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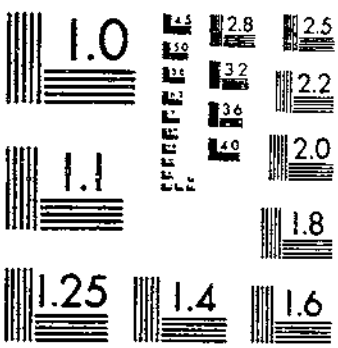
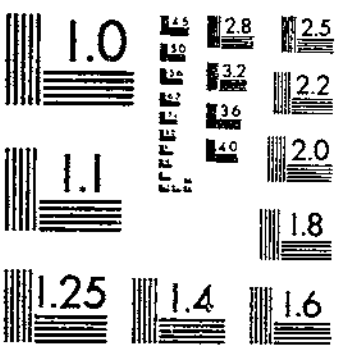


MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A



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UNITED STATES DEPARTMENT OF AGRICULTURE
WASHINGTON, D. C.

LAND UTILIZATION IN LAUREL COUNTY, KY.

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In Cooperation with Kentucky Agricultural Experiment Station

CONTENTS

INTRODUCTION

Laurel County is included in a group of 34 counties comprising the Kentucky portion of the Cumberland Plateau. The approximate western border of this region is marked by a line extending southwestward from Portsmouth on the Ohio River to the southwest corner of Wayne County. The rugged or rough topography characteristic of this region has given to it the name of the "Kentucky Mountains." It covers 10,450 square miles, or 26 per cent of the area of the State.

[1] The following divisions of the Bureau of Agricultural Economics participated in the study: Land economics, farm management and costs, and farm population and rural life. Tabulations and summaries of the data relating to individual fields and to farm wood lots were made under the direction of C. F. Clayton, Bureau of Agricultural Economics, who is also responsible for the organization of the material appear-

(Continued on p. 2)

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It seems appropriate to preface the presentation of the data of this initial study of land utilization in the Kentucky Mountains with a brief summary of important conditions which have affected the economic and social development of the mountain region. A general description will serve to indicate the portion of the area in which basic conditions are essentially like those in Laurel County, and for which the results of the present study may be regarded as generally significant. These conditions are the foundation of problems that now confront many mountain communities.

PHYSICAL FEATURES

Physiographically the mountain region is a maturely stream-dissected plateau. With the exception of Pine Mountain and Cumberland Mountain—the only true mountains in the region—the ridges are the result of erosional processes. The surface of the original plateau, through which the streams have cut, rose "from an altitude of 1,000 feet above sea level at the Ohio River to 2,000 feet above the same datum plane at the Tennessee line" (*8, p. 187*).[2]

Geologically this region is the eastern coal field. The conglomerate or lower portion of the coal measures extends in a strip from 5 to 25 miles wide along the western border. It includes portions of Wayne, Whitley, McCreary, Pulaski, Laurel, Rockcastle, Jackson, Owsley, Lee, Estill, Wolf, Powell, Menifee, Morgan, Rowan, Elliott, Carter, and Greenup Counties. In all, the area of the conglomerate outcrop, or lower "Coal Measures," includes about one-third of the entire field (*5*, p. *1067*). The westward facing escarpment of the Cumberland Plateau, formed by the conglomerate outcrop, presents a barrier between the mountain and the bluegrass regions, which has been compared to a Chinese wall (*8, p. 152*). This situation has exerted a profound influence on the economic and social development of the mountain region.

SETTLEMENT

Settlements in the mountains were not established until 1789 (*17, p. 74*), although settlements in the bluegrass were made as early as 1775. Not only the greater fertility of the bluegrass plains, but Indian hostility as well, operated to retard settlement in the mountains. During the decade, 1790–1800, there was a gradual increase in the number of permanent settlers in the mountains. In 1800, except in the lower Kentucky, Cumberland, and Licking Basins, density of population was less than 2 per square mile. From that time, population moved from the western margin of the mountains slowly up the main river valleys. In 1850 the general density of population

(Continued from p. 1)

ing in this bulletin and the preparation of the text. Tabulations and summaries of the farm management and of the population data utilized in this bulletin were prepared, respectively, by the Kentucky Agricultural Experiment Station, under the supervision of W. D. Nicholls and H. W. Hawthorne, and by the division of farm population and rural life, under the supervision of C. J. Galpin. For more detailed treatment of special aspects of this study, reference may be made to the following bulletins of the Kentucky Agricultural Experiment Station: Bulletin No. 305, Farm Management and Incomes of Farm Families in Laurel County Kentucky, by W. D. Nicholls and H. W. Hawthorne; Bulletin No. 301, Cost of Living and Population Trend in Laurel County, Kentucky, by Merton Oyler. The basic materials of these bulletins have been freely utilized in developing the present analysis. F. J. Marschner, division of land economics, Bureau of Agricultural Economics, developed a basis for and prepared the maps appearing in the present bulletin. Acknowledgments are also due Willard Rouse Jillson, director of the Kentucky Geological Survey, for assistance rendered Mr. Marschner in this work, and to C. H. Burrage, formerly university forester, Kentucky Agricultural Experiment Station, and Bernard Frank, assistant forest economist, United States Forest Service, who collected the data on farm wood lots.

[2] Italic numbers in parentheses refer to Literature Cited, p. 99.

was from 6 to 18 persons per square mile, and 20 years later, in 1870, the general average was from 18 to 45 to the square mile. By 1900 a density of 18 to 45 prevailed even in the more sparsely settled districts, while an increase from 45 to 90 persons to the square mile had taken place in the coal-mining districts along the upper Cumberland and Big Sandy Basins and had reached 90 and over along the Ohio River.

In 1920 the average density of the 34 mountain counties was about 53 persons to the square mile. If incorporated places having a population of 2,500 or more are excluded, the rural districts of these counties had a population density in 1920 of 48.8 persons to the square mile. Between 1840 and 1900 the increase of population was largely genetic. The development of mining has stimulated immigration since 1900, although some foreigners came in with the advent of the railroads. The foreign population is confined almost exclusively to the mining districts.

The State bureau of immigration, formed in 1880, encouraged immigration to the mountain region. In 1881 colonists from the Canton of Bern in Switzerland settled near Bernstadt (Laurel County). The immigrants began arriving in April, coming in groups of 10 to 40 persons. By 1883 about 900 settlers had arrived.[3]

The Bernstadt Colonization Co. had secured an option on a large acreage of land in Laurel County at $1 an acre. Sales were made to settlers at $3, $4, and $5 an acre. The terms required cash payment of one-fourth of the purchase price and the balance on mortgage at 6 per cent. A few families purchased 200-acre tracts, but the usual range was 20 to 100 acres per family, with the bulk of the purchases ranging from 20 to 40 acres.

The settlers produced berries, small fruits, and vegetables. They planted vineyards and grew grapes, and wine was produced locally.[4] Very few settlers arrived after 1884. After 1886 the coal mines near Pittsburg and East Bernstadt, where wages ranged from $3 to $7 a day, attracted many of the settlers. In 1889, 50 of the settlers migrated to Phillips County, Ark. The colony disintegrated rapidly. In 1927 there were about 150 persons of Swiss descent, mostly farmers, in the neighborhood of Bernstadt. This number included about 15 of the original settlers.

PIONEER ROADS

The early history of transportation in the mountains centers around four main transmontane routes of travel (*17, p. 57*).

The Wilderness road entered Kentucky through Cumberland Gap, following Boone's trace marked out in 1775 northwestward across the rugged plateau to the central bluegrass. The road passed through London at the site of the present courthouse. Just north of London, near the present site of Pittsburg, the road divided. One branch followed Logan's trace through Hazel Patch, Crab Orchard, and Danville to the falls of the Ohio, where the city of Louisville now stands. The other continued northward along Boone's trace through

[3] Verhoeff (*17, p. 28*) states: "There were 440 of these settlers, who had purchased 4,148 acres of colony lands." R. Ott, Bernstadt, Ky., one of the original settlers, gave the information used in the present account.

[4] "In the South (at Strassburg) there were wine-growers from the Upper Rhine, who planted a considerable acreage of grapes. There was also a colony (Pine Hill-Salzburg) in Rockcastle County. All of these immigrants came with the hope of producing wine, garden truck, and cheese, and when their efforts in these directions failed some went into the coal mines, but many left the mountains" (*17, p. 28*).

Richmond and Boonesborough (now Ford in Madison County) to the heart of the bluegrass, where Lexington now stands (*17, p. 82*).

A second pioneer route, the Owingsville and Big Sandy, extended northeastward from Mount Sterling through Owingsville to the Big Sandy River at Catlettsburg where it connected with the Greenbrier road in Virginia.

The third of the main lines was the Mount Sterling-Pound Gap route extending eastward from Mount Sterling to Paintville, thence southeastward through Prestonburg to Pikeville, where the road branched, the southern route connecting with the Virginia roads through Pound Gap and an eastward extension effecting a junction by following the Louisa fork of the Big Sandy River.

The Irvine-Pound Gap route connected with the Wilderness road at Richmond on the west and extended east and southeast through Jackson in Breathitt County and Hazard in Perry County to Sounding Gap. An extension of the road from this point connected it at Pound Gap with the south fork of the Mount Sterling-Pound Gap route.

From 1792 to 1850 the chief traffic on these transmontane roads was livestock. Cattle, hogs, horses, and mules were driven from central Kentucky across the mountain roads to the eastern and southern markets. "The farmers living along the mountain roads exhausted their lands in efforts to furnish a supply of food and forage sufficient for the journey" (*17, p. 98*). The hog drivers furnished a cash market for corn, with the result that the mountain farmers impoverished the land by continuously growing corn on it, and themselves by selling corn at 12.5 to 15 cents a bushel in the fall to obtain cash, only to be compelled to pay 35 to 40 cents a bushel for corn in the spring (*17 p. 146*).

The principal eastern markets were Baltimore and Philadelphia. To the south, Georgia and the Carolinas furnished a market, especially for horses and mules, which were driven along the Wilderness road through Cumberland Gap on their way to the southern markets (*17, pp. 98–99*). The peak of this transmontane traffic was reached in the period from 1830 to 1840 (*17, p. 126*).

In spite of steepness and frequent washouts, the mountain roads, up to about 1830, were as good as, and sometimes superior to, those of central Kentucky. But between 1830 and 1850 macadamized roads, built and successfully operated on the turnpike system by joint-stock companies, had surpassed the mountain routes. By 1848 the Wilderness road "had lost practically all significance as a transmontane route and was of mere local importance" (*17, p. 126*). By 1880 salt and livestock traffic, formerly the chief source of revenue, had practically disappeared. It was in the latter year that the tollgates on the Wilderness road were abolished, and, although nominally under the supervision of the State until that time, the road has been controlled since 1844 by the counties through which it extends (*17, p. 125*).

Two principal factors contributed to the decline in the importance of the mountain routes after 1850 (*17, p. 100*). Improved methods of transportation on the Ohio River caused the river route to absorb much of the traffic and led to the establishment of large packing houses in the principal river cities. The packing houses cut off the volume of livestock driven on foot to the eastern markets, thus elimi-

nating the principal source of revenue of the mountain routes and severing the chief line of communication between the mountain population and the "settlements."

A second factor in this decline was the rapid increase of railway mileage in the Ohio-Mississippi Valley about 1853, and the consequent shift of grain and livestock farming from the Ohio Valley to the Northwest. Along with this movement came the shift in the center of the meat-packing industry from Cincinnati to Chicago.

The mountain routes were abandoned. For more than half a century, after 1850, the mountain people were isolated to a degree that left them practically untouched by the economic and social ferment of the period.

RAILROADS

Exploitation of the natural resources [5] of the mountain counties, particularly of the coal fields, gave the chief impetus to the penetration of the mountain barrier by the railroads.[6] The rugged character of the country makes railway construction and operation expensive. Railway facilities are, therefore, limited in many of the mountain counties, and a few counties have no railroad within their borders. Lack of railroad facilities, together with poor wagon roads, always difficult and sometimes impossible to travel, greatly impede the movement of persons and goods in the more rugged sections. Economic and social isolation has been the inevitable consequence of this situation.

The railroads penetrated the mountain region through breaches made by rivers in the plateau escarpment. Six main lines now enter or cross the coal field (*8, p. 190*). Laurel County is traversed from north to south, a distance of 15 miles, by the Louisville, Knoxville, & Atlantic division of the Louisville & Nashville Railroad. Junction at East Bernstadt is made by the Rockcastle River Railroad, a short spur, extending through the northern part of the county to the Jackson County line. The influence of topography in determining the course of travel in the mountain region is illustrated by the fact that the railroad follows closely the old Wilderness road through Laurel County and southward, while to the north the railroad routes divide, along the courses of the pioneer roads, one branch following the Boone trail to the bluegrass, the other passing through Hazel Patch, Crab Orchard, and Danville along the route followed by the Indians and the pioneers to the falls of the Ohio River.

TIMBER

The area of Kentucky is 25,715,840 acres The original forest area was 24,320,000 acres. In 1920 about 9,400,000 acres of forest land remained. State and national forest lands aggregated 41,284 acres in 1925. A large part of the woodland acreage is included in farms.

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[5] The principal natural resources of Laurel County are timber and coal. Timber resources of the county are discussed in a subsequent section of this bulletin. The annual output of coal in Laurel County is now approximately 150,000 tons and the amount of labor employed is proportionately small. Only 22 farm families, among the 203 records summarized, reported receipts from mining coal in 1927, and five families reported hauling coal as a source of cash income. Supplementary receipts from coal mining would amount approximately to $20 a family if distributed equally to the 203 families included in the farm business summary. This is a cash item of some importance in an area where the annual cash income of nearly half the families is under $500 and averages only $319. But the opportunities afforded by coal mining in Laurel County either for full-time or part-time employment are limited, and any significant local expansion of the industry is improbable.

[6] "Railroad building began in 1856, but made no headway until between 1870 and 1890. Since then progress has been slow, and confined until recently to marginal counties. The explanation is found in the fact that none of the natural resources have been of sufficient commercial value in the past to warrant the large expenditures of labor and capital required by such schemes" (*17, p. 57*).

Approximately 20 years prior to the date (1927) of this study, it was estimated that 5,664,272 acres, or approximately 80 per cent, of the Kentucky mountain region was forested and that the total stand was about 18,000,000,000 board feet (*4, pp. 133–135*). The original hardwood stand was probably two and a half times as great. Lumber production in Kentucky reached a peak in 1907 (*14*). In some of the mountain districts, however, the peak of production was not reached until a later date, when railroad development made the stands accessible (*4, p. 11*). The opening of the coal mines expanded the local market for forest products. The forested areas were rapidly depleted.

LARGE HOLDINGS

Although a large part of the forested area of eastern Kentucky is in farms, large holdings are not uncommon, especially in the counties in which coal or other mineral resources exist. Some renter farmers and occasionally some squatters are found on these large tracts, but the land is principally in timber and is held in private ownership as a rule, primarily for the present or potential value of its mineral resources. The importance of conserving the timber on these tracts is, however, receiving increased attention, particularly in the matter of protecting the stands from fire. Data were obtained for 169 tracts of 1,000 acres and over, located in eastern Kentucky. Of this number, the distribution by counties was obtained for 122 tracts. These 122 tracts were distributed in 17 counties, including in addition to those shown in Figure 1 the following: Boyd, Carter, Greenup, Johnson, McCreary, and Pulaski. Of the 122 tracts, Letcher County had 26, Clay and Whitley Counties 14 each, McCreary 13, and Bell 11. Figure 1 is based on a map of fire-protection areas,[7] but does not show the boundaries of individual holdings.

Some idea of the approximate size of large holdings in most of the southeastern counties is given by figures[8] obtained from county seats. Tracts under 1,500 acres were most frequently listed, and approximately half the number of tracts listed was included in the three acreage groups below 2,500 acres. The remaining 50 per cent was distributed over a wide range, from 2,500 to 50,000 acres and over. Nine tracts of 1,000 acres and over, having a total area of 36,243 acres, including one holding of 21,277 acres, were listed in Laurel County. The 8 remaining tracts ranged in area from 1,000 to 4,000 acres and averaged 1,871 acres. The 9 tracts averaged 4,027 acres in area. With the exception of these 9 tracts there were only 4 tracts of 500 acres and over, ranging from 570 to 856 acres, 4 ranging from 300 to 400 acres, and 19 ranging from 200 to 275 acres. Approximately 1 acre in every 8 of all land in the county and approximately 3 acres in every 10 of the land not in farms was in privately owned tracts of 1,000 acres and over. These large holdings were chiefly in the western section of the county, districts 4 and 5.

[7] Furnished through the courtesy of the Kentucky State Department of Forestry.
[8] Furnished through the courtesy of S. D. Sulter, district forester, Pineville, Ky.

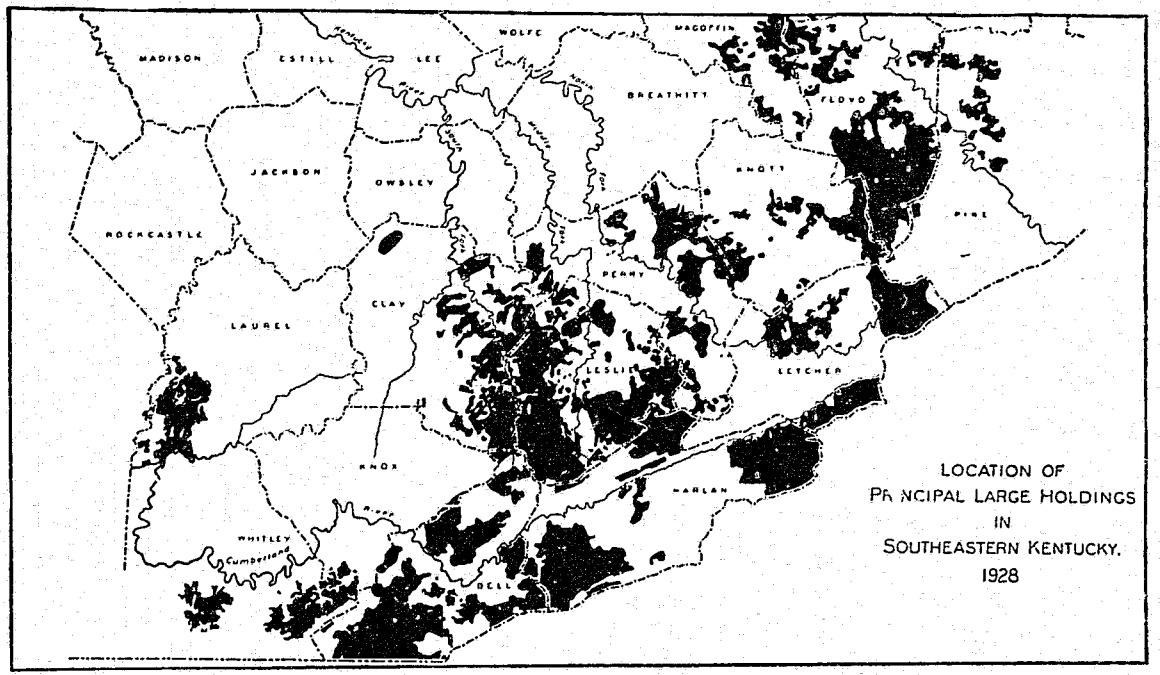


FIGURE 1.—Although a large part of the forested area of eastern Kentucky is in farms, large holdings are not uncommon, especially in the counties containing coal or other mineral resources. Such tracts are held in private ownership as a rule, primarily for the present or potential value of the minerals

COAL

The Kentucky mountain region is a part of the great Appalachian coal field. The entire region is underlain by coal, but there is great variation in the number and thickness of the seams and in the quality of the coal (*8, p. 121*).

Although the presence of coal in the mountain region has been known since the period of the earliest explorations, and coal has been produced since 1828, it is only in the last 15 years that commercial exploitation on a large scale of the more productive seams has taken place.

Until the railroads were extended into the mountains, coal was transported on the rivers by flatboats and rafts. The presence of coal stimulated the building of the railroads, and the improved transport facilities provided by the railroads made possible the commercial exploitation of the mines.

During the period from 1925 to 1928 coal was commercially produced in 20 counties embraced in the mountain region. Harlan County leads with an annual production approximating 12,000,000 tons, followed by Pike, Perry, Letcher, and Floyd Counties with annual outputs ranging approximately from 5,000,000 to 8,000,000 tons, and by Johnson and Bell Counties, which produce annually in excess of 1,000,000 and 2,000,000 tons, respectively (*7*). In a number of the other counties the annual output of coal is a factor of importance in furnishing employment to labor, although, of course, not on the scale provided by the heavy coal-producing counties.

OTHER MINERAL PRODUCTS

Oil was discovered in Kentucky in connection with the salt industry. The first oil strike was made in 1819 in Wayne (now McCreary) County (*8, p. 287*). Davis (*8, p. 128*) lists seven commercially productive sections in the mountains.

Commercial production of petroleum dates from about 1880. The peak of production was reached in 1919 with an output of 9,226,473 barrels in that year. The total estimated production up to 1927 was 80,000,000 barrels. The value of this large output is enormous, but the benefits derived by the oil-producing counties have been questioned.[9]

Natural gas, clays, sands, and gravel are also of present and potential importance among the natural resources of the mountains (*13*).

OBJECTIVES AND SCOPE OF THE STUDY

The principal objectives of the study were as follows: (1) To determine the present major uses of the land, that is, whether for crops, pasture, or woodland; (2) to relate the present utilization of the land to basic physical conditions for the areas studied, and to generalize these relationships, as far as possible, to the county as a whole; (3) to trace the relationship between the physical characteristics of land and (*a*) the distribution of land among various uses, (*b*) the size of the farm business, (*c*) the amount and sources of farm and other in-

[9] Davis (*8, p. 130*) observes that "it is doubtful whether the oil producing counties have benefited directly and permanently to any considerable extent. In many cases, the original holders of the land derived little or no financial profit from the discovery of oil, the returns from the exploitation of the resource going outside the area. With the depletion of the pools and the abandonment of the wells, the economic structure collapsed, leaving the region in worse condition than it was prior to the discovery of oil."

come, (*d*) the sources and value of the family living, and (*e*) the composition and characteristics of the population; and (4) to outline on the basis of the foregoing analysis a land-utilization program designed to

FIGURE 2.—LOCATION OF FARMS VISITED

The data of the study are based on farm-management and family-living records obtained from 203 farms, records for individual fields from 52 farms, wood-lot records from 49 farms, together with supplementary data relating to population and to unoccupied farms. The area south of London is referred to as the south area and the area northeast of London as the north area. (Topography based on United States Geological Survey. Cultural features based chiefly on sketches made in the field and on data supplied by the Kentucky Geological Survey.)

secure the optimum adjustments of the mode of living and of the social and economic institutions of the area.

The location of farms visited is shown in Figure 2. The area covered includes eight school districts, Old Union, McGill, and Wyan,

lying south of London (south area), and Old Salem, Pleasant View, Taylor, Twin Branch, and Long Branch, lying northeast of London (north area).

In 1927 the eight school districts covered by the study contained 17,642 acres of land in farms. This acreage was distributed among 277 farms, an average of 63.7 acres per farm. The total farm population was 1,259 in 1928. This represents a density of 45.7 persons per square mile for the farm population of the eight school districts.

The farm-business and family-living summaries contained in this bulletin are based on records of 203 farms, of which 83 were in the south area and 120 were in the north area. Farm-business records were obtained from 212 farms and family-living records from 227 farms. The farm-business and family-living records were for identical farms in 205 cases.

Schedules covering the physical characteristics of fields, together with a record of costs incurred and yields obtained in the production of crops over a 3-year period, were obtained from 52 farms, of which 22 were in the south area and 30 were in the north area. The same schedule provided data on the utilization and costs of pastures. Farm-business and family-living data were obtained for 51 of these farms. Data relating to the resources and utilization of farm wood lots were obtained from 49 farms, of which 31 were in the south area and 18 in the north area. The crop and wood-lot schedules were for identical farms in 35 cases.

For farms for which no farm-business record was available supplementary data were obtained to show the major uses of the land in 1927 and the occupancy of the farm for the preceding 10 years.

DESCRIPTION OF LAUREL COUNTY

GENERAL CHARACTERISTICS

Laurel County belongs to the double tier of counties comprising the western border of the Kentucky mountains. The counties of this western group, about 18 in number, have been characterized, in general, as the "ridge top" settlements in contrast to the "creek bottom"[10] settlements typical of the counties further east (*3, p. 14*).

The ridge-top settlements comprise about one-third of the area of the Kentucky Mountains. The economic and social aspects of land utilization in Laurel County are generally significant for, and broadly applicable to, the western third of the Kentucky Mountain region.

The present study proceeded on the assumption, therefore, that a detailed study of the economic and social aspects of land utilization in typical areas in Laurel County would yield results significant not only for the areas studied, but also for Laurel County and other counties in the Kentucky Mountains where conditions are similar, particularly the counties of the western group belonging to the ridge-top settlements.

The surface of the London quadrangle,[11] within which most of Laurel County lies, is about 1,200 feet above sea level. Knobs such

[10] A study in Knott County, Ky., which is in the creek-bottom settlements, was made by the Kentucky Experiment Station in cooperation with the United States Department of Agriculture in the summer of 1930.

[11] A special feature of the area included in the London quadrangle is that "the upper plain and the steep escarpment are lacking." This feature is due to the fact that at this point "the hardest rocks do not reach outward to the margin of the field" (*2*).

as Frazier Knob, Laurel Hill, and Raccoon Mountain (fig. 2), east of London, rise 300 feet or more above the general level. These are regarded as vestiges of the original plateau, the soft surface rock of which was removed, leaving the present structural plain formed by a hard cap of conglomerate into which the streams have cut to form the present rugged topography (*2*).

CLIMATE AND RAINFALL (15)[1]

Precipitation in eastern Kentucky is obtained chiefly from the storms which move northeastward from the western Gulf region. Records of monthly and annual mean precipitation at London, in Laurel County, and at four other stations in counties close to Laurel—Burnside and Eubank, Pulaski County; Manchester, Clay County; and Williamsburg, Whitley County—are available. These records show that the amount and distribution of precipitation are well suited to the growing of crops.

Mean annual temperatures at Eubank and at Williamsburg are 55.1° and 57.5° F., respectively. The warmest weather occurs in July and the coldest in February. The mean maximum temperature in July is 86.7° at Eubank and 88.5° at Williamsburg. The mean minimum temperatures at the same stations for February are 24° and 27°, respectively. The climate is mild and pleasant, although days of relatively extreme heat or cold occur. Frost data for Eubank and Williamsburg indicate a growing season of 177 and 189 days, respectively.

SOILS

The soils of Laurel County are chiefly residual, alluvial deposits being confined to narrow strips along the larger streams. These soils have been formed by the disintegration of the sedimentary rock. The residual soils of the county vary with the rock strata from which the various soil types were developed. Although no soil survey has been made in Laurel County, soil characteristics can be inferred, in general, from the nature of the rock strata. (Pl. 1.)

The rock formations of the portion of Laurel County shown in the London quadrangle belong principally to the Pennsylvanian series laid down in the Carboniferous period. Most of the area in the vicinity of London has soils derived from the Breathitt formation. Southeast of London the Corbin conglomerate at the top of the Lee formation appears, although the Breathitt formation predominates here also. Since the relation of these types to land utilization is hereafter considered, a brief description of each type is essential.

The Breathitt formation is composed of sandy shale and coarse ferruginous sandstone. The topography is characteristically hilly, with gentle slopes and rounded summits. On the shale outcrop the soil is fair, but soils derived from the sandstone are poor (*2*).

The Corbin conglomerate lentil is a cap of conglomerate and of coarse pink sandstone overlying the Lee formation. Clifflike topography and light, sandy soils are characteristic of the Corbin formation. An important phase of the DeKalb fine sandy loam is derived from the pink sandstone of the Corbin conglomerate. The DeKalb fine sandy loam is deficient in organic matter and is poorly adapted to agricultural uses. It is usually found on the knobs and ridges (*1*).

The Lee formation is composed of "sandy shale and sandstone with a few seams of coal" (*2*). Ridges and gently rolling uplands are characteristic of the topography. The soil survey of Rockcastle County, which adjoins Laurel County (*1*), found soils of the DeKalb series derived from the Lee formation. According to this survey, the sandstone and fine sandy shale of the Lee formation give rise to the DeKalb fine sandy loam, which is characteristically gray, but sometimes yellowish brown in color. Small sandstone pebbles and sandy shale are mixed with the soil and scattered over the surface.

Along the slopes where the sandstone of the Lee formation has been removed, this formation produces the DeKalb shale loam. This soil type is extensively developed in Rockcastle County, and extensive areas of the Lee formation, from which the type is derived, are shown on the London quadrangle in the northern and western parts of Laurel County. (Pl. 1.) But the Lee formation is exposed only to a limited extent in the vicinity of London. In the north area, farms lying along the Raccoon and the Little Raccoon Creeks include soils derived from the Lee formation, and on these farms it is probable that the DeKalb shale loam predominates. The rolling-to-rough topography is a limiting factor in the use of the land for the growing of cultivated crops, although the soil is fairly productive.

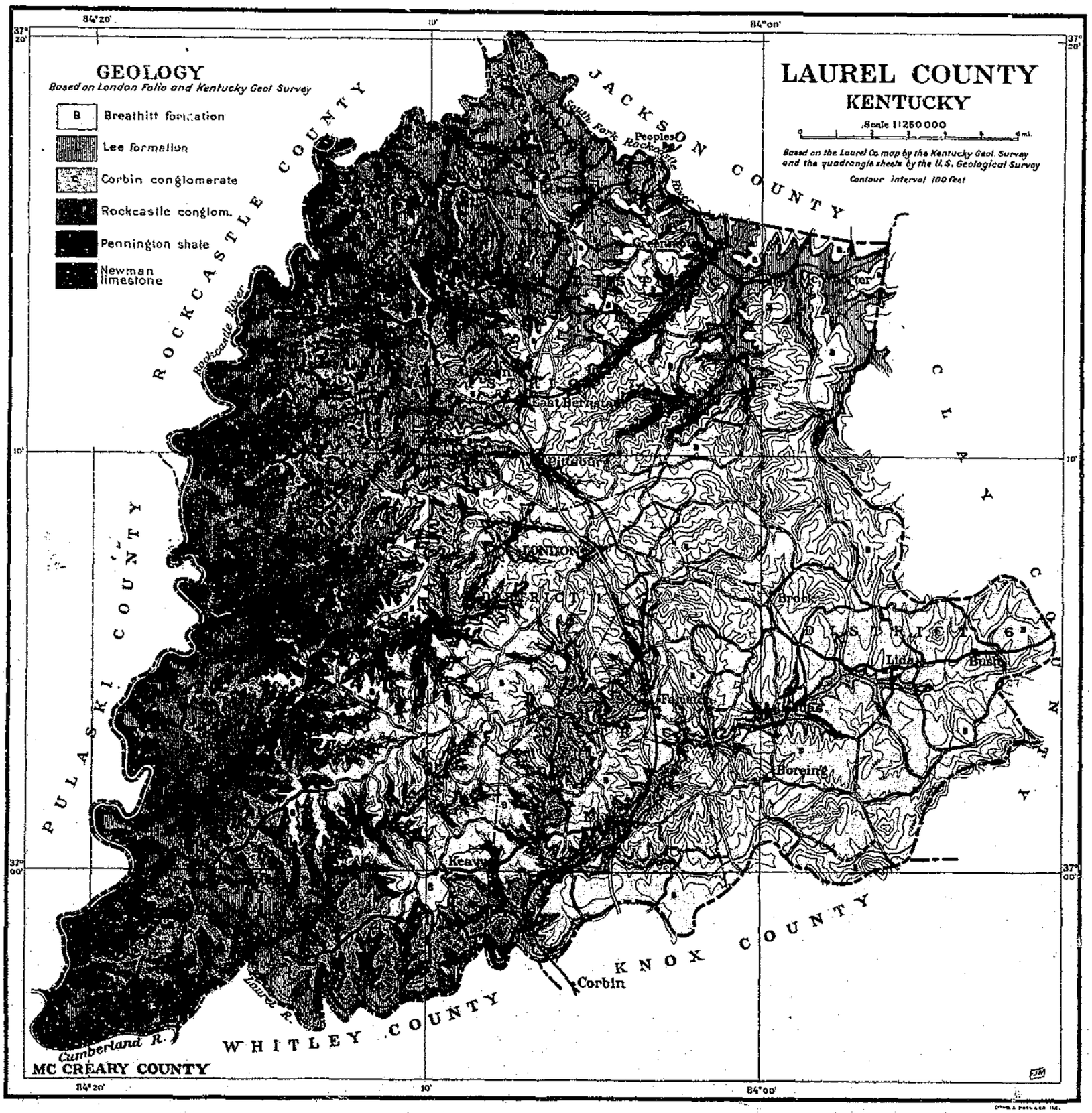
The DeKalb shale loam consists of a silt loam about 10 to 12 inches deep, underlain by compact, silty clay loam, grading into silty clay. In color the soil is usually light brown, ranging from a yellow to a brown. Erosion has progressed further on the yellow soils. Sand is sometimes present, and shale and sandstone particles in the soil and on the surface are common. The soil is derived from the weathering of the shales of the Lee formation.

The DeKalb sand and the DeKalb silt loam are typically ridge-top soils derived from the sandstones and shales of the Lee formation. The former type is loamy, forming a loose and incoherent soil which is low in organic matter and retains water poorly. The DeKalb silt loam is gray to light brown in color. Its organic content is higher that that of the lighter, sandy soils, but the soil is not so favorably regarded as the shale loam lying on the slopes. In the Rockcastle County survey only a limited area of these soils was found.

In the eastern portion of Laurel County the Breathitt formation, lying on top of the Corbin conglomerate, or on top of the Lee formation, is chiefly exposed. (Pl. 1.) In the western portion extensive areas of the conglomerate cap overlying the Lee formation have been exposed, and over a large part of this section the erosional process has gone further, removing the conglomerate cap from most of the area and leaving the Lee formation exposed. Along the Rockcastle River and at scattered points yet deeper Carboniferous strata have been uncovered in channels cut by the streams.

DRAINAGE

The Rockcastle and Laurel Rivers, tributaries of the Cumberland, drain the northern and southern portions, respectively, of Laurel County. The valley of the Rockcastle is narrow and bordered by precipitous sandstone or conglomerate cliffs. Except in its upper reaches, the Laurel, like the Rockcastle River, has cut through the conglomerate, forming steep walls from 100 to 400 feet high (*2*).



