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To the Graduate Council:

I am submitting herewith a thesis written by Phillip L. Thomason entitled "Soil Association Areas As A Force Influencing Economic Status of Rural Households In the Upper East Tennessee Valley." I recommend that it be accepted for nine quarter hours of credit in partial fulfillment of the requirements for the degree of Master of Science, with a major in Agronomy.

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Major Professor

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SOIL ASSOCIATION AREAS AS A FORCE INFLUENCING ECONOMIC STATUS OF RURAL HOUSEHOLDS IN THE UPPER EAST TENNESSEE VALLEY

A Thesis

Presented to

the Graduate Council of

The University of Tennessee

In Partial Fulfillment

of the Requirements of the Degree

Master of Science

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by

Phillip L. Thomason

August 1960

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CHAPTER I

INTRODUCTION

Economic and agronomic conditions in Tennessee and the Nation have remained favorable for several years for progress in agriculture. Improvements in physical production efficiency have resulted from farm production practices such as mechanization, improved soil management, and the use of higher yielding and better adapted crops. However, underemployed labor and low levels of efficiency in the use of resources with resulting low incomes characterize many of the rural areas of Tennessee.

Seven counties in the Upper East Tennessee Valley were selected as a sample area to represent similar areas in the Appalachian Region (figure 1). Only 1/4 of the full-time farmers in the sample area sold more than $2,500 worth of farm products in 1954. The rather rapid increase in industrialization and the increasing desirability of rural living have stimulated a trend toward part-time farming. Many city dwellers with a desire for country living have obtained small acreages and are combining small scale farming operations with a nonfarm job. Many small scale farm operators, dissatisfied with the inadequate incomes their farms returned, have taken advantage of industrial opportunities through off-farm employment. Many of these farmers have retained all or part of their farm acreage and are producing some agricultural products in addition to working at full-time or part-time employment

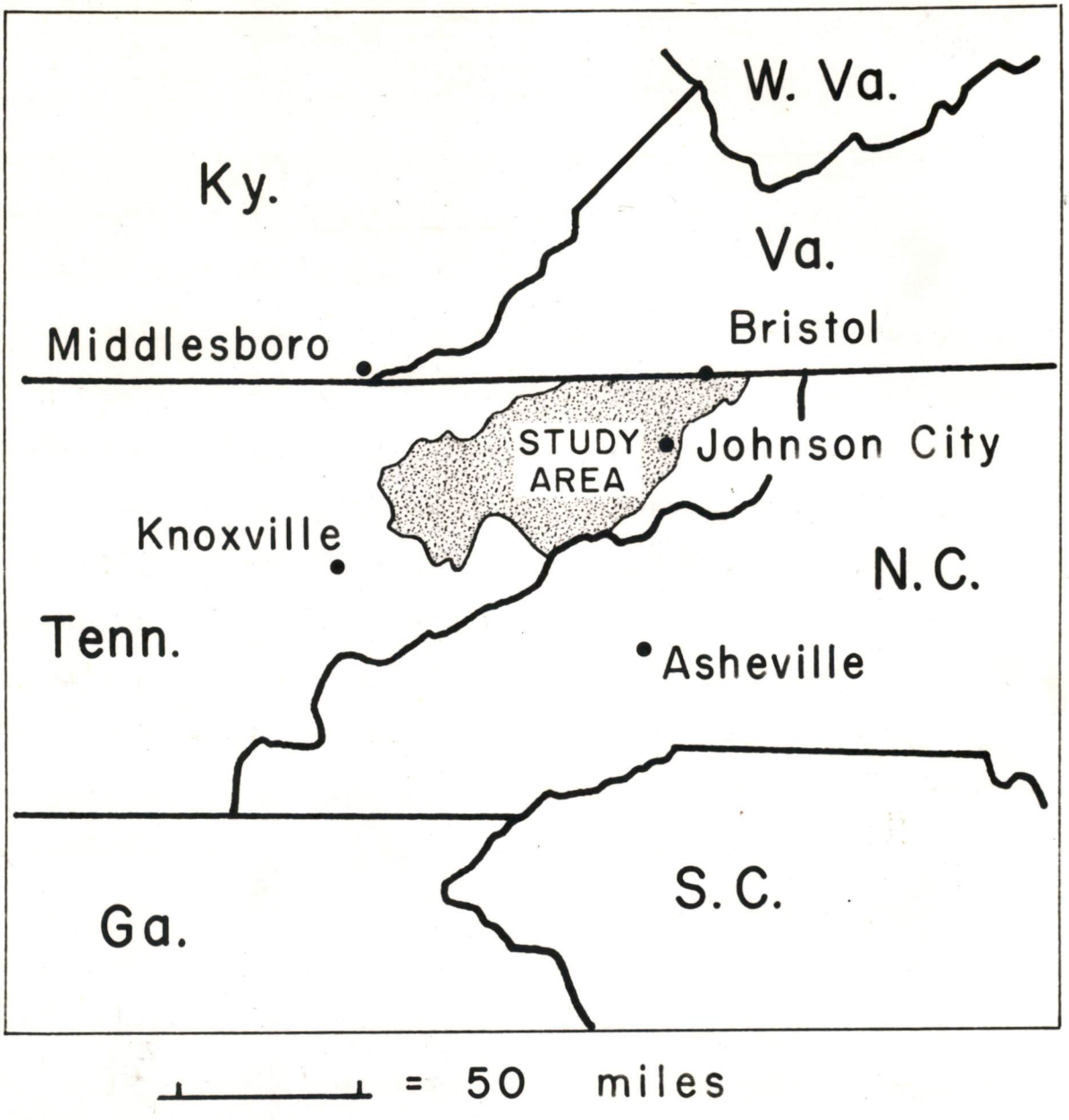


Figure 1.--Map of Upper South showing the study area.

off the farm. The location of small industries in rural and small town areas has been conducive to this type of farm-industrial job combination. These conditions indicate a need for adjustments in the agriculture of the area.

Programs directed at the problems of economic development in low income rural areas are being planned and developed at the National, State, and Local levels.

There is need for agronomic and economic research which will provide an understanding of the factors underlying the low income farm problem and a knowledge of the characteristics of the farm people and other resources in the area. There is a need for evaluation of alternative adjustment opportunities for the more important soil resource situations. There is also a need for appraisals of the implications of alternative lines of action.

A. Purpose of Study

This study was designed primarily to explore:

(a) The influence of different soil association areas in East Tennessee upon what is produced and sold from farms.

(b) The degree of adjustment of people from full-time farming to part-time farming and nonfarm employment in the different soil association areas.

(c) The influence of soil resources upon the income and level of living of people in the area.

Information obtained should be useful in planning, organizing, and implementing programs designed to improve the economic status of farm people in East Tennessee, and in similar areas in the Appalachian Region.

B. Soil Association Defined

The Soil Science Society of America Committee on Terminology (2) defined soil association as "a group of defined and named taxonomic soil units occurring together in an individual and characteristic pattern over a geographic region; comparable to plant associations in many ways." In some soil survey reports (6) it is described as "a geographic group of two or more soils that are together in a fairly uniform distribution pattern. Ordinarily, the boundaries of an association are fairly well defined. The soils within an association may differ from each other, but their proportions and distribution are about the same wherever the association occurs." Frequently a generalized map is made to show these groups of geographically associated soils, each group having a fairly uniform pattern of relief, drainage, suitability, and component soils throughout its extent. The usefulness and agricultural importance of a particular soil is affected by the kinds of soils with which it is associated.

CHAPTER II

LITERATURE REVIEW

A. Location of the Area

Lying east of the Cumberland Plateau and roughly parallel to it, with a general northeast-southwest trend, is the Great Valley of East Tennessee, a succession of parallel ridges and minor valleys. The width varies from 45 to 70 miles, the greatest east and west distance being in the northern part. The elevation averages approximately 1,000 feet above sea level. This is one of the largest physiographic regions of the state, containing approximately 8,000 square miles.

Fenneman (7) pointed out that the rock formations now exposed in the Great Valley, principally shale and dolomitic limestone, with some sandstone on the higher ridges, are of the Cambrian, Ordovician, and Silurian geologic systems. Limestone and shale are interbedded in places. However, interbedded sandstone and shale and interbedded sandstone, shale, and limestone occur in other places. The limestones vary from pure limestones to cherty dolomites. Because of the series of ridges and valleys already mentioned, one finds, in going from west to east, rapid topographic changes. Many of the ridges are high--over 300 feet above the valley floor; and because of the steep slopes, are still forest covered. Where the ridges are lower and more rounded, farming has often taken over the tops as well as the broad, gentle

slopes between. This entire region is the result of the geologic disturbance whose pressure, originating in the southeast, dislocated the original horizontal rock structures, setting many of the beds on edge. The Post-Cumberland Uplift was followed by the degradation of the less resistant rocks to make the Great Valley. The sandstones and cherty dolomites, being more resistant to erosion, usually form ridges; the more easily eroded limestones tend to form valleys. Between these two extremes lie all kinds of variations.

Greene and Washington are the only counties that do not lie entirely within the Great Valley part of the Ridge and Valley Province. According to Edwards et al. (5) "about 4/5 of Greene County lies within the borders of the Great Valley, and the rest is in the Appalachian upland." The rugged and mountainous Appalachian upland is underlain principally by quartzite and slate of the Pre-Cambrian Age.

Elder et al. (6) stated that "physiographically, most of Washington County is in the Great Valley part of the Ridge and Valley Province. Some of the eastern section of the county is in the mountains of the Blue Ridge Province. However, all of the county is within the Appalachian Highland.

Buffalo Mountain, a part of the Blue Ridge Province, is a massive ridge, with a few lateral spurs, in the southeastern part of the county. This steepsided, narrow-crested ridge is underlain by quartzite, shale, slate, and conglomerate (6)."

B. Climate of the Area

The climate ranges from humid temperate to temperate and continental.

"Rainfall is ample during most of the growing season. Normally, the driest weather occurs in August and September. This is very favorable for the harvesting of crops that mature late in the summer, but it is damaging to pastures and unfavorable for crops seeded in the fall. There is considerable excess moisture during the winter (5)."

Elder et al. (6) pointed out that the most noticeable features of the climate are its moderate winters characterized by short erratic cold spells, mild summers with cool pleasant evenings, and a well-distributed mean annual precipitation of 40 to 50 inches including about 6 to 10 inches of snow. The highest temperature recorded in the area was at the United States Weather Bureau Station in Johnson City; 105° F. This is unusual for most of the area as summer temperatures of more than 96° F. are uncommon. Although a temperature of -25° F. has been recorded at the Johnson City Station, subzero weather is unusual. The difference between the mean summer and winter temperatures is not great--only about 36 to 38° F.

Although no data are available for purely local variations in temperature and precipitation, apparently such variations exist. These variations are usually explained by the lay of the land, including direction of slope, and the effect of relief on air drainage, differences in elevation, and proximity and relationship to mountains. The winter

weather usually includes a short warm period, a subsequent short period of rain, occasionally some snowfall, and then a few days of low temperatures. The higher elevation of English, Clinch, Holston, and Bays Mountain brings about a lower mean temperature than exists on the lower ridges and valleys. The effect of these differences in elevation on climate and vegetation must be considered. Matzek et al. (11) reported that "an increase of 300 feet in elevation causes a decrease of 1° F. in temperature and a rise of 400 feet delays flowering 4 days. Higher elevations, moreover, usually receive more rainfall." Because of their elevation, these mountains support vegetation similar to that of lower regions farther north.

C. Description of Soil Association Areas

The eight generalized soil association groups of the study area are shown in figure 2. This figure shows areas dominated by related soil associations. Nineteen soil associations are made up of more than 30 major soil series.[1] The soils of these series normally occupy positions as follows: (1) uplands, (2) local alluvium, (3) terraces, and (4) bottom lands (table 1).

Hubbard et al. (9) stated that "the soils of the uplands have been formed from the residuum of the underlying rock, or from material

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1/ A detailed description of the soil series may be found in the county soil survey reports for the area.

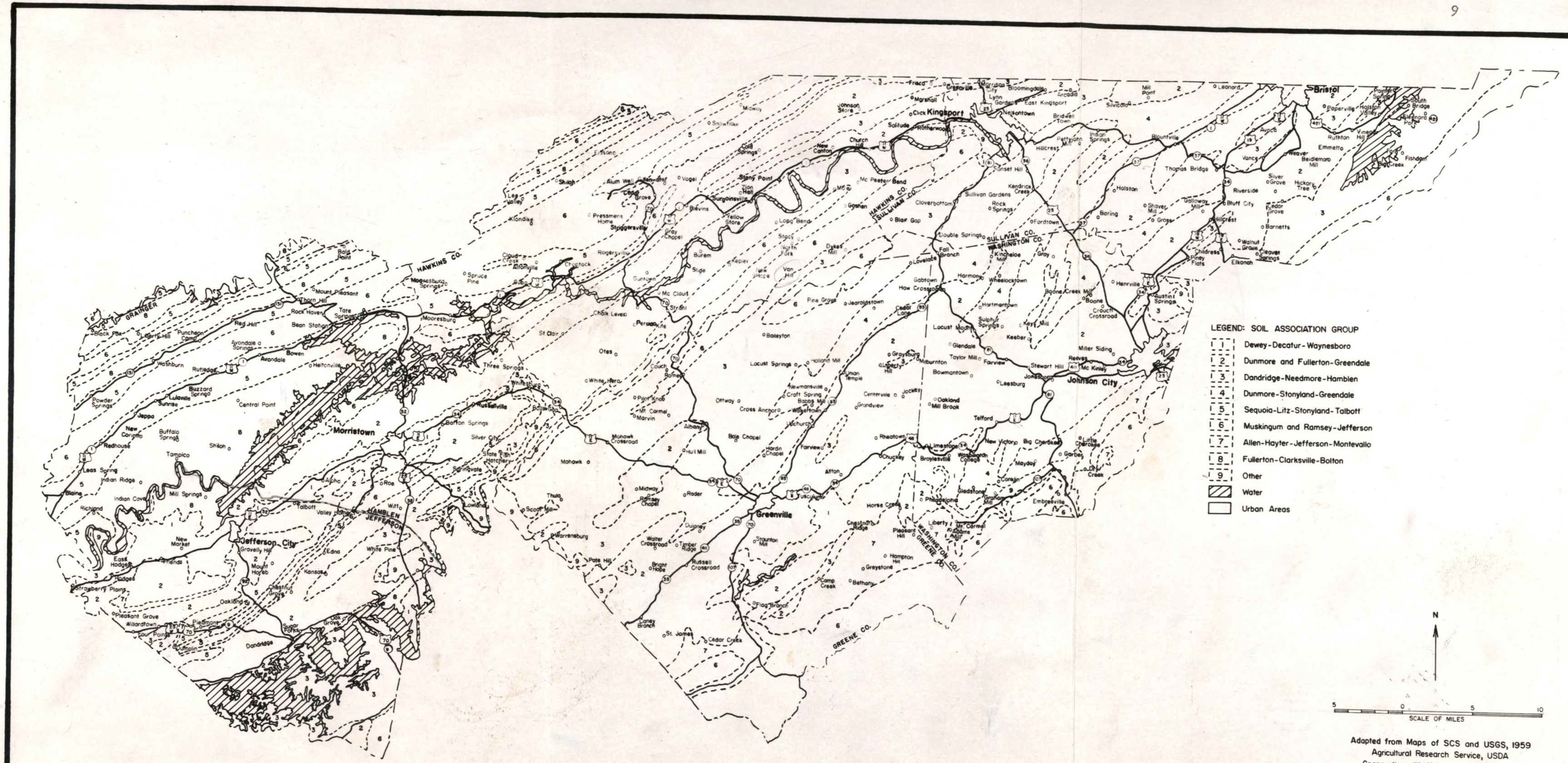


Figure 2.--Soil association map of Upper East Tennessee Valley, 1959.

