

Issued March 20, 1914.

U. S. DEPARTMENT OF AGRICULTURE,

BUREAU OF SOILS—MILTON WHITNEY, Chief.

IN COOPERATION WITH THE TENNESSEE GEOLOGICAL SURVEY,
A. H. PURDUE, STATE GEOLOGIST.

SOIL SURVEY OF ROBERTSON COUNTY,
TENNESSEE

BY

J. H. AGEE, LEWIS A. HURST, AND H. JENNINGS, OF THE
U. S. DEPARTMENT OF AGRICULTURE, AND R. F. ROGERS,
OF THE TENNESSEE GEOLOGICAL SURVEY.

HUGH H. BENNETT, INSPECTOR IN CHARGE SOUTHERN DIVISION.

[Advance Sheets—Field Operations of the Bureau of Soils, 1912.]



WASHINGTON:
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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF SOILS,
Washington, D. C., August 15, 1913.

SIR: In the extension of the soil-survey work in the State of Tennessee, work was undertaken in Robertson County during the field season of 1912. This work was done in cooperation with the Tennessee Geological Survey, and the selection of the area was made after conference with the State officials.

I have the honor to transmit herewith the manuscript report and map covering this work, and to recommend their publication as advance sheets of Field Operations of the Bureau of Soils for 1912, as authorized by law.

Respectfully,

MILTON WHITNEY,
Chief of Bureau.

Hon. D. F. HOUSTON,
Secretary of Agriculture.

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SOIL SURVEY OF ROBERTSON COUNTY, TENNESSEE.

By J. H. AGEE, LEWIS A. HURST, and H. JENNINGS, of the U. S. Department of Agriculture, and R. F. ROGERS, of the Tennessee Geological Survey.

GENERAL DESCRIPTION OF THE AREA.

Robertson County lies in the middle division of the State and next to the Kentucky line. The old Louisville and Nashville Pike marks the boundary on the east and separates it from Sumner County. On the south the line between Davidson and Robertson Counties is Sycamore Creek. Cheatham County also forms a part of the southern boundary. On the west lies Montgomery County. The area of Robertson County is 305,280 acres, or 477 square miles.

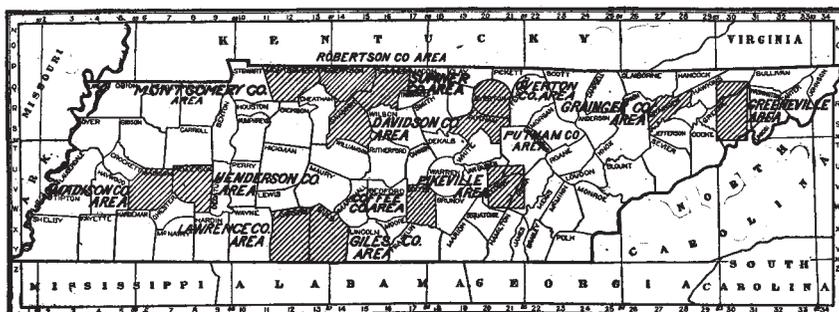


FIG. 1.—Sketch map showing areas surveyed in Tennessee.

The county lies entirely in the Highland Rim region and varies in elevation from 550 feet to 1,000 feet above sea level. The streams in the southern part have dissected the plateau to such an extent that numerous hills and ridges with intervening V-shaped valleys have been formed. The northern part of the county is prevailingly smoother, with considerable rolling to almost level upland country. Even here there are steep irregular slopes in the vicinity of streams, representing the valley walls of these streams. There are local areas characterized by knolls and depressions, the latter frequently lime sinks. With the exception of the steeper walls of the stream valleys and the rough country near the drop from the Highland Rim to the low country of the Central Basin, to the south, the land is all suitable for cultivation; that is, the surface is sufficiently smooth to be plowed without danger of serious erosion.

Practically the entire county is well drained. Red River, with its principal tributary, Sulphur Fork, drains approximately three-fourths of the county, while Sycamore Creek drains much of the remainder—the extreme southern part. Red River has a general westward trend. In the eastern part of the county it flows in a northwest direction until it leaves the county and passes into Kentucky. On its final return to the county the general direction is to the southwest.

The first settlement within the present limits of Robertson County is said to have been in 1778, on the South Prong of Red River, three-fourths of a mile west from the present site of Cross Plains. In the spring of 1779 other pioneers from North Carolina located near this place, and the settlement of the county was commenced in earnest. Subsequently settlers from North Carolina, Virginia, and the "east Tennessee settlement" gradually populated the area. Prior to the organization of the State, in 1796, Robertson County formed a part of what was known as Tennessee County. One of the first acts passed by the general assembly convened at Knoxville in 1796 was to establish Robertson County. Springfield was laid out in 1798. The present population is composed largely of descendants of the early settlers, there having been no recent influx of home seekers from the North, such as has taken place in some other parts of the State. The population of the county, according to the 1910 census, was 25,466, of which 6,822 were negroes.

Springfield, the county seat, which is located near the center of the county on the Louisville & Nashville Railroad, has a population of about 3,000. It is situated on Sulphur Fork. Besides the high school there is located in this place the Peoples Tucker Training School for Boys and Girls. The large woolen mill located in the extreme northern part of town gives employment to many boys and girls. The mill manufactures woolen blankets only and has a capacity of 180,000 per year. Fifteen tobacco houses are situated in or near the town, and there are other important commercial interests.

Adams, the second town of importance in the county, is situated on the Louisville & Nashville Railroad. It has a population of 600. Orlinda lies about 12 miles northeast of Springfield. It is in the center of a very fine farming section of the county and is a thriving town of about 600 people. Green Brier is on the same railroad about 7 miles southeast of Springfield. It is the center of trade for that section. Cedar Hill, Cross Plains, Sadlers, Barrenplain, Youngville, Handleyton, White House, and Turnersville are small towns and distributing points for their several districts. Hygeia and Ridgetop are summer resorts in the southern part of the county.

The many streams throughout the county afford sufficient water power for gristmills, of which there are several.

The Louisville & Nashville Railroad traverses the county in a northwesterly direction. It enters the county near Ridgetop through Ridgetop Tunnel and touches Hygeia, Green Brier, Springfield, Cedar Hill, and Adams, leaving the county near Sadlers. It affords near-by shipping points to all the farmers, except those living east of Or-linda, who are near Mitchellville and Portland, in Sumner County, these latter towns being located on a branch of the same road.

