ABSTRACT

MILLER, KEVIN TODD. Reaching Non-industrial Private Forestland Owners with Their Preferred Methods of Information Delivery. (Under the direction of Dennis Hazel and Bob Bardon.)

In North Carolina, a large population of non-industrial private forestland owners (NIPFs) controls approximately 78% of the state's forested resource. Because the 13.8 million acres of forestland they own provides benefits that contribute to the health and economic well-being of the state, it is critically important that this diverse group of people is supplied with research-based forestry information and education to ensure the sustainable management of North Carolina's natural resources. A study was conducted to discern and describe groups of landowners within the North Carolina's NIPF population. Identification of these groups will allow educational efforts to be more directed, making outreach efforts more efficient and cost-effective. A questionnaire was mailed to a stratified random sample of 2600 non-industrial private forestland owners from both urban and rural counties found within each of North Carolina's seven Cooperative Extension districts. Using the questionnaire responses, a *K*-means cluster analysis was performed to sort out distinct clientele groups among landowners based only on their preferences for delivery methods. Five clusters of landowners with specific preferences for information delivery methods were identified. The resultant clusters were then compared by socio-demographic, land ownership, and management experience characteristics. Differences among clusters with regard to these characteristics allowed the recognition of associations between preference for particular information delivery methods and more easily identifiable aspects of NIPFs and their land. Based on the results, it is recommended that educators use mail to market educational programs and solicit interest in their services. Traditional forestry programs and

demonstrations should be targeted at experienced land managers, while web-based information delivery and other emerging technologies should be directed at younger landowners with high levels of education and income. Further suggestions are made to assist Extension Forestry at North Carolina State University increase its impact on the citizens of the state.

REACHING NON-INDUSTRIAL PRIVATE FORESTLAND OWNERS WITH THEIR PREFERRED METHODS OF INFORMATION DELIVERY

by

KEVIN TODD MILLER

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BIOGRAPHY

Kevin Todd Miller was born in Raleigh, NC on April 23, 1980. As the first child of Colin Grant Miller and Trennie Marie Roberts Miller, he learned about the importance of our natural resources through explorations in nature with his family and years of scouting excursions. He attended Athens Drive High School, from which he graduated with honors. During high school, Kevin worked in the Crop Science Department of North Carolina State University. After graduation, he attended the same university, beginning as an engineering student. Following three semesters in engineering, he found his place in the College of Agriculture and Life Sciences, finally graduating in May 2002 with highest honors and Bachelor of Science degrees in Biological Sciences and Botany and a minor in Entomology. After a brief residency in Arizona, Kevin returned to North Carolina and worked at Hemlock Bluffs Nature Preserve in Cary, NC. During his employment, he returned to graduate school at NCSU in the forestry program. Kevin maintains an appreciation for natural resources and believes that educating the public will allow him to share his respect for natural resources with others who may not have had the childhood experiences with which he was blessed.

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Without these people, nothing I accomplished in my graduate experience would have been possible. I would not have returned to school, much less written a thesis, without the advice, support, friendship, and more than a little prodding from these people. I owe you all more than I could express with words, but here goes anyway…

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INTRODUCTION

Forestland covers approximately 18.3 million acres in North Carolina, or 59 percent of the total area of the state (Brown 2002). Non-industrial private forestland owners (NIPFs) control 13.8 million acres of this forestland, a little more than three-fourths of the forested area in North Carolina (Brown 2002). According to the United States Department of Agriculture-Forest Service, there were an estimated 704,900 private forestland owners in North Carolina in 1994 (Birch 1996). More recently, Butler (2006) determined that there are approximately 480,000 family forest ownerships in the state; however, this figure does not include private businesses, corporations, or other non-family ownerships. No matter what is the true number of NIPF ownerships, it is a fact that a majority of the forest resources of the state are privately controlled. Private ownerships supply timber products, wildlife habitat, and recreation opportunities that benefit the economy and the natural environment of North Carolina.

Some of the first intensive research on North Carolina's private forestland owners began in 1960 by The American Forestry Association. Pomeroy and Yoho (1964) found that on average, North Carolina's non-industrial forest owners were approximately 55 years of age with the equivalent of a junior high school education. They found that a third of owners were farmers and another fifth were "wage earners." They found a direct positive relationship between size of property and amount of education. Two-thirds of the population resided on their forestland, but non-residents controlled over half of the total forest area. Average tenure was 21.6 years, and "well over half" of the owners claimed to have

purchased at least some of their land. Almost a quarter of forest owners (24 percent) indicated that one reason for owning their land was growing timber for sale. Sixty percent of landowners had sold timber. Pomeroy and Yoho (1964) observed that the likelihood to practice forestry increased with tract size.

Muench (1965) continued the exploration of North Carolina's non-industrial private forestland owners. He attempted to determine the characteristics of forestland ownerships involved in public forestry programs, including Extension Forestry. He found that in 1965, 22.1% of landowners had sought advice or service from Extension Forestry and stated that, "…it is encouraging to note that about one-fourth of all forest landowners are somewhat receptive to educational efforts." He did not find a relationship between Extension Forestry program participation and occupation, and claimed, "…it must be concluded that the Forestry Extension program is effective in carrying the forestry conservation message to the forest landowner regardless of the owner's occupation." Muench (1965) did, however, determine that tract size and regional location (specifically the Mountains) were positively correlated with Extension Forestry participation. The foundations were thus laid for characterization of North Carolina's NIPF population and identification of links between landowner characteristics and their participation in educational programs.

Since the 1960s, some characteristics of landowners have changed while others remain about the same. Megalos (1999) found that the average North Carolinian private forestland owner was 62 years old, had some college education, and had a 1995 income of $30,000-$50,000. He or she typically owned more than 90 acres of land and had owned land for more than 20 years. Megalos (1999) also found that the majority of landowners resided

on their forestland, nearly half were retirees, 15.4% were in the managerial or professional occupations, and only 11.5% described themselves as working in agriculture, forestry, or fishing. Urban county landowners were also found to be less likely to embrace educational programs (Megalos 1999). Butler (2006) has compiled statistics on North Carolina's family owned forests and their owners, but his results are preliminary. He found that three-fourths of those who responded were over the age of 55 and approximately 30% have a college degree or higher. Nearly three-fourths of respondents to Butler's (2006) survey claimed that their family forestland is part of their primary residence, but only one fourth does not plan to manage their forestland in the future. Of Butler's respondents, only 9% have received information from a "state forest agency" and a mere 1.5% have received information from Extension. Compared to the studies of the 1960s, the average landowner of today has a significantly higher income, has more education, and is less likely to be a farmer. However, he or she is about the same age and has owned his land for approximately the same length of time. The percentage of landowners who have received information from Extension Forestry seems to be lower today than it was forty years ago.

