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LAND

CLEARING AND DRAINAGE

in Eastern
North Carolina



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Agricultural Research Service
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PREFACE

This report presents the results of a study of recent land clearing and drainage in selected areas of eastern North Carolina where appreciable land development has been taking place. The economic aspects of clearing and draining land are discussed in detail for the specific areas studied. This study should serve as a useful guide to research workers, extension personnel, and others who work with farmers, as well as other persons interested in the opportunities for agricultural development in eastern North Carolina and other parts of the southeastern Coastal Plain.

Acknowledgment is made especially to personnel in the Soil Conservation Service, U. S. Department of Agriculture, for their informal cooperation in carrying out the study. Helpful guidance from the North Carolina Agricultural Experiment Station is also acknowledged.

CONTENTS

	<u>Page</u>
SUMMARY-----	3
INTRODUCTION-----	5
BACKGROUND-----	7
Physical Characteristics-----	7
Land Use-----	10
Type of Farming-----	10
LAND CLEARING-----	12
Trends and Extent-----	12
Characteristics of Land Cleared-----	13
Methods of Land Clearing-----	21
Costs of Clearing Land-----	23
Uses of Cleared Land-----	26
Value of Cleared Land-----	27
LAND DRAINAGE-----	28
Historical Development and Extent-----	28
Organized Drainage Districts-----	30
Group Drainage-----	34
Farm Drainage-----	34
Benefits From Drainage-----	46

LAND CLEARING AND DRAINAGE IN EASTERN NORTH CAROLINA

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SUMMARY

This is the report of a study of recent land drainage and clearing operations in selected areas of the Coastal Plain of eastern North Carolina. It analyzes the costs and benefits of clearing and draining land, the characteristics of the land cleared and drained, the types of equipment used, and the uses made of the land on which improvements were made.

The Coastal Plain of eastern North Carolina is nearly level in the extensive lower areas and rolling to hilly in the higher inner part. Two-thirds of the total land area of the Coastal Plain of eastern North Carolina is in forest. Estimates of the United States Soil Conservation Service indicate that if cleared and drained, more than a third of the present forest area would be adapted to cultivation.

Since World War II, farmers have cleared thousands of acres of land for agricultural uses in the middle Coastal Plain and tidewater counties of eastern North Carolina. The acreage cleared in Beaufort, Pitt, and Robeson Counties, where the four townships selected for detailed study are located, amounted to about 43,000 acres. Two kinds of land clearing were noted. Clearing of land in blocks or tracts for establishing new fields was one kind; clearing associated with extending existing fields, cleaning out corners, wet spots, and so on, was the other kind.

Nearly all of the clearing since 1950 has been done on land with light and medium forest cover densities. On the farms studied, per acre costs for clearing averaged \$70 for light cover, \$91 for medium cover, and \$173 for heavy cover. Much of the land cleared since 1950 needs varying degrees of artificial drainage.

Most of the clearing for agricultural use in recent years has been accomplished with bulldozers. A heavy bush and bog disk is also generally used. Main ditches needed for drainage are usually dug with a dragline before the clearing operation begins. Practically all of the land in eastern North Carolina is being cleared by those who use their own land-clearing equipment or by farmers who have it done on a custom basis.

Costs of clearing land for agricultural uses vary widely among areas; but in general, costs varied only slightly between 1950 and 1958 in the areas covered in the study. The most expensive part of the land-clearing job was the use of a bulldozer to

push up the material to be cleared off the land. Tearing down and repiling heap rows following the burning of the piled material was generally the next most expensive part of the clearing operation.

Uses made of recently cleared land varied among and within the four areas under study. Soybeans and corn were the most common first crops planted on newly cleared land. Improved pastures were initial uses on several tracts cleared in Farmville Township, Pitt County. Most farmers contemplated no future change in the uses of the newly cleared land from that adopted during the first 3 or 4 years.

For much of the tidewater area and for many parts of the middle Coastal Plain, the land must be drained for successful agricultural use. Nearly all of the early field drainage was accomplished by using small ditches with spoil banks left beside the ditches. Today, tractors, draglines, graders, and other equipment are used. Where the grade is sufficient, soil conditions permit, and it is economical, tile is used as a means of enlarging fields and improving their layouts in order to permit more efficient use of mechanized farm equipment.

Drainage activity in North Carolina is carried out generally in three ways: By legally organized drainage districts, by voluntary group drainage, and by individual farmers.

Properly designed and constructed outlet ditches are vital to an efficient drainage system. The cost of outlet ditching averaged about \$1,800 per mile. This includes the cost of excavation, spreading of spoil, and some right-of-way clearing. The range in cost reported was from \$1,100 to \$2,500 per mile.

In eastern North Carolina, tile drains and open ditches are both used in draining farmland. Much of the tile drainage carried out on the farms covered in the study was installed mainly to drain wet spots. Most farmers contract to have their tile laid by a company or an individual who owns a power-operated wheel-excavator-type trenching machine. Practically no tile is installed by hand.

The cost of installing tile drainage averaged about 31 cents a foot from 1950 to 1958 inclusive. In order to accomplish spot or random drainage satisfactorily, about 200 feet of tile per acre is generally needed. Thus the average cost of tiling land in this way was running about \$62 per acre for the farms studied in the four townships in Robeson, Pitt, and Beaufort Counties.

Among the counties in which observations were made, most of the field drainage by open ditching was done in Beaufort County. Nearly all of this field ditching was done by draglines equipped with V-buckets. Per acre costs amounted to about \$11 or \$12. When the cost of digging and spreading the spoil banks of 2 lateral ditches needed as outlets for field ditches draining a section of land is added to the cost of field ditching, the cost reported for draining an acre in Pantego Township amounted to about \$20 to \$22. This includes neither group drainage costs nor the cost of main canals dug in organized drainage districts. Another \$5 to \$10 per acre should be allowed for these costs.

Several benefits are derived from draining agricultural land in eastern North Carolina. Much land cannot be used for crops unless it is drained artificially to

some extent. Yields are improved through drainage. Farmers emphasized as a benefit of drainage the greater assurance of a crop on adequately drained land. Where tile drains replaced open field ditches, several advantages were observed, such as a saving of land and fertilizer and greater efficiency and convenience in operating tractor-drawn equipment.

INTRODUCTION

Farmers and others interested in acquiring undeveloped or newly developed land need to know approximately how much it costs to improve such land. They need also to know how the land can be used and what the prospective returns are likely to be after improvements are made. They may need information on the methods or techniques used in developing or improving land.

The study was designed to investigate recent land drainage and clearing operations in selected areas of eastern North Carolina in order to determine the costs and benefits of draining and clearing land under specified conditions. The characteristics of the land drained and cleared and the uses made of the improved land were analyzed. The types of equipment used were studied also.

Four townships in Robeson, Pitt, and Beaufort Counties were selected to provide a partial cross section of physical conditions in those parts of eastern North Carolina where landowners have made significant progress in draining and clearing land during the last 10 to 15 years. The townships studied in detail were Alfordsville Township, Robeson County, Farmville Township, Pitt County, and Long Acre and Pantego Townships, Beaufort County. In figure 1, these four areas are shown in relation to major land-resource areas.

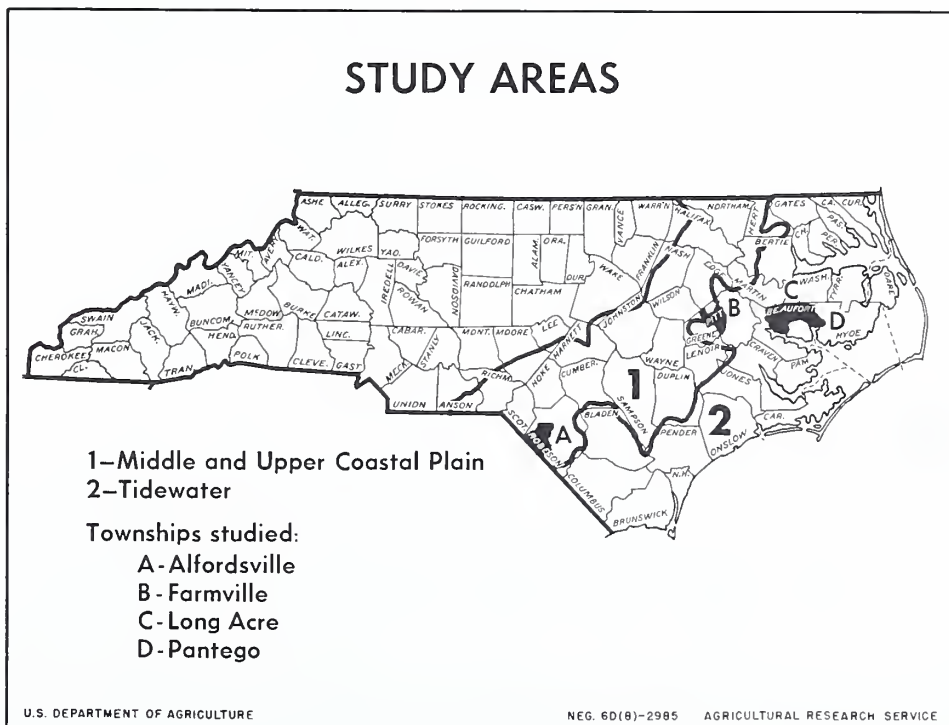


Figure 1

Comparison of two sets of airphotos taken about 15 years apart provided information on the changes in land use occurring in these areas. The data obtained from this study of airphotos were checked in the field. They were then discussed with local agricultural workers, who contributed additional information and rendered valuable assistance in selecting and arranging field interviews in these townships with owners who had developed land since 1950.

Altogether, 88 owners who had carried out clearing or drainage operations since 1950 in these four townships were interviewed in the fall of 1957. Additional information on land clearing and drainage was obtained from contractors and others in 1958. Table 1 shows the distribution of the interviews among the townships according to the land-development activities of the owners.

In each interview, an effort was made to obtain information on land use, tenure, and type of farming on the land developed. Data were compiled on the extent of clearing and drainage and the physical condition of the land. Finally, information was obtained on the costs and methods of clearing and draining land, as well as the benefits from development of farmland.

Table 1. - Distribution of selected farms by type of land-development activity reported, 4 townships in Robeson, Pitt, and Beaufort Counties, N. C.

Township	Land-development activity			Interviews	Total acreage in sample
	Drainage only	Clearing only	Clearing and drainage		
	Number	Number	Number	Number	Acres
Alfordsville-----	3	1	12	16	8,995
Farmville -----	14	10	17	41	10,042
Long Acre -----	0	0	24	<u>1</u> / 24	3,853
Pantego -----	0	0	7	7	18,977
Total -----	17	11	60	88	41,867

1/ Includes 3 owners who have land in both Pantego and Long Acre townships.

BACKGROUND

Physical Characteristics

Topography and Drainage

The Coastal Plain of eastern North Carolina, which occupies about 45 percent of the land area of the State, is nearly level in the extensive lower areas consisting of broad marine terraces and alluvial terraces of the larger rivers. The higher inner part is rolling to hilly, particularly in the interstream areas. Most of the Coastal Plain is less than 100 feet above sea level, except near the Piedmont where the higher elevations average about 250 feet. In the lower or tidewater part of the plain, elevations generally do not exceed 25 feet.

A succession of marine terraces underlain by unconsolidated materials with similar characteristics rise one above the other from the shoreline toward the fall zone, where the unconsolidated materials of the Coastal Plain meet the more resistant underlying rocks of the Piedmont.

