To the Graduate Council:

I am submitting herewith a thesis written by Lanny Wayne Hass entitled "The Impact of Land Ownership Characteristics on Soil Erosion in Tennessee." I have examined the final copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Agricultural Economics.

Thomas D. Klindt

Thomas H. Klindt, Major Professor

We have read this thesis
and recommend its acceptance:

Don L McLemore

Luther H Keller

Accepted for the Council:

L Evans Roth

Vice Chancellor
Graduate Studies and Research

THE IMPACT OF LAND OWNERSHIP CHARACTERISTICS ON SOIL EROSION IN TENNESSEE

A Thesis

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Degree

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Lanny Wayne Hass

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ABSTRACT

Soil erosion from agricultural land has caused concern over public costs associated with water pollution and long term degradation of the land resource. Such concerns have led to public intervention directed toward reducing soil erosion from agricultural land. Variation exists to the degree to which soil is allowed, through management decisions, to erode among tracts of land. If soil erosion rates on agricultural land are associated with ownership characteristics, then it is possible that efficiency in public policy could be enhanced through targeting of policy instruments on owners with specific characteristics. Accordingly, the general purpose of this study was to examine the relationship between landownership characteristics and soil erosion on agricultural land. Specific objectives were to: (1) determine socioeconomic and landholding characteristics of private landowners in Tennessee during 1978; (2) evaluate the relationship between cropland owner characteristics and management practices associated with soil erosion in Tennessee; and (3) indicate and evaluate conservation needs for Tennessee land uses.

Data were obtained from the National Resource Inventory conducted during 1977 by the Soil Conservation Service and the 1978 follow-up Landownership Survey conducted by the Natural Resources Economics Division of the United States Department of Agriculture.

There were 24.7 million acres of privately owned land in Tennessee, of which 3.9 million acres were cropland, 6.4 million acres were pasture, 13.7 million acres were forest, and 0.5 million acres were in "other" uses. On 21 million acres, estimated soil loss was

5 or fewer tons per acre per year (t/a/y). Cropland accounted for most of the land on which soil loss was greater than 5 t/a/y. On cropland, estimated soil loss was 20.5 t/a/y while the soil loss tolerance was 4.3 t/a/y.

The most commonly used conservation practices were contour farming, followed closely by crop residue cover. In terms of conservation practice needs, 1.5 million acres of cropland, including hay, was treated adequately in terms of soil conservation. Almost 3.2 million acres needed additional erosion control. On pastureland, no treatment was needed on 15 percent of the acreage. However, almost 72 percent of the pastureland in Tennessee needed to have vegetation established. A significant amount of forestland which was not grazed needed timber stand improvement.

To evaluate the relationship between landownership characteristics and soil erosion rates, regression analysis was used. The estimated soil loss in t/a/y was the dependent variable while selected owner characteristics were independent variables. In general, few significant relationships between dependent and independent variables were discovered.

Findings of this research provide little guidance in targeting soil conservation policy instruments on landowner characteristics.

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CHAPTER I

INTRODUCTION, OBJECTIVES, AND STUDY PROCEDURE

Introduction

Soil erosion may be defined as the natural process by which the land surface is worn away by wind and water (4, pp. 581-608). When topsoil has normal ground cover, the erosion process is typically so slow as to be nearly imperceptable (4, p. 583). Under such conditions, the slow breakdown of aggregates and production of organic matter can normally replenish the topsoil cover. However, soil erosion can be accelerated by changes in natural cover or ground conditions (10, p. 8). These changes can create a situation where the topsoil of a specific area is in deficit of its natural production process (i.e., there is more soil lost than produced).

One of the contributing activities in accelerating the rate of soil erosion has been man's involvement in agricultural production. Under a traditional tillage management practice, ground cover is removed for a portion of the year, usually during abundant rainfall periods (i.e., spring and summer), which exposes the soil to erosive forces. Moreover, crops typically provide a ground cover that is relatively sparse. The result of such practices in the past has been a rate of soil loss from cropland in excess of the rate of natural soil production (14). Nationwide, soil erosion from cropland has been estimated to be 10 tons per acre per year (t/a/y) (10, p. 8). In the western portion of Tennessee, where soil characteristics are conducive

to relatively high rates of erosion, soil loss rates have been estimated to average 30 t/a/y and be as high as 120 t/a/y on selected parcels of farmland (7, p. 17). These levels have been above what is considered "safe"[1] and provides a justifiable cause for concern.

Identifying the Problem

In Tennessee, most soil erosion is associated with forces of water, rather than wind. When raindrops strike uncovered soil, particles may be loosened and carried away in runoff. In addition, when runoff water concentrates in rivulets and/or gullies, additional soil can be washed away. The damages associated with these actions may be categorized as on-site and off-site (10, pp. 6-11).

On-site damages are those borne by the owner or user of the land on which the erosion occurred. Such damages include loss of the soil itself, loss of soil nutrients which implies loss of future soil productivity, and gullying which damages machinery during production.

Off-site damages are those borne by persons other than the owner or user of the tract on which erosion occurred, often the general public. Such damages include the effects of relatively unrestrained runoff on neighboring tracts (17). In addition, erosion from agricultural land has been the single largest cause of water pollution in the United States. It has been estimated that over 50 percent of the 4 billion t/a/y of nonpoint pollution in the United States stems from erosion of

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[1] While certain amounts of soil loss can be substained without any real danger to soil productivity, as a rule of thumb, most soil scientists believe that soil losses of less than 5 t/a/y on deep soils will not result in productivity losses (10, p. 8).

agricultural lands (10, p. 10). The sedimentation which accompanies erosion can cause silting of streams and reservoirs. Such sedimentation can result in drainage problems on fertile land, loss of wildlife, and increased dredging cost, just to mention a few (17, pp. 80-89).

The extent to which soil is eroded from a tract of land depends upon a number of factors. These factors have been incorporated into an equation used to estimate soil loss from a tract, given specific conditions (13, p. 9). The equation is referred to as the Universal Soil Loss Equation (USLE). Even though there has been and continues to be discussion surrounding the precision of specific estimates, the USLE is the most widely recognized empirical estimator of soil loss. For use in estimating average soil loss in tons per acre per year, the USLE incorporates five factors: rainfall (amount and intensity), soil erodibility, length and steepness of slope, cropping-management practices, and supporting conservation practices (13, p. 9). The first three factors are fixed physical characteristics of a site, while the latter two are alterable by management.

In a competitive environment, a profit maximizing landowner would, given site characteristics, manage land such that the discounted present value of the future returns would be maximized over his/her planning horizon (15, p. 2). Such management would imply a social optimum. In this environment, soil erosion rates in excess of soil generation would be attributable to the rate of discount, the capacity for land related production and/or the expected demand for such production. However, there exist imperfections in the socioeconomic environment so that rational soil management practices may diverge

from the optimum. Whether these management decisions are socially optimum, depends upon the socioeconomic environment of the landowner.

One source of imperfection in the competitive environment has already been noted. Off-site damages, or negative technological externalities, involve production costs which are not borne by the producer (17). These costs are not entered into the private entrepreneural decision calculus and therefore cannot be reflected in the market allocation of inputs. As a result, there exists a tendency toward greater than optimum rates of soil erosion.

Other market imperfections can influence management decisions related to soil erosion and on-site damages. Imperfect knowledge of the impact of prolonged soil erosion on soil productivity, of future relative prices of inputs and outputs, and of salvage values of the land resource can lead to an array of management decisions which, in the light of perfect knowledge, would be suboptimal.

If imperfections in knowledge and information were random, management decisions relating to soil erosion might be expected to yield a normal array of soil erosion rates greater than and less than the optimum. However, conservation practices tend to result in relatively certain near term costs and yield benefits in the future that are relatively uncertain. To the extent that entrepreneurs are risk averters, and discount uncertain benefits at a higher rate than the opportunity interest rate, suboptimal erosion rates may be biased toward a greater than optimum rate. Baumal suggests this higher discount rate is a "risk premium" that entrepreneurs demand (3, p. 179). In addition, limited capital availability may constrain entrepreneurs from investing in erosion control measures at a socially optimal rate (8, p. 945).

Another set of market imperfections broadly defined as institutional constraints, can lead to suboptimal management decisions related to soil erosion (5, p. 277). The institutional characteristics of landownership may have influence on these suboptimal management decisions. When land is owned under the institutional right of fee simple the owner of the land carries a bundle of rights that enables him to use his resources in almost unlimited fashion (5, p. 277). With these rights, under certain circumstances, the owner of the land could be led to exploit the stock resources of the land which depletes the future productivity of the land and may lead to suboptimality.

The above market imperfections do not establish the existence of erosion rates in excess of an optimum. Instead, they are cited to indicate the possibility that management decisions yielding nonoptimum erosion rates can exist in the agricultural industry.

Even though objective measures of detrimentally high levels of soil erosion are difficult to establish, legislative bodies have enacted proposals which serve as subjective measures for societal concern over high erosion rates. Many public programs directed toward soil conservation began in the 1930's under the Roosevelt administration. Programs since that time have largely been a combination of state and federal activities depending primarily on federal funding and voluntary cooperation of land users (7, pp. 17-39). Currently, some 34 programs dealing with soil and water conservation exist within the United States Department of Agriculture (22). Recent legislation includes the Soil and Water Conservation Act of 1977 (RCA) which called for the USDA to make continuing appraisals of the soil and water resources on nonfederal lands and develop a USDA program for soil and water conservation

in the United States (18). One of the concerns noted was maintenance of the soil resource of sufficient quantity and quality for the production of adequate food and fiber through the year 2030 (18, pp. 2-3). A further concern was water quality. The Act suggested that the USDA was to influence agricultural, silvicultural and land conversion activities to help meet state and national water quality objectives. The RCA analysis indicated that an effective soil and water conservation program was essential to prevent continuing degradation of the soil resource base through erosion and degradation of water quality from agricultural pollutants (18, pp. 1-2).

Another congressional mandate concerning soil conservation was Section 208 of the Federal Water Pollution Control Act of 1972 (20). The objective of this law was to restore and maintain the chemical, physical, and biological integrity of the nation's waters by 1983. Non-point pollution was one of the more important aspects of the law concerning agricultural lands. As noted previously, the largest single source of water pollution is runoff from agricultural lands (19).

