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Educational Needs of North Carolina Non-industrial Private Forest Landowners and Barriers to Meeting These Needs

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Educational Needs of North Carolina Non-industrial Private Forest Landowners and Barriers to Meeting These Needs

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Educational Needs of North Carolina Non-Industrial Private Forest Landowners and Barriers to Meeting These Needs

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Abstract. Forest landowners are an important target audience for many state Extension programs. Acknowledging the differences and associations between landownership values, characteristics, and educational preferences of forest landowners should lead to improvement of educational programs and ensuring that educational needs are being met. Through an internet-based survey of forest landowners four distinct landowner typologies were identified based on respondents' reason for owning forestland. Results also identified the educational needs and barriers to meeting these needs for the landowners. Creating typologies based on attitudinal responses will allow for a more focused approach to developing educational products and services to meet landowner needs.

INTRODUCTION

Non-industrial private forest (NIPF) landowners are an important target audience for many state Extension programs (Bardon et al., 2007; Khanal et al., 2019; Kuhns et al., 1998; Majumdar et al., 2008; Zobrist & Rozance, 2015). These landowners have dynamic characteristics, interests, and preferences that directly impact their expressed educational needs (Boon et al., 2002). Research has shown that Extension professionals should utilize a variety of information delivery methods and focus on topics of interest or concern to adequately reach a specific target audience (Bardon et al., 2007; Khanal et al., 2019; Kuhns et al., 1998; Majumdar et al., 2008; Zobrist & Rozance, 2015). Many of these studies developed NIPF landowner typologies based on preferences for information delivery methods and topics of interest for workshops and meetings.

The purpose of this study was to categorize North Carolina NIPF landowners based on their reason for owning forestland and to identify the educational needs—and barriers to meeting these needs—for the various groups identified. If Extension professionals can segregate landowners based on attitudinal responses and gaps in their identified educational needs, they can take a more focused approach to developing educational products and services to meet the needs of the landowners.

METHODS

The authors conducted a survey of 3,000 of the 500,000 NIPF landowners in North Carolina (Bissette & Arney, 2020). The landowners were equally distributed across 15 North Carolina counties selected using a stratified random sample of all 100 counties distributed between five North Carolina Cooperative Extension (NCCE) districts (Figure 1). Survey organizers selected three counties in each district, with at least one being urban and one being rural and all three representing North Carolina's Department of Commerce's three economic tiers of distress (North Carolina Department of Commerce, 2020). Researchers then randomly selected landowners from county parcel data obtained from North Carolina's OneMap, an online geodatabase. To be eligible to participate, landowners had to own 20 or more acres of forestland.

Survey designers based the survey itself on previous studies of NIPF owners (Bardon et al., 2007; Birch, 1996; Megalos, 1999) and using the *National Woodland Owner Survey* (USDA Forest Service, n.d.) and *Internet, Mail, and Mixed-Mode Surveys: The Tailored Design Method* (Dillman, 2014). The NCCE State Program Leader for Extension Evaluation supported survey development, NIPF landowners tested the survey, and the NC State University Institutional Review Board for the Protection of Human Subjects in Research approved the survey. Participants then received