THE GEOLOGIC AND TOPOGRAPHIC CHARACTERISTICS OF LAUREL COUNTY, KY., HAVE AN IMPORTANT BEARING ON LAND UTILIZATION

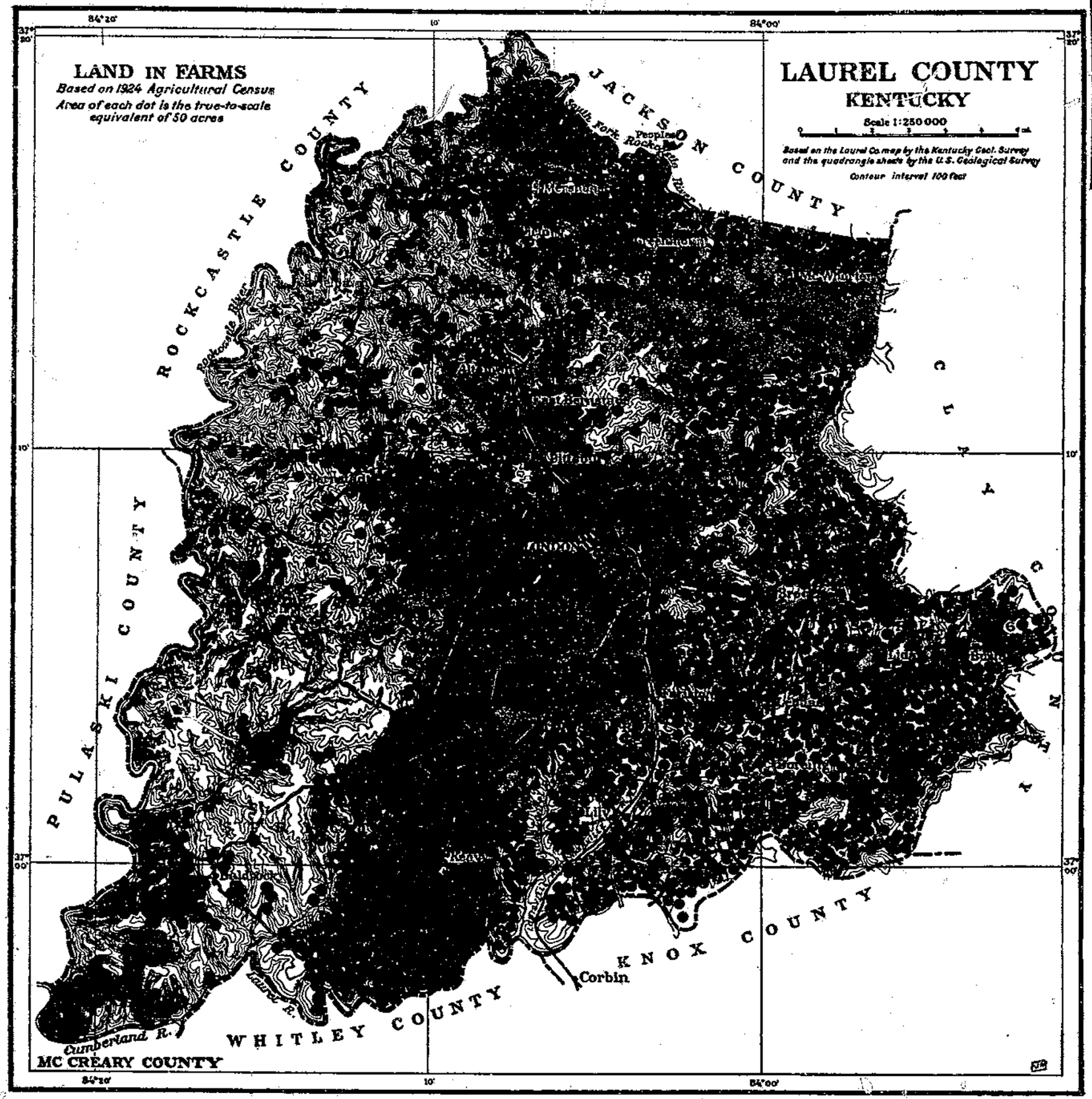


FIGURE 3.—The distribution of land in farms is closely related to the topographic and geologic features of Laurel County shown in Plate I

MAJOR USES OF THE LAND

The foregoing description indicates that the physical characteristics of the land have had a predominating influence on the economic and social history of the Kentucky Mountain region.

Data of the census on the utilization of land in Laurel County in 1924 are shown by districts in Table 1. Figure 3, based on Table 1, shows the distribution of land in farms. The topographic and geologic features of Laurel County shown in Plate 1, and the associated factors discussed in the text, are closely related to the distribution of land in farms shown in Figure 3 and suggest a preliminary basis for dividing the county into four main sections, each characterized by essentially different conditions affecting the use of the land. The marked contrast in the development of the rock strata of western and eastern Laurel County is shown by Plate 1. To a lesser degree there is also a contrast in topography between the two portions, the western part of the county being the more highly dissected and rugged.

TABLE 1.—*Farms and farm acreage, by districts, Laurel County, Ky., 1925*

Item	District 1	District 2	District 3	District 4	District 5	District 6	District 7	Total
Number of farms	290	482	484	299	304	506	294	2,809
	Acres	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*
Approximate land area	16,783	35,728	37,638	66,008	55,989	52,126	18,088	[1] 282,360
All land in farms	15,822	23,275	31,656	21,415	28,036	30,359	10,612	107,175
Average per farm	54.6	48.3	65.4	71.6	71.2	64.2	36.1	50.5
Crop land:								
Harvested in 1924	4,707	7,502	12,683	4,102	6,005	10,736	3,567	49,452
Crop failure	74	10	0	25	95	37	14	255
Idle or fallow	1,510	1,731	440	1,339	2,471	1,857	629	9,977
Total	6,291	9,333	13,123	5,526	8,571	12,630	4,210	59,684
Pasture land:								
Plowable pasture	3,102	5,621	7,813	2,275	2,003	1,803	785	23,402
Woodland pasture	659	129	490	1,450	529	890	837	4,984
Other pasture	1,427	523	511	306	671	5,846	405	9,689
Total	5,188	6,273	8,814	4,031	3,203	8,539	2,027	38,165
Woodland not used for pasture	2,430	6,249	3,948	10,673	12,061	6,185	3,054	44,609
All other land in farms [2]	1,904	1,420	5,771	1,185	4,111	9,005	1,321	24,717

Compiled from the Census of Agriculture, 1925 (*16*).

[1] The area of Laurel County shown is the sum of the areas of the several districts. These areas were computed by the use of a planimeter. The U. S. Census of Agriculture, 1925, and the Kentucky Geological Survey report, respectively, 286,080 acres and 282,982 acres as the area of Laurel County.

[2] According to the definition of the census, this includes "all rough, swampy, or waste land neither in forest, pasture, or crops, and also the land occupied by buildings, barnyards, feed-lots, roads, etc."

THE WESTERN SECTION

The rough topography characteristic of the western section (districts 4 and 5) is distinctly unadapted to agriculture and, in addition, the light, sandy soils derived from the conglomerate sandstone, which is extensively developed in this section, are deficient in organic matter and are unproductive. This section embraces 43.2 per cent of the area of the county, of which district 4 includes 23.4 per cent and district 5, 19.8 per cent. In the northern part of this section (district 4) only one-third (32.4 per cent) of the land area was in farms in 1925. (Table 2 and Fig. 3.) Of the land in farms, 56.6 per cent was woodland. Woodland in farms comprised, therefore, approximately 18.3 per cent of the total land area of the district. The area not in farms

is principally forest and woodland, and these classes of land comprised, therefore, approximately 85.9 per cent of the total area of district 4, of which 18.3 per cent was in farms and 67.6 per cent was not in farms. (Fig. 4.)

TABLE 2.—*Percentage distribution of farms and acreage, by districts, 1925*

Item	District 1	District 2	District 3	District 4	District 5	District 6	District 7	Total
DISTRIBUTION WITHIN THE COUNTY								
	Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
Number of farms	10.3	17.2	17.2	10.6	14.0	20.2	10.5	100.0
Approximate land area	5.9	12.7	18.3	23.4	19.8	18.5	6.4	100.0
DISTRIBUTION WITHIN THE DISTRICT								
Percentage of total land area in farms	94.3	65.1	84.1	32.4	50.1	69.8	58.7	[1] 60.2
All land in farms:								
Crop land	30.8	40.1	41.5	25.8	30.6	34.7	39.7	35.7
Pasture land [2]	28.6	26.4	26.3	12.1	9.8	21.0	11.2	19.8
Woodland [2]	19.6	27.4	14.0	56.6	44.9	19.5	36.7	29.7
All other	12.0	6.1	18.2	5.5	14.7	24.8	12.4	14.8
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Crop land:								
Harvested in 1924	74.8	81.3	96.6	75.3	70.1	85.0	84.7	82.9
Crop failure	1.2	.1	0	.5	1.1	.3	.3	.4
Idle or fallow	24.0	18.6	3.4	24.2	28.8	14.7	15.0	16.7
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Pasture land:								
Plowable pasture	59.8	89.6	88.6	56.4	63.5	21.1	38.7	61.5
Woodland pasture	12.7	2.1	5.6	36.0	16.1	10.4	41.3	13.1
Other pasture	27.5	8.3	5.8	7.6	20.4	68.5	20.0	25.4
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Crop land harvested, 1924:								
Corn	43.2	39.3	36.3	40.2	51.7	48.2	40.1	43.2
Small grains	14.2	11.6	17.9	12.8	12.2	9.2	15.2	13.4
Hay [3]	37.7	30.4	38.0	24.3	28.8	33.1	28.8	32.8
Tobacco	.4	.5	2.5	.5	.5	.5	1.2	1.1
Sorghum	.5	6.4	.1	3.7	1.2	1.1	1.4	1.8
Potatoes	1.1	2.1	.9	1.7	2.0	2.2	2.9	1.7
Sweetpotatoes	.7	.8	.6	.4	.5	.6	1.1	.7
All other [4]	2.1	8.9	3.7	7.4	3.1	5.1	9.3	5.3
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Compiled from the Census of Agriculture, 1925 (*16*).

[1] The census shows that land in farms in 1925 amounted to 58.4 per cent of the total area, instead of 60.2 per cent. For an explanation of this difference see footnote 1, Table 1.

[2] Woodland pasture, unless otherwise noted, will always be included in woodland, not in pasture land.

[3] The census shows a total of 18,774 acres in hay. This total includes 557 acres of annual legumes cut for hay for which figures by districts were not obtained. In computing the percentage distribution of the crop acreage, these 557 acres were included in the acreage of all other crops, not in the acreage of hay.

In district 4 crop land represents only 25.8 per cent of the land in farms, the lowest proportion represented by crop land among the districts in the county. Although the average acreage per farm (71.6 acres) is the largest among the districts, the average amount of crop land per farm (18.5 acres) is smaller than in any other district, except one. Farmers in district 4, although having more land per farm than in other districts, have less land that is worth having from an agricultural standpoint. Moreover, one-fourth of the crop land in this district was idle or fallow in 1924. A brief account has been given (p. 3) of the effort to establish a colony on the conglomerate and sandstone ridges around Bernstadt and of the emigration of most of

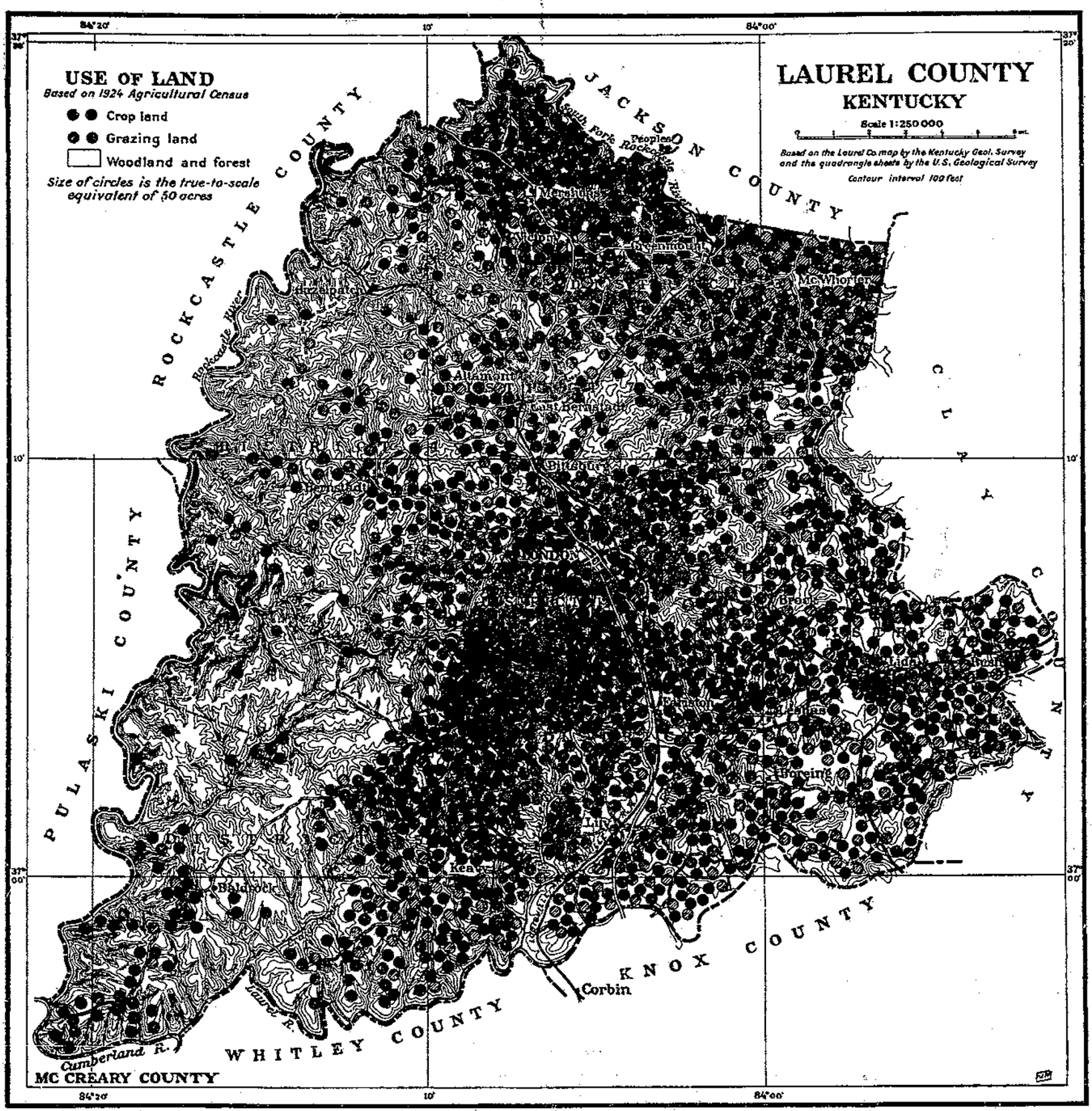


FIGURE 4.—Uses of land are influenced chiefly by differences in topography, but other significant factors include variations in soils, in highway and railway facilities, and in the availability of employment off the farm

the settlers and the rapid disintegration of the colony. Apparently, the ridges are too narrow, the soils too poor, and the slopes too steep to permit generally successful farming, particularly since the country is isolated by lack of roads.

The physical features of district 5 are also unfavorable to farming. Compared with district 4, however, the ridges in district 5 are broader and more extensive, the slopes, in general, are less precipitous, and the Breathitt formation, which affords a better soil foundation than the Corbin conglomerate, occupies a greater proportion of the area. As might be expected, therefore, a larger proportion (50.1 per cent) of the land area of district 5 than of district 4 was in farms in 1925. The acreage per farm (71.2 acres) averaged about the same as in district 4, but crop land averaged 21.8 acres per farm, which compared favorably, in amount at any rate, with the other districts of the county. But the fact that 28.8 per cent of the crop land in this district was idle or fallow in 1924 suggests that much of the land was of poor quality. Forest and woodland in farms comprised 22.5 per cent, and land not in farms (principally forest and woodland) 49.9 per cent of the land area of this district.

THE NORTHERN SECTION

The boundaries of district 3 roughly delimit the northern section. Geologically, it is differentiated by the fact that over a large part of the area the rock strata of the Breathitt formation have been removed, permitting extensive development of the Lee formation. This development in the northern section, unlike the situation in the western section, is not associated with exposures of the Corbin conglomerate, which is a hard conglomerate cap overlying the Lee. The fact has a twofold importance. In the first place, the relatively uniform exposure of the Lee formation produces broad ridges, moderate slopes, and gently rolling uplands, interspersed with stretches of bottom land along the creeks, which are better adapted to farming than are the relatively steep slopes and more rugged topography of the western section. (Pl. 1.) In the second place, from the rock strata of the Lee formation is developed the DeKalb shale loam, which is distinctly superior to the light, sandy soils characteristic of the Corbin conglomerate.

Of the total area of the district, land other than forest or woodland (principally crop and grazing land) comprised 72.3 per cent, woodland in farms 11.8 per cent, and land not in farms (principally forest and woodland) 15.9 per cent.

Land in farms comprised 84.1 per cent of the area of the northern section (district 3) in 1925, although much of the topography is rough. Farms averaged 65.4 acres per farm, but the amount (27.1 acres) of crop land per farm averaged higher than in any other district. Only 14 per cent of the area of land in farms was woodland. The spur-line railroad extending from East Bernstadt to the Jackson County line, along the valley of Little Raccoon Creek, relieves to some degree the isolation of adjacent farmers. Roads in the neighborhood are unimproved and often impassable. Further west, a north-south section of the Dixie Highway, passing through Victory and Mershons, supplements the transport assets of the district.

THE CENTRAL SECTION

Districts 1, 2, 6, and 7 offer little contrast in the character of the rock strata exposed. The Breathitt formation predominates, with considerable areas of the Corbin conglomerate exposed in each district, especially in district 2. Nevertheless, districts 1, 2, and 7, which are here designated as the central section, have certain features in common that differentiate them from district 6. Specifically, they are traversed by the only main-line railroad and the only through highway in the county. Consequently, the most populous towns in the county, including the county seat, are found within their borders. Coal-mining development in Laurel County, also, has been confined to these districts. A number of mines are located in district 7 along the Rockcastle River Railway, in the vicinity of East Bernstadt. These facts are enumerated because of their bearing on special features characterizing the use of land in these districts.

Farms are smaller than in other districts (Table 1), averaging 54.6 acres, 48.3 acres, and 36.1 acres in districts 1, 2, and 7, respectively. More farms in districts 1 and 7 are located on improved roads. District 2 is worse off in this respect than district 5, although nearness to railroad station and paved highway affords to the former district transport facilities superior to those of the latter. Farm real estate values in districts 1, 2, and 7 also average higher than in other districts. (Table 3.) The value per acre of land and buildings in district 7 is nearly four times as great as that in district 4. In district 2 the value per acre of land and buildings is twice, and in district 1 three times, as great as the value in district 6. Values in district 3, however, are equal to those in district 2. In districts 1 and 7, adjacent to East Bernstadt and London, respectively, the average investment per farm in implements and machinery is relatively high, compared with other districts. The same statement applies to the average mortgage debt per acre. Table 3 shows, however, that as a farming area district 3 compares favorably with the districts in the central section.

In average crop values per acre, farm population per square mile, farms reporting expenditures for feed, and value of dairy products per farm, district 3 ranks well to the front or leads the other districts. Attention has already been called to the superior quality of the soil associated with the Lee formation, which is extensively developed in district 3. Another factor in the relative prominence of district 3 as a farming area is indicated by data obtained in the study. Farms of the south area were located in districts 1 and 2 and farms of the north area were located in districts 3 and 6. It is interesting to find that of the 203 farms included in the farm business summary only 33.7 per cent of the operators in the south area depended mainly on farming for a livelihood, in contrast to 51.7 per cent of the operators in the north area. Apparently, because of better roads, nearness to town, and similar factors, there is a greater tendency in the south area to utilize farms primarily as residence sites, and to rely to a greater extent on outside employment as a principal source of income.

TABLE 3.—*Agricultural importance of the several districts as indicated by specified items, 1925*

Item	District 1	District 2	District 3	District 4	District 5	District 6	District 7	All districts
Value of harvested crops per acre of crop land, 1924.....dollars..	10	23	28	15	16	21	26	22
Value of land and buildings, per acre .....dollars..	36	24	24	10	14	12	39	20
Value of land excluding buildings, per acre.....dollars..	22	16	17	7	10	10	22	14
Value of implements and machinery, per farm.....dollars..	128	67	87	51	56	47	119	75
Farms reporting mortgage debt:								
Mortgage debt, per acre..dollars..	14	7	7	5	4	6	9	8
Ratio of debt to value..per cent..	26.2	20.6	27.0	46.5	19.8	41.2	29.0	27.8
White farm population, per square mile.....number..	59	42	45	15	21	36	40	32
Farms located on unimproved dirt roads.....per cent..	23.3	64.7	90.9	93.3	56.9	98.2	48.6	73.1
Farms reporting expenditures, 1924, for—								
Feed.....per cent..	61.0	72.0	70.0	51.8	38.3	46.5	69.7	58.4
Fertilizer.....do....	63.4	48.3	57.2	47.5	46.5	51.2	33.3	50.4
Labor.....do....	14.8	37.8	12.6	13.7	9.1	6.4	9.2	15.2
Cows milked, per farm, 1924 .....number..	1.97	1.74	2.26	1.79	1.34	1.74	1.36	1.76
Milk produced, per cow, 1924 .....gallons..	329	472	332	303	346	201	304	326
Value of dairy products, 1924:								
Butter made on farms...dollars..	14,491	29,604	15,984	11,037	12,488	15,595	8,494	107,693
Butterfat sold.....do....	1,488	209	2,098	2,375	487	202	35	6,982
Cream sold.....do....	1,326	7,212	17,066	129	1,872	60	2,044	29,709
Whole milk sold.....do....	1,487	7,203	791	0	8	390	1,235	11,114
Total.....do....	18,792	44,228	35,937	13,532	14,861	16,337	11,808	155,495
Per farm.....do....	65	92	74	45	38	29	40	55
Eggs produced, per farm.....dozen..	90	87	130	76	87	88	70	92

Compiled from the Census of Agriculture, 1925 (*16*).

In district 1 a very high proportion of the land is in farms (94.3 per cent), principally because of fairly even topography, relatively good roads, and nearness to London. Districts 2 and 7 include considerable rough land which tends to reduce the ratio of land in farms to all land in these districts, and to increase the ratio of woodland to all land in farms, in comparison with district 1. Forest or woodland comprises 24.2 per cent of the area of district 1, 52.7 per cent of district 2, and 62.8 per cent of district 7.

THE EASTERN SECTION

The eastern section (district 6) presents a rough topography, marked by such prominences as Raccoon Mountain and Laurel Hill in the northern portion, and by broad ridges and less precipitous slopes in the southern part. No railroad traverses the section. In the northern part there is no road worthy of the name, and in the southern part the main road passing through Lida and Bush and connecting London and Manchester, the county seats of Laurel and Clay Counties, respectively, was in very poor condition in 1928. To some extent, as previously noted, the rough topography characteristic of the northern part of the eastern section differentiates it from the central section (districts 1, 2, and 7), but a more significant difference between the eastern and the central sections is the relatively greater degree of isolation of the former, because of lack of roads. To reach

the railroad station at London from points along Slate Lick and Raccoon Creeks, with a team hauling a light load, is an arduous undertaking. The census shows that 98.2 per cent of the farms in this district in 1925 were located on unimproved dirt roads. (Table 3.)

District 6 and parts of district 3 are preeminently the areas where cropping of the slopes has left a waste of wornout, heavily eroded fields. There is less waste land in district 3, because of the relatively large amount of bottom land in that district. But the "all other land" classification of the census includes 18.2 per cent of the land in farms in district 3, which is higher than the figure for any other district except district 6. In district 6 nearly one-fourth of the land in farms is classed as "all other land," representing principally eroded, barren, or "filth"-covered [12] hillsides. (Table 2.)

Average farm values of land and buildings, implements and machinery, and dairy products are lower than in any other district, except districts 4 and 5. Average crop values per acre are also comparatively low in district 6, although district 1, in addition to districts 4 and 5, makes a poorer showing in this respect than does district 6.

In district 6 woodland in farms comprises 13.6 per cent and land not in farms, which is principally forest and woodland, 30.2 per cent of the area of the district.

Data on the major uses of the land obtained in the study cover five school districts [13] representing the north area and three school districts [14] representing the south area. In these school districts the use of all land in farms in 1927 was ascertained regardless of whether the farms were operated in that year. Detailed data on land use and land characteristics were also obtained from 52 farms, 30 of which were located in the north area and 22 in the south area.

To facilitate comparison, the percentage of farm land in each major use in Laurel County and in certain districts, as shown by the 1925 Census of Agriculture (*16*), is presented in Table 4, together with figures for identical items based on the data of the survey. The data of the census relate, of course, to the year 1924, whereas those of the survey relate to the year 1927. This may account, in part, for differences in the proportion of land in different uses shown by figures from the two sources. The census data also cover a larger area than the data of the survey. But these circumstances do not account for certain discrepancies which, obviously, are due to other causes. For example, the proportion of "other land" shown by the census for districts 3 and 6 is much larger than the corresponding figures of the survey for the north area, which is included in these districts. Most of the rugged land of the north area which was placed under the "other land" classification of the census, was, in the survey, classed as pasture or woodland. The large proportion of crop land shown by the data for 52 farms is probably due principally to two facts. These records covered the years 1926, 1927, and 1928, and any field cropped in that period was counted as crop land, although it may have been pastured in 1924 or in 1927. The amount of crop land in partly abandoned farms, which were not included in the 52 farms studied, would also tend to be small and thus tend to raise the proportion of crop land for the 52 farms compared with all farms.

[12] The term "filth" is used locally to refer to sprouts, briers, and weeds which infest the fields.
[13] Long Branch, Old Salem, Pleasant View, Taylor, and Twin Branch.
[14] McGill, Old Union, and Wyan.

TABLE 4.—*Use of land in farms in Laurel County, Ky., and in specified subdivisions, 1924 and 1927*

Use	North area, 1927		Districts 3 and 6, 1924 [3] (census)	South area, 1927		Districts 1 and 2, 1924 [3] (census)	52 farms [1]	8 school districts [2]	Districts 1, 2, 3, and 6 [3] (census)	Laurel County
	30 farms [1]	5 school districts [2]		22 farms [1]	3 school districts [2]					
	Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
Crop land	[4] 47.0	41.2	37.9	[4] 46.5	45.7	40.0	[4] 46.8	43.0	38.6	35.7
Pasture land	26.7	34.6	23.5	13.2	24.9	27.3	21.1	30.7	24.9	19.8
Woodland	19.6	20.4	16.9	32.8	25.6	24.2	25.1	22.5	19.6	29.7
All other [5]	[6] 6.7	3.8	21.7	[6] 7.5	3.8	8.5	[6] 7.0	3.8	16.9	14.8
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

[1] Physical description of crop and pasture fields and detailed data relating to the utilization of crop and pasture lands were obtained from these farms.
[2] Includes all land in farms, whether or not the farms were operated in 1927.
[3] Farms in the north area were located in districts 3 and 6 and farms in the south area in districts 1 and 2.
[4] Orchards and gardens are included under "all other."
[5] Includes farmstead, roads, and miscellaneous waste land. See also footnote 4.
[6] Waste land represents approximately 4.5 per cent of the total for the 30 farms, 4.2 per cent for the 22 farms, and 4.4 per cent for the combined 52 farms. (Table 7.)

On the basis of the general features of the geology and topography of the county and statistics of land use it has been possible to divide the county into four main sectons, the boundaries of which correspond roughly to boundaries of the enumeration districts of the census. This preliminary division of the territory makes possible a more precise definition of the problem. The agricultural potentialities of the western section (districts 4 and 5) are defined practically by what can be accomplished, agriculturally, under conditions prevailing in Laurel County on lands of broken topography, steep slopes, and light soils. The section is agriculturally undeveloped, roads are poor, and the population is sparse compared with other sections of the county. What do the data of the study suggest with regard to the agricultural possibilities of lands of this type?

The northern section presents a somewhat different question. Although a considerable portion of this section (district 3) is rugged, there are extensive areas having the soils and the topographic characteristics associated with the Lee formation. The section is handicapped by lack of roads and yet there is a farm population of 45 persons per square mile. For the northern section the specific questions are: What type of land is best adapted to agriculture? What mistakes, if any, are apparent in the use of this land? What crops and farming practices are best adapted to successful farming on the better lands? What adjustments in the use of land appear desirable?

With regard to the eastern section (district 6), the problems in the use of the land are essentially similar to those of the more rugged parts of the northern section (district 3). Specifically, the problem is to determine the extent to which bottom land and land of fairly moderate slope are essential to successful farming in the section. Corollary to this, is the question as to the amount of land in the section having the essential characteristics.

The central section (districts 1, 2, and 7) presents the anomaly of a large proportion of land in farms and a relatively small amount of farming. A large proportion of the income of farm families in this section is derived from employment off the farm. Is employment

off the farm greater in this section than in others because the land affords a poorer basis for farming, because opportunities for other employment are greater, or do both circumstances combine to furnish the explanation? If because of poor opportunities for farming families in this section must depend on outside employment to obtain an adequate living, what is the outlook for such employment?

In order to obtain from the data of the study at least a tentative answer to these questions, it is necessary to examine the relation of specific land characteristics to the use of land for crops and pasture. This introduces a second step in the analysis.

PHYSICAL CHARACTERISTICS OF CROP AND PASTURE LAND

Detailed physical description of the crop and pasture land was obtained from 52 farms—22 farms in the south area and 30 farms in the north area. On the basis of these data the total area of crop land and pasture land in the 52 farms was classified according to the distinctive physical characteristics or conditions to which the parcel in question most closely conformed. The physical characteristics or conditions definitive of each class of land are shown in Table 5.

TABLE 5.—*Physical characteristics recognized in the classification of crop and pasture land*

Class of land	Slope	Surface	Drainage or erosion	Stones	Stumps
1	Less than 10 per cent.	Smooth to slightly rolling.	Well drained	Typically none [1]	Typically none.
2	do	Smooth to rolling.	Typically sheet washing.[2]	Moderate or none.	Do.[3]
3	do	do	Heavy erosion	Heavy surface shale.	Do.[4]
4	do	do	Fair to well drained.	Typically none	Stumpy or filthy.[5]
5	5 per cent or less.	Smooth	Poor [6]	do	Typically none.
6	Typically flat.	do	do.[7]	do	Do.
7	10 to 20 per cent.	Rolling to rough or hillside.	Heavy erosion	Numerous stones or heavy shale.	Often scattered stumps and filth.
8	20 per cent or more.	Rough or steep hillside.	Erosion typically slight.	Few or none	Typically none.[8]
9	do	Rolling to rough or steep hillside.	Heavy erosion	Typically shale or stones.	Scattered old stumps.[9]
10	do	do	Typically slight erosion.	Typically few or none.	Numerous sound stumps or filth.[10]
11				Rock outcrop; stony land.	

[1] May have light surface shale or few scattered stones.
[2] Occasional gullies; wet spots often at foot of slopes.
[3] May have 1 old, rotten stump per acre.
[4] Weeds and other filth often infest these fields.
[5] Often new clearing with sound stumps combined with old clearing with rotten stumps.
[6] Generally low, with crawfishy or swampy patches.
[7] Predominantly wet, crawfishy, or swampy land.
[8] May have old, rotten stumps; no filth; good stand of grass.
[9] Old clearing; sprouts and other filth not uncommon.
[10] Recent clearing.

The presentation of the physical and economic data relating to the 52 farms is not designed to provide statistical demonstration of the relationships suggested by a comparison of the averages. In many instances the smallness of the sample imparts a very high probable error to the average, but since these averages exhibit a logical and clearly defined pattern, consistent with the pattern suggested by collateral data, it is reasonable to assume that the averages provide

a basis for describing qualitative differences between classes of land, although their use as a basis for accurate quantitative description or comparison may not be justifiable. For example, the figures may convey with all necessary conclusiveness the fact that land in class 1 is economically superior to land in class 3 while leaving a wide margin of doubt that the averages provide an accurate measure of the degree of that superiority.

The 52 farms from which were obtained data descriptive of the physical characteristics of the land comprised 4,643 acres. The percentage of the total acreage falling in each land class is shown in Table 6. Approximately 58 per cent of the farms and of the farm acreage of the 52 farms visited were in the north area. The crop and pasture land is comprised in classes 1 to 11, inclusive. The relatively rugged character of the farms in the north area is shown at once by noting that the crop and pasture acreage comprised in classes 8 to 11, which have slopes of 20 per cent and over, amounts to 46.7 per cent of the total acreage of the 30 farms, whereas the corresponding figure for the south area is 4.8 per cent. (Table 7.) Crop and pasture land in the north area having a slope of 10 per cent and over amounts to more than 50 per cent of the total farm acreage. (Classes 7 to 11.) In the north area, 63.3 per cent of the acreage of crop and pasture land has a slope of 20 per cent or more and 70.4 per cent has a slope of 10 per cent or more. Corresponding figures for the south area are 8 per cent and 29.6 per cent. The 52 farms contained 3,151 acres of crop and pasture land, of which 1,984 acres were in the north area and 1,167 acres were in the south area.

TABLE 6.—*Distribution of crop and pasture land, by classes of land, 52 farms, 1928*

Description	Designated class	Acreage in class	Percentage of total acreage
		Acres	*Per cent*
Smooth to rolling land (slope under 10 per cent):			
In good physical condition	1	364	1.6
In fair physical condition	2	367	11.6
Badly eroded on slopes	3	143	4.5
Stumpy or filthy	4	62	2.0
Total		936	29.7
Land needing drainage (slope 5 per cent or less):			
Generally low with wet spots	5	308	9.8
Predominantly wet or swampy	6	165	5.2
Total		473	15.0
Rolling to rough or hillside (slope 10 to 20 per cent):			
Overcropped and eroded	7	393	12.5
Rolling to rough or steep hillside (slope 20 per cent or more):			
Mostly too rough or steep for plowing	8	357	11.3
Overcropped and heavily eroded	9	875	27.8
Sprout land or new clearing	10	77	2.4
Total		1,309	41.5
Rock outcrop; stony land	11	40	1.3
All classes: total		3,151	100.0

TABLE 7.—*Distribution of all land in farms, by use, and of crop and pasture land, by classes of land, 52 farms, 1928*

Use and class of land	30 farms, north area			22 farms, south area			52 farms, both areas		
	Acreage	Percentage of all land in farms	Percentage of all crop and pasture land	Acreage	Percentage of all land in farms	Percentage of all crop and pasture land	Acreage	Percentage of all land in farms	Percentage of all crop and pasture land
Crop and pasture land in class—	*Acres*	*Per cent*	*Per cent*	*Acres*	*Per cent*	*Per cent*	*Acres*	*Per cent*	*Per cent*
1	136	5.0	6.9	228	11.7	19.5	364	7.8	11.0
2	126	4.7	6.4	241	12.4	20.6	367	7.9	11.6
3	35	1.3	1.8	108	5.5	9.3	143	3.1	4.5
4	37	1.4	1.9	25	1.3	2.1	62	1.3	2.0
5	151	5.6	7.6	157	8.0	13.5	308	6.6	9.8
6	102	3.8	5.1	63	3.2	5.4	165	3.6	5.2
7	141	5.2	7.1	252	12.9	21.6	393	8.5	12.5
8	330	12.3	16.6	27	1.4	2.3	357	7.7	11.3
9	818	30.4	41.2	57	2.9	4.9	875	18.8	27.8
10	70	2.6	3.5	7	.4	.6	77	1.7	2.4
11	38	1.4	1.9	2	.1	.2	40	.9	1.3
Total	1,984	73.7	100.0	1,167	59.8	100.0	3,151	67.9	100.0
Woodland	528	19.6	.....	638	32.7	.....	1,160	25.1	.....
Farmstead, orchard, and garden	59	2.2	.....	64	3.3	.....	123	2.6	.....
Roads and waste land	121	4.5	.....	82	4.2	.....	203	4.4	.....
Total	2,692	100.0	.....	1,951	100.0	.....	4,643	100.0	.....

