May 16, 1938

To the Committee on Graduate Study:

I submit herewith a thesis written by Joe David McClure and entitled " A study of Methods, Scope and Results of Demonstrations of the Soil Conservation Service in Camp Tennessee S.C.S.-4 Work Area" and recommend that it be accepted for nine quarter hours credit in partial fulfillment of the requirements for the degree of Master of Science, with a major in Agriculture.

W. J. Burg
Major Professor

At the request of the
Committee on Graduate Study,
we have read this thesis,
and recommend its acceptance.

H. E. Fitzgerald
J. E. Wills

Accepted for the Graduate
Committee

W. C. Smith
Dean

A STUDY OF METHODS, SCOPE AND RESULTS OF DEMONSTRATIONS OF THE SOIL CONSERVATION SERVICE IN CAMP TENNESSEE S. C. S. - 4 WORK AREA

- o -

A THESIS

Submitted to the Graduate Committee
of
The University of Tennessee
in
Partial Fulfillment of the Requirements
for the degree of
Master of Science

By

JOE DAVID MCCLURE

June 1938

ACKNOWLEDGEMENTS

The writer wishes to express his appreciation to Professor A. G. Burg, of the University of Tennessee Agronomy Department for supervising the preparation and editing of this manuscript. He also is grateful to Mr. Jack W. Morrison, Superintendent of Camp Tennessee S. C. S. - 4, and other officials of the Soil Conservation Service for their advice and suggestions.

26 Oct 31 M.D. 90

154231

TABLE OF CONTENTS

Page

CHAPTER I. INTRODUCTION AND DESCRIPTION OF THE AREA ..... 1.

Purpose of Study ..... 2.
General Description of the Work Area ..... 2.
Physical Factors ..... 3.
Soils ..... 5.
The Agriculture of the Region ..... 10.

CHAPTER II. CAUSES AND DEGREE OF EROSION AND SOIL DEPLETION IN THE WORK AREA ..... 14.

Soil Depleting Practices ..... 14.

CHAPTER III. SOIL CONSERVATION PRACTICES ORIGINALLY USED BY FARMERS IN THE WORK AREA ..... 18.

Means of Control ..... 18.

CHAPTER IV. THE SOIL CONSERVATION SERVICE - ITS ORGANIZATION AND AIMS ..... 22.

CHAPTER V. SCOPE OF SOIL CONSERVATION ACTIVITIES IN THE CAMP TENNESSEE S. C. S. - 4 WORK AREA .. 24.

CHAPTER VI. DESCRIPTION OF SOIL CONSERVATION PRACTICES USED AND DEMONSTRATED BY THE S. C. S. - 4 CAMP ..... 27.

Farm Layout ..... 27.
Crop Rotation ..... 29.
Contour Cultivation ..... 35.
Strip Cropping ..... 37.
Cover Crops ..... 41.
Fertilization ..... 44.
Outlets ..... 53.
Contour Furrows ..... 55.
Gully Control ..... 57.
Reforestation ..... 59.

CHAPTER VII. METHODS OF ATTACK USED BY THE SOIL CONSERVATION SERVICE ..... 71.

Page

CHAPTER VII. (Continued)

Sample Cooperative Agreement ..... 75.
Conservation Survey Symbol Sheet ..... 78.
Cooperative Agreements ..... 80.

CHAPTER VIII. SUGGESTIONS FOR SOIL AND WATER CONSERVATION BY FARMERS IN THIS AREA .....113.

TABLES

Table		Page
I.	A Comparison of Some Agricultural Statistics of Carroll County with the State of Tennessee	11.
II.	Effect of Crop Rotation on Yields	31.
III.	Seasonal Soil Losses from Cotton Planted on the Contour and with the Slopes	37.
IV.	Seasonal Soil Losses from Cotton Plots and Cotton Stripped with Soybeans	40.
V.	Results of Limestone and Phosphate when used Alone and Combined on Corn, Oats and Hay in Tennessee ..	48.
VI.	Results of Terracing	52.

MAPS

	Page
Woodland Management Map - B. B. Surber Farm	69.
Land Use Map - James W. Van Dyke Farm	81.
Land Use Map - E. E. Thomas Farm	92.
Land Use Map - John Owens Farm	102.

CHAPTER I

INTRODUCTION AND DESCRIPTION OF THE AREA

It has been wisely said that the Nation that destroys its soil destroys itself. The soil is the origin, not only of food, but of clothing and, in fact, most of the basic necessities of life.

Up until recent years we have considered it easier and in most cases, more profitable to utilize the soil fertility which it took nature centuries to build up, rather than to maintain this fertility. This needless wastage has resulted in a steady decline in our soil fertility and this wastage cannot continue long without the effects being felt by every member of society. Already thousands of farm families in this State have seen their standard of living lowered and many have even lost their homes and farms and have had to go on relief.

In the United States it is estimated that poor soil management and improper land use is costing $400,000,000 annually. In this country 100,000,000 acres of land have either been destroyed for profitable cultivation or so badly damaged that it will take many years to restore them to their former productivity.

In Tennessee it is estimated that 85% of the cultivated land has been damaged, gullies have practically destroyed 3,000,000 acres or about 9% of the total farm land in the State. It is estimated that sheet erosion has removed from 75% to 100% of the top soil from 11,000,000 more acres. (1)*

Purpose of Study

It is the desire of the writer to make a study of this problem of soil erosion and soil conservation in a representative area of West Tennessee with the aim of determing some of the more important factors causing erosion and soil depletion. It is also desired to make a study of the soil conservation practices which have been tried out by various farmers in this area, the results of these practices and the practices recommended and demonstrated by the Soil Conservation Service of the United States Department of Agriculture, through cooperation with farmers in this area. It is further desired to pull together this information and set up some principles that the average farmer in this area might apply to his farm in combating the ravages of erosion and soil depletion.

General Description of the Work Area

The area to be considered in this report refers to that section of country in West Tennessee worked by Camp Tennessee Soil Conservation Service #4 including the major portion of

---

* Numbers refer to citations of references.

Carroll County and small portions of Henry and Weakley Counties. This area, as this section will be referred to throughout this report, lies in North Central West Tennessee. Because of the fact that the major portion of the work area is in Carroll County and because the sections of Weakley and Henry Counties are very similar to Carroll County as to types of soil, general land uses, drainage, climate, and in fact all the major factors which will be taken up in this report as being important in relation to soil conservation practices, Carroll County will be used alone in making certain descriptions and the reader will consider the information given as being descriptive of the area as a whole.

Physical Factors

Geology. - In this report only the surface formations will be considered as we are concerned primarily with soil erosion and soil fertility and the relation of the types of soil and surface formations to soil fertility and soil conservation.

The area consists largely of the Wilcox group consisting of the Holly Springs sand and the overlying Grenada formation. The Holly Springs sand is the surface formation over most of the area. This formation consists predominantly of sand, strongly cross-bedded and of all sizes from small gravel to the finest of sand, which is in many places mixed with clay. The prevailing color of the sands is gray, followed by yellowish-brown.

Overlying the Holly Springs sand and cropping out in the west portion of the work area is the Grenada formation. This formation, like the Holly Springs, consists largely of cross-bedded sand of various colors. There is also considerable clay in this formation. (2)

Topography. - General topographic features in the area vary from fairly rolling areas to rather hilly sections. The highest precisely determined altitude in the area is 514 feet. The lowest known altitude is 395.5 feet, but the Valley of the South Obion River is said to be lower than this. Many of the hills are rather steep. There are several tracts of level to gently rolling land but most are rather small. (2)

Climate. - The climate of this area is characterized by a rather mild climate, usually without extreme heat or cold and usually without extremes in precipitation.

The mean annual temperature is 58.6 degrees F.

The mean annual precipitation is 49.19 inches, which is fairly well distributed throughout the year; however there is more rainfall in the winter and spring seasons.

The average date of the latest killing frost in spring is April 10, and of the first killing frost in the fall is October 22, giving an average growing season of 194 days. (3)

Drainage. - The area as a whole is well drained. Beaver Creek and Gwins Creek feed into the South Fork of the Obion River which drains the southern part of the area and Spring Creek feeds into the Middle Fork of the Obion River and drains the northern portion of the area. There is relatively a very

small area of swamp or marsh land.

Soils

In this area there are two principal kinds of soil-forming materials: (1) silty material that is characterized by the loess or windblown soils which usually range in depth from about 3-8 feet; and (2) unconsolidated silts and clays similar in nature to the sandy and clay strata which is found in much of the Coastal Plains region of the Southern States.

Following is a rather brief description of the major soil types found in this region.

Memphis Silt Loam. - This soil series is derived from the Group 1, mentioned above and is considered the most important soil series in the area.

The Memphis silt loam consists of a light-brown to brown silt loam usually underlain at about 8-10 inches by buff-colored, brownish-red, or a reddish-yellow silty clay or silty clay loam which passes into silty clay. As a rule with an increase in depth there is a decrease in the clay content and an increase in silt. Generally the color is more yellowish and less reddish in the lower subsoil. (3)

The Memphis silt loam is usually more uniform in color and texture than any other soil in the area. When the soil is dry, especially on land that has been cropped until the humus content has been lowered, the color is lighter, usually a grayish-brown or a brownish-gray.

In many places erosion has removed the silty surface soil forming small patches or "gall" spots of Memphis silty clay

loam.

The Memphis silt loam occupies most of the nearly level area and the more gently rolling upland in the area.

The drainage of Memphis silt loam is good. The soil retains moisture well and its physical properties are such as to provide good air and moisture circulation.

The soil is adapted to a wide variety of crops and when taken care of yields well. It responds well to manure and fertilizers. On most of the soil which has been heavily cropped the humus content is low.

Most of this soil is slightly acid, especially the more poorly drained areas.

Lexington. - Closely resembling the Memphis silt loam is the Lexington silt loam. This soil is characterized by a light-brown, brown, or yellowish-brown silt loam, underlain at depths of 8-12 inches by a yellow-red or brownish-red silty clay loam or silty clay. (3) This soil represents areas of the Memphis silt loam which have been modified by the removal of some of the surface material through erosion and mixing of subsoil with more sandy material. There are many eroded or galled spots of this type which represents a thin phase of Memphis silt loam, especially on the more steep hills and slopes.

This type has been cultivated extensively in this area and severe erosion is present in many places. In most cases the soil is rather poor, especially in humus supply. Sheet

erosion is severe and gullying is serious because the Lexington silt loam is of an erosive nature. There is quite an acreage of the Lexington series in this area that is not productive in its present state for the row crops and much of this land is lying idle or is being used as rough pasture land.

When this soil is judiciously farmed it yields well. This type responds well to commercial fertilizers and manure and may be built up to produce reasonably good yields.

Both the surface and underdrainage are good.

Grenada Silt Loam. - The Grenada silt loam is a light-brown silt loam, underlain at 8-10 inches by eyllowish-red or brownish-red silty clay loam which passes into a light-gray or mottled-gray and yellow or brown silty clay usually containing dark colored and rusty-brown splotches of concretionary material. When this area lies nearer the surface the soil is not as productive and tends to warm up later in the spring and also tends to bake in dry weather and the soil dries out more completely. (3)

This soil is not as productive as the Memphis silt loam, especially for corn but the grasses, lespedeza, and red top grow very well on this soil.

In many cases the surface drainage is poor and the soil is strongly acid.

Henry Silt Loam. - The Henry silt loam consists of light-gray silt loam which is underlain at about 3-10 inches by light-gray to whitish rather compact silt loam showing some mottlings of

yellowish-brown or brown. (3)

The Henry silt loam occupies poorly drained areas which are rather closely associated with the Grenada silt loam. There are several patches of this soil over the area.

This soil is adapted to lespedeza and is best suited to grazing and hay land.

Collins Silt Loam. - The Collins silt loam is a brown or light-brown silt loam frequently faintly mottled with gray and rusty-brown, grading at about 6-12 inches into mottled brown and gray heavy silt loam to silty clay loam. Usually there are dark-colored concretions in the subsoil. In dry weather the surface soil has a light-gray to whitish appearance.

There are also areas of Collins fine sandy loam about 6-10 inches deep underlain by mottled gray and brown fine sandy loam which is usually underlain by yellow, heavy silty clay loam. (3)

The Collins silt loam occupies the first bottoms of most of the small streams and creeks. The surface is usually level, rising toward the uplands. The soil is of an alluvial nature, representing material deposited by streams in time of overflow.

The soil is rather productive and is usually heavily cropped, especially in corn. In some areas there is a problem of drainage but this is not a serious problem.

Waverly Silt Loam. - The Waverly silt loam is a brown silty loam mottled with gray and rusty-brown, 3-4 inches deep, overlying whitish silt loam which is underlain by pale-yellow

silty clay. The more grayish phase is the characteristic soil of the permanently soggy bottoms. When concretions are exceptionally abundant, the soil is known as "buckshot" land and where it is very compact, whitish, or soggy it is often called "crawfish" land. (3)

The Waverly silt loam is poorly drained and usually consists of the wet, soggy swamp or bottom lands. Much of the Waverly soil is covered by timber but some areas are ditched and are in cultivation. The soil is not usually very productive for corn or cotton but the moisture loving grasses and lespedeza do quite well.

Lintonia Silt Loam. - The surface soil of the Lintonia silt loam is a brown or yellowish-brown silt loam with a reddish-brown or buff-colored silty clay. The soil is developed along or near streams. The drainage is good and good yields are usually obtained from this soil. (3)

Meadow. - Meadow consists of fine sandy loam, loam and silt loam soil occupying the narrow bottoms of the small areas. This material varies widely in color, texture, and structure within narrow limits though it includes small areas of established soil types.

Meadow includes small areas of Collins silt loam and Collins fine sandy loam. Coarser material occurs near the stream banks, while finer material of silt and clay is found farther away from the banks.

Meadow occupies first bottom land and is subject to

overflow. Much of this land has been cleared and is used for producing corn. (3)

Perhaps there are small scattered areas of other soil types but the ones described above are the important types found in this area.

As a whole the soils are poor in phosphate, lime and nitrogen. In most cases, especially of the upland soils, the humus supply is low. Most of the soils are slightly acid.

The Agriculture of the Region

From the standpoint of soil conservation the various factors considered under land utilization are important. The following table shows the various land uses, size of farms, and other information which must be studied in relation to soil conservation. The various factors considered in this area are compared with the State as a whole so one may get the relationship between this area and the State as a whole. It is to be understood here that the information given for Carroll County is given to represent the area as a whole since the type of farming and land utilization of the small portions of Weakley and Henry Counties included in this work are from observation and study very similar to Carroll County.

The following information in Table I is from the 1930 and 1935 Agricultural Census Reports of Agriculture. (4)

TABLE I. A COMPARISON OF SOME AGRICULTURAL STATISTICS OF CARROLL COUNTY WITH THE STATE OF TENNESSEE

Item	State	Carroll County
I. Number and size of farms -		
1. Number of farms	273,783	4,716
2. Per cent of land in farms	71.5%	83.9%
3. Average size of farm	69.7 A	70.5 A
4. Crop land harvested per farm	23.1 A	23.7 A
II. Per cent of Farm Land:		
1. In harvested crops	32.2%	33.7%
2. Idle or fallow	7.2%	7.1%
3. In pasture	29.6%	19.4%
4. In woodland not pastured	23.5%	22.7%
5. In all other land	6.5%	17.0%
6. Available for crops	56.2%	48.7%
III. Value of Land and Buildings -		
1. Per farm	$2,030.00	$1,227.00
2. Per acre	29.12	17.41
IV. Tenure - Per cent of Farms -		
1. Full owners	47.5%	37.7%
2. Part owners	7.9%	11.3%
3. Managers	.2%	.2%
4. Tenants	46.2%	50.9%
5. Croppers	18.8%	16.8%
V. Per cent of operators colored:	12.6%	13.1%
VI. Livestock - Numbers per farm		
1. Horses, 2 years old and over	.5	.4
2. Mules, 2 years old and over	1.1	1.4
3. Cattle and calves of all ages	4.5	2.7
4. Cows and heifers, 2 years old and over	2.5	1.7
5. Swine, all ages	3.7	2.7
VII. Acres and Yields of Crops		
1. Corn, acres per farm	10.4	10.9
2. Corn, bushels per acre	21.2	18.6
3. All hay, acres per farm	6.4	5.5
4. All hay, tons per acre	.9	.7
5. Cotton, acres per farm	2.8	5.8
6. Cotton, bales per acre	.52	.49
7. Sweet potatoes, acres per farm	.2	.3
8. Sweet potatoes, bushels per acre	102	114
9. Irish potatoes, acres per farm	.2	.6
10. Irish potatoes, bushels per acre	77	55

(Continued)

TABLE I. A COMPARISON OF SOME AGRICULTURAL STATISTICS OF CARROLL COUNTY WITH THE STATE OF TENNESSEE (Continued)

Item	State	Carroll County
VIII. Value of Farm Products per farm - 1929	$945.00	$842.00
IX. Proportion of Value of Products		
1. Crops sold or traded	41.2%	53.5%
2. Livestock sold or traded	16.2%	9.2%
3. Livestock products sold or traded	14.7%	8.4%
4. Forest products sold	1.9%	1.7%
5. Products used by family	26.0%	27.0%
X. Farms by Types, 1930		
1. Cotton	25.7%	58.5%
2. General	19.5%	19.0%
3. Truck	.7%	.55%
4. Dairy	2.4%	.46%
5. Animal speciality	4.4%	1.1%

It is noted that the area as represented by Carroll County is rather similar to the State as a whole as to the size of farms, crop lands harvested per farm, and per cent of land in farms. There is quite a difference, however, in the per cent of land in pasture, there being 29.6% of the total farm land in the State in pasture while in the area only 19.4% of the total farm land is in pasture.

The value of land per acre in the area is only slightly over one half of that of the State.

There is a marked difference shown as to the per cent of full owners of farms in the State compared to the area, there being 47.5% of the farmers in the State owning their farms while there are 39.7% of the farmers in the area being full owners.

There is a higher percentage of tenants in the work area than in the State. There is also a higher percentage of colored farm operators in the area as compared to the State.

As to livestock it is noticed that the number of livestock per farm in the area is lower than on the average farm in the State as a whole.

The number of acres of corn per farm is about the same while the yield per acre is slightly lower in the area.

There is almost 6 acres of cotton per farm in the area, yielding about one-half bale per acre.

The acreage in the small grains such as wheat, oats, rye and barley is small.

These data show that the farm products used by the family are slightly more for the area than for the State.

As to the types of farming in the area it is noted that 58.5% of the farms are classified as cotton farms, 19.0% as general farms and 10.3% as self-sufficing farms. The other types are relatively unimportant.

CHAPTER II

CAUSES AND DEGREE OF EROSION AND SOIL DEPLETION IN THE WORK AREA

Soil Depleting Practices

Tillage Practices. - Tillage practices which are favorable to erosion may be said to be one of the outstanding reasons of the severe soil losses in this area. Corn, cotton and sweet potatoes are the most important row crops. In many cases farmers do not plant these row crops on the contour but up and down the slope or at an angle with the slope. If the field is large and sloping there is an attempt to run the rows more or less on the contour. In many instances if the field drops off into a more steep slope usually the rows are run on to the field boundary rather than stopping and running short rows on the contour.

Many times when land is turned the farmer will finish up by leaving his last furrow running up and down the slope. This furrow acts as a ditch and begins to collect water. Often this ditch is the beginning of a gully. It is also noticed that in many cases when land is harrowed the farmer harrows up and down the slope. The harrow teeth make tiny furrows down the slope. When the rains come these tiny furrows catch water and begin to wash. They get bigger and soon gullies are formed.

Removal of Cover. - As the natural soil-forming agencies progressed throughout the ages Nature always protected her handiwork with some type of vegetative blanket. In this area, however, many farmers have disregarded this important principle.

From information already given in this report it was noted that there is an average of about 11 acres of corn and 6 acres of cotton per farm in this area. In a majority of cases this total of about 17 acres per farm is left bare in the winter. Usually the corn and cotton are harvested and the stalks remain standing in the field and the ground is not plowed or worked until the following spring. During the winter months there is usually a heavy rainfall. The ground becomes saturated with moisture and as there is little cover to protect the soil surface from the beating effects of the rain drops and to offer resistance in slowing down the velocity of the runoff or aid in binding the soil together by root growth there is a high percentage of runoff and the velocity of the runoff results in severe soil losses.

It is also known that when land is left bare there is nothing to use the food elements which are in the soil. As the water percolates downward through the soil certain water soluble plant-food elements are carried with it. These elements are lost because they are carried downward beyond reach of the plant roots. When land is left bare and when there is a heavy rainfall the losses of nitrogen, calcuim and magnesium, especially, may be severe.

In the past a large percentage of the upland in this area was covered with forests. Farmers first cleared the more level areas and used this land for cultivation. As the area became more populated the farms became smaller and more of the hill land was cleared and cultivated. At the present time most of the hill lands have been cleared and are under cultivation. Naturally this land produced well for a while but erosion was severe and in many cases as this land became less productive when it began to erode severely it was put into pasture. However, many farmers in this area are still cultivating this hill land rather heavily even though it is continuing to erode and decrease in fertility. Even on the pastured hill land there is severe sheet erosion and also many gullies due to the fact that the land is too poor to produce a good heavy protective cover and too often the pastures are overgrazed.

Extent of Erosion and Soil Depletion in the Work Area. - There has never been a detailed survey made as to the per cent of erosion in this area. However, studies by the writer of Henry, Henderson, and Madison Counties as well as rather close personal observations made of the area under discussion establish the fact that this area is very similar to conditions found in the Counties mentioned above with figures about the same as those for the State as a whole.