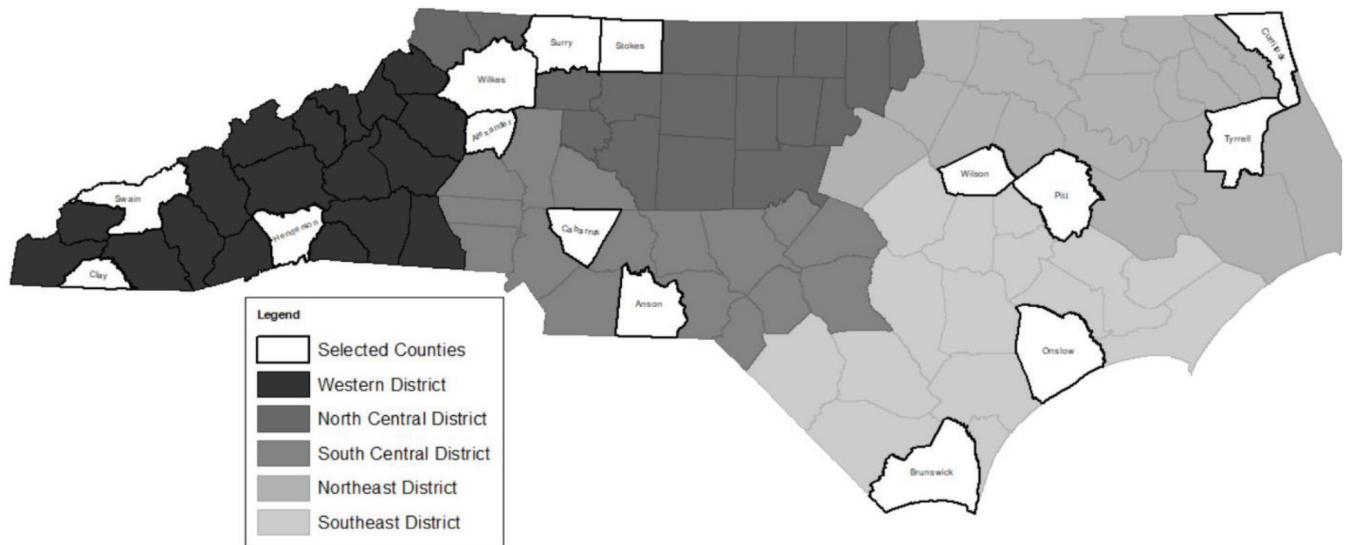


Figure 1. Selected counties within the five North Carolina Cooperative Extension districts.

the internet-based survey via Qualtrics but had the option to complete a printed version of the survey. Survey organizers administered the survey over a six-week period in June and July 2020 and notified landowners by mail. They then sent reminder cards via mail approximately two and five weeks after the initial notice of the survey.

The survey included questions about participants' reasons for owning forestland, general land ownership, current forestry knowledge, interest in various forestry topics, program delivery preferences, and socio-demographics. The survey required respondents to rank the importance of 13 reasons for owning their forestland on a 5-point Likert scale. The 13 reasons covered consumptive (e.g., timber production, hunting, grazing, medicinal, etc.) and non-consumptive (e.g., aesthetics, conservation, legacy, investment, etc.) land use.

Questions about general land ownership focused on themes such as the total acreage owned by the respondent, whether the respondent is a resident or absentee landowner, land tenure, land acquisition, type of land ownership and number of owners, the primary decision maker amongst multiple landowners, and the respondent's engagement level (based on a five-point scale ranging from unengaged to engaged). Unengaged landowners were defined as those who are aware that they own wooded land but who do nothing related to their property. Engaged landowners were those actively seeking knowledge about forestry; implementing forest practices such as timber harvesting, wildlife habitat improvement, or other activities; and possibly using technical assistance to achieve their land-related goals.

To gauge respondents' current level of knowledge and interest in 17 forestry topics, the survey authors utilized both 4- and 5- point Likert-scales. The 17 forestry topics covered environmental, economic, and social aspects of forestry.

The researchers determined participants' program delivery preferences based on three factors; respondents ranked their preferences from least to most preferred in regard to time of year (spring, summer, fall, and winter), program length (2 hours or less, 4 hours, 6-8 hours, or multiday, i.e., a weekend), and time of day for programs four hours or less (morning, afternoon, and evening). Researchers asked respondents to indicate one or more ways in which they would prefer to receive forestry information from Extension. These choices included mailed materials (e.g., brochures, factsheets, etc.), online materials (e.g., social media, website, e-newsletter, etc.), online programs (e.g., videos, seminars, self-paced courses, etc.), in-person programs (e.g., lectures, workshops, field trips, etc.), and a lack of desire to receive information from Extension. Noted socio-demographic data included each landowner's age, educational level, income, and employment status.

Researchers performed principal component analyses (PCA) on participants' reasons for owning land, knowledge level, and interest level to reduce data dimensionality and increase interpretability. They performed K-means clustering analysis using respondents' reasons for owning forestland. To investigate differences among clusters in respect to respondents' knowledge, interest, Extension programming preferences, and age, they performed one-way

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analysis of variance; for socio-demographic, land ownership characteristics, and preferred method for receiving information, they used Pearson's chi-squared.

RESULTS

The response rate for the study was 9.4%. Of the 281 returned surveys, 242 respondents completed the questions on land ownership reasons and knowledge and interest in forestry topics, and this data were utilized in statistical analysis. Analysis and summarization of general demographics and landowner comparisons included all 281 responses.