Table 1.--Characteristics of selected soil series; Upper East Tennessee Valley, 1957.

Series Name	Location	Special features	Color *** topsoil	Color *** subsoil	Soil drainage*	Parent material	Soil Association Groups	Productivity rating**
Armuchee	Upland	Steep and shallow	BG	RY	6	Interbedded shale & limestone	5	L
Bolton	Upland	D Brn concretions	B-DB	YR-R	4	Limestone	8	M
Clarksville	Upland	On ridges	G	RY	4-6	Cherty limestone	8	L
Dandridge	Upland	Shallow	GB	Y	6	Calcareous black shale	3	L
Decatur	Upland	Little chert, gentle relief	DRB	DR	4	Limestone	1	M-H
Dewey	Upland	Some chert, moderate relief	GB-B	R	4	Limestone	1-2	M-H
Dunsmore	Upland	Little chert	GB	YR	4	Limestone	2-4	M
Fullerton	Upland	Medium on ridges	BG	YR	4	Limestone	2-8	M
Lehew	Upland	Steep relief	DB	P	6	Sandstone & purple shale	6	L
Litz	Upland	Shallow & steep slopes	LB	Y-R	6	Calcareous yellow shale	4-5	L
Montevallo	Upland	Shallow	BG-G	Y	6	Acid shale black	7	L
Muskingum	Upland	Shallow & rocky	GB	BY	6	Sandstone	6	L
Needmore	Upland	Low ridge tops	YB	B	4-3	Calcareous shale	3	M
Ramsey	Upland	Steep & shallow	GB-YB	YB	6	Quartzite & slate	6	L
Sequoia	Upland	Rolling topography	LB	RY-YR	4-3	Interbedded shale & limestone	5	L-M
Stonyland	Upland	Rock outcrop, little soil	--	--		Limestone	4-5	L
Talbott	Upland	Plastic "B" shallow	GB	YR	4-3	Limestone	5	L-M
						Local alluvium from:		
Allen	Local Alluvium	Partly rounded stones	GB	R	4	Sandstone	7	M
Barbourville	Local Alluvium	Mostly from Ramsey	YB	YB	4-3	Shale, sandstone quartzite	6	M-H
Emory	Local Alluvium	Mostly from Dewey & Decatur	B-RB	B	4	Limestone	1	H
Greendale	Local Alluvium	Mostly from Fullerton&Dunmore	GB	YB-BY	4-3	Cherty limestone	2-4	M-H
Hayter	Local Alluvium	Mostly from Ramsey	B	YB	4	Shale, sandstone quartzite	7	H
Jefferson	Local Alluvium	More yellow than allen	BG	Y-BY	4	Sandstone	6-7	M
Pace	Local Alluvium	A fragipan in places	BG	BY-YB	3	Limestone	2-4	M
Leadvale	Local Alluvium	Fragipan in places	BG	Y-MY	3-2	Shale	3	M
Whitesburg	Local Alluvium	Mostly from Dandridge	LB	MY	3-2	Calcareous black shale	3	M-H
						Local alluvium from:		
Cumberland	Terrace	High terrace	DRB	D-RB	4	Limestone	1	M-H
Waynesboro	Terrace	High terrace	GB	R-YR	4	Sandstone	1	M
						Alluvium from:		
Hamblen	Bottom	Alluvium from	BG	Y-MY	3-2	Shale & sandstone	5	H
Lindside	Bottom	Alluvium from upland	GB	YB-MY	3-2	Limestone	5	H

* Four is the desired soil drainage for alfalfa; (1) very slow, (2) slow, (3) moderate, (4) well drained, (5) excessive.

** Productivity is based on ability to produce corn.

*** Standard Munsell color notations.

that has not been moved by water or gravity." Most of these soils lie above colluvium or local alluvium, terraces, or bottom land. Although soils of local alluvium, terraces and bottom lands are all deposited by water, the bottom lands are most affected by flooding.

A brief description of the primary soil association areas comprising each soil association group is helpful in understanding the soil resources.

Group I Dewey-Decatur-Waynesboro

Soil group I is composed primarily of the Dewey-Decatur-Waynesboro soil series intermixed with other associated soils of much lesser extent.

The relatively small areas of the Allen-Hayter-Jefferson-Montevallo soil association area of the original soil group VII were combined with soil group I and are treated as soil group I from this point forward in the study. It was pointed out in the Washington County Soil Survey Report (6) that the Waynesboro-Cumberland-Emory soil association areas consist chiefly of soils on the high terraces. "Associated soils on the first bottoms and low terraces are included in some places." The association area extends in a northeast-southwest belt roughly parallel to highway 411 in Greene and Washington Counties. "The relief is predominantly undulating to rolling although there are a few short, moderately steep slopes. Cumberland and Waynesboro soils cover the major part and are about equal in total area (6)." Emory soils occupy most of the foot slopes and also occur along intermittent drainageways.

The Dewey-Decatur-Emory soil association areas occupy irregular valley areas and undulating to rolling upland. Aandahl et al. (1) and Roberts et al. (13) stated that this association area extends in a northeast-southwest belt across Jefferson County to Russelville, which is northeast of Morristown in Hamblen County. It roughly parallels highway 11E. The natural drainage is good to excessive. Much of the' drainage water finds its way into sinks and finally into underground passages. Erosion has been very active on sloping lands under clean cultivation. Most of the Decatur and Dewey soils are cleared of the original hardwood growth. Dewey and Decatur are the principal red soils in the valley.

Group II Dunmore and Fullerton-Greendale

The Dunmore soil series are the predominant ones of soil group II. Less extensive areas of Fullerton-Greendale and associated soil series are included. The group consists of three associations.

The Dunmore-Greendale-Pace soil association is one of the more important soil association areas in the region. The association occurs in all seven counties. However, the majority lies in a broad northeast-southwest belt from below Greeneville to northeast of Bristol and in a narrow belt from the edge of Hamblen County to northeast of Kingsport. Elder et al. (6) said that " the prevailing relief is rolling to hilly. The association has a very irregular dendritic drainage pattern that is modified by sinks and subterranean streams, which give in some places a karst or knobby appearance." The ridgetops are comparatively broad

and winding with their slopes being short and moderately steep. The Dunmore soils occupy the rolling and hilly upland slopes with the Greendale and Pace located on the gently sloping local alluvial areas at the base of slopes and along narrow, intermittent drainageways. "Dunmore soils are well suited to a wide variety of crops, but they are not desirable for tilled crops because they are hard to conserve (6)." Greendale and Pace are very important crop soils on the farms containing them. However, most farms have only a few acres.

Edwards et al. (5) stated that the Dunmore-Greendale-Pace-Dewey soil association is far less extensive than is the soil association without the Dewey. The Dewey extends across the association at widely spaced intervals in a northeast-southwest direction.

The Hamblen County Soil Survey Report (1) revealed that the Fullerton-Greendale-Dewey is by far the most extensive in Hamblen County--making up nearly 2/3 of the total area. The association extends in a broad northeast-southwest intermittent belt across Hamblen and Jefferson Counties. The Fullerton soils dominate the most extensive portion of this association with Greendale and Dewey occupying considerably less. The prevailing relief is rolling to hilly. The topography is characterized by numerous sinkholes giving the area covered a hummocky or karst relief.

Group III Dandridge-Needmore-Hamblen

Soil group III is composed largely of Dandridge with less extensive areas of Needmore, Hamblen, and associated series. The largest areas of the Dandridge-Whitesburg-Leadvale soil association are in the

shale foothills of Holston Mountain and the shale belt northeast and southwest of Kingsport extending in a narrow to broad belt across Sullivan, Hawkins, and Greene Counties.

Edwards et al. (5) and Matzek et al. (11) stated that "the topography is characterized by narrow winding ridges and deep steep-sided V-shaped valleys." The Dandridge soils lie on the narrow ridge-tops and slopes. Small areas of Whitesburg and Leadvale extend up the narrow valleys and hollows below the Dandridge.

The Needmore-Dandridge-Hamblen soil association areas are comprised of soils developed over calcareous shales. They are primarily in the northwestern part of Greene County. The Needmore soils are deep and well suited to the production of crops. The Dandridge soils are better suited to pastures. The Needmore is on low ridgetops with Dandridge occupying the long, hilly slopes. The small areas of Hamblen soils are formed in depressions and bottoms (1).

Group IV Dunmore-Stony Land-Greendale

The Dunmore soils are the most extensive in soil group IV. The Greendale soils are of major importance in this group. However, they cover less area than either Dunmore or Stony land.

The Dunmore-Pace-Greendale-Stony Land soil association areas are relatively important in the region where they are located. These soils extend in a northeast-southwest belt from Greeneville to east of Kingsport and northwest of Bristol. The prevailing relief is undulating to hilly or steep. Ridgetops are relatively narrow and winding. However, the slopes are moderately steep in places.

According to Elder et al. (6) the Dunmore-Greendale-Stony Land-Litz soil association occurs intermittently with Dunmore-Greendale-Stony Land in limestone areas extending in a northeast-southwest direction. The dendritic drainage pattern is modified by sinks and underground streams. Dunmore silt loam soils are in the lower smoother areas in association with Dewey soils. Narrow belts of Greendale occupy local alluvial positions and bottom lands. Above the Dunmore soils lie small belts of Stony Land with the Litz soils which are underlain by acid shale occupying the highest position.

Group V Sequoia-Litz-Stony Land-Talbott

The topography of soil group V is primarily rolling to steep. The predominant soils are Sequoia, Litz, Stony Land and Talbott with small areas of Hamblen.

The Sequoia-Litz-Hamblen association areas are chiefly rolling to hilly and steep. These association areas spread out primarily in long northeast-southwest, narrow, intermittent belts across Grainger and Hawkins Counties. However, Aandahl et al. (1) and Roberts et al. (13) said that a small area lies in a similar belt southwest of Morristown. The Litz soils prevail on the steep slopes with Sequoia occupying the rolling topography. Small areas of Hamblen are included at the foot of these areas. The upland soils are relatively infertile for agricultural purposes. However, the small areas of Hamblen can be tilled safely and give fair yields of crops. The Sequoia soils are used chiefly for permanent pasture, hay, and some corn.

The Sequoia-Litz-Hamblen-Talbott association covers a relatively small area, and is a small finger-like projection above and below the county line south of Jefferson City (1).

The Talbott-Litz-Stony Land-Sequoia association is characterized chiefly by the Talbott soils. According to Hubbard et al. (9) and Aandahl et al. (1) these association areas are in long, narrow, intermittent northeast-southwest belts across Grainger and Hamblen Counties. The relief is hilly to steep. The Stony Land (Talbott and Colbert materials) consists chiefly of land types too stony to be tilled.

The Stony Land-Talbott-Lindside association lies in long narrow strips in limestone valleys extending in a northeast-southwest direction across Grainger and part of Hamblen Counties. It was pointed out in the Grainger County Soil Survey Report (9) that this association "consists chiefly of land types too steep to be tilled, although there are limited areas of Talbott, Colbert, and Lindside soils suited to crops requiring tillage."

The Armuchee-Stony Land-Sequoia association occupies long belts that extent in a northeast-southwest direction across Grainger and part of Hawkins Counties. It consists mostly of soils shallow to bedrock of limestone and shale. Because of relatively strong slopes, stoniness, and shallow depth to bedrock very little of this association is suitable for tillage (9).

Group VI Muskingum-Ramsey-Jefferson

Muskingum and Ramsey are the major soil series in this group. The topography is primarily hilly, steep, and mountainous.

The Ramsey-Jefferson-Barbourville soil association areas are characterized by the steep or very steep mountainous slopes they occupy. These soils extend in a long narrow belt across the southeastern edges of Greene, Washington, and Sullivan Counties. Elder et al. (6) stated that the Ramsey soils, occupying steep to very steep slopes, are the principal series in this association. Small areas of Jefferson and Barbourville occupy local alluvial slopes and depressions. Forestry is probably the best use for these soils.

The Lehew-Jefferson-Barbourville association areas are of little importance agriculturally. These soils extend in three narrow intermittent northeast-southwest belts from east of Morristown to Kingsport. They are of relatively limited extent. Lehew soils are predominant, occupy steep slopes, and are shallow to bedrock of sandstone and shale. The Jefferson and Barbourville occupy small areas at the foot of slopes and in depressions (1, 13).

Hubbard et al. (9) and Matzek et al. (11) reported that the Muskingum-Jefferson-Barbourville association areas occupy the crest and steep slopes of the mountainous areas underlain by sandstone and some shale. These soils are in a long relatively narrow northeast-southwest belt extending completely across Grainger and Hawkins Counties. A small area of Barbourville soils is included which lies on the lower local alluvial slopes and depressions. The Jefferson soils are on rolling topography of the lower local alluvial fans. Practically the entire area is covered in mixed hardwood-pine forest.

Group VIII Fullerton-Clarksville-Bolton

Soil group VIII is composed primarily of Fullerton, Clarksville, and Bolton.