The county roads are numerous, but in many places they are in poor condition. Some of them have such steep grades and are so rough as to be almost impassable, especially during wet weather, when they become deeply rutted. A great deal can be done to improve these roads at small expense, as beds of cherty limestone are easily accessible. Recently nearly a half million dollars was appropriated by Robertson County to improve the roads, and a system of main thoroughfares will eventually connect all important points in the county. There have already been built several miles of excellent macadam road.

Most of the smaller county post offices were abandoned after the introduction of the Rural Free Delivery Service, which now reaches all parts of the survey. Telephones are in general use, and there are very few homes that are not supplied with this convenience.

The central point in the county is only 29 miles from Nashville, from which place it receives much of the supplies, though a portion of the trading is done in Louisville, St. Louis, and Chicago.

Nashville affords a ready marketing place for the various farm products, except tobacco, which is sold principally to the agents of foreign countries.

CLIMATE.

Middle Tennessee is characterized by a mild, pleasant climate. During the summer months the days are warm, but the weather is seldom sultry or oppressive, and the nights are usually cool. Some snow falls during each winter, but the ground is rarely covered for more than a week or 10 days at a time.

According to the records of the Weather Bureau station at Clarksville the average date of first killing frost in the fall is October 28 and of the last in spring April 10. This gives a growing season of 200 days, which is ample for the maturing of all crops grown in the section. The records for Cedar Hill make the average date of killing frost in fall somewhat earlier.

The rainfall is usually evenly distributed and is generally sufficient during the growing season to produce good crops, even in the driest year. The heaviest rainfall occurs in the late winter or early spring, and the driest part of the year is experienced in midautumn.

The climatic data given in the following tables were compiled from the records kept at Cedar Hill and Clarksville, the latter station situated in Montgomery County, lying just west of Robertson. The data for this station cover a longer period and are more complete than those for Cedar Hill.

Normal monthly, seasonal, and annual temperature and precipitation at Clarksville, Montgomery County, and Cedar Hill, Robertson County, Tenn.

Month.	Clarksville.						Cedar Hill.	
	Temperature.			Precipitation.			Temper- ature.	Precipi- tation.
	Mean.	Absolute maxi- mum.	Absolute mini- mum.	Mean.	Total amount for the driest year.	Total amount for the wettest year.		
°F.	°F.	°F.	Inches.	Inches.	Inches.	°F.	Inches.	
December.....	40.5	73	- 5	4.49	1.80	9.76	38.6	3.96
January.....	37.9	75	- 6	4.22	1.33	2.38	36.9	4.16
February.....	40.3	75	-14	4.24	2.40	3.97	51.2	4.77
Winter.....	39.6	.....	.....	12.95	5.53	16.11	42.2	12.89
March.....	49.2	87	4	5.12	2.47	7.98	57.6	4.65
April.....	59.1	89	28	4.63	5.68	11.33	67.1	4.23
May.....	67.4	90	32	4.07	1.71	3.39	75.9	4.33
Spring.....	58.6	.....	.....	13.82	9.86	21.70	66.9	13.21
June.....	75.3	98	43	4.14	2.64	2.67	78.9	3.47
July.....	78.5	104	51	3.93	7.90 ¹	5.14	77.9	3.25
August.....	77.0	99	50	3.26	1.33	4.92	72.8	3.19
Summer.....	76.9	.....	.....	11.33	11.87	12.73	76.5	9.91
September.....	70.8	97	35	2.94	2.23	6.19	60.6	2.02
October.....	59.6	91	27	2.30	2.68	1.03	48.7	4.59
November.....	47.9	80	14	4.32	1.72	1.22	39.5	3.93
Fall.....	59.4	.....	.....	9.56	6.63	8.44	49.6	10.54
Annual.....	58.6	104	-14	47.66	33.89	59.98	58.8	46.55

¹ As of year 1908; other months as of 1912.

Average date of first killing frost at Clarksville in autumn, Oct. 28; of last in spring, Apr. 10. Date of earliest killing frost in autumn, Oct. 10; of latest in spring, May 1.

Average date of first killing frost at Cedar Hill in autumn, Oct. 22; of last in spring, Apr. 10. Date of earliest killing frost in autumn, Oct. 11; of latest in spring, Apr. 26.

AGRICULTURE.

Settlement was begun in the present territory of Robertson County in the year 1778 at what is now known as Cross Plains, on the South Prong of Red River, and this point is probably the location of the first farms in the county. Hunting and fishing were the most important means of livelihood in the early days of settlement, but small

patches of corn, tobacco, and cotton were grown for home use. Sheep, and later cattle, were raised to a small extent. The surplus corn was used by distilleries, while a large part of the wool and cotton was manufactured into wearing apparel at home. With an influx of settlers from North Carolina, Virginia, and east Tennessee after the formation of the county in 1796 cotton and tobacco became the important crops.

These crops were hauled to points on the Cumberland River and were shipped by boat down the Ohio and Mississippi Rivers to New Orleans. This latter place was also the most important market in which the products not grown at home were bought. Another market for the farm produce and for the purchase of necessaries was Louisville, which was reached over the old Louisville and Nashville Pike.

Corn and tobacco practically displaced the production of cotton in 1830 and continued to be the staple crops until after the Civil War. During the few years following there was an appreciable decrease in the production of tobacco, corn becoming the main crop. Later, however, with the construction of the Louisville & Nashville Railroad the demand for tobacco gave an impetus to the growing of this crop and the acreage has increased from year to year until it is at present the principal crop.

According to the Twelfth Census, Robertson County produced in 1899, 770,110 bushels of corn, 34,500 bushels of oats, 333,550 bushels of wheat, 5,646 bushels of Irish potatoes, 8,375 bushels of sweet potatoes, and 10,431,470 pounds of tobacco, with small quantities of forage and hay, principally timothy and clover. There was an increase in the production of all crops in 1909. Corn had increased to 958,859 bushels, oats 89,269, wheat 405,165, sweet potatoes 17,633, tobacco 15,110,684 pounds, and clover had more than doubled in production. The production of Irish potatoes in the same year was 24,970 bushels.

As shown by the above statistics tobacco is the main money crop of the county, corn is second, wheat third, and oats next. Fruit growing is becoming an important industry throughout the county, especially in the southeastern and southern sections.