Table 1 presents the results of principal component analyses on the 14 reasons landowners may own land and on the landowners' knowledge and interest levels in 17 forestry topics. The reasons for owning land were condensed into six factors, explaining 72% of the total variance (Table 1). The 17 forestry topics utilized for respondents' current level of knowledge were condensed into three factors, explaining

65% of the total variance. Similar results were obtained for the 17 forestry topics when examining respondents' level of interest. The 17 topics were again condensed into three factors, explaining 67% of the total variance. Researchers found that forest certification was the only topic that was not strongly correlated with participants' knowledge level or interest level.

Results of a K-means analysis reduced the six factors retained from the PCA associated with reasons for owning land into four landowner clusters (Table 2). Each cluster was given a unique name corresponding to the major reasons respondents reported for owning their land. Legacy-oriented respondents place a very high value on family and privacy, conservation-oriented respondents indicate a high value on nature and conservation, timber-oriented respondents place a high value on timber income, and investment-oriented respondents indicate land investment and recreation as positive reasons for owning their land.

Table 1. Results of Principal Component Analyses on 14 Reasons for Owning Land, Knowledge and Interest Levels Related to 17 Forestry Topics

Component	Total variance explained	Most strongly relates to
<i>Land ownership reasons</i> (Kaiser-Maier-Olkin = 0.642, Bartlett's sphericity test - $p < 0.0001$)		
Nature & Conservation	17.4%	Non-economic reasons for owning land centered around conservation and wildlife
Family & Privacy	14.7%	Reasons for owning land that are centered around secondary income, privacy, and leaving a legacy
Land Investment & Recreation	12.3%	Land investment; recreation is also correlated and has a similar focus on land use and holding
Firewood & Vacation	10.6%	Harvesting firewood from the property for personal use or a source of income; using the property as a vacation home
Timber Income	9.5%	Timber production
Intermittent Income	8.4%	Grazing income
<i>Level of knowledge</i> (Kaiser-Maier-Olkin = 0.924, Bartlett's sphericity test - $p < 0.0001$)		
Forest Management	24.2%	Selling timber, timber taxes, forest management, management plans, government incentives, and tree planting
Nature & Environmental	22.1%	Forest health, climate change, forest soils, water quality, and wildlife habitat
Liability & Inheritability	19.2%	Passing land on to future generations, landowner liability, and heirs' property
<i>Level of interest</i> (Kaiser-Maier-Olkin = 0.924, Bartlett's sphericity test - $p < 0.0001$)		
Forest Management	27%	Selling timber, timber taxes, forest management, management plans, government incentives and tree planting
Nature & Environmental	24%	Forest health, climate change, forest soils, water quality, and wildlife habitat
Liability & Inheritability	16.9%	Passing land on to future generations, landowner liability, and heirs' property.

Table 2. Final Cluster Mean Centers of the K-Means Analysis Output Based on Respondents' Reasons for Owning Forestland

Reasons	Clusters				F-Stat
	Legacy-oriented	Conservation-oriented	Timber-oriented	Investment-oriented	
Nature & Conservation	0.15933	0.52039	0.32914	-1.25437	87.79***
Family & Privacy	2.2613	-0.38036	-0.07242	-0.1522	90.63***
Land Investment & Recreation	0.36261	-0.49418	0.31332	0.32063	15.08***
Firewood & Vacation	0.6732	0.08932	-0.16961	-0.21086	5.34***
Timber Income	0.1325	-0.40858	0.91199	-0.38079	38.13***
Intermittent Income	0.73257	0.34477	-0.63152	-0.14326	20.72***
Percent Respondents ⁺	7.8%	34.9%	22.8%	21.0%	

***Statistically significant at $p < 0.001$

+13.5% of total survey respondents did not answer the questions needed to qualify for clustering

Table 3 presents participants' levels of knowledge and interest in various categories of forestry topics by cluster. Positive standardized scores (z-scores) indicate above-average knowledge or interest levels, and negative z-scores indicate below-average knowledge and interest levels. Legacy-oriented respondents displayed a below-average level of knowledge across the various forestry topics but an above-average interest in all the forestry topics, including a particularly high interest ($z = 0.72$) in forest management topics. This cluster has the highest interest in forestry management topics of all the clusters. The conservation-oriented respondents have an average level of knowledge on all but the forest management topics ($z = -0.34$) and are most interested in nature and environment topics (z score = 0.36). They have the most interest in nature and environment topics and the least interest in forest management topics

when compared to all other clusters. The timber-oriented respondents indicate being most knowledgeable about forest management ($z = 0.26$) and nature and environment ($z = 0.22$) topics and have an average level of interest in all three topic areas. They indicate having the most knowledge on nature and environment when compared to the remaining clusters. The investment-oriented respondents indicate an above-average knowledge level ($z = 0.37$) and interest level ($z = 0.26$) in forest management topics. They indicate having less than average knowledge and interest in the remaining topic areas. Compared to the other clusters, the investment-oriented cluster has the least knowledge ($z = -0.29$) and interest ($z = -0.75$) in nature and environment topics.