Nationwide, NIPF ownership statistics increased from 1978 to 1994 for white collar workers and retirees, but decreased for blue collar workers with respect to number of tracts and acreage owned (Birch 1996). The greatest increase in ownership, both in number of tracts and acreage owned, was found in retirees (Sampson and DeCoster 1997). Sampson and DeCoster (1997) state that a "significant proportion (35 percent) of the forestland owned by individuals is likely to change ownership within the next decade or so." Getting information to private landowners is more challenging when there is a high turnover rate among landowners (Sampson and DeCoster 1997). Newman, *et al*. (1996) found that in

Georgia, new timberland owners differed markedly from traditional landowners in that they were older, wealthier, better educated, and more rural than expected but were generally unaware of management opportunities and forest laws. Because these landowners are different, it may be more difficult to reach them using the same methods that work for traditional landowners. Webster and Stoltenberg (1959) tried to determine which ownership characteristics are useful for predicting response to forestry programs and found that "acreage owned" and "assessed value of the owner's property" were the only statistically significant characteristics, although their sample sizes were very small. In their conclusions, they called for additional ownership studies to test the relationship between easily recognizable ownership characteristics and response to various types of forestry programs (Webster and Stoltenberg 1959). Knowledge of such relationships would help identify ways to reach landowners who are new or different from Extension's traditional audience.

Dynamic ownership patterns and increased demands for forest products together emphasize the need to deliver relevant forestry information to a growing and changing NIPF population. In addition, after comparing studies from the 1960s and today, it seems that Extension Forestry's impact may be less than it once was. Giving one-on-one attention to each forestland owner would best satisfy their diverse needs, but would be impossible. Landowners must be reached with information delivery methods that are effective. Extension Forestry hopes to deliver education in ways that are preferred by its audience because, "if educators can provide private forest landowners with well-designed tailored programs, they may foster forest resources stewardship," (Downing and Finley 2005).

The choice of information delivery system used by an educator may have significant consequences for program effectiveness. Because so many delivery methods are available today, the preference of the audience for a particular method may be difficult to predict. Some fear that using one information delivery method may alienate those who prefer another, and particularly that "high-tech approaches may intimidate certain groups of clientele (e.g., older clientele)" (Rodewald 2001). To test this possibility, studies have attempted to determine preference of traditional versus non-traditional methods of education. An evaluation of conventional versus television instructional delivery methods in Utah determined that learners preferred conventional methods but concluded that interactive television instruction showed promise (Egan *et al*. 1992). Non-industrial private forestland owners in Mississippi were found to prefer traditional short courses over an interactive video (Londo and Gaddis 2003). Despite the Mississippi landowners' preference for traditional methods, 95% of participants in the interactive video course expressed a willingness to attend another interactive short course and 45% desired all short courses to be offered in the interactive video format (Londo and Gaddis 2003). Over half of "limited-scale" landowners in Oklahoma were determined to prefer direct mail overall but the Internet was preferred by nearly 20% of all landowners (Cartmell II, *et al*. 2006). While these results suggest that traditional methods of information delivery may be preferred, one study concluded that non-traditional methods could be utilized while maintaining Extension's current client base (Londo and Gaddis 2003). If that is the case, making use of non-traditional methods may only serve to increase Extension's clientele base. Collectively, this research reports that traditional methods of information delivery may be preferred; however, they also suggested

that non-traditional methods may increase educators' efficiency and reduce costs if they are used properly and directed at an appropriate audience.

Additional research has investigated links between socio-demographic characteristics and information delivery method preferences in order to determine if particular information delivery methods are preferred by distinct groups of people. In South Carolina, the usefulness of information delivery methods was compared across several demographic characteristics of private longleaf pine forest owners, and relationships between the two were identified (Radhakrishna, *et al*. 2003). It was found that delivery by video and the Internet were both negatively related to age and that landowner occupation was positively related to delivery by formal classes, video, and the Internet (Radhakrishna, *et al*. 2003).

Determining overall preferences for delivery methods for an audience may not reveal other important trends in delivery method preferences. Some researchers who have found that traditional methods are preferred by landowners as a whole also feel that their results suggest merit in non-traditional methods. A different kind of statistical analysis may allow the identification of subgroups of landowners who prefer non-traditional methods within a landowner base that prefers traditional methods overall. Many researchers (Cartmell II *et al*. 2006, Radhakrishna *et al*. 2003, Rodewald 2001, Egan *et al*. 1992) suggest using a diversity of information delivery methods to reach extension clientele, but particular information delivery methods must be matched with target audiences to insure their efficacy.

Previous studies of information delivery have identified the most preferred methods (Cartnell II *et al*. 2006, Rodewald 2001), but as was previously suggested, different statistical analyses might allow a better description of the particular respondents who prefer "other" methods. It is believed that the analysis of subgroups of respondents to this survey will allow

the landowners who prefer "other" methods to be identified and scrutinized. There is precedent for analyzing subgroups of landowners, and such studies resulted in recommendations based on their classifications that were used to aid forestry professionals and educators in their goal of reaching landowners with information about forest issues.

Birch and Pywell (1986) surveyed eight predetermined NIPF ownership groups, based on size of ownership and owner's occupation, in order to identify reasons for ownership, intent to practice forestry, and primary benefits expected from forestland. In their conclusions, they further defined the ownership groups within the forestland owner base in Pennsylvania and suggested methods for reaching these landowners, focusing especially on magazines they claimed were received in high percentages of the target groups' homes (Birch and Pywell 1986).

Kluender and Walkingstick (2000) studied non-industrial private forestland owners in Arkansas and attempted to identify groups of people with similar interests using a statistical tool called cluster analysis. Their mail survey sampled landowners from across their state and asked about ownership objectives, management intentions, previous management practices, and socio-demographic characteristics. Using seven questions from the survey as factors in the cluster analysis, they found four cohesive, stable groups of landowners within the sampled population. They nicknamed these groups, "Timber managers, Resident conservationists, Affluent weekenders, and Poor rural residents" and further described the groups based on their responses to the remainder of the survey questions. Kluender and Walkingstick's (2000) clusters were ultimately used to make long-term policy recommendations for forestry in Arkansas. The authors stressed that "…a broad

understanding of non-industrial landowners is of extreme importance in fostering sustainable forest management…" (Kluender and Walkingstick 2000).

Objectives:

The first objective of this project is to identify groups of non-industrial private landowners who have particular information delivery method preferences using a survey questionnaire. The second objective is to investigate these groups for descriptive socio-demographic, land, or management experience characteristics. If information delivery method preferences can be linked with socio-demographic, land, or management characteristics, educational efforts can be directed at specific groups of landowners using the methods they prefer. The final objective of this project is to make recommendations based on the survey questionnaire results that may help Extension Forestry develop more efficient and effective programs to assist North Carolinians in making informed decisions concerning their forest resources.