The Fullerton-Clarksville-Bolton soil association areas occupy the cherty ridges primarily in the northwestern half of Grainger County; however, a narrow belt is in the northwestern corner of Hawkins County. This association was formed from dolomitic limestone and consists chiefly of Fullerton and Clarksville series, with a moderate acreage of Bolton and Greendale soils intermingled. For the most part, the topography is that of a broadly-rounded ridgeland--the slopes running from 12 to 45%. "The soils are moderate to low in fertility, and a great part of the area is moderately cherty (9)."

D. General Characteristics of Farms

Henderson (8) pointed out that "the Upper East Tennessee Valley is characterized by relatively small units of land. Approximately 1/2 of the households control (leased or owned and not rented out) less than 10 acres each. Only 13% have 100 acres or more. The median size of unit is about 12 acres."

"Although 15% of the non-farm households had 10 acres or more land area, only 3% had 10 acres of cropland.

The cropland in the Upper East Tennessee Valley lies in small "patches" and "strips" separated by mountains and ridges which makes recombination into larger units difficult (8)."

Many part-time farmers have retained all or part of their farm acreage and are producing some agricultural products in addition to working at full-time or part-time employment off the farm. In 1954, approximately 29% of all farm operators worked off the farm 100 or more days contrasted to only 11% in 1934 (table 2). This was an increase of 18% in a 20-year period.

E. General Characteristics of Families

Commercial Farmers Older

The commercial farmers were usually older than the part-time farm or nonfarm salary workers. Almost 1/5 of the land is operated by households whose heads are 65 years of age or older (table 3).

Large Household But Few Workers

Several of the households are relatively large in size, but very few have men who are not restricted in their ability to provide a large income.

Almost 1/2 of the households had no male of an age normally acceptable as new employees in industry (ages 18-45) and without a noted handicap. Only 5% of the households had more than one employable male.

Education of Household Heads Is Low

"Almost 1/4 of the household heads in the sample had less than 5 years of formal schooling (8)." Only 14% of the household heads attended high school and only 3% had attended college.

Table 2.--Farm operators working off farm in 100 or more days in Tennessee 1934-1954.[a]

Year	All farm operators number	Farm operators working off farm 100 or more days	
		Number	Percentage of all farm operators
1934	273,783	29,735	10.8
1939	247,617	43,057	17.4
1944	234,431	42,000	17.9
1949	231,626	52,230	22.5
1954	203,149	58,318	28.7

a/ Taken from the United States Bureau of Census, United States Census of Agriculture for appropriate years.

Table 3.--Land controlled, by age of head of household, 506 rural households, Upper East Tennessee Valley, 1957.

Age	Percent of land operated
Under 25	5.0
25-34	18.9
35-44	16.8
45-54	22.9
55-64	17.4
65-74	17.1
75 & over	1.9
Total	100.0

F. Soil Resources Available to Households

Index of Land Quality Class

"The land was divided into five classes by quality, based primarily on topography.[2] Its present or past use was not considered in determining its present quality classification only those factors contributing to future use were considered.

Over 1/2 of the land operated was placed in Class III--gently to moderately rolling land suitable for rotation cropland. The majority of the rest was steeper land that must be kept under permanent cover to avoid serious erosion losses. A rather large part of the land of the less productive class is either public property or is held in large tracts by absentee land owners."[3] However, the land area reported in this study was exclusively land owned or operated by residents of the sample area.

2/ After discussions with agronomists familiar with the soils in the area it was believed that topography of upland and the respondents observation of productivity of bottom land was an indication of the general quality of the land resources. The five land classes used in this study do not correspond to the land use capability classes used by the Soil Conservation Service. Enumerators carried with them a photograph of a representative site with the various grades of upland delineated. The respondent was asked to estimate the number of acres of bottom land in two classes, based on his observation of how it would produce, and three classes of upland comparable in topography to those outlined on the photograph. He was asked if any of land characteristics that would make it unproductive other than topography, such as excessive outcropping of rocks. If yes, it was classed as V. Dr. Maxwell E. Springer, Agronomist, University of Tennessee, assisted in determining enumeration procedures for land and assigning productivity ratings for the classes.

3/ Henderson, H. A., Tennessee Agr. Exp. Sta. Unpublished data, 1958.

CHAPTER III

PROCEDURES AND METHODS

A. Description of Sample of Farms Taken on the Soil Association Areas

The primary data needed to carry out the objectives of the study were obtained through a personal interview survey of a random block sample of 506 rural families living in the area. The sample represents approximately 1 in 80. The area consisted of Grainger, Greene, Hamblen, Hawkins, Jefferson, Sullivan, and Washington Counties.[4] Households within these counties were believed to be similar to rural households in the general area with respect to the characteristics studied and to their economic environment. The sample is statistically representative of only the rural areas of the seven counties. However, the findings should have general application over a much larger area. A standard enumeration schedule was used by nine trained enumerators.[5]

Alternate blocks were used when the number of unavailable households in a county exceeded 1/2 the number in the alternate block. Refusal rates were less than 2% and unavailability rates for all causes were less than 5%. The survey was completed early in 1958.

4/ The sample was drawn by Earl E. Houseman in the Statistical Standards Dividion, Agricultural Marketing Service, U. S. Department of Agriculture.

5/ Enumerators were advanced undergraduate and graduate students at the University of Tennessee. They were William B. Ewing, Carol S. Murphey, Arnold F. Hunter, Marvis D. Cunningham, Charles Mounger, Charles B. Perkins, Maurice Hill, Herbert J. King, and James H. Witt. Mr. Ewing also assisted later with electronic data processing. Mr. H. A. Henderson, Agricultural Economist, and Mr. Samuel W. Atkins, Senior Agricultural Economist, Farm Economics Research Division, U. S. Department of Agriculture, edited the schedules. The assistance of these individuals is gratefully acknowledged.

Information Obtained

Information obtained included the following items: (1) available labor resources including information on age, sex, education, (2) land resources controlled including quality and use, (3) available capital resources such as livestock, machinery, and equipment, (4) enterprise combinations, (5) tenure status, (6) farm receipts and expenses, (7) nonfarm income, (8) full and part-time off-farm employment, (9) use of credit facilities, and (10) attitude toward problems and adjustment.

The survey data were processed for machine tabulation and analysis. Relationships between income and the availability and use of the various resources, as well as the relationships between income and land and other factors were studied. Farms and households were contrasted by soil association areas. Based on these analyses, farm families were classified into groups based on various causes of differences in income and potential for increasing it.

The soils were first grouped by association into 19 areas. These association areas were in turn grouped by similarity of soils and topography into 8 soil association groups for the purpose of having a larger sample in order to reduce the error factors.

The survey data were then sorted by the 8 association groups. However, after studying the 8 association groups further from an economic as well as agronomic point of view, a decision was made to combine groups I and VII. It was felt that the differences in soil productivity were considerably less than the error factor that might be involved if the two groups were not integrated.

Level of Living Index

The standard of living is in the individual's mind. It is the conception of the way that the individual wishes to live or it may be considered as the embodiment of his desires. One's level of living is the way that he lives, not the way that he wants to live.

The level of living index scale was devised to measure the economic status of the households on each of the soil association groups. Each household head in the sample was checked for possession of the following 10 items: (1) television, (2) one or more rooms per person, (3) own house--debt free, (4) central heat, (5) piped in water, (6) water heater, (7) complete bath, (8) power washing machine, (9) automobile, and (10) telephone.

The level of living index scale ranged from 0 to 10. The index scale number assigned to each household was based upon the number of these desirable economic goods it possessed.

Index of Land Quality

An index of land quality based on the productivity ratings given in table 5 was computed for each farm as follows: (1) determine the percentages of each class, (2) multiply the percentage of each class by its productivity rating, (3) add the results, and (4) divide by 100.

CHAPTER IV

RESULTS

A. Types of Farms

Tobacco and Dairying are Bases for Diversification

About 3/5 of the farms in the study area (table 4) are tobacco farms. More than 1/3 of the tobacco farmers rely upon their tobacco crop as the only source of cash farm income. Nearly 1/3 of the tobacco farmers have a year around income from dairying.

Some 20% of the tobacco farmers supplement their primary enterprise with livestock other than a dairy herd. However, less than 10% of the tobacco farmers supplement their tobacco crop sales with sales of other crops.

The dairy farmers of the area usually have small operations and rely upon diversification. Dairy farmers make up about 1/5 of the full-time farmers in the area. About 2/3 of the dairy farmers utilize their excess labor to produce tobacco. However, 1/3 of the dairy farmers either specialize in dairying or have enterprises other than tobacco.

General farmers (less than 50% of income from each enterprise) rank third in importance. They make up about 11% of the total full-time farmers.

Beef cattle, as a major enterprise, are produced by only 2% of the full-time farmers.

Soil group I supports the largest percentage of farmers who produce tobacco as the main enterprise--76%.

Table 4.--Type of farms, 257 rural households, Upper East Tennessee Valley, 1957.

Type of farms	Soil association group in percent							
	I	II	III	IV	V	VI	VIII	All farms
Tobacco farms								
Tobacco only	31	18	20	34	29	33	11	22
Tobacco-dairy	15	25	17	21	15	28	11	21
Tobacco-livestock	15	13	05	08	14	06	28	12
Tobacco-crops	15	04	02	08	07	06	14	06
Total tobacco farms	76	60	44	71	65	73	64	61
Dairy farms								
Dairy-tobacco	08	13	21	13	14	16	21	15
Other-dairy	08	07	12	04	07	00	00	07
Beef	00	03	02	00	00	00	07	02
General	08	14	14	08	00	11	04	11
Miscellaneous	00	03	07	04	14	00	04	04
Area	100	100	100	100	100	100	100	100

Only 44% of the farm households on soil association group III raise tobacco as the main enterprise. However, about 33% engage in dairying.

The largest percentage of beef producers within a soil group was supported by soil group VIII. About 7% of the farmers produce beef, 61% produced tobacco and 22% had dairy farms.

The farmers on soil group II produced tobacco, dairy and general farm products.

B. Soil Resources of Rural Households

Land quality class III, gently to moderately rolling upland, the predominant class is given a rating of 100 on the land quality index defined in Chapter III. The mean was 85 for all land in the sample. The median index of land held by the households was 100 and for all farms it was 90. There was a rather wide range in quality of land held by households.

A breakdown of the various land quality classes by soil association groups revealed that over 80% of soil association group II was composed of the gently to moderately rolling land class III. The only appreciable amount of land class I was on soil association group I and IV respectively. However, it is normally broken up into rather small, irregular "patches" that cannot be readily shaped into large units (table 5).

About 4/7 of the land operated was located on land quality Class III (table 6). The average farm consisted of only 69 acres. However, the average farm on soil association group VIII consisted of 112 acres.

Table 5.--Land quality class by soil association group, 257 farm households, Upper East Tennessee Valley, 1957.

Land quality class	Productivity index	Description	Conservation limitation	Soil association group						
				I	II	III	IV	V	VI	VIII
				Percent						
I	200	Good, well-drained bottom land	Intensive cropping	20.0	1.0	5.3	23.3	14.4	0.0	7.2
II	100	Other bottom land	Crops with special risk and precautions	8.0	7.4	7.0	4.4	7.2	7.2	14.4
III	100	Gently to moderately rolling	Row crops only once in 3 to 4 years	48.0	80.8	54.9	38.9	57.8	47.6	66.6
IV	50	Strongly rolling to moderately hilly	Close-growing crops with occasional cultivation of some. Some limited to forestry only	20.0	9.8	11.9	24.5	14.4	17.8	8.2
V	25	Steep, hilly, rocky mountainous, etc.	Woodland, contains some small "patches" suitable for pasture and row crops	4.0	1.0	20.9	8.9	6.2	27.4	3.6
Total				100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 6.--Average acres operated, by land quality class and soil association group, 223 rural farm households, Upper East Tennessee Valley, 1957.

Soil association group	Land quality class					
	Class I	Class II	Class III	Class IV	Class V	Total
I	10.6	.5	22.9	12.6	2.0	48.6
II	3.2	.1	65.0	18.0	3.9	90.2
III	4.3	.7	31.5	25.5	14.1	76.1
IV	8.6	.1	27.5	8.3	6.3	50.8
V	5.1	.1	15.1	17.0	4.5	41.8
VI	5.7	1.9	23.4	20.7	33.9	85.6
VIII	4.8	.2	66.9	34.0	6.0	111.9
All farms	4.1	.6	40.2	16.7	7.4	69.0

C. Tenure

More than 82% of all farm operators owned and operated land (table 7). However, 60% were involved in various types of land rental contracts. Of the 82% who operated some land they owned, 1/2 either rented in additional land or rented out some land. Only 16% of the farm operators were tenants or croppers and some of them owned some land.

The largest deviation from the mean was on soil association group IV. Ninety-six percent of the farmers owned some of the land that they operated. However, 58% either rented in additional land or rented out some land. More than 1/4 of the farm operators on soil association groups I and VI were tenants or croppers.

D. Value of Farm Real Estate

Farm Land Operated

There is a positive relationship of soil type with the value of land. Factors other than soils, of course, influence the value of land. In the Upper East Tennessee Valley, particularly in Sullivan and Washington Counties, the development of manufacturing and the increase in urban population is reflected in relatively high land values. The value of land alone is determined principally by the returns received from its use, while the value of buildings, for the most part, is a product of both use and cost of erection. The cost of buildings often has little relation to the value of these buildings on the farm. Consequently, the estimated valuation of a building is a product of both cost and use value.

Table 7.--Tenure of operator, by soil association group, 257 farms, Upper East Tennessee Valley, 1957.

Tenure type	Area	Soil association group I	II	III	IV	V	VI	VIII
	Percent							
Owner-operator								
Simple	42.0	32.0	41.4	41.0	38.0	49.6	44.0	45.0
Renting in additional land	19.0	15.0	14.0	19.0	30.0	14.4	22.4	18.7
Renting out land	3.0	7.0	5.5	7.0	4.0	0.0	0.0	0.0
Some land cropped by others	12.0	15.0	14.9	12.0	16.0	7.2	5.6	11.8
Tobacco tended by others	6.0	7.0	5.6	7.0	8.0	14.4	0.0	0.0
Total owner-operators	82.0	76.0	81.4	86.0	96.0	85.6	72.0	75.5
Partners (some land owned)	2.0	0.0	6.5	7.0	0.0	0.0	0.0	0.0
Tenants	8.0	0.0	6.0	7.0	0.0	7.2	22.4	15.9
Croppers	8.0	24.0	5.6	0.0	4.0	7.2	5.6	8.6
All farms	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

The value of farm buildings is for the most part in line with the value of the farm land. For example, the mountainous soils of Hawkins County where Muskingum and Ramsey-Jefferson soil association groups predominate, the mean overall value of land operated was only $6,700 per farm. The more productive farms on Dewey-Decatur-Waynesboro soil association group was valued at $24,900. The farms on the Dunmore and Fullerton-Greendale soil association groups were valued at $17,500 per farm. Between these two extremes are found the other soil association groups (table 8).