Analysis of several educational program characteristics by cluster did not statistically ($p < 0.05$) identify differences in respondents' preferences, but Table 4 summarizes the

Table 3. Standard Score (Z-Score) for the Level of Knowledge and Interest in Various Categories of Forestry Topics by Cluster

Topic		Clusters			
		Legacy-Oriented	Conservation-Oriented	Timber-Oriented	Investment-Oriented
Forest Management	Knowledge Level***	-0.07	-0.34	0.26	0.37
	Interest Level***	0.72	-0.34	0.04	0.26
Nature & Environmental	Knowledge Level*	-0.11	0.10	0.22	-0.29
	Interest Level***	0.16	0.36	0.09	-0.75
Liability & Inheritability	Knowledge Level	-0.25	0.09	0.06	-0.06
	Interest Level	0.31	0.09	-0.05	-0.19

***Statistically significant at $p < 0.0001$

*Statistically significant at $p < 0.05$

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Table 4. Respondents' Preference for Educational Program Characteristics

Preference for	Clusters			
	Legacy-oriented	Conservation-oriented	Timber-oriented	Investment-oriented
Time of Year	Summer	Spring	Winter	Spring
Time of Day	Evening	Evening	Morning/Evening	Morning
Program Length	Half-day	Multi-day	Half-day	Short

highest-ranked options in each cluster for time of year, time of day, and program length based on the z-scores. Legacy-oriented respondents prefer half-day educational programs that take place in the evenings during the summer. They are mostly interested in programs focused on forest management and are least interested in topics focused on nature and the environment. Conservation-oriented respondents prefer multi-day educational programs in the evenings during the spring. They indicate the most interest in programs focused on nature and the environment and are least interested in topics focused on forest management. Timber-oriented respondents prefer educational programs that take place in the winter as half-day programs. They least prefer attending afternoon educational programs and would prefer to attend programs offered either in the morning or evening. They indicate the most interested in educational programs focused on nature and the environment and are least interested in programs focused on liability and inheritability topics.

Table 5 shows respondents' preferences for information delivery methods by cluster. The preference for mailed materials was not found statistically significant ($p = 0.087$) between clusters, but results indicate that it is likely the preferred method by two-thirds or more of the respondents in all but the conservation-oriented cluster, whose preference is to receive information through online materials or online programs. Online programs were the only information

delivery method found to have a statistically significant ($p = 0.007$) difference of preference between clusters; more than two-thirds of the conservation-oriented respondents prefer this as a delivery method compared to 50% or fewer respondents in each of the other three clusters. In-person programs as an information delivery method were preferred by about 50% of the respondents in all but the legacy-oriented cluster, in which about 41% of the respondents preferred this method for receiving information.

Data analysis indicates that respondents' major barrier to meeting their educational needs is the same across clusters (Table 6). In each of the four clusters, a lack of awareness of educational programs is the major reason respondents are not having their educational needs met. Approximately 79% or more of the respondents in each of the four clusters did not find a lack of time, distance, or a lack of interest in topics to be major hurdles to meeting their educational needs. Even though distance does not appear to be a major hurdle to meeting educational needs, investment-oriented respondents were statistically ($p = 0.051$) more likely to find distance to a program to be an obstacle in meeting their educational needs than respondents in any of the other clusters. Only 15% or fewer respondents in each of the clusters felt that they are currently meeting their educational needs.

