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EVALUATION OF FACTORS THAT INFLUENCE PARTICIPATION IN A FEDERAL TREE PLANTING PROGRAM

A Thesis

Presented for the Master of Science

Degree

The University of Tennessee, Knoxville

Caroline Douglas Bell

May 1993

DEDICATION

This thesis is dedicated to my everlasting friend

William Travis Lambert

whose loving friendship knows no bounds

ACKNOWLEDGEMENTS

First, I would like to express my deep and sincere gratitude for that Power Greater Than Myself that supplied me with the strength, ability, courage and support to continue when I could find none within myself. Second only to that Power is my major professor, Dr. Burton C. English. I can unequivocably state that I would never have finished this degree without his continued support and faith in my competence. As a result, I have learned my profession as well as my ability as a professional.

I have the greatest admiration and respect for my other committee members. Over the years, Dr. Park has proved to be an excellent teacher and his guidance has been invaluable. His calm support has always been greatly appreciated. Dr. Wells exercised a great deal of patience in sharing his expertise, without out which I could not have produced this document with much confidence. Dr. Roland Roberts deserves a special note of thanks for encouraging me to begin what seemed to be an overwhelming task of developing and writing a thesis.

I would like to give my sincere thanks to my technical support. Dr. Rob Alexander has provided guidance, direction and most of all humor to what frequently seemed to be a dark abyss. Becky Bowling and Laura White deserve special thanks for not only have they given freely of technical support but have also been the mainstay of my emotional support in the office. Laura deserves a special note of thanks for persevering in the face of incomprehensible chaos. Matthew Ojo and Jose Velasquez have kept me on my toes and added to my backbone. Felicia Myers has given me that support so many take for granted - seeing to it that the details were completed. Kandy Kennedy's cheerful willingness to help has also been recognized and valued. Morgan Gray's patient help in developing the computer programs is appreciated. It has been an honor to

work with the graduate students in my department. I will never forget that they got to together and posted those 4000 surveys while I was delivering a baby.

My sister, Peggy Douglas, was the catalyst that began this journey and has continued to renew my energy both by example and through support of every type. The rest of my family, Sam, Mom, Dad, Ellene, and Lee Ann, have all been of immeasurable support whether it was financial, physical or emotional.

There have been so many friends that have offered support throughout these years. Thanks, Ginger, Mel, Courtney, Daniel, Sue, Bob, Lee Ann, Kim, Portia, Connie, Bill, and Bill W. I would also like to express my gratitude and appreciation to all those individuals omitted from this list but not from the heart.

Last, but far from least, I would like to extend my appreciation to my family, John and Taylor. Both have lended support and motivation to continue. John has weathered the difficult times I went through with an attitude of love, patience and tolerance. My son, Taylor, gives me inspiration just by being. This accomplishment is shared by all of us - certainly the burdens have been, but also the joys to be. Thank you.

ABSTRACT

The vast majority of nonindustrial private forestland in Tennessee, and much of the nation, is currently unmanaged. This results in a reduction of the quality of timber and other forest resources such as wildlife habitat and water quality. In the 1990 Farm Bill, Congress instituted the Stewardship Incentive Program, believing that management of these types of lands would be greatly beneficial to the nation as a whole. Apparently, owners do not perceive enough personal benefit from this type of forest management. Therefore, incentives may be necessary to induce landowners to practice management of their land.

Historically, the federal government has concentrated its efforts to promote improved farm practices on the use of monetary incentives. Consistent with past programs, the major incentive offered in the Stewardship Incentive Program for a landowner is that the government will share a percentage of the startup costs. However, participation in previous forestry programs using similar incentives has been chronically low, as evidenced by data from the Forestry Incentives Program and the Conservation Reserve Program.

It is the purpose of this study to determine the likely effect of cost-share incentives on participation in the Stewardship Incentive Program as well as to identify other factors that may contribute to participation. This information may prove useful in considering the most effective implementation strategy of the Stewardship Incentive Program.

In this study an indirect utility function is used to determine the probability an individual will choose to participate as well as to identify the relationship between that choice and certain attributes of the individual. Analysis of this choice as a function of economic, physical, and behavioral factors results in a qualitative model, specifically, a binary choice model since the

dependent variable is dichotomous in nature and represents the participate - not participate decision.

In order to determine the landowner's willingness to participate in a stewardship program in Tennessee, 4000 surveys were mailed to randomly selected owners of 100 acres or more. In the survey, participation is directly determined in a hypothetical situation and various cost share amounts were offered to different individuals. In addition to the effect of cost on participation the questionnaire was designed to identify owner characteristics in the following three categories:

1. demographic, socioeconomic;
2. attitudes and beliefs regarding conservation, information, and various goals of the program including timber, wildlife/fisheries, water quality, recreation, wetlands, aesthetic value;
3. attributes of the farm;

A logit procedure is used to estimate the model. Measures of the goodness of fit indicate the model fit the data fairly well. Cost to the owner of participating is found to be significant, however, the variables representing the attitudes and opinions of the respondent toward the goals of the program prove substantially more influential per unit on the probability of participating. This information may be valuable to decisionmakers faced with deciding the most effective method of implementing programs such as the Stewardship Incentive Program.

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CHAPTER I

INTRODUCTION

In the 1990 Farm Bill Congress found:

> adequate supplies of timber and other forest resources are essential to the United States . . . managed forest lands provide habitats for fish and wildlife, also aesthetics, outdoor recreation opportunities, and other forest resources . . . the soil, water, and air quality of the United States can be maintained and improved through good stewardship of privately held forest resources . . . trees and forests are of great environmental and economic value to urban areas . . . managed forests contribute to improving the quality, quantity, and timing of water yields that are of broad benefit to society . . . the products and services resulting from nonindustrial private forest land stewardship provide income and employment that contribute to the economic health and diversity of rural communities . . . tree planting in semiarid lands can improve environmental quality and maintain farm yields and income (U.S. Congress, Food, Agriculture, Conservation and Trade Act of 1990, Title XII, Section 1263(2a)).

Forests comprise 50 percent of the land area in Tennessee and as such represent one of the State's most valuable resources. Tennessee leads the nation in hardwood lumber production making hardwood lumber the State's third most important crop. Tourism and outdoor recreation stimulated by its forests have generated almost $5 billion to the State's economy annually. "Hunters and fishermen spent approximately $874 million in 1985 for equipment, food, lodging, transportation, and other expenses associated with their sport" (U.S. Department of Agriculture, Forest Service, Tennessee State Office, 1990). In addition, non-consumptive use equals or exceeds that of consumptive use. For example, over 70 percent of individuals over 16 years participate in such activities as observing, photographing, or feeding wildlife, a great number of which occurs on timberland† (U. S. Department of Agriculture, Forest Service, 1988).

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† "timberland" generally refers to "forested land that is capable of producing at least 20 cubic feet of wood per acre annually and that has not been withdrawn from utilization for timber by law or administrative regulation" (U. S. Department of Agriculture, Forest Service, 1988)

For years scientists and policymakers have recognized the many benefits forests provide as well as the potentially dangerous consequences from allowing them to degenerate. In the past, the federal government has initiated a few select programs targeted to offset specific problems concerning natural resources. However, today's broader understanding of the relationship between various resources means that forest management encompasses more that just one objective such as increasing timber growth, but also improvement of fish and wildlife habitat, protection of soil, air and water quality, increase in recreational opportunities, and the enhancement of scenic value. The Stewardship Incentive Program is an attempt by the federal government to recognize and support the important role healthy forests play in providing for the well-being of numerous other interrelated resources.

Many natural resources assume common property characteristics where the discipline of the market does not exist to promote maximum utility of the resource. Poor management of land can potentially result in an inefficient use of many resources by reducing the utility of one or more individuals being influenced by an activity under the control of another (Randall, 1987). The divergence between social and private benefits and costs will widen the greater the potential for benefits to exceed costs. Frequently, the forest resource gives rise to an external economy in which "the affected party, j, is made better off by the activity x and therefore has a desire to induce the acting party, k, to increase his or her level of that activity" (Randall 1987). For example, McKillop (1975) states "reductions in consumer outlays for wood products and dampening of future price rises are the major gains to the nation as a whole, but gains to geographical regions or sectors of the economy from forestry incentives programs may be appreciable." Skok and Gregersen (1975), point out "there are certain benefits that accrue to society at large, albeit on a regional basis, which are not taken into account by nonindustrial private owners when they make

decisions about investment in forestry (for example, benefits related to watershed protection, scenic beauty, wildlife habitat, and assurance of future timber availability)."

Table 1. Estimated national income gains and losses from a 45 million acre CRP.

Category	Value
Gross Income Gains:	$million
Landowners:	
Net farm income	9.2 to 20.3
Timber production	4.1 to 5.4
Natural	
Soil productivity	.8 to 2.4
Surface water quality	1.9 to 5.3
Filter strip water quality	0 to .3
Wind erosion	.4 to 1.1
Wildlife	3.0 to 4.7
Gross Income Losses:	
Consumer costs	(12.7 to 25.2)
Establishing cover crops:	
Landowner's share	(1.6)
Government's share	(1.6)
Technical assistance cost	(0.1)
Net Program Benefit	3.4 to 11.0

Source: Young, C. Edwin and C. Tim Osborn. 1990. *The Conservation Reserve Program, An Economic Assessment.* Agricultural Report 626, U.S. Department of Agriculture, Economic Research Service.

To illustrate, Table 1, from an economic assessment of the CRP conducted by Young and Osborn (1990) for the U. S. Department of Agriculture, shows net gains including those that individual farmers have realized from the sale of crops and timber. In addition, those individuals that practiced certain conservation measures have also produced social benefits, grouped in the table under natural resources/environment, and include reductions in soil and wind erosion and improvements in water quality and wildlife habitat. A breakdown of the environmental benefits by region is given in Table 2.

Social as well as private benefits may not be realized when land is poorly managed resulting in acres of idle pasture, impoverished cropland, deteriorating marginal land, and unmanaged forestland. The 1987 National Resources Inventory (NRI) reports 63 percent of all cropland in the U. S.; 56 percent of pastureland; 75 percent of rangeland; 71 percent of grazed forest land; and 54 percent of ungrazed forest land is in need of conservation treatment.

Table 2. Environmental benefits of the CRP, net present value, 1986-99.

Region	Soil Productivity	Water Quality	Wind Erosion	Wildlife
Best estimate:		$million		
Northeast	36.0	127.0	na	368.0
Appalachian	107.0	407.0	na	326.0
Southeast	43.0	280.0	na	376.0
Delta States	46.0	376.0	na	243.0
Corn Belt	473.0	584.0	na	846.0
Lake States	239.0	406.0	na	1,470.0
Northern Plains	216.0	306.0	148.0	100.0
Southern Plains	271.0	338.0	155.0	67.0
Mountain	150.0	458.0	217.0	18.0
Pacific	45.0	275.0	28.0	34.0
Total	1,626.0	3557.0	548.0	3,848.0
Low estimate:				
Northeast	18.0	76.0	na	282.0
Appalachian	54.0	160.0	na	250.0
Southeast	22.0	167.0	na	288.0
Delta States	23.0	231.0	na	187.0
Corn Belt	237.0	273.0	na	649.0
Lake States	120.0	232.0	na	1127 .0
Northern Plains	108.0	162.0	109.0	77.0
Southern Plains	136.0	181.0	99.0	52.0
Mountain	75.0	248.0	153.0	14.0
Pacific	23.0	152.0	25.0	26.0
Total	813.0	1,883.0	386.0	2,952.0
High estimate:				
Northeast	54.0	179.0	na	454.0
Appalachian	161.0	657.0	na	402.0
Southeast	64.0	400.0	na	463.0
Delta States	69.0	531.0	na	300.0
Corn Belt	709.0	895.0	na	1,043.0
Lake States	359.0	576.0	na	1,812.0
Northern Plains	324.0	459.0	312.0	123.0
Southern Plains	407.0	500.0	282.0	83.0
Mountain	224.0	671.0	440.0	23.0
Pacific	68.0	406.0	72.0	42.0
Total	2,439.0	5,274.0	1,106.0	4,745.0

Source: Young, C. Edwin and C. Tim Osborn. 1990. *The Conservation Reserve Program, An Economic Assessment.* Agricultural Report 626, U.S. Department of Agriculture, Economic Research Service.

In an effort to realize both social and private benefits as set forth in the goals of the 1990 Farm Bill, President Bush proposed a tree planting initiative entitled "America The Beautiful" which was enacted by the U. S. Congress in the Food, Agriculture, Conservation and Trade Act of 1990 (Title XII, Section 1263(2)). The purpose is to "promote the principles of basic forest stewardship through the nationwide planting, improvement, and maintenance of trees in order to increase reforestation, enhance the environment and aesthetic qualities of the United State's rural and urban areas, and reduce global carbon dioxide levels." One component of "America The Beautiful" is the Forest Stewardship Program, the goal of which is to encourage nonindustrial private landowners† to plant one billion new trees in the United States annually (U.S.Department of Agriculture, Forest Service Publication, 1990).

In the past, federal and state programs have provided various types of incentives to promote reforestation by private landowners. Skok and Gregersen (1975) categorized them as follows:

1. Indirect incentives - government research, forest protection, training, technical assistance, extension, and market information.
2. Direct fiscal incentives - exemption, remission or deferred payment of taxes.
3. Direct nonfiscal incentives - the subsidization of inputs through low-cost credit or outright payments.

The Tennessee Stewardship Plan uses a combination of indirect and direct nonfiscal incentives. Indirect incentives are used to combat the problem of lack of information by promoting public awareness through a continuing education program using the media, publications, programs, workshops, tours, and demonstrations. Technical assistance will be offered as individualized forest management plans for each landowner and suggestions from professionals as to the best strategy for accomplishing those goals.

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† "Nonindustrial private forest" refers to lands privately owned by individuals or corporations other than forest industry and incorporated farms.

To carry out this program and provide incentive for private landowners to participate, direct nonfiscal incentives will be subsidized through a complementary plan, the Stewardship Incentive Program that has been set up by the federal government and allows individual states to share 50 to 75 percent of the initial start up cost for planting the trees. There is concern, however, that this incentive will not generate enough participation and the actual number of trees planted will fall far short of the President's goal. For example, Paul Harte, of the ASCS office in Washington, D.C. (Sept. 07, 1990) expressed apprehension regarding the purpose of planting for natural resource improvement and felt that most participants would plant in pines for future commercial value possibly promoting a monoculture that does not enhance other resources such as wildlife habitat. This concern is not unfounded, Birdsey and McWilliams (1986) determined one of the midsouth's most significant trends has been a steady increase in the acreage of pines.

The Tennessee State Stewardship Plan for fiscal years 1990-1994 (U.S. Department of Agriculture, Forest Service, Tennessee State Office, 1990), has listed as a five-year total target of 64,200 acres planted in environmentally sound forests, 720 plans adopted, for a total in state and federal expenditures of $3,026,500 including administrative and other associated costs. In order to meet those goals the state has decided, based upon past incentive programs, to incur 65 percent of the cost of implementing each farmer's stewardship plan. The purpose of this thesis is to assess alternative incentive programs to decide the most economically effective method of implementation based upon the identification of farmer's motives to participate, ascertain whether the addition or lack of information has any effect on participation, and finally to discern the demographic characteristics of those individuals most likely to participate.

CHAPTER II

STATE OF THE CURRENT FOREST RESOURCE

> The condition of the nonindustrial private forest reflects the general neglect of its owners to practice intensive forest management. Poor stocking and low volumes-per-acre suggest that many NIPF owners are doing little to improve the status of their stands (Rosson and Dolittle, 1987).

One contributing factor to the need for conservation has been the shifting back and forth between pasture, cropland, and forest primarily resulting from the strength of land values any given time. Since 1980 there has been a substantial conversion from agricultural land to forest. This can probably be attributed to a weak agricultural economy or reduction in land speculation for real estate that has led to abandonment and reversion of marginal farmland. Pasture has contributed the most possibly due to marginal soils not suited to pasture and owners have allowed idle acres to revert to unmanaged forests, most of which yield low grade timber and depleted resources. In Table 3, from May (1991), it is apparent that a total of 824,600 acres have been converted to timberland

Table 3. Changes in timberland by survey region, Tennessee, 1980-1989.

Survey region	All land	Timberland	Net change	Additions from: Total	Agriculture	Other	Diversions to: Total	Agriculture	Other
	thousand acres								
West	6,007.0	1963.0	-189.9	30.8	21.6	9.2	20.7	189.2	1.5
West-Central	3,287.6	2333.7	148.1	155.2	105.8	49.4	7.1	5.8	1.2
Central	6,163.2	2461.3	298.9	344.7	268.1	76.6	5.8	6.7	29.1
Plateau	4,394.9	3064.8	86.8	150.9	90.5	60.4	4.1	19.8	44.3
East	6,486.4	3442.3	-38.1	143.0	88.8	54.2	81.1	51.7	129.4
All regions	26,339.1	13265.1	305.8	824.6	574.8	249.8	518.8	283.3	235.5

Source: May, Dennis M. 1991. "Forest Resources of Tennessee." *Resource Bulletin SO-160*, U. S. Department of Agriculture, Forest Service, Southern Experiment Station..

from other land uses. This is misleading, however, since most of this has been offset by the diversion of forestland to increasing urbanization in the east, and conversion to cropland in the fertile west, resulting in an overall increase in forestland of only 305,800 from 1980 to 1989, 27 percent less than in 1980.