Probably equally as important as the direct influence of soil productivity on the value of buildings per farm, is the type of farming. The investment in buildings, other than the dwelling, is determined largely by need. Thus in livestock producing areas, there is a comparatively larger investment in barns and storage facilities for feed.

E. Value of Non-Real Estate Farm Capital

Livestock and Equipment

The investment in farm implements is determined by the ability and readiness to make such investments and by the need for such investments. The need for farm implements is dependent principally upon the types of farming, area in crops, topography, and the size of the farm. Thus, to the extent that soil influences these factors, it indirectly influences the investment in farm implements.

Farmers on soil association group II (table 8) had a mean value of non-real estate farm capital (livestock and equipment) of $5,900. This may be compared with $2,100 on soil association group VI.

Table 8.--Farm investment, by soil association group, 223 farms, Upper East Tennessee Valley, 1957.

	I	II	III	IV	V	VI	VIII
Farm land (Owned and operated)	$24,900	$17,500	$ 9,600	$12,400	$7,300	$6,700	$11,800
Non-real estate farm capital							
Livestock	1,800	2,600	900	800	500	500	1,800
Equipment	4,600	3,300	2,100	1,800	1,300	1,600	2,800
Total farm investment	$31,300	$23,400	$12,600	$15,000	$9,100	$8,800	$16,400

The production of burley tobacco requires a small investment in equipment and buildings. Less than 2/3 of the farmers (table 4) on soil association group II produce tobacco. This may be compared to nearly 3/4 of the farmers on soil association group VI that produce tobacco. It should be kept in mind that the allocation of a tobacco base depends partially upon the size of the farm and the amount of tobacco produced in the past.

F. Total Farm Investment

The investment in farm implements and livestock (table 8) was small in the less productive regions and high in the more productive regions, as a rule. For example, the total investment per farm was $8,800 for soil association group VI and $23,400 for group II.

G. Major Activity of Head of Household

The labor force is probably the most important single resource in the rural household. Since the family head was the leader and instigated the standards or work activities which the household performed, a comparison of the head of households of the various soil association groups should reflect the major activities of the households in general.

An examination of the major activities revealed that 47% of the household heads were farm operators, and the other 40% of the household heads with commercial activities secured a livelihood from non-farm employment (figure 3).

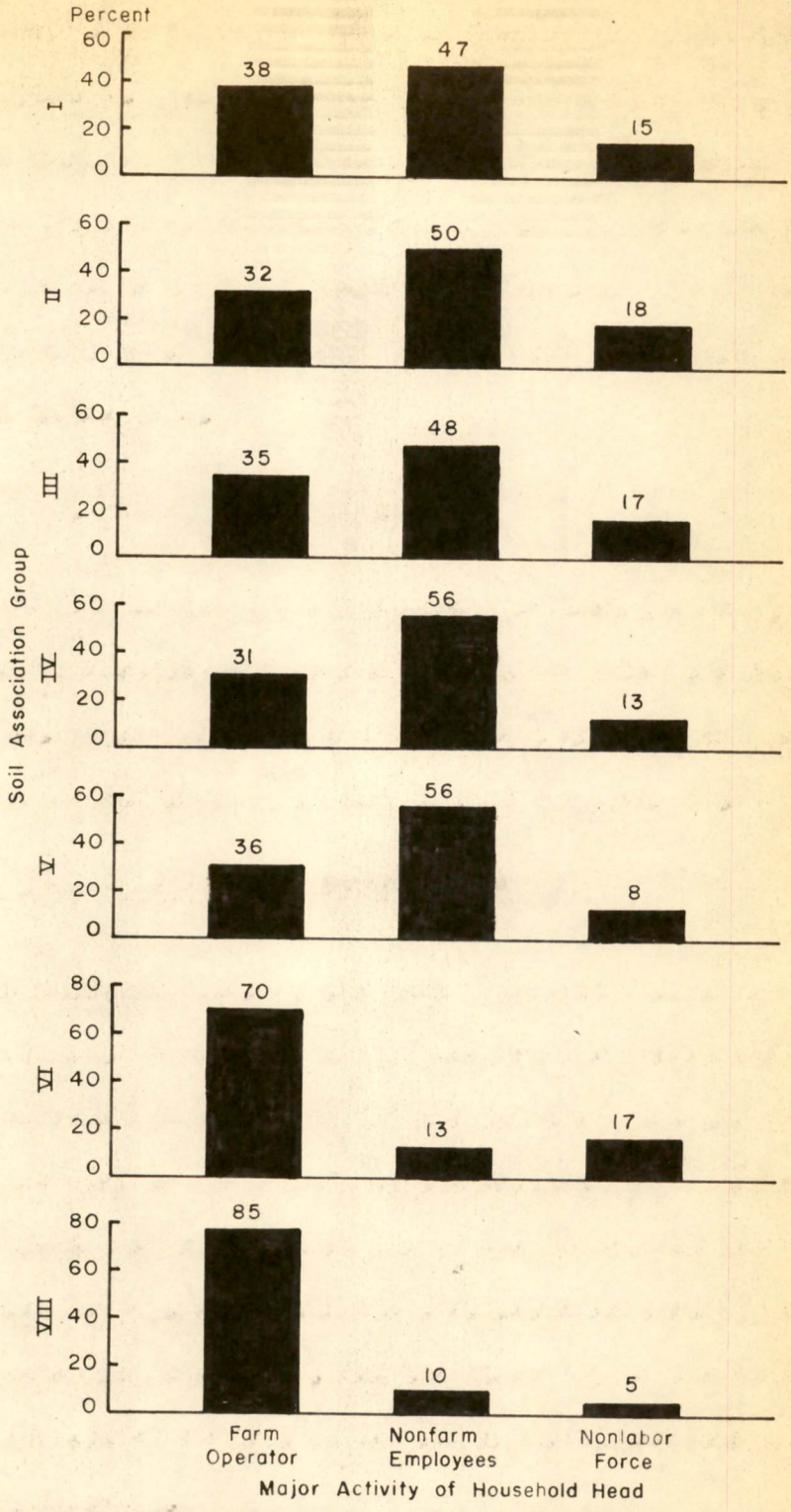


Figure 3.--Major activity of head of households, by soil association group, Upper East Tennessee Valley, 1957.

Of the household heads on soil association group VI, 65% were farm operators and 13% nonfarm salary workers. On soil association group VIII 85% were farm operators and only 10.2% nonfarm salary workers.

H. Able-Bodied Males 18-45

Nearly 1/2 of the 506 households sampled had no able-bodied male between the ages of 18 and 45 years while 2/3 of the farm households on soil association group V fell in this category (figure 4).

Households having only one able-bodied male were most common elsewhere. Households on soil association group I had 61.2% as contrasted to the mean of 49.2% for all groups. The households on soil association group V had the lowest percentage. However, it ranked second only to the households on soil association group II in percentage of households with two or more. On soil association group II, more than 1/2 of the farm households had two or more able-bodied males.

I. Size of Household

The number of members in a household does not always reflect its labor force or potential ability. However, it does reflect the overall cost of providing enough income for food, clothing, shelter, medical expenses, transportation, and luxuries.

Of all households, 23% consisted of only two members. However, three and four member households were almost as numerous and made up 22 and 19% respectively (figure 5).

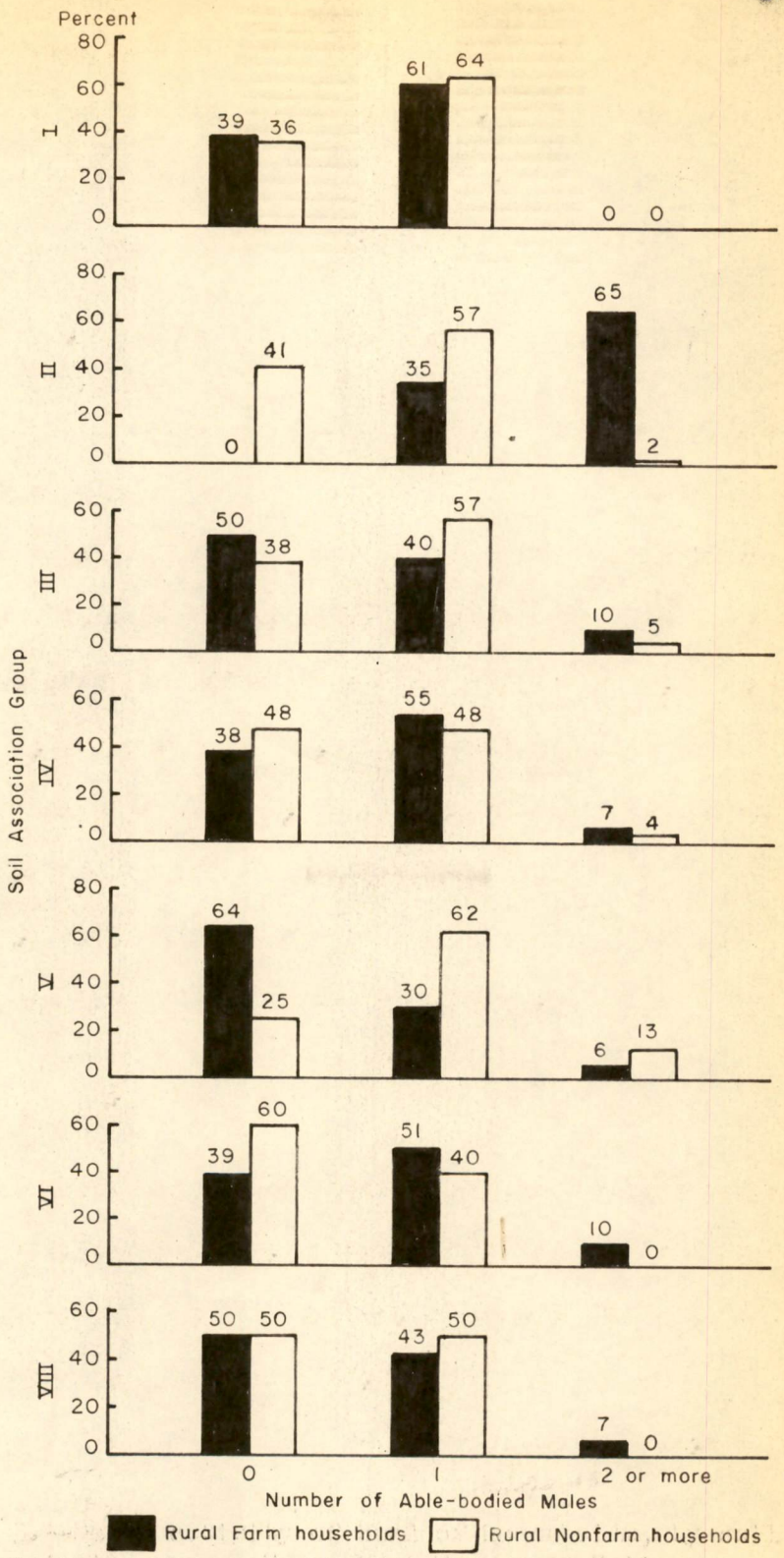


Figure 4.--Number of able-bodied males 18-45, by soil association group, 506 rural households, Upper East Tennessee Valley, 1957.

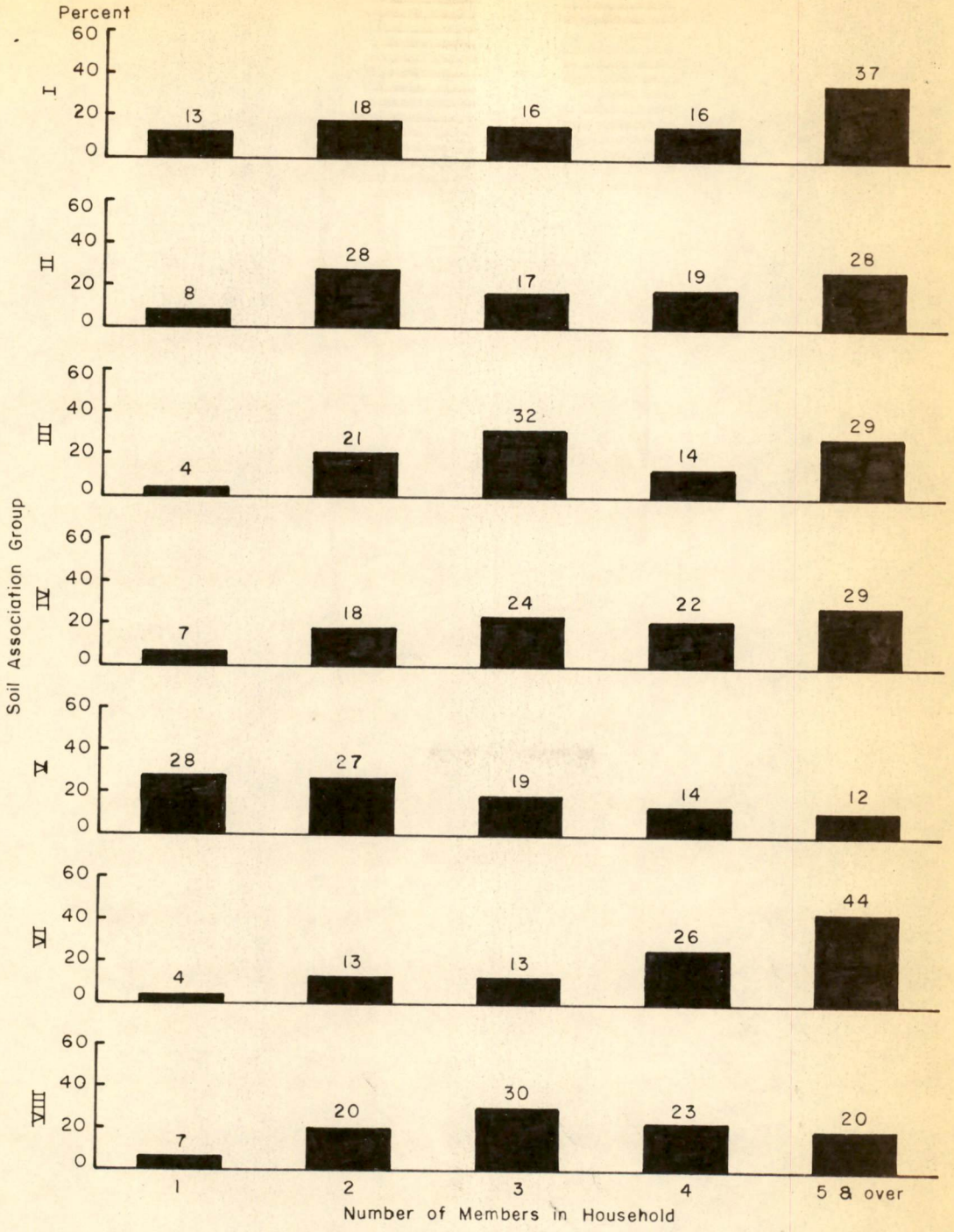


Figure 5.--Household size, by soil association group, 506 rural households, Upper East Tennessee Valley, 1957.