The Soil Conservation Service has made a survey of the State and the results are tabulated as follows: (1)

Area with little or no erosion 13.7%

Area affected by sheet erosion
One-fourth to three-fourths top soil lost 22.9%
Over three-fourths of top soil and some sub-soil lost 40.9%

Area affected by gullies
Occasional gullies 11.5%
Severe and destructive gullies 11.0%

Decrease in Fertility. - There is no definite way to determine the decrease in soil fertility because of the many factors involved. However, the writer has talked with several farmers over the area concerning this point and has observed this factor for several years and all information gained point to the fact that the yields on the average soil, under average conditions and common practices as to cultivation, crop rotation and fertilization, have decreased approximately one-fourth in the last twenty years. This large a decrease, however, is on land which has been heavily cropped and where commercial fertilizers, stable manure or green manures have been used to a minimum.

CHAPTER III

SOIL CONSERVATION PRACTICES ORIGINALLY USED BY FARMERS IN THE WORK AREA

Means of Control

Dams. - Prior to the influence of various "New Deal" Agencies which came to life beginning in 1932 there was practically no effort on the part of farmers in this area to construct dams in gullies, in a systematic manner at least, in order to aid in healing gullies and prevent soil losses due to erosion. Some farmers did throw trash into their gullies occasionally or even cut cedars or other trees and put into gullies in an attempt to stop erosion but these farmers were in the minority. The systematic construction of brush, log, wire, earth or concrete dams was practically unheard of.

Terraces. - A very few farmers have had terraces constructed on their farms for several years. Some of these terraces have shown very good results while others that were poorly laid out and constructed have proved a failure. Several farmers have attempted from time to time to lay out rather crude terrace systems merely by plowing out a few furrows, more or less on the contour, without the aid of an instrument to determine the correct line. There were only a very few terrace systems which were systematically planned out and properly constructed.

Contour Furrows. - The use of contour furrows as a means of preventing rapid runoff of surface water and thus aid in the prevention of erosion and the conservation of moisture has been negligible in this area.

Strip Cropping. - In a very few instances farmers have practiced strip cropping, after a fashion, at least. There has been practically no instance of farmers in this area that carried out a program of strip cropping very extensively or systematically but cases have been noted where farmers were using a strip of grass cover between row crops. In these few cases usually there were only one or two strips of cover and this strip was associated with a rather crude terrace system.

Contour Cultivation. - It may be said that a larger percentage of farmers in this area have practiced contour cultivation as an erosion control measure than any other one practice. Perhaps this is because the results were more easily seen than in some of the other practices. Practically all the farmers have practiced contour cultivation but many have done so only as long as it was more convenient to do so. A few farmers have practiced contour cultivation rigidly. In most cases farmers have run their rows along with, or nearly with, the slope as long as he could get his rows in long, but if his slope dropped off steeper or in a different direction he would run his rows on straight to the field boundary rather than stopping and filling in with short rows. It has been noticed that usually the farmer would make some attempt to

follow the contour but if he could get longer and straighter rows by running at an angle to the slope he would do so rather than curve his rows with the hill or slope.

Fertilization. - Some type of fertilization has, as would be expected, been practiced by all the farmers in this area. However, relatively few farmers have attempted to work out any kind of fertilization program to meet the needs of the farm as a whole.

In the last few years there has been quite an increase in the use of commercial fertilizers. Usually the farmers made no attempt to use different types of fertilizers for different crops or soils, nor did they consider the needs of the soil as to the amounts to use. Commercial fertilizers have been used by a fairly high per cent of farmers on cotton, potatoes, and truck crops. Especially has this been true on the hill lands where the fertility is low. There has been very little use of lime and phosphate. Manure has been poorly taken care of and poorly utilized in many cases. Pasture lands have received very little fertilizer treatment of any sort. Turning under of green manure crops has not been practiced very much in this area.

It has been the usual practice of farmers to cultivate their land without the use of fertilizers as long as even a fair yield was returned and when the land became low in fertility fertilizers were more often used, especially on the cash crops.

Forests. - There has been a steady decrease in forest lands in this area. There has been a relatively good market for timber and farmers have been steadily cutting and selling their timber. As the land has become lower in productivity the farmers have continued to clear new ground and cultivate this and in many cases let the old worn out land lay idle or grow up in bushes. There has been practically no attempt made to reforest denuded or idle areas.

CHAPTER IV

THE SOIL CONSERVATION SERVICE - ITS ORGANIZATION AND AIM

The Soil Conservation Service is a bureau of the United States Department of Agriculture. Its job is to discover methods of conserving soil and moisture and to apply them to the agricultural lands of the United States. The present bureau was originally the Soil Erosion Service which operated under the Department of the Interior. In March, 1935 the Soil Erosion Service was transferred from the Department of the Interior to the Department of Agriculture. Following this transfer, the Secretary of Agriculture ordered that all soil-erosion control activities already existing within his Department be combined under the Service. This meant that the Soil Erosion Service was expanded to include the Erosion Experiment Stations, Erosion Nurseries, and several hundred Civilian Conservation Corps Camps which had been doing soil erosion work.

On April 27, 1935, the President signed an Act of Congress declaring it to be "----the policy of Congress to provide permanently for the control and prevention of soil erosion ----". (5) This Act authorized the Secretary of Agriculture to establish an agency to be known as the Soil Conservation Service to carry out this policy. Accordingly, the Secretary of Agriculture changed the title "Soil Erosion Service" to "Soil Conservation Service."

This Service propogates the use of Soil Conservation practices in agriculture through several fields of activity, involving (1) the demonstration or practical and effective measures of soil conservation by (2) actual work upon the land in cooperation with land owners, and (3) the consistent development and improvement of such measures through research and investigation. (6)

The nucleus of the Service's program is a series of watershed demonstration areas over the nation within which the service applies a plan of soil and water conservation. Farmers within areas selected for these demonstration projects are invited to cooperate in carrying out completed plans.

The Service also directs the erosion control activity of approximately 500 Civilian Conservation Corps Camps assigned to such work over the country.

It is with the activities of one of these camps that the major portion of the remaining part of this report is based.

CHAPTER V

SCOPE OF SOIL CONSERVATION ACTIVITIES IN THE CAMP TENNESSEE S. C. S. #4 WORK AREA

In order to get a picture of the development of soil conservation work in this area a brief history of the soil conservation work carried out in the earlier days of the operation of this camp is included as follows:

The Civilian Conservation Corps was authorized by an Act of Congress April 5, 1933, as a national movement to build up the youth of the nation and to conserve and improve the natural resources. The supervision of each camp is under the direction of the personnel of the Using Service, which at present in this camp is the Soil Conservation Service, and the Reserve Officers of the U. S. Army. The Using Service approves, plans, and supervises all work projects in the selected work area. The Army is in charge of food, discipline, recreation, and education of the enrollees.

Camp Gordon Browning, Carroll PE - 59 was established at McKenzie, Tennessee, June 23, 1933 under the direction of the Tennessee Forest Service cooperating with the U. S. Forest Service. During the first three years of the camp's existence the activities dealt primarily with gully control work through the construction of brush, long and wire dams, and the reforestation of gullied and denuded areas, for the purpose of preventing further erosion and reclaiming gullied areas.

On December 27, 1935 the supervision of Camp PE - 59 was transferred to the Soil Conservation Service of the United States Department of Agriculture, and it is with this organization and the work sponsored by this Service that we are most interested.

This Service sponsors an enlarged and more balanced land use program than was attempted before. Here the entire farm is considered and a constructive, balanced program to fit the needs of the individual farm is worked out.

Not only is soil erosion work considered but the Service works with the farmer in setting up a system of crop rotation, fertilization, and soil conservation adapted to the individual farm. The Service Personnel helps the farmers in the work area work out his farm management problems as well.

It should be understood here that the big aim of the Service is not to actually do the work for all the farmers but to demonstrate the various practices of erosion control and farm management on various farms in the area and to get the farmers to adopt these practices to suit their needs. The various practices are worked out on a practical basis and are demonstrated from a practical, workable standpoint, with the idea of working with the farmer and getting him to learn now to do this work for himself.

The personnel of the Using Service consists of a Camp Superintendent to supervise and direct the work in the camp

area; Agronomist to work out 5-year crop rotations with the farmer, write contracts and give advice on agricultural problems; Engineer to lay out work for field crews, survey terraces, and assist in improving the farm lay out; Forester to carry on gully control work, timber stand improvement and supervise planting; four Foremen to supervise work crews, assisted by leaders and assistant leaders selected from enrollees; Auto Mechanic to care for trucks and motor equipment.

During the two year period beginning on December 27, 1935, when the camp was transferred to the Soil Conservation Service and up to December 20, 1937 the camp had 61 farms under contract in Carroll, Henry and Weakley Counties covering about 12,571 acres, and 200 other farms were on the application list covering about 40,000 acres. Work completed to November 30, 1937 on farms under contract in this area is as follows: 279 miles of terraces protecting 4,650 acres; 512 concrete dams built in gullies and outlets for erosion control purposes; 68,212 square yards of vegetation in outlets; 12,011 square yards of Bermuda sod and honey suckle plants set in gullies; tree plantings - black locust 119,440, white ash 15,910, yellow poplar 4,650, northern red oak 20,700, loblolly pine 13,000, short leaf pine 31,600, black walnut 25,650, pecan 770, white oak 4,300, chestnut oak 3,690, and long leaf pine 325; seed collections of all kinds of trees in the area for planting, 24,650 pounds; and fence constructed, 6,048 rods. (7) All this work has been done to stop erosion, improve agricultural land, and to demonstrate good farming practices.

CHAPTER VI

DESCRIPTION OF SOIL CONSERVATION PRACTICES USED AND DEMONSTRATED BY THE S. C. S. - 4 CAMP

In the following discussion it is desired to describe briefly the various soil conserving practices that the Service has demonstrated and is still demonstrating in this area, and to attempt to show the principles on which these practices are based. It should be understood here that these practices have not all been developed by this Service, but they have been tested and experimented with over the country under different conditions by the various Experiment Stations as well as farmers and workers in the various governmental agencies. The Service has helped to a large measure to develop many of these measures and to adapt the various practices to meet local conditions. The trained personnel in each camp has rendered an important service in studying local conditions and adapting the practices to meet the needs of the individual area.

Farm Layout

The Soil Conservation Service maintains that the problem of farm layout is closely associated with a program of conservation and in its work with farmers in this area the Service has been a big influence in bringing about a better planned farm layout on a number of farms in this area.

It has not been the objective of the Service to attempt to completely "over-haul" farms. There has been an attempt, however, to demonstrate in a practical way a few factors concerned with the physical layout of the farm that should save labor, make the operation of the farm more efficient, and make the farmstead more attractive.

In order to facilitate a crop-rotation system it is desirable that the farm be divided into fields of as near equal size as possible. The system of farming, topography, type of soil, wooded areas, roads, highways, rivers and other factors must be considered here. It is desired to have as nearly as possible the same soil type in each field. This makes it possible to have a field more uniformally adapted to any one crop. The number of fields will depend largely on the number of crops in the rotation. It is desired to have the fields as nearly equal in size and as large as possible. Large fields may be cultivated with less labor and there is less wastage due to corner and fence rows. It is also a commonly known fact that less fence is required to fence a few large fields than a larger number of smaller fields enclosing the same area.

Permanent pastures should be arranged, in so far as is practical, so that livestock will have access to the barn and to water at all times. If the pasture is so located so that the livestock must be driven to and from the pasture to the barn much time and labor will be required.

Sloping fields should be arranged so that contour cultivation can be practiced with a minimum of short rows. Short rows require some extra time and trouble but one should never sacrifice contour cultivation since the harmful effects of not cultivating with the slope have already been shown.

The Service does not urge that these changes be made at once but rather that they should be included in one's longtime improvement program.

Crop Rotation

Crop-rotation is a systematic arrangement for growing various crops successfully on the same soil. The Soil Conservation Service has included this phase of farm management in its program because of several reasons which will be briefly discussed. The experiments and years of observations carried out by the various experiment stations, the Soil Conservation Service and farmers substantuate the recommendations as to the practice of crop-rotation.

The general object is to utilize the plant-food in the soil most economically and, at the same time, maintain the soil in such condition, physical, chemical, and biological, as will promote the growth of maximum crops.

The beneficial effects in the way of increased crop production were observed long before the reasons for the effects were understood. Probably some of the effects are not clearly

understood yet. Among the principle things a well planned system of crop-rotation may be expected to do are: (1) change location of feeding-range of plants; (2) changes demand for individual plant-food constituents; (3) maintains supply of organic matter in the soil; (4) keeps soil in good physical condition; (5) keeps soil advantageously occupied in crops most of the time; (6) reduces injury caused by toxic substances in soils; (7) aids in controlling insects, weeds, and diseases; and (8) systematizes farming.

As has been mentioned many experiments have been run to determine the effects of crop rotation on crop yields. In order to give the reader some idea as to the value of rotations any why the Service emphasizes the use of crop rotation the following results obtained from the oldest rotation experiment in America are included. These experiments were run at the University of Illinois. (8) Table II shows the results obtained.

The yield for the ten-year period, 1906-1915, was 36.7 per cent greater when clover, corn and oats were grown than when no rotation was practiced.

Experience has taught that a well planned rotation provides for alternation of crops whose root systems occupy different portions of the soil. Because of this fact the available plant-food in any one layer is less quickly reduced since the plants grown do not take all their food from one

TABLE II. EFFECT OF CROP ROTATION ON YIELDS

Year the Experiment was begun	Cropping System	Yield after 36 years, 10 year average, 1906-1915			Per cent grater value per acre over no rotation
		Clover Tons	Corn Bus.	Oats Bus.	
	Corn continously	---	28.8	---	---
1879	Corn and oats in rotation	---	37.5 (1)	38.0 (1)	18.0
	Clover, corn and oats rotation	1.69	57.6 (2)	33.4 (3)	36.7

(1) Five-year average.
(2) Three-year average.
(3) Four-year average.

level, therefore it is logical to think that applications of fertilizer would be called for in smaller amounts or less frequently.

There is a variation in the demand for special forms of plant-food in a system of crop-rotation since some crops require more of one food, such as nitrogen, while another crop might require more potassium. It is easy to see then, that the continuous growing of one crop which consumes large amounts of potassium would sooner or later tend to reduce this plant-food in relation to phosphorus and nitrogen. If such a crop were followed by a crop that required less potassium but more nitrogen and phosphorus than the preceding crop then the plant-food would remain more balanced.

It was mentioned that a judiciously planned system of

crop-rotation would supply an economical supply of nitrogen. When legumes are a part of the rotation, and this point is stressed very much by the Service in this area since there is a decided shortage of nitrogen, atmospheric nitrogen is utilized by the plants and when these plants are turned under a very economical supply of nitrogen is supplied to the soil. Since nitrogen is one of the most expensive of the essential plant-foods this is a very good point in favor of crop-rotation including legumes in the rotation.

The maintenance of organic matter in the soil is very essential to soil fertility and conservation. When clean cultivated crops are continuously grown, as in the case on many farms in this area, the organic matter of the soil gradually becomes less because there is not much crop residue to turn under and usually the organic matter that undergoes complete decomposition is greater than that added. It is generally known that insufficient organic matter unfavorably affects the physical, chemical and biological conditions of the soil, with consequent reduction of crop yields. The Service recommends the use of green-crop manures as a means of providing a sufficient supply of organic matter.

Perhaps not so much thought of, nevertheless important result of crop-rotation is the improved physical condition of the soil. Grass crops tend to make a soil compact while cultivated crops tend to keep the soil in an open condition. Some soils, such as the heavier clays, need more crops that

tend to lighten the soil while the more sandy soils need crops that compact. The character of the soil, therefore, will help to determine the rotation to be used.

Crop-rotation makes it possible to keep the land occupied with a crop most of the time. This is an advantage in preventing the loss of soil by erosion and the loss of plant-food by leaching. Due to the nature of the land in this area both of these problems are very serious. The Service believes that a well planned system of crop-rotation will prove very successful in preventing these losses.

It has been noticed that in some cases soils on which crops are grown may contain substances toxic to plants, products of decomposition of soil organic matter. It seems that a change of crops in some way modifies conditions so that these toxins do not injure the succeeding crop when of a different kind.

Crop-rotation has proved very beneficial in the control of crop injuries due to insects, diseases, and weeds. Each crop seems to be associated with certain weeds that grow with it, therefore the continuous growing of the same crop favors the increase of the weeds characteristic of that crop while changing crops would tend to discourage the growth of these weeds. Similarly, rotation frequently is a great aid to farmers in preventing or lessening destruction caused by insects and plant diseases. Insects and diseases that infect one crop often cannot flourish when a crop of another kind is grown, thus this problem of controlling certain diseases and

insects is simplified.

Another point that might be pointed out is that crop-rotation tends to systematize farming. When once a system of crop-rotation is established, the management of a farm is much simplified.

On every farm cooperating with the Service in this area one of the chief jobs of the camp Agronomist is to make a study of that individual farm and work out with the farmer a crop-rotation system to fit the needs of the farm. This rotation is based on the general principles of providing cash crops, leguminous crops, feed for the livestock, and food for the family.

There are, of course, certain conditions that affect the rotation system such as climate, type and nature of soil, kinds of farming on each individual farm, economic factors, and condition of soil in relation to weeds, injurious insects and plant diseases.

As has been mentioned the Agronomist, working with the farmer, must consider the factors listed above in working out a rotation system but some of the general rules that should be kept in mind may be listed as follows: (1) Shallow-rooted crops and deep rooted crops should be alternated; (2) Crops which furnish organic matter should be alternated with those which favor its rapid decomposition; (3) There should be a legume included to increase the plant-food supplied and; (4) Crops in rotation should vary as much as possible as to

the amounts of plant-food required, character of root growth, and the time of year during which they cover the soil.

The Service has emphasized a more diversified farming program in this area and diversification is very closely connected with crop-rotation. A rotation which includes pasture and forage crops calls for more livestock and more livestock tend to make toward a more balanced farming program.

Contour Cultivation

In setting up an erosion-control program for the average farm, correct tillage is important. Even though the practice of contour farming, or the practice of plowing, planting, and cultivating around the slope rather than up and down the slope, is simple, inexpensive, and effective, many of the farmers in the area do not follow the practice, or at least do not attempt to follow it consistently.

The Service in this area has done much in the way of demonstrating to the farmers the value of contour cultivation and getting the farmers to see the need of following this practice on all cultivated land where the practice can successfully be adopted.

Considerable scientific experimental work has been done by various agencies including the Soil Conservation Service to determine the value of contour farming in preventing excessive soil and water loss. It is because of the very favorably re-

sults obtained from various experiments which have been completed along these lines that the Service is promoting the use of this practice to the maximum.

Due to the fact that the Soil Conservation Service has not conducted any experiment in the area under discussion which gives data showing results of contour cultivation the results of an experiment conducted at the Alabama Experiment Station will be briefly discussed so as to give one an idea what to expect from the use of this practice.

The soil, rainfall, crop, and other conditions in Alabama when this experiment was run are quite similar to those in the area and one might, therefore, expect similar results.

The test was made on plots containing cotton planted on the contour and cotton planted on the slope. Different slopes were used. The cotton was planted in 36-inch rows in both cases.

From Table III (9) it is noted that the seasonal losses from plots with contour-rows ranged from 4,178 pounds of soil per acre on the 5 per cent slope to 67,338 pounds on the 20 per cent slope . The losses from plots with slope-planted rows varied from 11,412 pounds of soil per acre on the 5 per cent slope to 121,046 pounds on the 20 per cent slope. The rainfall during the period was 13 inches; about 25 inches of the total fell as erosive rains.

When the rows are run around the slope each row acts as

TABLE III. SEASONAL SOIL LOSSES FROM COTTON PLANTED ON THE CONTOUR AND WITH THE SLOPE

Direction of Rows	Slope of land in per cent			
	5	10	15	20
	Soil losses in pounds per acre			
With Slope	11,412	58,580	86,160	121,046
On Contour	4,178	29,696	47,212	67,338

a minature terrace and tends to hold its part of the water thus giving the soil a chance to soak up more of the water. When the rows are run up and down the slope water concentrates in the middle of the rows and as it attains a higher velocity because there are no abstructions it rushes down the middles and the result is severe erosion.

Strip Cropping

Experience has taught us all that close growing vegetation is the most effective thing known for preventing erosion. If we could keep our lands sodded to grass we would have no erosion problem, but obviously we cannot do that, for we must cultivate part of our soil.

In the past many people have relied almost solely on terraces to control erosion. However, it has been found that terraces alone do not always do a thorough job, since the area between terraces is not protected from sheet erosion. Many areas cannot be successfully terraced because no suitable outlets can be established and many areas that are too small and irregular shaped to be easily terraced present a problem also.

Something has been needed to fill these needs and through the work of various individual farmers, Experiment Stations, and the Soil Conservation Service it is believed that the solution has been found in the practice of strip cropping, which operates on the principles of grass sod.

Strip crops may be defined as level or horizontal bands of thick growing plants spaced at intervals on cultivated hillsides. Perennial plants which are thick growing make the best strips for the reason that they give protection to the soil 12 months in the year.

A well established strip crop will spread out water which falls on it and so reduce its velocity that it will rob it of practically all the soil it is carrying. If the soil was permitted to reach the terrace channel, much of it would be carried off in the discharge waters. On properly planned fields the slope interval is so short that the water does not have an opportunity to pick up much more soil after passing a strip before it encounters another strip or a terrace or both. Thus the strips of close growing vegetation merely acts as a hindrance which tends to slow up the velocity of the water and also acts to sieve out the soil particles.

Although there has been considerable study concerning strip cropping during recent years not much experimental data are available concerning this practice. Some work has been done at the Alabama Experiment Station (10) and as conditions there

are quite similar to conditions in the area it would seem reasonable to expect at least similar results in the area. A brief discussion of the work done at this Station will be discussed.