In the townships selected for detailed study in Robeson and Pitt Counties, the topography varies from nearly level to gently sloping with elevations of about 75 to 100 feet above sea level. In Beaufort County, most of the land is nearly level. In Long Acre Township, elevations range mainly between 20 and 45 feet above sea level. In Pantego Township, elevations are between 10 and 20 feet above sea level.

The drainage system of the Coastal Plain is made up of several large rivers originating in the Piedmont and Mountain areas and of many shorter streams that rise in the Coastal Plain itself. In the lower or tidewater part of the Coastal Plain, many of these rivers broaden into tidal estuaries. Because much of this lower part is nearly level or only gently rolling, natural drainage is imperfect over extensive areas. Swamps, which are waterlogged and wooded, are prominent features, especially in the tidewater area. Most streams are bordered by strips of swamp. These river swamps occupy flood plains that lie just above the normal water level of the streams and are therefore subject to overflow. Extensive swamps are also found in the interstream areas, which are often only a few feet above sea level.

Soils

For the most part, the soils of the Coastal Plain of North Carolina are low in mineral plant nutrients, sandy in texture in the upper layers, and medium to strongly acid. The better drained soils have very little organic matter. Where natural drainage has been inadequate, organic soils have developed on one or more unconsolidated or partly consolidated beds of sand, silt, clay, and marl. Except in the coastal salt marshes, soils were formed principally under a vegetative cover of pine and oak forests.

In the low-lying tidewater area, poorly drained soils predominate. Soils of this area are interspersed with sizable bodies of peat and muck on interstream flats and depressions, ribbons of swamp along the rivers, and stretches of coastal marshland.

Areas of Norfolk and similar soils are found mainly along the upland fringes of the major valleys, where tributary streams have provided better natural drainage. Only small acreages of the poorly drained soils are cultivated. Extensive areas of good soils physically capable of use for agriculture need artificial drainage before they can be used for crops or pasture.

In the middle and upper Coastal Plain, well-drained soils predominate except in the lower part where moderately wet to very wet soils are frequently found. In the Sand Hills, many of the soils are excessively drained. Moderate and slightly wet soils are interspersed with well-drained soils. Very wet soils in the middle and upper Coastal Plain are found in some of the stream bottoms. Interstream swamps are less extensive here than in the tidewater counties.

Nearly 40 percent of the Coastal Plain soils of North Carolina are poorly to very poorly drained. Artificial drainage is necessary before crops can be grown on these soils. Another 20 percent of the soils are somewhat poorly drained. Unless they are drained artificially, growth of many crops is restricted. Thus nearly 60 percent of the Coastal Plain needs some artificial drainage for production of agricultural crops.

In their surface layers, most of the inorganic soils are coarse or medium textured. About 25 percent of these inorganic soils are sands and another 25 percent are sandy loams. The subsoil texture of about 35 percent of the soils is a sandy to a friable sandy clay loam. About 15 percent of the soils have sand to loamy sand subsoils and another 15 percent have firm sandy clay, silty clay, or clay subsoils. About 10 percent of the soils are organic; they are mainly muck or mucky peat soils, although some are peat soils.

The most promising possibilities for clearing and draining some of this wet land for agriculture in the next 20 to 25 years are found in the Bladen and associated soil areas and in some of the freshwater tidal marshlands. The Bladen soils occupy a strip of land about 10 to 75 miles wide, which parallels the coast about 10 to 20 miles inland. The freshwater tidal marshlands lie mainly between the Bladen strip of soils and the coast. Bladen and associated soils are generally heavy, black sandy loams with a very impervious subsoil. They have a high content of organic matter.

Some of these soils were drained and cultivated more than 100 years ago and good yields of corn, cotton, and potatoes were obtained. Present renewed interest in these soils is centered about their fitness for improved pasture grasses and legumes and for production of vegetables.

Soil associations with extensive areas now in forest that would be suitable for agricultural use if cleared and artificially drained are the Norfolk-Ruston, Dunbar-Lynchburg, Lynchburg-Rains, Coxville-Bladen, Craven-Shubuta, Bladen-Elkton, and Lenoir-Coxville associations. Smaller acreages of forest land suited to agricultural use if drained are in the Dragston-Fallsington and Bayboro-Muck associations. Altogether, between 2 and 3 million acres of forest land with poorly drained soils in these associations in eastern North Carolina could be cleared, drained, and used successfully for crops or pasture. In addition to the areas capable of use for agriculture, several areas of poorly drained soils in some of these associations would be suitable for agriculture except that adequate drainage is not possible because of insufficient outfall.

Soil associations with extensive areas of poorly drained forest land that are not well suited to agricultural use are the Klej-Leon, Rutlege-Plummer, and Portsmouth-Hyde associations and the muck-peak and swamp-tidal marsh areas. In general, these poorly drained soils are of only poor to fair quality for crops and pasture. Therefore, sufficient drainage for agricultural use of extensive areas of these soils is not now feasible.

Vegetation

The original vegetation of eastern North Carolina was mainly pines and hardwoods in the uplands and hardwoods and cypress in the bottom lands. On some of the better drained upland soils, mixed hardwoods of oak and hickory are found. In other upland areas, pines predominate. Mixed bottom-land hardwoods growing alone or intermixed with pines of various types are generally found on the poorly drained soils. An undergrowth of such shrubs as bay, gallberry, and myrtle is characteristic of the poorly drained areas. Coarse grasses, switch cane, and reeds are also found in some areas.

Pines cover more than half of the forest area. Loblolly, shortleaf, and pond pines are most common. The many hardwoods include such water-loving species as tupelo gum, blackgum, sweetgum, water oak, swamp white oak, willow oak, cypress, and juniper. Also found in eastern North Carolina are such hardwoods as pin oak, white oak, post oak, turkey oak, maple, and yellow poplar.

Nonforested areas include the freshwater marshes, tidal marshes, beaches, and dunes. There are also many cutover and severely burned areas. The muck areas were burned severely either before or following logging operations. Little sawtimber remains in these areas. The vegetation consists mainly of shrubs not easily damaged by fire, pond pine, and switch cane.

About 40 percent of the forest area of the North Carolina Coastal Plain has stands of sawtimber size. The rest is about equally divided between stands of pole timber size and those of seedling and sapling size. Less than 5 percent is poorly stocked or unstocked. Most of the land cleared for agricultural uses is from nonsawtimber stands, although some sawtimber stands are cleared for other uses following the cutting and sale of timber.

Climate

The climate of eastern North Carolina is characterized by hot, humid summers, short moderate winters, long frost-free seasons, relatively high precipitation with rainfall in the warm season somewhat exceeding that in the cool, and very little snowfall or snow cover. Average annual precipitation exceeds 40 inches. Where row crops dominate the cropping pattern, the problem of proper use of cropland exists, particularly on the sloping land that occurs in the higher parts of the Coastal Plain. High rainfall contributes to the problem of draining the low-lying flatlands of the lower Coastal Plain.

Land Use

In the Coastal Plain of eastern North Carolina, two-thirds of the total land area is in forest. Nearly a fourth is used as cropland. Only about 2 percent is open permanent pasture. A tenth of the land area is in other uses, such as roads, railroads, towns and cities, farmsteads, and miscellaneous, and in marshes and sand dunes (table 2).

Contrasts in land use between the lower and higher parts of the Coastal Plain are pronounced. These differences coincide closely with the major differences in soils and topography. Thus three-fourths of the tidewater area is forested and only about 16 percent is cropland. Only half of the middle Coastal Plain is forested, and more than a third is used as cropland (table 2).

The pattern of land use on the 88 farms in the four selected townships in Robeson, Pitt, and Beaufort Counties differs appreciably from the uses made of land reported in farms by the 1954 Census of Agriculture (table 3). Particularly significant is the fact that in the study a higher proportion of the land on these 88 farms was reported as cropland and a smaller proportion as forest land than in 1954. The active interest in land clearing and drainage on the selected farms is a major reason for the difference. The contrast indicates the possibilities for further clearing and drainage on other farms with similar physical conditions in these and other parts of the Coastal Plain.

Most of the land presently used as cropland in eastern North Carolina can be used for that purpose on a permanent basis. Very little of it is limited as to cultivation. On about 10 percent of the present cropland, relatively little attention to conservation is needed other than the application of good farming practices. On about 85 percent, needed conservation practices range from such easily applied practices as contouring, protective cover crops, and simple water-management operations to such intensive conservation measures as terracing and stripcropping on slopes and good management of water on flat areas.

Estimates of the U.S. Soil Conservation Service indicate that if cleared and drained, more than a third of the present forest area would be suitable for cultivation. About two-thirds of this forest land physically suitable for cultivation will need both clearing and draining. The remaining third will need only clearing. Approximately three-fifths of the forest land suitable for cropland is in the tidewater counties.

Some of this forest land is held in large tracts that are not parts of farm enterprises. However, a considerable acreage is distributed in small wooded tracts on existing farms. The latter is most readily available for development, provided the need for farm products warrants its use and provided also that farmers have adequate capital with which to do the job.

Type of Farming

The Coastal Plain of North Carolina has four generalized type-of-farming areas. The two largest are the flue-cured tobacco area of the middle Coastal Plain and the truck, tobacco, and livestock area of the tidewater counties. The other areas are

Table 2. - Land use in the Coastal Plain of North Carolina, 1954 ^{1/}

Land use	Tidewater or flatwoods		Middle Coastal Plain		Fall Line Sandhills		Total	
	1,000 acres	Percent	1,000 acres	Percent	1,000 acres	Percent	1,000 acres	Percent
Cropland ^{2/} -----	1,335	16	1,999	35	179	18	3,513	23
Pastureland -----	114	1	103	2	13	1	230	2
Forest land ^{3/} -----	6,147	74	2,928	52	686	69	9,761	65
Other land ^{4/} -----	742	9	637	11	123	12	1,502	10
Total -----	8,338	100	5,667	100	1,001	100	15,006	100

^{1/} Estimates of major uses of land are based on the 1954 Census of Agriculture, forest surveys made during the period 1951 to 1955 by the U. S. Forest Service, and data assembled by the Farm Economics Research Division, Agricultural Research Service.

^{2/} Includes cropland harvested, crop failure, cropland idle or in soil-improvement crops, and cropland used only for pasture.

^{3/} Includes a small amount of reserved forests in parks, national defense areas, and certain other special-use areas.

^{4/} Includes areas in highways, roads, and railroad rights-of-way; farmsteads, farm lanes; urban and town sites; nonforested areas in parks; wildlife refuges; and national defense (military) areas; and miscellaneous unaccounted-for areas, mainly marshes, sand dunes, and beaches not included among the above-listed special uses of land.

Table 3. - Land use on selected farms, 4 townships in Robeson, Pitt, and Beaufort Counties, N. C., 1957

Land use	Townships							
	Alfordsville		Farmville		Long Acre		Pantego	
	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent
Cropland ^{1/} -----	4,143	45	4,974	47	2,025	46	11,300	59
Pastureland ^{2/} -----	420	5	1,227	12	69	2	620	3
Forest land ^{3/} -----	4,259	47	3,979	38	2,256	51	6,603	34
Other land ^{4/} -----	294	3	279	3	66	1	718	4
Total -----	9,116	100	10,459	100	4,416	100	19,241	100

^{1/} Cropland includes cropland harvested, crop failure, cropland used only for pasture, and idle cropland or cropland used for soil-improvement crops.