Allred et al. (3) found that "the average rural farm family in Tennessee is largest in the poorest areas and smallest in the best farming areas." A brief comparison of households size on soil association groups II and VI (figure 5) will tend to support this theory.

J. Level of Living Index

There was a positive correlation (figure 6) between the level of living index and the desirability of the soil association group for farming and industrial use. On the more desirable soils of soil association group II, 48% of the households had a high level of living index. The less productive farming area of soil association group VI had none.

K. Economic Class of Households

A major cause of differences in the economic status of rural people is the type of activities in which they engage to earn a living.

Less than 1/5 of the non-farm households had more than $150 coming from farm products. The full-time and part-time farmers made up 25 and 26% respectively of the total households.

Differences in income due to soil type would be very difficult to delineate on similar soil groups. However, by modifying table 9 so that the full-time farms on contrasting soil association groups II, V, and VI were on a percentage bases, the picture could more readily be seen.

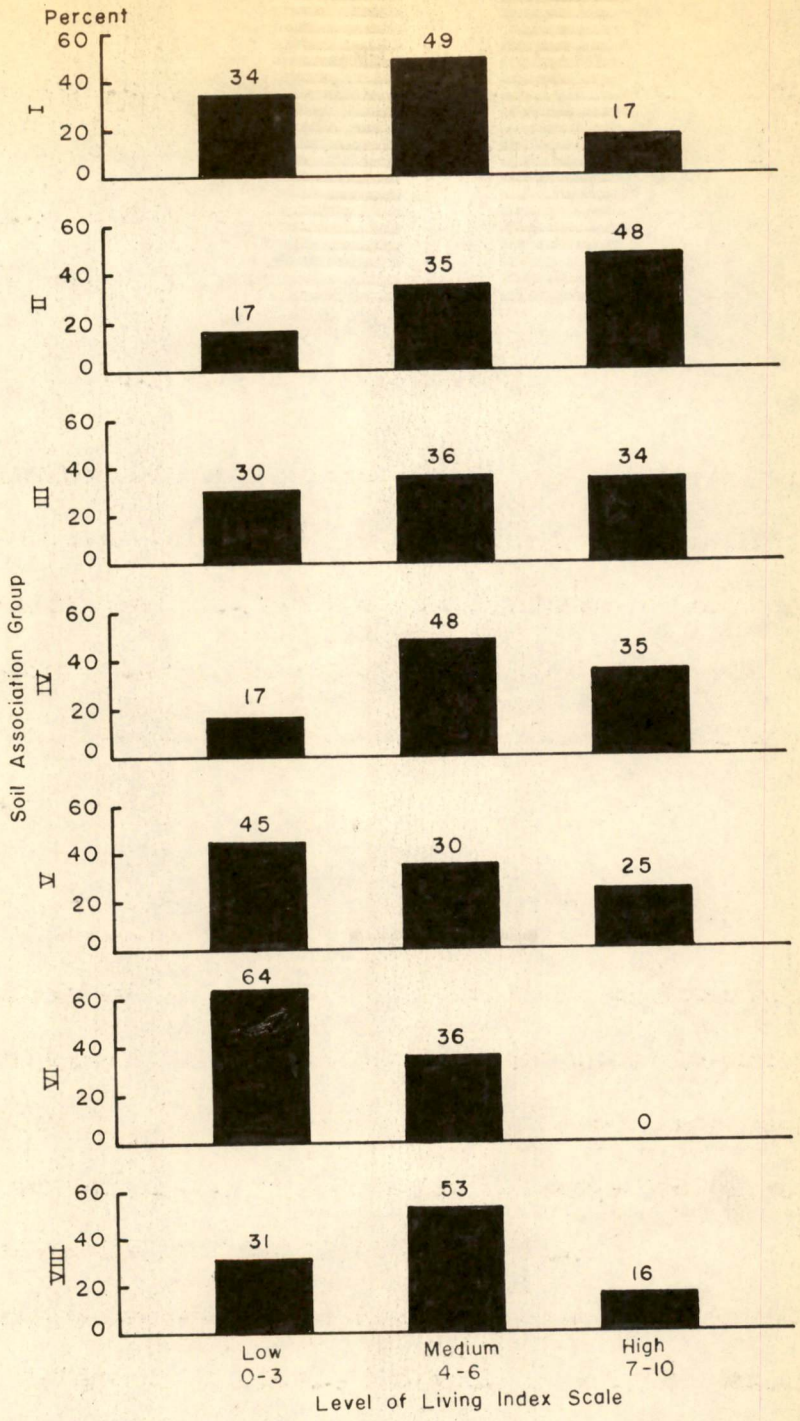


Figure 6.--Level of living index, by soil association group, 506 rural households, Upper East Tennessee Valley, 1957.

Table 9.--Economic class of households, by soil association group, 506 rural households, Upper East Tennessee Valley, 1957.

Soil association group	Non-farm[c] less than $150	Non-farm[c] over $150	Full-time farms[a] (I, II, III)	Full-time farms[a] (IV)	Full-time farms[a] (V)	Full-time farms[a] (VI)	Part-time farms[b] (I, II, III)	Part-time farms[b] (IV)	Part-time farms[b] (V)	Part-time farms[b] (VI)	Total
	Percent of households										
I	42.0	4.0	0.0	8.0	12.8	0.0	0.0	8.1	4.0	21.1	100
II	49.0	8.0	5.7	5.3	6.1	3.3	2.8	2.0	4.4	13.4	100
III	42.7	6.2	.9	3.5	13.2	6.2	0.0	0.0	7.9	19.4	100
IV	33.0	15.0	4.4	6.4	2.2	8.4	0.0	0.0	4.4	26.2	100
V	22.9	13.6	0.0	0.0	13.8	22.7	0.0	0.0	4.5	22.5	100
VI	17.1	4.5	0.0	4.3	8.7	30.4	0.0	0.0	4.6	30.4	100
VIII	6.2	0.0	13.0	17.0	30.0	10.0	0.0	3.4	10.2	10.2	100
All households	36.3	13.6	3.2	5.5	9.5	6.7	.4	1.9	5.5	17.4	100

a/ A farm consists of 3 acres or more which produces at least $150 of farm products from which some farm products are sold, or less than three acres from which is sold $150 or more.

b/ Operators worked 100 or more days off farm or family income from nonfarm sources exceeded farm sales.

$5,000 and over sales. . . . . I, II, & III
$2,500 to 4,999 sales. IV
$1,200 to 2,499 sales. V
$1 to 1,200 sales and residential. VI

c/ Farm products consumed.

Table 10 shows that 28% of the households on soil association group II had farm sales of over $5,000. However, soil association groups V and VI had none.

There were only 18% of the farmers on soil association group II who made less than $1,200 worth of farm sales as contrasted to 62% and 70% respectively for farmers on soil association groups V and VI. The full-time farmers on soil association group V reported no case where the household head made as much as $2,500 in sales.

L. Age, Sex, and Education of Household Head

Age

There is a marked relationship (figure 7) between farm operator's age and farming activities, with a decline in farming activities occurring rather rapidly after age 55. This decline is even more pronounced on part-time farms.

A large percentage of the older household heads (age 35-54) were farmers. However, a larger percentage of the younger household heads (age 20-34) were nonfarm salary workers.

Due to the small number of nonfarm households on soil groups VI and VIII, figure 7 reveals an unrealistic picture of the non-farm salary workers on these soil groups.

The young heads of households on soil group I were rapidly turning to nonfarm work for security. Not one young household head on soil group I reported income from full-time farming. However, 55% were nonfarm salary workers.

Table 10.--Farm sales from 138 farm households, Upper East Tennessee Valley, 1957.

Soil association group	$5,000 and over	$2,500 to $4,999	$1,200 to $2,499	$1,000 to $1,200	Total
	Percent of farms				
II	28	26	30	16	100
V	--	--	38	62	100
VI	--	10	20	70	100

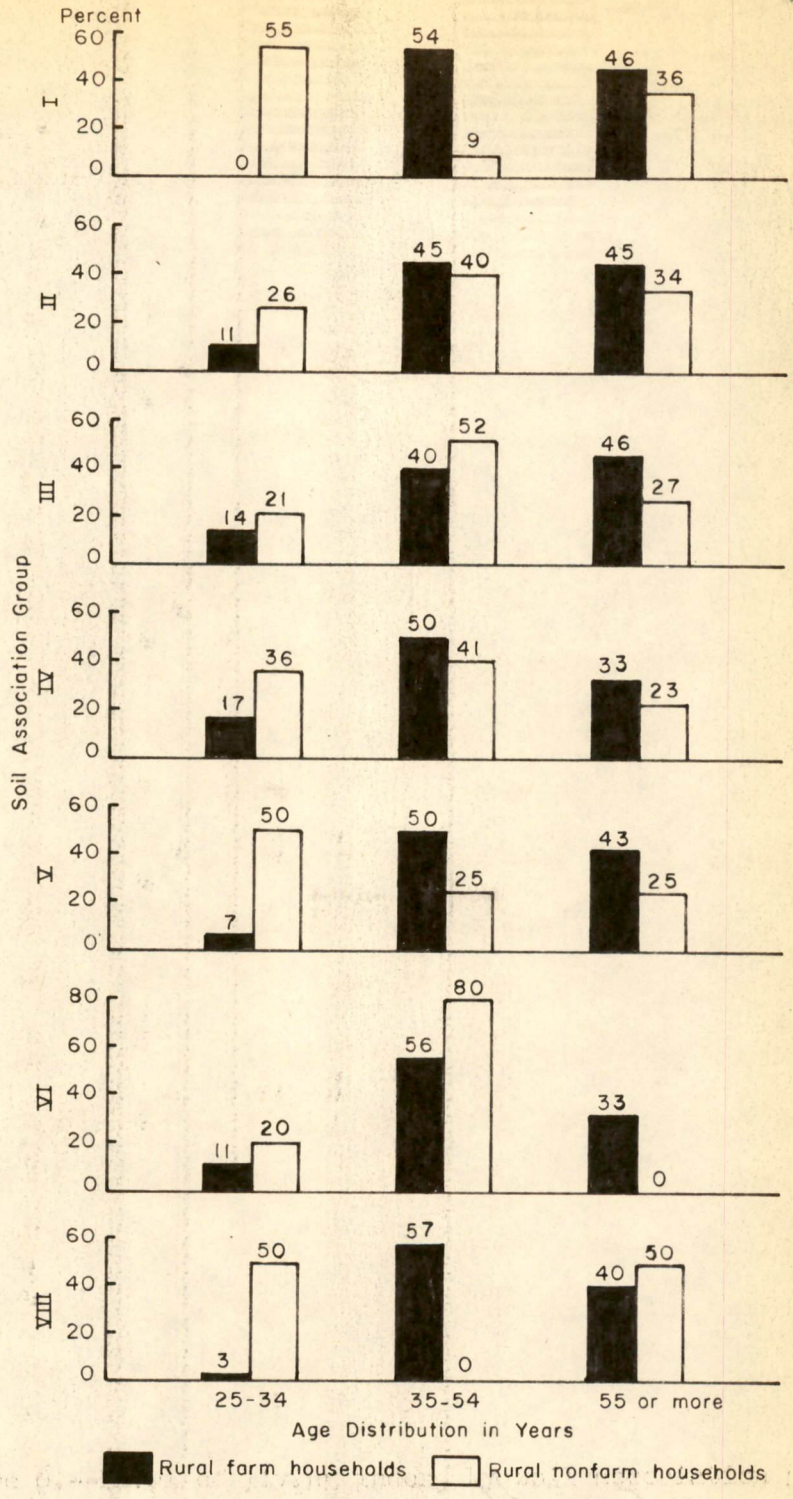


Figure 7.--Age distribution of household heads, by soil association group, 506 rural households, Upper East Tennessee Valley, 1957.

Sex

The pattern for sex of household heads was similar for most soil groups with only a few exceptions. Soil groups I and VI had about 9 to 12% more females for head of households than the other groups. Female head of households without a male cohabitant between the ages of 18-45 composed about 15% of the full-time farms. They consist primarily of widows retaining the home farm.

Education

There was a general tendency for the highest percentage of head of households with low formal education on the less productive soil groups. This is especially true where the topography is so rough that the land is sparsely populated. On soil association group VI 42% of the heads of households had less than 5 years of formal education as compared to only 20% on association group II.

Approximately 75% of the household heads (figure 8) in the area had 8 or less years of formal education. Household heads with this low education made up 69% on soil association group II as compared to 88% for those living on soil group VI. The largest educational difference between these two areas is probably in the number of household heads that have 12 or more years of formal education. There were 12% on soil group II with 12 or more years of formal education while there were none on soil group VI.

