done by lumbering, first of all it will be necessary to have a radical improvement in the fellings. Such an improvement is entirely practicable without additional cost per 1,000 feet B. M. of timber felled. It often requires no more labor to fell a tree up a slope than down it, or upon an open space rather than into a clump of young growth; and it is in just such cases as these that unreasoning disregard for the future of the forest is commonly manifested in the Southern Appalachians.

In the selection of trees to be felled the small farmers, who for a long time were the only lumbermen in the Southern Appalachians, have been governed by the same considerations that govern lumbermen elsewhere. They have taken the best trees and left uncut those of doubtful value rather than run the risk of loss in felling them. Furthermore, the fact that they have lumbered generally on a very small scale and have often had great difficulties with which to contend in the transport of logs has led them to extremes in this respect. The result is that they have reduced the general quality of the forests in a measure entirely disproportionate to the amount of timber cut. As a rule, only prime trees have been taken, and those showing even slight unsoundness have been left uncut, except where the stand of first-class timber was insufficient. Diseased and deteriorating trees remain to offset the growth of the forest by their decay and to reduce its productive capacity still further by suppressing the younger trees beneath them, while in the blanks made by the lumbering worthless species often contend with the young growth of the valuable kinds. In other words, the lumbering has closely followed the selection system, but the principles governing the selection have usually been at variance with the needs of the forest. Culling the forest under old system.

CONSIDERATIONS THAT SHOULD GOVERN IN THE MANAGEMENT OF THE PROPOSED FOREST RESERVE.

In order to bring about successful reproduction of the desirable species and to maintain the quality and density of the stand, lumbering in the mountain forests of the Southern Appalachians must be governed by the following main considerations:

(1) Remove all diseased, overripe, or otherwise faulty trees of a merchantable size where there is already sufficient young growth upon the ground to protect the soil and serve as a basis for a second crop of timber. (See Pl. LIV.) In extreme cases, where the condition of the forest is seriously impaired by the presence of a large number of such trees or where they overshadow and seriously retard promising young growth, their removal may be financially advisable when the sale of product no more than pays the cost of the logging. Removal of faulty trees.

(2) So direct the cuttings that the reproduction of the timber trees may be encouraged in opposition to those of Cut so as to encourage growth of valuable species.

less valuable kinds. This can not be successfully accomplished in the Southern Appalachians by cutting a diameter limit merely. A limit will by all means be advisable for each species, based upon a study of its rate of growth and the proportion which different diameters bear to its contents in board feet. It will be frequently necessary, however, to leave trees of a merchantable diameter where their removal would seriously impair the density or where seed trees are necessary.

Careful selection of seed trees.

In the leaving of seed trees many considerations are involved, only a few of which can be mentioned here. The Oaks, Hickories, Walnuts, and Chestnut should be favored, since their seed is too heavy to be carried by the wind, and much of it is eaten by animals. The marked tendency of the pines (see Pl. LV), Hemlock, and Yellow Poplar to reproduce by groups must be encouraged. On south slopes and in dry localities generally, where Dogwood, Sourwood, and Scrub Oak contend with the timber trees, great care must be taken not to disturb the balance between them. The rich, moist soil of the Poplar coves is particularly likely to produce a luxuriant growth of weeds and brambles instead of tree seedlings if too much light is admitted to the soil, while the Ash, Cherry, and Basswood, which are only sparsely represented in the mature stand and are further handicapped among the young growth by their strong demands upon the light, will require an exceedingly conservative method of management.

REPRODUCTION OF WHITE-PINE FOREST. (See pp. 67, 68.)

White-pine saplings on cut-over land, Graham County, N. C.

DESCRIPTION OF THE SOUTHERN APPALACHIAN FORESTS BY RIVER BASINS.

By H. B. Ayres and W. W. Ashe.

In order to present in more convenient form detailed information about the forest conditions in the Southern Appalachians, the following descriptions have been arranged by drainage basins, beginning at the northeast and moving around the mountains to the place of beginning, in the order given below. This arrangement will serve an important purpose in the consideration of water flow and also the question of transportation.

The region has for this purpose been divided into the following fourteen drainage areas: New River, South Fork of Holston River, Watauga River, Nolichucky River, French Broad River, Big Pigeon River, Northwestern Slope of Smoky Mountains, Little Tennessee River, Hiwassee River, Tallulah and Chattooga rivers, Toxaway River, Saluda River and First and Second Broad rivers, Catawba River, Yadkin River.

NEW RIVER BASIN.

[712,000 acres; 50 per cent wooded.]

New River, a feeder of the Ohio through the Kanawha, drains the eastern portion of the Appalachian Plateau lying between the Blue Ridge on the southeast and Iron Mountain on the northwest. The sources of the tributaries are high, from 3,000 to 5,000 feet, but the river valley below the junction of the North and South forks has been eroded down to an altitude of 2,500 to 2,000 feet. The resulting topography is a system of deep, narrow valleys and ravines, among which are a few isolated peaks (having an altitude of 5,000 feet and upward) and occasional flats, which are of two classes—(1) in high altitudes remnants of the old plateau, and (2) along the larger streams, narrow, sedimentary flats. Topography.

Agriculture. The greater portion of this area has been cleared, although mostly too steep to be arable. The hills are cleared for grazing, to which industry this land is better adapted than to agriculture, in view of the great erosion and the difficulty of maintaining roads in this remote and hilly region. Excellent crops of hay and grass are the rule on new land, and the custom is to crop and graze a clearing until it wears out, then clear a new field.

Erosion. Many of the old hill fields are now worn out by close pasturing and by the erosion of unprotected humus, and are being gullied to the underlying rock by every shower.

The forest. The forests of large area are limited to the higher altitudes on the isolated peaks between the North and South forks, and on Balsam and Iron mountains which form the northwestern rim of the plateau. On the southeastern slope of Balsam Mountain is an almost unbroken forest, approximately 5 miles square; but the long, narrow strip of woodland on Iron Mountain is considerably broken by clearings and burns, while the portions of Pond Mountain and White Top draining into New River have on them only remnants of the old forest.

Scattered among the clearings of the valley are wood lots, left usually on ridges and north slopes.

Composition.—The trees of these forests are principally oaks and chestnut, with a mixture of white pine, hemlock, black spruce, black gum, cherry, poplar, ash, cucumber, buckeye, linn, maple, birch, and many unimportant species. Altogether there are about 80 species of trees.

Condition.—All the forest is inferior in condition, being either culled, fire scarred, or full of old and defective trees, while a dense undergrowth usually covers the steep slopes.

The condition of these neglected forests would improve readily under forestry, as valuable species are abundant and reproduce easily and grow rapidly wherever they have an opportunity. The outlying isolated wood lots, surrounded by cleared land and held by thoughtful farmers, are noticeably in better condition than the larger wild areas in the remote mountains.

SOUTH FORK OF HOLSTON RIVER (SOUTHERN TRIBUTARY BASINS ONLY).

[233,000 acres; 80 per cent wooded.]

Topography. This area comprises the northern slope of the mountains between Watauga and New rivers, and is principally a long, narrow strip of steep mountain side, having a northward exposure and an altitude of 2,500 to nearly 6,000 feet. In addition to this uniform tract, this drainage system comprises the semicircular interrupted basin drained by Beaver, Tennessee Laurel, Green Cove, and White Top Laurel creeks, which join and cut through the mountains near Damascus.

Soil.

In this area are two distinct classes of land—mountain slopes and alluvial or sedimentary basins. The mountain slopes, steep and principally underlaid by quartzite, have light soil, with thorough drainage both on surface and underground, while the sedimentary valleys—as Holston River bottoms, Shady Valley, Laurel Bloomery, and others—have deep, loamy soils, remarkably fertile.

Agriculture

On the Tennessee Laurel substantially all the arable land is under cultivation, but along Shady Valley and White Top Laurel only a small portion of the arable land is cleared. The Holston River bottom is cleared to the foothills of the mountain. This land is well adapted to diversified farming, but is now devoted principally to corn and grazing.

Erosion.

Erosion is less marked in this area than in most others, a fact which is probably due to the larger proportion of wooded area.

The Tennessee Laurel is, however, subject to sudden rises, endangering the narrow bottom lands and even the lives of travelers who must cross the numerous fords in the gorge. There is also much erosion of soil locally on the older neglected fields of the tributaries of the Tennessee Laurel and on the poor portions of the foothills of Holston Mountain.

The forest.

Excepting a few mountain pastures, all the mountain ridges are wooded, and both east and west of Damascus are large areas of unbroken forest, covering both mountain and valley. The north slope of Holston Mountain also remains entirely wooded.

The forest of this drainage varies, naturally, with the soil, altitude, and exposure, and has also been seriously modified by fires. The northward slopes of Holston and Iron mountains are lightly timbered with oaks, black pine, chestnut, gum, etc., with some hemlock and white pine in ravines, nearly all culled. The southward slopes of the same mountains, and especially the lower portions of these slopes, are better wooded, except as cleared or deadened for grazing, and have some heavy stands of hemlock and white pine, among which hard woods are freely distributed.

The steep slopes west of Damascus and east of Como Gap are in a very inferior forest condition, owing largely to the long-continued prevalence of fires, which have not only prevented a vigorous growth, but have even driven out the most valuable species.

The trees of the ridges and north slopes are short and crooked, and as a rule the land is very imperfectly stocked and also very brushy. The forests of some of the tributary basins are in excellent condition, having more moisture and better soil and having been less injured by fire.

Except on the driest portions, lands cut or burned over are quickly restocked with valuable species, while the dry ridges and summits are soon occupied by chestnut and oak sprouts or by black pine, gum, sourwood, or trees of similar value.

Prevention of fire and judicious thinning would soon develop a valuable forest on these northern slopes, where now there is very little material that is marketable.

WATAUGA RIVER BASIN.

[441,000 acres; 66 per cent wooded.]

Topography. This basin, tributary to the Holston, lies almost entirely within the Appalachian mountain region. The main source of the river is on Grandfather Mountain, a prominent peak of the Blue Ridge, while the last mountain gorge is passed near Elizabethton, Tenn., where the river leaves the mountains. The highest points of this basin are Holston Mountain, 4,300 feet; Snake Mountain, 5,594 feet; Rich Mountain, 5,369 feet; Grandfather Mountain, 5,964 feet; Beech Mountain, 5,222 feet; Yellow Mountain, 5,600 feet; Roan Mountain, 6,313 feet, and Ripshin Mountain, 4,800 feet. These are on the borders. The interior portion is broken into many subordinate ridges, reaching an altitude of 3,000 to 4,000 feet, with deep, narrow valleys eroded down to an altitude of 3,000 to 2,000 feet.

Soil. Derived directly from granite, gneiss, and schist, by decomposition, the soil of the mountains and ridges has been fertile, much of it very fertile loam of excellent physical as well as chemical composition. Washing, however, has carried much of the desirable material down to the valleys and left the soil of the ridges inferior, especially on southward slopes. The valley soil is of two general classes, (1) the red clayey loam of the lower foothills and (2) alluvial bottom land, some of which is too porous or too stony, but mostly excellent farm land. Altogether, the newly cleared soil is very good, but many burned ridges and old washed fields are in a very poor condition, notably in the valley of Little Doe.

Agriculture.

Along Stony, Cove, and Roane creeks, Doe River, the main Watauga, and many minor valleys are excellent large farms, growing corn, wheat, rye, oats, grass, and vegetables. On almost every creek and in many of the mountain coves are families depending upon the farm for the greater portion or all of their living. While much has been cleared that would be better adapted to timber growing if a timber market were within reach, there is altogether a large area that is best adapted to farming. It is safe to say that a broad economic policy would have little or no more forest land cleared than is now under cultivation, and that attention should be given to keeping what land is cleared in good condition rather than to clearing more to be exhausted and washed until worthless.

Erosion.

In this basin it is estimated that the average damage by erosion during the season of 1901 to farm land has been not less than $1 per acre. This amounts to over $200,000 for the whole basin.

Damages to railroads amounted to $250,000, 19 bridges and about 25 miles of track being washed out.

The damage to wagon roads can hardly be estimated. In many places entirely new roads were necessary. The damage was probably $500,000 altogether.

Buildings and personal property destroyed swell the total loss to something like $2,000,000.

The forest.

Distribution.—The remaining forests are on the ridges and mountain ranges and spurs. These are somewhat dotted with clearings, especially in the granitic region south of the Iron Mountain Gorge and along the north slope of Beech Mountain and the Elk Creek Basin. The lowlands have been almost entirely cleared.

Composition.—The hard woods, in which the oaks and chestnut predominate, form a mixed forest on most of the area; some ravines carry hemlock almost exclusively, and on some of the ridges white pine is one of the principal timber trees. Spruce is found almost exclusively in some high mountain groups, while beech rules in zones on high mountains and on the crests of some ridges.

Condition.—Nearly all of the forest has been or is being culled of its most valuable timber, and is rapidly becoming inferior by the predominance of old and defective trees and undesirable species. Fires are preventing a good growth on large portions, although they are seldom so severe as to kill much timber. The few areas that are in good forest condition are merely enough to illustrate what forestry might do.

Reproduction.—Vigorous sprouts, seedlings, and saplings abound on old cuttings and burns, and prevention of fire and some judicious thinning would soon develop a forest that would justify transportation companies in building railroads to haul its products to market.

NOLICHUCKY RIVER BASIN.

[569,920 acres; 76 per cent wooded.]

Topography. A large portion of this basin lies within the mountain region. Its three principal tributaries, North Toe, South Toe, and Caney rivers, as well as several creeks of large size, are entirely between the rims. Mount Mitchell, the highest peak east of the Rocky Mountains, and Roan Mountain, well known by "Cloudland," the highest hotel of the East, are both on the borders of this basin. In the central part is a large portion of hilly agricultural land, and along creeks are many narrow strips of flat, alluvial bottom. In cutting through the northwestern rim of the plateau, however, the streams have worn long, deep gorges through the Unicoi and parallel mountain ranges, and the narrow tributary valleys of this portion of the basin have rapid torrential streams, very little bottom land, or none, and very steep and rocky mountain slopes.

Soil. The soil is in general very good, especially that of the lower portion of the interior basin, which was evidently deposited as a sediment before the gorge was cut to its present depth. The mountain coves also contain deep, dark loam, which is very fertile. Some of the ridges, however, have a light, shallow soil, owing to erosion of humus and loose earth.

Agriculture. Twenty-four per cent of this basin is cleared land, most of which is grazed, although much of it is well adapted to diversified farming, which is unprofitable now because of distance from market.

Erosion. A great drawback to agriculture is found in the cutting away of uncovered hill fields by the dashing rains and the deposition of the eroded material on other fields in the bottoms. The floods of the Nolichucky are well known. They may be partly due to the topographic configuration of the area, by reason of which a rise of the three main tributaries at one time may cause a flood in the river. There is no room for doubt, however, that the large amount of cleared land in this basin greatly increases the floods. Every resident who has known the river ten years or more states very positively that the volume of water is now much less constant than in former years. In Yancey County many of the steep slopes in the basins of Caney River, Bald Creek, and in the vicinity of Burnsville, which have for many successive years been planted in corn or small grain, are deeply eroded, and some such fields have been abandoned. The same statement will apply to much steep land in Mitchell County, on the waters of Cane and Big Rock creeks, and in the vicinity of Red Hill. The lands at higher elevations, which have been retained in grass, are less damaged.

The alluvial lands of the Nolichucky were severely washed by several freshets during the spring and summer of 1901, the most severe being that of May 20 to May 23, which caused damage to land and other property in Mitchell County to the amount of $500,000 or more. All of the soil on the flood plain of Cane Creek, 9 miles in length, was removed, leaving only the large stones and rocks, and many fine farms on North Toe River were destroyed. More than twenty dwellings, several mills and dams, and many million feet of saw logs are known to have been washed away. In addition, the damage to the public highways was $50 or more per mile, aggregating $50,000, while the railroad sustained an equal loss in the injury to roadbed, bridges, and culverts. (See Pl. XXXV (b) showing wreckage from Mitchell County, lodged near Erwin, Tenn.)

The forest.

Although greatly broken by clearings, large areas of woodland remain on the Unicoi and parallel ranges on the northwestern border, on Roan Mountain, the Blue Ridge, the Black Mountain group, and the western tributaries of Caney River. In composition there is great variety. Spruce and balsam prevail on the highest portions of the Black, Roan, and Sampson mountain groups. Hemlock, birch, maple, cucumber, ash, buckeye, linn, and other moisture-loving trees line the ravines, while oak, chestnut, gum, and other hard woods cover the ridges of the higher altitudes. Oak and pine form a less dense cover, usually very brushy, on the ridges of lower altitude.

In forest conditions there is also great variety, dependent largely upon the prevalence of fire. Fires are freely set during autumn, winter, and spring, and great injury to timber, forest seedlings, and soil results. A large proportion of the timber trees are defective, and much of the woodland area is imperfectly stocked.

The reproduction of trees is remarkably vigorous on cuttings, burns, and old fields, and growth is rapid. The prevention of fire and the application of improvement cuttings would wonderfully increase the value of the forest, which is the great natural resource of the mountainous portion of this basin.

FRENCH BROAD RIVER BASIN (NORTH OF SKYLAND).

[555,840 acres; 51 per cent in forest, besides wood lots.*]

Topography. This long and wide crescent-shaped valley heads on the Blue Ridge, which it drains from Swannanoa Gap to Panther Tail Mountain (62 miles) and reaches entirely across the highlands, which it leaves near the Tennessee line, about 80 miles from its source. Around the borders of this basin are the Craggy Mountains, Swannanoa Mountains, and Estatoe, Panther Tail, Pizgah, and Max Patch peaks, all high, forest-covered mountains. In Madison County, where the river has cut through the northwestern rim of the region, is a large area of broken, mountainous ridges, with very steep and rocky slopes. A great portion of the interior basin, however, is smooth enough and fertile enough for grazing or farming.

Soil. The soil is extremely variable, though in general very good. That of the lower hills is a red clay, a fine sedimentary deposit. It is fertile and recuperates readily, but erodes rapidly when uncovered. The ridge land, as usual, is well adapted to grass, but if closely pastured erodes rapidly and soon becomes worthless. The best soil is found in the coves and on the broad alluvial bottoms which border the river and its larger tributaries from the Blue Ridge in the southeast to the head of the gorge near Marshall.

Agriculture. Substantially all the lowland is occupied by farmers, and many of the plantations are very productive and well adapted to mixed farming. This is, in fact, one of the best agricultural valleys to be found in the East. The principal difficulties to be met are erosion of surface soil

* These wood lots are small and scattered so as to make it difficult to estimate their aggregate area.

on the hills and destructive floods on the bottoms. Much of the mountain region is also under cultivation. The cove lands are mostly cleared, and cleared mountain-side pastures dot the landscape, as viewed from every high point.

Erosion.

This basin is no exception to the rule for the region. Tobacco-growing on the lighter soils of the hills exhausted field after field, and finally the whole industry was abandoned, leaving large areas of desolate land exposed to the cutting action of raindrops and to gullying by running water. The same process has been in operation on old farm-land and pastures, until on many small tracts, as on the southward slopes of Poverty Hollow, near Barnardsville, there is but little soil left. There is hardly a farm in the entire basin that is not more or less gullied, although much care is taken by a few of the more thoughtful farmers to keep the earth covered by a vigorous crop. The inundations of the bottom lands are also seriously damaging, and the general testimony is that they increase as more land is cleared.

There is evident need of every protection against erosion in this valley, where so many people and so much valuable property are concerned, and where sudden heavy downpours of rain are common.

The forest.

Distribution.—The higher mountains are still forested, and the ridges and slopes above 3,000 feet are mostly covered, although some of the ridges, as Elk, Spring Creek, and New Found ridges have on them large proportions of cleared land, and the mountain sides are often dotted with clearings.

Composition.—In this region we have a mixed forest, in which the oaks and chestnuts predominate, with a sprinkling of white pine, hemlock, linn, gum, beech, birch, maple, ash, hickory, Shortleaf pine, poplar, cherry, walnut, and many other species of less importance.

Condition.—Besides the usual inferior condition of the natural forest, fires, grazing, and culling have greatly reduced its original quality. Bordering the farms are many fine stands of sapling second growth, but the remote mountains are full of defective trees and brush.

Reproduction.—Sprouts and seedlings spring up readily. White pine, shortleaf pine, poplar, ash, walnut, and cherry all abound in the forests in the form of promising young trees. Sumac and locust here reproduce rapidly and are well adapted to cover and prevent erosion on the old fields.

The farmers need to be taught that to recuperate their lands, instead of letting them stand bare and idle "to rest," they should grow clover and cowpeas on them, and always keep them covered as much as possible.

BIG PIGEON RIVER BASIN.

[345,440 acres; 79 per cent wooded.]

Topography. Big Pigeon River rises among the Balsam and Pizgah mountains, cuts its way through the Unaka Mountains, and joins the French Broad on the Tennessee Plain. It drains an interior agricultural basin which is oval in outline, the longer axis northwest, parallel to the general course of the stream, and almost entirely within the Appalachian Mountain region. It is circumscribed by lofty mountains, with many peaks more than 6,000 feet in altitude. Many minor ranges, springing from the surrounding mountains, converge toward the middle of the basin, dividing it into deep, narrow valleys, except near its upper end between the towns of Canton and Waynesville, where there is a broad, open valley of alluvial plains and rolling hills, dotted with low mountains.

Soil. The soils are loams and sandy loams, mostly fine grained in texture, derived from gneiss and schists, though in the mountains they are more siliceous and coarser—there the product of decomposed sandstones, quartzite, and conglomerates.

Agriculture. This basin is eminently adapted to grass, except where very sandy, and grass is the chief product of the region. Corn ranks next in importance; while the cultivation of wheat is largely confined to the broad valley of the Pigeon, between Canton and Ferguson, and to the Richland and Fines Creek valleys. Apples are extensively raised and have a wide reputation for their quality, and truck farming is yearly assuming greater importance.

Erosion. The alluvial valley lands have been little injured by freshets, and the soils of the uplands, with few exceptions, have not suffered severely from erosion, though a few badly gullied slopes, due to the continuous cultivation of corn, are to be seen in the older settlements.

The forest. The scarlet, black, and white oaks, associated with black pine, formed at one time an extensive forest on the hills between Canton and Waynesville, but this land, where not under cultivation, is now in second-growth forest. The forests of the mountains are of typical mixed Appalachian hard woods, with, in the Balsam and Pizgah ridges, a small amount of black spruce at high elevations, and some white pine in the lower part of the basin. These forests have been culled only of the most valuable timbers.

All species reproduce excellently under the proper light conditions; and with exclusion of fire and a judicious system of lumbering there would be no difficulty in perpetuating this forest and increasing the proportion of valuable species in its composition.

NORTHWESTERN SLOPE OF SMOKY MOUNTAINS.

[254,720 acres; 91 per cent wooded.]

Topography.

This tract is a mountain side between altitudes of 1,500 and 6,700 feet, and is drained by Little Pigeon and Little rivers into Holston River, and by Abrams Creek into Little Tennessee River. The surface is eroded into fan-shaped basins, very steep, and often precipitous near the summit, with high, narrow ridges dividing the main drainage basins. There is no alluvial land of consequence except at Briar Cove, Gatlinburg, Tuckaleechee Cove and Cades Cove.

Soil.

In general the soil is light-colored and shallow, especially on the ridges and steep slopes. In the coves, however, and along the foot of the ridges where the slope is more gentle, humus has accumulated and the soil is fertile. In general physical quality the soil is loam or clay loam.

Agriculture.

Corn is the principal farm crop, and 50 bushels per acre are sometimes grown on the best lowlands. This land can not compete with the alluvial river bottoms, however. Most of it is farmed only because it is cheap land and affords a chance for a poor man to make a living (by hard work.) The higher altitudes are favorable to fruit, grass, and vegetables, and also to stock raising in a limited degree, as cattle may roam in the woods and subsist on seedlings, shrubs, and weeds, and hogs in occasional years find abundant mast.

Erosion.

In general, the earth is fairly well covered, and thus protected from erosion, but the few old pastures are worn and gullied here, as elsewhere on hilly land.

In this region streams heading in unbroken forest are notably clear and their banks show little fluctuation in volume of water, while those from cleared lands are muddy and inconstant.

While present erosion is limited, there is evidence that it would be very great if large areas of the earth were uncovered.

The forest.

Distribution.—With the exception of a few "balds," or grassy areas on the higher summits, and the alluvial lands of the lower coves and creek valleys, the forest of this great mountain side is practically unbroken.

Composition.—The species of trees growing here number over 100, an unusually large number for one locality. Northern and southern trees are close neighbors, and all may be studied in traversing the different zones of altitude from 1,500 to 6,700 feet, instead of the necessary 1,000 miles of latitude at an altitude of 1,000 feet. Almost every tree enumerated in the accompanying list (p. 93) grows here.

Condition.—While some remarkably fine timber trees are here, the general average is far inferior to what might be grown with so favorable a soil and climate. Fire, grazing, and culling have reduced this forest considerably below its natural condition. Imperfect trees and inferior species are abundant, while some of the burns and cattle ranges are very deficient in stand.

Reproduction.—Hardly any other forest in the country would respond so readily to the forester's care and demonstrate so plainly that nearly all of this tract is best adapted to timber growing.

LITTLE TENNESSEE RIVER BASIN.

[1,018,054 acres; 91 per cent wooded.]

Topography.

Little Tennessee River with its tributaries drains a large area, extending from the Blue Ridge on the south to the Great Smoky Mountains on the north, including all of the territory between the basins of Big Pigeon and Hiwassee rivers. Its larger tributaries are the Tuckasegee from the east, the Oconalufty from the northeast, the Cheoah from the southwest, and the Nantahala from the south, while the upper portion of the Tennessee drains the extreme southern portion, heading on top of the Blue Ridge. These waters pass through the Tennessee into the Ohio River.

The upper or southern part of the basin lying on the northwest slope of the Blue Ridge is an elevated plateau region, having an altitude of more than 3,000 feet, with low, rounded granite knobs and few high summits, and broad alluvial flats, the deposit of the slow streams. The Balsam, Great Smoky, and Unaka mountains, with many

Potato Knob. Mount Gibbs (6,591 feet). Mount Mitchell (6,711 feet). Pinnacle.

PANORAMA OF THE BLUE RIDGE, MOUNT MITCHELL, AND SOUTHERN END OF THE BLACK MOUNTAINS. (See pp. 50, 114.)

crests more than 6,000 feet high, form the watershed on the north and west, and from these descend into the northern portion of the basin many swift streams, which have carved deep narrow valleys, leaving high intervening ridges with steep and rugged slopes. The watersheds between several of these streams are high and rough mountains, especially in the Cheoah, Nantahala, and Cowee ranges. The lower part of the basin includes some of the most rugged land in the southern Appalachians, with only a very small part suited for tillage, and few alluvial bottoms; but in the upper part much of the mountain land is not steep, and there are several large and fertile valleys.

The soils in the upper part of the basin are sandy, derived from granite, or in the Little Tennessee River, around and above Franklin, where most of the good farms are located, from schists, and are deep and fertile red loams. In the narrow valleys around the high mountains, where sandstones, quartzite, and conglomerates prevail, the soils are generally thin and sandy, and poor agriculturally, but on north slopes and in hollows are well suited to forests. The alluvial bottom lands along many of the streams are also light and sandy, though those of the Little Tennessee are silts of the finest texture. Soil.

All of the land available for tillage has been cleared. Corn is the staple crop on both alluvium and upland, the yield of small grain, grass, and apples being much smaller than in other mountain counties farther north. At high altitudes and on some of the stiffer soils grass thrives, but on the whole the soils are too light and too subject to drought for either grazing or forage grasses. Orchards have been planted, but are much neglected, and only a few apples are produced for market. Agriculture.

Much of the best valley land has been badly washed, especially on Tuckasegee River and Scott Creek. There are also many badly worn steep slopes on these streams and elsewhere. Erosion.

In general, the mountain ranges and spurs, and also the ridge lands of the valleys, are still principally wooded, although many clearings are found in mountain coves and on mountain slopes. The forest

The principal clearings, however, are on and about the alluvial lands, which appear on the map like broken chains along the larger tributaries.

The largest unbroken forest areas lie on Oconalufty, Cheoah, and Tuckasegee rivers, in the northern, northwestern, and northeastern parts of the basin, though there are some areas of fine forest at the head of Nantahala and Little Tennessee rivers, in the southern part of the basin.

At lower elevations the forests are of oaks and hickories, associated with black pine. On the thin soil of the slopes along the Blue Ridge small scarlet and white oaks, with occasional bodies of hemlock, form the forest, while elsewhere in the mountains typical Appalachian hardwoods prevail, with some few thousand acres of black spruce capping the highest summits of the Smoky and Balsam mountains. The best timber has been much culled for 20 miles from the Southern Railway, which crosses the middle of the basin. Repeated forest fires, started with a view to improve the pasturage, have destroyed much timber on dry south slopes, and by continued suppression of the young growth have greatly reduced the density. Reproduction, however, is good, and if the open woods were protected there would soon be a fine young growth beneath the old trees. Proper distribution of species could easily be secured by judicious cutting while logging.

HIWASSEE RIVER BASIN.

[223,456 acres: 71 per cent wooded.]

Topography. This drainage is tributary to the Tennessee River, which the Hiwassee joins above Chattanooga, and comprises the eastern tributaries of Hiwassee River above Murphy, equivalent to the western slope of the mountainous divide between Little Tennessee and Hiwassee rivers, which divide is a cross range between the Blue Ridge and the Smoky Mountains. The altitude of this tract ranges between 1,500 and 5,000 feet. Spurs from 5 to 20 miles long reach from the divide toward the river, while deep valleys extend from the river far into the mountains.

The mountain sides are steep and often rocky, while the creek valleys, of which there are six prominent ones, have considerable areas of alluvial flats and rolling foothills.

Soil. Even the alluvial flats along the rivers and creeks have a large proportion of clay, and the foothills are almost entirely clay. The mountain sides are loamy, the coves very fertile, and the soils of the ridges light, often stony.

Agriculture. Corn is the principal grain crop. Grass does well on low alluvial lands and in mountain coves, but burns out on the foothills. There are some fine farms on Valley River, Peach Tree, Tusquitee, Shooting, Tiger, and Hightower creeks, but large areas of hill land are worn out and abandoned to broom grass.

This basin, or part of it, seems unusually liable to floods, as is shown by the cutting of banks and the washing of fields. About the head of Peach Tree Creek, in 1900, several "waterspouts" are said to have occurred at one time, and the water from these joining formed a torrent that swept across fields and roads, doing great damage. Evidences of similar floods and of great erosion on old fields are to be found in almost every mile of travel. **Erosion.**

The uselessness of clearing the ridge lands has been discovered by the farmers, and no advances of cleared land have recently been made toward the mountains, but many old fields lie wasted and wearing away, scantily patched with broom grass, persimmon, and sassafras.

Distribution.—The mountains and spurs are principally forest-covered, although here and there clearings have been made in coves and along the tributary creeks. The larger creek valleys and the river valley are principally cleared. **The forest.**

Composition.—In this region is found a suggestion of the difference between the forest of the cool highlands and that of the southern slope of the Blue Ridge. In passing from the highlands we are leaving the region of most vigorous tree growth and approaching the piny regions. Oaks and hickories are more numerous, but shorter and smaller; hemlock and white pine are less abundant; the birches and hard maples become rare, and the southern red maple, pitch pine, and shortleaf pine more abundant.

Condition.—In condition, too, there is a noticeable contrast. Fires have been more prevalent and have kept decaying vegetation pretty thoroughly consumed. Fires have killed less timber, but have done no less damage by preventing that new growth which perpetuates the natural forest.

On isolated wood lots and near clearings are many tracts of thrifty saplings, but the general forest condition, owing to fire and grazing, is inferior to that of the plateau.

Reproduction.—The first and essential step toward the improvement of this forest would be the prevention of fire. Much of the stand is now so thin that thinnings need not be made at once.

Sprouts and seedlings will start freely, and the forest would grow well as soon as the forest soil reached natural condition again.

But few cattle are ranged in the mountains now, as the grazing has been too much reduced by repeated fires.

TALLULAH-CHATTOOGA RIVER BASIN.

[348,588 acres; 89 per cent wooded.]

Topography. This tract covers the entire basin of these rivers above their junction and drains into the Atlantic through Savannah River. Lying on the southeastern slope of the Blue Ridge, the altitude varies from 5,500 feet on Standing Indian, 5,100 feet on Ridgepole, 4,769 on Scaly Mountain, and 4,931 feet on White Sides to 1,000 feet at the junction of the Tallulah and Chattooga rivers. Many of the peaks and spurs are extremely bold, and there are numerous deep gorges and canyons. Along the creeks, especially along the Upper Tallulah and its tributaries, are alluvial bottoms of considerable area. Nearly all of the cleared land (11 per cent of entire tract) of this system is on creek bottoms.

Soil. Derived from gneiss and granite, the soil is generally of good physical composition, except in the foothills, where a stiff red clay predominates, which erodes readily and is hard to cultivate.

The bottom lands are loamy and fairly fertile, but the ridges have been so much burned and washed that on them the soil is light colored, thin, and poor.

Agriculture. Corn is the principle crop. Grass, except in the higher altitudes, does not hold. Sweet potatoes, cane, and cotton are grown along the southern limit of this tract. Peaches do well in the lower altitudes, and apples are grown on the mountains.

Erosion. The impervious clays of the foothills are frequently found barren and gullied, because left uncovered. The mountain ridges, having many stones and pebbles in their soil, resist erosion much better than the clays, but this advantage is counteracted by the steepness of their slopes, and the bed of every rivulet is eroded to the underlying rock. The creek bottoms are hardly less liable to damage. Sudden downpours of rain (11 inches have been known to fall in forty-eight hours) often cause such rises in the creeks as to cover the fields with gravel or cut them away.

Distribution.—All this tract is forest land except the creek bottoms and a few mountain coves, which have been cleared and together amount to 11 per cent of the area. The denser portions are in the coves at the higher altitudes. The forest.

Composition.—There is a noticeable contrast between the forests of the interior mountain region and of those of this region about the headwaters of the Tallulah and Chattooga rivers. Here the oaks are in greater predominance, and the hickories and Southern pines are more abundant, while beech, birch, maple, buckeye, and other lovers of cool air and abundant moisture are notably less. White pine and hemlock hold to the higher altitude, but are noticeably rare along the foothills.

Condition.—In condition, also, the forest is inferior to that of the highlands. The injuries by fire are greater. The rate of growth is further retarded by drought, and probably by occasional spring frosts killing buds and young leaves. The greater portion is in the condition of natural forest, with many old, crooked, fire-scarred, and otherwise defective trees and inferior species, and with subordinate saplings, crooked and retarded. Because of prevalent fires the stand is imperfect, many spaces being covered with mere brush where a stand of good timber is possible. Along the line of the old railroad grade from Walhalla to Rabun Gap much burning was done at the time of grading, and now the portion then severely burned is covered with a dense stand of saplings, principally oaks and hickory.

Reproduction.—The absence of protection from fire on its dry slopes would be the main difficulty in bringing this forest into good condition, as sprouts and seedlings spring up quickly where fire can be prevented.

The effect of the no-fence law is plainly noticeable south of the Chattooga River, where the forest is more severely injured by fires, which are there fiercer because of more combustible material.

TOXAWAY RIVER BASIN.

[52,248 acres; 95 per cent wooded.]

This basin drains into the Atlantic through Savannah River. The headwaters rise far back in and in fact have, by erosion, almost worked their way through the Blue Ridge. Topography.

The principal peaks about the headwaters are: Sheep Cliff, 4,653 feet; Double Knob, 4,417 feet; Great Hogback, 4,700 feet, and Cold Mountain, 4,500 feet. The descent from these peaks is rapid and amounts to 3,500 feet in 6 miles on the Toxaway. There are few prominent points within the basin, but the canyons are deeply eroded, and cascades are almost continuous along the Whitewater, Horsepasture, and other tributaries.

Soil.