An excellent grade of dark export tobacco is produced in Robertson County. The Clarksville silt loam and the rolling phase of this type are the principal soils used in tobacco production. These soils are well adapted to the crop, and good yields are obtained where the land is kept in a proper state of cultivation. A moderately heavy application of fertilizers is generally made for tobacco. Fertilizers could probably be in most cases in part dispensed with under a proper system of cultivation and crop rotation, though they are now considered necessary. The rotation commonly practiced with tobacco is to follow the crop with wheat and the wheat with clover. To-

bacco is considered a crop that draws heavily upon the soil. A four-year rotation, in which clover occupies the land two years, has been found a good plan. In order to obtain the best results it is necessary to put the land in good tilth before the plants are set, and to cultivate thoroughly and at the proper time. The cultivation of tobacco requires a considerable proportion of the farmer's time, so that he is often forced to neglect his other crops. Three to five acres of tobacco, with 15 to 20 acres of corn, will keep one man busy during the growing season. The average yield of tobacco is about 850 pounds per acre, although good land has produced as much as 1,200 pounds or even more per acre. The census of 1910 showed a production of 15,110,684 pounds, grown on 17,655 acres. The producer usually makes from \$75 to \$150 an acre on his tobacco crop. The tobacco goes directly into the hands of the representatives of the great tobacco firms of the United States and of European countries. Every year foreign tobacco buyers make their headquarters in Springfield and purchase large quantities of the leaf.

Corn is the second crop in importance and a large acreage is devoted to its production. It is grown in all parts of the county and upon all the types of soils with varying success, even on areas entirely too stony and rough for safe cultivation. The best corn lands are the colluvial and alluvial stream bottoms, for which purpose these soils are used very extensively. On such types the yields range from 30 to 70 bushels per acre. The Decatur soils are also well adapted to corn, yielding from 20 to 50 bushels per acre. On the Clarksville silt loam and other soils of this series the crop yields lightly under ordinary management, but by applying a sufficient quantity of barnyard manure and by practicing a rotation of crops, including the legumes, satisfactory results can be obtained. The yields could be considerably increased on all the soils simply by better preparation of the land and by proper seed selection. Poor stands and yields are traceable to inferior seed as often as to any other cause. The census of 1910 reported 43,441 acres planted to this crop, producing 958,859 bushels, or an average of 22.7 bushels per acre. The practice of sowing cowpeas in the corn at the last cultivation is to be commended.

Wheat is the third most important crop of the county. It is grown on the level and moderately rolling uplands, but not to any great extent on the stony soils of the steep slopes, on account of the difficulty of preparing the land and harvesting the crop. Oats have about the same distribution as wheat, but a much smaller acreage. The yield of both crops varies from light on the Clarksville silt loam to very good on the Decatur soils, depending upon the character of the soil and the different methods of cultivation employed. The productiveness of the Clarksville silt loam and the other soils could

be considerably increased by the application of barnyard manure or by suitable crop rotations. Where wheat or oats follow corn or tobacco, as is often the case, one method of preparing the land is simply to go over it once or twice with a disk harrow, after which the grain is either sown broadcast or drilled in. Better results are obtained where the land is given a deep, thorough breaking and harrowed to a good tilth before the planting is done. After planting the land should be rolled. In some instances wheat and oats are planted after cowpeas and clover, and occasionally fallow lands are used for the crop. Fertilizers are often considered necessary in growing the small grains, especially on the Clarksville silt loam, and from 100 to 300 pounds per acre are applied at the time of seeding. Following tobacco, wheat derives some benefit from the heavy fertilization given the former crop.

Most of the small grain is planted with a drill and harvested with a reaper or binder, but in the rougher country it is sowed broadcast and harvested with the cradle or scythe. This adds greatly to the cost of production. However, there is comparatively little land on which modern farm machinery can not be used. The seeding is done in September and October. Part of the oat crop is planted in the fall and part in the spring. The wheat is placed in the shock until dry and is then stacked to await the rounds of the thrashing machine. The last census gave 30,214 acres in wheat, with a yield of 405,165 bushels, or 13.3 bushels per acre. The total acreage in oats was 4,758, and the yield 89,269 bushels, or 18.7 bushels per acre.

The number of acres in hay and forage crops, in 1909, according to the census, was 15,312, and the production 16,041 tons. The grasses most generally grown are timothy and clover. Sometimes timothy is sown alone, but more often with clover. The census of 1910 reported 973 acres in timothy, producing 1,229 tons, while in timothy and clover mixed 4,130 acres were sown, yielding 4,405 tons. There were 7,168 acres sown to clover alone, and this acreage produced 7,533 tons. These are the principal hay grasses, though millet, Hungarian grass, red top, orchard grass, and bluegrass are also grown. Cowpeas have not become an important forage crop with most of the farmers. This crop does well on any of the soils and should be grown extensively as a soil improver as well as for hay. It is probable that millet and Hungarian grass will do well on the Clarksville silt loam. The prices received for timothy and other hay crops are comparatively high, making their production profitable, and they should receive more attention than at present.

Rye has been grown to a small extent and would prove a valuable crop for the lighter soils. It may be planted as a winter cover crop and will afford good pasturage until the time for planting other crops, when it may be plowed under to supply needed organic matter.

Irish and sweet potatoes are of minor importance and are grown principally for home use. Other vegetables do well on most of the soils, but are not produced on a commercial scale. It would seem that the production of Irish potatoes, cabbage, and possibly other vegetables could be made a profitable industry on the Clarksville silt loam and several of the other soil types if reliable markets could be found.

In adjoining counties the Clarksville silt loam and the Decatur silt loam have produced large quantities of strawberries and cantaloupes of an excellent quality. The soil should be thoroughly prepared for strawberries, cantaloupes, and vegetables. Barnyard manure and high-grade commercial fertilizers can be profitably used for such crops.

Sorghum is another crop of minor importance. It is grown in small patches for the production of sirup for home use.

The adaptation of a number of the soils to fruit is unquestioned. Good fruit is now grown, but only in a small way commercially. The orchards after being planted are frequently neglected, for many of the farmers do not seem to understand the value of spraying and otherwise properly caring for their orchards. Apples, peaches, pears, plums, and cherries are the principal fruits grown. The climate and several of the soil types seem especially favorable for the production of apples, particularly the late summer and early fall varieties. There are many parts of the rolling phases of the silt loam types and of the Clarksville stony loam that could be profitably used for apple culture. These soils are similar to those in the Ozark regions of Missouri and Arkansas and other sections on which apples do well where freedom from erratic frosts exists. It is probable that many of the other fruits would do equally as well as apples if given the same attention. Peaches are rather uncertain on account of late spring frosts. Raspberries, blackberries, and other berry crops can be successfully grown.