The summary report of the 1987 National Resources Inventory (U. S. Department of Agriculture, Soil Conservation Service) shows that in Tennessee between 1982 and 1987 the only net reduction in land use was pastureland; 51 percent was converted to cropland, 20 percent to forestland and the remaining 31 percent is no longer classified non-federal rural land of which urban development accounted for 74 percent and 26 percent became federal land. Although Tennessee has experienced a slight overall increase in forestland, most of it is a result of the reversion of former agricultural land and has not been managed to promote healthy or environmentally sound resource since conversion and reversion lowers the productivity of forest lands if left in a natural state. The U.S. Department of Agriculture, Forest Service (1988) reported timberland in the south is not producing to its potential and timber supplies could be increased through more intensive forestry treatment. In Tennessee, 82 percent of all the timberland needing treatment is privately owned. According to the literature, there exists the potential to improve a great deal of Tennessee's forestland resources. Realization of this potential would not only be beneficial in economic terms- from a thriving timber industry, but the other goals of the 1990 Farm Bill would also benefit from the conscientious stewardship of these lands.

This situation is not specific to Tennessee and variations are found throughout the country. Table 4, reproduced from the U. S. Department of Agriculture, Economic Research Service (Daugherty, 1991) shows that from 1982 to 1987 cropland used for crops and cropland idled declined from 404 million acres to 399 million acres, largely a result of land being idled through government programs. However, there was little net change from 1962 to 1987 since a 10

Table 4. Major uses of land, United States.

Land Use	1950	1959	1969	1978	1982	1987
Cropland	478.0	458.0	472.0	471.0	469.0	464.0
Cropland used for crops	383.0	359.0	333.0	369.0	383.0	331.0
Idle cropland	26.0	34.0	51.0	26.0	21.0	68.0
Cropland pasture	69.0	65.0	88.0	76.0	65.0	65.0
Grassland pasture and range	701.0	633.0	604.0	587.0	597.0	591.0
Forest-use land	652.0	728.0	723.0	703.0	655.0	648.0
Grazed	320.0	245.0	198.0	172.0	158.0	155.0
Other	332.0	483.0	525.0	531.0	497.0	493.0
Special use areas	118.0	123.0	141.0	158.0	270.0	279.0
Miscellaneous	324.0	329.0	324.0	345.0	274.0	283.0
Total land area	2,273.0	2,271.0	2,264.0	2,264.0	2,265.0	2,265.0

Source: Daugherty, Arthur B. 1991. *Major Uses of Land in the United States: 1987.* Agricultural Report 643, U.S. Department of Agriculture, Economic Research Service.

million-acre decline experienced in the Northeast, Lake States, Southeast, and Southern Plains, was offset by a collective increase of more than 10 million acres in the other farm production regions (Table 5). Tennessee is grouped under the Appalachian region classification. In 1987 nearly 15 percent of the U. S. cropland was idle, the largest ever reported since research began in 1945. Cropland pasture, grassland pasture, and rangeland have been declining since 1950, and during 1982 through 1987 it fell by six million acres. However, in their designation of the Appalachian region, cropland used for pasture accounts for 30 percent of all cropland - more than twice the national average. Land classed as forest exclusive of special purpose uses declined by 207 million acres from 1982 to 1987, mostly to cropland, pasture, urban, and other uses. Since colonial times total forest land, including all uses have experienced a downward trend except for a period from 1920 to 1960 (Birdsey, 1983).

Table 5. Cropland used for crops, by region for selected years.

Region	1962	1981	1987	Change 1962-81	Change 1981-87	Change 1962-87
	million acres					
Northeast	14.2	13.6	11.8	-0.6	-1.8	-2.4
Lake States	33.3	40.3	32.2	7.0	-8.1	-1.1
Corn Belt	70.7	87.5	73.6	16.8	-13.9	2.9
Appalachian	85.3	93.5	87.2	8.2	-6.3	1.9
Northern Plains	15.4	19.4	16.4	4.0	-3.0	1.0
Southeast	11.9	14.8	10.3	2.9	-4.5	-1.6
Delta States	12.7	19.6	15.6	6.9	-4.0	2.9
Southern Plains	34.4	38.0	29.1	3.6	-8.9	-5.3
Mountain	33.9	38.1	35.4	4.2	-2.7	1.5
Pacific	19.4	22.2	19.1	2.8	-3.1	-0.3
48 States	331.2	387.0	330.7	55.8	-56.3	-0.5

Source: Daugherty, Arthur B. 1991. *Major Uses of Land in the United States: 1987.* Agricultural Report 643, U.S. Department of Agriculture, Economic Research Service.

DYNAMICS OF TENNESSEE FORESTS

Physiography

Relative to the amount of benefits provided, the forest resource requires very little input. Generally, areas less conducive for agriculture and urban development such as rough terrain and poor fertility accommodate most of the State's forest land. Tennessee is composed of a variety of physiographic features that determine land use. The eastern region encompasses the dense forests of the Great Smoky Mountains National Park and International Biosphere Reserve and the Cherokee National Forest. Interspersed between these rugged mountains are coves and valleys in which agriculture is common. The heavily forested plateau region consists mainly of the Cumberland Plateau and the Highland Rim and is unsuitable for agriculture but accommodates the majority of Tennessee coal mining. Agriculture and livestock production comprise most of the rural land use in the central basin. The west central region is predominantly forested with agriculture

found along the bottomlands near the Tennessee River. The western region is mainly bottomland to the Mississippi River where soils are excellent for agriculture. (Birdsey, 1983).

Forest Types

Tennessee forests diversify following changes in physiography, climate, and elevation. The U.S. Department of Agriculture has defined eight disparate commercial forest types in Tennessee, none of which are evenly distributed throughout the state (Figure 1). May (1991) has a detailed description of their current status in a resource bulletin published by the U.S. Department of Agriculture. The upland hardwood species are found throughout the state and are comprised of the oak-hickory type that dominates 80 percent of the inventory and the maple-beech-birch type that represent less than 1 percent. Pine and mixed oak-pine forests are concentrated in the east with the mixed and loblolly-shortleaf [yellow pine] each representing about 8 percent of the entire inventory, and white pine less than 1 percent. The bottomland hardwood forests including the Elm-ash-cottonwood and oak-gum-cypress types occupy 5 percent, and are found mainly in western Tennessee on lower quality sites unsuitable for agriculture. Redcedar forests represent approximately 5 percent and generally found within the Central Basin. Figure 2 shows the area of timberland by the same five general forest types from 1952 - 1985 (Birdsey and McWilliams, 1986.)

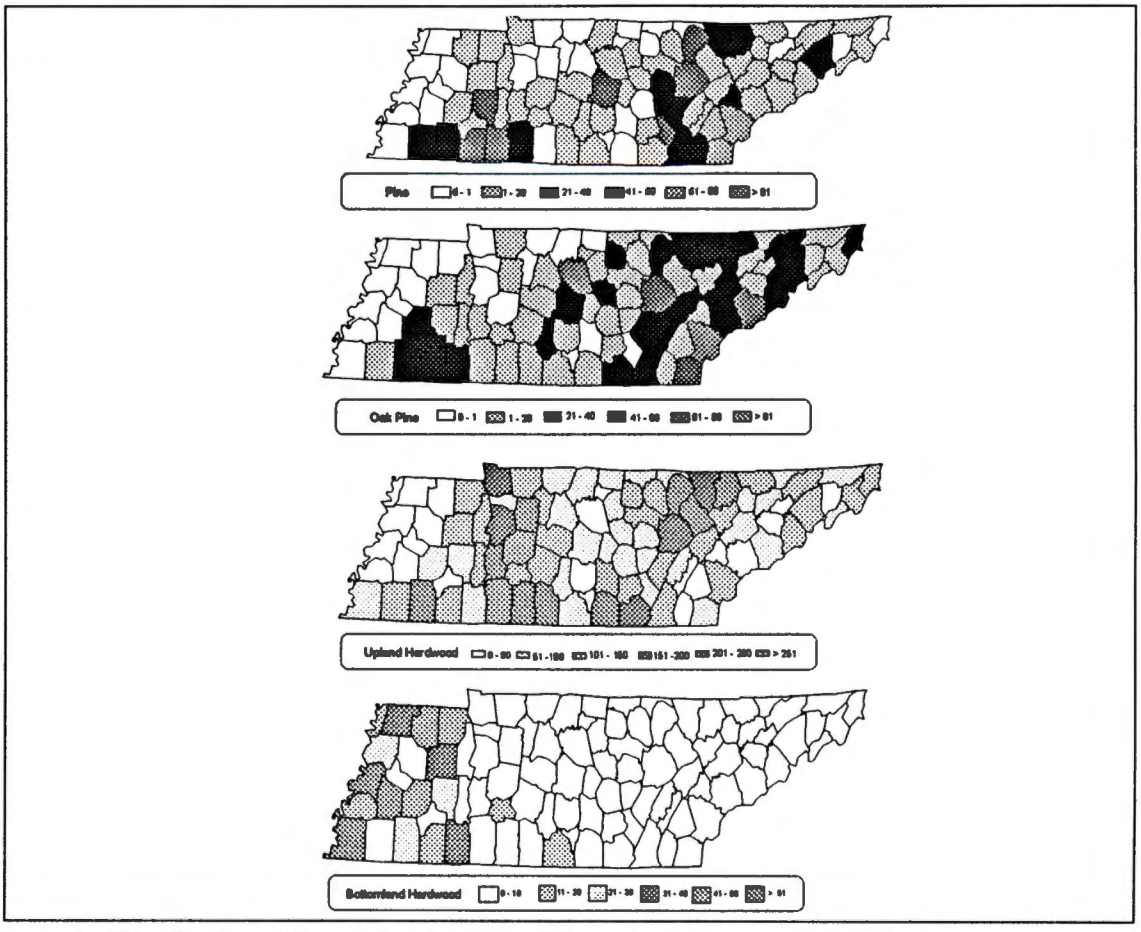


Figure 1. Distribution of forest plots by general forest type, Tennessee, 1989.
Source: U. S. Department of Agriculture, Forest Service. 1989. *Easy Access Forest Inventory and Analysis Tables.* Southern Forest Experiment Station, Starkville, Mississippi.

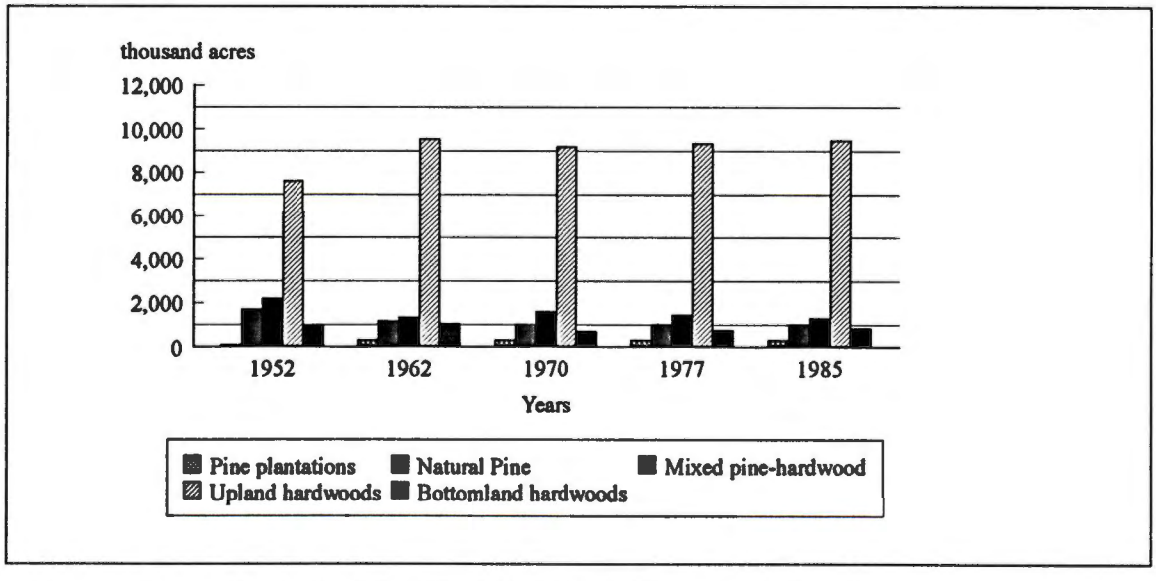


Figure 2. Area of timberland by general forest type for selected years, Tennessee.
Source: U. S. Department of Agriculture, Forest Service. 1989. *Easy Access Forest Inventory and Analysis Tables.* Southern Forest Experiment Station, Starkville, Mississippi.

THE TIMBER RESOURCE

Current Condition Of Timber

Most of the timber in Tennessee consists of upland hardwood species, chiefly white and red oaks, hickories, hard and soft maples, gums, yellow-poplar, and beech. As evidenced in Figure 3, since 1980, hardwood growing-stock volume has been centered in larger diameter classes with a loss of numbers in diameter classes under eight inches yielding a larger sawtimber inventory (Figure 4). However, quality has not increased with the maturing hardwoods. Timber grades one and two provide the basis for the State's hardwood industry, but Figure 5, shows "these grades have declined from 44 to 30 percent of the total hardwood inventory since 1980" (May, 1991). The explanation for this decline can be seen in Table 6, where it is obvious that removals have been concentrated in the higher grades, 1 and 2, while growth is centered on the lower grades, 3 and 4. (May, 1991).

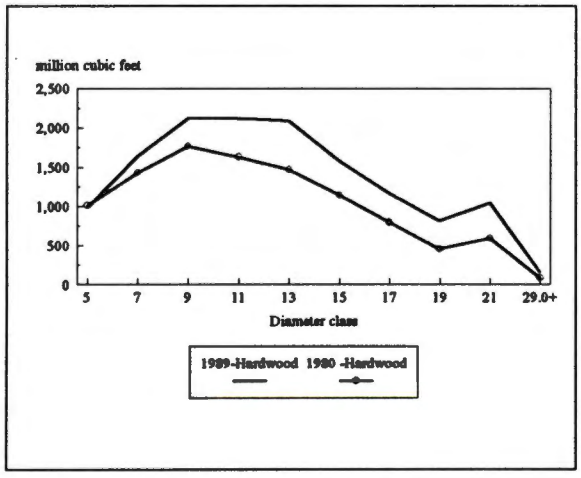
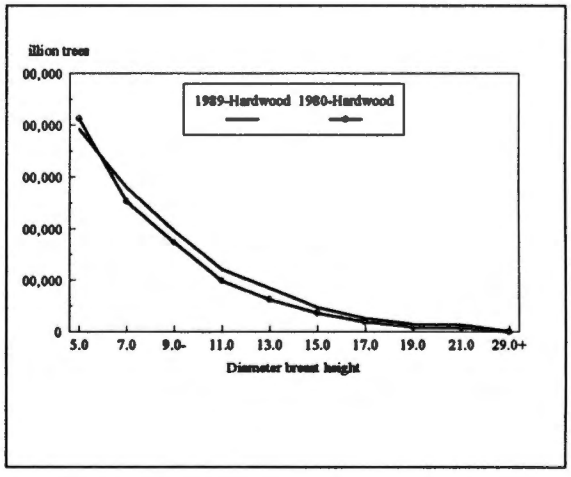


Figure 3. Volume of hardwood growing-stock trees by diameter class, Tennessee, 1980 and 1989.

Source: U. S. Department of Agriculture, Forest Service. 1989. *Easy Access Forest Inventory and Analysis Tables.* Southern Forest Experiment Station, Starkville, Mississippi.



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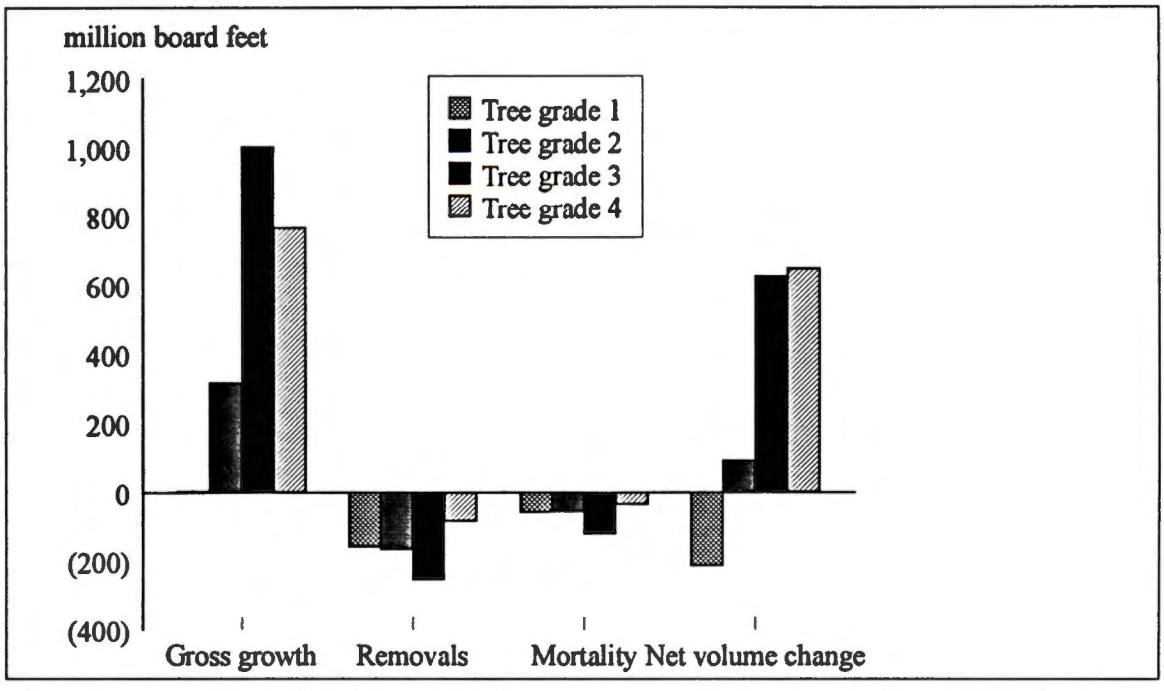

Figure 5. Average annual estimates of hardwood growing-stock growth and volume drain, Tennessee, 1980 and 1989.

