2000

Assessing West Virginia NIPF owner characteristics and preferred assistance topics

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Assessing West Virginia NIPF Owner Characteristics and Preferred Assistance Topics

Daniel J. Magill

Thesis Submitted to the College of Agriculture, Forestry and Consumer Sciences
at West Virginia University
in fulfillment of the requirements
for the degree of

Master of Science in
Forestry

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Morgantown, West Virginia
2000

Keyword: Non-Industrial-Private-Forest
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ABSTRACT

Assessing West Virginia NIPF Owner Characteristics and Preferred Assistance Topics

Daniel J. Magill

Four hundred and fifty-one Non-Industrial-Private-Forest (NIPF) owners (49% response rate) in West Virginia responded to a survey of their forestry assistance needs. Most of the socioeconomic characteristics of the respondents, their reasons for owning the property, the types of activities they were engaged in on the property and the agencies that provided assistance by themselves significantly (χ^2 & ANOVA) differentiated those interested and not interested in obtaining assistance. However, when all 39 factors were considered together (Logistic Regression) only a small number of these factors were needed to explain the difference between landowners wanting and not wanting a specific assistance topic. Landowner income and tenure were recurrent factors in the logistic analysis. Results of the study can be used to target landowners for specific topics as well as gear workshops or programs that reflect the property uses and activities conducted by these landowners within their property.

The West Virginia State Division of Forestry provided grant funding for the project Improving Resource Management on Non-Industrial-Private-Forest lands in West Virginia through Assessment and Training.

Acknowledgements

Let me begin by saying that words cannot express my sincerest appreciation to all those who have helped me achieve one of the greatest milestones of my life--a graduate degree from one of the finest institutions of higher learning in the country, West Virginia University. Since there are far too many people to thank individually, I would like to acknowledge the WVU faculty as a whole, especially the faculty and staff of the Departments of Forestry and Sociology for giving me the tools to achieve this educational goal.

I would also like to extend a special acknowledgement to several individuals, each of who provided me invaluable opportunities and assistance as an undergraduate and graduate student. To Bob Whipkey of the West Virginia Division of Forestry, I would like to say thank you for the generous financial and professional support you provided me during this project. I also thank Ed Collins and the county Extension Agents across the state that provided funding and contacts with landowners to conduct interviews and property case studies. Additionally, to Cliff Sypolt and the county agents of the USDA Farm Service Agency, I thank you for your logistic support to conduct mail surveys. I would also like to extend a very special thanks to Dr. Rory Fraser who provided me with excellent counseling, guidance and understanding that allowed me to accomplish this goal. To Dr Ray Hicks, I would like to thank you for guidance and the opportunity to participate in this project. I would also like to thank Dr. Ronald Althouse from the Department of Sociology for providing me with the knowledge to conduct landowner surveys. Finally, I would like to express my deep appreciation to my family for providing me with the time, patience and support to accomplish this educational objective.

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Introduction

West Virginia is nearly 80% forested and forests are vital for sustaining its economy. According to a 1997 survey, the timber industry and related businesses in West Virginia contributed \$3.2 billion to the state's economy (Greenstreet and Caldwell, 1997). At the same time, nature-based tourism and recreation industries contributed \$1.1 billion: (Teisl, 1997; Maharaj and Carpenter, 1997; Meyers, 1997; Bailey, 1997). The \$4.3 billion of total economic benefit (includes multiplier effect) from forest resources made up 12% of West Virginia's economic output in 1997. More importantly, these benefits were derived from resources that are renewable over the long-term, if they are properly managed. The private forestlands of West Virginia also provide a number of individual benefits such as privacy of residence, freedom of ownership and a sense of place. Other social benefits include forest recreational and subsistence uses as well as aesthetics, clean water and fresh air (Flora, 1992).

White (1993) reported that 83% of the forestland and 80% of the wood volume in West Virginia belonged to private landowners. According to a 1991 USDA Forest Service survey (Table 1), 75.7% of the privately owned forestland in the state belonged to NIPF owners while forest industries and other corporations owned the other 24.3% (Birch, 1996). Improving resource management within the 256,500 NIPF ownership in West Virginia is significant, because less than 15% of these landowners are known to have received assistance in this decade (Magill et al., 2000). Additionally, there is now concern that the indiscriminate product harvesting and environmental damage of West Virginia's forest resources that occurred in the past is being repeated on our second-generation forests (Fajvan et al., 1998).

Table 1: Private Forest Ownership in West Virginia for 1991.

Type of Owner	Number of Owners	Percent % Owners	Acres	% Acres
Non-Industrial-Private-Forest	256,500	98.50%	8,130,000	75.70%
Corporation	3,500	1.30%	1,606,000	14.90%
Forest Industry	400	0.20%	1,009,000	9.40%
All Private Forests	260,400	100%	10,745,000	100%

(Birch, 1996)

Practicing stewardship on Non-Industrial-Private-Forest (NIPF) land is a way of countering this potential threat and offers the possibility for sustaining a flow of economic, as well as social, goods and services from the forests of West Virginia. Sustaining the environmental health of private forestland protects their biological assets. Forest ecosystem processes and functions result from the inter-relationships between soil, water, sunlight, plants and animals (Maser, 1994). Improper use and management of these assets can compromise the long-term health and productivity of the forest and limit the supply of forest products and services from which society derives many benefits (Best and Wayburn, 1995).

Research Objective

The objectives of this study were to determine the demographic characteristics of NIPF owners in West Virginia, their reasons for owning forest property, the type of forestry activities they have conducted on their property, who provided them with assistance and what specific topics of assistance they prefer. This information should provide the basis for a better understanding of NIPF owner interests, needs and problems of ownership and management. The information could then be used to develop and/or improve assistance programs for these NIPF landowners.

Methodology

The study was conducted through the combined efforts of the West Virginia University Extension Service (WVUES) and Division of Forestry (WVUDOF) as well as the West Virginia State Division of Forestry (WVD OF) and USDA Farm Service Agency (USDAFSA).

Questionnaire

A seven-page questionnaire was used to collect data for the study. The components of this survey instrument were developed based on conversations with NIPF landowners and resource management professionals throughout West Virginia. Categories of questions were property size and ownership, forestland use and management, assistance received and

demographic information (appendix A & B). Mail surveys and personal interviews were conducted in the spring and summer of 1999 to collect NIPF owner information for the study.

The study was conducted in three stages:

- (i) Personal interviews with 20 landowners selected by County Extension Agents,
- (ii) Preliminary mail survey of 40 landowners contacted through the USDAFSA, and
- (iii) Mail survey of 1080 landowners based on the Dillman Method.

Survey Sample

Forty-percent of the landowners sampled were those listed as having properties with a written forest management plan under the West Virginia State Division of Forestry's Stewardship program (Whipkey, 1999). The other 60% were those selected from USDA Farm Service Agency assistance lists (Sypolt, 1999). The sample was split to provide a fair representation of NIPF owners known to have a plan and those only having received assistance. A stratified sample (by region, forest cover, acreage and plans) method was used to determine if regional property location, percent of county in forest cover, property size and having a management plan or not influenced NIPF ownership and/or management decisions.

The state was first divided into three regional strata (northeastern, southern and northwestern) based on USDA Forest Service Forest Inventory and Regional Assessment (DiGiovanni, 1990). This was done to determine regional differences in landowner characteristics. The number of owners to sample was based on the total amount of forest acres owned by farmers and individuals in each region, which are common NIPF characteristics (Birch, 1996). Next, the number of landowners to sample by cover type in each region depended on how many counties were 80+% or 60-79% in forest cover (DiGiovanni, 1990). As for example, if a region had seven 80+% counties and nine counties 60-79% in forest cover more NIPF owners would be selected from the 60-79% counties. The sample included 49 counties. Six counties (Ohio, Brooke, Hancock, Harrison, Berkeley and Jefferson) were not sampled because they were < 60% forested. Sampling by percent forest cover was done because landowners in counties

with extensive forest cover are more likely to be interested in managing their forest property (appendix C).

Landowners were then sampled based on acreage owned. The acreage stratification was to choose 85% owning 10-99 acres, 11% with 100-199 acres and 4% owning 200-299 acres within each region. This minimum sampling acreage was used because landowners with less than 10 acres have limited management options (Gracey & Pelkki, 1996). In contrast, the maximum of 299 acres was set because landowners controlling 300 or more acres are more likely to use private management services (Fraser & Magill, 2000). The acreage range sampled was chosen because this group of landowner's control 55% (average property size of 72 acres) of the 10,745,000 privately owned forest acres in WV and potentially can have the most impact on forest resources (Birch, 1996).

According to Birch (1996) there were 114,600 private forest ownership's in WV consisting of 10 to 299 acres in 1994, which is 44% of the 260,400 private owners in the state. The total sample of 1140 respondents for this survey was calculated as an approximate 1% sample of these 114,600 NIPF owners. Proportionally by region the total sample breakdown was 39% (446) in the northwestern, 35% (399) from the northeastern and 26% (295) in the southern region (Figure 1).

Statistical Analysis

Pearson's χ^2 , Analysis of Variance and logistic regression were used to analyze data in Statistica/PC. Data were analyzed to show significance at the alpha 0.10 level between independent and dependent variables. The dependent variables were the fifteen assistance topics included in the survey questionnaire (Table 2). Independent variables types included nominal, ordinal and continuous. The assistance topics were binary (Yes/No) and tested against 39 independent variables that included six demographics as well as fifteen property uses and fifteen management activities. In addition, the WVU Division of Forestry and Extension Service as well as the WV State Division of Forestry, were the assisting agencies included in the analysis (Table 2). The topics for which over 40% responded to in the survey were further analyzed.

Table 2: Fifteen Dependent and 39 Independent Variables used in the Analysis

Dependent Variables		Independent Variables		
Assistance Topics	Demographics	Property Uses	Management Activities	Assisting Agencies
Forest Health	Regional Location	Residence	Timber Harvest	WV State Division of Forestry WVU Division of Forestry WVU Extension Service
Water Resources	Property Size	Investment	Planted Trees	
Silviculture	Tenure	Wildlife Habitat	Thinned Trees	
Wildlife Habitat	Income	Hunting or Fishing	Cut Vines or Other Plants	
Liability	Age	Watershed Protection	Improved Visual Beauty	
Soil Resources	Education	Visual Beauty	Constructed Trails	
Visual Beauty		Hiking or Biking	Constructed Roads	
Dendrology		Timber Production	Planted Wildlife Food Crops	
Valuation		Christmas Tree Farm	Improved Soil Resources	
Access Roads		Fruit Tree Orchard	Improved Water Resources	
Survey Property		Ginseng or Mushrooms	Non-timber Products	
Non-timber Products		Livestock Pasture	Surveyed Property	
Forest Recreation		Firewood or Fence Posts	Protected Forest Health	
Management Coops		Maple Syrup Production	Leased Property	
Property Leases		Other Uses	Other Activities (Built Fences)	
15	6	15	15	3

Pearson's χ^2 was used to determine which landowner characteristics, both individually and proportionally, were significantly associated with an assistance topic. Property use questions were answered by ranking each use from most to least important and Pearson's χ^2 provided information to determine the rank importance of a significant property use. Using ANOVA provided a test of means to determine whether a significant landowner characteristic was negatively or positively associated with a specific assistance topic. If length of ownership were significant the test of means would indicate whether a shorter (negative) or longer (positive) term was prevalent for landowners interested in a certain assistance topic (Dowdy & Wearden, 1987).

A separate logistic regression model was used for each of the assistance topics selected for further analysis. In the Logistic Regression model, the significance of any one of the 39 independent variables or characteristics is conditioned by the presence of all the other characteristics in the model (Hosmer & Lemeshow, 1987). A significant characteristic in Pearson's χ^2 and the ANOVA, may not be significant once combined with the other characteristics in the model.

Nine additional logistic models were then run to test the significant characteristics of respondents interested in a specific assistance topic from the first model (39 df). As long as the

reduction in the χ^2 values between the first and second models are not significant, the second models with less degrees of freedom are parsimonious for identifying the significant characteristics of respondents requesting a certain assistance topic. The significant characteristics in the second logistic models were the basis for determining if there are fundamental differences between landowners requesting and not requesting a certain assistance topic.

Results

Sample Response

The 511 landowners that responded to the survey consisted of the 20 interviewed; the 31 of 40 who returned the preliminary survey; and 460 who returned the mass-mailed survey. Although 511 landowners responded, 60 were excluded from this analysis, because they both own less than 10 acres or 300 or more acres; and are not within the range of 10 to 299 acres chosen for analysis.

The 49% rate of response was based on reducing the total sample of 1140 down to 923 relevant possibilities. The original sample size was reduced because 106 questionnaires were mailed to the wrong address. Additionally, fifty-one were returned blank because the landowner either died, sold the property, cleared the forest or was unhappy with the questionnaire. These reasons along with not meeting the acreage requirement produced 451 relevant responses. The overall sample response of 451 landowners when analyzed by the χ^2 method proved representative across the state (appendix D-1 to D-3).

(i.) Regional Response:

Proportionally, the response by region was 36% (161) from the northwestern, 39% (175) in the northeastern and 25% (115) from the southern region (Figure 1).

Figure 1: Landowners Sampled and Responding to the NIPF Survey by Region

(ii.) Cover Type Response:

The proportion of returns by percent forest cover for all regions combined were 55% (250) from counties with 80+% forest cover and 45% (201) received from counties in the 60-79% forest cover range (Figure 2). The only county from which landowners did not respond was McDowell, which is located in the southern sample region of the state.

Figure 2: Landowners Sampled and Responding to the NIPF Survey by Cover Type

(iii.) Acreage Response

Response by acreage range across the state included 82% returned from those owning 10-99 acres, 13% with 100-199 acres and 5% owning 200-299 acres of forest property (Figure 3).

Figure 3: Landowners Sampled and Responding to the NIPF Survey by Acreage Range

Assistance Topics

The statistical analysis of responses from this study of NIPF owners in West Virginia provide some interesting results. Nine of the fifteen assistance topics included in the survey were analyzed. The nine topics were chosen based on the number ($\geq 40\%$ of 451) of owners (≥ 180) requesting each topic of assistance. The most sought after topic was forest health followed by water resources, silviculture, wildlife habitat, landowner liability, soil resources, visual beauty, dendrology and silvics, valuation of timber or forestland (Figure 4).

Figure 4: Forestry Assistance Topics Preferred by 451 NIPF Owners.

Pearson's χ^2 and Analysis of Variance (ANOVA)

Most of the 39 landowner-characteristics were significant in the χ^2 test of proportions and the ANOVA test of means (Tables 3 & 4). Years of property ownership and income level were consistently different between respondents interested and not interested in the nine preferred assistance topics (appendix E to M). However, some factors in both analysis types such as conducting timber harvest activities and property size were not consistently different for those wanting or not wanting a specific topic of assistance. On the other hand most of the reasons landowners that were interested in these nine topics gave for owning forest property and the activities they conducted on their land tested significantly different from those not interested. In addition, respondents interested in these topics were more likely to have received help from the three assisting agencies included in both analysis types (Tables 3 & 4).

Table 3: p-Values of Significance for Pearson's Chi² test (Magill, 2000).

	Dependent Variables = Nine Assistance Topics								
p-Value Significant ≤ 0.01 ***	FOREST	WATER	SILVICULTURE	WILDLIFE	LIABILITY	SOIL	VISUAL	DENDRO	VALUATION
p-Value Significant ≤ 0.05 **	HEALTH	RESOURCE	PRACTICES	HABITAT	ISSUES	RESOURCE	BEAUTY	ISSUES	ISSUES
p-Value Significant ≤ 0.10 *	p-Value	p-Value	p-Value	p-Value	p-Value	p-Value	p-Value	p-Value	p-Value
INDEPENDENT VARIABLES									
DEMOGRAPHICS									
REGION LOCATION IN WV				**			**	*	**
LANDSIZE									**
TENURE GROUP	*	**	***	***	***	**	***	***	**
INCOME LEVEL	**	***		***	***	*	**	***	**
AGE GROUP	***	***	***	***	***	***	***	***	***
EDUCATION LEVEL								**	***
PROPERTY USES									
PLACE OF RESIDENCE	***	*	*	***	*	*	***	*	***
INVESTMENT	***	***	***	***	***	***	***	***	***
WILDLIFE HABITAT	***	***	***	***	***	***	***	***	***
HUNTING OR FISHING	***	***	***	***	***	***	*	***	***
WATESHED PROTECTION	***	***	***	***	***	**	***	***	***
VISUAL BEAUTY	***	***	***	***	***	***	***	***	***
HIKING OR BIKING	***	***	***	***	***	***	***	***	***
TIMBER PRODUCTION	***	***	***	***	***	***	***	***	***
CHRISTMAS TREE FARM	***	***	***	***	***	***	***	***	**
FRUIT TREE ORCHARD	***	***	***	***	**	***	***	***	***
GINSENG OR MUSHROOMS	***	***	***	***	***	***	***	***	***
LIVESTOCK PASTURE	***	***	***	***	***	***	***	***	***
FIREWOOD OR POSTS	***	*	***	***	**			**	***
MAPLE SYRUP	***	***	***	***	**	***	***	***	***
OTHER USES	***	**	***	**	**	***	***	***	***
FOREST ACTIVITY									
TIMBER HARVESTING		*		**					
PLANTED TREES	***	***	***	***		*		***	
THINNED TREES	***	***	***	***		*	***	***	
CUT GRAPEVINES	***	***	***	***	**	**	**	***	***
IMPROVE VISUAL BEAUTY	***	***	***	***	**	**	***	**	
CONSTRUCTED TRAILS	***	***	***	***	***	**	**	***	***
CONSTRUCTED ROADS	**	***	***	***	*	***		**	
WILDLIFE FOOD CROPS		***	**	***		***	***	***	
IMPROVED SOIL	***	***	*	**	*	***	*		
IMPROVED WATER	**	***		**	**	**			
NON-TIMBER PRODUCTS	**	***	***	***		*		***	
SURVEYED PROPERTY	**	***		***		***	***	***	**
FOREST HEALTH	***	**	***	***	***	***	***		
LEASED PROPERTY	***				*			*	*
OTHER ACTIVITIES			***			**			***
ASSISTING AGENCIES									
WVU DIVISION OF FORESTRY		***	**	***	***		**		***
WVU EXTENSION SERVICE	***	***	***	***	***	**	***	***	**
WV DIVISION OF FORESTRY	***	***	***	***	***	***	***	***	***

Table 4: p-Values of Significance for Analysis of Variance (Magill, 2000).