Derived from gneiss, and in general well forested, the soil is fertile. It is usually a loam of good physical quality. The ridge land is, of course, less fertile, yet is capable of growing valuable timber.

Agriculture.

The few clearings that have been made yield good crops of grass and corn, but the roughness and steepness of the surface will prevent any extensive farming in this portion of this drainage.

So little of the land has been cleared that eroded fields are not a prominent feature of the landscape, as in many other localities, but enough has been cleared to show what the effect would be.

Erosion.

The soil, having numerous pebbles in it, does not erode by rainfall as readily as clay or sand, but, on the other hand, the slopes are so steep and the torrents so fierce that it would be unwise to uncover any but the gentlest slopes and the most fertile soil.

The forest.

The forest of this tract is but slightly broken, only 5 per cent being cleared. The northern portion, lying well up on the Blue Ridge, has substantially the same species as the forest of the highlands. The oaks, hemlock, and white pine predominate. Chestnut, ash, hickory and gum are also abundant. Lower on the slopes the oaks, hickories, and black and yellow pines become more prominent.

The forests of this region are variable. They have been seriously injured by fires, and as a result have some large openings on the ridges. Rhododendron and kalmia constitute a dense undergrowth in the hollows. Defective trees are abundant throughout, but the stand of valuable species is poor.

Improvement in forest condition may be rather more difficult here than elsewhere, owing to abundance of brush and the liability to fire. White and shortleaf pine are the most promising species for a future forest.

SALUDA RIVER BASIN.

[30,796 acres; 94 per cent wooded.]

AND

FIRST AND SECOND BROAD RIVER BASIN.

[54,400 acres; 80 per cent wooded.]

The small portions of these two drainage systems examined are so similar they may be described together. Both lie on the southeastern slope of the Blue Ridge, and both drain into the Atlantic through Santee River.

The Blue Ridge at the heads of these basins is low—about 3,000 feet—and the lowest land covered by these descriptions is about 1,200 feet. The slopes drained by the Saluda are steep and often precipitous, and include Table Rock and Cæsars Head, both bold rocky points, affording two of the grandest views in the whole region. The cascades and falls through the glens of South Saluda and other creeks are very pretty. There is very little alluvial land on the creeks until they reach the plain at the foot of the Blue Ridge. The slopes drained by the Broad rivers are more moderate. The spurs here reach out long distances toward the plains, while between these spurs are rapid but seldom cascading creeks, with somewhat interrupted alluvial bottom lands. Topography.

In both regions the soils are derived from granite, gneiss, and schists, which, when they remain in place, make excellent land, but when washed and the finer sediments left in one place, the coarser in another, become less desirable, as the clays thus formed are too stiff, too impervious to water, and too hard to work, while the gravels are too porous and too light. Soil.

Corn and cane are the principal crops of this region. Some grass is grown on the small clearings in the higher altitudes, and some inferior orchards are seen. Sweet potatoes are grown on every plantation, and a few small cotton fields were found on the edge of the plain. Agriculture.

The lack of grass on most of this area leaves the surface exposed to the cutting action of falling rain, and the eroding effect is so severe and so evident that, in the foothills, no one attempts agriculture upon the ridges. Even the gentler slopes on the border of the alluvial bottoms are often gullied until they have become not only worthless themselves, but are a source of damage to the bottom Erosion.

lands below, which receive the material washed from them. (See Pl. LXVII.)

The slight protection furnished by the frequently burned forests does not prevent the washing away of the humus from the woods, and being so light, it is carried far down the stream to still waters before it finds a lodging place.

The forest.

Substantially all the ridges and steeper slopes are forested more or less densely, while the creek bottoms are cleared. The cleared area on the Saluda comprises 6 per cent of that basin, while 20 per cent of the area of the Broad basins is cleared.

In composition these forests are principally oaks and hickory, with a sprinkling of nearly all other species mentioned in the accompanying list (p. 93).

In condition these forests are very inferior. There is very little log timber. Many of the trees are fire-scarred; many, though old, are small because fire and erosion of humus have retarded growth. Much of the area has a deficient stand, because fires have killed seedlings.

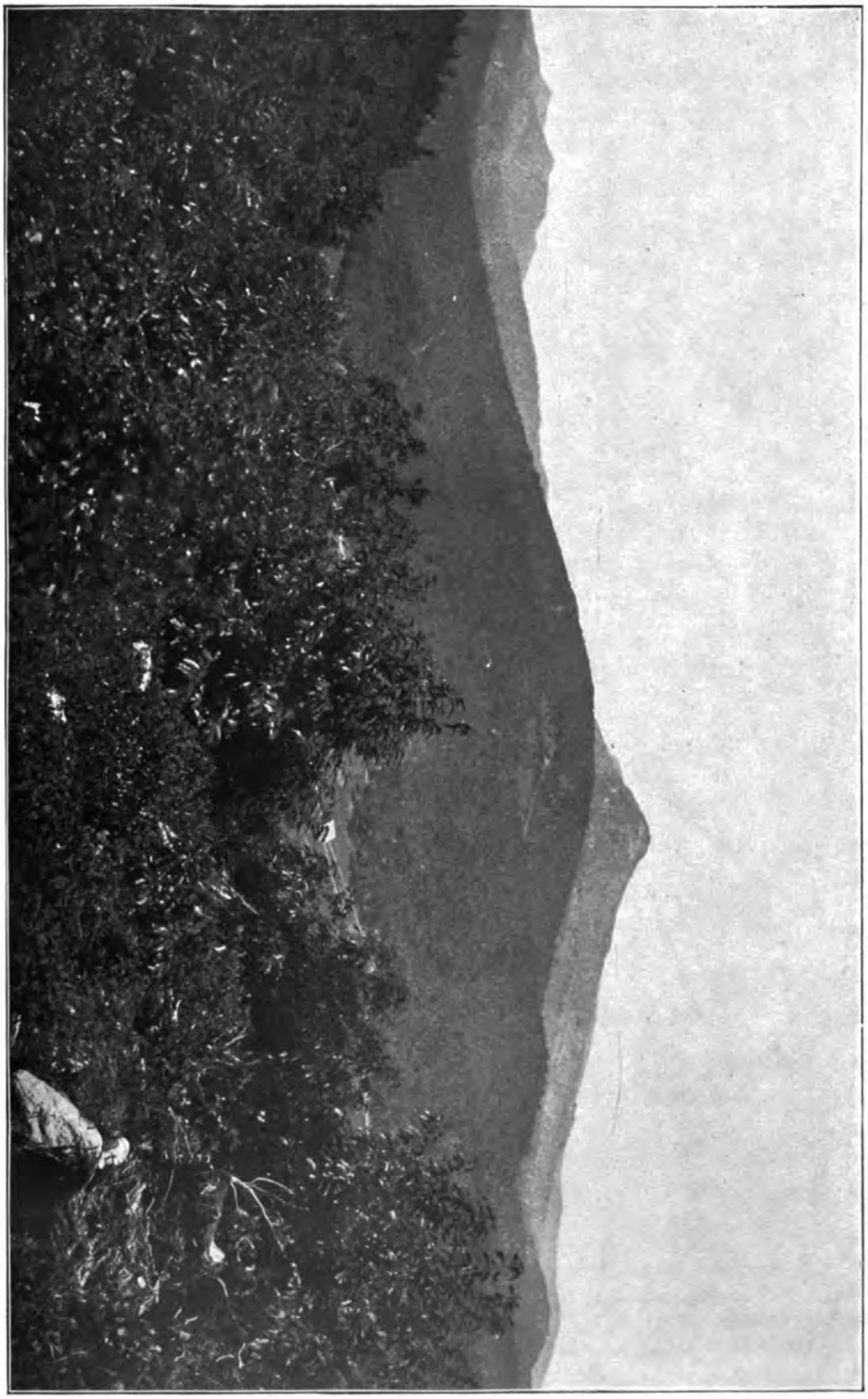
To improve this forest it would be necessary to prevent fire and possibly to thin out defective trees and undesirable species. The species to be favored here are poplar, ash, walnut, shortleaf pine, post oak, and white oak, and, in the higher altitudes, white pine.

CATAWBA RIVER BASIN.

[321,440 acres; 82 per cent wooded.]

Topography.

This area, as here limited, includes the eastern or southern slope of the Blue Ridge, with its numerous spurs, from Blowing Rock southward to Edmondson Mountain, and is drained by the headwaters of the Catawba River, including Johns and Linville rivers, and the north and south forks of the Catawba, directly through the Catawba River into the Atlantic. The elevated crest of the Blue Ridge, with few points on it at a lower elevation than 4,000 feet, and rising at Grandfather Mountain and Pinnacle to an elevation of more than 5,000 feet, forms the western and northern limits of the area; and from it extend steep, rugged spurs with a general north and south trend, gradually diminishing in altitude as they recede from the parent range, dividing the region into numerous parallel, narrow, often gorge-like, valleys. This type of valley reaches its culmination in the gorge of the Linville River, the wildest and most picturesque stream of the southern



GRANDFATHER MOUNTAIN, FROM NEAR LINVILLE, N. C., SHOWING TWO TYPES OF SUMMIT, RUGGED AND ROUNDED. (See pp. 114-115.)

Appalachians, in its descent of 2,400 feet in 20 miles, from the Linville Falls to the foothills. The alluvial lands in the valleys, except those along the Catawba for a few miles above Marion, are limited to narrow strips bordering the streams, or, as on the lower Linville and many tributaries of the Johns River, are altogether lacking.

The soils of the uplands, derived from the decay in place of quartzite, slates, sandstone, and gneiss, are sandy, or sandy loams, and are thin and poor, with few exceptions. Along the larger streams the alluvia are silty and fertile; along the smaller they are sandy and often less productive. Soil.

In the lower valleys corn and small grain are the common crops on the alluvia; corn the exclusive crop of the steeper slopes. Corn, oats, grass, and apples form the staple crops in the elevated valleys and on slopes at high altitudes. Agriculture.

The alluvial lands of the Johns River and the Catawbas have been severely damaged by recent freshets, which have in many places washed away the soil to a depth of several feet, leaving only the rock and gravel, while in other places the agricultural value has been destroyed by the deposition of beds of pure sand or coarse gravel above the alluvium. Soils on steep slopes which have been under tillage, especially those in corn, have also been badly damaged. Erosion.

The forests, except those of a few limited valleys at high elevation, are confined to the slopes, nearly all of the alluvial bottoms having been cleared.

Composition.—They are formed of hard woods, chiefly oaks, associated with pines, white or black; or of mixed hard woods—oaks, chestnut, maple, birch, linn, ash, and poplar—associated with hemlock in the deep hollows and on some northern slopes. The forest.

Condition.—Nearly all south and east slopes, especially at a low elevation, have been damaged by fires to some extent. The best hard woods have been culled from much of the area, and the best white pine from the lower part of the valley of the Johns River and from a portion of the Upper Linville. There is yet much hard wood, largely oak, on the headwaters of the Catawbas, Johns, and Upper Linville rivers.

Reproduction.—Reproduction of hard woods is free by stool shoots and seed, and of pine by seed. Protection from fire is greatly needed. This, with improvement cuttings, would soon develop a valuable forest.

YADKIN RIVER BASIN.

[253,120 acres; 54 per cent wooded.]

Topography. The portion of the basin of this river examined includes the eastern slope of the Blue Ridge, with its outlyers from Bullhead Mountain southward to Blowing Rock, and is drained by the head streams of the Yadkin and all of its northern tributaries eastward to and including Roaring River. The crest of the Blue Ridge, with an average elevation of more than 3,500 feet, limits the area on the north; and from this numerous sharp and steep spurs penetrate the area, dividing it into a series of narrow parallel northwest-and-southeast trending basins, from the southern ends of which the streams emerge and unite to form the Yadkin, at an elevation of about 1,000 feet.

The topography is rough, the slopes of the ridges steep, and the intervening valleys narrow, showing unchecked natural erosion from a high plateau region to a lower base level, in a country with rock of varying hardness and an abundant rainfall.

Soil. The alluvial lands in the valleys are narrow strips or small bodies, seldom more than a few acres in extent, of dark, sandy-loam soils, rich in humus, and fertile, or occasionally of coarse sand and poor. The soils of the uplands, produced by the decomposition of slates, sandstones, and gneiss, are highly silicious and often coarse and poor. On north slopes and in the hollows accumulated mold adds to the fertility and checks the removal of the finer clayey particles, while the poverty of the naturally infertile south slopes is augmented by repeated fires which destroy the litter and facilitate the removal of the finer particles of the soil by the heavy rains.

Agriculture. Corn is the staple crop, both on the alluvial lands and on the slopes at lower elevations; while corn, grass, and some apples are cultivated on the shady north slopes at high elevations and in the deep, cool hollows that indent the face of the mountain.

Some of the alluvial bottoms have been damaged by being washed and gullied by freshets, or by the deposit of coarse sand and gravel brought down from the mountains.

Erosion. Many of the steep slopes, exposed to erosion by the naked cultivation required for corn, have been gullied to the bed rock, and their agricultural value is temporarily destroyed. Many such abandoned fields are being colonized by wind-sown pine seedlings, which check further erosion and rebuild the soil.

The forests, which are confined to the slopes, are formed of hard woods, chiefly oaks, associated with pine (black, rarely with white) on the drier south and east slopes; and of mixed hard woods—oaks, chestnut, maple, poplar, linn, and ash—associated with hemlock in the deep hollows and on north slopes. The better forests lie to the south of Mulberry Gap. East of this gap the oaks and pines are smaller and of poorer quality, and have suffered more from fires; but fires have also done much damage to the pines and oaks growing on the southward slopes. Culling has been carried on for many years, and much of the choicest timber has been removed from the bordering lands, even to the very sources of the streams; but much oak and some pine yet remain.

The forest.

The hardwoods reproduce freely from both stool shoots and seed, and the pines from seed. To prevent further deterioration of the forest and improve its condition, protection from fire is necessary, while improvement cuttings are required in many places to remove worthless stock and to free young timber.

TREES OF THE SOUTHERN APPALACHIANS.

By W. W. Ashe and H. B. Ayres.

The following is a list of the trees growing in the Southern Appalachians, with notes concerning their distribution, size, uses, and reproduction. Accompanying this is a list of shrubs indigenous to that region.

White Pine (*Pinus strobus*) reaches a height of 160 feet and a diameter of 40 inches and forms nearly pure groves, or is associated with smaller hard woods. It prefers sandy or gravelly soils on northwest slopes lying between 1,700 and 4,000 feet elevation. It is the most important timber tree in the Eastern States, for its wood is light, strong, and durable, and is applied to nearly all uses. It makes rapid growth and reproduces freely. It is most abundant, attains its maximum size, and makes most rapid accretion on the western slopes of the Smoky and Iron mountains, especially in Shady Valley.

Loblolly Pine (*Pinus taeda*) in the Appalachians reaches a height of 80 feet and a diameter of 30 inches, and is found only in the southernmost part of the area, below an elevation of 1,200 feet. It occurs chiefly as a second growth in old fields, and is of great value in restocking them and preventing erosion. Nearer the coast it is a timber tree of the first importance.

Shortleaf Pine (*Pinus echinata*), reaching a height of 100 feet and a diameter of 36 inches, is frequent on well-drained soil below 2,000 feet elevation, becoming more common as the altitude decreases. The wood is yellow, strong, and very durable, and takes a fine finish. It seeds freely and reproduces abundantly under full light, often restocking old fields and waste places. It is one of the most valuable of the yellow pines, and forms the chief building material over much of this region.

Black Pine (*Pinus rigida*) reaches a height of 90 feet and a diameter of 28 inches. It is associated with the shortleaf pine, but it is the more abundant at higher elevations. Like that tree, it seeds freely and often, and restocks waste lands. It is not so large nor so valuable a tree, however, and the wood is coarser, more resinous, and not so free from knots. It is much used as a building material.

Table-Mountain Pine (*Pinus pungens*) is a medium-sized tree, which reaches a height of 70 feet and a diameter of 24 inches. It occurs on dry, rocky ridges between 1,500 and 3,000 feet elevation, and is most common along the Blue Ridge and on the Chilhowee and Holston mountains. It reaches its greatest size in the mountains of western North Carolina. It is not so large nor so valuable a tree as the short-leaf and black pines. Its wood is coarse and sappy. It will grow, however, on dry, rocky soil where the black pine does not. It seeds freely and makes rapid growtn, at least when young.

Scrub Pine (*Pinus virginiana*) is a slender tree, seldom more than 80 feet in height and 18 inches in diameter, which is common on dry, sandy, or gravelly land below 2,000 feet elevation. It propagates freely and makes rapid growth. It is not large enough to be of importance as a timber tree, though it is occasionally sawn.

Black Spruce (*Picea mariana*) is a slender tree reaching a height of 150 feet and a diameter of 30 inches. It is seldom found below 4,000 feet elevation, and only around a few of the highest mountains, where it forms dense forests of pure growth, or is associated with hemlock on cold northern slopes or along cold streams. It seeds at intervals of several years and reproduces freely if afforded the proper light and soil conditions, which are generally not produced in lumbering. The wood is light, but strong, and is largely used for lumber. It is the chief source of wood pulp for paper. It is one of the most valuable trees, and reaches its greatest individual development on the slopes of the Smoky Mountains.

Red Spruce (*Picea rubra*) is here a small tree, seldom 30 feet in height, and unimportant. It occurs only in a few mountain swamps.

Hemlock (*Tsuga canadensis*) is one of the largest of east American trees, attaining a height of more than 140 feet and a diameter of 5 feet, which is reached in the Southern Appalachians. It is common along streams and on cold, wet northern slopes above 1,500 feet elevation. The bark is extensively used in tanning, and the trunk supplies much rough lumber. Seeds are borne frequently, but reproduction is poor, as good reproduction requires a delicate adjustment of light and moisture conditions, which are seldom furnished in lumbering.

Carolina Hemlock (*Tsuga caroliniana*) is a smaller tree than the preceding, and its distribution is limited to a few localities in the Southern Appalachians. The greatest size is attained in the mountains of North Carolina. It is one of the most stately of American conifers.

Balsam (*Abies fraseri*) attains a height of 60 feet and a diameter of 2 feet. It is exclusively a Southern Appalachian tree, being confined to the summits of the highest mountains from Clingmans Dome north eastward. The maximum development is attained on the high peaks of the Black Mountains. The wood is soft and brittle and of little value. A medicinal resin balsam is obtained from its bark.

Arbor vitæ (*Thuja occidentalis*) is a small tree which occurs in the Southern Appalachians at only a few places, as on Cripple Creek and Linville River, on moist soil.

Red Cedar (*Juniperus virginiana*) is a small tree, seldom more than 50 feet in height, which is frequent below 1,500 feet elevation in old fields and along roadsides, especially on limestone soil at the foot of the western slope of the Smoky Mountains. The wood is soft, but durable and valuable. It reproduces freely, but the rate of growth is slow.

Butternut (*Juglans cinerea*) is a short-stemmed tree reaching a height of 70 feet and a diameter of 24 inches. It is frequent on rocky soil along streams between 1,500 and 4,000 feet elevation. It yields a valuable light-brown cabinet wood. Seed is borne at frequent and regular intervals, and reproduction is good.

Black Walnut (*Juglans nigra*) reaches a height of 110 feet and a diameter of 40 inches, attaining its greatest size in the deep hollows of the mountains of North Carolina, where it occurs mixed with oaks and chestnut. The larger and most valuable trees have generally been removed. It seeds regularly and reproduces freely. The black, fine-grained wood takes a good polish, and is largely used in Europe for furniture.

Bitternut (*Hicoria minima*) is one of the largest and most valuable of the hickories, often attaining a height of 110 feet and a diameter of 30 inches. It is frequent on lower moist slopes and along streams. Seed is borne in abundance at frequent intervals, and reproduction is good. The rate of growth is rapid. The wood is hard, heavy, and tough, and is much used for the handles of tools and in wagon manufacture.

Shagbark (*Hicoria ovata*) is frequent along streams and on moist, rich slopes, where it attains a large size. It reproduces freely by seed, and small trees sprout from the stump. The tough, elastic wood is regarded as being second in quality among all the hickories. The large, edible nuts are extensively gathered and sold.

Carolina Shagbark (*Hicoria carolinæ-septentrionalis*) is a smaller tree than the preceding, but its wood is of the same quality, and is used for the same purposes. It occurs on sandy soil at the southwestern end of the Appalachians, below 1,200 feet elevation.

Shellbark Hickory (*Hicoria laciniosa*) is a large and valuable tree which is found at only a very few places. It grows on alluvial lands at a low elevation.

White Hickory (*Hicoria alba*) is the most common hickory. It is frequent on rich, warm soil at a low elevation, where it becomes a large tree, sometimes 110 feet in height and 3 feet in diameter. The hard, tough wood is preferred to that of the other species for mechanical uses. It seeds and reproduces freely, and young trees are common in culled woods at low altitudes. This and the other species are largely used for fuel.

Red-heart Hickory (*Hicoria odorata*) becomes 120 feet in height and 30 inches in diameter, and is one of the most common species. In the Southern Appalachians it is second in value and importance only to the White Hickory. It prefers rich, warm soil at low elevations. Seed are borne often and in abundance, and reproduction is good.

Pignut (*Hicoria glabra*) is a slender tree, exceptionally 100 feet in height, generally growing on dry soil, but is not common. The timber is inferior to that of the red-heart hickory.

Hairy Pignut (*Hicoria glabra hirsuta*) is like the preceding in size and in the character of its timber, but is not so common.

Sand Hickory (*Hicoria villosa*) is a small, uncommon tree, yielding a wood similar to that of the pignut. It grows on sandy soil along streams and on dry ridges at low elevations.

Black Willow (*Salix nigra*) is a small tree reaching a height of 50 feet, and is common along streams below 3,000 feet elevation. The wood is not used, but the tree is important, as its tough roots serve to protect from erosion the banks of the streams along which the trees grow.

Silky Willow (*Salix sericea*) is a small tree 20 to 30 feet in height, with straight stems, which is common along streams and in wet meadows below 4,000 feet in altitude. It is too small to furnish useful wood, but as a protection against the erosion of the banks of small streams it is of more importance than the preceding. It seeds abundantly and reproduces freely.

Largetooth Aspen (*Populus grandidentata*) is a slender tree reaching a height of 50 feet. It is not common and the wood is not used.

Balm of Gilead (*Populus balsamifera candicans*) has been extensively planted along streams, where it makes an excellent soil binder and protects the banks against washing. It is also useful in building up low areas along streams which are subject to flooding, as the deposit of earth around its stems during freshets does not injure the health of the tree. The collection and sale of the large resinous buds, which are used medicinally, is an industry of some importance. It is a tree of rapid growth, and soon reaches a height of 50 feet. The wood is light, soft, and not durable.

River Birch (*Betula nigra*) reaches a height of 70 feet and a diameter of 30 inches, and occurs only along the banks of the larger streams. Seeds are borne abundantly and reproduction is good. The wood is coarse and hard. It is chiefly valuable in protecting the banks of streams.

Sweet Birch (*Betula lenta*) is found along cold mountain streams on northern slopes, where it reaches a height of 90 feet and a diameter of 3 feet. The timber is used to some extent in the manufacture of furniture. Birch oil is obtained by distillation from the bark. It seeds often and reproduces freely.

Yellow Birch (*Betula lutea*) reaches a height of 80 feet and a diameter of 36 inches, and is common in cold ravines and on northern slopes, especially at high elevations. Many of the trees are curly and yield a valuable cabinet wood. It seeds freely and reproduces well on moist land among laurel brush.

Hop Hornbeam (*Ostrya virginiana*) reaches a height of 40 feet and a diameter of 12 inches, and is common along streams. The wood is very hard and firm.

Ironwood (*Carpinus caroliniana*) is a small tree, seldom more than 30 feet in height and 10 inches in diameter. It occurs sparingly on moist-soiled, shady slopes. The wood is very hard and tough.

Beech (*Fagus americana*) reaches a height of 100 feet and a diameter of 30 inches. It is common on moist lands along streams and in hollows, where it attains its greatest size, and on cold slopes at high elevations, where it forms dense groves of small trees. It seeds frequently and reproduces freely. The wood is hard, tough, and fine grained.

Chestnut (*Castanea dentata*) is a large tree, which attains a height of 120 feet and a diameter 7 feet. It is common on nearly all soils above 2,000 feet elevation, but decreases in abundance below that, reaching its greatest development in deep hollows at about 3,000 feet elevation. The wood is rather soft, but valuable and durable, is extensively used locally for building and fencing, and is largely sawn for shipment. The collection of the nuts forms an important industry. It regenerates well from stool shoots and from seeds, which are borne regularly and in abundance. The rate of growth is very rapid, being greater than that of any other hard wood of the region.

Chinquapin (*Castanea pumila*) is a small tree, seldom more than 40 feet in height and 24 inches in diameter. It is frequent on dry soil below 3,000 feet elevation. The wood is similar to that of the chestnut.

White Oak (*Quercus alba*), reaching a height of 120 feet and a diameter of 5 feet, is common below 4,500 feet elevation, especially on rocky soil. The timber is regarded as superior to that of the other oaks and is largely used in the manufacture of farm implements and wagons, for furniture, and for interior finish. The bark is rich in tannin. Seed is borne abundantly and often, and reproduction is good. The rate of growth is rapid, though not so rapid as that of the red oaks.

Post Oak (*Quercus minor*) is a small tree, seldom more than 60 feet in height and 24 inches in diameter. It is especially valued for wagon hubs. It occurs only on dry soils, generally associated with the yellow pine and black oak, and is uncommon except at low elevations, especially toward the southwestern end of the mountains. It seeds freely and reproduces well. The rate of growth is fair.

Swamp White Oak (*Quercus platanoides*) becomes a large tree, 100 feet in height and 3 feet in diameter. It is found along streams, but is infrequent. The wood has the same qualities and uses as that of the white oak, though it is coarser and more brittle.

Chestnut Oak (*Quercus prinus*), reaching a height of 90 feet and a diameter of 40 inches, is common on dry and especially sandy slopes. The wood is harder and more durable than that of the other oaks of this region and is largely used for posts, railway ties, and insulator pins. The bark, which is rich in tannin, is extensively used in the manufacture of white leathers, thousands of trees being yearly stripped to supply the demand. It seeds frequently and in abundance, and reproduces freely. The rate of growth is slow, the large trees often being 250 years old.

Yellow Oak (*Quercus acuminata*), reaching a height of 90 feet and a diameter of 24 inches, occurs rarely along the larger streams. The wood has much the same quality and uses as that of the white oak.

Red Oak (*Quercus rubra*) is the largest oak in the Southern Appalachians, frequently reaching a height of 130 feet and a diameter of more than 5 feet. It is common above 1,500 feet, but attains its greatest size in deep, cool hollows, on fertile soil, where it grows with chestnut, linn, birch, and yellow poplar. It is extensively sawn, and the wood is largely used in the manufacture of furniture, for interior finish, staves, and in construction. It is a tree of rapid growth, seeds frequently and freely, and reproduces well.

Pin Oak (*Quercus palustris*) is a small tree, seldom more than 50 feet in height and 20 inches in diameter. It is found only at a low elevation, along streams flowing from the western slope of the Smoky Mountains. The wood is coarse and porous, and even were the tree more common would be little used.

Spotted Oak (*Quercus texana*) is a tall, slender tree, often 110 feet high and 30 inches in diameter, growing in the larger valleys below 1,200 feet elevation. It is not common, but reproduces well and makes rapid growth.

Scarlet Oak (*Quercus coccinea*), reaching a height of 100 feet and a diameter of 30 inches, but generally much smaller, is very common on dry soil, especially if stiff, below 4,000 feet elevation. The timber is not so valuable as that of the red oak, but is much used. It reproduces freely and makes good growth.

Black Oak (*Quercus velutina*), reaching a height of 100 feet and a diameter of 30 inches, is frequent on good soil on well-drained slopes below 2,500 feet elevation. The timber has about the same uses as that of the red oak. It is a tree of rapid growth and reproduces well. The bark is rich in tannin.

Southern Red Oak (*Quercus digitata*), reaching in the mountains a height of 80 feet and a diameter of 30 inches, is common only below

2,000 feet elevation, where it occurs on dry soils generally with the shortleaf pine. It is a tree of rapid growth and seeds abundantly every few years. The bark is rich in tannin.

Bear Oak (*Quercus pumila*) is generally a large shrub, sometimes becoming a small tree. It is unimportant as a timber tree, and not at all common except northeastward.

Black Jack (*Quercus marilandica*) is a small tree, seldom more than 30 feet in height. It is found only on poor, dry soil below 2,000 feet elevation, and is infrequent except on the southern slope of the Blue Ridge. The wood makes an excellent fuel, but is valueless as timber.

Water Oak (*Quercus nigra*) is a small tree, reaching a height of 50 feet and a diameter seldom greater than 20 inches. It is found occasionally along the larger streams around the southern base of the mountains. It is not sufficiently abundant to have any specific use in this region. The wood is similar to that of the shingle oak. described below.

Shingle Oak (*Quercus imbricaria*) is a small tree, seldom more tnan 50 feet in height, which occurs in the valleys below 2,500 feet elevation. The wood is used for no specific purpose, but is coarse-grained and porous like that of the black and scarlet oaks, and is adapted to similar uses. It seeds freely, reproduces well, and makes rapid growth.

White Elm (*Ulmus americana*), reaching a height of 80 feet and a diameter of 30 inches, occurs only along the larger streams. It is not abundant enough to be generally used. The wood is hard and tough.

Winged Elm (*Ulmus alata*) occurs only along the larger streams, especially toward the southern end of the Appalachians. It is seldom more than 50 feet in height and 20 inches in diameter, and is unimportant as a timber tree. The wood is hard and tough.

Slippery Elm (*Ulmus pubescens*), reaching a height of more than 100 feet and a diameter of more than 30 inches, is occasionally found in rich hollows. It is too infrequent to have any commercial uses.

Late Elm (*Ulmus serotina*) is a small tree occurring on the larger streams at the southern end of the Appalachian Plateau. Its timber is similar to that of the other species, but is not used.

Hackberry (*Celtis occidentalis*) is a slender tree, sometimes 90 feet feet high and 24 inches in diameter, which occurs along the larger streams. The wood is tough and strong, but is not used. It seeds freely and reproduces well.

Mississippi Hackberry (*Celtis mississippiensis*) is a tree similar in size and in the character of its wood to the preceding. It occurs along the larger streams, but is not common.

Rough Hackberry (*Celtis crassifolia*) is a smaller tree than the above, seldom more than 30 feet in height and 12 inches in diameter. The wood is tough and strong, but is not used.

Mulberry (*Morus rubra*) is a small tree with a very short stem, seldom more than 25 feet in height and 24 inches in diameter. The wood is tough and very durable, and is used for posts, etc. It is found in rich hollows at low elevations, but is in general cultivation for the fruit. It seeds regularly and abundantly, and makes rapid growth.

Cucumber-tree (*Magnolia acuminata*) is a large tree, becoming 120 feet high and 5 feet in diameter. It frequents the base of the mountains, generally above 1,500 feet altitude. The wood is rather soft and yellow, and is largely used in the manufacture of furniture, being marketed with that of the yellow poplar. Seed are not abundant and reproduction is scanty. The rate of growth is slow.

Yellow-flowered Cucumber-tree (*Magnolia acuminata cordata*) is a smaller tree than the preceding and is confined to the lower elevations at the southern end of the Appalachians. As a timber tree it is unimportant.

Largeleaf Umbrella-tree (*Magnolia macrophylla*) is a small tree, seldom more than 25 feet in height, which occurs at only a few places along streams or on shady slopes. It is often planted as an ornamental tree, but the wood has no uses.

Umbrella-tree (*Magnolia tripetala*) is a small tree very similar to the preceding, but more common.

Mountain Magnolia (*Magnolia fraseri*) is a tree 40 to 60 feet in height, growing along cool streams. The wood is soft and white, and is put to no uses. The bark is gathered and used medicinally.

Yellow Poplar (*Liriodendron tulipifera*) is the largest tree of the Appalachians, attaining a height of 140 feet and a diameter of 8 feet. It is common below 3,500 feet elevation, but is most abundant and reaches its largest size in cool, sheltered hollows on rich soil. The wood is soft and yellow, and is extensively used in the manufacture of furniture and for wood pulp. It seeds frequently and abundantly, but young trees are not very common, as a delicate adjustment of light and moisture condition is required for regeneration. It reproduces freely on the partly shaded portions of old pastures. It is a tree of only medium rapidity of growth.

Papaw (*Asimina triloba*) is a small tree, seldom more than 30 feet in height, growing on rich, moist soil at low elevations. It is uncommon.

Sassafras (*Sassafras sassafras*), reaching a height of not more than 40 feet and a diameter of 24 inches, is common on dry, sandy soil. The red wood is hard and fine grained, and takes a beautiful polish. It is sometimes used in the manufacture of furniture. It reproduces freely in old fields on stiff soil by seed and suckers.

Witch Hazel (*Hamamelis virginiana*) is a small tree, about 15 feet in height, or generally a slender shrub, common on moist soils up to 4,000 feet elevation. It seeds abundantly and reproduces freely. Extract of witch hazel is distilled from its bark.

Sweet Gum (*Liquidambar styraciflua*) is found in this area only along the larger streams at a low elevation. It becomes a tree 110 feet in height and 3 feet in diameter. The wood is red, hard, and fine grained, and is used for crates, shipping boxes, tobacco boxes, etc., and for flooring and furniture. It seeds regularly, and seedlings are not uncommon near old trees.

Sycamore (*Platanus occidentalis*) is a large tree, often 110 feet in height and 3 feet in diameter, common along the larger streams. The wood is hard and firm, with a beautiful grain, and is used for tobacco boxes, and to some extent in the manufacture of furniture. It seeds often and reproduces freely.

Crab Apple (*Pyrus coronaria*) is a small tree, 15 to 20 feet in height, common in old fields and open woods. The wood is hard and tough, and is used to some extent in turnery. It seeds abundantly and reproduces freely.

Narrowleaf Crab Apple (*Pyrus angustifolia*) occurs with the preceding and is very similar to it in its wood.

Mountain Ash (*Sorbus americana*) is a small tree, seldom more than 30 feet in height, which is found around the summits of the higher mountains. The timber is not used.

Service-tree (*Amelanchier canadensis*) is a small tree, seldom more than 45 feet in height and 20 inches in diameter, which is common above 2,000 feet elevation. The wood is hard and fine grained, and is sometimes used in turnery. It seeds abundantly, and young trees are common.

Small-flowered Service (*Amelanchier botryapium*) is a tree with the same distribution and uses as the preceding.

Cockspur Thorn (*Cratægus crus-galli*) is a small tree, seldom more than 25 feet in height, frequent along roadsides and in fields. The wood is not used.

Blue Ridge Thorn (*Cratægus multispina*), becoming 25 feet in height and 10 inches in diameter, is frequent in fields and on roadsides along the Blue Ridge. It is unimportant as a timber tree.

Black Thorn (*Cratægus tomentosa*) is a small tree, seldom 20 feet in height, which occurs along streams. It is unimportant as a timber tree.

Chapman Thorn (*Cratægus chapmani*) is very similar to the preceding in size and distribution.

New River Thorn (*Cratægus neo-fluvialis*) occurs along streams in the northern part of the plateau. It is not common and is unimportant as a forest tree.

Washington Thorn (*Cratægus cordata*) is very frequent on dry soil at low elevations. Unassuming in size, it is a most beautiful ornamental tree.

Spatulate Thorn (*Cratægus spathulata*) is frequent at low elevations around the base of the plateau on dry soil.

Parsley Thorn (*Cratægus apifolia*) is an infrequent tree, about 20 feet in height, occurring on dry soil around the base of the plateau.

Tree Thorn (*Cratægus viridis*), becoming 35 feet in height and 15 inches in diameter, occurs along the larger streams below 1,500 feet elevation.

Dotted Thorn (*Cratægus punctata*) is common along cold streams and around the summits of the high mountains.