Source: U. S. Department of Agriculture, Forest Service. 1989. *Easy Access Forest Inventory and Analysis Tables.* Southern Forest Experiment Station, Starkville, Mississippi.

Table 6. Average annual components of volume change of hardwood tree grades, Tennessee, 1980-89.

		Recruitment			Attrition			Volume Drain			
Tree grade	Survivor volume change	Volume from lower grade trees	Volume from higher grade trees	Volume from new sample trees	Volume to lower grade trees	Volume to higher grade trees	Gross growth	Removals	Mortality	Net volume change	Inventory volume
	million board feet*										
1	26.4	191.3	.....	101.1	-315.6	.....	3.2	158.9	58.3	-214.0	4,176.9
2	42.3	337.3	151.2	212.8	-330.4	-97.0	316.2	167.9	56.1	92.2	8,187.4
3	160.8	287.1	336.9	810.9	-324.9	-268.1	1,002.7	255.0	121.6	626.1	18,930.3
4	50.6	113.9	415.2	409.6	-25.9	-194.5	769.1	84.8	35.5	648.8	9,655.9

Source: May, Dennis M. 1991. *Forest Resources of Tennessee.* U.S. Department of Agriculture, Forest Service, Southern Experiment Station, Resource Bulletin SO-160,.

*International 1/4-inch rule.

Softwoods, mainly native yellow pine, constitute 15 percent of the basal area in Tennessee. The native pine species are diminishing however as more farmers plant loblolly so that there has been an actual increase in the total volume of softwoods while the number of growing stock trees has remained stable (Figures 6, 7).

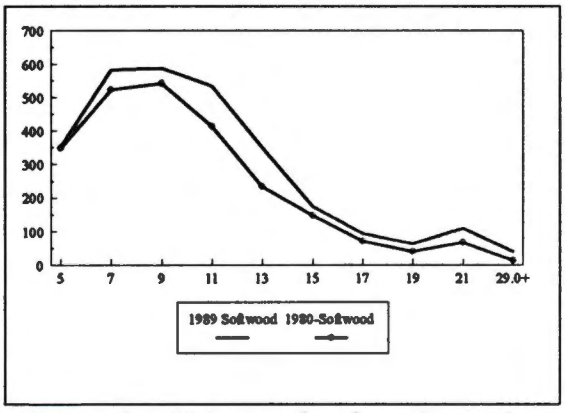

Figure 6. Volume of softwood growing-stock by diameter class, Tennessee, 1980 and 1989.

Source: U. S. Department of Agriculture, Forest Service. 1989. *Easy Access Forest Inventory and Analysis Tables.* Southern Forest Experiment Station, Starkville, Mississippi.

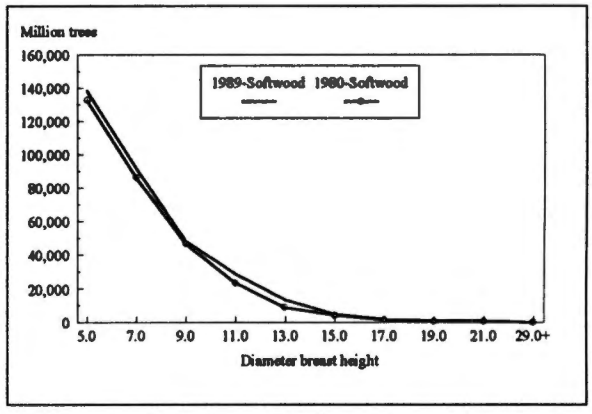

Figure 7. Number of softwood growing-stock by diameter class, Tennessee, 1980 and 1989.

Source: U. S. Department of Agriculture, Forest Service. 1989. *Easy Access Forest Inventory and Analysis Tables.* Southern Forest Experiment Station, Starkville, Mississippi.

Nature Of The Problem

The condition of forest stands is greatly influenced by the type of ownership. Figure 8, shows the number of acres currently held in each ownership class for the state of Tennessee for selected years. Public forests encompass 11 percent of Tennessee's timberland and are currently experiencing the greatest volume per acre because of increases in both pine and hardwood inventories from general maturation in larger diameter trees and losses concentrated in smaller diameter trees. Forest-industry, on the other hand, owns 9 percent of the State's timberland and has practiced intensive pine management. This has resulted in a "conversion of mature natural pine

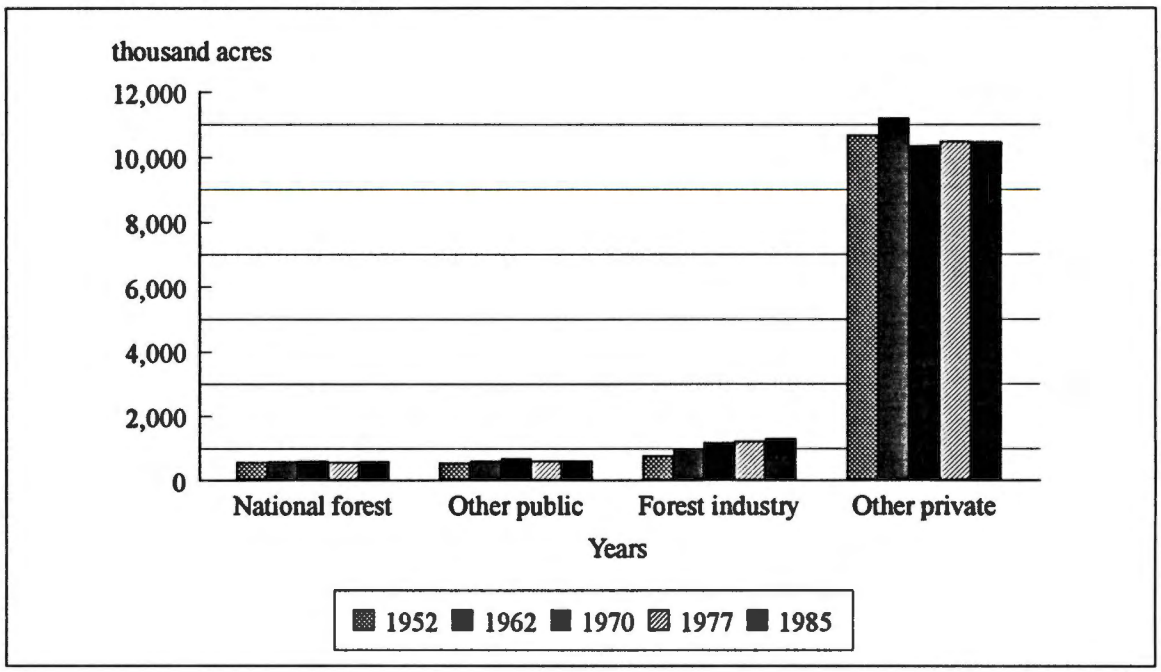

Figure 8. Area of timberland by ownership in selected years, Tennessee.
Source: U. S. Department of Agriculture, Forest Service. 1989. *Easy Access Forest Inventory and Analysis Tables.* Southern Forest Experiment Station, Starkville, Mississippi.

stands into young loblolly pine plantations [that] has swelled the inventory of pole-size trees and decreased the inventory of sawtimber-size trees . . . [as well as] declining inventories of both hardwood growing-stock volume and hardwood regeneration, which will likely continue as pines are favored." (May,1991). Since 1965, the forest industry has been increasing the harvest of natural pine and oak-pine and replacing them with planted pine (Birdsey and McWilliams, 1986). Owners of nonindustrial private forest land (NIPF), control 80 percent or 10.6 million acres of the State's commercial forest land, and therefore, this class inherently follows the State's pattern with increasing volumes on fewer but larger trees. Unfortunately, nonindustrial private forest land contains the one of the lowest volumes per acre usually as a result of poor management practices (Table 7).

The habitual use of inadequate management techniques on nonindustrial private forest land has been a concern to policymakers for decades. In fact, as previously discussed, timber quality is

Table 7. Area of timberland by stand volume and ownership class.

Stand Volume per Acre	All	Public Forests		Forest Industry		Nonindustrial Private Owner	
(board feet)	thousand acres						
Less than 1,500	3,704.9	210.7	14.0	480.9	42.0	3,013.2	28.0
1,500 to 5,000	5,396.7	604.3	40.0	406.9	36.0	4,385.4	41.0
More than 5,000	4,163.7	693.8	46.0	256.0	22.0	3,213.9	31.0
All classes	13,265.3	1,508.8	100.0	1,143.8	100.0	10,612.5	100.0

Source: U. S. Department of Agriculture, Forest Service. 1989. *Easy Access Forest Inventory and Analysis Tables.* Southern Forest Experiment Station, Starkville, Mississippi.

declining despite the overall increase in volume (U.S. Department of Agriculture, Forest Service, Tennessee State Office, 1990). May (1991) suggested that the quality of forest products can be improved in Tennessee by distributing growth and volume drain more advantageously.

Individual farmers cannot be expected to initiate such a change on their own. Findings from a Tennessee forest landowner survey indicates that "less than 2 percent of the estimated 250,000 to 300,000 private landowners receive assistance in managing their woodlands annually, and many owners are unaware of the opportunities that exist for managing their land . . . " (U.S. Department of Agriculture, Forest Service, Tennessee State Office, 1990). Royer and Kaiser (1983) found in the south that this lack of knowledge led to "a belief that sites would naturally regenerate to pine and apprehension about economic returns from forest investments were the two most important reasons for landowners' inaction." In a survey of landowners eligible for CRP, Esseks and Kraft (1988) concluded that "one year after the program was formally launched large proportions of the potential clientele were uninformed or misinformed about conditions critical to their decisions on participation."

Insufficient information may also explain why the quality of timber in Tennessee is reduced because landowners are unaware of progressive practices which promote healthy forests and insure quality timber in the future. An example is the practice known as high-grading, where many culls and trees of low value are not removed while only sawtimber of the highest grades are harvested. Customs such as these result in resource depletion which consequently yields poorer quality timber for future crops and can eliminate prime habitat for wildlife. In a study of factors affecting management of small woodlands, McDermid et. al. (1959), reported that many of the owners who were not managing their land "lacked an adequate concept of what forestry is or what it might bring them".

Poor management practices are caused from factors other than lack of information such as financial constraints. A farm's profit potential can be proportional to its size (Worrell and Irland, 1975) and Tennessee currently has approximately 19,000 owners of at least 100 acres and 250,000 owners of 100 acres or less. Financial ability plays a large part in determining whether owners of nonindustrial private lands will practice quality management. Straka et. al. (1984), suggest the possibility that economies of tract size or economies of scale may affect a landowner's financial ability to invest in timber production. Fixed costs are incurred independent of tract size, such that their effect as a cost of production is reduced the larger the tract resulting in larger expected returns as tract size increases. Worrell and Irland (1975), also present this concept as an explanation for the lack of nonindustrial private landowners to manage their properties for timber. Economies of scale may prevent the small farmer from improving management techniques simply from a financial standpoint - not only are there not enough acres to make the total yield profitable, but start-up costs may be prohibitive. On the other hand, larger properties may not follow a management plan simply because a low return per acre results in an insufficient potential profit.

Farm size also affects the availability of technical assistance. Not only does fragmentation cause a loss in efficiency for the farmer, but it increasingly becomes more difficult for agencies to service more landowners. Royer and Kaiser (1983) determined that where professional foresters advised owners, reforestation was significantly increased. For example, Skok and Gregersen (1975) suggest that agencies could "provide a means to organize the small forest properties in such a way that they can take advantage of economies of scale in both the growing and the harvest, marketing, and use of timber".

Despite the availability of information, financial ability, or technical assistance, the decision to practice a management plan by participating in a government sponsored program will ultimately be influenced by the attitudes, beliefs, and goals of the individual. Worrell and Irland (1975) contend that "lack of interest and goal conflicts that do not stem from low profit potential or lack of some essential ability may not be susceptible to change by any form of incentive program." Dicks and Grano (1988) bluntly state "if farmers dislike a program for personal reasons, they will not participate under any circumstances." Therefore, the utility a person might gain from any given management effort is related to attitudes and beliefs and consequently will affect the responsiveness toward an incentive program aimed at promoting management.

CHAPTER III

REVIEW OF SIMILAR PROGRAMS

Assistance and incentive programs have existed in federal programs for decades. Concern over crop surpluses and resource conservation led Congress to establish the Soil Bank Conservation Reserve Program that involved long term retirement of farmland and was administered by USDA from 1956 to 1962. Under the Soil Bank program farmers who enrolled any land used for field crop production for 3-10 years or trees for 10-15 years for trees received annual rental payments and 80 percent of the cost of installing a permanent land cover.

Poor management practices on potentially productive nonindustrial private forests and its effect on future timber supply led Congress in 1973 to approve funding of the Forestry Incentives Program (FIP) and was initially a part of the Rural Environmental Conservation Program (now the Agricultural Conservation Program); however, in 1975 it became a separately funded program. This program provides Federal cost-sharing of up to 65 percent of the cost of tree planting and timber stand improvement and cannot exceed $10,000 annually to an individual. In addition there are size and erodibility criterion that must be met (U.S. Department of Agriculture, Agricultural Stabilization and Conservation Service, 1990 (a)). It should be noted that the primary objective of FIP was not conservation but rather "to help assure a future supply of timber." (U. S. National Archives and Records Administration, Code of Fed. Reg. 1989, Ch.7, subpart 701.27).

The Payment-in-Kind (PIK) program was initiated in 1983 also in an attempt to resist overproduction of crops in that year and was again solely aimed as a commodity program. In addition, it was noted by conservation and environmental groups that this program as well as other single objective programs actually worked against environmental problems.

In the Food Security Act (FSA) of 1985, U. S. Congress established the Conservation Reserve Program (CRP) which addressed the conservation challenges to decrease soil erosion, reduce sedimentation, improve water quality, create better habitat for wildlife and fish in addition to continued economic concerns such as curbing production of surplus commodities, provide income support to farmers and protect the Nation's long-term capability to produce food and fiber. (FSA, Conservation Title 12, PL 99-1980). The CRP is more complicated than FIP in that it is aimed at all agriculture and subsidy decisions take into account numerous factors. Participation incentive involved a 50 percent share of establishment costs by the USDA but also incorporates an annual per-acre rental payment for enrolling fields with highly erodible soil for 10 years.

America the Beautiful appears to embody more of the objectives of the CRP program because of its conservation concerns; however, the application seems to come from FIP. Paul Harte (1990), of the ASCS office in Washington, said many were referring to it as 'Super FIP'. Eligibility criteria are generally the same: the applicant must be a private individual, group or association, and land must be nonindustrial private forest land. The main structural differences in this program from FIP are relaxed constraints as to land suitability such as the land must be productive but does not have to have previously been planted in crops, only maximum tract size will be limited, and reduction in the required erosion index.

FORESTRY INCENTIVES PROGRAM

Research has been conducted to determine the success of the FIP and CRP programs. Risbrudt et. al. (1983) found FIP to be cost effective for the Federal Government and landowners besides increasing the productivity of nonindustrial private forests. However, they felt improvement is possible with greater efforts toward upgrading silvicultural assistance/guidelines, improving state supervision of implementation, increasing training for field foresters, and critically

determine eligibility. Mills and Cain (1979), also found the program to be financially efficient and in addition to the recommendation for upgraded silvicultural practices also recommended maximum cost guidelines by practice, species, site index, and region and distribute cost-shares accordingly; avoid high maintenance sites; and finally, to ensure follow-up practices.

The success of FIP refers to its single objective of increasing the future supply of timber. Boyd, et al. (1988), examined the impacts of FIP on North Carolina landowners and found that the program is not efficient because some landowners do not harvest thereby receiving an internalized non-market gain from the cost share payment and contributes no timber value to society who is ultimately paying for the program. Their findings also revealed that taxpayer losses exceed the transfers to consumers and producers because some of their support has a greater opportunity return elsewhere. Ervin and Dicks (1988) also noted that rental payments are in part transfer payments from taxpayers to landowners and so, are not a real economic cost; however, the payments are based on landowners' expected losses from in net returns from foregone activities and so a net social loss as well as foregone payments are incorporated in rental payments.