	Dependent and Grouping Variables = Nine Assistance Topics								
p-Value Significant ≤ 0.01 ***	FOREST	WATER	SILVICULTURE	WILDLIFE	LIABILITY	SOIL	VISUAL	DENDRO	VALUATION
p-Value Significant ≤ 0.05 **	HEALTH	RESOURCE	PRACTICES	HABITAT	ISSUES	RESOURCE	BEAUTY	ISSUES	ISSUES
p-Value Significant ≤ 0.10 *	p-Value	p-Value	p-Value	p-Value	p-Value	p-Value	p-Value	p-Value	p-Value
INDEPENDENT VARIABLES									
DEMOGRAPHICS									
LANDSIZE	+		+						+
TENURE	-	-	-	-	-	-	-	-	-
INCOME	+	+	+	+	+	+	+	+	+
AGE				+					
EDUCATION	+	+	+		+				+
PROPERTY USES									
PLACE OF RESIDENCE		+	+			+	+		
INVESTMENT	+	+	+	+	+	+	+	+	+
WILDLIFE HABITAT	+	+	+	+	+	+	+	+	+
HUNTING OR FISHING	+	+	+	+	+	+	+	+	+
WATSHED PROTECTION	+	+	+	+	+	+	+	+	+
VISUAL BEAUTY	+	+	+	+	+	+	+	+	+
HIKING OR BIKING	+	+	+	+	+	+	+	+	+
TIMBER PRODUCTION	+	+	+	+	+	+	+	+	+
CHRISTMAS TREE FARM	+	+	+	+	+	+	+	+	+
FRUIT TREE ORCHARD	+	+	+	+	+	+	+	+	+
GINSENG OR MUSHROOMS	+	+	+	+	+	+	+	+	+
LIVESTOCK PASTURE	+	+				+		+	
FIREWOOD OR POSTS	+		+		+	+	+	+	
MAPLE SYRUP	+	+	+	+	+	+	+	+	
OTHER USES	+	+	+	+	+	+	+	+	+
FOREST ACTIVITY									
TIMBER HARVESTING		+							
PLANTED TREES	+	+	+	+		+		+	
THINNED TREES	+	+	+	+		+	+	+	
CUT GRAPEVINES	+	+	+	+	+	+	+	+	+
IMPROVE VISUAL BEAUTY	+	+	+	+	+	+	+	+	
CONSTRUCTED TRAILS	+	+	+	+	+	+	+	+	+
CONSTRUCTED ROADS	+	+	+	+	+	+		+	
WILDLIFE FOOD CROPS	+	+	+	+		+	+	+	
IMPROVED SOIL	+	+	+	+	+	+	+		
IMPROVED WATER	+	+			+	+			
NON-TIMBER PRODUCTS	+	+	+	+		+		+	
SURVEYED PROPERTY	+	+				+	+	+	+
FOREST HEALTH	+	+	+	+	+	+	+		
LEASED PROPERTY	+				+			+	+
OTHER ACTIVITIES			+	+		+			+
ASSISTING AGENCIES									
WVU DIVISION OF FORESTRY		+	+	+	+		+		+
WVU EXTENSION SERVICE	+	+	+	+	+	+	+	+	+
WV DIVISION OF FORESTRY	+	+	+	+	+	+	+	+	+

Logistic Regression Analysis (Nine Models)

The logistic models used in the analysis identified the most important characteristics of landowners interested in the nine preferred assistance topics. Lowering the degrees of freedom to an average of six in the models from 39 in the ANOVA and Chi^2 analysis did not significantly reduce the Chi^2 value making the models parsimonious for predicting these landowners. This means that fewer characteristics were needed in the regression analysis to identify respondents wanting one of these topics of assistance. The odds ratio calculated for each model was also good with an average of 4.2:1 meaning that the significant factors as a group in these models can be used to correctly predict on average every four (80%) out of five landowners wanting or not wanting a specific topic. Additionally, the models on average accurately identified 67% and 66% of those interested and not interested respectfully, in these topics of assistance based on individual significant factors in the models. (Table 5 & appendix E to M).

(i.) Forest Health:

Landowners interested in forest health issues tend to have higher income levels and use their property for wildlife habitat as well as timber production. They were also more inclined to be engaged in protecting the health of their forest and leasing their property for timber or recreational benefits. In addition, the West Virginia State Division of Forestry was an important source of assistance in the past for respondents wanting help to protect their forest property. These significant characteristics suggest that this group of landowners realize that poor forest health can jeopardize habitat for wildlife and while also negatively influencing the leasing of their forest property (Table 5). During personal interviews with NIPF owners and case-study visits to their property it was also evident that problems with gypsy moth, deer damage, grapevines, fire and poor timber harvesting practices were of great concern and the landowners were not sure how to deal with these problems (Magill, 2000).

(ii.) Water Resources:

Obtaining assistance to improve water quality and quantity was more likely to be requested by landowners earning higher incomes and owning their property for livestock pasturage. Additionally, this group of respondents tends to have conducted water improvement practices on their property while also previously receiving assistance from the West Virginia State Division of Forestry. The positive relationships between these characteristics indicates that this group of landowners is aware of the management required to sustain water resources for supporting their reasons of ownership, but they are in need of further assistance (Table 5). This was also evident during discussions and case study visits with NIPF owners who were interested in maintaining an adequate supply of clean water for wildlife and livestock (Magill, 2000).

(iii.) Silviculture:

Respondents interested in receiving assistance for planting, growing, thinning or harvesting trees and other forest plants as well as controlling grapevines (silviculture) tend to be more recent forest owners. Owning property for investment and timber production as well as growing or harvesting non-timber products (ginseng etc.) and building fences were identifying characteristics for landowners wanting silviculture assistance. Landowners interested in silviculture issues were also more likely to have gotten assistance in the past from the West Virginia State Division of Forestry. The relationship between these characteristics suggests that this group of landowners recognize that their preferred property uses and forest activities require silviculture assistance, which can be economically and biologically complicated (Table 5). NIPF owners who were visited for interview and case study also expressed an interests in and concern about silvicultural issues (Magill, 2000).

(iv.) Wildlife Management:

Getting assistance for improving wildlife habitat and food sources tended to be requested by more recent forest owners with higher incomes who also use their property for residence, hunting or fishing and wildlife habitat. Landowners more inclined to be interested in wildlife

management issues also tend to have established wildlife food crops on their property. The West Virginia State Division of Forestry was also indicated by this group of respondents as having provided them assistance in the past. The negative relationship between watershed protection and managing wildlife suggests that this group of landowners would like to be assisted in managing their property for wildlife without disrupting watershed quality. In contrast, the positive correlation among the other characteristics indicates that respondents interested in wildlife management issues seem to realize they need assistance to achieve their ownership and management objectives (Table 5). Receiving assistance for improving and managing wildlife habitat was also an important topic of interest and concern during conversations and property visits with NIPF owners (Magill, 2000).

(v.) Liability, Property Rights and Tax Issues:

Landowners interested in improving their knowledge of landowner liability, property rights or taxes tend to have higher incomes and be more recent forest owners as well as own their property for investment and ginseng or mushroom production. They were also more inclined to protect their forest property and tend to have previously received assistance from the West Virginia State Division of Forestry. Even though thinning trees was a significant activity, it was negatively correlated with requests for this assistance topic, which suggests that these landowners may want to know their liability rights before conducting tree thinnings. The positive relationship between the other significant factors indicates that these landowners want to protect their forest property investment while preserving their property rights (Table 5). NIPF owners that were visited also indicated a concern about their ownership liability while also revealing a general uneasiness with their involvement in assistance programs in relation to property rights and taxes. However, they did show an interest of wanting to be more informed about these issues (Magill, 2000).

Table 5: p-Values of Significance for Logistic Regression Models (Magill, 2000).

	Dependent Variables = Nine Assistance Topics								
p-Value Significant ≤ 0.01 ***	FOREST	WATER	SILVICULTURE	WILDLIFE	LIABILITY	SOIL	VISUAL	DENDRO	VALUATION
p-Value Significant ≤ 0.05 **	HEALTH	RESOURCE	PRACTICES	HABITAT	ISSUES	RESOURCE	BEAUTY	ISSUES	ISSUES
p-Value Significant ≤ 0.10 *	p-Value	p-Value	p-Value	p-Value	p-Value	p-Value	p-Value	p-Value	p-Value
INDEPENDENT VARIABLES									
DEMOGRAPHICS									
TENURE GROUP			***	***	**	*		***	
INCOME LEVEL	***	***		**	***	**			
PROPERTY USES									
PLACE OF RESIDENCE				+					
INVESTMENT			***		***			***	***
WILDLIFE HABITAT	***			***					
HUNTING OR FISHING				***					
WATESHED PROTECTION				***					
VISUAL BEAUTY							***		
TIMBER PRODUCTION	***		+						***
FRUIT TREE ORCHARD						**			
GINSENG OR MUSHROOMS					**				
LIVESTOCK PASTURE		**				***			
OTHER USES			**						
FOREST ACTIVITY									
THINNED TREES					***				
WILDLIFE FOOD CROPS				***				***	
IMPROVED SOIL						+			
IMPROVED WATER		***							
NON-TIMBER PRODUCTS			**						
FOREST HEALTH	***				***	+	***		
LEASED PROPERTY	+								
OTHER ACTIVITIES			***						***
ASSISTING AGENCIES									
WV DIVISION OF FORESTRY				**					
WV DIVISION OF FORESTRY	***	***	***	***	***	***	***	***	***
Significant Variables	6	4	7	9	7	7	3	4	4
Respondents: Yes = 1	252	245	238	235	232	225	224	193	192
Respondents: Total	451	451	451	451	451	451	451	451	451
Chi ² Value (df)	85.8 (6)	52.7 (4)	89.8 (7)	120.1 (9)	39.4 (7)	54.9 (7)	66.3 (3)	56.8 (4)	95.2 (4)
Odds Ratio	4.9:1	3.3:1	4.6:1	5.9:1	3.9:1	3.3:1	3.1:1	3.6:1	4.5:1

(vi.) Soil Resources:

More recent forest owners with higher incomes who use their property for a fruit tree orchard and livestock pasturage tended to be more interested in soil fertility and erosion control issues. They also tend to implement forest protection and soil improvement practices within their forest property. Additionally, the WV State Division of Forestry was the public agency that

respondents interested in soil resource issues tended to use in the past for obtaining management assistance. The relationship between these characteristics suggests that these landowners do acknowledge their need for soil management, which is important for them to successfully achieve their ownership and management objectives (Table 5). This was also evident during property visits with NIPF owners who showed a concern for and interest in soil resources including fertility and erosion control issues (Magill, 2000).

(vii.) Visual Beauty:

Landowners owning forest property for visual enjoyment and protecting its health tend to be interested in improving and managing visual resources. They also tend to have received assistance in the past from the WV State Division of Forestry. The positive relationship between these characteristics for this group of landowners suggest that they do realize the need to protect the visual forest resources of their property from fire, disease, insects and poor timber harvest practices, but they also recognize a need for assistance (Table 5). Property visits and discussions with NIPF owners also revealed an interested in protecting and maintaining visual resources (Magill, 2000).

(viii.) Dendrology and Silvics:

Landowners interested in dendrology issues tend to be more recent owners that own their forest property for investment. They were also more likely to establish wildlife food crops on their property and tend to have received assistance in the past from the WV State Division of Forestry. The positive relationship between these characteristics indicates an understanding by this group of landowners that the valuation and success of a forest investment often depends on the ability to correctly identify and know the growth requirements of forest plants, especially tree and shrub species (Table 5). Forest plant identification and reproduction issues were also highlighted conversation topics during visits with NIPF owners who wanted to learn more about this assistance topic (Magill, 2000).

(ix.) Valuation of Timber or Forestland:

Timber or forestland valuation assistance tended to be requested by landowners using their forest property for investment and timber production. Building fence (other activities) was a management practice that landowners interested in valuation assistance were more likely to implement on their property. In addition, landowners interested in valuation issues tend to have received help in the past from the WV State Division of Forestry. The positive relationship between these characteristics suggests that this group of landowners realize that proper valuation and protection of their forest assets (land or timber) can be complicated and often requires professional assistance (Table 5). During visits with NIPF owners, valuation issues were topics of conversation that most of the landowners were unsure about, but they were quite interested in getting help to better understand valuation principles (Magill, 2000).

Summarizing the Reduced Logistic Analysis

The landowners requesting these preferred assistance topics appear to understand that their reasons for ownership and activities they engage in on their property (Table 5) can be biologically and economically complicated. Proper identification of forest plants is critical for successful implementation of most forestland uses and management. Using forest property for investment can revolve around timber production, non-timber products (ginseng etc.), wildlife habitat or visual beauty and identifying valuable forest plant species is crucial for proper valuation assessment. Landowners interested in dendrology were more likely own their property for investment and tend to plant wildlife food crops on their property.

Utilizing silviculture to conduct proper management depends on knowing the growth and reproductive traits of trees and other forest plants as well as site factors such as soil and water resources. Respondents interested in silviculture and valuation issues tend to use their property for investment and timber production. Landowners interested in silviculture were also more likely to grow and harvest non-timber products (ginseng etc.), as were those with liability concerns (Table 5).

Forest protection and plant identification issues are critical for maintaining timber and non-timber plant species, wildlife habitats and food sources, hunting or fishing activities, watershed quality, soil fertility and visual resources. Implementing forest health improvements were characteristic of landowners inclined to be interested in forest health, liability, visual beauty and soil resource issues. Respondents interested in forest health issues also tend to own their property for timber production, as do landowners requesting silviculture and valuation assistance. Visual enjoyment of forest property tended to be a use engaged in by those interested in visual management issues.

Landowners interested in wildlife habitat improvement issues were more likely to establish wildlife food crops and use their property for residence and hunting or fishing while also being similar to respondents wanting forest health assistance in that they own their property for wildlife habitat. The negative relationship of watershed protection with requests for wildlife habitat assistance suggests that this group of landowners would like assistance to manage wildlife without disrupting watershed quality. Using property for livestock or a fruit tree orchard requires knowledge of soil and water properties. Livestock grazing often causes soil compaction resulting in a negative impact on ground water resources, which limits plant growth. Respondents interested in water resource issues tend to conduct water improvement practices and use their property for livestock grazing, which was synonymous with landowners wanting soil resource assistance. Soil resource assistance was also more likely to be requested by those conducting soil improvement practices and using their property for a fruit tree orchard.

Leasing forest property for timber or recreation and protecting visual resources often depends on the establishment, maintenance, protection and valuation of trees and other forest plants, wildlife habitat, soil fertility and water quality. Landowners requesting forest protection assistance tend to lease their property for timber or recreation. Tree thinnings were a significant activity for requests of liability assistance, but they were negatively correlated, which seems to suggest that these respondents want assistance to better understand the legalities before implementing such a practice. Landowners interested in liability issues were also more likely to use their property for investment.

Conducting silviculture practices, protecting forest resources and leasing property are liability concerns for NIPF owners, because of the responsibility the landowner may have to persons using their property for economic or recreational benefit. Keeping the property free of hazards is a way to reduce landowner liability (Allen et al., 1997). Other liability issues include owning forest property for investment and timber production as well as for growing non-timber products (ginseng, mushrooms etc.), which often involve trespassing. Constructing fences around property is one way to protect these assets. Landowners interested in silviculture and valuation issues tend to build fences on their property. Property rights and taxes are also concerns for landowners, especially if they get involved in assistance or management programs (McEvoy, 1998).

More recent forest ownership and higher incomes as well as previously receiving assistance from the WV State Division of Forestry were also consistent factors in the models for landowners requesting the nine preferred assistance topics. The WVU Division of Forestry tended to have provided assistance in the past to landowners interested in wildlife management issues (Table 5).

Comparing NIPF Respondents in West Virginia to those in Idaho and Indiana

Years of forest ownership and income were the only two significant socioeconomic characteristics in the logistic models for West Virginia NIPF respondents interested in the nine preferred assistance topics (Table 5). The significance of these two factors follows a similar pattern to surveys conducted in Indiana (Mills et al., 1996) and Idaho (Grasser & Force, 1996). These studies concluded that NIPF owners of more recent forest ownership and higher incomes tend to become more interested and involved in managing their forest resources.

The 451 landowners responding in the West Virginia study that preferred the nine assistance topics indicated more commercial (timber production, investment, livestock pasture and fruit orchard) than non-commercial (wildlife habitat, visual beauty, residence and hunting or fishing) reasons for owning forest property in the logistic models (Table 5). In contrast, the Indiana study concluded that NIPF owners tend to own their property for more non-commercial

reasons whether or not they participated in a forestry assistance program. Conversely, the West Virginia respondents tended to conduct an equal number of commercial (tree thinnings, soil improvements, leases, fencing and ginseng etc.) and non-commercial (wildlife food plots, water improvements, forest health) forestry practices within their property. This pattern was similar to NIPF owners from Indiana who participated in assistance programs (Mills et al., 1996).

Recommendations and Conclusion

Although landowners responding in this study are known to have previously received assistance, they still expressed a great deal of interest in obtaining assistance to manage their forest property (Table 5). This high level of desire for assistance could act as a catalyst to increase the involvement of public and private organizations in developing and providing forest management programs. The topics of interest for these landowners are varied and ranged from protecting forest health and soil and water resources to the valuation of timber and forestland. Other specific topics requested were plant identification and growth requirement issues, wildlife and visual resource management as well as growing, thinning and harvesting trees or other forest plants. These forest owners also expressed an interest in learning more about legal ownership issues such as landowner liability, property rights and taxes. It would appear that this group of NIPF owners are interested in sustaining their forest resources while simultaneously using and improving the resources for amenity, quality of life and income benefits (Table 5).

In the past, the low participation rate of landowners in assistance programs may have been due to the limited scope of topics offered. Perhaps offering programs that enable landowners to better achieve their management objectives would increase the participation rate. Even though a higher income level and more recent forest ownership were consistent characteristics for landowners requesting several of the survey topics (Table 5), audiences for assistance programs should not be limited to owners with these qualities. In fact, these constitute only a portion of the NIPF owners in West Virginia. The challenge is to devise methods for engaging all NIPF owners in programs that result in better resource management.

The results of this study (Table 5) also revealed the West Virginia State Division of Forestry to be the lead agency for providing assistance to landowners. Perhaps landowners used this agency to a greater extent, because it is more visible and available. However, the low rate of landowner participation in programs may be a reflection that this state agency's ability to provide services to NIPF owners is compromised by its regulatory responsibilities such as enforcing BMP regulations. This is not a negative reflection on the State Division of Forestry; the fact is they lack the resources to improve management on 256,500 NIPF ownership's alone (Table 1). Based on the logistic results, when considering all factors tested in the models, only those requesting wildlife management assistance indicated the West Virginia University Division of Forestry as being instrumental in providing assistance. Furthermore, the West Virginia University Extension Service was not revealed in the regression models as a means of delivery for landowners interested in any of assistance topics analyzed (Table 5). Perhaps having a wildlife extension specialist on staff is the reason why landowners interested in wildlife management issues tended to receive assistance from the West Virginia University Division of Forestry. Therefore, it is suggested that to increase interest in forest management programs the WVU Division of Forestry and Extension Service need to increase their visibility and availability to NIPF owners. Increasing the number of visits to NIPF properties by resource professionals and improving interagency cooperation as well as clarifying property rights and tax issues are also suggested for improving landowner interest and participation. Using financial incentives to promote sustainability and stewardship should be cautiously considered, because before landowners can use these incentives they must first understand good forest management practices (Magill et al., 2000).