Golden Thorn (*Cratægus crocata*) is very much like the preceding, and has the same distribution.

Hill Thorn (*Cratægus collina*), becoming 25 feet high and 12 inches in diameter, is frequent in fields and in open, dry woods to the south of Asheville.

Buckley Thorn (*Cratægus buckleyi*) is a slender tree, sometimes 30 feet in height, which occurs along streams at low elevations, especially in the valley of the French Broad River.

Catawba Thorn (*Cratægus catawbiensis*) is a small, bushy tree occurring along streams on the east slope of the Blue Ridge.

Pruinose Thorn (*Cratægus pruinosa*) is a small tree, seldom 20 feet in height, with a short trunk. It occurs on dry hills, especially along the Blue Ridge.

Boynton Thorn (*Cratægus boyntoni*) is seldom 20 feet in height. It is common on dry hills, especially in the French Broad Valley

Wild Plum (*Prunus americana*) is a small tree which is common in open woods and fields below 4,000 feet elevation. Its edible fruit is borne often and in abundance. The wood has no uses. It is the parent stock of many of the cultivated plums.

Chickasaw Plum (*Prunus angustifolia*) is a small tree much like the above, and also the parent of many cultivated varieties.

Fire Cherry (*Prunus pennsylvanica*) becomes 40 feet in height and more than 12 inches in diameter. It occurs in cold, damp woods around the high mountains, and often forms extensive groves of pure growth on burned spruce lands, where it prepares the soil for another growth of spruce. The wood is soft and brittle. Seeds are borne abundantly and frequently. The growth is rapid.

Wild Cherry (*Prunus serotina*) along streams at a low elevation is a small tree, but on moist land at high elevations becomes a tree 100 feet or more in height and 3 feet in diameter. The red wood is hard and takes a fine polish and is extensively used for interior finish, and was used for furniture until it became too rare. The rate of growth is rather slow. It seeds often, but young growth at high elevations is uncommon. The best trees have generally been removed.

Redbud (*Cercis canadensis*) is a small tree about 15 feet in height. It occurs along the edges of woods or on rocky banks of streams, seldom above 2,000 feet elevation. The wood is not used.

Honey Locust (*Gleditschia triacanthos*) is a tree reaching a height of 60 or 70 feet and a diameter of 24 inches. It was introduced into this region from middle Tennessee, but is thoroughly naturalized and propagates freely in old fields and waste places. The wood is not used, though it is tough, strong, and durable.

Coffee Tree (*Gymnocladus diocus*) is a small tree, seldom more than 40 feet in height. It occurs in fertile valleys at the foot of the western slope of the Smoky Mountains. The wood is not much used. It reproduces well.

Yellow-wood (*Cladrastis lutea*) is seldom more than 30 feet in height and a foot in diameter. It occurs in rich hollows at a low elevation at the southwestern end of the Appalachians. The hard, yellow wood takes a fine polish.

Locust (*Robinia pseudacacia*) is a slender tree sometimes 100 feet in height and 30 inches in diameter. It is frequent below 4,000 feet elevation on rather dry, yet shaded and deep soil. It seeds abundantly and reproduces freely by sprouts, suckers, and seeds. The hard, yellow wood is very durable in contact with the soil or on exposure, and is extensively used for fence posts, sills, bridge timber, and insulator and ship pins. A most valuable tree, but it is often attacked by a fungus which destroys the heartwood.

Clammy Locust (*Robinia viscosa*) is a small tree, 20 to 30 feet in height, with a short stem, or generally a large shrub found wild in this area only in its southeastern part. It is highly prized as an ornamental plant on account of the beauty of its flowers, and is extensively cultivated. Its wood has no uses. It seeds frequently and reproduces freely both by seed and suckers.

Prickly Ash (*Xanthoxylum clava-herculis*), becoming 25 feet in height and 1 foot in diameter, is frequent along streams. The wood is not used. An extract from the bark is used medicinally. It seeds abundantly and reproduces freely.

Ailanthus (*Ailanthus glandulosa*) is an introduced Asiatic tree which reaches a height of 40 feet and a diameter of 10 feet. It is extensively naturalized along some of the streams, where it propagates freely by means of suckers, and forms dense thickets. The wood is hard, durable, and valuable, but is not used. The growth is rapid.

Stayhorn Sumach (*Rhus hirta*) is a small tree, seldom 30 feet in height, growing along streams or in waste places, especially at high elevations. The bark yields a superior tannin for kids, but is not used locally.

Holly (*Ilex opaca*) is a small evergreen tree, rarely more than 50 feet in height and 1 foot in diameter, which grows chiefly in sandy flats along streams below 2,000 feet elevation. The wood is hard, white, and fine grained, and is used to some extent in cabinetmaking. It seeds often and abundantly, and reproduces well. It is much prized as an ornamental tree.

Deciduous Holly (*Ilex decidua*) is a small tree, seldom 25 feet in height, with a short trunk and large, spreading crown, growing along streams below 1,500 feet elevation. The wood is hard and tough, but is not used.

Mountain Holly (*Ilex monticola*), becoming 25 feet in height and 10 inches in diameter, is common on cold slopes at high elevations. The wood is not used.

Mountain Maple (*Acer spicatum*) is a small tree, seldom 20 feet in height, often with several stems from the same root, which grows in cold, wet soil at high altitudes. It has no uses.

Striped Maple (*Acer pennsylvanicum*), becoming 50 feet in height and 14 inches in diameter, is found frequently along cold streams above 3,000 feet elevation. The wood is put to no use.

Sugar Maple (*Acer saccharum*), reaching a height of 120 feet and a diameter of 40 inches, is common north of the Cowee Mountains, above 2,000 feet elevation, on cold, moist soil. The hard, fine-grained wood is sawn for flooring; the figured wood for furniture stock. A small quantity of maple sugar is made from the sap. Seed is borne frequently and abundantly, and young trees are common in damp woods. The rate of growth is slow.

Black Maple (*Acer nigrum*) is a tree similar in size to the preceding, but much less common, being largely confined to the western slope of the Smoky Mountains.

Red Maple (*Acer rubrum*), becoming 110 feet in height and 36 inches in diameter, is common on moist soil, and the young growth in culled woods. The wood is softer than that of the preceding, and inferior to it. It seeds freely and reproduces well. The rate of growth is slow.

River Maple (*Acer rubrum drummondii*) is a smaller tree than the preceding, seldom more than 80 feet in height and 2 feet in diameter, which is common along the banks of the larger streams. The wood is soft and white, and is not used. It seeds freely and young trees are common.

Box Elder (*Acer negundo*), becoming 40 feet in height and 1 foot in diameter, is frequent along the large streams at a low elevation. The wood is not used.

Buckeye (*Æsculus octandra*) becomes a tree 120 feet in height and 4 feet in diameter. It is common in cold hollows, especially above 3,000 feet elevation. The wood is light and soft, but is not generally used. It reproduces freely. The rate of growth is good.

Purple Buckeye (*Æsculus octandra hybrida*) is a smaller and less common tree than the preceding, and is confined to the western slope of the Smoky Mountains. The wood is similar to that of the preceding.

Buckthorn (*Rhamnus caroliniana*) is a small tree, seldom more than 25 feet in height, found on open slopes near the larger streams. The wood is not used.

Linn (*Tilia heterophylla*), becoming a tree 120 feet in height and 4 feet in diameter, is common along streams and in cool hollows. The wood is white, light, and soft, and is extensively sawn for lumber. It seeds freely, but seedlings are not common. It sprouts freely from the stump.

Blue Ridge Linn (*Tilia eburnea*) is a tree similar to the preceding in size and quality of wood. It is confined to the Blue Ridge Mountains, or the region near them.

Basswood (*Tilia americana*), reaching a height of more than 100 feet and a diameter of 3 feet, is confined to streams at the base of the western slope of the Smoky Mountains, but is by no means common. The wood is used with that of the linn without distinction.

Dogwood (*Cornus florida*) is a small tree, seldom 30 feet in height and 1 foot in diameter, common beneath the shade of other trees on fertile soil below 3,000 feet elevation. The wood is hard, heavy, and strong, and is used for shuttle blocks and a variety of mechanical purposes. It seeds abundantly and reproduces freely. The rate of growth is slow.

Blue Cornel (*Cornus alternifolia*), a slender tree 25 feet in height, is common along cold mountain streams.

Swamp Cornel (*Cornus sericea*), a bushy tree 20 feet in height, is common along the larger streams.

Black Gum (*Nyssa sylvatica*) is a tree sometimes 110 feet in height and 3 feet in diameter, but generally much smaller, which is common along streams at low elevations and on dry slopes at high elevations. The wood is hard and tough, but not durable, and is little used except as rails for tramways in logging. It seeds abundantly and reproduces freely. The rate of growth is good.

Sourwood (*Oxydendrum arboreum*), a tree 80 feet in height and 18 inches in diameter, is common on dry soil below 4,000 feet elevation. The red wood is hard and fine grained and takes a good polish. It is used to some extent in the manufacture of furniture. The seed are borne in abundance and reproduction is prolific. The rate of growth is fair.

Persimmon (*Diospyros virginiana*), a tree 40 feet in height and 18 inches in diameter, is found in fields and waste places. The hard, tough wood is used for shuttle blocks, shoe lasts, insulator pins, etc. It seeds freely and reproduces well, especially on old fields.

Sweetleaf (*Symplocos tinctoria*) is a small tree, seldom more than 20 feet in height, which grows on dry soil. The bark yields a yellow dye.

Peawood or *Bell-tree* (*Mohrodendron carolinum*) is common along streams, where it is a small tree, seldom 70 feet in height, but becoming in the rich, damp hollows of the Black and Smoky mountains a tree 100 feet in height and 30 inches in diameter. The reddish wood is hard and fine grained and takes a good polish, and on the western slopes of the Smoky Mountains is sawn and sold as cherry. It seeds frequently and freely and reproduces well. The rate of growth is fair.

Black Ash (*Fraxinus nigra*), a small tree not more than 30 feet in height and 1 foot in diameter, grows in cold mountain swamps. It is found only in a few places, and is unimportant as a timber tree.

White Ash (*Fraxinus americana*), becoming 130 feet in height and 40 inches in diameter, is one of the most common and important trees. The light brown, elastic wood is largely used in furniture, for handles of agricultural implements, etc. It seeds freely and reproduces well if proper soil and light conditions are afforded. The growth is good.

Red Ash (*Fraxinus pennsylvanica*) is a slender tree, seldom more than 110 feet in height and 2 feet in diameter, which is frequent along the banks of the larger streams. The wood is similar to that of the White Ash, and is put to the same uses.

Green Ash (*Fraxinus lanceolata*) is a tree with the same size and distribution as the above, but more common.

Biltmore Ash (*Fraxinus biltmoreana*) is a tree 20 feet in height and 2 feet in diameter, growing on the larger streams of the plateau. It is not common.

Catawba Ash (*Fraxinus catawbiensis*) is a slender tree, 110 feet in height and 30 inches in diameter. It occurs only on the banks of the larger streams at the foot of the Blue Ridge. Its growth is rapid and it reproduces freely.

Fringetree (*Chionanthus virginica*), becoming 25 feet in height and 8 inches in diameter, is common along streams at lower elevations.

Catalpa (*Catalpa catalpa*) is an introduced tree which has become naturalized along some of the larger streams. It becomes 40 feet in height and 2 feet in diameter, and is a tree of rapid growth. The wood is durable and makes excellent posts.

Black Haw (*Viburnum prunifolium*) is a small tree, 15 feet in height, frequent in fields and along small streams at low elevations. An extract from the bark is used medicinally.

LIST OF SHRUBS AND SOME PLANTS WHICH ONLY UNDER THE MOST FAVORABLE CONDITIONS ASSUME ARBORESCENT FORM.

By W. W. Ashe.

Cane (Arundinaria tecta).
Wild Sarsaparilla (Smilax glauca).
Greenbrier (Smilax rotundifolia).
Hispid Greenbrier (Smilax hispida).
Bristly Greenbrier (Smilax bona-nox).
Juniper (Juniperus communis).
Dwarf Willow (Salix humilis).
Gray Willow (Salix tristis).
Hazel (Corylus americana).
Beaked Hazel (Corylus rostrata).
Mountain Alder (Alnus alnobetula).
Common Alder (Alnus rugosa).
Dwarf Oak (Quercus prinoides).
Mistletoe (Phoradendron flavescens).
Sweet Fern (Comptonia peregrina).
Oil Nut (Pyrularia pubera).
Buckleya (Buckleya distichophylla).
Dutchman's Pipe (Aristolochia macrophylla).
Barberry (Berberis canadensis).
Moonseed (Menispermum canadense).
Sweet Shrub (Butnera fertilis).
Spicewood (Benzoin benzoin).
Mountain Hydrangea (Hydrangea arborescens).
Showy Hydrangea (Hydrangea radiata).
Syringa (Philadelphus inodorus).
Itea (Itea virginica).
Hop Trefoil (Ptelea trifoliata).
False Indigo (Amorpha virgata).
False Indigo (Amorpha fruticosa).
Rose Locust (Robinia hispida).
Boynton Locust (Robinia boyntoni).
Wistaria (Wistaria frutescens).
Red Root (Ceanothus americana).
Northern Fox Grape (Vitis labrusca).
Summer Grape (Vitis æstivalis).
Le Conte Grape (Vitis bicolor).
Riverside Grape (Vitis vulpina).
Frost Grape (Vitis cordifolia).
Bailey Grape (Vitis baileyana).
Muscadine (Vitis rotundifolia).
Virginia Creeper (Parthenocissus quinquefolia).
Sumach (Rhus copallina).
Smooth Sumach (Rhus glabra).
Poison Sumach (Rhus vernix).
Poison Ivy (Rhus radicans).
Poison Oak (Rhus toxicodendron).
Beadle Winterberry (Ilex beadlei).
Winterberry (Ilex verticillata).
Southern Winterberry (Ilex longipes).
Strawberry Bush (Euonymus americanus).
Burning Bush (Euonymus atropurpureus).
Wax Work (Celastrus scandens).
Bladdernut (Staphylea trifolia).
Gooseberry (Ribes cynosbati).
Mountain Gooseberry (Ribes rotundifolia).
Slender Gooseberry (Ribes gracile).
Mountain Currant (Ribes prostratum).
Fothergilla (Fothergilla monticola).
Ninebarks (Opulaster opulifolius).
Meadow-sweet (Spiræa salicifolia).
Hardhack (Spiræa tomentosa).
Mountain Spiræa (Spiræa corymbosa).
Virginia Spiræa (Spiræa virginiana).
Flowering Raspberry (Rubus odoratus).
Red Raspberry (Rubus strigosus).
Black Raspberry (Rubus occidentalis).
Mountain Blackberry (Rubus alleghaniensis).
Northern Blackberry (Rubus nigrobaccus).
Low-bush Blackberry (Rubus cuneifolius).

Thornless Blackberry (Rubus canadensis).
Hispid Bramble (Rubus hispidus).
Boynton Bramble (Rubus boyntoni).
Great Bramble (Rubus clava-herculis).
Watauga Bramble (Rubus wataugæ).
Appalachian Blackberry (Rubus argutoides).
Common Blackberry (Rubus argutus).
Wild Rose (Rosa carolina).
Dwarf Rose (Rosa humilis).
Red Choke-berry (Aronia arbutifolia).
Black Choke-berry (Aronia nigra).
Dreaded Thorn (Cratægus crux).
White-anthered Thorn (Cratægus eburnea).
Edible Thorn (Cratægus cibilis).
Thick Thorn (Cratægus densa).
Prolific Thorn (Cratægus farcta).
Discoid Thorn (Cratægus discoidea).
Light-green Thorn (Cratægus chlorina).
Pendent Thorn (Cratægus pendulina).
Particolored Thorn (Cratægus bicolor).
Fleshy Thorn (Cratægus carnosa).
Three-angled Thorn (Cratægus prismatica).
Bloody Thorn (Cratægus cruenta).
Three-seeded Thorn (Cratægus trisperma).
Curtis Thorn (Cratægus curtisi).
Bractless Thorn (Cratægus elracteata).
Brown Thorn (Cratægus addisoni).
Roan Thorn (Cratægus roanensis).
Thin-leaved Thorn (Cratægus tenuifolia).
Biltmore Thorn (Cratægus biltmoreana).
Small-flowered Thorn (Cratægus uniflora).
Vail Thorn (Cratægus vailiae).
Lookout-mountain Thorn (Cratægus macrosperma).
Oconaluftee Thorn (Cratægus roribacca).
Wrinkled Thorn (Cratægus rugosa).
Yellow-flesh Thorn (Cratægus flavo-carnis).
Rosy Thorn (Cratægus rubella).
Red-flesh Thorn (Cratægus hæmacarpa).
Cullasagee Thorn (Cratægus callasagensis).
Forest Thorn (Cratægus silvicala).
Thorn (Cratægus sororia).
Dwarf Cherry (Prunus cuneata).
Choke Cherry (Prunus virginiana).
Mountain Stuartia (Stuartia pentagyna).
St. Andrew's Cross (Ascyrum hypericoides).
Shrubby St. John's-wort (Hypericum prolificum).
Bushy St. John's-wort (Hypericum densiflorum).
Doubtful St. John's-wort (Hypericum ambiguum).
Riverside St. John's-wort (Hypericum nudiflorum).
Buckley St. John's-wort (Hypericum buckleyi).
Table-rock Hudsonia (Hudsonia montana).
Leatherwood (Dirca palustris).
Spikenard (Aralia spinosa).
Pepperbush (Clethra acuminata).
Early Azalea (Azalea nudiflora).
Downy Azalea (Azalea canescens).
Yellow Azalea (Azalea lutea).
Fragrant Azalea (Azalea arborescens).
White Azalea (Azalea viscosa)
Vasey Azalea (Azalea vaseyi).
Winterberry (Gaultheria procumbens).
Mountain Laurel (Rhododendron maximum).
Purple Laurel (Rhododendron catawbiense).
Small Laurel (Rhododendron punctatum).
Menziesia (Menziesia pilosa).
Leather-leaf (Chamædaphne calyculata).
Mountain Myrtle (Dendrium prostratum).
Blue-ridge Myrtle (Dendrium hugeri).
Sheep Wicky (Kalmia angustifolia).
Kalmia (Kalmia latifolia).
Dog Hobble (Leucothoe catesbæi).
Common Leucothoe (Leucothoe racemosa).
Buckley Leucothoe (Leucothoe recurva).
Fetter-bush (Pieris floribunda).
Stagger-bush (Xolisma ligustrina).
Tangle-berry (Gaylussaccia frondosa).
Northern High-bush Huckleberry (Gaylussaccia resinosa).
Dwarf Huckleberry (Gaylussaccia dumosa).
Buckberry (Gaylussaccia ursina).
Box Huckleberry (Gaylussaccia brachycera).
High-bush Huckleberry (Vaccinium virgatum).

Common Blueberry (Vaccinium corymbosum).
Mountain Huckleberry (Vaccinium pallidum).
Dwarf Blueberry (Vaccinium vaccilans).
Black Huckleberry (Vaccinium atrococcum).
Pale Deerberry (Vaccinium glaucum).
Deerberry (Vaccinium stamineum).
Sparkleberry (Vaccinium arboreum).
Hairy Huckleberry (Vaccinium hirsutum).
Cranberry (Oxycoccus macrocarpus).
Bearberry (Oxycoccus erythrocarpus).
Styrax (Styrax americana).
Common Elder (Sambucus canadensis).
Red-berried Elder (Sambucus pubens).
Pubescent Arrow-wood (Viburnum alnifolium).
Arrow-wood (Viburnum acerifolium).
Swamp Arrow-wood (Viburnum molle).
Hobble-bush (Viburnum lentago).
Swamp Haw (Viburnum cassinoides).
Swamp Haw (Viburnum nudum).
Black Haw (Viburnum rufomentosum).
Coral-berry (Symphoricarpos symphoricarpos).
Yellow Honeysuckle (Lonicera flava).
Mountain Honeysuckle (Lonicera glauca).
Woodbine (Lonicera sempervirens).

LETTER OF TRANSMITTAL.

DEPARTMENT OF THE INTERIOR,
Washington, December 13, 1901.

SIR: I have the honor to transmit herewith a letter from the Director of the Geological Survey, submitting brief reports on the topography and geology of the Southern Appalachian Mountains, by Arthur Keith, and on the hydrography of the same region, by H. A. Pressey and E. W. Myers, of the Geological Survey, for use in connection with your report on the forest conditions of the region.

Very respectfully,

E. A. HITCHCOCK,
Secretary.

The SECRETARY OF AGRICULTURE.

LETTER OF SUBMITTAL.

DEPARTMENT OF THE INTERIOR,
UNITED STATES GEOLOGICAL SURVEY,
Washington, D. C., December 12, 1901.

SIR: I send herewith for submittal to the Secretary of Agriculture, short reports on the topography and geology of the Southern Appalachian Mountains, by Arthur Keith, and on the hydrography of the same region, by H. A. Pressey and E. W. Myers, of the Geological Survey.

These special reports, embodying the results of investigations in this region, extending over several years, have been prepared at the request of the Secretary of Agriculture, and will accompany his report to Congress on the forest conditions in the Southern Appalachian region.

The results of the investigations made in this region show that the destruction of the mountain forests now in progress there is being followed by a consequent erosion of the mountain slopes and valleys, an increasing irregularity in the flow of streams, and a silting up of the river channels across the lowlands of the bordering States, which if continued will seriously and permanently injure the industrial conditions over considerable portions of these States.

Yours, respectfully,

CHAS. D. WALCOTT,
Director.

The SECRETARY OF THE INTERIOR.

APPENDIX B.

TOPOGRAPHY AND GEOLOGY OF THE SOUTHERN APPALACHIANS.

BY

ARTHUR KEITH,
United States Geological Survey.

TOPOGRAPHY AND GEOLOGY OF THE SOUTHERN APPALACHIANS.

By Arthur Keith.

That portion of the Southern Appalachian Mountains in which it is proposed to make a national park lies mainly in North Carolina, but comprises also small portions of South Carolina, Georgia, Tennessee, and Virginia. The area, as a whole, covers about 12,000 square miles, large portions of which are specially adapted to the purposes of a park. This region can be reached within a day's journey from the large cities east of the Mississippi, a measure of accessibility possessed by no other similar district in the United States. It is also nearer the center of population than any other mountain district.

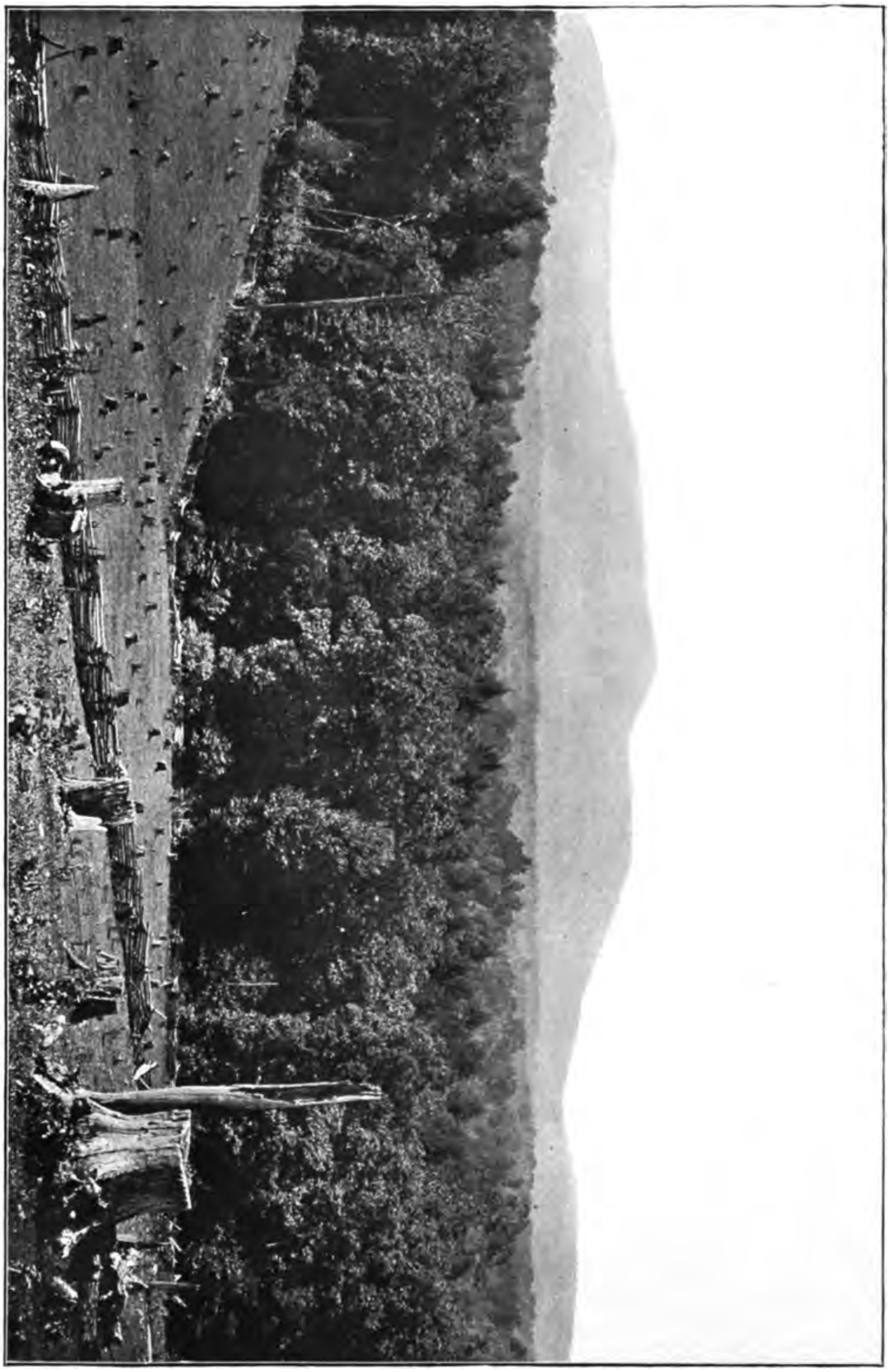
THE MOUNTAIN SYSTEMS.

Magnitude of the mountains.

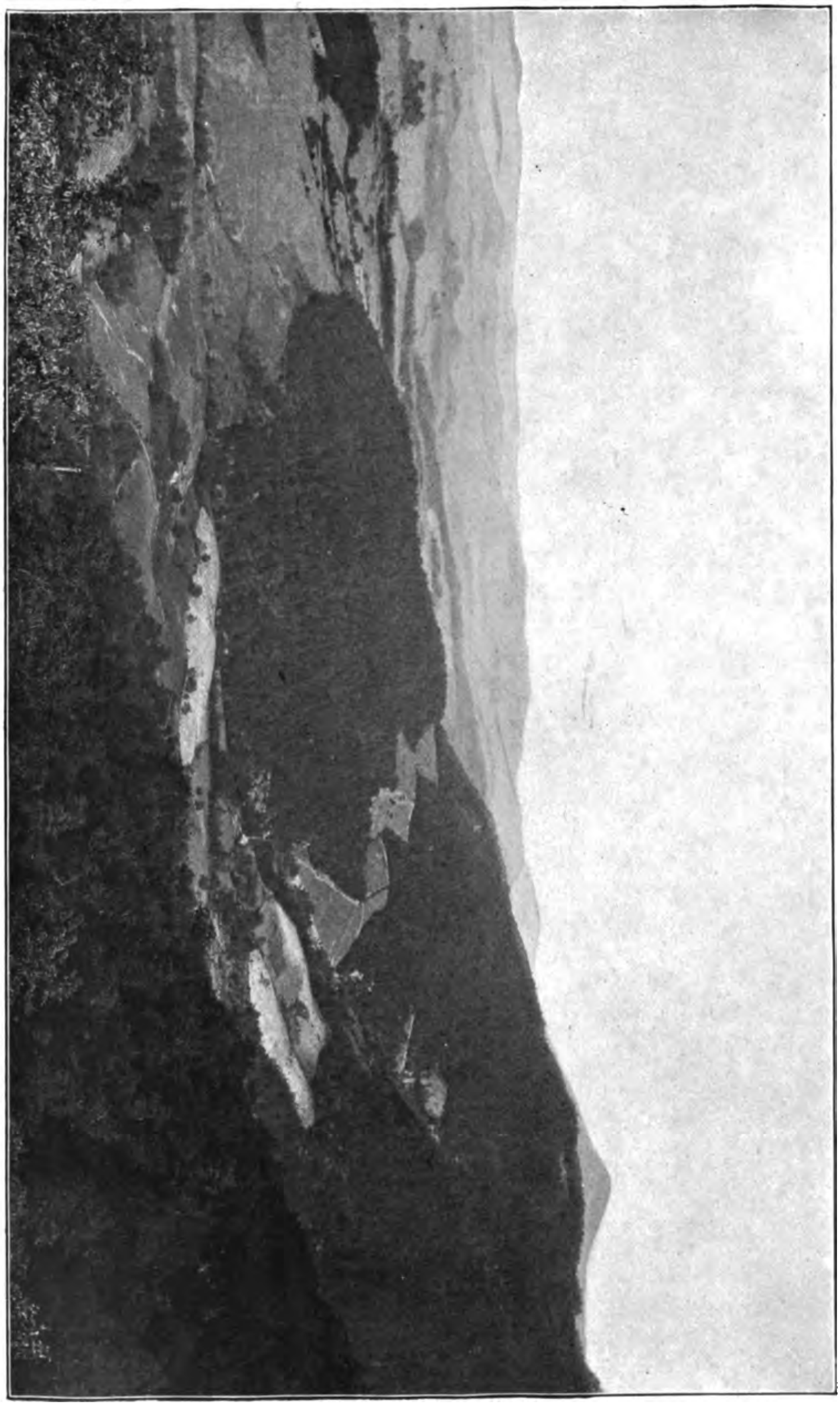
Although this region contains many large rivers and important valleys, it is preeminently a region of mountains. It includes the largest areas of land over 5,000 feet in height east of the Mississippi. In all, 46 peaks a mile or more apart and 41 miles of divide rise above 6,000 feet, while 288 peaks and 300 miles of divide are 5,000 feet or more in height. From the southeastern foot of this mass the Piedmont Plateau stretches southeastward with small interruptions, finally merging into the coastal plain which borders the Atlantic. Past its northwestern foot sweep the valleys of Tennessee and Virginia, with their included ridges and smaller mountains. The great mountain mass thus limited is composed of a number of large and many lesser chains, forming a belt over 300 miles long. Between the chains are extensive plateaus, which are themselves mountains when compared with the lower valleys that dissect them. The Blue Ridge forms the southeastern and the Unaka Mountains the northwestern front of the mountains. Seventy miles apart in North Carolina, they inclose many other extensive ranges between them. In Georgia they approach within 30 miles of each other, and in lower Virginia they coalesce. (Pl. LXV.)

Blue Ridge. The southeastern portion of the mountainous area is the Blue Ridge, a sinuous divide which parts the waters of the Atlantic and the Mississippi. The Blue Ridge stands above 3,000 feet in height, except in a number of deep gaps and a short stretch at the head of Broad River. The northern part of the Blue Ridge consists of ancient plateaus, whose summits are broad and gently rolling and rise to similar heights for long distances. From place to place these vary between 3,100 and 3,800 feet. Less regularity prevails in the southern part of the chain, upon which are situated a few individual peaks and ridges of commanding height. Chief of these are Grandfather Mountain, 5,964 feet, Pinnacle, 5,693 feet, and Standing Indian, 5,562 feet. Four other points exceed 5,000 feet in height. South of the Little Tennessee Basin the Blue Ridge becomes exceedingly irregular, both in height and direction, and finally merges into the Piedmont Plateau. The one feature which distinguishes the Blue Ridge from other Appalachian Mountains is its steep slope on the southeast. This is so extreme as to be, in places, precipitous, and it fronts the adjoining foothills and the Piedmont Plateau like a rampart. (Pls. LVIII, LIX.)

The Unaka Mountains. Roughly parallel to the Blue Ridge and bordering the Great Valley of Tennessee and Virginia lie a series of high mountains which have many features in common and arise from the same causes, although they have separate names. These begin at the southwest with the Unaka Mountains and are continued in the Great Smoky, the Bald, the Unaka, and the Iron mountains. This northwestern front of the mountain mass is termed, collectively, the "Unaka Mountains," a name which is also applied to two of its parts. In the Smoky Mountains several points are but a few feet less in altitude than Mount Mitchell—for instance, Mount Guyot, 6,636 feet, and Clingmans Dome, 6,619 feet. From this maximum in the Smokies the Unakas have progressively lower summits in all directions. Cut apart as the segments of the chain are by the rivers, no average elevations can be stated. South of Big Pigeon River most of the summits are above 5,000 feet. North of that river few exceed 5,000 feet, but many are over 4,000. In all, 125 of its summits rise above 5,000 feet, and 10 exceed 6,000 feet. The body of high land in the Smoky Mountains is the greatest in the Appalachians.



THE BLUE RIDGE PLATEAU AND GRANDFATHER MOUNTAIN, LOOKING WEST FROM NEAR BLOWING ROCK, N. C. (See p. 114.)



EASTERLY FRONT OF THE BLUE RIDGE IN VIRGINIA, SOUTH OF ROANOKE. (See p. 114.)

The hill country to the left is the Piedmont plateau.

Transverse mountain ranges.

Connecting the Unaka Mountains with the Blue Ridge are a series of more or less interrupted chains, most of which have a northwest direction. Chief of these are Tusquitee, Cheoah, Nantahala, Cowee, Balsam, Pisgah, New Found, Black, Yellow, Roan, Beech, and Stone mountains. Supporting and extending these are scores of smaller peaks and ridges. Here and there on these separate chains are many high points comparable with or exceeding those of the Unaka Mountains—for instance, Roan Mountain, 6,313 feet; Richland Balsam, 6,540 feet, and Mount Mitchell, 6,712 feet, the highest point east of the Rockies. As a whole they are much higher than the Blue Ridge, although they exceed the Unakas but little. One hundred and fifty-six summits are over 5,000 feet, and 36 rise over 6,000 feet. The Balsam and Pisgah mountains are the highest of the transverse ranges and form a maximum corresponding to the Smoky Mountains. (Pl. LXI.)

Thus, although the Blue Ridge is the watershed of this area, the highest points, excepting Mount Mitchell, are situated in the Unaka Mountains, where are also located the largest bodies of high ground. Accordingly the rivers flow northwest from the Blue Ridge in deeper and deeper channels, until their gorges are overshadowed by the peaks of the Unakas, a mile in height above them.

Surface forms.

Certain types of surface prevail throughout the mountain district. The mountains rest upon a low base, which varies from 1,500 to 2,500 feet in elevation. The rise of 2,000–5,000 feet up to the summits is made between narrow limits, so that the slopes are steep for the most part. Narrow valleys follow the rivers, in places from 2 to 5 miles in width, and with moderate eminences. From their borders rise the mountains, with slopes abruptly changing 20 degrees or more. These have a marked similarity throughout the mountains, whether high or low. The summits are usually rounded, and cliffs only here and there mar the smoothness of the slopes. The general aspect of these mountains is one of flowing curves, and their grandeur is impressed on the observer by their mass rather than by outline.

THE RIVER SYSTEMS.

Direction of flow in rivers.