During the summer of 1932 the Station grew cotton on low contour beds on one of two plots on slopes ranging from 5 per cent to 20 per cent. The comparison plots were planted in alternate 12.5-foot, contour strips of cotton and soybeans. Rainfall during the growing season totaled 22.5 inches.

Table IV gives the results of this work. It is noted that on a 5 per cent slope where cotton alone was grown there was a loss of 9.455 pounds of soil per acre while on the same slope where there was a strip of soybeans, 7,614 pounds of soil were lost. On the 10 per cent slope on cotton alone 16,963 pounds of soil per acre were lost, while on this same slope with the soybean strip only 9,733 pounds of soil were lost. On the 15 per cent slope having cotton alone there was a soil loss of 62,121 pounds per acre compared with only 15,019 pounds per acre on the same slope having a strip of soybeans. Finally on the 20 per cent slope 63,298 pounds were lost on the plot containing cotton alone while 18,412 pounds were lost where there was a soybean strip on the same slope. These data are summarized in the following table:

TABLE IV. SEASONAL SOIL LOSSES FROM COTTON PLOTS AND COTTON STRIPPED WITH SOYBEANS*

Period	Rainfall in Inches	Cropping System	Slope of Land in Per Cent			
			5	10	15	20
			Soil Losses in Pounds per acre			
Entire Growing Season	22.47	Cotton only	9.455	16.963	62.121	63.298
		Cotton and Soybean Strip	7.614	9.733	15.019	18.412

* 50-foot slope width of cotton alone; alternate with 12.5-foot strip of soybeans and cotton; soybeans in 18-inche contour rows planted flat; cotton in 3-foot rows on low contour beds.

It would be expected that where the strips consisted of a solid cover of grass or small grains the soil loss would be less than on the soybean strip in the results shown above as the soybeans were in 18-inch rows.

Strip cropping alone is not recommended by the Service on badly gullied fields or on fields of over approximately 4 per cent slope. On fields of greater slope, a combination of terracing and strip cropping is recommended as being the most efficient means of erosion control.

The spacing of the strips is governed by the slope of the land, character of soil, and type of farming. The steeper the slope and the more easily the soils erodes, the closer the strips should be spaced.

Some of the advantages of strip cropping may be listed as: (1) Costs but little and can be put into immediate use. (2) There is no labor necessary other than that required for

the crops being grown. (3) There are no obstructions to interfere with the use of any type of farm machinery. (4) There is no appreciable upkeep required. (5) Strip cropping does not materially interfere with any cropping system determined as best for a farm.

The Service has demonstrated the use of strip crops on several farms in this area and in practically all cases good results have been obtained and the farmers seem well pleased with the results obtained. The Service has studied carefully the needs of strip cropping and the results of the various demonstrations in this area with the intention of working out a system best adapted to the needs of this area.

Cover Crops

The use of Cover Crops has been stressed to the maximum by the Soil Conservation Service because of the important place cover crops hold in a balanced farming program. Much work has been done in recent years by experiment stations and farmers over the country to determine the benefits of cover crops and it is largely because of the very favorable results obtained by these workers that the Service urges the use of cover crops more extensively in this area. There is a large acreage of clean cultivated row crops, especially cotton and corn, grown in this area and losses of soil by erosion and plant food by leaching on this land presents a serious problem.

Cover crops aid in the prevention of erosion by acting as a physical barrier. It has long been observed that there is

considerably less runoff of surface water on land where there is some sort of cover since the velocity of the water is greatly reduced by coming into contact with the plants and more of the water soaks into the ground. Even when the soil becomes saturated with water the reduced velocity of the runoff results in less soil being carried away. The roots also tend to hold the soil in place by their binding action. Of course the nature of the cover will largely determine the soil loss on any given slope or type of soil.

The Service believes, however, that the most important use of winter cover crops is the practice of turning them under for soil improvement. The beneficial effects of turning under the cover crops as green manures will be briefly discussed.

Organic Matter. - The most extensive action of any green-crop manure is to furnish organic matter. Much of the land in this area has a decided shortage of organic matter due to heavy cultivation of row crops without turning under sufficient green manures. There is no other way in which such large amounts of organic matter can be added to the soil so cheaply under present conditions as turning under green manures. Organic matter aids the soil in a physical way by giving it a better texture, making it more mellow and easier to work and also adds to its moisture holding capacity. Other benefits will be mentioned.

Conservation of soluble plant-food. - When land is left bare, as during the winter following row crops as is the common

practice in this area, there is a danger of losing valuable plant-food elements by leaching. Especially is the loss of nitrate nitrogen likely to be severe. Nitrates are easily lost in drainage water and in some cases they are decomposed into free nitrogen. When the land is occupied by a crop the soluble plant food is largely taken into the plants and becomes a part of the crop growth. Other plant foods are collected and concentrated in the plant where they are stored for future crop use when the plant is turned under, decomposes, and becomes a part of the soil. Lime, which is also badly needed by crops in this area is also lost by leaching and may be conserved by the judicious use of cover crops.

Addition of nitrogen. - The Service stresses the use of leguminous crops as winter cover crops as well as for forage crops since they have the ability to use atmospheric nitrogen in their growth and when turned under add to the amount of nitrogen in the soil. Since nitrogen is the most expensive of plant foods essential to plant growth this factor is very important.

Concentration of plant-food. - In the case of plants whose roots penetrate the subsoil, as in alfalfa and many of the clovers, nitrogen, phosphorus and potassium compounds are collected from all parts of the soil and when the crop decomposes in the upper layers of the soil, this food is made available for the following crops. The subsoil is also improved by the penetration of the plant roots for when the roots decay extensive

passageways are opened for the percolation of water and circulation of air.

Various factors such as soil types and conditions, weather conditions, cost of seed and opinions of individual farmers largely determine the kind of crop used as a winter cover in this area. However, since many farmers have had success with a combination of crimson clover and rye grass in this area the Service is stressing the use of these crops.

Crimson clover is adapted to a great variety of soils, makes a good turf for winter pasturing, is ready to turn under early in the spring and decays quickly. It does require, however, a good firm and moist seed bed.

Rye grass will germinate and grow almost anywhere and is very hardy. It also gives a good cover and may be pastured.

Fertilization

The Service has dealt with a fertilization program primarily for pasture lands in this area. This is due to the fact that pastures have been neglected by most of the farmers in this area while the use of manure and commercial fertilizers has been rather widespread, especially on the cash crops in the area, for the last few years. However, the Camp personnel has done much toward educating the farmers as to better ways of selecting and using commercial fertilizers. In the past most farmers merely bought their fertilizer and applied the same kind of fertilizer to all his crops and on all his types of land making no differentiation as to the needs of the soil.

The Camp personnel and especially the Agronomist has been a big influence in helping the farmers to realize that different crops need different fertilizers and that different types of soil need different fertilizers.

The Service has also worked toward getting farmers to more fully appreciate the need of taking better care of the manure produced on the farm and utilizing this manure to the fullest extent. Usually farmers have piled the manure in the barnyard during the winter as it was produced and as a result of it staying out in the weather much of its value was lost. The Service has urged farmers to keep the manure in the barn, store under sheds, or place on the soil periodically rather than leaving it exposed to the weather where much of its value would be lost.

Fertilizers, in addition to materially increasing the yields of pasture grass, have steadily improved the condition of the sod. Especially has it been noticed that fertilization is important in the elimination of weeds and inferior pasture plants and as an aid to the more desirable plants.

Clovers and other legumes are very valuable pasture plants since they contain a high protein content and protein is the most expensive of the essential food elements required by animals, and these plants must usually be given special treatment to insure their growth in this area. Clovers are quite sensitive to shortages of lime, available phosphoric acid, and potash, and these materials must be supplied in sufficient quan-

tities to meet their requirements. For pasture soils which are and have been reduced to a low state of fertility, as many in the area are and have been, the amount of fertilizer required to reestablish clovers in much larger then the quantity ordinarily used. The fact is that such thoroughly depleted soils are low in organic matter and have so great a "chemical hunger" for phosphoric acid, potash, and lime that they may tie up any small application of fertilizer in a form so unavailable that the grasses, especially the clovers, fail to get it. This "chemical hunger" of the soil must be satisfied before the crop will get sufficient plant food to produce good yields.

On each individual farm cooperating with the Service the Agronomist studies the particular needs of the farm concerning such factors as natural differences between soils, kinds of herbage, the need for additional grazing, and the stage of exhaustion of fertility which has been reached. All of these factors are important and must be taken into consideration before working out a fertilization program. Based on these factors the Agronomist works with the farmer in mapping out a fertilization program to fit his needs.

Phosphoric acid is usually the first plant food to become seriously deficient in this area but much of the pasture land also needs organic matter, nitrogen, lime, and potash. The Service stresses most the use of phosphate and lime and the growing of legumes in the pasture mixture to supply nitrogen.

As a rule the land in this area is fairly well supplied with potash.

To successfully produce clovers it is advisable to maintain a soil pH of approximately 6.5 and the amount of limestone necessary to accomplish this will, of course, depend upon the individual farm or even field. Usually on the average pasture in this area one ton of ground limestone every four or five years will give good results. The amount of phosphate needed will also depend upon the soil needs but will usually be somewhere between 200 to 400 pounds of superphosphate annually per acre.

The Tennessee and other state agricultural experiment stations have for many years noted the disappearance of limestone and phosphate from the land and have been studying the response of crops when the materials were applied, both alone and in combination.

In general it was found that when either of the two materials are applied alone, there is some crop response if the land is in need of either material, but the results obtained show that phosphate should never be used alone except on soils known to be high in lime, and limestone should never be used alone except on soils known to contain abundant phosphate.

The Tennessee Agricultural Experiment Station has conducted experiments to show the results of using lime and phosphate on soils low in these materials. Table V (15) shows the results obtained from the use of two tons of limestone applied once in

ten years to an acre of corn, oats and hay, and 300 pounds of 16 per cent phosphate used each year on the same crops and then of both the limestone and phosphate in the same amounts as above used together. It is noted here that there was a decided increase in each crop on the plots containing the limestone alone and still a greater yield on all the crops where the phosphate alone was used while when the limestone and phosphate were used together they were nearly three times as effective as when either material was used alone.

TABLE V. RESULTS OF LIMESTONE AND PHOSPHATE WHEN USED ALONE AND COMBINED ON CORN, OATS AND HAY IN TENNESSEE

	Average increase in yield of corn	Average increase in yield of oats	Average increase in yield of Hay
Limestone alone, 2 tons per acre, applied once in 10 years	10.9 bu.	9.1 bu.	660 lbs.
Phosphate alone, 300 lbs. per acre per year	11.7 bu.	14.2 bu.	980 lbs.
Both limestone and phosphate applied together	26.9 bu.	22.6 bu.	2100 lbs.

It has been found that these two materials, limestone and phosphate, work together in harmony, especially in the growth of legumes and grasses and that the increased yields of these crops exert their influence on through the other crops which follow in the rotation.

It has also been found that limestone and phosphate not only produce higher crop yields, and more especially the yields

of pasture crops such as the grasses and legumes, but that they granulate the soil and aid in the control of soil erosion. The problem of soil erosion on the pasture lands in this area is a serious one since a large percentage of the pasture land is on the less fertile slopes, and in many cases the sod produced is not sufficient to hold the soil from washing. However, as has been said, lime and phosphate used correctly will aid in producing a better sod thus greatly minimizing this problem of erosion.

Another phase of the program of fertilization stressed by the Soil Conservation Service is the retention of all humus, vegetation or litter such as leaves, grass, corn and cotton stalks and other forms of plant growth that will add organic matter as well as certain essential food elements to the soil. Many farmers in this area have followed the practice of burning this litter or collecting it and filling gullies. The Service has done much toward educating the farmers as to the value of this sort of material and as a result of this influence many farmers have been led to see the value of conserving all this material and making it serve to maintain soil fertility.

Terraces

In principle terracing is essentially a process of constructing a series of drainage channels across the slope of hillsides whose purpose is to collect the runoff water before it attains harmful velocity and to conduct this water

slowly to an erosion-proof outlet. The drainage channels, which intercept the runoff and prevent its rapid flow down the slope, are formed by throwing up low embankments known as terraces.

Based on this principle the Soil Conservation Service in this area sponsors a terrace program, designed to meet the needs of the area as follows: ((12)

In general all crop lands with an average slope of no less than 2% slope (2 feet fall every 100 feet) nor more than 10% slope should be terraced.

The spacing between the terraces is governed mainly by the need for preventing appreciable erosion between the terraces and will vary with the slope of the land, the soil and cultural conditions. For the sake of economy in cultivation, it is desirable to space the terraces as widely as the soil and slope will permit.

In planning a system of terraces the field is first looked over and all available outlets are considered. Those which can be protected from erosion with the least labor are usually selected. It is not advisable to use a public road ditch as an outlet for terraces as there is likely to be an erosion problem established.

The first terrace is started at the top of the slope just above the first signs of erosion. The terraces are staked out on a variable grade, that is, the first 1/3 distance from the outlet is given about .2 of a foot fall per 100 feet. The second 1/3 distance from the outlet is given .1 of a foot per 100 feet and the last 1/3 distance is given .05 of a

foot per 100 feet.

Terrace construction in this area is usually done by a county terrace association unit. This is usually cheaper and more efficient than any other method of building terraces; however, some farmers use a V-dray, Kelley plow or road grader and team. Usually the machine built terraces are more satisfactory in that a wider ridge can be built at less cost.

The type of terrace usually constructed in this area is the Mangum broad base terrace which varies in width with the slope of the land. On as much as a 5% slope the width of the ridge should be no less than 18 feet wide. The ridge should be as much as 18 inches high after settling, with a flat channel of approximately 4 feet wide and a back slope of approximately 8 feet. The flat channel is recommended because the V-type channel concentrates the flow and increases the velocity and this is likely to cause erosion regardless of the grade. Fills across low places should be made at the time the terraces are built.

The maintenance of terraces is a very important factor. If terraces are not plowed out occasionally they may tend to fill up in places and will soon be breaking. Livestock may make paths across them and cause breaking. In plowing out terraces it is recommended that the dead furrow come about 2 feet above the center of the flow line of the terrace. It has been found that by using this method the terrace ridge can be widened each year and the depth of the flow line maintained.

The importance of terracing in erosion control is shown in Table VI, compiled from results of nineteen tests conducted in five states by Erosion Experiment Stations of the U. S. Department of Agriculture. (13) In each case the type of soil, per cent of slope, and crops grown on the terraced and unterraced plots were similar.

TABLE VI. RESULTS OF TERRACING.

	Average Annual Loss	
	Tons of Soil Per Acre	Per cent Water
Terraced Land	3.19	11.2
Unterraced Land	16.90	31.0

The Service in this area does not furnish labor to build the terraces but plans the terrace system and takes care of disposing of the water by constructing outlets. Most of the terraces in this area have been built by a County Terracing Association. In some cases the farmer builds his own terraces but in all cases if the farm is under contract with the Service the terraces must meet the specifications set up by the Service.

It should be understood that terraces alone must not be considered as a "cure-all" in erosion control work. Terracing should be though of as a measure for conserving good land rather than for redeeming gullied and worn out areas. On the more gentle slopes, when used in connection with other erosion-control measures, proper terracing is very effective.

Outlets

It is essential that a definite plan be made and carefully executed for the control of erosion in terrace outlet channels. An unprotected outlet may result in the formation of a gully that will be hard to check. Erosion in an unprotected terrace outlet may cause an abrupt drop at the end of a terrace which in turn causes cutting of the terrace channel. Terrace water, therefore, should be confined in a definite channel until it has reached an area where it will cause no damage by eroding or flooding crop land. Outlets may be protected from erosion by vegetation, by permanent dams, or by a combination of the two methods.

The Service assumes the responsibility of laying out and constructing outlets on farms under contract in this area. The camp personnel also helps a number of other farmers who call on them in the laying out of an outlet system. The suggestions as made by the Service as to outlets are about as follows: (14)

The land use, general lay of the land, soil type, slope, and drainage area determines the location and number of outlets to be used in any system. If the drainage area is not more than 30 acres and the average slope of the outlet is not more than 5%, with good top soil a vegetative outlet, seeded or sodded, may be used if the soil is not sandy. On smaller drainage areas outlets may be sodded where there is an average slope of up to 8%.

In the event the outlet is an old abandoned road, gully, or sandy soil a permanent structural protection, usually concrete dams, are used. Where the outlet drops into large drainage channels or over steep banks, dams are usually used to overcome the vertical drop, but in cases where the top soil is deep, sod flumes are desirable.

Each seeded or sodded outlet is designed for a definite velocity. The kind and amount of vegetation used depends on the size and carrying capacity of the outlet. Structural outlets are also designed to meet certain carrying capacity requirements.

Sodded outlets have been found to be more satisfactory than seeded outlets as a rule in that control is established quicker and it is not necessary to divert the water for such long periods, however, seeded outlets are less expensive in that less labor is required. Structural protection is more expensive than vegetation and is used only in cases where no type of vegetation can be established, usually where there is a large watershed area or where there are gullies and steep slopes.

The Service suggests the following seed mixtures for seeded outlets in this area.

No. 1 - For rich draws for hay - Per Acre.

1. Red top - 10#
2. White clover - 3#
3. Rye grass - 20#
4. Red clover - 8#
5. Alsike clover - 8#

Sown between August 20 - September 10. Should apply 3 - 4 tons of ground limestone and 200 - 400 pounds of 16% phosphate per acre.

No. 2 - For draws less fertile.

1. Red top - 10#
2. White clover - 3#
3. Rye grass - 20#
4. Crimson clover - 12#
5. Alsike clover - 4#

The above amounts are for one acre. Should apply lime, a complete fertilizer and manure as needed.

No. 3 - For outlets on fairly poor soil.

1. Red top - 10#
2. Rye grass - 25#
3. Crimson clover - 5#

Should apply lime, phosphate, complete fertilizers and manure as needed.

The ideal outlet is a dense growth of undergrowth and timber on a moderate slope with a thick mulch of leaves and debris to spread out and partially absorb the water discharge from the terrace channels. Next to a woodland a permanent pasture of good tough heavy sod is most satisfactory.

It is in cases where neither a wooded area or a permanent pasture can be utilized that an outlet must be constructed and protected by either vegetation or check dams.

Contour Furrows

Due to the fact that many of the permanent pastures in this area have been seriously affected by sheet erosion resulting in fertility depletion and thus less yields and less returns to the farmer, the Service has studied this problem closely and

has demonstrated on various farms the practice of "contour furrowing" or "contour ridging" as the practice is called. This is simply the practice of plowing up a ridge or furrow with the contour of the hill for the purpose of slowing up the surface runoff, thereby resulting in more water soaking into the soil and less erosion.

Not much experimental data are available as to the definite results of this practice, however, there has been some work along this line carried out at the McNeil Experiment Station, McNeil, Mississippi. (15) Following is an account of the methods used and the results obtained:

"The rainfall for this region is rather heavy, amounting to about 63 inches per year. In spite of this heavy and well distributed rainfall hill pastures frequently become dry in late summer and fall. Much of the rain was lost in runoff and sheet erosion was severe.

In 1929, a small area of carpet grass pasture with 20% grade was selected and level contours run out with a terracing instrument. These lines were plowed out with a two-row tractor middle buster making a continuous series of closed end, level terraces, 40 inches apart. The area was seeded broadcast with lespedeza, and the carpet grass turf soon replaced itself. This method of terracing was effective in preventing all runoff for the season except for excessive rains which overflowed the terraces. The area was kept under observation and it was very noticeable during late summer that the growth of the pasture plants was more vigorous and of better color than on the adjacent area. It was also noticed that cattle preferred to graze on the terraced area.

The results were so promising that in 1931 sixty acres of very rough land with steep slopes were level terraced with a spacing of 12 feet. With a little repair work after the first hard rain all the rainfall for the season of 1931 was held without runoff with the exception of two excessive rains which overflowed the terraces.

Catch basins were put in on a 10 per cent slope of carpet grass sod to determine the amount of runoff with a 10 -

foot and 20 - foot spacing. Seven rains sufficient to produce runoff from these plots, averaging 1.41 inches each, gave a runoff of 24.9 per cent from the 20 - foot plot and 6.5 per cent from the 10 - foot plot. This indicates that the length of the spacing between the ridges is an important factor in the rate of absorption of rainfall."

Gully Control

The work sponsored by the Service in this area dealing with gully control may be considered as one of the major activities since gullying is extensive and farmers, as a whole, have not learned how to cope with this problem in a practical and systematic way.

Gullying is an advance stage of erosion starting as a rule, after a considerable amount of top soil has been removed by sheet erosion. Gullying may be started by alternate thawing and freezing followed by heavy rains, by water collecting in natural depressions lacking a good vegetative covering, in wheel tracks, in plow furrows, in livestock paths, in crop rows planted and cultivated with the slope, by a break in a terrace or by overflows from drainage channels.

The loss due to gullying is very severe since fertile soil is carried away making the eroded areas less productive. Soils washed from hillsides is deposited on bottom land, making it less productive. Gullies reduce the area of tillable land thus reducing the income and value of the land.

The methods to use in controlling gullies in any area depends largely upon the number, location, size and slope of the gullies; the area, topography, vegetative cover and drainage conditions of the land; type of soil, and upon whether the

gullies are to be filled and restored to crop use, partially filled and used as drainage channels, or merely protected against further enlargement.

As a rule the Service has followed the practice of establishing check dams as the first means of control of erosion in the gully channel. The temporary check dam is used in the smaller gullies, or gullies where less water is concentrated and where some form of vegetation will ultimately serve as the control measure. These temporary dams are usually constructed of brush and will last from 3 to 6 years ordinarily. The purpose of this type of dam is to reduce the velocity of the runoff water sufficiently to prevent further deepening and widening of the gullies. They also serve to catch soil, thus covering the bottom of the gully with a soil suitable for establishing vegetation. For more complete control some form of vegetation must be used in conjunction with dams. The Service has used grass and trees as well as vines such as kudzu and honeysuckle to establish a cover and help hold the soil. The temporary brush dams will usually last long enough for the vegetation to get a good start. The gullied areas must be protected from livestock for a period long enough for the vegetation to become well established.