METHODS

Survey Recipients:

The target population was North Carolina's non-industrial private forestland owners. Although there are a huge number of individuals in the population - reportedly over 700,000 (Birch 1996) - Krejcie and Morgan (1970) report that a sample of 384 individuals is statistically representative of populations up to one million individuals. Our target sample size was therefore at least 384 respondents.

Because there is no comprehensive list or database of North Carolina's landowners, lists of landowners who qualified in 2004 for agricultural, horticultural, or forestry present use-value tax treatment were requested from county tax assessors. If only *forestry* present use-value tax treatment had been used, landowners with fewer than 20 acres of forested land would have been excluded. However, since some respondents qualified for *agricultural* or *horticultural* use-value, all of Birch's (1996) acreage classes were represented by valid responses to the survey.

The survey recipients constituted a stratified random sample of landowners in North Carolina who qualified for present use-value tax treatment. The sample was stratified by North Carolina's seven Cooperative Extension districts, thus ensuring that all regions of the state were represented (Figure 1).

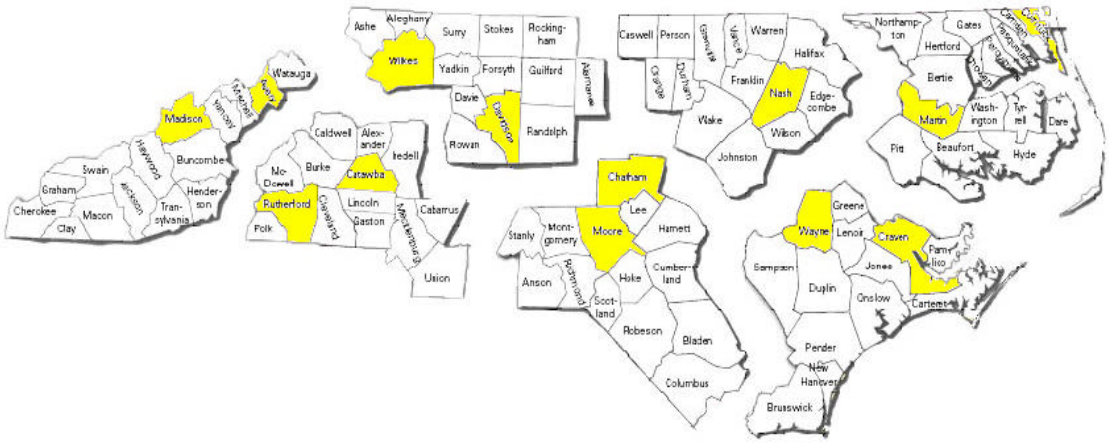

Figure 1. Distribution of sampled counties within North Carolina

Within each district, both an urban and a rural county (for a total of 14 counties) were randomly selected and tax assessors were asked for the aforementioned landowner lists. Thirteen of the 14 selected counties provided the requested information and 200 randomly selected landowners from each county's list were sent surveys; the total number of surveys sent was 2600.

Selecting the fourteen counties involved identifying the urban or rural classification of North Carolina's counties, then randomly choosing one of each class within each district. The urban or rural status of each county follows a classification produced by the state library (Universal Service Administration Company 2006). Choosing the sampled counties was accomplished by first assigning a number (1 to "n") to each county within the district. A random number generator was then used to randomly choose the two counties within each district (random.org 2006). The first county chosen in each district was determined to be either urban or rural; subsequently, additional counties from the district were randomly selected until the other status was attained for each district. The initial list of 14 counties was Avery, Catawba, Chatham, Craven, Currituck, Davidson, Madison, Moore, Nash,

Perquimans, Rutherford, Vance, Wayne and Wilkes counties. Perquimans County had to be substituted with Martin County (again randomly selected) when the required list of forestland owners was unavailable. Vance County never responded to the request for a list of landowners.

Two thousand four hundred surveys were mailed on August 19, 2005. The remaining 200 surveys, intended for Martin County, were sent September 22, 2005 because the county tax assessor had not yet responded by the original mailing, despite multiple requests. On September 9, 2005, a reminder postcard was sent to the recipients of the August mailing, thanking those who had responded and offering three methods for participating to those who had yet to respond. Late respondents were given the option to send in the original survey, request an additional survey by mail or telephone, or use a web address on the postcard to access an identical copy of the survey that could be completed online. Before another reminder was sent to increase the response rate of the survey, the number of responses surpassed the target sample size (n=384).

Survey Instrument:

The survey instrument was designed based on previous studies of non-industrial private forestland owners (Birch 1996) and using *Surveying the Social World: Principles and Practice in Survey Research* (Aldridge and Levine 2001). Before being mailed to landowners, the questionnaire was tested on six people of various backgrounds (local landowners, graduate students, and natural resource professionals who work with the public) and was reviewed by four North Carolina State University faculty members. Points of confusion or misunderstanding were corrected before the printing of the final instrument.

The questionnaire asked participants about their preferences for information delivery methods, their socio-demographics, their land, and their forest management experience. Participants were asked to rank information delivery methods using a four point scale: "Would never use" (1), "Would rarely use" (2), "Would sometimes use" (3), "Would often use" (4).

Definitions of the six information delivery methods were given in the questionnaire. Mail-based material was defined as "newsletters, brochures, compact discs, Extension publications, magazine articles, etc." Web-based material was defined as "web-site reading, downloadable publications, or streaming video." Short programs were considered "evening or less than half-day seminars or workshops at county facilities." Long programs were defined as "full day/multiple day field site visits or demonstrations." Participation in a landowner association was considered self-explanatory. Distance education was considered "web-based landowner courses, video-based landowner courses, or textbook-based correspondence courses."

The final instrument met with acceptance (considered exempt due to its non-offensive nature) by the Institutional Review Board for the Use of Human Subjects in Research (IRB) at North Carolina State University.

Survey Questions:

<u>Socio-demographics Questions:</u>

- Are you? (Male/Female)
- Are you married? (Y/N)
- What is your age? (Years)

- What is your primary occupation?
- Are you retired? (Y/N)
- How many children do you have below the age of eighteen?
- What was your total household income last year, before taxes?
    - less than $10,000
    - $10,000 to $39,999
    - $40,000 to $69,999
    - $70,000 to $99,999
    - more than $100,000
- What is the highest level of education you have completed to date?
    - did not complete high school
    - high school
    - some college
    - four-year college degree
    - graduate degree

Land Questions:

- How many acres of forestland do you own?
    - In North Carolina?
    - Out of State?
- How many tracts of forestland do you own?
    - In North Carolina?
    - Out of State?