M. Change in Labor Force Since 1950

There is an indication that communities located in the less

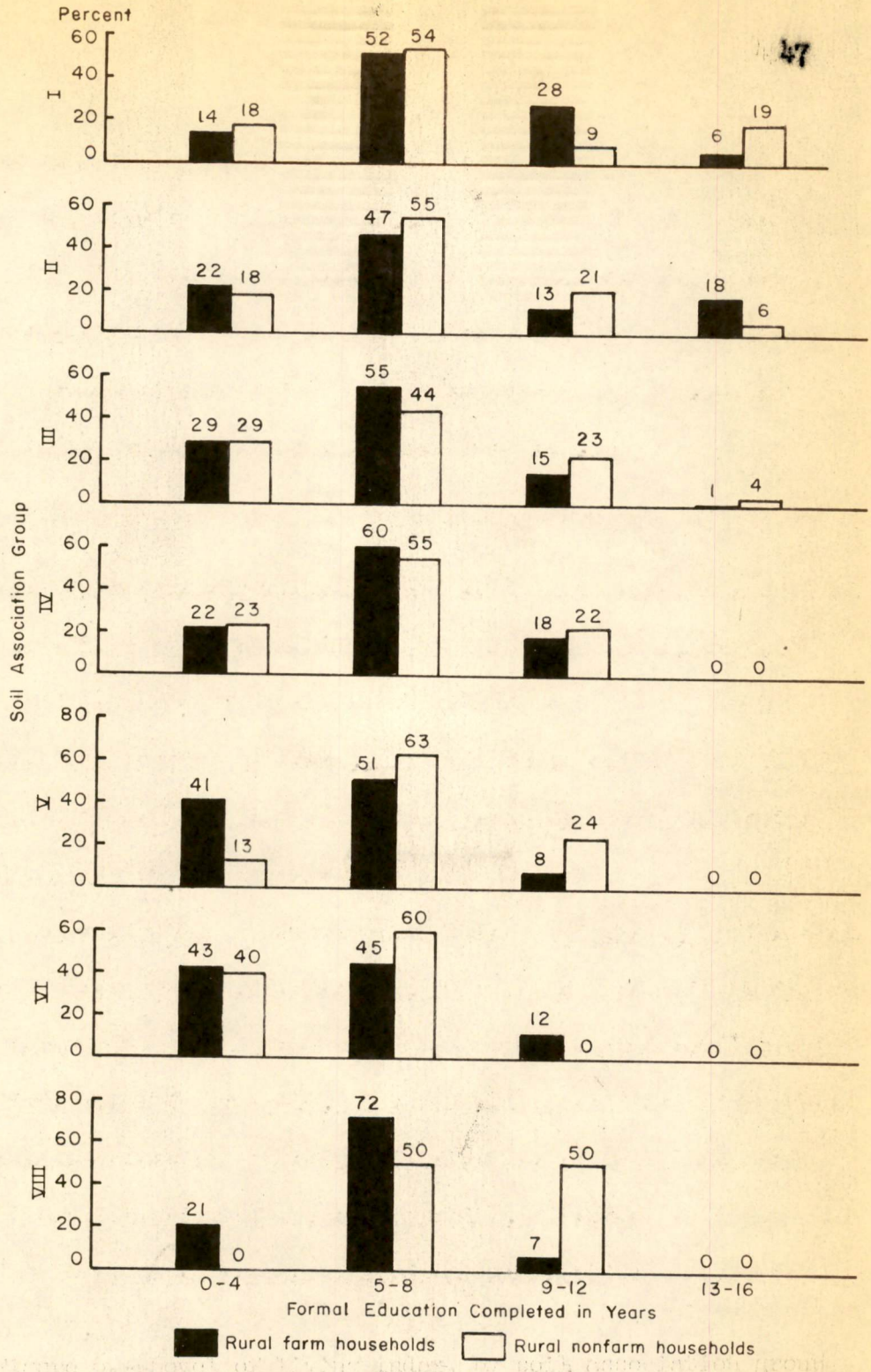


Figure 8.--Education of family head, by soil association group, 506 rural households, Upper East Tennessee Valley, 1957.

productive farming areas and at the greatest distance from sources of non-farm employment suffer the greater loss of children from migration.

An average of 44% of the households in the study area reported no losses in labor force since 1950 (table 11). The largest percentage of households, 63%, to report no losses in labor force since 1950 was on soil group IV. The households on the less productive soil group VI reported the largest percentage of households with a growing labor force. However, soil group VI also had the largest percentage (31%), of losses from its growing labor force during this period of time.

The partial transition from farm to non-farm employment may be indicated by the number of reported losses from each segment since 1950. Of the non-farm households, 15% reported a decline in the labor force as compared to 31% of the farm households.

Farm households on soil groups I and VIII reported the largest decline in the labor force.

In households on soil group VIII the primary loss was to old age. This loss to old age accounted for all but 28% of the losses in the labor force. However, soil group VIII ranks second only to soil group I in losses to other areas.

Twenty-five percent of the farm households on soil group I reported an increase in the labor force since 1950. Seventy-five percent of the farm households reported a decline in the labor force. Soil group II had the most static labor force. Evidently, most of the losses in the labor force were either from movement to an urban area within 100 miles or due to old age.

Table 11.--Changes in labor force since 1950, by soil association group in percent, Upper East Tennessee Valley, 1957.

Soil association group	249 non-farm households				257 farm households			
	Labor force growing or static		Labor force declining		Labor force growing or static		Labor force declining	
	No migration losses	Migration losses	Migration losses	Biological losses	No migration losses	Migration losses	Migration losses	Biological losses
I	54	9	28	9	25	0	75	0
II	56	8	13	23	47	8	25	20
III	57	8	18	17	43	5	25	27
IV	72	8	14	14	54	8	21	17
V	62	0	13	25	43	0	28	29
VI	40	40	20	0	44	22	17	17
VIII	50	0	0	50	36	8	28	28

N. Availability of Labor for Nonfarm Jobs

Less than 1/20 of the households with one full-time non-farm worker had others that desired a non-farm job. About 7% of the farm households in this category had someone desiring a non-farm job as opposed to only 3% of the non-farm households.

Households on soil group VIII had the largest percentage of individuals, 26.4%, desiring non-farm work (figure 9). This was possibly due to lack of employment or to the distance from an urban center where employment might be obtained. Households on soil group VI were the only others to report a large number desiring non-farm work. About 1/6 of soil group VI households reported inhabitants desiring non-farm work.

O. Households Net Earnings by Source

Income From Farming

A study of soils as they relate to the income of farmers, shows rather extensive areas of certain land types in which practically all the farms have low incomes and other areas in which high incomes are generally obtained. Incomes of farmers on infertile, rough, stony land are generally low, as compared with those of farmers on the deep, more fertile soils. For example, there were 7% of the farmers living on the more productive soils of group II who had a net income of over $3,000 as compared to none on soil groups III, V, and VI (figure 10).

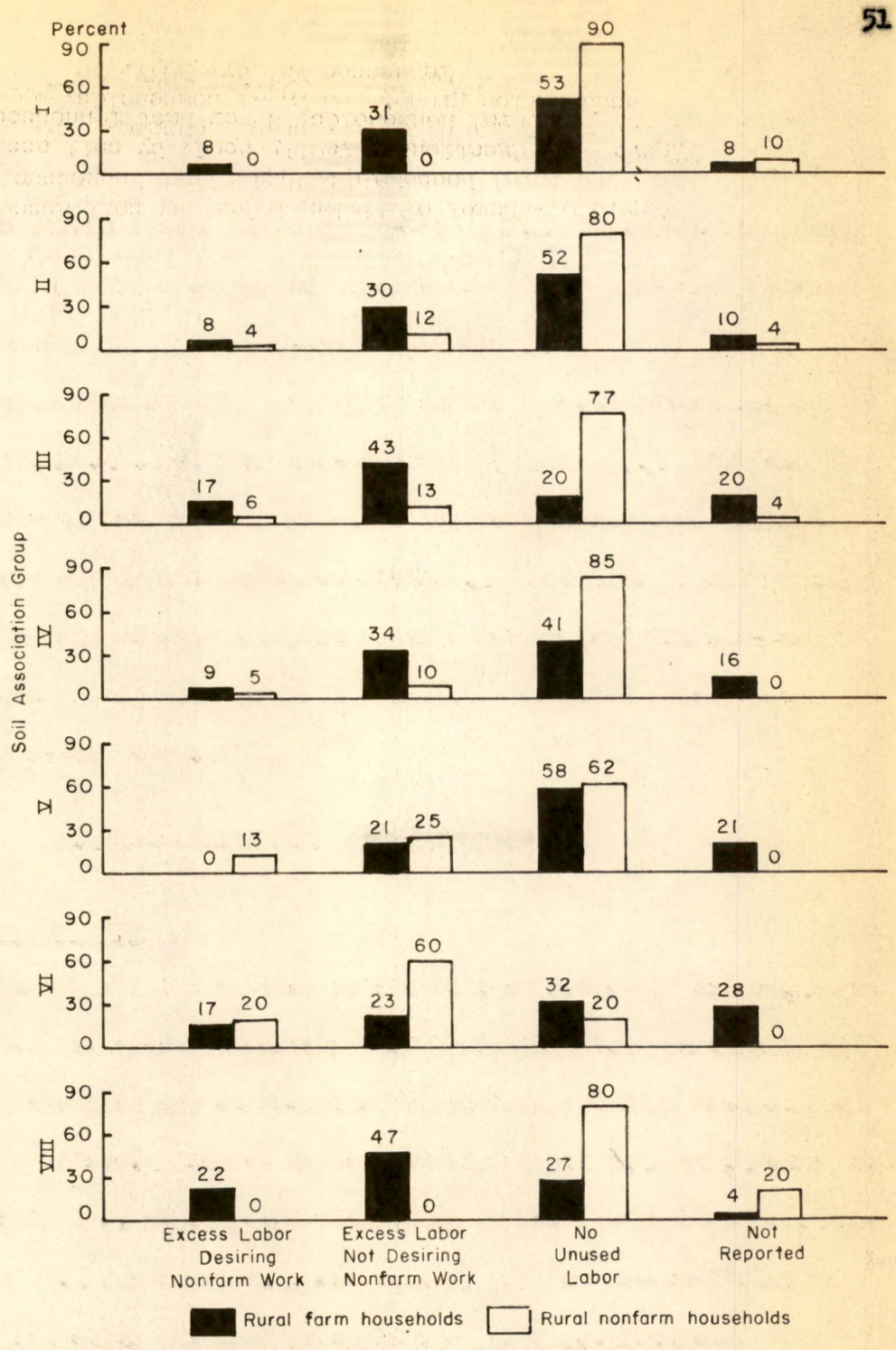


Figure 9.--Availability of labor for nonfarm jobs, by soil association group, Upper East Tennessee Valley, 1957.

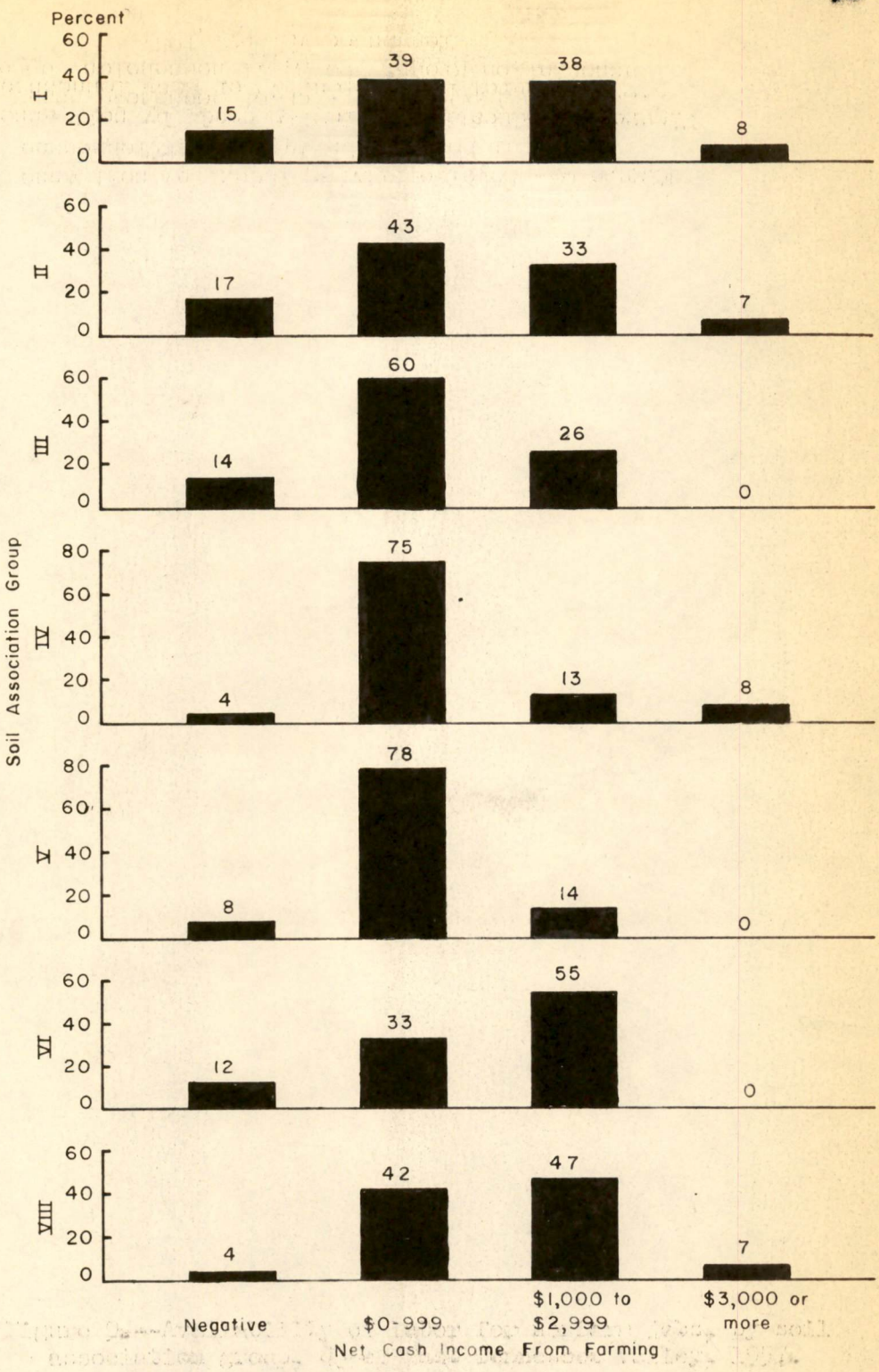


Figure 10.--Net cash income from farming, by soil association group, 257 rural farm households, Upper East Tennessee Valley, 1957.

Incomes From All Sources

Nearly 1/2 of the rural household heads are part-time farmers or non-farm laborers (figure 11). Therefore, a look at the net cash income per year from all sources will reveal the money the household has to promote its level of living (figure 11).

Households on soil groups I and II have the largest percentage, (49.5%), with a net cash income from all sources of $3,000 and more per year. Of non-farm households with a net cash income from all sources of $3,000 or more the largest percentage, (53%) was located on soil group II. In contrast, households on soil group VI had the lowest percentage, --5.5%. Slightly more than 60% of the households on soil group VI had net cash income from all sources of less than $1,000.

About 40% of the households on soil groups V and VI had a net family earning per person of less than $500. The mean for all groups was 24%. Fifty-five percent of the households on soil group II had a net family earning per person of over $1,000 as compared to only 8% on soil group VI (figure 12).