UTILIZATION OF LAND FOR CROPS

Crop land comprises 69 per cent and pasture land 31 per cent of the crop and pasture land in the 52 farms. (Tables 8 and 9.) But the proportion used as crop land varies widely between classes, ranging from 12.5 per cent in class 9 to 98.6 per cent in class 1. On the other hand, 50.3 per cent of all the land in pasture is in a single class—class 9. (Table 9.) The physical characteristics of the land undoubtedly affect its use. Conversely, the use of the land for specific crops will certainly affect the physical conditions of the land.

TABLE 8.—*Distribution of crop land, by classes of land, 52 farms, 1928*

Class of land	30 farms, north area			22 farms, south area			52 farms, both areas		
	Acreage of crop land	Percentage of all land in class used as crop land	Percentage of all crop land	Acreage of crop land	Percentage of all land in class used as crop land	Percentage of all crop land	Acreage of crop land	Percentage of all land in class used as crop land	Percentage of all crop land
	Acres	*Per cent*	*Per cent*	*Acres*	*Per cent*	*Per cent*	*Acres*	*Per cent*	*Per cent*
1	136	100.0	10.7	223	97.8	24.5	359	98.6	16.5
2	126	100.0	10.0	235	97.5	25.9	361	98.4	16.6
3	29	82.9	2.3	85	78.7	9.4	114	79.7	5.3
4	15	40.5	1.2	21	84.0	2.3	36	58.1	1.7
5	128	84.8	10.1	84	53.5	9.2	212	68.8	9.8
6	78	76.5	6.2	26	41.3	2.9	104	63.0	4.8
7	107	75.9	8.5	183	72.6	20.1	290	73.8	13.3
8	231	70.0	18.3	12	44.4	1.3	243	68.1	11.2
9	352	43.0	27.8	31	54.4	3.4	383	43.8	17.6
10	59	84.3	4.7	7	100.0	.8	66	85.7	3.0
11	3	7.9	.2	2	100.0	.2	5	12.5	.2
Total	1,264	63.7	100.0	909	77.3	100.0	2,173	69.0	100.0

TABLE 9.—*Distribution of pasture land, by classes of land, 52 farms, 1928*

Class of land	30 farms, north area			22 farms, south area			52 farms, both areas		
	Acreage of pasture land	Percentage of all land in class used as pasture land	Percentage of all land in pasture	Acreage of pasture land	Percentage of all land in class used as pasture land	Percentage of all land in pasture	Acreage of pasture land	Percentage of all land in class used as pasture land	Percentage of all land in pasture
	Acres	*Per cent*	*Per cent*	*Acres*	*Per cent*	*Per cent*	*Acres*	*Per cent*	*Per cent*
1	0	0.0	0.0	5	2.2	1.9	5	1.4	0.5
2	0	0	0	6	2.5	2.3	6	1.6	.6
3	6	17.1	.8	23	21.3	8.9	29	20.3	3.0
4	22	59.5	3.1	4	16.0	1.6	26	41.9	2.7
5	23	15.2	3.2	73	46.5	28.3	96	31.2	9.8
6	24	23.5	3.3	37	58.7	14.3	61	37.0	6.2
7	34	24.1	4.7	69	27.4	26.8	103	26.2	10.5
8	99	30.6	13.8	15	55.6	5.8	114	31.0	11.7
9	409	57.0	64.7	26	45.6	10.1	492	56.2	50.3
10	11	15.7	1.5	.....	.....	.....	11	14.3	1.1
11	35	92.1	4.9	.....	.....	.....	35	87.5	3.6
Total	729	38.3	100.0	258	22.1	100.0	978	31.0	100.0

RELATIONSHIP OF LAND USE TO LAND CHARACTERISTICS

The limitations which physical characteristics place on the use of land for crops and, conversely, the effect of the use of the land or of the kind of crops grown on the physical conditions of the land operate both ways to limit the amount of crop land available. Why is more than 25 per cent of the total corn acreage of the 52 farms grown on the steep, hillside fields of class 9, and only half that proportion on the gently sloping fields of class 1? (Table 10.) Although the acreage of land in class 9 is more than two and one-third times the acreage in class 1, the amount of crop land in the two classes is nearly equal. (Table 8.) Hay has first choice of the class 1 land, as compared with corn. More than 55 per cent of the crop acreage of class 9 land is in corn, whereas over 60 per cent of the crop acreage of class 1 land is in hay. The growing of corn on the steep fields of class 9 is accompanied by rapid erosion and exhaustion of the soil. Hence, fields are rapidly abandoned for crops and become pasture. In the north area, 64.7 per cent of the pasture land is in class 9, and that class comprises 50.3 per cent of all pasture land in the 52 farms.

Thus the amount of crop land, limited in the first instance by physical characteristics, becomes further reduced by conditions arising from the practice of growing crops on land unsuited for that purpose. How is this loss replaced? Historically, it was simply a process of clearing new land. But practically all available land was soon cleared. The characteristic cycle of land use in the mountains then developed. The sequence runs: Clearing, cropping, pasturing, abandonment; reclearing, cropping, etc. To break this vicious circle is the crux of the land-utilization problem in the mountain region.

TABLE 10.—*Acreage in crops and percentage distribution of acreage in crops and of crop acreage, by classes of land, 52 farms, 3-year average, 1926–1928*

ACREAGE IN CROPS

Class of land	Corn	Hay [1]	Oats [2]	Soybeans	Wheat	Tobacco	Miscellaneous	Total
	Acres	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*
1	65	215	31	12	22	6	2	353
2	97	131	42	12	28	3	13	326
3	33	33	8	2	1	(3)	3	80
4	6	19	8	----	2	----	(3)	35
5	37	115	15	3	6	----	1	177
6	5	28	3	----	----	----	1	37
7	70	71	32	3	10	1	3	190
8	42	98	35	3	8	1	4	191
9	137	45	52	----	1	1	5	241
10	19	3	7	1	----	----	----	30
Total [4]	511	758	233	36	78	12	32	1,660

PERCENTAGE OF ACREAGE IN CROPS

	Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
1	12.7	28.4	13.3	33.4	28.2	50.0	6.3	21.3
2	19.0	17.3	18.0	33.3	35.9	25.0	40.6	19.6
3	6.5	4.3	3.4	5.6	1.3	(3)	9.4	4.8
4	1.2	2.5	3.4	----	2.6	----	(3)	2.1
5	7.2	15.2	6.5	8.3	7.7	----	3.1	10.7
6	1.0	3.7	1.3	----	----	----	3.1	2.2
7	13.7	9.4	13.8	8.3	12.8	8.3	9.4	11.5
8	8.2	12.9	15.0	8.3	10.2	8.3	12.5	11.5
9	26.8	5.9	22.3	----	1.3	8.4	15.6	14.5
10	3.7	.4	3.0	2.8	----	----	----	1.8
Total [4]	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

PERCENTAGE OF CROP ACREAGE

1	18.4	60.9	8.8	3.4	6.2	1.7	0.6	100
2	29.7	40.2	12.9	3.7	8.6	.9	4.0	100
3	41.2	41.2	10.0	2.5	1.3	(3)	3.8	100
4	17.1	54.3	22.9	----	5.7	----	(3)	100
5	20.9	65.0	8.5	1.7	3.4	----	.5	100
6	13.5	75.7	8.1	----	----	----	2.7	100
7	36.8	37.4	16.8	1.6	5.3	.5	1.6	100
8	22.0	51.3	18.3	1.6	4.2	.5	2.1	100
9	56.8	18.7	21.6	----	.4	.4	2.1	100
10	63.4	10.0	23.3	3.3	----	----	----	100
Total [4]	30.8	45.7	14.0	2.2	4.7	.7	1.9	100

[1] Includes millet.
[2] Includes oats for hay as well as for grain.
[3] Less than half an acre.
[4] Class 11 is omitted from this and subsequent tables relating to the utilization of crop land, because the small acreage of crop land in this class was made up of scattered plots on which crops were grown only occasionally and for which no satisfactory figures on production were obtained.

The detailed study of 52 farms in Laurel County furnishes a cross-section view of this cyclical process in the utilization of land. Of the crop and pasture land in the 52 farms, 29.7 per cent has a smooth to rolling surface and a slope under 10 per cent. Land of this description is embraced in classes 1 to 4. (Table 6.) The simplest procedure in exhibiting the relationship of land use to land characteristics on these farms is to discuss the land classes seriatim.

Land placed in class 1 includes 11.6 per cent of the total crop and pasture area. It exhibits physical features and conditions well adapted to the growing of crops. Nearly all (98.6 per cent) the land in this class is crop land. The crop acreage averages over 60 per cent in hay, corn ranking second with 18.4 per cent. Over a 3-year

period 28.4 per cent of the total hay acreage was grown on class 1 land, although land in this class comprises only 16.5 per cent of the crop land. Class 1 land marks the high point, both from the physical and economic standpoint, in the utilization of smooth to rolling land with slopes under 10 per cent.

Class 2 includes practically the same acreage as class 1. The characteristic difference between land in class 1 and that in class 2 is the greater degree of erosion or "sheet washing" and the presence of occasional gullies on class 2 land. In addition, wet spots are found at the foot of the slopes of class 2 land, and scattered stumps occur in the fields. Crop land comprises 98.4 per cent of the acreage in class 2. Hay still predominates in the crop acreage with 40.2 per cent, but the proportion of the crop acreage in corn has increased from 18.4 per cent on the class 1 land to 29.7 per cent on the class 2 land. Nearly 20 per cent of the total acreage of corn is on class 2 land, although this class comprises only 16.6 per cent of the total crop land. Corn tends to be grown on the slopes of class 2 land in part because of better drainage, wet spots often occurring at the foot of the slopes. (Table 5, footnote 2.)

Class 3 includes 4.5 per cent of the total area of crop and pasture land. Class 3 land, essentially like classes 1 and 2 in other respects, is heavily eroded, and the washing out of the soil particles has left a heavy surface coating of shale on the fields. In passing from class 2 to the heavily eroded land of class 3, the most significant fact to note is the increase in the proportion of pasture. Pasture amounts to 20.3 per cent of the acreage in class 3. This pasture use represents, for the most part, a phase of the process of field abandonment and reversion to woodland. Much of the soil is too badly eroded and depleted longer to produce crops. Many of the fields have become infested with weeds and sprouts. (Table 5, footnote 4.) Fields of this description become pasture, and the remaining fields continue to be used principally for the production of hay and corn until the process of deterioration is complete.

The remainder of the area of smooth to rolling land with slopes under 10 per cent is included in class 4. This class comprises only 2 per cent of the acreage of all crop and pasture land in the 52 farms and but 6.6 per cent of the land area in classes 1 to 4, inclusive. In part, this land is made up of old clearings which have been cropped and reverted to pasture without reaching the state of improvement represented by class 1 land. Old clearings often have been extended by the clearing of new land. After cropping to corn for two or three years the land is usually seeded to oats and grass. Hay is cut as long as a stand can be maintained. Stumps interfere with good tillage, and weeds and sprouts quickly recapture the land. The fact that these fields have been incompletely cleared and have been cropped for relatively short periods has checked the progress of erosion.

Land needing drainage comprises 15 per cent of the total area of crop and pasture land in the 52 farms. Land of this description, is embraced in classes 5 and 6. (Table 5.) Land in class 5 is generally low. "Crawfishy" or swampy patches, fit only for grass, restrict the use of the land for cultivated crops. Sixty-five per cent of the crop acreage is in hay. Corn can be grown on some fields at the risk of having part of the crop drowned out. Class 5 comprises 9.8 per cent of the crop and pasture land of the 52 farms. Over 30 per cent of the

land in this class is in pasture. Class 5 includes 15.2 per cent of the total hay acreage on less than 10 per cent of the total crop land. Class 6 includes 5.2 per cent of the crop and pasture land. Land in this class is predominantly wet, "crawfishy," or swampy. Very little of this land can be used for the growing of cultivated crops. Hay averaged 75.7 per cent of the crop acreage over a 3-year period.

Hillside and rolling to rough land with slopes ranging from 10 to 20 per cent (class 7) comprises 12.5 per cent of the crop and pasture area. Although of increasing steepness as compared with land in classes 1 to 6, class 7 land is utilized extensively for the growing of corn. Consequently, the land is heavily eroded and numerous stones and a heavy covering of shale are found in the fields. One-fourth of the land in this class is now used only for pasture of the poorest quality, the use of the field for that purpose merely representing a stage in the process of abandonment. Scattered stumps and filth-infested fields further indicate that the attempt to utilize land of this class chiefly for the production of cultivated crops is likely to prove a failure.

Hillside and rolling to rough land with slopes of 20 per cent or more comprises 41.5 per cent of the crop and pasture area. The surface of much of the land in class 8 is either too rough or too steep to permit the growing of cultivated crops, except on a very limited scale. Class 8 includes 11.3 per cent of the crop and pasture land. Land in class 9 is characteristically more rolling than land in class 8. Its less broken character reduces the difficulty of growing cultivated crops, although the steep slopes erode rapidly under cultivation. The heavy erosion of class 9 land principally differentiates it from land in class 8. The steep, heavily eroded fields of class 9 comprise a larger proportion (27.8 per cent) of the crop and pasture land of the 52 farms than is found in any other class. A small proportion (2.4 per cent) of the crop and pasture area is made up of land of steep or rough topography which has been recently cleared. (Class 10.) Stumps and sprouts usually have not been cleared from the fields. More than 60 per cent of this land was in corn. Rock outcrop and stony land (1.3 per cent) constitutes class 11.

Land of steep slopes in classes 8 and 9 further illustrates the effect on soil conservation of different cropping practices. Over a 3-year period more than 50 per cent of the crop acreage in class 8 was in grass, whereas in class 9 less than 20 per cent was in grass during the same period. (Table 10.) The fields in class 8 show a good stand of grass and are clean as compared with the fields in class 9, in which sprouts, weeds, and briers abound. More than 55 per cent of crop acreage in class 9, over a 3-year period, was planted to corn. This difference in cropping practice is significant in view of the fact that erosion is typically slight on land of class 8, whereas land in class 9 is heavily eroded.

The relative scarcity of level land and its greater adaptibility to the production of hay, results in the planting of a greater proportion of the crop acreage to corn on lands of intermediate slope (class 7) than on lands of moderate slope. (Classes 1 and 2.) Fields of intermediate slope tend, therefore, to be worn out rapidly. In addition to the tendency to keep them in corn, the rapid erosion of fields in

class 7, due to their steeper slopes, causes them to deteriorate more rapidly than fields in classes 1 and 2. The actual physical difficulty of cultivating fields of more extreme slope in some cases (class 8) has caused these fields to be kept in grass, thus checking erosion. The fact that good stands of grass are maintained on fields of class 8 shows that erosion could be effectively controlled on fields of intermediate slope.

It is proposed now to utilize the classification of land presented here as a basis for studying some economic aspects of the relation of land characteristics to the utilization of crop land.

PERCENTAGE OF CROP LAND IN CROPS

A factor of considerable importance affecting the use of land for crops is the relation of the physical characteristics and conditions of the land to the amount of idle crop land. The proportion of total crop land in crops over a 3-year period ranged from 35.6 per cent for class 6 land to 98.3 per cent for class 1 land. (Table 11.) This ratio of utilization has a direct bearing on the question of a proper measure of the size of farms, and of the efficiency of the farm unit. A farm containing 100 acres of class 1 land will produce more over a given period than a farm containing 50 acres of class 1 land and 50 acres of class 6 land, assuming the same yield per acre on each class, because a very large part of class 6 land lies idle from year to year. To equalize the output on the two classes of land, assuming that idle land in each class is in the proportion shown in Table 11, would require a yield on class 6 land nearly three times as great as the yield on class 1 land. In fact, not only is the ratio of utilization much higher for class 1 than for class 6 land, but also yields obtained from class 1 land are higher. The importance of class 1 land in a farm arises, therefore, not only from the larger yields obtained from it, but also from its higher ratio of utilization as indicated by the proportion of total crop land actually cropped over a 3-year period. The data for extending this comparison to other classes of land appear in Table 11.

TABLE 11.—*Percentage of total crop land in crops, by classes of land, 52 farms, 3-year average, 1926–1928*

Class of land	Acreage of crop land, 1928	Acreage in crops, 1926–1928	Percentage of crop land in crops, 1926–1928	Description of land
	Acres	*Acres*	*Per cent*	
1	359	353	98.3	In good physical condition.
4	36	35	97.2	New clearing.
2	361	326	90.3	In fair physical condition.
5	212	177	83.5	Generally low with wet spots.
10	[1] 66	30	81.1	New clearing.
8	243	191	78.6	Mostly too rough or steep for plowing.
7	200	190	65.5	Overcropped and eroded.
9	383	241	62.9	Do.
3	114	80	70.2	Badly eroded on slopes.
6	104	37	35.6	Predominantly wet or swampy.
Total	[1] 2,168	1,660	77.6	

[1] Twenty-nine acres of land in class 10, not cleared prior to 1926 or 1927, deducted from this figure in computing the percentage of crop land in crops.

CLEARING AND CROPPING SEQUENCE

Thirty-six per cent of the total acreage of crop land in 1928 had been recleared at dates sufficiently recent to be reported by present farm operators for the 52 farms studied. (Table 12.) The proportion of the total acreage reported recleared was highest, naturally, in classes 10 and 4, both because the acreages in these classes are small and because a large part of the land included is new clearing or stump land. It follows that land in these classes has been cropped only a few years since reclearing. The average is 2.9 years for land in class 10 and 11.5 years for land in class 4. Where did the land in these classes appear before it reverted to pasture or brush? Reference to Table 5 will indicate that the rolling to rough or steep hillside land of class 10 is simply a phase of the cycle of utilization of class 9 land. Many of the fields in class 9 are old clearings. Sprouts and other filth are common. Corn occupies 56.8 per cent of the crop acreage. Erosion is heavy. Fifteen years hence the new clearings in class 10 will take the place of the old clearings in class 9.

TABLE 12.—*Average period in 1928 recleared fields had been used as crop land since date last recleared and average acreage recleared annually, 52 farms*

Class of land	Total acreage of crop land, 1928	Acreage in fields for which record of date was obtained		Average period (to 1928) used as crop land since last recleared [1]	Average acreage recleared annually
		Total	Percentage of total acreage of crop land		
	Acres	*Acres*	*Per cent*	*Years*	*Acres*
1	359	77	21.4	23.6	3.3
2	361	136	37.7	18.7	7.3
3	114	28	24.6	16.2	1.7
4	36	30	83.3	11.5	2.6
5	212	46	21.7	30.2	1.5
6	104	...	...	...	...
7	290	131	45.2	16.0	8.2
8	243	92	37.9	37.6	2.4
9	383	198	51.7	16.6	11.9
10	66	41	62.1	2.9	14.1
Total or average	2,103	779	35.9	20.6	37.8

[1] Average computed for all fields for which a record of date last recleared was obtained by multiplying the number of years prior to 1928 a field was last recleared by the acreage in that field, and dividing the sum of the products by the sum of the acreages.

Meanwhile, what is happening to this class 9 land? At present 56.2 per cent of it is in pasture. Nearly all this so-called pasture will require cleaning up or reclearing before the land can be cropped. At the rate of reclearing of land in class 10, the shift from class 10 to class 9 would be about 14 acres a year. Over a 15-year period this would add 210 acres of old clearing to class 9, whereas actually 198 acres were reported for an average period of 16.6 years.

The growth of sprouts and other filth on the pasture fields of class 9 tends to check erosion, and these fields are gradually converted into the type found in class 10. The fact that reclearing of this class of land appears to be proceeding at about the same rate as in the past suggests that the four phases of the cycle require about 60 years. Within this longer cycle there is often a shorter one associated with "filth cutting." For example, 20 acres of class 9 land, last cleared in

1928, was reported last previously cleared in 1922 and last cropped in 1924; 10 acres last cleared in 1928 was last previously cleared in 1916 and last cropped in 1919. A crop of sprouts is mowed off or grubbed out and the land is put in corn for two or three years. This process may be repeated a number of times before the field is allowed to revert to pasture.

This cropping sequence is illustrated in Table 13. The practice of cropping to corn two or three years and then pasturing or allowing the land to lie idle was confined largely to fields with steep slopes. This practice was followed on one-sixth of the acreage covered by the records, and three-eighths of the acreage on which the practice was followed was included in classes 9 and 10.

TABLE 13.—*Cropping sequence following clearing of fields, by classes of land, 52 farms*

Class of land	A: Fields for which sequence was corn first year followed by small grain (seeded with grass) second year			B: Fields for which sequence was corn two years followed by small grain (seeded with grass) third year			C: Fields for which sequence was corn two or three years followed by pasture crop or fallow third or fourth year		
	Number of records	Acreage	Percentage of total acreage	Number of records	Acreage	Percentage of total acreage	Number of records	Acreage	Percentage of total acreage
	Number	*Acres*	*Per cent*	*Number*	*Acres*	*Per cent*	*Number*	*Acres*	*Per cent*
1	3	7	3.3	4	16	5.9	0	0	0.0
2	6	36	16.8	10	37	13.8	3	6	6.1
3	1	11	5.1	1	5	1.9	0	0	0
4	0	0	0	3	15	5.6	0	0	0
5	4	28	13.1	1	2	.7	2	4	4.1
6	3	3	1.4	9	8	3.0	2	2	2.0
7	2	6	2.8	9	66	24.5	3	18	18.4
8	3	21	9.8	4	19	7.1	2	31	31.6
9	10	90	42.1	13	78	29.0	5	25	25.5
10	1	12	5.6	4	23	8.5	2	12	12.3
Total	33	214	100.0	58	269	100.0	19	98	100.0

Class of land	D: Fields for which sequence was corn four years followed by small grain (seeded with grass) fifth year			Percentage distribution of acreage				
	Number of records	Acreage	Percentage of total acreage	A	B	C	D	Total
	Number	*Acres*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
1	0	0	0.0	30.4	69.6	0.0	0.0	100
2	0	0	0	45.6	46.8	7.6	0	100
3	0	0	0	68.8	31.2	0	0	100
4	0	0	0	0	100.0	0	0	100
5	0	0	0	82.3	5.9	11.8	0	100
6	0	0	0	23.1	61.5	15.4	0	100
7	0	0	0	6.7	73.3	20.0	0	100
8	1	3	100.0	28.4	25.7	41.9	4.0	100
9	0	0	0	36.6	40.4	13.0	0	100
10	0	0	0	25.5	49.0	25.5	0	100
Total	1	3	100.0	36.6	46.1	16.8	.5	100

This practice of wearing out and reclaiming land is expensive and wasteful. The process is represented schematically in Figure 5. Some approximation of costs involved in clearing can be made from the data of Table 14. Dynamite is not used, nor are stump pullers employed. A considerable amount of stump land is cultivated, as indicated by land in classes 4, 7, 9, and 10. (Table 5.) In process of time the stumps decay and are chopped out by hand. Man labor is the principal cost involved.

TABLE 14.—*Hours of labor and cost per acre for clearing and breaking land, by classes of land, 52 farms*

Class of land	Records	Acreage	Man labor per acre	Horse work per acre	Cost per acre [1]	Class of land	Records	Acreage	Man labor per acre	Horse work per acre	Cost per acre [1]
	Number	*Acres*	*Hours*	*Hours*	*Dollars*		*Number*	*Acres*	*Hours*	*Hours*	*Dollars*
1	5	42	57.6	11.3	12.65	7	7	63	61.8	10.3	13.39
2	9	72	51.2	66.8	16.92	8	7	63	87.4	11.2	18.60
3	2	6	24.2	19.4	6.78	9	12	158	46.1	21.9	11.41
4	4	36	75.4	25.2	17.60	10	5	41	50.1	20.8	12.10
5	3	14	101.9	26.0	22.98						
6						All classes	[2] 37	495	58.4	[3] 40.5	15.73

[1] In computing money costs, man labor is figured at 20 cents an hour and horse work at 10 cents an hour.
[2] Records were obtained from operators of 37 farms, but when a record covered more than one class of land in a farm that farm was included in each land class covered by the record; hence, the sum of the frequencies is greater than the number of farms.
[3] All classes of land when originally cleared involved horse work. For that reason horse work is included for the entire acreage in computing the horse work involved in clearing all classes of land. The figure, therefore, is not an average of the figures for the several land classes, since these in many cases relate to subsequent stages of clearing operations in which horse work is not involved.

The clearing operations for which man and horse hours were reported were not uniform as to the size of brush or trees removed or as to the completeness of the operation. Consequently, variations in costs more nearly reflect differences in the density or size of the growth removed than differences in land character. However, since the density and size of growth are related to the cycle of land use (fig. 5), the costs are associated also with land character.

It is significant that the labor costs of clearing and breaking reported for class 2 fields closely approximate the costs reported for class 4 fields. (Table 14.) These costs relate, in fact, to the same stage of operations (see stage 6, fig. 5) and are applicable to class 4 land. The clearing costs reported for class 3 apply to the type of operation characteristic of stage 2A, Figure 5. Costs for class 1 and class 2 land logically relate to the type of operations represented by stage 7, Figure 5. The type of operation covered by costs reported for land in classes 5 and 8, include, as a rule, the removal of stumps and are roughly comparable. Operations on classes 9 and 10, on the other hand, are broken into stages—class 9 involving the clearing up of class 10 stump land (see class 1 costs), and the combined cost of the operations on the two classes of land approximate the costs reported for class 5.

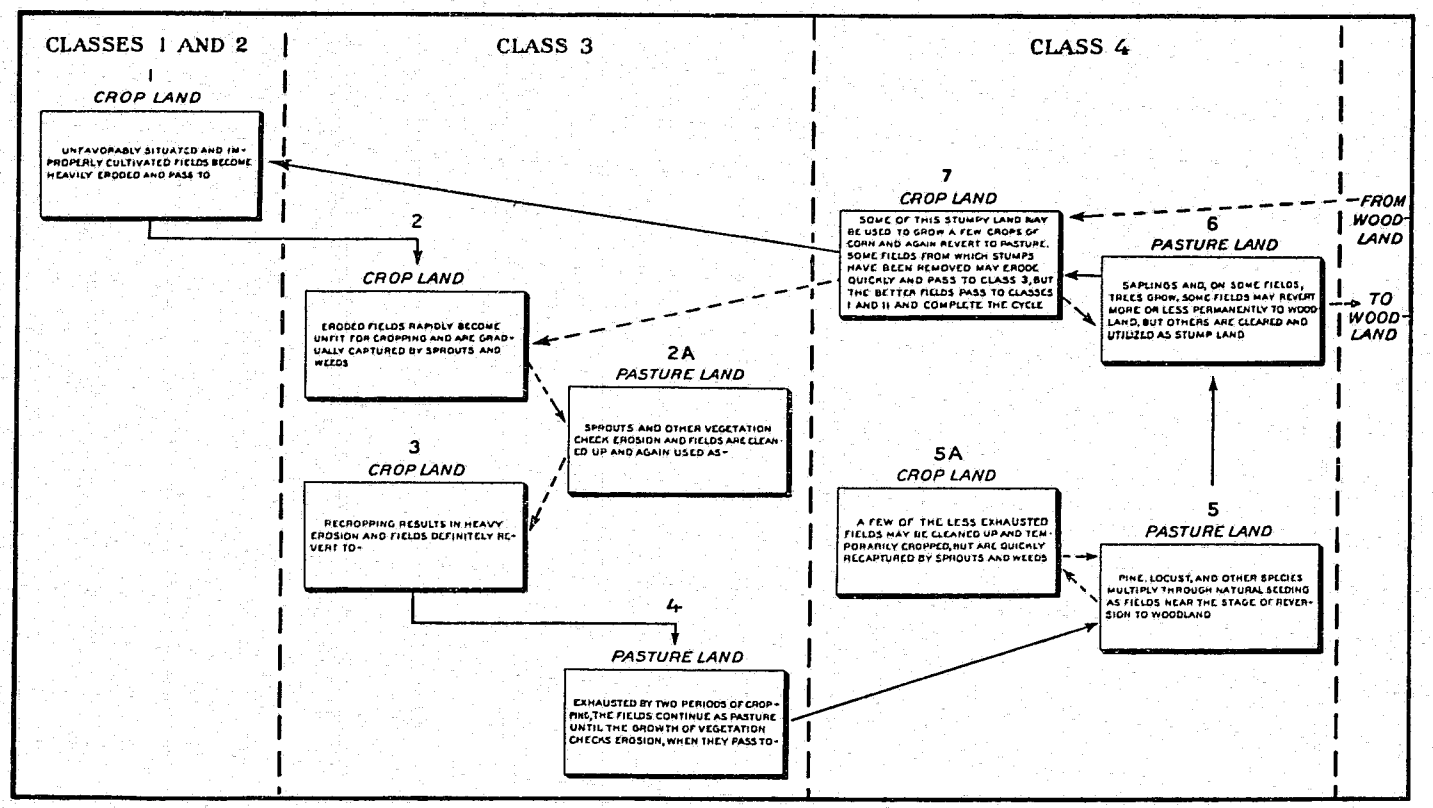


FIGURE 5.—SCHEMATIC PLAN OF THE CYCLE OF CLEARING AND CROPPING ON FIELDS OF MODERATE SLOPE

The exact sequence in this cycle in the utilization of fields is subject to variation. The cycle is not characteristic of all fields nor of the farm economy on all farms.

YIELDS, VALUES, AND COSTS, BY CLASSES OF LAND

To what extent do yields, values, and costs associated with the growing of crops justify the method of land utilization and the cycle of land use just described? The figures brought together in Table 15 provide a basis for an answer to this question. Table 12 shows the average number of years that fields reported recleared had been used as crop land subsequent to reclearing.

TABLE 15.—*Estimated annual return obtained from land in crops after deducting specified costs, 52 farms, 3-year average, 1926–1928*

Item	Class 1	Class 2	Class 3	Class 4	Class 5
Acreage in crops...acres	351	313	77	35	176
Acreage in crops grazed...do	207	171	35	16	120
Animal-days [1] grazed per acre...number	39.5	52.0	17.7	22.8	59.4
Percentage of crop acreage seeded...per cent	48.1	70.2	64.0	46.6	48.9
Percentage of crop acreage fertilized...do	20.3	46.0	38.4	33.8	27.2
Percentage of crop acreage limed...do	12.5	16.6	10.6	11.5	6.2
Annual value of crops produced [2]...dollars	6,451	4,598	916	213	1,531
Annual value of pasturage [3]...do	286	491	22	13	249
Total...do	6,737	5,089	938	226	1,780
Total annual cost of—					
Man labor [4]...do	2,331	2,316	339	197	708
Horse work [5]...do	1,000	1,142	162	71	320
Seed...do	223	257	36	16	57
Fertilizer...do	229	255	57	22	186
Lime...do	98	163	8	4	15
Total...do	3,872	4,133	602	310	1,286
Total annual net return...do	2,865	956	336	−84	494
Annual value per acre...do	19.19	16.25	12.18	6.46	10.11
Annual cost per acre...do	11.03	13.20	7.82	8.86	7.31
Annual net return or loss per acre [6]...do	8.16	3.05	4.36	−2.40	2.80

Item	Class 6	Class 7	Class 8	Class 9	Class 10	Total or average
Acreage in crops...acres	36	187	187	236	30	1,028
Acreage in crops grazed...do	36	136	93	159	30	1,003
Animals-days [1] grazed per acre...number	23.3	45.5	53.7	42.3	86.7	52.0
Percentage of crop acreage seeded...per cent	21.2	68.4	64.6	82.4	96.5	62.4
Percentage of crop acreage fertilized...do	22.6	43.2	35.9	40.2	60.6	37.1
Percentage of crop acreage limed...do	2.8	8.4	22.5	7.0	6.2	12.1
Annual value of crops produced [2]...dollars	233	2,055	2,891	2,815	564	22,267
Annual value of pasturage [3]...do	29	317	191	235	91	1,824
Total...do	262	2,372	3,082	3,050	655	24,091
Total annual cost of—						
Man labor [4]...do	250	860	1,238	2,714	193	11,152
Horse work [5]...do	142	393	598	748	57	4,633
Seed...do	9	96	145	105	11	955
Fertilizer...do	13	169	118	167	24	1,231
Lime...do	2	18	116	31	3	458
Total...do	422	1,536	2,215	3,765	288	18,429
Total annual net return...do	−160	736	867	−715	367	5,662
Annual value per acre...do	7.28	12.15	16.48	12.92	21.83	14.80
Annual cost per acre...do	11.72	8.21	11.84	15.95	9.60	11.32
Annual net return or loss per acre [6]...do	−4.44	3.94	4.64	−3.03	12.23	3.48

A minus sign indicates a negative return.

[1] One animal unit grazing on a field for a day constitutes an animal-day. The following were regarded as the equivalent of one animal unit: 1 cow, horse, mule, or steer; 2 calves, yearlings, or colts; 5 hogs; 7 sheep; 10 pigs; and 14 lambs.

[2] Miscellaneous crops not included.

[3] Estimated at 3.5 cents an animal-day.

[4] Estimated at 20 cents a man-hour.

[5] Estimated at 10 cents a horse-hour.

[6] Return obtained from land cropped during the 3-year period, 1926–1928. Cost of clearing and breaking not included.

Assuming that the average annual net return obtained from these fields over the cropping period were identical with the average annual net return obtained from fields in the corresponding land classes (Table 15), it is possible to compute the total net return per acre for cleared fields in each land class over the average period used as crop land. (Table 16). The value of the pasturage on fields reported grazed before and after harvest was included in the gross return from cropped fields. The charge for fertilizer and lime does not apply, of course, to the entire acreage cropped, since only 3 out of every 8 acres were fertilized and only 1 out of every 8 was limed. The figures of Tables 15 and 16 are not designed to show actual costs and returns to be expected from the utilization of various classes of land for crops. They provide, however, a basis for comparing the relative utility of crop land in various classes, under present methods of utilization.

TABLE 16.—*Estimated annual net return per acre obtained from land in crops during the period since last cleared, after deducting cost of clearing and breaking, 52 farms, by classes of land*

Item	Class 1	Class 2	Class 3	Class 4	Class 5
Period used as crop land [1]—year	23.6	18.7	16.2	11.5	30.2
Annual net return per acre [2]—dollars	8.16	3.05	4.36	−2.40	2.80
Total net return per acre for period used as crop land—do	193	57	71	−28	85
Percentage of crop land in crops [3]—per cent	98.3	90.3	70.2	97.2	83.5
Total net return per acre of land in crops—dollars	190	51	50	−27	71
Cost of clearing and breaking per acre [4]—do	13	[5] 13	7	18	23
Total net return per crop acre less cost of clearing and breaking—dollars	177	38	43	−45	48
Average annual net return or loss per acre [6]—do	7.50	2.03	2.65	−3.91	1.59

Item	Class 6	Class 7	Class 8	Class 9	Class 10	Average
Period used as crop land [1]—year	.....	16.0	37.6	16.6	2.9	20.6
Annual net return per acre [2]—dollars	−4.44	3.94	4.64	−3.03	12.23	3.48
Total net return per acre for period used as crop land—dollars	.....	63	174	−50	35	72
Percentage of crop land in crops [3]—per cent	35.6	65.5	73.6	62.9	81.1	77.6
Total net return per acre of land in crops—dollars	.....	41	137	−31	28	56
Cost of clearing and breaking per acre [4]—do	.....	13	19	11	12	16
Total net return per crop acre less cost of clearing and breaking—dollars	.....	28	118	−42	16	40
Average annual net return or loss per acre [6]—do	.....	1.75	3.14	−2.53	5.52	1.94

A minus sign indicates a negative return.