- How many years have you owned the majority of this forestland?
- Is your primary residence located on forestland you own? (Y/N)
- Where is your primary residence located?
    - Rural area
    - Small Town (less than 10,000 people)
    - City (more than 10,000 people)
- How did you obtain your forestland?
    - Purchased it
    - Inherited it
    - Other (please specify)

Management Experience Questions:

- How much experience do you have with forest management practices on your land?
    - [Ranked from "Not at all experienced" (1) to "Very experienced" (10)]
- How likely are you to practice forest management on your land in the future?
    - [Ranked from "Not at all likely" (1) to "Very likely" (10)]
- Please check the boxes of all sources from which you've received information about forest issues:
    - State Forest Service
    - Consulting Foresters
    - Cooperative Extension
    - Media (Newspaper, TV, Radio)
    - Forest Industry

    - Logger or Timber Buyer
    - Environmental Groups
    - Conservation Groups
    - Federal Agencies (NRCS, FSA, USFS)
    - Neighbors
    - County, State, or National Forest Landowner Associations
- Have you ever sold timber? (Y/N)
- If yes, did you use a consulting forester to conduct the sale? (Y/N)
- Do you require income from your forestland? (Y/N)
- If yes, do you derive income from: (check all that apply)
    - Wildlife
    - Recreation
    - Timber Harvest

The package received by landowners included the questionnaire, cover letter identifying the author and his graduate committee, and a business reply envelope. The bottom portion of the cover letter was a detachable entry form for those who wished to be eligible to win a prize: their choice of a chainsaw or a hummingbird feeder kit. Because the survey instrument itself did not request landowners' names, those who did not enter the drawing were able to maintain their anonymity. If returned envelopes contained entry forms, the completed surveys and entry forms were separated before data entry to protect landowners' privacy as much as possible.

Statistical analyses:

Once valid responses were entered into a spreadsheet, a *K*-means cluster analysis was performed using only respondents' preference for information delivery methods. Clustering schemes of 2, 3, 4, 5, and 6 clusters were investigated. The best scheme was determined by comparing several cluster summary statistics across the schemes (SAS Onlinedoc 2006). Cluster analysis was deemed to be superior to other classification methods because it does not require *a priori* classification, thus minimizing bias (Afifi and Clark 1996). Although cluster analysis can be sensitive to outliers, the data set consisted of ordinal responses that ranged only from 1 to 4, so outliers were not an issue. *K*-means cluster analysis is a non-hierarchical method that determines groups within a data set by simultaneously minimizing within-cluster variation and maximizing between-cluster variation (Kluender and Walkingstick 2000). Because it is non-hierarchical, *K*-means cluster analysis constantly re-evaluates placement of individuals within groups until the most stable groups possible are formed (Afifi and Clark 1996). The FASTCLUS procedure in SAS v.8.0 was used to perform the cluster analysis.

Following the *K*-means cluster analysis, an MRPP (multi-response permutation procedure) was performed to further evaluate the stability and validity of the clustering scheme that was determined best. MRPP is a nonparametric procedure for testing the hypothesis that there is no difference between groups of individuals (McCune and Grace 2002). Because it is nonparametric, it does not require distributional assumptions such as multivariate normality or homogeneity of variances among multiple variables. To perform the MRPP procedure, PCOrd 4.0 was used.

The cluster analysis and MRPP allowed the identification of stable groups of landowners who prefer certain types of information delivery. To investigate differences among clusters with regard to socio-demographics, land characteristics, and management experience, contingency tables were used. Contingency tables are superior in this case to regression or ANOVA because they do not require an assumption of normality; however, all survey responses must be categorical for analysis to be most effective. Nearly all survey questions inherently had categorical responses, but the few that did not (age, length of tenure on forestland, and acreage owned) were categorized using Birch's (1996) classifications. Contingency table analysis was performed using the FREQ procedure in SAS v. 8.0.

As part of the contingency table analysis the FREQ procedure produced an expected frequency for each question response within each cluster. The expected frequency is based on the assumption that there is no association between a respondent's cluster identity and his/her response to a given survey question. Comparison of the expected and observed frequencies allowed the researcher to determine whether or not clusters are significantly different with respect to a given socio-demographic, land, or management characteristic. To determine whether or not clusters are statistically significantly different with respect to a given question, Pearson's Chi-Square was used. A *p*-value of less than 0.05 was considered significant.

RESULTS

Survey Response:

Of 2600 surveys that were sent, 36 were undeliverable, 48 were returned incomplete, and 460 valid questionnaires were entered into the final data set, amounting to an overall response rate of 20%. Valid questionnaires were those that answered all questions about information delivery methods and claimed at least one acre of forestland. All but two questions had at least the requisite 384 responses (Krejcie and Morgan 1970). Two questions did not have at least 384 valid responses. The first concerned the forestland owner's occupation (because retirees were identified in a separate question and were removed from the occupation question) and the second asked if the landowner had used the services of a consulting forester when selling timber (only applied to those who had sold timber). The following tables (Tables 1 through 3) list socio-demographic, land, and management experience statistics for the entire data set. In table 3, "past experience" refers to forest management practices previously undertaken while "future plans" refers to the likelihood that a landowner will practice forest management on his or her land in the future.

Table 1. Socio-demographic statistics for all respondents

	Mean	Percentage	Standard Deviation	"n"
Average Age (years)	62.61		12.63	451
Percent Male		73.1%		458
Percent Retired		51.0%		454
Percent Married		81.4%		452
Percent With Children		15.3%		450
Occupation*:	2.34		0.76	218
Farmer (1)		17.9% (8.6% overall)		
Blue Collar (2)		30.3% (14.5% overall)		
White Collar (3)		51.8% (25.0% overall)		
Income:	3.55		1.18	396
less than $10,000 (1)		1.5%		
$10,000 to $39,999 (2)		22.0%		
$40,000 to $69,999 (3)		27.0%		
$70,000 to $99,999 (4)		19.2%		
more than $100,000 (5)		30.3%		
Education:	3.53		1.1	439
did not complete high school (1)		4.3%		
high school (2)		14.6%		
some college (3)		25.5%		
four-year college degree (4)		35.3%		
graduate degree (5)		20.3%		
Location of Residence:	1.52		0.79	457
Rural area (1)		66.7%		
Small town (<10,000 people) (2)		15.5%		
City (>10,000 people) (3)		17.7%		

*The first percentage given represents the ratio of each occupation type within only those who are not retired. The second percentage represents the ratio of each occupation type over all respondents.

Table 2. Land characteristics statistics for all respondents

	Mean	Percentage	Standard Deviation	"n"
Acreage owned in NC* (acres)	193.93*		564.57	451
	121.25*		155.67	439
Tracts owned in NC	2.43		2.27	451
Tenure on Land (years)	24.98		22.79	422
Resident Landowners		49.7%		453
Own forestland out of state		16.0%		460

*The first average acreage given represents all respondents. The second average acreage represents an average acreage with outliers removed.