Improving resource management on private forestland is especially important to West Virginia, which is heavily forested and where 80% of this forestland is controlled by private landowners. In addition, the future ecological, economic and social well being of the state and its residents may very well depend on the sustainable management of forest resources (Magill et al., 2000). The results of this survey can be used to target landowners for specific topics as well as gear workshops or programs that reflect the objectives of these landowners while simultaneously fostering owners who are better informed regarding forest management practices.

Even though the results of this study are interesting, there are different types of assistance landowner's need, which may require exploring a variety of possibilities. Perhaps the greatest challenge is to find ways to engage the non-participant populations in resource management assistance programs. The results of this study identifies populations who do participate, and by elimination, those who do not. Programs that appeal to low-income and older owners is a particular challenge that must be met in order to achieve good management on the broad land base in West Virginia.

In this study, NIPF owners that were interviewed who actively manage their property tended to have originally lived in a rural area, moved to a more urban environment and then returned to the land by purchasing forest property. They were also more likely to be middle age with higher than average incomes and have a high school education. Results of correlation analysis of socioeconomic factors for the entire sample population did not reveal a significant relationship between income and education level. However, both income and education level were significantly and positively associated with age of the respondents.

Delivery of programs that meet the interests and needs of the landowner as well as propagate sound management practices may require a variety of distribution mechanism and in different combinations, which is the subject of future study. Perhaps the computer inter-net could be used as a distance learning tool to provide more information access. In addition, using visual training mechanisms like the Stand Visualization System (appendix N) may allow landowners to make better management choices before forestry practices are conducted (Magill, 2000).

Appendix A

Questionnaire: Please answer questions by following the directions. It should take approximately 20 to 30 minutes to complete the questionnaire.

To Answer question 1, please write down the total number of forested acres for each property you own and the number of years owned as well as in which West Virginia County the property is located. In addition, for each parcel of property, please check mark how you got the property (Bought, Other or Inherited) and how the property is owned (Singly, Jointly or Other).

Question 1.

Property Numbers

	Property 1	Property 2	Property 3	Property 4	Property 5
CHECK ALL THAT APPLY					
Total Forested Acres					
Years Owned					
WV County Location					
Bought					
Other					
Inherited					
Singly					
Jointly					
Other					

To answer question 2, please write down the appropriate answers on the underlined blank spaces.

2. I permanently live in _____ and _____ and _____
COUNTY NAMESTATE NAMEZIP CODE

3. Please identify each of the uses of your forested property that are important to you, by circling ONE CHOICE for each of your forest property uses.

Property Uses	Most Important			Least Important	
As a Place to live	1	2	3	4	5
As an Investment	1	2	3	4	5
For Wildlife Habitat	1	2	3	4	5
For Hunting or Fishing	1	2	3	4	5
For Watershed Protection	1	2	3	4	5
For Visual Beauty	1	2	3	4	5
For Hiking or Biking	1	2	3	4	5
For Timber Production	1	2	3	4	5
For a Christmas Tree Farm	1	2	3	4	5
As a Fruit Tree Orchard	1	2	3	4	5
For Ginseng or Mushroom Production	1	2	3	4	5
For Livestock Pasture	1	2	3	4	5
For Firewood or Fence Posts	1	2	3	4	5
For Maple Syrup Production	1	2	3	4	5
For Other Purposes	1	2	3	4	5

Before continuing to answer the questions, please read the following definition of forest management.

Forest management includes any activity or recommendation to use, improve or maintain forest resources within a forested property. Forest resources include timber or trees, wildlife, recreation, visual beauty, soil, water (streams and ponds) and other plants (herbs & mushrooms).

To answer question 4, please refer to the definition of Forest Management given above.

4. In the last 15 years, have any forest resources been managed within any of your forested property?

CHECK ONE CHOICE ONLY

____ Yes ____ No

To answer question 5, please identify if you have done any of the following forest management activities to use, improve, or maintain forest resources within your forested property in the last 15 years.

CHECK ALL THAT APPLY

5. I have ____ Harvested Timber

I have ____ Used a Forester to Oversee the Most Recent Timber Harvest on My Property

I was ____ Satisfied With the Condition of My Property after the last Timber Harvest

I was ____ Not Satisfied With the Condition of My Property after the last Timber harvest

I plan ____ To Have Timber Harvested on My Property in the Next 5 Years

I have ____ Planted Trees (includes Christmas Trees and Shrubs)

I have ____ Thinned Trees

I have ____ Cut Grapevines or Other Vines and Plants

I have ____ Improved or Maintained Visual Beauty

I have ____ Constructed or Maintained Trails

I have ____ Constructed or Maintained Access Roads

I have ____ Planted Wildlife Food Crops

I have ____ Improved Soil Fertility or Controlled Soil Erosion

I have ____ Improved Water Quality or Quantity (springs, streams, ponds, or watersheds)

I have ____ Planted or Harvested Other Forest Plants (mushrooms, ginseng or other herbs)

I have ____ Had My Property Boundaries Surveyed

I have ____ Controlled Forest Damaging Agents (fire, disease, insects, deer or plants)

I have ____ Leased My Property for Timber Production, Hunting or Other Recreation Activities

I have ____ Done Other Forest Management Activities: Please List _____

To answer question 6, please check mark how important forest management is to you.
CHECK ONE CHOICE ONLY

6. As a forest landowner, forest management is _____ **Very Important** to me.

As a forest landowner, forest management is _____ **Important** to me.

As a forest landowner, forest management is _____ **Some What Important** to me.

As a forest landowner, forest management is _____ **Not Important** to me.

7. If you have not done anything to use, improve, or maintain forest resources within your forested property, would you like to in the near future?

Check One Choice Only

____ Yes

____ No

____ Does Not Apply

8. Do you currently have a written forest management plan for any of your forested property?

CHECK ONE CHOICE ONLY

____ Yes **ANSWER Q9 AND CONTINUE**

____ No **GO TO Q10 AND CONTINUE**

To answer question 9, please identify the number of the properties you listed in QUESTION 1 that have written forest management plans, by placing a check mark under the correct choices. In addition, please write down the total number of acres that are covered by a written forest management plan for each of the properties you have listed.

9. How many of your forested properties do you have written management plans for?

Property Numbers

	Property 1	Property 2	Property 3	Property 4	Property 5
CHECK ALL THAT APPLY					
Total Management Plan Acres					

10. If you do not have written forest management plans, would you like to have a plan in the near future?

____ Yes

CHECK ONE CHOICE ONLY

____ No

____ Does Not Apply

Before continuing to answer the questions, please read the following definition of forest management assistance.

Forest management assistance can include any informational, financial or technical training and assistance that is provided by any forestry organization, agency, company or forest resource professional. Forest resource professionals can include foresters, wildlife biologists, county extension agent's etc.

11. In the last 15 years, have you received forest management assistance?

CHECK ONE CHOICE ONLY

_____ Yes **ANSWER Q12 THROUGH 14 AND CONTINUE**

_____ No **GO TO Q15 ON THE NEXT PAGE AND CONTINUE**

12. In the last 15 years, what types of forest management assistance have you received?

CHECK ALL THAT APPLY

_____ Informational (Publications, News Letters etc.)

_____ Financial (Cost-Share, Grants etc.)

_____ Technical (Private Forester, State Forester, Extension Agents etc.)

_____ Workshop-Training (Indoor Classes, Outdoor Forest Demonstrations etc.)

_____ Other: Please List _____

13. In the last 15 years, which of the following organizations or agencies provided you with forest management assistance?

CHECK ALL THAT APPLY

I have received assistance from the _____ West Virginia University Division of Forestry

I have received assistance from the _____ West Virginia University Extension Service

I have received assistance from the _____ West Virginia Division of Forestry (County Forester)

I have received assistance from the _____ West Virginia Department of Agriculture

I have received assistance from the _____ West Virginia Department of Natural Resources

I have received assistance from the _____ West Virginia Forestry Association

I have received assistance from the _____ West Virginia Woodlands Owners Association

I have received assistance from the _____ West Virginia Tree Farm Program

I have received assistance from the _____ USDA Forest Service

I have received assistance from the _____ USDA Farm Service Agency

I have received assistance from the _____ USDA Natural Resources Conservation Service

I have received assistance from A _____ Timber Company

I have received assistance from A _____ Private Consulting Forester

I have received assistance from _____ Other Sources: Please List _____

14. How satisfied were you with the forest management assistance you received?

CHECK ONE CHOICE ONLY

I was _____ **Very Satisfied** with the assistance I received

I was _____ **Some What Satisfied** with the assistance I received

I was _____ **Some What Dis-Satisfied** with the assistance I received

I was _____ **Not Satisfied** with the assistance I received

15. Please identify whether or not you would like Forest Management Assistance for any of the Forestry topics that are listed on the next 2 pages. You can chose more than one type of assistance for any Forestry topics listed by check marking all of the types of assistance you would like. See Question 12 for Definitions of Assistance Types on Page 4.

For Example: Would you like assistance **To Improve or Manage Wildlife Habitat?**

☐ Yes ☐ No

If yes, would you like (☐ Workshop-Training), (☐ Financial), (☐ Technical) Assistance

By check marking Workshop-Training and Financial, you have identified that you would like Workshop-Training and Financial Assistance to Improve or Manage Wildlife Habitat.

Would you like Forest Management Assistance **For Thinning or Harvesting Trees or Other Forest Plants?**

☐ Yes ☐ No

If yes, would you like (☐ Workshop-Training), (☐ Financial), (☐ Technical) Assistance

Would you like assistance **To Identify or Grow Trees or Other Forest Plants?**

☐ Yes ☐ No

If yes, would you like (☐ Workshop-Training), (☐ Financial), (☐ Technical) Assistance

Would you like assistance **To Improve or Manage Wildlife Habitat?**

☐ Yes ☐ No

If yes, would you like (☐ Workshop-Training), (☐ Financial), (☐ Technical) Assistance

Would you like assistance **To Develop Forest Recreational Opportunities or Uses (Hunting, Fishing, Hiking, Biking)?**

☐ Yes ☐ No

If yes, would you like (☐ Workshop-Training), (☐ Financial), (☐ Technical) Assistance

Would you like assistance **To Improve Water Quality or Quantity from Springs, Streams, Ponds or Watersheds?**

☐ Yes ☐ No

If yes, would you like (☐ Workshop-Training), (☐ Financial), (☐ Technical) Assistance

Would you like assistance **To Improve Soil Fertility or Control Soil Erosion?**

☐ Yes ☐ No

If yes, would you like (☐ Workshop-Training), (☐ Financial), (☐ Technical) Assistance

Would you like assistance **For Valuing or Selling Timber or Forest Land?**

☐ Yes ☐ No

If yes, would you like (☐ Workshop-Training), (☐ Financial), (☐ Technical) Assistance

Would you like assistance **To Lease Forested Land for Timber Production, Hunting or Other Recreational Uses?** _____Yes _____No

If yes, would you like (_____Workshop-Training), (_____Financial), (_____Technical) Assistance

Would you like assistance **for Dealing with Landowner Liability, Property Rights or Taxes?**

_____Yes _____No

If yes, would you like (_____Workshop-Training), (_____Financial), (_____Technical) Assistance

Would you like assistance **For the Cooperative Management of Forest Land by Neighboring Landowners?** _____Yes _____No

If yes, would you like (_____Workshop-Training), (_____Financial), (_____Technical) Assistance

Would you like assistance **To Manage Other Forest Products like Ginseng, Mushrooms, Beehives etc.** _____Yes _____No

If yes, would you like (_____Workshop-Training), (_____Financial), (_____Technical) Assistance

Would you like assistance **To Understand and Conduct Property Boundary Surveying?**

_____Yes _____No

If yes, would you like (_____Workshop-Training), (_____Financial), (_____Technical) Assistance

Would you like assistance **To Build or Maintain Forest Access Roads or Trails?**

_____Yes _____No

If yes, would you like (_____Workshop-Training), (_____Financial), (_____Technical) Assistance

Would you like assistance **To Control or Prevent Forest Damage by Fire, Disease, Insects, Deer or Other Causes?** _____Yes _____No

If yes, would you like (_____Workshop-Training), (_____Financial), (_____Technical) Assistance

Would you like assistance **To Improve or Maintain Visual Beauty?**

_____Yes _____No

If yes, would you like (_____Workshop-Training), (_____Financial), (_____Technical) Assistance

To answer question 16, write down the correct number on the lines to the right of the question.

16. What is your birth date? _____Month and _____Year

17. What is your gender? I am _____Male
I am _____Female

18. What is your marital status? I am____ Married
CHECK ONE CHOICE ONLY I was____ Never Married
I am____ Widowed
I am____ Divorced
I am____ Separated

19. What is your annual household income? **CHECK ONE CHOICE ONLY**
Our Income is less than____ \$10,000
Our Income is less than____ \$20,000
Our Income is less than____ \$30,000
Our Income is less than____ \$40,000
Our Income is ____ \$40,000 or more

20. What is the highest level of education you have completed? **CHECK ONE CHOICE ONLY**
I did not Attend____ High School
I have Attended____ High School
I am a ____ High School Graduate or Equivalent (GED)
I have Attended____ College
I am an____ Associate Degree Graduate
I am a ____ Bachelor Degree Graduate
I have Attended____ Graduate School
I am a ____ Master's Degree Graduate
I have done____ Graduate Study Beyond Master's Requirements
I am a ____ PhD. or Professional Degree Graduate

21. What is your current employment status?
CHECK ALL THAT APPLY
I ____ Work 35 Hours or More per Week
I ____ Work Less Than 35 Hours per Week
I am ____ Self Employed
I am ____ Seasonally Employed
I am ____ Not Working, but Currently Looking for Work
I am a ____ Student Enrolled at an Educational Institution
I am ____ Retired and Receiving a Pension
I am ____ Disabled and Receiving Social Security Disability

22. How many hours each month do you spend managing your forested property? _____

23. How many hours each month do you need to best manage your forested property? _____

Once you have completed the questionnaire, we invite you to tell us in writing whether or not this questionnaire was adequate for this topic and provide additional comments and suggestions.

Thank you for your time and cooperation in filling out the questionnaire.

Sincerely yours,

Daniel J. Magill, M.Sc. Forestry Student, WVU Division of Forestry

Appendix B-1

Table 1-1: Independent Demographic Variable Categories and Codes

Variable	LANDSIZE	TENRGRUP	INCOME	AGEGROUP	EDUCATIO
Characteristics	Landsize Acres	Tenure Years	Income Annual	Age Years	Education Level
Measurements	3 Categories	3 Categories	5 Categories	4 Categories	9 Categories
Codes	2. 10-99 ac 3. 100-199 ac 4. 200-299 ac	1. 1-10 yrs 2. 11-20 yrs 3. 21+ yrs	1. < \$10,000 2. < \$20,000 3. < \$30,000 4. < \$40,000 5. \$40,000 +	1. < 25 2. 26-49 3. 50-64 4. 65+	1. No High School 2. High School 3. High School Grad. 4. Attended College 5. Associate Degree 6. Bachelor Degree 7. Graduate School 8. Master's Degree 9. Post Master's 10. PhD. Graduate

Table 1-2: Landowners Property Uses

Variable	Property Use	Measurement Ranking 1-5				
		Most Important	Important	Least Important		
		1	2	3	4	5
PLACLIV2	Residence					
INVESTM2	Investment					
WILDLIF2	Wildlife Habitat					
HUNTFIS2	Hunting or Fishing					
WATESHD2	Watershed Protection					
VISULBU2	Visual Beauty					
HIKBIKE2	Hiking or Biking					
TIMBERP2	Timber Production					
XMASTRE2	Christmas Tree Farm					
FRUITRE2	Fruit Tree Orchard					
GINSENG2	Ginseng or Mushrooms Production					
LIVSTOC2	Livestock Pasture					
FIREWOD2	Firewood or Fence Posts					
MAPLSYR2	Maple Syrup Production					
OTHRUSE2	Other Uses					

Appendix B-2

Table 1-3: Forestry Activities Conducted on Landowners Property & Assisting Agencies

Variable	Forestry Activities	Measurement Nominal	
		Yes=1	No=0
THARVEST	Harvested Timber		
PLANTREE	Planted Trees (includes Christmas Trees & Shrubs		
THINTREE	Thinned Trees		
CUTVINES	Cut Vines or Other Vines and Plants		
IMPRLOOK	Improved or Maintained Visual Beauty		
BILTRAIL	Constructed or Maintained Trails		
BUILROAD	Constructed or Maintained Access Roads		
WILDFOOD	Planted Wildlife Food Crops		
IMPVSOIL	Improved Soil Fertility or Controlled Soil Erosion		
IMPVWATR	Improved Water Quality or Quantity		
OTHFOPD	Planted or Harvested Mushrooms, Ginseng or other Herbs		
SURVEYS	Had Property Boundaries Surveyed		
FORHELTH	Controlled Forest Damage Agents (fire, disease, insects etc.		
LEASES	Leased their Property for Timber Production or Recreation		
OTHERACT	Conducted Other Forest Management Activities (Built Fences)		
Variable	Agencies Previously providing Landowners Assistance		
WVUNIDOF	West Virginia University Division of Forestry		
EXTENSIO	West Virginia University Extension Service		
WVFOREST	West Virginia State Division of Forestry		

Appendix C

Appendix D-1

**Table 1-1: Breakdown of 451 Responses, by First Property Owned and Percent Forest Cover
Region 1: Northeastern. n=175**

	Total Number of Owners Sampled				Number of Returns			
Ownership (Acres) = A_i	Percent County in Forest Cover		Total Number Sampled	Percent Sampled	Percent County in Forest Cover		Number Returned	Percent Returned
	Heavy: 80+%	Moderate: 60-79%			Heavy: 80+%	Moderate: 60-79%		
10 to 99	167	172	339	85%	Observed: O_i 69	Observed: O_i 75	Observed: O_i 144	82%
100 to 199	22	22	44	11%	10	11	21	12%
200 to 299	8	8	16	4%	5	5	10	6%
Totals 3	197	202	399		84	91	175	
Total Percent	49%	51%		100%	48%	52%		100%

Table 1-2: Percent County in Forest Cover

Ownership (Acres) = e_i	Heavy: 80+%	Moderate: 60-79%	Total	$(O_i - e_i)$	$(O_i - e_i)^2$	$(O_i - e_i)^2 / e_i$
	Expected e_i	Expected e_i	Expected e_i			
10 to 99	73	76	149	-5	25	0.1678
100 to 199	9	10	19	2	4	0.2105
200 to 299	3	4	7	3	9	1.2857
Totals 3	85	90	175	Chi ² Statistic		1.664

K = 3 categories

Degrees of Freedom = 2

Reject H_0 : if $CHI^2 > 9.210$ @ Alpha 0.01 and 2 Degrees of Freedom

$1.664 < 9.210$

Do not Reject H_0 : because there is no significant difference between the observed and expected number of landowners responding in the three acreage and two cover types sampled for the Northeastern region of WV.