The permanent check dams constructed by the Service are used in outlets and gullies which are used for outlets where rather large amounts of water is concentrated. These dams are strong and stable and are constructed of reinforced concrete. The size of each structure and the distance between each

structure will depend upon the amount of water concentrated in the outlet and the degree of fall in the outlet.

Reforestation

The importance of reforestation in a conservation program has long been recognized by the Soil Conservation Service. The Service has done and is still doing much toward demonstrating the use of a reforestation program.

The Service has based its recommendations as to the use of trees on years of observation and experimentation by workers in soil conservation over the entire country.

Erosion is rare in a forest. Water seldom runs off well-wooded areas, and when it does, soil is not often carried with it. Trees protect the soil from the beating of hard rains. Leaves and branches break the force of the falling water, and rain runs down the limbs and tree trunks to enter the ground without disturbing the soil. Rain-water is broken up into smaller droplets when it hits the leaves and litter, therefore hitting the soil with less force.

The litter and humus cover which is always present in properly managed wooded areas absorbs great quantities of water before any of the rainfall reaches the soil. Dry plant materials like well-decayed wood, leaves, and moss soak up rain-water like a sponge. In this way rain-water moves slowly to the soil beneath. As litter accumulates on the forest floor, it allows the soil underneath to absorb more and more water. Forest soils

well covered with plant litter rapidly absorb a rainfall of average intensity. Therefore it is easy to see why rainfall does not readily run off a good wooded area. Even during prolonged periods of rainfall when the ground and litter on the forest floor become saturated with water the litter and the trees themselves act as physical barriers which tend to slow up the velocity of the water as it drains off.

As has been mentioned before much has been done by various agencies to determine the benefits of forest in preventing soil and moisture losses. In order to give the reader some idea as to actural soil and water losses on areas treated in various ways the results of land use experiments run at the Statesville, North Caroline Experiment Station will be included here. (16)

The following data show the effect of land use on the average annual runoff and soil losses over a five year period, 1931-1935. The tests were run on Cecil sandy clay loam having a 10 per cent slope. The average annual rainfall during these years was 45 inches, which is about the same as the rainfall in the area covered by this report.

The first figure shows the runeff in per cent of rainfall when the plot was fallow, in continuous cotton, in rotation including cotton, corn, wheat and lespedeza, in grass, in woods where the cover was burned, and in virgin woods.

Figure 1 shows that when the land was fallow 29.6 per cent of the rainfall was lost in runoff. When the land was in con-

tinuous cotton, with the rows run on the contour, 10.2 per cent of the rainfall was lost in runoff. The plot having a four year rotation including cotton, corn, wheat and lespedeza lost 9.0 per cent of the total rainfall due to runoff. When the plot was in grass only 0.34 per cent of the rainfall was lost in runoff. The area that was in woods where the cover of leaves, branches and other litter was burned each year lost 3.6 per cent of the rainfall in runoff, while the area in virgin woods lost only 0.12 per cent of the total rainfall in runoff.

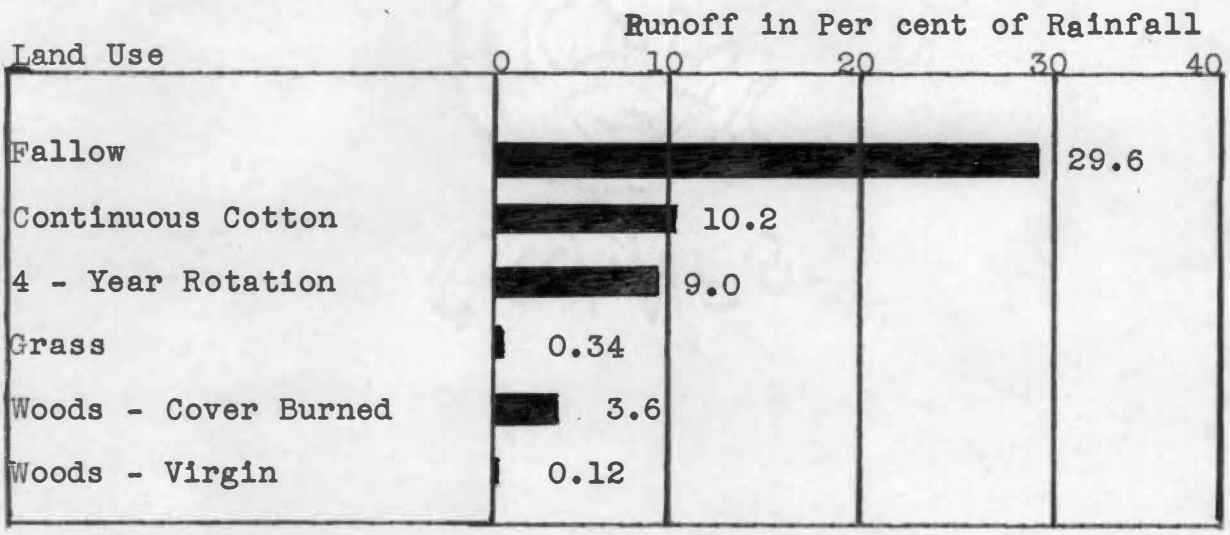


Figure 1. Effects of Land Use on the Average Annual Runoff of Rainfall (Statesville, North Carolina).

Figure 2 shows the effects of land use on soil losses per acre per year. The conditions in this experiment were the same as in the above test.

When the land was fallow there was a loss of 64.6 tons of soil per acre per year. At this rate it would take only 18 years to lose 7 inches of the topsoil. The plot having cotton

each year lost 22.6 tons per acre each year. The plot containing the four year rotation of cotton, corn, wheat and lespedeza lost 10.6 tons each year. The plot in grass lost 0.012 tons. The plot in woods where the cover was burned each year lost 0.36 tons per year while the plot in virgin woods lost only 0.0021 tons per year. It was calculated that it would take 548,000 years at this rate to remove 7 inches of the topsoil. By comparison it is easy to draw conclusions. It is significant to note the great difference between the 64.6 tons of soil lost per year when the land was fallow and 0.0021 tons per year when the land was in virgin woods. This information is shown grapically in Figure 2.

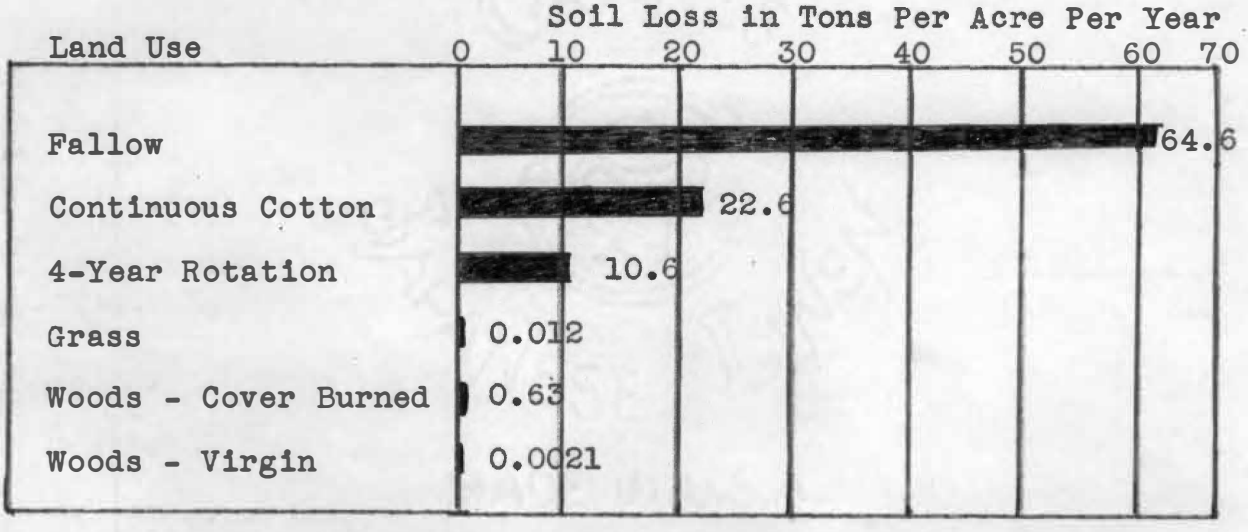


Figure 2. Effects of Land Use on the Average Soil Loss (Statesville, North Carolina).

All plants draw water from the soil and pass it into the air through their leaves, by the process known as transpiration. The roots of the trees penetrate more deeply into the soil and ground water than those of smaller plants, and the surface area

of the leaves is much greater than that of smaller plants. It is therefore reasonable to assume that forests draw more heavily upon ground-water supplies and through the process of transpiration a vast amount of water is taken up and given off into the air. The litter and humus also absorb large amounts of water and also aid in a physical way to slow down the water and even out the flow thus preventing fast and excessive runoff which, of course, aids in the prevention of floods.

The program of reforestation sponsored by the Service in this area consists of planting trees in gullies, usually supplemented by temporary check dams, the planting of denuded areas to more permanent trees and demonstrations of timber stand improvement work which deals with areas already in woods and has to do with the proper management of these areas.

Tree planting as related to gully control work consists of planting of trees which are adapted to growing under these conditions in gullies and on the banks, the primary object being to aid directly in erosion control. The trees grow and develop extensive root systems thus forming natural obstructions for the control of runoff. The trees are long-lived and can, therefore, be depended upon for extended service and for permanence as protective measures against erosion. However, it is not to be inferred that trees alone can be planted in gullies and be effective alone. Usually it is necessary to use temporary check dams to aid in controlling the water until the trees can get a start and become established.

One of the best and most widely used trees used by the Service in this area for gully control planting is the black locust. This tree grows rapidly and forms an extensive root system. It is a legume and aids in building up the soil. The Service recommends the planting of locust in the bottoms of gullies where there is not too much sand. They grow more successfully where the soil is not extremely thin. Where the soil is quite sandy loblolly pine and short leaf pine are used. Between the dams the trees are planted about 4 feet apart. The same spacing is used on the gully banks while about 20 feet back from the gully bank they are spaced about 6 feet apart. Black locust is very valuable on the farm as it is a fast growing tree and makes excellent fence posts.

The Service has also been a powerful influence in getting the farmers in this area to see the need for and the value of putting the denuded and rough eroded areas on the farm back into trees. Many acres of such land in the area have been reclaimed and put back into productivity by plantings of the more valuable species of trees. For these permanent plantings the Service uses trees adapted to this area including white ash, yellow poplar, northern red oak, pecan, white oak, chestnut oak, hickory and others. The Camp Forester advises as to what trees to plant on different soils and under different conditions. There are large areas of rough and denuded areas in this section of the State and the Service is doing much toward getting the farmers to realize the need of putting these areas in trees in order to prevent further erosion and at the same

time utilize this land so as to reap some returns in the way of fuel, posts and timber in a few years.

The Service has been planting many thousands of the various species of trees in this area each year. Many of the seedlings are grown in a nursery maintained by the Service and these seedlings are furnished and planted by the Service on the farm cooperating with the Service in this area. In addition to these seedlings thousands of pounds of seeds are gathered locally from the various hardwoods and are planted on the various farms over the area as needed.

Another very important phase of the forestry program sponsored by the Service in this area is timber stand improvement work. On the farms having woodlands which are cooperating with the Service an area, usually five acres, is selected to be used as a demonstration of proper woodland management. The Camp Forester plans and supervises the work to be done on this area. This work consists of removing dead and diseased trees, thinning if necessary, and the removal of trees of inferior type or species. This thinning and clearing out of dead and diseased timber tends to give the remaining and more valuable trees light and more growing space for development, insures that the favored trees have full access to the soil fertility, hastens growth and inproves the general health and looks of the woodland.

The Camp Forester makes a study of the woodland and develops a plan that the farmer can use in managing his woodland. He

determines the dominant species and the approximate rate of growth of each species and the approximate size of the trees in each species at maturity. This is done by boring into a number of trees with an increment borer and determining the rate of growth. If the tree is practically mature and growing very slowly it would be advisable to remove it and give room for a faster growing young tree.

A map of the woodland is made. The woods is then divided into sections or compartments to facilitate systematic cutting. It is planned that selective cutting be practiced in one area during a certain period of time followed by cutting in other areas during other periods. This is done so that the woods will be covered systematically and at the same time allow each compartment to produce as much timber as is being removed.

Following is a copy Woodland Management Plan worked up by the Forester in the Soil Conversation Service Camp in this area (17), which is included as an illustration.

This woodland is on one of the farms cooperating with the Service in this area.

"The following is a summary of the plan suggested for the management of this 88 - acre woodland. The purpose of the plan is to put the 88 - acre area to remain in woodland under sustained yield management. Sustained yeild is the yield or cut of timber from a forest which is managed in such a way as to permit the removal of an approximately equal volume of timber annually or periodically.

During 1937-1942 the sycamore-maple area of eight acres is to be cleared for crop land. It is estimated that the area will yield:

Sycamore	17	M. ft. B. M. (Doyle rule)
Red maple	34	
Yellow poplar	1	
Northern red oak	10	
White oak	5	
Total	57	M. ft. B. M. (Doyle rule)

Also 256 cords of wood from the tops and from trees below merchantable size.

It is suggested that before cutting this area the owner communicate with the box company in Milan, Tennessee where he will find a ready market for sycamore, red maple, and yellow poplar. The veneer bolts must be cut to their specifications to be accepted, and these change with the products manufactured at any time. Prices paid in 1937 for bolts delivered to the mill range from $10.00 to $18.00 M. ft. B. M. The red oak and white oak logs can be brought to the mill in McKenzie, Tennessee. This area will be cleared in winter.

The permanent forest area of 80 acres is divided into three acres to facilitate management. Area A is already segregated by a woods road and by fields. Areas B and C are to be divided by a woods road as shown on the attached map. This road will be necessary in getting out forest products. It is located as far as possible on the contour.

Beginning next winter (1939) the owner is to improve an average of eight acres of forest every year, using the five-acre demonstration plot established by the United States Soil Conservation Service in 1937 as a model.

The material so removed will furnish him with about 25 cords of wood to meet his winter needs.

During the 1947-1957 period the following products may be removed from area A (28 acres).

Northern red oak	30	M. ft. B. M. (Doyle rule)
White oak	5	
Post oak	1	
White hickory	30	cords.

From the tops of the trees, he will get approximately 130 cords of wood.

Red oak 16 inches in diameter breast high (4.5 feet from the ground) and above and other species 18 inches d.b.h. and above may be removed. Red and white oak logs cut

may be sold to the mill in McKenzie. White oak brings $10.00 to $30.00 M. ft. B. M. delivered at the mill, while red oak brings $10.00 to $20.00 M. ft. B. M. delivered. The Hickory is to be cut in 40-inch lengths and sold to the Handly Company at Huntingdon, Tennessee. Hickory is bought by the handle estimate and the grade of handle it will make. First grade brings $0.045; second $0.03; third $0.02 per handle. Average hickory runs 250 handles per cord or averages about $9.00 per cord.

During 1957-1967 Area B (27 acres) will yield the following products:

Northern red oak	70 M. ft. B. M. (Doyle rule)
White oak	7
Post oak	2
White hickory	45 cords.

From the tops of the trees, he will get approximately 345 cord of wood.

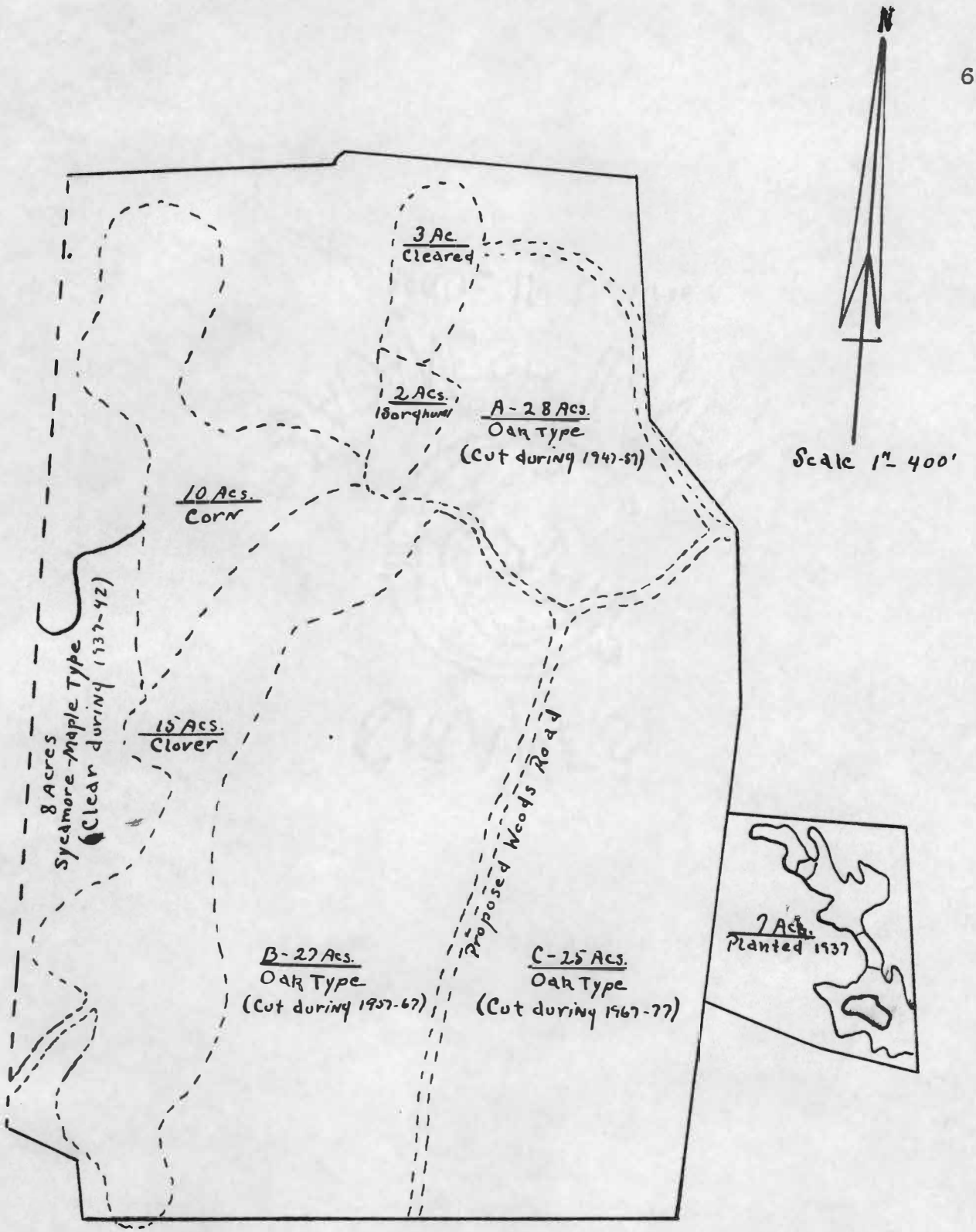
Red oak 14 inches D. B. H. and above and other species 16 inches D. B. H. and above may be cut.

It is estimated that the stand will be under sustained yield conditions by the end of the first cutting cycle in 1977. From then on, providing some unforseen calamity as fire, disease, etc. does not alter the growing stock left in the stand after the selective cutting as outlined above, the yield for each ten year period will approximate that of Area C in 1967-1977, for the respective areas.

By 1950 the seven-acre area planted by the Service will contain black locust of a size for fence post material. This should be removed with the idea of bettering the condition of the stand. It is to be kept in mind that the black locust was planted as a nurse crop to build up the soil until other more permanent forest trees could become established. Northern red oak, white oak, and walnuts were planted in mixture with the black locust. These trees together with the seedlings coming in from the adjacent oak-hickory type will constitute the future forest."

On each farm where there is quite a large area in woods the Camp Forester works out a plan similar to the above with the farmer and helps him with his woodland management problems.

The Forester recommends that the woodlands be protected from



Woodland Management Map

B.B. Sorbom #31

fire and livestock. The livestock tend to keep down reproduction by eating many of the young trees and aid erosion by making paths which tend to form gullies. Fire destroys both the young and old trees and removes much of the litter which is so important in enriching the soil and in erosion control.

CHAPTER VII

METHODS OF ATTACK USED BY THE SOIL CONSERVATION SERVICE

The various soil conserving practices sponsored and demonstrated by the Soil Conservation Service in the area under discussion have been rather briefly covered. It is hoped, however, that the reader has gained some idea as to the type of work carried on by this organization and why the different soil conserving practices are included. In the following discussion the writer desires to briefly discuss the methods of attack or planning the work demonstrated on the individual farm and some of the factors which determine the types of work that are carried on.

As soon as a farmer contacts the Service and makes known his desire to cooperate with the Service in working out a soil conservation program on his farm the Camp Agronomist, Engineer, and Forester visit the farm. They learn something about the type of farming practiced on the farm. The fertility of the soil, amount of erosion, and types of soil are noted. They are able by this preliminary survey to form some idea as to what can and should be done on the farm to make it more productive over a long period of years. The program worked out by the Service is thought of in terms of a long time program and not just for one or two years. In fact the cooperator agrees to follow the program set up for a period of five years and it is hoped that after this time he will follow in his planning along

similar lines.