Justification

For public policy concerning soil erosion to be effective, it must be directed toward those who utilize management practices conducive to soil erosion. In broad terms, this implies private owners of farmland, since more than 90 percent of the cropland and two-thirds of the pasture land in the United States is privately owned (16). However, it may be possible to further isolate those to whom policy instruments need to be directed. Research in Iowa has indicated that certain ownership characteristics such as tenure, age, education, and income are associated with resource uses conducive to soil erosion (5, 8, 9, 12).

However, a recent study conducted by Lee (15, p. 4), based on data from a national survey, suggested that ownership characteristics did not have a significant effect upon soil erosion. It was noted, however, that the Southeastern region appeared to be somewhat atypical, with several ownership characteristics being significantly associated with soil erosion. Lee suggested that further study was needed, probably on a state basis, to more accurately assess this relationship.

If certain landowners are more likely to make management decisions resulting in higher rates of soil erosion than others, then, the possibility exists that efficiency of public soil erosion control measures could be enhanced by targeting public policy instruments accordingly. A 1977 General Accounting Office report to Congress concluded that effective conservation policies may require identifying and seeking out landowners whose lands have critical erosion problems (via 15, p. 1). Even if landowner characteristics are unrelated to levels of soil erosion, information on ownership characteristics may provide information to aid in the incorporation of logical incentive measures in a general soil erosion control program.

Objectives

Consistent with the above justification, the objectives of this study were to:

1. Determine socioeconomic and landholding characteristics of private landowners in Tennessee during 1978.

2. Evaluate the relationship between cropland owner characteristics and management practices associated with soil erosion in Tennessee.

3. Indicate and evaluate conservation needs for Tennessee land uses.

Study Procedure

To meet these objectives, secondary data were used. The data were from a 1977 land and land use survey conducted by the Soil Conservation Service (SCS) and a 1978 survey of private landowners by the Economics and Statistics Service (ESCS) of the USDA. The source of data is more fully described in the next section.

Objective one was met by compiling descriptive statistics of landowner characteristics, land classes, and land uses in Tennessee. The second objective was met by using regression analysis in an effort to statistically associate selected farmland ownership characteristics with estimated rates of soil erosion. To meet objective three, information from the SCS survey concerning needed conservation practices were compiled and presented by land classes and selected ownership characteristics.

Data Description

The data used for this research were obtained from the Resource Economics Survey of 1978. This survey was composed of three interrelated surveys that were conducted by the USDA to gain knowledge about land resources in the United States. The first part was undertaken as the SCS's 1977 National Resource Inventory (NRI), and was concerned with the land, its use, cover, and physical characteristics. The second part dealt with characteristics of landowners and their relationship to the land. This survey was called the 1978 Landownership Survey

(LOS) and was conducted by the ESCS, USDA. The third and final part of the Resource Economics Survey consists of a series of follow-up surveys, subsamples of the LOS, to more closely identify and quantify owners' decisions to invest/disinvest in conservation measures, land clearing, drainage and cropland improvements or ownership transfers (6, p. 33).

The 1977 NRI used a subsample of the sample designed for the 1958 Conservation Needs Inventories (CNI). The CNI was a random sample of the nation's land area. Every county in the nation was included. Stratification of the land was on the basis of primary sampling units (PSU's) which were mostly 160 acres in size. Within each of the 70,000 PSU's selected, the SCS collected data on three randomly selected points to meet the NRI needs. The SCS provided the NRED with the names and addresses of the owners of the first point in each PSU of the NRI. Figure 1 shows a diagram of how the NRI, landownership, and follow-up surveys were related. A combination of mail, telephone, and personal interview data collection methods were used for the LOS. This approach was also employed for the follow-up surveys. Data collected in the ownership and follow-up surveys relate to features and practices on land owned in the county selected. Each data set from the follow-up surveys was matched with the ownership data which served as the reference center for all parts.

The landownership survey consisted of two phases; a mail-telephone phase with limited interviews, and a follow-up phase using telephone and personal interviews. A first and second mailing and telephone follow-up of nonrespondents was used for almost all of the sample points for which

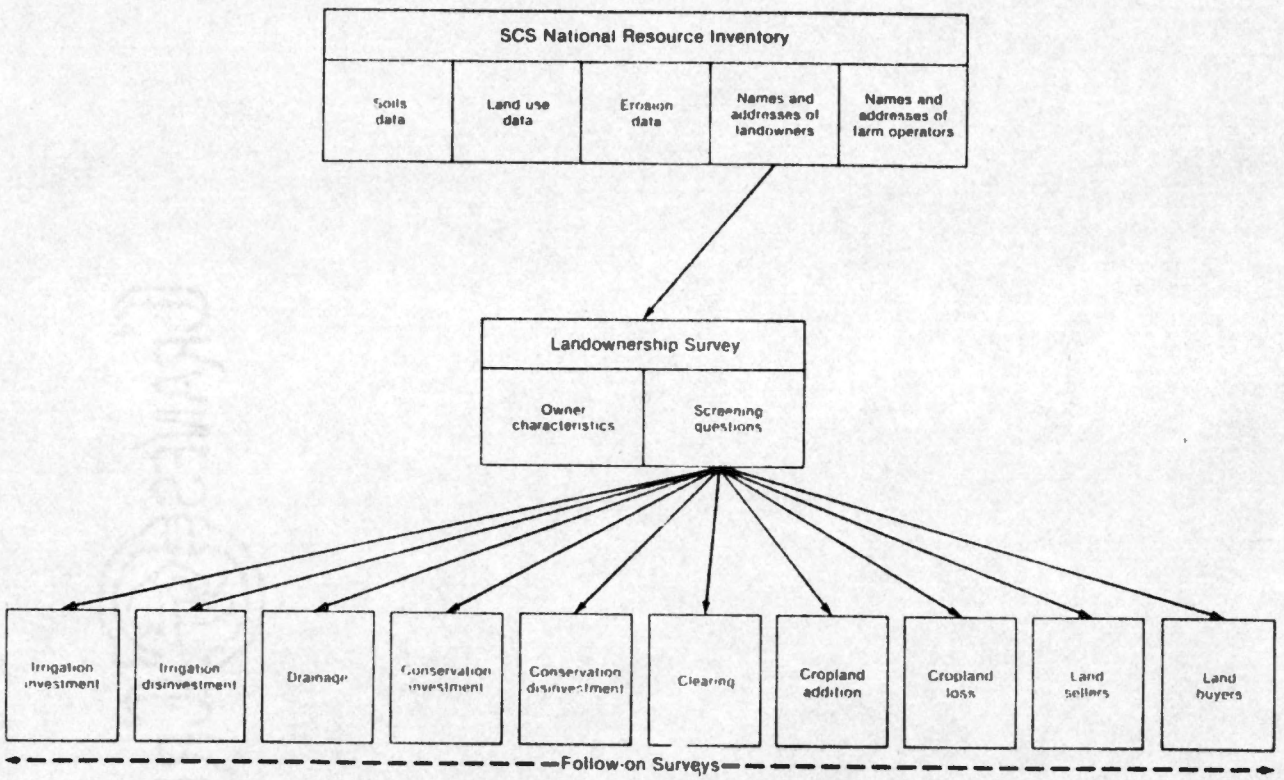


Figure 1. Relationship between National Resource Inventory Ownership Survey and Follow-Up Surveys (16, p. 34).

the owner's name and address were initially available. Sample points associated with owners of several tracts, owners known to be involved in other ESCS surveys, and owners known to be reluctant respondents were preselected for telephone or personal interview (16, p. 33).

Points not accounted for by mail or telephone completion or by preselection during the first phase of the survey were included in the follow-up phase. Almost 30,000 points with usable responses were accounted for in the first phase, while the remaining (28,000) were obtained in the follow-up phase.

The totals of the raw sample were expanded to predict values of the whole unit (160 acres). For expansions of acreage data, the probability of selection in the SCS sample was used as a base. The original SCS survey dated back to the 1958 CNI and the sampled PSU's accounted for 2 percent of the land area in the United States. The 1977 SCS survey sampled approximately one-third of the original PSU's. A common probability of selection for the survey was 1/144 or 0.006944. The expansion factor for a PSU was based on the probability of selection (PS), the acres in the PSU, and the acres in the reporting unit (R.U. = total acres owned in the county). The expansion factor (E.F.) was expressed as follows:

$$\text{E.F.} = \frac{1}{\text{P.S. of PSU}} \times \frac{\text{Acres in PSU}}{\text{Acres in R.U.}}$$

An example of how the expansion factor was calculated is given below. The P.S. for this PSU was 1/144, the size of the PSU is 160 acres, and the total land owned in the county by the owner is 800 acres. The owner was assumed to have acquired 450 acres through purchase from a non-relative, 250 acres through purchase from a relative, and 100 acres

through inheritance. Expansions would be as follows:

--Purchased from a nonrelative

$$144 \times \frac{160}{800} \times 450 = 12{,}960 \text{ acres}$$

--Purchased from a relative

$$144 \times \frac{160}{800} \times 250 = 7{,}200 \text{ acres}$$

--Inheritance

$$144 \times \frac{160}{800} \times 100 = 2{,}880 \text{ acres}$$

--Total land owned

$$144 \times \frac{160}{800} \times 800 = 23{,}040$$

For expansion of data items displaying counts of numbers of ownership characteristics the same procedure was used. Each respondent was counted as one ownership unit at the county level and represented a number of owners equal to the size of the expansion factor, i.e., in the example above there would be approximately 29 owners represented ($144 \times \frac{160}{800}$). The smaller the amount of land owned in the county, the larger the expansion factor thus the larger the number of owners represented.

Since the LOS was conducted using a land area sample basis, the estimates of area are better than other items such as number of owners in the population. Due to the U. S. land being associated with farmland, estimates of farmland appear to be more plausible than other nonfarmland samples. Expanded estimates from the survey are reasonably compatible with other similar nation and state surveys (16, p. 34). For example, estimates reported in the Tennessee Census of Agriculture of 1978 is compared to the LOS below:

	Tennessee Census of Agriculture (21)	1978 LOS (16)
Total Land in Farms in TN	13.0 million acres	13.8 million acres
Total Row Crops Grown in 1978	4.2 million acres	4.0 million acres
Average Age of Farmers	51.5 years	50.2 years
Total Land in Tennessee	27.0 million acres	24.7 million acres

Differences in acreage estimates given by the Tennessee Abstract and the LOS data can be largely accounted for in public landholdings. The LOS data represented estimates of private landholdings; federal, state, and water-covered lands were not included. For example, from LOS data, acreage in Tennessee was 24.7 million acres while the Tennessee Census of Agriculture indicated that there were approximately 27 million acres in Tennessee (21). The 2.3 million acre difference stems primarily from federally owned land (1.36 million acres), land owned by the Tennessee Valley Authority (473,000 acres), and inland water (560,000 acres) (22).