^{2/} Open permanent-type pasture. All except 165 acres of the total acreage in pasture was reported as improved pasture.

^{3/} Includes forest land pastured and that not pastured.

^{4/} Includes farmsteads, farm lanes, drainage ditches, and other land in farms not used for cropland, pasture, or forest.

the peanut area of the middle Coastal Plain of North Carolina and Virginia and the cotton and tobacco area of the middle Coastal Plain of North Carolina and South Carolina. The counties selected for this study of land development are in three of these areas – Beaufort in the truck, tobacco, and livestock area; Pitt in the flue-cured tobacco area; and Robeson in the cotton and tobacco area.

On 15 of the 16 farms on which data were collected in Alfordsville Township in Robeson County, sales of cotton and tobacco accounted for half or more of the total farm income. On 4 farms, beef cattle were an important source of income. Only 1 farm had a dairy enterprise.

In Farmville Township, Pitt County, flue-cured tobacco was a major source of income on each of the 41 farms used in the study. Nine farms also listed cotton and beef cattle as important sources of income. Hogs were a significant source of income on 5 farms. On 2 farms, dairying and poultry were additional sources of income.

In Long Acre Township, Beaufort County, 23 of the 24 farmers interviewed raised tobacco. Corn and soybeans were also significant sources of income. In Pantego Township, Beaufort County, corn and soybeans were the major crops on the farms selected for study. Most of this production was sold. Only two farms reported livestock (beef cattle) as an important source of income.

LAND CLEARING

Trends and Extent

Since World War II, farmers in eastern North Carolina have cleared land for different reasons. Some farmers cleared land because they could not conveniently buy or rent acreages to add to their tilled areas. Some farmers wanted more land suited to production of the main cash crops, especially tobacco, in order to avoid disease and drainage problems. Others cleared land to enlarge, consolidate, or reshape fields in order to use tractor-drawn equipment more efficiently. Still others needed to realine fields in order to improve farm drainage systems and to carry out conservation practices more satisfactorily.

Since the late thirties, several thousand acres have been cleared for agricultural uses in the middle Coastal Plain and tidewater counties. Much of the land clearing is occurring on land that needs also to be drained before crops and pastures can be seeded. Following World War II particularly, when bulldozers and other heavy equipment became available, land clearing was common in many parts of eastern North Carolina. With the favorable relationship between prices for farm products and costs of producing them continuing into the early fifties, the clearing of land was widespread during this period. In recent years, the acreage cleared has declined from the higher acreages cleared annually during the late forties and early fifties.

Estimates of the total acreage cleared in Beaufort, Pitt, and Robeson Counties were obtained from air photographs of these areas taken about 1939 and 1954. The

amount of land clearing that occurred during the 15-year period was determined from the stereoscopic examination of contact prints with a scale of 1:20,000 and from index maps with scales of 1 inch to 1 mile. 1/

The acreage cleared from 1939 to 1954 inclusive in Beaufort, Pitt, and Robeson Counties totaled approximately 43,000 acres. As most of the area cleared for agricultural uses during this 15-year period in these three counties occurred since World War II, the area cleared averaged more than 5,000 acres per year.

Of the three counties included in the study, most of the land clearing since 1939 has been done in Robeson and Beaufort Counties. About 24,000 acres in Robeson County and 15,000 acres in Beaufort County have been cleared since that year. The remaining 4,000 acres were cleared in Pitt County, where long-established tobacco farming has been a major factor in determining the land use pattern.

In general, two kinds of land clearing were noted – clearing of land in blocks or tracts for establishing new fields and clearing associated with the extending of existing fields, and cleaning out corners, wet spots, and so on. In Pantego Township, Beaufort County, practically all clearing was in blocks or tracts. In Long Acre Township, Beaufort County, and in Alfordsville Township, Robeson County, about three-fourths of the clearing was in blocks or tracts. In Farmville Township, Pitt County, only about half of the clearing done was of this type. These two kinds of clearing are illustrated in the photographs on pages 14 and 15.

In areas where tobacco is the major crop, some of the clearing of new land involved the clearing of patches at the edge of woods or in woods for tobacco seedbeds. In time, these cleared seedbeds may be merged into a field of a few acres.

Tracts or blocks of land consisting of contiguous areas of land in one ownership unit varied in size from a few to several hundred acres on two or three of the large farms (table 4). On the 88 selected farms in the four townships included in the study, 18 of the 79 pieces of land cleared since 1950 contained less than 5 acres. However, 27 tracts had more than 20 acres per tract. Most of the total area cleared was in these larger tracts.

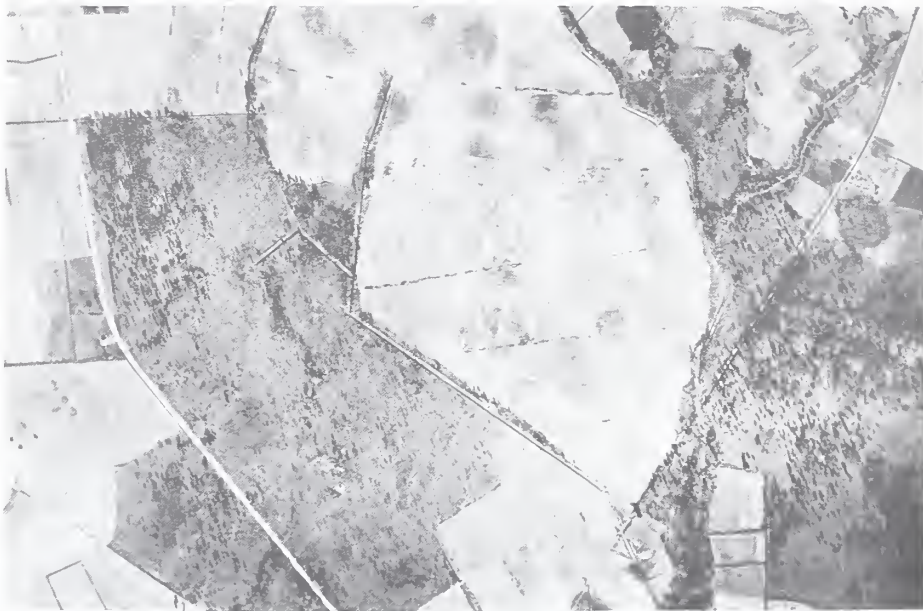
Characteristics of Land Cleared

Nearly all of the clearing since 1950 had been done on land with light and medium cover densities. About 70 percent of the 7,000 acres cleared on the 88 selected farms was thinly stocked woodland. Some of this land had been burned over and few or no standing trees were left. Cypress and juniper stumps, buried logs, and limbs in varying numbers were encountered on this kind of land in Pantego Township, Beaufort County. About 25 percent of the woodland cleared since 1950 had cover of medium density. Only about 5 percent of the woodland had a heavy cover of standing trees and bushes.

1/ Air photographs taken at different times since the midthirties are available from the Commodity Stabilization Service, U. S. Department of Agriculture, for most of the agricultural areas of the United States.



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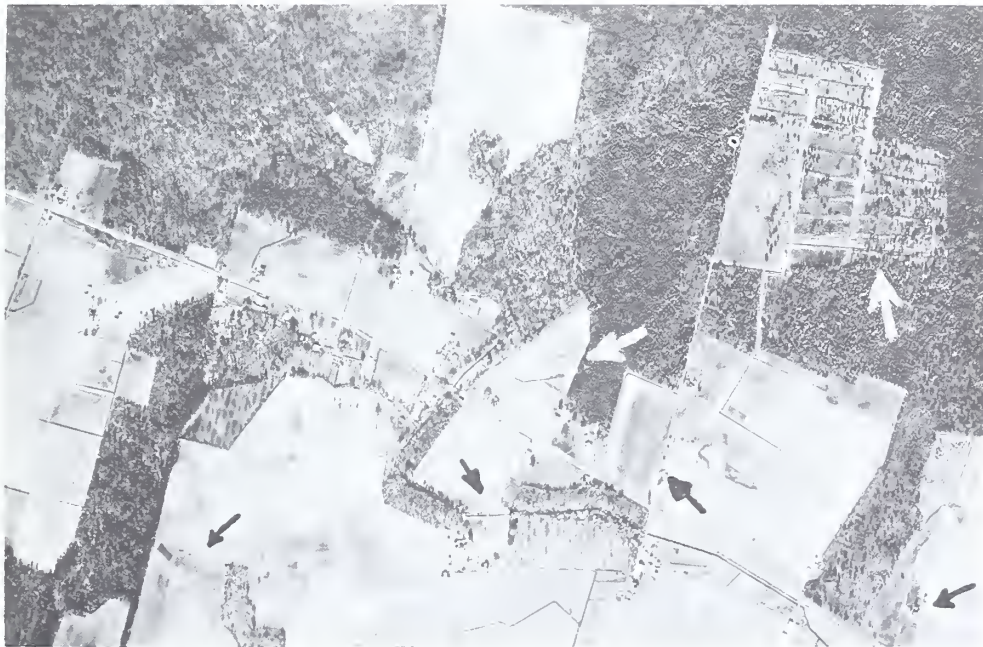


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The upper photograph shows the typical land use pattern in Robeson County, North Carolina, in 1938 before land clearing. The same area in 1951 after extensive land clearing was done is shown in the lower photograph. The remains of windrows of trees removed by bulldozer and piled for burning appear as dark dashes in the center and upper central portions of the lower photograph.



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The airphotos above show "spot" clearing in Pitt County, North Carolina. The upper airphoto shows conditions in 1938. Areas cleared are indicated in the lower photograph of the area taken in 1954.

Table 4. - Tracts cleared, by size of tract, selected farms, 4 townships in Beaufort, Pitt, and Robeson Counties, N. C., 1951-57

Township	Size of tracts cleared ^{1/}				Total
	Less than 5 acres	5 to 20 acres	Over 20 acres		
	Number	Number	Number	Number	Acres
Long Acre -----	9	16	6	31	394
Pantego -----	---	1	10	11	5,073
Farmville -----	7	12	5	24	350
Alfordsville -----	2	5	6	13	883
Total -----	18	34	27	79	6,700

^{1/} As used in this report, a tract is made up of a contiguous area of land in one ownership unit. The large tracts are usually divided into several fields for operating purposes.

Pairs of air and ground photographs are presented on pages 17, 18, and 19 to illustrate the woodland types generally cleared in eastern North Carolina. These photographs depict areas characterized by heavy, medium, and light cover densities.

Clearing costs were estimated for each of the three cover densities (table 5). Average costs for all four areas ranged from \$173 per acre for land with heavy cover to \$70 per acre for land with light cover. Within each of the three density classes, there was a considerable range in costs of clearing. The highest costs were reported on only a few acres with a very heavy stand of timber. The lowest costs on heavy cover were generally associated with dense stands of small bushes and saplings from which stump removal was no problem.

On land with light cover, the problem of stumps was generally present, particularly in the burned-over areas of Pantego Township, Beaufort County. Thus per acre costs on land with light cover characteristics were often not much less than those on land with a medium cover of standing trees.

Most of the tracts cleared since 1950 had a mixture of pine and hardwood trees with and undergrowth of hardwood bushes and shrubs, such as bay, gallberry, and myrtle. Some areas of coarse grasses, switch cane, and reeds were also encountered. Oak and gum were the principal hardwoods on land cleared, although on some of the tracts, trees of sawtimber size were standing when the clearing operation was begun. Generally, however, trees large enough for lumber, pulpwood, or fenceposts were cut before the complete clearing job was undertaken. Salable timber had been removed from many tracts several years before the clearing for agricultural use was undertaken.