Opponents of the FIP program also argue that it is an unnecessary expenditure and only functions as a substitution for autonomous investment. De Steiguer (1984), found that changes in the level of private forest investment is significantly influenced by personal income and interest rates, and that expected stumpage prices had no significant effect probably because they are not carefully considered when making a decision; however, Binkley (1981), found stumpage expectations to be positively related to reforestation. Finally, de Steiguer (1984) also found that FIP does not act as merely a substitution for autonomous investment in reforestation.

CONSERVATION RESERVE PROGRAM

Success of the CRP program is more complex since it involves multiple objectives. Before the fourth sign-up of the program rules and regulations clearly said that the primary objective of the CRP was to be "reducing the amount of erosion occurring on the nation's cropland," while the others were considered secondary benefits. As Dicks and Grano (1988) noted this "criterion emphasizes erodibility over six other program objectives and reduces the ability to achieve other program objectives . . . the CRP strategy selects all participants who are willing to accept an annual per acre rental payment less than the average cash rent (bid cap) for an area. This process sets a cap on government cost and maximizes the acreage enrolled at this cost; but it does nothing for targeting the seven program objectives. Performance in the case on any one objective is not maximized." In an earlier article, Dicks (1987), stated that only if the program were judged by the quantity of acreage enrolled can it be termed successful; however, if the CRP were evaluated on any single objective, including erosion, then the program is a failure. True success will be accomplished only if all costs and benefits are evaluated, given both the commodity and environmental goals. Peter C. Myers, the deputy secretary of agriculture, USDA, (1988), however, refers to the CRP as a "win-win" situation where farmers get financial incentive to take marginal, eroding land out of production thereby decreasing oversupply of commodities and reducing other commodity program costs. By March 1989, however, lack of participation caused the USDA to reduce the goal of 45 million acres to 40 million (Esseks and Kraft, 1989). There exists a wide diversity of opinions as to the success of CRP with most government agencies extolling its merits while others are mixed as to its efficiency and effectiveness. In Tennessee, 27,108 acres have been planted in trees at an average rental cost per acre of $51.71 through the CRP from March 1986 through August 1989 (U.S. Department of Agriculture, Agricultural Stabilization and Conservation Service, 1990 (b)). A total of 23,765 acres has been planted in

trees through FIP from 1975 through September 1989 at an average cost of $58.91 (tree planting only, not timber stand improvement) (U.S. Department of Agriculture, Agricultural Stabilization and Conservation Service, 1990 (a)).

The environmental impacts that America the Beautiful addresses such as reduction of global CO_2, enhancement of the environment and aesthetic qualities of rural and urban areas are more difficult to quantify than those of soil loss prevention, improved water quality, and reduction in sedimentation found in the CRP. This thesis will not attempt to determine the ability of the program to meet these objectives, but rather to estimate the demand for an environmentally sound forest as represented by estimated participation of Tennessee farmers in the program given various incentives.

CHAPTER IV

THEORETICAL CONSIDERATIONS

BACKGROUND

The literature contains numerous studies analyzing various aspects of government subsidized programs. Most measure the success of a program by whether it achieves its goals; however, since many programs are multi-objective a program can be successful in one goal but fail at another. A difficulty arises since the definition of success can be subjective, depending on which particular objective is being analyzed or, if a general analysis were performed there is debate on which objectives are more important and so contribute more to the success or failure of a program.

Some literature attempts to assess the overall performance of the CRP and FIP by measuring costs and benefits. Risbrudt et. al. (1983) evaluate the cost-effectiveness of the 1979 FIP by comparing the probable timber yield and value increases with the cost of making the investment. Their study assumes that the land enrolled would be naturally forested without the program, therefore, benefits only include the difference in timber quantity and quality resulting from federal and concomitant private investment. Mills and Cain (1979) compared average financial returns for the 1974 FIP cases with yield increases estimated by establishing stylized data based on silvicultural thresholds which also indicated possible reasons for low performance. However, these type of studies fail to account for variables that might explain resource conservation decisions by farmers.

Much of the literature involves analysis of the overall performance of various federally funded incentive programs by examining the effects of alternative policies. Most of these use some form of linear programming models. Boggess and Heady (1981) present a demand-endogenous, separable programming model that provides comparative static analysis on the CRP. Ervin and

Dicks (1988) built upon this work by developing a recursive model that uses a recursive programming approach done by combining the national resource linear programming model (NRLP) which analyzes supply adjustments, and the econometric model of the Food and Agricultural Policy Research Institute to estimate the demand side. This variation allows for greater attention to "the path of economic adjustment" and permits a dynamic analysis of the changes so as to analyze the potential economic welfare consequences of converting cropland to alternative uses to enhance conservation and environmental goals. This is accomplished first by identifying and measuring benefits and costs and subsequently by estimating the order of magnitudes of possible economic impacts for suggested program design improvements.

Besides mathematical models, many simulation models are used to gauge the performance of a program given alternative policies. Rausser and Yassour (1981) examine public policy by using a multi-attribute utility function to specify political preference that reflects the multiple objectives facing policymakers. They found that policy performance is highly sensitive to the value of weights given each objective. "Its principal value may be to provide focus on the major conflicts, tradeoffs, and subjective perceptions among affected groups. It can be used to isolate major disagreements, needed empirical evidence, appropriate degrees of risk aversion, equity value judgments, consensus solutions, and the like (p. 493)." Reicherfelder and Boggess (1988) used this model to determine political preferences and their effect in the initial year of implementation. Simulation of the outcomes of a fully enrolled program under alternative implementation schemes shows which variables can be manipulated to reach target preferences. The United States Department of Agriculture (U.S.D.A.) has published several reports that evaluate various aspects of the CRP. An economic assessment by Young and Osborn (1990) conducted simulations using the Food and Agricultural Policy Simulator (FAPSIM) model to estimate the CRP's progress toward its explicit goals as well as other effects that the program has on the overall economy.

A preponderance of the literature analyzes the individual farmer's decision to participate in a federally subsidized program. Traditional hypotheses establish private forest management decisions on pecuniary goals (de Steiguer, 1984). Investment theory is frequently used to explain adoption of forestry incentives. De Steiguer's (1984) model is based upon the economic model set forth by El-Mokadem where personal income is a measurement of total wealth and as such provides a satisfactory explanation of personal investment in financial assets, in this case reforestation investment. Market forces are compared to cost-share effects to examine investment decisions. Royer (1987) studies the behavior of landowners that face a reforestation decision just after harvest. His model is also based upon financial interest as the primary motivation for reforestation but he uses a logit transformation of a discrete choice model to include a role for technical assistance as well as incorporating non-timber objectives. In their report for the U.S.D.A., Nielsen et. al. (1989), use a simple linear approximation of the investment function that incorporates a varying expected cost of capital with expectations of future net returns as well as other economic factors expected to influence investment. A drawback of investment models is that most fail to capture motives other than money that may influence owner decisions.

Ervin and Ervin (1982) attempt to identify additional motives by dividing an owner's decision-making process into four categories: personal factors including education, orientation to farming, and attitudes; physical factors including slope and soil characteristics; economic factors including gross income, debt level, discount rate, risk aversion, and farm type; institutional factors including education and technical assistance, and subsidies. Estimation of their model by multiple regression resulted in many insignificant variables and most of the variation in any of the dependent variables was not explained.

In an effort to account for variables that may explain owner behavior, dynamic models, especially logistic regression models, are prominent in the literature. Konyar and Osborn (1990)

use the "minimum logit chi-square" method to estimate expected participation using nationwide data from the first three CRP signups. In using a discrete choice approach they define their dependent variable as a choice between the utility of enrolling versus the utility of not participating, such that a farmer will participate when the utility of doing so is greater than the alternative. In order to define utility the explanatory variables fall into two categories. The first encompasses the decision-maker's expectations regarding expected net return under CRP and the expected net revenue of non-participation. The second set of variables measure the farm's and farmer's characteristics including land value, farm size, erosion rate, farmer age and tenure status. Boyd (1984) constructs a model maximizing the utility of nonindustrial private landowners from both timber and non-timber uses by estimating the likelihood that an owner will improve a forest stand. His study also accounts for the roles of technology, capital and labor in the production of timber.

Lynne et. al. (1988) use an extension of the tobit method to estimate a model incorporating economic and behavioral theories that encompass a broad set of motivations. The idea of attitude is compared to the economic concept of expected utility "to say an individual has a strong attitude toward soil conservation activity is another way of stating that the farmer gains a large amount of utility from that action ." The dependent variable is viewed as a continuum of conservation effort quantified as observations by the number of conservation practices used by an individual. Independent variables include economic, physical, and personal characteristics, as well as measurement of attitudes. The model was found to strongly represent behavior and the attitude variables as a group were significant enough that substantial specification error would occur if only economic and physical variables had been used.

Finally, some literature uses acreage response as a measure of program success. The difficulty here is that land characteristics are heterogeneous across owners such that owners with identical personal characteristics may give different acreage responses. Alig (1986) studies the

interrelationships among major land uses in the southeast, with a focus on the influence of economic forces and demographic shifts. The use of seemingly unrelated regression equations support a model for projecting acreage in three major land uses and three ownership classes based upon changes in population, income, and socioeconomic variables and forest acreage. Alig believes the ability to project impacts on the supply of timber and other natural resources from land use shifts is improved. The model however, is unable to fully account for the diversity of landowner goals and the associated relevant benefits, especially non-monetary costs and benefits for alternative land uses. Hardie and Parks (1991) acknowledged that total acreage response to a land-use program can be affected by various landowner motives as well as land characteristics. Consequently, they have developed a method to simultaneously estimate the potential landowner and acreage response to economic incentives. A probit model is used to estimate a utility maximization function that determines the probability a landowner will invest, and the amount of acreage enrolled is estimated accounting for landowner attributes, intentions and attitudes.

This thesis assumes that the multi-objectives in the Stewardship Program have been deemed necessary and beneficial with their existence warranted in any amount such that an increase in tree plantings will reduce soil erosion, increase wildlife habitat, improve soil, air and water quality. Therefore, these values will only be treated qualitatively. This study will concentrate on identifying those variables that will significantly contribute to a landowner's decision to participate. A demand curve will be developed to identify the effects of various cost-share incentives on participation. The effect of information on participation rate will also be considered.

The nonindustrial private landowners that make the participation decision consist of both consumers and producers as in a household production model. Owners receive no utility from the simple possession of a forest - it is not until they have added inputs such as time and technology

that they produce utility-provided outputs. Variables that contribute to a landowner's decision to participate are reflections of those outputs which yield utility to the owner. For example, an owner's preferences toward conservation will reflect the amount of utility received from a given conservation effort.

DATA COLLECTION

The Stewardship Incentive Program has not been in existence long enough to generate data on participation, therefore, this study requires the use of a hypothetical market. In this study, the landowner is required to answer whether or not he/she would participate in a theoretical program given a certain cost share. This is a contingent valuation type of question and as such the survey is subject to many of the same difficulties found in contingent valuation studies. The theoretical implications of a contingent valuation are not applicable since this thesis is not an attempt to directly measure an individual's value of an environmental change or non-use benefit. However, the survey methods have similar properties and many concerns are common to both.

Survey Bias And Sources Of Error

Mitchell and Carson (1989) give three areas of primary concern in contingent valuation research which are also appropriate to this survey since it is a direct observation of responses set up with a hypothetical market:

Incentives To Misrepresent Responses

Strategic bias may occur if an individual believes he might really have to pay (receive) the stated amount. There is then the possibility that a respondent may try to influence the outcome of a study by understating (overstating) WTP (WTA). One major source of strategic behavior assumes that the amount of payment is uncertain and that the provision of a good is contingent upon the respondent's preference and such uncertainty should be avoided in the survey. Mitchell and Carson

(1989) believe the motivation for strategic behavior is weak for most CVM respondents because it would require a great deal of information; surveys normally convey the sense that there are a large number of interviews so that individuals generally do not perceive themselves as having much affect on the outcome; people do not lightly pledge a payment even in hypothetical situations; and under-pledging carries the risk that the good will not be provided.

There are three different types of tests for strategic behavior. Brookshire, et. al., (1976) base their test on the assumption that "true bids" are normally distributed; therefore, a large number of high or zero bids would indicate strategic bias. Rowe, et. al., (1980), gave respondents the opportunity to amend their initial response; the absence of any revision indicates the absence of strategic bias. Bohm (1984) use two subsamples to determine an upper and lower bound of "true" WTP (WTA).

Compliance bias occurs when a respondent gives answers to please the interviewer, especially when they do not have a strong view on the survey topic. Surveys conducted directly by interest groups may influence the respondent to meet their expectations and such studies are not valued by reputable researchers. In telephone and in-person surveys the respondents may look to the interviewer for confirmation that they are giving the "right" answer. Testing for compliance bias involves comparing the results of an interviewer with a large number of interviews.

Implied Value Cues

Individuals may be prone to make estimates by beginning with an initial value and all subsequent values are based upon it, resulting in a bias toward that initial value (Mitchell and Cameron, 1989). This occurs in the CVM when a respondent derives a value from the survey that the surveyor never intended, usually because of the elicitation technique, but also from the method of payment and the description of the amenity. There are five categories of implied value cues.

The most common is generally called starting point bias. Randall (1983) identified two possible sources for starting point bias. Answers may become inaccurate if the questionnaire were a lengthy bidding process and the respondent becomes bored or irritated. The actual starting point of the bid may influence the respondent's idea of an appropriate bid or cost. Most of the tests for starting point bias in CVM studies show that this bias occurs when the bidding game format is used. No valid method exists to adjust the findings obtained by this method. (Mitchell and Carson, 1989).

The payment card elicitation method was developed to avoid starting point bias; however, the nature of the range of values given influences the respondent's WTP (WTA) amount and is called range bias. The bias has four possible effects:

1. the maximum amount on the card may be lower than the maximum WTP of the respondent and artificially constrain his WTP (WTA) amount.
2. the maximum amount may be taken to imply a reasonable upper bound and induce the respondent to give a higher amount than he would give if the maximum were lower.
3. the amounts offered may not include the amount the respondent is willing to pay and may result in the individual choosing an amount higher or lower than his WTP (WTA).

Reference bias occurs when the respondent relies on the value of an associated or "reference" good to determine the maximum amount the good in question is worth. Scenarios must overcome any tendencies for related goods to be valued based on each other.

Importance bias is generated when a respondent concludes that the amenity must have value or the researcher would not have spent his resources in studying it. A scenario in which respondents feel comfortable answering that they are not willing to pay anything and that does not exaggerate the desirability or undesirability of the amenity will minimize importance bias.

Position bias transpires when a respondent gives more or less value because of the placement in a series of different levels of the good which the researcher does not intend.

Scenario Misspecification

Misspecification may be theoretical, which occurs when the researcher describes a scenario that is incorrect in economic theory or known facts. Methodological misspecification happens when the respondent misunderstands the scenario although it is appropriately described. Methodological misspecifications fall into two categories: those that involve the actual amenity, and those that involve other aspects of the questionnaire that create the context in which the amenity valuation is made.

Willingness To Pay (WTP) Versus Willingness To Accept (WTA)

Hypothetical questions of payment for services is inherently necessary in this study so that Mitchell and Carson's (1989) discussion of the pros and cons regarding the approach as it affects the respondents answer to the question of payment out versus payment for is relevant. Several hypotheses exist to explain the WTP < WTA difference. The first of these focuses on property rights where WTA values are higher because the individual rejects the property rights implied by the format of the question, such that, the respondent does not feel the agent has the right to the good in question. WTA surveys usually receive many protest answers, for example "I wouldn't sell no matter how much you offered."

The second theory attributes differences in WTP < WTA to the consumer being cautious. Hoehn and Randall (1987) argue that uncertainty, lack of time to optimize the decision, or risk-averse individuals will tend to give a lower WTP amount and a higher WTA amount. The third argument bases the differences in WTP < WTA on prospect theory, where the value function is steeper for losses than for gains.

Haneman (1984) set forth a theory that the difference between WTP < WTA amounts is a result of the relationship between income elasticity and the elasticity of substitution between the good being valued and all other goods. This means that for goods with many close substitutes, the

elasticity of substitution will be large so that the price flexibility of income is small resulting in WTP and WTA being close together. For a public good with small substitution possibilities, WTP and WTA can be infinitely far apart. In this case, the elasticity of substitution equals zero.

Mitchell and Carson (1989) take the viewpoint that the difference in WTP < WTA amounts may be explained by a combination of the factors identified in these theories. WTA surveys are not well accepted by the public probably because they find the situation improbable, while WTP formats cannot be substituted without biasing the findings if theory specifies WTA.

Sample Bias

The hypothetical scenario of the questions regarding willingness to pay a share of the cost of the program results in sampling issues that are analogous to contingent valuation. Survey bias may introduce significant error in the accuracy of aggregate estimates (Mitchell and Carson, 1989). Sample design and execution biases are represented by four general categories: 1) Population choice bias, 2) Sampling frame bias, 3) Sample non-response bias, and 4) Sample selection bias.