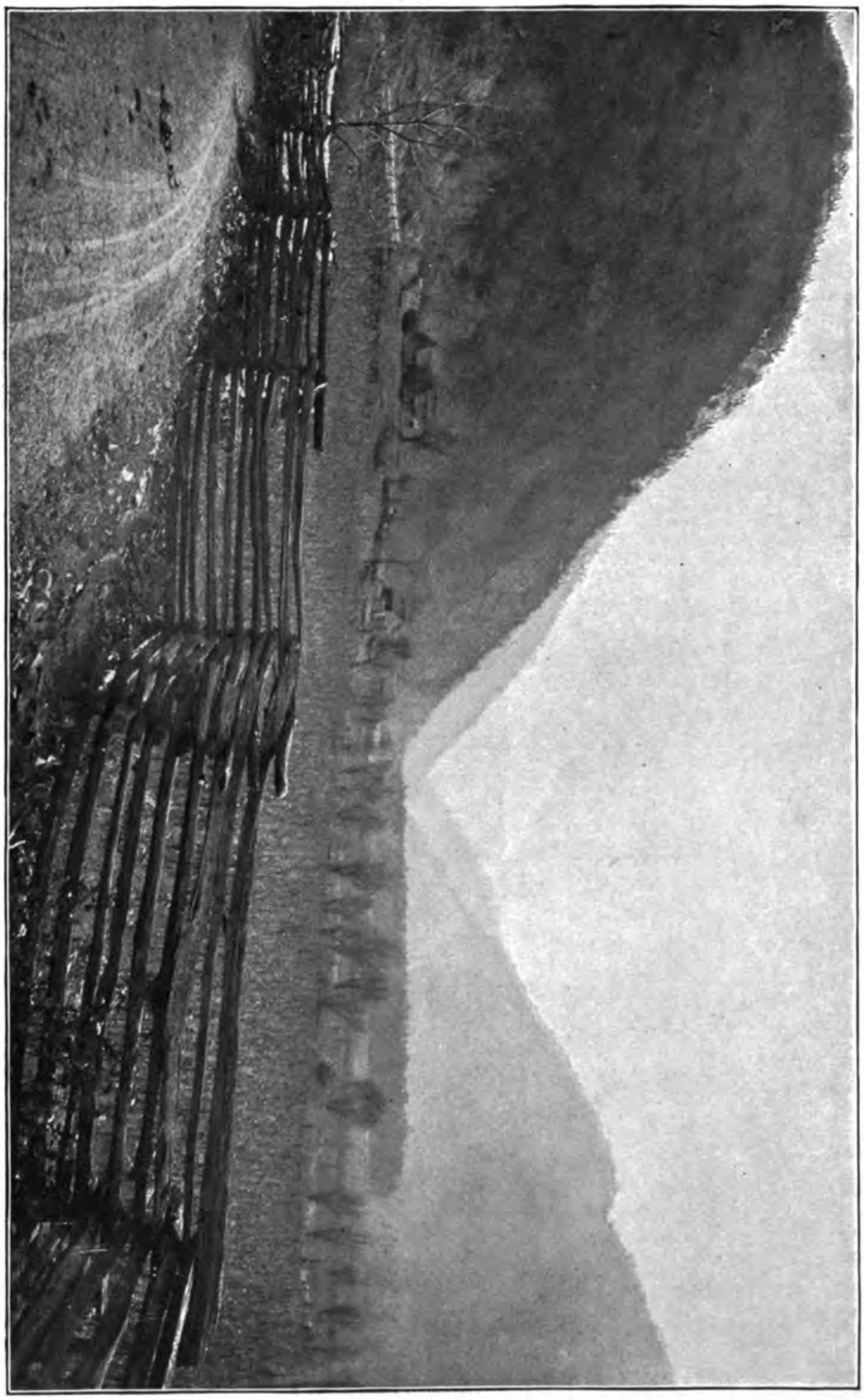
Probably no region in the United States is better watered or better drained than this. Most of the water passes into the Mississippi. through Tennessee River and its tributaries. Chief of these are the Ocoee, Hiwassee, Little

Tennessee, Tuckaseegee, Big Pigeon, French Broad, Nolichucky, Watauga, and Holston rivers. These all flow from the Blue Ridge northwestward through the Unaka Mountains and separate that chain into portions which have received individual names. In the northeastern portion of this region the New River, a branch of the Ohio, rises and flows northeastward. Southeastward from the Blue Ridge a large number of rivers flow into the Atlantic. These are the Yadkin, Catawba, Broad, Saluda, and Chatooga rivers. In the northeastern corner of Georgia rises the Chattahoochee, flowing southwestward into the Gulf of Mexico. Thus this region distributes its waters in all directions and is practically the apex of the drainage of many thousand square miles. From the Blue Ridge near Blowing Rock the waters may run through Watauga River into the Tennessee, through New River into the Ohio, or through the Catawba and the Yadkin into the Atlantic. From the Blue Ridge near the head of Hiwassee River they may flow through Chatooga River into the Atlantic, through the Chattahoochee into the Gulf of Mexico, or through the Hiwassee into the Mississippi. Into these large rivers flow hundreds of lesser rivers and creeks, which cover the country with a most intricate network. They are fed by myriads of springs which run from year to year with unceasing flow. (Pls. LX, LXII, LXIII.)

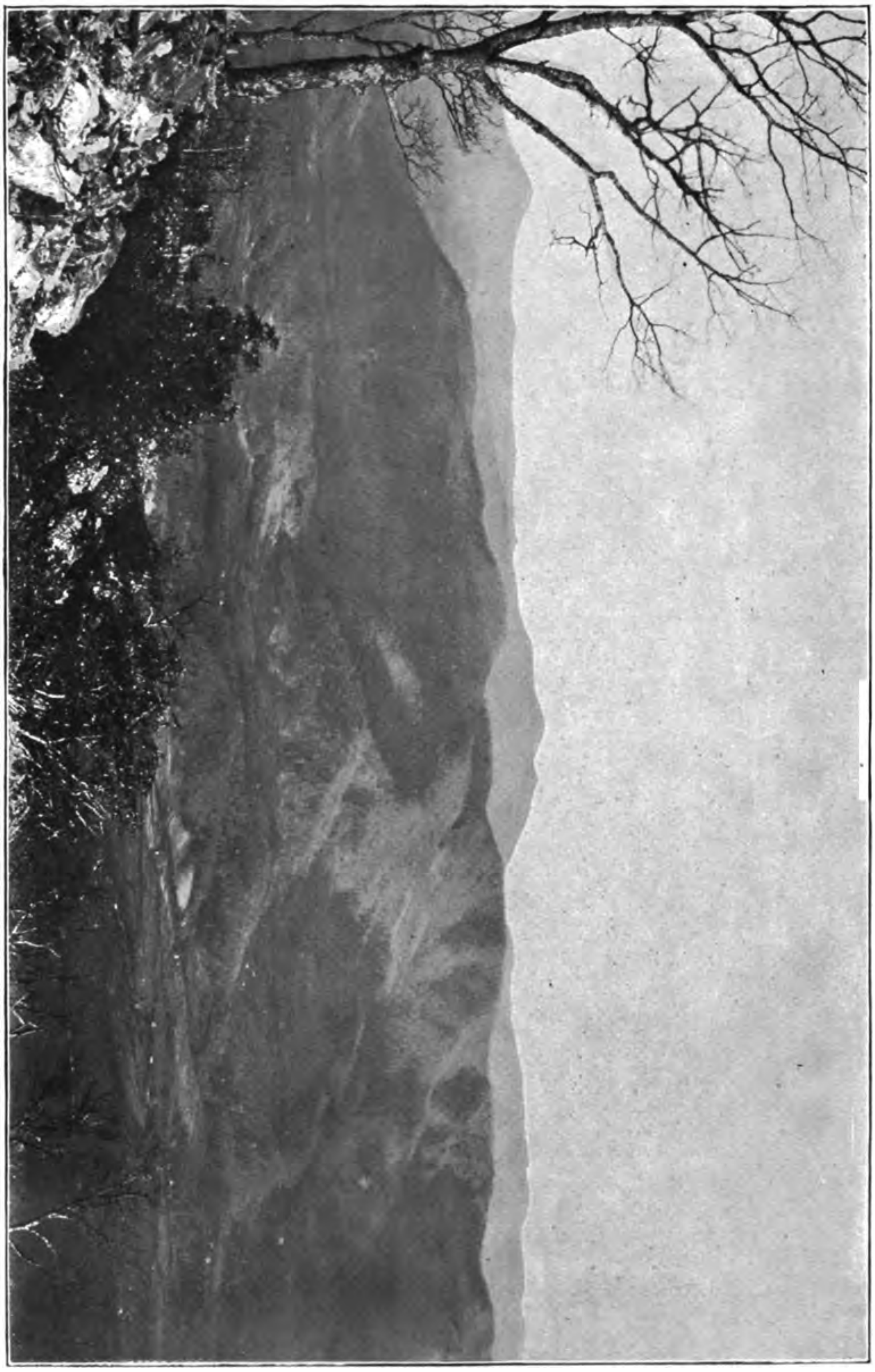
Radial drainage.

Grades in rivers.

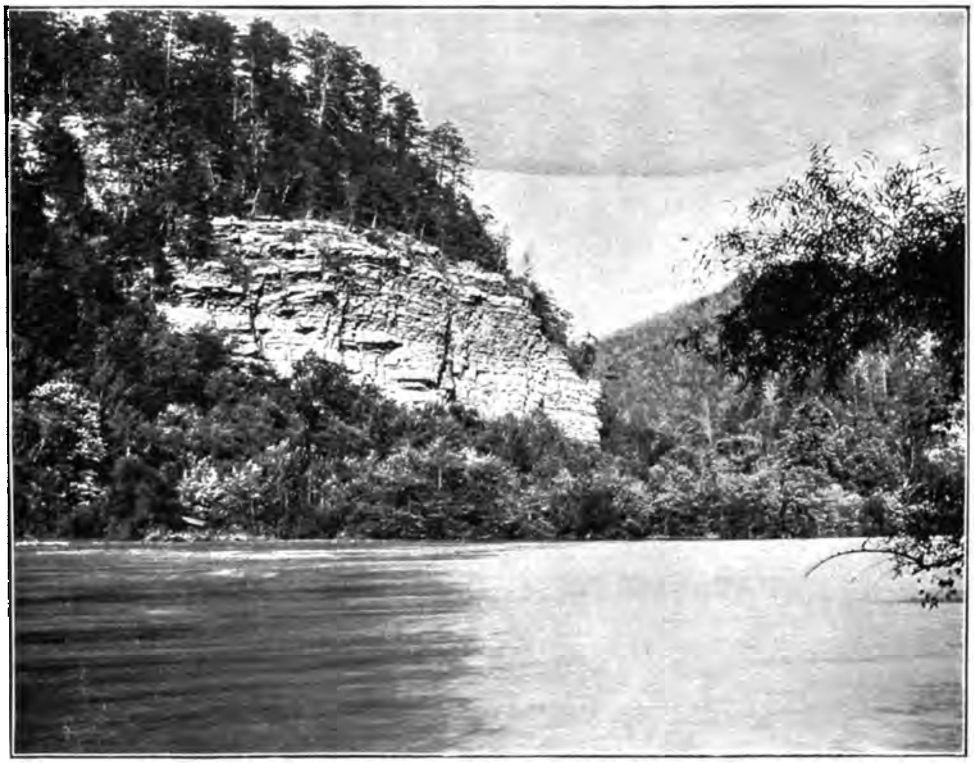
Starting southeastward from heights of 3,000 feet or more, the streams tumble rapidly from the Blue Ridge and reach the Piedmont Plateau at heights from 1,000 to 1,500 feet. Rivers running in the opposite direction emerge upon the Appalachian Valley at heights from 1,000 to 2,000 feet, the highest points being at the northeast. Few of these rivers flow as far as 100 miles in the mountains, so that this fall of 1,000 or 2,000 feet makes a very high average grade. The stretches of smooth water are seldom long, and the descent is mainly accomplished by countless rapids and minor falls. On the larger rivers few falls exceed 10 feet. Falls of 25 and 30 feet can be found here and there upon the smaller rivers, while in places the creeks and branches have direct plunges as great as 300 feet. That the scenery along the streams is picturesque scarcely needs to be said. From rapid to fall, and then a stretch of placid depth, the courses of the streams are pictures of kaleidoscopic variety. Come to them where you may, the charm is there, and fresh beauties are viewed at every bend.



THE NARROWS OF THE LITTLE TENNESSEE RIVER EMERGING FROM THE SMOKY MOUNTAINS. (See pp. 18, 116, and Pl. V.)

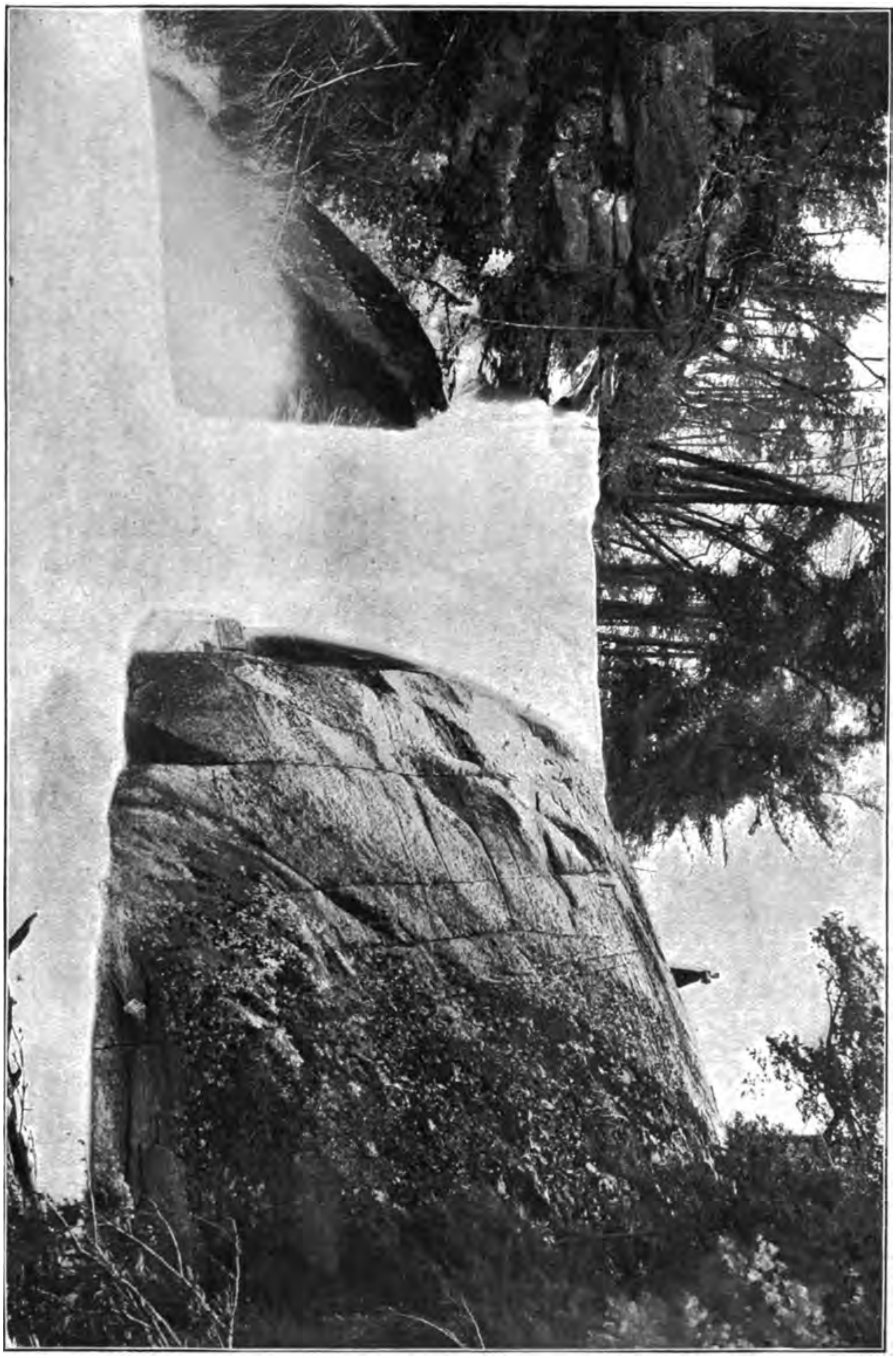


BALSAM AND PISGAH MOUNTAINS FROM JUNALUSKA, NEAR WAYNESVILLE, N. C. (See pp. 51, 115.)



(A) FRENCH BROAD RIVER, AT PAINT ROCK, N. C. (See p. 116.)

(B) OCOEE RIVER, IN UNAKA MOUNTAINS, TENNESSEE. (See p. 116.)



FALLS OF ELK CREEK, NEAR CRANBERRY, N. C. (See pp. 29, 116.)

Volume of flow in rivers.

From season to season the rivers vary in flow. Their least volume is in the early fall, when they have been reduced by the droughts and heat of summer. Only the smallest branches are ever entirely dried, however, and the severest droughts fail to stop any considerable stream. The greatest volumes are attained in the spring, when the snows melt rapidly and the winter's accumulation of water is leaving the soil. The freshets are not limited altogether to the spring, however; a cloud-burst, for example, may swell a lesser stream tenfold, or a hard rain of four or five days may flood even the largest river. In the upper courses of the streams, where the grades are highest, floods produce exceedingly swift currents, which are able to destroy obstructions and barriers which at ordinary stages would seem insurmountable. The rapid delivery of the waters from the stream heads make a sudden concentration where the branches have united and the grades are less, causing deep water and overflow. Thus, four days of hard rain recently raised Catawba River 30 feet and overflowed miles of bottom lands. The power of the upper and steeper streams at such times is almost incredible; bowlders tons in weight become mere playthings. On the lower reaches in deeper waters and slackened currents no fragments larger than cobblestones are moved, but wholesale changes in the shapes of the bottom lands are often accomplished. The same steep grades which cause the rapid floods are equally effective when the rains have ceased, so that the waters subside about as quickly as they rise. Aside from these temporary changes in volume the flow of the rivers is very steady, dependent as it is upon the discharge of countless springs and the seepage of waters from the soils.

Speed of flow.

CLIMATIC FEATURES IN THE MOUNTAINS.

Temperature.

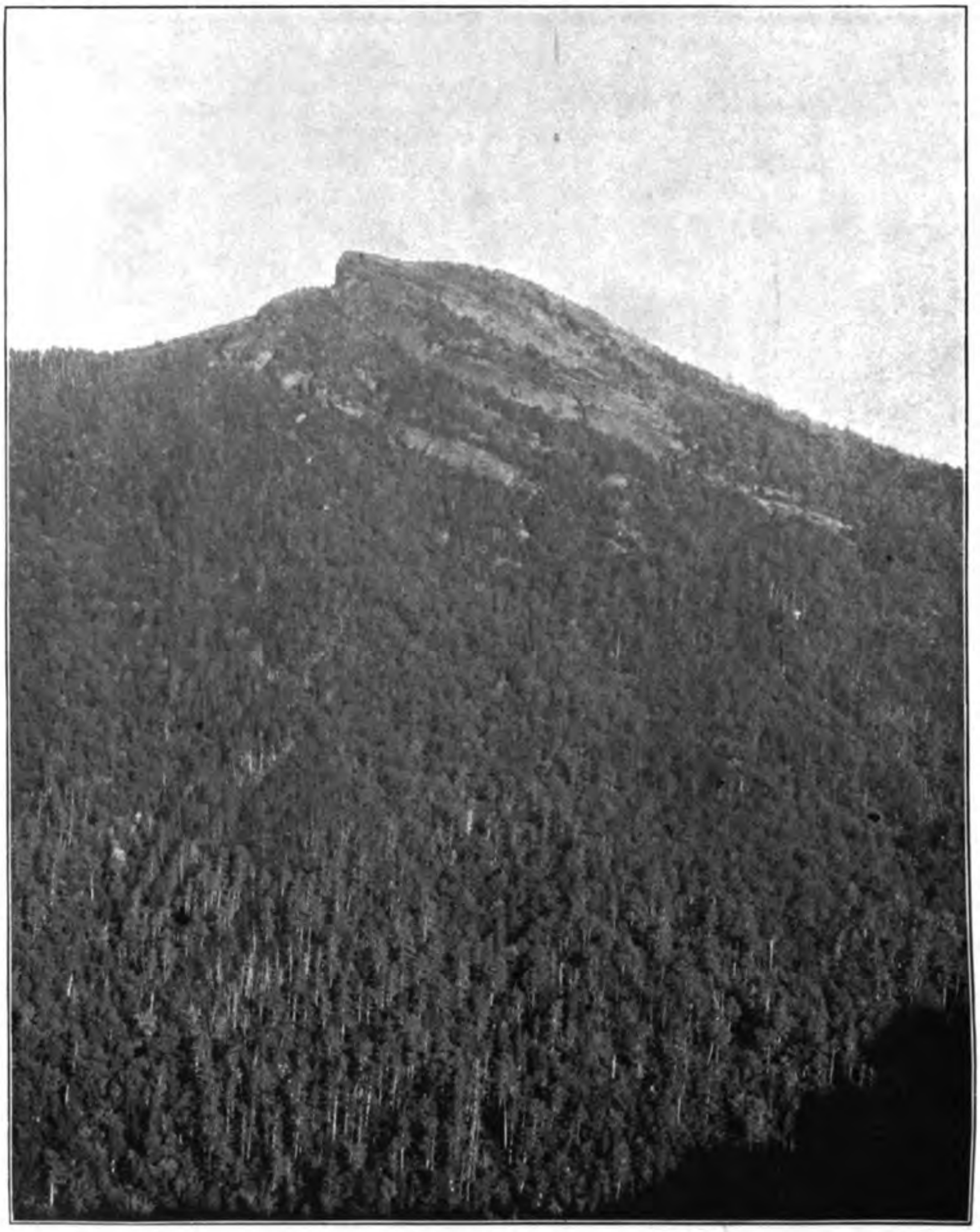
The region covered by this mountain mass possesses a climate which differs greatly from that of the surrounding regions. This is manifest first in lower temperatures and is due directly to the greater altitudes. The peaks, of course, are colder than the intermountain valleys, and both are colder than the adjoining Great Valley or the Piedmont Plateau. The differences in temperature are greater in summer than in winter, so that the climate of the higher portions is more equable than that of the valleys.

Rainfall.

In addition to the cold which it directly produces, the altitude also affects the climate of this region very decidedly through the precipitation. The prevailing winds of the region are southwesterly and are heavily laden with moisture derived from the Gulf of Mexico. As these winds rise over the mountain slopes they become colder and less able to retain moisture, which comes within the mountain's grasp as rain or snow. The birth of shreds of cloud in the uprising wind and their union into masses that shroud the mountains can be seen on every hand. Through them come glimpses of peak and forest, in a softness and beauty far beyond words. The direct effect of altitude in chilling the winds is assisted by the cooling effect of the almost universal forests. The forests in turn are fostered by the rainfall and humidity, and the two processes go hand in hand. In the winter much of the precipitation is in the form of snow. This is protected from melting by the forest cover and accumulates so as to mantle the ground for weeks, or even months. In this way a great store of moisture is retained and finds its way into the soil, to be absorbed in part by the forests when growth begins in the spring. Snow sometimes falls on the higher mountains by the first of October, and the last snow may remain until the middle of March.

Forest cover.

Between the temperature of the highest tops and that of the larger and lower valleys included in the mountain region there is a great difference. This is expressed in nature most prominently by the great variety of trees, shrubs, and plants. There is probably no region in the United States containing more species than this, which is appropriately termed the "botanist's paradise." During May and June it becomes a vast flower garden of unrivaled rarity and beauty. Rhododendron and azalea bloom mile on mile, or a score of blossoms are trodden at a step. In autumn the purple haze and the blaze of color in the foliage form a panorama that can not be surpassed. The amount of the forest is quite as striking as its variety, and is one of the most impressive features of the mountains. Owing to the warmth and humidity of the atmosphere the individual trees attain great size. White pines reach heights of 200 feet and poplars are 25 feet in girth. Thus, the existence of the forest cover as a whole and of the individual species that are favored by colder climates is dependent upon the altitude, which cools the air and brings moisture to the surface of the earth. Its favorable situation with



STEEP FOREST-COVERED SLOPE OF HAWKSBILL MOUNTAIN, SEEN ACROSS THE GORGE OF LINVILLE RIVER.
(See p. 118 and Pls. XXIX, LXXII.)

regard to the moist, warm winds from the Gulf combines with a general altitude unequaled east of the Mississippi to produce a unique and remarkable vegetation. (Pl. LXIV.)

THE GEOLOGIC FORMATIONS.

The geologic formations which underlie this mountain district may be divided into four large groups. Each differs widely from the others in age, and has very distinct features of its own. These broad differences have expressed themselves in such major topographic features as the Appalachian Valley, the Appalachian Mountains, and the Piedmont Plateau. These differences are also largely responsible for the principal variations in the character of the surface in the mountain district itself.

Limestone group.

The Appalachian Valley is underlain by a series of limestones, shales, and sandstones, mainly of late Cambrian and Silurian age, forming the youngest of the four groups in this region. Small outliers of these formations are included within the area of the mountains near the border of the Appalachian Valley.

Quartzite group.

The second group occupies the northwestern border of the mountain district, chiefly northeast of the French Broad River. It consists of a series of quartzites, sandstones, conglomerates, and shales of Lower Cambrian age. A second large area of these rocks occupies the Blue Ridge and adjacent territory, nearly in the center of this district.

Conglomerate group.

The third group is of Cambrian age. It occupies the northwest border of the mountain mass, corresponding in position to the previous group but best developed southwest of the French Broad River in the Smoky and Unaka mountains. The group consists of conglomerates, graywackes, sandstones, schists, and slates, and is called the Ocoee group. This and the preceding two groups were composed of the waste from older rocks, which was deposited under water. The thickness of the strata is approximately the same in the Ocoee group and the formations of the Appalachian Valley. The Lower Cambrian quartzites and shales of the second group have only from one-fourth to one-third of the thickness of either of the preceding groups.

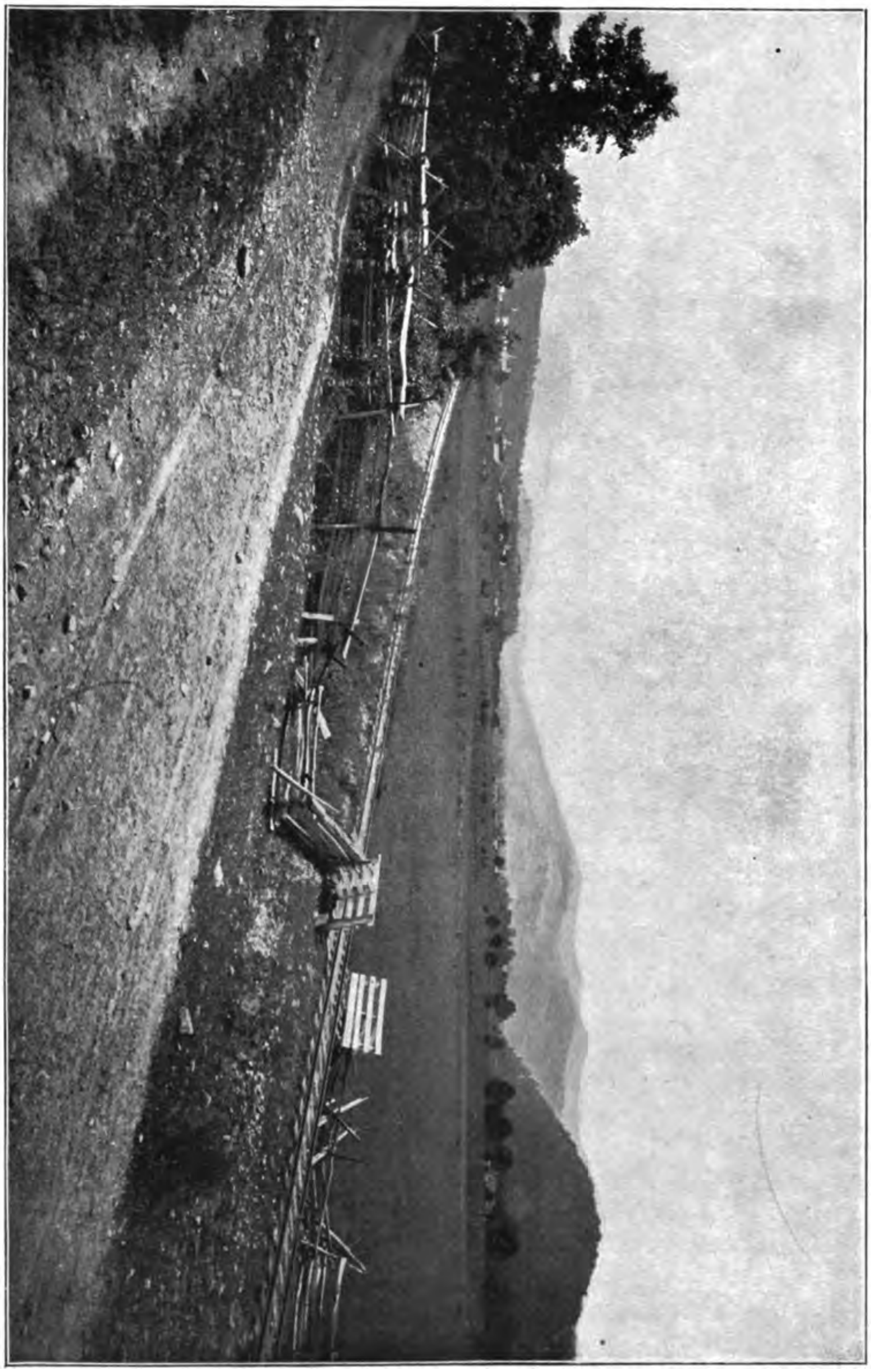
Gneiss group.

The fourth group is much the largest of all, both in actual bulk and area. It consists in the main of formations of the Archean, or oldest known age. The different rocks include several kinds of granite, diorite, mica-gneiss, hornblende-gneiss, and various schists. A large number of these are of igneous origin, but the original nature of many of the gneisses and schists is unknown. Formations also included in this group are the ancient volcanic rocks. These are developed most prominently in connection with the Cambrian quartzites in the northeastern part of the mountain district.

RELATION OF ROCKS TO SURFACE.

Solution of rocks.

Much of the surface of the Appalachian Mountains is exceedingly ancient. During the later geologic periods it has been subjected to the various natural agencies of destruction and has been worn down according as the rocks presented at the surface were susceptible to these influences. The materials composing these formations are attacked in varying degrees by solution and by chemical processes connected with atmospheric and underground water. Certain minerals—for instance, carbonate of lime—are readily dissolved by natural waters, and the rock in wasting away leaves behind only the less soluble portions in forms of clay. To this capability is directly due the reduction of the Great Valley below the mountain mass. Other minerals—for instance, feldspar—are in part dissolved and in part chemically altered and decomposed by natural waters, so that the coherence of the rock which contains them is largely destroyed. Two groups in this region have a large proportion of feldspar in their makeup, and their surfaces have been gradually lowered by its breaking down. These are the Ocoee group and the Archean group. A third mineral—quartz—is comparatively little changed by solution or chemical action near the surface. Formations made up in large part of this mineral retain their altitudes most persistently and are usually the last to be reduced. This composition is most pronounced in the Lower Cambrian group, but is shared also by the Ocoee group and the Archean group. Although the thickness of the Lower Cambrian quartzites is so much less than that of the other groups, their resistance to solution has caused them to remain upheld in very high ridges and peaks. To this are due the cliffs of Chilhowee, Camp Creek, and Iron mountains and the rugged crags of Grandfather. In the case of the Ocoee and Archean groups their immense thickness and the amount of quartz which



WEST FOOTHILLS OF THE UNAKAS AND VALLEY OF EAST TENNESSEE, NEAR ERWIN, TENN., SHOWING LIMESTONE VALLEY AND QUARTZITE RIDGES. (See pp. 17, 119.)

they contain have maintained the greatest elevations presented in this region. Of this the mighty domes of the Smokies, the Balsams, and the Roan, and the lofty peaks of the Blacks, are witnesses. (Pl. LXVI.)

Rock disintegration.

The moist atmosphere is conducive to the rapid decay of the rocks, which break up chiefly under the attack of rain, frost, the roots of the trees, the underground waters, and organic acids. At first decay works in along the various partings, resulting in the loosening of large masses, which gradually become smaller, until finally nothing is left of them except clay and the more obdurate bits of rock. The rocks reach the surface only over very small patches, while in places the disintegration attains a depth as great as 50 feet. On sloping surfaces the loose material is maintained in its place solely by friction. When this is lessened or overcome from any cause, the residual matter, be it clay or rock fragments, slides down the slopes until the friction is again sufficient to retain it in one position. Thus are formed immense thicknesses of loose material washed down from steep slopes and accumulated in the hollows and flatter places. This material gradually works its way downhill as it is pushed along by the freezing of the water which it contains, or is rendered more unstable as the water transforms it into mud. Eventually it finds its way into the streams and is carried by slow stages into the sea. (Pl. LXVII.)

PROTECTION OF THE SOILS.

The chief agent which checks this process of removal is the forest cover, even though the penetrating roots and the acids due to vegetation induce rock decomposition. These same roots, however, hold the loose material in place and hinder its tendency to slide downhill. With this assistance loose soils are upheld on slopes at angles fully double those which they could maintain unaided. Besides this direct check to the waste of slopes by increased friction, the action of the forests is as great in another way. Loose materials are washed downhill during rainstorms by even the tiniest rivulets. In open fields these gather in a few minutes and form deeper and deeper channels with each succeeding storm, finally removing the loose material down to the bare rock. This process is almost wholly prevented by the network of roots and the cover of leaves, both living and dead, and the water concentrates into rivulets by seeping through the soils so slowly that it carries no

Roots and leaves protect the soil.

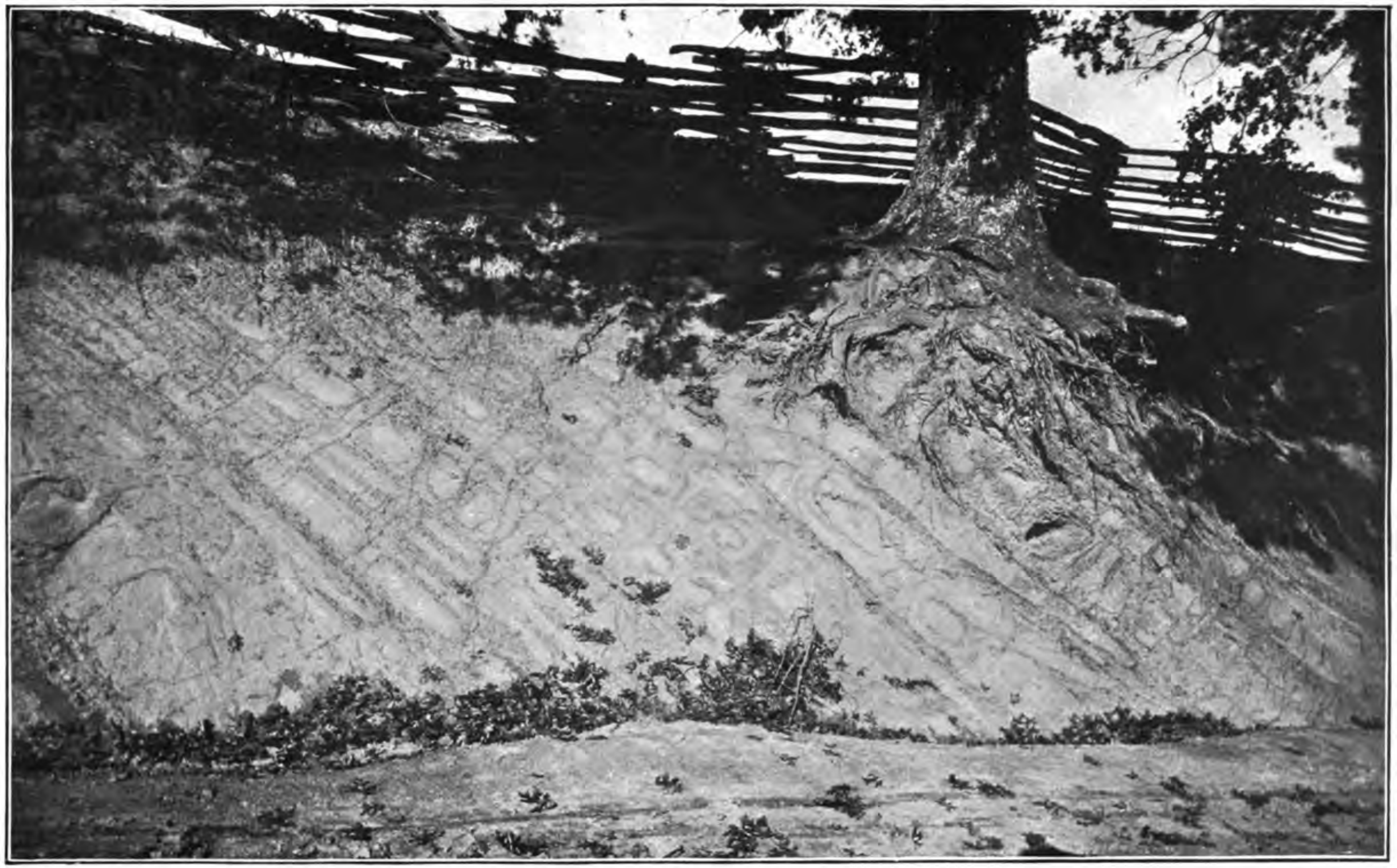
sediment. The waters drain off in the hollows and small streams whose channels have been fitted by long use to withstand the attacks of rushing water.