The data used in this research deal with Tennessee lands only. There were 802 samples taken on Tennessee lands by the landownership survey. The expansion factors were reliable at the state level and every county in Tennessee had at least one sample unit. Out of the 802 samples taken, 122 samples indicated ownership of cropland in Tennessee. It was expected that this data would supply appropriate information to meet the study objectives.

CHAPTER II

LAND USE AND SOIL EROSION IN TENNESSEE

An inventory of selected uses and ownership characteristics of Tennessee land, together with soil loss estimates and conservation needs during 1978, is presented in this chapter. Although the presentation is descriptive in nature, ownership and tenure characteristics have been found in previous research to be associated with land use and soil loss (5, 8, 9, 12). To the extent that such associations exist, categorical descriptions can be useful in determining the order of magnitude of certain characteristics for use in targeting public policy.

Data are described in three sections of this chapter. The first section provides information on ownership characteristics by land use. In the second section, land use and ownership characteristics are presented by soil loss categories. The third section shows conservation needs for Tennessee as identified by the Soil Conservation Service (SCS).

Data used were from the National Resource Inventory conducted during 1977 by the SCS and the 1978 follow-up Land Ownership Survey (LOS) conducted by the Natural Resource Economics Division of the United States Department of Agriculture. Estimates from the data are in expanded form as described earlier. Accordingly, acreage figures represent estimates for the State as a whole.

Land Use in Tennessee

In this study, land was divided into four major categories for purposes of examining land uses by selected landholding and ownership

characteristics. The land use categories were crop, pasture, forest, and "other." The cropland class included all privately owned land on which crops such as corn, cotton, soybeans, and wheat were grown during 1978. The pasture class included open land which was used for pasture while the forest class included land upon which timber was growing, including timberland used for grazing. The "other" class included miscellaneous uses such as built-up areas, barren land, and private roads. While the "other" land class is reported in tables for purposes of maintaining a complete inventory, little comment is offered concerning ownership characteristics because of the small acreage involved and the nonspecific use of the land.

The total acreage in each of the four land use categories is presented in Table 1. Nearly 4.0 million acres, or about 16 percent of the land in Tennessee was utilized for crop production in 1978. Nearly 6.5 million acres, 26 percent of the total, was pastureland. The largest land use category was forestland which accounted for almost 13.8 million acres, or 56 percent of the land base.

Table 1. Total Acres by Land Use, Tennessee, 1978

Land Use	Acres
Cropland	3,967,965
Pasture	6,459,739
Forest	13,785,616
Other	554,265
Total	24,767,585

Source: Data were from the National Resource Inventory (NRI) of 1977 conducted by the Soil Conservation Service (SCS) and the Landownership Survey (LOS) conducted by the Economics, Statistics, and Cooperatives Service (ESCS).

Land Use by Type of Owner

Legal ownership of land can occur in many forms, ranging from sole proprietorships to public corporations. Many intermediate types of ownership involve the inclusion of family members only. The method by which land was held relates to the dispersion of ownership rights and control over land and therefore can influence operational efficiency in land use (1).

The number of acres in crop, pasture, forest and "other" land uses by type of ownership is shown in Table 2. The majority of the land in each of the four uses was held under sole proprietorships and family ownerships. These closely held ownership units accounted for 68 percent of the cropland, 87 percent of the pasture, 66 percent of the forest, and 60 percent of "other" land. Sole proprietorships and family ownerships accounted for almost 18 million acres in total.

The second most common type of ownership was partnerships, particularly partnerships with family members. Almost 17 percent of the cropland in Tennessee was owned in partnerships, with 13 percent being held in family partnerships. Approximately 8 percent of pastureland, 15 percent of forestland, and 6 percent of "other" land were owned in partnership.

Family corporations owned relatively little land in any land use. The greatest percentage of family corporation ownership among the four land uses was in cropland where almost 7 percent was held in family corporations with 10 or fewer stockholders.

The only instance in which there was substantial differences in the relative holdings of land among the land uses was by "other" or

Table 2. Land Use by Type of Owner, Tennessee, 1978

Type of Owner	Land Use							
	Cropland		Pasture		Forest		Other	
	Acres	%	Acres	%	Acres	%	Acres	%
Sole Proprietor	1,328,121	33.5	1,914,614	29.6	3,907,124	28.3	152,428	27.5
Family Ownership	1,360,083	34.3	3,701,517	57.3	5,240,030	38.0	182,784	33.0
Partnership with Family Members	509,950	12.9	406,867	6.3	1,658,102	12.0	16,783	3.0
Partnership with Nonfamily Members	158,374	4.0	135,801	2.1	370,746	2.7	16,783	3.0
Family Corporation	--	--	--	--	--	--	--	--
10 or Fewer Stockholders	267,799	6.7	145,244	2.2	446,565	3.2	0	0.0
More than 10 Stockholders	0	0.0	26,144	0.4	115,449	0.8	0	0.0
Unknown Number of Stockholders	0	0.0	26,121	0.4	92,459	0.7	25,199	4.5
Other Corporations	12,510	0.3	103,429	1.6	1,704,796	12.4	160,287	28.9
Other	331,127	0.3	0	0.0	225,308	1.6	0	0.0
Total	3,967,965	100.0	6,459,737	100.0	13,785,616	100.0	554,265	100.0

Source: Data were from the NRI of 1977 conducted by the SCS and the LOS of 1978 conducted by the ESCS.

nonfamily corporations. Relatively little cropland and pasture (0.3 and 1.6 percent, respectively) was held by such owners. However, 1.7 million acres or 12 percent of forestland was owned by nonfamily corporations while the comparable figure for "other" land was 29 percent.

The average size of holdings varied substantially among types of owners. Sold proprietorship and family ownership owned an average of 46 acres per unit. The average size of holding for partnerships was 168 acres while the comparable figure for family corporations was 987 acres. The largest average size of holding was for nonfamily corporations with 1,227 acres.

Size of Holdings by Land Use

The percentage distribution of the size of holdings by land use in Tennessee during 1978 is shown in Table 3. In each land use, the first column shows the percent of acreage held in the particular size class while the second column indicates the cumulative sum of the percentages by each land use.

The holding class between 260 and 499 acres comprised 22 percent of the total cropland acreage. Over one-half of the total cropland acreage was in holdings of 259 acres or less while over 70 percent was in holdings of less than 500 acres. Less than 10 percent of the cropland in Tennessee was in holdings of over 2,000 acres.

Almost 22 percent of the pastureland in Tennessee was in holdings between 10 and 49 acres. Approximately 50 percent of pastureland was in holdings of less than 140 acres, while less than 2 percent was in holdings of over 1,000 acres.

Table 3. Size of Holdings by Land Use, Tennessee, 1978.

Size of Holdings (acres)	Land Use							
	Crop		Pasture		Forest		Other	
	%	Cumulative %	%	Cumulative %	%	Cumulative %	%	Cumulative %
Less than 10	2.0	2.0	1.5	1.5	1.8	1.8	4.5	4.5
Between 10 and 49	6.9	8.9	21.9	23.4	12.8	14.6	6.5	11.0
50 and 69	12.3	21.2	7.2	30.6	5.8	20.4	2.3	13.3
70 and 99	5.7	26.9	9.6	40.2	6.9	27.3	3.5	16.8
100 and 139	12.7	39.6	10.1	50.3	8.7	36.0	12.4	29.2
149 and 179	5.5	45.1	7.2	57.5	9.1	45.1	12.2	41.4
180 and 259	5.6	50.7	12.5	70.0	7.3	52.4	3.0	44.4
260 and 499	22.4	73.1	16.0	86.0	13.4	65.8	15.4	59.8
500 and 999	10.3	83.4	10.5	96.5	7.3	73.1	7.6	67.4
1,000 and 1,999	5.8	89.2	1.6	98.1	6.0	79.1	7.7	75.1
2,000 and 2,999	1.7	90.9	0.8	98.9	1.6	80.7	2.6	77.7
3,000 and 4,999	3.0	93.9	0.7	99.6	5.4	86.1	0.0	77.7
5,000 and 9,999	6.1	100.0	0.0	99.6	2.9	89.0	0.0	77.7
10,000 or more	0.0	100.0	0.2	99.8	10.9	99.9	22.2	99.9

Source: Data were from the NRI conducted by the SCS and the LOS of 1978 conducted by the ESCS.

Over 50 percent of the forestland was in holdings of less than 260 acres. However, the holding class between 260 and 499 acres comprised the largest percentage (13.3 percent) of all identified size classes. Unlike crop and pastureland, a sizable portion (10.9 percent) of the forestland was in holdings of 10,000 acres or more. Almost 60 percent of land in "other" uses was in holdings of less than 500 acres. However, about 22 percent of such land was in holdings of 10,000 or more acres.

The figures in Table 3 indicate a substantial diversity in the size of land holdings in Tennessee. Part of the reason for such diversity may be the variation in geography and crop production which exists in Tennessee.

Leasing Characteristics and Land Use

The distribution of Tennessee land by leasing arrangements and land use is shown in Table 4. A little more than 50 percent of the cropland in Tennessee was rented to others during 1978. About two-thirds of the acreage rented was under a share lease. This type of lease was used for over 1 million acres of Tennessee cropland. Cash leasing was the other popular form of rental arrangement. Cash leases were used on about half as much cropland acreage as share leases. Case (6) has hypothesized that share leases are more often used because they spread risk between leasee and lessor.

As compared to cropland, more acres of pastureland were owned and operated as a farm (over 4 million acres), but less was rented farmland. A greater proportion of pasture was operated under a cash lease than a share lease.

Somewhat less than 4 million of the estimated 13 million acres of forestland was operated as farms. Of the forestland on farms, about 25 percent was leased; about 54 percent of the leased forestland was operated under a cash lease.

