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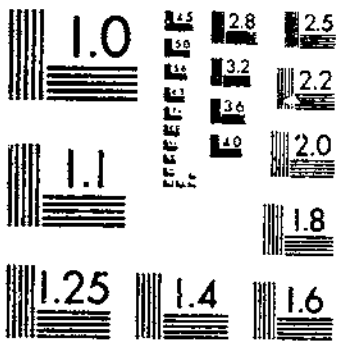

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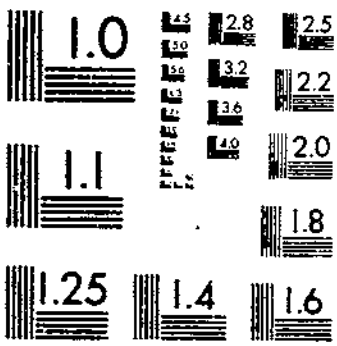

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UNITED STATES DEPARTMENT OF AGRICULTURE
WASHINGTON, D. C.

ECONOMIC UTILIZATION OF MARGINAL LANDS IN NICHOLAS AND WEBSTER COUNTIES WEST VIRGINIA

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In cooperation with the Agricultural Experiment Station of West Virginia

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INTRODUCTION

Nicholas and Webster Counties are typical of a large area in West Virginia and other Appalachian States in which the most economic utilization of the land resources is a puzzling problem.[1] The first

[1] This study is the first of several projects having similar general objectives and now under way in Kentucky, Pennsylvania, and Vermont. Being the first study of this kind undertaken by the cooperating parties, and with but few precedents for the guidance of those planning the project, it is too much to expect that the results will serve as a model for projects of this type. In fact, it is characteristic of studies of this kind that they can not be completly standardized, but must conform in scope, emphasis, and method to the special conditions of the area studied. Nevertheless, the results of this study may be found helpful not only in the facts and conditions described, but also in suggesting methods to those conducting similar undertakings.

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objective of the investigation reported in this bulletin is to show which type of land should be used for agriculture and which for forestry and to try to point out the conditions that will determine whether land not easily classified as farm land or forest land should be used for a different type of farming or for a different combination of agriculture and forestry. The second objective is to indicate lines of improvement in the utilization of both farm and forest lands, and the relation of such changes in utilization to the social institutions of the area, particularly the schools and roads.

During the last half century agriculture in this area has been closely linked with the development of the forest industries which have furnished employment and local markets for surplus farm products. Most of the old-growth timber has now been cut, and the remainder can not last long. On some of the land farming no longer pays and as a result many fields once cultivated are now growing up to brush. At the same time the burden of carrying cut-over land is pressing heavily upon the owners. The problem of future land utilization in part of the area is therefore of urgent interest from both private and public standpoints.

Agricultural programs formulated in the past have for the most part been concerned with the better farming sections where the problem was to make a fairly profitable agriculture more profitable. This study is intended to aid in formulating a program of land utilization for those areas in which some of the land now farmed is so near the margin of economic use that it is doubtful whether farmers are justified in continuing to try to make a living on it.

Projects of this kind involve local agricultural forecasting and may properly be regarded as long-time outlook studies. In making such an agricultural forecast one is confronted with many uncertainties, and on that account the conclusions presented here are tentative and may need to be revised from time to time in the light of changing conditions.

The solution of the problem must be based on an analysis of the influence of purely physical factors, the most important being topography, type of soil, elevation, rainfall, drainage conditions, and the length of the growing season. It requires also an analysis of the economic possibilities of utilizing different kinds of land in different ways, including a consideration of the effect of changes in mode of utilization or community organization and of the possibility of modifying the conditions of land utilization through collective action, as for instance through changes in the amount, form, or incidence of the tax burden.

In developing a concrete plan for utilizing the resources of an area, it is assumed that an "optimum" relationship between the natural resources and the population to be supported is the goal. This relationship changes with time and circumstances. The optimum at a given time is attained only if the size of the population is so adjusted to the natural resources of an area as to afford standards of living comparable with those obtainable with similar human ability, exertion, and capital resources in other lines of activity or in other areas. In other words, the regional plan should seek to remove the effects of maladjustment of population to resources. If the population is excessive in view of the limited resources of the region, the plan should

show how the excess can be removed. In time, the adjustment will take place of its own accord, but if the maladjustment is anticipated certain forms of public action can be brought into play to expedite the readjustment.

The regional plan outlined in the following pages is premised also on the assumption that people will ultimately migrate from districts in which the return from the employment of labor and capital is persistently below that prevailing elsewhere for the same grades of labor and of capital goods.

Adjusting the costs of government to diminishing sources of revenue is another of the economic problems in this section. While the natural resources, on which revenue is closely dependent, have been diminishing, expenditures and taxes have been mounting.

In these two counties there are three general classes of land from the standpoint of prospective land utilization. (1) The most important area is that designated as agricultural land which furnishes occupation and income to the largest single group of gainfully employed in each county. No attempt has been made to work out a definite program for increasing income on this land except for cases in which a part of the land is devoted to timber production. The largest part of the cash income on agricultural land is from livestock, and it naturally follows that increased income to the farmers would come by the reorganization of live stock enterprises and the use of more economical methods of livestock production. The authors have made no attempt to discuss improved methods that should be followed in these two counties. Other investigators are at work on the problems of production on this kind of land. For example, the Division of Animal Husbandry of the United States Department of Agriculture and the West Virginia Agricultural Experiment Station have been conducting cooperative experiments on various phases of beef-cattle production in an adjoining county, Greenbrier. The West Virginia Agricultural Experiment Station is carrying on experiments in the production of pasture and feed crops. A publication is being prepared by the Division of Animal Husbandry and the Division of Farm Management, both of the United States Department of Agriculture, on "Beef Cattle Production, Problems in the Central Appalachian Region and Suggestions for Solving Them."

(2) The largest general class of land in these two counties has a forest cover of some kind and so far as can be seen now will always grow trees if anything at all. A conservative estimate of the proportion of the land that belongs in this class is 70 per cent. At present, approximately 85 per cent of the total area of the two counties has a forest cover of some kind. Some of this woodland will be cleared and converted into farm land, but the land best adapted to farming was cleared many years ago and the poorer parts of it will go back to timber. A program of forest and recreational use has been suggested for the nonagricultural land.

(3) A third general class of land, comprising about 10 per cent of the total area, has been designated as doubtful for agricultural use. This consists of isolated areas of productive land, areas of the poorer soils that are well located as to markets that may not be permanent, such as sawmill towns, and areas of unknown possibilities for agriculture.

GEOGRAPHIC CHARACTERISTICS AND ECONOMIC DEVELOPMENT OF NICHOLAS AND WEBSTER COUNTIES AND THE SURROUNDING AREA

Nicholas and Webster are contiguous counties in the east-central part of West Virginia, about 30 miles from the Virginia boundary. The surface of both counties is a deeply dissected plateau. Plate 1 shows that in the northern, northwestern, and eastern parts of Nicholas County and in most of Webster County the ridges have narrow crests and steep slopes. The valleys between are narrow and V shaped, the floors lying from 800 to 1,500 feet below the ridge tops.

In the central part of Nicholas and extending in a northeasterly-southwesterly direction entirely across the county and into Webster is a belt of land with smoother terrain, where the physical conditions are suited to successful farming.

Nicholas County, together with most of Webster County, lies in the watershed of the Kanawha River. The drainage is satisfactory except for about 25,000 acres of the broad-valley lands, that are found between the hills.

Weather conditions in this section are well suited to human habitation The summers are pleasant, with cool nights and only occasional hot periods. The temperature varies with the elevation. On the higher ridges the winters are longer and more severe, and there is considerable snow. At Holcomb, in Nicholas County, with an elevation of 2,042 feet the average date of the last killing frost is May 15 and of the first, September 25. This gives the locality a growing season of about 4⅓ months. Killing frosts have occurred, however, as late as June 11 and as early as September 12 (*6*).[2]

The precipitation in the section is heavy, amounting to about 55 inches annually; it interferes with certain farming operations, especially at the higher elevations where fog often remains until late in the day.

The section has both residual and alluvial soils. The residual soils, derived from the weathering of interbedded sandstones and shales, are on the uplands, and their character is determined by the underlying rock. The alluvial soils are derived from materials washed down from the uplands and vary from very fine silt loams to sandy clay.[3]

Both counties formerly were covered with an excellent stand of timber yielding from 12,000 to 20,000 board feet per acre. At present only 7 per cent of the area is covered with virgin timber. The more level areas such as the glades, the rolling lands, and the wider valley bottoms have been almost entirely cleared. Forest cover, however, including farm woodland, still occupies about 83 per cent of the total land area in Nicholas County and 89 per cent in Webster.

The original forest has been either culled or heavily cut over.[4] The few remaining tracts of virgin timber are located in the northwestern part of Nicholas County and in the eastern part of Webster County. These stands are now being exploited.

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[2] Italic numbers in parentheses refer to Literature Cited, p. 64.

[3] The reports on the soil surveys of both counties provided the basis for classification. The investigators gathered additional data on topography, stoniness, and drainage.

[4] Culling refers to the cutting in the original forest of scattered trees of the best quality of a few species; heavily cut over refers to the removal of all valuable trees down to at least 10 inches on the stump.

PLATE 1 FOUND AT END OF BULLETIN.

Lightly culled stands are likewise found in northern and northwestern Nicholas County and in the eastern part of Webster County. The rest of the uncleared acreage consists of stands cut over more intensively. Frequently the close cutting is followed by bad slash fires. There are some fairly large tracts of merchantable second-growth timber, but much of the timber is of poor character, because of careless logging methods and frequent forest fires.

There are small, scattered strips of old-field stands along the slopes of some of the valleys, in the cove heads, and on those ridge tops which have again reverted to forest after having been cleared and cropped.

The forest cover of the section, influenced as it is by differences in climate, elevation, and topography, is composed of a large variety of species.

Three types of forest vegetation are present. The lowest in elevation is the southern hardwood forest, which covers more than half of the State and extends into the western quarter of Nicholas County. It contains oak, chestnut, hickory, yellow poplar, maple, red gum, and walnut. Sassafras, redbud, and persimmon are also typical.

The rest of Nicholas County, excepting the extreme northeastern corner, and most of Webster County, are in the transition-hardwoods and hemlock forest, containing chestnut, oak, poplar, and hickory mixed with beech, maple, birch, and hemlock.

The eastern corner of Nicholas County and the southern and southwestern portions of Webster County, having over 3,000 feet elevation, are in the spruce and hemlock forest. Red spruce, hemlock, and yellow birch are the characteristic species.

ECONOMIC DEVELOPMENT OF NICHOLAS AND WEBSTER COUNTIES

Settlements in Nicholas and Webster Counties were first attempted shortly after the close of the Revolutionary War but were not permanently established until after 1800. "After 1795, settlers from Greenbrier and Kanawha began to occupy new lands in the region which in 1818 was formed into the new county of Nicholas" (*2, p. 32*).

Daniel Boone was in the region as early as 1774. According to Callahan, much of Boone's time, while he lived in the Kanawha Valley, was spent in locating and surveying lands. He was familiar with the geography and topography of the whole country. He had traveled and hunted, fought and trapped up and down all the streams and knew where all the good lands lay.

The first permanent settlement in Nicholas County was made near Lockwood, about 1802, by settlers from eastern Virginia. Later immigrants from Virginia and western Kentucky, seeking new hunting grounds, came in, and settlements sprang up along Peters Creek and Strouds Creek (*6*).

Webster County was formed from parts of Nicholas, Braxton, and Randolph Counties in 1860 (*2, p. 109*). The early settlers in Webster County came mostly from Virginia. Later settlers came from Pennsylvania and Maryland. The pioneers in both Nicholas and Webster were predominantly of Anglo-Saxon origin, and this stock occupies the land at the present time.

In Webster County the settlers usually located their homes along the narrow creek bottoms. In Nicholas County, on the other hand, some of the ridges are fairly broad, and the settlers established themselves on the ridge tops more often than along the streams.

The population of Nicholas County increased during every decade from 1820 to 1920, except the decade 1830 to 1840, and the population in Webster County increased in every decade following the county's organization up to 1920. The census of 1930 shows a very slight decrease for Nicholas County, but for Webster County a large increase amounting to approximately 23 per cent.

West Virginia counties are constituted of smaller subdivisions known as magisterial districts. In many respects these subdivisions serve the same purpose as do the townships in States farther north. In all the magisterial districts of Nicholas and Webster Counties the population increased steadily from 1870 to 1910. The census of 1930, however, showed that in 3 of the 11 districts the population had decreased after 1910, and in all the others, except Glade and Fork Lick in Webster County and Beaver in Nicholas County, the population had increased only slightly. Glade is one of the better farming districts and is likewise the center of important logging operations, which, however, are now rapidly moving eastward into Pocahontas County. The increase of population in Beaver district is due to the large labor demands of the mills located at Richwood. From 1920 to 1930 the districts containing Richwood City and the village of Summersville increased in population, but there was a decrease in the territory outside those places. Population declined considerably in two districts and remained approximately the same in three. In Webster County, one district had the same population in 1930 as in 1910, all the others showing a considerable increase.

According to the census, the area of land in farms in Nicholas County decreased during the 35 years prior to 1925. (Table 1.) In Webster County, on the other hand, during the same period the area in farms remained almost constant. Webster is a newer county and until very recently has been somewhat more isolated. For that reason its farm population has not felt so strongly the pull of the industrial centers. Moreover, it is the center of large logging and lumbering operations, which furnish winter employment and a market for farm produce.

TABLE 1.—*Land in farms, number and size of farms, Nicholas and Webster Counties, 1880–1930* [1]

Year	Land in farms		Number of farms		Average size of farms	
	Nicholas	Webster	Nicholas	Webster	Nicholas	Webster
	Acres	*Acres*			*Acres*	*Acres*
1880	192,532	99,340	1,115	502	172.7	197.9
1890	187,112	104,689	1,459	767	128.2	136.5
1900	192,227	115,786	1,767	1,038	108.8	109.4
1910	157,375	109,043	1,670	1,084	94.2	100.6
1920	153,726	99,184	1,670	981	92.1	101.1
1925	136,065	110,703	1,574	1,065	86.4	103.9
1930	148,307	93,609	1,800	1,104	82.4	84.8

[1] United States Census figures.

Apparently agriculture has almost, if not quite, reached the limit of its expansion in these two counties. The census of 1900 shows the maximum amount of land in farms at any period for Nicholas and

Webster Counties combined, while the report for 1930 shows only 79 more farms than at the beginning of the century. Some farms have been abandoned during the period and others consolidated, which would decrease the number, but some new farms have been established following the removal of the timber.

ECONOMIC ORGANIZATION OF THE SECTION

Farming, lumbering, and some mining constitute the principal industries of Nicholas and Webster Counties. There are also a few wood-using factories at Richwood, the principal city of the section.

These counties have four main types of roads: (1) Class A or State; (2) county; (3) improved district; and (4) unimproved district. Many of the unimproved district roads are nearly useless for the traffic requirements of the present day.

During recent years many miles of class A highways and improved district roads have been built in Nicholas and Webster Counties. The latter are usually built to substantially the same specifications as the State (class A) roads but are not hard surfaced. Their construction has increased the tax burden in several districts by as much as 40 mills to the dollar. As shown later, it is an expenditure that should be scrutinized with extreme care, for in many cases it is doubtful whether the natural resources of various districts are of sufficient value to warrant such highway improvements.

Telephonic communication among farmers in Nicholas and Webster Counties is almost entirely lacking, although on the better soils farmers are sufficiently numerous to carry whatever overhead expense would be involved in maintaining and operating a telephone system.

Local markets absorb much of the section's surplus farm produce. Generally speaking, West Virginia is deficient in food production, because of the relatively small acreage of farm land and the considerable progress of industrialization in the State.

Because the expense of transporting supplies in and out of central West Virginia is relatively high, local prices depend largely on local supply and local demand, neither of which varies greatly from year to year. Prices of farm products are therefore unusually uniform one year with another. Furthermore, as shown in Table 2, the prices of important farm products are higher in the West Virginia counties than in sections of surplus production. Although the prices in surplus-producing sections are for December 1 only, and those for the West Virginia counties represent prices received by farmers for sales throughout the year, the comparison indicates approximately the differences.

TABLE 2.—*Average farm prices of crops in 1926 in Nicholas and Webster Counties compared with average farm prices as of December 1 in main surplus-producing areas for the same year*

Product	Unit	Farm price, season of 1926, Nicholas and Webster Counties	Farm price, December 1, 1926, in surplus-producing areas
Corn	Bushel	$1.26	$0.56 (in Iowa).
Wheat	do	1.83	1.19 (in Kansas).
Oats	do	.82	.35 (in Iowa).
Buckwheat	do	1.33	.89 (in Pennsylvania).
Hay	Ton	15.11	14 (in Ohio).
Potatoes	Bushel	[1] 1.14	1.20 (in Wisconsin).[2]

[1] The price range during the fall of 1926 was $1 to $1.25 per bushel.

[2] In the fall months, prior to December 1, the farm price in Wisconsin had been reported at 25 to 30 cents per bushel.

Fat lambs and a considerable amount of poultry, particularly turkeys, are shipped to outside markets, mainly to Jersey City and Baltimore.

Credit facilities in the Nicholas-Webster section are apparently adequate, in view of the small degree of commercialism which characterizes the system of farming. The habit of borrowing for productive purposes has not become very prevalent, and little use is made of farm-credit institutions other than the local banks. In 1924, according to the Federal census, only 9 per cent of the farms reported mortgage indebtedness. Most of this credit was extended by private individuals.

The general property tax is chiefly relied upon for the raising of county and district revenue in this and the surrounding area. In spite of the fact that the State aids liberally in the support of the schools, they and the roads absorb about 85 per cent of the taxes raised locally. Table 3 shows in detail the purposes for which tax levies were made in four typical magisterial districts.

TABLE 3.—*Rate of levy on each $100 of assessed value in typical districts of Nicholas and Webster Counties for year ended June 30, 1928*

Purpose of levy	Nicholas County		Webster County	
	Wilderness district	Hamilton district	Fort Lick district	Hacker Valley district
General State expenditures	$0.10	$0.10	$0.10	$0.10
State of Virginia debt	.04	.04	.04	.04
Total State levy	.14	.14	.14	.14
General county expenditures	.30	.30	.30	.30
County roads	.25	.25	.25	.25
District roads	.15	.15	.15	.15
Roads; interest and sinking fund	.32½		.30	.30
Health officer			.03	.03
Special emergency district road levy	.10	.10		
Total levies by county court	1.32½	.80	1.03	1.03
Elementary teachers	.65	.55	.54	.64
Maintenance of school buildings	.15	.08	.15	.15
New school buildings	.20	.05	.20	.15
High-school teachers	.13	.13	.45	.05
Maintenance of high-school buildings	.02½	.02½	.06	
School interest and sinking fund	.02½	.02½	.05	
Total levies by board of education	1.18	.86	1.45	.99
Grand total all levies	2.64½	1.80	2.62	2.16

Although the maximum rates permitted by law have been levied for most purposes, deficits are common, particularly in the general county and the various school levies. The deficits are becoming more frequent on account of the declining value of agricultural, coal, and timber lands. To avoid them, expenses must be reduced, or assessments must be raised, or the legal rates of levy must be increased. Perhaps all these measures must be employed.

DIFFERENTIATION OF FARM AND OTHER LAND—AGRICULTURAL PHASES OF THE PROBLEM

A study of land as it is related to the income of farmers showed that there are considerable areas of certain land types in which practically all the farms have low incomes [5] and that there are other areas in which high incomes are generally obtained.

Incomes made by the farmers on poor, rough, stony, badly located lands were generally low as might be expected, whereas the incomes of the farmers on the better kinds of land were much higher. The land that returned low incomes is referred to as nonagricultural while the land that returned relatively high incomes is called agricultural land. Plate 1 shows the location of the agricultural and the nonagricultural land. An arbitrary satisfactory income that will be discussed later was selected as one measure of the adaptability of a land type to agriculture.

It was not assumed that all the farms on a land type should be abandoned whenever a large number of the farmers failed to make this satisfactory income. Many individuals would undoubtedly get a better income on this poor land than could be obtained in any alternative situation under existing conditions. Until society has provided a directing agency that will enable people to change occupations or location wisely, the greatest number can be given help in improving their conditions in their present environment rather than by suggesting a change. In spite of the fact that a low income land type may be occupied by a large number of people who can not find a better alternative, it must be recognized that from a social point of view there are problems on such land.

In some cases there may be partial abandonment, thus increasing the burden of maintaining adequate institutions and in other instances the people may remain on the poor land content with inadequate social institutions. No general solution to the problems on poor land types can be given, but they must be recognized and plans should be made looking toward the provision of a better living for the people who are handicapped by poor land.

Tenants' expenditures, rather than owners', have been adopted as the most appropriate measure of the standard of living used as a criterion to determine whether the land should be regarded as below or above the economic margin of utilization (Table 4), because of the fact that if a Nicholas or Webster County farmer should migrate to another agricultural section where the land is considerably above the margin he would probably go there as a tenant, for even though he might have owned a farm in Nicholas or Webster County it presumably would have been of low selling value.[6]

An income of approximately $1,200 would probably support a farm-living standard in West Virginia equivalent to the somewhat more expensive standards for the other States shown in Table 4.

[5] For definition of income used, see p. 11.

[6] This statement is subject to some qualification. Some farms in this section are unsuited for profitable farming simply because they are too small. This is particularly true of the farms on Dekalb loam. Migration of a part of the population would permit consolidation of the small farms into larger ones. In this event the consolidating owner could afford to pay a price for land which, under the old order of things, was not yielding a reasonable return. As a matter of fact, land is frequently purchased for agricultural use, often at a high price, long after it has become submarginal for agricultural use. This is ordinarily because of misinformation, usually on the part of the unwary buyer. Moreover, the land, though submarginal for agricultural use, might still be supramarginal for forest use, in which case it would have some selling value.

Lumber is cheap, thus reducing the cost of housing. In central West Virginia the farm woodland furnishes a supply of fuel. Coal, too, is very cheap, many farmers having small mines on their own land.

TABLE 4.—*Tenants' standards of living as measured by the value of the various items of family living* [1]

Item of consumption	Kentucky [2]	Kentucky [3]	Ohio [4]	New York [5]	Missouri [6]	Iowa [7]	Kansas [8]	Average of totals
Number of farms	131	93	81	107	36	239	162	.....
	Dollars	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*
Food	550	594	564	818	789	600	592	642
Clothing	192	180	239	286	271	212	167	221
Furnishing and equipment	27	30	53	137	72	30	37	55
Operating expenses	155	155	198	134	260	216	168	184
Health	45	61	47	100	81	83	53	68
Advancement	38	53	49	319	122	72	65	103
Personal	23	11	52	24	61	25	40	34
Insurance	102	28	26	.....	59	49	30	43
Unclassified	5	.....	2	6	.....	.....	3	2
Total	1,143	1,110	1,240	1,823	1,701	1,287	1,161	1,354

[1] Value of shelter is not included among the items of family living, but value of food and fuel furnished by the farm is included, as well as items purchased. The aggregate values for the various surveys are adjusted to 1927 price levels, on the basis of the index numbers of prices of commodities used by farmers in family living. No modifications were made in the figures for 1922, 1923, and 1924, because the difference as compared with 1927 was so slight. The final average of totals is a simple average.

[2] NICHOLLS, W. D., and KIRKPATRICK, E. L. COST OF LIVING IN FARM HOMES, MASON COUNTY, KENTUCKY, A PRELIMINARY REPORT. U. S. Dept. Agr., Bur. Agr. Econ. 9 p. 1924. [Mimeographed.] Data for year ended June 30, 1923.

[3] KIRKPATRICK, E. L., and SANDERS, J. T. COST OF LIVING IN FARM HOMES IN SEVERAL AREAS OF KENTUCKY, TENNESSEE, AND TEXAS, A PRELIMINARY REPORT. U. S. Dept. Agr., Bur. Agr. Econ. 14 p. 1924. [Mimeographed.] Data for year ended Jan. 1, 1921. Data corrected to level of prices paid by farmers for commodities used in living, 1927.

[4] ——— and MELVIN, B. L. LIVING CONDITIONS AND COST OF LIVING IN FARM HOMES OF DELAWARE COUNTY, OHIO. A PRELIMINARY REPORT. U. S. Dept. Agr., Bur. Agr. Econ. 18 p. 1924. [Mimeographed.] Data for year ended Oct. 1, 1923.

[5] ——— ATWATER, H. W., and BAILEY, I. M. (5) Data for the year ended Sept. 1, 1921. Data corrected to level of prices paid by farmers for commodities used in living, 1927.

[6] ——— LIVING CONDITIONS AND COST OF LIVING IN FARM HOMES OF SELECTED LOCALITIES OF MISSOURI. A PRELIMINARY REPORT. U. S. Dept. Agr., Bur. Agr. Econ. 20 p. 1924. [Mimeographed.] Data for year ended Jan. 1, 1924.

[7] VON TUNGELN, G. H., THADEN, J. E., and KIRKPATRICK, E. L. (9). Data for year ended June 30, 1922.

[8] KIRKPATRICK, E. L., BURR, W., and BATCHELOR, E. M. LIVING CONDITIONS AND FAMILY LIVING IN FARM HOMES OF SELECTED LOCALITIES OF KANSAS. A PRELIMINARY REPORT. U. S. Dept. Agr., Bur. Agr. Econ. 21 p. 1925. [Mimeographed.] Data for year ended Dec. 31, 1923.

A schedule of expenditures which would need to have been made on the Nicholas and Webster County farms in 1928 to support standards of living equivalent to those found in supramarginal competitive agricultural sections is as follows:

Cost of living in Nicholas and Webster Counties, 1927 and 1928

Items of consumption	Cost
Food (purchased and home produced)	$628
Clothing	218
Furnishings and equipment	53
Operating expenses	93
Health	66
Unclassified	189
Total	1,247

People are bound by ties of sentiment and tradition to a section which has been their home for several generations. A considerable degree of inertia and friction is ordinarily involved in migrating from one place to another. It will therefore take a considerable difference of income to lead farmers to migrate. An allowance has been made

for these frictional elements, and in order to be conservative the necessary income for the West Virginia counties has been reduced from $1,247 to an even $1,200, of which approximately $450 is family living produced on the farm.