Population choice bias is present when the researcher does not correctly identify the population whose values are wanted. This choice is relatively simple when the population receiving the benefit is also the population paying for it. Identification of the relevant economic unit (i.e. households, individuals) to be questioned is vital and difficulty arises when such factors as ownership or spillover affects are involved.

The identified sample population must then be exactly defined as a list of individuals or households called a sampling frame. The survey method (mail, telephone, personal) determines the sampling frame, and a problem arises when the sample population and the frame are different.

Non-response bias occurs in one of two ways. First, when the individual fails to respond to the questionnaire because of absence or refusal to respond and secondly when a respondent does not answer all the questions in a survey. In ordinary surveys, questions regarding income can have a large non-response rate, but, non-response to other questions is generally less than 5 to 7 percent (Mitchell and Carson, 1989). Contingent valuation surveys, however, commonly experience nonparticipation rates of 20 to 30 percent for the WTP elicitation questions when the scenario is complex, the good is not ordinarily valued, and the sample is random and includes people of all educational and age levels. Mitchell and Carson (1989), state *"up to a certain point*, these higher levels of non-response to WTP questions are acceptable or even desirable." Their reasoning is that it is unrealistic to expect everyone to spend the time and energy to come up with a well considered WTP and so it is better that those who cannot do not guess, but rather do not respond.

Mitchell and Carson (1989) identify four categories of non-response: 1) do not knows, 2) refusals, 3) protest zeros and 4) responses that fail to meet an edit for minimal consistency. They also say that protest zeros are the most difficult since sometimes it is hard to distinguish them from those respondents that just do not wish to participate. To alleviate this problem they feel it is necessary to ask the reason for zero bids.

Non-response in contingent valuation leads to bias when the value for the good is related to differential response rates from identifiable categories or groups exist and when there are systematic differences between those within a particular group who did and did not answer the WTP questions. Failure to identify a characteristic related to WTP can cause a sample non-response bias to be a sample selection bias, and consequently, determination of a previously unobserved characteristic will cause the reverse to occur. Mitchell and Carson (1989), have developed a flow chart of questions that determine the existence of both types of bias.

The type of survey instrument, in-person, telephone and mail, can have a large effect on bias. Mail is especially susceptible to sample selection bias from self-administered questionnaires, as well as low unit response rates; however, survey response rates are improved when mail surveys meet three conditions (Mitchell and Carson, 1989; Dillman, 1978):

1. up-to-date list of names and addresses
2. well designed, packaged, and pre-tested questionnaire
3. noncommercial sponsor such as a university

Dillman (1978), states the correct method of calculating the response rate for a mail survey is to divide the number of completed questionnaires returned by the number in the original sample including non-response for all reasons such that it shows how well the researcher has done at reaching all potential respondents. Reduction in bias from all types can be achieved by employing follow-up methods, and careful pre-testing.

THEORETICAL MODEL

Normally, a consumer is faced with apportioning limited resources among various goods. A measure of a consumers behavior can be determined using a direct utility function which examines how a consumer chooses among competing goods, assuming that an individual, under ordinary circumstances, will attempt to maximize his satisfaction, or utility, from the choices available. Nicholson (1985) states "A person's utility is affected not only by his or her consumption of physical commodities but also by psychological attitudes, peer group pressures, personal experiences, and the general cultural environment." The direct utility function has limited use since utility is rarely derived from the particular good itself but more often from attributes of that good such that the bundles of goods chosen are really only outward manifestations of the true underlying benefit the user receives. This is generally referred to as an indirect utility function

which acknowledges that an individual's desire to maximize utility, given certain restraints, will in some part depend on aspects of other goods and unobserved motives.

In this study the measure of consumer behavior used is the indirect utility function since the landowner derives satisfaction from aspects of the forest that may not be obvious and characteristics of alternatives may affect the decision process. The individual derives utility from the current land use and from participation in the program that could yield future money income from forestry as well as other nonmarket benefits that may not be directly observable such that his utility function is:

$$\hat{U}_i = U(\chi_i + \delta) \qquad \begin{matrix} \text{i = 0 (non-participation)} \\ \text{1 (participation)} \end{matrix}$$

where:

χ_i is the vector of characteristics associated with the choice i.

δ is a vector of characteristics associated with the individual, including socioeconomic and demographic characteristics, attitudes and beliefs, features of the farm

The landowner is faced with two uses for his acreage subject to certain restrictions and must go through a choice process such that the final decision represents the highest utility realized by the landowner given by:

$$U^* = \max(U_i | i = 0, 1)$$

Although there are two choices, i^*, to participate or not, we know only the actual choice made and the characteristics of each alternative, χ_i. The difficulty is solved by determining the probability of choosing to participate, U_1, given that set of goods characteristics $\{\chi | i = 1\}$ and consumer characteristics, δ, such that $U_1 > U_0$.

$$prob(U_1) = P_i = prob[U(\chi_1 + \delta) > U(\chi_0 + \delta)]$$

Three axioms have been established in order to make the individual choice model workable, the first of which as stated by Hensher and Johnson (1981), the second and third from McFadden (1974):

1. Independence from irrelevant alternatives - the ratio of the probabilities of choosing one alternative from another is unaffected by the presence or absence of any additional alternatives in the choice set. This implies that the random elements in utility are independent across alternatives.
2. Positivety - the probability that a particular alternative is chosen, given the socio-economic characteristics and the alternatives in the choice set, has to be greater than zero for all possible alternative sets A, vectors of measured attributes, s, and $X \epsilon A$.
3. Irrelevance of alternative set effect - the function used in determining selection probabilities has the additive separable form. As long as the model is limited to situations where the alternatives can plausibly be assumed to be distinct and weighted independently in the eyes of each decisionmaker, and that there is, across replications, one alternative set then the selection probabilities can be obtained with some degree of confidence, although this is not a guarantee that the selection probabilities structure conforms precisely with the choice theory.

This study also assumes that the random elements in utility are also identically distributed so that the form of the model estimated is a multinomial logit model.

CHAPTER V

METHODOLOGY

EMPIRICAL MODEL

This study attempts not only to determine the probability an individual will choose to participate, but also to determine a relationship between that choice and certain attributes of an individual. Analysis of response as a function of economic, physical, as well as behavioral factors results in a qualitative model, specifically, a binary choice model since the dependent variable is dichotomous in nature. The following logit probability model specified (Pindyck and Rubinfeld, 1976) is the empirical form of the theoretical model where variables P_i, C, correspond to the χ_i vector, and Y, D, F, and A correspond to the δ vector:

$$\log\left(\frac{P_i}{1-P_i}\right) = \alpha + \beta X_i$$

$$\log\left(\frac{P_i}{1-P_i}\right) = \beta_1 + \beta_2 Y - \beta_3 C + \beta_4 D + \beta_5 F + \beta_6 A$$

where:

P_i is the probability that a landowner will choose to participate in the Stewardship Incentive Plan

Y is current income from all sources

C is the cost associated with participating in the Stewardship Program

$$\upsilon a$$

where:

υ is the farmer's percent share of the cost

a is the total establishment cost per acre

D are personal characteristics that influence participation including socioeconomic and demographic characteristics

F are features of the farm including size, current land use, ownership type

A are the attitudes and beliefs in conservation practices

DATA MEASUREMENT

Participation is directly determined in a hypothetical situation for two reasons. First because the program is currently not fully implemented and sufficient participation data does not exist. Secondly because this study examines the effect of incentives other than that offered by Tennessee Stewardship Plan. The method adopted by this thesis contains contingent valuation questions within the survey. However, the end result is not an estimate of the value of a change in environmental quality but simply the demand for the program given various cost share amounts and personal characteristics. The respondent's willingness to engage in the Stewardship Incentive Plan is a hypothetical direct method, but not a contingent valuation of the program.

Sample Population

Since the Stewardship Incentive Program is new, it is assumed that in the beginning the target population will be those individuals that will yield the best probability of success. As previously discussed, economies of scale increasingly make it more difficult for small farmers to participate as supported by the findings of Dicks and Grano (1988); Skok and Gregersen (1975); and Rosson and Doolittle (1987). Based on this assumption, this thesis will concentrate on ownerships of 100 or more acres. The only list of the total population of nonindustrial private landowners of 100 acres or more in the state of Tennessee was somewhat dated. It was felt that owners of larger tracts of land do not tend to move around very much and increasing the size of the sample would compensate for incorrect addresses. According to the unpublished list from the Tennessee Division of Forestry (1991), there are approximately 17,622 nonindustrial private landowners of 100 acres or more. Correct statistical analysis requires a sample response of 400 surveys given this population size (Dr. William Sanders, Univ. of Tenn. 1990). Surveys that contain willingness to pay questions, especially when they are also mail surveys, can experience

lower than average response rates. Therefore, it was estimated that 1000 surveys were necessary to send to obtain the 400 responses required.

Survey Instrument

Budget constraints required a mail survey; therefore, a close-ended, non-iterative format was chosen to simplify the choice process. The "take-it-or-leave-it" approach is generally used to estimate welfare functions and calculate welfare measures in a contingent valuation framework (McConnell, 1990); however, the design of this type question is appropriate in this survey for those specific questions asking willingness to participate at given cost share amounts. The method developed by Bishop and Heberlein (1979) was selected so that the owner only had to make a judgment about a given cost share amount which is especially suited for mail interviews. Hoen and Randall (1987), found that this method was compatible with the respondent's incentive since it is in their best interest to answer yes if their actual WTP were greater than or equal to the amount asked, and to say no otherwise. McConnell (1990) concurred that valuations based on these types of data have greater plausibility because they require only a yes or no response rather than an estimate of what consumers' pay, however, it may be subject to a non-zero background level of yea-saying.

VARIABLE MEASUREMENT

Dependent Variable

In order to simplify the individual's decision process, a binary dependent variable model representing the adopt-not adopt decision was chosen. The dependent variable is an unobserved utility measurement determined by the observable choice of whether or not to participate and as such it takes on discrete values with a lower bound of zero.

Independent Variables

The cost associated with participation includes a value for δ which is the cost share amount presented in that farmer's survey. Since hardwood forests accommodate more of the Stewardship Plan's goals, an establishment cost of $80 per acre was based upon typical startup costs for a Tennessee mixed hardwood forest from information obtained from the Tennessee Division of Forestry and the Department of Forestry, Wildlife & Fisheries at the University of Tennessee, Knoxville (Wells, 1990).

Personal characteristics (D_j), are represented by income, education, and occupation. Konyar and Osborn (1990), found age to be a significant variable such that the older the farmer, the less likely the probability of participating in the CRP. The forest commodity, is a little different from other goods, however, because it requires a long term investment frequently from 20 to 30 years. Farmers will invest in trees for very different reasons at all ages. Older farmers may invest for future generations while young farmers may invest for their own retirement, therefore, it is felt that age itself is not a determinant of participation.

The Stewardship Incentive Program requires an understanding and knowledge of forest resource management and if an individual does not already have the expertise, it must be learned. Individuals with a higher level of education will be more likely to have gained a broader expertise or will may more willing to learn what is necessary. It is expected that as the level of education to have a positive relationship with participation. A dummy variable will be used to distinguish between those respondents with at least some college education and those with a high school level or less.

This thesis expects individuals whose primary occupation is related to agriculture will be more likely to participate because of their familiarity with farm practices and they may already

have machinery and other inputs necessary to begin. Occupation is represented by a dummy variable where agriculture related job responses are assigned a 1 and all others a 0.

Features of the farm (F_n), are represented by the number of acres owned, a continuous variable, the size of the farm, a dummy variable with parcels equal to or greater than 10,000 acres given a 1, otherwise a 0, and primary current land use, a dummy variable for crop, pasture, unmanaged and other with managed land representing the intercept. As previously discussed, farm size is expected to have a positive relationship with participation in the Stewardship Incentive Program because of economies of scale and greater ability to invest over the long term. Current land use will be determined by the greatest value given in response to the number of acres currently in unmanaged forest land, pasture, cropland, wetland, gully or wasteland, and an "other" category. It is expected that those with unmanaged forestland and pasture as the primary land use will be more willing to participate than the others.

Five dummy variables are used to evaluate attitudes and beliefs in conservation practices (A_n). In the first question regarding the respondent's opinion about land management goal, the individual was asked to value each goal from "strongly want" to "strongly do not want". Based on the survey design these responses were ordinally ranked with "strongly want" as the lowest number, 6 possible points, to "strongly do not want", 30 possible points. A negative relationship between this variable and participation is expected such that the lower the value of the variable, the stronger the desire for conservation and management and participation.

Previous or current experience with forest management reflects a positive attitude toward the program and is expected to have a positive effect on participation. It is captured in a dummy variable such that if the respondent replied yes to any one of survey questions regarding forest management experience the variable is given a 1, if no is answered to all then a 0 is assigned.

As with experience in forest management, previous experience with conservation or other resource management program is assumed to represent a positive attitude toward the goals of the program and is expected to have a positive sign. It is also a dummy variable where if the person had any previous experience with any conservation or resource management programs a 1 is assigned, no experience at all is given a 0.

Previous work has shown that knowledge depicts interest in a program and will increase participation. Esseks and Kraft (1988) found, in two of their four sites, that recipients of technical assistance from government agencies or individuals enrolled in a government program in the last two years had a significantly higher probability of bidding in the CRP. A later study by Esseks and Kraft (1989), determined that visits to government offices, especially ASCS, made a significant difference in their knowledge of a program. As in the Esseks and Kraft case, this study expects the effect of information to have a positive impact on participation. A dummy variable will represent whether the respondent had actively sought information concerning land use practices or had received information from government agencies in the last two years. A summary of the variables used in the model and the expected sign is given in Table 8.

Table 8. Summary of variables used in the model.

Variable Group	Stated Hypothesis	Expected Sign	Variable Name: Description
			PART: logarithm of the odds of decision to participate in the Stewardship Incentive Program
Y	the higher the income, the more likely the indiv. will be to participate	+	**INCD1-5:** 5 dummy variables; income level 1 is captured in the constant, the other levels are each a dummy
C	the higher the cost borne by the farmer, the less likely he will be to partipate	-	**COST:** single var: farmer's share of cost *$80/acre
D	the higher the level of educ., the more likely they will particpate	+	**EDUC2:** single variable - categorized in years of school completed: 1 1-6 years 4 high school graduate 2 6-8 years 5 some college 3 8-12 years 6 college graduate 7 advanced degree
	indiv. whose primary occup. is ag. related will be more likely to participate	+	**OCCUP:** 1 = farmer/forestry 0 = all other occupations
F	as the amount of acreage owned increases so will participation	+	**ACRE:** continuous variable of actual acreage owned
	large farms will be more likely to participate than small	+	**SIZE:** 1 = ownerships of 10,000 or more acres 0 = all others
	those with unmanaged forest and pasture as primary land use will be more willing to participate than others	+	dummy variable for land use classification: **CONSTANT:** managed forest land **PSTR:** pasture **UNMGD:** unmanaged forestland **CROP:** cropland **OTHER:** all other uses
A	the stronger the desire for each goal as well as multiple goals the more willing to participate	-	**GOALS:** single variable: Survey Quest. 1a-f were summed such that the lower the number the stronge the desire for any goal
	the stronger the feeling for conservation, the more willing to participate	+	**CONEXP:** 1 = answered yes to any of Quest 5,8,9 0 = answered no to all of Quest. 1,8,9
	previous experience with forestry practices will result in a higher likelihood of participation	+	**FEXP:** 1 = any prior experience with forestry 0 = no prior experience with forestry
	if indiv. actively seek info. about any ag. subject, the more willing to participate	+	**INFOS:** 1 = if individual had gone anywhere for information about land use practices/programs 0 = if individual had never sought information about land use practices/programs
	receipt of ag. info. should have a positive influence on participation	+	**INFOR:** 1 = if individual had received information from government agencies in the last two years 0 = if individual received no information from government agencies in the last two years

CHAPTER VI

RESULTS

SURVEY

There were 4000 surveys mailed to nonindustrial private landowners. A 12 percent response rate was returned, however, 77 of these were disqualified: 22 as a result of blank answers to key questions, 9 because the total acreage reported was less than 100, 3 because they were not nonindustrial private owners, and 43 were protest responses to the participation question.

Of the landowners surveyed, the modal respondents are male, between the ages of 56 to 75, with either a bachelors or advanced degree, whose primary occupation is farming, forestry, or retirement, and have a household income over $50,000.

Determination of an individual's attitude and beliefs in conservation was in part represented by the individual's opinion regarding the land management goals (Table 9). In describing how they felt about each goal, the vast majority strongly want timber enhancement followed by protection of water quality. Improvement in fish and wildlife habitat was strongly desired by one-half of the respondents and another quarter of the group mildly want it. Close to one-half of the respondents either mildly or strongly want to protect wetlands, increase recreational opportunities and enhance scenic value. The most strongly opposed goal is protection of wetlands

Table 9. Respondent's opinion of each goal given in percentages.