Appendix D-2

**Table 2-1: Breakdown of 451 Responses, by First Property Owned and Percent Forest Cover
Region 2: Southern. n = 115**

	Total Number of Owners Sampled				Number of Returns			
Ownership (Acres) = A_i	Percent County in Forest Cover		Total Number Sampled	Percent Sampled	Percent County in Forest Cover		Number Returned	Percent Returned
	Heavy: 80+%	Moderate: 60-79%			Heavy: 80+%	Moderate: 60-79%		
10 to 99	188	63	251	85%	Observed: O_i 65	Observed: O_i 26	Observed: O_i 91	79%
100 to 199	24	8	32	11%	12	5	17	15%
200 to 299	9	3	12	4%	5	2	7	6%
Totals 3	221	74	295		82	33	115	
Total Percent	75%	25%		100%	71%	29%		100%

Table 2-2:

Ownership (Acres) = e_i	Percent County in Forest Cover			$(O_i - e_i)$	$(O_i - e_i)^2$	$(O_i - e_i)^2 / e_i$
	Heavy: 80+%	Moderate: 60-79%	Total			
	Expected e_i	Expected e_i	Expected e_i			
10 to 99	73	25	98	-7	49	0.5
100 to 199	9	3	12	5	25	2.0833
200 to 299	4	1	5	2	4	0.8
Totals 3	86	29	115	Chi ² Statistic 3.3833		

K = 3 categories

Degrees of Freedom = 2

Reject H_0 : if $CHI^2 > 9.210$ @ Alpha 0.01 and 2 Degrees of Freedom

3.3833 < 9.210

Do not Reject H_0 : because there is no significant difference between the observed and expected number of landowners responding in the three acreage and two cover types sampled for the Southern region of WV.

Appendix D-3

**Table 3-1: Breakdown of 451 Responses, by First Property Owned and Percent Forest Cover
Region 3: Northwestern. n = 161**

	Total Number of Owners Sampled				Number of Returns			
Ownership (Acres) = A _i	Percent County in Forest Cover		Total Number Sampled	Percent Sampled	Percent County in Forest Cover		Number Returned	Percent Returned
	Heavy: 80+%	Moderate: 60-79%			Heavy: 80+%	Moderate: 60-79%		
10 to 99	201	178	379	85%	Observed: O _i	Observed: O _i	Observed: O _i	84%
					70	65		
100 to 199	26	23	49	11%	11	10	21	13%
200 to 299	9	9	18	4%	3	2	5	3%
Totals 3	236	210	446		84	77	161	
Total Percent	53%	47%		100%	52%	48%		100%

Table 3-2:

Ownership (Acres) = e_i	Percent County in Forest Cover			$(O_i - e_i)$	$(O_i - e_i)^2$	$(O_i - e_i)^2 / e_i$
	Heavy: 80+%	Moderate: 60-79%	Total			
	Expected e_i	Expected e_i	Expected e_i			
10 to 99	73	64	137	-2	4	0.0292
100 to 199	10	8	18	3	9	0.5
200 to 299	3	3	6	-1	1	0.2
Totals 3	86	75	161	Chi ² Statistic 0.7292		

K = 3 categories

Degrees of Freedom = 2

Reject H_0 : if $CHI^2 > 9.210$ @ Alpha 0.01 and 2 Degrees of Freedom

0.7292 < 9.210

Do not Reject H_0 : because there is no significant difference between the observed and expected number of landowners responding in the three acreage and two cover types sampled for the Northwestern region of WV.

Appendix E-1

Forest Health Assistance

(i.) Demographics:

Three demographic characteristics were significant for the 252 landowners requesting forest health assistance. Respondents age 26-49 years old ($\text{Chi}^2 = 13.58, 2\text{df}$), owning forest property from 1-10 years ($\text{Chi}^2 = 4.55, 2\text{df}$) and earning $>\$30,000$ per year ($\text{Chi}^2 = 12.01, 4\text{df}$) were more likely to be interested in forest health issues (Table 1-1). The ANOVA indicated that landowners wanting forest health assistance tend to have on average significantly larger properties, higher incomes and educational levels than those not wanting forest health assistance. They also tend to average less years of forest ownership than those not interested in forest health issues (Table 1-1).

(ii.) Property Uses:

The five most importantly ranked of the fifteen significant property uses for landowners wanting forest health assistance were investment ($\text{Chi}^2 = 31.96, 5\text{df}$), wildlife habitat ($\text{Chi}^2 = 36.26, 5\text{df}$), visual beauty ($\text{Chi}^2 = 37.40, 5\text{df}$), timber production ($\text{Chi}^2 = 46.62, 5\text{df}$) and livestock pasturage ($\text{Chi}^2 = 35.82, 5\text{df}$)(Table 1-1). These same property uses were indicated in the ANOVA as being on average more important for landowners interested in forest health issues than those not interested in this assistance topic (Table 1-1).

(iii) Activities:

Twelve activities conducted within property owned by NIPF respondents wanting forest health assistance were significant. Forest health activities ($\text{Chi}^2 = 19.15, 1\text{df}$), grapevine control ($\text{Chi}^2 = 11.22, 1\text{df}$), building trails ($\text{Chi}^2 = 10.74, 1\text{df}$) and improving visual beauty ($\text{Chi}^2 = 9.58, 1\text{df}$) were the most likely practices conducted within the property of landowners interested in forest health issues Table 1-1). The ANOVA identified that respondents wanting forest health assistance were more likely on average to have conducted these same activities within their forest properties than landowners not wanting this topic (Table 1-1).

(iv.) Assisting Agencies:

Landowners requesting forest health assistance were more likely to have received assistance in the past from the WV State Division of Forestry ($\chi^2 = 24.30$, 1df) and the WVU Extension Service ($\chi^2 = 10.30$, 1df). The ANOVA test of means revealed that on average landowners wanting this topic were more likely to have used these three agencies than those not interested in forest health issues (Table 1-1).

(v.) Logistic Regression Model (6df): Forest Health Assistance:

The model indicated that landowners interested in forest health issues tend to have higher income levels ($p = 0.05$) as well as use their property for wildlife habitat ($p = 0.00$) and timber production ($p = 0.00$) (Table). They were also more inclined to conduct, within their forested ownership's, forest health activities ($p = 0.00$) and property leases ($p = 0.07$) while receiving help from the WV State Division of Forestry ($p = 0.00$). The positive relationships between these characteristics suggest that this group of landowners realize that damaging agents can jeopardize habitat for wildlife and timber while also negatively influencing the leasing of their forest property, but they need more assistance.

The model produced odds of 4.8:1 that these variables correctly predict respondents wanting and not wanting forest health assistance ($\chi^2 = 85.8$, 6df, $p = 0.00$) while correctly predicting 78% and 58% of those requesting and not requesting this assistance topic. The change in the χ^2 -value between the first (39df) and second (6df) models was not significant proving the second model parsimonious for identifying the significant characteristics of the landowners wanting forest health assistance (Table 1-2).

Appendix E-2

Table 1-1: Pearson's Chi² and Analysis of Variance Values of Significance

Dependent and Grouping Variable: Forest Health Assistance: p-Value Significant @ ≤ 0.10

p-Value Significant ≤ 0.01 *** p-Value Significant ≤ 0.05 ** p-Value Significant ≤ 0.10 *	Pearson's CHI ² Analysis		Analysis of Variance (ANOVA)			
				Forest Health Assistance Requests Test of Means (ANOVA)		
INDEPENDENT VARIABLES	CHI ² Value & (df ^o)	CHI ² P-VALUE	ANOVA p-Value	No = 0 Means (199)	Yes =1 Means (252)	Difference +/- Means (451)
DEMOGRAPHICS						
PROPERTY LANDSIZE	1.38 (2)	0.50	*0.08	71.83	81.89	+10.06
LANDOWNER TENURE	4.55 (2)	*0.10	***0.01	23.32	19.61	-3.71
LANDOWNER INCOME	12.01 (4)	**0.02	***0.00	2.90	3.63	+0.73
LANDOWNER AGE	13.58 (2)	***0.00	0.95	54.70	54.81	+0.11
LANDOWNER EDUCATION	12.97 (9)	0.16	**0.04	4.05	4.56	+0.51
PROPERTY USES						
LANDOWNERS PLACE OF RESIDENCE	16.78 (5)	***0.00	0.22	3.67	3.89	+0.22
PROPERTY AS AN INVESTMENT	31.96 (5)	***0.00	***0.00	2.12	2.99	+0.87
WILDLIFE HABITAT	36.26 (5)	***0.00	***0.00	2.61	3.55	+0.94
HUNTING OR FISHING	24.38 (5)	***0.00	***0.00	2.35	2.87	+0.52
WATESHED PROTECTION	34.68 (5)	***0.00	***0.00	1.74	2.52	+0.78
VISUAL BEAUTY	37.40 (5)	***0.00	***0.00	2.54	3.55	+1.01
HIKING OR BIKING	34.18 (5)	***0.00	***0.00	1.46	2.17	+0.71
TIMBER PRODUCTION	46.62 (5)	***0.00	***0.00	2.20	3.06	+0.86
CHRISTMAS TREE FARM	28.45 (5)	***0.00	***0.00	0.72	1.12	+0.40
FRUIT TREE ORCHARD	29.88 (5)	***0.00	***0.00	0.92	1.46	+0.54
GINSENG OR MUSHROOM PRODUCTION	26.91 (5)	***0.00	***0.00	0.84	1.31	+0.47
LIVESTOCK PASTURE	35.82 (5)	***0.00	**0.05	1.99	2.34	+0.35
FIREWOOD OR FENCE POSTS	16.36 (5)	***0.01	***0.01	1.82	2.23	+0.41
MAPLE SYRUP PRODUCTION	23.57 (5)	***0.00	***0.00	0.69	1.02	+0.33
OTHER USES	20.80 (5)	***0.00	***0.00	0.98	1.45	+0.47
FOREST ACTIVITY						
TIMBER HARVESTING	1.82 (1)	0.18	0.18	0.40	0.46	+0.06
PLANTED TREES	8.26 (1)	***0.00	***0.00	0.21	0.33	+0.12
THINNED TREES	7.36 (1)	***0.00	***0.01	0.31	0.44	+0.13
CUT GRAPEVINES OR OTHER PLANTS	11.22 (1)	***0.00	***0.00	0.36	0.52	+0.16
IMPROVE VISUAL BEAUTY	9.58 (1)	***0.00	***0.00	0.40	0.54	+0.14
CONSTRUCTED TRAILS	10.74 (1)	***0.00	***0.00	0.29	0.44	+0.15
CONSTRUCTED ROADS	4.23 (1)	**0.04	**0.04	0.44	0.54	+0.10
PLANTED WILDLIFE FOOD CROPS	6.49 (1)	0.11	***0.01	0.19	0.29	+0.10
IMPROVED SOIL RESOURCES	9.09 (1)	***0.00	***0.00	0.32	0.46	+0.14
IMPROVED WATER RESOURCES	5.79 (1)	**0.02	**0.02	0.32	0.43	+0.11
NON-TIMBER PRODUCTS (GINSENG etc.)	4.25 (1)	**0.04	**0.04	0.08	0.14	+0.06
PROPERTY BOUNDARY SURVEYED	5.04 (1)	**0.02	**0.02	0.29	0.39	+0.10
CONTROLLED DAMAGING AGENTS	19.15 (1)	***0.00	***0.00	0.11	0.28	+0.17
LEASED PROPERTY (TIMBER OR REC.)	6.41 (1)	***0.01	***0.01	0.01	0.04	+0.03
OTHER FOREST ACTIVITIES	1.82 (1)	0.18	0.18	0.09	0.13	+0.04
ASSISTING AGENCIES						
WVU DIVISION OF FORESTRY	2.14 (1)	0.14	0.14	0.15	0.20	+0.05
WVU EXTENSION SERVICE	10.30 (1)	***0.00	***0.00	0.10	0.21	+0.11

WV STATE DIVISION OF FORESTRY	24.30 (1)	***0.00	***0.00	0.25	0.47	+0.22
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Appendix E-3

Table 1-2: Logistic Model (6df) Forest Health Assistance

Model: Logistic regression (logit) N of 0's:199 1's:252 Dep. var: HELTASST Loss: Max likelihood (MS-err. scaled to 1) Final loss: 266.59128751 Chi ² (6)=85.793 p=.00000					-2*log (Likelihood) 533.1826 Intercept Only: 618.9760			
HELTASST		HELTASST			Classification of Cases (owner.sta)			
	Estimate	Std.Err.	t(444)	p-level	Odds ratio: 4.9037			
Const.B0	-1.83	0.31	-5.87	0.00	OBSERVED	Pred.	Pred.	Percent
INCOME	0.12	0.06	1.99	0.05		0	1	Correct
WILDLIF2	0.23	0.06	3.89	0.00		0	115	84
TIMBERP2	0.18	0.06	2.98	0.00		1	55	197
FORHELTH	0.93	0.28	3.29	0.00				
LEASES	1.98	1.07	1.85	0.07				
WVFOREST	0.69	0.23	3.04	0.00				

Determining significant change in Chi²-value from 39df to 6df
for requests of Forest Health assistance.

A significant change in Chi²-value at the 0.10 alpha level would be equal to ≥ 46.04 .

Logistic Model (39df) Chi²-value: 111.81

Logistic Model (6df) Chi²-value: - 85.79

Difference 26.02

Result: there is no significant change in Chi²-value, because $26.02 < 46.06$.

Appendix F-1

Water Resource Assistance

(i.) Demographics:

For the 245 respondents interested in water resource issues three demographic characteristics were significant. Landowners owning forest property from 1-10 years ($\text{Chi}^2 = 7.66, 2\text{df}$), earning >\$30,000 per year ($\text{Chi}^2 = 18.12, 2\text{df}$) and age 26-49 years old ($\text{Chi}^2 = 18.68, 2\text{df}$) were the most likely to request water resource assistance (Table 2-1). The ANOVA indicated that landowners requesting this topic on average have significantly higher income and education levels than those not requesting water resource assistance do. They also tend to average less years of forest ownership than landowners not interested in water resource issues (Table 2-1).

(ii.) Property Uses:

The three most importantly ranked of the fifteen significant property uses, for landowners interested in water resource issues, were wildlife habitat ($\text{Chi}^2 = 30.79, 5\text{df}$), visual beauty ($\text{Chi}^2 = 31.44, 5\text{df}$), hunting or fishing ($\text{Chi}^2 = 26.12, 5\text{df}$) and timber production ($\text{Chi}^2 = 26.81, 5\text{df}$). These same uses of property in the ANOVA tend to be on average more important for those wanting water resource assistance than those not interested in this topic (Table 2-1).

(iii.) Activities:

Thirteen activities conducted within property owned by respondents wanting water resource assistance were significant. Landowners interested in water issues tend to have improved water ($\text{Chi}^2 = 16.70, 1\text{df}$) and soil resources ($\text{Chi}^2 = 13.94, 1\text{df}$), conducted tree thinnings ($\text{Chi}^2 = 13.05, 1\text{df}$), built access roads ($\text{Chi}^2 = 9.51, 1\text{df}$) and improved visual beauty ($\text{Chi}^2 = 9.94, 1\text{df}$) within their property (Table 2-1). The same practices were indicated in the ANOVA as being on average more commonly conducted by landowners requesting water resource assistance than those not requesting this topic (Table 2-1).

(iv.) Assisting Agencies:

Landowners wanting water resource assistance tend to have previously received help

from the WV State Division of Forestry ($\text{Chi}^2 = 25.32$, 1df) as well as the WVU Extension Service ($\text{Chi}^2 = 7.33$, 1df) and Division of Forestry ($\text{Chi}^2 = 6.29$, 1df). The ANOVA revealed that on average respondents wanting this topic were likely to use these same agencies than landowners not requesting water resource assistance (Table 2-1).

(v.) Logistic Regression Model (4df): Water Resource Assistance:

The model (4df) indicates that landowners with a higher income level ($p = 0.01$) and using their property for livestock pasture ($p = 0.02$) tend to be more interested in water resource issues. Landowners wanting water resource assistance were also more likely to have conducted water improvement practices ($p = 0.01$) within their property and tend to have received help in the past from the WV State Division of Forestry ($p = 0.00$). The positive relationships between these characteristics indicates that this group of landowners is aware of the management required to sustain their water resources to support their reasons of ownership, but they are in need of further assistance.

This logistic model ($\text{Chi}^2 = 52.669$, 4df, $p = 0.00$) correctly predicted 70% and 59% of the landowners wanting and not wanting this assistance topic. The model also produced odds of 3.3:1 that the variables used will correctly predict landowners that would or would not request water resource assistance. Even though the reduction in the Chi^2 -value between the first (39df) and second model (4df) was significant, the difference was only 1.2, indicating the second model to be parsimonious for identifying landowners interested in water resource issues (Table 2-2).