The competitive positions of the different kinds of land may be changed by a variation in the prices of the products; but since a smaller income in this section would in all probability be accompanied by a smaller income in other sections, it is likely that the greater part of the land classified as nonagricultural will continue to be in that category.

The average expenditures for living by tenants in the different States is composed of individual expenditures that vary greatly in amount. It is also true that there is a great range in incomes received by the farmers in Nicholas and Webster Counties.

In some localities in these two West Virginia Counties in which the average incomes were below the $1,200 standard of expenditures, there were many farms with incomes above the standard. It is to be expected also that a part of the Nicholas and Webster County farmers would be unable to get a better income in a supramarginal area in another part of that State or in some other part of the country.

The number of farmers who could improve their condition by moving would not be large at any given time. It is clear, however, that some of the land now in farms is not adapted to cultivation but should be used for grazing or the production of timber, both of which uses would furnish a livelihood for fewer families.

In considering the alternatives for these farm families, it must be recognized that the size of the family has an influence in determining what income is necessary to attract farmers to another section. The families in the Nicholas and Webster section average 7.2 persons, and the tenant families whose average expenditures were shown in Table 4 vary from 4 to 4.8 persons. The expenditure per person is, therefore, greater for the tenant families than for all families in these two West Virginia counties. Assuming that expenditure gives some indication of a standard of living, it appears probable that the estimate of $1,200 on the 1927 basis as an income necessary to hold farmers in Nicholas and Webster Counties is conservative. It would be materially lower in 1931.

In this study it was decided to employ, as an important indication of the suitability of land for farming, the net income obtained by farmers as a result of their farming operations plus such incidental returns from outside employments as seemed to fit into the farm economy. Data were obtained from 225 farms of various soil types and topographic conformations. A detailed income analysis for each of 174 of the farms was obtained. For the other cases, information bearing on various aspects of the farm economy was obtained, but the records were not sufficiently complete or the farm units themselves were not of such character as to permit or justify making an income analysis.

As a measure of the ability of an area to yield a return capable of maintaining a standard of living considered requisite to justify permanent occupancy, a concept of net income is employed which is designated operator's net income. In computing operator's net

income the ordinary running expenses, taxes, and interest on the investment in work stock, equipment, and buildings, and a charge for depreciation and upkeep on machinery and buildings other than dwellings, were deducted from the gross income, which included family living obtained in kind from the farm, and receipts from outside employment, gas leases, and other local sources of income. Interest was not charged on the "investment" in the bare land.

The investigators were concerned only in discovering whether the bare land, along with the operator's labor and the requisite buildings and equipment, would yield the net income, that (together with the incidental earnings obtained by the farmers from other employments) is sufficient to furnish the economic support for a standard of living which farmers obtain in competitive agricultural sections that are clearly above the margin of economic use.[7] Thus, the term "income" as here used includes "economic rent," or the earnings of the bare land wherever the land is above the margin. Since the investigators' concern was in locating the margin of agricultural use, the measuring of economic rent did not enter into the problem. Any earnings the farmer may have received from outside employment have been included in his income. This appears justifiable, first, because the income was probably not greatly in excess of what the farmer could have earned by confining his efforts entirely to his farm, and second, because a certain amount of outside employment fits into the farm organization and management practices of the section.

In studying the effects of soils and topography on income, the term "operator's land-labor income" has been employed, and is defined as the operator's net income minus the family living from the farm and income from outside employment. It seemed desirable to omit these items in studying the influence of the physical factors on income, although they are included when considering the question whether a particular locality yields a return that justifies its continued occupancy by farmers.

For short periods the income from the investment in buildings, equipment, and livestock is a quasi rent, rather than a necessary cost (*4, p. 74, 412, 420–421, 425–426, 577–579, 622–628*). This quasi rent is dependent upon the prices of farm products and the prices of cost goods entering into the economy of the farm. For short periods the farm revenue need not necessarily be sufficient to allow an interest and depreciation charge on this investment. For long periods, however, (and it is with a long period that this study is mainly concerned) the farm must yield a revenue adequate to cover a normal interest and depreciation charge on the investment in buildings and equipment. It goes without saying that the farm must in the long run also yield a return for the family labor equivalent to the return which laborers with the same grade of ability obtain in distinctly supermarginal agricultural sections, or the income which labor of the same grade or ability obtains in industrial employment.

[7] In some sections the investment in buildings is greater or less than would be requisite for efficient farm operation, but it is not believed that in the section under consideration such tendencies introduce serious complications.

In localities where the operator's net income for most farms is insufficient to support the standard of living that these people are likely to demand, it appears probable that ultimately the land will be abandoned, and will revert to brush and trees. Where the operator's net income now obtained by the farmers in this section is more than adequate to support the standard of living that is secured by people of the same grade of ability in agricultural sections clearly supermarginal or in industrial employment, the land probably will remain in agricultural use.

RELATIONSHIP OF SOIL TYPE TO FARM ECONOMY

Income and other aspects of the farm economy were classified with respect to four main soil types. These were the Dekalb and Atkins silt loams in combination,[8] Dekalb silt loam alone, Dekalb loam, and Dekalb stony silt loam. The acreage of each of the soil types in Nicholas and Webster Counties is shown in Table 5.

TABLE 5.—*Soil areas of Nicholas and Webster Counties* [1]

Soil type	Nicholas County	Webster County	Total	
	Acres	*Acres*	*Acres*	*Per cent*
Dekalb series:				
Dekalb stony silt loam	163,732	235,492	399,224	51.75
Dekalb silt loam	113,068	23,657	136,725	20.02
Total smooth phase	17,758		17,756	
Dekalb stony loam	73,306		73,306	9.50
Dekalb loam	18,577		18,577	2.41
Pope series:				
Pope sandy loam	9,319	7,504	16,823	2.18
Pope loam	1,012		1,012	.13
Pope silt loam	379		379	.05
Miscellaneous series:				
Atkins silt loam	3,233	1,209	4,442	.58
Lickdale silt loam	1,204		1,204	.16
Upshur silty clay loam	696		696	.09
Upshur stony silty clay loam		7,186	7,186	.93
Meigs clay loam	250		250	.03
Moshannon fine sandy loam		2,162	2,162	.28
Rough stony land	14,074	77,650	91,724	11.89
Total land area	416,606	354,860	771,466	100.00
Water area of the larger streams	1,194	1,293		

[1] The figures for the total area of the counties are the result of controlled mensuration on the United States Geological Survey quadrangle sheets, with the areas of quadrilaterals of 5 minutes' extent in latitude and longitude serving as control. The areas of the soil types are taken from the soil survey reports but are adjusted proportionately to the new figures of the total land areas.

Table 6 shows, by major soil types, the operator's land-labor income, the value of family living furnished by the farm, the income from outside employment, and the operator's net income. Family living furnished by the farm is largely a function of size of family. The farm having poor soil and rough topography and the size of which is limited by the physical features of the land returns an inadequate income, and greater reliance must accordingly be placed on income from outside employment.

[8] Atkins silt loam is an excellent bottom-land soil but is subject to overflow. It is always used in connection with Dekalb silt loam, an upland soil. Since no farms were on Atkins silt loam exclusively, it was necessary to consider the Atkins silt loam in connection with Dekalb silt loam.

The largest operator's land-labor incomes were more frequently found on the combination of Dekalb and Atkins silt loams. (Fig. 1.) The next largest incomes were found on the Dekalb loam and the Dekalb silt loam, which were nearly the same. These incomes, however, were due in part to the larger size of the farms in the latter group. The lowest average land-labor incomes from the farm prevailed on the Dekalb stony silt loam. The relationship between soil type and income can not be attributed to the influence of soil type alone. The other influences—topography, size of the farm, and the personal characteristics of the operator himself—must be considered.

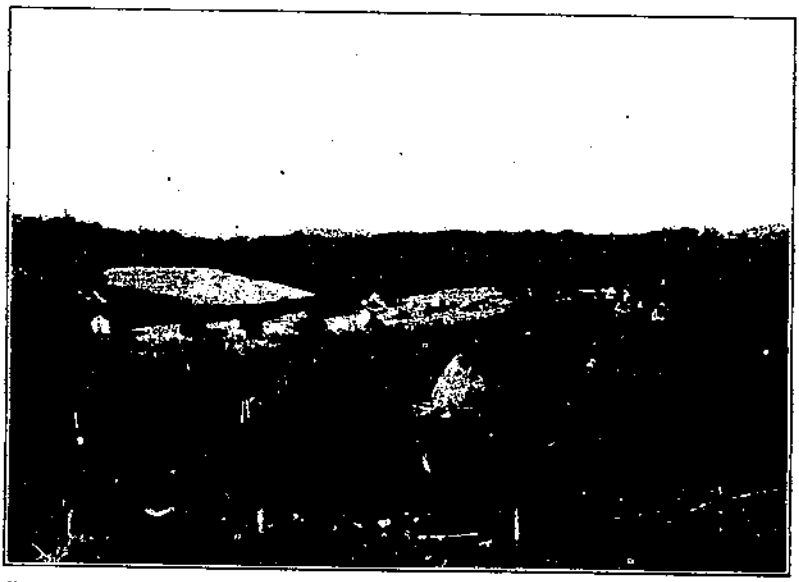

FIGURE 1.—The broad-valley type of land. The soil in this instance is largely Atkins silt loam and is used chiefly for meadow or pasture

But, where soil and topography were both unfavorable, the operator's land-labor incomes were, with few exceptions, low regardless of the personal characteristics of the farmer.

TABLE 6.—*Incomes of farmers on soils of the major types, Nicholas and Webster Counties*

Soil type	Number of farms [1]	Value of family living furnished by the farm	Operator's land-labor income	Income from outside labor	Operator's net income
Dekalb and Atkins silt loams [2]	24	$471	$866	$270	$1,613
Dekalb loam	9	476	540	185	1,201
Dekalb silt loam	89	457	521	255	1,233
Dekalb stony silt loam	24	474	145	367	986
Miscellaneous	28	421	396	184	1,001

[1] In the two counties 225 farms were visited. Complete income data were obtained on 174. On 28 farms the soil types were so varied that they did not fall clearly within any one of the 4 soil classes. These are designated in the table as miscellaneous.

[2] See note regarding combination of Atkins silt loam with Dekalb silt loam, p. 13.

SOIL TYPE AND CROPS

To understand why small incomes are associated with certain types of soil it is necessary to examine the utilization of the various soil types for cropping, grazing, and forestry and the yields that are obtained from these uses. Table 7 shows the size of the farms associated with the four main soil types and the percentage of the land in each type devoted to crops, pasture, and woodland, respectively.

The Dekalb and Atkins combination is ordinarily associated with large farms in the broad valleys. The Atkins silt loam in the broad

FIGURE 2.—A valley farm surrounded by hills of moderate slopes, partly cleared. The field in the foreground adjoining the railroad is a typical poorly drained meadow

valley bottoms has always been used for growing hay and until recently has furnished winter feed for large numbers of cattle brought down from the surrounding uplands. (Fig. 2.)

TABLE 7.—*Average size, distribution of farm acreage among major uses, and operator's land-labor income per acre of cleared land, by major soil types*

Soil type	Number of farms	Size of farm	Cleared land, per farm	Operator's land-labor income from the farm per acre of cleared land [1]	Percentage of the cleared land—		Percentage of land in farms which is woodland
					In crops	In pasture	
		Acres	*Acres*	*Dollars*	*Per cent*	*Per cent*	*Per cent*
Dekalb and Atkins silt loam	24	227	163.3	5.30	36.7	63.3	27.3
Dekalb loam	9	89	55.6	9.71	52.6	47.4	36.9
Dekalb silt loam	89	130	74.8	6.97	47.0	53.0	41.7
Dekalb stony silt loam	24	116	50.8	2.70	34.9	65.1	53.2
Miscellaneous	28	167	78.7	5.16	44.3	55.7	53.4

[1] The most significant measure of the size of farm is the acres of cleared land per farm. The woodland is for the most part cut over and will yield no cash income for some time. The amount of pasture furnished by the woodland is negligible.

The Dekalb loam is excellent for cropping. It is an upland soil and is well drained. The early settlers quickly learned of its superior productiveness, and as the population grew, the farms were frequently subdivided until they now contain an average of only 89 acres. The operator's land-labor income from the farm per acre of cleared land on this soil is somewhat greater than that of the Dekalb silt loam, but because the farms are small the income per farm is only slightly greater than on the Dekalb silt loam, a soil inferior to the Dekalb loam. The low return per acre on the Dekalb and Atkins silt-loam combination does not reflect so great a difference in fertility in comparison with the Dekalb loam and Dekalb stony silt loam. It is, rather, due to the fact that so large a proportion of the cleared land on the Dekalb and Atkins silt-loam farms is devoted to pasture and meadow, much of it being too wet for cultivation.

The Dekalb loam and Dekalb stony loam soils are of light texture; during dry weather they quickly lose their moisture, which makes them unsatisfactory for pasture use. Their light texture, however, is advantageous for cropping, and on the Dekalb loam farms potatoes frequently yield as much as 300 bushels per acre. The stony character of the Dekalb stony loam makes it unsuited for cropping, and its light texture makes it unadapted to pasture use. Its productivity is therefore even lower than that of the Dekalb stony silt loam, and on this account it has been excluded from the zone of agricultural use.

The "rough stony land," of which there are 92,352 acres in the two counties, is distinctly inferior to the Dekalb stony and Dekalb stony silt loams and is therefore placed in the zone of forest use. This disposition of the land is also justified by the fact that it has never been occupied by farmers.

The yields and acreages of the principal crops grown on the farms included in this study are shown in Tables 8 and 9, respectively. Differences in the yields of corn, hay, potatoes, and orchard products are notable. The yields on the Dekalb loam farms are fairly high, but the acreage of each crop per farm is small, largely because of the rugged topography of the section.

TABLE 8.—*Normal*[1] *yields per acre of the principal crops*

Soil type	Corn	Oats	Hay	Wheat	Buckwheat	Potatoes	Apples
	Bushels	*Bushels*	*Tons*	*Bushels*	*Bushels*	*Bushels*	*Bushels*
Dekalb and Atkins silt loam	42	28	1.1	16	28	144	52
Dekalb loam	37	27	1.1	16	27	138	56
Dekalb silt loam	36	28	.8	14	26	113	37
Dekalb stony silt loam	26	29	.9	15	25	95	25

[1] By "normal" is meant the yield which the farmer ordinarily expects.

TABLE 9.—*Average acreage per farm of the principal crops, 1927*

Soil type	Farms	Corn	Oats	Hay	Wheat	Buckwheat	Potatoes	Apples
	Number	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*
Dekalb and Atkins silt loam	24	8.5	6.1	41.0	1.0	0.5	0.9	1.4
Dekalb loam	9	5.1	5.0	10.0	3.8	1.6	.9	1.2
Dekalb silt loam	89	6.1	5.8	17.5	1.0	1.1	1.1	1.6
Dekalb stony silt loam	24	4.1	1.9	11.3	.1	------	.6	.8

SOIL TYPE AND LIVESTOCK ENTERPRISES

Livestock is the chief source of cash income in the West Virginia Appalachians. Farmers of Nicholas and Webster Counties usually raise from 8 to 10 head of lambs and from 3 to 12 head of beef-type calves each year. The size of the livestock enterprises is generally limited by the ability of the farms to supply winter feed and pasture. The number of cattle and sheep per farm and per acre was largest on the combination of Dekalb and Atkins silt loams. This is partly because of the larger size of these farms and partly because of the large yield of hay per acre on the Atkins silt loam bottom lands. The light texture of the Dekalb loam makes it better adapted to the growing of cultivated crops than to grazing. In Table 7 it is shown that the percentage of cleared land in crops is greatest on the Dekalb loam. The crop surplus on the Dekalb loam farms is sold to the growers of livestock on those soil types not so well suited to cropping.

The Dekalb stony silt loam is not suitable for cropping and therefore does not supply the winter feed required for growing cattle. As sheep raising is less dependent than cattle raising upon the growing of forage for winter feed, there are more sheep and fewer cattle per farm and per acre on the Dekalb stony silt loam than on either the Dekalb loam or the Dekalb silt loam. Nevertheless the number of animal units per farm on the Dekalb stony silt loam farms is very small, and this in turn is reflected in low incomes.

TABLE 10.—*Number of livestock and cash receipts from livestock per farm and per acre on the major soil types*

Soil type	Farms	Total cows, heifers, and steers		Ewes		Total animal units, cattle and ewes		Cash receipts from all livestock	
		Per farm	Per acre of cleared land	Per farm	Per acre of cleared land	Per farm	Per acre of cleared land	Per farm	Per acre of cleared land
	Number	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Dollars*	*Dollars*
Dekalb and Atkins silt loam	24	20.2	0.12	16.6	0.10	22.5	0.14	1,202	7.73
Dekalb loam	9	5.0	.09	8.8	.16	6.2	.11	687	12.37
Dekalb silt loam	89	7.8	.10	10.7	.14	9.3	.12	681	9.15
Dekalb stony silt loam	24	3.0	.06	10.8	.20	4.5	.08	286	5.32

RELATIONSHIP OF TOPOGRAPHY TO FARM ECONOMY

Farmers' incomes in this section are not dependent on soil type alone. To repeat, income is mainly the resultant of four major influences: Soil type; topography; size of business; and the personal characteristics of the operator himself as they affect methods of management and the conduct of operations. These are not independent influences. They are closely interrelated; it is consequently impossible to measure precisely the net effect of any one.

On the basis of topography the farms can be described as follows: Gently rolling upland, broad-valley, narrow-ridge, and narrow-valley. Twelve broad valleys occur in Nicholas and Webster Counties. They are from ¼ mile to 2½ miles in width and 1 to 12 miles long. The bottom land is usually Atkins silt loam; the upland, Dekalb silt loam. The total area of the broad valleys is approximately 25,000 acres.

The gently rolling upland includes, generally speaking, the Dekalb loam, the smooth-phase Dekalb silt loam, and the very small areas of Lickdale silt loam soils.

The effect of topography upon the distribution of farm land among its various uses is shown in Table 11. The narrow-ridge and narrow-valley farms are small and have fewer acres of cleared land and crop and pasture land per farm than do the broad-valley farms. This explains in part their low income-producing capacity. Since the steep hillsides are not suited to growing cultivated crops, the narrow-valley farms have a relatively small percentage of their cleared acreage in crops and a large percentage in pasture. Because they are subject to overflow, the broad-valley farms also are characterized by a small percentage of cleared land in crops and a large percentage in pasture. (Fig. 2.)

TABLE 11.—*Major land uses on the principal kinds of topography*

Topography	Farms	Size of farm	Cleared land per farm	Crops per farm	Cleared land in crops	Cleared land in pasture	Woodland
	Number	*Acres*	*Acres*	*Acres*	*Per cent*	*Per cent*	*Per cent*
Broad valley	16	304	193.8	64.6	33	67	35
Gently rolling	45	148	93.6	45.7	49	51	38
Narrow ridge	56	121	60.4	29.9	50	50	49
Narrow valley	57	123	67.0	25.6	38	62	45

The narrow-ridge farms, like the narrow-valley farms, are small, partly because of the subdivision which is one of the consequences of the gradual increase of population in a more or less isolated section, and partly because of the difficulties of farm organization and management involved in operating a large farm on a long, narrow ridge. As the farms are inclined to be stony, hand cultivation is necessary, and it naturally follows that the extent of crop land per farm must be relatively small.

Table 12 shows that the gently rolling land was, generally speaking, the most remunerative at the time of this study. The apparent influence of size of farm on operator's land-labor income for a specific type of topography is marked. It is true, the variations shown in Table 12 are not in every case precisely what would be expected, but it should be remembered that in the cross tabulation the 174 farms are subdivided into 24 classes and subclasses. Part of this variation can be attributed to the personal characteristics of the farmer, but no measure of this type of influence on income is available.

TABLE 12.—*Relationship between topography, size of farm, and operator's land-labor income from the farm, 1926–1927* [1]

Topography	Less than 50 acres		50 to 99 acres		100 to 149 acres		150 to 199 acres		200 to 249 acres		Over 249 acres	
	Farms	Income	Farms	Income	Farms	Income	Farms	Income	Farms	Income	Farms	Income
	Number	*Dollars*	*Number*	*Dollars*	*Number*	*Dollars*	*Number*	*Dollars*	*Number*	*Dollars*	*Number*	*Dollars*
Gently rolling	10	478	22	520	8	1,379	2	564	1	1,077	2	1,684
Broad valley	1	346	5	405	3	988	2	892	------	------	5	1,052
Narrow ridge	27	300	23	407	2	328	4	952	------	------	------	------
Narrow valley	23	113	21	289	9	739	3	823	1	571	------	------
Total and average	61	260	71	416	22	968	11	819	2	1,124	7	1,232

[1] The data are for 174 farms.

TOPOGRAPHY AND CROPS

The relationship between topography and the acreage and yields of the principal farm crops is shown in Tables 13 and 14. The acreage of most of the crops is smallest on the narrow-ridge and narrow-valley farms. The fact that in the case of some crops the yields on the two poorest classes of land are not notably less than on the two best classes probably reflects in part the fact that ordinarily only the better-lying land on the narrow-ridge and narrow-valley farms is used for cropping purposes and perhaps only the better soils.

TABLE 13.—*Average acreage of principal crops per farm by topography, 1927* [1]

Topography	Corn	Oats	Hay	Wheat	Buckwheat	Potatoes	Orchard	Garden	Other crops
	Acres	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*
Broad valley	7.4	5.5	46.7	0.8	1.1	0.9	1.6	0.3	0.0
Gently rolling	7.8	7.1	20.2	2.2	2.1	1.8	1.0	.4	.8
Narrow ridge	4.6	4.6	15.3	1.2	.7	1.1	1.8	.4	.5
Narrow valley	5.4	3.8	13.1	.1	.5	.7	1.4	.3	.3

[1] The data are for 174 farms.

TABLE 14.—*Normal yields per acre of principal crops* [1]

Topography	Corn	Oats	Hay	Wheat	Buckwheat	Potatoes	Orchard	Garden, value per acre
	Bushels	*Bushels*	*Tons*	*Bushels*	*Bushels*	*Bushels*	*Bushels*	*Dollars*
Broad valley	38	25	1.1	11	27	140	61	258
Gently rolling	36	31	.9	14	25	138	57	310
Narrow ridge	38	27	.8	16	23	99	45	203
Narrow valley	30	27	.9	14	23	103	36	233

[1] Based on data from 174 surveyed farms.

TOPOGRAPHY AND LIVESTOCK

A more pronounced relationship exists between topography and livestock operations than between topography and crop growing. Table 15 indicates that the numbers of both cattle and sheep are larger on the broad-valley and gently rolling farms than on the narrow-ridge and narrow-valley farms. The number of cattle per acre is also largest in the first two groups, but the number of sheep per acre is largest in the two latter groups. More feed is required to carry cattle through the winter than sheep. Since the acreage of crops is small on the narrow-ridge and narrow-valley farms it is more economical to raise sheep on farms of this type. On the other hand, the broad-valley farms produce a large quantity of hay, and for that reason their operators find it more economical to raise cattle. In the broad valleys the dampness of the ground is an obstacle to raising sheep, which thrive much better on the uplands than on the lowlands. Some consolidation of small farms will probably take place. This should make for more profitable livestock farming.

TABLE 15.—*Number of livestock on farms of the various topographic classes*

Topography	Farms reporting	Total cows, heifers, and steers		Ewes		Total animal units cattle and ewes		Cash receipts from livestock	
		Per farm	Per acre of cleared land	Per farm	Per acre of cleared land	Per farm	Per acre of cleared land	Per farm	Per acre of cleared land
	Number	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Dollars*	*Dollars*
Broad valley	15	29.7	0.11	15.3	0.08	22.9	0.12	1,361	7.02
Gently rolling	45	12.7	.14	13.8	.15	14.7	.16	931	9.94
Narrow ridge	55	5.2	.09	9.6	.16	6.6	.11	485	8.02
Narrow valley	57	5.1	.08	11.1	.17	6.7	.10	544	8.12

COMBINED EFFECT OF SOIL TYPE, TOPOGRAPHY, AND SIZE OF FARM ON FARM INCOME

The relationship of topography and size of farm was analyzed for the four most important soil types. A summary of this analysis is as follows: (1) On the Dekalb and Atkins silt-loam combination, 22 of 24 farms yielded a return of more than $1,200. These soils, therefore, appear to be adapted to reasonably successful farming. (2) The farms on the Dekalb loam are too small to return a satisfactory income but all of the land is agricultural and some consolidation of farms may be expected. (3) Only one of the 70 Dekalb silt loam farms containing less than 100 acres returned the minimum of $1,200. On the other hand 18 of the 19 farms containing 100 acres or more yielded incomes in excess of $1,200. It appears probable, therefore, that wherever topography permits tracts of Dekalb silt loam larger than 100 acres to be brought under single management, farming can be depended upon to continue indefinitely if the land lies in contiguous acreages large enough to support the necessary community institutions. (4) Only one of the Dekalb stony silt loam farms, regardless of size, yielded a satisfactory income. The Dekalb stony silt loam is always associated with the more rugged of the narrow-valley and narrow-ridge lands. There appears to be no type of farming suited to the utilization of the Dekalb stony silt loam soils. "Where fields of Dekalb stony silt loam are farmed longer than a few years or severely grazed they often become so eroded that they are practically valueless for agriculture and are abandoned or revert to forest. The forest growth should never have been removed entirely from much of the type that has been cleared." (*6, p. 16.*)

This soil type comprises approximately 52 per cent of the two counties. The Dekalb stony loam that constitutes about another 10 per cent of the area is of less value for farming.

THE COMMUNITY AS A FACTOR IN DRAWING THE LINE BETWEEN FARM AND OTHER LAND

So far the discussion mainly concerned the farmer as an individual, but another important aspect of the problem is the relationship of his farm to other farms in the community. The question is whether it is likely that this group of farms will in the future be able to produce enough to maintain a satisfactory community standard without a subsidy from outside.

PLATE 2 FOUND AT END OF BULLETIN.