In planting an orchard care should be exercised in selecting a site where the air drainage is good and in securing good trees of the best varieties from a reliable nursery. After the orchard is set out it should be properly cultivated, and the trees should be pruned and sprayed.

Grapes have not been grown to any great extent in this county, but it is known that the same character of land in the adjoining county of Montgomery produces them successfully.

There is one large nursery just north of Green Brier, which supplies young trees and vines to different parts of the county and to other sections of the State.

Stock raising has received attention only at the hands of a few. Most of the farmers have one or two cows, and a few steers and beef cattle are sold each year. The better breeds of cattle are not raised as much as they should be. The raising of sheep, horses, and mules receives some attention also, and should prove profitable on the stony and rough lands, which, while affording good pasturage, are fit for little else. Sheep will do well on such lands. The Dorset is a good breed for supplying early spring lambs, while the Merino, crossed with native stock under proper selection, will give a flock bearing heavy fleeces of good quality. Shetland ponies are raised on a number of farms. These ponies are in fair demand at good prices. The census of 1910 gave 15,251 swine in the county, and those farmers who raise hogs find it a remunerative industry. The improved breeds are generally raised. The Jersey is the principal dairy cow in the county, but at the present time dairying is an industry of little importance. However, there is apparently no reason why dairying should not be made a profitable business, with the Nashville market so near and other conditions favorable. While only a few have made the production of poultry a specialty, considerable quantities of eggs and chickens are shipped out of the county. In order to make this business as remunerative as possible, improved breeds should be introduced. This has already been done in many instances. In general, animal husbandry should receive more attention than it has heretofore.

Commercial fertilizers are used extensively, especially in growing tobacco. In 1910 the expenditures for fertilizers amounted to over \$127,501. Great care should be taken in applying fertilizers to soils more or less deficient in humus, for a condition known as "killing" or "burning out" of the land may result. While the present use of commercial fertilizers is no doubt profitable, it would be well for the farmers to endeavor to determine the exact fertilizer requirements of the several soils, by experimenting with various mixtures, and not to be satisfied with the very general practices now followed. By a proper rotation and cultivation of crops, equal results may be had with considerable saving in the expenditure for commercial fertilizers. Lime has a beneficial effect on all the soils of the county, but is hardly used at all, though it can be obtained easily from the underlying limestone formations. Notwithstanding the fact that they are formed from limestone, leaching has been so complete that the soils are now deficient in lime. Lime is often necessary for best results with clover and grasses, and the yields of both wheat and corn may be increased by its use. The soils are in

many places acid. This condition can be corrected by applications of burned lime or ground limestone.¹

Good farm lands range in price from \$30 to \$125 an acre, and the best farms are usually not for sale at any price. There is a wide range in farm values, and even adjoining farms, where the soils and other conditions are about the same, will vary considerably in value, owing to improvements and the present condition of the land. The rougher and stonier lands can be purchased sometimes as low as \$12 to \$15 an acre, but there is not much land for sale at this price. The price of land generally depends upon the character of the soil, surface features, improvements, and the nearness to town or shipping point.

Most of the farm labor is performed by the farmer and his family. However, a considerable number employ help, especially during the busier periods of the tobacco season. At such times labor is often obtained with difficulty, and it is not as efficient as could be desired. The labor employed is both white and negro, mainly the latter. The wages usually range from 75 cents to \$1 a day, though at certain times \$2 a day is paid. Farm hands receive from \$15 to \$30 a month with board. Most of the laborers prefer to work on shares rather than by the day. The scarcity of laborers is partly due to their unwillingness to work for a daily wage for periods covering only a part of the year.

According to the census of 1910 the average size of farms in the county is 75.6 acres.²

There are a few estates having over 1,000 acres, and quite a number containing from 250 to 500 acres. About 54.1 per cent of the farms are operated by the owners, 45.7 per cent by tenants, and a few by managers or overseers. The large farms are operated wholly or in part by tenants on shares, the usual plan of renting. A cash rent, varying with the character of the land, is paid by some tenants. If the tenant furnishes everything but the land and house, he usually receives two-thirds of the crop. In some cases the landlord furnishes

¹ Prof. H. A. Morgan, of the Tennessee Agricultural Experiment Station, summarizes the reasons for the use of lime as follows: (1) It cures soil acidity and improves the mechanical and physical condition of the soil; (2) it increases crop production; (3) it increases activity of the soil and the value of commercial plant food; (4) it encourages the growth of legumes and these add nitrogen to the soil; (5) it makes possible the growing of alfalfa and clover; (6) it permits more economical rotations; (7) it is especially beneficial to meadow and pasture grasses; (8) it makes animal husbandry possible. Lime in the form of ground limestone should contain at least 90 per cent of calcium and magnesium carbonates, and may be applied to the soil in almost any quantity without danger, although it is generally recommended at the rate of 2,000 to 2,500 pounds per acre. It should be applied every three or four years. Burned lime, also known as "lump lime," "quick lime," and "caustic lime," is the most active form of lime and may be used at the rate of 1,000 to 1,200 pounds per acre. Hydrated lime and air-slacked lime are forms that may be applied to the soils in almost the same amounts as for burned lime. The lime may be applied by means of a lime spreader, the ordinary fertilizer drill, with gloved hands, or spread with a shovel.

² The census tabulated each tenancy as a farm. The average size of holdings is therefore larger than that stated.

the house and land, and half of everything else needed to grow the crops, and receives half the proceeds. The tenant often farms for one-third the corn, and one-half the tobacco, curing the latter himself. The owner furnishes a house, work stock, wood, and all fertilizer, except a part—usually one-half—of that used on the tobacco crop.

There are a few old fields and quite a number of waste places to be seen throughout the county, thrown out of cultivation because of unproductiveness. These areas are gullied and generally covered with a growth of broom sedge, which naturally does well on the local soils.

But little attention is given to the prevention of washing. The practice of letting the land rest for a year or more should be discontinued as it is not necessary, and such land often suffers more from erosion than it would were it in cultivation. Some crop should always be grown, if for no other purpose than to improve the soil and keep it in good condition.