Appendix F-2

Table 2-1: Pearson's Chi² and Analysis of Variance Values of Significance

Dependent and Grouping Variable: Water Resources: p-Value Significant @ ≤ 0.10

<p>p-Value Significant ≤ 0.01 ***</p> <p>p-Value Significant ≤ 0.05 **</p> <p>p-Value Significant ≤ 0.10 *</p>	Pearson's		Analysis of Variance (ANOVA)			
	CHI ² Analysis		ANOVA p-Value	Water Resource Assistance Requests Test of Means (ANOVA)		
	CHI ² Value & (df°)	CHI ² P-VALUE		No = 0 Means (206)	Yes =1 Means (245)	Difference +/- Means (451)
INDEPENDENT VARIABLES						
DEMOGRAPHICS						
PROPERTY LANDSIZE	0.77 (2)	0.68	0.66	76.06	78.63	+2.57
LANDOWNER TENURE	7.66 (2)	**0.02	***0.00	24.09	18.85	-5.24
LANDOWNER INCOME	18.12 (4)	***0.00	***0.00	2.97	3.60	+0.63
LANDOWNER AGE	18.68 (2)	***0.00	0.99	54.75	54.77	+0.02
LANDOWNER EDUCATION	10.54 (9)	0.31	***0.00	3.95	4.66	+0.71
PROPERTY USES						
LANDOWNERS PLACE OF RESIDENCE	10.18 (5)	*0.07	*0.09	3.63	3.93	+0.30
PROPERTY AS AN INVESTMENT	31.20 (5)	***0.00	***0.00	2.20	2.94	+0.74
WILDLIFE HABITAT	30.79 (5)	***0.00	***0.00	2.68	3.51	+0.83
HUNTING OR FISHING	26.12 (5)	***0.00	***0.00	2.27	2.95	+0.68
WATESHED PROTECTION	20.45 (5)	***0.00	***0.00	1.83	2.47	+0.64
VISUAL BEAUTY	31.44 (5)	***0.00	***0.00	2.67	3.47	+0.80
HIKING OR BIKING	22.39 (5)	***0.00	***0.01	1.62	2.05	+0.43
TIMBER PRODUCTION	26.81 (5)	***0.00	***0.00	2.36	2.94	+0.58
CHRISTMAS TREE FARM	22.74 (5)	***0.00	***0.00	0.74	1.12	+0.38
FRUIT TREE ORCHARD	30.17 (5)	***0.00	***0.00	0.93	1.48	+0.55
GINSENG OR MUSHROOM PRODUCTION	26.06 (5)	***0.00	***0.00	0.84	1.32	+0.48
LIVESTOCK PASTURE	40.50 (5)	***0.00	***0.01	1.94	2.40	+0.46
FIREWOOD OR FENCE POSTS	10.47 (5)	*0.06	0.20	1.94	2.14	+0.20
MAPLE SYRUP PRODUCTION	21.52 (5)	***0.00	***0.00	0.73	1.00	+0.27
OTHER USES	11.50 (5)	**0.04	*0.09	1.11	1.36	+0.25
FOREST ACTIVITY						
TIMBER HARVESTING	2.99 (1)	*0.08	*0.08	0.39	0.47	+0.08
PLANTED TREES	10.74 (1)	***0.00	***0.00	0.20	0.34	+0.14
THINNED TREES	13.05 (1)	***0.00	***0.00	0.29	0.46	+0.17
CUT GRAPEVINES OR OTHER PLANTS	6.80 (1)	***0.01	***0.01	0.38	0.51	+0.13
IMPROVE VISUAL BEAUTY	9.94 (1)	***0.00	***0.00	0.40	0.55	+0.15
CONSTRUCTED TRAILS	8.95 (1)	***0.00	***0.00	0.30	0.43	+0.13
CONSTRUCTED ROADS	9.51 (1)	***0.00	***0.00	0.42	0.56	+0.14
PLANTED WILDLIFE FOOD CROPS	12.79 (1)	***0.00	***0.00	0.17	0.31	+0.14
IMPROVED SOIL RESOURCES	13.94 (1)	***0.00	***0.00	0.30	0.47	+0.17
IMPROVED WATER RESOURCES	16.70 (1)	***0.00	***0.00	0.28	0.47	+0.19
NON-TIMBER PRODUCTS (GINSENG etc.)	8.33 (1)	***0.00	***0.00	0.07	0.16	+0.09
PROPERTY BOUNDARY SURVEYED	6.36 (1)	***0.01	***0.01	0.29	0.40	+0.11
CONTROLLED DAMAGING AGENTS	4.48 (1)	**0.03	**0.03	0.16	0.24	+0.08
LEASED PROPERTY (TIMBER OR REC.)	2.12 (1)	0.15	0.15	0.01	0.04	+0.03
OTHER FOREST ACTIVITIES	0.97 (1)	0.33	0.33	0.10	0.13	+0.03
ASSISTING AGENCIES						
WVU DIVISION OF FORESTRY	6.29 (1)	***0.01	***0.01	0.13	0.22	+0.09
WVU EXTENSION SERVICE	7.33 (1)	***0.01	***0.01	0.11	0.20	+0.09

WV STATE DIVISION OF FORESTRY	25.32 (1)	***0.00	***0.00	0.25	0.48	+0.23
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Appendix F-3

Table 2-2: Logistic Model (4df) Water Resource Assistance

Model: Logistic regression (logit) N of 0's:206 1's:245 Dep. var: WATRASST Loss: Max likelihood (MS-err. scaled to 1) Final loss: 284.58665963 Chi ² (4)=52.669 p=.00000					-2*log (Likelihood) 569.1733 Intercept Only: 621.8420			
WATRASST		WATRASST			Classification of Cases (owner.sta)			
	Estimate	Std.Err.	t(446)	p-level	Odds ratio: 3.2895			
Const.B0	-1.20	0.26	-4.63	0.00	OBSERVED	Pred.	Pred.	Percent
INCOME	0.15	0.06	2.70	0.01	0	0	1	Correct
LIVSTOC2	0.13	0.06	2.36	0.02	0	121	85	58.73787
IMPVWATR	0.59	0.21	2.77	0.01	1	74	171	69.79592
WVFOREST	0.97	0.22	4.48	0.00				

Determining significant change in Chi²-value from 39df to 4df
for requests of Water Resource assistance.

A significant change in Chi²-value at the 0.10 alpha level would be equal to ≥ 46.04 .

Logistic Model (39df) Chi²-value: 99.93

Logistic Model (4df) Chi²-value: - 52.67

Difference 47.26

Result: there was a slight significant change in Chi²-value, because $47.26 > 46.06$.

Appendix G-1

Silviculture Assistance

(i.) Demographics:

Two demographic characteristics were significant for the 238 respondents interested in silviculture issues. Landowners age 26-49 years ($\text{Chi}^2 = 16.64$, 2df) and owning forest property for 1-10 years ($\text{Chi}^2 = 14.33$, 2df) were more likely want silviculture assistance (Table 3-1). The ANOVA indicated that landowners wanting silviculture assistance tend to have on average significantly larger properties as well as higher income and education levels than those not interested in this topic. They also on average were more likely to be recent forest owners than respondents not interested in silviculture issues (Table 3-1).

(ii.) Property Uses:

Visual beauty ($\text{Chi}^2 = 50.26$, 5df), investment, ($\text{Chi}^2 = 44.34$, 5df), timber production ($\text{Chi}^2 = 43.15$, 5df) and wildlife habitat ($\text{Chi}^2 = 37.47$, 5df) were the most importantly ranked of the fifteen significant property uses for landowners interested in silviculture issues (Table 3-1). The ANOVA revealed that on average these same property uses were more important for landowners wanting silviculture assistance than those not interested in this topic (Table 3-1).

(iii.) Activities:

Thirteen forestry practices were significant for respondents wanting silviculture assistance. Landowners interested in silviculture issues tend to have conducted tree thinnings ($\text{Chi}^2 = 15.44$, 1df), removed vines ($\text{Chi}^2 = 14.20$, 1df), constructed trails ($\text{Chi}^2 = 15.07$, $p=0.00$) and access roads ($\text{Chi}^2 = 12.57$, 1df) as well as improved visual beauty ($\text{Chi}^2 = 9.14$, $p=0.00$) within their forest property (Table 3-1). These same forestry practices were indicated in the ANOVA as being on average more likely to be conducted by landowners requesting silviculture assistance than those not requesting this topic (Table 3-1).

(iv.) Assisting Agencies:

The agencies most likely to have previously provided assistance to landowners interested

in silviculture issues were the WV State Division of Forestry ($\chi^2 = 39.82$, 1df) as well as the WVU Division of Forestry ($\chi^2 = 4.25$, 1df) and Extension Service ($\chi^2 = 8.92$, 1df) (Table 3-1). In the ANOVA these three agencies were more likely on average to have previously helped respondents wanting silviculture assistance than those not interested in this topic (Table 3-1).

(v.) Logistic Regression Model (7df): Silviculture Assistance:

The model (7df) indicated that NIPF owners interested in silviculture issues tend to be more recent owners ($p = 0.01$) while using their property for investment ($p = 0.00$), timber production ($p = 0.06$) and other uses ($p = 0.03$). Landowners wanting silviculture assistance were also more likely to grow or harvest non-timber products ($p = 0.04$) and conduct other activities ($p = 0.01$) such as building fences within their property. The WV State Division of Forestry ($p = 0.00$) was the agency most likely to have previously helped landowners interested in silviculture issues. The relationship between these characteristics suggests that this group of landowners recognize that their preferred property uses and forest activities require silviculture assistance, which can be economically and biologically complicated.

This model ($\chi^2 = 89.801$, 7df, $p = 0.00$) correctly predicted 71% and 65% of the respondents wanting and not wanting silviculture assistance while producing odds of 4.6:1 that these variables can identify landowners interested and not interested in silviculture issues. The change in χ^2 -value between the first (39df) and second (7df) models was not significant making the second model parsimonious for identifying respondents wanting silviculture assistance (Table 3-2).

Appendix G-2

Table 3-1: Pearson's Chi² and Analysis of Variance Values of Significance

Dependent and Grouping Variable: Silviculture: p-Value Significant @ ≤ 0.10

INDEPENDENT VARIABLES	Pearson's CHI ² Analysis		Analysis of Variance (ANOVA)			
	CHI ² Value & (df ^o)	CHI ² P-VALUE	ANOVA p-Value	Silviculture Assistance Requests Test of Means (ANOVA)		
				No = 0 Means (206)	Yes =1 Means (245)	Difference +/- Means (451)
DEMOGRAPHICS						
PROPERTY LANDSIZE	1.66 (2)	0.44	*0.06	71.84	82.48	+10.64
LANDOWNER TENURE	14.33 (2)	***0.00	***0.00	24.04	18.74	-5.30
LANDOWNER INCOME	6.21 (4)	0.18	**0.05	3.14	3.47	+0.33
LANDOWNER AGE	16.64 (2)	***0.00	0.58	55.27	54.30	-0.97
LANDOWNER EDUCATION	14.42 (9)	0.11	*0.09	4.12	4.53	+0.41
PROPERTY USES						
LANDOWNERS PLACE OF RESIDENCE	10.48 (5)	*0.06	*0.09	3.64	3.93	+0.29
PROPERTY AS AN INVESTMENT	44.34 (5)	***0.00	***0.00	2.12	3.04	+0.92
WILDLIFE HABITAT	37.47 (5)	***0.00	***0.00	2.73	3.50	+0.77
HUNTING OR FISHING	30.27 (5)	***0.00	**0.03	2.44	2.82	+0.38
WATESHED PROTECTION	33.54 (5)	***0.00	***0.00	1.77	2.54	+0.77
VISUAL BEAUTY	50.26 (5)	***0.00	***0.00	2.52	3.62	+1.10
HIKING OR BIKING	31.65 (5)	***0.00	***0.00	1.43	2.23	+0.80
TIMBER PRODUCTION	43.15 (5)	***0.00	***0.00	2.21	3.10	+0.89
CHRISTMAS TREE FARM	20.75 (5)	***0.00	***0.01	0.80	1.08	+0.28
FRUIT TREE ORCHARD	23.61 (5)	***0.00	***0.00	0.93	1.49	+0.56
GINSENG OR MUSHROOM PRODUCTION	18.74 (5)	***0.00	***0.00	0.89	1.29	+0.40
LIVESTOCK PASTURE	21.06 (5)	***0.00	0.35	2.10	2.26	+0.16
FIREWOOD OR FENCE POSTS	21.06 (5)	***0.00	***0.00	1.77	2.31	+0.54
MAPLE SYRUP PRODUCTION	16.12 (5)	***0.01	***0.00	0.73	1.01	+0.28
OTHER USES	24.33 (5)	***0.00	***0.00	0.93	1.53	+0.60
FOREST ACTIVITY						
TIMBER HARVESTING	0.94 (1)	0.33	0.33	0.41	0.45	+0.04
PLANTED TREES	9.30 (1)	***0.00	***0.00	0.21	0.34	+0.13
THINNED TREES	15.44 (1)	***0.00	***0.00	0.29	0.47	+0.18
CUT GRAPEVINES OR OTHER PLANTS	14.20 (1)	***0.00	***0.00	0.36	0.53	+0.17
IMPROVE VISUAL BEAUTY	9.14 (1)	***0.00	***0.00	0.40	0.55	+0.15
CONSTRUCTED TRAILS	15.07 (1)	***0.00	***0.00	0.28	0.45	+0.17
CONSTRUCTED ROADS	12.57 (1)	***0.00	***0.00	0.41	0.58	+0.16
PLANTED WILDLIFE FOOD CROPS	5.79 (1)	**0.02	**0.02	0.19	0.29	+0.10
IMPROVED SOIL RESOURCES	3.06 (1)	*0.08	*0.08	0.35	0.43	+0.08
IMPROVED WATER RESOURCES	2.23 (1)	0.14	0.14	0.35	0.42	+0.07
NON-TIMBER PRODUCTS (GINSENG etc.)	7.97 (1)	***0.00	***0.00	0.07	0.16	+0.09
PROPERTY BOUNDARY SURVEYED	1.48 (1)	0.22	0.22	0.32	0.37	+0.05
CONTROLLED DAMAGING AGENTS	5.98 (1)	***0.01	***0.01	0.15	0.25	+0.10
LEASED PROPERTY (TIMBER OR REC.)	0.96 (1)	0.33	0.33	0.02	0.03	+0.01
OTHER FOREST ACTIVITIES	10.90 (1)	***0.00	***0.00	0.06	0.16	+0.10
ASSISTING AGENCIES						

WVU DIVISION OF FORESTRY	4.25 (1)	**0.04	**0.04	0.14	0.21	+0.07
WVU EXTENSION SERVICE	8.91 (1)	***0.00	***0.00	0.10	0.21	+0.11
WV STATE DIVISION OF FORESTRY	39.82 (1)	***0.00	***0.00	0.22	0.51	+0.29

Appendix G-3

Table 3-2: Logistic Model (7df) Silviculture Assistance

Model: Logistic regression (logit) N of 0's:213 1's:238 Dep. var: SILVICUL Loss: Max likelihood (MS-err. scaled to 1) Final loss: 267.01580335 Chi ² (7)=89.801 p=.00000					-2*log (Likelihood) 534.0316 Intercept Only: 623.8322			
SILVICULTURE					Classification of Cases (owner.sta)			
					Odds ratio: 4.6007			
	Estimate	Std.Err.	t(443)	p-level	OBSERVED	Pred.	Pred.	Percent Correct
Const.B0	-0.82	0.34	-2.40	0.02				
TENRGRUP	-0.28	0.11	-2.45	0.01				
INVESTM2	0.19	0.06	3.05	0.00	0	139	74	65.25822
TIMBERP2	0.12	0.06	1.87	0.06	1	69	169	71.0084
OTHRUSE2	0.16	0.07	2.19	0.03				
OTHFOPD	0.74	0.35	2.11	0.04				
OTHERACT	0.91	0.37	2.49	0.01				
WVFOREST	0.92	0.23	4.09	0.00				

Determining significant change in Chi²-value from 39df to 7df for requests of Silviculture assistance.

A significant change in Chi²-value at the 0.10 alpha level would be equal to ≥ 46.04 .

Logistic Model (39df) Chi²-value: 123.95

Logistic Model (7df) Chi²-value: - 89.80

Difference 34.15

Result: there was no significant change in Chi²-value, because $34.15 < 46.06$.

Appendix H-1

Wildlife Habitat Assistance

(i.) Demographics:

Four demographic characteristics were significant for the 235 landowners interested in wildlife habitat assistance. Respondents owning property for 1-10 years ($\text{Chi}^2=33.40$, 2df) in the southern region of WV ($\text{Chi}^2=9.13$, 3df), age 26-49 years old ($\text{Chi}^2=24.75$, 2df) and earning >\$30,000 per year ($\text{Chi}^2=14.84$, 4df) were more likely to request wildlife habitat assistance (Table 4-1). The ANOVA indicated that landowners requesting wildlife habitat assistance tend to be on average older in age and have higher incomes than those not interested in wildlife habitat issues. They were also more likely to average less years of forest ownership than respondents not requesting this topic of assistance (Table 4-1).

(ii.) Property Uses:

Wildlife habitat ($\text{Chi}^2=56.61$, 5df), hunting or fishing ($\text{Chi}^2=55.13$, 5df), visual beauty ($\text{Chi}^2=27.19$, 5df), timber production ($\text{Chi}^2=26.78$, 5df) and investment ($\text{Chi}^2=20.76$, 5df) were the most importantly ranked of the fifteen significant property uses for landowners requesting wildlife habitat assistance (Table 4-1). The ANOVA indicated that these same property uses on average were more important for owners interested in wildlife habitat issues than those not interested in this topic (Table 4-1).

(iv.) Activities:

Thirteen forest activities conducted within property owned by respondents interested in wildlife habitat issues were significant. Landowners wanting wildlife habitat assistance were more likely to have built trails ($\text{Chi}^2=27.74$, 1df) and access roads ($\text{Chi}^2=20.96$, 1df) as well as improved visual beauty ($\text{Chi}^2=14.89$, 1df), conducted tree thinnings ($\text{Chi}^2=12.72$, 1df) and planted wildlife food crops ($\text{Chi}^2=31.78$, 1df) (Table 4-1). These same activities were indicated in the ANOVA as being on average more commonly conducted by landowners interested in wildlife habitat issues than those not interested (Table 4-1).

(iv.) Assisting Agencies:

Landowners requesting wildlife habitat assistance tend to have previously received help from the WV State Division of Forestry ($\chi^2=24.64$, 1df) as well as the WVU Division of Forestry ($\chi^2=13.54$, 1df) and Extension Service ($\chi^2=8.11$, 1df). The ANOVA indicated that landowners interested in wildlife habitat assistance were more likely on average to have received assistance in the past from these same agencies than those not wanting this topic (Table 4-1).

(v.) Logistic Regression Model (9df): Wildlife Habitat Assistance:

This model (9df) revealed that NIPF owners wanting wildlife habitat assistance tend to be recent owners ($p=0.00$) and have higher incomes ($p=0.04$). They tend to use their property for a place to live ($p=0.08$), wildlife habitat ($p=0.00$) and hunting or fishing ($p=0.00$) while also being more likely to plant wildlife food crops ($p=0.00$) within their property (Table). In addition, respondents more likely to be interested in wildlife habitat improvements were those previously receiving help from the WV State ($p=0.00$) and University ($p=0.04$) Divisions of Forestry. The negative relationship of watershed protection ($p=0.01$) with requests for wildlife habitat assistance suggests that this group of landowners would like assistance to manage wildlife without disrupting watershed quality. Additionally, the positive relationship between these characteristics suggests that this group of landowners realize they need wildlife habitat improvement assistance given their preferred property uses and activities conducted.

This model ($\chi^2=120.11$, 9df, $p=0.00$) correctly predicted 72% and 70% of the respondents wanting and not wanting this assistance topic while producing odds of 5.9:1 that these variables can identify landowners wanting and not wanting wildlife habitat assistance. The change in χ^2 -value between the first (39df) and second (9df) models was not significant making the second model parsimonious for identifying landowners wanting wildlife habitat improvement assistance.