Soil stripped from clearings.

Countless illustrations of this process can be seen during any rainstorm. Streams which drain considerable areas of cleared land rise fast and become turbid with mud. Those which drain areas protected by forests rise much more slowly, and by comparison the water could be called clear, except in the most violent storms. This result is of course most striking at the very headwaters, the little streams rising in the fields and in the woods. The effects of this work are seen in the innumerable gullies which gash fields left to the elements for any time. In fact, unless checked by the most constant attention, these gullies soon strip off the soil and clay and ruin the fields. In the forests, on the other hand, one rarely sees a slope of soil not covered by vegetation, and it is only along the immediate banks of the streams that raw slopes of loose material are exposed. In short, in this region of deep residual soils the influence of the forest is paramount. It is a fact well known among the mountaineers that the soils are far more fertile when first cleared of timber than ever again. It is equally well known among the farmers along the river bottoms that the same crops have been planted with the same success for scores of years. These latter soils, however, are refreshed from time to time by the overflowing waters, which have swept off fertile materials from the steeper slopes above. The natural fertility of these mountain soils is very great, as is abundantly shown by the tremendous forest growth. The pristine strength of the soil soon wanes in the clearings, and there ensues a loss which is permanent for at least a generation. To convince one's self of the existence of this condition it is only necessary to visit the region.

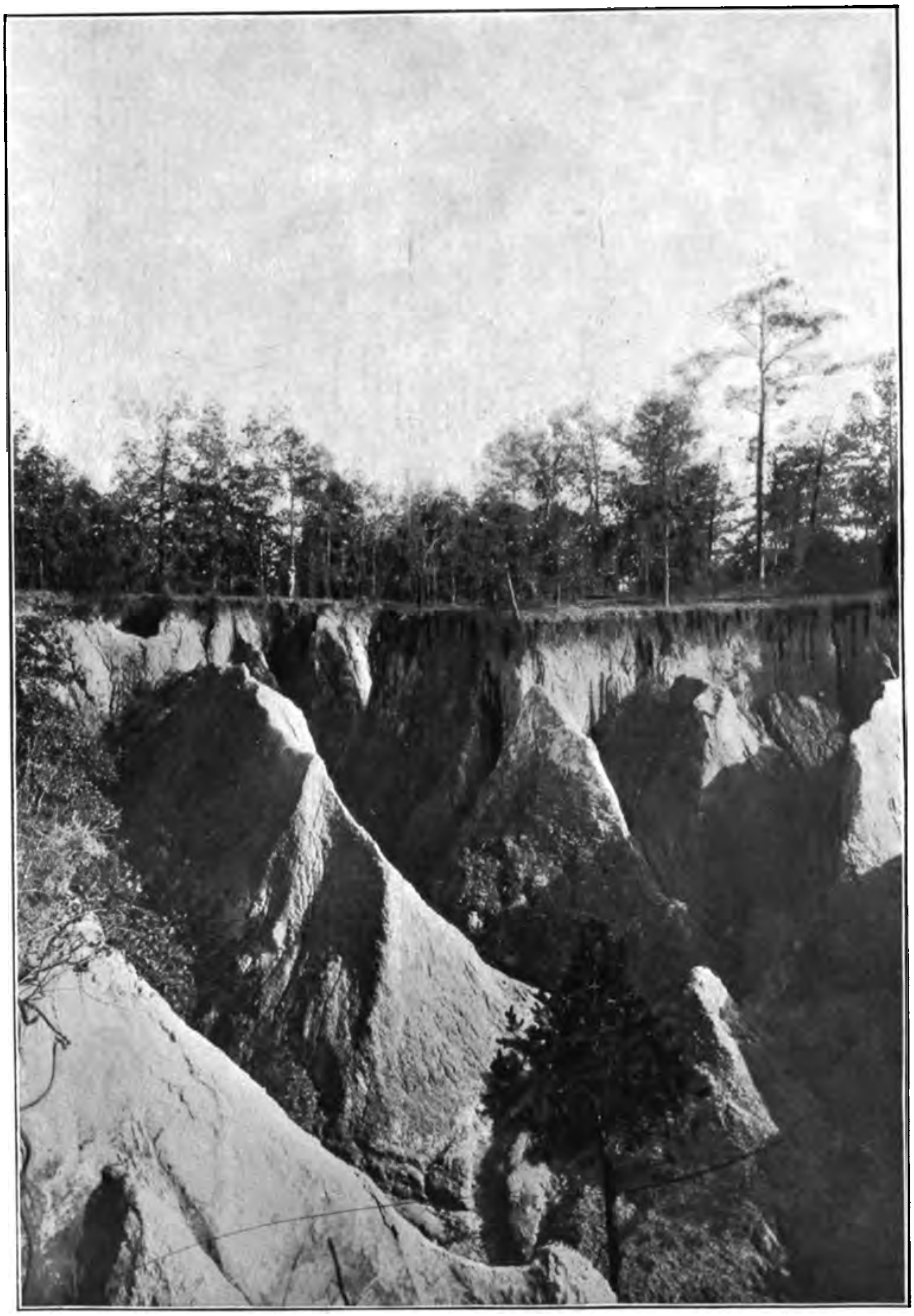
Storage of water reduced.

In addition to the loss inflicted by forest cutting upon the steep slopes themselves great damage also results to the lands lying farther down the streams. The deep clays and underlying rocks form a kind of gigantic sponge, which stores up water when it is abundant. When the forests are stripped away the water collects and runs off with vastly greater speed, and much evaporates, so that not only is less stored up, but the discharge is more irregular and temporary. Destructive floods result and droughts are wider spread. Thus, viewed from the standpoint either of utility or beauty, these unrivaled forests are the keystone of the arch.



ROCK WEATHERING AND DECAY IN THE SOUTHERN APPALACHIANS, NEAR DELRIO, TENN. (See p. 121.)

The cracks and seams in these rocks increase their storage capacity for water, and thus help regulate the flow of the mountain streams.



LAND EROSION, NEAR MARION, N. C., SHOWING RAPID REMOVAL OF THE SOILS BY HEAVY RAINS WHEN THE FOREST COVER IS REDUCED OR DESTROYED. (See pp. 26-28, 122.)

YONAHLOSSEE ROAD ON THE SOUTHERN SLOPE OF GRANDFATHER MOUNTAIN.

APPENDIX C.

HYDROGRAPHY OF THE SOUTHERN APPALACHIANS.

BY

H. A. PRESSEY, Hydrographer, and E. W. MYERS, Resident Hydrographer,
United States Geological Survey.

THE HYDROGRAPHY OF THE SOUTHERN APPALACHIANS.

PHYSIOGRAPHIC FEATURES OF THE REGION.

The Southern Appalachian Mountains, located in the States of Virginia, North Carolina, South Carolina, Tennessee, Georgia, and Alabama, stand out from and above the surrounding country as an elevated physiographic unit. They rise above the Piedmont Plateau, which borders them on the east and south, and above the valley of East Tennessee, which lies on their western flanks, to a height of from 2,000 to nearly 6,000 feet above sea level.

A well watered region.

This is preeminently a region of mountains. (See Pl. IV.) The slopes are mostly covered with deep soil, which is kept in an open, porous condition by the humus that enters into its composition and is spread over the surface, and which is held in place by the myriads of roots of trees and shrubs and grasses growing upon it. (See Pl. LXIX *a*.) In this region the raindrops are battered to pieces by the twigs and leaves and the water is caught by the grasses, shrubs, and ferns below and soaks through the covering humus into the soil and rock fissures underneath. (See Pl. LXIX *b*.) The portion that is neither used by the vegetation nor evaporated from the surface emerges about the mountain slopes weeks or months after its fall in countless springs that feed with striking regularity the many brooks, creeks, and rivers which thus have their sources here. These conditions combine to make this one of the best watered regions on the continent.

This region embraces an irregular, mountainous tableland, lying between the steep and well-defined escarpment of the Blue Ridge on the southeast and the less rugged, but higher and more massive Unaka chain on the northwest. Numerous cross ridges separated by narrow valleys and river gorges connect these two ranges or extend out between them. The region, taken as a whole, has an average elevation of more than 2,500 feet, but there are many peaks that rise to about 5,000 feet, and a considerable number to over 6,000 feet. The mountain slopes, though usually steep, are forest-covered, and have a deep, fertile soil of varying physical character, which is very readily eroded and washed away when the forest covering is removed. The Blue Ridge, though not so high as the mountains to the west, is an older range and constitutes the divide between the waters flowing to the east and those flowing to the west, the streams flowing in either direction having their head springs in or near the gaps of this divide. (Pls. LXIX, LXX.)

The Blue Ridge the great divide.

In considering the Blue Ridge as the great divide of this region two portions of it are especially notable. (See Pl. XII.) Near Grandfather Mountain, the highest point on the Blue Ridge, the New or Kanawha River rises and flows northward through Virginia and thence northwestward into the Ohio; the Yadkin rises a few yards distant on the east and flows northeast and then southeast into the Atlantic; the Linville, a branch of the Catawba, rises on the west side and flows south-southeast, cutting across the Blue Ridge in a deep gorge, while a few miles farther west the Watauga and Nolichucky flow northwest and southwest, respectively, into the Tennessee and the Gulf. One hundred and fifty miles farther southwest, where the Blue Ridge is somewhat broken up near its junction with the Balsam cross ridge, the French Broad rises and flows eastward; the Saluda flows southeast; the Savannah south, and the Tuckasegee west-southwest, into the Tennessee. (Pl. LXXI.)

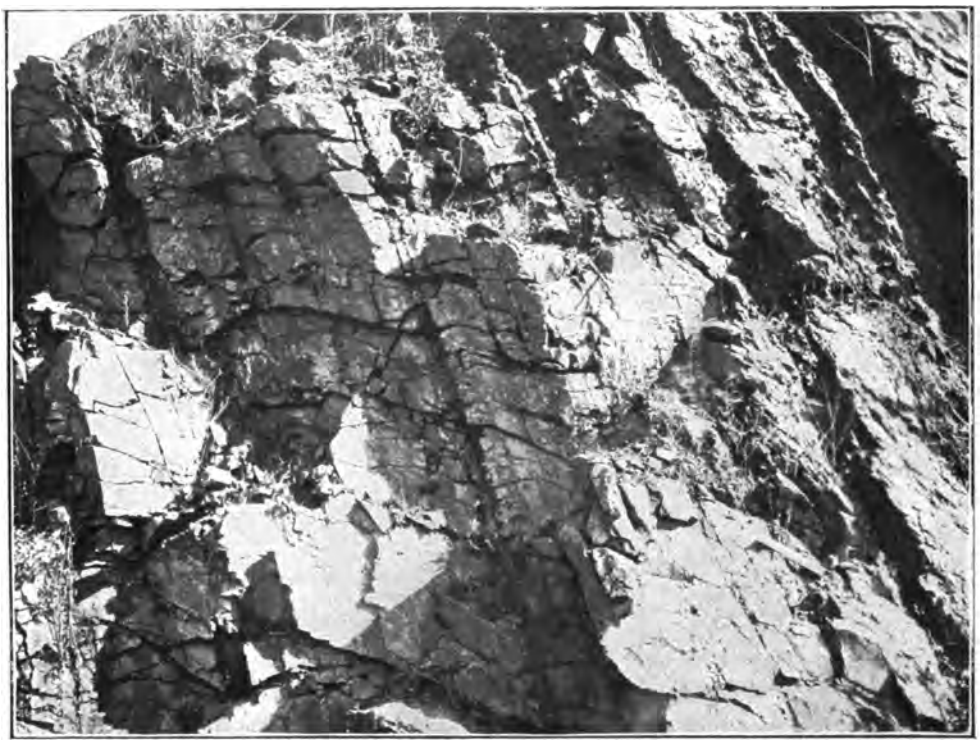
The most striking characteristic of the Blue Ridge is the great apparent difference in height when viewed from its two sides, the streams flowing toward the east plunging down its sides in narrow V-shaped gorges for a thousand feet or more in a distance of a few miles until they reach the gentle slopes of the Piedmont Plain. (See Pl. XXVII). Those flowing westward have a much easier descent.

The river gorges.

This is well shown by the great falls on the Linville River, which, rising on the western slopes of Grandfather Mountain, in Mitchell County, flows in a general southerly course to its junction with the Catawba River, near the southern end of the Linville Mountains. The falls proper, which are located about 3 miles below the Mitchell-Burke County line, have a perpendicular plunge of 40 feet, and the cascades above are about 50 feet in height, this fall of 90 feet occurring in a linear distance

(*A*) RHODODENDRON UNDERGROWTH HOLDING THE SOIL AND THE WATER.

Undergrowth like this holds in place indefinitely the deep, fertile soil of the steep Appalachian mountain slopes.



(*B*) SEAMS IN THE ROCK FACILITATE THE STORAGE OF WATER FROM HEAVY RAIN.

These supplement the work of the soil on the mountain slopes in storing the excessive rains and giving out this water during the drier seasons of the year. But when the forests are destroyed, both the soils and the half-decayed rocks are rapidly carried away, and the mountain rains rush into the streams below, causing floods of increasing violence.

(Photographed by Seadin.)

UPPER FALLS, WHITEWATER RIVER. (See pp. 29, 126.)

The Whitewater is one of the several streams rising on these mountain slopes which unite in the hill country below to form the Savannah River, and to operate the large manufacturing establishments at Augusta, Ga.

(Photographed by Lindsay.)

LOWER CULLASAJA FALLS, MACON COUNTY, N. C. (See pp. 29, 126.)

On one of the sources of the Little Tennessee River.

of about 100 feet. For a distance of about 10 miles below the falls the river flows in a series of cascades through a narrow gorge, whose sides are from 500 to nearly 2,000 feet high, the walls being cut down through the eroded Linville quartzites into the granite below. (See Pl. LXXII.) In the first 6 miles below the falls the descent averages 208 feet to the mile, and the total descent from the head of the falls to the lower end of the gorge, a distance of about 10 miles, is 1,800 feet, as determined by a line of levels. Along the upper 6 or 7 miles of this distance the bottom of the gorge is scarcely wider than the stream. The total fall of the stream from its source in Linville Gap to its mouth is about 3,030 feet in a distance of about 36½ miles, the average fall per mile being about 83 feet.

The Watauga River also rises near Linville Gap, and flows first in a northeasterly and then in a northwesterly direction, its length from its source to Butler, Tenn., where it leaves the mountainous region, being about 33 miles. The total fall in this distance is about 2,000 feet, and the average slope, therefore, about 61 feet per mile. Of this 2,000 feet, between 900 and 1,000 feet are found in the first 6 miles, where the stream rushes down the slopes of Grandfather Mountain.

As is the case with most of the other streams rising on the western slope and flowing westward across the elevated plateau, this stream has its channel for a part of its course in a rather broad and smooth valley before entering the steep and rocky gorge of its middle course. Here it cuts its way through the Unaka mountains in a deep canyon, about 8 miles in length, where the fall averages about 65 feet per mile, but is very much greater at numerous places, the channel being extremely rough and broken. The depth of the gorge through the Unakas is nearly 2,000 feet, but the walls slope down much more gently than those of the Linville just described, though they often show precipitous rock cliffs several hundred feet in height.

Streams about the Unakas.

The Unaka range on the western edge of this plateau, unlike the Blue Ridge, has slopes equally steep on both sides, descending often some 4,000 feet from the crest of the mountains to the stream beds. In the upper part of their courses all of the rivers of the Unakas partake of the nature of mountain torrents, with the greatest fall near their sources, and in their lower courses they flow in valleys where there has been much clearing, the amount of water increasing rapidly at the time of rain on the mountain sides. In many parts the stream valleys are simply mountain gorges, with steep, vertical sides, and with very small flood plains. Water powers could be developed at many places along these rivers, the fall in the upper part reaching, in some cases, 100 feet in an almost vertical drop, though the quantity of water at these points is comparatively small. When the rivers reach the plains lying at the edge of the mountain system their fall is very much less, yet at frequent intervals decided drops occur, and the flow is so increased by the numerous tributaries that water powers of considerable magnitude and value can be developed.

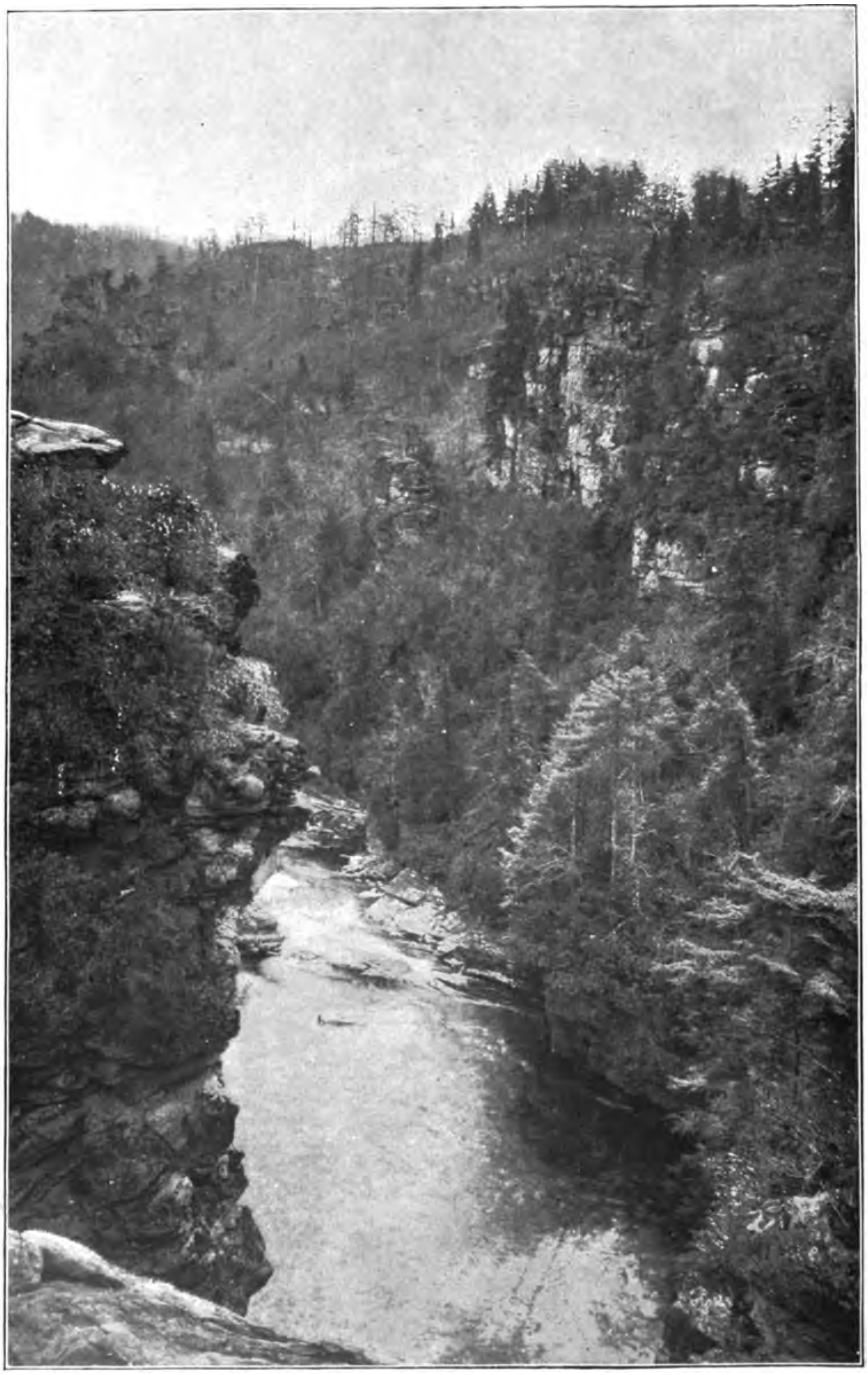
THE RAINFALL AND RUN-OFF IN THIS REGION.

In this region the influence of elevation on climate is supreme; the summers are colder, the winters more severe, and the climate is drier and more salubrious than at points not far distant, but outside of the high mountain area. The trend of the mountains to the southwest influences the prevailing winds, while the great diversity in topographic features give rise to many interesting climatic peculiarities.

On the mountains near the southern end of the Appalachian system the rainfall is very heavy, but, on the other hand, in many central valleys the rainfall is as light and the climate as mild as at many points east of the Blue Ridge.

Climate described in Weather Bureau paper

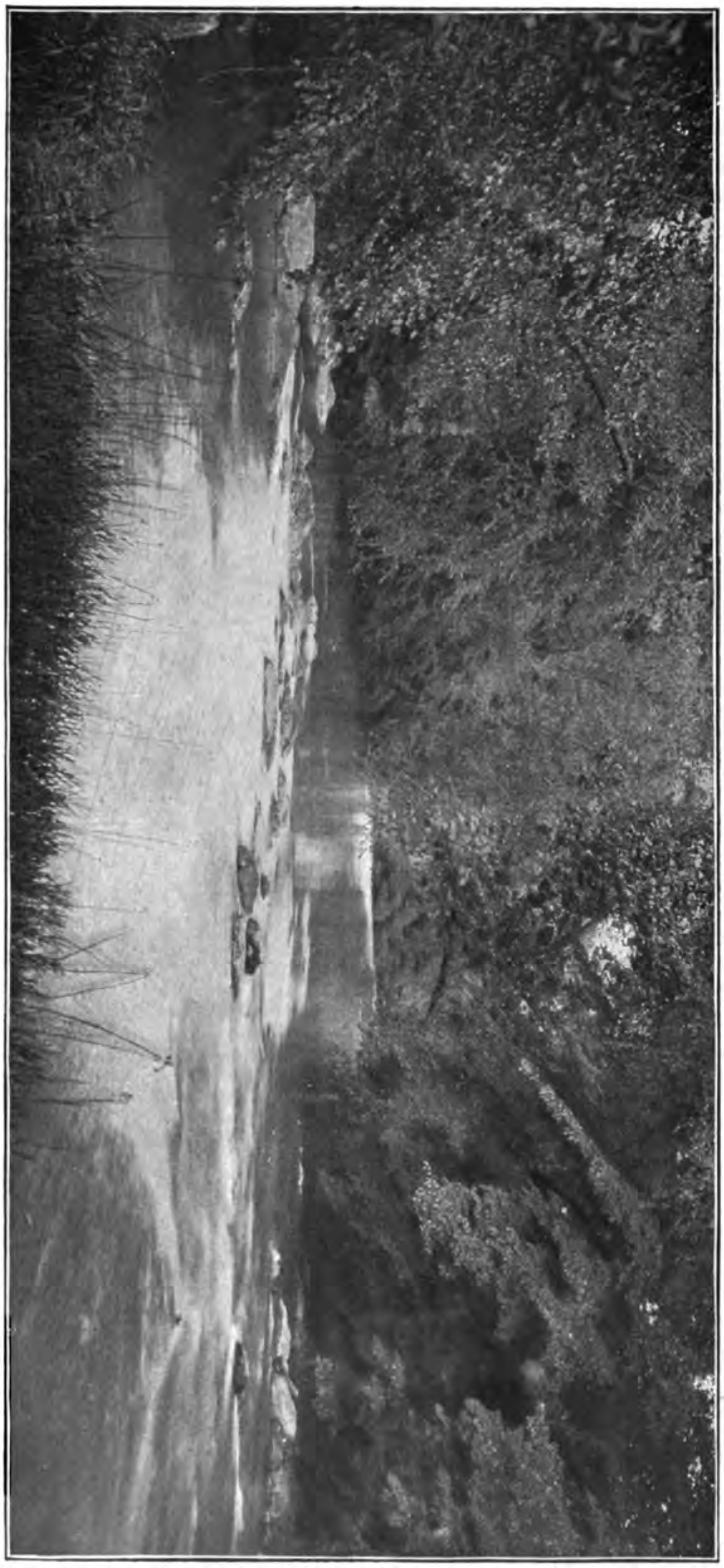
The area embraced in the proposed reserve belongs to that portion of the eastern United States characterized by the greatest annual rainfall, there being places along the southeastern slopes of the Blue Ridge which receive an annual precipitation not exceeded elsewhere in the United States, except along the northwest Pacific coast. The average rainfall for a period of more than ten years at various places in the southern Appalachian Mountains in northern Georgia and western North Carolina and South Carolina has been nearly 73 inches, while at times the precipitation for a single month has been between 20 and 30 inches, the greatest amount falling in the three summer months and the least in autumn, the amounts in winter and spring being about the same. It is worthy of remark that the average precipitation at Asheville is only about 42 inches—the smallest rainfall record made at any station in the region.



(Photographed by Lindsay.)

THE GORGE OF THE LINNVILLE RIVER ACROSS THE BLUE RIDGE. (See pp. 29, 126.)

On these steep, rocky walls are forests which should forever be preserved.



(Photographed by Ray.)

SWANNANOA RIVER, NEAR ASHEVILLE, N. C. (See pp. 29, 128.)

The birch and other water-loving trees which grow out over these mountain streams, to better catch the sunlight, add greatly to the beauty of their occasional stretches of deeper, placid water.

These and other facts concerning the general climatic conditions of this region are brought out in the accompanying paper by Professor Henry of the United States Weather Bureau, showing the records of temperature, rainfall, and humidity at the stations of the Weather Bureau between Lynchburg, Va., on the north, and Montgomery, Ala., on the south, and from Salisbury, on the east, to Knoxville, on the west.

Heavy rainfall.

The entire region is characterized by extremely heavy rainfall in very short periods of time, and owing to the steep slopes and the absence of lakes, ponds, or marshes, which could act as reservoirs and hold back the storm waters, protracted heavy precipitation is followed by a rather rapid increase in the flow of the streams, the rise lasting generally for only a few hours, and the stream soon assuming its normal stage of flow. This is more especially the case where there are forest clearings. Consequently these violent rains, under certain conditions—i. e., where rains are excessive and clearings extensive, or where forest areas are burned over so as to destroy the humus and undergrowth—give rise to floods which are very destructive to property and which cause occasionally the loss of human life. To a certain extent the forest acts as a reservoir, for it keeps the soil porous, allows it to absorb and hold the water for a time, and gradually gives it forth in the form of springs and rivulets. Where the areas have been deforested, however, the rain water forms small but swift-flowing torrents down the sides of the mountains, and quickly reaches the streams below. Deep channels are cut in the mountain sides, and all of the top fertile soil is carried off, leaving only the underlying clays, which are of poor quality and do not yield to cultivation.

After a storm the streams rising in the deforested areas are extremely turbid with mud from the mountain sides, while those from the forest areas are comparatively clear. This erosion can be noted by the most casual observer, and it forms one of the greatest menaces to the region. The soil is deep and fertile, as is shown by the splendid growth of forest trees and by its yield under the first cultivation, but it is only a question of time, if the forests are wantonly cut, when all of the soil and vegetation will be washed from the mountain sides and nothing will remain but the bare rock.

These floods, due to protracted rains, are also destructive in strips of valley lands bordering the streams in the mountain region and in the wider valleys along their courses across the lowlands beyond. Bridges, mills, settlements, public roads, dams for developing water power, indeed, everything in the course of such a mountain stream is liable to be swept away by its rapidly increasing force.

Damages from floods.

During the spring of 1901 this region was visited by the most severe rain storm of its recent history. Many of the streams rose to unprecedented heights, and the flood damages to the farms, bridges, and dwellings on or near practically all of the streams flowing from these southern Appalachian Mountains were enormous. During the summer season later floods added largely to this destruction.

Along the valley of the Catawba River in its course across the two Carolinas these flood damages to farms, bridges, highways, buildings, etc., during the high-water season of 1901, aggregated nearly two million dollars. The storm damages during the same season along the tributaries of the James, the Roanoke, the Yadkin, and the Broad, in Virginia and North Carolina, added a million dollars; and those on the tributaries of other streams rising about the Blue Ridge in South Carolina and Georgia add still another million, making four million in all for the streams flowing from the Blue Ridge across the Piedmont Plateau. Add to this the damages along the streams flowing out of the southern Appalachian Mountains to the north, west, and southwest, and we have another and a larger story of destruction:

On the New (Kanawha) and other smaller adjacent streams in Virginia and West Virginia	$1,000,000
On the Watauga, in North Carolina and Tennessee	2,000,000
On the Nolichucky, in North Carolina and Tennessee	1,500,000
On the French Broad and Pigeon, in North Carolina and Tennessee	500,000
On the Tuckasegee, Little Tennessee, and Hiwassee, in North Carolina and Tennessee	500,000
On the tributaries of western Georgia and Alabama streams rising in this region	500,000

This aggregate of $10,000,000 tells a story of destruction never before equaled in this region. Bridges were swept away by the score; houses by the hundred; thousands of miles of public roads were washed away almost beyond the possibility of repair. (See Pl. LXXVI.) The soil in the narrow, irregular, fringing valley lands in the mountain region was in many cases partially and in other cases completely washed away. In the lowlands beyond,

(A) SAWMILL WRECKED BY THE FLOODS ON THE NOLICHUCKY RIVER, EAST TENNESSEE, MAY, 1901. (See pp. 32, 130.)

(B) DÉBRIS FROM WRECK OF SAWMILL AND LOG BOOM ON LINNVILLE RIVER BY FLOODS, IN WESTERN NORTH CAROLINA, MAY, 1901. (See pp. 32, 130.)

(A) HIGHWAY BRIDGE WASHED AWAY BY FLOODS. (See pp. 32, 130.)

Many bridges on these Southern mountain streams, even when built on successively higher piers, have been washed away several times by floods during the past few years.

(B) PUBLIC ROAD RUINED BY FLOODS, MITCHELL COUNTY, N. C.

The clearing of the mountain slopes and the destruction of humus and undergrowth by forest fires cause the water from heavy rains to rush down the mountain sides on the public roads, and to wash the latter away. The damages to the public highways in the mountain counties of western North Carolina from this cause during the past few years are estimated to have reached several million dollars.

(A) FLOOD DAMAGES TO MINING SETTLEMENT, NORWOOD, W. VA., 1901.

(B) FLOOD DAMAGES TO RAILROAD AND MINING SETTLEMENT, KEYSTONE, W. VA., 1901.

The damages from floods in streams rising in these Southern Appalachian mountains during the spring and summer of 1901 aggregated $10,000,000; and during the following December, January, February, and March they reached $8,000,000 additional, making a total of $18,000,000.

TOCCOA FALLS, HABERSHAM COUNTY, GA. (See pp. 29, 138, 139.)

the broader bordering valleys were damaged beyond recuperation. Some areas were denuded of soil, while others were covered with desert-like, almost barren white sand extending for miles along the course of a stream. (See Pl. XXXIV.)

But while the damage from the storm of 1901 exceeds that of any preceding year, it is common knowledge among the mountaineers that annually the floods have risen irregularly but steadily higher, and that their destructive work has been increasing in proportion as the forest clearings and the forest burnings have proceeded. We may confidently expect that floods of the future will exceed those of the past.

Forest clearing and water powers.

Many of these streams have fine water powers along their courses, the value of which is limited by their low-water flow. Deforestation means the destruction of the only source of natural storage in the region, and that the rainfall will reach the stream almost as soon as it falls, so that in the dry season there will be no reserve supply to augment the low-water flow, which is drawn principally from subsurface sources. These water powers are a potential source of prosperity to the region in which they are found, and since their value depends entirely upon the water available, anything tending to reduce its amount or to change its distribution by increasing the violence of the floods and at the same time diminishing the low-water flow, will work injury in precise proportion to the change produced. This result is inevitable upon the deforestation of the drainage basin, and on many of the streams has already become evident. It is the general testimony of the older inhabitants of the region that the streams are now much more irregular than they were before active and widespread clearing operations had been begun. And while the evidence of the "oldest inhabitant," as an individual, may not be quite all that can be desired, collectively it is entitled to large credence. Already 24 per cent of the total area of this region has been cleared of its forests.

Forest destruction by lumbermen.

Lumbering operations are at present rather widespread, and the forests in many regions already begin to show evidence of their effect. The large mills are usually steam sawmills, to which the logs are either transported by a system of tramroads radiating from the site of the mill, or, where the mill is located near a stream of sufficient size, the logs are brought down by splashing. A number of small sawmills have been erected which make use of the abundant water power furnished by the various streams. These are, as a rule, of small capacity, from 500 to 1,000 feet per day, and do mainly the custom sawing for the region near by. In addition to these there are numerous small sawmills, owned for the most part by some firm holding extensive tracts of forest, and these are moved from place to place as the near-by timber becomes nearly exhausted.

In any case the effect of the sawmill on the forests is the same. All the trees available for use in any manner are cut into plank, and the careless methods destroy the greater part of the young growth, which would otherwise in course of time replenish the supply. The logs when cut are "snaked" downhill by mule team, soon cutting a deep channel in the earth, which the waters from the first rain storm turn into a yawning gully that rapidly spreads in extent. (See Pl. LIII.) The tops and those parts of the trunk unsuitable for lumber are left on the ground to furnish fuel for the first fire or a breeding place for insects destructive to tree life.

Forest destruction for tan-bark.

In addition to the lumbering operations, the tan-bark industry is making great inroads on forest growth. Every year thousands of cords of bark are stripped in these mountains, and each load means that some giant of the forest has been felled and lies useless, for the trunks are rarely used for timber, the expense of transporting them to the mills from the high mountain slopes being in most cases prohibitive.

Destructive work of forest fires.

But great as is the work of the lumberman in this forest destruction, his part has in the past been small when compared with that of the forest fire and that of the farmer in clearing land for agricultural purposes. Forest fires have been one of the great curses in the southern Appalachians as truly as elsewhere in the country. They were common in the days of Indian occupation. Thus, they have preceded the lumberman, but they have also accompanied him and followed in his wake. Their work has been rendered far more destructive because the lumberman has left his brush scattered among the remaining growth in such way that in the burning it has fed the fire.

In some regions these fires have destroyed the forests entirely. Especially has this been the case where the soil has been thin and composed largely of humus. The fire has destroyed this humus and the remaining soil has soon washed away, leaving the trees on the bare surface of rock, to dry out and die. (See Pl. XLVIII *b*.) Even under more favorable conditions these fires have destroyed the undergrowth, and the larger trees have been burned near their roots in such a way as to cause their destruction. (See Pl. XLVI.) The repeated fires have frequently exterminated the grasses and other forage plants, so that instead of improving the pasturage, which has often been the object in starting the forest fire, the result has been, in the course of years, its almost total destruction.

Forest fires cause irregular flow in streams.

This burning of the humus and the undergrowth in the forests always seriously affects the flow of the streams. No one who has ever been in a forest during a heavy rain storm can fail to realize this fact. In the virgin forests the raindrops are caught by the underbrush and pass downward through the humus into the less porous soil and the rock fissures beneath, to reappear weeks and months later in the form of numberless springs. But where this underbrush and humus have been burned away, one can not fail to see that during a heavy rain storm much less of the water soaks directly into the soil, and the remainder flows down the surface with a velocity varying with the slope, sometimes washing the soil into small furrows and gullies. Hence, the burning of this humus decreases the storage of water in the soil and causes the more rapid accumulation of this water in the brooks, and results in floods in the larger streams below.