[1] Table 12.
[2] Table 15.
[3] Table 11.
[4] Table 14. Since the purpose of the computation of net returns is to provide a basis of comparison between classes of land to illustrate the futility of the practice of wearing out and reclaiming fields, not to measure the comparative advantage of alternative uses of resources, the method employed does not include an interest charge in figuring the costs of improvements and investments.
[5] The type of clearing operation is like that on class 1 land, hence the same cost is used for the 2 classes. (Fig. 5.)
[6] Return from crop land during the average period since last recleared. Cost of clearing and breaking included.

Crop values and costs per acre are given in Table 17. In computing the total net return per acre from cleared fields (Table 16), it is necessary also to allow for the fact that the average annual net return was not obtained each year during the period these fields were cropped, since the data of Table 11 indicate that the acreage of crop land

utilized annually averages less, and often very considerably less than the total acreage of crop land. The total net return per acre was estimated, therefore, to correspond to the ratio of utilization shown in Table 11. The total net return per acre was obtained, it is assumed, at a cost of clearing shown in Table 14. Deducting the cost of clearing gives the estimated average return from an acre over the average period cropped, after principal direct costs (Table 15) and cost of clearing have been deducted. This figure divided by the number of years cropped gives the estimated average annual net return per acre from the utilization of cleared land for crops in the several land classes.

TABLE 17.—*Value per acre of crops produced and of pasturage of cropped fields and cost per acre of producing crops for specified items of cost, 52 farms, 8-year average, 1926–1923*

Class of land	Value per acre of—		Cost per acre of [1]—				
	Crops produced [2]	Pasturage of cropped fields [3]	Man labor	Horse work	Seed	Fertilizer	Lime
	Dollars	*Dollars*	*Hours*	*Hours*	*Dollars*	*Dollars*	*Dollars*
1	18.38	1.38	33.2	28.5	1.32	2.14	2.23
2	14.69	2.87	37.0	36.6	1.17	1.77	3.14
3	11.90	.63	22.0	21.0	.73	2.65	1.02
4	6.09	.81	28.1	20.3	.98	1.86	1.08
5	8.70	2.08	20.1	18.2	.00	3.88	1.38
6	6.47	.82	35.6	30.4	1.18	1.60	1.67
7	10.99	1.59	23.0	21.0	.75	2.09	1.12
8	15.46	2.05	33.1	32.0	1.20	1.76	2.75
9	11.93	1.48	57.5	31.7	.54	1.76	1.74
10	18.80	3.03	32.2	19.0	.38	1.32	1.64
Average	13.68	1.82	34.3	28.5	.94	2.04	2.32

[1] The costs per acre for seed, fertilizer, and lime apply, not to the total acreage in crops (Table 15), but only to the proportion of the total acreage for which the given cost was incurred. The proportions are shown in Table 15. The figures for man labor and horse work apply to the total acreage in crops.
[2] Obtained by dividing the annual value of crops produced by the acreage in crops. (Table 15.)
[3] Obtained by dividing the annual value of pasturage by the acreage in crops grazed. (Table 15.)

Crops grown on class 1 land showed a high average yield and value of product per acre (Table 18) compared with yields and values per acre for other classes of land. The return per acre after deducting principal direct costs amounted to $8.16 for class 1 land. This comparatively high return is due principally to the relatively high crop values per acre (Table 17), since labor costs are considerably lower on certain classes of land from which the return obtained is less. Although the cost per acre of seed, fertilizer, and lime is comparatively high, the percentage of the total acreage fertilized is relatively low. The net return per acre obtained from land in this class over an average period of 23.6 years, after deducting the cost of clearing and breaking, amounted to $7.50 annually. (Table 16.) The relative superiority of class 1 land is reflected by an average reported value of $61 an acre, which is much higher than the average reported value of any other class of land.

TABLE 18.—*Yield and value per acre of crops, by classes of land, 52 farms, 3-year average, 1926–1928*

YIELD PER ACRE

Class of land	Corn	Hay [1]	Oats for hay	Oats for grain	Soybeans	Wheat	Tobacco	Miscellaneous [2]
	Bushels	*Pounds*	*Pounds*	*Bushels*	*Pounds*	*Bushels*	*Pounds*	
1	26.2	1,398	1,011	10.1	2,025	9.6	922	
2	22.2	1,134	614	13.3	1,464	5.7	782	
3	15.4	689	417	8.9	1,556	4.0	800	
4	13.4	784	417	8.8		0		
5	15.4	874	174	10.6	2,000	5.9		
6	15.4	662	0	0				
7	19.3	827	331	8.9	1,467	2.9	686	
8	23.8	1,375	1,534	11.8	2,667	11.1	754	
9	15.4	622	751	10.2		8.0	575	
10	23.4	2,000		8.0	1,600			
Average	19.8	1,131	731	10.6	1,801	7.0	825	

VALUE PER ACRE

	Dollars	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*
1	26	12	9	7	21	14	222	9
2	22	10	5	7	14	8	182	7
3	15	6	3	5	15	6	144	22
4	13	5	3	4		0		9
5	16	7	1	6	18	9		8
6	15	5	0	0				14
7	19	6	3	5	14	4	128	32
8	24	13	15	6	20	15	140	6
9	15	5	6	7		12	108	12
10	24	15		5	14			
Average	20	9	6	6	17	10	189	12

[1] Includes millet.
[2] Includes buckwheat, potatoes, cowpeas, cane, rye, and truck.

On the slightly eroded land of class 2 yields and values per acre are lower than on class 1, and the net return per acre falls to $3.05. This decline is due only in part to lower crop values. The principal factor is higher labor costs. It is an interesting fact that less fertilizer is used per acre, but a much larger proportion of the acreage is fertilized—46 per cent of the class 2 compared to 29.3 per cent of the class 1 acreage. A larger proportion of the class 2 acreage also is limed and at a somewhat higher cost per acre. In spite of these higher costs, incurred in an effort to combat the declining fertility of the soil by more extensive fertilizing and liming and by more intensive cultivation, erosion progresses, and weeds and sprouts tend to recapture the fields. After allowing for cost of clearing and breaking these fields show an annual net return per acre of $2.03 over the average period cropped. This decline in the quality of the land is reflected in a rapid decline in the average reported value per acre of land in this class. The figure for class 2 land is $40 as compared with $61 for class 1 land.

Obviously, some of this class 2 land rapidly reaches the condition descriptive of class 3 land—heavily eroded, weedy, and filth-infested fields. Corn yields decline from 22 to 15 bushels per acre, and hay yields from 1,134 pounds to 689 pounds. These two crops occupy over 80 per cent of the crop acreage of class 3 land. Crop values decline from $14.69 an acre to $11.90 an acre. But in spite of this decline in gross crop values, return per acre, after principal direct costs are deducted, amounts to $4.36 on class 3 land compared with

$3.05 on class 2 land. Seed costs decline principally because the land in class 3 is seldom seeded to hay, as indicated by the decline in the proportion of the crop acreage occupied by oats and the increase in the proportion occupied by hay. (Table 10.)[15] The hay cut is of very poor quality—and the decline in quality is fully reflected neither in the yields nor in the price.

This decline in quality is one factor indicating that the closing phase of a wasteful cycle of land use has arrived. The second is the very marked decline in labor costs. This is not a matter of increased efficiency. On the contrary, it simply represents abandonment by neglect. Over a third of the land lies idle every year. A decreasing proportion of the land is fertilized or limed. The apparent superiority of land in class 3 compared with land in class 2 is of brief duration and appears only at the expense of the land itself. The decline in the quality of the land is accompanied by a decline in the average reported value per acre from $40 for class 2 land to $25 for class 3 land. After allowing for a low ratio of utilization and cost of clearing, class 3 land shows an average annual net return of $2.65 per acre. The fact that this return appears principally through decreased labor costs, associated with neglect of the land and decline in quality of crops, causes the land to pass rapidly into the pasture stage. (Fig. 5, 2A and 4.)

Just as the pasture land of class 4 represents the end of the cycle of land use for land of moderate slope, so also the stumpy or filthy crop land of that class marks the beginning of the cycle. These fields represent a small residuum of land cleared for cropping: (1) Old clearing on which the brush and stumps have never been sufficiently cleared away to permit the fields to pass into classes 1 and 2 or to permit erosion to progress to the point characteristic of fields in class 3; and (2) new clearing on land either too poor or too recently cleared for the stumps to have been removed. This newly cleared land reflects the desperate need for "new" land to replace the worn-out fields of which class 3 land is an example. Except for two or possibly three fair crops of corn, the land does not justify the cost of growing crops, to say nothing of the cost of clearing. The annual loss involved in clearing and using such land does not take account of the deterioration of the soil due to exhaustive cropping and the loss of possible alternative returns to be obtained from the land if devoted to other uses. The unreclaimed land in this class yields even less than class 3 land, on the whole, and crops grown average much less in value per acre. Costs are high relative to class 3 land, so that the returns do not cover the direct costs of growing crops. Operators' estimates of value per acre of this land averaged $17.

Classes 1 to 4 include all the land in the 52 farms having a slope under 10 per cent, except the poorly drained land in classes 5 and 6. With respect to the economy of reclearing land for crops in these four classes, there is no question that the present cycle of utilization is extremely wasteful and ineffective. And yet, the returns obtained from class 1 land indicate that with proper attention to the maintenance and increase of soil fertility through the control of erosion, proper cropping practices, and the economical use of manure, commercial fertilizer, and lime, the land of moderate slope is capable of

[15] Grass crops almost invariably are seeded with oats.

producing a fair return. But obviously that result never can be achieved so long as the present wasteful cycle of land use is permitted to continue.

Fifteen per cent, an unexpectedly large proportion, of the crop land in the 52 farms was found to need artificial drainage. This land is included in classes 5 and 6. For class 5 land the ratio of utilization is low, and nearly two-thirds of class 6 land lies idle annually. Land in these classes is not subject to soil erosion. The land is level and relatively free from stones. If properly drained, therefore, it would have great advantages from the standpoint of cultivation. Drainage and the use of lime would greatly increase the productive capacity of the soil. Under present conditions, the use of class 5 land is largely restricted to the growing of hay, principally redtop, because of poor drainage and the sour condition of the soil. The returns obtained, however, somewhat more than cover the direct costs of producing crops. Class 6 land, on the other hand, is too poorly drained to yield returns which will justify the use of this land for crops. (Table 15.)

Class 7 includes land with slopes intermediate between land in classes 1 to 6 and land in classes 8 to 10. Land in this class, on account of the steeper slopes, erodes rapidly. Recleared fields are cropped for relatively short periods. Of the acreage of crop land in this class 45.2 per cent was reported recleared over a period averaging 16 years. Approximately one-third of the crop land lies idle each year. Sprouts and weeds infest many of the fields. Except for the steeper slopes, class 7 land is similar to class 3 land. Crop values and labor costs per acre for the two classes of land do not differ greatly. (Table 17.) The cropping of the steeper class 7 land produces all the evil effects associated with the use of land of more moderate slope and produces these effects more quickly. One effect of the steeper slopes of class 7 is that the intermediate stage in the deterioration of the land represented by class 2 for land of moderate slope, does not appear. Consequently, the clearing and cropping of class 7 land afford a relatively short interval when the land is in good physical condition. The average period recleared land was reported cropped was 24 years for class 1 land and 19 years for class 2, but only 16 years for classes 3 and 7. The use of class 3 land has the advantage, at least, of a considerable period of cropping (the intermediate stage represented by class 2) before the land deteriorates. The more rapid deterioration of class 7 land makes the use of this land even more uneconomical than the use of the land with moderate slopes. Clearing operations on class 7 land, like those on class 1 land, involve the final stages of cleaning up of fields which have been utilized for crops or of land which has reverted to pasture for relatively short periods. But returns are too low, and reversion is too rapid to justify this clearing and cropping cycle.

The utilization of land in class 8 offers an interesting contrast with utilization of class 7. The slopes of land in class 8 are steeper. Fields in class 8 have been cropped for an average period of 38 years since last recleared, compared with 16 years for class 7 fields. Yet erosion is heavy on fields of class 7 and typically slight on fields of class 8. The superiority of class 8 to class 7 fields is reflected by a higher value per acre, a higher gross per-acre value of crops, a higher yield per acre for all principal crops, more than two and a half times as large a proportion of the acreage limed, a higher ratio of utilization,

and by higher returns per acre. The explanation of this apparent all-round superiority of class 8 land is found principally in the fact that more than half of class 8 land is kept in grass and the fields are managed, in general, to control erosion and to conserve soil fertility. The more moderate slopes of class 7 land tend to encourage the overcropping of these fields.

If class 8 land serves to illustrate what can be done with land of steep slopes, class 9 land is an excellent example of what can not be done. Class 9 land is somewhat less rough than class 8 land, and like class 7 land the fields are somewhat less difficult to cultivate than many fields in class 8. Consequently, over a 3-year period, 57 per cent of the crop acreage of class 9 land was in corn. The extensive growing of corn involves a large amount of hand labor, resulting in relatively high man-labor costs. If anything, class 9 land offers better opportunities for effective utilization than class 8 land, but the difference in method of utilization places all the advantages, so far as results are concerned, with class 8 land. To enumerate: For land in class 9 value per acre is lower, gross value of crops per acre is lower, yields per acre are lower, a much smaller proportion of the acreage is limed, the ratio of utilization is lower, returns per acre are lower.

Most of the land in class 10 is relatively new clearing. Sixty-three per cent of the land is in corn. Yields obtained compare favorably with other classes of land and are much better than yields obtained on the eroded fields of class 9. The land in class 10 was valued at an average of $18 an acre, and the gross value of crops per acre was $18.80, a figure higher than for any other land class. The proportion of the acreage fertilized is practically the same as the acreage in corn, although the quantity of fertilizer used per acre is relatively small. Although the returns obtained from this new land are comparatively good, it is obvious that a few years of cropping to corn will convert these fields into the type found in class 9. That has been and is taking place. At the same time, some of this class 10 land has been developed into land of the type in class 8. There appears, in fact, on land of steep slope in classes 8, 9, and 10, the same cycle of land use, in all essential respects, described for land in classes 2, 3, and 4. The significant difference is that the utilization of class 8 land more closely approaches a sound method, a method designed to give a permanent status to the land, than is true of land either in class 1 or class 2.

The preliminary conclusions relative to the utilization of land for crops may be summarized as follows:

The amount of crop land available is limited chiefly by steep slopes, but approximately 15 per cent of the land is in need of drainage. The practice of cropping the slopes to corn results in rapid erosion, so that fields are quickly worn out. As the land deteriorates it becomes pasture, which, as a rule, is merely a stage of abandonment.

As a consequence of this exhaustive cropping, fields often lie idle. The proportion of the crop land utilized annually decreases as erosion and other types of deterioration of the land progress.

The natural scarcity of land suitable for cropping and the rapid exhaustion of fields by overcropping and consequent heavy erosion, lead to the reclaiming of old fields which have gone back to brush or woodland to replace abandoned crop land.

This clearing and cropping sequence establishes a cycle of land use, the succeeding stages of which are marked by a decline in the physical condition of the land and in the economic returns obtained from it.

Nearly one-fourth of the crop land (classes 4, 6, and 9, Tables 8 and 15) has so deteriorated that the returns obtained are less than the direct costs of growing crops. On an additional 19 per cent (classes 3 and 7) these costs are covered, for short periods, only by "mining" the soil and neglecting the fields.

Conservatively, 4 out of every 10 acres of crop land are losing money, through direct costs and through decline in the value of the land, for the farmer who crops them.

That worth-while returns can be obtained from land in good condition is illustrated, for land of gentle slopes, by class 1 land, and that sound cropping practices are not inconsistent with sound economy is illustrated for land with steep slopes by the fact that on class 8 land where erosion is effectively controlled the returns obtained are positive, whereas on the overcropped and eroded land of class 9 the returns are negative.

UTILIZATION OF LAND FOR PASTURES

Attention has been directed to the fact that a great deal of the land classified as pasture is represented by worn-out fields which have been exhausted by cropping and the progress of erosion. For example, only 1.1 per cent of all land in pasture is represented by the relatively level and slightly eroded fields in classes 1 and 2, although these classes include 23.2 per cent of the crop and pasture land in the 52 farms. On the other hand, 50.3 per cent of the land in pasture is represented by the rough and heavily eroded fields of class 9, although the acreage in this class comprises only 27.8 per cent of the crop and pasture land in the 52 farms.

DESCRIPTION OF LAND IN PASTURES

On the basis of records covering 85.5 per cent of the pasture acreage in the 52 farms, approximately three-fourths of the land in pasture is tillable. (Table 19.) The tendency to use all available bottom land for crops, including hay, is illustrated by the fact that the generally low, crawfishy, or swampy land in class 6 is seldom utilized for pasture if the land can be cropped. Only 20.6 per cent of the pasture land in this class was reported tillable in contrast to much higher percentages in other classes.[16] More than 25 per cent of the pasture land of the rough and eroded fields of class 9 was reported as nontillable, although a part of the acreage, at least, of most pastures in this class was reported tillable. Conditions in class 8, similar to those in class 9, caused about 15 per cent of the acreage to be reported nontillable, and poor drainage placed about 19 per cent of class 5 pasture land in the same status.

[16] Class 11, described as rock outcrop, has very little tillable land.

TABLE 19.—*Percentage of acreage in pasture which farm operator regarded as tillable, by classes of land, 52 farms, 1928*

Class of land	Percentage of acreage for which data were obtained	Percentage of acreage tillable in group—						
		None	1–20	21–40	41–60	61–80	81–100	Average
	Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
1	100.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0
2	100.0	0	0	0	0	0	100.0	100.0
3	76.7	0	0	0	0	0	100.0	100.0
4	57.4	0	0	0	0	0	100.0	98.6
5	99.0	2.7	0	8.6	0	14.1	74.6	81.4
6	100.0	70.6	0	0	0.0	29.4	0	20.6
7	97.1	0	0	0	0	0	100.0	98.3
8	75.7	9.6	0	0	0	0	90.4	85.6
9	82.3	8.2	1.2	8.1	12.1	25.2	47.2	72.7
10	100.0	0	0	0	0	0	100.0	95.0
11	100.0	94.3	0	0	0	0	5.7	5.7
Average	85.5	13.1	.6	3.9	0.5	15.1	80.8	74.4

Some fields that were reported wholly or in part nontillable may have been cropped to some extent at an earlier period. For example, on the basis of records covering 75.1 per cent of the acreage in the class, only 5.3 per cent of the acreage of the rough and eroded fields of class 9 was reported as previously used for pasture only (Table 20), although more than 25 per cent of the pasture land was reported as nontillable. From 10 to 25 per cent of the land in pasture is now, apparently, regarded by the farmers themselves as unfit for cropping, although all fields now in pasture were probably cleared originally for the purpose of cropping.

TABLE 20.—*Use of pasture fields before conversion to pasture, by classes of land, 52 farms, 1928*

Class of land	Percentage of acreage for which data were obtained	Percentage of acreage in specified use before conversion to pasture					
		Crop land	Crop and pasture land	Pasture land only	Woodland	Idle	Total
	Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
1	100.0	0.0	100.0	0.0	0.0	0.0	100
2	100.0	100.0	0	0	0	0	100
3	100.0	100.0	0	0	0	0	100
4	100.0	87.0	0	0	13.0	0	100
5	35.9	89.5	0	3.0	0	7.5	100
6	100.0	11.2	0	88.8	0	0	100
7	97.1	83.0	15.0	0	2.0	0	100
8	71.6	39.0	47.4	13.6	0	0	100
9	75.1	86.2	6.9	5.3	0	1.6	100
10	100.0	100.0	0	0	0	0	100
11	28.6	100.0	0	0	0	0	100
Average	74.7	70.1	12.0	10.0	.7	1.2	100

In general, the less rugged fields (classes 1, 3, and 4) are cleared up at shorter intervals than are the steep or rough fields in classes 7, 8, and 9. On the average, for each field covered by the data a period of 25.8 years elapsed since it was last cleared. The average was 30.1 years for each acre reporting. (Table 21.)

TABLE 21.—*Period since fields utilized as pasture in 1928 were last cleared, by classes of land, 52 farms*

Class of land	Percentage of acreage for which data were obtained	Period since field was last cleared		Class of land	Percentage of acreage for which data were obtained	Period since field was last cleared	
		Average per field	Average per acre			Average per field	Average per acre
	Per cent	*Years*	*Years*		*Per cent*	*Years*	*Years*
1	100.0	8.0	10.7	8	75.9	26.0	27.7
2	0			9	69.3	29.2	34.8
3	93.1	16.3	17.2	10	90.9	[1] 60.0	[1] 76.0
4	69.2	10.2	8.3	11	94.3	24.2	31.8
5	8.9	23.3	19.4				
6	23.8	1.5	1.9	Average	59.2	25.8	30.1
7	34.0	24.2	24.1				

[1] The figure is relatively high because one operator reported a field last cleared 100 years ago.

Farmers agreed that approximately three years was the desirable period to keep a field in pasture. However, fields were reported last seeded 6.7 years ago, on the average, and many fields have been in pasture for much longer periods without reseeding. (Table 22.) Except on class 8 land, which has been protected from erosion, long periods without reseeding indicate, as a rule, that the land is too badly deteriorated to justify reseeding.

TABLE 22.—*Period since fields utilized as pasture in 1928 were last seeded, by classes of land, 52 farms*

Class of land	Percentage of acreage for which data were obtained	Percentage of acreage last seeded within—									Average period since last seeded
		1–3 years	4–6 years	7–9 years	10–12 years	13–15 years	16–18 years	19–21 years	22–24 years	25–27 years	
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Years*
1	100.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0
2	0										
3	100.0	0	23.3	10.0	0	0	66.7	0	0	0	13.2
4	100.0	68.5	13.0	0	0	18.5	0	0	0	0	4.6
5	38.0	19.7	8.5	64.8	7.0	0	0	0	0	0	6.3
6	17.9	62.5	37.5	0	0	0	0	0	0	0	2.8
7	42.7	4.5	70.5	18.2	6.8	0	0	0	0	0	5.6
8	90.3	37.7	40.8	8.1	0	0	0	13.4	0	0	6.1
9	80.6	26.2	44.8	1.8	10.1	8.1	0	0	7.5	1.5	7.2
10	100.0	100.0	0	0	0	0	0	0	0	0	3.0
11	28.6	80.0	20.0	0	0	0	0	0	0	0	3.4
Average	69.3	20.7	40.2	7.4	6.7	5.5	3.0	2.2	4.4	.9	6.7

PREPARATION AND USE OF PASTURES

The meadow and pasture stage in field utilization may be reached after one to four years of cropping to corn. (Table 13.) The general practice has been to crop the land to corn as long as a crop can be obtained and then seed oats and some grass, usually redtop, although timothy, orchard grass, and clover are seeded. After harvesting a

crop of oats,[17] hay will be cut as long as a stand can be maintained, then the field may be pastured or may lie idle from four to six years. At the end of this period sprouts may be cleared off and the field plowed and replanted to corn. This process may be repeated a number of times before the field ceases to be reclaimed from the pasture stage and reverts to woodland. The land usually is plowed, and sometimes harrowed and dragged before the seed is sown by hand; the seed is then harrowed or plowed in.

An average of 8.5 man hours and 14.8 horse hours per acre was reported for plowing and 2.6 man hours and 4.8 horse hours per acre for other operations, or a total of 11.1 man hours and 19.6 horse hours per acre for seed-bed preparation. Labor costs reported for plowing averaged somewhat higher on the wet soils of fields in class 6 than on fields in other classes reporting. (Table 23.) Labor costs of seeding averaged only 2.3 man hours and 4 horse hours per acre.

Since most fields are seeded by hand, there are no significant differences in cost between the various land classes. On the average there are expended on each acre in pasture 5.7 hours of man labor and 3 hours of horse labor annually for filth cutting. (Table 23.) Labor costs of keeping weeds and sprouts under control are relatively high on the partially cleared land in class 4 and on the steep and eroded fields of class 9. A mowing machine is often employed to clear a field of sprouts. But pastures with steep slopes, particularly those which have been neglected (class 9), are usually cleaned up by using a mattock to chop or grub out the sprouts.

TABLE 23.—*Man and horse hours per acre employed on pasture fields for preparing seed bed, seeding, and filth cutting, by classes of land*

Class of land	Seed-bed preparation						Seeding		Filth cutting		Total	
	Plowing		Other operations		Total							
	Man labor	Horse work	Man labor	Horse work	Man labor	Horse work	Man labor	Horse work	Man labor	Horse work	Man labor	Horse work
	Hours	*Hours*	*Hours*	*Hours*	*Hours*	*Hours*	*Hours*	*Hours*	*Hours*	*Hours*	*Hours*	*Hours*
1												
2												
3	7.8	15.7	2.6	5.2	10.4	20.9	1.8	3.2	1.4	2.9	13.6	27.0
4	7.2	12.8	2.0	4.0	9.2	16.8	2.3	1.8	6.7	5.7	18.2	24.3
5	10.0	11.4	3.2	4.2	13.2	15.6	3.3	4.6	3.7	4.0	20.2	24.2
6	10.0	20.0	0	0	10.0	20.0	2.0	4.0	2.7	4.2	14.7	28.2
7	6.6	13.2	2.0	4.1	8.6	17.3	2.7	4.7	3.1	3.5	14.4	25.5
8	8.7	17.2	2.7	5.4	11.4	22.6	1.7	4.4	2.6	2.9	15.7	29.9
9	8.6	14.5	2.6	4.8	11.2	19.3	2.5	3.9	7.0	2.5	20.7	25.7
10	0	0	0	0	0	0	0	0	5.0	0	5.0	0
11							3.1	2.5			3.1	2.5
Average	8.6	14.8	2.6	4.8	11.1	19.6	2.3	4.0	5.7	3.0	19.1	26.6

PASTURE COSTS AND RETURNS

For the purpose of evaluating the relative utility of the various classes of land for use as pasture, a typical 6-year period was employed. The land is seeded to oats and hay. An oat crop is harvested

[17] In 1927 the oat crop was practically destroyed by rust.

the first year, followed by two crops of hay. The land is then pastured for three years, during which period allowance is made for the annual cost of filth cutting. Since a varying proportion of the pasture land in the several land classes has been seeded within the last 6-year period (Table 22), costs and returns from oats and hay are included only for the proportion of acreage in each land class which was reported seeded within the 6-year period. For the remaining acreage in each land class returns were estimated only for the pasturage over the 6-year period, and filth cutting was the only cost included for this acreage. Costs of fertilizer were included only for a small proportion of the acreage. The proportion was determined by applying to the acreage seeded in each class of land, the ratio of the acreage of pasture fertilized to the acreage seeded during the period 1926–1928. (Table 24.)

TABLE 24.—*Comparative data relating to the utilization of land for pasture, by classes of land, 52 farms, 1926–1928*

Class of land	Fields for which data were obtained	Acreage in pasture		Value per acre of—			Proportion of acreage fertilized to acreage seeded	Animal units carried per acre	Length of pasture season	Optimum period to pasture field
		Total	Permanent	Seed	Fertilizer	Pasturage [1]				
	Number	*Acres*	*Acres*	*Dollars*	*Dollars*	*Dollars*	*Per cent*	*Number*	*Months*	*Years*
1	1	5	0			2.00		0.50	5.0	0.0
2	1	6	6			2.00		.50	5.0	0
3	2	29	27	0.35	0.43	1.86	46.7	.33	5.7	3.0
4	4	28	4	1.42	1.41	2.76	18.2	.50	5.5	3.0
5	11	96	96	3.02	2.26	1.81	42.4	.35	5.2	3.6
6	6	51	51	1.60	1.44	1.53	100.0	.31	4.9	1.6
7	13	103	91	1.89	1.10	.84	51.4	.19	4.4	3.5
8	8	114	34	1.15	2.49	2.08	13.5	.47	6.4	4.2
9	20	492	292	1.68	1.01	1.83	15.0	.35	5.3	3.2
10	1	11	0			1.20		.20	6.0	4.0
11	3	35	35			.80		.17	4.7	3.0
Total or average	70	978	636	1.49	1.27	1.87	20.6	.34	5.5	3.2

[1] Annual rental value.

Results of the computation appear on an acre basis in Table 25. In arriving at the estimates in Table 25, no account was taken of taxes, interest on investment in land, or the cost of fencing pastures. Taxes and interest on investment would bear little definite relation to the physical characteristics of the land since these charges are based on the value of the farm as a whole. As for the cost of fencing, reports from 52 farms showed for all land classes the following average construction costs per rod: For man labor 0.7 hour, for wire 27 cents, and for posts 20 cents. In computing the value of pasturage the value per acre for pasturage when rented, as estimated by operators, was used. (Table 24.)

TABLE 25.—*Estimated annual net return obtained from pasture land, based on typical 6-year period, by classes of land,*[1] *52 farms*

Item	Class 3	Class 4	Class 5	Class 6	Class 7	Class 8	Class 9	Total
Acreage both cropped and pastured ..... acres	7	18	11	11	33	85	220	385
Acreage pastured only ..... do	22	8	85	50	70	29	272	536
Total ..... do	29	26	96	61	103	114	492	921
Value of crops and pasturage on acreage both cropped and pastured:								
Oats, one year ..... dollars	35	72	96	.....	165	510	1,510	2,388
Hay, two years ..... do	84	180	154	110	396	2,210	2,200	5,334
Pasturage three years ..... do	30	149	60	50	83	760	1,208	2,340
Value of pasturage on acreage pastured only:								
Pasturage, six years ..... dollars	246	132	923	543	353	519	2,987	5,703
Total ..... do	404	533	1,203	703	997	3,999	7,935	15,774
Annual value per acre ..... do	2.32	3.42	2.09	1.92	1.61	5.85	2.09	2.85
Cost on acreage both cropped and pastured:								
Seed-bed preparation ..... dollars	29	63	46	44	114	386	917	1,599
Seed ..... do	2	26	33	18	62	98	370	609
Fertilizer [2] ..... do	1	4	11	16	19	29	34	114
Seeding ..... do	5	12	12	9	33	60	190	333
Harvesting oats ..... do	12	54	18	.....	54	218	102	358
Harvesting hay, two years ..... do	43	86	53	53	162	530	1,135	2,068
Fifth cutting, three years ..... do	12	103	38	32	96	207	1,089	1,577
Costs on acreage pastured only:								
Fifth cutting, six years ..... do	75	92	581	288	407	141	2,003	4,277
Total ..... do	179	440	792	460	947	1,681	6,030	11,435
Annual cost per acre ..... do	1.03	2.82	1.38	1.26	1.53	2.46	2.35	2.07
Annual net return per acre ..... do	1.29	.60	.71	.66	.08	3.39	.34	.78

[1] Data relating to land in classes 1, 2, 10, and 11 were not sufficiently comprehensive for the purpose of this table.

[2] Applies only to the proportion of the seeded acreage which was fertilized.

The figures of Table 25 are not designed to show actual costs and returns to be expected from the utilization of various classes of land for pasture. They do reflect, however, the relative utility of land in various classes for pasture under present methods of utilizing these lands. To illustrate, the rough or steep land included in class 8 has no natural advantages to account for the fact that the pastures are superior to those of the rolling-to-rough or steep land of class 9 or to the smooth-to-rolling land of moderate slope in class 3. On the contrary, the physical characteristics of much of class 8 land, in contrast to land in classes 3 and 9, practically prohibit cropping. The result is that a definite effort is made to maintain pastures on class 8 land, thus checking erosion and maintaining fields in a condition generally superior to fields that are overcropped. The general tendency in other classes is to crop fields until they are no longer fit either for crop land or pasture. The results are of the same kind—heavy erosion and exhaustion of soil fertility—whether the land is of moderate slope (class 3) or of steep slope (class 9), although the effects are more rapid and more pronounced on the steep slopes.

CONCLUSIONS RELATIVE TO PASTURES

Two conclusions, one positive and the other negative in regard to the relation of land characteristics to the utilization of land for pasture are suggested by the data. The positive conclusion is that a good

quality of pasturage can be maintained on land too rough or too steep for plowing. (Class 8.) The negative conclusion, borne out by the results shown by every class of land in which fields are subject to overcropping, is that attempts to establish or maintain such fields in pasture either by cultivation, reseeding, or both, without other treatment are hopeless.

The data point also to two conclusions in regard to improving present practices. Preliminary to all other measures, the vicious and wasteful cycle of field utilization characteristic of the farm economy must be eliminated. No sound basis for expenditures for improving pastures can be found until sound practices are followed in the utilization of fields. Pastures can not be established, much less maintained, when rough or steep hillside land (class 9) is allowed to become heavily eroded by overcropping before an attempt is made to convert it into short-term pasture. Seed, labor, and even fertilizer applied under such conditions are almost wholly wasted.

With this preliminary condition met it is clear, in the second place, that yields can be improved and stands of grass maintained only by an adequate application of lime and fertilizer. Recent experiments on methods of pasture improvement, conducted on the livestock and the dairy farms of the West Virginia Agricultural Experiment Station, demonstrate several points which have a direct application to Laurel County farms. The experiments referred to were conducted on lands that were "too steep or rough to make plowing and reseeding practical, but which may be improved by top-dressing with fertilizer and lime" (*10, p. 4*). Some results of these experiments of interest in the present connection follow:

Effect of seeding.—Complex seed mixtures showed no permanent advantage over simple mixtures either in yield or in composition of the pasture. To scatter seed, no matter what the mixture, without applying both lime and fertilizer is a waste of time and effort.

Effect of cultivation.—Liming and fertilizing without cultivation are effective, although a slight increase of yield results from cultivation. Disking without other treatment is futile.

Effect of lime and fertilizer.—Manure, superphosphate, and lime in combination produced the best results. Manure and lime proved the next best treatment. Superphosphate and lime gave marked improvement in yield and quality. Omitting lime reduced the effectiveness in each case. Lime alone gave only small increases in yields, but considerable improvement in quality.

Effect of grazing or mowing.—In the character of vegetation, plots grazed showed little difference from plots mowed.

Costs.—An annual cost of $3 per acre, excluding labor, was involved over a 6-year period in the application of lime, superphosphate, and a seed mixture consisting of timothy, Kentucky bluegrass, alsike clover, and white clover.

Results.—The carrying capacity of pastures, it was estimated, was three times as great as before this treatment was applied, as a result of increased yields and improvement in the quality of the pasture.

The figures of Table 25, particularly those for land in class 8, suggest that a threefold increase in carrying capacity would amply justify an annual expenditure of $3 an acre for lime, superphosphate, and seed on many Laurel County pastures. These West Virginia experiments support the conclusion suggested by the data of the pres-

ent study, particularly by the results obtained from the utilization of the rough or steep land in class 8, that good quality pastures can be maintained on rough or steep land, provided the farm economy is so organized that such lands are not periodically exhausted and subjected to excessive erosion by cropping. But rough land and land with steep slopes are not alone subject to the deteriorating effects of overcropping. The use of lime and fertilizer in combination with a crop rotation to control erosion and soil fertility is also essential on land of more moderate slope, as illustrated by the poor condition both of crop and pasture land in classes 3 and 4. Reference to Table 5 will show that land in class 7 is intermediate in slope between classes 1 to 6 and classes 8 to 10. Land in this class is badly overcropped. The pastures, so called, are virtually worthless, comprising, for the most part, merely exhausted and abandoned crop land.

Detailed suggestions relating to the management of hay and pasture fields are contained in the discussion of the farm management aspects of the study (*9, pp. 252–255*). The data on which these suggestions are based further emphasize the importance of using lime and phosphate and the value of top-dressing with manure to secure good stands of hay and to establish pastures. Control of the growth of filth is also stressed as an important factor in the maintenance of pastures, and it is pointed out that the principal difficulty is encountered during the first year after the land is seeded down to grass.