Level cultivation, when practiced upon the uplands and where the slopes are not too steep, gives the best results, as the soil retains a larger quantity of moisture and crops suffer less from the effects of summer droughts. Shallow plowing is the usual practice for all the crops, and this should be discontinued. Washing is much more likely to take place in fields broken only to 3 or 4 inches, even where the slopes are gentle. Deep plowing in the fall would allow much of the rain which occurs in winter to sink into the ground and to be retained for the use of the spring and summer crops. Terracing and contour cultivation should be practiced in the hilly sections to prevent washing. Absorption by the deeply broken soil, together with the means last mentioned, would greatly diminish the washing that now results from water flowing in unrestricted rills down the slopes.

The agricultural needs of the county are a more diversified system of cropping, the systematic rotation of crops, and better preparation and cultivation of the soil. More grain and forage crops, especially the legumes, such as clover and cowpeas, should be grown. The supply of organic matter should be maintained by plowing under green manuring crops. More attention should be given to fruit culture and live-stock production. With more stock the hay and grain can be fed on the farm and the manure returned to the soil, allowing only the finished products in the form of meat, butter, etc., to go on the market. Cowpeas are grown to a limited extent at present. This crop and the soy bean—a leguminous crop little known here—will do well here, supplying a large quantity of forage and improving the land. These crops add nitrogen, which can be secured more cheaply in this way than in commercial mixtures.

Proper crop rotation affords the easiest and most efficient means of keeping the soil in a productive state and at the same time increases the value of the farm. The injurious effects of growing the same crop

continuously on a given piece of land are generally recognized by farmers, and most of them change their crops from field to field, but they do not follow any systematic plan, taking the farm as a whole. The rotation commonly practiced is to sow wheat and clover and plant tobacco on the sod land. A four-year rotation in which clover occupies the land two years is a better plan.

In the preparation of the land the depth of plowing should, in general, be increased. The land should then be thoroughly worked and harrowed to give a mellow seed bed. Shallow and frequent cultivation are necessary for corn and other intertillage crops. Care should be taken to injure the roots of the growing plants as little as possible. Especially in growing tobacco is it essential that the land should be in good tilth.

Robertson County is a prosperous agricultural community. It is said to have fewer farm mortgages than any county in the State. This prosperity is in part due to local conditions, but is chiefly due to the ruling high prices of tobacco, the principal money crop. Many of the farms are equipped with riding plows, disk harrows, reapers and binders, and other modern farm machinery. A few have steam plows. As a rule the farm dwellings are substantially built, and there are many beautiful country homes scattered over the county. A large number of the older houses are giving place to new and better ones. The outbuildings are generally well kept, but many farmers neglect to house their machinery and implements.

SOILS.

The soils of Robertson County may be divided broadly into two groups—residual and alluvial. The residual soils are those that have been derived directly through weathering of the underlying rocks, while the alluvial soils consist of reworked material carried down by water and deposited along the stream courses. Including Rough stony land, 8 types and 2 phases were mapped, 6 of which are residual and 2 alluvial. The residual or upland soils are the most extensive and most important agriculturally, the alluvial soils occupying only a small part of the county.

The residual soils are derived mainly from the St. Louis limestone, but the Fort Payne chert, often called the Tullahoma formation, is the source of the residual soils on the lower slopes in the southern part of the county. The St. Louis limestone consists in the main of a thick bed of limestone, gray to blue in color, and containing considerable chert. The unweathered ledges of limestone are rarely exposed away from the stream channels. The tops of the ridges and the flat areas as a rule are occupied by material very fine in texture, which was largely mapped as Clarksville silt loam, while on the slopes to stream courses a large percentage of chert material is present, and the soils

there are consequently more or less stony in character. It is probable that portions of the St. Louis contained larger amounts of iron oxide, or there were laid down in the rock beds lentils of limestone high in iron content. The weathering of such rock masses has given rise to soils of the Decatur series. An underlying bed of cherty material assists in the drainage of the smoother areas. The soils are strong, durable, reliable, never failing to produce fair crops where well cultivated, whether the season be wet or dry.

The Fort Payne chert consists of platy calcareous, siliceous shale; massive calcareous chert; dense noncalcareous chert; and but little or no limestone. All these different kinds of rock vary in color from bluish black to black, and each is present in varying amounts in different parts. Over most of the county where this rock is exposed the lime has leached out and it is only the weathered rock that is seen. In such places it is a yellow, porous, soft earthy chert, occurring in thin pieces and overlain by a thin gray stony soil. The formation on the highest parts is overlain by the St. Louis limestone, and at such places the Fort Payne exposures are generally concealed by colluvial material from above.

The alluvial soils consist of reworked material carried down by water and deposited as bottom lands along the stream courses. The larger streams have built up along their courses rich alluvial lands mapped as the Huntington silt loam, while along the smaller streams are found narrower bottoms of similar material, except that it is modified by an admixture of gravel brought down from the adjoining hills. This type is known as the Huntington gravelly loam.

The following table gives the name and extent of the various soil types mapped in the county:

Areas of different soils.

Soils.	Acres.	Per cent.	Soils.	Acres.	Per cent.
Clarksville silt loam.....	108,800	53.3	Clarksville stony loam.....	9,792	3.2
Rolling phase.....	54,016		Guthrie silt loam.....	3,968	1.3
Decatur silt loam.....	55,680	24.7	Huntington gravelly loam.....	1,792	.6
Rolling phase.....	19,776		Rough stony land.....	1,600	.5
Decatur clay loam.....	39,616	13.0	Total.....	305,280	.....
Huntington silt loam.....	10,240	3.4			

CLARKSVILLE SILT LOAM.

The soil of the Clarksville silt loam consists of a pale-yellow to grayish-yellow silt loam, underlain at about 10 to 15 inches by a friable silty clay loam to silty clay of a pronounced yellow color. This yellow subsoil material may extend to a depth of 3 feet or more, but generally the substratum beginning at about 40 to 50 inches is of

a light-red color in the upper portion and deeper red, like that of the Decatur subsoil material below. In some of the flatter, poorly drained places the subsoil is mottled faintly with gray, while in some of the better drained situations it is tinged with red, having a light-buff or yellowish-red color. Usually the first 2 or 3 inches of surface material of the forested areas is gray and of floury structure. When dry the subsoil is compact and difficult to bore into. The type for the most part is free from stones, but in places chert fragments occur both in the soil and subsoil with layers of chert in the substratum.

This type occupies flat and undulating country, the higher plateaus having an elevation varying between 680 and 1,000 feet above sea level. It is often present on the divides as a very narrow band, but there are large uninterrupted bodies. In other areas the type is associated with areas of the Decatur silt loam, occupying generally country of somewhat less smooth topography. It is widely distributed and one of the most extensive types in the county.