Table 3. Management experience statistics for all respondents

	Percentage	"n"
Past Experience*	43.1%	450
Future Plans*	78.7%	451
Sold Timber	80.9%	460
Require Income	35.4%	460
Information Sources Used		460
State Forest Service	60.6%	
Consulting Forester	46.5%	
Cooperative Extension	47.8%	
Media	26.9%	
Forest Industry	16.1%	
Logger/Timber Buyer	46.3%	
Environmental Group	12.8%	
Conservation Group	18.3%	
Federal Agencies	20.9%	
Neighbors	22.8%	
Landowner Association	14.3%	

*Questions on past and future management were answered using a 1 to 10 scale where 1 is lowest and 10 is highest. The listed percentage is the ratio of respondents who answered 6 or higher.

Figure 2 presents the overall average likelihood that a respondent to the survey will use each information delivery method and illustrates the overall preferences for information delivery methods of the entire set of respondents. Information delivery methods were ranked by the four-point scale described previously where a higher value indicates a greater preference for a method. The scale in Figure 2 is an adjusted mean response of all respondents, calculated by subtracting 2 from the mean response. The adjusted mean response indicates the average likelihood of using a particular information delivery method better than the mean response because negative values indicate that respondents would rarely or never use that delivery method while positive responses indicate a greater likelihood for usage. Mail-based information is the preferred delivery method overall, followed by short programs and web-based information. Long programs are least likely to be used by respondents.

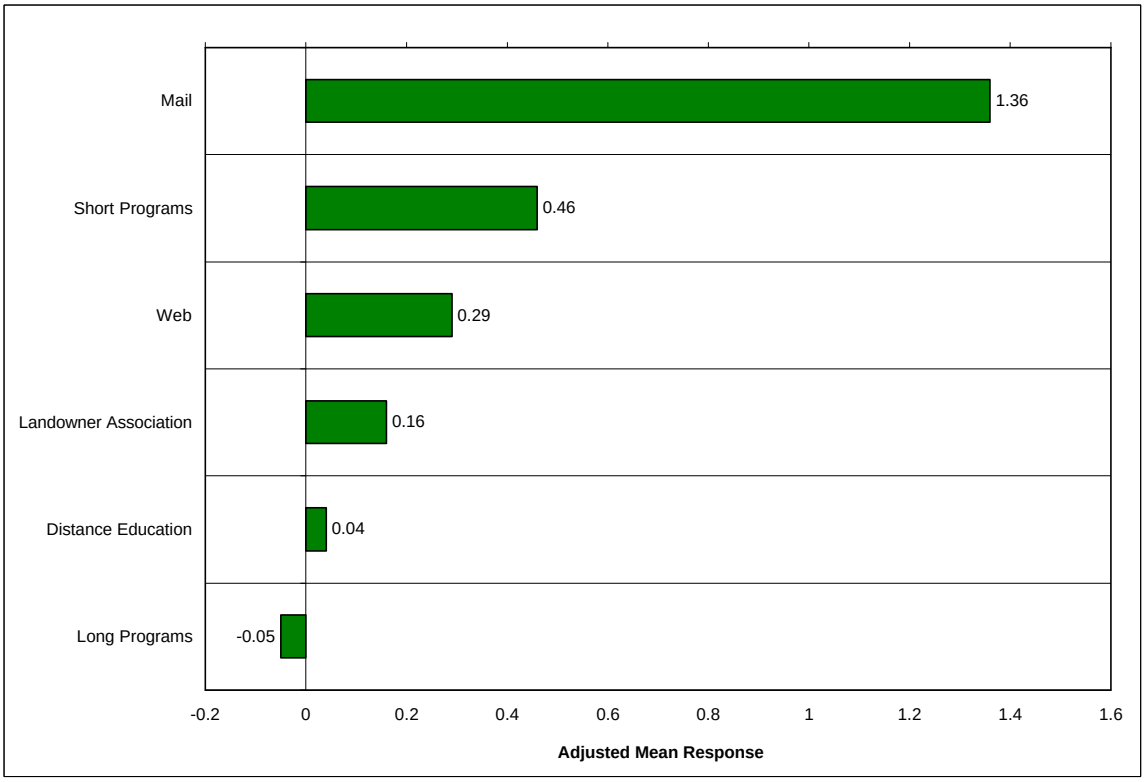

Figure 2. Information delivery method preferences of all respondents

Cluster Analysis/MRPP Results:

Classification schemes of two through six clusters were tested using *K*-means cluster analysis and cluster summary statistics were compared (Table 4). The best cluster scheme was determined by first looking for peak values of the pseudo *F*-statistic and cubic clustering criterion (CCC). The schemes of two and five clusters exhibited peaks in both values, indicating that they should be further investigated to determine which of the two is best.

These schemes were then compared with regard to their average RMS standard deviation, overall $R^2/(1-R^2)$ and average maximum distance from seed to observation. The average RMS standard deviation is smallest in the scheme with five clusters, indicating more cohesiveness in the five cluster scheme as compared to all other schemes. In addition, the overall $R^2/(1-R^2)$ is higher in the five cluster scheme than in the two cluster scheme, while

the average maximum distance from seed to observation is lower. Collectively, the cluster summary statistics indicate that the scheme of five clusters is best.

Table 4. Cluster summary statistics for all classification schemes

Number of clusters	Two	Three	Four	Five	Six
Pseudo F-statistic	243.05	171.71	136.45	146.85	126.40
CCC	28.431	23.268	17.467	24.273	19.768
Avg. RMS Std. Dev.	0.7472	0.7007	0.6707	0.5834	0.5963
Overall $R^2/(1-R^2)$	0.5307	0.7515	0.8977	1.2910	1.3921
Avg. Maximum Distance	3.6469	3.1903	3.1789	2.8991	2.7861

The five cluster scheme was then further validated by MRPP, which used a Euclidean distance measure to investigate the previously identified groups. The MRPP arrived at a chance-corrected within-group agreement of A=0.293 (p <0.0001), indicating that within-cluster disagreement is minimal and the five clusters are much more different from one another than would be expected by chance (McCune and Grace 2002).

Further Investigation of the Clusters:

The *K*-means cluster analysis identified five groups of landowners that are cohesive with respect to preference for information delivery methods. Figure 3 shows the likelihood that a member of a given cluster will use a particular information delivery method. The scale in Figure 3 is an adjusted mean response similar to that in Figure 2, but calculated within each cluster rather than for all respondents. Each cluster has been given a memorable name that helps describe the preferred method of information delivery. The “Don’t Bother Me” cluster is unlikely to use any information delivery method. The “Snail-mailers” prefer only mail-based information delivery. The “Short-mailers” prefer mail-based materials and short

programs. The "Web-mailers" are most likely to use mail-based information and the Internet. Finally, the "Fan Club" cluster will likely use any information delivery method.