It was found that some farmers in the area obtain good yields of clover by using as little as 200 pounds per acre of special finely ground limestone, while other farmers using coarsely ground limestone find it necessary to apply from 2 to 3 tons per acre. The use of finely ground limestone should prove especially advantageous to operators of farms located on poor roads.

Successful farmers recommended for pastures the use of lime and phosphate and a seed mixture including red clover, orchard grass, timothy, Lespedeza, and sweetclover. Red clover and timothy appear best adapted to the production of hay, provided the land is limed. Timothy yields a better tonnage than redtop, although redtop does better on wet land and land not limed. Lespedeza is especially valuable when liming is not feasible.

This detailed examination of the relation of land characteristics to the utilization of land for crops and pastures shows the need of examining the farm economy in relation to the land in the farm. Although class 8 land, for example, can be utilized effectively, it can not be utilized effectively as the basis of an entire farm economy. The same statement holds for class 9 land and, at the other extreme, for poorly drained lands in class 5. The definition of agricultural land has, therefore, two aspects. In relation to an area the question is not simply whether the type of land characteristic of the area can be utilized for agriculture, but, further, whether effective utilization of that land depends upon combination with a more or less definite amount of land of a different type. The decision as to the agricultural status of such an area hinges, therefore, on the amount and availability of this additional land. If a sufficient amount of land of the required type is available in an area to justify classing the area as agricultural, it does not follow, of course, that all farms within the area will have the combination of land types essential for successful operation.

From the standpoint of the individual farmer, this second aspect of the problem is the more important. The successful operation of a farm within an agricultural area is contingent upon a proper amount of the favorable type or types of land or combination of such land with less favorable types within the boundaries of the given farm.

The definition of the status of an area provides a basis for a sound policy with respect to the promotion of agriculture, forestry, or other uses of the land. But land characteristics, particularly in an area in which the land is close to the margin of agricultural use, are highly important in relation to the organization of the individual farm. Accordingly, the detailed presentation in this and the preceding section of the relation of land characteristics to the utilization of land for crops and pasture will be turned to account in a subsequent section for two major purposes: (1) To differentiate on the basis of land characteristics, areas which appear to justify agricultural use; and (2) to indicate for the areas so defined the combination of land characteristics within the individual farm that appear to be essential for success. These matters will be presented in the section on farm organization in relation to land characteristics.

UTILIZATION OF WOODLAND

In 1925 woodland in farms amounted to 49,593 acres, or 29.7 per cent, of all land in farms in Laurel County. (Tables 1 and 2.) Woodland comprised 25.1 per cent of the farm area of the 52 Laurel County farms studied by individual fields. (Table 7.) A study was made of the farm wood lots on 49 farms to estimate their significance in the farm economy and their relation to the problem of land use. These 49 farms included 35 of the 52 farms for which records were obtained by individual fields. Thirty-one of the 49 farms were in the south area and 18 were in the north area. The total area of the 49 farms was 4,922 acres. Woodland comprised 1,331 acres, divided into 77 separate tracts, or 27 per cent of the area of the 49 farms. This ratio exceeds by approximately 2 per cent the ratio for the 52 farms and is approximately 3 per cent less than the ratio for the county. (Table 4.)

SLOPE, SURFACE, AND DRAINAGE

Farm wood lots are not confined to the rough or rugged land. The surface of 65.6 per cent of the acreage in woodland in the 49 farms was classed as smooth and an additional 18.2 per cent as rolling. Nor are the wood lots confined to the steep slopes. More than a third of the acreage had a slope of 4 per cent or less and on more than 50 per cent of the acreage slopes ranged under 15 per cent.

The need of land of moderate slope for crops has a tendency, however, to confine farm wood lots to the poorly drained areas for slopes under 5 per cent. Nearly 50 per cent of the woodland acreage with slopes under 5 per cent was reported as only fairly well drained or else wet or swampy. For slopes of 10 per cent and over, comprising 56.6 per cent of the woodland acreage in the 49 farms, poor drainage was practically never a factor.

Relative stoniness of the land was reported for 99.4 per cent of the woodland acreage in the 49 farms. Twenty per cent was described as rock outcrop and surface stones were reported on an additional 41.2 per cent. Except for the considerable porportion of rock outcrop, stoniness as such probably has little to do with the differentiation of

woodland from crop or pasture land in these farms. The hillside lands selected for clearing or cropping are normally those contiguous to the more level land available, while similar land somewhat farther along is allowed to remain in timber. In general, soil depth corresponds to relative stoniness of the land.

PREDOMINANT ORIGIN OF TIMBER

The predominant origin of the timber in the farm wood lots was reported for all except 3 of the 49 farms. For 46 farms, embracing 1,241.5 acres of woodland, the timber on 68.2 per cent of the acreage was predominantly of seedling origin, on 29.8 per cent mixed, and on only 2 per cent predominantly sprout. Approximately 37 per cent of the acreage was reported regularly grazed in 1928. In many instances stock had access to the farm wood lot along with adjacent open pastures, so that no satisfactory estimate of the intensity of grazing was obtained. In some instances stock is turned into the wood lot the year round, but usually from six to nine months is the limit of the pasture season. Reports as to the extent of fencing were obtained from 74 of the 77 tracts. Of those reported, 32 per cent were completely fenced, 57 per cent were partly fenced, and 11 per cent were unfenced. Fencing, however, often consisted only of a strand or two of barbed wire stapled to trees. This type of fence serves to keep cattle and mules out of the cornfields but obviously is no protection against hogs. Consequently, few hogs are turned into the farm wood lots. This is favorable to a large proportion of seedling trees in the stands.

Farm wood lots have suffered very little fire damage in recent years. One or two rumors of fires of incendiary origin for the sake of improving the grazing were heard, but no actual instance was encountered. Only 6 of the 77 tracts reported fires in 1928. These were confined to small areas, so that the extent of the damage was slight. According to the reports of farmers, fires on these 77 tracts have averaged about 1 tract a year during the last 20 years.

COMPOSITION AND VOLUME OF FARM WOOD LOTS

Data on species and volumes obtained from 77 tracts distributed among 49 farms afford a basis for estimating volumes per acre. The estimated total volume of saw timber was 3,109,760 board feet besides 14,531 cords from tops and from trees and species unfit for saw timber. This total gave an average stand per farm of 63,464 board feet and 297 additional cords, and a stand per acre of 2,385 board feet and 11 additional cords. (Table 26.) For the purpose of estimating marketing possibilities as affected by the location of wood lots, the 49 farms were grouped according to the number of trips a day that could be made in hauling timber to the nearest railroad point. These groups were designated, as follows: Group A, 4 trips a day; Group B, 3 trips a day; Group C, 2 trips a day; Group D, 1 trip a day. Table 26 also shows estimated volumes by species separately for these groups. Tracts located close to a railroad point have the largest stand per acre among the several groups, but only a small proportion of the total stand. In fact, only 5 of the 49 farms were located close

enough to a railroad point to admit of four trips a day. Group B (3 trips), included 15 farms; Group C (2 trips), 19 farms; and Group D (1 trip), 10 farms. Tracts on 29, or nearly 60 per cent, of the farms were located so far from a shipping point as seriously to affect the profitable marketing of timber products, particularly in view of the light loads made necessary by poor roads.

TABLE 26.—*Estimated volume of saw timber and cordwood in farm wood lots, by species, 49 farms, 1928*

Species	Group A, 5 farms [1]		Group B, 15 farms [1]		Group C, 19 farms [1]		Group D, 10 farms [1]		Total, 49 farms	
	Saw timber	Cordwood	Saw timber	Cordwood	Saw timber	Cordwood	Saw timber	Cordwood	Saw timber	Cordwood
	Board feet	*Cords*	*Board feet*	*Cords*	*Board feet*	*Cords*	*Board feet*	*Cords*	*Board feet*	*Cords*
Beech	12,583	55	0	72	6,225	22	0	0	18,808	149
Chestnut	0	47	26,332	177	73,420	177	34,450	340	132,220	741
Gum	64,457	256	66,945	404	45,653	153	20,506	93	196,961	906
Hemlock	0	0	34,876	342	0	18	47,540	168	82,418	528
Maple	21,333	250	47,610	781	10,679	235	66,683	129	146,305	1,394
White oak	55,096	177	200,514	1,360	206,022	718	254,529	1,276	716,761	3,531
Other oaks	57,111	105	251,039	1,005	366,761	1,311	182,890	876	857,801	3,387
Poplar	35,685	43	106,593	329	92,830	100	24,092	126	259,200	598
Sourwood	0	42	0	68	0	32	0	64	0	206
Pine	8,415	0	133,368	524	73,353	498	412,798	875	627,934	897
Hickory	6,901	46	12,317	163	8,439	81	11,436	348	38,253	638
Birch	6,609	39	11,314	20	4,848	94	5,467	0	28,238	152
Black walnut	0	0	0	0	4,861	0	0	0	4,861	0
Wahoo	0	0	0	0	0	0	0	106	0	106
Sassafras	0	0	0	0	0	0	0	64	0	64
Ash	0	0	0	42	0	33	0	0	0	75
Dogwood	0	0	0	23	0	24	0	0	0	47
Shadbush	0	0	0	0	0	21	0	0	0	21
Service	0	0	0	81	0	0	0	0	0	81
Total	267,950	1,150	890,910	5,400	890,500	3,517	1,060,400	4,464	3,109,760	14,531
Stand per farm	53,590	230	59,394	360	46,868	185	106,040	446	63,464	297
Stand per acre	2,835	12	1,089	12	2,666	10	2,492	10	2,385	11

[1] Groups are based on the number of trips a day that can be made from the farm wood lot to the nearest railroad point by a team hauling a loaded wagon: Group A, 4 trips a day; Group B, 3 trips a day; Group C, 2 trips a day; Group D, 1 trip a day.

The percentage distribution of volumes by species shows that oaks predominate over all other species combined, accounting for 50.6 per cent of the estimated total volume of saw timber in the 77 tracts. White oak comprised 23 per cent of this volume. (Table 27.) The quality of the white, red, and small chestnut oak in these stands was generally good. This was true also of yellow poplar, pine, and red gum. Among these species, pine alone accounted for any considerable proportion of the total volume. Most of the pine was shortleaf, although a considerable amount of pitch pine was found. Natural seeding of shortleaf pine quickly recaptured abandoned fields. One old-field stand showed a mean annual growth of 400 board feet per acre for 38 years. At the time of the study this stand tallied 16,000 board feet per acre.

TABLE 27.—*Percentage distribution of volume of saw timber and cordwood in farm wood lots, by species, 49 farms, 1928*

Species	Group A, 5 farms		Group B, 15 farms		Group C, 19 farms		Group D, 10 farms		Total, 49 farms	
	Saw timber	Cordwood	Saw timber	Cordwood	Saw timber	Cordwood	Saw timber	Cordwood	Saw timber	Cordwood
	Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
Beech	4.7	4.8	0.0	1.3	0.7	0.8	0.0	0.0	0.8	1.0
Chestnut	0	4.1	2.0	3.3	8.0	5.0	3.3	7.6	4.3	5.1
Gum	24.0	22.3	7.5	7.5	5.1	4.4	1.9	2.1	8.3	6.2
Hemlock	0	0	3.9	6.3	0	.5	4.5	3.8	2.7	3.6
Maple	8.0	21.7	5.3	14.5	1.2	6.7	6.3	2.9	4.7	9.6
White oak	20.8	15.4	22.5	25.2	23.1	20.4	24.0	28.6	23.0	24.3
Other oaks	21.3	17.6	28.2	18.6	41.2	37.3	17.2	19.6	27.6	23.3
Poplar	13.3	3.7	12.0	6.1	10.4	2.8	2.3	2.8	8.3	4.1
Sourwood	0	3.6	0	1.3	0	.9	0	1.4	0	1.4
Pine	3.1	0	15.0	9.7	8.2	14.2	38.9	19.6	20.2	13.1
Hickory	2.3	4.0	1.4	3.0	1.0	2.3	1.1	7.8	1.2	4.4
Birch	2.5	3.4	1.3	.5	.5	2.7	0.5	0	.9	1.1
Black walnut	0	0	0	0	.6	0	0	0	.2	0
Wahoo	0	0	0	0	0	0	0	2.4	0	.7
Sassafras	0	0	0	0	0	0	0	1.4	0	.5
Ash	0	0	0	.8	0	.9	0	0	0	.5
Dogwood	0	0	0	.4	0	.7	0	0	0	.3
Shadbush	0	0	0	0	0	.6	0	0	0	.2
Service	0	0	0	1.5	0	0	0	0	0	.6
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

An interesting feature of Table 27 is the tendency for the proportion of oak and pine in the stands to increase as the distance from the railroad point increases, indicating that variation in distance from market is probably the most significant factor affecting the present composition of stands. The other merchantable species making up these stands were generally inferior in quality. Scarlet oak was very wormy and showed rot, but this condition was less pronounced in swamps. Black oak was somewhat less defective. Chestnut blight was in evidence. As a rule, neither chestnut nor hemlock was of good quality.

Rot and limbiness were the usual defects reported to account for the inferior quality of the stands. Fire scars were reported in only a few instances, although some of the cases of rot reported were doubtless due to fire. None of these stands is fully stocked; hence the land is not being utilized to maximum capacity. One consequence is excessive limbiness and inferior quality of timber. Trees showing rot or other damage and species of inferior value should be culled from these stands to encourage restocking of sound trees of preferred species. Grazing should be controlled to permit full restocking of stands. Density of stands averaged about 0.7, although tracts in group C average 0.8. Limbiness was reported for a considerably smaller proportion of the acreage in this group.

Under present conditions natural reproduction does not appear to be increasing the density of stands. The nine tracts included in Group A showed an average density of 0.8 for the reproduction, but apparently considerable of the young growth was shaded out in the comparatively denser stands in Group C. The average density of reproduction of stands in this group was 0.6. The reproduction was reported as suppressed on a considerable proportion of the acreage falling in Groups B and C. Oak predominates among the species in the reproduction, with 28.5 per cent of the total, of which white oak makes up approximately 12 per cent. Red maple comprises 17.8 per cent of the reproduction, gum 13.3 per cent, of which 9.8 per cent

is black gum and 3.5 per cent is sweetgum. Such comparatively valuable species as pine, poplar, hickory, and chestnut comprise comparatively small proportions of the reproduction. (Table 28.)

TABLE 28.—*Percentage distribution of reproduction, by species, 1928*

Species	Group A, 5 farms	Group B, 15 farms	Group C, 10 farms	Group D, 10 farms	Total, 40 farms
	Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*
White oak	3.9	11.1	8.3	15.4	11.6
Black oak	5.8	7.4	8.0	5.5	6.7
Black and white oak [1]	0	0	.8	0	.2
Scarlet oak	1.6	2.9	7.6	7.4	5.5
Red oak	3.9	4.0	2.6	0	2.2
Chestnut oak	3.9	1.7	4.2	.0	2.1
Post oak	1.0	.3	.1	0	.2
Maple	18.8	18.3	9.6	21.8	17.8
Dogwood	4.5	6.6	8.4	12.6	9.1
Black gum	15.5	9.9	10.4	8.3	9.8
Sweetgum	18.8	5.2	1.7	0	3.5
Sourwood	4.2	9.6	7.9	6.8	7.8
Hickory	3.9	3.5	6.6	3.7	4.2
Chestnut	3.4	1.8	7.7	2.7	3.5
Pine	0	3.2	1.5	4.0	2.9
Sassafras	0	1.2	0	3.1	1.6
Poplar	1.3	2.0	2.5	.2	1.4
Black locust	1.8	.9	1.0	1.0	1.0
Hemlock	0	1.0	0	.6	.5
Shadbush	0	1.2	.1	0	.4
Birch	0	0	1.0	0	.3
Alder	0	.4	.1	0	.2
Miscellaneous [2]	7.7	7.8	9.3	6.0	7.5
Total	100.0	100.0	100.0	100.0	100.0

[1] Not separately recorded.

[2] Miscellaneous species, no one of which comprised more than one-tenth of 1 per cent of the reproduction on the 40 farms, included the following: Holly, magnolia, redbud, hornbeam, shingle, black walnut, ash, witch hazel, red cedar, cherry, and beech.

MARKET CONDITIONS AND STUMPAGE VALUES

The market for lumber in Laurel County is poor. Very little shipping is done, and local demand is slight. Some southern pine is shipped in. Stumpage prices were reported to average about $2.50 per thousand feet at points 10 to 15 miles from a railroad for mixed yellow poplar and white and red (including black and scarlet) oak. Logs have sold for $9 per thousand feet delivered at mill. Log-run yellow poplar lumber is quoted at $25 f. o. b. shipping point.

Ties are in very little demand and grading is strict. For both white oak and red oak the following prices are quoted: No. 5, $1 each; No. 4, 90 cents; No. 3, 70 cents; No. 2, 60 cents; No. 1, 40 cents. Switch ties bring $24 per thousand board feet.

Under present conditions mine timbers afford the best outlet for farm wood-lot products. Generally, all species, except poplar, basswood, and buckeye, are accepted for props, although some companies specify oak and chestnut. Props may be either round or split. The minimum size accepted is 16 square inches at the small end, and the maximum diameter is 10 inches. Lengths desired vary, depending upon the depth of the coal seam, but the range generally is from 5 to 8 feet. Props 6 feet in length would load about 800 to 1,000 in a 40-foot car and 45 props of average diameter would be required for a cord. From 15 to 25 props is a wagon load. Prices paid by local agents of mine companies range from 7 to 18 cents a prop, depending on size. Mine collars are 4 inches minimum diameter at the small end and are from 10 to 14 feet long. Some companies specify that collars must be flat on two sides. Generally, oak and chestnut are the only species accepted for collars. Local prices range from 20 to 60 cents. From 8 to 12 collars is a wagon load.

An abundant local supply of coal reduces the demand for cordwood both for farm use and for sale. In subsequent estimates cordwood is figured at $5 a cord, but the volume of sales is small.

A small quantity of pulpwood is shipped. The principal market, at present, is Kingsport, Tenn. All softwoods are accepted, but no pine or hemlock was reported shipped. Red maple supplies the bulk of the output, but other species included are black gum, sweetgum, and yellow poplar. Wood for pulp is cut in 5-foot lengths and must be peeled, but need not be split. Prices for a cord of 160 cubic feet ranged from $8 to $9, loaded. A small quantity of chestnut extract wood is also shipped at prices ranging about the same as for pulpwood.

Fence posts are in little demand, although a few purchases by farmers in the south area from farmers in the north area have occurred. White oak, post oak, and chestnut fence posts are priced at 15 to 25 cents each. Prices of black locust and red cedar posts range from 40 to 50 cents. Few sales are made at any price.

A few sales of tanbark were reported at $14 a cord (2,200 pounds). The quantities at present available are limited, as most of the chestnut oak trees in the area are small.

This brief summary indicates that the valuations in subsequent tables placed on farm wood lots, under present market conditions, relate more to the potential than to the current value of these stands. Although present markets are not favorable to extensive cuttings from understocked stands, particularly on tracts at a distance from a railroad point, there is an opportunity to cull less valuable trees and species with a view to improving the quality of stands and, except for the more isolated tracts, to cover or better than cover the costs involved in the operation.

The principal factor affecting the stumpage values of these farm wood lots is the distance to a railroad. Hauling costs are especially significant because of very poor roads. However, when farms are grouped by distance to railroad point, there is some difference also in the volume per acre between the different groups. This difference is especially pronounced in the case of Group B farms. On these the farm wood lots averaged 1,980 board feet per acre, whereas Group D farms, the next higher, averaged 2,492 board feet per acre (Table 26), a difference of over 500 board feet per acre.

By utilizing the data of Table 26, stumpage values were computed for farm wood lots in each group of farms. (Table 29.) Wood lots on farms in Group A are relatively accessible. The estimates for wood lots in this group are based on the assumption that a team hauling an average load could make four trips a day to the railroad point. The estimated stumpage value of saw timber for this group is $10.29 an acre, or $3.63 per 1,000 board feet. Tops and trees unfit for saw timber were tallied as cordwood. Cordwood was subdivided into timber fit for mine props and for pulpwood. According to these estimates, each acre of the farm wood lots in Group A contained on the average 2,835 board feet of saw timber, 151 mine props, 7 cords of pulpwood, and 0.5 cord of cordwood. If softwoods fit for mine props were utilized as such, the figure for mine props would be 332, and for pulpwood 0.7 cord. Only trees over 9 inches in diameter at breast height were tallied for saw timber. As pointed out previously, no market for cordwood exists, and the market for mine props and pulpwood is limited. It is probable, therefore, that stumpage values for these stands would average little, if any, over $10.29 an acre.

TABLE 29.—*Estimated value of stumpage of farm wood lots, based on volume per acre in 1928, by types of products, 49 farms*

SAW TIMBER

Group	Acreage[1]	Volume		Market value[2]		Total operating cost at—[3]			Value of stumpage estimated at—[4]					
									Maximum cost		Minimum cost		Average cost	
		Total	Per acre	Total	Per acre	Maximum rate	Minimum rate	Average rate	Total	Per acre	Total	Per acre	Total	Per acre
	Acres	*Board feet*	*Board feet*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*
A	94.5	267,950	2,835	5,359	57	3,931	2,725	3,328	338	3.58	1,605	16.98	972	10.29
B	450.0	890,910	1,980	17,818	40	13,560	9,551	11,555	610	1.36	4,819	10.71	2,715	6.03
C	334.0	890,500	2,666	17,810	53	14,542	10,535	12,538	−427	−1.28	3,780	11.32	1,677	5.02
D	425.5	1,060,400	2,492	21,208	50	20,858	16,086	18,472	−4,228	−9.94	783	1.84	−1,723	−4.05
Total or average	1,304.0	3,109,760	2,385	62,195	48	52,891	38,897	45,893	−3,707	−2.84	10,987	8.43	3,641	2.79

CORDWOOD (INCLUDING MINE PROPS AND PULPWOOD)

	Acres	*Cords*	*Cords*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*
A	94.5	1,150	12	5,750	61	4,600	3,450	4,025	102	2.03	1,342	14.20	767	8.12
B	458.0	5,499	12	27,000	59	25,218	19,818	22,518	−2,718	−5.93	2,682	5.86	−18	−.04
C	339.0	3,517	10	17,585	52	21,102	17,585	19,344	−6,448	−19.02	−2,931	−8.65	−4,690	−13.83
D	425.5	4,464	10	22,320	52	44,640	40,176	42,408	−26,040	−61.20	−21,576	−50.71	−23,808	−55.95
Total or average	1,317.0	14,531	11	72,655	55	95,560	81,029	88,295	−35,014	−26.59	−20,483	−15.55	−27,749	−21.07

In computing the stumpage value of saw timber, the total overhead cost was estimated at 5 per cent of the total operating cost.
A minus sign indicates a loss.

[1] The figures in this column apply only to the acreage of the given type of product, not to the entire acreage in woodland or in the several groups. The total woodland acreage was distributed as follows: Group A, 99 acres; Group B, 458 acres; Group C, 339 acres; Group D, 435 acres; total 1,331 acres.

[2] The following market prices, f. o. b. shipping point, were used: Lumber, $20 per 1,000 board feet; mine props, 12 cents each; pulpwood, $8 a cord (160 cubic feet); cordwood, $5 a cord.

[3] The following maximum, minimum, and average rates were used: Saw timber, per 1,000 board feet: Felling, $2, $1.50, and $1.75; skidding, $5, $3, and $4; sawing, $6, $4, and $5; pulpwood, per cord, cutting, $2, $1, and $1.50; mine props, per prop, cutting, 3 cents, 2 cents, and 2.5 cents. Hauling was figured at $4 a day for all products. Wagon load: Lumber, 600 board feet; mine props, 20 props; pulpwood and cordwood, 0.5 cord.

[4] Computed by the formula $S=\frac{M}{1+r}-C$, in which S=stumpage value, M=market price, C=operating costs, and r=rate of profit. The rate of profit assumed was 20 per cent.

TABLE 29.—*Estimated value of stumpage of farm wood lots, based on volume per acre in 1928, by types of products, 49 farms*—Continued

CORDWOOD (EXCLUDING MINE PROPS AND PULPWOOD)

Group	Acreage	Volume		Market value		Total operating cost at—			Value of stumpage estimated at—					
									Maximum cost		Minimum cost		Average cost	
		Total	Per acre	Total	Per acre	Maximum rate	Minimum rate	Average rate	Total	Per acre	Total	Per acre	Total	Per acre
	Acres	*Board feet*	*Board feet*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*
A	94.5	46	0.5	46	.49	184	138	161	−146	−1.54	−100	−1.06	−123	−1.30
B	458.0	377	.8	377	.82	1,761	1,384	1,572	−1,447	−3.16	−1,070	−2.34	−1,258	−2.75
C	339.0	191	.6	191	.56	1,146	955	1,050	−987	−2.91	−796	−2.35	−891	−2.63
D	425.5	582	1.4	582	1.37	5,820	5,238	5,529	−5,335	−12.54	−4,753	−11.17	−5,044	−11.85
Total or average	1,317.0	1,196	.9	1,196	.91	8,911	7,715	8,312	−7,914	−6.01	−6,718	−5.10	−7,315	−5.55

MINE PROPS

	Acres	*Number*	*Number*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*
A	94.5	31,350	332	3,762	40	2,508	2,191	2,351	627	6.63	941	9.96	784	8.30
B	438.5	147,646	337	17,718	40	14,322	12,845	13,583	443	1.01	1,920	4.38	1,182	2.70
C	332.0	91,356	275	10,963	33	11,876	10,963	11,420	−2,740	−8.25	−1,827	−5.50	−2,284	−6.88
D	425.5	133,145	313	15,977	38	30,623	29,292	29,958	−17,309	−40.68	−15,978	−37.55	−16,644	−39.12
Total or average	1,290.5	403,497	313	48,420	38	59,329	55,294	57,312	−18,979	−14.71	−14,944	−11.58	−16,962	−13.14

MINE PROPS (EXCLUDING SOFTWOODS)

A	94.5	14,277	151	1,713	18	1,142	999	1,071	286	3.03	429	4.54	357	3.78
B	438.5	86,911	198	10,429	24	8,430	7,561	7,996	261	.60	1,130	2.58	695	1.58
C	332.0	56,066	169	6,728	20	7,289	6,728	7,008	−1,682	−5.07	−1,121	−3.38	−1,401	−4.22
D	425.5	72,081	169	8,650	20	13,579	15,858	16,218	−9,371	−22.02	−8,650	−20.33	−9,010	−21.18
Total or average	1,290.5	229,335	178	27,520	21	33,440	31,146	32,293	−10,507	−8.14	−8,213	−6.36	−9,360	−7.25

PULPWOOD

	Acres	Cords	Cords	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
A	96.5	645	7	5,160	53	2,580	1,935	2,258	1,720	17.82	2,365	24.51	2,042	21.16
B	452.5	2,690	6	21,592	48	12,604	9,905	11,255	5,389	11.90	8,088	17.87	6,738	14.89
C	339.0	1,074	3	8,592	25	6,444	5,370	5,907	716	2.11	1,790	5.28	1,253	3.70
D	425.5	2,010	5	16,080	38	20,100	18,090	19,095	−6,700	−15.75	−4,690	−11.02	−5,695	−13.38
Total or average	1,313.5	6,428	5	51,424	39	41,728	35,300	38,515	1,125	.86	7,553	5.75	4,338	3.30

PULPWOOD (EXCLUDING SOFTWOODS FIT FOR MINE PROPS)

A	96.5	70	0.7	560	6	280	210	245	187	1.94	257	2.66	222	2.30
B	452.5	268	.6	2,304	5	1,345	1,057	1,201	575	1.27	863	1.91	719	1.59
C	339.0	119	.4	952	3	714	595	654	79	.23	198	.58	139	.41
D	425.5	153	.4	1,224	3	1,530	1,377	1,454	−510	−1.20	−357	−.84	−434	−1.02
Total or average	1,313.5	630	.5	5,040	4	3,869	3,239	3,554	331	.25	961	.73	646	.49

Figures for farms in Groups B, C, and D were computed on the same basis as the figures for farms in Group A. Stumpage values average $6.03 an acre, or $3.05 per 1,000 board feet for stands in Group B, and $5.02 an acre, or $1.88 per 1,000 board feet, for stands in Group C. At present prices, mine props can not be profitably marketed from tracts that permit less than three trips a day. One farmer stated that less than four trips a day was unprofitable for the sale of mine props. Conditions vary, of course, between individual farms.

The farm wood lots in Group D are so distant from a shipping point that only one trip a day could be counted on. The timber stands on those wood lots show a higher volume per acre than the stands on farms in Group B. Yet the excessive cost of hauling so increases the operating costs that average stumpage values are negative. On the assumption of minimum operating costs, stumpage values on these tracts amount only to $1.84 an acre or 74 cents per 1,000 board feet.

For the 49 farms, stumpage values average $2.79 an acre or $1.17 per 1,000 board feet, If full allowance were made for the sale of pulpwood in addition to saw timber, the average value per acre of these stands would amount to $6.09.

PRESENT METHODS OF UTILIZATION]

Most of the farm wood-lot stands are remnants of original growth following partial or selective cutting. Farmers were unable to give a systematic account of cuttings on these tracts, but data were obtained from 42 tracts, which, although incomplete, offer some suggestions as to the type of utilization of farm wood lots and wood-lot products. Minimum diameters of saw timber reported cut from 12 tracts in various years between 1881 and 1910 declined from 18 inches in the first decade to 10 inches in the last decade of the period, indicating a tendency towards heavier culling of these tracts. Nine tracts reported cuttings during the period 1911–1915. Four thousand board feet for home use were reported cut to a minimum diameter of 14 inches from one tract of 15 acres. Pine and oak for lumber and ties were reported cut from five tracts totaling 148 acres. This lumber averaged $15.50 a thousand at the mill. There were 576 ties reported cut from these tracts, of which 476 sold at prices averaging 45 cents, and 100 at prices averaging 88 cents.

Reports covering the last 20 years indicate that an increasing proportion of timber goes into ties, but the volume of sales both for ties and lumber has been small. Small quantities of custom-sawed lumber are also reported cut for farm use. The sale of mine props was not reported for any tract prior to 1926. Reports covering the 3-year period 1926–1928 included five tracts totaling 50 acres, from which 3,050 props were sold at prices averaging 13 cents. Three of these tracts reported minimum diameters as 8 inches, and one reported 10 inches. Posts cut for sale were reported by six tracts for the period 1921–1925 and by three tracts for the period 1926–1928 at prices averaging 18 cents in the earlier period and 20 cents in the later. In most cases reported, small trees were cut for props, but in a few instances 10-inch trees and larger were felled and split. No firewood was reported cut for sale and very little for farm use. Data in

regard to species reported utilized for various products appear in Figure 6.

The fact that comparatively little timber is cut for farm use limited the number of records that could be obtained of labor costs involved in cutting, skidding, and hauling farm-used products of the farm wood lot. Money costs computed from a record of labor hours for cutting timber for farm use are necessarily arbitrary in any event. This work is generally done at a time when opportunities for alternative employment of the farmers' labor are at a minimum. Assuming, however, a rate of 20 cents an hour for man labor and 10 cents an hour for horse work, rates commonly quoted for this type of work, the few records obtained indicate that from 5 to 6 cents a post will cover the cost of cutting and hauling posts for farm use. Cordwood cut for farm use averages $2.90 a cord on the same basis. The

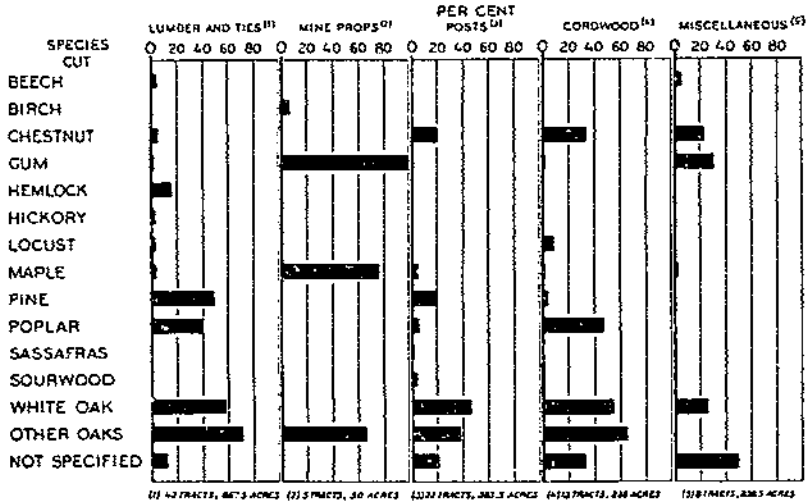


FIGURE 6.—RATIO OF ACREAGE IN TRACTS FROM WHICH A SPECIES WAS CUT FOR SPECIFIED PRODUCTS TO ACREAGE IN ALL TRACTS FROM WHICH THE PRODUCT WAS CUT

Oak, pine, poplar, and hemlock are the species principally cut from farm wood lots for saw timber and ties. Inferior species such as gum, maple, black oak, and scarlet oak go principally into mine props. Rot-resistant species, particularly white oak and post oak, are utilized for posts. Chestnut, gum, and white oak enter into miscellaneous products such as tanbark, extract wood, pulpwood, and staves. Cordwood usually is a by-product of other uses.

records gave a figure of $5.40 a thousand board feet for cutting, skidding, and hauling saw timber for farm use. This appears low when compared with similar figures reported for timber cut for sale, but it is probable that logs cut for farm use can be obtained in sufficient quantity close to the loading point, thus materially reducing the labor of skidding.

These scattered records indicate that farm wood lots have not been utilized to any great extent, if at all, as an established farm enterprise from which a regular income might be derived. So far as the recollection of present farm operators serves as an index of the character and amount of the farm income derived from this source, it would be correct to say that for decades cuttings have been unsystematic and irregular, depending as a rule on the initiative of small sawmill operators who desired to exploit an especially accessible

or valuable tract or on the urgency of the operator's need for ready cash due to special circumstances or conditions. Naturally, the income derived from farm wood lots under these conditions has been neither regular in character nor significant in amount when considered over a period of years.

Instances were reported in which farm operators had more than paid for a tract of land by the sale of the saw timber from a timbered portion of the area purchased. Such instances do not indicate ignorance either of seller or buyer of the potential value of the timber, but in general, markets for timber are so limited and the need for cleared land for crops is so pronounced, that seller and buyer alike are apt to value land in terms of agricultural use. Farmers were often heard to express the view that a hillside already showing a thrifty growth of valuable species 6 to 8 inches in diameter ought to be cleared. The timber was regarded as a liability. It was not needed for home use. Current market conditions suggested no potential and realizable value. But cleared land has a "home use" and a sale value which is immediate, tangible, and realizable from the point of view of the farm operator.

The present study has sufficiently demonstrated the futility of exhaustive cropping, abandonment, and reclearing of fields. The introduction of profitable methods of management and utilization of farm wood lots would do much to justify to the farmer the abandonment of this wasteful process of land use. The data of Table 29 show that timber products can not be marketed profitably at present prices from the less accessible locations. These small tracts would not permit operations on a scale large enough to prove profitable. But the same conditions which make profitable utilization of farm wood lots impossible also operate to inhibit the use of the land for farming. The principal factor is lack of a good road. Markets for products from isolated farms are poor, whether the product comes from the field or the wood lot.

These isolated and so-called self-sufficing farms exist simply because corn and potatoes can be eaten, whereas trees can not. There is no cash market for any crop. The land in these isolated farms is seldom adapted to the growing of cultivated crops. It is forest land. Land of this type and location, if consolidated under private or public ownership into tracts sufficiently large and properly managed, may be economically used to produce timber crops. It is not adapted to the production of corn.