The Clarksville silt loam is a residual soil derived from the weathering of beds of the St. Louis limestone, probably of low chert content. In places the limestone is somewhat argillaceous; elsewhere it appears to be of a purer composition.

Originally a forest growth consisting of white oak, post oak, red oak, hickory, black gum, redbud, sweet gum, chestnut, persimmon, dogwood, and poplar covered the Clarksville silt loam areas, and a few small wooded tracts still remain.

Since tobacco has become the chief crop of the county the Clarksville silt loam has proved one of the most important types, as it is the best tobacco soil in the State. This crop yields from 600 to 1,000 pounds per acre.

Although the yield of tobacco from Clarksville silt loam is not so heavy as from the Decatur silt loam, the better quality of the leaf more than offsets the lighter yield. In the use of the former soil the tendency is to plant largely to this one crop, which makes it difficult to follow a proper rotation. When a rotation of crops is practiced at all, wheat follows tobacco, which in turn is succeeded by clover. Corn is the crop of second importance and the ordinary yield is from 12 to 25 bushels per acre. The usual wheat yield for this type is 10 to 15 bushels per acre, while that of oats is 15 to 25 bushels per acre.

Though only moderately productive, this soil, owing to its favorable position, is a very desirable type. It appears to be deficient in lime and organic matter, and these should be supplied. Either the burned lime or ground limestone may be used. In adding organic matter green manuring crops are valuable where the supply of barnyard manure is inadequate. The soil is very easily compacted and deep and frequent plowing is necessary to maintain it in a friable condition. Subsoiling would very likely prove beneficial.

Clarksville silt loam, rolling phase.—The soil of the rolling phase of the Clarksville silt loam is about like that of the typical soil, except that fragments of chert are very much more plentiful. The phase really includes many small patches which are nearly or quite gravelly enough to be mapped as the Clarksville gravelly loam, but the small size of these areas made it impracticable to separate them. Very little of the type, however, is sufficiently gravelly to prevent cultivation. Another difference between the soil of this and of the typical Clarksville silt loam is that the surface layer of the former is shallower and the depth to the red material is less. The greater portion of the soil consists of a pale-yellow to grayish-brown silt loam, underlain at about 5 to 10 inches by a yellow, friable silty clay loam which frequently grades into a yellow or reddish silty clay. In places the subsoil throughout has a faint reddish cast.

This land occupies rolling topography in the vicinity of streams usually flanking the higher and more nearly flat typical Clarksville silt loam. The surface is characterized by a smoothly sloping or regular surface rather than a rough or gullied irregular topography. Many of the slopes, however, are steep enough to induce destructive erosion, and in places the yellow clay subsoil and occasionally the red clay substratum have been exposed at the surface.

A large proportion of the land is cultivated, while nearly all of it can be cultivated. It is used for the same crops as the typical soil and the yields are very nearly the same. Cultivation is somewhat more difficult on account of the steeper topography, and more care is necessary to prevent erosion. The origin of the material of this phase is the same as that of the typical soil. The greater abundance of chert fragments, at least in places, is due to accumulation of such fragments through the removal by erosion of the finer constituents of the soil mass. On the other hand, much of the material is probably derived from a more cherty limestone than that from which the soil portion of the typical soil is derived, probably from a stratum more like that giving the cherty substratum portion of the typical soil.

As is indicated by the topography, the drainage of the phase is perfect, in fact, the run-off is too rapid and erosion results where the land is not cultivated with care. The chert fragments scattered over the surface and distributed through the soil mass make the material more open and more absorptive and consequently help to prevent erosion. The stone fragments serve to retard, to a considerable degree, the removal of the fine particles by rains. In order to prevent excessive wash, terracing and contour cultivation are recommended.

Some of this type remains in forest, from which most of the merchantable timber has been removed. The principal trees in these

tracts are oak, tulip, poplar, hickory, black walnut, elm, maple, and chestnut.

This soil will produce apples and peaches of good quality. It seems especially well adapted to apples, particularly the summer and fall varieties. Blackberries and other small fruits do well. Fruit growing could be made a profitable industry on this type. At present very little fruit is grown on a commercial scale.

CLARKSVILLE STONY LOAM.

The profile of the Clarksville stony loam is much like that of the Clarksville silt loam, except that the depth to the yellow silty clay loam or silty clay subsoil and to the red substratum is less. The soil consists of about 6 inches of a gray or light-yellow to grayish-brown silt loam, underlain by a yellow silty clay loam or silty clay which frequently grades into reddish clay. The type occupies steep slopes adjacent to the streams in the southern part of the county. These slopes are considerably steeper than those of the rolling phase of the Clarksville silt loam. Much of the land mapped under this name occupies slopes too steep to permit safe cultivation and is only suited for pasturage or forestry. Both soil and subsoil contain a large percentage of broken chert varying in size from pieces no larger than a marble to fragments 10 inches or more in diameter. In small included patches the proportion of fragments is not large enough to interfere seriously with cultivation, but over most of the type the coarse fragmental rock makes cultivation quite difficult. A few small patches included in this type have been washed sufficiently to expose the yellow material of the subsoil or the red clay of the substratum.

The drainage of the type is perfect, and were it not for the large quantity of stones on the surface erosion would be excessive. The rock fragments serve to prevent erosion by making the soil more porous and absorptive and by checking the velocity of the rills running down the slopes after heavy rains. In dry weather the stones, acting as a mulch, retard evaporation and aid in keeping up a suitable moisture supply.

The material forming this type has the same origin as the rolling phase of the Clarksville silt loam.

Most of the type is forested with oak, hickory, black and white walnut, chestnut, dogwood, and redbud. A few fields have been cleared and are used for the general farm crops. Fruit growing is possibly the most promising industry for this type. A few orchards are scattered over these areas, but fruit growing on a commercial scale has not been attempted.

Much of the Clarksville stony loam should be left in forest.

GUTHRIE SILT LOAM.