If the farmer agrees to cooperate with the Service and to carry out the program worked out, the survey crew, composed of enrollees and supervised by the Service Personnel goes out on the farm and makes a detailed base map of the farm. The farm boundaries are run out. All fences, buildings, roads, creeks, ponds, badly eroded areas, and wooded areas are placed on the map. The fields and the present use of the land is designated. This base map serves as a base for all future farm planning. A soils map is then made by the Service soil expert. This map shows the degree of erosion and the per cent of slope on the various sections of the farm. Each soil type found on the farm is plotted as the Camp Agronomist uses this information in working out the land use program for the farm. Since the per cent of slope, the fertility, and the degree of erosion in each field is known the crop and length of rotation best suited to meet these conditions can be worked out. At the same time the Camp Engineer makes a study of the water disposal system that can most successfully meet the needs of the farm and makes a map showing the system to be used.

The farm is now attacked from three angles namely; the Agronomist, who works out a farming program; the Engineer, who works out a water disposal system and; the Camp Forester, who plans and supervises the plantings and the farm woodland program.

The Camp Agronomist works with the farmer in working out a balanced farming program. The farmer determines what live-

stock and the approximate number of each type he wishes to produce, what crops and approximately how many acres of each he desires to grow each year during the next five years. The ratio between livestock and crops is balanced as for as is possible considering the facilities on the farm to produce each. If the farmer has been growing large acreages of row crops and only a few or no livestock the Agronomist urges him to balance his program by reducing his cultivated crops, increasing his forage crops and pasture, and producing more livestock. He also works out a crop-rotation system for the farm. The soils map is used to determine the best crops or rotation of crops to use on the different fields on the farm. Since the per cent of slope and the degree of erosion in each field is known, the crop best suited to these conditions is used on each field. Plans for strip-cropping, the use of cover crops, and the length of the rotation are also partially determined by the fertility, erosiveness, and other conditions of each field.

Since the approximate number of each class of livestock to be produced in the future is anticipated the Agronomist determines the approximate amount of feed that will be needed to feed these animals. Then in working out the cropping system he includes sufficient forage crops and pastures in the rotation to provide this feed if this plan is practical for the individual farm. Ordinarily the Agronomist urges that all feeds for livestock with the exception of protein and mineral supplements be produced on the farm.

The needs for fertilization are approximately determined and plans to meet these needs are included in the conservation program. Also seed mixtures for pastures and cover crops are suggested.

At the same time the Agronomist is working on the farm management program with the farmer the Camp Engineer is working on engineering phases of the conservation program including terraces, water disposal, planning and construction of check dams in gullies and outlets, and laying out contour furrows. Of course not all farms will require the same types of work but whatever is needed as to the engineering phases is determined by the Camp Engineer. It should be remembered that the Service plans and lays out the terrace system and contour furrows but does not actually construct them. However, certain specifications are set up by the Service and these specifications must be met. The terrace outlets are constructed by the Service. Erosion control dams are also constructed by the Service.

Gully control activities as to the planting of trees, vines, and grasses are included in the duties of the Camp Forester. He also has charge of all forestry work such as timber stand improvement demonstrational areas, working out farm woodland management plans, and reforestation activities. In the S. C. S. - 4 Camp the Forester also supervises the construction of fences built by the Service.

The Forester makes a study of the farm to determine the

needs along the lines mentioned above and then works with the farmer in meeting these needs. The Service in the past has furnished supervision and materials to do all the above work mentioned with the exception of furnishing materials for the fences built by the Service.

Sample Cooperative Agreements

In order to show definitely the type of cooperative agreement for demonstrational and experimental work in soil and water conservation worked out by the Cooperator and the Soil Conservation Service three sample agreements representing what is considered three representative farms in this area are included. These cooperative agreements are exact replicas of agreements worked out on the three farms. All the major soil conserving practices sponsored by the Service are demonstrated on these three farms.

The agreements, as the included samples will show, cover the complete treatment of the farm. The Cooperator is given one of the copies and this serves as a guide for him to follow in operating his farm.

The symbol sheet shows the symbols used on the map to designate the degree of erosion, land use, per cent of slope, type of soil, and various other factors such as rock, fences and streams.

The land use map included in each agreement shows the physical layout of the farm. The homestead, field divisions,

and fences are designated. The number of acres in each field is shown. The terrace system, ponds, streams, roads, and similar items are shown. The soil map shows the soil divisions on the farm, and also the land use, degree of erosion, and type of soil. This map is used to a large extent by the Agronomist as a basis on which to work out a crop rotation system.

The work sheet, as will be noted in each agreement, gives a summary of the enterprises carried out on the farm. A brief history of the enterprises on the farm for a period of three years previous to the time the farm enters into the agreement with the Service are shown and the kind and size of enterprises for the next five years, the extent of the agreement, are shown. The anticipated number and kinds of livestock and the approximate amounts of feed necessary to carry these animals are designated. The changes in land use and cultural practices such as contour strip cropping or contour tilling are shown on this sheet.

The plan of conservation operations gives a rather detailed description of the land use of each field on the farm during the five year period covered by the agreement. The treatment of each field as to how it is being used at present and how it will be used in the future, what treatment as to fertilization each field will receive, and how the field will be managed in other ways are included. The part the Cooperator as well as the Government will play in the management of the land is clearly designated. Materials furnished by the Cooperator and by the Government are specified. The soil conservation practices to be

carried out on each field are shown.

The agreement includes a summary of materials used in carrying out the various soil conserving practices. Materials furnished by the Cooperator must meet certain specifications and these specifications are included.

The cropping plan shows the use to be made of each field on the farm each year. The field number of each field as designated on the land use map are shown on the cropping plan, and the use of the field or part of field each year is specified. The farmer, therefore, only has to consult his cropping plan to determine what crop he will have on each field of his farm each year.

The Cooperator must agree to follow the provisions set up in the plan of conservation operations and in the cropping plan. However, if at anytime during the five years conditions arise which makes it desirable to change any of the provisions the Cooperator sends to the Service a request for an amendment stating the change he wishes to make, why he desires the change and the conditions which cause him to want to make the change. If the change is in accord with a sound farming program the amendment is written into the agreement.

CONSERVATION SURVEY SYMBOL SHEET
FOR SCS CAMPS TENNESSEE --1,2,3,4, and 5

Oct. 13, 1937

EROSION

Symbol	Degree of Erosion
+	Recent alluvial and colluvial deposition
1	No apparent erosion (virgin soil areas)
2	Slight sheet erosion (Less than 25% of surface soil removed)
3	Moderate sheet erosion (25-50% surface soil removed)
33	Moderate-severe sheet erosion (50-57% surface soil removed)
4	Severe sheet erosion (75% to all of surface soil removed. Also some of upper "B" horizon removed in spots)
5	Very severe sheet erosion (Sheet erosion of the lower "B" horizon and the "C" horizon, or underlying material)
7	Occasional gullies (1 to 3 per acre)
8	Frequent gullies (More than 3 per acre)
9	Destroyed by gullies.

LAND USE

Symbol	Use
L1	All row crops
L2	All other rotation land
P	Pasture
F1	Good forest cover
F2	Scrub forest or brush pastured woodland shall be indicated by overscoring the symbol "F"
X1	Idle land resting
X2	Idle land abondoned

SLOPE

Symbol	Percent slope
A	0 to 2%
B	2 to 6%
BB	6 to 9%
C	9 to 12%
D	Over 12%

Figures before D slope symbol indicate dominant percent slope.

EROSION - LAND USE
Slope-Soil

The area bounded by the solid line has moderate sheet erosion, frequent deep gullies, going down into the underlying sand and gravel, is pasture land between 9 to 12% slope and is a deep rolling upland (loess) soil with good drainage.

(Cont.) CONSERVATION SURVEY SYMBOL SHEET
FOR SCS CAMPS TENNESSEE --1,2,3,4, and 5

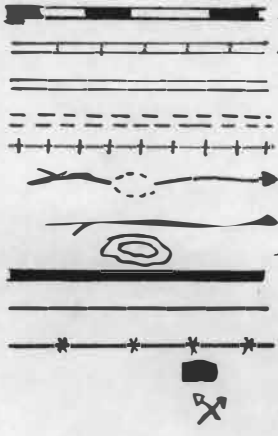
Oct. 13,1937

SOILS

Symbol	Soil
11	Well drained bottom land suitable for cultivation.
12	Medium drained bottom land suitable for cultivation.
13	Poorly drained bottom land with restricted cultivated crop use.
21	Bottom land unsuitable for cultivation due to poor drainage, sand, etc.
31	Medium to well drained terrace soil suitable for cultivation.
32	Poorly drained terrace soil having a restricted cultivated crop use.
40	Terrace soil not suitable for cultivation.
51	Soils developed from a mixture of loessial and coastal plain materials (sand or gravel 0 to 30 in.)
61	Deep upland (loess) soils (good drainage).
62	Deep upland (loess) soils (poor drainage).
63	deep upland (loess) soils (medium drainage).

SEQUENCE OF SYMBOLS

Example - 



NOTES

A "V" following the gully symbol indicates penetration into underlying material. A circle around the gully symbol indicates a gully too deep to be crossed by tillage implements. Symbol 9 and are used without sheet erosion symbols.

SCS-551
(Revised 1-1-37)

UNITED STATES
DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

COOPERATIVE AGREEMENT

AGREEMENT FOR DEMONSTRATIONAL AND EXPERIMENTAL WORK IN SOIL AND WATER CONSERVATION

THIS AGREEMENT, entered into this 22 day of September, 19 37, by the United States of America, by the Project Manager, hereinafter called the Government, and

(Last name)	(PRINT) (First name)	(City)	(State)
Van Dyke,	James W.	Henry	Tenn.

hereinafter called the Cooperator(s):

WITNESSETH, that the parties hereto do mutually agree as follows:

ARTICLE 1. The officer in charge shall be the Project Manager, hereinafter called the officer in charge.

ARTICLE 2. The Government agrees to make the essential surveys for use in developing a suitable plan of soil and water conservation, and to assist in formulating a plan of conservation operations.

ARTICLE 3. The Cooperator(s) agrees to follow the plan of conservation operations attached hereto, in accordance with the directions and under the guidance of the officer in charge or his duly authorized representatives, insofar as the officer in charge may find it necessary for the purposes of soil and water conservation.

ARTICLE 4. For a period of 5 years from the date of this agreement, the Cooperator(s) agrees to continue all farming,

8—8857

grazing, wild-life, and forestry practices required by this agreement and to maintain all fences, terraces, and other structures erected pursuant thereto, in a condition and in a manner satisfactory to the officer in charge.

ARTICLE 5. The Cooperator(s) agrees to furnish material, equipment, and labor as specified in the plan of conservation operations, attached hereto.

ARTICLE 6. It is stipulated that planting stock and materials furnished by the Government shall not be sold or disposed of by the Cooperator(s).

ARTICLE 7. The Cooperator(s) agrees to protect, to the best of his ability, from fire, all wooded and other areas not used for farm crops.

ARTICLE 8. The Government agrees to build the necessary structures and devices which it may deem necessary and practical in special cases to prevent damage from uncontrolled waters entering upon the farm from neighboring lands.

ARTICLE 9. In order that the Government may direct and supervise the work, the farming, grazing, wild-life, and forestry practices undertaken in this Agreement, the Cooperator(s) shall allow the officer in charge and/or his duly authorized agents free access to any of the lands involved during the period of this agreement.

ARTICLE 10. In the event that the Cooperator(s) fails to fulfill his undertaking in a satisfactory manner, the parties agree that the Government may terminate this agreement and shall be entitled to recover as liquidated damages the cost of materials (but not equipment) used by the Government, under this agreement.

ARTICLE 11. The Cooperator(s) agrees that the Government shall not be liable for any injury to person or property incurred in connection with the prosecution of the work under this agreement.

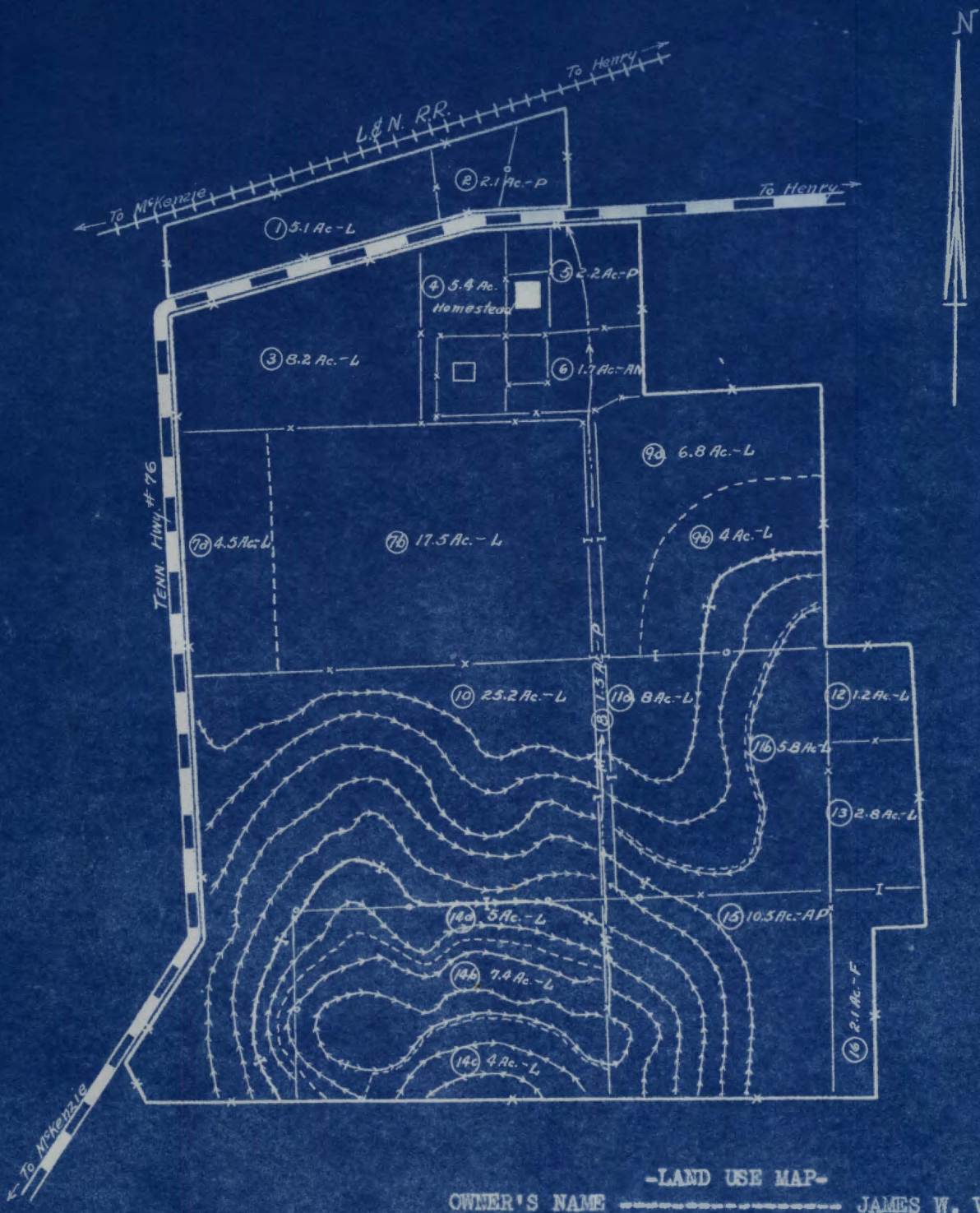
ARTICLE 12. In consideration of the benefits to be derived from the establishment of the erosion-control practices adopted on the land, the landlord/tenant agrees to be bound by the terms of this agreement as though he were named as the Cooperator(s).

ARTICLE 13. If at any time a party hereto shall cease to have any legal relationship (whether as landlord or tenant) to the land described on the map attached hereto and incorporated as part of the agreement, this contract shall become inoperative and of no further force or effect as to such party.

ARTICLE 14. In event present or future farm legislation interferes with the cropping plan of this agreement, the needed changes may be made subject to the approval of the officer in charge.

ARTICLE 15. The site of the work, with land description, plan of conservation operations, cropping plan, and map attached hereto, are incorporated as part of the agreement.

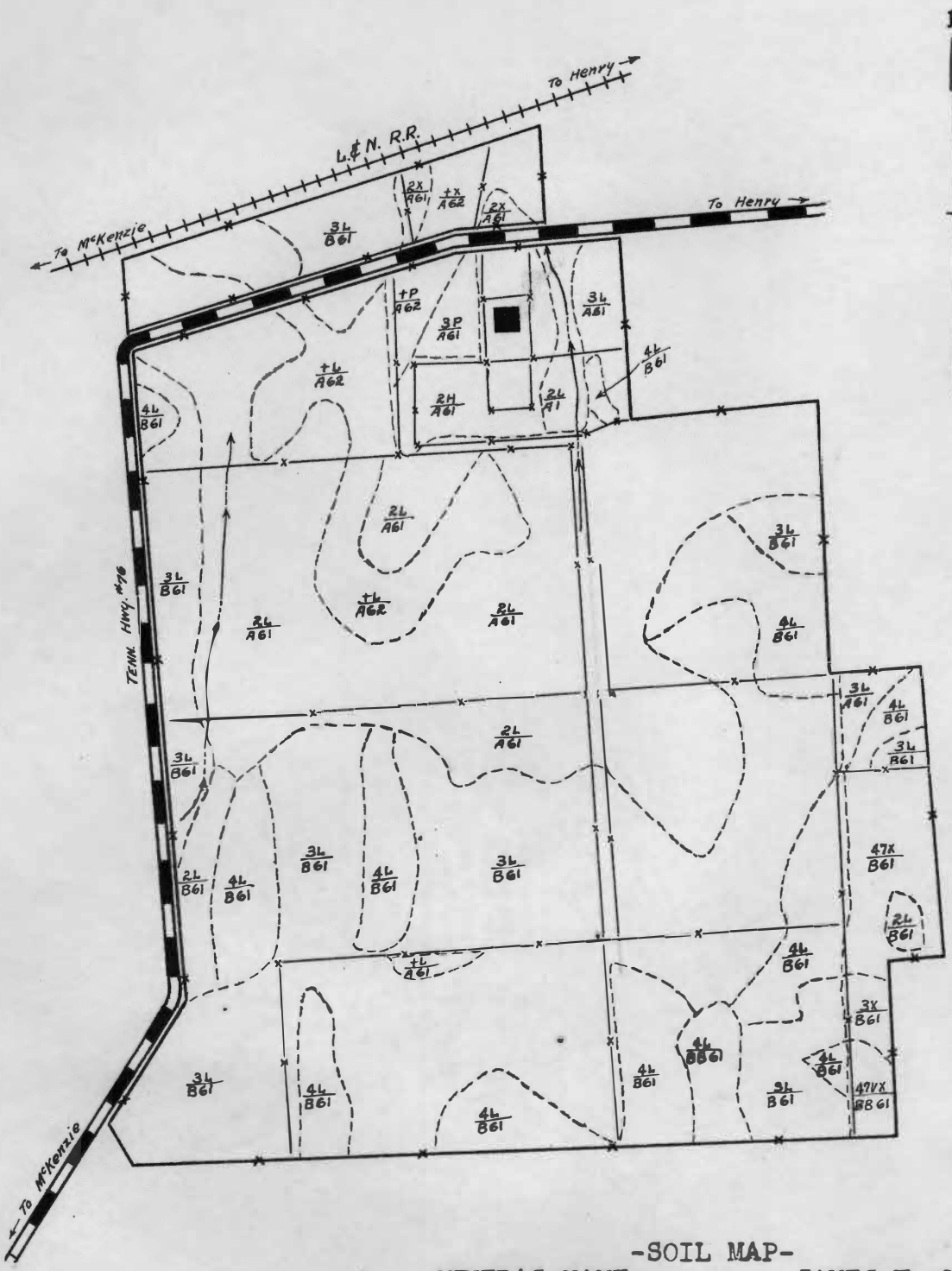
ARTICLE 16. No Member of or Delegate to Congress or Resident Commissioner shall be admitted to any share or part of this contract or to any benefit that may arise herefrom, but this restriction shall not be construed to extend to this contract if made with a corporation or company for its general benefit.



-LAND USE MAP-

OWNER'S NAME ---------- JAMES W. VANDYKE
OWNER'S ADDRESS ---------- PARIS, TENN.
OPERATOR'S NAME ---------- C.E. CATE
OPERATOR'S ADDRESS ---------- HENRY, TENN.
LEGAL DESCRIPTION ---------- 1/2 MI. S.W. OF HENRY, ON TENN. HWY. NO. 76. 4th DIST. OF HENRY COUNTY.

CONTRACT BY ---------- HUGH BROOKS
FARM NO. ---- 79
ACRES ---- 131
DATE ---- NOV. 12,1937
SCALE ---- 1" = 500'



-SOIL MAP-

OWNER'S NAME --------	JAMES W. VANDYKE
OWNER'S ADDRESS -----	PARIS, TENN.
OPERATOR'S NAME -----	C.E. CATE
OPERATOR'S ADDRESS --	HENRY, TENN.
LEGAL DESCRIPTION ---	½ MI. S.W. OF HENRY, ON TENN. HWY, #76. 4th DIST. OF HENRY CO.
MAPPED BY ----------	RAY K. WEDGWORTH
FARM NO. -- 79	ACRES -- 131
DATE -- NOV. 12,1937	SCALE -- 1"= 500'

Form Z-24(Revised 2-8-37) WORK SHEET

Project No. _____ Owner's Name James. W. Van Dyke Acres 131

County Henry Farm No. 79 Camp No. SCS-4

Table 1. Crops 3 Yr. Av. 1934-36 Cropping Plan Balance - Acres

CROPS	Acres	Yield per A.	Total	Bot.	Sold	1937	1938	1939	1940	1941	1942
Corn	35	30	1050			41.9	30.8	30.2	29.7	31.5	20.8
Silage											
Oats											
Wheat											
Cotton	12	325	3900		3900	10.2	6.8	10.2	8.6	8.0	9.6
Potatoes	6	200	1200		1200	4.5	4.0	4.0	5.0	4.5	4.0
Soybeans or C.Peas	10	1 T.				2.7	13.8				
Alfalfa						1.7	1.7	1.7	1.7	1.7	1.7
Oth. Meadow	40	1 T.				40.9	33.7	47.8	48.9	29.2	30.9
Woods Pastured		xxxx									
Other Pasture	20.5	xxxx				16.6	32.7	29.6	29.6	48.6	46.5
Woods not Past.		xxxx	xxxx	xxx	xxx		2.1	2.1	2.1	2.1	2.1
Idle & Misc.	7.5	xxxx	xxxx	xxx	xxx	7.5	5.4	5.4	5.4	5.4	5.4
Total Acres	131.0	xxxx	xxxx	xxx	xxx	131.0	131.0	131.0	131.0	131.0	131.0
Protein Supple.	xxxx	xxxx	xxxx		xxx						
Oth. Concentrates	xxxx	xxxx	xxxx		xxx						
Cover Crops	0	xxxx	xxxx	xxx	xxx	27.3	41.6	44.4	43.3	46.0	44.4

Table II.