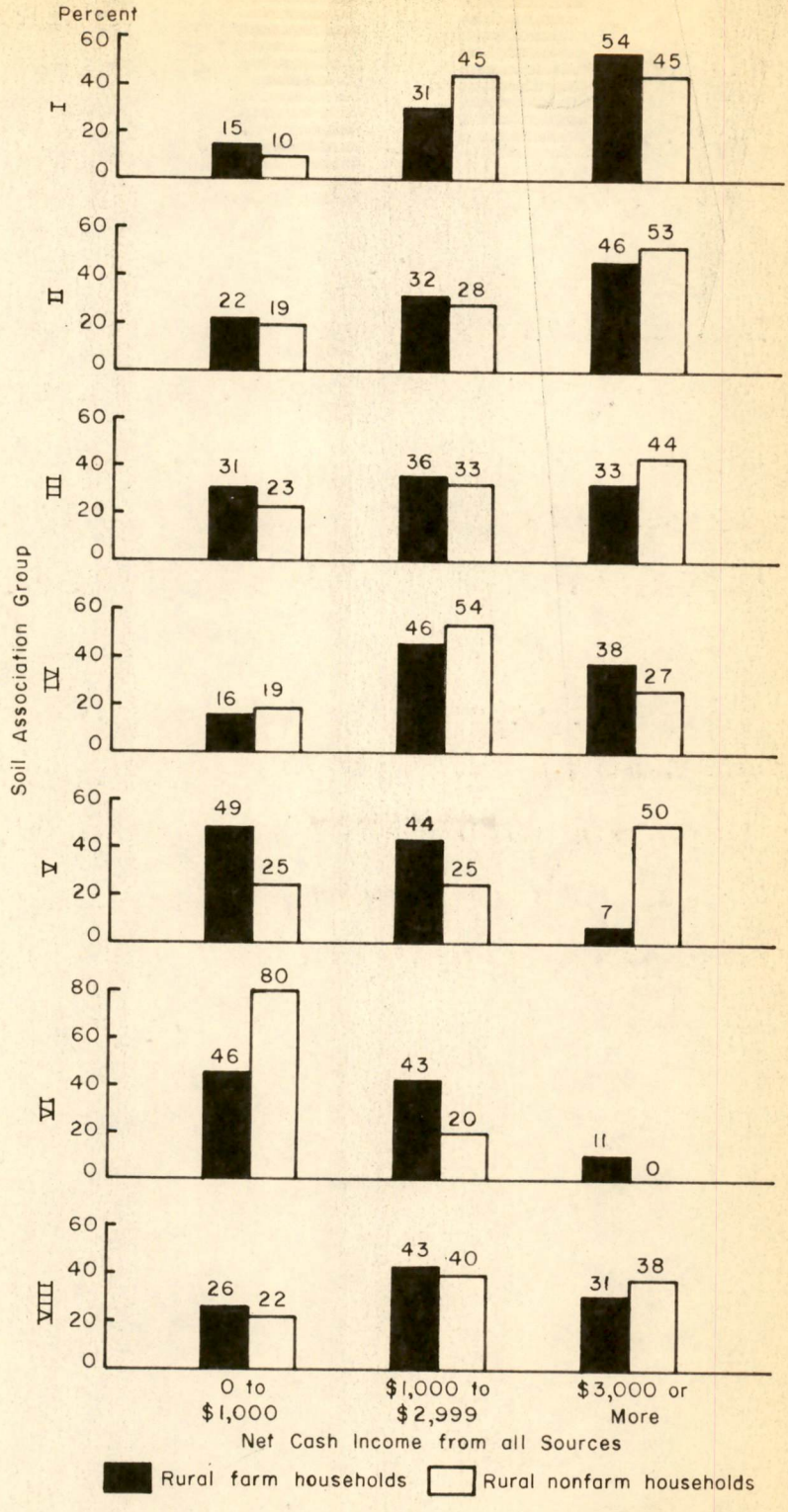


Figure 11.--Net cash income from all sources, by soil association group, 506 rural households, Upper East Tennessee Valley, 1957.

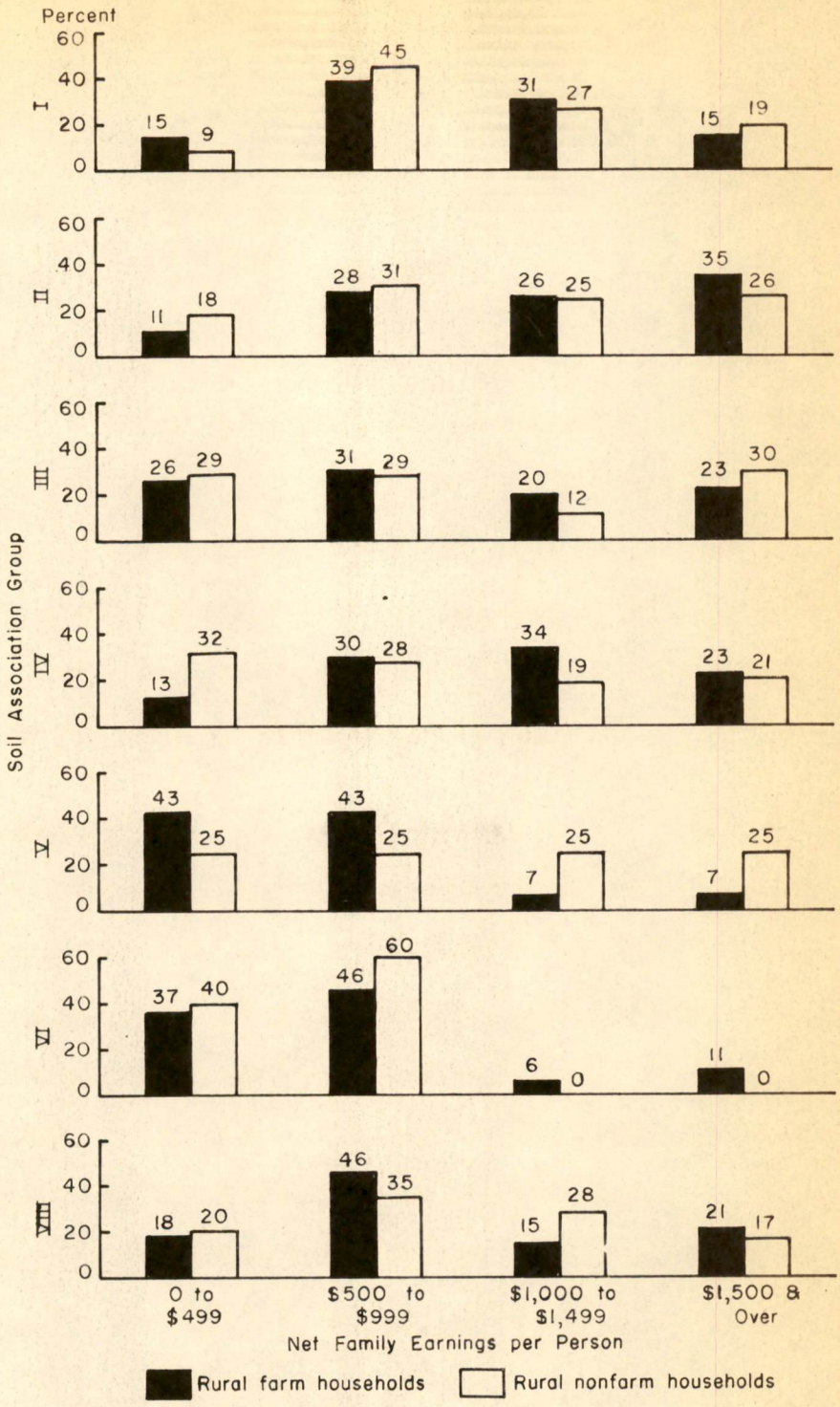


Figure 12.--Net family earnings per person, by soil association group, 506 rural households, Upper East Tennessee Valley, 1957.

CHAPTER V

DISCUSSION

A. Conditions Conducive to Earning a Successful Living on a Full-Time Farm

Mode of Measurement

The level of living index described in Chapter III was used in Chapter IV to reflect the success in obtaining the desired conveniences by the households on each of the soil groups.

Based upon the assumption that the majority of the households desire modern conveniences, success at their occupation would permit a high rating on the level of living index scale.

Labor Force Important

Parson and Long (12) implied that perhaps the most important single resource on any farm is the labor force. Its size, stage of growth, desires, and capabilities influence greatly both the present use of the resources and future possibilities.

It has been pointed out by Ramney (14) that Tennessee farmers have a maximum size of business as measured by work units per man by 35 years of age. The size then declines with the age of the farmer so that those over 75 have only 1/10 the size of business as those under 35.

Management Skills Essential

Lee and Chastain (10) indicated that risk and uncertainties arise from imperfect knowledge regarding expected changes. The farm

manager must act in an environment characterized to a large degree by imperfect knowledge. The availability of a large supply of land, labor, and capital does not necessarily guarantee a high net income. They must all be combined under good management skills, if the individual is to find success in his endeavors.

An education alone will not necessarily make a good farm manager out of an individual. However, it will certainly increase his efficiency in reaching the proper balance between risk-taking and conservatism.

Age of Farmer

It takes several years for a farmer to accumulate enough of the factors of production to farm efficiently. Normally, a farmers most productive years are between the ages of 35 and 55.

Land

Soil sometimes varies tremendously from one section of a field to another. The soils of the area range from small "patches" of very fertile alluvial soils to the infertile sandy and rocky mountain soils. Farmers needed a minimum of $14,000 invested in farm cropland under the present level of production. This would be made up primarily of land quality classes I, II, and III with some class IV land.

Capital

The skilled farm manager's supply of capital will influence the returns from his decision-making processes and ultimately his level of

living. A close relationship exists between the value of land operated and the ultimate level of living (table 12). The households of the area needed over $14,000 to place them in the high level of living bracket. Comparison of net worth with the level of living shows approximately how much capital is required to earn a net income sufficient to place a household in the high level of living group (table 13). In order to have a high level of living one's capital assets should be in excess of $16,000 under the present level of management. It is realized that the capital needs will vary with the type of farming, soil fertility, and management skills employed. These standards reflect only what was being done in 1957 and previous years. They do not reflect the potential income that might be received under a high level of management on some of the better soils.

B. Part-Time Farms Increasing

The study revealed that less than 1/4 of the full-time farmers have obtained enough of the factors of production to raise the level of living to their desired level. The rather rapid increase in industrialization and the increasing desireability of rural living have stimulated a trend toward part-time farming in East Tennessee.

Due to prevailing agronomic and economic conditions, it is obvious that the Upper East Tennessee Valley cannot expect to expand greatly toward the large units necessary for economical mechanization. Over 60% of the present farms have less than 20 acres of cropland and only 16% more than 50. One possible alternative would be to develop some intensive enterprises that would be profitable.

Table 12.--Level of living and value of farm land, 257 farm households, Upper East Tennessee Valley, 1957.

Level of living	Level of living index	Value of farm land operated
Low	1	$ 3,300
	2	3,700
	3	5,300
Medium	4	6,700
	5	8,300
	6	9,700
High	7	16,300
	8	14,400
	9	20,900
	10	26,600

Table 13.--Level of living index, assets, debts, and net worth of 257 farm households, Upper East Tennessee Valley, 1957. a

Range	Index scale	Total assets	Debts	Net worth
Low	0		$ 220	$ -220
	1	$ 1,200	250	950
	2	2,890	160	2,730
	3	4,620	510	4,110
Medium	4	7,400	410	6,990
	5	8,250	740	7,510
	6	10,000	1,470	8,530
High	7	16,140	1,130	15,010
	8	15,800	1,070	14,730
	9	18,850	2,280	16,570
	10	23,630	2,700	20,930

a/ Total assets includes value of all real estate and non real estate business investments. Non real-estate, and non-business assets were not enumerated. All debts were, however, enumerated.

The increasing number of small industries in the rural and small town locations will be more conducive to farm-industrial job combination in the future than it has been in the past.

The part-time farmers generally had larger families than the full-time farmers. The fact that the part-time farmers were younger on the average than all farmers in the area undoubtedly had some effect on the family size. Young families had a larger number of their children still home. Another factor of importance concerning the part-time farmer was the greater need for producing food on the farm. In addition, among the larger families more labor would be available for doing farm work.

The majority of the small part-time farmers looked toward the farm as a source of food and as an environment conducive to rearing a family rather than as a large source of cash income. Less than 1/3 had more than $1,200 sales (table 9). Value of perquisites was almost 3 times the net cash income of part-time farms.

Baird and Bailey (4) pointed out that there is evidence to show that in a limited number of cases part-time nonfarm employment is a means of obtaining enough capital to become a full-time farmer.

C. Households Have Different Adjustment Potentials

Many Households Limited in Opportunity

The households were divided into two groups which indicated adjustment and earning ability according to characteristics of the household head (table 14).

Table 14.--Adjustment potential, by soil association group, 506 rural households, Upper East Tennessee Valley, 1957.

Adjustment potential group	Characteristics of head of households	Soil association group							
		I	II	III	IV	V	VI	VIII	Total
I. Adjustment potential limited									
A. Seriously limited									
	a. 65 years of age or more	17	21	20	17	14	00	10	18
	b. Physically handicapped	8	4	14	7	4	9	00	6
	c. Female head of household	21	13	6	6	9	17	3	10
	d. Less than 5 years schooling	17	20	29	22	32	44	20	23
	(Less duplication)	-17	-21	-20	-15	-14	- 9	- 3	-17
Total group IA		46	37	49	37	45	61	30	41
B. Moderately limited									
	Not in IA and:								
	a. 55 to 64 years of age	4	11	6	4	9	9	20	10
	b. 45 to 54 (without either 12 years of schooling or $8,000 net worth)	8	10	5	15	14	8	10	9
Total group IB		12	21	11	19	23	17	30	19
Total group I		58	58	60	56	68	78	60	60
II. Adjustment potential relatively unlimited									
	Not in group I and:								
	a. Under 45 years of age	42	42	40	44	32	22	40	40
All households		100	100	100	100	100	100	100	100

Those in group IA were seriously limited and usually had little opportunity for adjustment as a household unit. On soil group VI there were 61% of these. About 50% on soil group III were seriously limited in adjustment opportunities. Household heads on soil groups II and IV represent the modal with 37% being seriously limited.