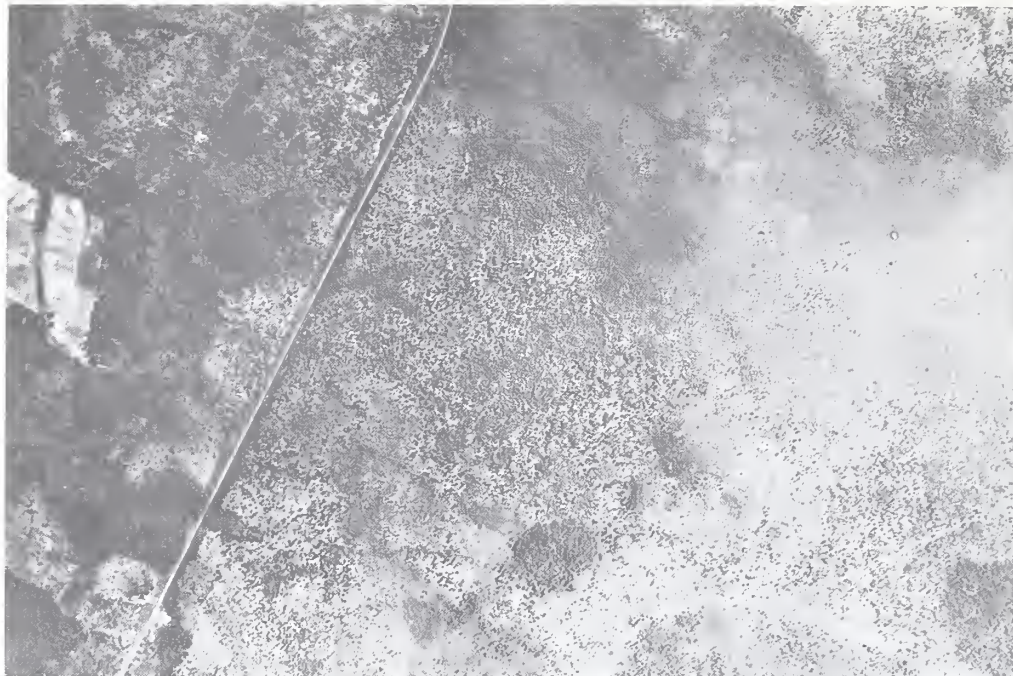


BN - 11327-x



BN - 11361-x

The airphoto above taken in Beaufort County shows the "heavy" type of woodland adjacent to the areas that have been drained and cleared. The photograph below taken from the ground shows a closeup of this type of cover.



BN - 11328-x



BN - 11367-x

Woodland of the "medium" type as it appears on the airphoto, Beaufort County, North Carolina. A closeup photograph is shown below.



BN - 11326-x



BN - 11366-x

Woodland cover of the "light" type is shown at the right on the airphoto taken in Beaufort County. These areas have been burned and have only a sparse cover of trees. A closeup photograph is show below.

Table 5. - Land clearing costs by cover-density classes, selected farms, 4 townships in Beaufort, Pitt, and Robeson Counties, N. C., 1950-57 ^{1/}

Township and cover-density class	Acreage reported	Total cost per acre		
		Average	Lowest	Highest
	Acres	Dollars	Dollars	Dollars
Alfordsville:				
Medium-----	841	76	30	130
Light -----	76	51	30	75
All -----	917	75	30	130
Farmville:				
Heavy -----	176	161	40	350
Medium-----	350	115	28	250
Light -----	25	39	39	39
All -----	551	125	28	350
Long Acre:				
Heavy -----	287	178	117	450
Medium-----	152	128	57	194
All -----	439	161	57	450
Pantego:				
Medium-----	232	100	100	100
Light -----	4,841	71	54	82
All -----	5,073	72	54	100
All townships:				
Heavy -----	463	173	40	450
Medium-----	1,575	91	28	250
Light -----	4,942	70	30	82

^{1/} See figure 1 for descriptions of the cover density classes. Costs are based on contract rates paid by farmers reporting.

Much of the land cleared on the 88 selected farms since 1950 needs varying degrees of artificial drainage before it can be used profitably for crops and pasture. Fine sandy loam is a common surface texture encountered on recently cleared land. Most of the newly cleared land with inadequate drainage falls in classes IIw and IIIw of the land capability classification developed by the U. S. Soil Conservation Service. Class IIw land is nearly level productive land requiring rather simple water-management practices. Land in class IIIw is flat, wet land, which requires drainage for cultivation but is productive under careful management.

Methods of Land Clearing

Most of the work of clearing land for agricultural use on the farms of eastern North Carolina in recent years has been done with bulldozers. Bulldozers were used on all except 4 of the 88 farms visited in the study. Only a very small acreage was cleared without a bulldozer. One operator had removed some stumps with a dragline on about 12 acres of land that had been burned over and on which practically no standing trees had been left. Blasting with dynamite was used only occasionally for removal of difficult stumps. Practically no land was cleared completely by hand methods. A little land had been cleared by using chain saws and the farm tractor; in some instances, this was confined to cutting trees off near the surface and leaving the stumps for the first years the land was farmed.

Crawler-type tractors equipped with a fork or rake, as shown in the photograph below, were most commonly used. Heavy bush and bog disks of the type shown in the photograph on page 22, were also used in most clearing operations. These heavy disks usually weigh from 3 to 4 tons. Other equipment was used in some clearing operations. but such equipment was used less widely than crawler tractors equipped with a fork and a bush and bog disk.

A crawler tractor equipped with a blade set at less than a right angle to the direction of movement was used by one contractor. This angle blade bulldozer was effective on thinly stocked land, where limbs, rotted stumps, small trees, bushes, and other debris could be pushed aside onto land already disked. A bush and bog disk was pulled at the same time the pushing operation was carried out. Later, the bulldozer was used separately to pile the debris into windrows or piles.



BN - 11364-x

One of the more powerful bulldozers being used to clear land. The rake is slanted in order to push material to one side as the bulldozer moves forward pulling a bush and bog disk.

The methods used in clearing land varied somewhat from farm to farm but for the most part, they can be conveniently placed into two general groups of operations from the standpoint of the sequence of each step and the time involved in completing the operation. Both of these methods of clearing land involve the use of bulldozers.

In both methods of clearing, the main ditches are generally dug with a dragline at the beginning of the operation before a start is made at clearing land needing drainage also. In some parts of Pantego Township, in particular, this is a necessary first step, as until the saturated soils have been partially dried out, they will not support a bulldozer. Cutting the main ditches first usually has two advantages: (1) It makes it possible to use heavy machinery more easily; and (2) the wetting and drying process that starts after drainage is initiated begins very soon to rot out the buried roots, logs, limbs, stumps, and other debris. This is an especial advantage in burned-over areas, where much of the material to be cleared off is either below ground or scattered about on the surface.

Following the digging of the main ditches and sometimes before the ditches are dug, all usable trees are cut. Some of these trees may be sold as sawlogs, but as a rule pulpwood and fence posts are the principal wood products obtained from the kind of woodland that is being cleared in eastern North Carolina for agricultural purposes. In Pantego Township, some of the burned-over areas have very good cypress logs that have long been buried and preserved in waterlogged soils. These logs are salvaged after the main ditches are dug.

Standing trees, bushes, stumps, buried logs and limbs, and other debris are next pushed into heap rows. This continuous pile of debris usually runs the length of



BN - 11365-x

A heavy bush and bog disk used in clearing land.

the field. If the standing vegetation is very sparse or if there is not too much underground debris, separate piles rather than continuous rows may be made. The heap rows are aligned parallel to one another and often parallel to the main ditches that have been dug. This permits the start of the next step of the clearing operation and use of the land for crops or pasture before the material pushed into the heap rows is disposed of by repeated burning and repiling.

A heavy bush and bog disk is used following removal of the big trees and bushes and any stumps and limbs. The disk may be used twice, sometimes with an interval of time between operations to permit rotting and deterioration of the debris. After the disk has been used, the materials left on top of the ground are picked up by hand, placed on trailers pulled by farm tractors, and carried to the nearest heap row.

If the pushing operation is completed in winter or early spring before the sap has begun to rise in the hardwood trees, it may be possible to burn the heap rows for the first time in early summer. Otherwise, burning over for the first time is left until the following autumn or winter. After the first burning, the bulldozer repiles the unburned material for a second burning. At this time, some of the soil that has been pushed into the heap row with the trees is spread out over the field. Frequently, a second or third burning is necessary and in some instances, a bulldozer is needed to repile the unburned material. It may take 3 or 4 years to dispose completely of the material cleared from the land.

While the heap rows are being disposed of, further attention is given to preparing the land for cultivation. Disks mounted on frames permit some leveling during the land-preparation stage. A heavy rotary tiller has also been used effectively in some land-clearing operations. Ordinarily, plows are not used in the field until after the above sequence of operations has been carried out. At the time of the first plowing, it is usually necessary to remove some remaining stumps, roots, and limbs.

Another approach to clearing involves a drying-out period for the material pushed down before it is pushed into heap rows. Some farmers follow this method, but it is not used as commonly as the heap-row method. When this approach is used, the material gets a chance to dry out at the place where it was pushed out of the ground. After a sufficient time has elapsed for this drying to take place, the material is pushed into piles or heap rows for burning. The advantage of this method is that it leaves most of the soil in place. A major disadvantage is because the partly cleared land must remain idle for a time before any financial returns can be obtained from its agricultural use.

Practically all of the land in eastern North Carolina is cleared by those who use their own land-clearing equipment or by farmers who have it done on a custom basis. Only a very few farmers undertake to clear land with wheel-type tractors and other standard farm equipment. Many who owned bulldozers and heavy bush and bog disks were doing custom work for neighboring farmers. Several land developers specialize in operating draglines and bulldozers to drain and clear land for farming and other purposes.

Costs of Clearing Land

Costs of clearing land for agricultural uses vary widely. The four different areas of eastern North Carolina were selected in order to study some of the variations that occur in the costs of clearing land, and the differences in methods of clearing,

the characteristics of land cleared, and the uses and value of recently cleared land. In table 6, the costs of clearing land in these areas are presented in terms of the highest, lowest, and average costs encountered on the 88 farms selected for study. Also presented is the percentage distribution of these total costs among the various operations involved in clearing land.

The costs reported in table 6 are based on custom rates reported by farmers who were carrying out clearing operations. For those farmers who owned their equipment, costs were based on the hourly rates for bulldozer work that they charged other farmers for clearing land with the same kind of equipment they used in clearing their own land.

Average total costs range from \$160 per acre in Long Acre Township, Beaufort County, to \$70 per acre in adjacent Pantego Township in the same county. In Pantego Township, much burned-over land was in process of clearing. In contrast to the varying quantities of standing timber on the land cleared for agriculture in Long Acre Township, very little of the land cleared in Pantego Township contained much standing timber. In Alfordsville Township, Robeson County, where total costs averaged \$75 per acre, much of the clearing was done on land that had been heavily cut over in recent years. In Farmville Township, Pitt County, the total costs of clearing land averaged \$125 per acre.

All costs reported are based on acreages cleared between 1950 and 1958. In general, costs varied only slightly during this period in the areas covered by the study. A slackening in land clearing during the latter part of the period led to increased competition among contractors for the clearing jobs available. This tended to maintain stability in the custom clearing rates charged farmers in the face of increased operating expenses and higher replacement costs for the equipment used.