Table 4. Distribution of Farmland by Leasing Arrangements and Land Uses, Tennessee, 1978

Tenure Characteristics	Land Use			
	Crop	Pasture	Forest	Other
Percent of Owned Land				
Operated as a Farm	48.2	88.2	75.2	66.7
Rented to Others	51.8	11.8	24.8	33.3
Percent of Rented Land				
Under a Cash Lease	32.0	65.0	53.8	31.3
Under a Share Lease	67.1	34.0	41.7	68.7
Under Other Lease	1.0	1.0	4.5	0.0

Source: Data were from the NRI of 1977 conducted by the SCS and the LOS of 1978 conducted by the ESCS.

Acquisition and Land Use

Two sections which pertain to acquisition of land in Tennessee is shown in Table 5. The first section indicates methods of acquiring land by land use while the second section indicates when land was purchased by land use.

In general, the distribution of land in acquisition methods was similar across land uses. Most land was purchased from a nonrelative. Except for cropland, over 70 percent of the land in each use category was acquired by purchase. Sizable acreages of land were obtained through inheritance and gifts. The percentage was highest for cropland

Table 5. Distribution of Land by Acquisition Characteristics and Land Use, Tennessee, 1978

Acquisition Characteristics	Land Use			
	% of Cropland	% of Pasture	% of Forest	% of Other
Method of Acquisition				
Purchased from nonrelative	57.6	56.2	55.4	62.0
Purchased from relative	11.9	19.6	17.1	21.1
Inherited	22.8	12.5	15.0	3.8
Gift	1.0	1.1	0.6	0.0
Other	0.4	2.5	1.8	5.3
No response	6.4	8.2	10.1	7.7
Date of Acquisition				
1970-1977	26.6	19.6	27.2	14.5
1960-1969	19.9	26.5	22.9	48.3
1950-1959	17.1	22.5	14.2	19.4
1940-1949	14.0	11.2	9.7	4.2
Prior to 1940	13.6	14.6	14.7	10.6
No response	8.7	5.7	11.2	3.0

Source: Data were from the NRI of 1977 conducted by the SCS and the LOS of 1978 conducted by the ESCS.

where almost 24 percent was acquired through gift or inheritance. Comparable figures for pasture and forestland were 13.6 percent and 15.6 percent, respectively.

Estimates from the survey indicate that over 6 million acres of land in Tennessee changed ownership during the period 1970-1977. This acreage included about 27 percent of the crop and forestland and about 20 percent of the pastureland. Of 1977 land holdings, the percent of land acquired in progessively distant decades diminished. Less than 15 percent of the current (1977) holdings were acquired prior to 1940.

Age and Education of Landowners by Land Use

The age distribution of Tennessee landowners was similar to that reported for the United States (16). The average age of farmland owners in the nation was 52 while the comparable figure for Tennessee was 50. The distribution of land in Tennessee by age groups is shown in Table 6. Generally, there was little difference among the land use categories except that proportionally more pastureland was held by younger landowners. Only 0.7 percent of cropland and 0.4 percent of forestland owners were less than 30 years of age, while the comparable figure for pastureland was 4.0 percent. The distribution of land among relatively older landholders can be highlighted by examination of the cropland category. There, over 54 percent of the land was held by persons 50 years of age or older and over 36 percent of the land was held by persons 65 years of age or older. Comparable percentages for pasture and forestland were somewhat lower. The relative percentages in the "no response" category are consistent with the percentages of corporate and "other" (not sole proprietorship, family ownership or partnership)

Table 6. Percentage Distribution of Land by Land Use and Age, Education of the Landowners, Tennessee, 1978

	Land Use (acres)			
	Crop (%)	Pasture (%)	Forest (%)	Other (%)
Age of Owners (years)				
Less than 25	0.0	0.4	0.0	4.5
25-29	0.7	3.6	0.4	0.0
30-34	3.7	1.3	2.2	0.0
35-39	6.2	7.3	3.9	6.5
40-44	4.8	9.8	8.1	2.6
45-49	4.1	9.2	8.5	4.5
50-54	5.0	10.6	9.4	6.1
55-59	12.9	11.3	6.7	4.7
60-64	5.3	8.8	6.9	8.3
65-69	10.8	11.1	10.0	3.5
70-74	13.4	8.5	7.6	3.0
75 or older	12.0	11.1	9.7	12.5
No response	21.2	7.0	26.7	43.8
Education of Owners (years)				
Less than 9 years	23.5	23.7	22.9	7.7
9-11 years	12.3	12.3	9.0	6.9
High school	21.6	27.1	14.5	15.3
Some college	7.2	9.5	9.6	0.0
College degree or more	12.2	13.5	13.5	27.7
No response	23.2	13.5	30.5	42.3

Source: Data were from the NRI of 1977 conducted by the SCS and the LOS of 1978 conducted by the ESCS.

shown in Table 2, page 17. While such ownership units which do not exhibit age failed to account for all of the "no response," they did account for a sizable portion.

Compared to the United States average, Tennessee farmland owners had less formal education. For the nation as a whole, the average number of years of education was 12 while the comparable figure for Tennessee was 9.5. The percentage distribution of land in Tennessee in educational attainment categories is shown in Table 6. About 23 percent of crop, pasture, and forest acreage was owned by persons with less than 9 years of education. Alternatively, about 13 percent of land in the various categories was owned by persons with a college degree. Once again, a relatively high no-response rate can be partially accounted for by landownership by entities with no educational record such as corporations.

Land Class by Land Use

The Soil Conservation Service has developed land class categories which serve to define, in a general way, agricultural land use capabilities. The eight land classes are defined in the Appendix. Agricultural use capability varies inversely with land class numbers. Land Class I is most suitable for crop production. Class IV land is the highest numbered class suitable for cultivation but has very serious conservation problems and normally is best suited for pasture and hay. Class VII land is best suited for trees and, perhaps, limited grazing.

The total acreage in Tennessee within each land class is shown in Table 7. Also shown is the percent of each land class that is used for each of the land use categories and the percent of each land use

Table 7. Percentage Distribution of Land Use by Land Class, 1977

Land Class[1]	Total Acres	Land Use			
		% of Total Cropland	% of Total Pastureland	% of Total Forestland	% of Total Other Land
Class I	869,404	12.5	3.2	1.2	0.0
Class II	4,555,108	46.6	25.6	6.9	18.8
Class III	5,005,787	27.0	25.0	16.2	17.2
Class IV	3,045,621	9.7	18.1	10.6	7.7
Class VI	3,793,432	2.8	18.8	16.8	28.9
Class VII	7,439,903	1.3	9.2	48.4	27.0

Land Use	Land Class[1]					
	% of Class I Land	% of Class II Land	% of Class III Land	% of Class IV Land	% of Class VI Land	% of Class VII Land
Crop	57.2	40.6	21.4	12.6	3.0	0.7
Pasture	23.6	36.3	32.3	35.4	32.1	8.0
Forest	19.2	20.8	44.3	47.6	60.7	89.3
Other	0.0	2.3	1.9	1.4	4.2	2.0

Source: Data were from the NRI of 1977 conducted by the SCS and the LOS of 1978 conducted by the ESCS.

[1]No land in Tennessee is defined as Class V.

that is on the various land classes. For example, about 870,000 acres of Class I land exist in Tennessee. Of that acreage, 57.2 percent was used for crop production, 23.6 percent was used for pasture, and 19.2 percent was used for forests. The land in the crop use column indicates that 12.5 percent of land used for crops was on Class I land. Moreover, 46.6 percent of the cropland was on Class II land, 27.0 percent was on Class III land, 9.7 percent was on Class IV land, 2.8 percent was on Class VI land, and 1.3 percent was on Class VII land.

Generally, the figures in Table 7 indicate that in the aggregate, lower numbered land classes were used more intensively and higher numbered land classes were used less intensively. Approximately 86 percent of the land on which crops were grown were on Class I, II or III land. Moreover, about 65 percent of the forestland was on Class VI or VII land. However, the potential exists for land utilization which is more consistent with land capability. Approximately 20 percent of Class I and II land, about 1 million acres, was used in forest production. Alternatively, 1.5 percent, just over 165,000 acres, of Class VI and VII land was used for crop production.

Although too few observations existed for firm conclusions, every instance of using Class VI and VII land for crop production was from ownership units categorized as sole proprietorships or family ownership.

Soil Erosion and Landownership Characteristics on Tennessee Land

The average estimated soil loss for Tennessee cropland was 20.5 tons per acre per year (t/a/y), however, the average soil loss

Owner Type by Soil Loss

Several studies have been conducted by Iowa State University on how tenure and landownership arrangements influence soil conservation (5, 8, 9, 12). The acreage distribution of Tennessee land by ownership type and soil loss during 1977 is shown in Table 10. Land that was owned by a family included nearly 9 million acres of land where soil losses were less than or equal to 5 t/a/y. There were approximately 1.5 million acres (14 percent) of family owned land over 5 t/a/y. Land that was held by a sole proprietor had close to 6.0 million acres of land on which soil losses were less than 5 t/a/y and close to 1.5 million acres (21 percent) under sole proprietorships had soil losses over 5 t/a/y. Relatively little acreage under corporate ownership had soil losses in excess of 5 t/a/y. This observation probably reflects little other than that corporations used little land for cropping purposes.

Size of Holdings by Soil Loss

A breakdown of the size holdings by soil loss categories is shown in Table 11. The three sizes of holding categories with the greatest percentage of acres with soil losses in excess of 5 t/a/y were 50 to 69 acres, 70 to 79 acres, and 260-499 acres with 33 percent, 26 percent, and 23 percent, respectively. The size category 260-499 acres had over 900,000 acres with soil loss in excess of 5 t/a/y, by far the largest category. Moreover, this category had the greatest acreage with soil loss in excess of 15 t/a/y.

Table 10. Acreage Distribution of Owner Type by Soil Loss Categories, Tennessee, 1977

Type of Owner	Acreage with Estimated Soil Loss of: (in tons per acre per year)			
	5 or Fewer	5.01-10	10.01-15	15.01 or Greater
Sole Proprietor	5,786,344	929,221	97,597	199,775
Family Ownership	8,989,472	582,742	387,126	525,075
Partnership with Family Members	2,255,874	210,853	74,900	50,075
Partnership with Non-family Members	535,840	25,037	120,827	
Family Corporation:				
10 or Fewer Stockholders	833,465	26,144	0	0
More than 10 Stockholders	141,593	0	0	0
Unknown No. of Stockholders	143,779	0	0	0
Other Corporation	1,898,056	70,457	12,510	0
Other Type of Ownership	400,913	14,572	0	140,951

Source: Data were from the NRI of 1977 conducted by the SCS and the LOS of 1978 conducted by the ESCS.