Forest clearing on mountain slopes causes irregular flow in streams.

Following in the wake of the forest fire in this connection is the farmer who is continually clearing the mountain slopes for agricultural purposes. Instead of trying to improve his soil in the valley and on the adjacent slopes he has for years followed the policy of clearing additional patches on the mountain side as rapidly as others are worn out and abandoned. Each one of these hillside fields must be abandoned in from three to five years, as their productiveness is short lived. After the trees have been girdled and the underbrush has been destroyed, such a field may be planted in corn for one or two years, then in grain for a year, and one or two years in grass. Then it may be pastured for a year or two until with increased barrenness the grass gives place to weeds and the weeds to gullies. (See Pl. XLIX.)

Forest clearings and floods.

Within two or three years after these mountain-side fields have been cleared the soil loses its color, changing from dark gray or black to red, as the organic matter disappears. Meanwhile it is losing more and more its porous nature, and hence its capacity for absorbing water; and the rains being unable to soak into it wash it away.

Thus, the lumberman, the forest fire, and the farmer cooperate in the work of forest destruction and the consequent disturbance of the regularity of the flow of the streams. This increases the floods which destroy the valley lands below, and as the irregularity of their flow increases the streams lose their value for water powers during the dry season, and during the season of rain the floods wash away the farming lands in the valleys and carry destruction along their courses across the lowlands. As the rains wash away the cleared fields on the mountain slopes and the farming lands in the valleys, these soils on their way toward the sea incidentally silt up the river channels and the harbors. Hence, it is strictly true that in destroying forests these agencies are removing the soils, ruining the rivers, and destroying the mountains themselves; and along the lower courses of these streams they are thus destroying agricultural and manufacturing interests, and incidentally seriously affecting important navigation facilities.

The preservation of these mountain streams a forest problem.

In New England and many of the Northern States the numerous lakes and glacial deposits of sand and gravel, spread out over the hills and valleys, serve as storehouses for the water and help materially to preserve uniformity in the flow of the streams. In this respect they cooperate largely with the forest cover in that region; and indeed they would accomplish much in that direction were the forest cover entirely removed. But in the southern Appalachian region there are no lakes and no glacial gravels and sands; the forest and the soil are the factors upon which the solution of the problem of water storage depends. And that the problem resolves itself largely into one of forest cover, with its undergrowth and humus, is seen by the fact that in the streams of the Piedmont Plain of the South Atlantic States the irregularity in flow, as observed for a number of years, has been almost directly proportional to the extent of forest clearings. Observations and measurements of the southern Appalachian mountain streams made during the last few years show that the same is true in that region. Hence, here the water problem is a forest problem.

STREAM FLOW IN THE REGION AND ITS MEASUREMENT.

Southern Appalachian region a well-watered one.

The region is well watered, and from it several of the largest rivers of the country receive their supply. (See Pl. XII.) The chief rivers in the States of Virginia, North Carolina, South Carolina, Georgia, Alabama, Tennessee, and West Virginia rise in these mountains. One of the principal tributaries of the Ohio and one of the largest feeders of the Mississippi head here also. So that this region may justly be considered one of the important watersheds of the United States. The Yadkin, Catawba, Broad, Saluda, and Chattooga flow into the Atlantic. The Chattahoochee and the Coosa flow into the Gulf. New River flows to the north and enters the Kanawha, whose waters finally reach the Mississippi through the Ohio, while the Tennessee, with its large tributaries, the Holston, the Nolichucky, and the French Broad, flow to the west through the State of Tennessee, finally entering the Mississippi. The Cheoah, the Nantahala, the Oconalufty, and the Tuckasegee, all large streams from 50 to 100 yards wide, join their waters to the Tennessee and flow in a narrow and rocky gorge through the Great Smoky Mountains, while the Hiwassee unites with that river in the State of Tennessee beyond the mountains.

An examination of the watersheds and a general investigation of the streams in this mountain region were made by the United States Geological Survey during the summer of 1900, the detailed results of which will be published in a series of Water-Supply and Irrigation Papers of the Survey. The following general facts are, however, presented for publication in this paper.

Stream measurements.

During the hydrographic investigation of this region, extending through 1900 and 1901, measurements of flow were made on the larger streams and more than one thousand of their upper tributaries, and 54 gauging stations were established. At each station a gauge was permanently placed, upon which the height of the water surface was read and recorded daily by a local observer, and to which were referred the current-meter measurements, which were made about every sixty days, or oftener, as circumstances demanded or permitted. From these data a curve was platted, according to the method usually followed by the Survey. From this curve, the mean of the daily gauge readings being known, the approximate daily discharge has been calculated. The great difficulty encountered at these stations was to obtain measurements at the time of high water, for after a rain the rivers rise rapidly and fall as quickly. Hence, unless the observer is on hand at the time, the high water passes before he can reach the point of measurement. A list of the gauging stations in this region from which data have been obtained is given in the following tables (see Pl. XII):

Special gauging stations established by the United States Geological Survey on streams of the southern Appalachian region.

Stream.	Station.	Date established.
New River	Oldtown, Va	Aug. 5, 1900
South Fork of New River	New River, N. C	July 29, 1900
North Fork of New River	Weaversford, N. C	Do.
Yadkin River	Siloam, N. C	Aug. 3, 1900
Catawba River	Morganton, N. C	June 19, 1900
John River	do	Do.
Linville River	Bridgewater, N. C	July 3, 1900
Broad River	Dellinger, S. C	Aug. 30, 1900
South Fork of Holston River	Bluff City, Tenn	July 17, 1900
Watauga River	Butler, Tenn	Aug. 11, 1900
Roan Creek	do	Do.
Elk Creek	Lineback, Tenn	Aug. 5, 1900
Nolichucky River	Chucky Valley, Tenn	Sept. 20, 1900
Pigeon River	Newport, Tenn	Sept. 4, 1900
French Broad River	Oldtown, Tenn	Do.

Besides the foregoing stations, which were established during the summer of 1900, the following gauging stations have been maintained for several years upon streams flowing from the southern Appalachian Mountains:

Regular gauging stations on streams flowing from the Southern Appalachian Mountains.

River.	Station.	River.	Station.
New	Radford, Va. Fayette, W. Va.	Oconee	Near Dublin, Ga.
James	Glasgow, Buchanan, Cartersville, and Holcomb Rock, Va.	Chattahoochee	Oakdale and Westpoint, Ga.
Roanoke	Roanoke, Va. Neal, N. C.	Coosawattee	Carters, Ga.
Dan	South Boston, Va.	Oostanaula	Resaca, Ga.
Staunton	Randolph, Va.	Coosa	Rome, Ga. Riverside, and Locks Nos. 4 and 5, Ala.
Yadkin	Salisbury and Norwood, N. C.	Toccoa	Near Blueridge, Ga.
Catawba	Catawba, N. C. Rockhill, S. C.	Nottely	Ranger, N. C.
Broad (of the Carolinas).	Alston, S. C.	Hiwassee	Charleston and Reliance, Tenn. Murphy, N. C.
Saluda	Waterloo, S. C.	Tennessee	Chattanooga and Knoxville, Tenn.
Tallulah	Tallulah Falls, Ga.	Little Tennessee	Judson, N. C.
Tugaloo	Near Madison, S. C.	Tuckasegee	Bryson, N. C.
Savannah	Calhoun Falls, S. C. Augusta, Ga.	French Broad	Asheville, N. C.

These stations cover every stream rising in the southern Appalachian Mountain area.

Besides measurements at the foregoing regular stations miscellaneous measurements were made in the watersheds of all of the larger rivers, on both the main streams and on their principal tributaries. The following large rivers were measured: Yadkin, Catawba, Broad (of the two Carolinas), Saluda, Tugaloo, Broad (of Georgia), Savannah, Oconee, Ocmulgee, Chattahoochee, Etowah, Coosawattee, Conasauga, Coosa, Tallapoosa, New, French Broad, Nolichucky, Holston, Watauga, Tennessee, Hiwassee, and Toccoa (or Okoee). A complete list of the measurements made, showing the discharge of the various rivers and their tributaries, has been published in Water Supply and Irrigation Paper of the United States Geological Survey No. 49.

In some respects the summer of 1900 was a peculiar one in the Appalachian region. Rain was abundant during June, and the streams were moderately high during the early part of the summer, but later very little rain fell, and most of the rivers and their tributaries were at an extremely low stage, as low as they have been for a number of years. During the spring of 1901, however, the rivers were at a higher stage, and a number of high-water measurements were obtained, the results of which will be published in a later number of the Water-Supply Papers by the United States Geological Survey. With a view to making more than one measurement at the same place on each stream a bench mark was established at the time the first measurement was made, and the relative height of the water surface was noted at each succeeding gauging, so that in this way the relation between the rise of the stream and the discharge could be ascertained. Examinations were also made for the watermarks at the time of previous floods, and when the yearly fluctuations of the streams could be obtained they also were noted. With the numerous gauge heights, and measurements of flow that have now been made, fairly complete data of the flow from the various drainage basins are available.

Stream conditions in 1900 and 1901.

VALUE OF THESE MOUNTAIN STREAMS FOR WATER-POWER PURPOSES.

The greater part of this region is occupied by gneissic rocks, having for the most part a characteristic northeast-to-southwest strike, the irregular rock layers dipping

Conditions favoring water-power development.

beneath the surface at varying but generally steep angles. The southern half of the region has along its western border an irregular belt of bedded slates, limestones, quartzites, and conglomerates. These rocks, which make up the great bulk of the surface, have a general northeasterly strike and a steep but varying dip; while near the eastern border there is another, but narrow and more irregular, belt of rock of somewhat similar character, which follows approximately the general position of the Blue Ridge, and dips steeply southeastward.

As stated above, the important streams rising in Virginia, the Carolinas, and Georgia have their origin on the slopes of the Blue Ridge. Those rising on the eastern slope, such as the James, Roanoke, Yadkin, Catawba, Broad, Savannah, and Chattahoochee, flow generally toward the southeast, their head streams plunging down the mountain slopes many hundreds of feet in short distances and soon reaching the gentle slope of the Piedmont Plain. (See Pls. XXVII and LXX.) The streams rising on the western slopes of the Blue Ridge—the Watauga, Nolichucky, French Broad, Pigeon, Little Tennessee, Tuckasegee, and Hiwassee rivers—flow in the general characteristic northwesterly direction across the upturned ridges of the gneiss and more recent bedded rocks, with frequent falls, into the great valley of East Tennessee. (See Pl. LXXI.) The Holston River, which flows along this valley from its upper end to its junction with the Tennessee system, forms an exception to the general direction of flow in this region, for its course lies toward the southwest; and the Coosa River, of Alabama, which has its headwaters on the southeastern slopes of the Blue Ridge, takes a similar direction. The New River, also, which rises in the cross ranges connecting the Unakas and the Blue Ridge, flows toward the northwest into the Ohio. The elevation of the country is so great and the descent of the stream is so rapid that the general course of the principal rivers has been but little modified by the geologic structure of the region, though they lie directly across the strike of the rocks. The resulting conditions produce occasional falls and cascades in the streams (see Pl. LXXVII); but the larger part of the courses of these streams consists of a succession of rapids (see Pl. LXXIII), furnishing ample opportunities for water-power development by the building of dams at intervals across the deep, narrow gorges. A number of the smaller tributary streams in North Carolina and in

IMPROVED WATER POWER, ON THE SAVANNAH RIVER, AT AUGUSTA, GA., OPERATING COTTON MILLS. (See pp. 29, 139–141.)

The principal sources of this and other important rivers of the Southeastern States are within the region of the proposed Appalachian forest reserve; and the perpetuation of the water powers on these streams, valued at more than $20,000,000 per annum, depends largely upon the preservation of these mountain forests.

Virginia flow in either a northeast or southwest direction along the strike of the rocks, and at places give rise to conditions favorable to water-power development. This is the case for the most part where a change in the direction of flow causes a change in the character of the rock in the stream bed.

In northern Georgia different conditions seem prevalent; the general course of the stream is southeast or southwest, and many shoals and cascades are to be found. Some of the cascades are of great height, and large water powers could be easily and cheaply developed. Notable among these are Tallulah Falls (see Pl. XXVIII), where the descent is 335 in about 4,000 feet; Duke's Creek Falls, Minnehaha Falls, and Annie Ruby Falls, where the descent in each case is about 300 feet within a short distance. These are found on rather small streams, but illustrate the difference in the prevalent condition.

Waterfalls and cascades in the Georgia portion of the Southern Appalachians.

As before stated, this part of northern Georgia embraces the headwaters of three great drainage systems, the Coosa, the Chattahoochee, and the Savannah. At various points along their courses all of these streams possess magnificent water powers which present conditions favorable to development, and which at some future time will be made to supply the varied and growing industries of the nearby region with the power necessary for their continuance and growth. Any impairment of these powers by diminution of the low-water flow of these streams will most assuredly work great injury in future years to the industrial welfare of the region.

Development of manufacturing enterprises.

The States through which flow the streams rising in the region of the proposed Appalachian Forest Reserve have for many years past been devoted mainly to agricultural pursuits; but within recent years a great awakening has come, and a tendency to manufacture the raw material at home has become manifest. Already the results are to be seen in the increased prosperity of the region, resulting from the development of diversified industries.

This tendency is growing with great rapidity, and while its beneficial effects will be felt most in the section where it has appeared, it can not fail to have a considerable influence on the prosperity of the entire country, for prosperity comes to those who produce sooner than to those who consume—to the seller who can supply the commercial needs of the world, rather than those who feel the want.

Importance of water-power preservation.

Water power is universally recognized as the cheapest power to be secured for any species of manufacture, for when once the constructional development is at an end the attendant expenses become very small, since, through the operation of the laws of nature, the water flows without cost by day and night, while every ton of coal that passes in at the furnace door represents a certain expenditure, and in plants requiring great power this fuel cost may come to represent a large proportion of the cost of manufacture.

In the past the chief advantage of steam power over water power was the mobility of the former, for steam could be generated wherever fuel could be obtained and mills could be built and where the transportation facilities were such as to insure the quick disposal of the finished product. By reason of the great improvements in electrical transmission of power, steam has lost its advantage, for water power can now be brought to a mill for distances of many miles more cheaply than power can be obtained from coal at most points. The water powers, therefore, in the not far distant future, may become as valuable as coal mines, and as the local coal supply becomes more costly by reason of deeper mining, the water powers will increase in value.

This wealth should not be wantonly wasted. Its present value can be conserved and its future value increased by the preservation of the forests about the headwaters of the streams; and this preservation would seem desirable, therefore, if for no other reason than this, entirely apart from the wealth-producing capabilities of the forests themselves.

Aggregate water power in southern Appalachian region.

It is impossible at this time to give an accurate statement of the total power available on all the streams rising in and flowing from this area, for the reason that the power on any stream can not be determined accurately without a survey of the entire course of the stream with this object in view, and any discussion of this, based on the total fall from source to mouth and the average quantity of water carried by the stream, would be worse than misleading; for the mere fact that there is on any stream a certain fall within a certain distance, over which flows a certain amount of water, does not mean that this locality constitutes an available water power. Theoretically the power is there, but practically it is nonexistent unless it can be developed and brought to use for a sum which is not prohibitive. In other words, the availability of a water power depends entirely on the economic situation at the point considered, and every location must be viewed by itself in such determination.

It is, however, certain that on all of these streams large amounts of power can be easily and cheaply developed when the demand for it is sufficient, for the average fall in the streams is great, and is noticeably high at great numbers of points, while the low-water flow is fairly large on account of the large annual rainfall and the storage effect of the great forests. Furthermore, at many points, the conditions favorable for easy and cheap development are present; and on some of the streams surveys have been made which render approximate estimates easy. The more important of these are given below.

Water power available and that already developed on these streams.

In regard to the power actually utilized conditions are more favorable, since such information can be readily obtained by letter and inquiry from the owners and users thereof, and such has been obtained and is presented below. The aggregate amount is very small, for the reasons that the entire region is largely agricultural in its pursuits and that manufacturing is only beginning.

On the New (Kanawha) River and its tributaries, where the available horsepower amounts to 60,000, the amount actually reported as used is 8,700 horsepower, of which amount 2,500 is used by a single plant recently built.

On the James River the amount of available power is estimated as 45,000 horsepower, the amount actually used being 14,000. On the Roanoke River the available horsepower is estimated as about 50,000, of which not more than 17,000 is actually in use. On the Yadkin River the available horsepower is estimated at 60,000, the amount actually used being about 2,500. The available power on the Catawba River is estimated at 57,000 horsepower, the amount in use being 4,000 horsepower. On Broad and Saluda rivers the available power is estimated at 43,000 horsepower, the amount actually used being about 25,000 horsepower. The available power on the Savannah River is estimated to be about 77,000 horsepower, the amount used being about 1,000 horsepower. Near the fall line the city of Augusta has developed about 11,000 horsepower.

On the Chattahoochee River the available power is estimated by Mr. B. M. Hall to be 115,000 horsepower, the amount utilized being only about 10,000, while the available power on the Coosa River is about 140,000 horsepower, the amount in use being approximately 13,000.

On the Tennessee River, in Alabama, there is available 100,000 horsepower, while on the tributaries of the Tennessee, in North Carolina and Tennessee, large amounts of power are available, as shown in the following paragraphs:

On the Hiwassee and its tributaries the available power is estimated to be 75,000 horsepower, though the amount used is very small, the only users of power in the basin being some small plants.

On the Little Tennessee system, including the Little Tennessee, Cheoah, Tuckasegee, Nantahala, Oconalufty, Tellico, Ellijay, and Little Pigeon rivers, the available power is 100,000, while the amount utilized is only 1,700.

On the French Broad River and tributaries, rising in the southern Appalachian Mountains, the aggregate horsepower available is 50,000, while that used is about 3,500, though more than this will come into use in the near future when some developments which are now under way are completed. Others in this basin are projected.

In the Nolichucky Basin about 700 horsepower is in use, and 35,000 is available.

On the Watauga the amount of power available is 20,000, while only a few small powers have been developed, aggregating 450 horsepower. In the Holston Basin 4,700 horsepower has been utilized, and 40,000 remain undeveloped.

It would be entirely safe to estimate the available but undeveloped water power on the streams rising among the southern Appalachian Mountains as equivalent to not less than 1,067,000 horsepower, and the developed power is 117,750. It would also be entirely correct to state that the future value of these water powers, as indeed the future value of almost everything of value about these mountains, depends largely upon the future preservation of the forests.

APPENDIX D.

CLIMATE OF THE SOUTHERN APPALACHIANS.

BY

ALFRED J. HENRY,
Professor of Meteorology,
United States Weather Bureau.

LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Weather Bureau,
Washington, D. C., December 12, 1901.

Sir: I beg to transmit herewith, in response to your request of a few days since, a short report on the climate of the southern Appalachian region, by Prof. Alfred J. Henry of this Bureau.

Tables of monthly means and extremes of temperature, average rainfall, and relative humidity accompany the paper.

Very respectfully,

Willis L. Moore,
Chief, United States Weather Bureau.

Hon. James Wilson,
Secretary of Agriculture, Washington, D. C.

THE CLIMATE OF THE SOUTHERN APPALACHIANS.

By Alfred J. Henry,
Professor of Meteorology, United States Weather Bureau.

The climate of the southern Appalachian region possesses some distinctive features, yet, on the whole, it is rather closely related to the great continental type of the middle latitudes. The pure type of continental climate—cold winters and hot summers—is found immediately to the westward in the Mississippi Valley and the plains region beyond, up to the foothills of the Rocky Mountains. The Atlantic slope has a climate somewhat less severe than that of the interior valleys, being oftener under the influence of warm southerly winds in winter and cooling oceanic winds in summer.

Climatic conditions vary with topographic features.

Intermediate in geographic position between the two great areas just mentioned the southern Appalachian region naturally possesses a climate that partakes somewhat of the main features of the climatic zones both to the westward and the eastward. Its distinctive features are lower temperature, both summer and winter, a drier atmosphere, greater rainfall and snowfall, higher wind velocity, and a greater intensity of the direct solar rays. These characteristics are due for the most part to the greater altitude of the Appalachian region as compared with surrounding levels. In a region of such extremely varied topography there must naturally be limited areas in which, owing to some natural advantage of position or exposure, the climatic conditions are materially different from those which obtain over the greater part of the region. Thus, for example, a mountain slope or a valley facing southward would naturally possess a higher temperature and an immunity from frost not to be found in similar orographic conditions with a northern exposure.

Temperature. The temperature of the region as a whole can not well be stated, since it is in general proportional to the altitude and is always higher on southern than on northern slopes. Few meteorological observations of any character whatsoever have been made except in the valleys and lower levels; indeed, with the exception of a few months' observations on the summit of Mount Mitchell, no meteorological observations are available for the 4,000-foot level and but two series of observations for the level between 3,000 and 4,000 feet.

The monthly means and extremes of temperature, to which reference will again be made, are given for a number of stations in the tables which accompany this paper.

Winds and weather types. The wind system of the southern Appalachians in spring, fall, and winter is largely conditioned by the movement in latitude of cyclonic and anticyclonic storms. In the summer season these disturbances move across the country so far to the northward that their influence upon the weather of the southern Appalachians is almost inappreciable. The winds of summer will depend very largely upon the contour of the country, being upward from the valleys along the mountain side during the day and downward at night, with a general westerly drift over the mountain summits. In the more boisterous circulation of spring, late fall, and winter the winds are almost wholly controlled by the atmospheric disturbances passing eastward over the lake region or northeastward from the Gulf of Mexico.

The movement of cyclonic storms eastward across the lake region produces a type of weather in the southern Appalachians which, for convenience, may be called the *southwest* type. The chief characteristics of this type are southwesterly winds with rising temperature and increasing cloudiness. The velocity of the wind generally increases for a day or so, and finally shifts to the west and northwest, with lower temperature, but not much rain. The southwest is the most common type experienced, and is often associated with long periods of fair, dry weather.

Next in point of frequency to the southwest type is what may be called the *west gulf* type, from the fact that the weather with which it is associated is produced by storms which approach from the west Gulf States. In this type fresh to brisk southeast to east winds are experienced with generally heavy rain throughout the entire region. As soon as the storm passes the winds shift to a westerly quarter, with markedly cooler weather and frequently snow on the higher summits in winter.

A third type of weather may be mentioned, viz, a type produced by storms which move from the Gulf of Mexico or the West Indies northeastward along the Atlantic coast. In this type strong northeast to north winds prevail. The rainfall, especially in the warm season, is often torrential, and in spring and autumn may continue for several days in succession. In winter such storms are attended by heavy snow and followed by very cold weather.

Weather conditions at high levels.

In 1873 a party of Signal Service observers spent the months of May, June, July, and August on the summit of Mount Mitchell, North Carolina, carefully observing the temperature, rainfall, barometric pressure, and other features of the weather.

The highest temperature observed on the summit of the mountain during the four months was 72° in July; the lowest, 41° in June. The monthly mean temperatures for the four months were as follows: May, 49.3°; June, 54.1°; July, 56.4°, and August, 55.3°. The rainfall was very heavy, 36.8 inches being recorded while the observers were on the summit. Rain fell on 21 days in May, 22 in June, 15 in July, and 21 in August. There was a great abundance of foggy and cloudy weather, the fog and clouds being frequently below the summit. The prevailing winds were from a westerly quarter.

A summary of meteorological observations in the southern Appalachian region appears in the tables which accompany this paper. The highest point at which observations have been made is at Highlands, N. C., elevation 3,817 feet. The mean temperature of summer at that station is 65.7°, of winter, 35.4°. The extremes reached during a period of eight years, 1893–1900, were 19° below zero in February, 1899, and 86° above zero in June, 1895. The temperature has not reached 90° at that station or at Linville, N. C., the next highest station, altitude 3,800 feet, during the period of observations.

Rainfall.

The precipitation on the southern slopes of the Blue Ridge and connecting spurs is the heaviest in the United States with the exception of the north Pacific coast. It ranges from about 60 inches in northern Georgia to 70 inches in western North Carolina, whence it diminishes northward, falling as low as 40 inches in the southwestern part of Virginia and to almost that figure locally in several portions of the intermediate region. The rainfall of the western slope of the Appalachians in considerably less than on the summits and along the eastern and southern flanks of the mountains, though it generally averages from 40 to 50 inches annually on the lower levels.

As previously stated, the rainfall in the southern Appalachian region is occasionally torrential in character. The mountain ranges of western North Carolina and northern Georgia are so situated with respect to the rain-bearing winds as to greatly facilitate the rapid condensation of moisture, whether borne by the winds from the Gulf of Mexico or the Atlantic Ocean. The indraft of warm, moist air from these great storehouses of moisture and the subsequent cooling as it is forced up the mountain sides give downpours of rain seldom experienced in the adjacent lowlands. On September 22, 1898, 7.57 inches of rain fell within 24 hours at Linville, 6 inches at Lenoir, 8.30 inches at Paterson, 6.75 inches at Marion, and 5.75 inches at Flat Rock. During August, 1901, the total rainfall for the month at Flat Rock was 30 inches; at Highlands, 30 inches; at Hendersonville, 26 inches; at Horse Cove, 26 inches; at Paterson, 24 inches, and at Marion, 21 inches. The precipitation for the year 1898 in western North Carolina at Highlands was 105.25 inches; at Horse Cove, 99.97 inches; Flat Rock, 78.39 inches, and Linville, 71.05 inches. These heavy downpours naturally cause destructive floods in the streams whose headwaters penetrate the mountain region. The severity of the floods is in a large measure mitigated by the fact that a large proportion of the rainfall is conserved by the forest covering, which abounds on the greater part of the area, and is thus prevented from reaching the streams quickly and in great volume, as would be the case were the mountain sides and the summits bare. It is a mistake to suppose the forests *per se* tend to increase precipitation. The precipitation would be equally heavy, forest or no forest. In the latter case it would run off more quickly and the regimen of the streams would be much more irregular than in the case of a forested area.

Not much can be said of the relative humidity of the higher elevations, since no observations have been made. Along the western edge of the Piedmont Plateau the air is considerably drier than on the coastal plain. Tables of monthly mean relative humidity for Atlanta, Ga., Charlotte and Asheville, N. C., and Chattanooga and Knoxville, Tenn., accompany this report, and there have been added, for the sake of comparison, similar data for Savannah, Wilmington, and Raleigh on the east, Montgomery on the south, and Memphis, Nashville, and Cincinnati on the west. The data for Asheville are not directly comparable with those of the remaining stations, since the Asheville observations were made three times daily, viz, at 7 a. m., 2 and 9 p. m., whereas observations at the remaining stations were made but twice daily, viz, at 8 a. m. and 8 p. m. The omission of an observation during the driest part of the day tends to give mean values somewhat above the true figures. Nevertheless, the observations at Asheville confirm the local belief that the relative humidity of the mountain region is less than that of lower levels.

TABLE 1.—*Normal monthly mean temperature (in degrees Fahrenheit,) compiled in the Weather Bureau, United States Department of Agriculture, from observations extending over a series of years.*

Stations.	Elevation above sea level.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.
Georgia:	*Feet.*	°	°	°	°	°	°	°	°	°	°	°	°	°
Clayton	2,100	39.8	39.1	49.8	56.5	66.6	73.1	74.4	74.8	69.1	57.2	48.2	41.2	57.5
Diamond	2,020	38.0	41.4	47.6	57.5	65.2	72.3	74.6	73.1	69.0	56.7	48.4	41.9	57.1
North Carolina:														
Abshers[a]	......	39.2	35.8	47.2	53.7	65.2	73.2	76.7	75.9	69.9	60.9	48.1	39.5	57.1
Asheville	2,250	37.8	39.8	45.7	54.8	62.6	69.6	72.0	70.6	64.9	58.2	45.2	38.9	54.6
Highlands	3,817	33.5	36.6	41.6	50.6	57.5	64.7	67.1	65.4	60.2	51.0	42.2	36.0	50.5
Linville	3,800	31.0	31.0	40.5	46.7	57.6	62.4	66.1	64.9	59.7	47.3	41.4	34.8	48.6
Tennessee:														
Bristol	1,757	33.9	33.5	45.3	54.1	64.6	71.7	73.8	72.2	67.7	55.4	45.4	36.0	54.5
Chattanooga	762	41.0	45.5	50.5	60.9	67.7	75.2	77.8	75.9	70.7	60.5	49.9	43.6	59.9
Greeneville	1,581	36.6	40.1	46.3	57.0	64.5	72.2	74.7	73.3	69.1	56.9	46.5	39.5	56.4
Knoxville	1,004	37.7	42.3	47.6	58.2	66.2	73.6	76.4	74.8	69.3	57.6	46.6	39.9	57.2
Rogersville	1,212	35.8	39.3	45.9	56.5	64.3	71.9	74.4	73.5	68.2	55.9	46.2	38.2	55.8
Virginia:														
Bigstone Gap	1,966	32.7	33.8	45.5	53.5	62.5	70.1	72.0	71.2	66.2	53.8	43.5	34.5	53.3
Lynchburg	681	36.8	40.0	45.2	55.9	66.0	74.2	77.5	75.3	69.0	57.1	46.3	39.3	56.9
Wytheville	2,370	31.5	33.2	43.3	52.5	63.2	69.0	72.0	71.0	65.7	53.8	43.7	35.5	52.9

[a] Record for 4 years and 6 months only.

TABLE 2.—*Highest temperatures observed during the eight years 1893 to 1900, at the points named;*[a] *compiled in the Weather Bureau, United States Department of Agriculture.*

Stations.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Georgia:	°	°	°	°	°	°	°	°	°	°	°	°
Clayton	70	71	83	91	94	96	96	95	93	89	76	69
Diamond	65	68	81	91	94	97	98	94	94	86	76	67
North Carolina:												
Abshers[b]	73	73	85	89	93	98	99	100	98	92	83	72
Asheville[c]	70	72	86	90	91	94	94	95	95	87	80	68
Highlands	63	66	75	81	84	86	85	85	84	77	69	60
Linville	61	61	75	79	83	83	84	85	82	74	66	59
Tennessee:												
Bristol[d]	68	72	81	88	89	94	96	94	92	86	77	66
Chattanooga	75	78	85	90	93	98	101	100	98	91	79	73
Greeneville	71	74	82	88	91	95	96	97	96	89	77	68
Knoxville	74	79	83	90	94	99	100	100	99	94	81	75
Rogersville	69	74	81	90	89	96	93	96	95	88	74	67
Virginia:												
Bigstone Gap	67	74	82	90	92	96	97	95	96	88	77	68
Lynchburg	77	75	86	95	97	98	102	100	99	92	81	73
Wytheville	65	71	84	87	91	92	97	97	99	86	80	70

[a] From 1893 to 1900, inclusive, except Chattanooga from 1879 to 1900, Knoxville from 1871 to 1900, and Lynchburg from 1873 to 1900, inclusive.
[b] Record from April, 1897, to September, 1901, inclusive.
[c] From May, 1898 to 1900, inclusive, record from Biltmore, N. C.
[d] Record from 1894 to 1900, inclusive.

TABLE 3.—*Lowest temperatures observed during the eight years 1893 to 1900, at the points named;*[a] *compiled in the Weather Bureau, United States Department of Agriculture.*

[Minus signs indicate temperatures below zero F.]

Stations.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Georgia:	°	°	°	°	°	°	°	°	°	°	°	°
Clayton	1	− 5	8	23	31	42	50	47	36	24	14	2
Diamond	− 6	−12	− 3	25	32	47	46	50	35	27	11	8
North Carolina:												
Abshers[b]	4	− 9	5	20	34	46	44	51	30	25	16	1
Asheville[c]	− 9	−10	4	22	30	45	45	48	34	22	13	− 3
Highlands	−14	−19	− 7	15	27	35	43	45	27	20	6	−10
Linville	−15	−16	− 4	15	29	37	40	38	28	18	9	− 5
Tennessee:												
Bristol[d]	−15	−20	2	20	30	43	50	46	27	23	14	−11
Chattanooga	− 7	−10	2	25	40	39	56	54	38	27	16	3
Greeneville	−20	−14	3	21	31	35	51	49	31	26	16	− 4
Knoxville	−16	−10	5	24	34	43	52	50	35	25	12	− 5
Rogersville	−13	−17	7	24	34	46	52	51	33	27	13	− 1
Virginia:												
Bigstone Gap	−26	−18	3	21	26	33	40	43	25	19	8	− 5
Lynchburg	− 6	− 3	14	25	34	45	53	47	35	28	13	− 5
Wytheville	− 5	− 9	3	19	32	41	46	46	33	21	13	− 5

[a] From 1893 to 1900, inclusive, except Chattanooga from 1879 to 1900, Knoxville from 1871 to 1900, and Lynchburg from 1873 to 1900, inclusive.
[b] Record from April, 1897, to September, 1901, inclusive.
[c] From May, 1898 to 1900, inclusive, record from Biltmore, N. C.
[d] Record from 1894 to 1900, inclusive.

TABLE 4.—*Mean monthly and annual precipitation, in inches and hundredths; compiled in the Weather Bureau, United States Department of Agriculture, from all available records from the beginning of observations to December, 1900.*

Stations.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
Georgia:													
Clayton	7.05	5.93	6.79	5.26	3.37	3.40	8.79	7.10	5.08	4.45	4.22	4.58	66.02
Diamond	6.78	4.21	5.24	5.06	4.14	4.46	6.50	4.85	3.31	2.18	4.68	5.00	56.41
North Carolina:													
Abshers [a]	3.50	4.19	6.34	4.99	4.76	6.45	5.92	7.07	5.22	6.36	3.11	3.41	61.32
Asheville	3.17	3.48	3.86	3.20	3.70	3.99	5.05	4.56	2.83	2.62	2.99	2.93	42.38
Highlands	6.53	8.19	5.91	6.25	4.45	5.53	6.21	6.17	6.02	4.78	4.94	6.32	71.30
Linville	4.08	4.08	4.45	5.26	4.49	4.86	8.29	3.76	4.59	6.69	5.58	5.60	61.73
Murphy	6.19	6.44	6.46	5.00	3.51	5.51	6.53	5.40	3.18	2.80	4.58	4.96	60.56
Tennessee:													
Bristol	2.96	3.62	5.80	2.19	3.14	3.36	5.76	4.47	2.68	1.97	2.41	2.39	40.75
Chattanooga	6.19	5.32	5.95	4.52	3.89	4.49	4.22	3.80	3.70	2.71	3.79	4.32	52.90
Greeneville	3.66	4.30	5.16	3.36	4.11	4.76	4.90	4.16	2.32	2.59	2.47	2.66	44.45
Knoxville	5.53	5.32	5.37	4.95	3.92	4.10	4.32	4.07	2.70	2.79	3.81	4.11	50.99
Rogersville	3.86	4.92	5.28	3.54	3.94	3.83	4.84	3.88	2.22	2.72	3.01	3.68	45.72
Virginia:													
Bigstone Gap	3.93	5.06	7.06	3.17	5.37	3.67	7.11	4.85	2.34	2.65	2.65	3.24	51.10
Lynchburg	3.95	3.53	3.67	3.36	3.91	3.46	3.90	4.01	3.81	3.26	2.94	3.05	42.85
Wytheville	2.16	3.54	2.85	2.42	3.70	4.30	4.76	4.42	3.54	3.10	1.67	2.42	38.88

[a] Record for 4 years and 6 months only.