Wide variations in costs were reported in each of the four areas studied. However, the variations were not nearly so pronounced in Pantego Township, Beaufort County, where cover characteristics on the lands cleared were similar. The greatest extreme in costs occurred in adjacent Long Acre Township, where one or two farmers reported clearing relatively small acreages of dense stands of pine at very high cost. Special considerations led them to undertake this expensive clearing. Some of the land cleared had been used for crops as recently as the 1930's; therefore, the cover was not very dense and stumps presented little difficulty. Similar variations occurred in Farmville Township, Pitt County. There, the more expensive land clearing occurred on small tracts, some of which had considerable value for growing tobacco. With land that could be used for growing tobacco, farmers tended to incur higher land-clearing costs in both Long Acre and Farmville Townships than in Pantego and Alfordsville Townships in Robeson County. Many farmers needed larger acreages of good tobacco land on which to rotate their crops in order to reduce the danger of loss from disease and to have land free from water damage because of poor drainage.

The most expensive part of the land-clearing job was the use of a bulldozer to push up the material to be cleared off into heap rows. The cost of this operation accounted for about two-fifths of the total cost in Farmville Township, Pitt County, and Pantego Township, Beaufort County. In the other two areas studied, this operation was reported as accounting for about three-fifths of the total cost in Long Acre Township, Beaufort County, and for more than half the total cost in Alfordsville Township, Robeson County.

Table 6. - Land-clearing costs per acre, by type of operation, selected farms, 4 townships in Pitt, Robeson, and Beaufort Counties, N. C., 1951-57

Township	Percentage of costs attributed to —				Total cost per acre of clearing ^{1/}		
	Pushing up into heap rows	Tearing down and repiling heap rows	Pulling heavy bush and bog disk	Picking up and burning	Average	Highest	Lowest
	Percent	Percent	Percent	Percent	Dollars	Dollars	Dollars
Alfordsville --	54	19	13	14	75	130	30
Farmville ---	39	28	16	17	125	350	28
Long Acre ---	63	16	7	14	161	450	57
Pantego -----	39	25	28	8	72	100	54

^{1/} Costs are based on custom rates reported by farmers who were carrying out clearing operations. For farmers who owned their own equipment, costs were based on the hourly rates for bulldozer work that these farmers were charging other farmers for clearing land with the same kind of equipment that they used in clearing their own land.

Tearing down and repiling heap rows following the burning of the piled material was generally the next most expensive part of the clearing operation except in Pantego Township, where the more extensive use of the heavy bush and bog disk slightly outweighed the cost of tearing down and repiling heap rows. Included in the tearing down and repiling of heap rows was the job of respreading the soil that had been pushed into the heap rows.

Heavy bush and bog disks were used in nearly all clearing operations to some extent. Variations in costs of using the bush and bog disk are attributable largely to the number of times the disk was used. In Pantego Township, where it was an effective piece of equipment in the land-clearing job, it was ordinarily used twice on the same land. In other areas, it was more frequently used only once. On newly cleared land where it was used only once, farmers often used their farm tractors and disks for one operation.

Picking up and burning was ordinarily done by the farmer with help he hired. The farm tractor and a trailer were commonly used in this operation. The cost of the burning and picking up operation usually accounted for about a tenth to a fifth of the total clearing costs. Per hour wage rates for labor used in this operation were relatively low.

Several factors account for the marked differences in clearing costs among areas and among tracts of land in the same area. First, the size, type, and density of the timber and brush cover is very important in determining the cost of the clearing operation. Some trees are more easily uprooted and disposed of than others. Some types of brush are more troublesome than other types. Soil type also may have a bearing on the clearing operation. In eastern North Carolina, soils with light sandy subsoils are not as difficult to clear as are those with heavy clay subsoils. Drainage also affects the cost of clearing land, as do the kind and size of equipment used and the skill of the operator.

Another variable that was of considerable importance in the area under study was the disposal of the material cleared off. In clearing many of the relatively small pieces of land, it was fairly common practice to push the material into adjacent wooded areas that were not to be cleared. This eliminated the cost of repeated burning and repiling. Usually, it meant that soil pushed into the piles with the debris was not scattered back on the fields from which it had been removed.

A less expensive clearing operation was generally possible if a longer time were taken to complete the job, thus giving the green trees and stumps adequate time to dry out before complete disposal was attempted. The least expensive method then was pushing down the trees and letting them lie in place before piling. However, the use of this method meant forfeiting at least one year's income from crops that might have been grown on the newly cleared land.

Costs of clearing land to be used for improved pasture only were usually about 50 percent as high as the costs of clearing land to be used for crops. This is accounted for principally by the fact that stump removal is less complete when the intended use is improved pasture. Scattered large trees, the most difficult kind to remove, or clumps of smaller trees, are often left standing for shade. However, the farmers contacted in the study reported that only relatively small acreages had been cleared specifically for improved pasture.

Uses of Cleared Land

Uses made of recently cleared land varied among and within the four areas under study. In Alfordsville Township, Robeson County, where cotton and tobacco are the main cash crops, the uses made of land that had been cleared since 1950 varied considerably. On some of the land, watermelons were first planted on the newly cleared fields to take advantage of the disease-free condition of the soil. After the first year, a 3- or 4-year rotation was started, consisting of a small grain crop, such as oats sown with lespedeza, followed by soybeans and corn. On part of the land, cotton was grown in a 5-year rotation. In some fields, corn and soybeans were the first crops planted. Two crops of corn were sometimes grown in succession on the same field. Ladino-fescue pasture and other improved pastures were the initial agricultural uses made of some of the newly cleared land. In general, farmers reported that they planned to make very little change in use of the land following adoption of the 3- or 4-year rotations or after it had been planted to improved pastures.

In Farmville Township, Pitt County, corn, soybeans, and improved pasture were about equally important as the first use made of land cleared since 1950. In a few instances, a small grain sown with lespedeza was used the first year. A rotation of corn, soybeans, oats, and lespedeza was common for the new cropland. On several fields or parts of fields, tobacco entered the rotation in the second, third, or fourth years following clearing. Improved pasture was the first use made of a few of the newly cleared fields.

In both Long Acre and Pantego Townships, Beaufort County, soybeans were usually the first crop planted. This was particularly true in Pantego Township. Corn was used as a first crop on several fields in Long Acre Township, but it was so used on only one field on the farms in Pantego Township. On many of the fields in Long Acre Township, a 2-year rotation of soybeans and corn was used on recently cleared land. Small grains were occasionally planted, and the rotation was lengthened to 3 years. Several farmers in Long Acre Township anticipated using the better drained parts of newly cleared fields for tobacco. Several farmers had planted corn or soybeans on the new land for 2 successive years and in a few instances, 3 years of corn had been used.

In Pantego Township, soybeans and corn were practically the only crops grown on land cleared since 1950 except occasionally for potatoes or a truck crop such as snap beans. Several of the farmers reported 3 and even 4 successive years of soybeans. A 2-year rotation of corn and soybeans was the anticipated future use of most of the land.

Yields reported for corn and soybeans, the two main crops planted on land cleared since 1950 varied considerably from farm to farm and from year to year. Severe drought affected yields adversely in some recent years. Yields of corn varied from practically nothing to as much as 100 bushels per acre on land recently cleared. Corn yields usually ranged from 30 to 60 bushels per acre. Yields for the first year following clearing were consistently lower than yields thereafter.

For soybeans, very good yields per acre were reported for large acreages grown in Pantego Township, Beaufort County. Yields reported in this township usually ranged from 25 to 30 bushels per acre. Some complete or nearly complete failures were reported, mainly because of flooding before the crop could be harvested. In other townships, yields of soybeans were not so consistently high, although some farmers reported yields in excess of 30 bushels to the acre. On several fields where soybeans were the first crop planted, the crop was turned under as a green manure crop.

Value of Cleared Land

Reasonably good estimates of the value of land before and after clearing were available on some farms; on others, no information could be obtained pertaining to valuation. The estimated value placed on unimproved cutover woodland ranged from \$15 to \$25 per acre to \$75 to \$100 per acre, depending to a considerable extent upon the quantities of salable timber and pulpwood still on the land. Considerable acreages had been purchased by the present owners for taxes in the 1930's or had been bought from people who had moved away and who saw little or no opportunity in the near future

for developing the unimproved timberland. In some of the areas in which land had been recently developed for farming, this unimproved woodland was also being purchased by corporations specializing in lumber, pulpwood, and other wood production. These corporations were interested in assuring an adequate supply of timber and particularly of pulpwood for the large mills that have been built in eastern North Carolina.

For the extensive acreage cleared in Pantego Township, Beaufort County, the asking price for unimproved cutover and burned over woodland, which is frequently referred to locally as "rough land," ranges from \$20 to \$30 per acre. Following clearing and drainage and raising of the first crop, the asking price for this land is between \$150 and \$200 per acre. After 2 or 3 years of cultivation, life insurance companies make loans of \$150 per acre on land that has been cleared since 1950.

In other townships covered in the study, asking prices of land improved by drainage and clearing covers a considerably greater range than those for land in Pantego Township. A greater variety of possible uses and the greater variations in the physical characteristics of the land cleared are the principal explanations for this greater range in land values. Whether or not the physical characteristics or available tobacco allotments favor the growing of tobacco is highly significant in determining the price at which newly developed land may be bought or sold in these areas.

LAND DRAINAGE

Historical Development and Extent

In much of the tidewater area and in many parts of the middle Coastal Plain of North Carolina where natural drainage is poor, the land must be drained for successful agricultural use. High rainfall, low elevation, level topography, and shifting tides are natural causes of poor drainage. Sluggish streams that are easily clogged with debris and vegetative growth are characteristic. Remedial action must reckon with these problems before forests can be cleared and the land used for crops and pasture.

Most of the early field drainage in the Coastal Plain of North Carolina was done through small ditches with spoil banks left beside them. These ditches were usually dug by hand during wet weather, or as an off-season job in winter. Most of the work is now highly mechanized. Tractors, draglines, graders, and other equipment are used. Old ditches are frequently redesigned and relocated to permit more efficient use of tractor-drawn equipment in farming the land.

When the grade is sufficient, soil conditions permit, and it is economical, tile is used on many farms as a means of enlarging fields and improving their layouts to permit more efficient use of mechanized farm equipment. Tile drains were used on 14 percent of the acreage benefited by farm drainage carried out under the Agricultural Conservation Program in eastern North Carolina between 1947 and 1957 inclusive.

Improper establishment and maintenance of drainage works have resulted in the failure of many enterprises in the Coastal Plain. Organized group drainage enterprises, which are generally responsible for construction of canals and ditches, are

essential to the establishment of good farm drainage works. Cooperative effort among farmers is necessary in order to build these main outlets for field drains. The success of both group and farm drainage enterprises is determined largely by careful planning based on good soil and engineering surveys, by careful consideration of expected benefits in relation to costs, and by sound financial planning. After an enterprise is established, close cooperation must continue if the project is to be adequately maintained.

In 1950, land in organized drainage enterprises in eastern North Carolina totaled nearly a million acres. This was about equally divided between the tidewater counties and the middle Coastal Plain. A total of 373 drainage enterprises reported this acreage. The average size was 2,500 acres, with those of the tidewater counties averaging about 2,000 acres and those of the middle Coastal Plain about 3,200 acres (table 7). Of the land in organized drainage enterprises, only about 45 percent was reported as having good drainage; 30 percent had only fair drainage; and 25 percent had poor drainage.