It remains true, nevertheless, that many farms now producing high farm incomes, relative to farms closer to a railroad point, are included among those which can not profitably market farm wood-lot products. For example, farm incomes of farms in Group C average higher than those of farms in Group B. These relatively high farm incomes are usually associated with favorable land characteristics, which offset, in part, the disadvantages of location. Clearly, however, a sound plan of farm organization under conditions confronting farmers in Laurel County must include economical management and utilization of farm wood lots in combination with improved practices in the utilization of land for crops and pasture.

The first consideration in the development of such a plan is to determine the areas in which primary land characteristics are such as to afford a basis for farming. The important problem then is to

determine the methods of land utilization essential to successful farming within these areas. Finally, the conditions corollary to these adjustments such as the extension and improvement of roads, improvements in methods of marketing, etc., must be pointed out. The central thought is the development of efficient farm units, based on the most advantageous use of all the resources of the farm, as the foundation for wholesome family and community life and the maintenance of essential public utilities and services. The data presented in the preceding sections of this bulletin have been designed to provide a basis for these concluding phases of the discussion.

FARM ORGANIZATION IN RELATION TO LAND CHARACTERISTICS

A farm-business analysis of 203 farms[18] shows a wide variation in farm income and in farm organization among these farms. In some respects farms in the south area exhibit characteristics differing in kind or degree from farms in the north area. The present purpose is to relate these differences between farms and between areas to land characteristics with a view to determining their implications and importance from the standpoint of land utilization.

SIZE OF FARMS AND GEOLOGICAL FORMATIONS

Farm income normally bears a direct relation to the number of crop acres in the farm. The number of crop acres in a farm is, therefore, frequently used as a measure of the size of the farm business. But merely to show that an increase in the number of crop acres per farm is attended, on the average, by an increase in farm income of the 203 farms obviously fails to touch certain important questions of farm economy in Laurel County. In the forefront of this problem of the size of farms is the question whether land characteristics permit any significant expansion in the number of crop acres. Where are the relatively small farms as measured by the number of crop acres located? With what land characteristics are these small farms associated?

For the present purpose the factors involved in the location include the area in which the farm is situated, the geological structure from which the soil is principally derived, and the general topographic characteristics and condition of the land. In Table 30 the 83 farms in the south area and the 120 farms in the north area are grouped by number of crop acres, and the percentage of the farms located on each type of geological formation is shown for each crop-acreage group. The fact is at once noted that in the south area the percentage of farms located on the Breathitt formation increases as the number of crop acres increases, whereas in the north area this relationship is inverse. Since in the south area only the Breathitt and Corbin formations are exposed and in the north area only the Breathitt and the Lee formations,[19] it follows that the proportion of farms located on the Corbin conglomerate (south area) decreases as the crop acreage increases, whereas the proportion of farms located on the Lee formation (north area) tends to increase as the number of crop acres increases.

[18] Details of this phase of the Laurel County study appear in Kentucky Agricultural Experiment Station Bulletin No. 305 (9).

[19] The area of the Corbin conglomerate in the north area is too limited to be of significance.

TABLE 30.—*Farms in each crop-acreage group classified by type of geological formation on which the farms were located, 203 farms,[1] 1927*

Size group (crop acres)	Farms	North area				South area		
		Farms	Percentage on Breathitt formation	Percentage on Corbin conglomerate	Percentage on Lee formation	Farms	Percentage on Breathitt formation	Percentage on Corbin conglomerate
	Number	*Number*	*Per cent*	*Per cent*	*Per cent*	*Number*	*Per cent*	*Per cent*
15 or less	40	20	95.0	5.0	0.0	20	55.0	45.0
16–30	86	56	89.3	0	10.7	30	63.3	36.7
31–45	52	31	71.0	3.2	25.8	21	66.7	33.3
Over 45	25	13	61.5	0	38.5	12	75.0	25.0
Total or average	203	120	82.5	1.7	15.8	83	63.9	36.1

[1] Farm-business and family-living summaries are based on records obtained from these farms. The 203 farms include all but 1 of the 52 farms for which detailed data relating to the use of crop and pasture land were obtained.

The importance of these relationships is that soil and topographic characteristics limiting the size of farms are associated with the geological structure on which farms are located. The topographic and soil characteristics of the Corbin conglomerate generally require small farms and the incomes derived directly from the farm are, therefore, usually small. In the north area, the Lee formation, both from the standpoint of soil and topography, is adapted to a larger crop acreage and to the production of a relatively large farm income. The impediments to successful cultivation offered by the Breathitt formation are chiefly topographic. This factor is more pronounced in the north than in the south area, so that a larger proportion of the farms located on the Breathitt formation fall in the larger crop-acreage groups in the south area than in the north area. Table 31 shows the distribution. In the north area only 8.1 per cent of the farms located on the Breathitt formation have over 45 crop acres, whereas 26.3 per cent of the farms located on the Lee formation fall in this class. More than two-thirds of the farms on the Lee formation had over 30 crop acres, whereas two-thirds of the farms on the Corbin conglomerate (south area) had only 30 crop acres or less. Three farms located on the Corbin conglomerate, south area, contained however, 45 crop acres or more (Table 31) and, moreover, the average income obtained from these farms was comparatively high. (Table 32.)

TABLE 31.—*Farms located on each type of geological formation, distributed by crop acreage, 203 farms, 1927*

Area and formation	Farms	Percentage of farms with crop acreage of—				Total
		15 or less	16 to 30	31 to 45	Over 45	
	Number	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
North area:						
Breathitt	99	19.2	56.5	22.2	8.1	100
Corbin	2	50.0	0	50.0	0	100
Lee	19	0	31.6	42.1	26.3	100
South area:						
Breathitt	53	20.8	35.8	26.4	17.0	100
Corbin	30	30.0	36.7	23.3	[1] 10.0	100
Total or average	203	19.7	42.4	25.6	12.3	100

[1] See text, p. 60.

TABLE 32.—*Average farm income by location of farms, geological formation, and crop acreage, 208 farms, 1927*

Location and formation	15 acres or less			16–30 acres			31–45 acres		
	Farms	Farm income [1]		Farms	Farm income [1]		Farms	Farm income [1]	
		Total	Directly from the farm		Total	Directly from the farm		Total	Directly from the farm
North area:	*Number*	*Dollars*	*Dollars*	*Number*	*Dollars*	*Dollars*	*Number*	*Dollars*	*Dollars*
Breathitt	10	149	30	50	257	155	22	331	155
Corbin	1	208	−77				1	−19	−19
Lee				6	410	388	8	463	312
South area:									
Breathitt	11	317	−62	19	288	33	14	332	101
Corbin	9	216	−46	11	164	−12	7	195	−54
Total or average	40	352	−15	86	262	123	52	327	157

Location and formation	Over 45 acres			Total		
	Farms	Farm income [1]		Farms	Farm income [1]	
		Total	Directly from the farm		Total	Directly from the farm
North area:	*Number*	*Dollars*	*Dollars*	*Number*	*Dollars*	*Dollars*
Breathitt	8	564	430	90	277	154
Corbin				2	140	−48
Lee	5	527	480	19	404	380
South area:						
Breathitt	0	558	198	53	455	83
Corbin	3	[2] 543	[2] 459	30	225	15
Total or average	25	552	362	208	332	134

A minus sign indicates a loss.

[1] Obtained by subtracting total farm expenses from total farm receipts. The figure for income obtained directly from the farm was computed by deducting from the total farm income, cash received by the operator for man and team labor and machine work away from the farm, rent of land and buildings, sale of honey, lumber, wood, and similar products. The principal source of such income was from the labor of the operator away from the farm, usually in occupations other than farming.

[2] See text, p. 60.

The acreage in one of these farms included 33 crop acres share rented, leaving only 28 crop acres definitely located on the Corbin conglomerate. A second farm, although located on the Corbin conglomerate, was exceptional in two respects: (1) An unusually large area of level or gently rolling land was available for cropping; and (2) a considerable acreage of truck crops was grown and sold, thus giving a relatively high cash income for the farm. The relatively high farm incomes of these two farms can not be accepted as typical of farms located on the Corbin conglomerate.

Both as to land characteristics and as to farm income, the third farm is more in line with other farms on the Corbin conglomerate. More than two-thirds of the crop land in this farm was rolling to rough or steep hillside, with slopes from 10 to 20 per cent. Fields were heavily eroded and often infested with sprouts and weeds. This farm produced a farm income of $188, which, after deducting income for labor off the farm, was reduced to −$12. On the other two farms, farm income averaged $720. When income from labor off the farm was deducted, the two farms averaged $695.

These relationships suggest, at least as a preliminary conclusion, that farms located on the Lee formation or on the less rugged portions of the Breathitt formation will, as a rule, yield a much better return than farms located on the Corbin conglomerate. If additional facts support this preliminary conclusion, a fair basis will be established for a generalized classification of all the land in Laurel County, so far as its relative agricultural possibilities are concerned.

SIZE OF FARMS AND LAND CHARACTERISTICS

Of the 52 farms studied by individual fields, 51 are included in the group of 203 farms covered by the data of the farm-business analysis. These 51 farms provide a basis for estimating the importance of land characteristics in determining the crop acreage of farms located on each type of geological formation. (Table 33.)

TABLE 33.—*Percentage of crop land in each class of land, by location, geological formation, and crop acreage, 51 farms, 1927*

Location, formation, and size group (crop acres)	Farms	Percentage of crop land in—											Total
		Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	Class 7	Class 8	Class 9	Class 10	Class 11	
North area:	*No.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
Breathitt—													
15 or less													
16–30	10	10.0	13.0	9.4	2.6	3.1	3.5	8.3	10.3	37.6	2.2	.....	100
31–45	8	2.2	15.0	.8	2.8	2.4	7.5	14.8	11.2	37.4	5.0	.....	100
Over 45	5	14.1	8.7	.....	.8	1.9	1.5	.....	53.5	13.3	6.2	.....	100
Total	23	8.4	12.4	3.4	2.1	2.5	4.3	8.1	23.9	30.1	4.8	.....	100
Lee—													
15 or less													
16–30	1	34.4	.....	.....	.....	.....	13.5	.....	.....	46.9	.....	5.2	100
31–45	2	.8	6.7	.....	.....	12.3	.....	18.9	11.1	36.8	13.4	.....	100
Over 45	3	28.6	9.7	.6	.....	11.3	1.2	13.4	7.7	14.3	13.2	.....	100
Total	6	21.4	7.3	.3	.....	9.8	2.8	12.9	7.5	26.0	11.2	.8	100
Total	29	11.9	11.0	2.6	1.5	4.5	3.9	9.4	19.5	29.0	6.5	.2	100
South area:													
Breathitt—													
15 or less[1]	1	2.0	49.0	30.6	.....	18.4	.....	.....	.....	.....	.....	.....	100
16–30	4	5.5	14.0	17.4	.....	7.4	1.6	28.0	6.3	14.5	3.5	.....	100
31–45	6	36.0	33.4	1.2	.....	2.1	1.5	24.2	.....	1.6	.....	.....	100
Over 45	5	23.1	22.6	15.9	.....	13.5	5.3	15.4	1.4	2.1	.7	.....	100
Total	16	23.6	26.0	11.5	.....	8.4	3.0	20.5	1.8	4.2	1.0	.....	100
Corbin—													
15 or less													
16–30	3	30.3	31.9	3.2	.....	22.2	10.3	.....	.....	2.1	.....	.....	100
31–45	2	28.7	35.0	26.7	0.4	1.0	1.6	.....	.....	.....	.....	.....	100
Over 45	1	20.8	.....	7.5	.....	.....	.....	67.9	.....	3.8	.....	.....	100
Total	6	27.5	25.5	3.1	9.3	11.5	4.8	16.5	.....	1.8	.....	.....	100
Total	22	24.6	25.9	9.4	2.3	9.2	3.5	19.5	1.3	3.6	.7	.....	100
Both areas:													
15 or less	1	2.0	49.0	30.6	.....	18.4	.....	.....	.....	.....	.....	.....	100
16–30	18	14.6	15.6	9.4	1.3	7.2	5.1	11.0	6.6	26.8	1.9	.5	100
31–45	18	16.3	22.4	.8	4.1	4.0	3.9	17.0	6.2	21.1	4.2	.....	100
Over 45	14	21.1	13.5	6.6	.3	8.2	2.7	13.4	20.2	8.7	5.3	.....	100
Total	51	17.5	17.6	5.6	1.9	6.6	3.7	13.9	11.5	17.7	3.9	.1	100

[1] The single farm included in this group was not operated. The farmer spent 10 months in work off the farm. Consequently, the small crop acreage is not associated with the land characteristics.

In the south area most of the crop land of the Breathitt formation has a slope under 10 per cent. (Classes 1 to 6.) Land in class 7 is of intermediate slope but is heavily eroded and of little use for crops. Class 3 land also, although smooth to rolling, is badly eroded and practically valueless for cropping in its present condition. Farms in the south area located on the Breathitt formation containing over 30 crop acres had a relatively large proportion of crop land in class 1. This is smooth to slightly rolling land. There is little or no erosion, and fields are practically free of stumps and stones.

Farms in the south area located along the Breathitt formation ridges have, as a rule, sufficient land of gentle slope to maintain 30 acres or more in crops. Better cropping practices would easily increase the quantity and improve the quality of available crop land by preventing the loss of fields through erosion, as in classes 3 and 7.

Farms in the south area located on the Corbin formation present a somewhat different picture. Unfortunately, no records of land characteristics were obtained for farms of this group having 15 crop acres or less. From the standpoint of slope and topography, fields on these Corbin formation bottoms are well adapted to cultivation, but this advantage is more than offset by three decisive limitations: (1) Along the margins of the exposed Corbin formation, where the Breathitt formation has been removed, the topography is likely to be precipitous, tending to limit the farm area and to isolate the farm; (2) a considerable portion of the land available for crops requires drainage; and (3) the light, sandy soils derived from the Corbin formation are not, in general, adapted to agriculture.

In the north area a large proportion of the land in farms on the Breathitt formation has steep slopes. A relatively large crop acreage usually necessitates, therefore, the utilization of hillsides with slope of 20 per cent or more. The control of erosion and of filth on these steep slopes is the primary problem in keeping a considerable acreage in crops. On a majority of the farms the operators have not solved this problem, as indicated by the fact that 70 per cent of these farms had 30 crop acres or less. (Table 31.)

The problem centers about the utilization of land of the type in classes 8 and 9. (Table 5.) On farms with more than 45 crop acres nearly three-fourths of the crop land had a slope of 20 per cent and over. (Classes 8 to 10.) But on over 50 per cent of the crop land (Class 8) in farms having more than 45 crop acres erosion is very slight, fields are relatively free of stones, filth has been effectively controlled, and good stands of grass are maintained. As the acreage of crop land decreases there is also a decrease in the proportion of class 8 land and an increase in the proportion of class 9 land—that is, failure to control erosion and filth has resulted in a loss of acreage available for crops.

Nevertheless, the successful utilization of hillside lands is contingent on a combination with land of more moderate slope in the farm acreage. Farms of 16 to 30 crop acres located on the Breathitt formation in the north area have a relatively small crop acreage principally because of failure to control erosion. Land in classes 2 and 3, amounting to more than 20 per cent of the crop land in these farms, illustrates the progress of erosion on fields of gentle slope. Farms in the 31 to 45 crop-acreage group exhibit the same tendency. Fields of intermediate slope (class 7) have been overcropped, as has

been the case, also, with fields of gentle slope until nearly all of this latter type of land has fallen into class 2.

It is possible, therefore, at this point to amplify the picture of the cycle of land utilization previously presented, to include the farm unit. The wasteful methods of utilizing land, previously described, tend slowly to reduce the crop acreage in the farm until its productive capacity is practically destroyed. In terms of family welfare, the result of this process has often been that the son began, not where the father left off, not even where the father began, but actually under a greater handicap through the progressive "mining" to which the land had been subjected.

The limitations imposed on farms located on the Breathitt formation by the necessity of utilizing steep slopes for crop land is less significant for farms located on the Lee formation. Farms located along the Lee formation bottoms have the double advantage of superior soils and of favorable topography. Less than one-third of the crop land of farms on the Breathitt formation has a slope under 10 per cent, whereas in farms on the Lee formation the proportion is over one-half. Moreover, poorly drained land in classes 5 and 6 is of special significance in the case of farms on the Lee formation bottoms. This land produces good yields of hay and is much valued by farmers. Among farms of this group the tendency is for the crop acreage to decline as the proportion of hillside crop land in the farm increases. Of course, the problem of controlling erosion and filth is much simpler with a relatively small proportion of hillside land in crops. Under these conditions, therefore, it is much easier to maintain a relatively large crop acreage.

Taking the several crop-acreage groups without regard to the location of farms, the figures indicate a pronounced tendency for the proportion of the poorly conditioned and heavily eroded hillside crop land (class 9) to decline as the crop acreage per farm increases. Conversely, there is a much larger proportion of the well-conditioned hillside land (class 8) in farms with 45 crop acres and over than in farms with smaller crop acreages. The proportion of class 1 crop land also tends to increase with an increase in the crop acreage.

In general, the situation in the south area may be summarized as follows: (1) Farms on the Breathitt formation must utilize a considerable amount of land of intermediate slope (class 7) as crop land; the rapid erosion of these fields introduces a serious difficulty in maintaining an adequate crop acreage; this problem of erosion control is simplified when a considerable acreage of level or gently rolling land (classes 1 to 6) is embraced by the farm, and if such land is not available the crop acreage must (as a rule) necessarily be small; but even with such land many fields are overcropped (class 2 and especially class 3 land) thus reducing the quantity and quality of the crop land available; (2) farms on the Corbin conglomerate have the double handicap of poor soil and poor drainage; the extent of crop land available is usually small.

In the north area, (1) farms on the Breathitt formation must, as a rule, control erosion and filth on steep, hillside fields in order to maintain an adequate crop acreage; to accomplish this a considerable proportion of ridge land of gentle slope must be included in the farm acreage; (2) farms on the Lee formation are able to maintain relatively large crop acreages, although better control of erosion on the hillsides,

and ditch or tile drainage of the bottoms are greatly needed on these farms.

SIZE OF FARMS AND LAND CHARACTERISTICS IN RELATION TO FARM INCOME

Forty farms having 15 crop acres or less had an average farm income of $352 per farm; 86 farms with 16 to 30 crop acres averaged only $262 per farm, and 52 farms with 31 to 45 crop acres averaged $327—an amount less in each case than that averaged by farms in the lowest crop-acreage group. (Table 32.) But when there is deducted from the net farm income the income derived from other sources,[20] the essential fact appears that the larger the crop acreage the nearer the farm as such comes to returning a living to the operator.

Table 32 shows that work off the farm accounts for a much larger proportion of the income of operators in the south area than in the north area. The question is whether this difference is due to easier access to sources of outside work in London and Corbin from farms in the south area or to poorer opportunities for successful farming in the south area. Topographically, farms in the south area are better adapted to farming than are those in the north area. On the other hand, small incomes derived from farms on the Corbin conglomerate in the south area appear to be due to relative deficiency of the land compared with land on the ridges and moderate slopes of the Breathitt formation and with the land of the Lee formation bottoms.

In general, it appears to be true that farms with less than 45 acres of land suitable for crops, except those located on the Lee formation, whether in the south or the north area, must rely on work off the farm for a considerable portion of the farm income. Incomes earned in the south area indicate that a small crop acreage combined with earnings off the farm as a principal source of income gives a better total net return than a somewhat larger crop acreage with a smaller proportion of the income from work off the farm.

Land characteristics are the principal factor limiting the crop acreage. When the available crop acreage is thus limited, work off the farm is essential to obtain an income adequate for the elementary needs of living. The combination of soil deficiency and unfavorable topography undoubtedly would eliminate a considerable number of the farms in both areas as submarginal even under favorable conditions of farm organization and management.[21]

Some operators now maintaining a fairly large crop acreage, much of it on steep, heavily eroded, overcropped land, would do better to spend all or a major part of their time in other employment, utilizing the farm principally as a residence and garden. Some farms with small acreages but favorable land characteristics would justify an expansion of the crop acreage sufficiently to employ all or a major part of the time of the operator. To obtain an adequate income from the farm, it is apparently essential to have at least 30 to 50 acres of crop land. The smaller the acreage, the greater the proportion of it that must be of gentle slope, relatively free from erosion, and in good tilth (class 1) or land not too wet to produce good crops of hay and

[20] Table 32, footnote 1.

[21] The average net farm income of 90 farm operators who depended mainly upon farming for a livelihood was $319 (9, p. 234). Dependence on the farm as the principal source of income is not, however, necessarily confined to farms having favorable land characteristics. Neither is a large crop acreage always directly associated with favorable land characteristics.

fair crops of corn (class 5). Drainage would increase the amount and improve the quality of available crop land on many farms. The inclusion of heavily eroded and poorly conditioned land of gentle slope (class 3) or of intermediate slope (class 7) in itself suggests either unsound cropping practices or an inadequate amount of level or gently rolling land. In the former case, there is no substitute for the introduction of a good rotation, based on a proper selection of crops and the use of fertilizer, to conserve and build up the soil as a means of obtaining an adequate income from the farm. In the latter case, except for possible use as a residence and garden site, the land is definitely submarginal for farming.

No exact line exists for classifying a given farm as above or below the margin of profitable farming, but definite criteria can be applied. Less than 30 crop acres are not likely to yield adequate income under the type of farming suitable for Laurel County. In view of the limited amount of available crop land, if less than 30 per cent of it is of the type falling in classes 1 or 5, or in these two classes combined, if the land with slopes of 20 per cent and over comprised in the crop acreage is not of the type falling in class 8, the farm may rather safely be regarded as submarginal.

It is true that some farms classed as submarginal might be reclaimed by restoring the fertility and conserving the soil of slightly eroded fields (class 2), by redeeming heavily eroded and filth-infested fields (class 3), by establishing permanent pastures on eroded hillsides (class 9), and by draining and utilizing available stretches of bottom land (class 6). Most land in Laurel County that is worth farming can be effectively utilized for that purpose by the relatively simple expedients of properly combining enterprises, using limestone and phosphates, draining wet fields, protecting hillsides from erosion by keeping them in grass and rotating crops.[22]

In addition to the criteria mentioned, it should be added that the soils of the Corbin conglomerate because of their light, sandy character and deficiency of organic matter impose a special difficulty in the successful operation of farms located on this formation. This relative deficiency was reflected to some degree in the average yields of corn obtained from farms located on the Corbin conglomerate compared with average yields obtained from farms located on other formations. For farms in the south area, the average yield on the Corbin formation was 19 bushels, as compared with 21.6 bushels on the Breathitt formation. Farms on the Lee formation in the north area had an average yield of 20.4 bushels, but yields on the steep Breathitt formation slopes in the north area averaged only 19.2 bushels. On the basis of slope and stoniness farms on the Corbin conglomerate compare rather favorably with farms in other locations, although on these farms, as is also true of farms on the Lee formation, poorly drained land usually comprises a considerable proportion of the crop acreage.

VALUE OF CROP LAND IN RELATION TO LAND CHARACTERISTICS

On each of the 52 farms studied in detail an attempt was made to obtain the operator's estimate of the value of individual fields. The aim was to test whether the operators' valuations would bear any relation to the physical descriptions of corresponding fields and to the

[22] The matter of farm budgets is discussed in Kentucky Experiment Station Bulletin 305 (9).

yields obtained from them. Notwithstanding an obvious tendency of operators to value all crop land in the farm at the same price per acre, the wide range in the utility of fields was recognized by operators and is reflected to some extent in the estimated values per acre.

The estimates obtained for fields in each land class were grouped according to the geological formation on which the farm was located and then averaged. The results appear in Table 34. Average values conform, in general, to the relative utility of fields as reflected by the physical description of land in the several classes. Average values of class 1 land are highest no matter on what formation the farm is located. The scarcity of level or bottom land is reflected in high average values for land in classes 5 and 6. From the standpoint of its productive capacity, this type of land is overvalued, particularly so in the case of land in class 6. Crop land in farms in the south area tends to be valued at a higher figure than is land of similar characteristics in the north area. This indicates an effect of proximity to London and to the State highway. The relatively high productive capacity of the Lee formation bottoms is reflected in a high reported value of class 1 land for farms located on the Lee formation.

TABLE 34.—*Average value per acre of crop land, based on operators' estimates, by geological formations and classes of land, 52 farms, 1928*

Class of land	Value per acre, north area			Value per acre, south area			Average
	Breathitt formation	Lee formation	Average	Breathitt formation	Corbin formation	Average	
	Dollars	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*
1	45	83	61	61	57	60	61
2	23	28	26	53	39	49	40
3	17	15	17	28	25	28	25
4	14	.....	14	.....	20	20	17
5	16	13	13	31	38	33	20
6	19	19	19	62	37	48	25
7	18	18	18	18	18	18	18
8	27	0	25	12	.....	12	24
9	12	9	11	14	15	14	11
10	23	16	18	16	.....	16	18
Average	25	22	23	39	38	39	20

SOURCES AND VALUE OF THE FAMILY LIVING IN RELATION TO LAND CHARACTERISTICS

VALUE OF FAMILY LIVING

Family living data were also summarized for the 83 farms located in the south area and the 120 farms located in the north area for which the farm-business data were obtained. The total value of the family consumption of goods, including value of products furnished by the farm, was less than $900 for 165, or 81.3 per cent, of these families. Only four families, or 2 per cent, consumed goods valued at $1,500 or more. The range in the value of the family living for all families was from $214 to $1,946. The proportion of families consuming goods valued at $900 and over was much greater in the south area than in the north area, amounting to 30.1 per cent in the former and to 10.8 per cent in the latter. (Table 35.)

TABLE 35.—*Number and percentage of families in each cost-of-living group, by areas, 203 families, 1927*

Cost-of-living group	North area		South area		Both areas	
	Number	*Per cent*	*Number*	*Per cent*	*Number*	*Per cent*
Less than $600	61	50.9	30	36.2	91	44.8
$600–$899	46	38.3	28	33.7	74	36.5
$900–$1,199	10	8.3	16	19.3	26	12.8
$1,200 and over [1]	3	2.5	9	10.8	12	5.9
Total	120	100.0	83	100.0	203	100.0

[1] Includes four families over $1,500.

SOURCES OF INCOME

The relatively higher value of the family consumption of goods by families residing in the south area than by families residing in the north area should be considered in relation to the difference in the sources of income of operators in the two localities. Only one-third of the farm operators in the south area depend mainly on farming for a living, in contrast to one-half of the operators in the north area. (Group A, Table 36.) In the north area, also, a larger proportion of the operators derived their incomes principally from their own labor than was the case in the south area.

TABLE 36.—*Location and size of farms in relation to sources and value of the family living, 203 farms, 1927*

Area, formation, and size group (crop acres)	Farms	Percentage distribution of farms in [1]—				Total value of goods consumed	Income directly from the farm [2]	Farm income [2]
		Group A	Group B	Group C	Total			
	Number	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Dollars*	*Dollars*	*Dollars*
North area	120	51.7	18.3	30.0	100.0	609	186	305
South area	83	33.7	22.9	43.4	100.0	805	58	372
North area:								
Breathitt—								
15 or less	19	26.3	21.1	52.6	100.0	446	30	149
16–30	50	50.0	20.0	30.0	100.0	576	155	257
31–45	22	63.7	13.6	22.7	100.0	667	155	331
Over 45	8	50.0	12.5	37.5	100.0	935	436	564
Total	99	48.5	18.2	33.3	100.0	600	154	277
Corbin—								
15 or less	1			100.0	100.0	616	−77	298
16–30								
31–45	1		100.0		100.0	519	−19	−19
Over 45								
Total	2		50.0	50.0	100.0	568	−48	140
Lee—								
15 or less								
16–30	6	100.0			100.0	562	388	416
31–45	8	50.0	25.0	25.0	100.0	611	312	466
Over 45	5	80.0	20.0		100.0	861	480	527
Total	19	73.7	15.8	10.5	100.0	661	380	484

A minus sign indicates a loss.

[1] The classification here used is that developed in Kentucky Agricultural Experiment Station Bulletin No. 305 (9). Group A includes operators who depended mainly upon farming for a livelihood; Group B, operators whose chief sources of income were contributions of relatives, pensions, interest, and other sources not entailing labor on their part; Group C, operators who derived the greater part of their income from work away from the farm.

[2] See Table 32, footnote 1.

TABLE 36.—*Location and size of farms in relation to sources and value of the family living, 203 farms, 1927*—Continued

Area, formation, and size group (crop acres)	Farms	Percentage distribution of farms in—				Total value of goods consumed	Income directly from the farm	Farm income
		Group A	Group B	Group C	Total			
South area:								
Breathitt—	*Number*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Dollars*	*Dollars*	*Dollars*
15 or less	11	18.2	9.1	72.7	100.0	872	—62	517
16–30	19	31.6	26.3	42.1	100.0	815	33	288
31–45	14	64.3	21.4	14.3	100.0	879	191	332
Over 45	9	33.3	33.4	33.3	100.0	994	198	558
Total	53	37.7	22.7	39.6	100.0	874	83	455
Corbin—								
15 or less	9	.....	44.4	55.6	100.0	581	—46	216
16–30	11	27.3	18.2	54.5	100.0	703	—12	164
31–45	7	42.9	14.2	42.9	100.0	709	—54	195
Over 45	3	66.7	.....	33.3	100.0	869	459	543
Total	30	30.7	23.3	50.0	100.0	684	15	295

Income from sources other than the labor of the operator, such as contributions of relatives, pensions, and interest, was the principal source of the family living for a larger proportion of farms in the south than in the north area. (Group B, Table 36.) In general, two-thirds of the families living in the south area depend for their living on the labor of the operator off the farm, supplemented by gifts, pensions, interest, and similar sources of income. In the north area, 81.7 per cent of the families studied depend for their living directly on farming, supplemented by income derived from the labor of the operator off the farm.

Here are two rather distinctive conditions—in the south area a reliance primarily on employment supplementary to farming to obtain an income and in the north area a dependence primarily on farming. Under these conditions, as might be anticipated, income derived directly from the farm is greater on the average in the north area ($186) than in the south area ($58). But of greater significance is the fact that the net farm income (that is, income derived from the farm and from the labor of the operator off the farm), is greater on the average in the south area ($372) than in the north area ($305), and the total value of the family living obtained is also greater, amounting to $805 in the south area, and to $609 in the north area.

A question suggested by the relatively better results obtained by operators who do relatively less farming is whether part-time farming should be generally encouraged in the two areas. Are farm income and value of family living relatively high in the south area because of part-time farming and relatively low in the north area because of too much dependence on the farm as a source of income? This question should be examined.

FAMILY LIVING AND SOURCE OF INCOME

In the south area 53 farms are on the Breathitt formation and 30 farms are on the Corbin formation. The proportion of farms of 31 acres and over is less on the Corbin formation than on the Breathitt formation. The explanation of this fact was discussed in connection with Tables 31 and 32. The present purpose is to call attention to the corollary fact that the proportion of operators obtaining their incomes primarily from farming is also less for farms on the Corbin formation than for farms on the Breathitt formation. The

specific question is: Is a relatively good living associated with relatively little farming? Among farms on the Breathitt formation 11 families consumed goods valued at $872, and 14 families consumed goods valued at $879. In the first group nearly three-fourths of the operators depended primarily on income from work off the farm, whereas in the second group nearly two-thirds of the operators obtained their income principally from farming. Similarly, for farms on the Corbin formation, not 1 of 9 farms with value of family living averaging $581 depended primarily on farming as a source of income, whereas 3 farms among a group of 7 with value of family living averaging $709 depended primarily on farming as a source of income. Similar relationships are found among farms located on the Breathitt formation in the north area. In each case the group of farms depending principally on part-time farming had a relatively small crop acreage and the group of farms depending principally on farming for an income had a relatively large crop acreage.

To generalize on the relationship, the tendency seems to be for the proportion of farmers depending on farming as a principal source of income to increase as the crop acreage increases and for the average value of the family living also to increase with the crop acreage. Does this lead to the conclusion that the more farming the better the living?

Such a conclusion would appear to be further supported by the fact that in the south area families on the Corbin formation, which is poorly adapted to farming, obtain a poorer living than families located on the Breathitt formation, which is relatively better adapted to farming. Similarly, in the north area families on farms located on the Breathitt formation, which is relatively less adapted to farming than the Lee formation, obtain a relatively poorer living than families occupying farms on the latter formation.

The fact is that neither part-time farming nor full-time farming, as alternative methods of earning a living, is necessarily to be recommended in all cases. More precisely the situation is this: Operators of farms in locations which provide an adequate amount of land adapted to the growing of crops can advantageously obtain their incomes principally from farming. Operators of farms in which there is relatively little land suitable for growing crops must rely primarily on income from work off the farm or from other sources to provide a living for their families. The value of the family living is greater in the south than in the north area, not because part-time farming is, in general, relatively more profitable than full-time farming, but because it is possible to a much greater degree in the south than in the north area to supplement by work off the farm the necessarily small income obtained from farms embracing land poorly adapted to farming. The explanation of this is the proximity of farms in the south area to London and Corbin and the opportunity of supplementary employment thus provided.

In general, operators obtain larger farm incomes and larger incomes directly from the farm, and the value of goods consumed by the family increases, as the number of crop acres in the farm increases. A farm containing 45 acres or more, adapted to cropping, provides an opportunity for making a good living for a family if proper enterprises are selected and good farming practices are followed. Operators of such farms are not under the necessity of relying upon outside work to

obtain a comfortable living. The inclusion in the farming system of intensive enterprises such as tobacco and dairying will, as a rule, increase the income obtained. In the analysis of the farm-management data the same general conclusion was expressed in the observation that the operation of well-organized farms of proper size "compares favorably, as a means of livelihood, with an occupation which includes nonfarming work as a chief source of income" (*9, p. 258*). That is, in general, the better the opportunities the land affords for farming, the better the opportunities the income obtained provides for living. But in the south area, where the opportunities for outside employment are relatively good, there are notable exceptions to this rule. The net farm income obtained from farms in the smallest crop acreage group is greater (and for farms on the Breathitt formation very much greater) than net farm incomes in the two next larger crop acreage groups. The value of goods consumed is also notably high for small farms located on the Breathitt formation. The conclusion is clearly suggested that, where opportunities for outside employment exist, a small farm and little or no farming is better than a slightly larger farm and relatively more farming.

FACTORS LIMITING THE AMOUNT OF THE FAMILY LIVING

In the last analysis, of course, the problem confronting the farm operator is to obtain an income adequate to provide properly for his family. The nature of the conditions confronting farm operators in Laurel County in realizing this objective can be stated rather definitely.

(1) Approximately 20 per cent of the operators of the 203 farms in the areas studied obtained their incomes principally from pensions, gifts, interest, and similar sources, not involving labor on their part. The successors of present operators of these farms are likely in most instances to be worse rather than better off with respect to the resources available for family living, for two reasons.

In the first place, under the methods of farming practiced by many of the present operators, farms in this group deteriorate rapidly. The point may be illustrated by indicating the characteristics of the crop land typical of these farms. For two farms in the south area located on the Corbin conglomerate, the farm income in both instances was negative. Nearly 50 per cent of the crop land in one farm was eroded (classes 2 and 7), and erosion on the other was in evidence on 85.9 per cent of the crop acreage (class 2). Among farms on the Breathitt formation in the same area, heavily eroded land of intermediate slope (class 7) comprised 71.7 per cent of the crop land of one farm and 66.7 per cent of another. Neither farm had an acre of class 1 crop land. These last two cases are perhaps extreme, but not exceptional as to the general character of the land in farms of this group. In the north area, 85.7 per cent of the crop land in one farm on the Breathitt formation was steep, heavily eroded hillside land.