Data analysis revealed that approximately one-third or fewer respondents in each of the clusters uses Extension

Table 5. Percent of Respondents Within Each Cluster by Preferred Information Delivery Method

Information Delivery Method	Clusters				p-value
	Legacy-Oriented	Conservation-Oriented	Timber-Oriented	Investment-Oriented	
Mailed Materials	68.2%	54.7%	73.4%	67.8%	0.087
Online Materials	59.1%	71.6%	57.8%	55.9%	0.162
Online Programs	50.0%	68.4%	48.4%	42.4%	0.007
In-Person Programs	40.9%	54.7%	54.7%	49.2%	0.627
No Information from Extension	4.5%	4.2%	0.0%	3.4%	0.434

Table 6. Reasons for Not Meeting Educational Needs by Cluster

Reason for not meeting educational needs	Clusters				<i>p-value</i>
	Legacy-oriented	Conservation-oriented	Timber-oriented	Investment-oriented	
Unaware of programs	70.0%	61.6%	62.1%	43.9%	0.419
Lack of time	5.0%	14.0%	12.1%	19.3%	0.484
Too far to attend	10.0%	5.8%	8.6%	21.1%	0.051
Topics are of no interest	0.0%	5.8%	8.6%	7.0%	0.486
Currently meets their needs	15.0%	12.8%	8.6%	8.8%	0.874

as a primary or secondary source for forestry information (Table 7). Many of the respondents, ranging from 42% to 55% between clusters, are aware of Extension as a resource but do not use this resource for forestry-specific information. Approximately one-third or fewer of the respondents in each cluster were unaware that Extension was a resource for forestry information.

Analysis of several socio-demographic characteristics indicate that in general, each cluster has a similar demographic makeup except regarding gender ($p = 0.011$) and education (0.005) (Table 8). Even though age was not statistically different at the 0.05 level, it appears there are differences among the clusters. Legacy-oriented respondents were the youngest of all four clusters; investment-oriented respondents were the oldest. Respondents in all four clusters were primarily Caucasian. Gender was significantly different between clusters, with the conservation-oriented cluster having fewer males than the other three clusters. Legacy-oriented respondents were primarily employed full time, while conservation- and investment-oriented respondents were most likely to be retired. Timber-oriented respondents were about equally split between being retired and employed full-time. The clusters had similar distributions of respondents among income brackets, with the highest percentage of respondents making \$200,000 or greater (legacy-oriented 26.3%, conservation-oriented 27.1%, timber-oriented 20.3%, and investment-oriented 23.2%). Even though education level varied among clusters, most respondents had associate degrees or higher.

DISCUSSION

Cluster analysis identified four distinct landowner groups based on their primary reasons for owning forestland: legacy-oriented, conservation-oriented, timber-oriented, and investment-oriented. Conservation-oriented respondents were the most prevalent, followed by timber-oriented, then investment-oriented, and finally legacy-oriented, in terms of acreage owned and proportion of the survey population.

Most of the respondents expressed that the main reason they were not meeting their educational needs was a lack of awareness of available programs. Additionally, a majority of respondents in each cluster did not rate Extension as their primary or secondary information source. The lack of connection to these landowners presents a challenge for Extension professionals. Until the connection to these landowners is restored through more aggressive outreach, there will continue to be a lack of engagement with this target audience.

To reach the greatest number of NIPF landowners, Extension agents should prioritize a combination of mail and electronic delivery methods, such as email or social media, delivering information on a variety of topics. If financial and technical resources are limited, the mailing and use of postcards, flyers, and newsletters could be a more cost-effective option than larger informational packets. Online delivery should include the use of newsletters, blogs, or social media as ways to reach the audience. This combined method will target the broader audience, including aging landowners

Table 7. Awareness of North Carolina Cooperative Extension as an Information Source by Cluster

Awareness	Clusters				<i>p-value</i>
	Legacy-oriented	Conservation-oriented	Timber-oriented	Investment-oriented	
Unaware	32%	29%	21%	24%	0.791
Aware, but do not use	42%	55%	44%	53%	0.760
Secondary source	16%	13%	23%	15%	0.492
Primary source	10%	3%	12%	8%	0.319

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Table 8. Respondents' Socio-Demographic Characteristics by Cluster