Appendix H-2

Table 4-1: Pearson's Chi² and Analysis of Variance Values of Significance

Dependent and Grouping Variable: Wildlife Assistance: p-Value Significant @ ≤ 0.10

INDEPENDENT VARIABLES	Pearson's CHI ² Analysis		Analysis of Variance (ANOVA)			
	CHI ² Value & (df ^o)	CHI ² P-VALUE	ANOVA p-Value	Wildlife Habitat Assistance Requests Test of Means (ANOVA)		
				No = 0 Means (216)	Yes =1 Means (235)	Difference +/- Means (451)
DEMOGRAPHICS						
PROPERTY LANDSIZE	0.36 (2)	0.84	0.20	73.60	81.00	+7.40
LANDOWNER TENURE	33.40 (2)	***0.00	***0.00	25.50	17.33	-8.17
LANDOWNER INCOME	14.84 (4)	***0.01	***0.00	2.96	3.63	+0.67
LANDOWNER AGE	24.75 (2)	***0.00	*0.08	56.36	53.29	+3.07
LANDOWNER EDUCATION	11.65 (9)	0.23	0.13	4.14	4.51	+0.37
PROPERTY USES						
LANDOWNERS PLACE OF RESIDENCE	16.89 (5)	***0.00	0.28	3.69	3.89	+0.20
PROPERTY AS AN INVESTMENT	20.76 (5)	***0.00	***0.00	2.30	2.89	+0.59
WILDLIFE HABITAT	56.61 (5)	***0.00	***0.00	2.51	3.70	+1.19
HUNTING OR FISHING	55.13 (5)	***0.00	***0.00	2.06	3.17	+1.11
WATESHED PROTECTION	21.10 (5)	***0.00	***0.00	1.92	2.41	+0.49
VISUAL BEAUTY	27.19 (5)	***0.00	***0.00	2.65	3.51	+0.86
HIKING OR BIKING	37.25 (5)	***0.00	***0.00	1.55	2.14	+0.59
TIMBER PRODUCTION	26.78 (5)	***0.00	***0.00	2.39	2.94	+0.55
CHRISTMAS TREE FARM	33.60 (5)	***0.00	***0.00	0.71	1.16	+0.45
FRUIT TREE ORCHARD	25.36 (5)	***0.00	***0.00	0.95	1.48	+0.53
GINSENG OR MUSHROOM PRODUCTION	20.08 (5)	***0.00	***0.00	0.91	1.28	+0.37
LIVESTOCK PASTURE	42.46 (5)	***0.00	0.31	2.10	2.27	+0.17
FIREWOOD OR FENCE POSTS	14.63 (5)	***0.01	0.14	1.93	2.16	+0.23
MAPLE SYRUP PRODUCTION	22.49 (5)	***0.00	***0.00	0.74	1.00	+0.26
OTHER USES	11.79 (5)	**0.04	***0.00	1.03	1.44	+0.41
FOREST ACTIVITY						
TIMBER HARVESTING	4.70 (1)	**0.03	0.33	0.38	0.48	+0.10
PLANTED TREES	10.39 (1)	***0.00	***0.00	0.21	0.34	+0.13
THINNED TREES	12.72 (1)	***0.00	***0.00	0.30	0.46	+0.16
CUT GRAPEVINES OR OTHER PLANTS	6.28 (1)	***0.01	***0.00	0.39	0.51	+0.12
IMPROVE VISUAL BEAUTY	14.89 (1)	***0.00	***0.00	0.38	0.57	+0.19
CONSTRUCTED TRAILS	27.74 (1)	***0.00	***0.00	0.25	0.49	+0.24
CONSTRUCTED ROADS	20.96 (1)	***0.00	***0.00	0.38	0.60	+0.22
PLANTED WILDLIFE FOOD CROPS	31.78 (1)	***0.00	**0.02	0.13	0.35	+0.22
IMPROVED SOIL RESOURCES	5.58 (1)	**0.02	*0.08	0.34	0.45	+0.11
IMPROVED WATER RESOURCES	5.28 (1)	**0.02	0.14	0.33	0.43	+0.10
NON-TIMBER PRODUCTS (GINSENG etc.)	10.36 (1)	***0.00	***0.00	0.06	0.16	+0.10
PROPERTY BOUNDARY SURVEYED	6.81 (1)	***0.01	0.22	0.29	0.40	+0.11
CONTROLLED DAMAGING AGENTS	6.70 (1)	***0.01	***0.01	0.15	0.25	+0.10
LEASED PROPERTY (TIMBER OR REC.)	2.59 (1)	0.11	0.33	0.01	0.04	+0.03
OTHER FOREST ACTIVITIES	1.74 (1)	0.19	***0.00	0.09	0.13	+0.04
ASSISTING AGENCIES						

WVU DIVISION OF FORESTRY	13.54 (1)	***0.00	***0.00	0.11	0.24	+0.13
WVU EXTENSION SERVICE	8.11 (1)	***0.00	***0.00	0.11	0.20	+0.09
WV STATE DIVISION OF FORESTRY	24.64 (1)	***0.00	***0.00	0.25	0.48	+0.23

Appendix H-3

Table 4-2: Logistic Model (9df) Wildlife Assistance

Model: Logistic regression (logit) N of 0's:216 1's:235 Dep. var: WILDLIFE Loss: Max likelihood (MS-err. scaled to 1) Final loss: 252.15429209 Chi ² (9)=120.11 p=.00000					-2*log (Likelihood) 504.3086 Intercept Only: 624.4181			
WILDLIFE					Classification of Cases (owner.sta)			
					Odds ratio: 5.9485			
	Estimate	Std.Err.	t(441)	p-level	OBSERVED	Pred.	Pred.	Percent Correct
Const.B0	-1.33	0.46	-2.87	0.00				
TENRGRUP	-0.47	0.12	-3.86	0.00				
INCOME	0.13	0.06	2.06	0.04				
PLACLIV2	0.11	0.06	1.75	0.08				
WILDLIF2	0.28	0.08	3.57	0.00				
HUNTFIS2	0.19	0.07	2.84	0.00				
WATESHD2	-0.18	0.07	-2.44	0.01				
WILDFOOD	0.83	0.27	3.03	0.00				
WVUNIDOF	0.63	0.31	2.03	0.04				
WVFOREST	0.70	0.24	2.92	0.00				
					0	151	65	69.90741
					1	66	169	71.91489

Determining significant change in Chi²-value from 39df to 9df
for requests of Wildlife Habitat assistance.

A significant change in Chi²-value at the 0.10 alpha level would be equal to ≥ 46.04 .

Logistic Model (39df) Chi²-value: 145.70

Logistic Model (9df) Chi²-value: - 120.11

Difference 25.59

Result: there was no significant change in Chi²-value, because $25.59 < 46.06$.

Appendix I-1

Landowner Liability, Property Rights and Tax Assistance

(i.) Demographics:

For the 232 landowners interested in liability, property rights and tax issues, three demographic characteristics were significant. Respondents owning forest property for 1-10 years ($\text{Chi}^2=14.90$, 2df), with income levels $>\$30,000$ per year ($\text{Chi}^2= 23.00$, 4df) and age 50-64 years ($\text{Chi}^2= 12.96$, 2df) were more likely to request this type of assistance (Table 5-1). The ANOVA indicated that respondents interested in these issues tend to average higher income and education levels than those not interested in this topic. They also tend to average less years of forest ownership than the respondents not wanting liability, property rights and tax assistance do (Table 5-1).

(ii.) Property Uses:

Investment ($\text{Chi}^2=23.36$, 5df), wildlife habitat ($\text{Chi}^2=19.41$, 5df), visual beauty ($\text{Chi}^2=20.62$, 5df), timber production ($\text{Chi}^2=17.29$, 5df) and hunting or fishing ($\text{Chi}^2=15.86$, 5df) were the five most importantly ranked of the thirteen significant property uses of landowners wanting this type of assistance (Table 5-1). In the ANOVA these same uses of property were indicated on average to be more important for landowners interested in liability issues than those not requesting this type of assistance (Table 5-1).

(iii) Activities:

Fourteen activities conducted within property owned by respondents wanting liability, property rights and tax assistance were significant. Landowners interested in these issues tend to have removed grapevines ($\text{Chi}^2=4.01$, 1df), improved forest health ($\text{Chi}^2= 11.77$, 1df), constructed trails ($\text{Chi}^2=7.56$, 1df) and roads ($\text{Chi}^2=2.73$, 1df), improved visual beauty ($\text{Chi}^2=5.03$, 1df) and water resources ($\text{Chi}^2=3.76$, 1df) within their forest properties (Table 5-1). These six activities were indicated in the ANOVA as being on average more commonly conducted by landowners interested in these issues than those not interested (Table 5-1).

(vi.) Assisting Agencies:

The respondents most likely to request this type of assistance have previously obtained help from the WV State Division of Forestry ($\chi^2=17.67$, 1df), as well as the WVU Division of Forestry ($\chi^2= 6.60$, 1df) and Extension Service ($\chi^2= 6.01$, 1df). These same agencies were indicated in the ANOVA as being on average more commonly used in the past by landowners interested in these issues than those not wanting this topic of assistance (Table 5-2).

(v.) Logistic Regression Model (7df): Landowner Liability, Property Rights and Tax Assistance:

This model (7df) revealed that landowners of more recent ownership ($p=0.02$) and higher incomes ($p=0.00$) as well as using their property for an investment ($p=0.01$) and ginseng or mushroom production ($p=0.02$) tend to be more interested in these issues (Table). Respondents having forest health activities ($p=0.00$) conducted within their property and previously receiving assistance from the West Virginia State Division of Forestry ($p=0.00$) were also more likely to want this type of assistance. Even though thinning trees ($p=0.01$) was a significant activity in this model, it was negatively correlated with requests for this type of assistance. This suggests that these landowners may want to know their rights before conducting tree thinnings, which also illustrates the importance of the property uses and activities that were positively correlated with landowners requesting liability assistance in that they want to protect their forest property investment.

This model ($\chi^2=39.369$, 7df) correctly identified 69% and 64% of the landowners wanting and not wanting this type of assistance while producing odds of 3.9:1 that these significant characteristics can be used to identify those interested and not interested in these issues. The reduction in the χ^2 -value between the first (39df) and second (7df) models was not significant, proving the second model to be parsimonious for identifying landowners wanting liability, property rights and tax assistance (Table 5-2).

Appendix I-2

Table 5-1: Pearson's Chi² and Analysis of Variance Values of Significance

Dependent and Grouping Variable: Liability: p-Value Significant @ ≤ 0.10

INDEPENDENT VARIABLES	Pearson's CHI ² Analysis		Analysis of Variance (ANOVA)			
	CHI ² Value & (df ^o)	CHI ² P-VALUE	ANOVA p-Value	Liability Assistance Requests Test of Means (ANOVA)		
				No = 0 Means (219)	Yes =1 Means (232)	Difference +/- Means (451)
DEMOGRAPHICS						
PROPERTY LANDSIZE	0.09 (2)	0.95	0.32	74.52	80.22	+5.70
LANDOWNER TENURE	14.90 (2)	***0.00	***0.00	24.32	18.34	-5.98
LANDOWNER INCOME	23.00 (4)	***0.00	***0.00	2.90	3.69	+0.79
LANDOWNER AGE	12.96 (2)	***0.00	0.68	55.14	54.41	+0.27
LANDOWNER EDUCATION	10.12 (9)	0.34	***0.01	3.99	4.66	+0.67
PROPERTY USES						
LANDOWNERS PLACE OF RESIDENCE	9.67 (5)	*0.09	0.97	3.79	3.80	+0.01
PROPERTY AS AN INVESTMENT	23.36 (5)	***0.00	***0.00	2.22	2.97	+0.75
WILDLIFE HABITAT	19.41 (5)	***0.00	***0.00	2.79	3.45	+0.66
HUNTING OR FISHING	15.86 (5)	***0.01	***0.01	2.41	2.86	+0.45
WATESHED PROTECTION	17.95 (5)	***0.00	**0.04	2.00	2.35	+0.35
VISUAL BEAUTY	20.62 (5)	***0.00	***0.00	2.74	3.44	+0.70
HIKING OR BIKING	19.74 (5)	***0.00	***0.00	1.60	2.09	+0.49
TIMBER PRODUCTION	17.29 (5)	***0.00	***0.00	2.40	2.94	+0.54
CHRISTMAS TREE FARM	17.81 (5)	***0.00	***0.00	0.79	1.09	+0.30
FRUIT TREE ORCHARD	13.58 (5)	**0.02	**0.04	1.10	1.35	+0.25
GINSENG OR MUSHROOM PRODUCTION	17.61 (5)	***0.00	***0.00	0.89	1.31	+0.42
LIVESTOCK PASTURE	17.71 (5)	***0.00	0.23	2.08	2.29	+0.21
FIREWOOD OR FENCE POSTS	11.66 (5)	**0.04	**0.02	1.86	2.23	+0.37
MAPLE SYRUP PRODUCTION	12.38 (5)	**0.03	**0.03	0.78	0.97	+0.19
OTHER USES	11.73 (5)	**0.04	***0.01	1.05	1.42	+0.37
FOREST ACTIVITY						
TIMBER HARVESTING	0.02 (1)	0.90	0.90	0.43	0.44	+0.01
PLANTED TREES	0.03 (1)	0.86	0.86	0.28	0.28	0.00
THINNED TREES	0.01 (1)	0.92	0.92	0.38	0.38	0.00
CUT GRAPEVINES OR OTHER PLANTS	4.01 (1)	**0.05	**0.05	0.40	0.50	+0.10
IMPROVE VISUAL BEAUTY	5.03 (1)	**0.02	**0.02	0.42	0.53	+0.11
CONSTRUCTED TRAILS	7.56 (1)	***0.01	***0.01	0.31	0.43	+0.12
CONSTRUCTED ROADS	2.73 (1)	*0.10	*0.10	0.46	0.53	+0.07
PLANTED WILDLIFE FOOD CROPS	0.94 (1)	0.33	0.33	0.22	0.26	+0.04
IMPROVED SOIL RESOURCES	2.64 (1)	*0.10	*0.10	0.36	0.43	+0.07
IMPROVED WATER RESOURCES	3.76 (1)	**0.05	**0.05	0.34	0.43	+0.09
NON-TIMBER PRODUCTS (GINSENG etc.)	2.40 (1)	0.12	0.12	0.09	0.14	+0.05
PROPERTY BOUNDARY SURVEYED	1.07 (1)	0.30	0.30	0.32	0.37	+0.05
CONTROLLED DAMAGING AGENTS	11.77 (1)	***0.00	***0.00	0.14	0.27	+0.13
LEASED PROPERTY (TIMBER OR REC.)	2.74 (1)	*0.10	*0.10	0.01	0.04	+0.03
OTHER FOREST ACTIVITIES	2.01 (1)	0.16	0.16	0.09	0.13	+0.04
ASSISTING AGENCIES						

WVU DIVISION OF FORESTRY	6.60 (1)	***0.01	***0.01	0.13	0.22	+0.09
WVU EXTENSION SERVICE	6.01 (1)	***0.01	***0.01	0.11	0.20	+0.09
WV STATE DIVISION OF FORESTRY	17.67 (1)	***0.00	***0.00	0.27	0.47	+0.20

Appendix I-3

Table 5-2: Logistic Model (7df) Liability Assistance

Model: Logistic regression (logit) N of 0's:219 1's:232 Dep. var: LIABASST Loss: Max likelihood (MS-err. scaled to 1) Final loss: 277.73727472 Chi ² (7)=69.369 p=.00000					-2*log (Likelihood) 555.4745 Intercept Only: 624.8440			
LIABASST					Classification of Cases (owner.sta)			
	Estimate	Std.Err.	t(443)	p-level	Odds ratio: 3.9381			
Const.B0	-0.83	0.36	-2.28	0.02	OBSERVED	Pred.	Pred.	Percent
TENRGRUP	-0.25	0.11	-2.27	0.02		0	1	Correct
INCOME	0.18	0.06	3.05	0.00		0	140	79
INVESTM2	0.16	0.06	2.62	0.01		1	72	160
GINSENG2	0.22	0.09	2.29	0.02				
THINTREE	-0.61	0.23	-2.69	0.01				
FORHELTH	0.75	0.26	2.84	0.00				
WVFOREST	0.70	0.22	3.13	0.00				

Determining significant change in Chi²-value from 39df to 7df
for requests of Landowner Liability, Property Rights and Tax assistance.

A significant change in Chi²-value at the 0.10 alpha level would be equal to ≥ 46.04 .

Logistic Model (39df) Chi²-value: 89.79

Logistic Model (7df) Chi²-value: - 69.37

Difference 20.42

Result: there was no significant change in Chi²-value, because $20.42 < 46.06$.

Appendix J-1

Soil Resource Assistance

(i.) Demographics:

Three demographic characteristics were significant for the 225 landowners requesting soil resource assistance. Respondents owning forest property for 1-10 years ($\text{Chi}^2=7.26$, 2df), earning >\$30,000 per year ($\text{Chi}^2=8.63$, 4df) and age 26-49 years old ($\text{Chi}^2=29.64$, 2df) were more likely to be interested in soil resource issues (Table 6-1). The ANOVA indicated that landowners requesting soil resource assistance tend to be on average more recent forest owners and average higher income levels than those not interested in this topic (Table 6-1).

(ii.) Property Uses:

The most importantly ranked of the fourteen significant property uses (Table 6-1) for landowners wanting soil resource assistance were residence, ($\text{Chi}^2=10.17$, 5df), investment ($\text{Chi}^2=17.96$, 5df), wildlife habitat ($\text{Chi}^2=15.23$, 5df), hunting or fishing ($\text{Chi}^2=16.47$, 5df), visual beauty ($\text{Chi}^2=21.59$, 5df) and timber production ($\text{Chi}^2=23.58$, 5df). These same uses of property were indicated in the ANOVA as being on average more important for landowners interested in soil resources than those not interested (Table 6-1).

(iii.) Activities:

Thirteen activities conducted within property owned by respondents interested in soil resource issues were significant (Table 6-1). Landowners wanting soil resource assistance tend to have implemented soil ($\text{Chi}^2=15.14$, 1df) and water improvement practices ($\text{Chi}^2=4.29$, 1df), constructed roads ($\text{Chi}^2=6.23$, 1df), improved visual beauty ($\text{Chi}^2=4.49$, 1df) as well as conducted tree thinnings ($\text{Chi}^2=3.80$, 1df) and grapevine control ($\text{Chi}^2=5.80$, 1df) within their properties. The ANOVA revealed that landowners interested in soil resource assistance were more likely on average to conduct these same management practices than those not interested in soil issues (Table 6-1).

(iv.) Assisting Agencies:

Landowners wanting soil resource assistance tend to have received help in the past from the WV State Division of Forestry ($\text{Chi}^2=12.55$, 1df) and WVU Extension Service ($\text{Chi}^2=4.92$, 1df). The ANOVA indicated that on average landowners requesting this topic were more likely to have previously received assistance from these same agencies than those not requesting soil resource assistance (Table 6-1).

(v.) Logistic Regression Model (7): Soil Resource Assistance:

This reduced model (7df) revealed that landowners wanting soil resource assistance were likely to be more recent forest owners ($p=0.07$) with higher incomes ($p=0.03$) while implementing fruit tree orchard ($p=0.05$) and livestock pasturage ($p=0.01$) property uses. They were also more likely to have already implemented soil ($p=0.09$) and forest health ($p=0.09$) improvement practices within their forest properties. Additionally, the WV State Division of Forestry ($p=0.01$) was the public agency that respondents interested in soil resource issues tended to use in the past for obtaining management assistance. The positive relationship between these characteristics for this group of landowners suggests that they do acknowledge their need for soil management, which is important for the successful implementation of their property uses and forest management activities.