Some farms in Group B, of course, have crop land of a type that indicates the farm should produce a good income. Probably a substantial pension does not, in general, encourage attention to the earning of an income from the farm. So far as farming possibilities are concerned the general tendency among farms of this group is for them to grow worse, rather than better. The successors of many of the present operators, therefore, probably will have a poorer farm to

start with. This is one reason why the income available for family living is likely to be less. In the second place, obviously, it is highly improbable that the succeeding operator of one of these farms will inherit or acquire the pension or other gratuitous income enjoyed by the present operator.

Group B includes 41 farms, of which 9 had 15 crop acres or less, 17 had 16 to 30 crop acres, 10 had 31 to 45 crop acres, and 5 had 46 crop acres or more. The continued operation of the farms of this group will mean that 15 to 25 families of succeeding operators, unless they are able to find additional land fit for cropping, must depend on the labor of the operator off the farm as the principal source of income and that the remainder must, for the most part, introduce improvements in present farming methods and practices, or also depend principally on work off the farm to obtain an adequate living for their families.

The difficulties confronting operators of farms in this group are based on the fact that, on the one hand, opportunities for outside work are limited, and, on the other hand, the land in some farms is too poor to yield an adequate living from the farm.

(2) A second major difficulty confronting farmers is that steep slopes, erosion, rough topography, poor soils, stones, and weeds and sprouts in varying degrees and combinations limit the amount of available crop land. Thus, of the 203 farms studied, 20 per cent had only 15 crop acres or less and 62 per cent had 30 crop acres or less. As has been shown, these small crop acreages usually are associated with crop land having characteristics that do not permit an expansion of the crop acreage. But the difficulty goes further. The actual crop acreage embraces land often wholly unfit for cultivation. The rapid deterioration of fields of this kind under cultivation makes impracticable the rotation of crops. The result is the rotation of fields. The pernicious effects of this process have been described.

The remedy is not to be found in the rotation of crops on the hillside land, because erosion can be controlled only by keeping these fields in grass. Moreover, where there is little or no land of moderate slope available keeping the hillsides in grass and cultivating only the land of moderate slope is impracticable. For example, farmer No. 175 owned 90 acres. He operated 80 acres, of which 38.75 acres were classed as crop land. This crop land was described as follows: 33.50 acres, or 86.5 per cent, heavily eroded, steep, hillside land with shale or stones scattered over the surface of the fields and many weeds and sprouts (class 9); 2 acres, or 5.2 per cent, of smooth to rolling land, heavily eroded and covered with surface shale (class 3); 3 acres, or 7.7 per cent, of steep, hillside land in good physical condition (class 8); 0.25 acre, or 0.6 per cent, rock outcrop. (Class 11.) In 1927, this farmer rented out 10 acres and cropped 16.5 acres. His net income derived directly from the farm was $84. He made his living by work away from the farm.

Another example: Farmer No. 185 owned 145 acres, of which he rented out 11 and operated 134. Sixty acres were classed as crop land, which was described as follows: 54 acres, or 90 per cent, of heavily eroded, steep land like that in farm 175 (class 9); 6 acres, or 10 per cent, of smooth land in good condition, cleared in 1912. (Class 4.) In 1927 this farmer had 26.5 acres in crops. His net income derived

directly from the farm was minus $311. The $300 he earned by work off the farm left him a net farm income of minus $11.

The problem of obtaining a better living for farmers situated like these two (who are typical of many) obviously is not solved by more farming. It is equally true that the introduction of better farming methods would offer only a limited opportunity for betterment when only 6 acres or less is the maximum area suitable for cultivation. In short, no plan of organization based on a farm economy exclusively can promise substantial improvement in the economic basis of living on farms of this type.

Two courses remain open for improving the condition of operators of farms of this type—a change of location for operators of these farms or a change in the type of economy. A change of location is essential unless a basis for part-time farming can be established by the development of local industries to provide employment supplementary to farming. Such a development would be facilitated by the construction of a few good roads, and such roads would also provide better access to part-time employment by operators of farms of this type.

An increase in available supplementary employment, in addition to affording more efficient utilization of the operator's time, would have the important corollary effect of permitting the practice of a type of farming adapted to the utilization of small acreages and would tend to restrict the practice of cropping steep hillsides. Very small acreages could be utilized primarily for home gardens. Where larger acreages are available, a considerable income could be obtained from poultry and dairy products and tobacco could be grown as a cash crop.

(3) Under present conditions there is little question that many farmers derive little, if any, advantage from a large part of the acreage they own. As a rule, the farm wood lots contribute no regular income to the farm. The pastures are extremely poor, chiefly because steep land has been eroded and worn out by cropping before reverting to pasture. Because of the exploitative methods of utilization, the crop land, also, is much less productive than it might be. Under present methods of utilization many farmers own land that is not worth the taxes they pay on it. In many instances a reduction of the total acreage in the farm would improve the economic position of the operator.

Crop land should be confined to land adapted to that purpose. Long-lay pastures should be established on the slopes. Steep hillsides should be allowed to revert to woodland. There seems to be little present opportunity for the individual wood-lot owner to realize an assured annual income from his holding. The most promising method of improving this situation appears to be the development of some form of cooperative organization including 300 or 400 farmers. Such an organization would be in a position to make contracts with paper mills, mines, railroads, and other manufacturers and users of timber on the basis of an assured annual volume of pulpwood, mine timbers, ties, stave bolts, etc. Local labor could be utilized in cutting, skidding, and hauling. The logs could be sawed by a portable mill operated under cooperative ownership.

Probably no plan of economic and social reorganization, however, will prove adequate to establish a sound basis of living for the more isolated and inferior farms. The extent to which readjustments can be confined to changes within the area depends on the relation of

present and potential resources to the present and potential population of the area. Attention is directed to this phase of the problem in the next few pages.

POPULATION AND POPULATION CHANGES IN RELATION TO LAND UTILIZATION

DENSITY OF POPULATION

In discussing the process of settlement of the Kentucky mountain region, attention was directed to the fact that the density of the population has steadily increased since the last decade of the eighteenth century. Until 1900 this increase was almost entirely genetic and since then very largely so. The population density of the rural mountain districts was 48.8 persons per square mile in 1920. In Laurel County the density of population in 1920 was 40.5 if the town of London is excluded and 44.3 if London is included. For the county as a whole, therefore, the density of population is not so great as for the mountain region as a whole. On the other hand, the density for the whole mountain region is affected by the relatively populous mining counties. Between 1910 and 1920 there was a slight decrease in the total population of Laurel County, but this decrease was more than offset by a gain of 1,295 in the total population between 1920 and 1930.

The north and south areas, in which farms were visited in the present study, are relatively populous portions of Laurel County. The north area is relatively isolated, compared with the south area. Population trends in each area will, therefore, indicate in a general way what is happening to the population in relatively isolated areas in comparison with areas closer to towns and to the State highway.

The families studied resided in an area of 27.57 square miles, of which the north area comprised 16.57 square miles and the south area 11 square miles. In 1918 density of population in the two areas was 43, and 10 years later, in 1928, the density was 45.7. (Table 37.) The increase amounted to 2.7 persons per square mile, or 6.2 per cent. The ratio of increase was greater for males than for females. In the north area the increase was only 1.4 persons per square mile or 3.4 per cent (Table 37), whereas in the south area the increase amounted to 4.6 persons per square mile, or 9.9 per cent. This relatively large increase in the population of the south area brought the population there to 51.5 persons per square mile in 1928. In the north area the density was 41.8 in 1928. A population of this density is large, in view of the limitations of the agricultural and other economic resources of the areas studied.

TABLE 37.—*Population and population changes, north and south areas, by sex, 1918 and 1928*

TOTAL POPULATION

Sex	North area		South area		Both areas	
	1918	1928	1918	1928	1918	1928
	Number	*Number*	*Number*	*Number*	*Number*	*Number*
Male	323	341	270	294	593	635
Female	346	351	246	273	592	624
Total	669	692	516	567	1,185	1,259

TABLE 37.—*Population and population changes, north and south areas, by sex, 1918 and 1928*—Continued

POPULATION PER SQUARE MILE [1]

Sex	North area		South area		Both areas	
	1918	1928	1918	1928	1918	1928
	Number	*Number*	*Number*	*Number*	*Number*	*Number*
Male	19.5	20.6	24.5	26.7	21.5	23.0
Female	20.9	21.2	22.4	24.8	21.5	22.7
Total	40.4	41.8	46.9	51.5	43.0	45.7
INCREASE OF POPULATION, 1918–1928						
		Per cent		*Per cent*		*Per cent*
Male		5.6		8.9		7.1
Female		1.4		11.0		5.4
Total		3.4		9.9		6.2

[1] The north area contained 10.57 square miles and the south area 11 square miles.

The general effects of pressure of population on economic and social conditions in the area are rather clearly exhibited by the results of the study. Agriculturally, the pressure of population has led to attempts by many farmers to utilize for the production of crops land that is wholly unadapted to that purpose. The scarcity of available land has led to overcropping of fields on these farms. The fields have thus been depleted of soil fertility, both by erosion resulting from cropping steep slopes, and from continuous cropping. The pernicious effects of these practices tend to be cumulative. The fields are worn out and are recaptured by sprouts and briers. Old fields are recleared. The farm economy on these farms degenerates into a routine of utter futility, based essentially on the rotation of fields and the growing of corn. The less productive the land becomes, the more important it is that the crops obtained contribute directly and immediately to the family living. Subsistence farming, the so-called self-sufficing agriculture,[23] is enforced by the necessity of living, while failing to provide adequate, and tending to provide less and less, living necessities for families on these farms.

The inadequate agricultural basis of living provided by farms of this type has important effects on the individual, the population, and the community. The central factor in the whole situation is economic and social isolation. The geographic factors are probably the original foundation of this isolation. But geographical isolation is succeeded by barriers of an economic and social sort that tend to persist long after geographical obstacles have been surmounted.

The problems in the mountains to-day take their special character from the fact that the railroad, the highway, the automobile, the telephone, and other means of communication have to a considerable extent pierced the geographical barriers isolating the mountain population, creating for these communities rather difficult problems of adjustment. The barriers of economic and social isolation are crumbling before the impact of new contacts, new ideas, and wider

[23] Subsistence farming is fmptly called "self-sufficing agriculture." It is not agriculture and it does not suffice.

horizons. The effect of these new forces and influences on the individual emerges primarily in his capacity to see himself in relation to a wider environment and in a consequent development of his individuality. A growing consciousness of the contrast between the privileges and opportunities provided by the home community and those offered elsewhere is inevitable. The chief objective manifestation of this is found in the migration of young people to other communities.

SONS AND DAUGHTERS AWAY FROM HOME

Among the families studied, the children who left home averaged between 19 and 20 years of age at the time of leaving. The average age of daughters on leaving home was slightly less than that of sons. Of the total number of sons and daughters away from home daughters comprise a greater proportion than sons, but a rather interesting contrast in this particular is offered by the south and north areas. In the south area, in contrast to the north area, the proportion of sons away is greater than the proportion of married daughters. The same is true as to the number of single daughters. (Table 38.) This difference probably reflects, in part, the influence of a greater degree of isolation of farms in the north area compared with farms in the south area. The marriage of daughters normally involves a change to the homes of their husbands. When the larger proportion of children leaving home are daughters, and marriage of daughters is the principal occasion of departure, a relatively low mobility of the population is indicated.

TABLE 38.—*Sons and daughters away from home, north and south areas, classified by sex and by marital status of daughters, 208 families, 1927–28*

NUMBER AWAY

Member of family	North area	South area	Both areas
	Number	*Number*	*Number*
Sons	91	87	178
Married daughters	121	54	175
Single daughters	7	15	22
Total	219	156	375
NUMBER AWAY PER FAMILY			
Sons	0.7	1.0	0.9
Married daughters	1.0	.7	.8
Single daughters	.1	.2	.1
Total	1.8	1.9	1.8
PERCENTAGE AWAY			
	Per cent	*Per cent*	*Per cent*
Sons	41.6	55.8	47.5
Married daughters	55.2	34.6	46.7
Single daughters	3.2	9.6	5.8
Total	100.0	100.0	100.0

This situation and the inference, as applied to the north area, are supported by collateral data. For example, the same line of reasoning would suggest that in the north area a larger proportion of the children away from home would reside in the area or under conditions similar to

those at home. Measures of the validity of these inferences are to be found in a classification of children away from home in each area by present residence and by present occupations. What becomes of the assumption that children in the north area will show less mobility both as to movement and as to occupation than children in the south area?

In the case of 178 sons away from home, 48.3 per cent in the south area as compared with 27.4 per cent in the north area had their present residences in a State other than Kentucky. That, perhaps, is less significant than the fact that 36.8 per cent of the sons away from home in the south area, in contrast to 58.3 per cent away from home in the north area, continued to reside in mountain counties. (Table 39.) The contrast between the two areas as to present residence of married daughters away from home is similar. (Table 39.) It is difficult to believe that these differences are wholly fortuitous or that they are unrelated to differences in the kind or in the degree of cultural forces, economic and social, that have influenced individuals in the two areas. It is less difficult, in fact it is reasonable, to suppose that these differences and their consequences will be less evident in the future.

TABLE 39.—*Sons and married daughters away from home, north and south areas, by present locations, 203 families, 1927–28*

SONS AWAY

Present location	North area		South area		Both areas	
	Number	*Per cent*	*Number*	*Per cent*	*Number*	*Per cent*
In area	18	19.8	11	12.6	29	16.3
In Laurel County	23	25.3	5	5.8	28	15.7
In adjacent county	6	6.6	8	9.2	14	7.9
In mountain region	6	6.6	8	9.2	14	7.9
Elsewhere in Kentucky	13	14.3	13	14.9	26	14.6
In another State	25	27.4	42	48.3	67	37.6
Total	91	100.0	87	100.0	178	100.0

MARRIED DAUGHTERS AWAY

In area	36	29.8	9	16.7	45	25.7
In Laurel County	42	34.7	7	13.0	49	28.0
In adjacent county	11	9.1	6	11.1	17	9.7
In mountain region	3	2.5	4	7.4	7	4.0
Elsewhere in Kentucky	9	7.4	12	22.2	21	12.0
In another State	20	16.5	16	29.6	36	20.6
Total	121	100.0	54	100.0	175	100.0

SONS AND MARRIED DAUGHTERS AWAY

In area	54	25.5	20	14.2	74	21.0
In Laurel County	65	30.7	12	8.5	77	21.8
In adjacent county	17	8.0	14	9.9	31	8.8
In mountain region	9	4.2	12	8.5	21	5.9
Elsewhere in Kentucky	22	10.4	25	17.7	47	13.3
In another State	45	21.2	58	41.2	103	29.2
Total	212	100.0	141	100.0	353	100.0

As to occupational mobility, also, the evidence is that the north area has less than the south area. In the north area, the farmer's daughter marries a farmer, and the farmer's son follows the occupation of his father. Such, at any rate, is the tendency to a much greater degree in the north than in the south area. In the north area 40.6

per cent of the sons away from home were farmers; in the south area, 16.3 per cent. (Table 40.) In the north area, 64.7 per cent of the married daughters away from home were wives of farmers; in the south area, 31.4 per cent. (Table 41.)

TABLE 40.—*Sons away from home, north and south areas, by present occupations, 208 families, 1927–28*

Occupation	Sons away from home					
	North area		South area		Both areas	
	Number	*Per cent*	*Number*	*Per cent*	*Number*	*Per cent*
Farmer	37	40.6	14	16.3	51	28.8
Tradesman	9	9.9	13	15.1	22	12.4
Professional service	10	11.0	20	23.2	30	17.0
Merchant or dealer	5	5.5	6	7.0	11	6.2
Public service	9	9.9	11	12.8	20	11.3
Laborer	21	23.1	22	25.6	43	24.3
Total	91	100.0	[1]86	100.0	177	100.0

[1] Occupation was not reported for 1 of the 87 sons away from home in the south area.

TABLE 41.—*Married daughters away from home, north and south areas, by present occupations of husbands, 208 families, 1927–28*

Occupation of husband	Married daughters away from home [1]					
	North area		South area		Both areas	
	Number	*Per cent*	*Number*	*Per cent*	*Number*	*Per cent*
Farmer	77	64.7	16	31.4	93	54.7
Tradesman	4	3.3	5	9.8	9	5.3
Professional service	2	1.7	6	11.8	8	4.7
Merchant or dealer	2	1.7	1	1.9	3	1.8
Public service	10	8.4	7	13.7	17	10.0
Laborer	24	20.2	16	31.4	40	23.5
Total	119	100.0	51	100.0	170	100.0

[1] Excluding 5 persons for whom the information was not given.

MIGRATION OF CHILDREN AND SIZE OF FARMS

Is the migration of children from the better or from the poorer land, from the larger or from the smaller farms? The immediate effectiveness of migration as a means of adjusting population to resources would be greater, of course, if the process were restricted to the poorer land and the less favorable locations. However, there is a theoretical basis for supposing that the tendency may be precisely opposite—that the children of the operators of the larger and more prosperous farms will be first to migrate. The supposition may be based both on biological and economic considerations. It may be that the better land and larger farms are occupied by the biologically superior portions of the population, so that migration takes place principally from among this element of the population, which is endowed with the initiative to challenge life, and the capacity to grasp the instruments of living in a more complicated and competitive environment. On purely economic grounds, also, through the enjoyment of superior educational opportunities, occasional travel, and similar influences, children of the more prosperous operators are more likely than the children of oper-

ators less fortunately situated, to acquire training and experience that would influence them to leave the mountains.

The data of the study provide no conclusive answer to the question. It is true that of the number of children away from home in the south area, the greater proportion are from farms having 30 crop acres or less. (Table 42.) But the number away per family is greater for farms in the larger crop-acreage groups. The north and south areas exhibit marked differences in this respect. In the north area the proportion of children from farms of 30 crop acres or less is much greater than in the south area, and the number per family from very small farms in the north area is also large, both as compared with farms of similar size in the south area and with respect to all but the largest crop-acreage group in the north area. Migration of children from the very small farms in the north area is probably enforced, to a much greater degree than in the south area, by the greater dependence on farming as a source of family income in the former than in the latter area.

TABLE 42.—*Sons and daughters away from home, north and south areas, classified by size of farm occupied by parents, 208 farms, 1927–28*

Size group (crop acres)	North area	South area	Both areas
	NUMBER AWAY *		
	Number	*Number*	*Number*
15 or less	42	30	72
16–30	102	54	156
31–45	42	45	87
Over 45	33	27	60
Total	219	156	375
	NUMBER AWAY PER FAMILY		
15 or less	2.1	1.5	1.8
16–30	1.8	1.6	1.8
31–45	1.4	2.1	1.7
Over 45	2.5	2.2	2.4
Total	1.8	1.9	1.8
	PERCENTAGE AWAY		
	Per cent	*Per cent*	*Per cent*
15 or less	19.2	19.2	19.2
16–30	46.6	34.6	41.6
31–45	19.2	28.9	23.2
Over 45	15.0	17.3	16.0
Total	100.0	100.0	100.0

The central problem as to the point in question, however, is not touched by the data of Table 42. That problem is suggested in the question: Where are the children away from home located? It is of very real import, therefore, to know the extent to which children of present operators are migrating from the mountain area, and whether and to what extent this migration is contributing directly to a solution of the land problem by the evacuation of the less prosperous farms. Some further light is thrown on this question by combining the data of Tables 39 [24] and 42.

[24] Modified to include unmarried daughters away from home.

When this is done the contrast between the north and the south areas, indicated by Table 42, is more sharply defined. (Table 43.) In the north area, children leaving home tend to stay in the mountains, no matter what the size of the farm, but with the tendency to leave the mountains somewhat greater among children from the smaller farms. In the south area, children tend to leave the mountains, no matter what the size of the farm, but with the tendency to leave the mountains somewhat greater among children from the larger farms.

TABLE 43.—*Sons and daughters away from home, north and south areas, classified by present location and number of crop acres in farms occupied by parents, 1927–28*

NUMBER IN EACH SIZE GROUP

Location	North area			South area		
	30 crop acres or less in parents' farm	Over 30 crop acres in parents' farm	Total	30 crop acres or less in parents' farm	Over 30 crop acres in parents' farm	Total
	Number	*Number*	*Number*	*Number*	*Number*	*Number*
In mountains	94	53	147	41	23	64
Not in mountains	50	22	72	43	49	92
Total	144	75	219	84	72	156

PERCENTAGE IN EACH SIZE GROUP

	Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
In mountains	65.3	70.7	67.1	48.8	31.9	41.0
Not in mountains	34.7	29.3	32.9	51.2	68.1	59.0
Total	100.0	100.0	100.0	100.0	100.0	100.0

The tendency of children from the north area to stay in the mountains suggests that the relatively greater geographic isolation of that area has reduced economic and social barriers to migration from the mountains to a smaller degree than in the south area where this tendency is reversed. The fact also that in the north area children from small farms leave the mountains in greater proportion than children from large farms suggests that migration from the north area is to a considerable degree enforced by the limitations of farming as a source of livelihood. The presumption suggested by the figures is that lack of local opportunity is a more potent factor in inducing children in the north area to leave the mountains than is the consciousness of broader opportunities elsewhere, combined with the desire and the resources to grasp them.

In the south area, on the other hand, a greater degree of accessibility to outside contacts appears to be manifested in a greater consciousness of opportunities outside the mountains combined with the pursuit of these opportunities by a greater proportion of the children from large than from small farms. This tendency for migration from the mountains to be associated with the more prosperous farms in the south area may, in fact, be more pronounced than the figures of Table 43 indicate, because the prevalence of part-time farming often causes relatively good incomes to be associated with

relatively small farms, thus obscuring the normal relationship between income and size of farm.

Contrasts between the north area and the south area—between relatively isolated and relatively accessible population groups—are of moment only to the extent that they suggest a clue to the probable effect on the younger generation of mountain children of changes now under way in the mountains. Will the children in localities like the relatively isolated north area tend more and more to leave the mountains, like the children in the more accessible south area, as geographic barriers to external economic and social influences disappear? The figures of this study suggest an affirmative answer, and that conclusion is too strongly supported by the history of population movements to require elaborate substantiation in its present application.

The implications of such a conclusion do not, however, necessarily lead to a solution of the central problem of adjustment of population to resources. Although the age distribution of the population of the north and south areas indicates that heavy emigration has taken place (*11, p. 80*) from both areas during the 10-year period, 1918–1928, the total population of each area increased in the same period, as shown by Table 37. Since 62.8 per cent of the present operators were born in Laurel County and 93.9 per cent were born in Kentucky, immigration does not appear to be a significant factor in this increase. It is in the effect of changed conditions on the composition and characteristics of the population with particular reference to changes in birth rates and death rates that light on this further aspect of the problem must be sought.

COMPOSITION AND CHARACTERISTICS OF THE POPULATION[31]

In 1928 families averaged 4.8 persons per family and 5.3 persons per household. The average number of rooms used per family was 4.5, and there were on the average only 2.5 bedrooms for a household of 5.3 persons. The houses were equipped with practically none of the conveniences and facilities of the modern home. Only 1 in every 40 houses in the area had either a central heating or lighting system. With these exceptions there was no modern equipment in the houses.

Nevertheless, there were a number of attractive, comfortable farm houses of adequate size in both areas. The unfavorable conditions indicated by the averages reflect the evils associated with attempts to farm land unsuited to that use, poor farming practices, and the consequent inadequacy of the family living provided by many farms. But a substantial number of families who live in these areas are no longer occupying isolated mountain homes. Isolation is a relative matter as it affects individuals, families, and communities.

The impact of new ideas and influences even on the more isolated families to-day is much greater than might be inferred from a first-hand contact with their present situation. News travels rapidly in the mountains. The significant fact is that the character of word-of-mouth contacts has changed. These mountain communities have long been highly self-contained social and economic units. Gossip dealt with the routine of life among familiar persons and conditions. News of change in a changing world is a part of the routine of life,

[31] See also Kentucky Agricultural Experiment Station Bulletin No. 301 (*11*).

but such news is highly personal, novel, and significant when it touches the lives of individuals and the customary mode of living in a self-contained community. The changed conditions which have given a new character to the social and economic environment of the mountain community have profoundly affected the individual. The nature of these effects suggests that corresponding changes have taken place in the composition and characteristics of the mountain population.

A comparison of the age distribution and sex composition of the population in 1918 and 1928 confirms, in general, the conclusions reached in the preceding section in regard to the migration of sons and daughters from the north and south areas, respectively. The analysis at this point is based on the data of Tables 44 and 45.

TABLE 44.—*Percentage of population in specified age groups, north and south areas, by sex, 1918 and 1928*

Age (years)	North area				South area			
	Ratio of males to total male population		Ratio of females to total female population		Ratio of males to total male population		Ratio of females to total female population	
	1918	1928	1918	1928	1918	1928	1918	1928
	Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
0–9	25.1	23.2	25.4	23.5	29.3	28.9	26.2	27.1
10–19	22.0	25.5	27.7	23.1	25.6	27.5	27.7	24.5
20–29	12.1	10.6	10.7	13.1	11.1	9.2	13.0	10.6
30–39	11.4	12.0	10.7	11.4	9.6	6.8	12.6	12.5
40–49	11.8	10.8	11.0	8.0	9.6	11.2	6.9	10.6
50–59	5.9	8.5	5.2	8.2	5.9	9.9	8.1	8.1
60	10.8	9.4	9.3	9.7	8.9	6.5	6.5	6.6
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

TABLE 45.—*Males per 100 females, north and south areas, by age groups, 1918 and 1928*

Age (years)	North area		South area		Age (years)	North area		South area	
	Males per 100 females		Males per 100 females			Males per 100 females		Males per 100 females	
	1918	1928	1918	1928		1918	1928	1918	1928
	Number	*Number*	*Number*	*Number*		*Number*	*Number*	*Number*	*Number*
0–9	92.0	84.0	127.4	114.9	40–49	100.0	132.1	152.0	113.8
10–19	77.1	107.4	101.5	120.9	50–59	105.6	100.0	80.0	131.8
20–29	105.4	78.3	93.8	93.1	60	109.4	94.1	150.0	105.6
30–39	100.0	102.5	83.0	58.8					

In making the following comparisons it is recognized that the age and sex groups are small and, therefore, subject to wide variation in the percentage distribution of the population because of possible differences in the number of births in the two decades. Although this consideration may invalidate conclusions drawn from comparisons between age and sex groups, it does not preclude examination of the data to test the consistency of the tendencies suggested with those exhibited by other data of the study.

In the north area in 1918 there were 92 males per 100 females among children under 10 years of age. Ten years later, in 1928,

among children 10 to 19 years of age there were 107.4 males per 100 females. The proportion of females in the 10 to 19 age group was smaller and the proportion of males was larger in 1928 than in 1918. The decline in the proportion of females may be attributed principally to marriage prior to 1928 of females who were 10 to 14 years old in 1918. Females who leave the mountains tend to do so at the time they marry, that is, from 16 to 19 years of age. The preponderance of males in the 10 to 19 age group in the north area in 1928 in contrast to 1918 suggests a tendency for marriages of this type to increase.

In the south area, also, the migration of females at a younger age than males has the same general effect on the population in the 10 to 19 age group as in the north area. But in the south area this migration of females continues to a later age, probably because women in the south area have opportunities for marriage or employment outside the area superior to those of women in the north area. As a consequence of this migration of women from the south area, the proportion of females in the 20 to 29 age group, as well as in the 10 to 19 age group, is less in 1928 than in 1918.

The low ratio of males to females in the 10 to 19 age group in 1918 in the north area appears to be due to the high ratio of female to male births or to a higher death rate among males, particularly in the 10 to 14 age group. The low sex ratio (78.3) in 1928 among persons in the north area 20 to 29 years of age is probably due, in part, therefore, to the excess in the number of females among children under 20 years of age in 1918, as well as to the migration of males, and there is the possibility, of course, of disturbing influences attributable to the war.

In the south area the situation is different. An excess in the number of males among children 10 to 19 years of age in 1918, is changed among the 20 to 29 age group to a ratio of 93.1 males per 100 females. And it is significant to note that a ratio only slightly higher prevailed for this same age group in 1918. That is, in line with the analysis of the preceding section, the process of migration has been under way longer in the south than in the north area, and its effects on the composition and characteristics of the population are more pronounced in the former area. The migration of males in the 20 to 29 age group between 1918 and 1928, reduced the sex ratio in the 30 to 39 age group to 58.8 in the latter year. In the 30 to 39 age group also, the ratio of males to all males declined from 9.6 per cent in 1918 to 6.8 per cent in 1928.

The population of the north area in 1918 shows a balanced ratio between the sexes for the adult groups and may be accepted as a fair representation of the situation before changed conditions began to upset the equilibrium of the sexes. The consequences of these disturbing influences may be discerned, in their early effects, in the changes in the population of the north area, and in their more mature effects, by changes in the population of the south area. This relationship furnishes an additional basis for the inference that the isolated portions of the mountain area will tend to undergo changes similar to those now under way in the less isolated portions, when the new influences at work penetrate present social and geographic barriers.

So far as the history of the 10 years, 1918 to 1928, is concerned, the population of the north area has shown a tendency to decline. The emigration of children is somewhat offset by the return to the area of older persons who have previously migrated. Old houses vacated are about equally replaced by new houses or houses reoccupied. There were in the area 147 occupied houses in 1918 and 144 in 1928. Families move in to replace families moving out. Birth rates tend to decline. The population increased only slightly between 1918 and 1928. The present economic basis of living is inadequate to support a larger population. The pressure of population tends to induce emigration. Between 1920 and 1930, according to the 1930 census of population, the population of district 3 declined from 2,691 to 2,579, while the population of district 6, numbering 3,615 in 1920 and 3,616 in 1930, remained practically unchanged. The north area is included in districts 3 and 6.

A consideration of the same factors in the south area reveals significant differences. The part-time farming which has developed in the south area has mitigated to a considerable extent the adverse effects of the decline in income from supplementary industries such as mining and forestry, associated with farming in the mountains at an earlier period. As a consequence, the number of families residing in the area has tended to increase rather than diminish during the 10-year period. (Table 46.) The number of houses vacated during the period indicates, in comparison with the north area, relatively little economic pressure leading to emigration. On the contrary, in the south area 23 additional houses, of which 19 represented new construction, were occupied, and only 5 were vacated during the 10-year period. Expansion in the number of occupants kept pace with expansion in the number of houses. In the north area 17 additional houses, of which 15 represented new construction, were occupied, but 18 were vacated during the 10-year period. Moreover, while the number of houses was increasing by 13, the number of occupied houses was decreasing by 3.

TABLE 46.—*Changes in the number of houses and in the number of old and new houses occupied, north and south areas, by years, 1918–1928*

NORTH AREA

Year	Habitable houses		Cumulative change in—		House occupied which was—		Houses vacated	Houses destroyed
	Total	Occupied	Habitable houses	Occupied houses	Formerly vacant	New		
	Number	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*
1918	155	147			0	0	3	1
1919	154	143	−1	−4	0	3	3	0
1920	157	143	2	−4	0	4	0	0
1921	161	147	6	0	1	1	0	0
1922	162	149	7	2	0	2	6	0
1923	164	145	9	−2	1	1	0	0
1924	165	147	10	0	0	4	2	0
1925	169	149	14	2	0	0	1	0
1926	169	148	14	1	0	0	1	1
1927	168	146	13	−1	0	0	2	0
1928	168	144	13	−3				
Total or average	163	146	13	−3	2	15	18	2

TABLE 46.—*Changes in the number of houses and in the number of old and new houses occupied, north and south areas, by years, 1918–1928*—Continued

SOUTH AREA

Year	Habitable houses		Cumulative change in—		House occupied which was—		Houses vacant	Houses destroyed
	Total	Occupied	Habitable houses	Occupied houses	Formerly vacant	New		
	Number	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*
1918	107	98			0	0	0	[1] 1
1919	106	98	−1	0	2	0	0	0
1920	106	100	−1	2	1	4	0	0
1921	110	105	3	7	1	2	0	0
1922	112	108	5	10	0	1	3	0
1923	113	109	6	8	0	3	1	0
1924	116	108	9	10	0	3	0	0
1925	119	111	12	13	0	2	1	0
1926	121	112	14	14	0	3	0	0
1927	124	115	17	17	0	1	0	0
1928	125	116	18	18				
Total or average	114	107	18	18	4	19	5	1

[1] Vacant in 1918.

Pressure of population has been more severe in the north than in the south area during the 10-year period, although the density of population is greater in the latter area. This difference in the pressure of population in the two areas is further confirmed by figures of the 1930 census of population for districts 1 and 2, which include the south area. Between 1920 and 1930, the population of district 1 (excluding London) increased 790, from 1,528 to 2,318, and the population of district 2 increased 1,752 from 2,246 to 3,998. These increases are in contrast to a net decrease during the same period in the population of districts 3 and 6 which include the north area.

Whatever the present tendencies may be it is obvious that pressure of population has had important effects on economic and social conditions in both areas. As to the economic manifestations of the pressure of population enough has been said. As to the social and institutional aspects of the problem, the data of the study permit only rather general observations. But it is pertinent here to give precise statement to two general questions: (1) What measures can be taken to obtain a better adjustment of population to resources? (2) What measures can be taken to ameliorate present economic and social conditions while long-time adjustments are in progress?

Some suggestions bearing on these questions will be made in the recommendations to follow, but preliminary to that a general sketch of certain community aspects of the problem is necessary.

COMMUNITY CONDITIONS AND PROBLEMS

Changed and changing social and economic conditions in the mountains raise many problems of adjustment relating to community institutions and services. The data of the present study permit no more than a few general suggestions regarding the nature and significance of these problems.

CHANGED BASIS OF FARMING

Undoubtedly the depletion of the forests and the consequent decline of the logging industry have been of serious consequence to many

farmers in Laurel County. For a time mining developments around Pittsburgh and East Bernstadt afforded employment to part-time farmers, but the number now employed is not commensurate with the need for work. Occupants of small farms in the relatively inaccessible north area and in similar areas elsewhere have found no adequate source of outside employment. The isolated farmer has been compelled to rely principally on farming as a source of livelihood, whereas the edaphic limitations of the area make impossible on many farms the earning of an adequate income from farming.

In addition to other consequences a marginal group of farms has appeared. Two principal conditions explain the existence of these farms. The first rests on physical conditions, primarily edaphic, which are practically insurmountable at present; the second rests on social inertia, growing out of the long isolation of the population. The effect of the tendency to stay in the mountains in the face of adverse conditions has not been specifically considered although some data bearing on the phenomenon have been presented showing that the tendency is most pronounced in the isolated area.

The existence of land marginal for farming usually is the result of a combination of physical and economic conditions over which the individual has little control. But it is the occupancy of that land for farming that creates the marginal farm. The land problem, in its present aspect, emerged when the land became marginal for agriculture and continued to be occupied for that purpose. The solution of that problem must, of necessity, begin with the man on the land.