Goal	Strongly Want	Mildly Want	Indifferent	Mildly do not Want	Strongly do not Want	Total
Timber	72.0	14.0	11.0	1.0	2.0	100.0
Wildlife	50.0	27.0	19.0	2.0	2.0	100.0
Water Quality	65.0	18.0	16.0	0.0	1.0	100.0
Recreation	20.0	27.0	41.0	6.0	6.0	100.0
Scenic	32.0	30.0	33.0	3.0	2.0	100.0
Wetland	25.0	20.0	39.0	7.0	9.0	100.0

with 16 percent either mildly or strongly not wanting it. Of all the goals listed, almost two-thirds of the respondents chose enhancement of timber growth as the most important goal on their own land (Table 10) and 66 percent of the respondents felt improvement was necessary to achieve their

Table 10. Number and percent of each goal chosen as the most important.

Goal	Total Number	Percent of Total
Timber enhancement	269.0	70.0
Improvement of fish/wildlife habitat	55.0	15.0
Protection of water quality	44.0	11.0
Protection of wetlands	2.0	1.0
Increase recreational opportunities	3.0	1.0
Enhance scenic value	13.0	3.0
Total	386.0	100.0

primary goal.

The other variable used to estimate the individual's attitudes and beliefs in conservation involve prior experience with conservation and forestry. Fifty-six percent of the respondents had any experience with conservation management. The most common of which was to enhance timber growth where about one-half the respondents had experience. Protection of wetlands proved to be the least frequently managed with only 10 percent of the respondents having any prior experience. Management to increase recreational opportunities was not much more popular with 14 percent of the respondents. Experience in management for the improvement of wildlife habitat, protection of water quality, and enhancement of scenic value range from 35 to 22 percent of the respondents. Only 15 percent of the respondents are members of any environmental organization.

Approximately one-half of the respondents have previously participated in a government cost share program. Eighty-four percent of the respondents have some experience with forestry.

Features of the farm were represented by two variables, primary current land use and farm size. Fifty-two percent of all the land uses were managed forest according to the returned surveys. Of the six forest management techniques listed in the survey, intermediate harvesting and exclusion of livestock were by far the two most common practices. Sixty-four percent of trees planted in stands were sawtimber (12" diameter breast height, DBH), twenty-eight percent were poletimber stands (6-12" DBH), and only eight percent were seedling or sapling size stands (1' tall to 6" DBH). Respondents recorded nearly one-half of the remaining 48 percent of the land as unmanaged forest. Of forest types, oak-hickory comprise the vast majority of either managed or unmanaged. The 'other' category was the next largest forest type and this was almost entirely specified as a 'mixed regime' indicating that owners either are not certain which forest types prevail on their land or are not familiar with standard forestry classifications. Wetlands, cropland, and pasture made up the remaining land uses in that order. Sixty-four percent of the cropland was slightly to moderately erodible, twenty-one percent was highly erodible. The majority (73%) of pasture was registered as highly erodible, the remainder was evenly divided between moderately, slightly, and not erodible.

Farm size ranged from just under 100 acres to 190,000 acres. Sixty-seven percent of the respondents owned farms that were under 500 acres, however these represent only ten percent of the total acreage reported. Seven respondents own over 10,000 acres which make up 63 percent of all the acreage. 80 percent of the owners with less than 500 acres were not farming as a primary occupation. As tract size increases, however, farming as a primary occupation also increases up to 5000 acres at which point the percent of farmers drops off completely, only to rise substantially with landholdings greater than 10,000 acres.

Information sources were divided into two categories: 1) where does the individual go when seeking information and, 2) from whom does the individual receive information. Individuals in the sample survey mainly go to the ASCS (Agricultural Stabilization and Conservation Service) (34%) for information. The majority (37%) of information received by the returned surveys also came from ASCS. Agricultural extension agent followed as the next most frequented source of information (29%), and as the next most common source of information received. The forest service and SCS were far behind the other two in both information received and sought. (Table 11).

Table 11. Number and percent of respondents seeking information from or receiving information from selected sources.

Source	Information sought from:			Information received from:		
	Yes		No	Yes		No
ASCS	288.0	34.0	105.0	264.0	37.0	139.0
Agricultural extension agent	235.0	28.0	147.0	200.0	28.0	189.0
SCS	129.0	15.0	229.0	117.0	16.0	259.0
Forest service	156.0	18.0	208.0	112.0	15.0	260.0
Other	43.0	5.0	276.0	26.0	4.0	309.0
Total	851.0		965.0	719.0		1156.0

MODEL

The model was estimated using the logit option in the Shazam (White, et. al., 1988) software package. Table 12 includes the maximum likelihood estimated coefficients, t-ratio, weighted aggregate elasticity, likelihood ratio test, McFadden R-Square, and prediction success statistics. Measures of the goodness of fit indicate that the model fit the data fairly well. The likelihood ratio test which measures the significance of the logit function, given a large sample, scored 84.3028 which is significant at a p value of less than .001 so the null hypothesis that the

Table 12. Results of the model.

VARIABLE NAME	ESTIMATED COEFFICIENT	T-RATIO	WEIGHTED AGGREGATE ELASTICITY	CHANGE IN PROBABILITY
COST*	-0.02977	-1.87750	-0.32408	-0.0059
EDUC2	0.03261	0.34582	0.06352	0.00647
OCCUP	0.08587	0.29492	0.00815	0.01702
FEXP*	0.86755	2.50760	0.27351	0.17199
ACRE	-0.00009	-1.38930	-0.03733	-0.00002
SIZE	2.57730	1.16140	0.01369	0.51094
UNMGD*	0.9390	3.09460	0.20175	0.18615
PSTR*	1.12000	2.55070	0.04712	0.22204
CROP*	1.28770	2.29660	0.02898	0.25528
OTHER	0.27444	0.32342	0.00215	0.05441
GOALS*	-0.13010	-4.19330	-0.56929	-0.02580
CONEXP	0.24665	0.97318	0.05298	0.04890
INFOR	0.13675	0.41493	0.04134	0.02711
INFOS*	1.94980	3.06980	0.69290	0.38654
INCD2	0.02163	0.03814	0.00092	0.00429
INCD3	0.49658	0.90291	0.02740	0.09844
INCD4	0.24220	0.41940	0.01036	0.04802
INCD5	0.36181	0.66468	0.02260	0.07173
INCD6*	1.04170	1.99540	0.14847	0.20651
CONSTANT	-1.70520	-1.55600	-0.63258	-0.33805
LOG-LIKELIHOOD RATIO TEST				84.30000
MCFADDEN R^2				0.16000
PREDICTION SUCCESS:			Concordant	68.00000
			Discordant	32.00000

*denotes significant at $\rho < .1$

probability of an individual choosing to participate is not related to any of the suggested variables is rejected. McFadden's R-Square is .16143, slightly under the .2 and .4 range which Hensher and Johnson (1981) consider would denote "extremely good fits". The model correctly predicted 68 percent (257 out of 378) of the respondents. Correct predictions were relatively evenly distributed with 59 percent of the non-participants (104 predicted, 176 actual) correctly predicted and 76 percent of the participants correctly (153 predicted, 202 actual).

Interpretation of the estimated coefficients must be done with some care since the individual estimates are the weights of that parameter which, when multiplied times the left side of the equation will effect that much change in the logarithm of the "odds" of choice - not of the probability itself (Pindyck and Rubinfeld, 1976 and Neter, et. al., 1983). For example, a 1 unit increase in GOALS, say from 6 to 7, would result in a .13010 decrease in the logarithm of the odds that an individual will choose to participate in the Stewardship Incentive Program. There are two methods which yield a better interpretation of a parameter. Pindyck and Rubinfeld, 1976, recommend solving for the change in probability at the mean:

$$\Delta P_i = \beta[P_i(1 - P_i)]$$

where,

P_i = estimated probability of participation at each observation.
β = estimated coefficient for a parameter.

The change in probability is a function of the probability itself and as such represents the percent change in the probability of the event occurring given a change in the parameter, *ceteris paribus*. For example, that same 1 unit increase in GOALS will result in a 2 percent decrease in the probability of participating. (Pindyck and Rubinfeld, 1976).

Another generally accepted method of interpreting the estimated coefficients is the weighted aggregate elasticity, also known as the sample enumeration method (Hensher and Johnson, 1981). The elasticity for each individual is estimated at the mean and then aggregated,

weighting each individual elasticity by the individual's estimated probability of choice. Interpretation means that a 1 percent change in the independent variable will result in a corresponding percent change in the overall probability of participation holding everything else constant. For example, a 1 percent increase in GOALS will result in a .57 percent decrease in the probability of participating in the Stewardship Incentive Program. (Hensher and Johnson, 1981). Obviously this interpretation is not as easily understood in the case of dummy variables, since it is not clear what a percent of that variable represents, therefore, this analysis will concentrate more on the change in probability.

Examination of the coefficients reveals that within the demographic (D) variables only INCD6 is significant. This indicates that incomes under $50,000 will not often effect participation, however, at some income greater than $49,999 a shift occurs and the demand for the program increases. The change in probability strongly reinforces the existence of this phenomenon by predicting a 20 increase in participation for a change into the INCD6 category. The variable, COST, has a negative sign as expected, denoting the higher the cost borne by the farmer (which in effect reduces income), the lower the probability of participation in the program. Again, this variable is significant, meaning it frequently has some effect on the decision to participate. The change in probability indicates that an increase in the cost share offered, from 50 to 65 or from 65 to 75 will increase participation by a total of 12 percent.

OCCUP and EDUC2 were both found to be insignificant but do have the expected signs. Although research of other programs found these two variables to be significant, the reported research dealt with mainly crop related programs. The nature of growing a forest is quite different in that it is a long term investment requiring inputs of land but limited labor, such that owners with occupations other than farming may find this an acceptable land use option. Farmers, on the other

hand, may not be able to convert crops to forest and may only be willing to enroll existing unmanaged forests or unused pasture.

Attributes of the farm (F) were substantially represented by the land uses. UNMGD, PSTR and CROP were all significant to the model. This is a dummy variable which means these land types participate more frequently than managed forest land. The change in probability indicates that owners with cropland as the major land use will affect the most change in the probability of participating, such that as land use changes to primarily cropland, that owner will be 25 more likely to enroll some of his land in the program. The other land use variables are similarly interpreted.

Surprisingly ACRE is not significant at the 90 level and the sign indicates that the greater the number of acres owned the less probability of participation. SIZE is a dummy variable, with owners of 10,000 acres or more given a 1. Although insignificant, the sign on SIZE implies that owners of the large tracts of land are more likely to participate.

The category of variables estimating owner attitudes and opinions (A) contain those variables that have the highest significance of any variables in the model. The GOALS variable indicates that there is positive relationship between willingness to participate and the respondent's feeling for the goals of the program. The GOALS variable represents the individual's feeling toward the goals of the Stewardship Incentive Program, such that the higher the number, the more strongly they are disliked. The change in probability means that a 1 unit change toward a more favorable attitude, for example from 15 to 14 total points, will increase the probability of participating by 2. This may become clearer if the impact with regard to what a unit change in attitude is considered. The value range for the GOALS variable is ranked such that a 6 signifies a strong desire for all goals; 12 mildly desires all goals; 18 that they are indifferent to the goals; 24 they mildly do not want the goals; and finally, a 30 represents a strongly do not want any of the

goals. With this in mind, a change in an individual's attitude from indifferent to mildly want the goals, will increase the probability of participating by 15 percent. To fully appreciate the significance of a change in attitude examine the case of an individual that went from strongly opposed to strongly in favor of the goals where the probability of participating would be increased 60.

FEXP, is also highly significant and exhibits a strong positive relationship with participation. In this dummy variable any type of experience, with forest management, most of which was fundamental, was considered a positive and rated a 1. The change in probability reveals that a 1 unit increase in any type of experience will create a 17 percent increase in participation. CONEXP, however, is not significant but does have the expected sign.

INFOS is highly significant, however, INFOR is not, but does have the expected sign. The change in probability for INFOS is important since it shows that a change from someone that does not seek information on forest practices to someone who does actively seek such information will result in 38 increase in the probability of participating. It is interesting that individuals who seek information regarding land use practices and programs are very likely to participate in the Stewardship Program, whereas, information received from various agencies is not likely to influence participation at all. Apparently the effort used by an individual to gain knowledge regarding farming or forestry practice is a reflection of their interest or attitude and is a good indicator of potential participation.

To illustrate the application of these results, a description of the type of individual most likely to participate would have a family income of over $50,000, have an occupation other than farming or forestry, but have experience with forestry, actively seek information regarding forestry programs, is supportive of conservation and the goals of the program, and whose land use is primarily unmanaged forest. On the other hand, the individual least likely to participate is a farmer

whose primary land use is not unmanaged forest, has a low family income, is not interested in the goals of the program, has no experience with forestry practices, and does not attempt to learn about new practices or programs.

Finally, there were forty three protest "no's" out of 421 total responses, that were not included in the model because respondents stated they would not participate under any circumstances as a result of an objection to any government involvement. There were also 32 who would not participate without more information regarding this particular program.

CHAPTER VII

CONCLUSIONS AND LIMITATIONS

The results of this model support the hypothesis that a negative attitude regarding the program could outweigh benefits including monetary gains, such that the individual will not participate regardless of the cost share. Figure 9 is based upon a typical respondent that would participate in the program given his particular set of variables and the effect of changes in cost share and goals. A negative attitude greater than 18 results in non- participation at any cost share level. This is very significant for policy decisions aimed at an implementation strategy that would yield the greatest participation. Individuals willing to participate given the *status quo* would make a good first target for the Stewardship Incentive Plan. A minimum outlay of agency time and capital will be necessary to induce participation for those individuals that are strongly in favor of

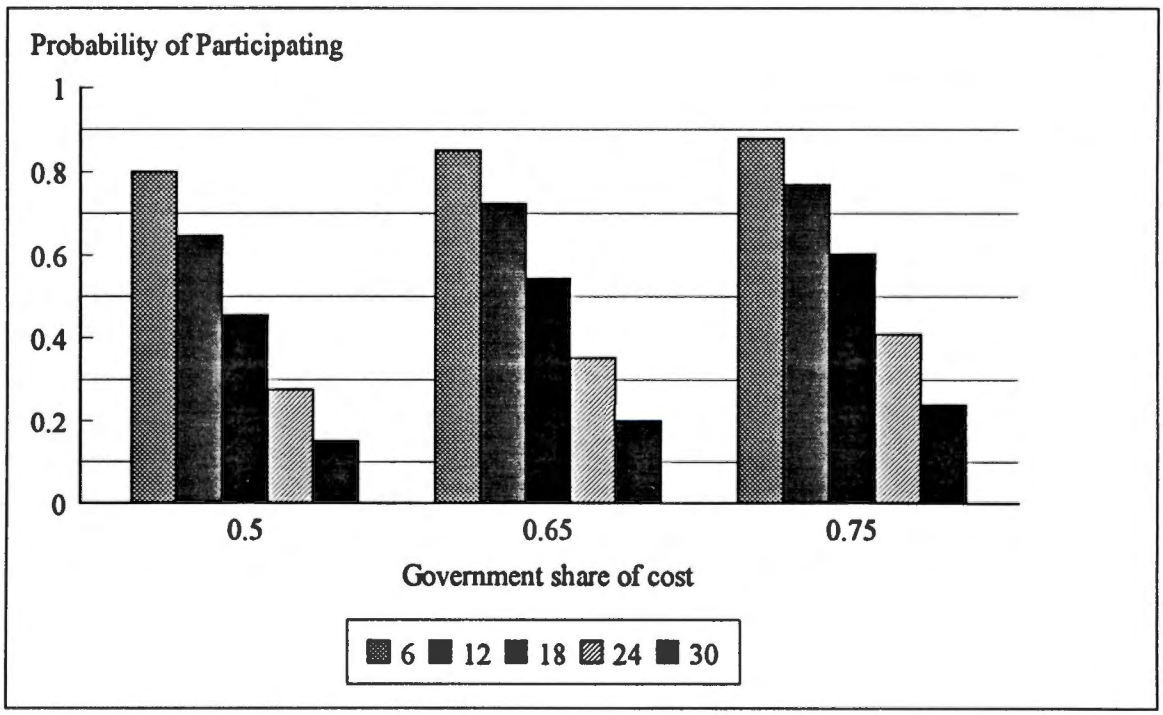

Figure 9. Effect of various cost-share incentives and changes in attitude on a typical respondent that is willing to participate, *ceteris paribus*.

the type of goals in the plan. A difficulty arises however, since it is not known how costly it would be to identify these individuals, therefore, the practicality of targeting them requires additional study.

Once identified, additional incentive is not necessary and really only acts as a substitute for autonomous investment as is the case in individuals with a positive attitude of 12 or less in Figure 9. As you graduate from individuals with strong favorable opinions to those less favorable, participation willingness will begin to decrease. Traditionally, direct financial incentives have been used as the primary tool to increase willingness. This model, however, indicates that indirect incentives aimed at creating a more favorable attitude toward the program itself will have a stronger influence on participation than monetary incentives (Figure 10). The drawback is that there is no way to compare the cost to implement a one unit change in attitude to the expense of creating a change in participation from a cost share incentive.