In attempting to draw the line between farm land and other land and to determine institutional readjustments that appear desirable in connection with such a differentiation, a special study was made of the relation between the cost of supporting certain community institutions, particularly roads and schools, and the soil and topographic peculiarities of the section. These additional data in turn tend to confirm all the conclusions with respect to the distinction between farm and other land that had been drawn through considering merely the individual farm economy.

The first step in the study of the various communities was to locate each farm on a soil and topographic map, on the basis of information supplied by the district assessors. Plate 2 shows the location of the farms with respect to soil type and topography. It was found that the density of the farms and consequently of population, varied with soil and topographic conditions, being much less on poor than on good soils. Thirty-five per cent of all the farms in the two counties are located on soils on which incomes of less than $1,200 per farm can be expected. These soils constitute 73 per cent of the area of the two counties. On the other hand, 65 per cent of the farms are on land on which incomes of more than $1,200 per farm can be expected and which makes up the remaining 27 per cent of the total area. This difference in density of population makes the cost of schools and roads relatively high on the nonagricultural soils.

It was found that in certain small areas the soil and the lay of the land were satisfactory for farming, but there was not enough land of this character to provide a sufficient number of farms to support needed community institutions. In these more or less isolated communities the cost of financing schools and roads would now be more than the farmers could bear were they required to contribute all the cost or even a very substantial part of it. In such communities the largest part of the cost of maintaining schools and roads is borne by the nonagricultural land; that is to say, the timberland. Once the timber is removed, the financial support for the roads and schools will vanish, and the farmers will be forced to abandon their farms or get along with very inferior schools and roads.

Two areas that illustrate these conditions are upper Hamilton and lower Wilderness districts in Nicholas County. In reaching a decision as to the permanent agricultural possibilities of these two districts the determining factor was the cost of roads and schools per farm. In considering this cost the contributions from the county and the State have been included. Where the good land lies in small tracts and the farms are therefore scattered, the cost of maintaining schools and roads is so high that it would be cheaper for the State and county to buy the farms than to continue to maintain roads and schools.

In considering whether population in a particular area is sufficiently dense to justify the public in providing schools and other facilities and is likely to continue so, it is necessary to have in mind also those who make a living partly or wholly from nonagricultural occupations, and those who appear to be in various stages of gradually abandoning farming as an occupation. The farm residences of the section were therefore grouped according to type of use into six classes as follows: (A) Farms giving exclusive employment to operator; (B) farms operated throughout the year but operator working elsewhere during winters; (C) farms operated largely by family labor, but operator working

elsewhere most of the year; (D) farms used for garden and residence only; (E) farms operated in connection with an adjacent or neighboring farm; and (F) farms of which neither the land nor the buildings were being used. The number of each type is shown in Table 16.

TABLE 16.—*Number of farms on agricultural and nonagricultural land grouped according to the dependence of the farmers upon them for their living*

Class of land	Type of use						Total number of farms
	A	B	C	D	E	F	
Agricultural	596	145	375	320	137	171	1,744
Nonagricultural	172	69	290	255	50	122	958
Total	768	214	665	575	187	293	2,702

A = Farms giving exclusive employment to operator.
B = Farms operated all year but operator working out winters.
C = Farms operated largely by family labor, exclusive of head of family.
D = Farms used for garden and residence only.
E = Farms operated in connection with adjacent or neighboring farms.
F = Farms where neither land nor buildings are used.

TABLE 17.—*Percentage of farms on agricultural and nonagricultural land grouped according to the extent to which farmers depend upon them for their livelihood*

Class of land	Type of use [1]						Total
	A	B	C	D	E	F	
Agricultural	78	68	56	56	73	58	65
Nonagricultural	22	32	44	44	27	42	35
Total	100	100	100	100	100	100	100

[1] For definition of type of use (A–F) see Table 16.

TABLE 18.—*Number and percentage of farms by districts, land grouped according to the dependence of the farmers upon agriculture for their living*

District	Type of use [1]												Total	
	A		B		C		D		E		F			
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Nicholas County:														
Beaver	82	29	20	7	67	23	69	24	36	12	13	5	286	100
Grant	72	44	14	9	26	16	27	16	8	5	16	10	163	100
Hamilton	66	22	38	13	80	27	49	17	12	4	49	17	294	100
Jefferson	39	27	10	7	24	16	43	30	9	6	20	14	145	100
Kentucky	118	35	23	7	59	18	73	22	11	3	51	15	335	100
Summersville	65	40	10	6	27	17	26	16	9	6	24	15	161	100
Wilderness	155	51	17	6	47	15	26	9	28	9	32	10	305	100
Webster County:														
Fork Lick	35	20	12	7	60	34	33	19	10	6	24	14	174	100
Glade	74	19	33	8	134	35	84	22	34	9	26	7	385	100
Hacker Valley	30	14	23	11	53	26	81	30	13	6	9	4	209	100
Holly	31	14	16	6	96	39	63	26	12	5	24	10	245	100
Total	770	28	216	8	673	25	574	21	181	7	288	11	2,702	100

[1] See Table 16 for definition of type of use.

Type A and type B farms, which took practically all the operators' time throughout the year, were more frequently found on the better soils. Forty-two per cent of the farms on the agricultural soils were of these types. On the nonagricultural soils, however, only 25 per cent of the farms were of the A and B type. The type C and type D farms, which are mainly country residences with some farming done by family labor, were found in greater proportion on the nonagricultural soils. These two types made up 57 per cent of the farms on the nonagricultural soils, whereas they constituted only 40 per cent of the farms on the agricultural soils. The fact that the type A and type B farms are more often associated with the better soils, and the type C and type D farms with the poorer soils, is another indication that the latter are less productive and that greater dependence must be placed upon outside labor to maintain such standards of living as the people of the section insist upon.

The percentage of abandoned farms was not much greater on the nonagricultural soils than on the agricultural soils for two reasons. In the first place a considerable extent of the soil which has been designated here as being suitable for agricultural use is associated with a type of topography unsuited to agriculture. In the second place, lumbering operations are found in localities close to the rougher land and poorer soils. On this account, farms that would otherwise be abandoned are now in use, but mainly for residential purposes.

An analysis showed that the cost per farm of maintaining roads and schools for the widely scattered communities is very high. In 9 of the 11 districts the tax on the farms was scarcely enough to cover the cost of building and maintenance of roads; therefore, taxpayers other than farmers paid the entire cost of running the schools. These scattered, isolated communities are usually in the midst of large timbered tracts and derive the financial support for their roads and schools from the timbered lands. As the timber resources become depleted the farms will have to absorb this cost. It is obvious that they can not do so permanently, and unless large appropriations of State aid are made the schools and roads must deteriorate. This in turn will hasten farm abandonment, for people will not live permanently where the schools and roads are inferior to those that they now have.

Table 19 shows the cost to all taxpayers of maintaining roads and schools in the various districts of Nicholas and Webster Counties. The third column shows the total cost of providing these services for the individual farms. The fourth column shows that part of the cost paid by the farms themselves. The remainder of the cost, shown in the last column, is the amount paid per farm by taxpayers other than farmers, mainly owners of timber land.

TABLE 19.—*Average cost per occupied farm to all taxpayers and to taxpayers other than farmers, for roads and 1-room schools, and average taxes paid by occupied farms in the various districts of Nicholas and Webster Counties, 1927–28*

District	Average cost to all taxpayers per occupied farm			Average real-estate tax paid by farmers per occupied farm	Average cost to taxpayers other than farmers, per occupied farm
	For 1-room schools	For county and district roads [1]	Total		
Nicholas County:	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*
Beaver	60	113	173	40	133
Grant	62	33	95	32	03
Hamilton	65	58	123	45	78
Jefferson	89	66	155	25	130
Kentucky	80	30	110	26	84
Summersville	81	56	140	41	99
Wilderness	71	24	95	35	60
Webster County:					
Fork Lick	160	108	268	44	224
Glade	93	62	155	34	121
Hacker Valley	81	25	106	40	66
Holly	66	28	94	20	74

[1] Levies for highway bonds were omitted because nearly all of these funds have been used to build trunk and State roads between the towns.

The maintenance of the country roads and rural schools of Nicholas and Webster Counties costs taxpayers other than the farmers from $53 to $223 per occupied farm. That is to say, for each of the farms in the various school districts there was required from $53 to $223 of outside money to support the schools and roads. If funds were borrowed at 4½ per cent interest and the present taxes were used in paying the interest on these funds, it would be economical to buy these farms, paying as much as from $1,316 to $4,954 for each, in order to eliminate the cost of maintaining roads and schools. According to the 1925 Census of Agriculture (*9*), the average value of farms in Nicholas County was $2,993, and in Webster $3,062. In certain of the magisterial districts where the land is universally inferior for agricultural purposes all the farms could be purchased for much less than the capitalized value of the existing taxes that the taxpayers other than farmers are now paying to maintain schools, roads, and other institutions.

In the two counties there are 74 schools in the nonagricultural districts. In 45 school communities out of 116 in the two counties, eight or fewer occupied farms lay within the territory from which the schools drew their patrons. With an average of approximately five occupied farms per school, the average cost of these schools in Webster County ranged from $156 to $245 per occupied farm. The latter amount would pay the interest at 4½ per cent on $5,444 worth of bonds, which would provide sufficient funds to buy all the farms in the territory patronizing these schools, at the average census value for the county in 1925, and would leave a balance of $2,382 per farm. In Nicholas County the average cost of maintaining small 1-room schools in 12 selected communities was $184 per occupied farm. This sum would pay the interest on a fund of $4,088, which would leave a balance of $1,095 for each farm above the average census value of farms of the county in 1925. These farms could probably be bought for less than the average value of farms for the county as a whole, and the saving would be still greater.

It is significant that 78 per cent of the 45 rural school communities mentioned were located on soils designated as being nonagricultural, and the remainder were located on agricultural soils of steep or narrow topography. This fact, considered in connection with the high cost of schools per occupied farm, confirms the validity of excluding certain soil types and certain kinds of topography from the zone of agricultural use.

FORESTRY ASPECTS OF THE LAND-UTILIZATION PROBLEM

THE PRESENT SITUATION

REMOVAL OF OLD-GROWTH TIMBER

The old-growth timber (fig. 3) in central West Virginia seems destined to be removed completely within the next 15 to 20 years. If the rate of cutting that prevailed in 1927 should continue, the section

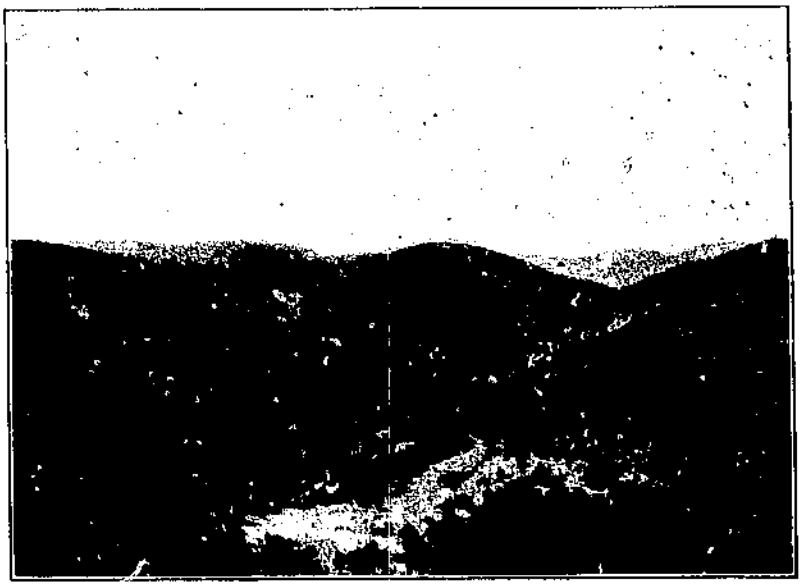

FIGURE 3.—Most of the rugged area of Nicholas and Webster Counties is still covered with timber. The valley of the Elk River from Webster Springs eastward contains one of the largest single tracts of virgin hardwoods in the East

would be entirely divested of its large tracts of virgin timber in 10 years and of its lightly culled timber in 18 years. It is not likely that the large band mills will afterwards turn to the second-growth timber. Cutting in this class of forest probably will not be materially increased, within the next 20 years at least, over the present rate. If this assumption is correct and if fires are kept within reasonable bounds, the forest at the end of the next 20 years, including the growth made in the meantime, may contain a total volume of around 1,750,000,000 feet board measure or about 6,700,000 cords of timber covering about 692,000 acres. This will consist largely of second growth, with small scattered remnants of the old-growth forest, mostly on farms, or in very inaccessible locations. These stands, together with the mer-

chantable second growth, wherever accessible, will be exploited mainly by portable sawmills.

EFFECT ON FOREST INDUSTRIES

The existing wood-using plants, including the pulp and paper mills, depend entirely upon the native supplies of old-growth timber. With the possible exception of the pulp mill they are all bound to disappear with, or shortly after, the band mills, or they will be withdrawn when the supply of large-size timber is gone.

It seems likely that the second-growth forests should afford an ample supply of timber at least for the secondary wood-working plants, which now consume in the aggregate slightly over 17,400,000 board feet annually. But even if the desired species (beech and maple) were present in the larger sizes suitable for veneer and handle stock, which is not likely to be the case, their scattered distribution among the many other species would alone prohibit their removal at a profit.

The plants utilizing hardwoods may continue operation for several years after the larger sawmills close down, by purchasing logs from farmers and from other owners of small tracts. Because of the small number of species that they can use, however, and because of the limited distribution of those species, they probably will not obtain a supply sufficient to warrant indefinite operation.

Second-growth forests will not yield sufficient spruce and hardwood to supply the pulp mill: its life can be extended beyond the 20-year period only by importing pulpwood, or by changing its equipment so as to utilize hardwoods. Whether the soda process would be commercially feasible for the many species available, particularly those of dark color, is open to question. The semichemical process, which is cheaper and more efficient in utilizing hardwoods, might be employed. The outlook for a continuation, possibly permanently, of pulp and paper manufacture is somewhat encouraging, in view of the ample quantity of available raw material and the short rotations required to grow trees of the requisite sizes.

On this situation hinges the continued operation of the Richwood branch railroad after the next 15 to 20 years. It is hardly likely, considering the nature of the products now being hauled out of the section and the limited possibilities for expansion of the coal industry, that sufficient tonnage would be available to justify a continuation of this line if all the large wood-working plants should cease their operations.

Such forest products as lumber and ties formed from 83 to 91 per cent of the total annual freight tonnage shipped from the section during the years 1922 to 1927. Other products derived from the forests, such as paper, wooden dishes, and clothespins, constituted an additional 6 to 11 per cent, and all forest products combined averaged 97 per cent of total shipments during those years. (Fig. 4.)

The products of agriculture alone certainly can not furnish sufficient tonnage, and it is doubtful whether the cut-over lands under present conditions will furnish material other than hardwood pulpwood sufficient to warrant continued operation.

EFFECT ON AGRICULTURE

While they lasted, the forest industries afforded important local markets for farm produce and an opportunity for employment which was needed to supplement the small farm incomes. The poorly

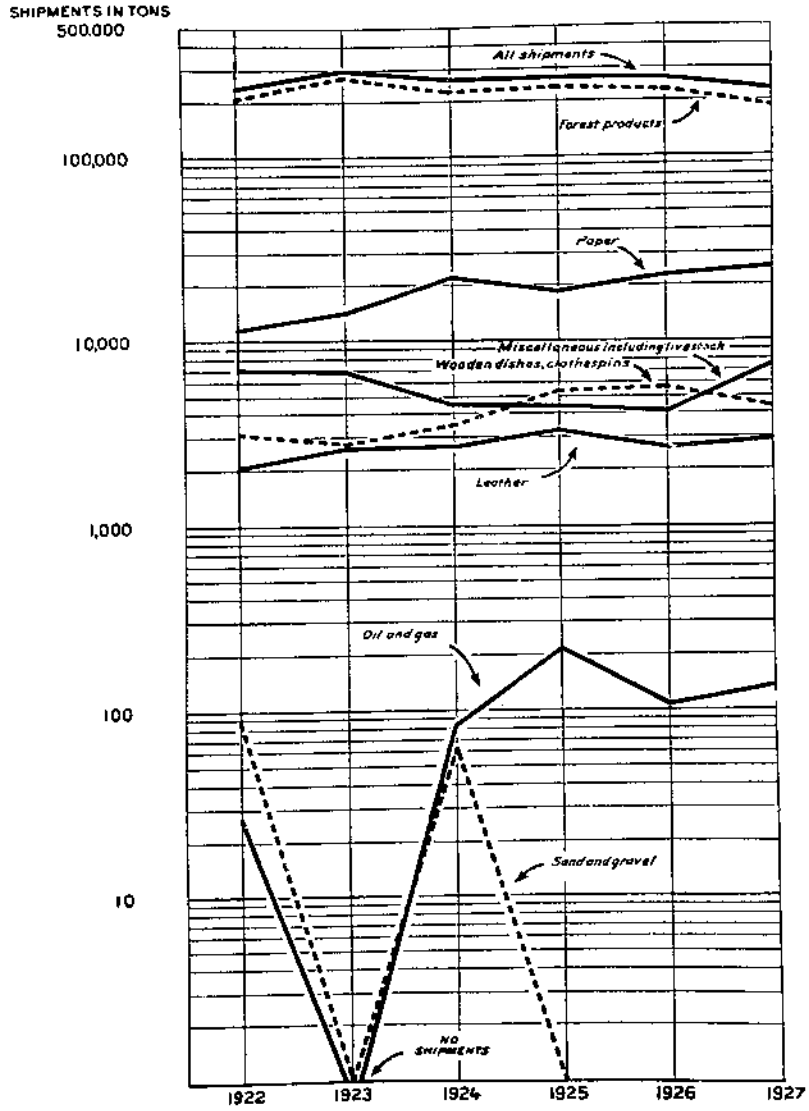

FIGURE 4.—SHIPMENTS FROM NICHOLAS-WEBSTER TERRITORY BY BALTIMORE & OHIO RAILROAD, 1922–1927

There is a slight trend downward of all shipments, and no products seem to be replacing those of the forest in importance.

stocked second-growth forests can not be expected to support industries on anywhere near so large a scale as those based upon the original stand. Only when effectively protected from fire and placed under

management will they ever give employment on any considerable scale.

Most of the farmers on the poorer soils are receiving inadequate incomes even with returns from outside employment amounting to about $300 a year. With the passing of the old-growth forests it will be difficult to maintain the present standard of living. Aside from the individual suffering, communities with persistently low incomes and consequently low standards of living constitute a threat to the standards of other communities more fortunately situated.

PRESENT FOREST COVER

The present forest cover including farm woodland and abandoned fields, either grown up or in the process of restocking, occupies roughly 664,000 acres, or 86 per cent of the entire land area of Nicholas and Webster Counties. Its distribution by classes of timberland is shown in Plate 3. The area of each class, including old fields, is given in Table 20. Various factors have influenced the development of many of the present characteristics of the forest cover.

TABLE 20.—*Distribution of forest areas by classes* [1]

Class of forest	Area in Nicholas County		Area in Webster County		Total area	
	Acres	*Per cent*	*Acres*	*Per cent*	*Acres*	*Per cent*
Virgin	11,200	3	34,900	11	46,100	7
Lightly culled	31,400	9	41,300	13	72,700	11
Merchantable second growth	104,100	30	60,000	19	164,100	25
Nonmerchantable cut over	181,500	53	171,500	54	353,000	53
Old field	18,800	5	9,500	3	28,300	4
Total	347,000	100	317,200	100	664,200	100

[1] Determined on the basis of information obtained from county officials, from maps of the larger holdings, from field observation, and from sample plots scattered throughout the section.

DEVELOPMENT OF LUMBERING

Much has been written concerning the early logging operations in West Virginia (*1*). In the section studied, the first cuttings, beginning as early as 1870, were strictly of a selective nature and included only the largest and best trees of a few species, because of the existing demand for but relatively few kinds of wood, and also because of the limitations of water transportation, used exclusively at that time to get the logs to the sawmills. Yellow poplar (*Liriodendron tulipifera*), black walnut, basswood, and later, spruce and hemlock were the species chiefly selected. During this period large numbers of logs were lost along the banks of the streams, for no attempts to salvage them were made.

Later, when mills were established closer to the forest and pole roads were built along the smaller streams, selected oak and chestnut trees were also taken.

After railroads were built into the territory, beginning in 1892, the more efficient railroad transportation rapidly replaced the wasteful "drifting" of logs. By 1910, 11 band mills in Nicholas County and 2 outside were cutting over 200,000,000 board feet annually, and in Webster County 4 band mills and 15 smaller scattered portables were in operation.

PLATE 3 FOUND AT END OF BULLETIN.

As the more intensive phase of lumbering developed, the possibilities of manufacturing products other than lumber were recognized and a large tannery, a pulp and paper mill, a woodenware plant, and a dowel and handle factory were established in Richwood, together with a softwood band mill. As a result, Richwood has become the center of the wood-using industry of the section.

The number of band mills has decreased since 1910 because of depletion of the timber. To-day there are four band mills in Nicholas County and four in Webster County.

EFFECT OF TYPE OF CUTTING ON FOREST COVER

VIRGIN STANDS

Nearly all the old-growth stands owned by farmers have been lightly cut into for domestic use. In other respects their character is no different from that of the large virgin tracts, except that they have received slightly better protection from fire. The volume of these stands runs from 12,000 to 25,000 board feet per acre, depending upon site, species, and severity of previous fire damage. Most of the volume is in the diameters [9] ranging from 12 to 24 inches, although these diameter classes contain only a small proportion of the total number of trees.

Severe suppression of the smaller trees (4 to 12 inches) is characteristic of old-growth stands. Suppression may be complete, preventing satisfactory growth of these smaller trees which, normally, would be growing the more rapidly.[10] Since the largest trees have passed their prime, disease and decay offset or even exceed the growth.

LIGHTLY CULLED STANDS

Lightly culled old growth (fig. 5) is characterized by the removal of large select trees of the best species. This practice leaves openings in which young trees, if present, find space for more rapid growth. If there is no young growth, new reproduction becomes established before the crowns of the remaining trees extend to close the openings. Most of the trees in these stands are still under 12 inches in diameter.

STANDS CUT TO DIAMETER LIMIT

After about 1900, operators began cutting to a rough diameter limit and utilized a wider range of species. The limit has varied from 18 inches to 12 inches, but in the earlier operations trees under 16 inches on the stump were not usually taken. This method of cutting left the stands in relatively good condition and with volumes averaging from 5,000 to 6,000 board feet per acre. Stands cut in this way from 6 to 25 years ago are now being cut over again.

STANDS HEAVILY CUT OVER

The present intensive phase of lumbering leaves principally those stands classed here as "heavily cut over" or "nonmerchantable

[9] Diameters of standing trees are measured at a height 4.5 feet from the ground, designated as breast height. This is usually written d. b. h.

[10] The individual trees may be divided into classes on the basis of the relative freedom of their crowns from shade. The collective term "dominant and codominant" is used to denote the fact that all or most of the crown is free of shade. Such trees are relatively of average size and larger. The term "intermediate and suppressed" indicates that most or all of the crown is shaded by taller trees. These terms apply to trees with straight, sound stems. Injured, deformed, or diseased trees, irrespective of their crown positions, are classed as "defective."

cut over." This is especially the case in stands either previously culled or cut to a diameter limit. Seventy-five to ninety per cent of the trees left are 10 inches or less in diameter, and the total residual volume is seldom over 2,000 to 4,000 feet per acre. From one-third to one-half of the remaining trees are defective. This large percentage of defect and decay in the small trees materially affects the ability of the stand to utilize the productive capacity of site. All stages of lumbering have been marked by removal of the most valuable and rapidly growing species. The remaining inferior species and defective trees have reseeded the ground and prevented adequate reproduction of the more valuable species. The slash left on the ground increases the danger of fire, which in many instances has completely destroyed such desirable second growth as had become established.

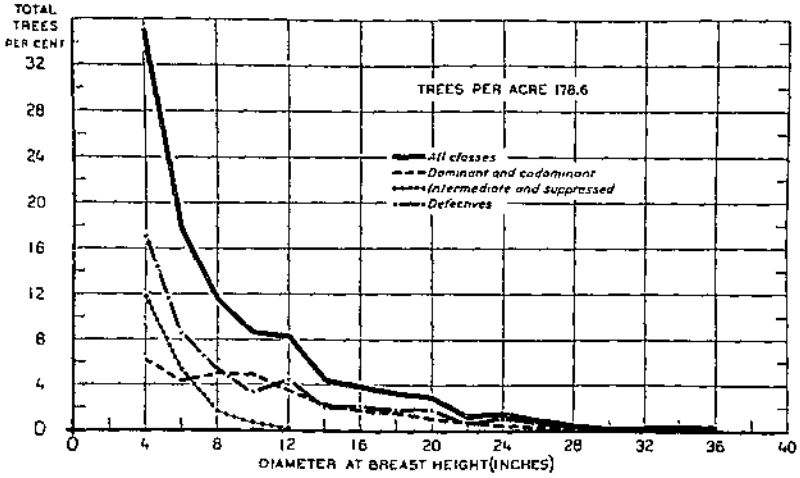

FIGURE 5.—STEM DISTRIBUTION IN LIGHTLY CULLED STANDS BY TREE CLASSES: OAK-CHESTNUT-HICKORY TYPE

The young trees of the dominant and codominant classes 4 to 12 inches in diameter have room to grow in the lightly culled stands.

EFFECTS OF FIRE ON THE FOREST COVER

As in all other sections of the southern Appalachians, fires have swept through the forests repeatedly. The greater part of the decay and the injury due to "timber worms" found in the older stands is the aftermath of earlier fire scarring. Fires have also impaired the fertility of the soil by burning the humus. This, along with the effects of scarring, has hastened decay and death of the timber.

The common butt rot, which is only one of the consequences of forest fires, renders valueless that part of the tree that contains the highest grade of lumber. Furthermore, the dead wood resulting from one fire furnishes excellent fuel for the next, and repeated burnings so weaken the trees that many of them are broken off by the wind.