Animals KIND	*Units of Livestock Ave.No. 1934-36 No. Animals	Ave.No. 1934-36 No. Units	Ave.No.1939-41 No. Animals	Ave.No.1939-41 No. Units	Ave. Feed Required 1939-1941 By Livestock Classes Hay (Tons)	Grain (Bushel)	Pasture *(A.U.)
Horses or Mules							
Dairy Cows	7	6	5	4	6	80	2
Young Beef & Dairy	10	10	5	5	10	100	5
Beef Breeding	10	0	14	3	4	15	3
Beef Feeding			10	10	20	50	10
Sheep Breeding			5	5	10	140	5
Sheep Feeding							
Hogs	42	6	42	6	1	450	4.5
Poultry	100	1	100	1		75	
	169	23	181	34	51	910	29.5

*Animal Unit-1 cow or horse, 2 young cattle, 7 coarse or 10 fine wooled sheep, 14-20 lambs, 1400# hogs, 100 chickens

Feed Required 1939-41 (Total) / Feed Available and Anticipated			
Feed Available 1934-36	40	1050	15
Feed Anticipated 1937	45	1257	11
" " 1938	47	924	21
" " 1939	47	910	22
" " 1940	48	920	25
" " 1941	50	945	30

CHANGES IN LAND USE AND CULTURAL PRACTICES

Contour strip cropping agreed, Acres _____

Cultivated land agreed to be retired to:

Per. Hay, Acres _____ Per. Past. 10.5

Woodland, Acres _____ Oth. Uses _____

Woodland fenced to exclude grazing, Acres 2.1

Contour tilling agreed, Acres 105.5

Pasture to Woodland agreed, Acres _____

Newly terraced, agreed, Acres 65.9

Woodland Planting except gullies, Acres _____

Explanation - Make notations which will aid in giving a complete picture of the situation.

This farm is tenant operated. The tenant owns all the livestock on the farm at the present time.

Remarks - Make notations which will show why the program was worked out as it was.

The Cooperator agrees to purchase 4 Or 5 good beef breeding cows and gradually build up to a herd of 10 cows.

By planting rye grass and crimson clover on his pasture each year he will be able to pasture in the winter and early spring, thereby reducing the amount of hay required for the cattle. He will buy hogs to feed when there is a surplus of corn.

PLAN OF CONSERVATION OPERATIONS

Owner: James W.Van Dyke Operator: C.E.Cate Farm No: 79

Fields 1,3,7a,7b,9b - 46.1 Acres

These fields will remain rotation crop fields, being cultivated on the contour. The entire area will be treated with limestone and superphosphate in 1939. Winter cover crops will be turned under for green manure.

The Cooperator agrees to contour cultivate, apply 92 tons of limestone and 4600 pounds of 43% superphosphate. He further agrees to furnish 1070 pounds of Crimson Clover seed and 2140 pounds of rye grass seed.

Fields 2 and 5 - 4.3 Acres

These fields will remain permanent pasture and will be treated with limestone and superphosphate in 1938. Crimson Clover and Rye Grass will be sown for winter pasture. Weeds will be controlled by clipping when needed.

The Cooperator agrees to clip the weeds as needed, apply 8 tons of limestone and 400 pounds of superphosphate. He further agrees to furnish 100# of crimson clover seed and 200# of rye grass seed.

Field 4 - 5.4 Acres

This will remain in the farm homestead.

Field 6 - 1.7 Acres

Thiss field will remain permanent meadow.

Field 8 - 1.5 Acres

This field will remain in permanent pasture, sodded with Bermuda sod and used as an outlet. Two (2) concrete structures will be built at the upper end of this field to overcome the vertical drop coming from the outlet in field 15. Ninety (90) rods of fence will be constructed on each side of the outlet to permit grazing. Rye grass and crimson clover will be seeded in the fall to furnish winter pasture.

The Cooperator agrees to furnish 180 rods of 39" No. 9 woven wire, 540 rods of barb wire, 240 posts, 36 pounds of staples and 72 pounds of brace wire. He also agrees to construct 136 rods of fence and apply 3 tons of limestone, 200 pounds of phosphate and furnish 75 pounds of crimson clover seed and 150 pounds of rye grass seed.

The Government agrees to furnish labor and supervision

for placing 4000 square yards of Bermuda sod and for constructing the two dams; also to replace 54 rods of fence removed at the upper end of the outlet for terrace construction and outlet work. It further agrees to furnish 48 bags of cement, 8 yards of gravel, 10 pounds of nails, 200 feet of lumber, and 280 pounds of steel.

Fields 10, 11a, 11b,14a,14b,14e,- 55.4 Acres

These fields will remain rotation crop fields, being cultivated on the contour in conjunction with a terrace system to be built in the spring of 1838. The entire area will be treated with limestone and superphosphate in 1939 and 1941. 96 rods of 39" No. 9 woven wire fence will be constructed between fields 10 and 14; 52 rods between fields 9 and 11, and 12 rods between fields 11 and 15. Winter cover will be turned under for green manure where these fields are pultivated. When these fields are pastured, rye grass and crimson clover will be sown for winter pasture.

The Cooperator agrees to build 3½ miles of terraces and furnish 110 tons of limestone, 5540 pounds of 43% superphosphate, 1310 pounds of crimson clover seed and 2568 pounds of rye grass seed. He further agrees to furnish 160 rods of 39" woven wire, 220 posts, 35 pounds of staples, 40 pounds of brace wire, and 480 rods of barb wire.

The Government agrees to furnish labor and supervision for laying out terraces and for the construction of 160 rods of fence.

Fields 12 and 13 - 4.0 Acres

These fields will remain rotation crop fields, being cultivated on the contour and treated with lime and phosphate in 1940. Winter cover will be turned under for green manure.

The Cooperator agrees to furnish 8 tons of limestone, 400 pounds of superphosphate, 78 pounds of crimson clover seed and 156 pounds of rye grass seed.

Field 15 - 10.5 Acres

This field will be retired from cultivation to permanent pasture and terraced in the spring of 1938 in order to complete the terrace system. The entire area will be treated with limestone and 43% superphosphate. The pasture will be clipped to control weeds. Rye grass and crimson clover will be planted to furnish winter pasture for his cattle. The terrace outlet will be sodded with Bermuda sod.

The Cooperator agrees to construct the terraces and clip the pastures as needed. He will furnish 20 tons of limestone, 1000 pounds of superphosphate, 250 pounds of crimson clover seed and 500 pounds of rye grass seed.

The Government agrees to furnish labor and supervision for laying out the terrace system and for placing 370 yards of Bermuda sod.

Field 16 - 2.1 Acres

This field will be transferred from idle land to protected forest. Fifteen (15) rods of 39" No. 9 woven wire will be built between field 15 and field 13.

The Cooperator agrees to protect this area from cattle and fire and to furnish 15 rods of woven wire, 20 posts, 3 pounds of staples, 15 pounds of brace wire, and 45 rods of barb wire. He further agrees to break the ground for tree planting.

The Government agrees to furnish labor and supervision for constructing the fence and for planting 3000 trees; also to furnish 3000 trees.

GENERAL ITEMS:

1. Fence posts will meet the following specifications: Corner and brace posts will not be less than 8½ feet long and 10 inches in diameter. Line posts will be not less than 7½ feet long and have a minimum diameter of 6 inches.

2. Brace wire will be #9 galvanized wire.

3. The Cooperator will furnish necessary team labor for for transporting materials within farm boundaries and for outlet construction and planting trees.

4. Species of trees to be planted will be specified by the Camp Forester, selection being governed by adaptability and availability of species.

5. The Cooperator agrees to furnish labor for planting trees furnished by the Government under Government supervision provided Camp labor is not available at planting season.

6. The Cooperator agrees to use cover crop, turning it under in the spring, on all fields in cultivation which will be in cultivation again the following year, as shown by the attached cropping plan. The Cooperator agrees to use the following mixture for cover crop: twenty (20) pounds rye grass and ten (10) pounds crimson clover seed per acre.

7. The landlord agrees to incorporate this plan of conservation operations and cropping plan as a part of all future lease contracts involving this farm for the five year period covered by this Agreement.

SUMMARY OF MATERIALS:

1. Furnished by the Cooperator

a. 2 tons Basic Slag
b. 60 lbs. rye grass seed
c. 35 lbs. crimson clover seed
d. 50 lbs. Korean lespedeza seed
e. 20 lbs. red top seed
f. 40 rods woven wire, 32"
g. 120 rods barb wire, 4-point cattle
h. 55 posts, as per specifications
i. 15 lbs. smooth wire, #9 galvanized
j. 20 lbs. staples
k. 1 ton barnyard manure
l. 12 lbs. alsike clover seed
m. 30 lbs red clover seed

2. Furnished by the Government

a. 84 bags cement
b. 20 tons gravel
c. 10 tons sand
d. 520 lbs. steel, re-inforcing
e. 4300 trees, more or less

(All materials are approximately)

CROPPING PLAN

Farm Owned by James W. van Dyke Tenant C. E. Cate

Township Henry Section 4th Dist. Acres in Farm 131 Farm No. 79

FIELD	PART	ACRES	1937	1938	1939	1940	1941	1942
1		5.1	2.4 Corn 2.7 Beans	Corn Beans Cover	Past.	Past.	Past.	Corn Beans Cover
2		2.1	Past.	-----	-----	-----	-----	-----
3		8.2	Corn Peas	Corn Beans Cover	Past.	Past.	Corn Beans Cover	Corn Beans Cover
4		5.4	-----	Homestead	-----	-----	-----	-----
5		2.2	Pasture	-----	-----	-----	-----	-----
6		1.7	Alfalfa	-----	-----	-----	-----	-----
7	a	4.5	S.Pot. Cover	Meadow	Meadow	Corn Beans Cover	Potatoes Cover	Meadow
	b	17.5	Corn Beans	Corn Beans Cover	Meadow	Meadow	Corn Beans Cover	Corn Beans Cover
8		1.5	Past.	-----	-----	-----	-----	-----
9	a	6.8	Past.	Cotton Cover	Meadow	Meadow	Past.	Cotton Cover
	b	4.0	Past.	Potatoes Cover	Mead.	Meadow	Past.	Potatoes Cover
10		25.2	Mead.	Mead.	Corn Beans Cover	Corn Beans Cover	Meadow	Meadow
11	a	8.0	Corn Cover	Beans	Mead.	Mead.	Cotton Cover	Past.
	b	5.8	Corn Cover	Beans	Mead.	Mead.	Corn Beans Cover	Past.

CROPPING PLAN

Farm Owned by James W. Van Dyke Tenant C.E.Cate

Township Henry Section 4th Dist. Acres in Farm 131 Farm No. 79

FIELD	PART	ACRES	1937	1938	1939	1940	1941	1942
12		1.2	Cotton Cover	Mead.	Mead.	Cotton Cover	Mead.	Mead.
13		2.8	Mead.	Mead.	Cotton Cover	Mead.	Mead.	Cotton Cover
14	a	5.0	Mead.	Past.	Corn Beans Cover	Potatoes Cover	Past.	Past.
	b	7.4	Meadow	Past.	Cotton Cover	Cotton Cover	Past.	Past.
	c	4.0	Mead.	Past.	Potatoes Cover	Mead.	Past.	Past.
15		10.5	9 Cotton 1.5 Mead.	Past.	-------	-------	-------	-------
16		2.1	Idle	Forest	-------	-------	-------	-------

The parties hereunto have executed this agreement, the United States of America by the contracting officer, and the Cooperator(s) has hereunto signed his name, the day and year hereinabove written.

THE UNITED STATES OF AMERICA,

Manager.

Cooperator.	(Title—owner or operator)
Cooperator.	(Title—owner or operator)
Cooperator.	(Title—owner or operator)
Cooperator.	(Title—owner or operator)
Cooperator.	(Title—owner or operator)

WITNESS:

Contracting Officer.

U. S. GOVERNMENT PRINTING OFFICE 8—8857

SCS-551
(Revised 1-1-37)

UNITED STATES
DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

COOPERATIVE AGREEMENT

AGREEMENT FOR DEMONSTRATIONAL AND EXPERIMENTAL WORK IN SOIL AND WATER CONSERVATION

THIS AGREEMENT, entered into this 31 day of July, 1937, by the United States of America, by the Project Manager, hereinafter called the Government, and

(Last name)	(PRINT)	(First name)	(City)	(State)
Thomas,	E. E.		McKenzie,	Tenn.
Thomas,	Robert		McKenzie,	Tenn.

hereinafter called the Cooperator(s):

WITNESSETH, that the parties hereto do mutually agree as follows:

ARTICLE 1. The officer in charge shall be the Project Manager, hereinafter called the officer in charge.

ARTICLE 2. The Government agrees to make the essential surveys for use in developing a suitable plan of soil and water conservation, and to assist in formulating a plan of conservation operations.

ARTICLE 3. The Cooperator(s) agrees to follow the plan of conservation operations attached hereto, in accordance with the directions and under the guidance of the officer in charge or his duly authorized representatives, insofar as the officer in charge may find it necessary for the purposes of soil and water conservation.

ARTICLE 4. For a period of 5 years from the date of this agreement, the Cooperator(s) agrees to continue all farming,

8—8857

grazing, wild-life, and forestry practices required by this agreement and to maintain all fences, terraces, and other structures erected pursuant thereto, in a condition and in a manner satisfactory to the officer in charge.

ARTICLE 5. The Cooperator(s) agrees to furnish material, equipment, and labor as specified in the plan of conservation operations, attached hereto.

ARTICLE 6. It is stipulated that planting stock and materials furnished by the Government shall not be sold or disposed of by the Cooperator(s).

ARTICLE 7. The Cooperator(s) agrees to protect, to the best of his ability, from fire, all wooded and other areas not used for farm crops.

ARTICLE 8. The Government agrees to build the necessary structures and devices which it may deem necessary and practical in special cases to prevent damage from uncontrolled waters entering upon the farm from neighboring lands.

ARTICLE 9. In order that the Government may direct and supervise the work, the farming, grazing, wild-life, and forestry practices undertaken in this Agreement, the Cooperator(s) shall allow the officer in charge and/or his duly authorized agents free access to any of the lands involved during the period of this agreement.

ARTICLE 10. In the event that the Cooperator(s) fails to fulfill his undertaking in a satisfactory manner, the parties agree that the Government may terminate this agreement and shall be entitled to recover as liquidated damages the cost of materials (but not equipment) used by the Government, under this agreement.

ARTICLE 11. The Cooperator(s) agrees that the Government shall not be liable for any injury to person or property incurred in connection with the prosecution of the work under this agreement.

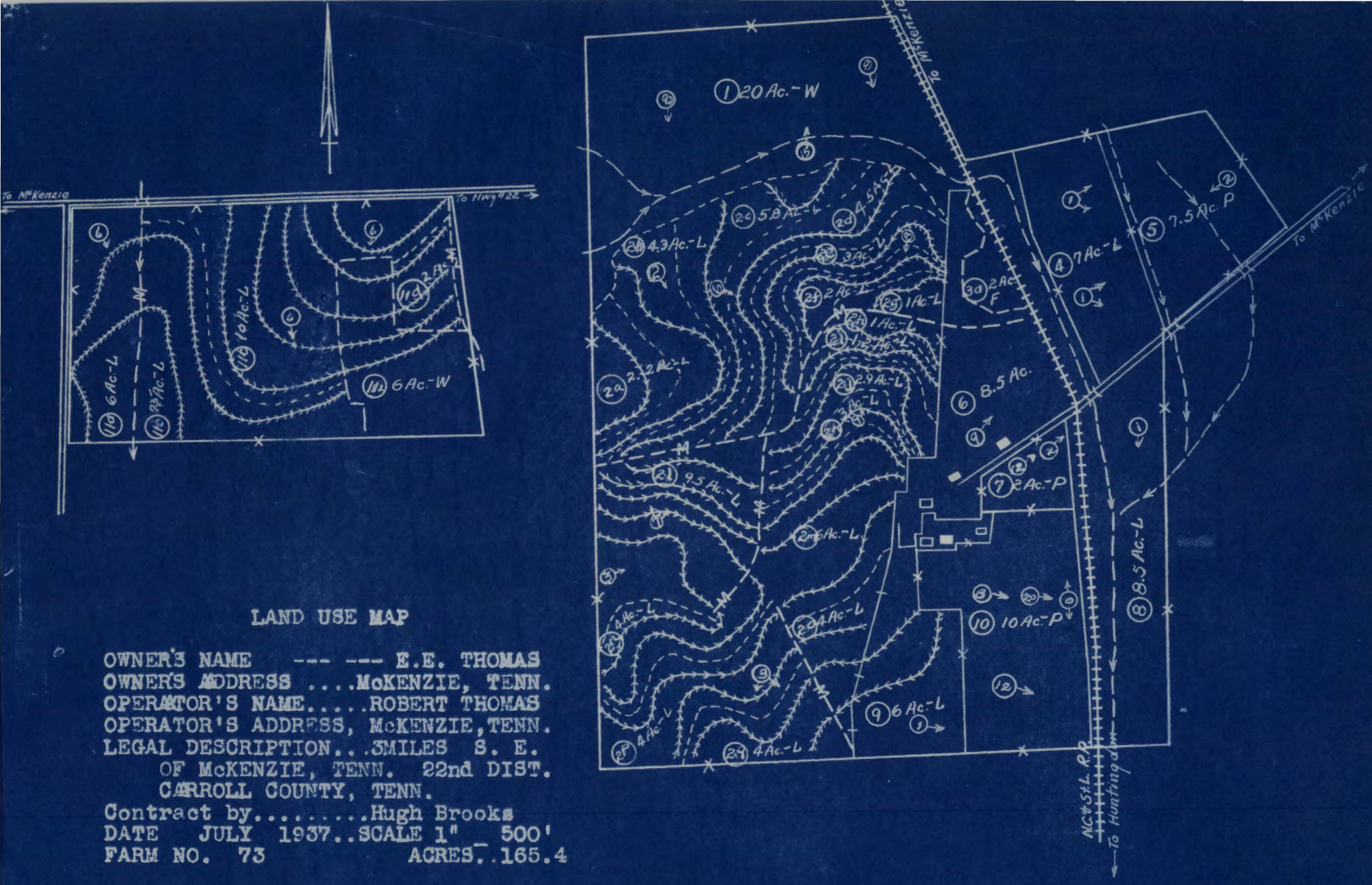
ARTICLE 12. In consideration of the benefits to be derived from the establishment of the erosion-control practices adopted on the land, the landlord/tenant agrees to be bound by the terms of this agreement as though he were named as the Cooperator(s).

ARTICLE 13. If at any time a party hereto shall cease to have any legal relationship (whether as landlord or tenant) to the land described on the map attached hereto and incorporated as part of the agreement, this contract shall become inoperative and of no further force or effect as to such party.

ARTICLE 14. In event present or future farm legislation interferes with the cropping plan of this agreement, the needed changes may be made subject to the approval of the officer in charge.

ARTICLE 15. The site of the work, with land description, plan of conservation operations, cropping plan, and map attached hereto, are incorporated as part of the agreement.

ARTICLE 16. No Member of or Delegate to Congress or Resident Commissioner shall be admitted to any share or part of this contract or to any benefit that may arise herefrom, but this restriction shall not be construed to extend to this contract if made with a corporation or company for its general benefit.



LAND USE MAP

OWNER'S NAME --- --- E.E. THOMAS
OWNER'S ADDRESS ....McKENZIE, TENN.
OPERATOR'S NAME.....ROBERT THOMAS
OPERATOR'S ADDRESS, McKENZIE, TENN.
LEGAL DESCRIPTION...3MILES S. E.
OF McKENZIE, TENN. 22nd DIST.
CARROLL COUNTY, TENN.
Contract by.....Hugh Brooks
DATE JULY 1937..SCALE 1" = 500'
FARM NO. 73 ACRES..165.4

Form Z-24(Revised 2-8-37) WORK SHEET

Project No. _____ Owner's Name E.E. Thomas Acres 165.4

County Carroll Farm No. 73 Camp No. SCS-4

Table 1. Crops 3 Yr. Av. 1934-36 Cropping Plan Balance - Acres

CROPS	Acres	Yield per A.	Total	Bot.	Sold	1937	1938	1939	1940	1941	1942
Corn	30	30	900		225	29	31.3	28.5	28	27	27.3
Silage											
Oats											
Wheat											
Cotton	25	200	5000		5000	17.1	16	15.4	15.5	15.3	15.4
Sweet Potatoes	10	150	1500		1500	3	3.9	4	3	3	4
Sorghum	2.4	3 T.	7.2								
Soybeans or C.Peas	2	1.5	3				2	4.3		6	5
Alfalfa											
Oth. Meadow	40	0.5	20			60.3	56.2	57.2	62.9	58.2	56.7
Woods Pastured	0	xxxx									
Other Pasture	19.5	xxxx				19.5	19.5	19.5	19.5	19.5	19.5
Woods not Past.	26	xxxx	xxxx	xxx	xxx	26	28	28	28	28	28
Idle & Misc.			xxxx	xxx							
Total Acres	165.4	xxxx	xxxx	xxx	xxx	165.4	165.4	165.4	165.4	165.4	165.4
Protein Supple.	xxxx	xxxx	xxxx		xxx						
Oth. Concentrates	xxxx	xxxx	xxxx		xxx						
Cover Crops		xxxx	xxxx	xxx	xxx	13.4	25.7	21.8	8.2	13.8	24.9

Table II.