From 1910 to 1919 inclusive, more than two-fifths of the land in drainage enterprises reported in the 1950 Census of Agriculture was organized in these enterprises (table 7). Considerably less land was placed in organized drainage enterprises during the 1920's, particularly in the tidewater counties. In the middle Coastal Plain, the largest acreage was put into organized enterprises in the 1930's. With the advent of World War II and higher prices for farm products, interest in draining land continued.

Table 7.- Number of organized drainage enterprises and acreages drained, by period organized, Coastal Plain of N. C. 1/

Period organized	Tidewater <u>2/</u>		Middle Coastal Plain <u>2/</u>		Total	
	Enterprises	Acreage drained	Enterprises	Acreage drained	Enterprises	Acreage drained
	<u>Number</u>	<u>Acres</u>	<u>Number</u>	<u>Acres</u>	<u>Number</u>	<u>Acres</u>
Before 1900 -----	34	38,510	7	45,435	41	83,945
1900 to 1909 ----	22	69,376	5	20,416	27	89,792
1910 to 1919 ----	46	209,581	19	85,864	65	295,445
1920 to 1929 ----	20	35,434	9	62,040	29	97,474
1930 to 1939 ----	13	34,344	8	128,066	21	162,410
1940 to 1949 ----	96	97,890	94	106,701	190	204,591
Total -----	231	485,135	142	448,522	373	933,657

1/ Compiled from U. S. Census of Agriculture, 1950 (v. 6). Drainage enterprises of less than 500 acres in size were not included.

2/ For counties located in each area refer to figure 1.

Rehabilitation of drainage ditches and canals dug before 1860 or established mainly from about 1915 to 1925 is an important part of the present drainage activity. Many of these early drainage projects failed because land of low fertility was often included, and because planning, design, construction, and maintenance of the drainage works were frequently inadequate. The cost of renovating drainage works that have not been properly maintained is often about as high as the original cost of development.

Since about 1942, farmers in eastern North Carolina have received technical assistance from the U. S. Soil Conservation Service in planning both their group and farm drainage projects. The group-enterprise jobs are in addition to work done on individual farms, although the acreages benefited are the same in many instances.

From 1947 to 1957 inclusive, the Agricultural Conservation Program Service gave financial assistance in draining more than 860,000 acres of farmland in the Coastal Plain of North Carolina (table 8). This was an average of more than 70,000 acres drained per year. Most of this acreage was drained with the technical assistance of the Soil Conservation Service. The major emphasis of the work now done under this program is to improve drainage on land in agricultural use rather than to drain land not presently farmed. In previous years, however, some new land was developed with assistance from this program.

Drainage activity in North Carolina is carried out generally by legally organized drainage districts, voluntary group drainage, and individual farmers.

Organized Drainage Districts

Land-development activities in parts of eastern North Carolina were numerous during the early part of the century. As virgin and second-growth timber was cleared, land-development companies bought large tracts of the cutover land for resale to prospective farmers. A State drainage law was passed permitting the formation of incorporated drainage districts and the sale of bonds for financing construction of drainage works.

Table 8. - Farm drainage, Coastal Plain of North Carolina, 1947-57 1/

Area <u>2/</u>	Open drains	Tile drains	Total
	<u>Acres</u>	<u>Acres</u>	<u>Acres</u>
Tidewater-----	477,591	38,352	515,943
Middle and Upper Coastal Plain---	263,632	77,770	341,402
Fall Line Sandhills -----	2,675	1,641	4,316
Total-----	743,898	117,763	861,661

1/ Acreage drained in 11 years with financial assistance from Agricultural Conservation Program Service.

2/ For counties located in each area refer to figure 1.

Some of these land-development activities were successful in converting the cutover forest land into farms. Others were failures because of attempts to drain land unsuited to agriculture. In some areas, peat soils were burned to depths ranging from 1 to 3 feet. The financing of worthwhile areas was later hindered or prevented by failure to retire the drainage bonds in many of these unsuccessful districts.

In three of the four townships selected for the study, organized drainage districts have played an important part in the land-development process. Long Acre Township, Beaufort County, has no organized drainage enterprise.

In Farmville Township, Pitt County, the Little Contentnea Creek Drainage District, also designated as Pitt County Drainage District No. 1, was organized in 1928. About 90,000 acres were included in the district. The original assessment was \$72,000. An additional assessment of \$6,000 was later made in order to clean out the channel 1 mile below the district boundary so that landowners in the lower part of the district would be adequately benefited. The canal was 10 miles long.

For assessment purposes, the land in the district was divided into five classes and assessment rates were established for each class according to the estimated benefits that were to accrue to the land through drainage. The rate was \$15 per acre for class A, \$12 for class B, \$9 for class C, \$6 for class D, and \$3 for class E land. Interest was at 6 percent. Because of difficulty in getting the project financed elsewhere, the bonds were bought by Pitt County. The schedule of payments provided for the debt to be paid off in 10 years. Interest only was collected in 1928 and 1929. Collection of the principal, which started in 1930, was to be completed by 1939. Some landowners, however, were late in completing payments, but by 1946 all payments had been made except for \$6.00. Present assets of the district are \$1,600, of which \$1,000 is in a United States Government bond and \$600 is in a local bank.

The original assessment included a 10 percent allowance for maintenance as provided by State law. Shrubbing and removal of stumps from the channel has been done two or three times since the canal was dug.

Additional work is needed to restore the canal to good working condition. Insufficient funds are available to do such work. Making a reassessment is difficult and time-consuming. Thus, maintenance of the canal is a continuing need that is not adequately met. This is a problem common to many organized drainage districts.

The Broad Creek Drainage District, which includes a part of Pantego Township in Beaufort County, has been a successful drainage district. Canal construction started in 1913 for the district, which then included 20,514 acres. A main canal about 4 miles long and 36 miles of laterals were dug at a cost of \$98,000. Payment on the bonds was completed in 1935. In 1920, the canals were partially cleaned out.

In 1948, the landowners in the Broad Creek Drainage District were called together in a public meeting. It was decided at that meeting that canals should be redug. The Drainage Commissioners, who are elected by the landowners with each acre having 1 vote, proceeded to have the canals redug at a cost of approximately \$105,000, of which \$70,000 was paid in cash, leaving about \$35,000 in bonds to be paid off. Most of these bonds have since been retired.

A new assessment will be necessary to shrub and clean out the canals. One commissioner pointed out that assessment of landowners for doing this work will be cumbersome. He feels that each property owner should be responsible for shrubbing along his own land, thus eliminating the need for formal action by the district. A typical instance of the need for this work is shown in the photograph below.

In Robeson County, Back Swamp Canal, which is one of four drainage districts organized in that county in the 1927-30 period, affects a part of Alfordsville Township. This drainage district is not now active.

The organized drainage districts described have provided the necessary outlets for much of the farm or field drainage subsequently carried out in these localities. Without them, adequate field drainage would not have been possible for many farms. Yet, despite the contribution to land development made by organized drainage districts and other group efforts, there is still need for adequate outlets for field ditching and tiling in many parts of eastern North Carolina. Agricultural progress in this part of the State will be closely related to the solutions that are found for this problem. Several landowners, contractors, and others stated that more effective drainage of agricultural land might be obtained if more public money were spent in developing necessary outlets rather than in providing aid to farmers in carrying out field drainage on their farms. The photographs on pages 32 and 33 illustrate the serious need for cleaning out standing trees, fallen logs, and stumps in main outlet channels, as well as for deepening of these channels.



BN - 11370-x

Maintenance of ditches and canals is vital to the effective operation of drainage enterprises.



BN - 11369-x



BN - 11354-x

Main outlet channels through forested areas need special attention in order to provide free movement of water. A channel in need of clearing and one recently cleared are shown above.

Group Drainage

In recent years, farmers have made frequent use of Federal cost-sharing arrangements under the Agricultural Conservation Program and of technical assistance available from the Soil Conservation Service to carry out drainage operations requiring the cooperation of two or more landowners. No legal corporation of landowners, such as is required by State law for an organized drainage district, is needed.

During the calendar year 1953, group drainage jobs completed in North Carolina numbered 175. These group jobs benefited 799 farms and 42,000 acres. As of December 31, 1953, a total of 1,198 group jobs had been completed in North Carolina, with 7,624 farms and 545,000 acres benefited. Thus, on the average, about 6 farmers cooperated on each group job. The average acreage benefited per job was 455 acres.

The total cost of the 1,198 group jobs that had been done as of December 31, 1953, was \$2,624,876. This was an average cost of about \$2,200 per job and \$4.80 per acre benefited.

In the four townships in which drainage developments were studied in detail, participation in 19 group jobs from 1950 to 1957 was reported by the farmers interviewed. Altogether, 72 landowners participated in these 19 jobs. A total of 113,000 feet of outlet ditching was provided at a cost of about \$40,000. The average cost per linear foot was 35 cents and the average cost per mile was approximately \$1,900. This included the cost of clearing a right-of-way through wooded areas, as well as the cost of digging. Examples of outlet ditches being dug through the group efforts described are shown on page 35.

Canals dug through this type of cooperative effort have permitted the installation of field drainage by many farmers who could not have done so otherwise. For others, existing field drainage was made more effective. As participation must be voluntary for a group job to be eligible for ACP payments, fewer landowners and a smaller acreage are usually involved than for an organized drainage enterprise. In most instances, however, the individual landowners could not have completed the jobs. Cost-sharing arrangements are worked out by the farmers before the job is undertaken. The Soil Conservation Service designs the system, makes cost estimates, and inspects the completed work.

Farm Drainage

As used in the study reported, farm drainage includes the part of the drainage system that is on or borders the farm, except for main canals or natural streams. The farmer usually pays for these drainage works. If eligible, he usually seeks direct financial assistance from the Agricultural Conservation Program Service and technical assistance from the Soil Conservation Service. In general, farm drainage consists of two types of improvements – outlet drainage and field drainage. Outlet ditches or laterals are the drains that collect the water from the field drains and transport it to the main canals or to natural or improved stream channels. An outlet ditch may serve more than one farm. If more than one landowner is involved, a group drainage agreement may be worked out under the Agricultural Conservation Program. Field drainage provides for removal of excess surface water from the fields and for internal drainage. Field drainage is usually provided either by open ditches or by tile drains.



BN - 11368-x



BN - 11362-x

Many outlet ditches are being dug through voluntary cooperation among landowners. Fallen logs in ditches such as shown in the lower photograph can soon cause trouble.

Outlet drainage. - Properly designed and constructed outlet ditches are vital to an efficient drainage system. An effective outlet ditch should carry away surplus water quickly, permitting the land to be worked early in the spring. The ditch should be deep enough to drain all low areas. If it is to serve as an outlet for a tile drain, it should be deep enough so that the bottom of the tile outlet is 1 to 1 1/2 feet above low water flow. The ditch bank should have a slope varying in feet from 1 1/2:1 to 1:1 depending upon soil type. Generally, draglines equipped with regular-type buckets of three-fourths of 1 cubic yard or 1 cubic yard capacity are used in digging outlet ditches.

In order to provide proper outlets, ditches were dug 5 to 5 1/2 feet deep in Pitt County, where most ditches are dug to furnish adequate outlets for tile drains. A ditch dug to a depth of only 4 to 4 1/2 feet may not be deep enough to permit future tying in of tile drains.