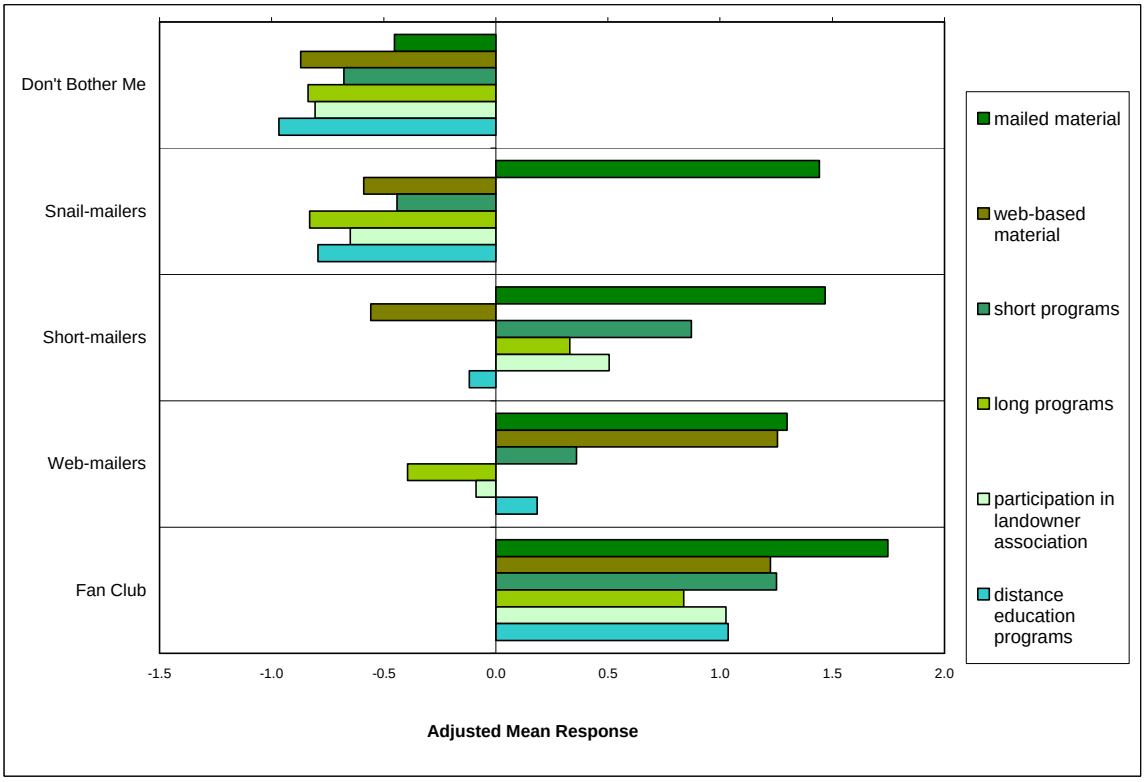

Figure 3. Information delivery method preferences of clusters

After the cluster analysis identified groups of people who are different in terms of preference for information delivery methods, these groups were then further investigated to determine if the members of these clusters differ by socio-demographic, land, or forest management experience characteristics as well. Contingency table analysis determined that the five clusters are statistically significantly different with respect to many of these characteristics.

Socio-demographic Differences Among Clusters:

Table 5 lists the percent of respondents within each cluster that falls into each particular socio-demographic category. Contingency table analysis resulted in the identification of several socio-demographic characteristics that differ significantly across clusters. Only significant socio-demographic characteristics are represented.

Table 5. Socio-demographic characteristics of clusters

	Don't Bother Me	Snail-Mailers	Short-Mailers	Web-Mailers	Fan Club	*p-value*
Retired	58.1%	68.4%	57.8%	41.2%	35.1%	<0.0001
Married	67.7%	65.3%	78.9%	90.4%	86.5%	0.0001
Have Children	3.2%	7.4%	9.2%	23.7%	21.6%	0.0003
Age Classes (years)						<0.0001
18-25	0.0%	0.0%	0.0%	0.0%	0.0%	
26-35	0.0%	1.1%	1.8%	3.5%	0.9%	
36-45	0.0%	2.1%	0.9%	7.9%	10.8%	
46-55	12.9%	9.5%	11.0%	21.1%	27.0%	
56-65	22.6%	21.1%	34.9%	40.4%	31.5%	
66+	61.3%	64.2%	50.5%	26.3%	26.1%	
Occupation						0.011
Farmer	9.7%	4.2%	11.9%	5.3%	11.7%	
Blue Collar	16.1%	13.7%	14.7%	11.4%	17.1%	
White Collar	9.7%	11.6%	15.6%	38.6%	34.2%	
Income						0.0007
less than $10,000	0.0%	4.2%	0.9%	0.0%	0.9%	
$10,000 to $39,999	25.8%	25.3%	22.9%	10.5%	16.2%	
$40,000 to $69,999	22.6%	23.2%	22.0%	19.3%	28.8%	
$70,000 to $99,999	16.1%	12.6%	16.5%	18.4%	18.0%	
more than $100,000	16.1%	11.6%	21.1%	41.2%	30.6%	
Education						<0.0001
did not complete high school	6.5%	8.4%	6.4%	1.8%	0.0%	
high school	29.0%	18.9%	22.0%	3.5%	8.1%	
some college	16.1%	24.2%	23.9%	21.1%	30.6%	
four-year college degree	25.8%	31.6%	28.4%	37.7%	38.7%	
graduate degree	19.4%	13.7%	16.5%	28.1%	18.0%	

Land Ownership Differences Among Clusters:

Contingency table analysis revealed that clusters differ by acreage class and by length of tenure (Table 6). Acreage class refers to the amount of land owned in North Carolina, but

does not necessarily indicate the size of individual tracts. Tenure refers to the length of time the respondent has owned the majority of his or her forestland. In the questionnaire, respondents were asked to give a numerical value for acreage owned in North Carolina and the actual number of years they have owned their forestland. Both variables were categorized during data analysis following the classifications of Birch (1996).