Animals KIND	*Units of Livestock Ave.No. 1934-36 No. Animals	Ave.No. 1934-36 No. Units	Ave.No. 1939-41 No. Animals	Ave.No. 1939-41 No. Units	Ave. Feed Required 1939-1941 By Livestock Classes Hay (Tons)	Grain (Bushel)	Pasture *(A.U.)
Horses or Mules	6	6	6	6	12	120	6
Dairy Cows	4	4	4	4	8	80	4
Young Beef & Dairy	3	1.5	3	1.5	2.25	10	1.5
Beef Breeding	0	0	0	0	0	0	0
Beef Feeding	0	0	0	0	0	0	0
Sheep Breeding	0	0	0	0	0	0	0
Sheep Feeding	0	0	0	0	0	0	0
Hogs	20	3	20	3	.75	225	1.5
Poultry	200	2	200	2	.50	150	0
Total				16.5	23.50	585	13

*Animal Unit-1 cow or horse, 2 young cattle, 7 coarse or 10 fine wooled sheep, 14-20 lambs, 1400# hogs, 100 chickens

Feed Required 1939-41 (Total)

Feed Available and Anticipated

Feed Available 1934-36	30	930	14
Feed Anticipated 1937	28.1	939	14
" " 1938	28	855	14
" " 1939	31	840	14
" " 1940	29	810	14
" " 1941	28	819	14

CHANGES IN LAND USE AND CULTURAL PRACTICES

Contour strip cropping agreed, Acres 18.6

Cultivated land agreed to be retired to:

Per. Hay, Acres 0 Per. Past. 0

Woodland, Acres 0 Oth. Uses 0

Woodland fenced to exclude grazing, Acres 0

Contour tilling agreed, Acres 45

Pasture to Woodland agreed, Acres 0

Newly terraced, agreed, Acres 30

Woodland Planting except gullies, Acres

Explanation - Make notations which will aid in giving a complete picture of the situation.

Field 11 is about one mile from the rest of the farm. Field 11e consists in part of a locust plantation three years old. Terraces were carried through this area to the outlet.

Remarks - Make notations which will show why the program was worked out as it was.

This farm has been heavily cropped in the past, and the soil is deleted considerably by sheet erosion. The owner is interested in improving his soil by the use of terraces, contour cultivation, cover crops, and long rotation period.

This farm has good Bermuda grass, lespedeza and red top pastures with a carrying capacity of about an animal unit per acre.

PLAN OF CONSERVATION OPERATIONS

Owner: E.E.Thomas Operator: Robert Thomas Farm No: 73

Fields 1 and 11e - 26 Acres

These fields will remain in protected woods. Two acres of Timber Stand Improvement will be done in the Northeast corner of Field #1.

The Government agrees to furnish labor and supervision for the Timber Stand Improvement work.

Fields 2a, 2b, 2c, 2l, 2m, 2n, 2p, 2q - 44 Acres

These fields will remain in cultivation and contour tillage will be practiced. A crop rotation will be followed as stipulated in the cropping plan. Two terrace outlets will be constructed to control terraces in these fields. These outlets will be seeded in the fall of 1937 with rye grass, crimson clover, Korean Lespedeza, red clover, and alsike clover. Four concrete structures will be built in Outlet No. 2 at the last fout terraces.

The Cooperator agrees to furnish two tons Basic Slag to be applied to ten acres before seeding of red clover. He also agrees to furnish 30# rye grass, 18# crimson clover, 25# Korean lespedeza, 10# red top, 15# red clover, and 6# alsike clover.

The Government agrees to furnish materials for the construction of approximately 14 cu. yds. concrete; labor and supervision for construction of outlet channels structures, and seeding.

Fields 2d, 2e, 2f, 2g, 2h, 2i, 2j, and 2k - 18.6 Acres

These fields will remain in cultivation and contour strip cropping will be practiced following a crop rotation as specified by the attached cropping plan.

Field 3a - 2 Acres

This field will be transferred from idle land to protected new forest planting.

The Cooperator agrees to furnish team and plow for contour furrows in which to set trees. He further agrees to protect area from fire and grazing.

The Government agrees to furnish and deliver approx. 4300 trees, labor, and supervision for planting same if labor is available (see note in General Items)

Field 4 - 7 Acres

This field will remain in cultivation, and a crop rotation of not less than three years will be followed as stipulated by the attached cropping plan.

Field 5 - 7.5 Acres

This field will remain in permanent pasture, and be clipped to control weeds.

The Cooperator agrees to clip this pasture when needed.

Field 6 - 8.5 Acres

This field will remain in homestead, roads, orchard, and miscellaneous uses.

Field 7 and 10 - 12 Acres

These fields will remain permanent pasture and will be clipped when needed to control weeds. Eroded areas will be plowed and treated with barnyard manure and Bermuda sod. Contour furrows will be constructed in these fields.

The Cooperator agrees to furnish one ton of barnyard manure, one hundree square yards of Bermuda sod, and labor for treatment of eroded areas. He also agrees to furnish plow, team, and labor for construction of contour furrows. He further agrees to clip these fields as needed.

The Government agrees to supervise the laying out of contour furrows.

Field 8 - 8.5 Acres

This field will remain a rotation crop field following not less than a three year rotation as stipulated by the attached cropping plan.

Field 9 - 6 Acres

This field will remain in cultivation. Corn and beans will be grown each year and hogged down. A fence will be constructed on the west side to permit this practice.

The Cooperator agrees to furnish approximately 40 rods of 32" woven wire, 120 rods 4-point cattle barb wire, 55 posts, 15 lbs. brace wire, and 20 lbs. staples.

The Government agrees to furnish labor and supervision for the construction of the fence.

Fields 11a, 11b, 11c, 11d - 28 Acres

These fields will remain in cultivation and contour tillage will be practiced. A rotation will be followed as stipulated by the attached cropping plan. A vegetative outlet will be constructed on the east side of the field to control all but four of the terraces which empty into the natural drain on the west side of the field. This outlet will be seeded with Korean lespedeza, red clover, rye grass, red top, alsike clover.

The Cooperator agrees to furnish 25# Korean lespedeza, 15# red clover, 30# rye grass, 10# red top, and 6# alsike clover for seeding outlet in these fields, and team and plow for constructing the outlet.

The Government agrees to furnish labor and supervision for the construction and seeding of the outlet channel.

GENERAL ITEMS:

1. Fence posts will meet the following specifications: Corner and brace posts will be not less than 8½ feet long and 10 inches in diameter. Line posts will be not less than 7½ feet long and have a minimum diameter of 6 inches.

2. Brace wire will be #9 galvanized smooth wire.

3. The Cooperator will furnish necessary team labor for transporting materials within the farm boundary and for the construction of outlets and planting of trees.

4. Species of trees to be planted will be specified by the Camp Forester, selection being governed by adaptability and availability of species.

5. The Cooperator agrees to furnish labor for planting trees furnished by the Government under Government supervision provided Camp labor is not available at planting seasom.

6. The Cooperator agrees to use cover crop, turning it under in the spring, on all fields in cultivation which will be in cultivation the following year, as shown by the attached cropping plan. The Cooperator agrees to use the following mixture for cover crop: twenty (20) pounds rye grass seed and ten (10) pounds crimson clover seed per acre.

7. The landlord agrees to incorporate this plan of conservation operations and cropping plan as a part of all future lease contracts involving this farm for the five year period covered by this Agreement.

SUMMARY OF MATERIALS:

1. Furnished by the Cooperator

a. 2 tons Basic Slag
b. 60 lbs. rye grass seed
c. 35 lbs. crimson clover seed
d. 50 lbs. Korean lespedeza seed
e. 20 lbs. red top seed
f. 40 rods 32" woven wire
g. 120 rods barb wire, 4-point cattle
h. 55 posts, as per specifications
i. 15 lbs. smooth wire, #9 galvanized
j. 20 lbs. staples
k. 1 ton barnyard manure
l. 12 lbs. alsike clover seed
m. 30 lbs. red clover seed

2. Furnished by the Government

a. 84 bags cement
b. 20 tons gravel
c. 10 tons sand
d. 520 lbs. steel, re-inforcing
e. 4300 trees, more or less

(All materials are approximately)

CROPPING PLAN

Farm Owned by E. E. Thomas Tenant _____

Township _____ Section _____ Acres in Farm 165.4 Farm No. 73

FIELD	PART	ACRES	1937	1938	1939	1940	1941	1942
2	o	4	Mead.	Mead.	Potatoes Cover	Corn	Mead.	Mead.
	p	4	Corn	Mead.	Mead.	Mead.	Corn	Mead.
	q	4	Corn	Mead.	Mead.	Mead.	Corn Cover	Potatoes
3		2	Idle	Forest	Forest	Forest	Forest	Forest
4		7	Corn Beans	Corn Beans	Mead.	Mead.	Corn Beans	Corn Beans
5		7.5	Pasture	Pasture	Pasture	Pasture	Pasture	Pasture
6		8.5	Homestead, roads, miscl.					
7		2	Pasture					
8		8.5	Meadow	Meadow	Corn Beans	Corn Beans	Mead.	Mead.
9		6	Meadow	Corn Beans	Corn Beans	Corn Beans	Beans	Beans
10		10	Pasture					
11	a	6	Meadow	Meadow	Corn Cover	Cotton	Meadow	Meadow
	b	10	Corn	Meadow	Meadow	Meadow	Cotton	Meadow
	c	7.5	Meadow	Meadow	Meadow	Corn	Meadow	Mead.
	d	2	Meadow	Corn Beans	Corn Beans	Corn Beans	Meadow	Mead.
	e	6	Protected Woods					

CROPPING PLAN

Farm Owned by E.E. Thomas Tenant _____

Township _____ Section _____ Acres in Farm 165.4 Farm No. 73

FIELD	PART	ACRES	1937	1938	1939	1940	1941	1942
1		20	Pro. Woods					
2	a	2.2	Meadow	Cotton	Meadow	Meadow	Corn	Mead.
	b	4.3	1 Cotton 1 Cover 3.3 Mead.	Cotton Cover	Beans Cover	Cotton	Meadow	Mead.
	c	5.8	2 Cotton 2 Cover 3.8 Meadow	Corn	Mead.	Mead.	Corn Cover	Corn
	d	4.5	1.5 Cotton 1.5 Cover 3.0 Meadow	Corn	Meadow	Meadow	Meadow	Corn Cover
	e	3	1.5 Cotton 1.5 Meadow	Mead.	Mead.	Cotton Cover	Cotton	Mead.
	f.	2	Cotton Cover	Beans Cover	Cotton	Mead.	Mead.	Cotton Cover
	g	1	Cotton	Meadow	Meadow	Cotton Cover	Cotton	Meadow
	h	1	Cotton Cover	Potatoes Cover	Cotton	Mead.	Mead.	Cotton Cover
	i	1.2	Cotton	Mead.	Mead.	Cotton Cover	Cotton	Mead.
	j	2.9	Cotton Cover	Potatoes Cover	Cotton	Mead.	Mead.	Cotton Cover
	k	3	Cotton	Mead.	Mead.	Potatoes Cover	Potato	Mead.
	l	9.5	3 Potatoes 3 Cover 6.5 Mead.	Cotton Cover	Cotton	Mead.	Mead.	Cotton Cover
	m	6	Mead.	Corn Cover	Corn	Mead.	Mead.	Corn Cover
	n	4	Corn	Mead.	Mead.	Mead.	Corn Cover	Corn

The parties hereunto have executed this agreement, the United States of America by the contracting officer, and the Cooperator(s) has hereunto signed his name, the day and year hereinabove written.

THE UNITED STATES OF AMERICA,

Manager.

Cooperator.	(Title—owner or operator)
Cooperator.	(Title—owner or operator)
Cooperator.	(Title—owner or operator)
Cooperator.	(Title—owner or operator)
Cooperator.	(Title—owner or operator)

WITNESS:

Contracting Officer.

U. S. GOVERNMENT PRINTING OFFICE 8—8857

SCS-551
(Revised 1-1-37)

UNITED STATES
DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

COOPERATIVE AGREEMENT

AGREEMENT FOR DEMONSTRATIONAL AND EXPERIMENTAL WORK IN SOIL AND WATER CONSERVATION

THIS AGREEMENT, entered into this 10 th day of August, 19 37, by the United States of America, by the Project Manager, hereinafter called the Government, and

(Last name)	(PRINT)	(First name)	(City)	(State)
Owen		John	McKenzie	Tennessee

hereinafter called the Cooperator(s):

WITNESSETH, that the parties hereto do mutually agree as follows:

ARTICLE 1. The officer in charge shall be the Project Manager, hereinafter called the officer in charge.

ARTICLE 2. The Government agrees to make the essential surveys for use in developing a suitable plan of soil and water conservation, and to assist in formulating a plan of conservation operations.

ARTICLE 3. The Cooperator(s) agrees to follow the plan of conservation operations attached hereto, in accordance with the directions and under the guidance of the officer in charge or his duly authorized representatives, insofar as the officer in charge may find it necessary for the purposes of soil and water conservation.

ARTICLE 4. For a period of 5 years from the date of this agreement, the Cooperator(s) agrees to continue all farming,

8—8857

grazing, wild-life, and forestry practices required by this agreement and to maintain all fences, terraces, and other structures erected pursuant thereto, in a condition and in a manner satisfactory to the officer in charge.

ARTICLE 5. The Cooperator(s) agrees to furnish material, equipment, and labor as specified in the plan of conservation operations, attached hereto.

ARTICLE 6. It is stipulated that planting stock and materials furnished by the Government shall not be sold or disposed of by the Cooperator(s).

ARTICLE 7. The Cooperator(s) agrees to protect, to the best of his ability, from fire, all wooded and other areas not used for farm crops.

ARTICLE 8. The Government agrees to build the necessary structures and devices which it may deem necessary and practical in special cases to prevent damage from uncontrolled waters entering upon the farm from neighboring lands.

ARTICLE 9. In order that the Government may direct and supervise the work, the farming, grazing, wild-life, and forestry practices undertaken in this Agreement, the Cooperator(s) shall allow the officer in charge and/or his duly authorized agents free access to any of the lands involved during the period of this agreement.

ARTICLE 10. In the event that the Cooperator(s) fails to fulfill his undertaking in a satisfactory manner, the parties agree that the Government may terminate this agreement and shall be entitled to recover as liquidated damages the cost of materials (but not equipment) used by the Government, under this agreement.

ARTICLE 11. The Cooperator(s) agrees that the Government shall not be liable for any injury to person or property incurred in connection with the prosecution of the work under this agreement.

ARTICLE 12. In consideration of the benefits to be derived from the establishment of the erosion-control practices adopted on the land, the landlord/tenant agrees to be bound by the terms of this agreement as though he were named as the Cooperator(s).

ARTICLE 13. If at any time a party hereto shall cease to have any legal relationship (whether as landlord or tenant) to the land described on the map attached hereto and incorporated as part of the agreement, this contract shall become inoperative and of no further force or effect as to such party.

ARTICLE 14. In event present or future farm legislation interferes with the cropping plan of this agreement, the needed changes may be made subject to the approval of the officer in charge.

ARTICLE 15. The site of the work, with land description, plan of conservation operations, cropping plan, and map attached hereto, are incorporated as part of the agreement.

ARTICLE 16. No Member of or Delegate to Congress or Resident Commissioner shall be admitted to any share or part of this contract or to any benefit that may arise herefrom, but this restriction shall not be construed to extend to this contract if made with a corporation or company for its general benefit.

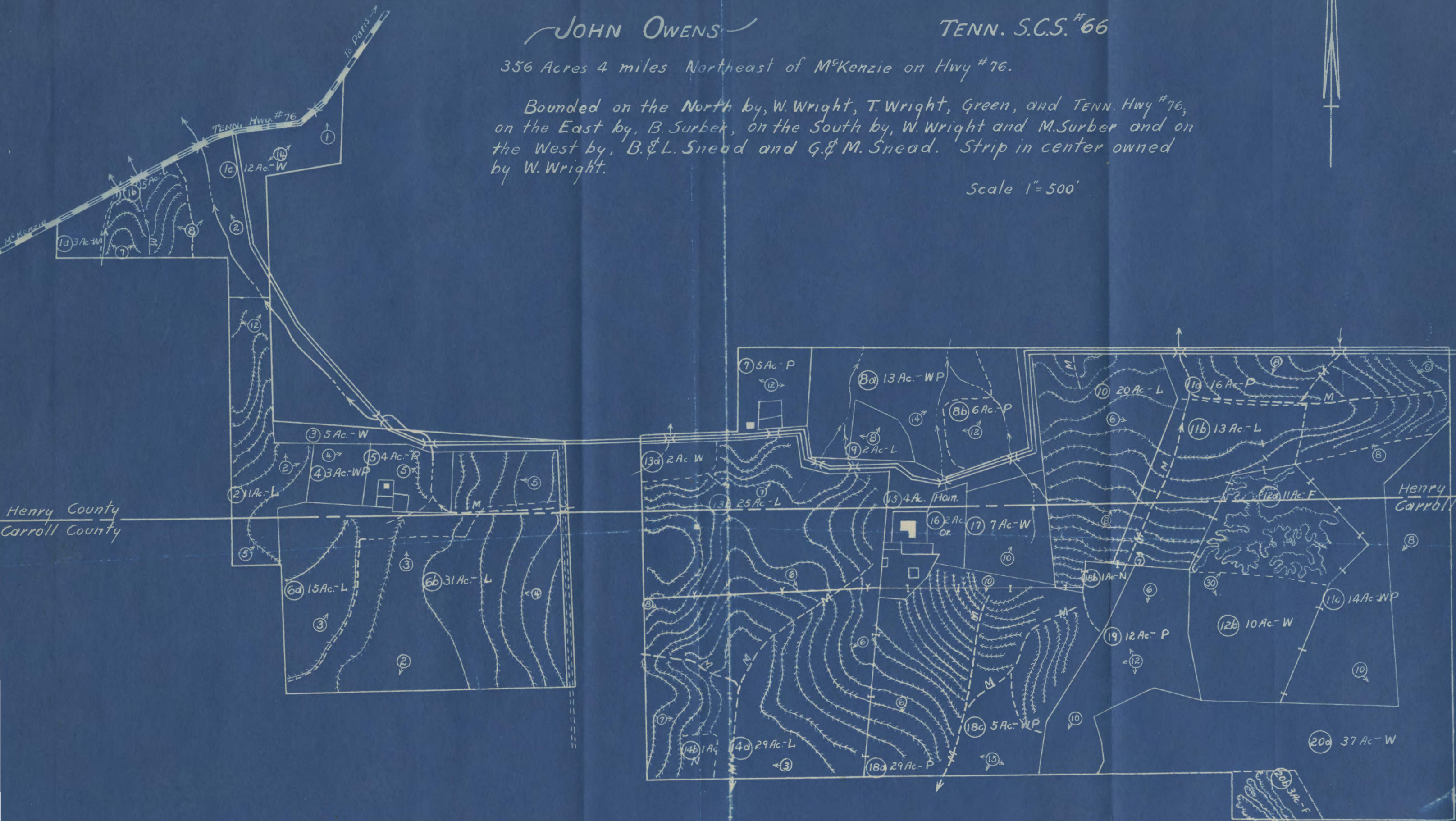
JOHN OWENS

TENN. S.C.S. #66

356 Acres 4 miles Northeast of McKenzie on Hwy #76.

Bounded on the North by, W. Wright, T. Wright, Green, and TENN. Hwy #76; on the East by, B. Surber, on the South by, W. Wright and M. Surber and on the West by, B. & L. Snead and G. & M. Snead. Strip in center owned by W. Wright.

Scale 1" = 500'



Form Z-24(Revised 2-8-37) WORK SHEET

103.

Project No. _____ Owner's Name John Owens Acres 356

County Carroll and Henry Farm No. 66 Camp No. SCS-4

Table 1. Crops 3 Yr. Av. 1934-36 Cropping Plan Balance - Acres

CROPS	Acres	Yield per A.	Total	Bot.	Sold	1937	1938	1939	1940	1941	1942
Corn	50	25	1250	200		59	42	42	42	42	42
Silage											
Oats											
Wheat											
Cotton	35	350	(Lint)			37	20	25	20	22	22
Soybeans or C.Peas	5										
Alfalfa											
Oth. Meadow	50	1T	50			54	77	101	81	71	75
Woods Pastured	64	xxxx	94			35	35	35	35	35	35
Other Pasture	83	xxxx	80			73	86	57	82	86	86
Woods not Past.	60	xxxx	xxxx	xxx	xxx	76	90	90	90	90	90
Idle & Misc.	9	xxxx	xxxx	xxx	xxx	22	6	6	6	6	6
Total Acres	356	xxxx	xxxx	xxx	xxx	356	356	356	356	356	356
Protein Supple.	xxxx	xxxx	xxxx		xxx						
Oth. Concentrates	xxxx	xxxx	xxxx		xxx						
Cover Crops		xxxx	xxxx	xxx	xxx						

Table II.