Costs of digging outlet ditches on 27 farms in the four selected townships in Robeson, Pitt, and Beaufort Counties are shown in table 6. These costs are for those ditches dug between 1950 and 1957. Excavation costs only are shown in table 9. For the 34 miles of outlet ditching, the average excavation cost per mile was \$1,375. Farmers who reported costs of spreading spoil indicated that this cost would amount to about \$100 per mile. The cost of clearing the right-of-way, when such clearing was necessary, varied considerably with the kind of cover to be cleared. For a right-of-way 50 feet wide, approximately 6 acres per mile would need to be cleared. If a clearing cost of \$150 per acre is assumed, \$900 per mile for right-of-way clearing would be needed. Based on the costs reported by these farmers, outlet ditches thus cost from about \$1,500 per mile for those dug on open land to about \$2,400 per mile for those dug through wooded areas.

Table 9. - Extent and cost of digging outlet ditches on selected farms, 4 townships in Robeson, Pitt, and Beaufort Counties, N. C., 1950-57

Township	Number of feet dug <u>1/</u>	Total cost <u>2/</u>	Cost per foot <u>2/</u>	Farms on which outlet ditches were dug
	<u>Feet</u>	<u>Dollars</u>	<u>Dollars</u>	<u>Number</u>
Alfordsville -----	57,642	18,446	0.32	3
Farmville-----	5,220	1,085	.21	3
Long Acre -----	13,310	3,137	.24	11
Pantego-----	104,364	23,915	.23	10
Total or average -----	180,536	46,583	.26	27

1/ Includes only the footage reported dug from 1950 to 1957.

2/ Does not include cost of spreading spoil and right-of-way clearing.

Estimates obtained from contractors and Soil Conservation Service technicians working in several counties in eastern North Carolina indicate that the cost of outlet ditching averaged about \$1,800 per mile. This included the cost of excavation, spreading of spoil, and some right-of-way clearing. Costs reported by these contractors and technicians ranged from \$1,100 to \$2,500 per mile. The cost varied from 20 to 35 cents per cubic yard with an average of 24 cents for excavation, spreading of spoil, and some right-of-way clearing.

The maximum Federal cost-sharing permitted in North Carolina under the 1957 Agricultural Conservation Program was 10 cents per cubic yard of material moved. Contractors operating draglines and farmers having dragline work done in Beaufort, Pitt, and Robeson Counties, where interviews were obtained, reported charges for dragline work at about 15 cents per cubic yard of material moved in digging outlet ditches with a regular-type bucket in open fields. Contractors stated that they usually charged about 3 cents more per cubic yard for dragline work in wooded areas, where the right-of-way had been cleared but stumps remained for removal by the dragline. Some dragline operators also charged about \$0.2 more per cubic yard when under very wet conditions, it was necessary for the dragline to work on mats.

In general, the cost of providing outlet ditching was highest in the middle Coastal Plain because the ditches were dug deeper to provide adequate outlets for tile drains.

Field drainage. - In eastern North Carolina, tile drains and open ditches are both used to drain farmland.

On the 88 farms selected in four townships in Robeson, Pitt, and Beaufort Counties for detailed study, open field ditches and tile drains were installed on a total of about 8,500 acres from 1950 to 1957 inclusive (table 10). Thus for these farms, drainage was at the rate of about 1,000 acres per year. The 8,500 acres affected by drainage improvements accounted for a fifth of the total acreage and for a third of the open or nonforested acreage on the selected farms.

Table 10. - Acreage reported drained on selected farms, 4 townships in Robeson, Pitt, and Beaufort Counties, N. C., 1950-57

Type of drainage	Townships				Total
	Alfordsville	Farmville	Long Acre	Pantego	
	Acres	Acres	Acres	Acres	Acres
Open field ditches ----	0	207	660	6,026	6,893
Regular bucket-----	0	173	42	16	231
V-bucket-----	0	16	608	6,010	6,634
Hand-dug-----	0	18	10	0	28
Tile drains-----	1,069	531	22	0	1,622
Total or average--	1,069	738	682	6,026	8,515

Part of the drainage improvements were made on land that was being cleared for crops and pasture. Nearly all of the land drained on the selected farms in Pantego Township, Beaufort County, was cleared of stumps, buried logs, and some standing trees at the time drainage improvements were made. The initial job in developing some of this land is to "open up" the fields to be improved by putting in about half the ditches before clearing is started. This is done so that bulldozers and tractor-drawn equipment can be used in the land-clearing operations and to permit the wetting and drying process to speed up the rotting of buried roots and limbs.

Tile drains. - During the 7 years covered in the study of the 88 selected farms, 1,622 acres were reported drained by tile. This was about a fifth of the total acreage drained on these farms during the period. Most of this tile drainage was in Pitt and Robeson Counties. Very little tile had been laid in Beaufort County. There are two main reasons for this: (1) It is not economically feasible for the crops usually produced and (2) grade and outlets are inadequate. In Pitt and Robeson Counties, farmers were installing tile in fields where tobacco is frequently grown to lessen the possibility of losing even a small part of this valuable crop because of wetness. Tile is also being installed in large, newly cleared fields and in existing cultivated fields where low spots need to be drained in order to make efficient use of tractor-drawn machinery. Tile is also replacing old field ditches to permit more effective use of tractors.

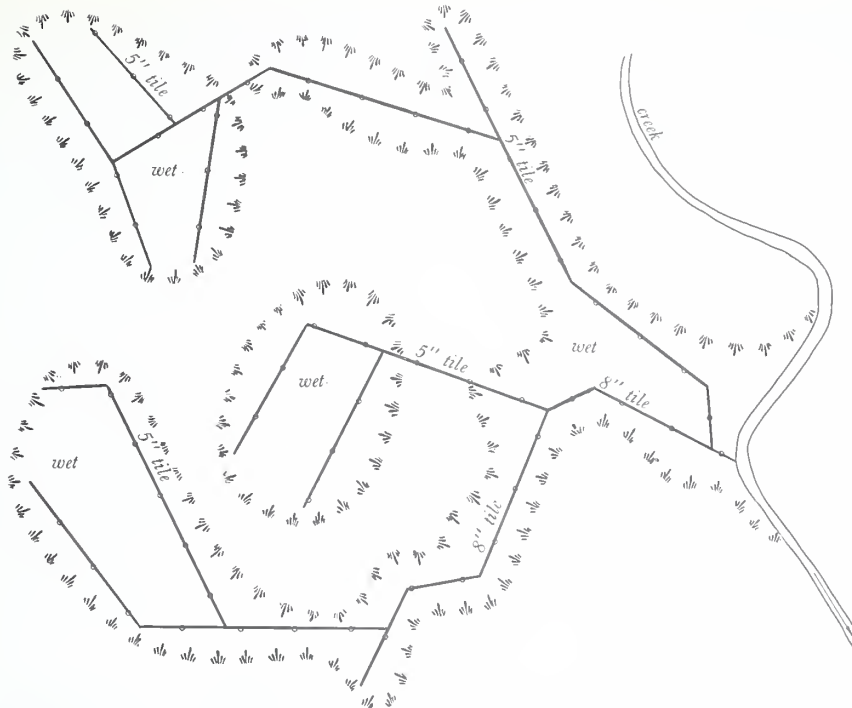
Tile is laid in order to provide complete drainage for fields that are uniformly wet. For most of these complete tile systems in eastern North Carolina, the spacing is 100 feet between lines except on the heavier soils where it is reduced to 75 to 80 feet. With lines spaced 100 feet apart, it takes about 400 feet of tile to drain an acre of land.

In other fields, tile drains are installed mainly to drain wet spots. This type of installation is often referred to as random or spot drainage. Much of the tile drainage carried out on the farms where interviews were conducted was of this type. In order to accomplish this spot or random drainage, about 200 feet of tile per acre is usually needed, according to plans provided farmers by the Soil Conservation Service in eastern North Carolina. The diagram on page 39 illustrates the random method of installing tile drainage. Some of the farmers interviewed had installed only part of the tile they actually needed in a field. They had taken care of the critical areas but hoped to be able to add more later to complete the job as planned by the Soil Conservation Service.

The Soil Conservation Service recommends that in eastern North Carolina, the tile be placed 3 to 4 feet below the surface in the low areas of the field to be drained. Most farmers install 6-inch tile drains except for mains or larger systems where 8-inch tile is required for the greater capacity needed.

Most farmers contract to have their tile laid by a company or individual owning a power-operated trenching machine. Wheel-excavator-type trenching machines, such as the one pictured on page 39, are used to install tile drainage in Pitt, Robeson, and Beaufort Counties. Only two farmers reported installing tile by hand trenching, and only a very small amount was installed on their farms. The general practice in these counties is for the contractor to operate the trenching machine with 1 or 2 men. Each farmer also furnishes several men to lay the tile in the trench.

RANDOM TILE SYSTEM



BN - 11350-x

Tile spaced at random to drain wet spots in fields is the most common use of tile in eastern north Carolina. Some fields are drained by tile spaced at regular intervals.



BN - 11353-x

Nearly all tile is now being installed after a trench has been dug with a wheel-excavator-type trenching machine.

From 1950 to 1957, approximately 330,000 feet of tile drains were installed on 45 of the 88 farms on which interviews were made in the four townships in Robeson, Pitt, and Beaufort Counties. Most of this tile was installed in Pitt and Robeson Counties, as only 2 of 31 farmers interviewed in Beaufort County reported installing tile. More than 2 million feet of tile has been installed in Pitt County. This county was among the early counties in eastern North Carolina to make extensive use of tile drainage. The extent of tile drainage carried out on the farms where interviews were made is shown in table 11. More than \$100,000 was spent on tile drainage on these farms during this period. The amount installed on any one farm varied from thousands of feet to only a few hundred.

From 1950 to 1957, the cost of installing tile drainage averaged 31 cents per foot on the 45 farms on which the drains were installed. Costs were from 2 to 4 cents higher per foot at the end than at the beginning of the period. This was due to an increase in the cost of the tile and other materials and to increases in local labor costs. Cost of tiling was less in Alfordsville Township, Robeson County, mainly because of the large-scale operation used in installing much of the tile in that area. In Long Acre Township, Beaufort County, costs were higher because a trenching machine had to be brought in from Pitt County and because of a higher delivery price on tile.

Cost of materials accounted for slightly more than half the total costs. This included the cost of the tile, which ranged from 14 to 16 cents a foot for 6-inch tile. Other materials used were paper for covering the joints, Y's, elbows, and masonry. "Orangeburg" or similar pipe or sometimes corrugated metal pipe is used for the

Table 11. - Extent and cost of tile drainage on selected farms, 4 townships in Robeson, Pitt, and Beaufort Counties, N. C., 1950-57

Township	Acreage reported drained	Farms on which tile was installed	Footage installed		Cost		
			Total	Per acre drained	Total	Per acre	Average per foot
	Acres	Number	Feet	Feet	Dollars	Dollars	Dollars
Alfordsville	1,069	15	205,606	192	61,552	57.58	0.30
Farmville	531	28	117,521	221	38,035	71.63	.32
Long Acre	22	2	4,600	209	1,522	69.18	.33
Pantego	0	0	0	0	0	0	0
Total or average	1,622	45	327,727	202	101,109	62.34	.31

1/ Estimates of the acreage drained by random tiling were those made by the farmers and Soil Conservation Service technicians.