The model correctly identified 64% and 65% of those interested and not interested in soil resource issues ($\text{Chi}^2=54.926$, 7df, $p=0.00$) while producing odds of 3.3:1 that these characteristics can accurately predict landowners wanting and not wanting soil resource assistance. The reduction in the Chi^2 -value from the first (39df) to the second (7df) model was not significant making the second model parsimonious for identifying landowners interested in soil management issues (Table 6-2).

Appendix J-2

Table 6-1: Pearson's Chi² and Analysis of Variance Values of Significance
Dependent and Grouping Variable: Soil Resource: p-Value Significant @ ≤ 0.10

Dependent and Grouping Variable: Soil Resource Assistance Requests p-Value Significant ≤ 0.10						
p-Value Significant ≤ 0.01 *** p-Value Significant ≤ 0.05 ** p-Value Significant ≤ 0.10 *	Pearson's CHI ² Analysis		Analysis of Variance (ANOVA)			
	CHI ² Value & (df ^o)	CHI ² P-VALUE	ANOVA p-Value	Soil Resource Assistance Requests Test of Means (ANOVA)		
				No = 0 Means (226)	Yes =1 Means (225)	Difference +/- Means (451)
INDEPENDENT VARIABLES						
DEMOGRAPHICS						
PROPERTY LANDSIZE	0.15 (2)	0.93	0.17	73.56	81.36	+7.80
LANDOWNER TENURE	7.26 (2)	**0.03	***0.01	23.31	19.17	-4.14
LANDOWNER INCOME	8.63 (4)	*0.07	***0.00	3.01	3.61	+0.60
LANDOWNER AGE	29.64 (2)	***0.00	0.48	55.38	54.14	-0.24
LANDOWNER EDUCATION	8.12 (9)	0.52	0.14	4.15	4.52	+0.37
PROPERTY USES						
LANDOWNERS PLACE OF RESIDENCE	10.17 (5)	*0.07	**0.05	3.62	3.96	+0.34
PROPERTY AS AN INVESTMENT	17.96 (5)	***0.00	***0.00	2.30	2.91	+0.61
WILDLIFE HABITAT	15.23 (5)	***0.01	***0.00	2.83	3.44	+0.61
HUNTING OR FISHING	16.47 (5)	***0.01	***0.01	2.39	2.89	+0.50
WATESHED PROTECTION	13.36 (5)	**0.02	***0.00	1.91	2.44	+0.53
VISUAL BEAUTY	21.59 (5)	***0.00	***0.00	2.78	3.43	+0.65
HIKING OR BIKING	16.67 (5)	***0.01	**0.05	1.69	2.01	+0.32
TIMBER PRODUCTION	23.58 (5)	***0.00	***0.01	2.46	2.90	+0.44
CHRISTMAS TREE FARM	19.01 (5)	***0.00	***0.00	0.81	1.09	+0.28
FRUIT TREE ORCHARD	27.73 (5)	***0.00	***0.00	0.97	1.48	+0.51
GINSENG OR MUSHROOM PRODUCTION	18.30 (5)	***0.00	***0.00	0.93	1.27	+0.34
LIVESTOCK PASTURE	33.51 (5)	***0.00	***0.00	1.88	2.49	+0.61
FIREWOOD OR FENCE POSTS	7.46 (5)	0.19	*0.08	1.91	2.19	+0.28
MAPLE SYRUP PRODUCTION	16.77 (5)	***0.00	***0.00	0.75	1.00	+0.25
OTHER USES	15.34 (5)	***0.01	**0.02	1.08	1.41	+0.33
FOREST ACTIVITY						
TIMBER HARVESTING	1.63 (1)	0.20	0.20	0.40	0.46	+0.06
PLANTED TREES	3.68 (1)	*0.06	*0.06	0.24	0.32	+0.08
THINNED TREES	3.18 (1)	*0.07	*0.08	0.34	0.42	+0.08
CUT GRAPEVINES OR OTHER PLANTS	5.80 (1)	**0.02	**0.02	0.39	0.51	+0.12
IMPROVE VISUAL BEAUTY	4.49 (1)	**0.03	**0.03	0.43	0.53	+0.10
CONSTRUCTED TRAILS	5.19 (1)	**0.02	**0.02	0.32	0.42	+0.10
CONSTRUCTED ROADS	6.23 (1)	***0.01	***0.01	0.44	0.56	+0.12
PLANTED WILDLIFE FOOD CROPS	8.28 (1)	***0.00	***0.00	0.19	0.30	+0.11
IMPROVED SOIL RESOURCES	15.14 (1)	***0.00	***0.00	0.31	0.48	+0.17
IMPROVED WATER RESOURCES	4.29 (1)	**0.04	**0.04	0.34	0.43	+0.09
NON-TIMBER PRODUCTS (GINSENG etc.)	3.19 (1)	*0.07	*0.07	0.09	0.14	+0.05
PROPERTY BOUNDARY SURVEYED	7.31 (1)	***0.01	***0.01	0.29	0.41	+0.12
CONTROLLED DAMAGING AGENTS	8.00 (1)	***0.00	***0.00	0.15	0.26	+0.11
LEASED PROPERTY (TIMBER OR REC.)	0.33 (1)	0.56	0.56	0.03	0.02	-0.01
OTHER FOREST ACTIVITIES	5.05 (1)	**0.02	**0.02	0.08	0.15	+0.07
ASSISTING AGENCIES						

WVU DIVISION OF FORESTRY	1.92 (1)	0.17	0.17	0.15	0.20	+0.05
WVU EXTENSION SERVICE	4.92 (1)	**0.03	**0.03	0.12	0.20	+0.08
WV STATE DIVISION OF FORESTRY	12.55 (1)	***0.00	***0.00	0.29	0.45	+0.16

Appendix J-3

Table 6-2: Logistic Model (7df) Soil Resource Assistance

Model: Logistic regression (logit) N of 0's:226 1's:225 Dep. var: SOILASST Loss: Max likelihood (MS-err. scaled to 1) Final loss: 285.14551312 Chi ² (7)=54.926 p=.00000					-2*log (Likelihood) 570.2910 Intercept Only: 625.2166			
SOILASST		SOILASST			Classification of Cases (owner.sta)			
	Estimate	Std.Err.	t(443)	p-level	Odds ratio: 3.3080			
Const.B0	-1.02	0.36	-2.82	0.01	OBSERVED	Pred.	Pred.	Percent
TENRGRUP	-0.20	0.11	-1.82	0.07		0	1	Correct
INCOME	0.13	0.06	2.17	0.03		0	147	79
FRUITRE2	0.17	0.09	1.95	0.05		1	81	144
LIVSTOC2	0.16	0.06	2.76	0.01				64
IMPVSOIL	0.37	0.22	1.71	0.09				
FORHELTH	0.44	0.26	1.71	0.09				
WVFOREST	0.58	0.22	2.70	0.01				

Determining significant change in Chi²-value from 39df to 7df
for requests of Soil Resource assistance.

A significant change in Chi²-value at the 0.10 alpha level would be equal to ≥ 46.04 .

Logistic Model (39df) Chi²-value: 77.68

Logistic Model (7df) Chi²-value: - 54.93

Difference 22.75

Result: there was no significant change in Chi²-value, because $22.75 < 46.06$.

Appendix K-1

Visual Beauty Assistance

(i.) Demographics:

For the 224 landowners interested in visual beauty resources, four demographic characteristics were significant. Respondents owning forest property from 1-10 years ($\text{Chi}^2=13.30$, 2df) in the southern region of WV ($\text{Chi}^2=7.61$, 3df), earning >\$30,000 per year ($\text{Chi}^2=9.79$, 4df) and age 26-49 years old ($\text{Chi}^2=13.21$, 2df) were more likely to want visual beauty assistance (Table 7-1). The ANOVA revealed that landowners interested in visual beauty issues tend to average less years of forest ownership and higher incomes than those not interested in this topic of assistance (Table 7-1).

(ii.) Property Uses:

The most important of the fourteen significant property uses for landowners wanting visual beauty assistance (Table 7-1) were visual beauty ($\text{Chi}^2=50.86$, 5df), wildlife habitat ($\text{Chi}^2=36.29$, 5df), timber production ($\text{Chi}^2=15.17$, 5df), hunting or fishing, ($\text{Chi}^2=10.44$, 5df) watershed protection ($\text{Chi}^2=18.37$, 5df) and investment ($\text{Chi}^2=14.23$, 5df). These same property uses were identified in the ANOVA as being on average more important for landowners interested in visual beauty management than for those not interested in this topic (Table 7-1).

(iii.) Activities:

Eight activities conducted within property owned by respondents wanting visual beauty assistance were significant (Table 7-1). Landowners interested in visual beauty issues tend to have conducted visual beauty ($\text{Chi}^2=12.45$, 1df) and soil ($\text{Chi}^2=3.42$, 1df) resource improvements, built trails ($\text{Chi}^2=5.53$, 1df) as well as implemented tree thinning ($\text{Chi}^2=5.94$, 1df) and grapevine control ($\text{Chi}^2=4.48$, 1df) practices. The ANOVA revealed that on average these practices were more commonly implemented by landowners wanting visual beauty assistance than those not wanting this topic (Table 7-1).

(iv.) Assisting Agencies:

Landowners wanting visual beauty assistance tend to have previously received help from the WV State Division of Forestry ($\chi^2=4.48$, 1df) as well as from the WVU Division of Forestry ($\chi^2=4.48$, 1df) and Extension Service ($\chi^2=4.48$, 1df). In the ANOVA, respondents wanting visual beauty assistance on average were more likely to have previously received assistance from these same agencies than landowners not interested in visual beauty issues (Tables 7-1).

(v.) Logistic Regression Model (3df): Visual Beauty Assistance:

The model indicates that landowners wanting visual beauty assistance tend to use their forest property for visual beauty enjoyment ($p=0.00$) while also being more likely to conduct forest health or pest management practices ($p=0.01$) within their property. They also tend to have received assistance in the past from the WV State Division of Forestry ($p=0.00$). The positive relationship between these characteristics for this group of landowners suggest that they do realize the need to protect their forest property from fire, disease and insects in order to sustain the aesthetics of their forest property while also recognize a need for assistance.

This model ($\chi^2=66.252$, 3df, $p=0.00$) correctly identified 69% and 58% of the respondents wanting and not wanting visual beauty assistance while producing odds of 3.1:1 that these variables can predict landowners interested and not interested in visual beauty issues. The reduction in χ^2 -value from the first (39df) to the second (3df) model was not significant proving the second model parsimonious for identifying landowners wanting visual beauty assistance (Table 7-2).

Appendix K-1

Table 7-1: Pearson's Chi² and Analysis of Variance Values of Significance
Dependent and Grouping Variable: Visual Beauty: p-Value Significant @ ≤ 0.10

p-Value Significant ≤ 0.01 ***	Pearson's CHI ² Analysis		Analysis of Variance (ANOVA)			
p-Value Significant ≤ 0.05 **				Visual Beauty Assistance Requests		
p-Value Significant ≤ 0.10 *				Test of Means (ANOVA)		
INDEPENDENT VARIABLES	CHI ² Value & (df ^o)	CHI ² P-VALUE	ANOVA p-Value	No = 0 Means (227)	Yes =1 Means (224)	Difference +/- Means (451)
DEMOGRAPHICS						
PROPERTY LANDSIZE	0.63 (2)	0.73	0.84	78.02	76.88	-1.14
LANDOWNER TENURE	13.30 (2)	***0.00	***0.00	23.32	19.14	-4.18
LANDOWNER INCOME	9.79 (4)	**0.04	***0.01	3.10	3.53	+0.43
LANDOWNER AGE	13.21 (2)	***0.00	0.73	55.07	54.45	-0.62
LANDOWNER EDUCATION	6.83 (9)	0.66	0.35	4.22	4.45	+0.23
PROPERTY USES						
LANDOWNERS PLACE OF RESIDENCE	18.95 (5)	***0.00	**0.05	3.62	3.97	+0.35
PROPERTY AS AN INVESTMENT	14.23 (5)	***0.01	***0.00	2.31	2.90	+0.59
WILDLIFE HABITAT	36.29 (5)	***0.00	***0.00	2.67	3.60	+0.93
HUNTING OR FISHING	10.44 (5)	*0.06	**0.03	2.44	2.84	+0.40
WATESHED PROTECTION	18.37 (5)	***0.00	***0.00	1.86	2.50	+0.64
VISUAL BEAUTY	50.86 (5)	***0.00	***0.00	2.51	3.70	+1.19
HIKING OR BIKING	20.00 (5)	***0.00	***0.00	1.57	2.14	+0.57
TIMBER PRODUCTION	15.17 (5)	***0.01	***0.00	2.43	2.92	+0.49
CHRISTMAS TREE FARM	18.39 (5)	***0.00	***0.00	0.77	1.13	+0.36
FRUIT TREE ORCHARD	22.44 (5)	***0.00	***0.00	1.00	1.46	+0.46
GINSENG OR MUSHROOM PRODUCTION	14.89 (5)	***0.01	***0.00	0.92	1.29	+0.37
LIVESTOCK PASTURE	15.93 (5)	***0.01	0.16	2.07	2.31	+0.24
FIREWOOD OR FENCE POSTS	6.86 (5)	0.23	**0.04	1.89	2.21	+0.32
MAPLE SYRUP PRODUCTION	15.86 (5)	***0.01	***0.00	0.74	1.02	+0.28
OTHER USES	16.32 (5)	***0.01	***0.00	1.03	1.46	+0.43
FOREST ACTIVITY						
TIMBER HARVESTING	2.40 (1)	0.12	0.12	0.40	0.47	+0.07
PLANTED TREES	1.82 (1)	0.18	0.18	0.25	0.31	+0.06
THINNED TREES	5.94 (1)	***0.01	***0.01	0.33	0.44	+0.11
CUT GRAPEVINES OR OTHER PLANTS	4.48 (1)	**0.03	**0.03	0.40	0.50	+0.10
IMPROVE VISUAL BEAUTY	12.45 (1)	***0.00	***0.00	0.40	0.56	+0.16
CONSTRUCTED TRAILS	5.53 (1)	**0.02	**0.02	0.32	0.42	+0.10
CONSTRUCTED ROADS	1.61 (1)	0.20	0.20	0.47	0.53	+0.06
PLANTED WILDLIFE FOOD CROPS	11.36 (1)	***0.00	***0.00	0.18	0.31	+0.13
IMPROVED SOIL RESOURCES	3.42 (1)	*0.06	*0.06	0.35	0.44	+0.09
IMPROVED WATER RESOURCES	2.45 (1)	0.12	0.12	0.35	0.42	+0.07
NON-TIMBER PRODUCTS (GINSENG etc.)	2.33 (1)	0.13	0.13	0.09	0.14	+0.05
PROPERTY BOUNDARY SURVEYED	6.63 (1)	***0.01	***0.01	0.29	0.41	+0.12
CONTROLLED DAMAGING AGENTS	8.27 (1)	***0.00	***0.00	0.15	0.26	+0.11
LEASED PROPERTY (TIMBER OR REC.)	1.43 (1)	0.23	0.23	0.02	0.04	+0.02
OTHER FOREST ACTIVITIES	1.93 (1)	0.16	0.17	0.09	0.13	+0.04
ASSISTING AGENCIES						

WVU DIVISION OF FORESTRY	3.70 (1)	**0.05	**0.05	0.14	0.21	+0.07
WVU EXTENSION SERVICE	6.34 (1)	***0.01	***0.01	0.11	0.20	+0.09
WV STATE DIVISION OF FORESTRY	22.89 (1)	***0.00	***0.00	0.26	0.48	+0.22

Appendix K-3

Table 7-2: Logistic Model (3df) Visual Beauty Assistance

Model: Logistic regression (logit) N of 0's:227 1's:224 Dep. var: BUTYASST Loss: Max likelihood (MS-err. scaled to 1) Final loss: 279.473 Chi ² (3)=66.252 p=.00000					-2*log (Likelihood) 553.9470 Intercept Only: 625.1988			
BUTYASST		BUTYASST			Classification of Cases (owner.sta)			
	Estimate	Std.Err.	t(445)	p-level	Odds ratio: 3.0568			
Const.B0	-1.46	0.23	-6.43	0.00				
VISULBU2	0.33	0.06	5.68	0.00	OBSERVED	Pred.	Pred.	Percent
FORHELTH	0.62	0.25	2.44	0.01	0	0	1	Correct
WVFOREST	0.77	0.21	3.65	0.00	1	132	95	58.14978
						70	154	68.75

Determining significant change in Chi²-value from 39df to 3df
for requests of Visual Beauty assistance.

A significant change in Chi²-value at the 0.10 alpha level would be equal to ≥ 46.04 .

Logistic Model (39df) Chi²-value: 98.21

Logistic Model (3df) Chi²-value: - 66.25

Difference 31.96

Result: there was no significant change in Chi²-value, because $31.96 < 46.06$.

Appendix L-1

Dendrology Assistance

(i.) Demographics:

Five demographic characteristics were significant for the 193 landowners interested in dendrology issues (Table 8-1). Respondents owning forest property for 1-10 years ($\text{Chi}^2=27.68$, 2df) in the southern region of WV ($\text{Chi}^2=6.34$, 3df), earning >\$30,000 per year ($\text{Chi}^2=15.31$, 4df), having attended college ($\text{Chi}^2=16.71$, 9df) and age 50-64 years ($\text{Chi}^2=22.64$, 2df) were more likely to want dendrology assistance. The ANOVA indicated that landowners interested in dendrology tend to average less years of forest ownership and have higher average income levels than those not wanting this topic (Table 8-1).

(ii.) Property Uses:

Investment ($\text{Chi}^2=24.30$, 5df), wildlife habitat ($\text{Chi}^2=20.87$, 5df), hunting or fishing ($\text{Chi}^2=18.96$, 5df), watershed protection ($\text{Chi}^2=20.80$, 5df), visual beauty ($\text{Chi}^2=31.71$, 5df) and timber production ($\text{Chi}^2=21.74$, 5df) were the most important of the fifteen significant property uses for landowners wanting dendrology assistance (Table 8-1). The ANOVA indicated these same uses of property on average were more important for landowners interested in dendrology assistance than those not interested in this topic (8-1).

(iii.) Activities:

Ten activities conducted within property owned by respondents wanting dendrology assistance were significant (Table 8-1). Landowners interested in dendrology issues were more likely to implement tree thinning ($\text{Chi}^2=7.95$, 1df) and grapevine control ($\text{Chi}^2=8.38$, 1df) practices, improve visual resources ($\text{Chi}^2=5.73$, 1df) as well as build trails ($\text{Chi}^2=7.12$, 1df) and access roads ($\text{Chi}^2=3.73$, 1df). These same practices were indicated in the ANOVA as being on average more commonly implemented by landowners interested in dendrology than for those not interested in this topic (Table 8-1).

(vi.) Assisting Agencies:

Landowners requesting dendrology also tended to have previously received help from the WV State Division of Forestry ($\chi^2=14.15$, 1df) and the WVU Extension Service ($\chi^2=6.31$, 1df). The ANOVA indicated that landowners interested in dendrology on average tend to have previously received assistance more from these same agencies than those not wanting this topic (Table 8-1).