Within household adjustment group IB, adjustments for non-farm families, such as changing jobs within a company, or taking jobs of similar kind within the area, could be easily made if these adjustments seemed desirable. Similarly, farmers in group IB could easily make changes in production practices with the present farm organization or make minor changes in organization.

The mean for household adjustment group I which represented those household heads with at least some limitations was 60%. Households on soil group IV had the lowest percentage with at least some limitations.

The short productive life expectancy of group IA indicated two things: (1) it was not long enough to justify many to make major long-term investments or costly adjustments that do not have short pay-out periods, and (2) what resources they had would soon be available to others. Adjustment opportunities for personnel group IAa. were limited and consisted primarily of minor adjustments in their present farming systems or occupations. Because of the large number of individuals with handicaps other than age, any major expansion adjustments would be even more difficult. The greatest problems facing this group are how to best dispose of their present resources profitably and how to make the best of the present situation.

Adjustment Potential of Soil Groups Differ

The future of the area depends primarily upon the action taken by adjustment group II. About 40% of the household heads can make extensive practical adjustments. The flexibility of the people in this younger age group, plus a long expectancy of life, gives them a chance to make longer range adjustments. The better education, physical and net-worth characteristics enhances this group's adjustment potential. The study reveals that specific adjustments of individual households may vary both in desirability of kinds and in ease of making.

The primary goal of the household heads in adjustment group II will be acquiring resources that may be released by group I upon retirement and absorbing them into profitable farm and non-farm units. The adjustment potentials of soil group III and the more productive soils of groups I, II, and IV are similar in several respects.

All the farm households on these groups have relatively large farm investments in comparison to the farmers on the less productive soil group V and VI. Farmers on soil group I had the largest farm investment--$31,000.

The largest percentage of head of households with 13 or more years of formal education were located on soil groups I, II, and III.

Heads of households on soil groups II and IV had the highest modal level of living index.

Soil group III and the more productive soils of groups I, II and IV supported the largest percentage of households with high net cash income from all sources. Soil Group I reported the largest percentage with income from all sources exceeding $3,000--54%.

Soil group II tended to be making the adjustment to the changing conditions in the area faster than the households on soil groups I, III, and IV. Even these, however, were adjusting to the changes more rapidly than soil groups V and VI.

About 50% of the household heads on soil group II had secured non-farm employment and produced less than $150 in farm products. Sixty-five percent of the farm households on soil group II had two or more able-bodied males between the ages of 18 and 45. The soil resources of soil group II are conducive to a high level of farm management practices. About 1/6 of the farm household heads living on soil group II reported sales of $5,000 and over. Some 32% of the household heads are farmers. Over 1/2 of the households on soil group II reported that the labor force was either growing or at least remaining constant.

On soil group II, it may be possible to combine enough land into an economical unit to compete as a full-time farm with other sections of the state. Only 2/5 of the household heads in soil group II can make extensive adjustments. Therefore, they should have less competition in acquiring an economical sized unit of land. If they should add mechanization and a higher level of technological management practices to a larger unit of land it is quite possible that agriculture will continue to compete with industry on soil group II and similar groups. The households on the rough mountainous soils of group VI and the rolling to steep soils of group V have several characteristics in common. In contrast to soil groups I, II, III and IV, the farm households on soil groups V and VI have relatively small farm investments. The mean farm investment is only $9,000 as compared to $31,000 on the more productive soil group I.

The heads of households on the less productive soil groups V and VI were characterized by a low to medium level of living, low education and low material wealth. Only 7% of the head of households on soil group V had a net cash income from all sources of more than $3,000 as compared to 54% on soil group I.

On soil group VI nearly 6/10 of the farmers are seriously limited in adjustment potential. Nearly 3/4 of the farmers are owner-operators with the other 1/4 composed primarily of tenants. Only 4% of the farm households reported farm sales of more than $2,500. The soil group is characterized by large families. About 44% of the households consisted of 5 or more members.

About 22% of the households had secured non-farm employment to assist in securing a higher level of living. The inhabitants of this group are probably in the most serious situation. Due to the topography of the land and the distance from present non-farm employment, adjustment opportunities were limited for those that could or would not leave the area.

The soil productivity level and related factors are so low that it would not be economically feasible to attempt to raise the level of living appreciably by general farming.

If industry should move into the area in the future, the level of living may be raised by non-farm employment along with small scale part-time farming.

In general, the soils of this group are better suited to forestry than to general farming.

Soil association group VIII is similar to VI in that it has relatively little industry. However, it has rolling to hilly topography similar to that of groups where industry has located. It is quite similar to soil group II in that it has soils that are quite responsive to improved farm management practices.

Soil group VIII is quite similar to the more productive soils in soil group I, II, III, and IV. The farm households have an average farm investment of about $16,000. The households have a level of living index of 5 which is similar to soil groups II and IV. About 40% of the head of households can make extensive adjustment.

Eighty-five percent of the household heads reported farming as the major activity. Only 10% resorted to non-farm employment to increase their level of living.

Evidently this low figure for non-farm employment was a result of the fact that soil group VIII is too far from an urban center with industry. The largest percentage of households reporting unused labor with a desire for non-farm work was located on this soil group.

Soil association group VIII may follow the trend toward part-time farming and non-farm employment. However, soil resources are satisfactory to raise the present level of living conditions if mechanization and modernization of farm practices are instigated. The future of this soil group depends upon the action of those people in adjustment group II who are able to make extensive adjustments. Further studies need to be made to determine the best of these possible actions.

Change Toward Part-Time Farming Likely

Soil association groups I, III, and IV are presently undergoing trends similar to soil association group II. The number of full-

time farmers is decreasing. However, the number of households farming part time with non-farm employment tends to be increasing.

CHAPTER VI

CONCLUSION

A distinct relationship was found between the local existing living conditions and the desirability of the soil association group upon which the households lived.

There was evidence of strong competition for the better soils for construction projects. Due to the physical characteristics of the soil types and the lower cost of construction, the engineers of railroads, highways, and industries seemed to have acquired the better soils for building purposes.

Nearly 1/3 of the farmers on soil group III have dairy farms. However, only 4/10 have tobacco farms and produce other enterprises.

The largest percentage of beef farmers are located on soil group VIII--7%. However, only 2 to 3% of the farmers on soil groups II and III raise beef as a major enterprise.

Nearly 3/4 of the farmers on soil group VI had tobacco farms.

The required investment in farm implements was determined primarily by the ability and readiness of the household heads to make such investments and by the need for these investments. The need for farm implements was based principally upon the types of farming, area in crops, topography, and size of the farm. Hence, to the extent that soil types influenced these factors, they indirectly influenced the investment in farm implements.

Adjustment Varies with Soil Association Groups

Households on the rough mountainous soils of group VI were undoubtedly the least adjusted to the change from full-time farming to part-time farming supplemented by non-farm employment. Soil association group VI is characterized by large families with relatively few years of formal education. Nearly 1/2 of the households have 5 or more members and nearly all of the household heads have 8 years or less formal education. About 2/3 of the households on soil group VI had a low level of living and the other 1/3 had only a medium level. The labor force tends to be growing despite the large loss to areas within and beyond a 100 mile radius.

Small industries have not located on this soil group. Less than 1/5 of the household heads are non-farm employees. The remainder of the households were composed of low-income farmers. Nearly 3/4 of the full-time farmers and over 8/10 of the part-time farmers had sales of less than $1,200. Agriculturally, group VI is comparatively unimportant.

Only 22% of the households head were under 45 years of age and could make extensive adjustments. However, the labor force tended to be growing despite the large loss to outside areas.

Due to the large relatively-uneducated families, low productivity of soils, rough topography, and geographical location, adjustment opportunities were limited for those that could or would not leave the area.

Adjustment Favorable on Some Soil Association Groups

Recent changes on the more productive soils of group II have followed the national trends in farm mechanization and intergration of agriculture with industry. Local industrial-urban development brought

with it higher farm capital and higher farm income per worker.

The soil resources are conducive to a higher level of farm management practices than is the case on soil groups V and VI.

About 37% of the household heads of soil group II are seriously limited; however, nearly 1/2 of the household heads furnish a high standard of living for their families. About 42% were under 45 years of age and could make extensive adjustment. Over 9% of the household heads living on group II reported $5,000 and over from farm sales. About 12% of the head of households have 12 or more years of formal education.

About 1/2 of the household heads have secured non-farm employment and produce less than $150 farm products. About 1/2 of the households living on soil group II had a high level of living and over 1/3 had a medium level of living. Nearly 1/3 of the household heads are farmers. Almost 2/3 of the farm households on soil association group II had two or more able-bodied males between the ages of 18 and 45. Over 1/2 of the households reported the labor force increasing. About 20% of its losses were due to old age or biological factors.

From an agricultural point of view soil association group II is very important in the Upper East Tennessee Valley (table 15).

The heads in 42% of the households and the second able-bodied male, normally the son, in 65% of the households are able to make extensive adjustments. One of these may continue, through modernization and mechanization, to farm on soil group II or similar soil groups despite the strong non-farm competition for the better soils.

Table 15.--Summarization of related characteristics, by soil association group, 506 households, Upper East Tennessee Valley, 1957.

Related characteristics	Soil association group						
	I	II	III	IV	V	VI	VIII
506 households, modal level of living index	3	5	4	5	3	3	5
223 farm households, farm investment in thousands of dollars	31	23	13	15	9	9	16
Percent of household heads that farm as major activity	38	32	35	31	36	70	85
Percent of household heads, nonfarm workers as major activity	47	50	48	56	56	13	10
Percent of farm households with 2 or more able bodied males	0	65	10	7	6	10	7
Percent of households with 5 or more members	37	28	29	29	12	44	20
Percent of farm household heads age 35-54	55	45	40	51	57	6	68
Percent of household heads with 13 or more years of formal education	25	24	5	0	0	0	0
Percent of households with labor force growing	47	52	50	66	45	70	41
Percent of farm households with net cash income from farming more than $3,000	8	7	0	8	c	0	7
Percent of farm households with net cash income from all sources more than $3,000	54	46	33	38	7	11	31
Percent of farm households with per capita income less than $500	15	11	26	13	43	37	18
Land quality index	107	95	84	104	103	71	98

The general adjustment trend has been toward the larger, economical land tracts of fairly productive soils being utilized for full-time farming. However, the smaller tracts of land either supported small scale, part-time farmers or was used for a residential environment free of city congestion.

Soil Resources Influence Economic Status

Soil resources have played an important role in delineating the economic status of the rural households in the Upper East Tennessee Valley. The more productive soils of some groups have been valued very highly and the competition for these soils has been very strong, especially in recent years.

Soil resources and location often determined the type of farming or use and the intensity with which the business was conducted within a given area.

A major cause of differences in the economic status of rural households was the type of activities they engaged in to earn a living.

The level of living that the farm household had depended largely upon the soil resources and how well they were combined with other factors of production--labor, capital, and management skills.

The farmers on the better soils had more material comforts and a higher level of living than did the households on the less productive soil groups. They had taken advantage of education opportunities and had accumulated more material luxuries. The households on the better soils had fewer children and a higher per capital income.

CHAPTER VII

SUMMARY

By the use of a personal interview survey of a random block sample of 506 rural farm families in the Upper East Tennessee Valley and related published data, a study was designed to measure the influence of soil association areas upon the following:

(a) What is produced and sold from farms.

(b) Adjustment of people from full-time farming to part-time farming and nonfarm employment.

(c) The income and level of living of people in the area.

The study area consisted of Grainger, Greene, Hamblen, Hawkins, Jefferson, Sullivan, and Washington Counties.

The data were processed for machine tabulation and analyses were made to relate income and other factors to land. Farm families were classified into groups which reflected causes of differences in income as well as potential for increasing income.

The soils were grouped into 7 primary groups on the basis of soils and topography. The survey data were then sorted by the 7 soil association groups and the results were analyzed.

The type of farming conducted and the income received was affected by land quality classes. The households living on the more productive soils were better rewarded for their endeavors.

Soil group III and the more productive soils supported the households with the higher formal education, higher level of living, and greater material wealth.

The households on the rough and mountainous Muskingum and Ramsey-Jefferson soils of association group VI were the least adjusted to change from full-time farming to part-time farming supplemented by non-farm employment. Sixty percent of the household heads were seriously handicapped. Only 22% were under 45 years of age and could make extensive adjustments. The maximum number of years of formal education reported was about 8 years. Only 13% had received nonfarm employment. The labor force tended to be growing despite the large loss to outside areas.

Small industries have not located on these steep mountainous soils of association group VI as they have on the majority of the other soil groups. This soil association group remains predominantly in small, low income farms. Nearly 3/4 of the full-time farmers and 91% of the part-time farmers had sales of less than $1,200.

Nearly 2/3 of the households on soil association group VI had endured a low level of living and the other 1/3 had only a medium level of living.

Contrary to soil association group VI and the somewhat similar soil group V, soil association group II has followed the national trends in farm mechanization and integration of agriculture with industry.

About 1/2 of the household heads on soil association group II had secured non-farm employment and produced less than $150 farm products. About 1/3 of the household heads are farmers. Thirty-seven percent of the head of households were seriously limited in adjustment potential. However, 42% were under 45 years of age and could make extensive adjustments. Some 28% of the full-time farmers had farm sales of $5,000 or more. However,

about 16% had sales of less than $1,200. About 56% of the households on soil association group II reported the labor force increasing. About 20% of its losses were due to old age or biological factors.

About 71% of the heads of households on soil group II had 8 or less years of formal education. Some 12% had 12 or more years.

Nearly 50% of the households living on soil association group II had a high level of living, and 35% had a medium level of living.

The various users of soil resources were attracted to some soil association groups. The extent of this attraction depended upon the fertility level, location, and physical characteristics of the soil and upon topography. Competition for these natural resources definitely influenced the type of activities that the inhabitants engaged in to earn a living. The type of activity influenced the level of living that the family had.

In the entire area the general adjustment trend is toward the utilization of the few larger tracts of fairly productive soils for full-time farming. Where small local industries are near, the smaller farms are being used for small scale, part-time farming supplemented by non-farm employment. Occasionally these small tracts of land which are away from the congestion of the city are used simply for a residential area which is more conducive to rearing a family.

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LITERATURE CITED

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APPENDIX

APPENDIX

NUMBER OF 506 HOUSEHOLDS WITHIN SOIL GROUP, UPPER EAST TENNESSEE VALLEY, 1957.

Soil Groups	257 Farms	249 Nonfarm
I	13	11
II	102	145
III	58	56
IV	24	22
V	14	8
VI	18	5
VIII	28	2