Table 11. Distribution of Land in Soil Loss Categories by Size of Holdings, Tennessee, 1977

Size of Holdings	Acreage with Estimated Soil Loss of: (in tons per acre per year) 5.00 or Fewer t/a/y	5.01-10.00 t/a/y	10.01-15.00 t/a/y	15.01 or More t/a/y	Total Holdings with More than 5 t/a/y
Less than 10 acres	405,259	25,198	19,163	0	9.9
10-49 acres	3,032,368	116,274	195,874	138,652	12.9
50-69 acres	1,177,804	270,276	99,845	221,318	33.4
70-99 acres	1,341,810	376,124	25,037	81,591	26.5
100-139 acres	2,080,429	132,527	75,983	134,709	14.2
140-179 acres	1,800,364	110,553	16,675	77,771	10.2
180-259 acres	1,708,109	234,675	42,611	66,912	16.8
260-499 acres	2,955,356	408,988	217,769	273,689	23.4
500-999 acres	1,882,924	92,509	0	168,765	12.2
1,000-1,999 acres	1,143,937	51,181	0	16,783	5.6
2,000-2,999 acres	283,076	40,715	0	25,037	18.8
3,000-4,999 acres	913,390	0	0	0	0
5,000-9,999 acres	641,039	0	0	0	0
10,000 or more acres	1,644,440	0	0	0	0

Source: Data were from the NRI of 1977 conducted by the SCS and the LOS of 1978 conducted by the ESCS.

Leasing Arrangements and Soil Loss

Fisher and Timmons indicated that tenant operators and leasing arrangements influenced soil conservation practices (9). An overview of leasing arrangements and soil loss in Tennessee is presented in Table 12. Of the farmland acreage which was operated by the owner, 17.6 percent had erosion rates in excess of 5 t/a/y while 5.7 poercent of this acreage had erosion rates in excess of 15 t/a/y. Of farmland which was operated under a cash lease, 22.8 percent and 11.3 percent had erosion rates in excess of 5 t/a/y and 15 t/a/y, respectively. Operators of farmland under a share lease had the highest percentages in relatively high erosion rate categories; 36.4 percent had soil erosion rates in excess of 5 t/a/y while 13.6 percent had soil erosion rates in excess of 15 t/a/y.

The above figures should be examined in the context of the aggregate uses made of the land in the tenure categories. Table 9 showed that land used for crop production had a much higher rate of soil erosion than was the case for other uses, which had nearly identical rates of erosion. Table 4, page 21, showed that about 48 percent of land which was operated by the owner was used for crop production while 32 percent and 67 percent of the land under a cash lease and share lease, respectively, were used for crop production. Taking into account the uses of land, it appears that Tennessee is compatible with the Iowa findings in that rented land is subject to higher rates of erosion.

Acquisition Characteristics and Soil Loss

Time and/or method of acquisition of the land has been cited as having an influence upon soil conservation (5, p. 410). These studies

Table 12. Distribution of Farmland in Soil Loss Categories by Tenure Characteristics, Tennessee, 1977.

Tenure Characteristics	Percentage Acreage with Estimated Soil Loss of: (in tons per acre per year)			
	5 or Fewer t/a/y	5.01-10.00 t/a/y	10.01-15.00 t/a/y	15.01 or More t/a/y
Acres of Farmland Operated by Owner	7,713,033	940,013	169,162	536,747
Percent	82.4	10.0	1.8	5.7
Acres of Farmland Rented Out	2,414,791	315,546	266,783	426,215
Percent	70.5	9.2	7.8	12.5
Acres of Farmland Under Cash Lease	1,201,408	153,499	25,037	175,621
Percent	77.2	9.9	1.6	11.3
Acres of Farmland Under Share Lease	1,173,407	179,546	241,746	250,595
Percent	63.6	9.7	13.1	13.6

Source: Data were from the NRI of 1977 conducted by the SCS and the LOS of 1978 conducted by the ESCS.

have concluded that one of the reasons that farmers adopted soil conservation policies was that they took pride in maintaining their land or felt morally obligated to keep soil productivity at high levels (5, p. 410). An example might be a sense of stewardship felt by a farmer who has land handed down from generation to generation.

The distribution of land by acquisition characteristics and soil loss categories in 1977 is shown in Table 13. Between 85 and 88 percent of land acquired by the present owner by purchase had soil erosion rates of 5 or fewer t/a/y. Alternatively, 78 percent of land acquired through inheritance and 75 percent of the land obtained by gift had a similar low rate of soil erosion. The figures showing soil loss by dates of acquisition indicate no consistent trends.

Age, Education, and Soil Loss

Blase and Timmons (5, p. 410) suggest that education and age can have a positive influence on adoption of soil conservation practices. Total acres of Tennessee land distributed by age, education, and soil loss categories in 1977 is shown in Table 14. The percent of land with soil erosion rates in excess of 5 t/a/y were highest for the 30-34, 55-59, 70-74, and 75 and older categories. It can be noted, however, that by far the greatest acreage of land in the highest soil loss category was owned by the two oldest age groups, age 70 and over.

Educational levels of landowners appeared to have little association with the percent of land in soil loss categories of more than 5 t/a/y. Those with educational levels of less than 9 years and 9-11 years both had over 19 percent of their land in soil loss categories of

Table 13. Distribution of Land in Soil Loss Categories by Methcd and Date of Acquisition, Tennessee, 1977

Method of Acquisition by Present Owner	Estimated Soil Loss (in tons per acre per year) 5 or Fewer t/a/y	5.01-10.00 t/a/y	10.01-15.00 t/a/y	15.01 or More t/a/y
Acres Purchased from a Nonrelative	11,835,761	1,008,324	503,126	543,915
Percent	85.2	7.3	3.6	3.9
Acres Purchased from a Relative	3,670,102	429,946	50,856	45,062
Percent	87.5	10.2	1.2	1.1
Acres Inherited	2,969,224	295,861	101,641	431,495
Percent	78.2	7.8	2.7	11.4
Acres Obtained as a Gift	150,380	43,043	2,137	4,606
Percent	75.1	21.5	1.1	2.3
Date of Acquisition				
1970-1978, acres	5,009,649	584,835	338,560	223,883
Percent	81.4	9.5	5.5	3.6
1960-1969, acres	5,416,206	285,155	25,666	206,312
Percent	91.3	4.8	0.4	3.4
1950-1959, acres	3,572,574	305,396	112,059	212,684
Percent	85.0	7.3	2.7	5.1
1940-1949, acres	1,992,394	247,229	116,993	276,295
Percent	75.7	9.4	4.4	10.5

Table 13 (Continued)

Method of Acquisition by Present Owner	Estimated Soil Loss (in tons per acre per year)			
	5 or Fewer t/a/y	5.01-10.00 t/a/y	10.01-15.00 t/a/y	15.01 or More t/a/y
Prior to 1940, acres	3,035,263	385,069	73,535	72,411
Percent	85.1	10.8	2.1	2.0

Source: Data were from the NRI of 1977 conducted by the SCS and the LOS of 1978 conducted by the ESCS.

Table 14. Distribution of Soil Loss Categories by Age and Education of the Owner, Tennessee, 1977

	Acreage with Estimated Soil Loss			
	5 or Fewer t/a/y	5.01-10.00 t/a/y	10.01-15.01 t/a/y	15.01 or More t/a/y
Age of Owner (years)				
Less than 25	50,379	0	0	0
25-29	285,058	0	0	26,121
30-34	383,420	25,037	120,827	0
35-39	1,157,635	111,691	0	25,039
40-44	1,739,979	96,737	0	49,774
45-49	1,629,702	277,471	41,820	0
50-54	2,021,226	93,163	19,163	83,365
55-59	1,730,908	242,275	55,860	154,736
60-64	1,500,807	166,653	67,810	41,820
65-69	2,256,456	165,119	66,538	56,391
70-74	1,711,887	69,677	69,238	298,577
75 or older	2,000,918	287,872	120,821	182,294
Education of Owner				
Less than 9 years	4,569,420	603,617	166,111	322,349
9-11 years	2,007,205	248,207	54,777	196,185
High School	3,971,155	193,409	199,385	152,418
Some College	1,911,156	228,600	49,826	36,823
College degree or more	2,971,265	292,668	66,911	51,181

Source: Data were from the NRI of 1977 conducted by the SCS and the LOS of 1978 conducted by the ESCS.

5 t/a/y or more. Similar percentages for other educational level categories ranged from 12.1 to 14.4 percent.

Land Class by Soil Loss

How the land in Tennessee was distributed by soil loss categories and the Soil Conservation Service's classification of land during 1977 is shown in Table 15. As shown in Table 7, page 26, most of the cropland in Tennessee was found on Class II and III land. Table 15 indicates that Class II and III land was responsible for 55 percent (over 2 million acres) of the acreage on which soil loss was over 5 t/a/y. This seems reasonable due to the high erodibility factors on Tennessee lands and the disturbance of these lands by agricultural production.

About 87 percent of the Class IV land had erosion rates of 5 t/a/y or less and only about 3 percent between 5 and 15 t/a/y. However, almost 10 percent was in the highest soil loss category. One explanation of this configuration of loss rates was that Class IV land is generally unsuitable for crop production because of erosion potential. However, about 12 percent of Class IV land is used for crop production (Table 7). It seems likely that the 300,000 acres of Class IV land in the highest soil loss category were used largely for crop production. Relatively little erosion occurred on Class I land, particularly high rates of erosion. This class has physical properties such that it can be utilized without high soil losses. The higher numbered classes also had relatively small acreages on which soil loss was over 5 t/a/y. In these cases, however, the land was used relatively less intensively.

Table 15. Distribution of Land in Soil Loss Categories by Land Class, Tennessee, 1977

Land Class[1]	Estimated Soil Loss (in tons per acre per year)			
	5 or Fewer t/a/y	5.01-10.00 t/a/y	10.0-15.00 t/a/y	15.01 or More t/a/y
Class I	702,256	157,148	0	0
%	80.8	19.2	0.0	0.0
Class II	3,373,392	545,252	345,740	390,724
%	71.9	12.0	7.6	8.6
Class III	4,238,927	301,507	89,485	375,869
%	84.7	6.0	1.8	7.5
Class IV	2,646,287	57,038	42,450	299,863
%	86.9	1.9	1.4	9.8
Class VI	3,360,161	299,127	46,522	87,621
%	88.6	7.9	1.2	2.3
Class VII	6,731,028	488,954	168,763	51,158
%	90.5	6.6	2.3	0.7

Source: Data were from the NRI of 1977 conducted by the SCS and the LOS of 1978 conducted by the ESCS.