Besides directly damaging the mature timber, fire greatly reduces the vigor of the forest. Although a large quantity of reproduction may follow even a severe fire, its quality is seriously impaired. Instead of seedlings, the new growth consists of sprouts, largely of

inferior species. This growth monopolizes the site and thereby reduces its productive capacity (fig. 6).

If, as often happens, fire breaks out in a young stand after cutting and before the slash has decayed, destruction of the young growth is nearly complete. Even a light fire in a young stand does far more damage than is outwardly apparent. Seemingly healthy trees in such stands frequently become infested with heart rot, although the fire scars may heal over. Trees damaged by fire when young can not be expected to maintain a vigorous growth. On the contrary, the rate of growth will gradually decrease as the decay established in the fire scar extends through the stem.

The early ascendancy of the useless species and the long time which must elapse before seedlings of the more valuable kinds can replace the inferior sprout growth, represent a distinct loss. If

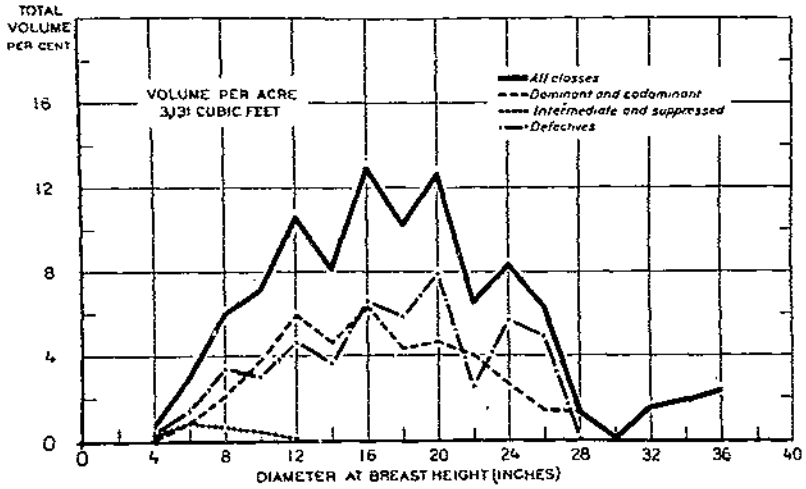

FIGURE 6.—VOLUME DISTRIBUTION IN LIGHTLY CULLED STANDS BY TREE CLASSES: OAK-CHESTNUT-HICKORY TYPE

A large proportion of the volume of lightly culled stands is in trees 16 inches and more in diameter.

fires again sweep through such stands, as too often happens, the productive capacity of the site may be totally destroyed.

EFFECT OF CHESTNUT BLIGHT

The nature, extent, and effects of the chestnut blight are not generally understood locally. Only during the last four to six years has any attention been paid to its progress. The damage done by the blight has generally been mistakenly attributed to insects. The blight has spread rapidly since 1927 and is affecting chestnut in farm woodland as well as in other timberland in all parts of both counties.

The blight is a fungous disease that attacks the living bark and outer sapwood, forming cankers which finally girdle and kill the part affected. Although the blight does not damage the wood, the dead part of the tree is quickly attacked by wood-destroying fungi and by insects and "timber worms," all of which combine to cause

rapid deterioration. The effects of these agencies have often been confused with the effects of the blight because their attacks occur so soon after the blight has killed the affected parts.

As the farmers of the section have depended mainly on mast crops to fatten their hogs, and as chestnuts have formed a large proportion of this crop, one effect of the blight will be to reduce this source of feed.

A more important effect of the blight is the killing of standing chestnut. Many farmers intend to hold their chestnut timber for better prices because lumber prices are now at a very low level. The heartwood of blight-killed chestnut is usually sound for about five years after death, and only the sapwood is immediately attacked by rot. Chestnut pole timber should be sold as soon as a market can be found, since users will not buy after sapwood has rotted.

FIGURE 7.—Dense reproduction of oak which has occupied the recently abandoned crop and pasture fields throughout the gently rolling glade area of Nicholas and Webster Counties. Three stages of growth are represented here. Every effort should be made to protect such growth and to improve it by occasional thinnings

EFFECT OF ABANDONMENT OF MARGINAL FARM LANDS

Abandonment of lands formerly used for agriculture has generally been quickly followed by the establishment of forest growth. Such factors as the existence, position, and species of seed trees, the degree, evenness, and exposure of slopes, and the direction of the prevailing winds have determined the character of regeneration. For example, on the Dekalb silt loam and on the dry slopes and coves of Grassy Creek in Webster County the oaks predominate because the forests surrounding the abandoned fields are composed largely of oak trees. (Fig. 7.)

Besides those old-field stands consisting chiefly of white, red, and scarlet oaks, designated here as the oak type, there are others con-

sisting mainly of yellow poplar, designated as the yellow-poplar type. A third class of stands, in which oak and yellow poplar are associated with various inferior species, is designated as the miscellaneous-species type. Nearly pure stands of black locust have been observed, but because of its short life and its susceptibility to the locust borer, black locust is not treated here as a separate type. The more prevalent invading species increase in numbers and gradually dominate the site to form eventually one of the three types mentioned.

The types may best be described by examples of specific, representative stands. A 13-year-old stand of oak occupies a north slope in Webster County on a field which was abandoned 14 years ago. Except for a few sprouts, the present growth seeded in from the mature trees on the slope above the field.

Practically all the trees are under 4 inches in diameter and average 18 feet in height. There are 3,408 trees to the acre, uniformly distributed. White oak alone constitutes 86 per cent of the total and scarlet oak 6 per cent. Red maple, hickory, dogwood, sourwood, and chestnut make up the remainder.

Another old-field stand of practically the same age and height is fairly dense, having 2,380 trees per acre, all under 3 inches in diameter breast high. White oak composes 48 per cent, red oak 19 per cent, and red maple, chestnut, and hickory the remainder.

Table 21 shows the diameter-distribution and number of trees of three older stands, all situated on Dekalb stony silt loam. The first is on a slope, the second in a cove, and the third on a slope. All face south or west.

Stands of yellow poplar occur on slopes or in coves facing north or northeast. Most of these are on fields abandoned since the Civil War, and after lumbering began. Because the rich fertility of the cove heads and slopes was rapidly reduced by erosion, the period of cultivation was too short to eradicate entirely the aggressively sprouting species such as chestnut, black locust, sassafras, and sumac, but enough yellow-poplar seed blew in from the near-by trees to take eventual possession of the site.

TABLE 21.—*Number of trees, by diameter classes, on 1 acre in three representative old-field stands of oak*

Diameter class	25 years old		30 years old		45 years old	
	Number	Per cent	Number	Per cent	Number	Per cent
4 to 10 inches	406	97.0	206	93.7	178	77.9
12 to 22 inches	10	2.5	14	6.3	42	18.3
24 inches and up [1]	2	.5			9	3.8

[1] Trees already present when stand was established.

As in the case of the oak, there is much difference between stands even when they are of the same age. Yellow poplar forms 55 to 87 per cent of the total number of trees, other valuable species 5 to 43 per cent, and inferior species 2 to 8 per cent. Three stands of practically the same age (26 to 27 years) had from 234 to 438 trees per

acre. Figures 8 and 9 show the distribution of diameters and volume in one of these stands.

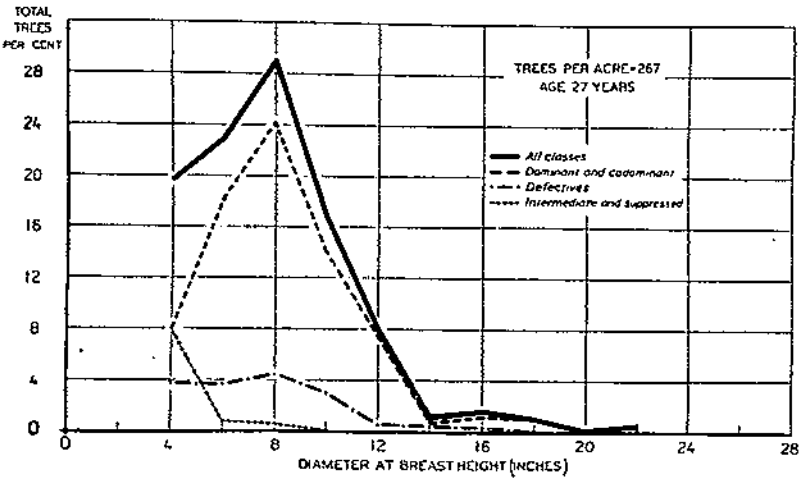

FIGURE 8.—STEM DISTRIBUTION IN OLD-FIELD STANDS, BY TREE CLASSES: YELLOW-POPLAR TYPE

The dominant and codominant trees make up a relatively high percentage of the old-field stands.

Stands of the miscellaneous-species type are also common in this section. Table 22 shows the mixed composition of three representa-

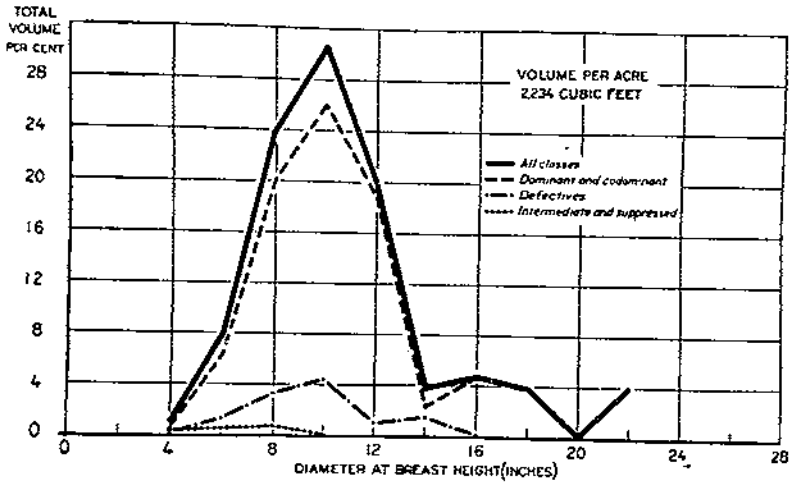

FIGURE 9.—VOLUME DISTRIBUTION IN OLD-FIELD STANDS, BY TREE CLASSES: YELLOW-POPLAR TYPE

Most of the volume of old-field stands is in the dominant and codominant trees.

tive stands of this type. These stands are on steep slopes too rough for farming.

TABLE 22.—*Composition of three representative old-field stands of the miscellaneous-species type*

Species	3-year stand	16-year stand	30-year stand	Species	3-year stand	16-year stand	30-year stand
	Per cent	*Per cent*	*Per cent*		*Per cent*	*Per cent*	*Per cent*
Yellow poplar	3.2	4.6	12.5	Black locust	11.3	-------	5.0
Red oak	1.8	21.1	1.5	Black gum	-------	-------	4.2
White oak	2.6	25.1	7.4	Sassafras	-------	36.6	36.6
Chestnut oak	4.2	-------	.9	Sourwood	-------	-------	2.1
Hickory	6.2	9.7	12.2	Dogwood	7.8	-------	-------
Chestnut	12.4	1.1	4.5	Sumach	41.3	-------	-------
Sugar maple	1.0	-------	3.0	Elderberry	4.6	-------	-------
Red maple	.2	-------	8.9	Witch hazel	.2	-------	-------
Beech	.2	.6	-------	Total	100.0	100.0	100.0
Yellow birch	.2	-------	-------				
Black cherry	.8	-------	-------		*Number*	*Number*	*Number*
Cucumber magnolia	.2	-------	-------				
White ash	1.0	-------	-------				
Ohio buckeye	-------	1.2	-------	Trees per acre	1,988	1,750	336
Butternut	.8	-------	1.2				

DISTRIBUTION OF FOREST COVER BY SPECIES

SOIL TYPE AND DISTRIBUTION OF SPECIES

The great number of tree species found in this section is characteristic of the southern Appalachian hardwood forest. On all soil types except the Upshur stony silty clay loam, chestnut is the most abundant species, followed by white oak, yellow poplar, beech, the black oaks, and hickory. Although most of the species are found on nearly all soils, their relative abundance varies.

On Dekalb stony silt loam, the most numerous trees in order of their abundance are chestnut, white oak, yellow poplar, hickory, beech, black oak, and basswood. Yellow poplar, basswood, and butternut are relatively more abundant than on any other soil type.

On Dekalb silt loam the chestnut, white oak, beech, sourwood, black oak, red maple, and chestnut oak are most abundant. Sourwood, hemlock, and sassafras are relatively more abundant than on other soils.

On rough stony land, beech, birch, sugar maple, black gum, magnolia, dogwood, and white ash occur more abundantly than elsewhere. The most common trees on this soil type are chestnut, beech, white oak, black oak, hickory, yellow poplar, sugar maple, and black gum.

On Dekalb stony loam the most abundant trees are chestnut, black oak, chestnut oak, white oak, black locust, sourwood, and hickory. Chestnut, chestnut oak, black locust, and black cherry attain their greatest relative abundance on this type of soil. Chestnut forms over one-third of the total stand.

The limited area of Upshur stony silty clay loam supports various species with yellow poplar, beech, sycamore, and sugar maple predominating.

Dekalb loam, which is confined chiefly to ridge tops, is also relatively unimportant because of its restricted area and irregular occurrence. Chestnut and white oak, hickory, black oak, and red maple are the species found most often on this soil.

TOPOGRAPHY AND DISTRIBUTION OF SPECIES

Topography as a factor in the distribution of species is important chiefly on the slopes of the broader valleys where the contrast be-

tween slopes with different exposures is most pronounced. The growth in coves is also affected by the direction of exposure.

In ascending a cool, moist slope with a northern or an eastern exposure a mixture of many species is found, with yellow poplar predominating and often forming pure stands. As the ridge crest is approached, the mixture changes to one of chestnut oak, hickory, and black gum; below, on the opposite slope, with its southern or western exposure, the stand consists chiefly of oak.

Definite combinations of species are often associated with particular types of topography. Two of the combinations most generally observed are designated here as the oak-chestnut-hickory type and the oak-chestnut-poplar type. The first is more often associated with the dry upper slopes and narrow ridges; it is also the most common combination on the gently rolling topography of the glade area. The second generally occurs on the less-exposed middle and lower slopes.

The number of species is largest on the long, smooth, moist slopes and benches of the deeper valleys, on the lower slopes of the narrow, sheltered valleys, and at the heads of moist coves. For the sake of simplicity such combinations have been designated here as the miscellaneous-species type.

OWNERSHIP OF FOREST LANDS

Nearly half of the forest land is held by individuals in small scattered tracts, mainly in "surface" ownership.[11] The remainder, in large blocks, is held in surface or "fee" ownership by corporate interests. (Table 23.)

Large lumber companies own approximately 19 per cent of the timberland in Nicholas County and 44 per cent in Webster County. A large portion of these tracts contains only nonmerchantable timber. It is being held for various reasons which are discussed later.

Coal companies own in fee approximately 12 per cent of the land in Nicholas County but practically none in Webster. This is in addition to the tracts owned by operators of mineral and timber together, whose holdings have been included in the lands owned by lumber companies. As a matter of fact, some of the mine corporations are affiliated with, or subsidiary to lumber organizations, so that the consolidation of the timber and mineral resources is all the more complete.

TABLE 23.—*Ownership of forest land in Nicholas and Webster Counties, 1927*

Ownership	Nicholas County		Webster County	
	Acres	*Per cent*	*Acres*	*Per cent*
Farm woodland [a]	49,000	14.1	66,000	20.8
Individually owned—				
Small scattered tracts [b]	116,500	33.6	90,000	28.4
Large tracts (500 acres or over)	13,800	4.0	18,000	5.7
Lumber and coal corporations	107,000	30.8	141,900	44.8
Land-holding organizations	60,700	17.5	1,000	0.3
Total forest land	347,000	100.0	316,900	100.0

[a] From U. S. Census of Agriculture, West Virginia, 1925 (*9*).
[b] Includes areas owned by large corporations.

[11] "Surface" ownership does not include any mineral rights. "Fee" is ownership of both surface and mineral rights.

RELATION OF OWNERSHIP TO METHODS OF UTILIZATION

Methods of forest utilization are but little influenced by the character of ownership. If timber is sold by a certain coal land corporation, for example, the only requirement is that the trees be cut to a diameter limit, generally above 14 inches. The purpose is to save the smaller trees for the use of those who will eventually mine the coal. If timber is sold by farmers or other small holders a minimum diameter limit may or may not be agreed upon. Trees of certain species may or may not be reserved, depending upon the inclination of the seller. Stipulations are seldom made as to how the tract shall be cut. In any event the farmer is in a position to give personal attention to the way in which his woodland is cut over should he wish to do so.

In the case of lumbermen cutting their own tracts, there is little evidence that they take any measures to perpetuate the forest other than by cutting to a diameter limit.

Small holdings, such as those included within farm boundaries, are usually close to roads and can be reached by portable mills. Tram roads are sometimes necessary, but in any case only a relatively small investment is required.

The larger tracts, on the other hand, can be made accessible only through heavy investments in logging equipment. The construction cost alone of a narrow gauge railroad amounts to about $3,500 a mile. For this reason operators consider that a million feet of timber must be available for each mile of railroad in order to keep unit costs within reasonable limits.

Large tracts lend themselves more readily than small tracts to management for sustained yield. At least one of the prerequisites of forest management—sufficient volume of timber to enable the production of steady supply in reasonably large quantities—is satisfied by large holdings; another advantage is that the overhead costs for protection and administration, being spread over a large acreage, are smaller per acre than in the case of small tracts.

PRESENT ORGANIZATION OF FOREST INDUSTRIES

Five kinds of wood-using industries are represented in the section: Sawmills, a pulp and paper mill, a dowel and handle factory, a woodenware plant, and a tannery.

PORTABLE SAWMILLS

Lumber is the principal product manufactured by the portable mills, but some of them also saw lath and have an annual output of 750 to 7,000 ties per mill. The annual output of a portable mill ranges from 500,000 to 4,500,000 feet of lumber. These mills depend almost entirely upon small tracts of farmer-owned timber. Because of their mobility they can reach small virgin tracts, as well as the more accessible cut-over areas. Logs are also purchased, and the smaller mills do custom work. Timber is purchased by the "boundary" or by the acre, rarely by the thousand board feet. Stumpage is purchased at an average of $5 a thousand for virgin timber, consisting mostly of oak, yellow poplar, and chestnut, and $3 for merchantable second growth. Because he is able to buy stumpage very cheaply, the mill operator can realize a profit despite his often wasteful and inefficient logging and milling methods.

The combined cost of felling and skidding is reported to average $6 per thousand feet. Logs bring about $8 to $9 per thousand feet log scale, delivered at the mill.[12]

Logs are transported by either standard or narrow gauge railways on some of the larger portable operations. Tram roads and inclines are also used. If the mill is situated on the timber tract the logs are skidded direct to it. Motor trucks are also used in logging by mills situated on Class A roads, and logs from farm tracts are frequently hauled over relatively long distances by wagon.

Hauling logs by rail costs from $4 to $10 per thousand board feet, depending on the width of gauge and the length of haul. The cost of hauling by horses averages $5 per thousand feet and by tram road $2 per thousand.

The average cost of sawing is about $6 per thousand board feet. Lumber grades usually run around 35 per cent No. 1 common and better, and 65 per cent No. 2 common and below.

The lumber is hauled by truck from 3 to 16 miles to points on the Baltimore & Ohio or the New York Central railroads. In most cases it is marketed through wholesalers who pay $40 to $45 per thousand board feet for the best grade of white oak and yellow poplar and $30 to $35 for average mill run at the railroad. The average cost of hauling is about $8 per thousand feet.

The ties go to the Baltimore & Ohio, the New York Central, and the local narrow-gage railroads. These railroads purchased about 4,000,000 feet of ties and 300,000 feet of lumber in 1927. Standard ties bring an average of $1 per tie, or $26 to $28 per thousand feet.

BAND-SAW MILLS

The timber supply of the large mills comes from several sources. Some of it is from their own land. Timber rights are also purchased from corporations or individuals, including farmers.

Stumpage values differ according to accessibility, logging costs, and quality of timber. Average prices for both virgin and second growth run from $3 to $6 per thousand board feet. The combined cost of felling and skidding is reported to average $8 per thousand. Logs are brought to the mill by standard or narrow-gage railroad at a cost ranging from $4 to $10 per thousand feet.

Logs are also purchased by some of the mills at from $9 to $25 per thousand, delivered at the mill. From 200,000 to 1,000,000 feet a year are purchased.

The annual lumber output of a band mill runs from 4,500,000 to 30,000,000 feet. The total output of all band mills in the two counties, including ties and lath, is about 107,000,000 feet annually. This will be increased by about 35,000,000 feet upon the completion of two other mills. The section produces yearly about 35,000 cords of spruce and hemlock pulpwood, 10,000 cords of hemlock bark, and 25,000 cords of slab wood. Spruce pulpwood, delivered, sells for about $18 a cord, hemlock for $12.

Milling costs average about $7 per thousand feet.

The grades of lumber obtained from old-growth timber range from 27 to 40 per cent No. 1 common and better. Not enough merchantable second growth has been cut to determine the average

[12] In this discussion, costs given for various operations, and prices paid for stumpage or received for timber are for the year 1927–28, when the field work for this study was carried on.

percentage of grades. One band mill, which is utilizing the timber from tracts containing much young growth, reports 40 per cent No. 1 common and better.

The average price f. o. b. mill is about $35 per thousand feet with higher prices for poplar and oak.

All the lumber manufactured is shipped out of the State to northeastern, central, and midwestern markets. The output is disposed of either through wholesalers or through the manufacturers' own selling organizations.

Two of the large mills sell hardwood and softwood slabs, tanbark, pulpwood, and hardwood logs, the output going to the local wood-using plants.

OTHER MILLS

The pulp and paper mill is a sulphite mill with a daily output of 100 tons of wood pulp. It uses annually 35,000 cords of spruce and hemlock logs and 17,000 cords of soft-wood slabs, obtained entirely from the old-growth stands.

The clothespin and wooden-dish factory uses native beech and maple logs which cost, delivered at the yard, $22 per thousand feet for beech, and $28 and $35 for the two grades of maple used.

The dowel and handle factory uses native beech only, paying $21 and $25 per thousand feet, delivered, for the two grades of logs that are purchased.

The tannery buys 10,000 cords a year of native hemlock bark. Chestnut-extract liquor is also shipped in from Tennessee.

FOREST INDUSTRIES AND LOCAL LABOR

The forest industries are the main source of employment for local labor. Most of the work in the woods and all the sawmill work are performed by native labor. The tannery and the pulp and paper mill employ some foreign labor.

The average wage paid woods labor is about $3.50 a day and board. Teams bring an average of $2.50 and feed.

The money wages of mill workers are slightly higher, but the real wages received may be less because the woods workers usually receive their board. Wages in the secondary industries differ according to the degree of skill required. Skilled labor commands from $5 to $8.50 a day. The lowest daily wage paid to unskilled male labor is $3.50. The clothespin factory and the paper mill employ women at piece work for about $2.50 a day. These two plants furnish the only important outlets for women's labor within the territory.

During the "off" season farmers work in the woods and to a smaller extent around the portable mills, sometimes using their farm teams which otherwise would remain idle during the winter. Money earned in this way often forms the greater part of their total cash income.

CHANGES IN EXTENT AND CHARACTER OF FOREST RESOURCES

An increase in abandonment of marginal farm lands is bound to occur as the result of removing the old-growth timber. Most of this land will revert to forest. The area in forests at the end of the next 20 years may be about 692,000 acres, or 28,000 acres more than at

present. Some new lands or old fields may be cleared, but it is unlikely that such acreages will permanently be used for agriculture.

On the forested areas the character of the growth is undergoing a rapid transition. The area of merchantable timber, now some 283,000 acres, probably will shrink to 183,000 acres, or only 26 per cent of the total forest area, within the next 20 years. The remainder will consist almost entirely of nonmerchantable growth.

Without adequate fire protection much of the remainder will be more or less badly burned, and consequently of greatly decreased capacity for further growth and value. Even if adequately protected, its maximum value can not possibly be realized unless it is also placed under management.

TREND IN OWNERSHIP

Land ownership within the section, because of the potential value of the mineral resources, is marked by high stability and little tax delinquency. The present policy of most of the large landowners is to retain possession of cut-over areas with a view to obtaining mine timber whenever the exploitation of coal becomes commercially feasible. One of the largest operators, who owns thousands of acres of cut-over land, is holding it for future growth, perhaps intending to harvest hardwood pulp after the present supply of native softwoods is exhausted.

Although the tendency is toward greater concentration of ownership, the policies of the various classes of large land holders are by no means definitely established. There is no certainty that all of the land is underlaid with coal, nor can anyone predict when even the best of the coal will be exploited on a large scale, considering the present state of the industry.

So far as the surface of the cut-over land is concerned, no definite attitude toward its future use or disposal has been taken. Rather, the policy is one of continuing possession and watchful waiting. Some owners hope that the Federal Government may take the problem of the least productive lands off their hands by acquiring it for national forests.

In the meantime the numerous small stands of good timber are being rapidly exploited. Only the isolated, relatively inaccessible tracts will be left when the period of large-scale lumber production comes to an end.

POSSIBILITIES OF FOREST LANDS UNDER MANAGEMENT

From the standpoint of private owners, the desirability of holding forest land for future timber production depends primarily upon the prospect that the income from the forest in the long run will repay the costs, together with a reasonable profit. The net returns possible from growing timber are largely dependent upon the nature and efficiency of the methods employed in handling the existing stands. Mere protection of forests from fire will not insure the growth or improve the position of the most valuable species. It is necessary that the existing forests be utilized in such manner as to leave the remaining stand in the best possible condition for future productivity. In any event, sufficient trees of the better species should be left over a long enough period to produce saw timber and furnish seed for future growth. The amount of net return will depend in the first place upon the rate of tree growth under various conditions.

RATES OF GROWTH OF INDIVIDUAL SPECIES

The rates of growth of individual species can be treated here only in a summary way. Relationships between tree growth and topography and soil are very complex. There is little doubt that certain soils, such as Dekalb silt loam and Upshur stony silty clay loam, are more favorable to rapid growth than are Dekalb stony loam, Dekalb stony silt loam, or rough stony land. The better soils occupy in general the more gentle slopes and the broader ridges; the poorer soils occupy the narrower ridges and the rugged slopes.