Animals	*Units of Livestock				Ave. Feed Required 1939-1941 By Livestock Classes		
	Ave.No. 1934-36		Ave.No.1939-41				
KIND	No. Animals	No. Units	No. Animals	No. Units	Hay (Tons)	Grain (Bushel)	Pasture *(A.U.)
Horses or Mules	9	9	6	6	12	120	3
Dairy Cows	18	18	20	20	40	400	20
Young Beef & Dairy	6	3	8	4	6	28	4
Beef Breeding							
Beef Feeding							
Sheep Breeding							
Sheep Feeding							
Hogs	30	5	30	5	1.2	376	2.4
Poultry	250	2.5	300	3	.9	234	
Feed Required 1939-41 (Total)					60.1	1156	29.4

*Animal Unit-1 cow or horse, 2 young cattle, 7 coarse or 10 fine wooled sheep, 14-20 lambs, 1400# hogs, 100 chickens

Feed Available and Anticipated

Feed Available 1934-36	50	1450	36
Feed Anticipated 1937	54	1475	35
" " 1938	68	1150	32
" " 1939	81	1050	30
" " 1940	81	1050	30
" " 1941	66	1150	32

CHANGES IN LAND USE AND CULTURAL PRACTICES

Contour strip cropping agreed, Acres 0

Cultivated land agreed to be retired to:
Per. Hay, Acres 0 Per. Past. 12
Woodland, Acres 0 Oth. Uses 0

Woodland fenced to exclude grazing, Acres 11

Contour tilling agreed, Acres 65

Pasture to Woodland agreed, Acres 0

Newly terraced, agreed, Acres 0

Woodland Planting except gullies, Acres 0

Explanation - Make notations which will aid in giving a complete picture of the situation.

Remarks - Make notations which will show why the program was worked out as it was....

PLAN OF CONSERVATION OPERATIONS

Owner: John Owens Operator: John Owens Farm No: 66

Fields 1a, 1c, 3, 12b, 13a, 17, 20a - 76 Acres

These fields will remain in protected woods. Five (5) acres in the northeast corner of field 20a will be used for a demonstrational timber stand improvement area.

The Cooperator agrees to protect these fields from grazing and fire.

The Government agrees to furnish supervision and labor for the timber stand improvement work.

Fields 1b, 2 - 16 Acres

These fields will remain rotation crop fields and will be contour cultivated. The rotation shown on cropping plan will be practiced. In field 1b terraces will continue to drain into the old gully now established with honeysuckle. No structures will be used, and the present vegetation will not be disturbed. Terraces of field 2 will continue to empty into the woods.

Fields 5, 7, 6b, 18a - 43 Acres

These fields will remain in permanent pasture. They will be clipped when needed to control weeds. These fields will be treated with 1000 pounds of crushed agricultural limestone and 200 lbs. of 43% tri-superphosphate. The terraces in field 18a will be maintained and the outlet controlling them will be sodded to Bermuda grass. One concrete structure will be placed at the lower end of the outlet. One hundred and fifty five (155) rods of 39" woven wire fence will be constructed to enclose this pasture.

The Cooperator agrees to clip the pastures when needed, to furnish 43000 lbs. crushed agricultural limestone, 8600 lbs. 43% tri-superphosphate, and approximately 2600 square yards of Bermuda sod. He further agrees to furnish team, driver, and plow for preparation of outlet for sodding. He also agrees to furnish approximately 155 rods of 39" woven wire, 310 rods of four point cattle barb wire, 210 posts, and brace wire and staples as needed.

The Government agrees to furnish labor and supervision for sodding outlet, building concrete structures in outlet, and for constructing approximately 155 rods of fence. The Government also agrees to furnish material for construction of approximately 4 cubic yards of concrete.

Fields 4, 8a, 11c, 18c - 35 Acres

These fields will remain in unprotected woods.

Fields 6a, 6b - 46 Acres

These fields will remain rotation crop fields, being cultivated on the contour. Eighty percent of this area will be treated with one ton of crushed agricultural limestone and 80# of 43% tri-superphosphate per acre in 1939 before the seeding of red clover. Two of the terraces in field 6a, will be drained into the woods and sodded with honeysuckle. The terraces in field 6b, will empty into an outlet controlled at the upper end with heavy mixed sod taken from adjoining area, and at the lower end with three concrete structures of approximately 4 cu. yds. each.

The Cooperator agrees to furnish 73,600 lbs. of crushed agricultural limestone, 2944 lbs. of 43% tri-superphosphate, honeysuckle and other sod for outlets.

The Government agrees to furnish supervision and labor for sodding outlets and for construction of concrete structures. It further agrees to furnish the materials for approximately 12 cu. yds. concrete.

Field 9 - 2 Acres

This field will remain in cultivation. A soil maintaining rotation will be practiced and contour tillage will be employed.

Field 10 - 20 Acres

This field will remain a rotation crop field and will be cultivated on the contour. Eighty percent of this area will be treated with one ton of crushed agricultural limestone and 120 lbs. of 43% tri-superphosphate per acre before seeding to red clover in the spring of 1938. The outlet controlling these terraces will be constructed in field 11b parallel to the fence, and will be sodded with Bermuda sod.

The Cooperator agrees to furnish twenty tons of crushed agricultural limestone, 2400 lbs. 43% tri-superphosphate, and approximately 3000 sq. yds. of Bermuda sod.

The Government agrees to furnish supervision and labor for sodding the outlet.

Field 11a - 16 Acres

This field will remain in permanent pasture, and the terraces will be maintained. The water from these terraces will be conducted by an outlet controlled at the upper end

by Bermuda sod and at the lower end by four concrete structures containing approximately 17 cu. yds. of concrete.

The Cooperator agrees to furnish approximately 2700 sq. yards of Bermuda sod.

The Government agrees to furnish supervision and labor for sodding outlet, and for constructing concrete dams. It further agrees to furnish materials for approximately 14 cubic yards of concrete.

Field 11b - 13 Acres

This field will be removed from permanent pasture and cultivated for two years in 1939 and 1940. A temporary three strand barb wire fence of approximately 65 rods will be constructed in 1939 to protect crops. Terraces will be maintained, and will empty into same outlet as those in field ten.

The Cooperator agrees to furnish labor for construction of temporary fence and approximately 195 rods of barb wire, 85 posts, and 10 lbs. of staples.

Fields 12a, 20b - 14 Acres

These fields will be transferred from idle land to new forest plantings. A four strand barb wire fence will be built to protect field 12a. This fence will be approximately 122 rods long.

The Cooperator agrees to furnish team, plow, and driver for preparation of planting area. He also agrees to furnish approximately 488 rods of four point barb wire, 55 lbs. No. 9 smooth wire, 160 posts, and 20 lbs. staples.

The Government agrees to furnish supervision and labor for construction of fence, and for preparation of planting area and for planting if labor is available. It also agrees to furnish approximately 44,600 trees.

Fields 13b, 14a - 54 Acres

These fields will remain rotation crop fields, and contour cultivation will be practiced. In fall of 1937, 80% of this area will be treated with 80 lbs. of 43% tri-superphosphate and 400 lbs. crushed agricultural limestone per acre. Rye grass will be seeded in field 14a in the fall of 1937 and 1938 and the area will be used for winter pasture. Terraces in field 13 which empty into the woods will be dug into the woods approximately 10 ft. and sodded with honeysuckle. The outlet controlling the other terraces in this field and ther terraces in field 14a will be sodded with Bermuda sod and will be lowered into an old gully with two concrete structures of approximately 7 cubic yards.

Field 14b - 1 Acre

This field will be transferred from idle land to permanent meadow. The entire area will be plowed, treated with manure and spotted with Bermuda sod.

The Cooperator agrees to furnish team, plow, and driver for preparation, approximately two tons barnyard manure, and 500 square yards of Bermuda sod.

The Government agrees to furnish supervision and labor for spotting this sod.

Fields 15, 16 - 6 Acres

These fields will remain in homestead and orchard, and miscellaneous uses.

Field 18b - 1 Acre

This field will be transferred from idle land to permanent pasture. It will be plowed, treated with manure, and spotted with Bermuda sod.

The Cooperator agrees to furnish team, plow, and driver for the preparation, and sod for spotting the area, and approximately two tons of manure.

The Government agrees to furnish supervision and labor for spotting Bermuda sods.

Fields 19 - 12 Acres

This field will be removed from cultivation and retired to permanent pasture and seeded to Permanent Pasture Mixture No. 1 in the Spring of 1938.

The Cooperator agrees to furnish 216 lbs. Permanent Pasture Mixture No. 1 (Mixture specified in General Items)

CROPPING PLAN

Farm Owned by John Owens Tenant

Township Section Acres in Farm 356 Farm No. 66

FIELD	PART	ACRES	1937	1938	1939	1940	1941	1942
1	a	3	Woods					
	b	5	Corn Rye Grass	R.G-C.C(1) Cotton	Meadow	Meadow	Meadow	Cotton R.G-C.C.
	c	12	Woods					
2		11	Corn R.G-C.C.	Corn R.G-C.C.	----(Pasture if Needed) Meadow	Mead.	Mead.	Corn R.G-C.C.
3		5	Woods					
4		3	Woods-Pasture					
5		4	Pasture					
6	a	15	Cotton R.G-C.C.	Cotton	Red Cl. Mead.	Red Cl. Mead.	Corn R.G-C.C.	Cotton R.G-C.C.
	b	31	Corn R.G-C.C.	Corn	Red Cl. Mead.	Red Cl. Mead.	Corn R.G-C.C.	Corn R.G-C.C.
7	a	5	Pasture					
8	a	15	Woods Past.					
	b	6	Pasture					
9		2	Cotton	Meadow	Meadow	Meadow	Cotton R.G-C.C.	Cotton R.G-C.C.
10		20	Cotton	Red Cl.	Red Cl.	Cotton R.G-C.C.	Cotton R.G-C.C.	Meadow
11	a	16	Pasture					
	b	13	Pasture	Pasture	Corn R.G-C.C	Corn R.G-C.C	Pasture	Pasture
	c	14	Woods Pasture					

CROPPING PLAN

Farm Owned by John Owens Tenant _____

Township _____ Section _____ Acres in Farm 356 Farm No. 66

FIELD	PART	ACRES	1937	1938	1939	1940	1941	1942
12	a	11	Idle	Forest	----	----	----	----
	b	10	Protected Woods	----	----	----	----	----
13	a	2	Protected Woods	----	----	----	----	----
	b	25	Red Cl. Mead.	Red Cl. Mead.	Cotton R.G-C.C.	Pasture	Red Cl. Mead.	Red Cl. Mead.
14	a	29	Rye Gr. Mead.	Rye Gra Mead.	Corn R.G-C.C.	R.G-C.C. Corn	Mead.	Mead.
15		4	----	----	Homestead	----	----	----
16		2	----	----	Orchard	----	----	----
17		7	Protected Woods	----	----	----	----	----
18	a	29	Pasture	----	----	----	----	----
	b	1	Idle	Pasture	----	----	----	----
	c	5	Woods-Pasture	----	----	----	----	----
19		12	Corn	Pasture	----	----	----	----
	a	3	Idle	Forest	Forest	Forest	Forest	Forest

Note (1) R.G indicates Rye Grass
C.C indicates Crimson Clover

GENERAL ITEMS

1. The Cooperator will furnish necessary team labor for all soil preparation operations and outlet construction work and for transporting all necessary materials within the farm boundaries.

2. The Cooperator will furnish new posts for all fencing operations done by the Government. Brace posts will be not less than 8½ feet in length and not less than 10 inches at the small end. Line posts will be not less than 7½ feet in length and not less than 6 inches in diameter.

3. Staples and brace wire will be furnished, as needed, by the Cooperator.

4. The Cooperator will furnish all seeds to be used as cover crops, pastures and meadow crops.

5. The Cooperator will use a mixture of 20# rye grass and10# crimson clover seed per acre for winter cover cops.

6. The Cooperator will build up terraces and maintain terraces to a 18 foot base width and 1½ foot height as a minimum. Water will be diverted from all vegetative and seeded outlets until growth becomes well established.

7. The Cooperator will spread all crushed limestone and fertilizer.

8. Permanent Pasture Mixture No. 1 will consist of the following: 8# red top and 10# lespedeza.

9. The Cooperator agrees to furnish labor to plant trees furnished by the Government in the event that the Camp is moved from the vicinity before planting time.

10. Species of trees to be planted will be specified by the Camp Forester, selection being governed by the adaptability and availability of species.

11. The Landlord agrees to incorporate this plan of conservation operations and cropping plan as a part of all future lease contracts involving this farm for the five year period covered by this Agreement.

SUMMARY OF MATERIALS:

1. Items furnished by the Cooperator:

   a. 155 rods woven wire, 39", #10 top and bottom
   b. 100 lbs. smooth wire
   c. 933 rods barb wire, 4-point cattle
   d. 100 lbs. staples
   e. 455 posts
   f. 11000 sq. yds. Bermuda sod
   g. 173880 lbs. crushed agri. limestone
   h. 15400 lbs. triple superphosphate, 43%
   i. 216 lbs. permanent pasture mixture # 1
   j. 4 tons barnyard manure

2. Items furnished by the Government:

   a. 222 bags cement
   b. 1375 lbs. re-inforcing steel
   c. 26 tons sand
   d. 53 tons gravel
   e. 44600 trees, more or less

(All items are approximately)

The parties hereunto have executed this agreement, the United States of America by the contracting officer, and the Cooperator(s) has hereunto signed his name, the day and year hereinabove written.

THE UNITED STATES OF AMERICA,

---*Manager.*

---*Cooperator.*	---(Title—owner or operator)
---*Cooperator.*	---(Title—owner or operator)
---*Cooperator.*	---(Title—owner or operator)
---*Cooperator.*	---(Title—owner or operator)
---*Cooperator.*	---(Title—owner or operator)

WITNESS:

---*Contracting Officer.*

U.S. GOVERNMENT PRINTING OFFICE 8—8857

CHAPTER VIII

SUGGESTIONS FOR SOIL AND WATER CONSERVATION BY FARMERS IN THIS AREA

The following suggestions, based on the work of various Experiment Stations over the country, the work demonstrated by the Soil Conservation Service in this area, and by experiences of farmers, are offered as an outline that the average farmer in this area might follow in planning and executing a conservation program:

1. Make a map of the farm. For all practical purposes a rough sketch will suffice. The physical layout including the homestead, field divisions, fences, wooded areas, streams and roads should be shown on this map. This map will serve as a basis for future study and reorganization of the farm.

2. Make a study of the soil types and soil series found on the farm and determine the characteristics and adaptations of the soils. Study the results obtained by various farmers in the community when certain crops were grown on various soil types. Study local Experiment Station recommendations as to the best uses of the various types. Make a map similar to the base map and show the soil type divisions on the farm. Determine the per cent of slope of the various fields and include this information on the soils map. From past experiences as to crop yields designate the soil fertility of each field as poor, medium, or good in relation to other fields on the farm.

3. Determine the proper land use for every part of the farm. Proper land use may be considered as growing the type of vegetative cover, crops, pasture or forest, for which the land is best adapted or which the land will permit, in order to conserve the soil and maintain its fertility.

4. It is suggested that the steeper and more erosive areas be put or kept in trees or permanent pasture. Contour furrows should be used on the permanent pastures to conserve moisture and prevent erosion. The more rolling and less fertile fields should be cropped less frequently. Contour tillage should be practiced on all cultivated crops. All cultivated fields with a slope of between 2% and 10% should be terraced. On cultivated areas of more than 10% or where terraces are not practical strip cropping should be practiced. The more fertile lands should be cropped most frequently. Make a careful study of the soils map before working out the crop-rotation system. The kinds of crop grown and the length of the rotation will be based primarily on the slope, type of soil, and fertility of the various crop fields on the farm.

5. Determine the approximate amounts and kinds of live-stock that will be kept on the farm and estimate the kinds and approximate amounts of feeds needed to carry this stock. Determine the kinds and approximate amounts of crops that will be grown each year. Work out a crop rotation system based on good land use practices that will normally provide these crops.

6. Retire badly eroded areas to trees. Protect from

cattle and fire. Use check dams in gullies supplemented by grasses, trees or vines in reclaiming gullied areas. Work out a management plan for established woodlands on the farm. Follow the practice of selecting for cutting the dead or diseased trees and the mature trees. Protect the stand from fire and livestock.

7. Study the needs for fertilization of each field. Provide the kind and amount of fertilizer needed for each type of soil and for each kind of crop.

8. Keep cover crops on all fields during the winter or when land would otherwise be bare. It is suggested that a legume be used for cover crops as well as a forage crop in the rotation since legumes add nitrogen to the soil.

9. Carry out a systematic pasture management plan. Balance the pasture mixture with grasses and legumes so as to get a long grazing season and a better balanced animal food. The use of phosphate on pastures in this area is strongly recommended. Protect the pasture from over or under grazing, use contour furrows and destroy weeds by harrowing.

10. Plan to change the farm layout, when practical, to conform to the cropping system. Fences should be constructed on the contour to facilitate contour cultivation. Fields should be laid out as nearly the same size as possible so as to facilitate the operation of a crop-rotation system.

It is not suggested that the average farmer attempt to completely reorganize his farm to conform to all the practices

mentioned but rather to include these practices, in so far as they are practical on the individual farm, in a long-time conservation program.

CITATIONS

1. ----- "Winter Cover Crops for Pasture and Soil Conservation." Tennessee Agricultural Extension Service, Publication 188, 1936. P. 2.

2. Wells, Francis G., "Ground-Water Resources of Western Tennessee." Tennessee Division of Geology, 1933. Pp. 120-121.

3. ----- "Soil Survey of Henry County, Tennessee." U. S. Department of Agriculture, Bureau of Soils, 1925. P. 81.

4. ----- "United States Census of Agriculture Report." United States Department of Agriculture, 1935.

5. ----- "Soil Conservation." Soil Conservation Service, United States Department of Agriculture, August, 1935, P. 3.

6. See Citation 5, P. 3.

7. ----- "Progress Report." From Records of Camp Tennessee S. C. S. - 4 Files, December, 1937.

8. Weir, W. W., Productive Soils. The J. B. Lippincott Co., Philadelphia, 1931. Pp. 26-269. (Taken from Soil Report No. 20, Illinois Agricultural Experiment Station).

9. Diseker, Ellis G., and Yoder, Robert E., "Sheet Erosion Studies on Cecil Clay." Alabama Experiment Station, Bulletin 245, November, 1936. P. 46.

10. See Citation 9, P. 41.

11. Hendricks, H. E., "Lime, Phosphate and Legumes In The 1937 Agricultural Conservation Program." Agricultural Extension Service, Publication No. 208, March, 1937. P. 6.

12. Ellison, W. D., "Engineering Practices and Standard Plans for E. C. W. Erosion Control Camps." Soil Conservation Service, United States Department of Agriculture, 1935.

13. Ayres, C. E., Soil Erosion and Its Control. The McGrow-Hill Book Co., Inc., 1936. P. 79.

CITATION (Continued)

14. Rogers, R. W., Local Recommendations given to the Writer by Mr. Rogers, Engineer, S. C. S. - 4, McKenzie, Tennessee.

15. Greene, S. W., "Level Terracing for Pasture Lands." Record of Proceedings of the Twenty-fourth Annual Meeting of the American Society of Animal Production, 1931, Pp. 156-159.

16. ----- "Efferts of Land Use of Surface Runoff and Erosion." United States Department of Agriculture, Circular 347, June, 1935.

17. Stoehr, Henry A., Local plans and Recommendations given to the Writer by Mr. Stoehr, Forester, in the S. C. S. -4 Camp, McKenzie, Tennessee.

BIBLIOGRAPHY

1. Burgess, Austin Earle, Soil Erosion Control. Turner E. Smith and Company, Atlanta, Georgia, 1936.

2. Ayres, Quincy Claude, Soil Erosion and Its Control. McGraw-Hill Book Company, Inc., New York, 1936.

3. Weir, Wilbert Walker, Productive Soils. Third Edition. J. B. Lippincott Company, Philadelphia and London, 1931.

4. Van Slyke, Lucius L., Fertilizers and Crop Production. Orange Judd Publishing Company, Inc., New York, 1932.

5. Hinkle, S. F., Fertility and Crop Production. Published by the Author and printed by E. E. Donnelly and Sons Company, Chicago, 1925.

6. Crandall, W. T., Ayres, T. L. and Others, "Planning a Conservation Program for an Individual Farm." Agricultural Education, Volume 13, Number 1 and 2.

7. ----- "Cover Crops For Soil Conservation." United States Department of Agriculture, Farmers Bulletin Number 1758.

8. ----- "Stop Gullies - Save Your Farm." United States Department of Agriculture, Farmers Bulletin, Number 1739.

9. Tascher, W. R., and Clark, M. W., "Conserving Soil with Natural Grass Waterways." University of Missouri, Agricultural Extension Service, Circular 362.

10. ----- "Gullies - How to Control and Reclaim Them." United States Department of Agriculture, Farmers Bulletin, Number 1234.

11. ----- "Using Soil-Binding Plants to Reclaim Gullies in the South." United States Department of Agriculture, Farmers Bulletin No. 1697.

12. ----- "Results of Erosion." Department of Agricultural Education, Clemson College, Clemson, South Carolina, Volume 12, Numbers 6-9.

13. Shivery, G. B., "The Farm Woodland in Tennessee." Tennessee Agricultural Extension Service, Publication 144.

14. Roberts, George, Welch, E. G., and Kelley, J. B., "Soil Erosion and Its Control." University of Kentucky Extension Division, Circular Number 304.

BIBLIOGRAPHY (Continued)

15. Miller, M. F., "Cropping Systems in Relation to Erosion Control." Missouri Agricultural Experiment Station, Bulletin Number 366.

16. Miller, M. F., "Soil Conservation in an Improved Agriculture." Missouri Agricultural Experiment Station, Bulletin Number 362.

17. Tascher, W. R., and Clark, M. W., "Conserving Soil by Strip Cropping." Missouri Agricultural Extension Service, Circular Number 368, June, 1937.