TABLE 5.—*Monthly mean relative humidity; compiled in the Weather Bureau, United States Department of Agriculture.*

Stations.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.	Length of record.
	P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*Per cent.*	*Years.*
Atlanta, Ga	76.4	73.9	68.6	62.4	65.8	71.1	76.3	77.9	75.2	68.4	73.3	75.6	72.1	9
Charlotte, N. C	72.3	72.4	68.1	62.9	67.1	72.0	75.8	78.2	77.7	69.8	72.0	72.6	71.7	9
Chattanooga, Tenn	78.2	73.8	69.0	65.6	72.8	75.4	76.6	78.1	78.8	73.1	73.0	75.9	74.2	9
Knoxville, Tenn	76.0	70.9	68.0	62.7	71.4	74.3	77.3	78.9	76.9	72.6	73.3	75.3	73.1	9
Asheville, N. C	68.7	65.4	63.6	59.2	65.6	67.1	72.9	73.0	73.5	66.3	62.5	65.0	66.5	9
Savannah, Ga	77.2	78.3	74.1	74.4	74.3	78.6	81.3	83.4	84.1	78.2	80.6	80.0	78.7	9
Wilmington, N. C	79.1	80.1	78.7	76.7	78.9	81.8	84.0	84.6	83.2	79.3	80.7	78.6	80.5	9
Raleigh, N. C	74.4	74.3	70.1	66.9	71.9	73.3	77.6	80.4	79.0	73.6	76.1	72.9	74.2	9
Montgomery, Ala	75.3	74.7	68.8	64.8	66.8	70.1	76.0	78.1	74.0	69.0	72.7	75.6	72.2	9
Memphis, Tenn	75.9	73.2	70.7	66.3	69.8	72.9	75.3	75.3	75.0	70.6	74.0	75.6	72.9	9
Nashville, Tenn	76.6	74.2	68.4	63.7	67.6	70.7	71.9	72.3	74.0	68.7	72.8	74.6	71.3	9
Cincinnati, Ohio	76.7	74.0	68.8	61.0	63.6	64.6	64.6	65.3	69.1	68.8	73.1	74.7	68.7	9

APPENDIX E.

THE PRESENT STATUS OF THE MOVEMENT FOR THE PROPOSED FOREST RESERVE IN THE SOUTHERN APPALACHIANS.

MEMORIALS AND RESOLUTIONS FAVORING THE PROPOSED APPALACHIAN FOREST RESERVE.

- Memorial of the Appalachian Mountain Club.
- Memorial of the Appalachian National Park Association.
- Resolution of the American Association for the Advancement of Science.
- Resolution of the American Forestry Association.
- Resolution of the National Board of Trade.
- Resolutions passed by other boards of trade.

PRELIMINARY REPORT OF THE SECRETARY OF AGRICULTURE ON THE FORESTS OF THE SOUTHERN APPALACHIAN REGION, JANUARY 1, 1901.

REPORT ON THE CREATION OF THE SOUTHERN APPALACHIAN FOREST RESERVE BY THE SENATE COMMITTEE ON FOREST RESERVATIONS AND THE PROTECTION OF GAME, FEBRUARY 12, 1901.

RESOLUTIONS AND ACTS BY THE LEGISLATORS OF STATES WHOSE TERRITORY EXTENDS INTO THE REGION OF THE PROPOSED FOREST RESERVE.

- Virginia.
- North Carolina.
- Tennessee.
- South Carolina.
- Georgia.

EXTRACTS FROM THE PRESS.

THE PRESENT STATUS OF THE MOVEMENT FOR THE PROPOSED FOREST RESERVE IN THE SOUTHERN APPALACHIANS.

The necessity for the preservation of the forests in the Southern Appalachian region in order to prevent the washing away of the mountain lands and the destruction of the mountains themselves has for many years been advocated by the geologists working in that region. Their position in this has met with the hearty approval of the forestry experts and even the lumbermen who have gone into that region. The growing prominence and recognized suitability of much of this region as a health and pleasure resort has added this element also to the movement for the preservation of these forests and rivers. The increasing violence and destructiveness of the floods during the past few years, and the general recognition of the fact that the continued clearing of these mountain slopes would soon result in the absolute ruin of all the interests of this region and of the adjacent lowlands in the several States—this has combined and strengthened this movement in the country at large, and has brought it to its present position before Congress.

On November 22, 1899, the Appalachian National Park Association was organized at Asheville, N. C., with a large membership, including citizens from Northern, Southern, and Western States. On January 2, 1900, memorials from this Appalachian National Park Association and the Appalachian Mountain Club of New England were presented to Congress, asking that measures be taken looking to the preservation of the Southern Appalachian forests. In response to these memorials, supported by the unanimously favorable press of the country, Congress incorporated in the bill carrying the appropriation for the Department of Agriculture for the fiscal year ending June 30, 1901, a provision that a "sum not to exceed $5,000 may, in the discretion of the Secretary of Agriculture, be used to investigate the conditions of the Southern Appalachian mountain region of Western North Carolina and adjacent States."

The United States Geological Survey of the Department of the Interior cooperated with the Department of Agriculture in this investigation so as to have it include a study of the geology and topography and rivers of the region.

In January, 1901, the Secretary of Agriculture submitted a short preliminary report[a] setting forth the result of these investigations up

[a] See pp. 166–168.

to that time. This report was transmitted to Congress by President McKinley in a brief commendatory message on January 16, 1901.

On January 10, 1901, a bill was introduced in the Senate by Mr. Pritchard, of North Carolina, which provided an appropriation of $5,000,000, to be expended under the Secretary of Agriculture in the purchase of not less than 2,000,000 acres of mountain lands in the States of Virginia, North Carolina, South Carolina, Tennessee, Georgia, and Alabama. This bill was favorably reported to the Senate by the Committee on Forest Reservations and the Protection of Game, February 12, 1901.[a]

This movement has from its beginning received the active support of both the general and the technical press of the country, and it may be said that this agency has done more than all others to awaken the American people to the importance of preserving the remnants of our forests before it is too late, and of educating them to a knowledge of the fact that these forests are for this generation to legitimately use, but not to destroy.

The list of papers and periodical publications that have contained articles favoring the proposed Appalachian forest reserve is too long to be enumerated here, but it may not be improper to mention especially two such articles which have recently appeared, viz, one by Prof. W J McGee, of Washington, D. C., in the World's Work for November, 1901, and another by Prof. N. S. Shaler, in the North American Review for December, 1901. On page 180 will be found brief extracts relative to the proposed forest reserve from a few papers and magazines.

The following papers, arranged somewhat in the order of their adoption, are here reproduced so as to make them more accessible to those who may have occasion to refer to them:

MEMORIAL OF THE APPALACHIAN MOUNTAIN CLUB.

To the Senate and House of Representatives of the United States of America:

The petition of the Appalachian Mountain Club respectfully shows.

That your petitioner is an organization of about 1,200 members, composed principally of residents of Boston, Mass., and New England, with scattering members throughout the Union, organized in January, 1876, and reorganized and chartered as a corporation by the Commonwealth of Massachusetts in April, 1878.

That its object is to bring together for cooperation all those interested in the mountains of New England and adjacent regions. * * * To combine the energies of all those who are interested in efforts not only to preserve the present beauty and attractiveness of our mountain resorts—and in particular their forests—but also to render them more

[a] See p. 168.

attractive by building paths, camps, and other conveniences, constructing and publishing accurate maps, and by collecting all available information concerning the mountain regions.

* * * In short, the club may be considered the representative in this part of the country of the interests of all lovers of the mountains, in addition to which it has made such substantial contributions to various departments of geography as to gain recognition as a representative of general geographical science.

It having come to the knowledge of this club that there is now on foot a movement for the establishment of a national forest and mountain preserve in the southern Alleghenies, to be known as the National Appalachian Park; and further, that there is now before the Congress a petition from an organization known as the Appalachian National Park Association, "praying for such action as will result in causing to be forthwith made such examination and surveys as may be necessary to determine the best possible location and the proper area for a national park in the southern Appalachian region, to the end that upon the coming in of the report of the forester, or of such reports as the Congress may desire, appropriate steps may be taken to acquire the title to the land to be comprised within the limits of the park; or that the Congress may take such other action as it may deem proper."

Your petitioners therefore state that they believe the movement is inaugurated at a most opportune time, being well aware of the increased difficulty that will attend the securing of suitable land for this purpose at a later date, when land values increase and timber and land interests combine against such a movement; that they are deeply interested in this movement, which they believe, if carried out, will result in untold health and recreation for future generations, and heartily concur in the above-mentioned petition; and they respectfully pray that the said petition of the Appalachian National Park Association may receive favorable consideration with the Congress.

ALBION A. PERRY, *President.*
ROSEWELL B. LAWRENCE, *Recording Secretary.*
JOHN RITCHIE, Jr., *Corresponding Secretary.*

MEMORIAL FROM THE APPALACHIAN NATIONAL PARK ASSOCIATION.

To the Senate and House of Representatives of the United States of America:

The petition of the Appalachian National Park Association respectfully shows:

That your petitioner is an organization composed of citizens from many States in the Union, and was formed for the purpose of bringing to the attention of the Congress of the United States the desirability of establishing a national park at some place in the southern Appalachian region.

That the facts which led to the organization of your petitioner, and which are presented as reasons for the establishment of such a national park, are as follows:

RARE NATURAL BEAUTY OF THE SOUTHERN APPALACHIAN REGION.

In western North Carolina and eastern Tennessee (or, more definitely, in the heart of the Great Smoky Mountains, the Balsam Mountains, and the Black and Craggy Mountains) is found not only the culmination of the Appalachian system, but the most beautiful as well as the highest mountains east of the lofty western ranges. Forty-three mountains of 6,000 feet and upward in altitude, as well as a great number of inferior height, all clothed with virgin forests and intersected by deep valleys abounding in brooks, rivers, and waterfalls, combine to make this a region of unsurpassed attractiveness.

Standing upon the summit of one of these sublime heights the eye often seeks in vain for the bare mountain side—the evidence of the devastating ax—and before one stretches out a view magnificently beautiful.

If the national parks already established have been chosen for their unusual natural beauty, here is a national park conspicuously fine, awaiting official recognition as an addition to the number.

SUPERB FORESTS OF THE SOUTHERN APPALACHIAN SYSTEM.

No other portion of our country displays a richness of sylva equal to that found in the high mountains of the Southern Appalachian region in the variety of its hard woods and conifers. Professor Gray, the eminent botanist, is authority for the statement that he encountered a greater number of indigenous trees in a trip of 30 miles through western North Carolina than can be observed in a trip from Turkey to England, through Europe, or from the Atlantic coast to the Rocky Mountain plateau. Here is the home of the rhododendron and the kalmia; here is the meeting place of the mountain flora of the North and of the South, and the only place where distinctive Southern mountain trees may be found side by side with those of the North. Here, too, are found trees of from 5 to 7 feet, and even more, in diameter, which tower to a height of 140 feet, and, occasionally, much higher, and these patriarchal trees, though innumerable, are but the greatest in a dense forest composed of many other large, beautiful, and valuable varieties. In fine, here is the largest area of virgin forest in the South Atlantic region, and the finest example of mixed forest (by which is meant a forest of deciduous and evergreen trees) in America.

There is but one such forest in America, and neglect of the opportunity now presented of saving it may work irretrievable loss. The forest once destroyed can not be restored. Reforestation is a slow process; it is for subsequent generations. The experience of the old countries in this matter stands as a warning. The increasing scarcity of timber is causing the large areas of forest in this part of our country to be rapidly acquired by those whose one thought will be immediate returns from a system of lumbering utterly reckless and ruinous from any other point of view, and in a few years this forest will be a thing of the past.

The National Government, and it alone, can prevent this destruction, and, by the application of the methods of scientific forestry, preserve the forest as a heritage and blessing to unborn generations.

NECESSITY OF PRESERVING THE HEADWATERS OF MANY RIVERS RISING IN THESE MOUNTAINS.

At this late date the calamities of flood and drought resulting from the wanton destruction of forests are well known. The forest acts as a storehouse of moisture for the dry season, and tends to prevent floods.

Many rivers rise in these mountains, and the same causes which will destroy the forests will work irreparable injury to the sources of the water supply.

It is the duty of the National Government, as the guardian of the national interests, not the least among which are the rivers, to protect their sources and the water supply of the country.

HEALTHFULNESS OF THE REGION.

It is a well-recognized fact that the plateau lying between the Great Smoky Mountains and the Blue Ridge is one of the most deservedly popular health resorts of the world. The geographical location and the geological formation are peculiarly adapted to the production of those conditions which make for health in generel.

Malaria is unknown. It rivals Arizona as a sanitarium for those suffering from pulmonary troubles. No better place could be found for the establishment of a sanitarium for the soldiers and sailors of our country.

CLIMATE IS FINE THE WHOLE YEAR.

By reason of its considerable altitude its summer climate is more agreeable than that of regions farther north. Those living in the South, but in regions of less altitude, and in increasing numbers others from the North and West, are learning to appreciate the advantages of its summer climate. For many years to those wishing to escape the rigors of a Northern winter this plateau has been a place of favorite resort. It has one of the best all-year climates in the world.

The existing national parks can only be visited in summer; snow and ice bar the way at all other times. If a national park were created in this favored mountain region it could be visited and enjoyed at all seasons of the year.

LOCATION IS CENTRAL.

This part of the Appalachian Range is but twenty-four hours from New York, Chicago, St. Louis, Toledo, and the Gulf States. It is, therefore, within easy reach of millions of people, and a park there could be in fact, as in name, a national park.

EASTERN STATES ARE ENTITLED TO A NATIONAL PARK.

There is no national park of the character of the one suggested east of the Yellowstone, which is considerably more than 2,000 miles from the Altantic coast, nor is there even a forest reserve east of western Dakota, which is but a few hundred miles nearer.

The Chickamauga battlefield, though called, it is believed, a "national park," possesses none of the characteristics of such a park as is now under consideration, and was created because of the historical interest investing its locality and is of very limited area.

PARK WOULD PAY AS A FOREST RESERVE.

It is confidently asserted that no forest reserve of the country, with possibly one exception, would yield a larger return to the Government.

The forests are very dense; the timber of valuable species, such as tulip (poplar), oak, chestnut, hemlock, and pine, and of great size. The undergrowth is still to a large extent uninjured by fire, and the forest, when made accessible by Government roads and managed in a scientific manner, would yield an immediate, a constant, and a comparatively large revenue.

The Government is now about to institute methods of scientific forestry. No better place in the United States can be found for the institution on a governmental scale of forestry operations, and because of the fine climate, summer and winter alike, it would be the only forest reserve of the country where such operations could be carried on uninterruptedly throughout the year.

The forests and the climate, both incomparable, ordain this as the place for the commencement of forestry operations, and, perhaps, as the location eventually of a national school of forestry.

THE TITLE TO THE LAND CAN BE EASILY ACQUIRED.

A site for the park can easily be chosen where the land is held in large areas and where the settlers are few. The land now sells for about $2 an acre, so that a comparatively large park could be secured at what would be greatly less than its value to the nation.

SUGGESTIONS REGARDING LOCATION OF PARK.

That the foregoing are the considerations which your petitioner deems of the most imperative nature and which it respectfully suggests should have the early attention of the Congress.

That your petitioner does not consider that it would be proper for it to suggest in anything more than a general way what should be the area or the boundary lines of a park in the Southern Appalachian region. In the opinion of your petitioner, this is a matter which could well be left to the decision of the forester of the Government.

Your petitioner is, however, of the opinion that it would be proper to express its conviction that whatever may be the decision respecting the area or exact location of such a national park, it should contain the highest mountains and the finest scenery in the whole Appalachian system, and this is found in the heart of the Great Smoky and Black mountains; and that the park should also embrace the largest area of virgin forest and the finest example of mixed forest in America, and this is found in the heart of the Balsam Mountains, and all of these are embraced within the limits of the tract hereinafter described.

The tract of land will be found to comprise two areas of land, each lying partly in Tennessee and partly in North Carolina, connected by a narrow strip extending along the line dividing those States and embracing land in each of them. In the eastern end of this tract will be found, with others, the following-named mountains:

	Altitude in feet.		Altitude in feet.
Mount Mitchell	6,711	Cat Tail Peak	6,611
Balsam Cone	6,671	Black Dome	6,502
Deer Mountain	6,233	Mount Gibbs	6,591
Roan Mountain	6,313	Mount Hallback	6,043
Big Craggy	6,068	Hairy Bear	6,691
Potato Top	6,393	Long Ridge	6,259
Black Brother	6,619		

In the western part of said tract will be found Mount Guyot (altitude 6,636 feet), Clingman's Dome (altitude 6,650 feet), Bald Mountain (altitude 6,220 feet), and many other high mountains, as well as the untouched tract of virgin forest hereinbefore referred to.

Your petitioner therefore states that, in its opinion, by far the best land for the Appalachian national park lies between parallels 35 and 37 of north latitude, and between the lines 82 and 85 of west longitude, and within the tract described as follows:

Beginning at Joanna Bald Mountain, in the State of North Carolina, on the line dividing the county of Graham from Cherokee and Macon counties, and running thence easterly along said line and the line between eastern Graham County and Swain County to a point on the Tuckasegee River near Bushnell; thence up the Tuckasegee River to a point 2 miles west of Bryson City; thence due north 4 miles; thence east about 12 miles to the line dividing Swain and Jackson counties; thence south to the Tuckasegee River; thence east to the Plott Balsam Ridge; then along said ridge, crossing the line between Haywood and Jackson counties, to a point 2 miles west of Waynesville; thence northeastwardly to Pigeon River; thence down Pigeon River to Fines Creek; thence in a northwestwardly direction to French Broad River, at the mouth of Big Laurel Creek; thence due east to the line dividing Madison and Yancey counties; thence due south to a point 2 miles north of the Swannanoa River; thence easterly along a line parallel with and 2 miles north of the line of the Southern Railway Company to a point due north of Old Fort; thence due north to North Toe River; thence down North Toe River to the line dividing the State of Tennessee from the State of North Carolina; thence westwardly in the State of Tennessee to Big Butte, at the corner of Washington, Green, and Unicoi counties, in Tennessee, and of Madison County, in North Carolina; thence southwestwardly along the line dividing the State of Tennessee from the State of North Carolina to Rocky Ridge; thence southwestwardly in a straight line to the French Broad River, at the mouth of Paint Creek; thence down the French Broad river to the mouth of Rock Creek; thence westwardly to the southeast corner of Jefferson County, Tenn.; thence southwestwardly to Round Top, at a corner in the easterly line of Blount County, Tenn.; thence in a southwestwardly direction to the Tennessee line at the mouth of Abram or Panther Creek; thence south to the line dividing Cherokee and Graham counties, in North Carolina, and thence along said dividing line eastwardly to Joanna Bald Mountain, the place of beginning.

Your petitioner therefore prays that the Congress will take under consideration the matter herein set forth and cause the same to be examined into, and will take such action as will result in causing to be forthwith made such examination and surveys as may be necessary to determine the best possible location and the proper area for a national park in the Southern Appalachian region, to the end that upon the coming in of the report of the forester, or of such other reports as the Congress may desire, appropriate steps may be taken to acquire the title to land to be comprised within the limits of such park; or that the Congress will take such other action as it may deem proper.

And your petitioners will ever pray, etc.

GEO. S. POWELL,
President Appalachian National Park Association.
DR. C. P. AMBLER,
Secretary.

ASHEVILLE, N. C., *December 19, 1899.*

RESOLUTIONS.

[American Association for the Advancement of Science, June 23, 1900, New York City.]

Resolved, That the American Association for the Advancement of Science, recognizing the importance of the preservation in its original condition of some portion of the hard-wood forests of the Southern Appalachian region, respectfully petitions Congress to provide for the establishment in that region of a national forest reserve.

[American Forestry Association, December 13, 1900, Washington, D. C.]

Resolved, That the action of Congress in making an appropriation to investigate the forest conditions of the Southern Appalachian Mountains meets with our cordial approval, and that we recommend that further steps be taken for the creation by purchase of a national Appalachian park in the high mountain region of the States of North and South Carolina, Georgia, and Tennessee.

[National Board of Trade, January 23, 1901, Washington, D. C.]

Resolved, That the National Board of Trade respectfully urges upon Congress the establishment of the proposed Minnesota National Park and of the proposed Southern Appalachian Forest Reserve as a just and necessary measure of forest protection to those portions of our country which at present contain no national forest reserves.

[Memphis (Tenn.) Board of Trade.]

Whereas there is a widespread movement in this country looking to the establishment by the General Government in the high forest-covered mountain portions of Tennessee, North Carolina, Virginia, and South Carolina of a national forest reserve, which will perpetuate the forest of this region, forever protect the headwaters of many important streams in these States, and serve as a pleasure and health resort at all seasons for a large portion of the people of this country; and whereas the proposal that the Government establish such a forest reserve has been approved by the leading scientific societies and forestry associations of this country, and by the general press:

Resolved, That the Board of Trade of Memphis, Tenn., also heartily approves of the establishment of such a forest reserve, and respectfully asks the Senators and Representatives at Washington from this State to urge upon Congress the favorable and prompt consideration of this measure.

Similar resolutions favoring the establishment of the proposed forest reserve or park by the Government have been passed by the commercial organizations in Richmond, Raleigh, Wilmington, Charleston, Columbia, Savannah, Augusta, Atlanta, Mobile, Knoxville, Chattanooga, Nashville, Memphis, and in many other of the larger cities of the country.

PRELIMINARY REPORT OF THE SECRETARY OF AGRICULTURE ON THE FORESTS OF THE SOUTHERN APPALACHIAN REGION.

To the Senate and House of Representatives:

I transmit herewith, for the information of the Congress, a letter from the Secretary of Agriculture, in which he presents a preliminary report of the investigations upon the forests of the Southern Appalachian Mountain region. Upon the basis of the facts established by this investigation the Secretary of Agriculture recommends the purchase of land for a national forest reserve in western North Carolina, eastern Tennessee, and adjacent States. I commend to the favorable consideration of the Congress the reasons upon which the recommendation rests.

WILLIAM McKINLEY.

EXECUTIVE MANSION, *January 16, 1901.*

UNITED STATES DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., January 3, 1901.

The PRESIDENT:

The bill making appropriations for the Department of Agriculture for the fiscal year ending June 30, 1901, provides that a "sum not to exceed $5,000 may, in the discretion of the Secretary of Agriculture, be used to investigate the forest conditions in the Southern Appalachian Mountain region of western North Carolina and adjacent States." In accordance with this provision I have made a thorough investigation of the forests in a portion of the Southern Appalachian Mountains, as directed above, including an estimate of the amount and condition of the standing timber, an inquiry as to the suitability of this region for a national park, as proposed by the Appalachian National Park Association, and an examination of the validity of the reasons advanced by its advocates for the creation of such a park. In this task I have received generous and effective cooperation and assistance, through the United States Geological Survey, from the Department of the Interior, which recognized in this way the deep and widely diffused public interest in the plan.

The forest investigation was made to include a study of the character and distribution of the species of timber trees, the density and value of forest growth, the extent to which the timber has been cut or damaged by fire, the size and nature of the present holdings, the prices at which these forest lands can now be purchased, and the general and special conditions that affect the prosecution of conservative forestry on a large scale.

The hydrographic survey of the region, conducted by the United States Geological Survey, includes a general study of its topographic features; of the relation of the soils, forest cover, and rainfall; of the quantity of water flowing out of it through the various streams during different seasons, and of the influence exerted on the regularity of this flow by forest clearings. More than 750 stream measurements have already been made and much additional data of special value has been secured.

In addition to these investigations I have given thorough attention to the arguments advanced by the movers for the proposed park and to those of their opponents, and as a result I am strongly of the opinion that this matter is worthy of careful consideration.

I have the honor to transmit herewith a mounted original copy of a large map, which shows in detail the mapping of forests accomplished during the past summer over an area of nearly 8,000 square miles. A full report of the work and its results is now in preparation and will be submitted for your consideration at an early date. The following preliminary statement is made to bring before you without delay a summary of the facts sufficient to set forth clearly the principal features of the region and the plan.

The movement for the purchase and control of a large area of forest land in the East by the Government has chiefly contemplated a national park. The idea of a national park is conservation, not use; that of a forest reserve, conservation by use. I have, therefore, to recommend a forest reserve instead of a park. It is fully shown by the investigation that such a reserve would be self-supporting from the sale of timber under wisely directed conservative forestry.

Extensive areas of hard-wood forests within the region colored on the accompanying map are still in their primitive condition, and these are among the very best and richest hard-wood forests of the United States. The region in general is better adapted for forestry than for agricultural purposes. It is located about the headwaters of numerous streams, such as the Ohio, Tennessee, Savannah, Yadkin, and Roanoke, which are important both for water power and for navigation. The general conditions within the region are exceptionally favorable for the carrying on of large operations in practical forestry, and the weather is suitable for lumbering operations at all seasons of the year. It contains a greater variety of hard-wood trees than any other region of the United States, since the Northern and Southern species here meet. It is a region of exceptional beauty and picturesqueness, and, although it would not be easily accessible to visitors in all parts at all seasons of the year, by far the greater portion of its area would be easily reached and climatically pleasant throughout the year.

It contains within the forest-covered areas no large settlements or large mining operations which would interfere with the management of such a forest reserve, and yet there is a sufficient population for the working and protection of the forests. Large lumber companies are rapidly invading the region, and the early destruction of the more valuable timber is imminent. Lands in this region suitable for such a forest reserve are now generally held in large bodies of from 50,000 to 100,000 acres, and they can be purchased at prices ranging from $2 to $5 per acre. It is probable that the average price would not exceed $3 per acre. In explanation of the widespread and urgent demand for the establishment in this southern Appalachian region of a national park or forest reserve, it may be added that it contains the highest and largest mountain masses, and perhaps the wildest and most picturesque scenery, east of the Mississippi River; that it is a region of perfect healthfulness, already largely used as a health resort both summer and winter, and that it lies within a little more than a day's travel of the larger portion of the population of this country.

The rapid consumption of our timber supplies, the extensive destruction of our forests by fire, and the resulting increase in the irregularity of the flow of water in important streams have served to develop among the people of this country an interest in forest problems which is one of the marked features of the close of the century. In response to this growing interest the Government has set aside in the Western forest reserves an area of more than 70,000 square miles. There is not a single forest reserve in the East.

I have the honor to be, very respectfully,

JAMES WILSON, *Secretary.*

REPORT OF THE SENATE COMMITTEE ON FOREST RESERVATIONS AND THE PROTECTION OF GAME.

[Fifty-sixth Congress, second session. Senate Calendar No. 2227. Report No. 2221.]

FOREST RESERVE IN THE SOUTHERN APPALACHIAN MOUNTAIN REGION.

[February 12, 1901.—Report by Mr. Beveridge, from the Committee on Forest Reservations and the Protection of Game, to accompany S. 5518.]

A majority of the Committee on Forest Reservations and the Protection of Game, having had under consideration the bill (S. 5518) to provide for the establishment of a national forest reserve in the Southern Appalachian Mountain region, reports the bill with the recommendation that it do pass and submits the following report:

An investigation of the forests of this region, authorized by Congress at its last session, has been conducted during the past year by the Department of Agriculture, with the cooperation of the United

States Geological Survey. A preliminary report from the Secretary of Agriculture, transmitted to Congress with a brief commendatory message by the President, is herewith included. It is preceded by a letter from the Secretary of Agriculture, which declares his full approval of this bill. The plan to purchase a forest reserve or park in the Southern Appalachian Mountains has been favorably considered and is advocated by the National Board of Trade, by the American Association for the Advancement of Science, by the American Forestry Association, and by numerous similar organizations throughout the United States. Resolutions from the bodies named are presented in the appendix as showing that the movement for the establishment of this forest reserve is based not upon local or selfish interests, but upon the widespread, intelligent national appreciation of the importance of prompt and favorable action by Congress.

That such a forest reserve should be established in the hard-wood regions of the East is the general conviction of men of science, experts in forestry, intelligent lumbermen, and of men connected with the great business interests of the country; and this view finds frequent and emphatic expression in the technical and general press. Reckless cutting and the forest fires which follow are now destroying these hard-wood forests at a rate and to an extent which is already having serious results over wide areas. In addition to its probable effect on climate, it is causing irregularities in the flow of the streams, which are destroying their value for water power and navigation during the dry seasons, and during the rainy seasons are washing away the soils on the steeper hillsides and mountain slopes, filling up the stream beds with sediment, and destroying the agricultural value of the lowlands along the streams. Both the diminishing flow of water during the dry season and the deposit of sediment in the stream beds and harbors during periods of flood are becoming yearly more dangerous to navigation and are leading directly to increased annual appropriations for rivers and harbors.

The establishment of the proposed national forest reserve will tend to remedy these serious and growing evils, will protect the sources of many important streams, and, under the management of trained forest experts, will serve as a demonstration of the method of perpetuating forests and yet making them pay. Such an example will lead both States and individuals to encourage and practice forest management and restoration on all lands which are better suited to forest growth than for agricultural purposes.

The proposed national reserve for the protection and use of hard-wood forests should be located in the Southern Appalachian Mountains for several reasons.

That region contains the greatest variety of hard woods to be found anywhere on this continent, because the northern and southern forest flora intermingle there. A list of the trees native to the region of the proposed reserve is given hereafter. We find there the largest remaining bodies of these forests in their virgin condition, the largest and highest mountains east of Colorado, and the largest mountain masses covered with hard-wood forests in the United States.

The slopes of these mountains contain the sources of the Tennessee, the Savannah, the Broad, the Catawba, and other rivers, and important tributaries of the Ohio. This fact is doubly significant because this region has none of the extensive glacial gravel deposits which serve in the more northern States as storage reservoirs for water, and so aid the forests to maintain uniformity of flow in the streams. Hence this measure stands on a basis of its own, and need not be regarded as creating a precedent for similar action in other cases.

This should be a national forest reserve, for the reason that the problems and dangers which it is intended to meet are national. It is true that a few States are now establishing State forest reserves, and it is believed that the measure now proposed will encourage such a movement on the part of other States. In New York large expenditures are being made to purchase reserve forest lands lying entirely within that State, about the headwaters of important streams which also lie within the limits of the State. But the great mountain masses of this proposed national forest reserve lie in several States, and the streams which rise among them flow through and are of importance to more than as many others. The combined annual income of the several States grouped about this region is but little greater than the appropriation carried by this bill.

It may be urged against this measure that it is a new departure for the Government. But the Western forest reserves have been set aside out of the public domain which was purchased by the Government at a time when the nation was composed largely of the Eastern States. Out of the lands so purchased nearly 50,000,000 of acres of forest-covered lands have been set aside as national forest reserves and parks for the purpose of perpetuating a timber supply in the Western States and Territories and for preserving forever the sources of their more important streams. Furthermore, the Government has recently been purchasing lands in the East for military parks and reservations and for other purposes. Hence it may be asserted in all fairness that what is now proposed is new neither in principle nor practice. In view of the importance of the measure now proposed in behalf of the hard-wood forests of the country, and considering the fact that there are no public lands covered with hard-wood forests, and that neither individuals nor the States adjacent to this region can reasonably be expected to establish such forest reserves as are absolutely essential, it is evidently the duty of the General Government to take the present step.

It will be asked how far the management and care of such a forest reserve will prove an annual expense to the Government. Attention is called, in reply, to the accompanying letter from the Secretary of Agriculture, in which he says: "I am entirely confident that very soon after its creation the proposed reserve would, under conservative forestry, be self-supporting from the sale of timber." Further, it may be said that many European forests, under government supervision, yield a net annual income from the sale of timber and other products of from $1 to $2 per acre or more. While no such income is expected to result from the proposed reserve in the immediate future, yet it is confidently expected that in the course of a few years this reserve will be self-supporting; and that subsequently, as the hard-wood forests of other regions are cut away and the country more thickly settled, the sale of timber and other products from this reserve will yield a considerable net profit.

Other important questions connected with this measure which have been considered by the committee are fully answered in the statement which follows from the Secretary of Agriculture. The memorial of the Appalachian National Park Association and other documents are added.

The legislatures of the several States within which the proposed forest reserve may be located, with a single exception, have already conferred upon Congress the necessary authority to acquire lands within their boundaries. In the case of the exception a resolution which indorses the plan has passed both houses of the legislature, and further action may confidently be expected in due time.

This is a measure which has every consideration in its favor; and, in view of its importance and the beneficent results which will certainly flow from its adoption, it should commend itself to the wisdom of Congress, as it must appeal to the patriotism of every citizen.

APPENDIX.

FEBRUARY 9, 1901.

MY DEAR SENATOR: I am in receipt of your letter of this date, in which you ask for an expression of my opinion regarding Senate bill 5518, which provides for the purchase of a forest reserve in the Southern Appalachian Mountains. After a thorough investigation of the forest conditions of this region, I am heartily in favor of the creation of the proposed reserve and of Mr. Pritchard's bill. The region in which it is proposed to locate this reserve contains the finest hard-wood forests yet remaining in the United States; it is admirably adapted to the purposes of a public resort for health and recreation; the land may be purchased at a reasonable price; the preservation of the forest is essential not only to the well-being of the region itself, but to that of great rivers which flow from it and to the interests they subserve; and I am entirely confident that very soon after its creation the proposed reserve would, under conservative forestry, be self-supporting from the sale of timber.

Very respectfully,

JAMES WILSON, *Secretary.*

Hon. ALBERT J. BEVERIDGE,
United States Senate.

You will find a more detailed statement of my position in my letter to the President, transmitted by him to the Congress January 16. (See p. 166.)

LEGISLATIVE RESOLUTIONS AND ACTS IN THE SEVERAL STATES WHOSE TERRITORY EXTENDS INTO THE REGION OF THE PROPOSED FOREST RESERVE.

VIRGINIA.

AN ACT to give consent by the State of Virginia to acquisition by the United States of such lands as may be needed for the establishment of a national forest reserve in the said State.

[Approved February 15, 1901.]

Whereas it is proposed that the Federal Government establish in the high mountain regions of Virginia and adjacent States a national forest reserve, which will perpetuate these forests forever and preserve the headwaters of many important streams, and which will prove of great and permanent benefit to the people of this State; and

Whereas a bill has been introduced in the Federal Congress providing for the purchase of such lands for said purpose: Therefore,

Be it enacted by the general assembly of Virginia, That the consent of the State of Virginia be, and is hereby, given to the acquisition by the United States, by purchase or gift, or by condemnation according to law, of such lands in Virginia as in the opinion of the Federal Government may be needed for the establishment of such a national forest reserve in that region: *Provided,* That the State shall retain a concurrent jurisdiction with the United States in and over such lands so far that civil process in all cases, and such criminal process as may issue under the authority of the State against any person charged with the commission of any crime without or within said jurisdiction, may be executed thereon in like manner as if this act had not been passed. *And provided,* That in all condemnation proceedings the rights of the Federal Government shall be limited to the specific objects set forth by the laws of the United States in regard to forest reserves.

2. That power is hereby conferred upon Congress to pass such laws as it may deem necessary to the acquisition, as hereinbefore provided, for incorporation in said national forest reserve such forest-covered lands lying in Virginia as in the opinion of the Federal Government may be needed for this purpose.

3. Power is hereby conferred upon Congress to pass such laws and to make or provide for the making of such rules and regulations of both civil and criminal nature, and provide punishment for violation thereof, as in its judgment may be necessary for the management, control, and protection of such lands as may be from time to time acquired by the United States under the provisions of this act.

4. This act shall be in force from its passage.

[For resolution of March 21, 1902, see p. 190.]

NORTH CAROLINA.

A RESOLUTION favoring the establishment of a national forest reserve in the Southern Appalachian Mountain region.

Resolved by the house of representatives, the senate concurring:

The general assembly of North Carolina hereby expresses its approval of the movement looking to the establishment by the Federal Government of an extensive national forest reserve in the Southern Appalachian Mountain region as a wise and beneficent measure, such as many other nations have already adopted, and which this country should adopt before it is too late, looking to the conservation of its forests and the protection of the sources of important streams; and

Whereas the proposal to establish this forest reserve has been approved and urged by the leading scientific societies and forestry associations of this country, and by the general press; and

Whereas this general assembly has passed an act granting its consent to the acquisition of lands in western North Carolina by the Federal Government for incorporation in such a forest reserve, believing the reserve to be one of great importance to the people of this State; and

Whereas a bill is now before the Federal Congress providing for the purchase of lands for this purpose:

Resolved, That the Senators and Representatives in Congress from this State are hereby requested to urge upon Congress the importance of prompt and favorable action in behalf of this measure.