Tables 24 and 25 give generalized growth rates for dominant and codominant trees of various species in uneven-aged stands and in even-aged old-field stands, respectively.

TABLE 24.—*Rate of diameter growth of dominant and codominant trees in uneven-aged stands* [1]

Present diameter	Amount by which diameter will increase in 20 years		
	Chestnut oak, white oak, hickory, black gum	Beech, maple, birch, hemlock, white ash, black oaks	Yellow poplar, basswood, cucumber, walnut, butternut, black cherry, black locust
	Inches	*Inches*	*Inches*
0 to 3 inches	1.5–3.0	3.0–4.0	4.5–6.5
4 to 7 inches	2.5–3.5	3.0–4.0	4.5–7.0
8 to 11 inches	2.5–3.5	3.5–5.0	4.5–6.5
12 to 15 inches	2.5–3.5	3.0–5.0	3.5–5.0
16 inches and over	3.0	3.0–4.5	3.0–4.5

[1] Based on measurement of 1,178 trees in Nicholas and Webster Counties.

TABLE 25.—*Rate of diameter growth of dominant and codominant trees in even-aged stands* [1]

Present diameter	Amount by which diameter will increase in 20 years		
	Hickory, white oak	Red oak, black walnut, butternut	Yellow poplar
	Inches	*Inches*	*Inches*
0 to 3 inches	3.0–4.0	4.0–5.0	4.0–6.5
4 to 7 inches	3.5–5.0	5.0–6.5	7.5–9.0
8 to 11 inches	3.5–5.0	5.0–7.0	(2)
12 to 15 inches	(2)	6.0–7.0	(2)

[1] Based on measurement of 194 trees in Nicholas and Webster Counties.
[2] No data.

Intermediate and suppressed trees in crowded stands grow much more slowly than the dominant individuals, yet many of these, if in healthy condition, can be counted on to increase their rate of growth when they are released from suppression by the cutting of their larger neighbors. In many stands the growth rate of various species freed from suppression has increased by as much as 200 to 300 per cent. Species ordinarily considered slow growing, such as white oak,

chestnut oak, hickory, and hemlock, show a striking capacity for recovery after their release and have increased their growth rate sometimes by as much as several hundred per cent.

GROWTH OF MIXED, UNEVEN-AGED STANDS

The rate of growth of uneven-aged stands was computed by applying the rates of diameter, height, and volume increment for various-sized trees of individual species to tables representing the average composition of the stand. For each type of forest, these stand tables were prepared by tallying the trees on several sample tracts so as to show the number in each species and diameter class on an average acre. For purposes of predicting increment following cutting, it was assumed that the growth of intermediate, suppressed, and badly defective trees can be ignored. No growth was calculated for chestnut, even for dominant trees, because of the probability that most of the chestnut will succumb to the blight within a very few years. For this reason, the growth during the last 20 years as shown in Table 26 is less than the actual growth. It probably also gives a very conservative indication of the growth that may be expected on the same stands during the next 20 years. The volume growth is expressed in both board feet and cubic feet. Board-foot volume applies only to trees 10 inches or over in diameter breast high; cubic volume applies to all trees 4 inches and over.[43]

TABLE 26.—*Volume growth following cutting in uneven-aged mixed stands*

Method of cutting and type of forest	Present dominants and codominants								All other classes *	
	Volume per acre 20 years ago		Present volume per acre		Total growth in 20 years		Average annual growth		Present volume per acre	
	Bd. ft.	*Cu. ft.*	*Bd. ft.*	*Cu. ft.*	*Bd. ft.*	*Cu. ft.*	*Bd. ft.*	*Cu. ft.*	*Bd. ft.*	*Cu. ft.*
Lightly culled:										
Oak-chestnut-hickory	1,886	646	4,630	1,324	2,744	678	137	34	5,605	1,817
Oak-chestnut-poplar	4,503	1,044	7,930	1,738	3,367	694	168	35	6,179	1,719
Miscellaneous species	4,787	1,181	7,679	1,829	2,892	648	145	32	4,427	1,408
Cut to diameter limit:										
Oak-chestnut-hickory	424	261	1,894	803	1,470	542	74	27	3,240	1,251
Oak-chestnut-poplar	789	281	2,013	852	1,224	401	61	20	3,110	1,033
Miscellaneous species	1,283	453	3,221	1,017	1,941	564	97	28	2,731	1,013
Heavily cut over:										
Oak-chestnut-hickory	31	120	561	454	533	325	27	16	1,870	949
Oak-chestnut-poplar	0	17	270	268	270	251	14	12	2,109	639
Miscellaneous species	535	190	1,704	623	1,169	333	53	17	2,473	837

* Volumes in "all other" column are relatively large, because they include chestnut and other defectives which are really of dominant and codominant crown class.

Table 26 indicates only roughly what may be expected in unmanaged and unprotected stands following cutting by the usual methods. The application of these data to any given tract of forest must take into account the conditions peculiar to that tract. For example, fire influences the rate of growth in practically all stands. Two timber tracts alike in every other respect may grow at widely different rates on this account. Irregular cutting methods, too, influence subsequent growth. Much more damage has been done to

[43] All computations throughout this report that involve board-foot volume are based on the Scribner Decimal C rule, since the only available volume tables are in terms of this rule. The rule in general use in the section, however, is the Doyle-Scribner rule. This has also been officially adopted by the National Hardwood Manufacturers' Association. It gives values roughly 30 to 50 per cent lower than does the Scribner Decimal C rule, depending on whether the stand contains a fair proportion of large-sized trees or whether the larger trees have been removed.

small trees on some operations than on others, depending upon the logging conditions and the current attitude of timberland owners and operators toward forestry.

GROWTH OF EVEN-AGED OLD-FIELD STANDS

The rate of growth in several representative old-field stands is shown in Table 27. There is considerable variation in the volume that is produced in different stands, because of differences in productive capacity of the site, in the proportion of species associated in mixed stands, and in the density of stocking. It is not possible to say how much increase would result from thinnings or improvement cuttings, but there is no doubt that the increase would be significant. Investigations in thinned and unthinned oak stands in the central hardwood section in New York have established the fact that through systematic thinnings in even-aged stands the period required for oaks to attain diameters of 12 inches or over may be reduced by 30 to 50 years (7).

TABLE 27.—*Volume and rate of growth of selected even-aged old-field stands*

Age of stand (years)	Number of trees per acre	Present volume				Mean annual growth for all trees	Average annual growth of dominant and codominants during last 20 years
		All trees		Dominant and codominants			
		Cu. ft.	*Bd. ft.*	*Cu. ft.*	*Bd. ft.*	*Cu. ft.*	*Cu. ft.*
OAK TYPE							
25	418	843	510	598	300	34	29
35	220	1,440	3,062	948	2,112	41	47
45	229	2,057	5,885	713	2,768	46	36
YELLOW-POPLAR TYPE							
25	438	902	282	741	282	36	36
28	234	746	452	654	452	21	32
27	267	2,234	5,928	1,941	5,346	83	91
MISCELLANEOUS-SPECIES TYPE							
30	236	1,534	2,463	----	----	51	39

YIELDS OF SAW TIMBER

The number of years required to produce saw timber in each of the various types of forest will depend on the past treatment and the manner in which these forests are handled in the future.

Roughly speaking, a cut-over tract should contain from 2,500 to 4,000 board feet per acre in trees at least 14 inches in diameter breast high before it can again be profitably logged for saw timber. For the farmer who does his own cutting and hauls his logs to a mill it will suffice if only a few trees per acre reach a diameter of 14 inches. But it would hardly pay to set up a portable mill on tracts with less than 2,500 feet of saw timber; and on tracts of large size, selective railroad logging would not be feasible until at least 4,000 feet an acre could be obtained.

To predict accurately the yields to be expected from the cut-over, mixed, and uneven-aged stands of the section is practically out of the question. Nevertheless, no extensive calculations are needed in order to say that the more heavily cut stands, from which all or most of the merchantable timber has been logged, and on which much of the thrifty young growth has been injured or destroyed, will require a discouragingly long time to again furnish a profitable crop.

By applying the growth data obtained from sound, growing trees on various sites to specific stands recently cut over, the possible yields of existing stands within the next 20 to 40 years may be roughly estimated.

Table 28 gives an example of what might be expected from stands cut so heavily as to remove all merchantable trees over 12 inches in diameter, and Table 29 shows the possible yields from two stands in which some of the larger trees were left.

TABLE 28.—*Approximate yields of saw-timber attainable in two selected, heavily cut stands*

STAND A

Species	Healthy growing trees left after last cut		Diameters and volumes after—			
			20 years		30 years	
	Trees per acre	Diameter breast high	Diameter breast high	Merchantable volume [1]	Diameter breast high	Merchantable volume [1]
	Number	*Inches*	*Inches*	*Board feet*	*Inches*	*Board feet*
Hickory	1	6	9		11	
Hickory	1	10	13		15	150
Cucumber magnolia	1	6	10		12	
Cucumber magnolia	1	10	14	100	16	150
Red oak	1	4	8		10	
Red oak	1	12	18	300	20	425
Birch	1	4	8		10	
Birch	1	10	14	100	16	150
Black gum	1	12	14	100	15	125
Black locust	1	4	9		11	
Black locust	1	10	12		13	
Chestnut oak	1	10	13		15	125
Red maple	1	4	8		10	
Basswood	1	8	14	150	16	200
Basswood	1	10	16	200	18	275
White ash	1	4	8		10	
Total	16			950		1,600

STAND B

Red oak	2	6	10		13	
Basswood	2	10	18	400	18	550
Beech	6	4	8		10	
Beech	8	6	10		12	
Beech	4	12	16	600	18	900
Sugar maple	2	4	8		10	
Total	24			1,000		1,450

[1] Trees less than 11 inches diameter breast high not included.

Table 30 indicates that it will take about 30 years for lightly cut stands again to produce saw logs in quantity and that approximately 3,000 to 5,000 board feet per acre will be available for selective cutting at the end of that period. Heavy cutting will yield a slightly higher immediate return but it may necessitate twice as long a wait before sufficient timber for the next cut will be produced.

The advantage of even crude diameter-limit cutting is evident in the shorter time that must elapse before the next crop can be harvested.

Also it causes the stand to be left in much better condition. Stands that have been cut during the last 25 years to some diameter limit, usually 12 to 14 inches, and that have not been damaged too severely by fire, now average from 5,000 to 6,000 feet per acre in trees 10 inches and up and are growing at the rate of 60 to 100 board feet per acre per annum.

TABLE 29.—*Approximate yields of saw-timber attainable in two selected lightly cut stands*

STAND C

Species	Healthy growing trees left after last cut			Diameter and volumes after—			
				20 years		30 years	
	Trees per acre	Diameter breast high	Merchantable volume [1]	Diameter breast high	Merchantable volume [1]	Diameter breast high	Merchantable volume [1]
	Number	*Inches*	*Board feet*	*Inches*	*Board feet*	*Inches*	*Board feet*
Sugar maple	4	4		8		10	
Yellow poplar	4	6		11		13	
Do	4	7		13		15	700
Hemlock	4	9		12		14	250
Beech	4	4		8		10	
Do	8	8		12		14	800
Yellow birch	4	14	440	18	900	19	1,050
Black cherry	8	4		10		13	
Do	8	5		12		15	1,350
Do	4	7		13		16	850
Do	4	9		15	700	18	1,250
Total	56		440		1,600		6,250

STAND D

Cucumber	12	10		14	170	16	275
Sugar maple	12	4		8		10	
Do	12	12		16	390	18	500
Do	12	10	390	20	680	22	850
Beech	12	6		10		12	
Do	12	8		12		14	200
Do	12	10		14	400	16	625
Hickory	12	8		11		13	
Do	12	10		13		15	300
Yellow birch	12	4		8		10	
Do	12	6		10		12	
Basswood	12	14	280	19	635	21	825
Red oak	12	4		8		10	
Total	32		670		2,275		3,575

[1] Trees less than 14 inches diameter breast high not included.

The annual net incomes possible from a given tract cut to various diameter limits are illustrated by the following hypothetical example:

Given a tract of 6,000 acres, 3,000 feet per acre being available for cutting to a 14-inch limit or 4,000 if cut to a 10-inch limit, exclusive of additional volumes resulting from growth during the cutting period:

With light cutting, a 30-year cutting cycle may be used, a different 200-acre tract being cut each year for 30 years. At the end of this period the 30 years of growth on the 200 acres first cut over will have produced a stand of approximately 5,000 board feet per acre, and the program of annual 200-acre cuttings may be repeated.

With heavy cutting, a 60-year cutting cycle will be required for a continuous operation, 100 acres being cut annually. At the end of the 60 years 7,000 feet per acre would be available for clear cutting on the first 100 acres, or 5,000 per acre for selective cutting.

Assuming that annual taxes would amount to 15 cents an acre and that fire protection would cost 2 cents an acre in each case, the annual net income derived from each method would be as shown in Table 30.[14]

TABLE 30.—*Hypothetical yields of a 6,000-acre tract under light cutting during a 30-year cycle and under heavy cutting during a 60-year cycle*

Item	Light (selective) cutting	Heavy (clear) cutting
Volume per acre at beginning [1] ..... board feet	3,000	4,000
Average total increment per acre during 1 cutting cycle [2] ..... do	375	2,250
Average volume cut per acre ..... do	3,375	6,250
Area cut each year ..... acres	200	100
Average volume cut annually ..... board feet	675,000	625,000
Stumpage value per 1,000 feet [3] ..... dollars	6.50	6.00
Total stumpage value of annual cut ..... do	4,387.50	3,750.00
Less annual taxes and fire protection on 6,000 acres ..... do	1,020.00	1,020.00
Net annual income ..... do	3,367.50	2,730.00
Net income per acre ..... do	.56	.46
Net annual income per acre, second cycle ..... do	.91	(4)

[1] Volume of trees 14 inches and over and 10 inches and over, respectively.
[2] Average increment for 0 to 30 years on trees 14 inches and over at time of cutting, for light cutting; and increment for 0 to 60 years on trees 10 inches and over at time of cutting, for heavy cutting.
[3] The difference between the stumpage values of trees 14 inches and up and trees 10 inches and up is due to the greater costs of logging and milling the smaller-sized trees, and to the lower grades of lumber sawed from the smaller logs.
[4] Income not calculated for second 60-year cycle.

After 30 years the annual net income from the tract cut to a 14-inch diameter limit would increase by reason of the increase in growth brought about by judicious cutting.

The available volume per acre might then average 5,000 feet, permitting an annual cut of 1,000,000 feet from 200 acres. With stumpage values and costs remaining the same, the net income per acre during the second 30-year period would be $0.91, the capitalized value of which at the beginning of the period (30 years hence) would be $12.57.

The present capitalized value of the annual net income per acre ($0.56) received during the first 30 years plus that received during the second 30-year period ($0.91) amounts to $11.23. This is $3.88 more than the corresponding figure for the same period for the stand cut to a 10-inch limit.

Comparison of the returns per acre from selective and heavy logging indicates that if the land is to be held for timber growing the lighter cutting will yield the higher income. Should the owner decide to sell the 6,000-acre tract immediately rather than to hold it, he would receive, on the basis of current market values, about $9 an acre. This is $2.23 below the present capitalized value of the annual net income computed for selective cutting over a 60-year period.

YIELD OF PULPWOOD

Instead of saw timber, or in addition to it, forests in this section may be managed for the production of wood in other forms. Even though there is now little or no market for other products, it is probable that a demand for them can be developed. The increasing demand for hardwood pulpwood, for instance, undoubtedly will

[14] Interest on initial investment is not included because only forest properties already in operation are considered. The purpose is merely to compare future incomes possible from such properties through the different cutting methods described.

result in an extension of that market into this territory. One advantageous feature of growing pulpwood is the short interval required between crops. (See Table 31.)

Table 30 shows the entire usable volume in the average stand. However, the net income would be greater if the larger trees were cut for lumber than if they were cut for pulpwood. Hence in actual practice only part of the total yields indicated would be available for pulpwood. Furthermore, stands predominantly oak, or containing much oak and similar dense hardwoods, would furnish little pulpwood under the present standard pulping processes. (The semichemical pulping process, which is readily adapted to the conversion of hardwoods, may make the utilization of such species for pulp commercially feasible in the future.) Therefore, in case it was decided to grow pulpwood instead of saw timber on the 6,000-acre tract used in the illustration above, only a small yield could be expected during the first cutting period. Immediately following the cut for saw timber 2½ to 5 cords of pulpwood per acre would be available, according to whether the cutting had been heavy or selective. During this period the greater part of the income would still come from saw logs.

Assuming that the saw timber were to be cut selectively and that pulpwood logging would proceed simultaneously, the tract after 30 years would have been completely logged over for both products. Not all the trees 6 to 14 inches in diameter at the time of cutting would have been cut for pulp during this time, however. Species unsuited to this product, like oak, hickory, and ash, would be left.

TABLE 31.—*Average time required to grow hardwoods of pulpwood size and probable yields under present conditions*

Class of forest	Time required to grow trees to 6 inches diameter breast high	Approximate yield per acre
	Years	*Cords*
Old fields:		
Yellow-poplar type	20	18
Miscellaneous-species type	30	15
Heavily cut over	20	6
Cut to diameter limit	20	15

During the second cutting period the yield of pulpwood might be as much as 8 to 10 cords per acre, and there might be, in addition, 1,500 to 3,000 feet of high-grade saw logs, depending upon the proportion of the denser hardwoods.

Even though the existing hardwood forests can not be managed solely or even chiefly for the production of pulpwood, it seems likely that this may constitute an important by-product from many stands.

COMBINATION OF VARIOUS PRODUCTS

The best utilization of the mixed, uneven-aged hardwood forest would result if it were managed so as to yield a variety of products. In this forest, valuable species of all sizes are intermingled with those of little value. Such a condition favors the harvesting of several kinds of crop.

There is likely to be a demand in the future for saw logs, veneer logs, crossties, telephone poles, pulpwood, mine timbers, fence posts, and

perhaps extract wood. A tract capable of yielding several different products will be likely to produce a steadier and larger income than a tract yielding a single product. The values and sizes of various products obtainable from the average mixed hardwood forest in this section are shown in Table 32.

From 25 to 30 crossties constitute a thousand board feet. The practice of the mills cutting them is to use the heartwood of the timber for ties and the sapwood for lumber.

Fence posts from large white oak trees are better than those from small trees, which have too much sapwood to make durable posts. Posts average 50 to the cord. The few fence posts and rails made at present are used locally; rail fences are giving way to wire fencing. Chestnut and black locust furnish practically the entire domestic need at present.

TABLE 32.—*Specifications and values for products from mixed uneven-aged forests*

Product	Size of product		Approximate value [1]—			Species	Desirable minimum diameter breast high for cutting
	Minimum diameter at small end	Minimum length	Per thousand board feet	Per piece	Per cord		
	Inches	*Feet*	*Dollars*	*Dollars*	*Dollars*		*Inches*
Saw logs	10	10	8–9			All commercial	14
			50–65			White oak	
			45–60			Red oak	
Veneer logs	18	4	50–100			Walnut	20
			30–65			Yellow poplar	
			20–25			Red gum	
Crossties	7 by 9	8½	28–33	0.75		Oak, chestnut, black gum, others [2]	14
				0.15–.25		White oak	14
Fence posts	4	6½		.15–.25		Chestnut oak	10
				.15–.25		Chestnut	6
				.40–.50		Black locust	8
Mine props	5	5		.10–.15		Oak, chestnut, maple, others [3]	6
Mine collars	4	10		.40–.60		Same as above	6
Telephone poles	8	20		1.00–10.00		Chestnut	10
Pulpwood	4	4			8.00–9.00	All hardwoods except oak, hickory, and ash	6
Fuel wood	2	4			1.00	Beech, black gum, birch, maple, oak, chestnut [4]	
Extract wood	2	4			2.50	Chestnut [4]	

[1] Values are for products delivered on cars or at mill.
[2] Average tie.
[3] Other hard-textured woods such as beech, birch, black gum, black cherry, hemlock.
[4] Tops, branches, dead and defective trees.

Mine timbers must be of hard-textured woods. Props average 45 to the cord; collars, 35 to the cord. The possibility of return from the local sale of mine timbers is slight so far as the small land owner is concerned. The large companies who own mineral rights own most of the surface as well, and could supply their needs from their own holdings.

The values given for chestnut poles and extract wood are estimates. Untreated poles bring from $2.25 to $19.50 each, depending on the length. Chestnut trees of good form are cut for poles in some localities. The cutting is being accelerated because of the chestnut blight and because the preparation of poles requires but little capital or equipment.

The values shown for hardwood pulpwood and fuel wood are based on existing market prices in southern Kentucky, as there is no present market for these products in the section being studied. Very little wood is used for fuel, as coal is plentiful and cheap and underlies most of the farms so that it is directly available for domestic consumption.

Not all these products may be marketable at any one time from a given tract. While nature, with man's assistance, is constantly at work producing the raw material, the question of just what product or products should be manufactured can be answered only by a study of current market conditions. Fortunately the forest crop is unlike agricultural crops in that usually it need not be entirely removed at one cutting nor at any particular time to save it from deterioration. If prices are unsatisfactory or if the trees are too small for the manufacture of those products yielding the highest net returns, the harvest may be deferred until conditions are more favorable provided the owner can wait for income.

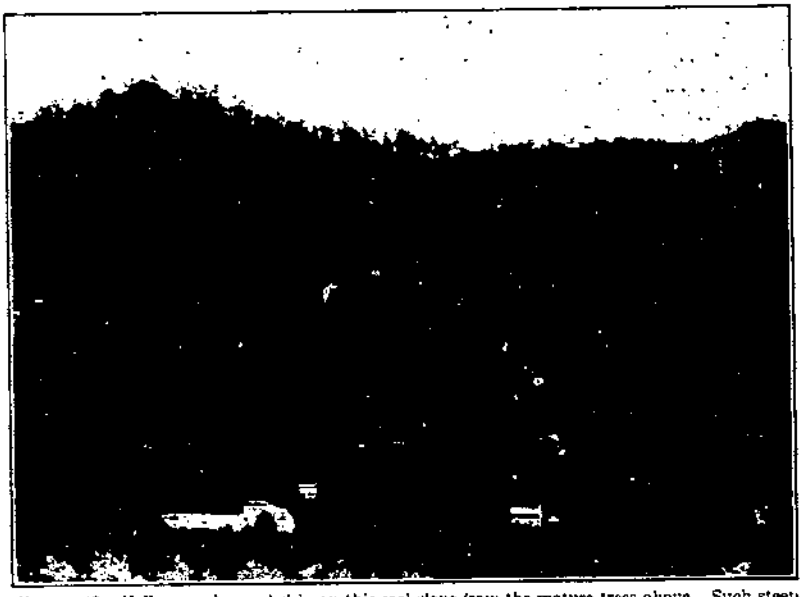

FIGURE 10.—Yellow poplar seeded in on this cool slope from the mature trees above. Such steep slopes should never be cleared

MANAGEMENT OF FARM WOODLAND

Much of the foregoing discussion applies equally well to large tracts and to small ones such as farm woodlands.

Although the market situation is now uncertain and far from satisfactory, partly because of overproduction, all the large tracts will be cut over within the next 15 to 20 years. Small holdings containing timber of good quality will then be in demand at good prices. Their present relative inaccessibility to market will be remedied by the construction of Class A roads which are now being built through this section.

Yellow poplar logs (fig. 10) for lumber, veneer, and pulpwood; black walnut for veneer; oak for ties, veneer backing, and lumber; and hickory for vehicle stock and handles will be readily salable at

good prices. The fact that some species will attain pole and tie size at the time that the others attain lumber and veneer-log size, especially where oak and yellow poplar are mixed, will make for more complete and profitable disposal of the products.

The possibilities of saw-timber production on old fields are indicated by Table 33.

TABLE 33.—*Average price per thousand feet for logs delivered at the mill*[1] *and number of years required for trees to grow to 14 inches diameter breast high on old fields*

Species	Period	Price	Species	Period	Price
	Years	*Dollars*		*Years*	*Dollars*
Yellow poplar	45	23.87	Red oak	55	20.33
Black walnut	55	119.92	Hickory	80	30.68
White oak	70	20.33	Sycamore	45	20.57

[1] Average log prices for 1924, Appalachian region. From Statistical Bulletin 21 (7).

What may be expected from careful management of existing mixed stands is indicated by the following example of results actually obtained on a farm wood lot in Webster County.

On a 40-acre tract of the oak-chestnut-hickory type three cuttings have been made. Thirty years ago 2,000 to 4,000 feet per acre of selected oak and poplar were removed from the virgin stand. Eleven years ago a second cutting took out 4,858 feet per acre, of which 3,233 feet was in the form of ties and 1,625 feet of saw logs. Two years ago a third cutting removed 2,077 feet per acre, 1,133 feet as ties, and the rest as saw timber. The present stand contains 228 trees per acre, 30 per cent of which are 10 inches and over in diameter, with a volume of 5,000 board feet per acre. The smaller trees from 4 to 10 inches in diameter have a volume of 245 cubic feet per acre.

The smaller healthy trees are mostly dominants, since the large timber has all been removed. There is, therefore, ample opportunity for rapid growth on the part of the vigorous young stock which has been left uninjured by the later cuttings.

The trees that are now 10 inches and over will be large enough for ties and lumber within the next 20 years, and there are enough smaller trees to warrant thinning should a demand arise for such products as mine props, pulpwood, or fence posts.

The stands that have grown up on old fields are especially valuable to their owners. Because of conditions favorable to rapid growth, such stands may contain from 5,000 to 14,000 feet per acre at 30 to 50 years of age.

Trees usually reach post size, tie size, pole size, and lumber size more quickly on old fields than on any other type of land. Growth in height and diameter is more uniform, and there is the additional advantage of freedom from suppression by large trees. The evenness of the stand, the comparatively small number of species, and the natural dominance of the more valuable trees are other favorable factors.

Present values of 14-inch logs may be somewhat below the averages as shown in Table 33, particularly in the case of black walnut.