Table 6. Land aspect characteristics of clusters

	Don't Bother Me	Snail-Mailers	Short-Mailers	Web-Mailers	Fan Club	*p-value*
Acreage Class						0.0017
1-9	6.5%	2.1%	2.8%	4.4%	2.7%	
10-49	58.1%	41.1%	27.5%	31.6%	29.7%	
50-99	22.6%	27.4%	22.0%	28.1%	18.0%	
100-499	3.2%	22.1%	33.0%	29.8%	35.1%	
500-999	0.0%	1.1%	11.9%	4.4%	7.2%	
1000+	3.2%	2.1%	1.8%	0.9%	5.4%	
Tenure Since:						0.0193
2000-2004	6.5%	6.3%	6.4%	11.4%	14.4%	
1999-1990	32.3%	18.9%	14.7%	29.8%	31.5%	
1989-1980	12.9%	31.6%	22.0%	26.3%	23.4%	
1979-1970	12.9%	14.7%	21.1%	7.0%	14.4%	
1969-1960	9.7%	5.3%	12.8%	6.1%	8.1%	
1959-1950	9.7%	12.6%	6.4%	7.0%	3.6%	
1949-forever	6.5%	3.2%	3.7%	1.8%	1.8%	

Management Experience Differences Among Clusters:

Analysis of the clusters' management experience characteristics revealed four key areas of differences: past management experience, future plans for management, the percent of the cluster's respondents who require income from their forestland, and sources from which forestry information has been obtained (Table 7). The definitions of "past experience" and "future plans" are the same as in Table 3. Three information sources, Forest Industry, Logger/Timber Buyer, and Neighbors, did not differ significantly among clusters.

Table 7. Management experience characteristics of clusters

	Don't Bother Me	Snail-Mailers	Short-Mailers	Web-Mailers	Fan Club	*p-value*
Past Experience*	22.6%	29.5%	47.7%	40.4%	55.9%	0.0034
Future Plans*	38.7%	52.6%	78.9%	89.5%	95.5%	<0.0001
Require Income	22.6%	28.4%	37.6%	32.5%	45.9%	0.0353
Information Sources						
State Forest Service	38.7%	54.7%	70.6%	57.0%	65.8%	0.0071
Consulting Forester	25.8%	32.6%	52.3%	47.4%	57.7%	0.0006
Cooperative Extension	29.0%	32.6%	56.9%	37.1%	67.6%	<0.0001
Media	16.1%	32.6%	26.6%	18.4%	34.2%	0.0313
Forest Industry	12.9%	11.6%	14.7%	13.2%	25.2%	0.0515
Logger/Timber Buyer	45.2%	44.2%	48.6%	42.1%	50.5%	0.7366
Environmental Group	9.7%	2.1%	14.7%	14.0%	19.8%	0.0040
Conservation Group	9.7%	3.2%	25.7%	21.1%	23.4%	0.0001
Federal Agencies	12.9%	14.7%	22.9%	14.0%	33.3%	0.0017
Neighbors	16.1%	26.3%	25.7%	14.9%	27.0%	0.1298
Landowner Association	9.7%	8.4%	13.8%	12.3%	23.4%	0.0251

*Questions on past and future management were answered using a 1 to 10 scale where 1 is lowest and 10 is highest. The listed percentage is the ratio of respondents who answered 6 or higher.

DISCUSSION

This project had an objective of finding groups of people within North Carolina's huge landowner population at whom Extension Forestry and other natural resource educators can direct educational programs to make their services more efficient and cost-effective. Past studies have determined overall information delivery method preferences and have compared traditional with non-traditional methods of information delivery, but have been unable to find differences among landowners that are associated with their preferences for particular information delivery methods. In this study, non-industrial private forestland owners were surveyed and cluster analysis resulted in the identification of five groups of respondents who have particular information delivery method preferences. The clusters were investigated for socio-demographic, land ownership or management experience differences. Contingency table analysis allowed statistically significant differences among clusters to be identified, so it is possible to connect information delivery preferences with other characteristics of landowners. The combination of statistical analyses allowed the identification of target groups of people within North Carolina's landowner population at whom educational efforts can be directed to increase Extension Forestry's efficacy in dissemination of research-based knowledge to the citizens of the state.

When compared to other recent North Carolina landowner survey results (Megalos 1999, Butler 2006), the respondents to this survey appear to be slightly more educated, have a higher income, and own more land. This could be an artifact of the method used to obtain landowner names. The landowners contacted were those who qualified for agricultural,

horticultural, or forestry use-value tax treatment. It seems that while these landowners differ in some ways from the "typical landowner" as described in other surveys, they appear to be no different in terms of several socio-demographic characteristics such as age, percent retired, and tenure. Although a higher percentage of respondents to this survey claim to have received information from the State Forest Service and Cooperative Extension than was found by Butler (2006), a majority of respondents have not received information from extension, so there is potential for increasing Extension Forestry's impact by reaching these people more effectively.

Cluster Discussion:

The objective of the cluster analysis was to determine who to target with which information delivery methods. It was determined that there are five groups of people with respect to information delivery method preferences. One of the clusters, the "Don't Bother Me" cluster, expressed very little interest in any information delivery method. Because of this, the "Don't Bother Me" cluster is likely to be very difficult to reach. They only constitute 7% of the respondents, so expending effort to direct educational efforts at this group of people is not advised.

A second cluster, the "Fan Club" cluster, expressed interest in all information delivery methods. This group represents 24% of respondents. A majority of respondents in this cluster indicate that they have received forestry information from the State Forest Service and/or the Cooperative Extension Service. Many of these landowners are probably already being reached with information, but if they are not, information delivery methods

targeted at other groups will also reach this group. Tables 5 through 7 offer more information about these two clusters.

The three remaining clusters have particular information delivery method preferences and each has characteristics that will allow educators to identify these people within their target audience. Focusing on these three clusters will help Extension Forestry and other educators make a bigger impact on North Carolina's private forestland owners in a cost-effective way.

The three focus clusters are the "Snail-mailers," the "Short-mailers," and the "Web-mailers." Contingency table analysis determined that there are significant differences among the clusters with respect to socio-demographic, land ownership, and management experience characteristics. The clusters are different, but not mutually exclusive. It cannot be said that only young landowners are "Web-mailers" for example, or that "Short-mailers" are the only people who require income from their forestland. However, notable differences did express themselves in the analysis, and it is believed that these prominent characteristics of the clusters are most strongly associated with their delivery method preferences. Because it is believed that these noteworthy characteristics are the differences among landowners that will allow educators to target them with their preferred information delivery methods, notable differences will be highlighted in the discussion of the three focus clusters. Any characteristics of these clusters that are not specifically discussed here may be found in Tables 5 through 7.

"Snail-mailers":

The "Snail-mailers" prefer mail-based information over all other delivery methods. Approximately 21% of respondents were classified as "Snail-mailers." Nearly two-thirds of this cluster are over 66 years old. More than two-thirds of this cluster are retired. Compared with the other two focus clusters, the "Snail-mailers" cluster has a higher percentage of respondents who earned less than $40,000 last year, likely because many members of this cluster are no longer employed. Among all respondents, members of the "Snail-mailers" cluster are most likely to reside in a city.