PROBLEM OF THE MARGINAL FARMER

The farmer occupying one of these marginal mountain farms, if pictured in his present situation against the background of his own life, must appear as a rather bewildered individual. He is not a migrant like the sons and daughters who found opportunity in new and strange conditions. But he is a mover. His moves are from farm to farm. He fights defeat by holding fast to familiar ways; but, holding fast, he is ever defeated. The first approach to a solution of the land problem in the mountains is to face the problem of these marginal farmers. Theirs is a problem primarily of psychological and social adjustment. The conditions under which the marginal farmer lives may not satisfy the demands of a minimum standard of living; they may not satisfy him. It does not follow that he would thrive better elsewhere, under the handicap of adapting himself to new conditions. To remove the marginal farmer from his present environment would probably have the effect, in many instances, of shifting him from a condition that is bad to one that is worse.

Data on the changes of occupancy of 294 farms during the period 1918 to 1928 are available for the north and south areas. There were 245 farms reported occupied in 1918, 49 per cent of which were occupied by the same operators in 1928. In other words, of the 260 occupied farms in the two areas in 1928, only 120, or 46.2 per cent, were occupied by the same operators in 1918. Operators of these 120 farms have managed to develop an economy that had in it the elements of stability under the conditions of the last decade. (Table 47.)

TABLE 47.—*Changes in the occupancy of 294 farms, north and south areas, 1918–1928*

Item	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928
Farms with a habitable house (beginning of year):											
Occupied.....number.	245	241	243	252	257	251	255	260	260	261	260
Vacant.....do....	17	19	20	19	17	26	26	28	30	31	33
Total.....do...	262	260	263	271	274	277	281	288	290	292	293
Farms without a habitable house (beginning of year).....number..	32	34	31	23	20	17	13	6	4	2	1
Total.....do....	294	294	294	294	294	294	294	294	294	294	294
Farms with a habitable house (end of year):											
Not changing occupants during year.....number..	227	211	218	233	224	227	210	228	229	232	.....
Changing occupants during year...do...	14	27	25	19	24	23	37	30	29	27	.....
Built and occupied during year...do...	0	3	8	3	3	4	7	2	3	1	.....
Vacant house occupied during year.....number..	0	2	1	2	0	1	0	0	0	0	.....
Vacant during year.....do....	16	17	19	17	17	25	26	28	30	31	.....
Vacated during year.....do....	3	3	0	0	0	1	2	2	1	2	.....
Total.....do....	260	263	271	274	277	281	285	290	292	293	.....
Farms without a habitable house (end of year):											
No house at beginning of year...number..	32	31	23	20	17	13	6	4	1	1	.....
House destroyed during year.....do....	2	0	0	0	0	0	0	0	1	0	.....
Total.....do....	34	31	23	20	17	13	6	4	2	1	.....
Grand total.....do....	294	294	294	294	294	294	294	294	294	294	.....
Percentage distribution of occupants in 1928 by first year of occupancy.....per cent	46.2	1.2	6.2	4.2	4.6	2.7	4.6	6.9	6.2	6.5	10.7
Percentage of first-year occupants remaining on the same farm in subsequent years:											
1918.....per cent	100.0	92.7	82.9	76.3	70.6	64.0	61.6	56.7	53.1	51.0	49.0
1919.....do....	.....	100.0	57.1	42.9	35.7	28.0	28.6	21.4	21.4	21.4	21.4
1920.....do....	.....	.....	100.0	78.1	73.1	68.7	62.5	56.2	56.2	50.0	50.0
1921.....do....	.....	.....	.....	100.0	88.2	61.8	50.0	38.2	35.3	32.4	32.4
1922.....do....	.....	.....	.....	.....	100.0	75.1	66.7	62.5	50.0	50.0	50.0
1923.....do....	.....	.....	.....	.....	.....	100.0	70.4	44.4	33.3	25.0	25.0
1924.....do....	.....	.....	.....	.....	.....	.....	100.0	57.1	50.0	46.4	42.9
1925.....do....	.....	.....	.....	.....	.....	.....	.....	100.0	68.2	47.7	40.9
1926.....do....	.....	.....	.....	.....	.....	.....	.....	.....	100.0	65.6	50.0
1927.....do....	.....	.....	.....	.....	.....	.....	.....	.....	.....	100.0	53.1
1928.....do....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	100.0

The number of changes averaged 30 annually over the 10-year period, or approximately 10 per cent of the total number of farms. There were 295 changes made among a total of 304 individuals and 294 farms. Deducting the 120 farms which did not change occupants, leaves 174 farms which were shifted about among 184 farmers. In 1918, on 32 farms there was no house. Houses were built on 34 farms during the period, but the increase in the number of farms occupied was only 15. For the remaining 19 farms on which houses were constructed, an equivalent number of occupied houses were vacated or destroyed—17 vacated houses were not reoccupied and 2 occupied houses were destroyed.

In 195 of the 295 changes of operator, or 66.1 per cent of the cases, the succeeding operator was not related to the previous operator. In 48 cases a son and in 16 cases a son-in-law was the successor. In seven instances an operator returned, after one or more years, to a farm previously occupied by him during the period.

The situation presents a picture of two opposing forces in juxtaposition—one economic, the other social. Economic forces have so changed the requirements for successful farming that many farms

formerly occupied on the basis of employment in industries supplementary to farming, such as lumbering and mining, are now marginal. Social forces, on the other hand, exert a powerful influence on individuals, tending to cause them to remain on these farms. The extent of such influences is likely to be underestimated unless account is taken of the strong emotional attachment which leads families to cling tenaciously to their native environment.

Pressure of population leads to two major economic difficulties. In addition to enforcing the utilization of land marginal for farming, it tends to create a false impression of a scarcity of labor. The difficulties of maintaining a few patches of crop land against the inroads of briers and sprouts tend to convince the farmer who is confronted with these difficulties that he needs the help of a large family in the struggle. Large families are typically associated with subsistence farming. Family labor is substituted for capital investment.

Changes in the number and distribution of the population which may be anticipated from the normal operation of economic and social forces may ultimately correct the more serious maladjustments in land utilization, but immediate attention should be given to practical measures for improving living conditions by stimulating better farm management and by expanding the opportunities provided, particularly to the occupants of marginal farms, of supplementary employment.

LOCAL INDUSTRIES AND MARKETS

Depletion of the forest and coal resources of Laurel County has been counterbalanced, to some extent, by employment incident to improved transport facilities and the increased accessibility of towns like London and Corbin. In general, these opportunities are not the kind that lead to the stabilization of agriculture in the area; they are casual, or they tend to serve as a substitute for, rather than as a supplement to, farming. It is principally by the encouragement of local industries genuinely supplementary to farming from the standpoint both of the products utilized and the employment of the farmers' time that an economy indigenous to the area can be developed. Such a development requires cooperative effort.

Consider first opportunities for saving through cooperative purchase of farm supplies, particularly seed, feed, and fertilizer. Between March 1, 1927, and March 1, 1928, in-shipments by railroad freight to London and East Bernstadt of seed (including potatoes), feed, and fertilizer, amounted to 11,073,709 pounds or the equivalent of 276.8 carloads of 40,000 pounds each. This would be at the rate of approximately 1 carload each of five week days and one-third of a carload on each Saturday throughout the year, or 5.32 carloads a week. During the period covered by the figures, shipments of seed were received every month, the heaviest receipts coming in February and continuing well into June. The volume again rose in September and October for fall seeding and then declined to the lowest point for the year in November, with relatively small receipts in December and January.

Some hay was shipped in, although this crop occupies a large proportion of the crop acreage. In-shipments of hay by rail amounted to 292 tons. The heaviest receipts were in December, January, and February, reaching a peak for the year in February. Shipments of hay declined when stock began to go on spring pasturage. No

receipts of hay at either point were recorded for April, July, and November during the period.

In-shipments of corn, on the other hand, were reported for every month in the year, the volume of shipments following, in general, the same seasonal variation as hay. The total volume of corn shipped in, amounting to 7,719 bushels, appears small. But allowing an average of 9 acres in corn per farm and an average yield of 20 bushels per acre, the total yield on the 203 farms for which data were summarized would amount to only 36,540 bushels. In-shipments, therefore, amounted on this basis to more than 20 per cent of the total production on these farms. In-shipments of oats amounted to 36,544 bushels, or nearly five times the amount of the production on the 203 farms. In addition to these feeds, 2,279 tons of concentrates were also shipped in. Other important items include receipts of considerable quantities of fertilizer and lime. These data amply demonstrate that there is a local market for home-grown feeds of good quality. But there are few farms that produce a surplus.

There is no present basis for supposing that local dealers are not providing efficient service to farmers in supplying these items and in providing the necessary credit. But there are undoubtedly opportunities for farmers to cooperate with local dealers by concentrating orders, pooling shipments, cooperative delivery, and similar means to reduce the cost and increase the effectiveness of this service.

There is a rather definite opportunity for farmers to cooperate on the producing and selling side. The possibility of developing cooperative methods for the production and sale of farm wood-lot products has been suggested. Mine props comprise the largest volume of shipments at present. The principal market is Lynch, Ky. Allowing 80,000 pounds to the carload, approximately 68.8 carloads were shipped during the year. Shipments were made every month, the largest volume occurring in October. Stave bolts were shipped to Cincinnati, Ohio. Some tanbark and a small quantity of pulpwood were shipped, and a few carloads of cordwood. The development of a local organization among farmers to assure volume and quality at low cost should be of help in maintaining and expanding the markets for these products.

Tobacco is the chief, and practically the only, cash crop. The principal market is Richmond, Ky. In 1927–28 freight shipments to this point from London and East Bernstadt amounted to 304,792 pounds. Truck shipments probably account for an equal or a larger volume. The bulk of the shipments were made in December and January, but small quantities were shipped in the two succeeding months. Cream is an important source of cash income. Shipments go to Cincinnati, Knoxville, Lexington, and Louisville. Some shipments are made direct by parcel post or as baggage, but an increasing proportion is delivered by farmers to London, East Bernstadt, and other points where it is purchased by local buyers for large manufacturers of dairy products. Competition among local buyers has tended to assure good prices to farmers, but the development of better facilities for delivery through cooperative organization among groups of farmers would materially improve the quality of the cream and tend to assure better average prices.

Farmers derive considerable income from the sale of poultry and eggs. The principal buyer of these products is a wholesale firm located

in Cincinnati which maintains a branch under a local manager in London. Here again it is probable that private agencies are providing a reasonably efficient selling service, but cooperative or community organizations for culling, grading, assembling, and delivering should increase the net returns to farmers.

Cattle are shipped out in considerable volume, and in the spring two or three carloads of hogs are shipped. Cattle shipments are usually made by enterprising local dealers who go from farm to farm making purchases until a carload can be shipped out. The months of heavy shipments are August and November. The principal market is Richmond, Ky. On account of scarcity of feed, Laurel County is not adapted to livestock production, but there is an opportunity for a few favorably situated farmers to make a fair return from this enterprise by organizing for cooperative shipments of livestock by rail, or truck to Richmond or other local concentration points.

The present volume of output of farm and forest products from Laurel County farms is too small, even in the aggregate, to attract privately owned and operated local creameries, cheese factories, woodworking plants, and similar enterprises for the utilization of the local production and the employment of local labor. The introduction and support of such enterprises is of doubtful feasibility and must depend, in any event, upon cooperative effort.

SCHOOLS

The grade school training of most children in Laurel County is still limited to the facilities of the 1-room school. Consolidation of schools is impracticable in many districts because of the difficulty of providing for the transport of children over the poor roads. Under present conditions children frequently travel to school on mules or on horseback.

The school census of Laurel County of April 1, 1928, gave 6,510 children between 6 and 18 years of age. Of this number, 2,866 boys and 2,743 girls were reported as enrolled in public elementary schools, 153 boys and 181 girls as enrolled in public high schools, and 62 boys and 110 girls as enrolled in private high schools. The annual report of the superintendent of the Laurel County schools for the school year ended June 30, 1928, reported about "100 high-school pupils in other high schools, for which we pay tuition." There were 86 wooden school buildings for white students: Seventy were 1-teacher schools, 13 were 2-teacher schools, and 3 had three or more teachers. There were 107 classrooms, or 1.24 rooms per school, and 108 teachers, including principals. The school term was seven months. The total number of elementary pupils enrolled was 4,498, and the average attendance was 3,318. This would give an average enrollment of 52.3 and an average attendance of 38.6 pupils per school, while the averages per room would be 42 and 31 pupils, respectively. The average aggregate seating capacity was 32.7 pupils per room, or 998 short of the total enrollment. Only 30 of the 86 schools were reported as having libraries.

The average annual salary paid white elementary teachers was $564.33. Thirty-seven per cent of the elementary teachers were men. There was no graduate of a standard college among the 108 elementary teachers. Only 5 teachers, 2 men and 3 women, had completed two

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years of college work. Teachers with no high-school work included 7 men and 6 women, and 40 teachers, including 19 men and 21 women, had only two years of high-school work as their foundation for teaching. Nearly one-fourth of the teachers were teaching their first term, and approximately 50 per cent had taught less than three years.

The total school revenue of Laurel County in 1926–27 was $76,469.31, (*12, p. 362*) of which 52.4 per cent came from the State school fund, 39.2 per cent from local taxation, 8.1 per cent from loans and bonds, and 0.3 per cent from other sources. The total sum from these sources was augmented by a balance of $2,108.99, giving a grand total of $78,578.30, of which $78,444.91 was spent during the school year. County school funds derived from local taxation are based on a rate of 75 cents on each $100 of real and personal property and a poll tax of $1.

If the total amount available ($78,578.30) were distributed equally among the 88 schools (including two elementary schools for colored children) there would be available approximately $892.94 for each school. The figure sufficiently explains the low average annual salary of all county teachers (elementary and high school) and the inadequate training of the teachers. Transportation at public expense was not privided for any of these schools. In Kentucky, State school funds are so apportioned as to make it possible for counties that have relatively small tax resources to receive a greater amount of money per school child than do more wealthy counties. A continuance and extension of this policy should result in a considerable betterment of the school opportunities of the children of Laurel and other counties in eastern Kentucky.

CONCLUSIONS AND RECOMMENDATIONS

The central objective of the study was to differentiate the land in Laurel County farms on the basis of its important physical characteristics and then to relate differences in land character to important economic and social factors affecting family and community welfare. The relationships exhibited by the study provide the basis for a number of recommendations directly applicable to Laurel County and applicable, in principle, to localities in other counties where conditions are essentially similar.

BASIC CONDITIONS

Figure 7 shows the principal physical characteristics of 3,151 acres of crop and pasture land in 52 farms in Laurel County. Operators of these 52 farms had, over a 3-year period, an average, in round numbers, of 40 acres of crop land and 20 acres of pasture land per farm. The description of this crop and pasture land shown in Figure 7 indicates the importance to farmers in Laurel County of the kind, as well as the amount, of land in the individual farm.

The general effect of the physical characteristics of this land is to limit the amount of crop land, both because of the scarcity of land adapted to that use and because of the rapid deterioration of the land due to wrong cropping practices.

The combined effect of physical characteristics of the land and of cropping practices associated with the use of land (fig. 8) has been to establish a cycle in the utilization of fields. (Fig. 5.) The cycle

runs: Clearing, cropping, pasturing, abandonment; reclearing, cropping, etc. The exact sequence is subject to variation. The cycle is not characteristic of all fields or of the farm economy on all farms, but it is the most significant general characteristic of farming in Laurel County, and it is the central factor in the land utilization problems of that area. A summary of the consequences of this method of field utilization appears on pages 38 and 39 for crops and on pages 44 to 46 for pastures.

In 1924 approximately 30 per cent of the land in farms in Laurel County was woodland. (Table 2.) Unquestionably the development of profitable methods of management and utilization of farm

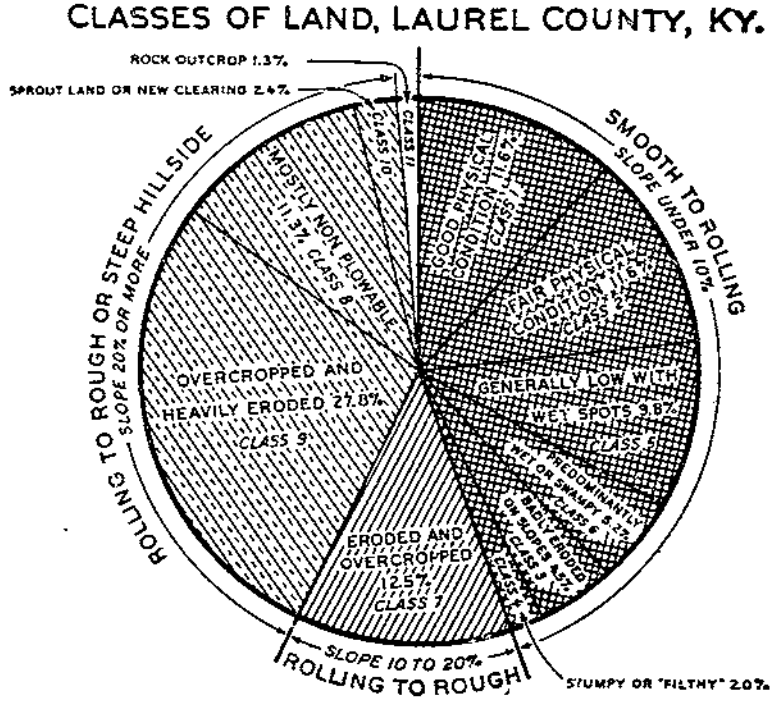

FIGURE 7.—Physical description of the crop and pasture land in 52 farms, Laurel County, Ky., 1928

wood lots would facilitate the introduction of improved practices in the utilization of land for crops and pastures and would, therefore, do much to correct the present practice on many farms of rotating fields in a wasteful cycle of reclamation, ruin, and abandonment. The conclusions as to the present relation of farm wood lots to the farm economy suggested by a study of sample plots on 49 farms are summarized on pages 56 to 59.

Obviously, the basic conditions suggested by Figures 7 and 8 and the conclusions reached with respect to present methods of utilizing land for crops, pasture, and timber, present a number of problems of considerable import to the future of agriculture in Laurel County and to the welfare of the population.

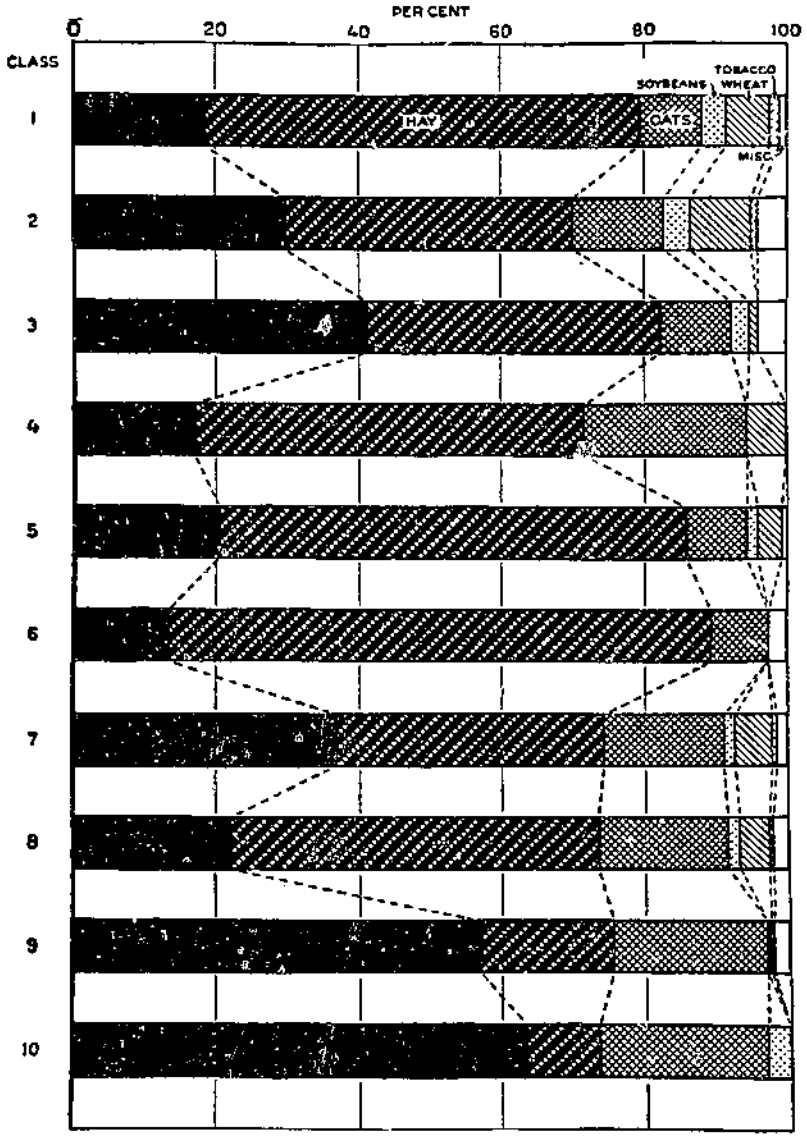

FIGURE 8.—PERCENTAGE OF CROP ACREAGE IN EACH LAND CLASS

The tendency to grow hay on the level or wet land is illustrated by the proportion of the acreage occupied by that crop on land in classes 1, 5, and 6. As land of moderate slope deteriorates through exhaustion of soil fertility by erosion and cropping a larger proportion of the acreage goes into corn. (Classes 2 and 3.) The effect of cropping land of intermediate slope to corn is illustrated by the condition of land in class 7. (Fig. 7.) Classes 8 and 9 offer a significant contrast in the condition of rough or steep land principally used for growing hay (class 8) and that of land of similar type (class 9) principally used for growing corn. (Fig. 7.) New clearings on steep land (class 10) are used principally for growing corn, whereas a large proportion of the partly reclaimed smooth to rolling land (class 4) is in hay.

RECOMMENDATIONS

GENERAL POLICY OF LAND UTILIZATION

A general policy of land utilization for Laurel County must take certain important considerations as a point of departure.

Farming, in combination with the utilization of timber products from farm wood lots, probably will continue to be the principal type of land utilization in the county for the indefinite future. No policy based on enforced evacuation can be regarded, under present conditions, as sound in principle or feasible in practice. Voluntary evacuation of farms as a condition prerequisite to the conversion of extensive areas from farming to forestry uses, obviously can be anticipated only in localities where the public or private advantages to be derived from such conversion are clearly indicated by the relatively small acreages under cultivation, and similar factors. A policy of land utilization can not be divorced from broader questions of public policy associated with the support of schools, of public health facilities and services, and the construction and maintenance of roads.

A policy directed to the future utilization of land in Laurel County should recognize a broad distinction between agricultural and nonagricultural areas.

Within the limits of the general considerations outlined above, it should be regarded as sound policy to encourage the development of public or private forestry instead of farming in the nonagricultural areas, and to develop a better coordination of agriculture, forestry, and related industries and enterprises in the agricultural areas. Broken topography, steep slopes, and light soils unfit a large part of the land in the western section (districts 4 and 5, pl. 1) for agricultural use. Compared with other sections of the county, this section is now agriculturally undeveloped, roads are poor and population is sparse. The present study has indicated that the agricultural possibilities of land of the type which chiefly characterizes the western section are slight. Between 1920 and 1930, according to the 1930 census of population, the population of district 4 declined from 1,744 to 1,661 and the population of district 5 declined from 3,260 to 1,828.

A considerable acreage in the western section is now consolidated in large privately owned timber holdings. (Fig. 1.) From the standpoint of private economy it would be of great advantage, since the land in this section is generally unadapted to the growing of crops, if public encouragement were given to the expansion, under private ownership, of the acreage utilized for growing timber.

Furthermore, the deterioration of the land in agricultural use operates in the long run to reduce the taxable basis, and hence increases the importance from the standpoint of public policy of diverting the land to uses that will conserve its productive capacity.

Expansion of forestry under private ownership depends to a considerable degree upon the application of principles of forest taxation that will encourage methods of management necessary to the proper development, adequate protection, and economical utilization of stands.

Although much of the land in agricultural use in other sections of Laurel County is physically unadapted to that use, these sections must, in view of the general considerations outlined above, be regarded as agricultural. Once this general conclusion is accepted the more

specialized questions of land utilization in Laurel County emerge. In the northern, central, and eastern sections, the determinative factor in a land-utilization program is the central place that farming occupies and, it must be assumed, will continue to occupy, in determining methods of using the land and modes of living. In these sections more especially, therefore, attention must be directed to adjustments in farm, forest, family, and public economy, involving primarily, not changes in the major use of land, but major changes in methods of use. The adjustments suggested are arranged under four headings to serve as a summary of the principal conclusions of the study.

ADJUSTMENTS IN FARM ECONOMY

Special attention should be given to obtaining a combination of land of the proper types in the individual farm.

Many farms in the north and south areas embrace land so poorly adapted to farming as to make profitable operation difficult or impossible. In general, it appears to be true that operators of farms with less than 45 acres of land suitable for crops, except those located on the Lee formation, whether in the north or the south area, must rely on work off the farm for a considerable portion of the farm income.

The type of land available for crops is more important than the mere aggregate of the crop acreage.

The smaller the acreage of crop land, the greater the proportion of it that must be of gentle slope, relatively free from erosion, and in good tilth (class 1) or land not too wet to produce good crops of hay and fair crops of corn (class 5). If less than 30 per cent of the crop land available is of the type falling in classes 1 or 5, or in these two classes combined, if the land with slopes of 20 per cent and over comprised in the crop acreage is not of the type falling in class 8, the land may rather safely be regarded as unadapted to farming.

An expansion of the crop acreage in a farm should not be undertaken as a means of increasing the total net returns from the farm, unless the land in the farm is of the proper type.

Farms located on the Lee formation and on the less rugged portions of the Breathitt formation usually embrace an adequate acreage of land of types suitable for cropping, although drainage would greatly increase the productive capacity of much of this land. Most farms on the Corbin conglomerate are under the double handicap of poor soil and poor drainage in securing an adequate acreage of land adapted to cropping. Operators of farms embracing a considerable extent of hillside crop land on the more rugged portions of the Breathitt formation can not successfully control erosion on the slopes, unless a considerable proportion of ridge land of gentle slope is included in the acreage. Some operators now maintaining a fairly large crop acreage, much of it on steep, heavily eroded, overcropped land, would do better to spend all or a major part of their time in other employment, utilizing the farm principally as a residence and garden. Some farms, with small crop acreages but favorable land characteristics, would justify an expansion of the crop acreage sufficient to employ all or a major part of the time of the operator. The practice of growing intensive crops such as tobacco, potatoes, and other truck, on small acreages of good land should be substituted for the practice of expanding the acreage to include poor land in the production of less intensive crops.

The establishment of long-lay pastures on the hillsides would permit an expansion in the dairy enterprise on many farms which, in combination with poultry, would absorb family and operators' labor to much better advantage than would the growing of corn on the hillsides.

Opportunities for operators to find part-time employment in occupations supplementary to farming or in other occupations should be expanded.

The data of the study indicate that where opportunities for outside employment exist a small farm and little or no farming is better than a slightly larger farm and relatively more farming. As a means of increasing income, expansion of opportunities for work off the farm is much more practicable than expansion of the crop acreage on farms which sometimes have not an acre and often have not an additional acre suitable for cultivation. In the south area opportunities for employment off the farm in occupations generally unrelated to farming are more extensive than in the less accessible north area.

In the less accessible areas, incomes of farmers may be increased by promoting cooperative organization along limited lines. Improvements in the harvesting and marketing of the products of the farm wood lot provide an opportunity for expanding employment supplementary to farming. The establishment of local cooperative plants for processing dairy products does not appear to be feasible. Until opportunities for supplementary employment are expanded, operators of many farms must continue to find it difficult to earn an adequate living. Coal mining provides part-time employment to a limited number of the operators of marginal farms, but there is no present prospect of an increase in the employment provided by local mines.

There are, however, a number of lines of cooperative endeavor which would tend to improve their methods of farming and to increase farm incomes.

Operators of farms, particularly in the less accessible localities, should take full advantage of all opportunities for effecting economies through cooperative organization along limited lines. Potential opportunities of this type include: (1) Cooperative purchase of farm supplies, particularly seed, feed, and fertilizer or lime; (2) cooperative delivery (and possibly sale or shipment) of cream; (3) cooperative culling of poultry flocks and cooperative grading, assembling, and delivering of poultry and eggs; and (4) cooperative shipment of livestock by rail or truck to local concentration points.

Better methods of farm organization and management should be encouraged as a means of effecting significant improvements in conditions on many farms. *(9)*

Of central importance in improved farm management practice is the more general adoption of effective and economical means of increasing crop yields. Soil experiments carried on in Laurel County since 1916 by the Kentucky Agricultural Experiment Station show that the use of agricultural limestone, phosphate, legumes, animal manure, and sods are the chief factors in securing larger yields on Laurel County farms. The more general use of legumes is essential for soil maintenance. Clovers require special soil treatment, except on recently cleared land. The soil experiments and the experience of local farmers who have applied the knowledge gained from these experiments show that the use of limestone and phosphate assures a good stand of clover. The experience of local farmers has also demonstrated that thin, unproductive crop land can be brought into good

condition by soil treatment, the growing of legumes and other feed crops, the feeding of these to livestock, and the application of the manure to the land.

A larger place in the farm organization should be given to intensive crops like tobacco, potatoes, and truck, and more intensive methods should be employed in the production of all crops grown. Growing intensive crops and using more intensive methods in crop production are equivalent to an increase in the amount and quality of crop land, and there is no greater economic need in the farming of the county than more good crop land. This need is a factor on practically all farms, but it is especially evident on a large number of farms which without the use of intensive enterprises are too small to provide adequate productive employment for the available farm labor. Since land suitable for cultivation is so scarce, it is imperative that efficient use be made of every acre of tillable land. A smaller acreage will then provide an adequate family living, and thus reduce the acreage of steep land which many operators who use less intensive crops and methods feel compelled to cultivate.

Since much of the land of this area is rolling or steep, the proper utilization of the land in any system of cropping must provide a sod cover for the land most of the time. It follows that grass and roughage-eating livestock are necessary to an efficient farm economy. Laurel County is in a deficit feed area and prices of both grain and roughage feeds are high. Livestock, to be profitable, must be limited as a rule to the kinds and numbers that can be carried on home-grown grass and roughage supplemented by limited quantities of purchased concentrates.

Because of the small size of most of the farms and the relatively large amount of family labor to be employed, dairy cattle fill the most important place as a livestock enterprise. Beef cattle and sheep offer an economic means for utilizing grass and hay land when labor, markets, or other requisites of dairying are not available.

Hogs do not fit well into a plan of farm organization in Laurel County and have no place as a farm enterprise, except to provide meat for the family and possibly a small quantity of fresh pork for sale locally. Poultry are more profitable users of home-produced grain and dairy by-products than are hogs.

Special attention should be given to the production of a supply of home-grown food products ample for the family needs.

Vegetables, fruits, and dairy and poultry products can be provided by most farmers in quantities adequate for the family table. Although it is true that more than this is required in order for a farm to provide an adequate living, yet improvements to be achieved in this way are applicable to so many farms and are of such immediate practicability as to justify placing the increased production of home-grown foods for family use as a first step in securing a better adjustment of the economy on many farms.

ADJUSTMENTS IN FOREST ECONOMY

The central objective should be to manage and operate the farm wood lot as an integral part of the farm economy.

The essential adjustments include: (1) Restriction of the farm wood lot to a size that can be efficiently managed and economically utilized

as a part of the farm economy and, as a corollary; (2) consolidation of numerous small, poorly managed, and inefficiently utilized tracts into large, efficiently managed forest reserves; [26] (3) management and utilization of the farm wood lot as a farm enterprise, with a view to obtaining the full benefit of its complementary and supplementary relationships to other farm enterprises, and to securing from it a regular annual income as from other enterprises of the farm.

Lumbering, sale of farm wood-lot products, and the development of wood-using industries offer the most practicable means of supplementing income from farming, particularly among operators of farms in the less accessible localities.

Any considerable expansion in employment in lumbering is contingent on the development of stands in large units, to permit large-scale operations; the development of an organization among farmers for the cooperative production and marketing of farm wood-lot products, such as mine props, ties, staves, and poles, would tend to stabilize and increase the income derived from these sources; successful developments along the lines suggested would tend to provide a basis for the successful operation of a local woodworking establishment.

ADJUSTMENTS IN POPULATION

A decrease in the pressure of population appears to be essential to the solution of major economic problems.

Economically, pressure of population has led to attempts to utilize for the production of crops, land that is wholly unadapted to that purpose. The result has been to place many families on a subsistence economy, the economic basis of which tends to decrease with progressive deterioration of the land; socially, the depletion of the economic basis of life has undermined the stability and security of many families and caused frequent moves from farm to farm in an effort to obtain a livelihood; culturally, the development of a subsistence economy behind geographic barriers has retarded and tends to impede the infiltration of external social and economic influences; psychologically, social and cultural isolation has habituated the individual to a mode of life that is not easily adjusted to the requirements of industrial or commercial occupations.

Educational effort should be directed to adjusting the social and cultural environment of the family to changes in the economic environment.

Economic forces have so changed the requirements for successful farming that some families are under strong economic pressure to leave the mountains. Social forces, on the other hand, operating through the family, create in the individual strong emotional attachments which operate against migration. Nethertheless, migration from the mountains is taking place, particularly from areas in which external contacts have been facilitated by improved means of travel and communication. There is evidence that migration from the more isolated areas will increase as such facilities improve. Improvements in housing, selection and preparation of foods, care of farm gardens,

[26] The limited forest tract assessment and yield tax law of Kentucky (*f*) has been held unconstitutional by the attorney general. A State forest tax law designed to permit and encourage, under proper regulations, the consolidation under cooperative ownership, management, and utilization of wooded areas now in farms, but which can not practicably be utilized as farm wood lots, would provide a helpful basis for improving farm-forest economy.

sanitation, hygiene, child care, and similar factors relating to standards and conditions of living can be achieved by many families simply by utilizing the resources at hand. Extension instruction and demonstration would be of great practical benefit. The type of adjustments in farm and forest economy suggested as desirable are, however, fundamental to the development of a more adequate basis of family living and the conditions of a more wholesome family life. These developments would tend to adjust population to resources, both by a better distribution of population within the area, and by better utilization of the land. The most practicable means of accelerating the adjustment of population to resources are the improvement and expansion in educational opportunities and in means of travel and communication.

ADJUSTMENTS IN PUBLIC POLICY

Four important phases of public policy are inseparably involved in other adjustments suggested. A policy of liberal State support to developments along the following four lines should not only accelerate the progress of adjustment, but serve to ameliorate conditions while adjustments are being effected.

(1) Roads: The significance of a few good roads in the agricultural areas will not end with the transportation of persons and goods, but will facilitate adjustments and improvements through the communication of ideas. A policy designed to provide good roads in areas adapted to farming would encourage the proper utilization of the land and enhance the returns to be obtained from it.

(2) Schools: Adequate educational facilities and competent instruction are of fundamental importance, particularly as a means of facilitating the adjustment of population to resources. Better roads would greatly simplify the problem of better schools. Improvements in the location, construction, and facilities of schools would be feasible under the proposed plan of adjustments. A reduction in the number of schools and an increase in the capacity would facilitate improvements in the quality of the instruction. In Kentucky, State school funds are apportioned so as to make it possible for counties having relatively small tax resources to receive a greater amount of money per school child than more wealthy counties. A continuance and extension of this equalization policy should result in a considerable betterment of the educational opportunities of the children of Laurel and other counties in eastern Kentucky.

(3) Forests: The importance of a good forest tax law was noted above.

(4) Credit: It should be an important feature of public policy to develop or make available to farmers adequate credit facilities, including facilities for financing such cooperative enterprises as may contribute to the economical operation of the mountain farm.

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