These figures indicate that it may well be worth while for farmers to encourage the natural growth of well-formed trees of these more valuable species on worn-out fields and pastures, and even to restock

such lands by planting where it can be done at little expense. The uncertainty of natural, haphazard restocking on many old fields could be avoided by planting, since composition and density would be entirely under control. Either pure stands of yellow poplar or mixed stands containing poplar could be planted, depending on the site and on the products desired. One-year-old seedlings can be planted, spaced 8 by 9 feet, at a cost of $5 or $6 an acre.

Yellow poplar, black walnut, black locust, and black cherry would make a good combination. Black locust grows well during the first 20 to 25 years of its life. It should then be cut for posts, props, etc., along with the yellow poplar for pulpwood, leaving the black walnut, black cherry, and some of the best poplar for saw timber and veneer logs. The cost of planting and management could be met in part from this intermediate cutting and thinning.

The revenue possible from thinning is indicated by a stand of almost pure yellow poplar, near Cranberry, N. C., which was partly thinned when about 35 years old and yielded 8 or 9 cords of pulpwood per acre, worth $4 per cord.[15]

In most instances the sale value of the farm would be materially increased by the presence of a well-established stand of thrifty young growth.

COSTS OF HOLDING TIMBERLAND

The costs of holding land for timber growing consist mainly of taxes and the expense of fire protection. The cost of administrative and silvicultural measures would vary according to the intensity of forestry practice. Such costs would usually be more than offset by the increased yields and better quality of timber grown.

COST OF PROTECTION AGAINST FIRE

Expenditures for fire protection in this section are borne by the State and by private associations. The State spends 1 cent per acre per year, and the members of the Central West Virginia Fire Protective Association contribute an additional 1 cent per acre for such tracts as are owned by them. The extra sum spent on association lands has been well justified by the better protection afforded. At least 2½ cents and possibly 3 cents an acre must be spent, however, to ensure really adequate protection. This would provide for the maintenance of a permanent organization sufficient to cope with all fires in an efficient manner.

TAXATION OF TIMBERLAND

Timberland, like all other classes of property, is assessed under the so-called general property tax. The problem of determining the bases for the values placed upon different classes of timber is complicated by the presence of underlying mineral resources which may or may not be under the same ownership as the timber. This is true also of those smaller tracts which, together with improved land, constitute farm units. The land books fail to differentiate between forested and other areas, where the ownership is in fee or surface; nor is there any indication of the proportionate value given to forest land. In fact, although the various types of timberland have fairly specific

[15] UNITED STATES DEPARTMENT OF AGRICULTURE, FOREST SERVICE, BRANCH OF RESEARCH. MONTHLY REPORT, September, 1928, p. 11. [Mimeographed.]

values, these do not appear to be taken into consideration. For example, timberland held in fee may have been assessed at a valuation of, say, $25 an acre. Later the timber is sold, The area is then taxed in "fee except timber" [16] but still carries the same valuation as before. The same kind and quality of forest land in the same district, when held only as timber or as surface may be assessed at $15 to $30 an acre. On forested areas owned as surface the valuation is more likely to be lowered after cutting, especially if all merchantable material is cut. Light cullings and sometimes diameter-limit cuttings, which leave a fairly large number of merchantable trees, are not always followed by lower assessed valuations.

Timber tracts held only in surface or in timber afford a good index to the current valuation of timberland. Virgin or lightly culled timber is usually assessed higher than timber more heavily cut over. Accessibility is recognized in fixing valuations, but size of holding does not necessarily exert an influence. For example, a small tract in the midst of a large tract or adjacent to it usually will be assessed at the same rate as the large tract although the timber must be sold to the owner of the larger tract, usually at a low price, if it is sold at all.

Theoretically, values are placed according to the assessor's judgment and knowledge of general market conditions, but in reality the county board of equalization and review sets the final value so that usually the current year's assessments are merely copied from the books of the previous year, and no change is made until such time as the board decides to make a revaluation. Examination of the assessments of surface or timber rights on 50 tracts selected at random in the two counties showed that the average assessed valuation for virgin or lightly culled timber is $25 an acre, and for merchantable stands cut to a fairly high diameter limit, $15. Heavily cut-over, nonmerchantable stands are assessed at about $6 an acre in Nicholas County and $8 in Webster. Examination of a considerable number of transactions shows that there is no consistent relationship between assessed and sales values.

Judging from the trend of the tax rates and assessed valuation, the tax on timberland will continue to increase. Assessed valuations on forests containing merchantable timber were raised 25 to 100 per cent between 1915 and 1920. The valuation of cut-over land has remained constant since 1910. Tax rates have risen steadily in all the districts, the average annual increase during the last 17 years being about 8 cents per $100 of valuation.

The increase in the average amount of tax on each of the three classes of timberland is shown in Table 34.

TABLE 34.—*Tax per acre on timberland, average for all districts of Nicholas and Webster Counties in specified years*

Class of forest	1910	1915	1920	1925	1927
	Cents	*Cents*	*Cents*	*Cents*	*Cents*
Virgin and lightly culled	14	18	42	50	56
Merchantable second growth	8	11	25	30	34
Nonmerchantable cut over	6	7	12	14	16

[16] "Fee except timber" refers to the ownership of all the usual rights to land except the timber rights which refer to timber only.

Whether timberland will bear any greater share of the total tax burden in the future than in the past is a matter of conjecture. There is no doubt that the removal of the merchantable material from all the large tracts within the next 20 years will necessitate substantial increases in tax rates and probably also in assessed values, in order to meet the financial needs of the counties.

It is doubtful whether the assessed values on badly skinned forest land held in surface will be raised. The valuation of tracts on which the young timber is approaching merchantability probably will go higher. Such stands, when held in surface, are usually assessed now as bare land, but undoubtedly, under the steady pressure of need for additional revenue, cognizance will be taken of their increasing values.

OUTLINES OF AN ECONOMIC PROGRAM FOR THE NICHOLAS-WEBSTER SECTION

ECONOMIC PROGRAM FOR FARMING

Farming in Nicholas and Webster Counties eventually will be confined largely to the area that has been designated as agricultural. Outside this area the conditions are not suited to modern farming, and the investigators are convinced that people in general will not persistently follow the present type of farming in this nonagricultural zone.

The conditions under which farming in the agricultural zone will be practicable have been discussed.

For many years people will remain on farms in the nonagricultural zone. This is probably desirable. They have houses and outbuildings, garden plots, and a few head of stock, enabling them to live more comfortably here than they would if they were to sell their homes and move to town. Doubtless some young people will take up farming in the nonagricultural zone, but it is impossible to predict the trend for many years in the future.

The need for a larger degree of cooperation in the various agricultural undertakings is evident. At present there are practically no cooperative organizations. One of the most desirable forms of cooperative enterprise would be the formation of a cooperative motor-trucking association. The section is inadequately served by railroads, and many of the farm settlements are from 15 to 25 miles from a shipping point. The problem of hauling produce and supplies is therefore serious.

For example, it is almost out of the question for the farmers in the vicinity of Summersville to use lime on their fields because of the high cost of hauling it from Fenwick, 20 miles or more away. If the community in the vicinity of Summersville were to organize a cooperative motor-trucking association, the cost of hauling could probably be reduced to the point at which farmers could afford to use lime. The cooperative trucks could haul various kinds of produce from farm to market as well as haul supplies from their unloading point to the farm. The administration of such an organization would be simple as compared with many types of undertakings now handled by cooperative associations.

The agricultural extension and home demonstration work should be planned with a view to consolidating the agricultural industry in the agricultural zone. But farmers in the nonagricultural zone should

not be slighted; their precarious economic position is in itself a reason for giving them special attention. Whenever it can be shown that their land is not permanently suitable for farming, plans should be made for the best temporary use for farming or a combination including timber growing.

It would be helpful if the residents of tracts unsuited to profitable farming could be informed concerning opportunities for industrial or agricultural employment elsewhere (whenever conditions permit). This would enable those leaving the farms to seek employment under the most favorable conditions. A campaign to encourage farm abandonment is not suggested.

As stated previously, this study is an attempt to develop a long-time outlook. In order that a program of action be developed, there is need for the coordination of local activities by the organizations and the authorities interested in taxation, roads, schools, health, agriculture, and industry. Suggestions may come from the outside, but forward steps can be taken only by those who are directly interested in the welfare of their neighbors and themselves.

The local people will need to decide for themselves whether the interests of all will be best served by an improvement program for agriculture in a doubtful area or by the gradual abandonment of land not suited to farming. The situation is undoubtedly different in 1932 than it was in 1928, and changes will continue. Changing conditions make the task of planning difficult, but they also make planning all the more necessary.

PUBLIC ACQUISITION OF SCATTERED FARMS

It would be well if the State could purchase the scattered farms that are too few to support roads and schools, particularly where the maintenance of such facilities could be discontinued. These areas could then be blocked out wherever possible by further purchases from other forest-land owners in order to facilitate the organization of adequate fire protective measures and to provide for efficient forest management. The public should then be advised that settlers going into such tracts would not be provided with schools and roads. Settlement could be barred from State-owned land in any event. Later, when these tracts under proper forest management were again on a productive basis, small permanent wood-using industries, their capacity based upon the growth of the State-owned forests, could be introduced, as hereafter described. The land would again become populated, not by scattered settlers but by thriving communities gaining their entire livelihood from the products of the growing forests, and fully alive to the significance of this natural resource to their social and economic welfare.

COST OF GOVERNMENT

As eventually there probably will be fewer farms in Nicholas and Webster Counties and as the virgin timber resources are rapidly passing, it is time to make a special examination of the cost of carrying on local government. Probably it will be economical and feasible to consolidate certain county offices so that work of the various offices can be done with a smaller number of officials. This would effect a considerable saving to the taxpayers.

Fortunately, West Virginia has adopted the county-assessor system, but it is the practice to appoint deputy assessors to assist with the assessment. In these counties, as in most rural areas, the assessment is neither very accurate nor equitable and is unduly expensive.

FOREST INDUSTRIES

The manufacture of finished or semifinished products by permanent industries within the region, obtaining their raw material from the timberlands around them, would be of great benefit to the local communities. This would expand and stabilize the outlets for local produce and labor, increase the purchasing power of the community, and make possible a more satisfactory standard of living.

Before the old-growth timber is entirely removed it will be well to plan for the introduction of industries to utilize second-growth timber. Sawmills should be smaller than those now operating, because they should be based on the capacity of the forest to supply them continuously and permanently. Where supplies are obtained from large tracts under unified control, stationary band mills should be used rather than portable circular mills. The stands should be placed under management for sustained yield, and only a quantity of timber approximately equal to the annual growth should be cut in any one economic unit in a single year. Subsidiary industries, preferably under the same management, so as to insure efficient integration, should be established to utilize the sawmill by-products.

Economic disposal of small-sized products would mean closer utilization in the woods, resulting in less slash, and consequently less fire hazard than from present operations. The forest would also be kept more sanitary and would be less susceptible to damage by insects and disease. For example, manufacture of hardwood pulp would result in closer utilization of hardwood tops and large limbs in the woods and in the reclamation of much mill waste.

Lumber or logs, instead of being shipped out, would be manufactured locally into finished products. Stable industrial settlements, built around the local industries, would offer permanent markets for labor and agricultural products and would greatly benefit the community.

Many problems would arise in planning such permanent industries, particularly that of transportation. Where small materials are to be hauled, highways might be constructed on the grades of abandoned logging railroads, and trucks or tractors employed. The construction of flumes, or perhaps even of permanent, well-built dams, to carry or float pulpwood bolts or other small products, might be considered. In some cases it might even prove advisable to rebuild main-line railroads, using narrow-gage tracks and light steel.

The size of plant in a given locality would be governed by the quantity and availability of merchantable timber. The rugged character of the topography over most of the section would have to be considered in determining the availability of the timber and hence the most economic size of the unit.

The village of Cowen, for example, could be the site of a plant obtaining its supplies from some 40 to 60 farm tracts located within a radius of 5 to 10 miles. Let us assume, on the basis of the actual forest conditions in that locality, that an aggregate of 5,000 acres of

woodland is available and that 4,000 acres contain merchantable timber in the following classes:

	Acres
Virgin timber	1,000
Lightly culled timber	2,000
Merchantable second growth	1,000
Total merchantable	4,000
Nonmerchantable cutover	1,000

Before starting operations or deciding how the woodland should be handled, it would be wise to draw up a management plan providing for continuous, permanent production. An inventory of the quantity and kind of timber down to the smallest sizes, and a rough study of the annual growth should first be made. These might be supplemented by figures on growth obtained from the Appalachian Forest Experiment Station of the United States Forest Service.

Let it be assumed that a timber cruise shows a total of 41,000,000 board feet of timber 14 inches and upward in diameter breast high and that the percentages of the principal species are as follows: White oak, 30 per cent; red oak, 20; chestnut oak, 15; chestnut, 15; yellow poplar, 5; hemlock, 5; and miscellaneous, 10.

The average annual growth on the entire 5,000 acres is ascertained to be 433,000 board feet. A cutting cycle of 30 years, on the basis of the present stand and growth, can be adopted. A small-dimension mill and sawmill combined, cutting 500,000 feet annually, would be large enough.

Proper management of the contributing farm woodlands might be assured either by stipulating the kinds and sizes of trees desired or, better still, by going into the woods and marking specific trees for removal in accordance with silvicultural and economic considerations. The amount to be obtained in a given year from each tract would thus be determinable and the farmer would be paid only for the stipulated quantity of logs which he could cut and haul to the mill.

At the end of 30 years the first cutting of the 4,000 acres now merchantable will have been completed. A total stand of approximately 39,000,000 feet, consisting of 13,000,000 feet of new growth and 26,000,000 feet of old growing stock, will be left standing ready for the second cutting cycle. The woodlands will then be in a well-managed condition, capable of supporting the mill, which would now be cutting no more than the annual growth. As a result of good management, this growth may be expected to have increased to several times the amount at the start.

Lumber need not be the only product manufactured. Ties, squared stock, posts, and props might be milled to advantage. Poles and pulpwood might be produced whenever market conditions warranted their manufacture. Slabs, edgings, thinnings, and the lower grades of lumber could be converted most profitably into roughly sawn, small-dimension stock by means of additional but inexpensive equipment. Oak and chestnut stock could be shipped to furniture factories, and yellow poplar converted into squares for shelving and similar uses.

CONSOLIDATION AND MANAGEMENT OF FARM WOODLANDS

The development of agricultural operations on the better soils, and the accompanying consolidation of farms into larger units, is a step in the right direction. Many fine tracts of farm timberland still

remain in the section. Records of sales made by farmers show that the full value of stumpage is seldom, if ever, realized. Permanently established wood-using industries similar to those described will place the farmer in a more advantageous financial position with respect to his woodland and even his agricultural crops. He should attract and support such industries by foregoing the higher immediate but transitory income obtained by allowing the timber operator to "skin" his woodland in favor of the more moderate but continuous annual income derived from a community-building enterprise.

With the assurance of good future markets for woodland products, it will pay the farmer to consider carefully the manner of disposing of his timber. It is to his best interest to do his own cutting. In this way he can derive greater returns from his woodland. During the winter he can use his labor and teams in the woods. Furthermore, he can regulate the cutting according to desirable forestry practice, leaving the woods in good shape for later crops. The outside operator who buys the timber by the boundary, or by the acre, or perhaps by the thousand board feet, can not be depended upon to give the valuable young growth any consideration.

The farmer who goes no further than to cut his own products, hauling them as an individual to uncertain, shifting markets and accepting whatever prices are offered, may not be making the best of his opportunities. He can frequently achieve more through cooperative effort in some or all of the processes leading up to the final disposal of the finished products. By forming cooperative pools similar to those used in selling sheep or other farm products he would be able to reach wider markets and obtain better prices than are now offered. By shipping carload lots he would have the advantage of lower freight rates.

Pools would be advantageous particularly to those farmers whose woods are relatively far from the railroad, or are inaccessible, or are light and spotty. Tracts that could feasibly be operated by either large or small mills might also be handled to greater profit by cooperative enterprise.

By establishing connections with sawmills, veneer plants, furniture factories, and other wood-using industries through the efforts of the county agent and extension forester, farm woodland owners would be quoted definite prices for all grades of products. The estimated combined log output of the members of the pool, delivered at the track at any central shipping point, would then represent a stipulated value, and the farmers would feel assured in advance that they were employing their time and labor, and selling their product, to best advantage. Indeed, it would soon be learned, as it has been elsewhere, that more money could be realized in this way than by selling stumpage under present conditions.

The requirements of the wood-using industries would influence the cutting policy on the farm woodland in that only those trees that meet their specifications would be taken. As a result selective cutting and continuous production would be practiced, in contrast to the obsolete, wasteful "skinning" practices now prevalent.

CONSOLIDATION AND MANAGEMENT OF LARGE TRACTS

More than 80 per cent of the forest is located in large, unbroken tracts in the rougher, higher portions of the section. Ownership of many of these tracts is divided among a large number of individuals and

corporations. That the forests may be protected and managed more effectively, and because of the heavy investments necessary for the transport of forest products from such lands, it is desirable that they be consolidated into blocks, each of which should be either under single ownership or under coordinated management. Without such consolidation it will be difficult, in many instances, to insure that the lands will continue to be utilized for timber production.

CUTTING POLICIES

In selling timber from a large tract it is highly desirable to safeguard the owner's interests in its future value. Methods of cutting should be stipulated. Provision should be made in the contract for employing suitable fire-prevention measures, and for care in felling and skidding trees in order to reduce damage to young growth. Enforcing measures of this kind would entail no loss of time or money to either owner or operator. Lumbermen who operate in the national forests in the Appalachian region and elsewhere observe such regulations.

The operator who cuts on his own land should also be guided by the desire to protect the future value of his timber. The best use of the land will be realized only by allowing the more valuable trees to stand at least through their period of rapid growth. The range of minimum diameters for cutting conforming to the value and growth rate of the several species is indicated in the following list:

16 inches:
- Yellow poplar.
- Black walnut.
- Red oak.
- White ash.
- Black cherry.
- Cucumber magnolia.

14 inches:
- White oak.
- Chestnut oak.
- Basswood.
- Sugar maple.
- Hemlock.

12 inches:
- Hickory.
- Red maple.

10 inches:
- Black birch.
- Yellow birch.
- Beech.
- Butternut.

8 inches:
- Black locust.
- Black gum.

Species of lesser value should be cut to the smallest sizes practicable.

Rapid-growing trees should be grown for other products as well as for saw timber. Pulpwood is chief among these products; it offers perhaps the most permanent and satisfactory source of income for the future. This and other minor products may be obtained from intermediate cuttings made to improve the forest, as well as from the main operations.

The purpose in favoring certain species over others when cutting is to maintain or to increase the dominance of the most valuable species and consequently to render the site more productive. The truly selective cutting method is far better than the common practice of cutting out the best and leaving the poorest. The detrimental effects of the latter practice are evident throughout the cut-over forest areas of the southern Appalachian region.

In the oak-chestnut-hickory type, occurring chiefly on dry slopes and ridges, the oaks, hickories, and black cherry should be favored if they are already present. The blight-affected chestnut and the inferior species (black gum among others) should not be too heavily removed

at any one cutting; in fact, it is important that all cutting be light in order not to expose the vegetable mold to wind and sun unduly. Cutting may be heavier in that portion of the type located in the plateaulike glade area, where the greater dominance and better growth of the oaks and hickories on the rich soil and the level topography make the problem of improving the forest relatively simple.

In the oak-chestnut-poplar type it is best to favor the red and white oaks, yellow poplar, white ash, basswood, cucumber magnolia, and hickory, and the black walnut if it is present. Cutting may be heavier in this type wherever the present composition of the stand is poor enough to warrant.

PROTECTION FROM FIRE

The first and most important step in administration is protecting the forest from fire. To reduce and eventually to eliminate fire, the forest owners and the general public must cooperate fully with the State. Some owners cooperate now through the medium of forest-protective associations. Holders of small tracts adjacent to or within large forest areas should avail themselves of the extra protection afforded by association membership.

The farm woodland owner is most advantageously located to prevent and control fire in his neighborhood. Once his indifference to its effects is overcome, he can be depended upon to regard fire as a menace not only to his buildings and fences, but also to his woodland, whether it be mature timber, cut-over land, or restocking old fields. Furthermore, he will see that it is worth while to prevent and to check fires in the woods adjacent to his own, whether they be owned by fellow farmers or by large corporations.

The State and the individual counties should cooperate in a campaign of education and law enforcement to inculcate the idea of fire protection and to teach the proper use of fire. Then, when the laws against incendiarism, careless handling of brush and camp fires, and negligence of operators in failing to use fire-precautionary measures, are swiftly and effectively enforced, and when local sentiment can be depended on to support these laws by jury action, adequate protection from fire will be assured.

PUBLIC ASSISTANCE IN PRIVATE FORESTRY

Since so much of the Nation's wood supply comes from privately owned holdings, the private practice of forestry should be of much concern to the public. Most of the forest area in the region is capable of continuously producing good forest crops if it is properly managed. The State and Federal Governments can assist greatly by protecting the area from fire, from insect pests, from diseases, and from other destructive agencies; by extending credit for forestry operations; by giving technical advice and assistance; and by cooperating in management. One of the most effective ways in which the State can promote private forestry would be the adoption of a system of taxation under which taxes on forest lands would be commensurate with the productive capacity of those lands and under which the time of payment would be adjusted to correspond with the receipt of income from the forest.

Possibilities in extending long-time credit for forestry operations, particularly those of farm cooperatives, have not been studied thoroughly, nor have there been attempts to conduct cooperative

forestry operations. It may be that some form of cheap credit such as that provided for farming operations by the Federal farm loan act would be effective in financing cooperative forestry enterprises.

PUBLIC ACQUISITION OF FOREST LAND

Forest lands that are unsuited to private management because they can not support timber of rapid growth and high quality, or because of other unfavorable characteristics causing operating costs to be excessive or returns to be low, are not likely to be kept in a productive condition unless they are in public ownership. It is desirable for the public interest that a forest cover be maintained on most, if not all, of these lands, regardless of their value in producing commercial forest crops. Such forest cover would be of great benefit, both direct and indirect, to this and adjacent sections.

The forests at the highest elevations shelter the headwaters of many rivers and make the flow of the feeder streams more uniform. In other sections similar forests are being publicly acquired and placed under management wholly for the purpose of watershed protection.

Another possibility in public acquisition is that of providing recreation forests. The need for these is well recognized. In other States, large tracts are being purchased for this purpose. Forest areas that contain views, cliffs, caves, cascades, and excellent stands of virgin hardwoods which enhance the scenic values, are particularly adapted for recreational use.

The field observations indicate that there are several tracts in this territory that should be acquired by the public. A more intensive survey would be necessary to determine accurately the location, character, and extent of such land, but the following tracts may be suggested tentatively as suitable for acquisition:

The spruce forest at the headwaters of the Cherry, Gauley, and Elk Rivers is most important for watershed protection. Its extent in Nicholas and Webster Counties has been described.

The hardwood-forest areas along Point Mountain should be considered for their recreational value. (Fig. 11.) The rugged beauty of the territory along Point Mountain—the steep, deep valleys with the tumultuous, winding, silvery streams; the clear view of range after range as far as the eye can discern—is considerably enhanced by the continuous green mantle of forest growth, much of which is still in the virgin state although it is being cut over at the rate of 2,500 acres a year. The Elk River and its Back Fork furnish fine trout fishing, and the surrounding mountains offer good hunting and can be reached easily by automobile and railroad. A recreation reserve might comprise at least 40,000 acres from Webster Springs eastward along Point Mountain to beyond the county line, extending on both sides to Back Fork Mountain on the north and Gauley Divide on the south.

The Gauley Cliff and the Open Rock formations in central Nicholas County are of sufficient interest to be set aside for park purposes. Their forest cover enhances their value. The Open Rocks cover only a few hundred acres, but are near enough to the Gauley River to be a part of that territory. A belt of about 20,000 acres extending at least one-fourth mile on each side of the Gauley River from Persinger Ford to the western boundary of Nicholas County would form a substantial reserve easily accessible by automobile and offering suitable camping facilities.

Other localities furnishing excellent hunting (bear, deer, raccoon, and turkey) and fishing are found in the more inaccessible protection forests. For those hardy ones who wish to get back into the real wilderness such reservations would be very attractive.

THE PLACE OF SCHOOLS IN THE REGIONAL PROGRAM

It would be to the interest of the section to plan eventual curtailment of school and road expenditures in the part that is regarded as nonagricultural. But wherever in this section the population is fairly dense (and this will be the case in the vicinity of important logging operations) schools will be required regardless of the agricultural quality of the land. Practically no more land in this section will be

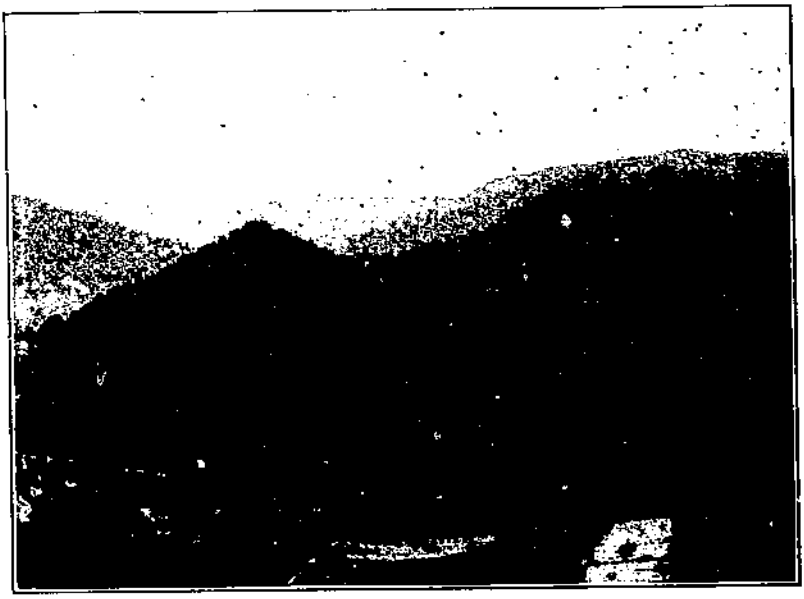

FIGURE 11.—A scene near Point Mountain. A recreational reserve in this locality would comprise inspirational scenery, the attractiveness of which is due largely to the sheltering mantle of green timber. (Elk River, several miles above Webster Springs)

cleared for agricultural use, consequently, when new schools are built, it should be kept in mind that their use probably will be temporary and expenditure should therefore be kept to a minimum.