[1]No land in Tennessee is defined as Class V.

Conservation Practices and Needs

This section provides an overview of the conservation practices used in 1977 and additional conservation practices needed. The information was collected by the Soil Conservation Service in the National Resource Inventory survey during 1977. The NRI survey allowed coding of up to three conservation practices being used. State level estimates reported in Table 16 were derived using previously discussed methods.

Table 16. Acres of Land on Which Specified Management Practices Occurred, Tennessee, 1977

Management Practice	Acres
Contour Farming	783,667
Crop Residue	672,351
Water Diversion	145,196
Minimum Tillage	122,155
Strip Cropping	93,216
Terraces	324,068

Source: Data were from the NRI of 1977 conducted by the SCS and LOS of 1978 conducted by the ESCS.

The most commonly used conservation practice was contour farming (783,667 acres), followed closely by crop residue cover (672,351 acres). Other conservation practices were used on smaller acreages.

In terms of SCS's conservation practice needs, 1.5 million acres of cropland, including hay, was treated adequately in terms of soil conservation. Almost 3.2 million acres needed additional erosion control and about 439,000 acres needed drainage systems. On pastureland, no treatment was needed on 826,000 acres, or about 15 percent. However, about 3.9 million or 72 percent needed to have vegetation

established or re-established. Most of the forestland which was not grazed needed timber stand improvement while most of the grazed forestland needed to have a reduction in grazing.

CHAPTER III

ANALYSIS OF THE RELATIONSHIP BETWEEN OWNERSHIP CHARACTERISTICS AND SOIL EROSION

The purpose of the research reported in this chapter was to evaluate the relationship between ownership characteristics and soil erosion on Tennessee cropland. Farmland owners must often select from among alternatives which, on one hand, result in depletion of their soil resources, or on the other, more nearly maintain the soil resource but yield relatively lower short-term profit. Selection of less exploitive alternatives by some landowners has been attributed, at least in part, to a conservation ethic or a philosophy of "stewardship of the land" (2, p. 231). It can be hypothesized that such stewardship is associated with landowners possessing identifiable characteristics. In addition, more or less exploitive uses of land can be associated with such economic measures as wealth, position, and cash flow, etc. It is hypothesized that these identifiable characteristics with economic positions and soil stewardship philosophies are associated with actions which influence soil erosion. If ownership characteristics can be associated with soil erosion, public information and education programs, and other public policy instruments can be targeted for greater effect.

The first portion of this chapter concerned model specification. Data sources were then specified, variations were defined and relationships were hypothesized. Finally, results were presented.

Theoretical Construction

The theoretical form of the model used in this study was:

$$Y = f(X_1, X_2, X_3, X_4)$$

where

Y = Average soil loss in tons per acre per year

X_1 = Economic position of the landowner

X_2 = Coincidence of ownership and management functions

X_3 = Availability of management input

X_4 = Demographic characteristics.

The dependent variable, Y, stems from a combination of physical properties of soil, climatic conditions, and management factors (13, p. 8). Obviously, the physical properties of the soil and climatic conditions are given for a particular tract of land. Management decisions, however, are variable, but take on meaning in terms of soil erosion only in the context of the given physical factors. That is, terracing or no-till operations have varying impacts on soil loss, depending upon the physical characteristics surrounding their use. Soil loss, then, is representative of management practices in the given physical environment in which they are used.

Management practices which influence soil loss are expected to be influenced by a number of variables. These include economic constraints, the state of economic incentives, availability of management, and demographic variables.

Ordinarily, benefits of soil erosion control are not expected to occur in the short run. Capital investments are sometimes needed and, in other instances, current production may be reduced. Expected

benefits include relatively higher future productivity of the land, with accompanying higher income and an increased salvage value of the land at the time of sale. The value placed on such expected benefits depend upon the economic position of the landowner (X_1). If a landowner has a relatively low current financial status, he would be expected to place a premium on acquiring current rather than future income. If a landowner is in a position of relatively limited capital, alternative uses of capital may force benefits from soil erosion control to be discounted at a relatively high rate, resulting in the implementation of fewer erosion control measures. Finally, if the cash flow and capital position of the landowner are such that survival of the firm is in jeopardy, then foregoing current income for future benefits at any reasonable rate of discount may be prohibited.

Implementation of erosion control measures that diminish current income is in favor of future income and the salvage value of the land has implications for the distribution of returns from land between the operation and ownership functions (X_2). The operating function often receives returns from current production while the ownership function receives residual returns, often in the future. When these functions are separated, incentives for operators to implement soil erosion control measures can be reduced.

Erosion control measures usually require explicit decision making and place additional time consuming requirements on land managers and operators (X_3). For example, potential erosion problems must be identified, alternative control strategies must be evaluated and the selected alternative must be implemented (9, p. 2). The latter often

requires additional operator time; fields may need to be realigned into shapes that conform less well to ease of mechanical operations, waterways may need to be established and maintained, etc. The management input, just as in the case of capital, tends to be allocated to efforts yielding the highest return. In cases where the management input is relatively limited, due either to a relatively small quantity of the input or relatively great demands (opportunity costs) for the input, marginal uses of the management input for soil erosion control may be out bid by other uses.

The conservation ethick is believed to exist outside (but may be broadly constrained by) traditional economic incentives. However, presence of the conservation ethic may be identified with certain demographic characteristics (X_4) of landowners such as age or education. To test the hypothesis in the above theoretical model, an analysis of soil erosion and landowner characteristics was conducted. The study was limited to cropland owners in Tennessee.

Data

The data used for this study were obtained from the National Resource Inventory conducted during 1977 by the Soil Conservation Service and the 1978 follow-up Landownership Survey conducted by the Natural Resource Economics Division of the United States Department of Agriculture (see Chapter I). Certain limitations existed in use of the data for this study. The data were not collected specifically for this study and often did not address the variables outlined in the above section directly. As a result, it was often necessary to use measures for which data were available only as proxies.

Model Specification

The empirical method used in this study was regression analysis. The variables used are defined in Table 17 and described below.

Dependent Variable

The dependent variable was average soil loss in tons per acre per year from cropland in Tennessee during 1977. The soil loss was estimated from the Universal Soil Loss Equation (USLE). The USLE considers effects of the major factors which influence rainfall erosion (13, p. 4). The equation used was A = RKLSCP. The predicted average annual soil loss in tons per acre per year, A, is the product of the following factors: R, rainfall index; K, soil erodibility; LS, length and steepness of slope; C, cropping management; and P, supporting conservation practices (13, pp. 8-9).

The component factors of the USLE were not included in the regression model used in this study. Lee suggests that it is difficult to separate the influence of management and physical factors on erosion since management practices are a reaction to the natural environment (15, p. 5). The independent variables of the regression analysis were expected to explain results of the cropping management and conservation practice factors in the context of the other given factors.

The dependent variable was an estimated average soil loss. As such, it excluded the presumably random variation which would be associated with climatic conditions of actual on-site measurements of soil loss were used.

Table 17. Names and Definitions of Variables Used in the Regression Analysis

Variable Name	Definition
Soil Loss	Estimated soil loss in tons per acre per year
Income	Net farm income of the cropland owner (by categories)
Purchased	Has a value of one if more than 50 percent of the land was purchased as opposed to other means of acquisition
Recent Purchase	Has a value of one if more than 50 percent of the land use purchased between 1970 and 1978
Old Purchase	Has a value of one if more than 50 percent of the land was purchased before 1960
Family Own	Has a value of one if more than 50 percent of the land was family owned
Nonfamily Own	Has a value of one if more than 50 percent of the land was owned by nonfamily members
Landlord In	Has a value of one if the owner leased out all land and resided in the same county in which the land was located
Landlord Out	Has a value of one if the owner leased out all land and did not reside in the same county in which the land was located
Part-time	Has a value of one if the landowner operated his land and worked off the farm more than 100 days per year
Total Land	Total acres owned
Percent in County	The percentage of total acres owned in the sample unit county
Absent Owner	Has a value of one if landowner resides outside the sample unit county
Multiholdings	Has a value of one if the owner has two or more separate tracts
Age	Age of the landowner

Table 17 (Continued)

Variable Name	Definition
Sex	Has a value of one if landowner is male
Education	Years of formal education completed by landowner

Independent Variables

Independent variables representing the explanatory variables of the theoretical model were not available. Instead, proxy variables were used.

Variables used to represent the economic position of the landowner were Income, Purchased, Recent Purchase, and Old Purchase. The Income variable was a measure of current (1978) farm income of cropland owners. It was hypothesized that a low cash flow would inhibit farmland owners from postponing current income in favor of future income, as is the common result of soil conservation efforts. This hypothesis is consistent with the findings of Jensen, Baumann, and Heady (12, p. 268). The sign of the estimated coefficient of the Income variable was expected to be negative.

The dummy variable, Purchased, had a value of one if the landowner purchased most of his land as opposed to acquiring it by gift or inheritance. Landowners who purchased their land were expected to have less equity in their land. Accordingly, capital constraints were expected to be relatively more severe and conservation efforts requiring capital investments to be less common. Similarly, the date of purchase was expected to influence a landowner's equity position. Landowners who purchased their land recently were expected to have less equity than those who purchased land earlier. A set of dummy variables were used to measure the influence of date of purchase. Recent Purchase had a value of one if land was purchased between 1970 and 1978 while Old Purchase had a value of one if land was purchased before 1960. Purchased and Recent Purchase were expected to have positive signs while Old Purchase was expected to have a negative sign.

The coincidence of ownership and management functions (X_2) were measured by four proxy variables, Family Own, Nonfamily Own, Landlord In, and Landlord Out. Family Own and Nonfamily Own were dummy variables with sole proprietorship as the omitted class. It was hypothesized that Family Own and Nonfamily Own represent progressively dispersed ownership and management functions as compared to the omitted class. Lee has suggested that a larger, more corporate agricultural sector will lack a conservation ethic and will be more likely to choose a conservation policy that will maximize current income at the expense of future soil quality (10, p. 3). In addition, when more than one entrepreneur is in the same decision making unit, conservation decisions may be more difficult to reach when compared to the sole proprietor. Coefficients for both Family Own and Nonfamily Own were expected to have positive signs.