To reach this cluster most effectively, educators should specifically target retirees. If possible, efforts should be even more directed toward retirees in urban areas. Programs and services should be announced using mail. Two-thirds of this cluster reports that they have not received information from the Cooperative Extension Service in the past, so Extension Forestry can increase its impact and enlarge its base of program participants by reaching this group. A list of landowners in a target audience should be compared with lists of past program attendees, and mailings should be directed at the landowners who have not previously attended.

"Short-mailers":

"Short-mailers" are most likely to use mail-based information or short programs such as half-day seminars or workshops. They constitute approximately 24% of respondents. They are somewhat similar socio-demographically to the "Snail-mailers," but slightly younger and with a lower percentage of retirees. Besides their willingness to attend short programs, "Short-mailers" are different from the other focus clusters in that they have more

experience with managing their forestland and more of them require income from their forestland. Nearly half own more than 100 acres of forestland in North Carolina and nearly half have owned their land for more than 25 years. Over 70% of "Short-mailers" have received forestry information from the State Forest Service.

To reach this cluster, educators should target landowners who actively manage their land. Names and addresses of landowners who have sought technical assistance can be obtained from the State Forest Service and those landowners can be sent mailings that market educational short programs. Because almost half of this group requires income from its forestland, they are likely interested in education related to deriving income from their forestland.

"Web-mailers":

The final focus cluster is the "Web-mailers." This cluster constitutes 25% of respondents and prefers mail-based and web-based information delivery. They are significantly younger, more likely to be married, more likely to have children, and less likely to be retired than members of the other focus clusters. Sixty percent of this cluster makes more than $70,000 per year and two-thirds of "Web-mailers" have at least a four-year college degree. Ninety percent of this group expressed that they are likely to manage their forestland in the future.

To reach this cluster, areas of high income and high levels of education should be targeted. Landowners should be sent mailings that inform them of internet-based resources that are currently available. Educators need not develop their own web-based materials because they can make an impact by informing members of this cluster about resources of

which they may have been unaware. In mailings, a voluntary e-mail listserv can be announced so that interested landowners can sign themselves up. Using this tool, educators can inexpensively market a program with a click of a button. Many "Web-mailers" have job or family responsibilities that can limit their ability to attend programs. However, cost-effective, non-traditional methods such as internet-based information delivery may be effective in increasing Extension Forestry's impact on this group.

Recommendations:

Taking into account the focus clusters discussed above and the overall information delivery method preferences of all respondents, the author presents an overarching strategy to Extension Forestry for more effectively reaching landowners. This strategy must not only be based upon the findings of this study, but also consider the resources and limitations of Extension Forestry in North Carolina. With unlimited resources, extension could employ an agent with expertise in forestry in every county with forestry responsibilities. The state specialists in Extension Forestry, with unlimited time and money, could visit each county and give more specialized advice and support. Specific attention and education could be tailored to every landowner of the state. With no limitations, extension could have a database of all landowners in the state. In reality, extension agents in 99 counties of North Carolina have multiple areas of responsibility, in which forestry is included. Only four agents have degrees in the field of forestry. The agents without technical background in forestry are nevertheless a vital part of the resources of Extension Forestry, and they are served by five state specialists at North Carolina State University. These five specialists have limited time, money, and ability to serve the entire state, but they have a large amount of expertise. It is

therefore important to Extension Forestry as a whole to determine a realistic strategy for maximizing its impact using its limited resources.

First, as has been repeatedly found in other assessments of information delivery method preference (Cartnell II *et al*. 2006, Radhakrishna *et al*. 2003, Rodewald 2001), mail-based information is preferred by most respondents. Therefore, mail flyers and newsletters should be used as much as possible to announce educational programs and solicit interest in services. If large mailings are not possible due to budgetary constraints, newsletters should be directed at specific municipalities or groups of landowners who are most likely to be interested.

Second, newsletters should announce the formation of a voluntary Extension Forestry listserv. Such a listserv would provide a forum for discussion amongst agents, specialists, and landowners. In addition, it is suggested that the most frequently asked questions from the listserv be compiled on a separate web page. Extension Forestry personnel can direct landowners to this resource first for advice and answers, thus saving time and money.

Third, educators should direct traditional methods such as short programs and demonstrations at landowners who have experience managing their land and who require income from their forestland. These programs should be announced through the mail and the list of recipients of these mailings should be obtained from the State Forest Service, consulting foresters, and any other forest professionals willing to divulge the names of those with which they have interacted.

The results of this study have guided these recommendations and provided the basis for suggestions for reaching the target clusters. The recipients of this survey were a

subpopulation of the NIPFs of North Carolina and suggestions that apply to them may not be best for the entire landowner population. In addition, those who responded may have expressed their preference for a particular delivery method with best intentions, but the actual group of users of that delivery method may be different from what is suggested by responses to the survey.

In light of these potential issues, the author's final recommendation for Extension Forestry is to survey the actual users of their diverse programs, specifically requesting information on socio-demographics, land ownership, and management experience. This need not be a costly mailed survey, but could be a short questionnaire handed to participants of forestry education programs. The results of such a follow-up survey will identify characteristics of the actual users of information delivery methods and may provide different or better suggestions for how to increase the impact of Extension Forestry in North Carolina. The ultimate intention is to help Extension Forestry make a greater impact on the citizens and forestland of North Carolina through delivery of research-based information and education.

Conclusions:

Results of this study indicate that the most preferred method of information delivery is mail. However, further investigation using cluster analysis revealed five distinct groups of landowners with particular delivery method preferences. While mail may be an effective delivery method for a majority of the respondents to this survey, it is a costly and time-consuming way to repeatedly reach a large group of people, such as North Carolina's NIPF population. In order for educators to increase efficiency and reduce costs, the delivery methods that have the ability to reach landowners coupled with a minimal resource expense

should be employed. When landowners are willing to use the internet, teleconferences, or other resource-saving, non-traditional techniques, educators should take advantage of the benefits they offer. Likewise, short programs and forestry demonstrations can be very effective for some landowners, but they must be targeted at those most likely to participate to maximize their usefulness as a delivery method. Educational efforts must be directed.

This study allowed for the identification of associations between delivery method preferences and other characteristics of landowners, including socio-demographics, land ownership, and management experience. Connecting such easily identifiable characteristics of landowners with their preferences for information delivery methods allows educators to predict the delivery methods most likely to be effective for their target audience by knowing the makeup of their target audience. If they know the characteristics of their target landowners, educators can use the results of this study to make a more informed forecast of their audience's response to web-based materials or forestry demonstrations, for example.

Educators can make a greater impact by delivering information to landowners the way they want it. They can use associations between landowner characteristics and delivery method preferences to continually meet the needs of a dynamic NIPF population and to match their audiences with delivery methods most likely to be effective. They can save money and time by targeting specific groups of people with specific information delivery methods. This study was meant to help educators to direct educational efforts and make a greater impact with fewer resources.

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