Where there are only four or five farm families per school it would be advisable for the school districts, the county, and the State to purchase these farms in order to close the schools and eliminate the expense of their maintenance.

Where topographic conditions permit, it will be possible to consolidate several district schools into single schools although the rugged topography of the section will limit the extent to which this can take place. There are several creeks along which are scattered from three to a half dozen schools. To consolidate the small schools along a creek or ridge road would be advantageous. Wherever there are paved Class A roads the situation is favorable for consolidation. Such consolidated schools would provide a type of instruction superior

to that now offered, and their cost should not exceed the per capita cost of furnishing the present type of instruction.

There will be a permanent need for county high schools. There are now four in Nicholas and Webster Counties; these will be sufficient to meet the counties' needs for a long time. It would be better to give the existing county high schools larger financial support than to increase the number of such schools.

At present a liberal amount of State aid is given to the district schools. In general this should be continued. To whatever extent the State contribution relieves the local population of a part of the expense necessary to maintain schools of a given standard, it would appear to make it possible to farm on lands where the farmers could not make a living if such aid were not available. To whatever extent this is true, the granting of State aid defeats its own purpose; it tends to perpetuate the agricultural industry on lands that could not otherwise support the existing standard of living. Of course, this is not the case where the State contribution is employed wholly for the purpose of improving the quality of the local schools.

In an old section, as in Nicholas and Webster Counties, where the agriculture is static, particularly in the part designated as nonagricultural, one might well reason that the granting of State aid would tend not to stimulate agriculture but to retard its decline. It is a commonly accepted belief among many observers, however, that even if State aid for schools and roads were withdrawn from these marginal localities and the schools and roads should become inferior to those now maintained, people would persist in remaining there for a long time.

It is said further that since the people will persist in remaining it is necessary to retain State aid. Otherwise the inferior schools and roads would so react on the people as to render them a menace to the progress of surrounding communities.

The most effective means of maintaining a satisfactory standard of living within the section is redistribution of the population. This would be facilitated by so managing the forest resources as to achieve continuous, permanent production, thereby increasing the stability of communities within the section devoted to timber growing and by improvement in live stock production in other localities. Plans should be made to concentrate the expenditure of schools and road funds in localities that are capable of maintaining population on a reasonable standard of living by farming and forestry.

ROADS IN RELATION TO REGIONAL PLANNING

Such class A roads as are required in the section should be built by the State and should be constructed only where they will serve as links in the State highway system. As such they will be greatly needed to care for the cross-State traffic.

Certain county roads also serve as links of secondary importance in the State highway system and should receive some State aid. The West Virginia highway law should be revised to legalize financial aid in the construction and maintenance of county highways wherever they serve primarily the State class A highway system.

It is a common practice for the magisterial districts to bond themselves heavily in order to build roads of the class A type. This is rarely if ever advisable. In view of the facts that in most of the section

the virgin timber has been cut over and that the agricultural resources are less valuable than is commonly supposed, it is not inconceivable that some of the magisterial districts may be forced to default on their bonds.

The experience of many counties in the cut-over areas of the Middle West and the Northwest shows that high taxes in a cut-over area often lead to tax delinquency. In West Virginia there has been little tax delinquency thus far because the county and district expenditures have been low; the stand of virgin timber has been able heretofore to bear a heavy tax; and people have continued temporarily to pay fairly heavy taxes on denuded timber land for the coal which is supposed to underlie much of the territory.

In a cut-over area it is unwise to commit counties and magisterial districts to heavy expenditures. In such an area the tax base is very

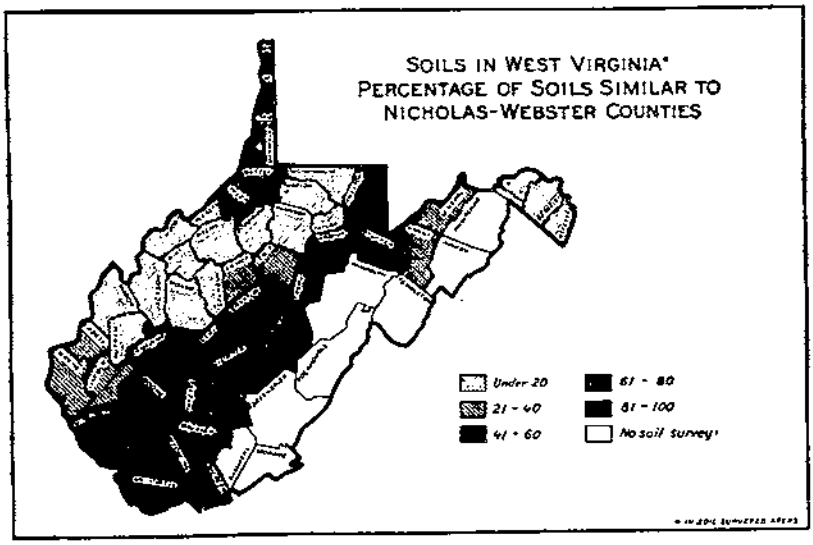

FIGURE 12.—The counties having soil characteristics similar to Nicholas and Webster are a part of the Appalachian highlands. Parts of unsurveyed counties are also in that region

unstable and will remain so until it is known how much of the tax the remaining farms and the cut-over woodland will bear. For that reason it is strongly recommended that the magisterial districts refrain from bonding themselves for construction of class A highways. A less expensive highway it is felt would serve the needs of the district adequately, and at the same time avoid a heavy bond issue, which may turn out to be more of a millstone than now seems commonly apparent.

EXTENT OF AREA IN WEST VIRGINIA TO WHICH RESULTS OF THIS STUDY PROBABLY APPLY

That the results of this inquiry apply in large measure to a considerable number of counties other than Nicholas and Webster, appears to be indicated by personal observation, analysis of census data, study of published geographical reports, computations based on soils maps, and examination of topographic maps. Figure 12 shows that 81 to 100

per cent of the soils in five of the chain of counties extending from Barbour to McDowell and Mingo are like those studied in Nicholas and Webster. Sixty-one to 80 per cent of the soils in six other counties—Fayette, Tucker, Clay, Braxton, and Raleigh—are like those of the Nicholas-Webster section. In 10 additional counties, 41 to 60 per cent of the soils are similar to those in Nicholas and Webster. Soil surveys of 47 neighboring counties have been made. The extent to which the results of this study apply to the larger adjacent section may be indicated roughly by the fact that of these 47 counties 15 have soils over 50 per cent of which are similar to those of Nicholas and Webster Counties. In counties of which the soils have not been surveyed it is to be supposed that a large proportion of the soil is like that of the counties for which soil-survey reports have been published.

However, the results of the study of land utilization in Nicholas and Webster Counties apply only in a general way to sections of similar characteristics. So far as the recommendation of specific measures is concerned the differences in transportation and market facilities; in distribution of farm areas; in the extent, character, and development of forest resources; and in other important factors may more than offset similarities in soil and topographic types. Separate study would be essential before specific measures could be framed for adoption.

It is believed that the broader aspects of public policy indicated in this bulletin would appear to apply to other large sections in the State.

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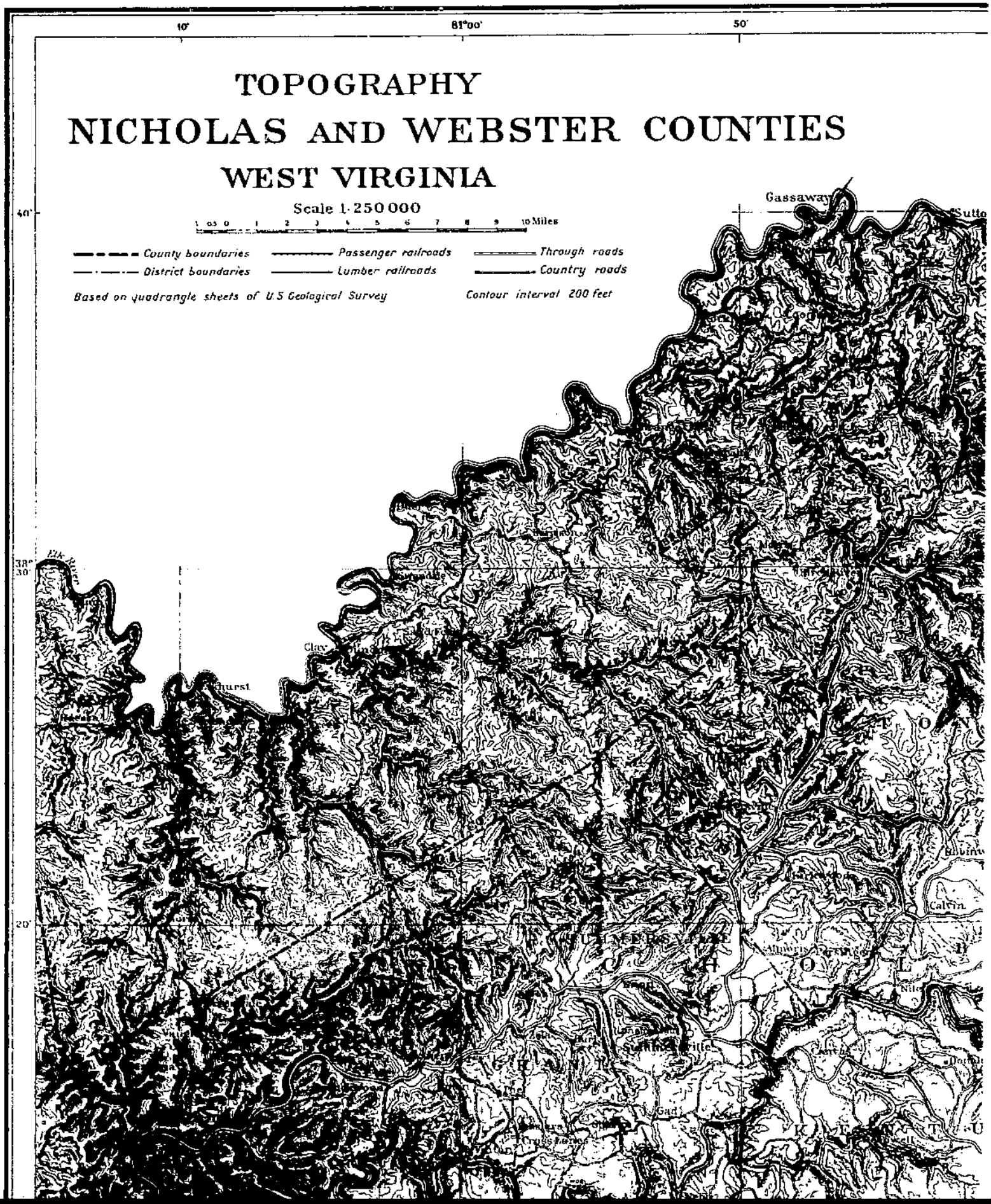
PLATE 1.—TECHNICAL BULLETIN 303
UNITED STATES DEPARTMENT OF AGRICULTURE
BUREAU OF AGRICULTURAL ECONOMICS
PREPARED BY F. J. MARSCHNER



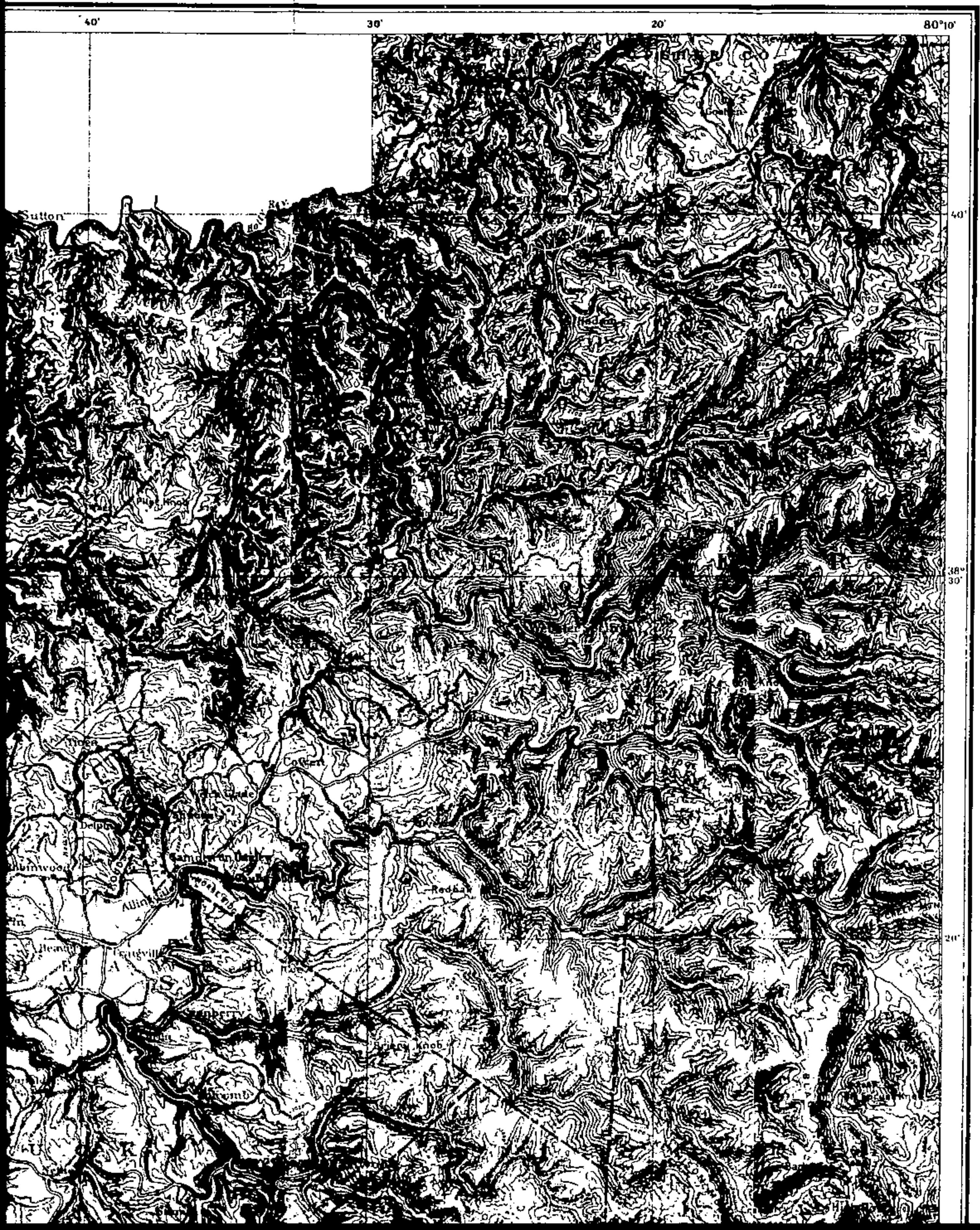
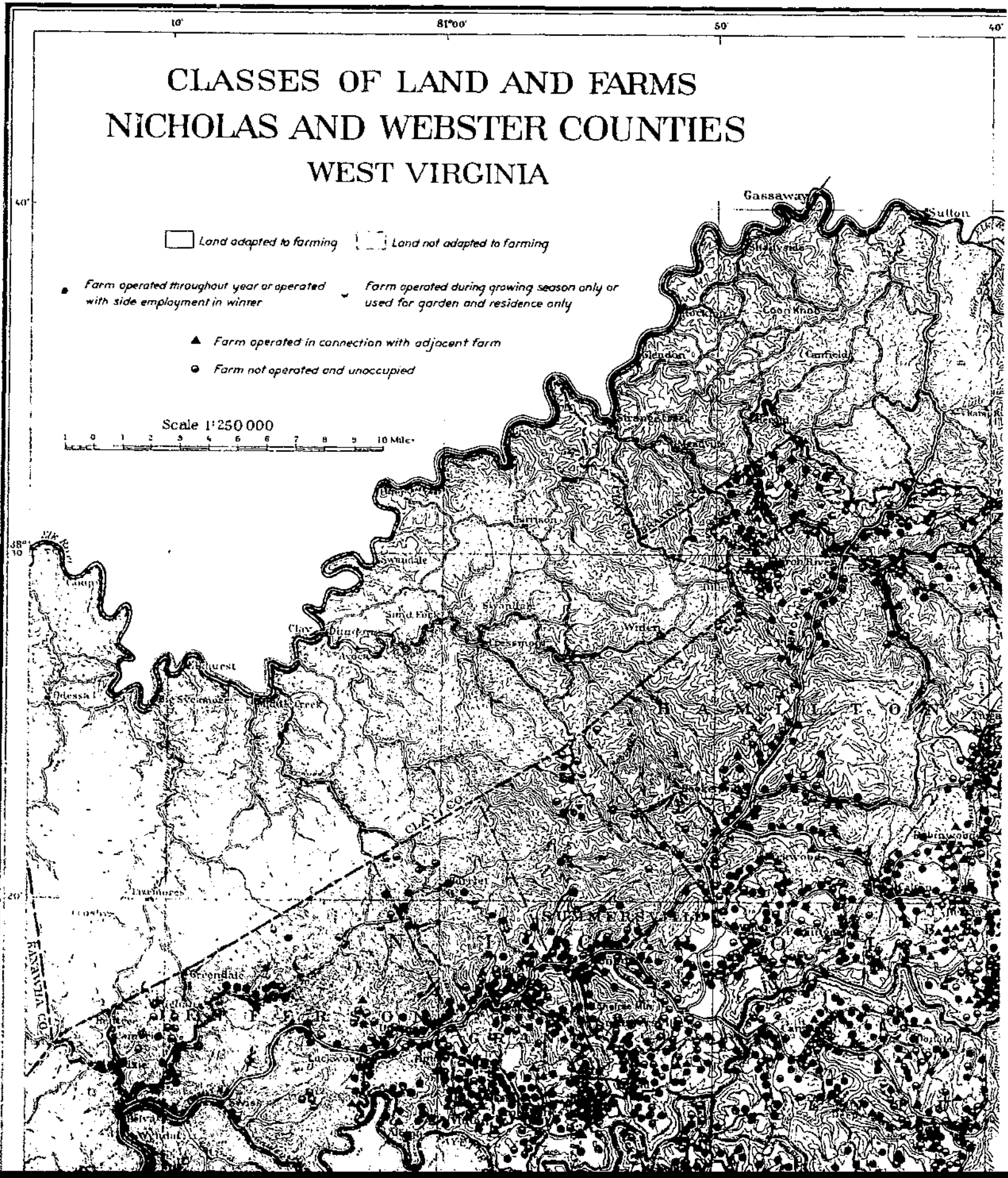
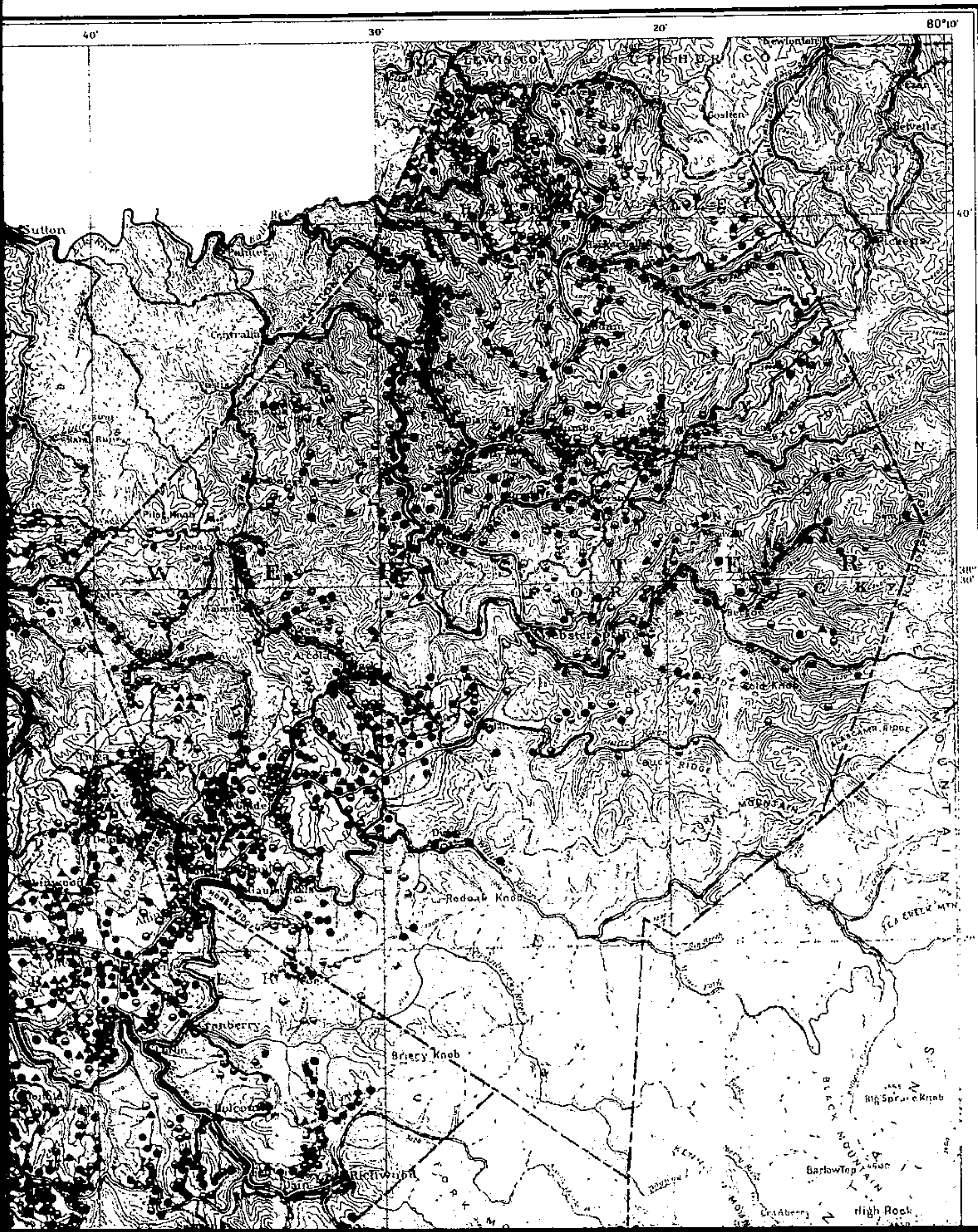

40'
30'
20'
80°10'
40'
38° 30'
20'
Sutton
Briery Knob

PLATE 2.—TECHNICAL BULLETIN 303
UNITED STATES DEPARTMENT OF AGRICULTURE
BUREAU OF AGRICULTURAL ECONOMICS
PREPARED BY MILLARD PECK AND PAUL A. EKE





40'
30'
20'
80°10'
40'
LEWIS CO
Sutton
Centralia
Arcola
Redoak Knob
Briery Knob
Cranberry
Richwood
Cold Knob
BUCK RIDGE
Big Spruce Knob
Barlow Top
High Rock

PLATE 3.--TECHNICAL BULLETIN 303
UNITED STATES DEPARTMENT OF AGRICULTURE
BUREAU OF AGRICULTURAL ECONOMICS
PREPARED BY BERNARD FRANK

CLASSES OF TIMBERLAND
NICHOLAS AND WEBSTER COUNTIES
WEST VIRGINIA

Scale 1:250 000

1 0 1 2 3 4 5 6 7 8 9 10 Miles

County boundaries
District boundaries
Passenger railroads
Lumber railroads
Through roads
Country roads