(v.) Logistic Regression Model (4df): Dendrology Assistance:

This reduced model (4df) revealed that landowners interested in dendrology issues tend to be more recent owners ($p=0.00$) while using their forest property for investment ($p=0.00$) and also being more likely to plant wildlife food crops ($p=0.00$). Additionally, they also tend to have received assistance in the past from the WV State Division of Forestry ($p=0.02$). The positive relationship between these characteristics indicates an understanding by this group of landowners that the valuation and success of a forest investment often depends on the ability to correctly identify and know the growth requirements of forest plants, especially tree and shrub species.

The model ($\chi^2=56.825$, 4df, $p=0.00$) correctly identified 47% and 80% of the respondents wanting and not wanting dendrology assistance while producing odds of 3.6:1 that these characteristics can predict landowners interested and not interested in dendrology issues. In addition, the reduction in the χ^2 -value from the first (39df) to the second (4df) model was not significant making the second model parsimonious for identifying landowners interested in the identification and growth requirements of forest plants (Table 8-2).

Appendix L-2

Table 8-3: Pearson's Chi² and Analysis of Variance Values of Significance
Dependent and Grouping Variable: Dendrology Assistance: p-Value Significant @ ≤ 0.10

INDEPENDENT VARIABLES	Pearson's CHI ² Analysis		Analysis of Variance (ANOVA)			
	CHI ² Value & (df°)	CHI ² P-VALUE	ANOVA p-Value	Dendrology Assistance Requests Test of Means (ANOVA)		
				No = 0 Means (258)	Yes =1 Means (193)	Difference +/- Means (451)
DEMOGRAPHICS						
PROPERTY LANDSIZE	0.81 (2)	0.67	0.18	74.11	81.93	+7.82
LANDOWNER TENURE	27.68 (2)	***0.00	***0.00	24.25	17.23	-7.02
LANDOWNER INCOME	15.41 (4)	***0.00	***0.00	3.10	3.60	+0.50
LANDOWNER AGE	22.64 (2)	***0.00	0.14	55.88	53.26	-2.62
LANDOWNER EDUCATION	16.71 (9)	**0.05	0.33	4.23	4.47	+0.24
PROPERTY USES						
LANDOWNERS PLACE OF RESIDENCE	10.60 (5)	*0.06	0.22	3.70	3.92	+0.22
PROPERTY AS AN INVESTMENT	24.30 (5)	***0.00	***0.00	2.27	3.05	+0.78
WILDLIFE HABITAT	20.87 (5)	***0.00	***0.00	2.81	3.56	+0.75
HUNTING OR FISHING	18.96 (50)	***0.00	***0.00	2.35	3.03	+0.68
WATESHED PROTECTION	20.80 (5)	***0.00	***0.00	1.88	2.58	+0.70
VISUAL BEAUTY	31.71 (5)	***0.00	***0.00	2.71	3.62	+0.91
HIKING OR BIKING	34.49 (5)	***0.00	***0.00	1.56	2.24	+0.68
TIMBER PRODUCTION	21.74 (5)	***0.00	***0.00	2.43	3.01	+0.58
CHRISTMAS TREE FARM	22.35 (5)	***0.00	***0.00	0.77	1.18	+0.41
FRUIT TREE ORCHARD	29.70 (5)	***0.00	***0.00	0.98	1.56	+0.58
GINSENG OR MUSHROOM PRODUCTION	32.55 (5)	***0.00	***0.00	0.90	1.37	+0.47
LIVESTOCK PASTURE	16.62 (5)	***0.01	*0.08	2.06	2.36	+0.3
FIREWOOD OR FENCE POSTS	12.70 (5)	**0.03	***0.01	1.88	2.28	+0.40
MAPLE SYRUP PRODUCTION	24.22 (5)	***0.00	***0.00	0.73	1.07	+0.34
OTHER USES	20.28 (5)	***0.00	***0.00	1.00	1.57	+0.57
FOREST ACTIVITY						
TIMBER HARVESTING	1.14 (1)	0.29	0.29	0.41	0.46	+0.05
PLANTED TREES	6.56 (1)	***0.01	***0.01	0.23	0.34	+0.11
THINNED TREES	7.95 (1)	***0.00	***0.00	0.33	0.46	+0.13
CUT GRAPEVINES OR OTHER PLANTS	8.38 (1)	***0.00	***0.00	0.39	0.53	+0.14
IMPROVE VISUAL BEAUTY	5.73 (1)	**0.02	**0.02	0.43	0.54	+0.11
CONSTRUCTED TRAILS	7.12 (1)	***0.01	***0.01	0.32	0.44	+0.12
CONSTRUCTED ROADS	3.72 (1)	**0.05	**0.05	0.46	0.55	+0.09
PLANTED WILDLIFE FOOD CROPS	15.78 (1)	***0.00	***0.00	0.17	0.34	+0.17
IMPROVED SOIL RESOURCES	0.88 (1)	0.35	0.35	0.38	0.42	+0.04
IMPROVED WATER RESOURCES	0.94 (1)	0.33	0.33	0.36	0.41	+0.05
NON-TIMBER PRODUCTS (GINSENG etc.)	10.26 (1)	***0.00	***0.00	0.07	0.17	+0.10
PROPERTY BOUNDARY SURVEYED	7.62 (1)	***0.01	***0.01	0.29	0.42	+0.13
CONTROLLED DAMAGING AGENTS	1.77 (1)	0.18	0.18	0.18	0.23	+0.05
LEASED PROPERTY (TIMBER OR REC.)	2.87 (1)	*0.09	*0.09	0.02	0.04	+0.02
OTHER FOREST ACTIVITIES	1.57 (1)	0.21	0.21	0.10	0.13	+0.03

ASSISTING AGENCIES						
WVU DIVISION OF FORESTRY	2.40 (1)	0.12	0.12	0.15	0.21	+0.06
WVU EXTENSION SERVICE	6.31 (1)	***0.01	***0.01	0.12	0.21	+0.09
WV STATE DIVISION OF FORESTRY	14.15 (1)	***0.00	***0.00	0.30	0.47	+0.17

Appendix L-3

Table 8-2: Logistic Model (4df) Dendrology Assistance

Model: Logistic regression (logit) N of 0's:258 1's:193 Dep. var: DENDRO Loss: Max likelihood (MS-err. scaled to 1) Final loss: 279.49662627 Chi ² (4)=56.825 p=.00000					-2*log (Likelihood) 558.9932 Intercept Only: 615.8180			
DENDRO		DENDRO			Classification of Cases (owner.sta)			
	Estimate	Std.Err.	t(446)	p-level	Odds ratio: 3.6211			
Const.B0	-0.38	0.31	-1.26	0.21	OBSERVED	Pred.	Pred.	Percent
TENRGRUP	-0.42	0.11	-3.83	0.00		0	1	Correct
INVESTM2	0.22	0.06	3.77	0.00		0	207	51
WILDFOOD	0.70	0.23	2.97	0.00		1	102	91
WVFOREST	0.49	0.21	2.35	0.02				47.15026

Determining significant change in Chi²-value from 39df to 4df
for requests of Dendrology assistance.

A significant change in Chi²-value at the 0.10 alpha level would be equal to ≥ 46.04 .

Logistic Model (39df) Chi²-value: 94.48

Logistic Model (4df) Chi²-value: -56.83

Difference 37.65

Result: there was no significant change in Chi²-value, because $37.65 < 46.06$.

Appendix M-1

Forestland or Timber Valuation Assistance

(i.) Demographics:

Six demographic characteristics were significant for the 192 landowners interested in the valuation of timber or forestland (Table 9-1). Respondents owning 100-199 acres ($\text{Chi}^2=6.84$, 2df) for 1-10 years ($\text{Chi}^2=7.84$, 2df) in the southern region of WV ($\text{Chi}^2=7.67$, 3df) and age 26-49 years old ($\text{Chi}^2=11.19$, 2df) were more likely to want valuation assistance. In addition, they tend to have an income level of $>\$30,000$ per year ($\text{Chi}^2=11.48$, 4df) and a Masters level college education ($\text{Chi}^2=22.77$, 9df). The ANOVA indicated that respondents interested in valuation issues tend to have on average significantly larger properties and higher incomes than those not requesting this topic do. They also tend to average less years of forest ownership than respondents not interested in valuation issues (Table 9-1).

(ii.) Property Uses:

The most importantly ranked of the nine significant property uses (Table 9-1) for respondents wanting valuation assistance were timber production ($\text{Chi}^2=63.98$, 5df), visual beauty ($\text{Chi}^2=32.19$, 5df), investment ($\text{Chi}^2=40.25$, 5df), wildlife habitat ($\text{Chi}^2=18.64$, 5df) and hunting or fishing ($\text{Chi}^2=23.03$, 5df). These same uses were indicated in the ANOVA as being on average more important for landowners interested in valuation issues than for those not interested in this topic (Table 9-1).

(iii.) Activities:

Landowners wanting valuation assistance tend to have implemented grapevine removal ($\text{Chi}^2=15.32$, 1df) and other (fencing) practices ($\text{Chi}^2=15.97$, 1df) as well as constructed trails ($\text{Chi}^2=6.48$, 1df) within their property (Table 9-1). They were also more likely to lease their property for timber or recreation ($\text{Chi}^2=2.93$, 1df) and have the property boundaries surveyed ($\text{Chi}^2=4.98$, 1df). The ANOVA revealed that landowners interested in forestland or timber

valuation issues were more likely on average to engage in these forestry practices than respondents not interested in this assistance topic were (Table 9-1).

(iv.) Assisting Agencies:

The WVU Division of Forestry ($\text{Chi}^2=9.60$, 1df) and Extension Service ($\text{Chi}^2=5.26$, 1df) as well as the WV State Division of Forestry ($\text{Chi}^2=38.45$, 1df) were the most likely agencies to have previously helped respondents wanting forest valuation assistance (Table 9-1). These same agencies were indicated in the ANOVA as being more likely on average to have previously assisted landowners interested in timber or forestland valuation issues than those not wanting this topic (Table 9-1).

(v.) Logistic Regression Model (4df): Forestland or Timber Valuation:

This model (4df) revealed that landowners wanting timber or forestland valuation assistance tend to use their property for investment ($p=0.00$) and timber production ($p=0.00$) while also being more likely to implement other (fencing) forestry practices ($p=0.00$). In addition, landowners interested in valuation issues tend to have received help in the past from the WV State Division of Forestry ($p=0.00$). The positive relationship between these characteristics suggests that this group of landowners realize that proper valuation and protection of their forest assets (land or timber) can be complicated and often requires professional assistance.

The model ($\text{Chi}^2=92.218$, 4df, $p=0.00$) correctly identified 59% and 76% of the landowners interested and not interested in valuation issues while producing odds of 4.5:1 that these characteristics can predict landowners wanting and not wanting timber or forestland valuation assistance. The reduction in Chi^2 -value from the first (39df) to the second (4df) model was not significant making the second model parsimonious for identifying landowners interested in forest valuation issues (Table 9-2).

Appendix M-2

Table 9-1: Pearson's Chi² to Analysis of Variance Values of Significance

Dependent and Grouping Variable: Valuation Assistance: p-Value Significant @ ≤ 0.10

p-Value Significant ≤ 0.01 ***	Pearson's CHI ² Analysis		Analysis of Variance (ANOVA)			
p-Value Significant ≤ 0.05 **				Valuation Assistance Requests Test of Means (ANOVA)		
p-Value Significant ≤ 0.10 *						
INDEPENDENT VARIABLES	CHI ² Value & (df ^o)	CHI ² P-VALUE	ANOVA p-Value	No = 0 Means (259)	Yes =1 Means (192)	Difference +/- Means (451)
DEMOGRAPHICS						
PROPERTY LANDSIZE	6.84 (2)	**0.03	***0.00	70.41	86.96	+16.55
LANDOWNER TENURE	7.84 (2)	**0.02	**0.03	22.66	19.33	-3.33
LANDOWNER INCOME	11.48 (4)	**0.02	***0.00	3.08	3.63	+0.55
LANDOWNER AGE	11.19 (2)	***0.00	0.72	55.03	54.40	-0.63
LANDOWNER EDUCATION	22.77 (9)	***0.01	***0.00	4.00	4.78	+0.78
PROPERTY USES						
LANDOWNERS PLACE OF RESIDENCE	19.56 (5)	***0.00	0.40	3.86	3.71	-0.15
PROPERTY AS AN INVESTMENT	40.25 (5)	***0.00	***0.00	2.19	3.16	+0.97
WILDLIFE HABITAT	18.64 (5)	***0.00	***0.01	2.95	3.39	+0.44
HUNTING OR FISHING	23.03 (5)	***0.00	**0.02	2.46	2.88	+0.42
WATESHED PROTECTION	23.38 (5)	***0.00	**0.03	2.02	2.40	+0.38
VISUAL BEAUTY	32.19 (5)	***0.00	***0.00	2.78	3.54	+0.76
HIKING OR BIKING	24.01 (5)	***0.00	***0.01	1.67	2.10	+0.43
TIMBER PRODUCTION	63.98 (5)	***0.00	***0.00	2.16	3.37	+1.21
CHRISTMAS TREE FARM	13.59 (5)	**0.02	**0.05	0.86	1.06	+0.20
FRUIT TREE ORCHARD	21.28 (5)	***0.00	0.35	1.18	1.29	+0.11
GINSENG OR MUSHROOM PRODUCTION	21.92 (5)	***0.00	0.72	1.08	1.13	+0.05
LIVESTOCK PASTURE	24.29 (5)	***0.00	0.76	2.17	2.22	+0.05
FIREWOOD OR FENCE POSTS	20.66 (5)	***0.00	0.12	1.95	2.19	+0.24
MAPLE SYRUP PRODUCTION	14.12 (5)	***0.01	0.34	0.84	0.93	+0.09
OTHER USES	16.36 (5)	***0.01	***0.01	1.08	1.47	+0.39
FOREST ACTIVITY						
TIMBER HARVESTING	1.32 (1)	0.25	0.25	0.41	0.46	+0.05
PLANTED TREES	1.29 (1)	0.26	0.26	0.26	0.31	+0.05
THINNED TREES	2.32 (1)	0.13	0.13	0.35	0.42	+0.07
CUT GRAPEVINES OR OTHER PLANTS	15.52 (1)	***0.00	***0.00	0.37	0.56	+0.19
IMPROVE VISUAL BEAUTY	0.92 (1)	0.34	0.34	0.46	0.51	+0.05
CONSTRUCTED TRAILS	6.48 (1)	***0.01	***0.01	0.32	0.44	+0.12
CONSTRUCTED ROADS	1.15 (1)	0.28	0.28	0.47	0.53	+0.06
PLANTED WILDLIFE FOOD CROPS	0.23 (1)	0.63	0.63	0.24	0.26	+0.02
IMPROVED SOIL RESOURCES	0.68 (1)	0.41	0.41	0.38	0.42	+0.04
IMPROVED WATER RESOURCES	0.73 (1)	0.39	0.40	0.37	0.41	+0.04
NON-TIMBER PRODUCTS (GINSENG etc.)	0.73 (1)	0.39	0.39	0.10	0.13	+0.03
PROPERTY BOUNDARY SURVEYED	4.98 (1)	**0.03	**0.03	0.31	0.41	+0.10
CONTROLLED DAMAGING AGENTS	1.90 (1)	0.17	0.17	0.18	0.23	+0.05
LEASED PROPERTY (TIMBER OR REC.)	2.93 (1)	*0.09	*0.09	0.02	0.04	+0.02

OTHER FOREST ACTIVITIES	15.97 (1)	***0.00	***0.00	0.06	0.18	+0.12
ASSISTING AGENCIES						
WVU DIVISION OF FORESTRY	9.60 (1)	***0.00	***0.00	0.13	0.24	+0.11
WVU EXTENSION SERVICE	5.26 (1)	**0.02	**0.02	0.12	0.20	+0.08
WV STATE DIVISION OF FORESTRY	38.45 (1)	***0.00	***0.00	0.25	0.54	+0.29

Appendix M-3

Table 9-2: Logistic Model (4df) Valuation Assistance

Model: Logistic regression (logit) N of 0's:259 1's:192 Dep. var: VALUASST Loss: Max likelihood (MS-err. scaled to 1) Final loss: 261.50541958 Chi ² (4)=92.218 p=.00000					-2*log (Likelihood) 523.0109 Intercept Only: 615.2284			
VALUASST		VALUASST			Classification of Cases (owner.sta)			
	Estimate	Std.Err.	t(446)	p-level	Odds ratio: 4.4501			
Const.B0	-2.11	0.26	-8.03	0.00	OBSERVED	Pred.	Pred.	Percent
INVESTM2	0.20	0.06	3.12	0.00		0	1	Correct
TIMBERP2	0.29	0.06	4.48	0.00		0	196.00	63.00
OTHERACT	1.02	0.34	2.97	0.00		1	79.00	113.00
WVFOREST	0.88	0.22	4.02	0.00				75.68
								58.85

Determining significant change in Chi²-value from 39df to 4df for requests of Valuation assistance.

A significant change in Chi²-value at the 0.10 alpha level would be equal to ≥ 46.04 .

Logistic Model (39df) Chi²-value: 128.53

Logistic Model (4df) Chi²-value: - 92.22

Difference 36.31

Result: there was no significant change in Chi²-value, because $36.31 < 46.06$.

Appendix N

The **Stand Visualization System (SVS)** " generates computer graphic images depicting forest stand conditions represented by a list of individual stand components, e.g., trees, shrubs, and down material using detailed geometric models. The images produced by SVS, while abstract, provide a readily understood representation of stand conditions and help communicate silvicultural treatments and forest management alternatives to a variety of audiences."

SVS provides the following capabilities:

- Displays stand information represented by a list of individual plant and log components in a realistic, although abstract fashion
- Displays stand information in a manner that communicates the overall structural diversity present within the stand
- Differentiates between stand components using different plant forms, colors, or other types of marking
- Displays overhead, profile and perspective views of a stand
- Provides a mechanism that allows users to define plant forms and colors based on species, growth form, and plant position within the canopy
- Provides tabular and graphical summaries of stand information before and after a silvicultural treatment
- Facilitates the design of silvicultural treatments by allowing users to select (or mark) stand components and specify treatments
- Displays information describing individual stand components as they are selected by the user

"SVS is executable on IBM-compatible personal computers using the MS-DOS operating system (or a compatible operating system) and requires no specialized hardware or additional software."

Table 1: SVS Data Requirements

Species code	Height	Crown radius 2	Expansion factor
Plant identifier	Lean angle	Crown ratio 2	Marking status
Tree Class	Felling angle	Crown radius 3	X postion
Crown Class	End diameter	Crown ratio 3	Y postion
Plant status	Crown radius 1	Crown radius 4	Elevation
Diameter	Crown ratio 1	Crown ratio 4	

(McGaughey, 1998)

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