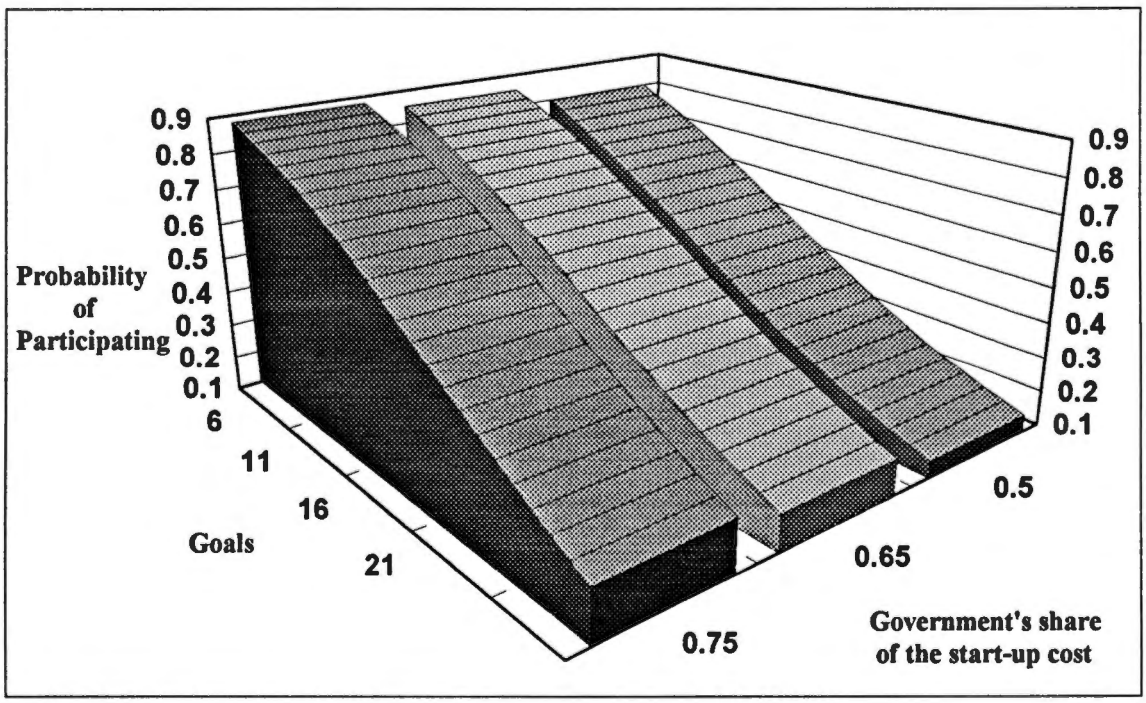

Figure 10. Typical participant and the effect of changes in cost-share and attitude toward goals.

As the willingness to participate in the population begins to decrease, the most effective approach may be to concentrate government funds on such indirect incentives such as training and technical assistance provided it is practical to do so. For example, the individual in Figure 9 with an indifferent attitude of 18 can either be induced to participate at a 50 percent cost share by increasing his attitude to 12, creating a movement along the individual response function, *ceteris paribus*; or by leaving his attitude alone and increasing the amount of cost the government will incur to 65 percent cost share, depicted also as a movement along the individual response function, *ceteris paribus* (Figure 11). Again, it is important to realize that individuals with an attitude of 25 or greater will not participate at any of the offered cost share incentive and only a change in attitude will promote participation.

Changes in the other variables in the model will also result in a shift of an individual's demand curve. As previously reported, many of landowners are uninformed, and according to the

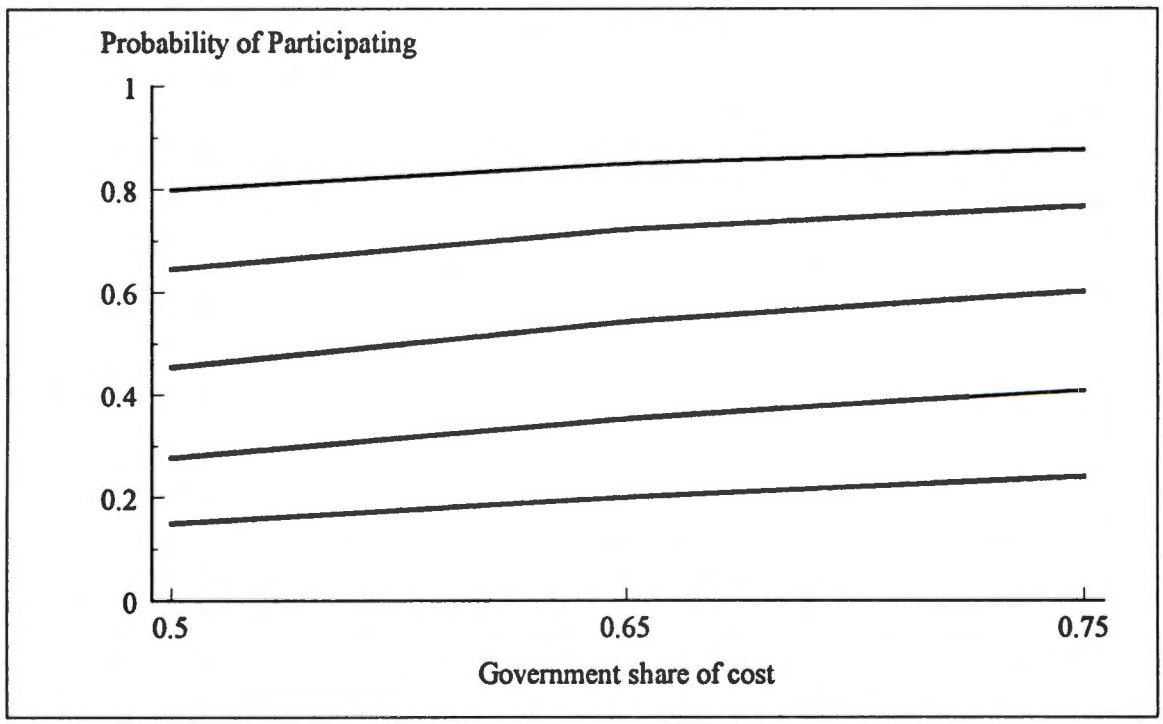

Figure 11. Response functions for effect of various cost-share incentives and changes in attitude on a typical respondent that is willing to participate, *ceteris paribus*.

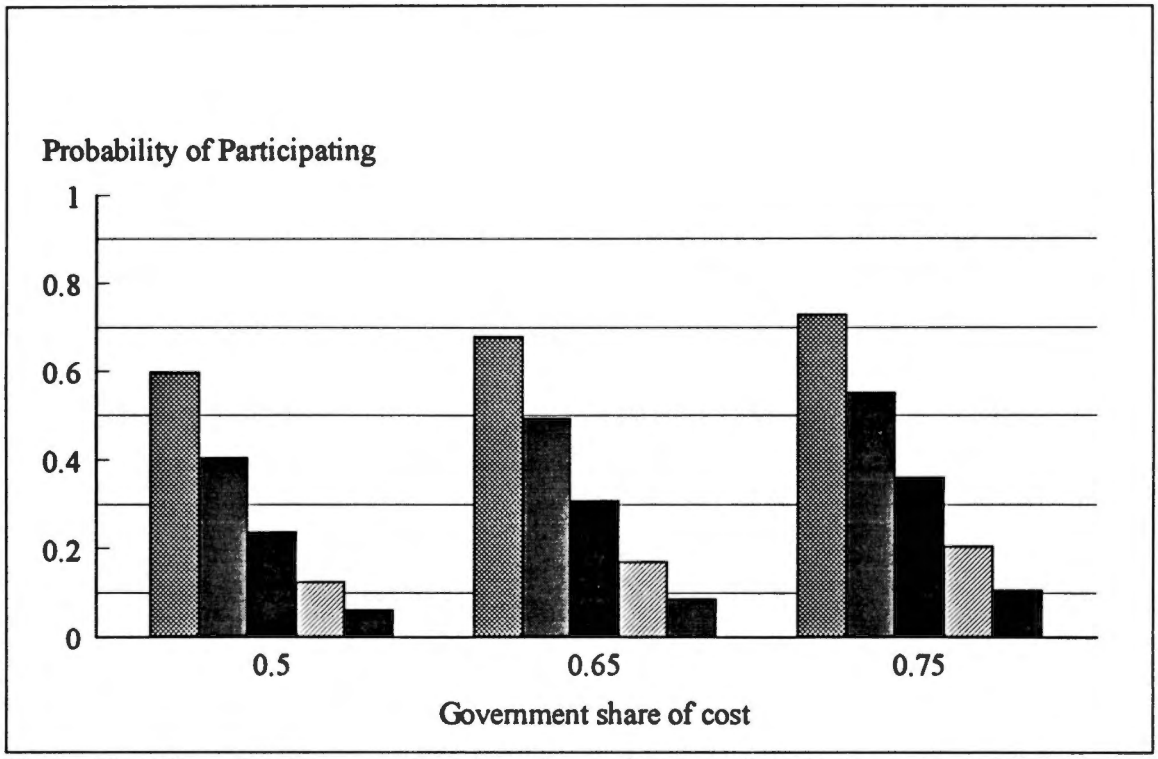

Figure 12. Effect of various cost-share incentives and changes in attitude on a typical respondent that is not willing to participate *ceteris paribus*.

estimated model, experience with forestry would have a substantial impact on the willingness to participate. In addition to increasing the individual's willingness to participate, trained experience would also promote progressive forestry practices and increase the quality of forest resources. Figure 12 is based upon a typical respondent that would choose not to participate. The main difference between the individuals in Figures 9 and Figure 12 is their level of income, Figure 12 has a 2 level of income and Figure 9 is in the 6 level, significant above $50,000. If the person in Figure 12 had a positive change in income such that it increased the income level to above $50,000, then this would tend to shift the response function so that the individual would have the same response function displayed in Figure 9.

There are other variables that would have similar effects. Another group that would appear to be a productive first target are large landholdings and farms whose primary land use is

unmanaged forestland since financial constraints are not as pressing. The variable, SIZE, in the estimated model is not statistically significant. However, the generated information on the impact of the variable indicates that it could have a strong effect on an individual's participation decision.

According to Worrell and Irland (1975), if large tracts are not willing to participate it is probably because the owner simply does not believe the investment is worth the return. If this is true, then only a monetary incentive that would make the investment profitable would be acceptable to them. Frequently however, the owner is misinformed and an approach that corrected this knowledge would be highly effective if it was less expensive than just offering the desired cost-share.

Owners of primarily unmanaged forest land are frequently willing to participate in a program such as the Stewardship Incentive Plan probably because they foresee a return on a small investment of an existing land use. Since start-up costs are the only drawback, a financial incentive works well. Training and technical assistance are also necessary to ensure full participation since knowledge of efficient and productive forestry techniques increase returns.

In summary, given the type of characteristics of these respondents, both direct and indirect incentives are necessary to promote participation in this type of program. It depends on the ultimate goal and any constraints as to which approach is best. In order to simply maximize participation, implementation should concentrate time and capital on those strategies which would improve attitudes, and increase knowledge and experience provided the cost to implement such a program is not prohibitive. If, however, the goal is to achieve maximum efficiency to get the most participation given a budget constraint, then frequently a determination must be made as to which is more cost effective: to change attitudes or to offer a higher share of the start-up costs. If the former is adopted, in the case of both the participants in Figures 9 and 12, it is theoretically possible to induce all landowners to participate *ceteris paribus*. On the other hand, if increasing

the cost-share is chosen, given a base of 50 percent cost-share, then resources should be concentrated only on those individuals with an attitude of 12 or 18, funds are lost on the others, *ceteris paribus*.

Changing attitudes or offering a share of the cost are two of the most influential variables in the model. According to the model, changes in attitude alone could induce participation in any individual, on the other hand, increasing cost-share alone has limited effect and must be used in conjunction with changes in other variables changes to result in a larger proportion of participants. One final consideration is that a change in opinions will probably have lasting effects so that when similar programs are offered in the future, this individual will already be more likely to participate. A monetary incentive that has been used to overcome objections to participating is only effective for that particular program and any future programs would probably require additional monetary incentives - if the attitude was the same.

Finally, there was the group of protest respondents that were unwilling to participate under any circumstances. The model suggests that attitudes and beliefs regarding forestry and conservation goals are strongly influential in an individual's willingness to participate. Although not included in the model, the protest "no's" are also an indication of the strength of an individual's attitude. Implementation strategy aimed at altering such attitudes would probably be the only effective method of promoting participation.

Many of the variables were captured as dummy variables and more detailed information regarding them would be highly beneficial. The land use category is especially interesting since unmanaged appears to frequently influence participation, but cropland and pastureland have stronger impacts in the participation decision. The point above an income level of $50,000 where participation suddenly begins to increase should be determined and investigated. INFOS and

FEXP need to be refined to determine exactly what aspects of these two variables are generating the impact on participation.

Determination of the cost to implement a change in attitude between the various levels is vital so that comparison to the cost of changes in cost-share can be made. No policy decisions can be made until these costs are estimated.

There are many important concerns that are beyond the scope of this study, but would be useful for future research. Aggregation of the findings to make predictions for the state would be extremely useful. For example, estimation of the benefits that would accrue to the state given various changes in the population's attitude and the resulting effect on participation. Also, an assessment of the amount of acres that would be enrolled given various incentives and the cost associated with implementing the changes would provide policymakers with definitive information to make policy decisions. If participation was substantial, this information could provide the data necessary to predict the economic effect the program would have on local communities as well as the state. It would also provide the information necessary to determine the effect the plan is having on the goals. For example, the amount of CO_2 that would be removed by Tennessee's participation in the program, or the amount of timber expected to be available for future use. An estimate of the dollar amount most landowners would accept for participation could potentially save a great deal of money. Programs such as the Stewardship Incentives Plan involve billions of dollars and the welfare of much of our resources. Research in this field is vital because policymakers need information to make educated decisions.

List of References

LIST OF REFERENCES

Alig, Ralph J. 1986. "Econometric Analysis of the Factors Influencing Forest Acreage Trends in the Southeast." *Forest Science* 32(1):119-134.

Bishop, Richard C. and Thomas A. Heberlein. 1979. "Measuring Values of Extra-Market Goods: Are Indirect Measures Biased?" *American Journal of Agricultural Economics* 61(5):926-930.

Binkley, Clark Shepard. 1981. *Timber Supply from Private Nonindustrial Forests: A Microeconomic Analysis of Landowner Behavior*. Yale University, Bulletin 92.

Birdsey, Richard. 1983. *Tennessee Forest Resources*. U. S. Department of Agriculture, Forest Service, Southern Forest Experiment Station, Resource Bulletin SO-90.

Birdsey, Richard A. and William H. McWilliams. 1986. *Midsouth Forest Area Trends*. U. S. Department of Agriculture, Forest Service, Southern Forest Experiment Station, Resource Bulletin SO-107.

Bohm, Peter. 1984. "Revealing Demand for an Actual Public Good." *Journal of Public Economics* 24:135-151.

Boyd, Roy G., Barbara J. Daniels, Robert Fallon, and William F. Hyde. 1988. "Measuring the Effectiveness of Public Forestry Assistance Programs." *Forest Ecology and Management* 23(1988):297-309.

Bogess, W.G. and E.O. Heady. 1981. "A Sector Analysis of Alternative Income Support and Soil Conservation Policies." *American Journal of Agricultural Economics* 63(4):618-628.

Brookshire, David S., Berry C. Ives and William D. Schulze. 1976. "The Valuation of Aesthetic Preferences." *Journal of Environmental Economics and Management* 3(4):325-346.

Daugherty, Arthur B. 1991. *Major Uses of Land in the United States: 1987*. U.S. Department of Agriculture, Economic Research Service, Agricultural Economic Report 643.

de Steiguer, J. E. 1984. "Impact of Cost-Share Programs on Private Reforestation Investment." *Forest Science 30(3):697-704.*

Dicks, Michael. 1987. "More Benefits with Fewer Acres Please!" *Journal of Soil & Water Conservation* 42(3):170-173.

Dicks, Michael R. and Anthony Grano. 1988. "Conservation Policy Insights for the Future. *Journal of Soil & Water Conservation* 43(2):148-151.

Dillman, Don A. 1978. Mail and Telephone Surveys- The Total Design Method. Wiley, New York.

Ervin, David E. and Michael R. Dicks. 1988. "Cropland Diversion for Conservation and Environmental Improvement: An Economic Welfare Analysis." *Land Economics 64(3):256-268.*

Ervin, Christine A. and David E. Ervin. 1982. "Factors Affecting the Use of Soil Conservation Practices: Hypotheses, Evidence, and Policy Implications." *Land Economics* 58(3):277-292.

Esseks, Dixon J. and Steven E. Kraft. 1988. "Why Eligible Landowners Did Not Participate in the First Four Sign-ups of the Conservation Reserve Program." *Journal of Soil & Water Conservation* 43(3):251-255.

Esseks, Dixon J. and Steven E. Kraft. 1989. "Marketing the Conservation Reserve Program." *Journal of Soil & Water Conservation* 44(5):425-430.

Haneman, W. Michael. 1984. "Welfare Evaluations in Contingent Valuation Experiments with Discrete Responses." *American Journal of Agricultural Economics* 33:332-341.

Hardie, Ian W. and Peter J. Parks. 1991. "Individual Choice and Regional Acreage Response to Cost-Sharing in the South, 1971-1981." *Forest Science* 37(1):175-190.