Based on quadrangle sheets of U.S. Geological Survey

Contour interval 200 feet

Virgin timberland

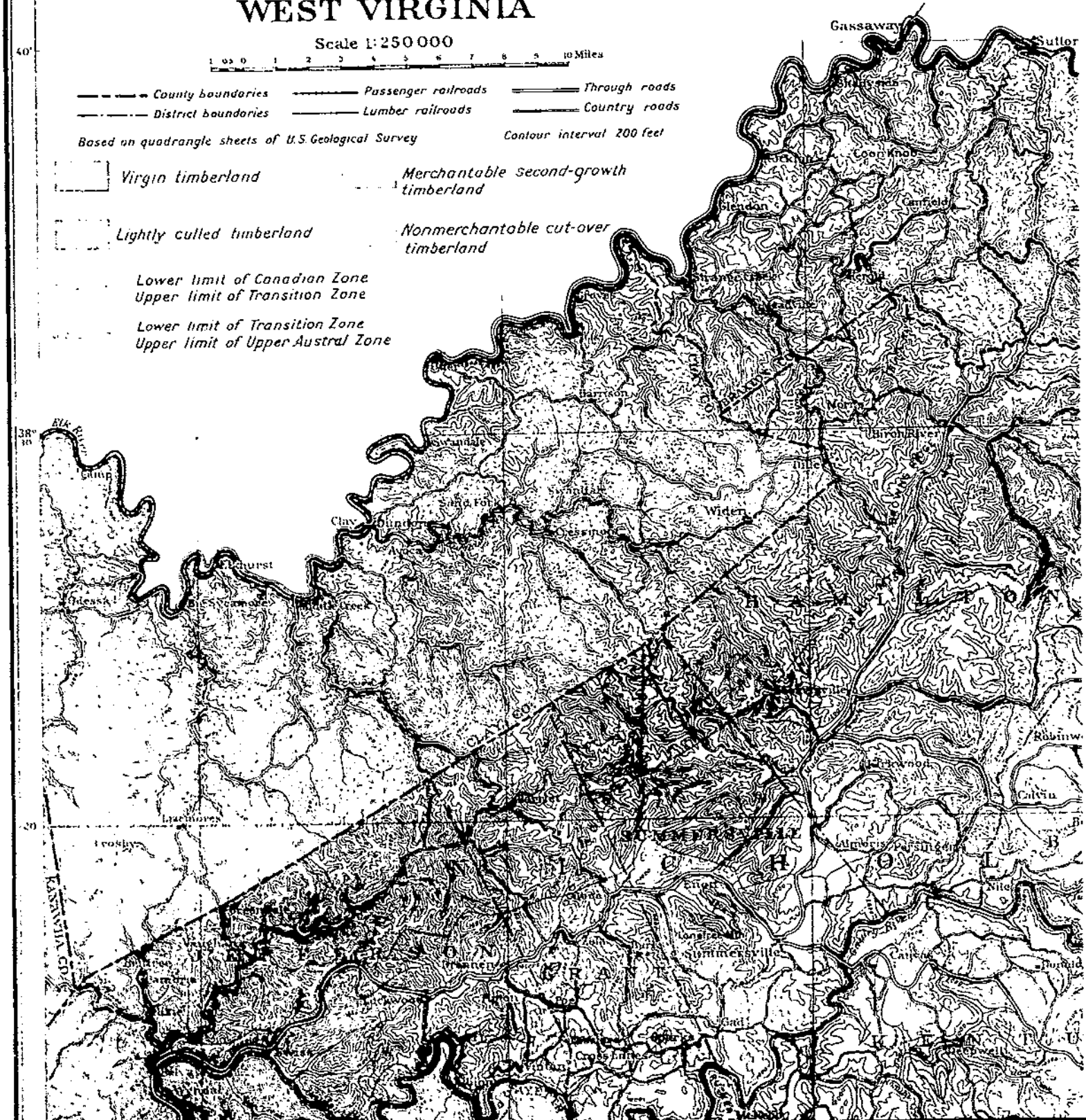
Lightly culled timberland

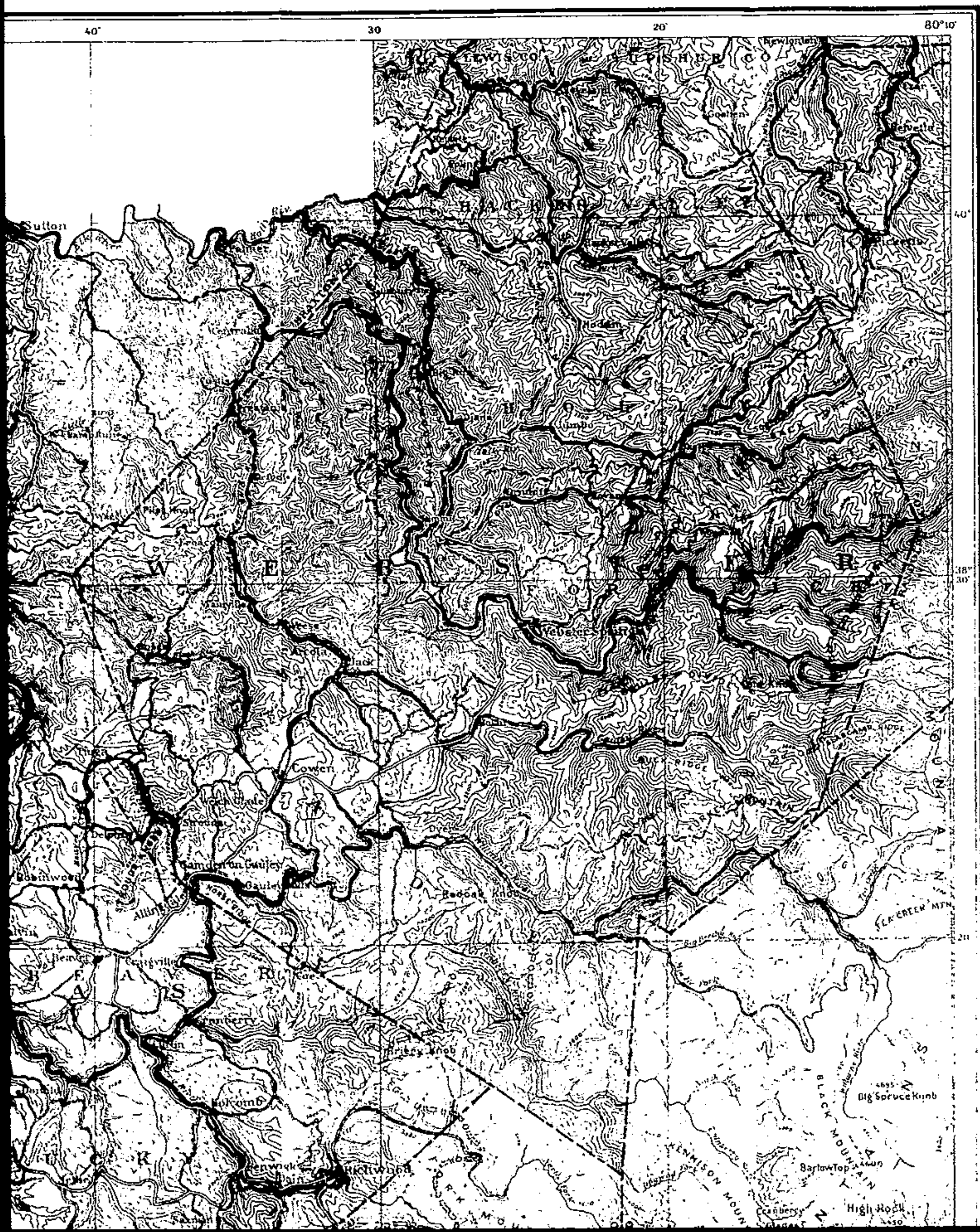
Merchantable second-growth timberland

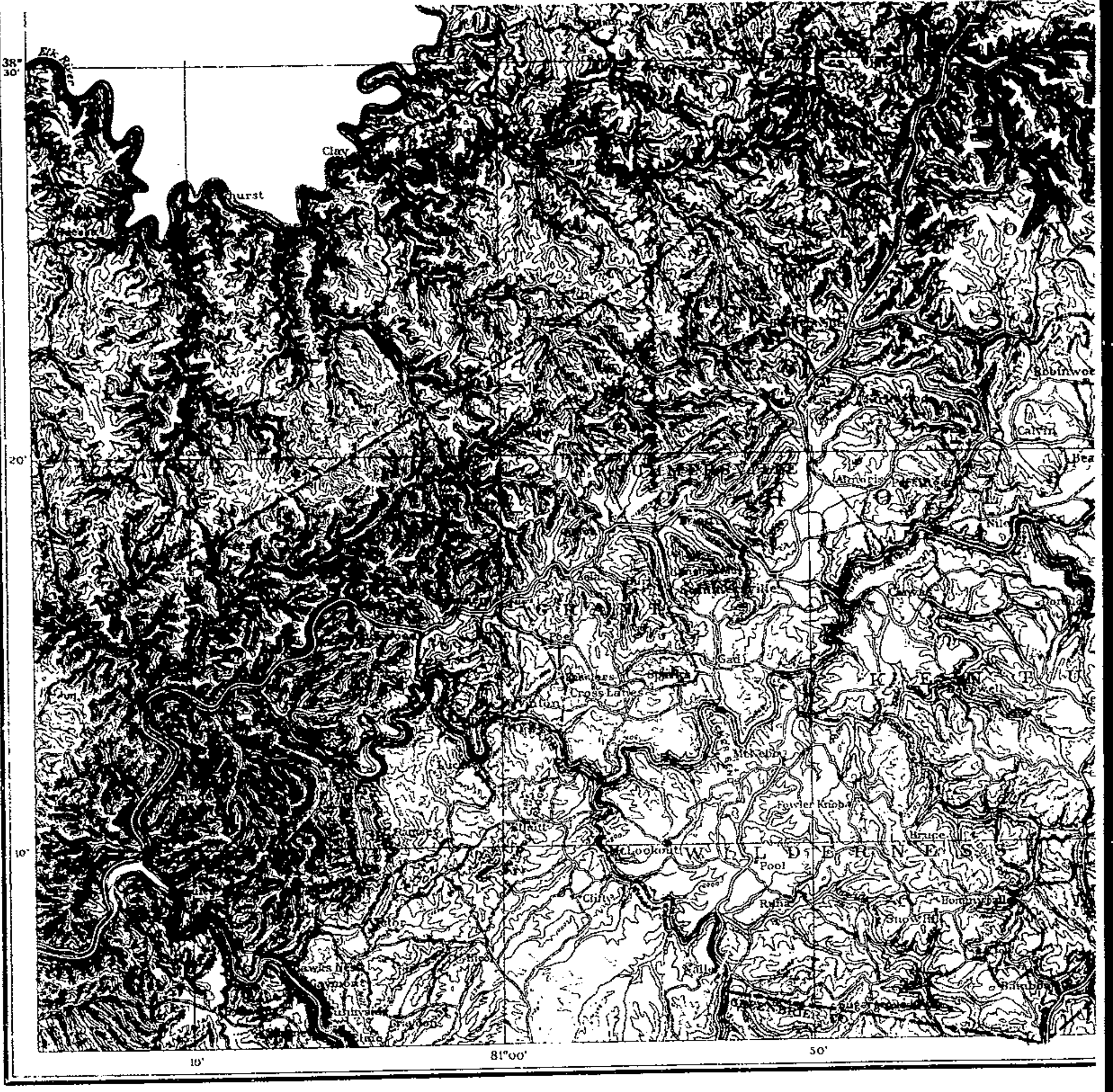
Nonmerchantable cut-over timberland

Lower limit of Canadian Zone
Upper limit of Transition Zone

Lower limit of Transition Zone
Upper limit of Upper Austral Zone

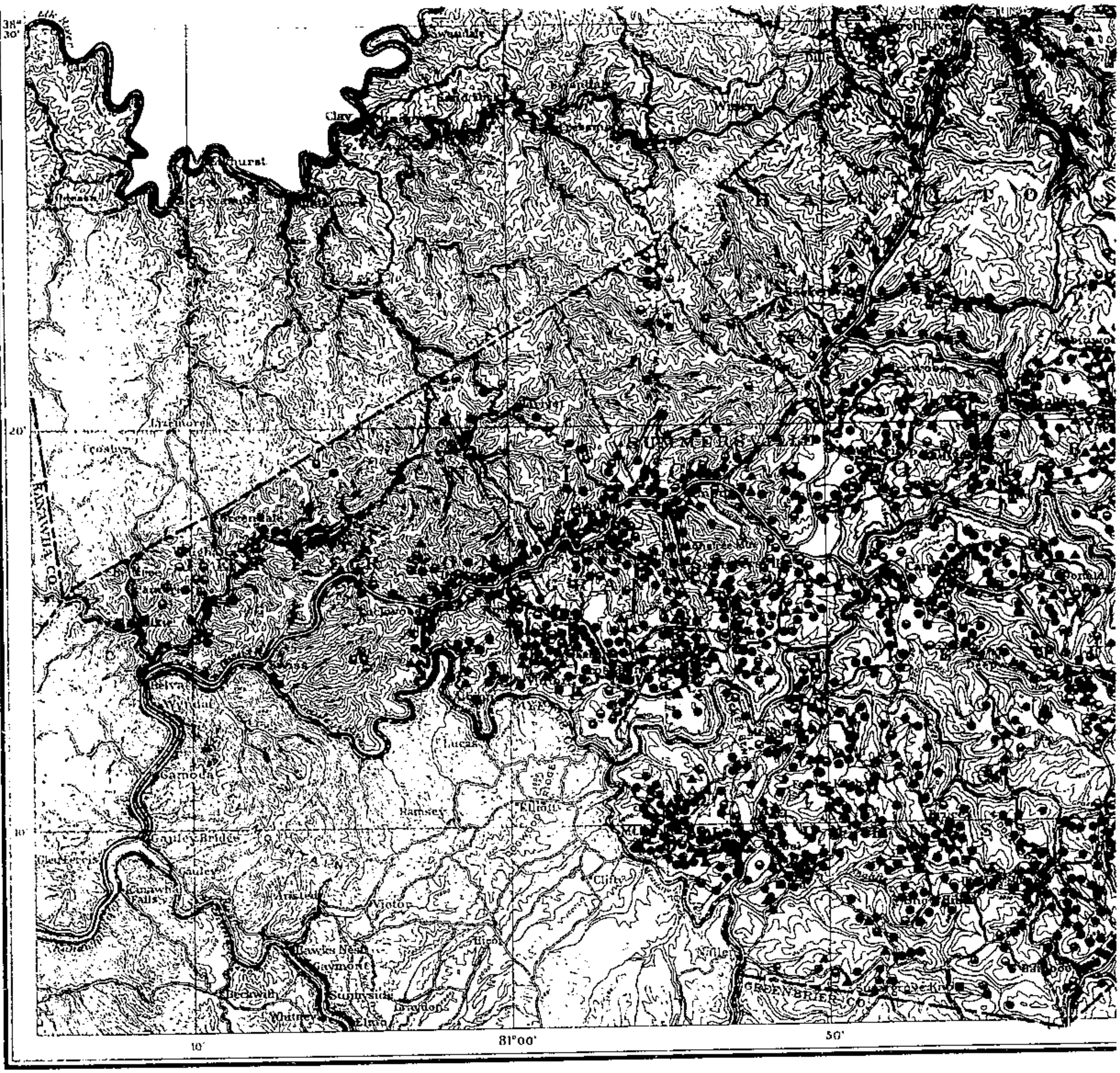



40'
30
20'
80°10'
40'
38°
30'
20'
Sutton
LEWIS CO.
UPSHUR CO.
Goshen
Helvetia
Pickens
Hodam
Jumbo
W E B S T E R
Cowen
Camden on Gauley
Redoak Knob
Cranberry
Briery Knob
Big Spruce Knob
BLACK MOUNTAIN
Barlow Top
High Rock

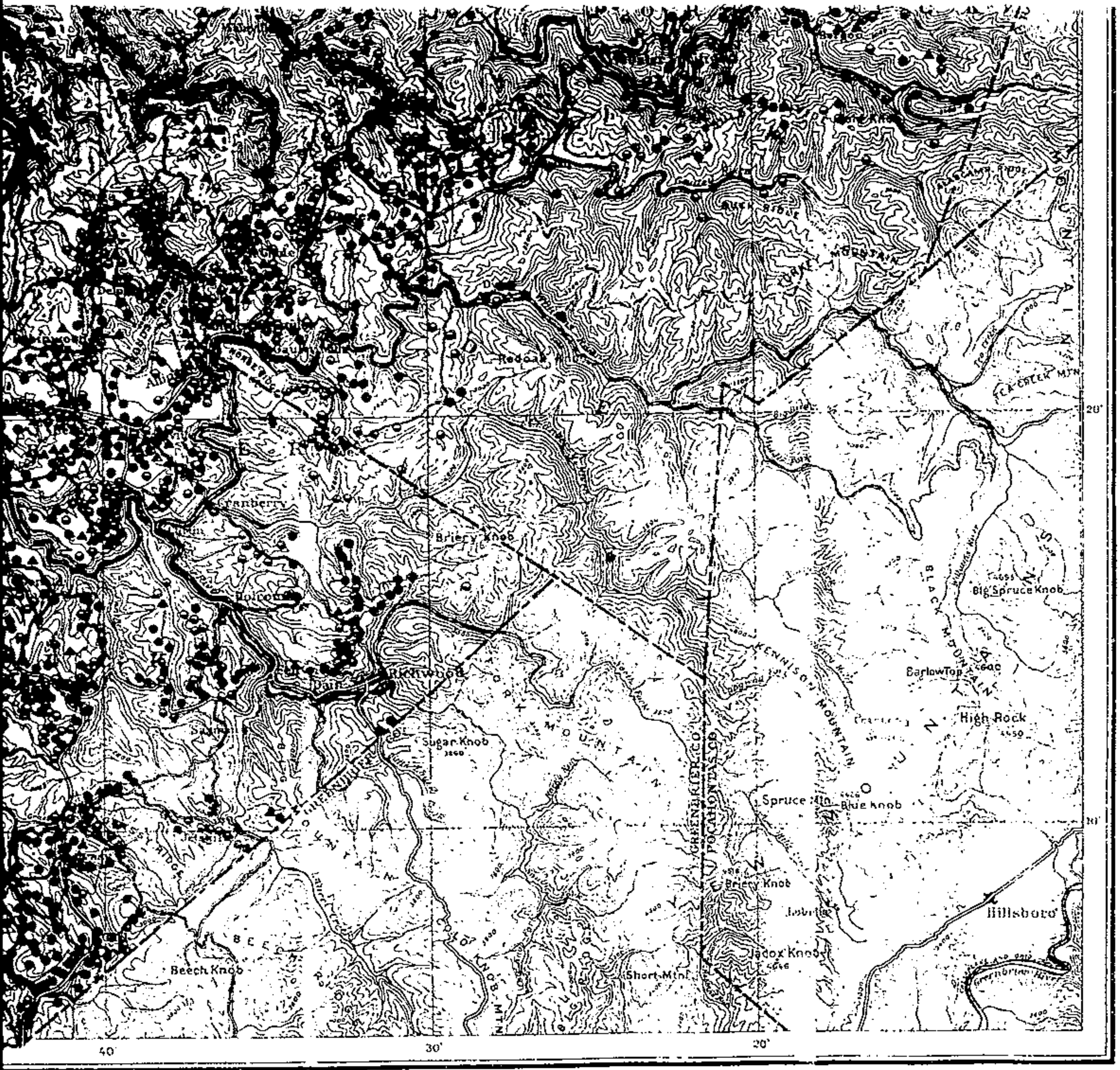


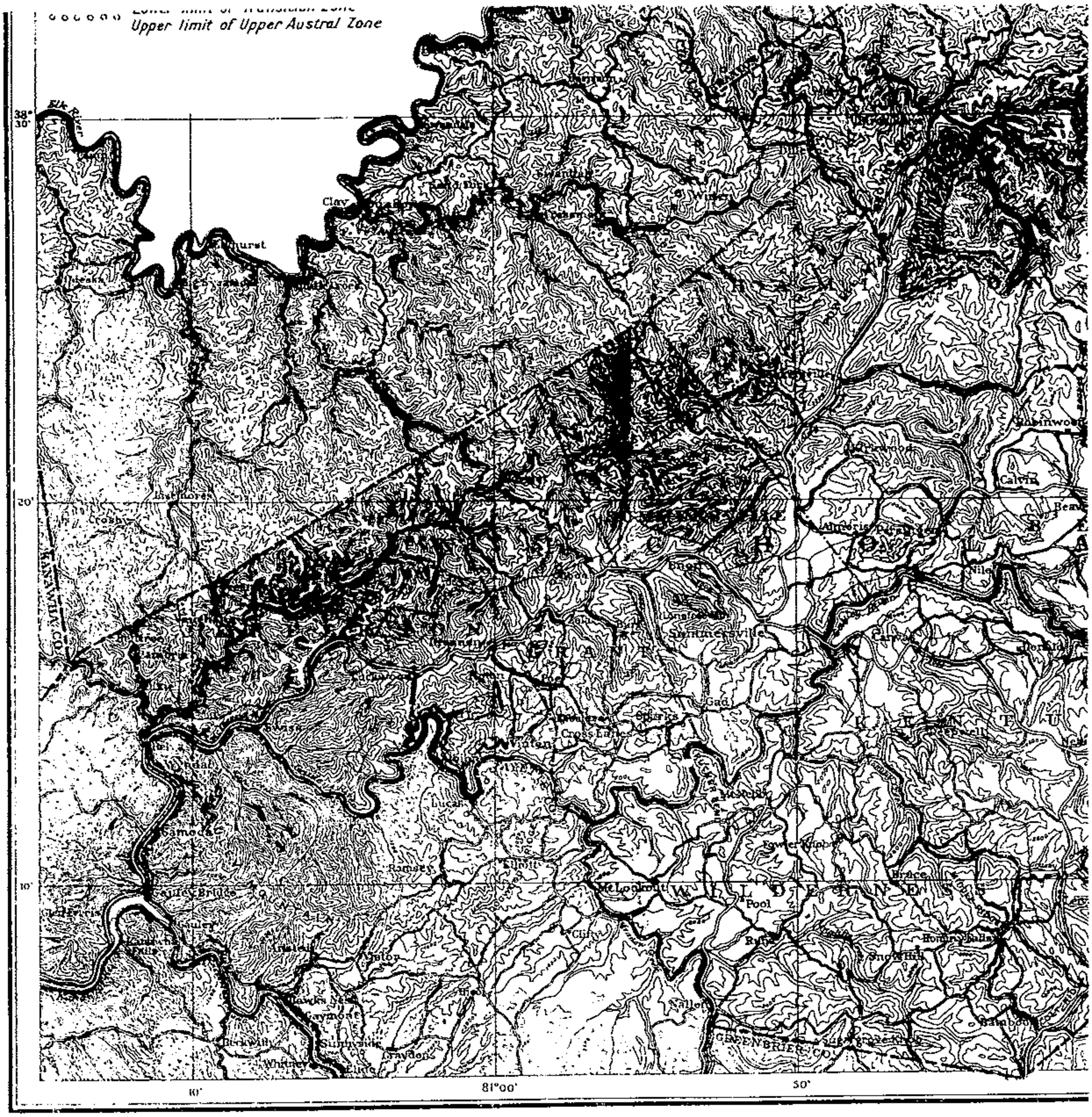
38°
30'
Elk River
Clay
Calvin
Gad
Cross Lanes
Fowler Knob
Lookout
Pool
Bruce
20'
10'
10'
81°00'
50'


38°
30'
20'
10'
40'
30'
20'
Hillsboro

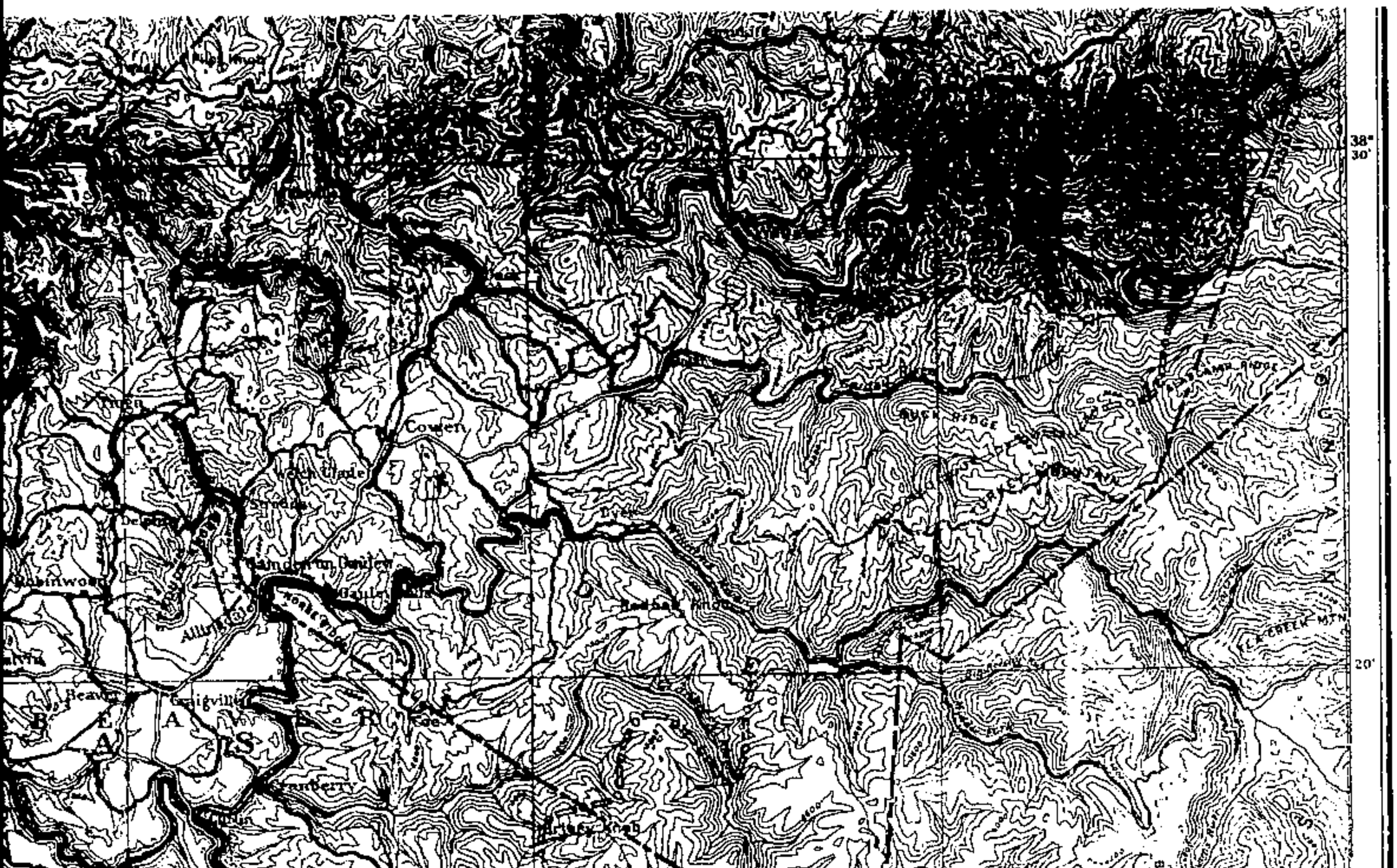


Clay
Gauley Bridge
Victor
Lucas
Ramsey
Sunnyside
Gaymont
Clifty
GREENBRIER CO.
KANAWHA CO.
20'
10'
81°00'
50'


Redoak
Cranberry
Briery Knob
Big Spruce Knob
KENNISON MOUNTAIN
BLACK MOUNTAIN
Barlow Top
High Rock
Sugar Knob
Richwood
Spruce Mtn
Blue Knob
Briery Knob
Hillsboro
Jacox Knob
Short Mtn
Beech Knob
Greenbrier River
TEA CREEK MTN
POCAHONTAS CO
40'
30'
20'
20'
10'



Upper limit of Upper Austral Zone
Elk River
38°
30'
Clay
Calvin
20'
Cross Lanes
Gad
Ramsey
10'
Pool
Snow Hill
Whitney
81°00'
50'


38° 30'
20'
10'
40
30'
20'
Cowen
Craigsville
Beaver
Cranberry
Holcomb
Richwood
Sugar Knob
Short Mtn
Beech Knob
Jacox Knob
Spruce Mtn
Big Spruce Knob
Barlow Top
High Rock
Cranberry Glades
Kennison Mountain
Black Mountain
Hillsboro
Greenbrier River

END