2/ Average is for the 8-year period. Costs were about 2 to 4 cents higher at the end of this period.

outlet. Digging the trench, distributing the tile to the field, laying the tile, and backfilling the trench accounted for other costs. The cost of digging the trench ranged from 10 to 12 cents a foot with 12 cents more common in recent years. Cost of distributing and laying tile averaged 4 cents per foot. Cost of backfilling was a cent a foot. A farm tractor with a small blade mounted in front (as illustrated below) or a small bulldozer is generally used for backfilling. Contractors generally dig the trench and backfill it and make a single charge for these two operations.

Per acre costs of installing drain tile vary appreciably. In part, this is related to the degree of drainage desired by the farmer. The cost of tiling is not as high for random drainage of wet spots in a field as for complete field drainage. It must be pointed out also that a farmer may not be financially able to install at one time as much tile as he may need to drain a piece of land effectively.

For the 45 farms on which tile drainage was installed from 1950 to 1957, the overall average was \$62 per acre for the four townships in Robeson, Pitt, and Beaufort Counties. Among the townships, some variations in per acre costs were reported. Farmers interviewed in Alfordsville Township, Robeson County, reported \$58 as the average per acre cost, while in Farmville Township, Pitt County, per acre costs of \$72 were reported. On two farms in Long Acre Township in Beaufort County, the costs were \$69 per acre. Much of the tile drainage reported on these farms was of the random type, and therefore the cost is lower than average for fields on which complete tile drainage has been installed.



Oh - 60662 (SCS)

Refilling the trench after the tile has been laid is a simple operation completed by use of a farm tractor equipped with a small blade.

Estimates of per acre costs of tile drainage made in 1956 by Soil Conservation Service personnel working in eastern North Carolina indicate that for class IIw land, the average cost is about \$100 per acre. Class IIw land is good land from an all-round standpoint, but it is naturally wet and requires drainage. Costs of draining this kind of land ranged from \$20 to \$200, chiefly because random or spot drainage was installed in some fields and complete drainage was used in others. The cost of draining classes IIIw and IVw land averaged \$160 per acre, according to estimates made by these SCS technicians.

In 1957, the maximum Federal share of the cost in North Carolina was 18 cents per linear foot for 6-inch tile. For 8-inch tile, the Federal payment was 25 cents per linear foot. Prior to 1957, the Federal share was 11 cents per linear foot. No Federal cost sharing is allowed for repairing or maintaining existing drains. To qualify for payment, the tile drainage must be installed on farmland with soil types that respond well to tile drainage and are suitable for cultivated crops, pasture, or improved meadows. This limitation is an important factor in orienting land development in the Coastal Plain, as it helps to prevent drainage of land that would not be suitable for agricultural production.

In addition to the ACP payment made to farmers for the practice of tile drainage, the Soil Conservation Service is responsible for determining the need, designing the layout, assisting the farmer in staking and surveying, supervising the installations, and making the final check.

Open ditches. - Among the counties in which observations were made, most of the field drainage by open ditching was being done in Beaufort County, although about 200 acres had been drained by open ditches in Farmville Township, Pitt County (table 12). In Beaufort County, nearly 700 acres in Long Acre Township and about 6,000 acres in Pantego Township were drained by open ditches.

Field ditches dug from 1950 to 1957 by draglines equipped with V-buckets were reported on 31 of the 88 farms on which interviews were made. Regular bucket field ditches totaling 4 miles were reported on 12 farms. But nearly 200 miles of V-bucket ditching was reported on the 31 farms on which such ditches were installed.

Most of the field ditching in Beaufort County was done by draglines equipped with V-buckets. About 20 draglines operated in Beaufort County in 1957 and 1958. Several landowners have their own draglines. In addition to their own ditching, they do custom work for other farmers. Most of the contract work is done by the hour. The prevailing rate in Beaufort County was \$12 per hour. An alternative method of charging is by the cubic yard. In 1958, the most commonly quoted rate was 15 cents per cubic yard. It takes from 8 to 13 hours or more to dig a half-mile of V-bucket ditch. This amounts to about \$100 to \$150 per half-mile of ditch. It takes considerably longer to dig ditches on new land than on land previously ditched and cropped.

The V-bucket has been widely used for field ditching in the Tidewater counties in recent years. The V-bucket ditch has a bottom that is usually about 18 to 20 inches wide. It has a side slope of 1/2 or 3/4 to 1 and is usually 3 to 4 feet deep. The dragline equipped with a V-bucket and a V-bucket ditch are shown in the photographs on page 44.

Table 12.- Open field ditches dug on selected farms, 4 townships in Robeson, Pitt, and Beaufort Counties, N. C., 1950-57

Township	Acreage reported drained <u>1/</u>		Farms reporting <u>1/</u>		Linear feet dug <u>2/</u>	
	Regular bucket	V-bucket	Regular bucket	V-bucket	Regular bucket	V-bucket
	Acres	Acres	Number	Number	Feet	Feet
Alfordsville-----	0	0	0	0	0	0
Farmville -----	173	16	8	1	9,885	1,900
Long Acre -----	42	608	3	19	8,750	87,848
Pantego -----	16	6,010	1	11	2,640	933,550
Total -----	231	6,634	12	31	21,275	1,023,298

1/ Excludes 28 acres drained on 2 farms by ditches dug by hand.

2/ Excludes 1 farm for which information was not available.

Ditches are dug at varying distances apart, depending upon how the particular soil responds to ditching. On the farms in Pantego Township, the ditches were cut about 330 feet apart from center to center. Ditches were generally a half-mile long. Thus, there were about 17 to 18 acres of tillable land per "cut," which is the area lying between two field ditches. Some of the older cuts contained only about 15 acres or less. In the photograph on page 45, the typical size and arrangement of cuts are shown on an aerial photograph.

Costs for digging V-bucket field ditches varied mainly between those dug on new-land fields and those dug on land already cropped. In new-land areas, roots and other underground obstructions were often encountered. In new-land areas in some instances, the dragline had to be operated on mats.

Some dragline operators reported digging ditches in established farming areas in Pantego Township, Beaufort County, for about \$100 a half-mile. For other dragline operators who had dug ditches on new land, estimated costs ranged from \$150 to \$200 for a half-mile ditch. Custom rates of \$12 per hour were generally applicable to both areas.

Costs reported for V-bucket field ditches amounted to about \$11 or \$12 per acre for those ditches dug between 1950 and 1957 on farms in Beaufort and Pitt Counties from which information on ditching costs was supplied. This includes an excavation cost of \$10.60 per acre, as shown in table 13, plus a cost of about a dollar per acre for spreading the spoil banks.



NC - D17-79 (SCS)



BN - 11395-x

A dragline equipped with a V-bucket and a ditch dug with such a bucket are shown above.

Table 13. - Cost of digging field ditches on selected farms, 4 townships in Robeson, Pitt, and Beaufort Counties, N. C., 1950-57

Township	Total cost <u>1/</u>		Cost per acre <u>1/</u>		Cost per foot <u>1/</u>	
	Regular	V-	Regular	V-	Regular	V-
	bucket	bucket	bucket	bucket	bucket	bucket
	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
Alfordsville-----	0	0	0	0	0	0
Farmville -----	2,202	150	12.70	9.40	.22	.08
Long Acre -----	1,014	6,308	24.10	10.40	.12	.07
Pantego -----	225	64,071	14.10	10.70	.09	.07
Total or average --	3,441	70,529	14.90	10.60	.16	.07

1/ Does not include cost of spreading spoil banks.



BN - 5292-x

This airphoto taken in Beaufort County shows the pattern and interval between the "cuts" made to provide drainage by use of open ditches.

When the cost of digging and spreading the spoil banks of 2 lateral ditches needed as outlets for the field ditches draining a section of land (640 acres) was added to the cost of field ditching, the cost of draining reported by farmers in Pantego Township amounted to about \$20 to \$22 per acre. Neither group drainage costs nor the cost of main canals dug in organized drainage districts are included. Another \$5 to \$10 per acre should be allowed for these costs, making the total cost of draining land for farming in Pantego Township about \$25 to \$30 per acre. These estimates do not include the costs of clearing the land.

Field estimates made by the Soil Conservation Service in several counties of eastern North Carolina show that on the average about \$19 per acre is needed to provide open-ditch drainage on class IIw land. The average cost of providing this drainage on class IIIw land is about \$26 per acre and on class IVw land the average would be about \$35 per acre. When the land is to be used for pasture rather than for crop production, the average cost for open-ditch drainage is estimated at about \$20 per acre for land in capability classes IIIw and IVw.

Under the 1957 Agricultural Conservation Program, the maximum Federal share of costs of open-field ditching was 10 cents per cubic yard of material moved. Drainage ditches constructed with such assistance had to be for the purpose of draining cropland and pasture. Federal cost-sharing for ditches constructed through wooded areas was not permitted unless the ditches were dug specifically to provide an outlet for crop or pasture land above the ditch.

The Soil Conservation Service is responsible for rendering technical assistance to farmers, so that specified standards relative to grade, depth, side slope, and other requirements will be met. Ditches must be provided with adequate outlets. The Soil Conservation Service must also determine that the land to be drained is of a capability to justify the cost of drainage. Federal cost-sharing is not allowed for cleaning out existing ditches.

Benefits From Drainage

Several benefits are derived from the drainage of agricultural land in the areas of eastern North Carolina selected for study. It must first be emphasized that much of the land currently cleared for agricultural uses requires artificial drainage if it is to be used profitably for crops and pasture. None of the land being developed in Pantego Township, Beaufort County, could be used profitably for crops without drainage. In the other three selected townships, some of the land required drainage before use for agriculture.

On other tracts on which some agricultural use had already been made of the land, crop yields were increased by drainage. Exact information as to the increase in yields that actually occurred could not be obtained within the framework of the study. Some farmers reported yield improvements on corn amounting to 10 to 15 bushels per acre. In practically all instances, the assurance of having a crop was strongly emphasized by those interviewed as one of the principal benefits of drainage. This assurance was particularly stressed as a benefit by those farmers who had recently put in drain tile to eliminate wet spots in fields used for tobacco. In the production of this high-value crop on a limited acreage controlled by allotment, it is

especially important to have the land on which the main cash crop is planted free from the hazard of damage from standing water during rainy periods. As tobacco is usually planted on the better drained soils, the farmer who drains fields used for tobacco is concerned with spot or random rather than complete drainage.

Additional advantages or benefits of tile drainage were also stressed by the farmers interviewed. It was pointed out by most farmers who were replacing open field ditches with tile drains that a considerable saving of land resulted from the replacement. Open ditches through cultivated fields, along with the necessary area for turning on each side of the ditch, generally meant that a strip about 20 feet wide was not available for crop use. If such a ditch was in a field suited to tobacco production, this loss of good tobacco land was an important factor in favor of putting in tile drainage and filling up the open ditches in such fields.

In addition to making more land available for crop use, farmers also stressed the greater efficiency with which tractor-drawn equipment could be operated in fields where tile drainage had replaced open ditches. Larger fields and elimination of short rows are advantages when tractors are used. More efficient application of fertilizer is also possible on longer rows and in larger fields. It has also been observed that tile does a better and more efficient job of field drainage than open ditches.

The cost of maintaining drainage works is reduced when open field ditches are replaced by tile drains. Cleaning out and "shrubbing" open field ditches is often neglected. The impairment of efficient drainage that results from this neglect frequently affects crops adversely. This is another advantage of tile drainage.



Growth Through Agricultural Progress