Landlord In and Landlord Out were dummy variables which indicated that the land was operated under a lease. They were differentiated by whether or not the landlord resided in or out of the county in which the land was located. Other research (11, p. 35) has indicated that different types of operators, full owners, part owners, and tenants classify erosion problems differently. Separation of the ownership and operation function was expected to influence management practices because of disruption of existing incentives for soil erosion control. Tenants often make most of the operational decisions on the land they rent and derive income from current production. Erosion control often reduces current income in favor of future benefits, which more often accrues to landowners. Tenants were expected to use a short

planning horizon, often attempting to maximize income in one year cycles, resulting in the exploitation of the stock resource. Thus, it was hypothesized that leasing of land would be positively associated with soil loss. Landlords who recognize the need for soil erosion control can influence management decisions in a number of ways, ranging from informal request to lease specifications. Absentee owners who lease their land and live out of the county may not have close contact with the conservation needs of the land and lack the visual reminders of the needs. Accordingly, estimated coefficients for Landlord In and Landlord Out were expected to be positive, with the latter having the greater magnitude.

Variables reflecting the availability of management inputs (X_3) were Part-time, Total Land, % in County, Absent Owner, and Multi-Holdings. The rationale for including availability of management inputs was that erosion control measures usually require management inputs. To the extent that such inputs are relatively scarce, erosion control may suffer.

Part-time was a dummy variable designating farm operators who work off the farm more than 100 days per year. Part-time farmers were expected to have less time to spend on farm operations including time for soil erosion control management than their full-time counterparts. The constraining resource upon which income would be maximized would more likely be time rather than land. As a result, measures to protect the land resource were expected to be less common and a positive coefficient was expected. It was recognized that a relative lack of time would be consistent with a less intensive use of land, such as using

cropland for pasture, which would tend to reduce soil erosion. However, it was believed that this problem was reduced by sampling only farm operators who used land for crop production.

In most farm operations, the number of acres operated increases, available management decreases on a per acre basis. In this case, there exists relatively more demands for on-site management with which soil erosion control management must compete. As a result, soil erosion is expected to increase. Even though a larger operation could develop more management skills to reduce soil erosion, the estimated coefficient for Total Land was expected to be positive.

The variables, % in County, Absent Owner, and Multi-Holdings, were intended to measure geographic dispersion of land holdings. As geographic dispersion increased, the relative availability of on-site management was expected to decrease, as was knowledge of on-site erosion problems which comes, at least in part, from visual reinforcement. As % in County increased, less dispersion was expected and the estimated coefficient was expected to be negative. The variables, Absent Owner and Multi-Holdings, were believed to represent relatively greater dispersion and the estimated coefficients were expected to be positive.

Landowner age, sex, and education were demographic variables (X_4) which were expected to represent the availability of certain skills and characteristics associated with a "conservation ethic." Other research (5, 8, 9, 12) has indicated that landowner age was an important variable in explaining soil conservation efforts. Demographic variables such as age and sex may incorporate (reflect) a number of characteristics which affects erosion control practices. These might include

income levels, equity positions, management skills, and/or ethical values. It was hypothesized that the estimated coefficients for age and sex would both be negative.

The education variable measured the years of formal education attained by landowners. Previous research has indicated that an inverse relationship exists between education and soil erosion (12, p. 468). It was expected that as education increased, management skills would increase and soil loss would decrease.

Results

Results of the regression analysis are presented in Table 18. The model explained less than 20 percent of the variation in the dependent variable and was not statistically significant at commonly accepted levels. Among the independent variables, only two were significant at the 0.10 level, and one of them had an estimated coefficient with a sign opposite the hypothesis.

In general, results of the analysis failed to support the hypothesis. Reasons for such failure can be attributed to a number of sources. These include inappropriate proxy variables, measurement errors, violation of statistical requirements of the model, and/or an invalid theoretical construct.

Independent variables used to represent the theoretical phenomena of interest may simply not have been adequate. If the variables used in the estimation procedure did not represent the theoretical variables, then the theoretical model was, in essence, never tested. The relationship between certain theoretical variables and proxies,

Table 18. Results of Regression Analysis to Explain Soil Erosion on Tennessee Cropland, 1978

Variable Name	Specification	Hypothetical Direction	b Value	Probability of > F
Intercept	--		46.77	--
Income	class	-	0.70	.267
Purchased	0,1	+	- 8.42	.152
Recent Purchase	0,1	+	-18.08	.013
Old Purchase	0,1	-	-12.71	.059
Family Own	0,1	+	-10.65	.118
Nonfamily Own	0,1	+	5.09	.781
Landlord In	0,1	+	- 5.06	.487
Landlord Out	0,1	+	5.32	.688
Part-Time	0,1	+	4.97	.452
Total Land	100 acres	+	- 0.03	.882
% in County	%	-	12.52	.508
Absent Owner	0,1	+	-10.02	.313
Multi-Holdings	0,1	+	- 7.10	.189
Age	years	-	- 0.37	.101
Sex	0,1	-	3.18	.597
Education	years	-	- 0.59	.496

R^2 = .183 F = 1.47 n = 122 Prob. > F = .123

Average Soil Loss = 20.3 tons/acre/year

particularly those representing the availability of management, were recognized as tenuous. They were used because they were believed to be the best available. Other proxy variables such as leasing arrangements to represent the separation of ownership and management functions were believed to be relatively more sound. Tests of whether or not the proxy variables were adquate were unavailable given the data set. Appropriateness of the variables would have to be evaluated in separate research.

Errors in the measurement of dependent or independent variables represent another source of poor empirical results. Data in this study were supplied by the Soil Conservation Service and the Economics, Statistics and Cooperatives Service and no means were readily available to evaluating reliability of measurements.

Even if proxy variables were appropriate and measurements were accurate, violation of statistical requirements of the empirical model were possible. A common problem in economic studies which utilize least squares analysis is multicolinearity. However, the problem was not believed to be serious in this study. Although not conclusive, simple correlations shown in the Appendix, Table 19, implied that the correlation matrix was of reasonable magnitude. Moreover, multicolinearity generally influences the levels of significance but not the sign of estimated coefficients. A potentially more serious problem was one of omitted variables. The physical factors used to help calculate the dependent variable (A) were left out of the model. Important omitted variables can influence levels of significance and bias estimated parameters.

Finally, it is possible that the theoretical construct was inappropriate: the economic position of landowners, separation of ownership and management functions, variations in the availability of management inputs and demographic characteristics have little or no influence on soil loss. Soil loss obviously varies across cropland, as do physical characteristics (rainfall, soil type, length and steepness of slope) which influence soil loss. It is possible that management decisions are made with little regard for the interrelationships between management practices, physical characteristics, and soil loss. This case could exist if soil loss were simply not a concern of cropland owners or if information and education on appropriate management practices to reduce soil loss were deficient. In either case, economic constraints would be inoperative, any breakdown of economic incentive by separation of ownership and management functions would fail to be reflected, variations in management inputs would make little difference, and demographic characteristics would fail to differentiate among soil conserving practices. Assuming the above, existing soil conservation efforts would have to be explained by other means. The implication of this position differs from the preceding section on omitted variables. In one case, the hypothesized relationships did not exist to a measurable extent. In the other, omitted variables may have had statistical properties which disguised the hypothesized relationships of interest.

In summary, the empirical model failed to support the hypothesized relationships between ownership characteristics and soil loss on cropland. A number of possible reasons for such failure were cited. However, specific causes were indeterminate.

CHAPTER IV

SUMMARY AND CONCLUSIONS

Soil erosion has been defined as the natural process by which the land surface is worn by wind and water (4, p. 582). One of the contributing activities in acceleration of this rate of soil erosion in the past has been man's involvement in agricultural production. The result of such involvement has been a rate of soil erosion from cropland in excess of the rate of natural soil production. This irreversible process (soil erosion) contributes to soil losses of 10 tons per acre per year (t/a/y) nationwide. More specifically, portions of Western Tennessee have soil loss rates averaging 30 t/a/y and estimates have been as high as 120 t/a/y on some Tennessee cropland.

Summary

This study was an attempt to investigate the characteristics of Tennessee landowners for the purpose of determining the influence these characteristics have upon management decisions which influence soil losses on their lands. The need for the study was evident both in the agricultural economic literature and recent legislative proposals on soil erosion. The objectives of this study were:

1. To determine the socioeconomic and landholding characteristics of private landowners in Tennessee during 1978.

2. To evaluate the relationship between cropland ownership characteristics and management practices associated with soil erosion.

3. To indicate conservation needs for Tennessee during 1978.

Data used in the study were from a 1977 land and land use survey conducted by the Soil Conservation Service and a 1978 survey of landowners conducted by the Economics and Statistics Service of the United States Department of Agriculture.

Ownership Characteristics

Out of the total 24.7 million acres of privately owned land in Tennessee, 3.9 million acres were used for cropland during 1978. A majority of the cropland acreage was held either under a sole proprietorship or a family husband-wife ownership. Approximately one-half of the cropland acreage was in holdings of 259 acres or less; in addition, less than 10 percent of the cropland in Tennessee was in holdings of 2,000 acres or more. It appears that Tennessee is consistent with most southern states in that a majority of these lands are held by one or two owners (18, p. 8).

The Landownership Survey indicated that over one-half of the croplands in Tennessee (58 percent) was purchased from a nonrelative. A significant amount of the cropland acreage was acquired within the period 1970 to 1977. This situation may imply that, in general, Tennessee cropland owners have a somewhat high degree of mortgage indebtedness.

A little more than 50 percent of the cropland in Tennessee was rented to others during 1978. Approximately two-thirds of this acreage was under a share lease. This type of lease was used for over 1 million acres of Tennessee cropland. It was noted that the other popular form of lease, the cash lease, comprised only half the acreage of the share leases.

The age distribution of Tennessee landowners was similar to that reported for the United States (21). The average age of farmland owners in the United States was 52 while the comparable figure for Tennessee farmers was 50. The final section on landownership characteristics was land class by land use. There was a small amount of acreage in the Class I cropland use. This situation implied that most of the cropland in Tennessee was not found on the best land for conservation purposes. Most of the cropland in Tennessee was found on Class II and Class III lands.