Throughout the uplands, in the areas of Clarksville silt loam, there are many slightly depressed, flat-bottomed areas, some of them too small to map, which have been caused apparently by solution and removal of the underlying limestone—a process related to that, or the same as that giving rise to the common sink holes of the region. These areas are poorly drained on account of their flat surface and lack of outlets, water frequently standing on the surface for considerable periods after rains. This poor drainage has caused the light-gray color of the soil material and the mottled gray and yellow color of the subsoil material found here. The soil, where typically developed, consists of a gray to white floury silt loam, underlain at about 15 inches by a mottled yellow and gray or drab silty clay loam to silty clay. The material is unquestionably the same in source as that giving the Clarksville silt loam, poor drainage, and retarded weathering being responsible for present differences. By proper drainage a more uniform distribution of moisture could be maintained and the productiveness of such areas could be increased. The installation of tile drains is especially recommended for this type, although ditches can be made to do effective work.

The free use of lime or ground limestone, phosphate, and barnyard manure, following drainage, will go far to put the soil in good productive condition.

The two areas of this type of greatest extent occur in the vicinity of Cedar Hill and southwest of Doziers School, respectively. The last mentioned is the larger and contains about 2 square miles.

At present very little of the type is under cultivation. Most of it is forested with white oak, water oak, post oak, gum, maple, and hickory. Redtop and lespedeza can be readily seeded on properly reclaimed areas.

DECATUR SILT LOAM.

The Decatur silt loam consists of a brown to reddish-brown friable silty loam or mellow silt loam, underlain at about 8 to 12 inches by a red silty clay loam, which passes at 18 to 24 inches into a deep-red silty clay of a brittle or moderately crumbly structure. When dry the subsoil is quite compact.

The surface is characteristically undulating to very gently rolling, averaging slightly more rolling than the Clarksville silt loam. The soil occurs over the higher and broader stream divides and is developed entirely in the northern half of the county. Many included areas, too small to map, have been eroded in such a way as to expose the red subsoil material. These represent patches of Decatur clay loam. A few chert fragments are encountered in the soil section of some areas and in the substratum chert fragments are

often abundant. As a whole the type is well drained. The rolling condition of the topography permits the water to run off and the character of the soil mass is such that it permits the percolation of the water downward. Tile drainage is to be recommended for the level areas which are imperfectly drained.

The Decatur silt loam appears to be derived from a stratum or from lentils of limestone in the St. Louis formation differing from those forming the Clarksville soils, possibly being a purer or more ferruginous limestone. The fact that the Decatur silt loam frequently occupies similar topography to that of the Clarksville silt loam would seem to controvert the theory that the red color of the Decatur is due to more complete oxidation of the material resulting from better drainage. However, it is by no means certain that the red color does not have some connection with an advanced stage of oxidation.

Nearly all of the type is cleared and under cultivation, but small areas remain in forests of oak, hickory, black and white walnut, poplar, maple, elm, and red ash. Being the most highly prized of the soils, general farming is practiced on this type more than on any other in the county. The type is inherently more productive than the Clarksville.

Tobacco is the chief crop, the yield ranging between 800 and 1,200 pounds per acre. Corn gives good results, yielding on the average a little over 30 bushels per acre. Wheat yields from 20 to 30 bushels per acre. The yield of oats is about 30 bushels per acre.

In other counties this soil has proved to be an excellent one for truck farming. With constant cropping the supply of organic matter has been decreased. The soil is also deficient in lime. To replace the latter applications of ground limestone or burned lime should be made. The content of organic matter should also be increased. Planting legumes and plowing under an occasional crop or applying barnyard manure where available should be made part of the farming practice. The best yields of which this soil is capable can not be expected so long as the deficiencies pointed out are allowed to exist.

Decatur silt loam, rolling phase.—The Decatur silt loam, rolling phase, differs from the typical soil mainly in its more rolling topography. It occupies the more eroded areas, generally near streams or about the headwaters of drainage ways. The average depth to the red silty clay loam or clay is about 6 inches, the surface soil thus being noticeably shallower than the soil of the typical Decatur silt loam. Chert fragments are usually found scattered over the surface and throughout the soil section, but are not present in sufficient quantity to interfere materially with cultivation.

The drainage of the phase is perfect, and, as is the case of the Clarksville silt loam, rolling phase, it is subject to washing. The chert fragments check the too rapid run-off and allow much of the rainfall to soak into the ground by making the soil more porous.

Much of the phase can be used for general farm crops, but it is recommended that the steeper slopes be utilized for soil-binding crops, such as grass and clover, and not for intertilled crops.

There is very little difference in the yields on the cultivatable parts of this phase and the typical Decatur silt loam, but cultivation is always more difficult and is attended with increased erosion. A slightly heavier farm equipment is necessary to cultivate the phase properly than is required on the typical soil.

Hopper-shaped sink holes and wide, circular, pondlike depressions occur in a few of the areas mapped in the phase, and the skill of the farmer is taxed to prevent the rims of these depressions from becoming impoverished by the wash of the soil into their bottoms.

A small proportion of this type remains in forest, the principal trees being hickory and walnut, with a scattering of cedar, chestnut, black oak, white oak, and ash.

DECATUR CLAY LOAM.

The Decatur clay loam consists of a reddish-brown silty clay or brownish-red clay loam, underlain at 4 to 10 inches by a heavy red clay, which is compact and brittle when dry and moderately plastic when wet. The type includes areas of Decatur silt loam too small to map on the scale used. A considerable proportion of this land represents former areas of Decatur silt loam the surface of which has been removed by erosion. The topography is characteristically rolling to sloping, many areas occurring on the slopes approaching the streams. This position gives good drainage. On these steep slopes patches of the soil have been washed off and in a newly plowed field a somewhat spotted appearance is the result. Chert fragments are of common occurrence over the surface, in the soil and subsoil, and are abundant in the substratum.

This type is highly prized for wheat and corn production and during a good season produces a heavy yield of tobacco, but the inferior quality of the leaf and the danger of leaf burning during a dry period just before cutting time make the type less desirable to the growing of the last-mentioned crop than other types already described.

A small acreage is devoted to clover, millet, cowpeas for hay, and redtop. Corn yields from 20 to 50 bushels, wheat 12 to 30 bushels, and oats 25 to 45 bushels per acre. The wide range in yields is due not so much to a difference in the soil on different farms as to varying methods of cultivation.

Somewhat heavier plows and teams are required to maintain a good condition of tilth than in the case of the silt loam member of the series.

On this type it is recommended that the system of farming should be changed to one in which stock raising plays a more important part. Under the present system the revenue is obtained very largely from the sale of the grain crops and very little attention is paid to keeping the soil in a state of productiveness. Hay crops should replace the grain crops in many instances, and the areas which have a tendency to wash should be sown in cowpeas and later sown in grass for permanent pasture.