In the general assembly, read three times, and ratified this the 18th day of January, A. D. 1901.

W. D. TURNER,
President of Senate.
WALTER E. MOORE,
Speaker of the House of Representatives.

AN ACT to give consent by the State of North Carolina to the acquisition by the United States of such lands as may be needed for the establishment of a national forest reserve in said State.

Whereas it is proposed that the Federal Government purchase lands in the high mountain regions of western North Carolina and adjacent States for the purpose of establishing there a national forest reserve which will perpetuate these forests and forever preserve the headwaters of many important streams, and which will thus prove of great and permanent benefit to the people of this State; and whereas a bill has been introduced in the Federal Congress providing for the purchase of such lands for said purpose: Therefore, the general assembly of North Carolina do enact:

SEC. 1. That the consent of the general assembly of North Carolina be, and is hereby, given to the acquisition by the United States, by purchase or by condemnation, with adequate compensation except as hereinafter provided, of such lands in western North Carolina as in the opinion of the Federal Government may be needed for the establishment of such a national forest reserve in that region: *Provided*, That the State of North Carolina shall retain a concurrent jurisdiction with the United States in and over such lands so far that civil process in all cases and such criminal process as may issue under the authority of the State of North Carolina against any person charged with the commission of any crime without or within said jurisdiction may be executed thereon in like manner as if this act had not been passed.

SEC. 2. That power is hereby conferred upon Congress to pass such laws as it may deem necessary to the acquisition as hereinafter provided for incorporation in said national forest reserve such forest-covered lands lying in western North Carolina as in the opinion of the Federal Government may be needed for this purpose: *Provided*, That as much as 200 acres of any tract of land occupied as a home by bona fide residents in this State at the date of the ratification of this act shall be exempt from the provisions of this section.

SEC. 3. Power is hereby conferred upon Congress to pass such laws and to make or provide for the making of such rules and regulations of both civil and criminal nature, and provide punishment therefor, as in its judgment may be deemed necessary for the management, control, and protection of such lands as may be from time to time acquired by the United States under the provisions of this act.

SEC. 4. This act shall be in force from and after its ratification.

In the general assembly, read three times, and ratified this the 18th day of January, A. D. 1901.

W. D. TURNER,
President of the Senate.
WALTER E. MOORE,
Speaker of the House of Representatives.

TENNESSEE.

A RESOLUTION favoring the establishment of a national forest reserve in the Southern Appalachian Mountain region.

Resolved by the house of representatives, the senate concurring: The general assembly of Tennessee hereby expresses its approval of the movement looking to the establishment by the Federal Government of an extensive national forest reserve in the Southern Appalachian Mountain region as a wise and beneficent measure, such as many other nations have already adopted, and which this country has already adopted in the West and should adopt in the East before it is too late, looking to the conservation of its forests and the protection of the sources of important streams; and

Whereas the proposal to establish this forest reserve has been approved and urged by the leading scientific societies and forestry associations of this country and by the general press; and

Whereas this general assembly has before it a bill granting the State's consent to the acquisition of lands in eastern Tennessee by the Federal Government for incorporation in such a forest reserve, believing the reserve to be one of great importance to the people of this State; and

Whereas a bill is now before the Federal Congress providing for the purchase of lands for this purpose:

Resolved, That the Senators and Representatives in Congress from this State are hereby requested to urge upon Congress the importance of prompt and favorable action in behalf of this measure.

Adopted February 1, 1901.

E. B. WILSON,
Speaker of House of Representatives.
NEWTON H. WHITE,
Speaker of Senate.

AN ACT to give consent by the State of Tennessee to the acquisition by the United States of such lands as may be needed for the establishment of a national forest reserve in the said State.

Whereas it is proposed that the Federal Government establish in the high mountain regions of eastern Tennessee and adjacent States a national forest reserve, which will perpetuate these forests and forever preserve the headwaters of many important streams, and which will thus prove of great and permanent benefit to the people of this State.

And whereas a bill has been introduced in the Federal Congress providing for the purchase of such lands for said purpose: Therefore,

Be it enacted by the General Assembly of the State of Tennessee,

SECTION 1. That the consent of the State of Tennessee be, and is hereby, given to the acquisition by the United States, by purchase, gift, or condemnation according to law, of such land in this State as in the opinion of the Federal Government may be needed for the establishment of such a national forest reserve in that region:

Provided, That the State shall retain the concurrent jurisdiction with the United States in and over such lands so far that civil process in all cases, and such criminal process as may issue under the authority of the State against any person charged with the commission of any crime without or within said jurisdiction, may be executed thereon in like manner as if this act had not been passed:

Provided further, That this act shall apply to lands in Tennessee lying within 20 miles of the North Carolina State line; that all condemnation proceedings herein provided shall be limited to lands now forest covered, and that in all such condemnation proceedings the right of the Federal Government shall be limited to the specific objects set forth in this act and in the laws of the United States in regard to forest reserves.

SEC. 2. *Be it further enacted*, That power is hereby conferred upon Congress to pass such laws as it may deem necessary to the acquisition, as hereinbefore provided, for incorporation in said national forest reserve such forest-covered lands lying in the State as in the opinion of the Federal Government may be needed for this purpose.

SEC. 3. *Be it further enacted*, That power is hereby conferred upon Congress to pass such laws and to make or provide for the making of such rules and regulations of both civil and criminal nature, and provide punishment for violation thereof, as in its judgment may be necessary for the management, control, and protection of such lands as may be from time to time acquired by the United States under the provisions of this act.

SEC. 4. *Be it further enacted*, That this act take effect from and after its passage, the public welfare requiring it.

Passed April 16, 1901.

E. B. WILSON,
Speaker of the House of Representatives.
NEWTON H. WHITE,
Speaker of the Senate.

Approved April 23, 1901.

BENTON MCMILLAN, *Governor.*

SOUTH CAROLINA.

A RESOLUTION favoring the establishment of a national forest reserve in the Southern Appalachian Mountain region.

Resolved by the House of Representatives, the Senate concurring: The general assembly of South Carolina hereby expresses its approval of the movement looking to the establishment by the Federal Government of an extensive national forest reserve in the Southern Appalachian Mountain region as a wise and beneficent measure, such as many other nations have already adopted, and which this country should adopt before it is too late, looking to the conservation of its forests and the protection of the sources of important streams; and whereas the proposal to establish this forest reserve has been approved and urged by the leading scientific societies and forestry associations of this country, and by the general press; and whereas this general assembly has passed an act granting its consent to the acquisition of lands in northern South Carolina by the Federal Government for incorporation in such a forest reserve, believing the measure to be one of great importance to the people of this State; and whereas a bill is now before the Federal Congress providing for the purchase of lands for this purpose:

Resolved, That the Senators and Representatives in Congress from this State are hereby requested to urge upon Congress the importance of prompt and favorable action in behalf of this measure.

Ratified.

AN ACT to give consent by the State of South Carolina to the acquisition by the United States of such lands as may be needed for the establishment of a national forest reserve in said State.

Whereas it is proposed that the Federal Government establish in the high, mountain region of South Carolina and adjacent States a national forest reserve which will perpetuate these forests and forever preserve the headwaters of many important streams, and which will thus prove of great and permanent benefit to the people of this State; and whereas a bill has been introduced in the Federal Congress providing for the purchase of said lands for such purpose: Therefore,

Be it enacted by the general assembly of the State of South Carolina:

SECTION 1. That the consent of the State of South Carolina be, and is hereby, given to the acquisition by the United States, by purchase, gift, or condemnation according to law, of such lands in this State as in the opinion of the Federal Government may be needed for the establishment of such national forest reserve in that region: *Provided*, That the State shall retain a concurrent jurisdiction with the United States in and over such lands so far that civil process in all cases, and such criminal process as may issue under the authority of the State against any person charged with the commission of any crime without or within said jurisdiction, may be executed thereon in like manner as if this act had not been passed.

SEC. 2. That power is hereby conferred upon Congress to pass such laws as it may deem necessary to the acquisition as hereinbefore provided, for incorporation in said national forest reserve, of such forest-covered land lying in the State as in the opinion of the Federal Government may be needed for this purpose.

SEC. 3. Power is hereby conferred upon Congress to pass such laws and to make, and provide for the making, of such rules and regulations, of both civil and criminal nature, and provide punishment for violation thereof, as in its judgment may be necessary for the management, control, and protection of such lands as may be from time to time acquired by the United States under the provisions of this act.

SEC. 4. That this act shall be in force from and after its ratification.

GEORGIA.

A RESOLUTION concerning the ceding of the jurisdiction over certain lands in the State of Georgia to the United States of America for the purpose of establishing a national forest reserve or park.

Whereas there is a widespread movement in this country asking that the Federal Government purchase from the present owners certain forest-covered lands lying within the high mountain regions of the States of North Carolina, South Carolina, Georgia, and Tennessee, about the headwaters of the larger streams flowing through these and adjacent States, for the purpose of establishing in this region a national forest reserve, which will forever protect the sources of the rivers that furnish our water powers and navigation facilities, which will demonstrate to the people of the country how such forest-covered areas can be managed and perpetuated to the best advantage, and which will become a great national resort within easy reach, at all seasons, of much of the larger portion of the population of this country; and whereas this general assembly desires to place on record its interest in, and encouragement of, a movement which promises such great and lasting benefits to the people of Georgia and the neighboring States:

Be it resolved by the general assembly of the State of Georgia, That this general assembly hereby expresses its willingness to cede to the United States of America the jurisdiction of the State of Georgia in and over such of the forest-covered mountain lands in this State as may be needed for the purpose of establishing such national forest reserve or national park, when the land areas of such tract or tracts have been designated, and a plat or plats of the same deposited with the secretary of state in Atlanta: *Provided*, That the State shall retain concurrent jurisdiction with the United States in and over said tract or tracts so far that all civil and criminal processes issued under the authority of the State may be executed thereon in like manner as if this act were not in force: *And provided further*, That said cession of jurisdiction shall not take effect until the United States shall have acquired title to said tract or tracts.

The general assembly respectfully asks the favorable consideration of this measure by Congress.

CLARK HOWELL,
President of the Senate.
CHAS. S. NORTHEN,
Secretary of the Senate.
JOHN D. LITTLE,
Speaker of the House of Representatives.
JNO. T. BOIFEUILLET,
Clerk of the House of Representatives.

Approved December 18, 1900.

A. D. CANDLER, *Governor.*

AN ACT to give consent by the State of Georgia to the acquisition by the United States of such lands as may be needed for the establishment of a national fores reserve in said State.

Whereas it is proposed that the Federal Government establish in the high mountain regions of Georgia and adjacent States a national forest reserve, which will perpetuate these forests and forever preserve the headwaters of many important streams, and which will thus prove of great and permanent benefit to the people of this State; and whereas a bill has been introduced in the Federal Congress providing for the purchase of such lands for said purpose, the general assembly of Georgia do enact:

SECTION 1. That the consent of the State of Georgia be, and is hereby, given to the acquisition by the United States, by purchase or gift, or by condemnation according to the law, of such lands in the mountain region of Georgia as in the opinion of the Federal Government may be needed for the establishment of such a national forest reserve in that region: *Provided*, That the State shall retain a concurrent jurisdiction with the United States in and over such lands so far that civil process in all cases, and such criminal process as may issue under the authority of the State against any person charged with the commission of any crime without or within said jurisdiction, may be executed in like manner as if this act had not been passed: *And provided*, That in all condemnation proceedings the rights of the Federal Government shall be limited to the specific objects set forth by the laws of the United States in regard to forest reserves.

SEC. 2. That power is hereby conferred upon Congress to pass such laws as it may deem necessary to the acquisition as hereinbefore provided, for incorporation in said national forest reserve, of such mountain lands lying in Georgia as in the opinion of the Federal Government may be needed for this purpose.

SEC. 3. Power is hereby conferred upon Congress to pass such laws and to make, or provide for the making, of such rules and regulations, of both civil and criminal nature, and provide punishment therefor, as in its judgment may be necessary for the management, control, and protection of such land as may be from time to time acquired by the United States under the provisions of this act.

This act shall be in force from its passage.

Passed December 13, 1901.

EXTRACTS FROM THE PRESS.

The few extracts from the press given below will serve as an illustration of the extent to which the proposal that the Government establish a forest reserve or park in the southern Appalachian region has met with public approval:

[New York (N. Y.) Tribune.]

If no steps by the Government of the United States are taken, the entire tree system of these States will be obliterated, leaving the peaks and valleys of six great States of the Union divested of timber and foliage.

[Hartford (Conn.) Courant.]

The Appalachian Park ought in a dozen years from now to be one of the chief attractions of the United States. The decisions in its favor would be unanimous if the matter was left to those who knew the country and its possibilities.

[Boston (Mass.) Transcript.]

We hope the plan will fructify, for it would give us benefit and bring us credit as a people. * * * It is most sincerely to be hoped that this admirable scheme will be quickly and cordially taken up by Congress and carried to success. It is a case of now or never.

[Buffalo (N. Y.) Commercial.]

The United States Government has gone into the forestry business on an extensive scale, and it is believed that the future returns will more than justify the liberal policy adopted in this respect.

[New York (N. Y.) Times.]

The receipts from the French national forests altogether were about twice their expenses in the last year for which the returns are accessible.

The urgency in this case is greater than it was in the case of the Yellowstone Park, when it was laid out. Certainly no American citizen now grudges the expense of that public possession.

[Baltimore (Md.) Sun.]

Among the many measures that have come before Congress none merits more thoughtful consideration or commends itself more impressively to the consideration and approval of the two Houses.

[Providence (R. I.) Journal.]

As a mere measure of protection to the material interests which may be affected by the cutting of the timber and the drying up of streams, Congress ought to do something about this as a Federal question.

[Logansport (Ind.) Reporter.]

The General Government ought to step in before it is too late. * * * If the timber is all stripped from these hills the streams will dry up and the ultimate loss will be serious and widespread.

[Springfield (Ill.) Journal.]

It is certainly true that there have been few park projects that have had more to recommend them.

[Cleveland (Ohio) Leader.]

It is claimed with reason that such a park would not only be more accessible to the great majority of the American people than the Yellowstone Park ever can be, but it would also be available as a place of resort all through the year. * * * It is true, further, that the proposed Appalachian Park would contain far better specimens of typical American forest life than any which can be found in the Yellowstone Park. That is an important item to be taken into account.

[Providence (R. I.) Journal.]

There is but one such forest in America, and neglect of the opportunity now presented of saving it may work irretrievable loss. The forests once destroyed can not be replaced.

[New York Lumber Trade Journal.]

The Journal is heartily in favor of such a park and hopes that Congress will give it favorable attention.

[Louisville (Ky.) Courier-Journal.]

I can not believe that the next Congress will fail to allow an appropriation to carry forward this great work. The Government has already set aside in Western reserves an area of more than 70,000 square miles, while there is not a single Government forest reserve in the East.

[Forest and Stream.]

The Appalachian Forest Reserve measure must go over to another Congress. We believe, however, that this is simply a postponement, not a defeat, of the scheme. The reserve, there is abundant confidence for believing, will ultimately be established.

[Forester, Washington, D. C.]

It is safe to say that only the great pressure of other business prevented the House from voting in its favor this year. Some ground will have to be gone over again, but it needs no prophet to see that, though its friends failed of success this year, this reserve will in time be established.

[Farmer Advocate, Topeka, Kans.]

Everyone interested in having this beautiful region preserved from wanton destruction by fire and timber thieves should write at once to their Congressmen to vote for the passage of the bill establishing the park.

[The Medical Dial, Minneapolis, Minn.]

The therapeutical uses of such a national park are exceedingly great. The salubrity of the climate in this section of the country, amid the everlasting hills and the giant trees, has no parallel in the world.

[St. Louis (Mo.) Star.]

It is to be hoped Congress will act favorably upon the petition. Such a park would be a proper twin for the Yellowstone.

[Davenport (Iowa) Democrat.]

There are very many reasons for it—none worth counting on the other side.

[American Field, New York City.]

The American Field urges every public-spirited citizen of this country to "put his shoulder to the wheel" and to work upon his representatives in both halls of Congress to obtain during the next session of Congress decisive action toward the creation of the Appalachian and Minnesota national parks.

[Harrisburg (Pa.) Telegraph.]

This country is gradually waking up to the destruction of its timber, and the Secretary of Agriculture does wisely when he advocates forest preservation and forest reservation.

[Pittsburg (Pa.) Commercial-Gazette.]

Such a forest reservation ought to prove a good investment of national money.

[Brooklyn (N. Y.) Citizen.]

Measures to stop the destruction of mountain forests which protect the water sources in the Appalachians and elsewhere will need to be taken some day, and they ought to begin now when the Government is in pecuniary condition to make the cost of condemnation and care a trifling matter.

[New York Herald, January 12, 1900.]

The efforts of the Appalachian Park Association are to be commended. Its promoters are moved only for the public good, and should this movement finally succeed, the thanks of the entire community will be due to them for their earnest efforts.

[Albany (N. Y.) Argus, January 7, 1900.]

It is sincerely hoped Congress will immediately take up the matter and establish the park.

[The Tradesmen, Chattanooga, Tenn.]

The movement to establish a national park in the Southern Appalachian Mountains deserves a general and hearty support.

[Knoxville (Tenn.) Times.]

If the Government wants to make an appropriation to encourage both the aesthetic and the useful, it could not easily do a better thing than to establish this Appalachian National Park.

[New Orleans (La.) Picayune.]

The Appalachian region is accessible to a greater number of the citizens of the United States than any other section where there is any likelihood of a national park reserve being established.

[Parkersburg (W. Va.) Sentinel.]

That such a forest reserve should be established in the hardwood regions of the East is the opinion of men of science, experts in forestry, intelligent lumbermen and men connected with the business interests of the country.

[Lynchburg (Va.) Advance.]

The merits of this scheme should commend it to the judgment of Congress and insure the speedy passage of the bill.

[Montgomery (Ala.) Advertiser.]

The Appalachian Park will offer many substantial advantages which the Yellowstone lacks, and we hope the matter will not be allowed to rest until all steps are taken and all the laws passed necessary to carry the project to a successful termination.

[Hartford (Conn.) Courant.]

No part of the United States offers more attractions to the sight-seer. It is ideally fitted for a park and the Government will miss a great opportunity if it fails to avail itself of the present conditions and to secure the lands which can still be had for reasonable prices.

[Toledo (Ohio) Journal.]

This part of the Blue Ridge is recognized as the most salubrious, combining a dry and equal climate, attracting thousands of people from the North during the winter months, and drawing large numbers from the South during the warm season. It enjoys the best properties of a winter park and a summer resort. The climate is healthy, equable, balmy, yet exhilarating.

[Indianapolis (Ind.) News.]

The preservation of forests is a subject to which too little attention has been paid in the past and to which should be given much thought. Already the country is experiencing the bad effects of indifference.

[Tallahassee (Fla.) Tallahassian.]

The wildest and most naturally beautiful part of this country east of the Rocky Mountains is that region where North Carolina, Tennessee, Virginia, South Carolina, and Georgia approach each other.

[Chicago Times-Herald, December 24, 1899.]

The Blue Ridge has a climate that is delightful at any season of the year, and as it is only twenty-four hours travel from Chicago, New York, or New Orleans, the mass of the population in the east, even those in moderate circumstances, could readily avail themselves of the advantages it offers as a health and pleasure resort.

[Cincinnati Volks Freund, February 1, 1900.]

We wish the undertaking complete success.

[Newport (R. I.) News.]

The central location of the proposed park is undoubtedly a strong point in its favor. It is within easy reach of most of the great cities of the middle Western States and the Eastern and Southern States. Apart from these natural reasons, the Eastern States are entitled to a national park.

[St. Louis (Mo.) Globe-Democrat.]

There is every reason why the movement for the establishment of the Appalachian Park in North Carolina should succeed.

[The Hartford Courant.]

The wildest and most naturally beautiful part of this country east of the Rocky Mountains is that region where North Carolina, Tennessee, Virginia, South Carolina, and Georgia approach each other. It is a mountain country with an average elevation of 4,000 feet and peaks running up to thousands of feet higher. The tallest mountain east of the Rockies is in North Carolina.

This wild region abounds in timber, and is still a natural and unbroken wilderness except as the lumbermen invade its quiet. They have come. Already traffic in forest land is on and the railroads of the vicinity are loaded with lumber for the market. Let the American people sit by with their accustomed optimistic apathy and before long the forests will be gone, the water courses left to dry up, the bears, deer, and other wild animals killed off, and nothing but a fading memory remain of what now is a great natural park.

The General Government ought to step in, before it is too late, and take possession of the whole region. The Yellowstone Park, far away and to all but a few inaccessible, should be supplemented by this natural reservation, which is easily reached by the great majority of the people of the United States. Take your map and you will find that from Boston on the east around by Buffalo, Cleveland, Cincinnati, Chicago, and St. Louis to New Orleans, Jacksonville, and so on up to Washington every city on the imaginary circuit has railroad facilities bringing it within not more at most than one night's ride of Asheville, the central point in the Blue Ridge and Great Smoky country. Establish a park there and people from every large city this side of the Mississippi would be visiting it in large numbers at all seasons of the year.

As an opportunity for conferring on the citizens of the country a means of great enjoyment, this chance for Congressional action is unique. But that really would be only an incident of the work. In this elevated land are multitudes of clear, sweet streams delivering water to the Atlantic coast and to the Mississippi River. The divide is in the possible park. If the timber is all stripped from these hills, the streams will dry up and the ultimate loss will be serious and widespread. Leading citizens of North Carolina and other States adjoining have recently held a meeting and formed themselves into the Appalachian National Park Association to push the project. It ought to go without much pushing. All that is needed is to set people thinking about it.

Look at what the Government might do, and at what, on the contrary, will be done if the National Government does not come in and protect nature there. Once done the mischief could never be undone. The loss would not be local, but national. Everybody who fails to see the North Carolina mountains suffers a direct loss, whether he knows it or not. Open the region to the whole country and let these sights be assured and available at all times, and the park would be one of the most popular resorts in the United States.

Congress ought to jump at the chance to get possession of the great tract, at least 500,000 acres, said to be purchaseable now at hardly more than nominal figures. The cost of a single battle ship would give us this park available for future generations as well as for ourselves. It is to be hoped the committee will set the work going early and carry it to the success that the American people will wish for it and for themselves.

[The Scientific American.]

Within about a day's travel of New York, Philadelphia, Baltimore, Washington, and most of the Atlantic seaboard, and quite as accessible to Pittsburg, Cincinnati, Louisville, Indianapolis, and St. Louis there are vast stretches of virgin forests—along the line of the Great Smoky

Mountains, on the border between Tennessee and North Carolina—that are thoroughly suited to the purposes of a great game and forest preserve. Going up from the lowlands of Walhalla, S. C., to the high plateau surrounding Highlands, N. C., a stage trip of about 30 miles, the late Professor Gray, the eminent botanist of Harvard, tells us that he encountered a greater number of species of indigenous trees than could be observed in a trip from Turkey to England through Europe, or from the Atlantic coast to the Rocky Mountain plateau. The region surrounding that described by Professor Gray, especially to the west, with the headwaters of the Tennessee, the French Broad, and the Savannah rivers, all within a few miles of each other, with fertile valleys and mountain elevations of 5,000 feet or more, and a density of verdure unapproached elsewhere, is an ideal spot for a preserve, where every sort of North American animal or fish would thrive, and where almost every tree or plant found within our borders, from the Atlantic to the Pacific, would grow uncared for.

[The New York Sun.]

A national forest reserve in the Appalachian belt can be established only by the purchase of land, for there is no public domain in that region. The bill now before Congress directs the Secretary of Agriculture to purchase not more than 2,000,000 acres of forest in the Southern Appalachians and appropriates $5,000,000 for that purpose. The lands must be situated within the States of Virginia, North and South Carolina, Georgia, Alabama, and Tennessee. The purpose of establishing the proposed reserve is to introduce scientific forestry methods, conserve the forests, and at the same time permit lumbering in this large area of hard woods.

No one now doubts that it was wise policy to set apart the forest reserves which have been established since 1896 in eleven of our Western States and Territories. The idea was at first strongly opposed on the ground that the withdrawal of so much public land from purchase would retard the development of the States concerned and delay the discovery of new sources of mineral wealth. These misgivings, however, were not justified by our policy with regard to the reserves. The Geological Survey has been engaged since the summer of 1897 in studying the timber, mineral, and agricultural resources of these regions. All of them may be developed as fast as capital and labor seek employment there. In some of the reserves, as in the Black Hills, for example, large industries have long been established. But these large areas can no longer be stripped of all their timber without a thought of tree replanting. The propagation of timber must hereafter go hand in hand with its utilization; and destruction by forest fires that have swept large areas will at least be diminished by proper regulations.

But in our forest reserves the hard woods that have so prominent a place in our lumber industry and agricultural implement, furniture, and cabinet manufactures are scarcely represented. The cedar, tamarack, canon live oak, and tan-bark oak are the only hard woods of commercial importance found on the reserves. Our walnut, maple, ash, locust, hickory, cherry, and beech timber are as yet derived almost wholly from the Central States, mainly east of the Mississippi. Timber planting has not kept pace with timber cutting, and the supply is diminishing. Furniture makers already complain of the scarcity of black walnut.

The only other source of these hard woods is the Appalachian belt from the southern part of New York to Alabama. They grow in largest numbers on the slopes of the southern half of these mountain ranges. On the neighboring lowlands spread away the forests of long-leaf, short-leaf, and loblolly pines, which make the great lumber industry of our South Atlantic States. The hard woods above them have as yet scarcely been touched, but with the diminishing supply of hard woods on the central plain from the Mississippi eastward, lumbermen are beginning to look to the mountains.

The question is whether this large source of supply shall also be depleted or whether, by the methods of scientific forestry, the timber shall be renewed, so that later generations, as well as ourselves, may have the benefit of it. These forests can be protected only by Government regulation, and if the States do not take steps to conserve these large sources of wealth the question whether the National Government should not acquire the right to do so at a time when it is asserted it may be cheaply acquired is certainly worthy of serious consideration.

[The New York Times.]

One of the most interesting matters now before Congress, and one which should attract general attention, is the proposition for the establishment of the Appalachian forest reserve, for which a bill was introduced in Congress a few days ago. This proposed measure directs the Secretary of Agriculture to purchase not to exceed 2,000,000 acres.

[The Wilmington (Del.) Star.]

The efforts of the Appalachian National Park Association are succeeding far beyond the anticipation of the most urgent supporters of this great movement. * * * Prominent and influential men in every part of the country have given their aid, numerous newspapers have advocated the project, and as yet no adverse or unfavorable criticism has been heard or written, and it seems practically certain that with a united movement the park can be secured. * * *

[Washington Post, January 3, 1900.]

The location in western North Carolina of a great national park would be a cause of more pleasure and benefit to more people than any other public institution we can think of at this moment.

[Brooklyn Eagle, January 14, 1900.]

It ought to go without much pushing. All that is needed is to set the people thinking about it.

[Prof. N. S. Shaler, in The North American Review, December, 1901.]

It may be charged that the legislation which established these reservations is, in its tendencies, socialistic, but the most inveterate enemy of that political theory, if he be open to reason, will not be disposed to contend against such action. He will have to acknowledge that these gifts to the community are very helpful to its best interests, and that they could not have been secured by private or corporate endeavor or even by the action of individual States. They can be obtained by national action alone. * * *

Although a national reservation in the southern upland will, perhaps, most commend itself to the people from their interests in the noble forests which it will permanently preserve, there are economic considerations that would of themselves warrant the undertaking. The effect of such a forested area on the streams which have their headwaters in this mountain district would be considerable and most advantageous. Properly located, this park would include the tributaries of rivers which flow to the Ohio, as well as streams that course to the Atlantic. It is evident that, in the future, these water courses, like all others in settled countries, are to be extensively utilized as sources of electric power. Owing to the form of the country, it will not be possible, as it is in New England, to hold back the stream water in reservoirs for use in the dry season of the year; the only economical method will be to have the water stored in the spongy mat which naturally forms in an unbroken forest, and which to a great extent prevents the water courses from becoming beds of torrents in rainy seasons and in other times dry channels. In proportion to its area and rainfall, in relation to the whole of the drainage of the rivers flowing from it, such a forest reservation would serve to diminish the floods which, year by year, become more destructive to the tilled grounds and towns along the lower reaches of our great waterways, and more injurious to their value for navigation. This evil, already great, is constantly becoming a more serious menace, as the steep sides of the mountains are further stripped of their woods. * * *

It is, or should be, an accepted principle that the Government is to provide for public needs when private enterprise, for any reason, can not be induced to make adequate provisions. * * *

Such truly imperial gifts have greatly enriched a part of this country; it will be well, before the remnants of primeval nature have vanished, that the other parts of our realm should have like share in them.

[Prof. W J McGee in the Worlds Work, November, 1901.]

The geographer in studying the Appalachian region perceives that in the wooded wilderness nature provides a vast reservoir system for the storage of storm waters—a system at once so perfect and so economical that all the year's rainfall (and light snow fall as well) is first appropriated to the uses of plant life, then conserved for a time in the subsoil against drought, and finally carried by subterranean seepage to the lower levels, where only the excess above local plant needs and animal demands is allowed to flow through spring and stream and river down the long way to the distant ocean. * * *

Now he may turn another leaf to the closing lines of his lesson and read of that delicate interrelation of natural conditions which has resulted throughout the Appalachian region in the development of a floral mantle to stay the storms, and thus at once to sustain the flora itself and to estop destructive erosion. These final lines run deep into earth science and into plant science and need not be followed save by the specialist. Yet the ultimate axiom is simple, so simple that he who runs might read, so simple as to make it a marvel that observant men did not grasp it at the beginning of knowledge rather than wait until the end—it is the simple axiom that life prevails over death, that plant power is stronger than rock power. Nor can the geographer in the Appalachian region fail to apply the axiom. He may call the application theory, argument, policy, cause; he may whisper it in private council, may announce it in scientific conclave, may proclaim it in legislative halls, may send it ringing through the world and up the corridors of future time to benefit all mankind; he may smother it cravenly in coward breast, or he may sacrifice it to paltry greed, yet if he is honest with his facts and with himself he can not fail to realize that the forests must be preserved, else the mountains will be destroyed.

Only a generation ago science plodded wearily along one side of the pathway of human progress, while statecraft flitted airily along the other side of the straight and narrow path, both led in part by hereditary theories. But within the work time of men now living science and statecraft have drawn well into the main pathway of practical humanity, and in this country at least, they have joined hands firmly; to-day science stands in the Federal Cabinet in all the dignity of an executive department, while the leading statesmen are grasping that modern geography which seeks to assimilate science. So it is but natural that the mountaineers of the Appalachian region, a virile and farseeing race, and various representatives of public interests have come to read alike the public lesson of conservation, the conservation of forests, in order that the very mountains may be conserved. Naturally, too, the applications of the lesson first came home to the hearts of the mountaineers amid their beloved ranges and rivers. They first noted the gullying of hillsides, with the accompanying loss of soil and clogging of valleys and polluting of streams, when clearings were pushed too far up the valley sides. They first observed that the carelessly set forest fire produced, although more slowly, effects as disastrous as those of injudicious clearing. They first noticed that reckless lumbering robbed the land not merely of trees but of soil, of welling springs, and of the trout-filled brook, which were converted into muddy, freshet-ridden streams, running dry in midsummer. They first realized that the stripping of the chestnut oaks for tan bark was but the first step in a cumulative desolation. They were the first to realize the gradual change of brook and river from crystal streams flowing steadily all the season round to dirty danger lines mapped out by disastrous wrecks with every storm, only to lose themselves in mud between storms. Naturally, then, the agitation of a policy began among the mountaineers, and their voices were heard first in local conventions, then in the legislative halls of several States, and finally before Federal Congress and Cabinet. Such, in brief, is the history of the movement toward an Appalachian forest reserve, a movement which may lag or lunge according to the firmness of the alliance between science and statecraft, but which is manifestly destined for ultimate success, to the immeasurable benefit of mankind.

RESOLUTION OF THE LEGISLATURE OF VIRGINIA.

Resolved by the senate of Virginia, the house of delegates concurring, That the general assembly of Virginia, hereby expresses its approval of the movement looking to the establishment by the Federal Government of an extensive national forest in the Southern Appalachian Mountain region as a wise and beneficent measure, such as many other nations have already adopted, and which this country has already adopted in the West and should adopt in the East before it is too late, looking to the conservation of its forests and the protection of the sources of important streams; and

Whereas the proposal to establish this forest reserve has been approved and urged by the leading scientific societies and forestry associations of this country and by both the general and technical press; and

Whereas the general assembly of Virginia has already passed an act granting the State's consent to the acquisition of lands in Virginia by the Federal Government for incorporation in such a forest reserve, believing the reserve to be one of great importance to the people of this State; and

Whereas a bill is now before the Federal Congress providing for the purchase of lands for this purpose:

Resolved, That the Senators and Representatives in Congress from this State are hereby requested to urge upon Congress the importance of prompt and favorable action in behalf of this measure; and that copies of this resolution be sent to the Senators and Representatives from Virginia.

Passed unanimously by the legislature of Virginia, March 21, 1902.

PARTIAL LIST OF PAPERS THAT HAVE MADE FAVORABLE COMMENT ON PROPOSED APPALACHIAN FOREST RESERVE.

Boston Herald.
Boston Transcript.
Hartford Courant.
New York Times.
New York Sun.
New York Herald.
New York Lumber Trade Journal.
New York Mail and Express.
Great Round World, New York City.
New York Tribune.
New York Evening Post.
Engineering Journal, New York City.
Ithaca Journal.
Albany Times.
Albany Argus.
Buffalo Commercial.
Turf, Field, and Farm, New York City.
Jamestown (N. Y.) Journal.
Brooklyn Eagle.
Brooklyn Citizen.
Times Union, Albany, N. Y..
Outing, New York.
Recreation, New York.
Brooklyn (N. Y.) Standard-Union.
Washington Star.
Washington Post.
Washington Times.
Forest and Stream.
American Gardening.
Southern Field.
Detroit Free Press.
Baltimore Sun.
Baltimore Herald.
Baltimore American.
Philadelphia Call.
Harrisburg Telegraph.
Philadelphia American.
Philadelphia Inquirer.
Pittsburg Dispatch.
Pittsburg Post.
Pittsburg Press.
American Field.
The Forester.
Country Gentleman.
Field and Stream.
Chattanooga Times.
Memphis Herald.
Savannah (Ga.) Press.
Parkersburg (W. Va.) Sentinel.
Roanoke (Va.) World.
New Orleans Picayune.
Louisville Dispatch.
Louisville Courier-Journal.
Citizen, Berea, Ky.
Birmingham (Ala.) Age-Herald.
Montgomery (Ala.) Advertiser.
Newport (R. I.) News.
Providence (R. I.) Journal.
Indianapolis News.
Indianapolis Sentinel.
Logansport (Ind.) Reporter.
Terre Haute Gazette.
St. Louis Globe-Democrat.
The Taxpayer (St. Louis, Mo.).
Lynchburg (Va.) Advance.
Inland Printer.
Engineering News (New York).
Nashville American.
Asheville Gazette.
Atlanta Constitution.
Atlanta Journal.
Richmond Dispatch.
Knoxville Sentinel.
Knoxville Times.
The Observer (Charlotte, N. C.).
Raleigh (N. C.) Observer.
News and Courier (Charleston, S. C.).
Journal (Daytona, Fla.).
Tallahassee (Fla.) Tallahassian.
Standard (Bridgeport, Conn.).
Cincinnati Enquirer.
Cleveland Leader.
Toledo Journal.
Chicago Times-Herald.
Springfield (Ill.) Journal.
Joliet (Ill.) News.
Chronicle (Chicago, Ill.).
Tradesman (Chattanooga, Tenn.).
American Israelite (Cincinnati, Ohio).
Forest Leaves (Philadelphia), Pa..

INDEX.

A.

B.

E.

G.

H.

M.

O