Harte, Paul. 1990. U. S. Department of Agriculture, Agricultural Stabilization and Conservation Service. Personal telephone interview, September 07, 1990. Washington, D. C.

Hensher, David A. and Lester W. Johnson. 1981. Applied Discrete-Choice Modelling. John Wiley & Sons, New York.

Hoehn, John P. and Alan Randall. 1987. "A Satisfactory Benefit Cost Indicator from Contingent Valuation." *Journal of Environmental Economics and Management* 14(3):226-247.

Konyar Kazim and C. Tim Osborn. 1990. "A National-Level Economic Analysis of Conservation Reserve Program Participation: A Discrete Choice Approach." *The Journal of Agricultural Economics Research* 42(2):5-12.

Lynne, Gary D., J. S. Shonkwiler, and Leandro R. Rola. 1988. "Attitudes and Farmer Conservation Behavior." *American Journal of Agricultural Economics* 70(1):12-19.

May, Dennis M. 1991. *Forest Resources of Tennessee*. U. S. Department of Agriculture, Forest Service, Southern Forest Experiment Station, Resource Bulletin SO-160.

McConnell, K.E. 1990. "Models for Referendum Data: The Structure of Discrete Choice Models for Contingent Valuation." *Journal of Environmental Economics and Management* 18:19-34.

McDermid, Robert W., Paul D. Kitt, and Sam Guttenberg. 1959. *Ownership Factors Affecting Management of Small Woodlands in St. Helena Parish, Lousiana.* Louisiana State University and Agricultural and Mechanical College, Agricultural Experiment Station, Bulletin No. 520.

McFadden, D. 1974. "Conditional Logit Analysis of Qualitative Choice Behavior", in Zarembka, P. (ed.). Frontiers in Econometrics, Academic Press, New York.

McKillop, William. 1975. "Social Benefits of Forestry Incentives Program." *Journal of Forestry* 73(4):214-216.

Mills, Thomas J. and Daria Cain. 1979. "Financial Efficiency of the 11974 Forestry Incentives Program." *Journal of Forestry* 77(10):661-666.

Mitchell, Robert Cameron and Richard T. Carson. 1989. Using Surveys to Value Public Goods: The Contingent Valuation Method. Resources for the Future, Washington, D.C.

Myers, Peter C. 1988. "Conservation at the Crossroads." *Journal of Soil & Water Conservation* 43(1):10-13.

Neter, John, William Wasserman, and Michael H. Kutner. 1983. Applied Linear Regression Models. Richard D. Irwin, Inc., Homewood, Illinois.

Nicholson, Walter. 1985. Microeconomic Theory, Basic Principles and Extensions, Third Edition. The Dryden Press, Chicago, Illinois.

Nielsen, E.G., J.A. Miranowski and M.J. Morehart. 1989. U.S. Department of Agriculture, Economic Research Service, Agricultural Economic Report 601.

Pindyck, Robert S. and Daniel L. Rubinfeld. 1976. Econometric Models and Economic Forecasts. McGraw-Hill, Inc., New York.

Randall, Alan. 1983. "Frontiers of Nonmarket Valuation." Proceedings of the Southern Natural Resource Economic Committee Regional Workshop, Southern Rural Development Center and the Farm Foundation, SNREC No. 18.

Randall, Alan. 1987. Resource Economics. Grid Publishing Company, Columbus, Ohio.

Rausser, Gordon C. and Joseph Yassour. 1981. "Multiattribute Utility Analysis: The Case of Filipino Rice Policy." *American Journal of Agricultural Economics* 63(3):484-494.

Reichelderfer, Katherine and William G. Boggess. 1988. "Government Decision Making and Program Performance: The Case of the Conservation Reserve Program." *American Journal of Agricultural Economics* 70(1):1-11.

Risbrudt, Christopher D., H. Fred Kaiser, and Paul V. Ellefson. 1983. "Cost-effectiveness of the 1979 Forestry Incentives Program." *Journal of Forestry* 81(5):657-659.

Rosson, James F. Jr. and Larry Dolittle. 1987. *Profiles of Midsouth Nonindustrial Private Forests and Owners.* U. S. Department of Agriculture, Forest Service, Southern Forest Experiment Station, Resource Bulletin SO-125.

Rowe, Robert D., Ralph C. d'Arge and David S. Brookshire. 1980. "An Experiment on the Economic Value of Visibility." *Journal of Environmental Economics and Management* 7:1-19.

Royer, Jack P. 1987. "Determinants of Reforestation Behavior Among Southern Landowners." *Forest Science* 33(3):654-667.

Royer, Jack P. and H. Fred Kaiser. 1983. "Reforestation Decisions on Harvested Southern Timberlands." *Journal of Forestry* 81(10):657-659.

Skok, Richard A. and Hans M. Gregersen. 1975. "Motivating Private Forestry, An Overview." *Journal of Forestry* 73(4):202-205.

Sanders, William. 1990. Personal interview. Statistician, University of Tennessee, Knoxville.

Straka, Thomas J., Harold W. Wisdom, and James E. Moak. 1984. Size of Forest Holding and Investment Behavior of Nonindustrial Private Owners". *Journal of Forestry* 82(8):495-496.

U. S. Congress. Food, Agriculture, Conservation, and Trade Act of 1990. 101st Congress, 2nd session, Washington, D. C.

U. S. Congress. Food Security Act of 1985. 99th Congress, Washington, D. C.

U. S. Department of Agriculture, Agricultural Stabilization and Conservation Service. 1990(a). "Forestry Incentives Program: From Inception of Program through September 30,1989." Washington, D. C.

U. S. Department of Agriculture, Agricultural Stabilization and Conservation Service. 1990(b). *Conservation Reserve Program: "Logo- Package" includes ninth Signup Results.* Washington, D.C.

U. S. Department of Agriculture, Forest Service. 1988. *The South's Fourth Forest: Alternatives for the Future.* Forest Resource Report 24, Washington, D.C.

U. S. Department of Agriculture, Forest Service, Tennessee State Office. 1990. "Tennessee State Stewardship Plan, Fiscal Year 1990-1994." Nashville, Tennessee.

U. S. Department of Agriculture, Forest Service. 1990. "America the Beautiful: Nation Tree Planting Initiative, Washington, D. C.

U. S. Department of Agriculture, Forest Service. 1989. *Easy Access Forest Inventory and Analysis Tables*. Southern Forest Experiment Station, Starkville, Mississippi.

U.S. Department of Agriculture, Soil Conservation Service. 1987. *Summary Report 1987 National Resources Inventory*. Iowa State University Statistical Laboratory, Statistical Bulletin 790.

U. S. National Archives and Records Administration. Code of Federal Regulations. Revised as of January 1, 1989. Part 7, Chapter 7, Subpart 701.27, page 30.

Wells, G. R. Personal interview. 1990. Department of Forestry, Wildlife & Fisheries, University of Tennessee, Knoxville.

White, Kenneth J., Shirley A. Haun, Nancy G. Horsman and S. Donna Wong. 1988. Shazam Econometrics Computer Program: User's Reference Manual, Version 6.1. McGraw-Hill Book Company, New York.

Worrell, Albert C. and Lloyd C. Irland. 1975. "Alternative Means of Motivating Investment in Private Forestry." *Journal of Forestry* 73(4):206-211.

Young, C. Edwin and C. Tim Osborn. 1990. *The Conservation Reserve Program, An Economic Assessment.* U.S. Department of Agriculture, Economic Research Service, Agricultural Economic Report 626.

APPENDIX

Please write the number of your response in the blank on the left of each question unless otherwise instructed.

1. The Forest Stewardship Program is aimed at management of land resources for several goals. Please indicate how you feel about management for each of the goals listed by placing the appropriate numbered response next to each.

   1. Strongly want
   2. Mildly want
   3. Neither want nor don't want
   4. Mildly do not want
   5. Strongly do not want

   a) ___ to enhance timber growth
   b) ___ to improve fish & wildlife habitat
   c) ___ to protect water quality
   d) ___ to protect wetlands
   e) ___ to increase recreational opportunities
   f) ___ to enhance scenic value

___ 2. Of the goals, (a-f), listed above, which is most important to you on your own land? Place the letter in the space provided.

___ 3. Do you feel additional improvement is required on your land to achieve the goal listed in Question 2?

   1. Yes
   2. No
   3. Not sure

___ 4. Do you believe the value of timber is increasing or decreasing?

   1. Increasing
   2. Decreasing
   3. Not sure

___ 5. Do you currently subscribe to any hunting or fishing magazines?

   1. Yes
   2. No

___ 6. In what what magazines do you read forestry articles?

1. Forest farmer
2. Tree Farm Newsletter
3. Progressive Farmer
4. Wildlife Conservation
5. Other environmental or Natural resource magazines:_____

_____

___ 7. Have you ever been recognized as a certified tree farmer (American Tree Farm System)?

1. Yes
2. No
3. Not sure

8. Are you currently managing or have you ever managed land for any of the goals listed. Please list all the appropriate numbers in the space provided.

Yes	No	
___	___	to enhance timber growth
___	___	to improve fish & wildlife habitat
___	___	to protect water quality
___	___	to protect wetlands
___	___	to increase recreational opportunities
___	___	to enhance scenic value

___ 9. Are you currently, or have you ever been enrolled in any conservation program or resource management plan?

1. Yes, currently
2. Yes, previously
3. No

___ 10. If yes, which program?

1. Soil Bank
2. REAP, Rural Environmental Ag. Program
3. Conservation Reserve Program
2. Forestry Incentives Program
3. Other _____

___ 11. Have you ever received any awards for using conservation practices on land you managed?

1. Yes
2. No
3. Not sure

12. Where do you go for information about land use practices and programs?

Yes	No	
__	__	1. ASCS
__	__	2. Agricultural extension agent
__	__	3. SCS
__	__	4. Forest service
__	__	5. Other _____
__	__	6. Not sure

13. Have you received any information from the following government agencies in the last two year?

Yes	No	
__	__	1. ASCS
__	__	2. Agricultural extension agent
__	__	3. SCS
__	__	4. Forest service
__	__	5. Other _____

14. How many acres of the following land types do you own?

a) _____ Managed forest land
b) _____ Unmanaged forest land
c) _____ Pasture land
d) _____ Crop land
e) _____ Farmstead (houseplace, barnyard,etc.)
f) _____ Ponds, lakes, and other permanently wet lands
g) _____ Gullied, or waste lands
h) _____ Other _____

15. **If you do not own managed timber, please skip to question 19.** What types of timber management techniques do you currently practices? Please list all the appropriate numbers in the space provided.

Yes	No	
__	__	1. Exclusion of livestock
__	__	2. Replanting of harvested stands
__	__	3. Conversion of other lands to timber
__	__	4. Intermediate harvesting when needed
__	__	5. Maintaining fully stocked condition
__	__	6. Killing or harvesting unwanted cull trees
__	__	7. Other _____

16. How many acres of each of the forest types do you manage?

_____ White Pine
_____ Cedar
_____ Loblolly-shortleaf pine
_____ Oak-pine
_____ Oak-hickory
_____ Oak-gum-cypress
_____ Elm-ash-cottonwood
_____ Maple-beech-birch

___ 17. What percent of the forest in question number 16 are bottom-land hardwoods?

18. How many acres of each of the following stand classes do you have?

_____ Sawtimber-most of the trees in the forest type are 12" DBH.(diam. breast height)
_____ Poletimber-most of the trees in the forest type range from 6-12" DBH.
_____ Seedlings and saplings-stand is mainly trees from 1' tall up to 6" DBH.

___ 19. **If you do not own pasture, please go to question 21.** If the pasture land were cropped, would it be:

1. Highly erodible
2. Moderately erodible
3. Slightly erodible
4. Not erodible
5. Not sure

20. How many acres of your pasture land is used for the following?

_____ Beef cows
_____ Dairy cows
_____ Idle
_____ Other _____

21. **If you do not own cropland, please go to question number 23.** How many acres of the crop land would you say fall in the following erosion categories:

Number of Acres	Degree of erosion
_____	Highly erodible
_____	Moderately erodible
_____	Slightly erodible
_____	Not erodible

22. **Please fill in the following table:**

CROP	ACRES	YIELD PER ACRE	SALE PRICE PER UNIT	PERCENT FED TO LIVESTOCK
Corn grain				
Soybean				
Oats				
Wheat				
Corn Silage				
Tobacco				
Hay Fescue				
Alfalfa				
Other Hay				
Cotton				
Vegetables				
1.				
2.				
3.				
Other				
1.				
2.				
3.				

A cost share refers to financial assistance typically provided by a government agency. Such financial assistance is usually given to promote use of certain management practices. In the past numerous programs have been offered to producers with cost share provisions.

___ 23. **Please read the above paragraph.** Have you ever participated in a cost-share program?
1. yes
2. no
3. don't know

Suppose the federal government offered a Stewardship Incentive Program by sharing in the cost of planting trees for timber, provided the owner agrees to manage those lands for other goals such as fish and wildlife enhancement, soil and water improvement, wetlands, and recreation or beautification.

___ 24. How many acres of your pasture land would you be willing to convert to a Stewardship Program at a 50% government cost share?

___ 25. How many acres of your unmanaged forest land would you be willing to convert to stewardship program at a 50% government cost share?

___ 26. How many acres of your cropland would you be willing to convert to a stewardship program at a 50% cost share?

___ 27. How many acres of your permanently wetlands would you be willing to convert to a stewardship program at a 50% cost share?

___ 28. How many acres of your gullied, or waste lands would you be willing to convert to a stewardship program at a 50% cost share?

The following questions are included so that responses can be compared across various groups of people. Again, YOUR INDIVIDUAL ANSWERS ARE COMPLETELY CONFIDENTIAL.

___ 29. In what year were you born?

___ 30. Are you:
1. male
2. female

___ 31. Are you a member of any environmental organization?

1. yes
2. no

___ 32. How many years of school have you completed?

1. 1-6 years
2. 6-8 years
3. 8-12 years
4. high school graduate
5. some college
6. college graduate

___ 33. Which of the following best describes your primary occupation:

1. Manufacturing
2. Construction
3. Transportation, Public utilities
4. Trade
5. Finance, insurance, real estate
6. Services
7. Government
8. Farming, Forestry
9. Household

___ 34. How many people live in your household?

___ 35. Which of the following best describes your total family income from all sources in 1990?

1. Under $10,000
2. $10,000 - $19,999
3. $20,000 - $29,999
4. $30,000 - $39,999
5. $40,000 - $49,999
6. $50,000 and above
7. not sure

___ 36. In which of the categories would your annual sales from all farming (including timber sales) operations fall:

1. less than 5,000
2. 5,000 - 15,000
3. 15,000 - 30,000
4. 30,000 - 50,000
5. 50,000 - 80,000
6. 80,000 - 120,000
7. 120,000 and above

___ 37. Did you sell any trees this past year?

1. ___ Yes
2. ___ No

38. What were the total gross sales in each of the following categories:

_____ pine sawtimber
_____ oak sawtimber
_____ mixed hardwood
_____ pine pulpwood
_____ hardwood pulpwood

___ 39. How many total acres do you currently own (including life interest)?

___ 40. Which of the following best describes your type of ownership:

1. Individual, non-industrial
2. Partnership, non-industrial
3. Corporation, non-insustrial
4. Individual, farm
5. Corporation, industrial, non-wood oriented

___ 41. How many acres do you currently lease from someone else?

___ 42. How many acres do you lease out to someone else?

Number of Acres

_____ Long term
_____ Short term

A cost share refers to financial assistance typically provided by a government agency. Such financial assistance is usually given to promote use of certain management practices. In the past numerous programs have been offered to producers with cost share provisions.

___ 23. **Please read the above paragraph.** Have you ever participated in a cost-share program?

1. yes
2. no
3. don't know

Suppose the federal government offered a Stewardship Incentive Program by sharing in the cost to planting trees for timber, provided the owner agrees to manage those lands for other goals such as fish and wildlife enhancement, soil and water improvement, wetlands, and recreation or beautification.

___ 24. How many acres of your pasture land would you be willing to convert to a Stewardship Program at a 65% government cost share?

___ 25. How many acres of your unmanaged forest land would you be willing to convert to stewardship program at a 65% government cost share?

___ 26. How many acres of your cropland would you be willing to convert to a stewardship program at a 65% cost share?

___ 27. How many acres of your permanently wetlands would you be willing to convert to a stewardship program at a 65% cost share?

___ 28. How many acres of your gullied, or waste lands would you be willing to convert to a stewardship program at a 65% cost share?

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___ 24. How many acres of your pasture land would you be willing to convert to a Stewardship Program at a 75% government cost share?

___ 25. How many acres of your unmanaged forest land would you be willing to convert to stewardship program at a 75% government cost share?

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VITA

Caroline Douglas Bell was born in Chattanooga, Tennessee on July 23, 1957. She attended Lookout Mountain Elementary School (Chattanooga). She moved to Ft. Lauderdale, Florida during junior high school, but moved to Nashville, Tennessee during high school, graduating from Hillwood High School in June, 1975. The following September she entered The University of Tennessee, Knoxville and in December, 1980 received the degree of Bachelor of Science in Wildlife and Fisheries. She reentered The University of Tennessee in August, 1989 and in May, 1993 received a Master of Science degree in Agricultural Economics.

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