HUNTINGTON SILT LOAM.

The soil of the Huntington silt loam to a depth of 10 to 12 inches is a light-brown to dark-brown silt loam, containing considerable organic matter. The subsoil is slightly heavier, sometimes a clay loam or silty clay loam, and varies from chocolate brown to light yellowish brown in color.

This soil occupies the bottom lands along the courses of the larger streams and is subject to overflow. It is most extensively developed along Red River and its principal tributary, Sulphur Fork, while along the smaller creeks the areas are merely narrow strips. The type is of recent alluvial origin and is composed of material washed from adjacent uplands and deposited by the streams during high water.

The Huntington silt loam is best adapted to the growing of corn, and during good seasons produces from 30 to 60 bushels per acre. Grass does well also, and from 1 to 2 tons of hay may be cut from an acre.

The Huntington silt loam when seeded to grass makes excellent pastures. During dry seasons oats do well, but in seasons of more than normal rainfall the upland soils give relatively better results with this crop. Wheat does not, as a rule, succeed on this soil. It is likely to be injured by the spring floods.

HUNTINGTON GRAVELLY LOAM.

The Huntington gravelly loam is very similar in its fine-earth constituents to the Huntington silt loam, but contains a large percentage of subangular chert fragments and gravel. It is a light-brown to dark-brown silt loam, from 8 to 10 inches deep, which varies in color, texture, and in content of gravel and angular rock fragments washed from near-by slopes. The subsoil is decidedly variable, ranging from reddish chocolate brown to yellowish-brown silty loam or silty clay loam, passing into a bed of gravel at about 24 to 36 inches, which

consists chiefly of angular chert fragments. The type occurs as narrow strips along the smaller streams and represents the wash from the adjacent lands, reworked more or less by these streams. Cobbles of considerable size are present in some places.

The Huntington gravelly loam often produces good crops of corn, but owing to its small extent it is of very little importance.

ROUGH STONY LAND.

Rough stony land includes areas marked by frequent rock outcrops and having bedrock so near the surface that the land can not be cultivated. Most of the Rough stony land mapped really represents rock outcrop. Small strips of this land usually occur near stream courses, the largest area shown is in the southern part of the county, about $2\frac{1}{2}$ miles southeast of Crunk. Practically all of the Rough stony land is in forest and should be left so. It is too steep and stony to have any other value.

SUMMARY.

Robertson County, with an area of 477 square miles, or 305,280 acres, is one of the northern tier of counties in middle Tennessee.

It lies entirely in the Highland Rim at an elevation varying from 550 to 1,000 feet above sea level. It has been more or less dissected by streams, and the surface ranges from hilly in the southern part to slightly rolling or level in the northern part. Drainage is well established.

In 1910 the population was 25,466. Springfield, the county seat and principal market, is located near the center of the county and has a population of about 3,000.

The county is traversed by the main line of the Louisville & Nashville Railroad, affording connections with markets both to the north and south.

The climate of Robertson County is mild, with a long growing season and ample rainfall for agriculture.

Tobacco, corn, and wheat are the main crops. Some live stock is raised, mainly cattle and hogs.

Systematic rotation of crops is practiced by a few of the better farmers. The majority grow the money crops from year to year, with little regard to the matter of soil improvement. Commercial fertilizers are used extensively on all the lighter soils. Liming is practiced to some extent and should be given more attention.

Land values on the whole are moderate, the best of the limestone soils bringing from \$30 to \$120 an acre, while some of the more poorly drained areas may be bought for \$10 to \$40 an acre.

Farm laborers are paid on the average \$1 a day and by the month from \$15 to \$30.

The soils of the county fall naturally into two groups, residual and alluvial. The residual soils owe their origin to the weathering and decomposition of the St. Louis limestone and Fort Payne chert. These are the source of all the soils in the county, as the alluvial soils represent reworked upland material.

Including Rough stony land, 8 soil types, 2 of which are alluvial, were mapped.

The Clarksville silt loam is one of the most extensive and important soils in the county. Tobacco, corn, and wheat are grown successfully. These crops should continue to dominate, but systematic rotations should be followed in their production.

A rolling phase of the type is found. This is adapted to the same crops as the typical soil, but requires more careful management to prevent erosion. Orchard fruits, especially apples, do well on suitable areas of the rolling phase.

The Clarksville stony loam is much like the silt loam, except that the soil is shallower and there is a larger proportion of chert fragments in the former. General crops are grown on small areas, but the type is better suited for pasture land or for forestry.

The Decatur silt loam is characterized by its heavy red subsoil. Tobacco, wheat, corn, oats, and forage crops do well. Small grains and corn are especially suited to this type.

The rolling phase of this type has about the same adaption as the typical, but must be handled more carefully to prevent erosion.

The Decatur clay loam is especially well adapted to wheat and forage crops. It is a heavy soil, and requires heavy implements and teams to cultivate it properly.

The Huntington silt loam is the most important alluvial soil in the county, and is utilized mainly for the production of corn and hay, of which large yields are obtained.

The Huntington gravelly loam differs from the silt loam in that it contains a large quantity of subangular chert fragments. It is best adapted to grazing, although corn does well.

Rough stony land includes areas of shallow soil and rock outcrop. It should be devoted to forestry.

The Guthrie silt loam is a poorly drained soil occurring in depressions in the uplands. It is of little agricultural value in its present condition, but when reclaimed will give good results with the staple crops of the region.

[PUBLIC RESOLUTION—No 9.]

JOINT RESOLUTION Amending public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, "providing for the printing annually of the report on field operations of the Division of Soils, Department of Agriculture."

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, be amended by striking out all after the resolving clause and inserting in lieu thereof the following:

That there shall be printed ten thousand five hundred copies of the report on field operations of the Division of Soils, Department of Agriculture, of which one thousand five hundred copies shall be for the use of the Senate, three thousand copies for the use of the House of Representatives, and six thousand copies for the use of the Department of Agriculture: *Provided*, That in addition to the number of copies above provided for there shall be printed, as soon as the manuscript can be prepared, with the necessary maps and illustrations to accompany it, a report on each area surveyed, in the form of advance sheets, bound in paper covers, of which five hundred copies shall be for the use of each Senator from the State, two thousand copies for the use of each Representative for the congressional district or districts in which the survey is made, and one thousand copies for the use of the Department of Agriculture.

Approved March 14, 1904.

[On July 1, 1901, the Division of Soils was reorganized as the Bureau of Soils.]

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