In addition to cropland use in Tennessee pasture, forest, and "other" land uses were examined by landownership characteristics. Of this 24.7 million acres in Tennessee, there were 6.4, 13.7, and 0.5 million acres of pasture, forest, and "other" lands respectively during 1978. Like cropland, a majority of the land in pasture and forest was held under a sole proprietor or a husband-wife family ownership (86 and 66 percent, respectively). Approximately 50 percent of the pastureland was in holdings of less than 140 acres while just over 50 percent of the forestland was in holdings of less than 260 acres. In general, there was substantial diversity in the size of holdings in Tennessee. Part of the reason for such diversity was variation in the geography and crop production of Tennessee.

As compared to cropland, pastureland had more acreage owned and operated as a farm, but had less acreage of rented land. Unlike cropland, the cash lease was the most popular lease for pastureland. This seemed logical since pastureland yields for a share leasing arrangement may be harder to determine. As for forestland, relatively little acreage was operated or rented as a farm.

Most of the pasture and forestland acreage was purchased from a nonrelative. A majority of the pastureland was acquired during the period 1960 to 1969. Over 62 percent of the pastureland was acquired after 1950. In addition, a significant amount of the forestland was acquired before 1950 (64 percent).

Pasture and forestland had a very small acreage held by owners who were under 25 years of age. In fact, close to half of the pasture and forest acreage was held by owners 50 years and older (50.7 and 50.2, respectively). Most of the pasture landholders had a high school education or less (63 percent) while most of the forest landowners had a high school education or more (85 percent).

Finally, most of the pastureland was distributed on Class II, III, and IV lands. The largest proportions of forestland (48 percent) were found on Class VII land which is a highly desirable land use on this land class.

Soil Erosion and Landownership Characteristics in Tennessee

There were approximately 21.0 million acres of Tennessee land on which the soil loss was equal to or less than 5 t/a/y. However, almost 3.7 million acres had soil losses in excess of 5 t/a/y. The estimated average soil loss for Tennessee cropland during 1978 was 20.1 t/a/y. The average soil loss tolerance for Tennessee cropland was 4.3 t/a/y. This land use had the largest average soil loss, demonstrating that when ground cover is disturbed soil loss potentials increase.

Of land that was owned by a (husband-wife) family, nearly 9.0 million acres had soil losses of less than 5 t/a/y. Even so, there were approximately 1.5 million acres of family owned land over 5 t/a/y.

Compared to family ownership, proprietorships had close to 6.0 million acres of land on which soil losses were over 5 t/a/y. Relatively little acreage under corporate ownership had soil losses in excess of 5 t/a/y. This observation probably reflects the fact that corporations use little land for cropping purposes.

Tennessee landholdings between 50 and 69 acres comprised 33 percent of the land where soil losses were over 5 t/a/y. The acreage held between 1,000 and 9,999 had the largest percentage (95 percent) less than 5 t/a/y of soil loss.

Of acres purchased from a nonrelative, 35 percent had over 5 t/a/y of soil loss. Approximately 200 thousand acres purchased from a nonrelative lost over 25 t/a/y of soil. Tennessee land that was acquired between 1970 and 1978 had over 1 million acres of soil loss over 5 t/a/y. Land that was acquired between 1940 and 1949 had the largest percentage (24 percent) of acreage over 5 t/a/y.

As indicated in Chapter II, the average age of farmers was close to 50 years. The percent of land with erosion rates in excess of 5 t/a/y were highest for the 30-34, 55-59, 70-74, and 75 and older categories. It was noted, however, that by far the greatest acreage of land in the highest soil loss category was owned by the two oldest groups, age 70 and older. Figures suggest that there was little correlation between age of the landowner and soil erosion rates in Tennessee. Figures concerning soil loss and education indicated that landowners with the least education had the highest percentage of land in soil loss categories of more than 5 t/a/y.

Since most of the cropland in Tennessee was found on Class II and III land, 44 percent of the soil loss over 5 t/a/y was on these lands. Class I land, as expected, had a relatively small amount of acreage over 5 t/a/y. There were, however, over a half million acres of Class VII land where soil loss was over 5 t/a/y. In general, most of the soil loss came from Class II and III land. This was not surprising considering that a large percentage of agriculture production was on these lands.

Conservation Practices and Needs

The Soil Conservation Service collected information on the conservation practices that were applied to and that were needed on Tennessee land during 1977. The most commonly used conservation practice was contour farming, followed closely by crop residue cover. In terms of conservation practice needs, 1.5 million acres of cropland, including hay, was treated adequately in terms of soil conservation. Almost 3.2 million acres needed additional erosion control and about 439,000 acres needed drainage systems. On pastureland, no treatment was needed on 15 percent of the acreage. However, close to 72 percent of the pastureland in Tennessee needed to have vegetation established or re-established. A significant amount of forestland which was not grazed needed timber stand improvement while most of the grazed forestland needed to have a reduction in grazing.

Regression Analysis

To evaluate the relationship between soil erosion and landownership characteristics, a regression analysis was conducted. The dependent variable was estimated soil loss from cropland included in the

in the Natural Resource Inventory Survey in Tennessee. Independent variables were ownership characteristics intended to measure the: economic position of the landowner, coincidence of ownership and management functions, availability of management input, and demographic characteristics.

Results of the regression explained less than 20 percent of the variation in the dependent variable and were not statistically significant at commonly used levels. In general, results of the regression failed to support the hypothesis that a relationship existed between soil loss on Tennessee cropland and landownership characteristics. Reasons for such failure could be attributed to any of a number of sources. These included inappropriate proxy variables, measurement errors, violation of statistical requirements of the model, and/or an invalid theoretical construct.

Conclusions

The regression results and descriptive statistics on the relationship between landownership characteristics and soil erosion indicated a lower degree of correlation than hypothesized. This situation was consistent with Lee's findings at the national level that management practices and soil conservation were not notably related. Lee's results did suggest, however, that the Southeast might be consistent with findings from Iowa studies (5, 8, 9, 12) that landownership characteristics were responsible for management practices geared toward soil conservation. No support for such findings were available from this study.

Part of the reason for initiating this study was to provide information with which public policy could more effectively be targeted to landownership characteristics for purposes of controlling soil erosion. Subject to data and methodological limitations, in this study, there was little information with which to effectively target public policy. However, a deductive approach may be used. This study did not indicate where targeting should take place, only that public policy directed toward landownership characteristics, specifically tenure relationships, could be questionable. Even so, the descriptive statistics shown should give the policy makers a better understanding of the soil erosion situation in Tennessee, particularly in defining erosion on land classes rather than by ownership characteristics.

Further study is needed in defining incentives for soil erosion control. Management decisions concerning erosion control vary among landowners. Insight into the reasons for such variation can guide further research and public policy concerning soil conservation studies applied on education and information blocks that seem to exist between farmers and the services that provide this information. If these studies are reasonably accomplished, farmers should be able to manage their resources in a more efficient manner.

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APPENDIX

LAND CLASS DEFINITIONS

Land Suitable for Cultivation	Class I	Very good land with only minor classification problems. Frequent or continuous cultivation requires good farm practices.
	Class II	Good land with moderate conservation problems that are relatively easy to overcome.
	Class III	Good land (moderately) with one or more serious conservation problems requiring considerable treatment and careful management.
	Class IV	Land with one or more very serious conservation problems requiring very careful treatment and management. Best suited for pasture or hay.
Land Suited for Permanent Vegetation, Pasture, Trees	Class V	Few limitations if used for permanent vegetation. Unsuited for cultivation.
	Class VI	Land requiring permanent vegetation, usually pasture and having only moderate conservation problems when in such use.
	Class VII	Generally best suited for trees, with only most favorable sites suitable for limited grazing.
	Class VIII	Suitable for wildlife or recreation. Unfit for cultivation.

Table 19. Bivariate Correlations between Selected Variables

	Income	Pur-chased	Recent Pur-chase	Old Pur-chase	Family Own	Non-Family Own	Land-lord In	Land-lord Out	Part-time	Total Land	% in County	Absent Owner	Multi-Hold-ings	Age	Sex	Educa-tion
Income	1.00	-0.01	-0.13	0.03	-0.17	-0.03	0.04	-0.23	-0.05	-0.24	0.17	-0.16	0.01	0.13	0.15	-0.11
Purchase		1.00	-0.14	0.07	-0.18	0.00	-0.12	-0.05	0.09	0.06	0.00	-0.00	-0.10	-0.19	0.27	-0.17
Recent Purchase			1.00	-0.55	-0.06	0.14	-0.11	0.05	0.06	-0.10	-0.15	0.08	-0.03	-0.40	0.03	0.17
Old Purchase				1.00	-0.02	-0.04	0.28	-0.13	-0.16	-0.15	0.20	-0.27	0.06	0.48	-0.03	-0.09
Family Own					1.00	-0.08	-0.00	0.12	0.07	0.27	-0.06	-0.02	0.05	-0.04	-0.15	0.07
Nonfamily Own						1.00	0.15	-0.05	0.00	-0.04	-0.35	0.06	0.09	-0.05	0.11	0.13
Landlord In							1.00	-0.20	-0.41	-0.11	0.10	-0.28	-0.09	0.24	-0.18	0.01
Landlord Out								1.00	-0.23	0.41	-0.31	0.69	-0.04	0.00	-0.18	0.17
Part-time									1.00	-0.14	0.11	-0.02	-0.04	-0.22	-0.05	-0.10
Total Land										1.00	-0.47	0.26	-0.05	-0.11	-0.22	-0.01
% in County											1.00	-0.38	0.03	0.21	0.14	-0.20
Absent Owner												1.00	-0.21	-0.14	-0.15	0.08
Multi-Holdings													1.00	0.02	0.05	0.17
Age														1.00	-0.03	-0.19
Sex															1.00	-0.03
Education																1.00

VITA

Lanny Wayne Hass was born in Statesville, North Carolina, on June 28, 1956. He grew up and lived on a livestock farm in Iredell County. After graduation from North Iredell High School in 1974, he attended Mitchell Community College until 1976. He entered the University of North Carolina at Asheville in the fall of 1976 and graduated in May 1979 with a B. S. degree in Economics. In the fall of 1979, he began a graduate program in the Department of Agricultural Economics at The University of Tennessee, Knoxville. In December 1981 he received the Master of Science degree with a major in Agricultural Economics.

After graduation he will be employed by Virginia Polytechnic Institute and State University as an Agricultural Extension Agent for the Southwest District.