Socio-Demographics	Clusters				p-value
	Legacy-Oriented	Conservation-Oriented	Timber-Oriented	Investment-Oriented	
Average Age (years)	60	66	66	69	0.066
Percent Caucasian	95.0%	98.9%	98.4%	96.6%	0.643
Percent Male	85.0%	65.5%	86.9%	82.0%	0.011
Percent Retired	35.0%	51.7%	43.3%	53.4%	0.414
Percent Full-Time	60.0%	39.1%	41.7%	36.2%	0.337
Income					0.223
Less than \$10,000	0.0%	2.4%	0.0%	5.4%	
\$10,000 to \$24,999	5.3%	1.2%	0.0%	7.1%	
\$25,000 to \$49,999	10.5%	7.1%	18.6%	8.9%	
\$50,000 to \$74,999	21.1%	7.1%	20.3%	14.3%	
\$75,000 to \$99,999	5.3%	12.9%	15.3%	12.5%	
\$100,000 to \$149,999	15.8%	25.9%	13.6%	16.1%	
\$150,000 to \$199,999	15.8%	16.5%	11.9%	12.5%	
\$200,000 or greater	26.3%	27.1%	20.3%	23.2%	
Education					0.005
< 12th grade	0.0%	0.0%	0.0%	1.7%	
High school degree/GED	15.0%	2.3%	6.6%	10.3%	
Some college	20.0%	8.0%	13.1%	12.1%	
Associate degree	15.0%	6.9%	9.8%	3.4%	
Bachelor's degree	15.0%	31.0%	52.5%	37.9%	
Advanced degree	35.0%	51.7%	18.0%	34.5%	

who may not use the internet, those from rural locations who lack a stable internet connection, those who are not internet savvy, and those who may not have even heard of Extension. This combined outreach would provide the opportunity for landowners to individually request additional information by mail or encourage them to seek out additional material online. Directing more people to online resources while still providing in-person educational opportunities for those who need it is a delicate balance, yet a key aspect, in meeting the educational preferences of an array of landowners.

Since the onset of the COVID-19 pandemic, many aspects of Extension have been affected significantly, causing many, if not all, in-person county meetings and programs to be postponed or moved online. Because of this, many people who might otherwise have limited technological literacy have increased their proficiency with technology (Homan & DeRose, 2020; Fawcett et al., 2020). Encouraging

the use of online resources and webinars will create more opportunities for landowners to learn from Cooperative Extension than ever before; using mailed materials for program announcements or newsletters will keep those who are unable to use the internet from falling through the cracks. Combining these two methods will hopefully foster a better learning experience for landowners.

Landowner demographics across all four clusters are similar to those displayed in other studies (Bardon et al., 2007; Butler et al., 2020; Measells et al., 2006; USDA Forest Service, 2021). The response rate of this study was better than the 2013 and 2018 NWOS surveys for North Carolina (Butler & Butler, 2016; USDA Forest Service, 2021), but was lower than the previous needs assessment by 7.9% (Bardon et al., 2007). The COVID-19 pandemic could be the main reason for the lower response rate, as we administered the survey amidst the lingering pandemic. Due to the possibility of differences

between those who did and did not respond, the application of this survey's results may be limited. In comparison to the most recent educational needs assessment conducted of forest landowners in North Carolina, educational needs assessment of southern forest landowners, and the National Woodland Owner Survey, landowner socio-demographics and reasons for owning land seem to be similar across the studies, indicating that the study is applicable (Bardon et al., 2007; Measells et al., 2006; USDA Forest Service 2021).

CONCLUSION

North Carolina Cooperative Extension (NCCE) focuses their efforts and resources on assisting their target audiences. A periodic needs assessment survey informs Extension professionals of the changing dynamics of their target audiences, their knowledge level, interests, and preferred outreach methods. The primary target audience for NCCE forestry's educational outreach and programs are non-industrial private forest (NIPF) landowners. Previous studies have focused on specific aspects of NIPF landowners within North Carolina, such as their preferred delivery methods, current land management activities, or their responsiveness to forestry incentives, and the last comprehensive survey on North Carolina NIPF landowners and their educational needs was conducted in 2007 (Bardon et al., 2007). This study identified the learning gaps of the NIPF landowners in North Carolina, the delivery method preferences of NIPF landowners, and any barriers for NIPF landowners in terms of meeting their educational needs.

The identification of the four distinct clusters based on respondents' reasons for owning forestland has shown that there are differences amongst the general population in current knowledge of and interest in various topics. The findings of this study provide Cooperative Extension agents and educators with clear guidance in designing and delivering Extension programs that meet the educational needs of NIPF landowners.

Cooperative Extension educators can create a more impactful and dynamic educational experience for NIPF landowners by utilizing their stated preferences. Acknowledging the differences and associations between landownership values, characteristics, and educational preferences will allow for the continual improvement of programs and the consistent meeting of educational needs. Using targeted delivery methods to disseminate information about a variety of forestry topics allows for a more efficient and cost-effective process, ultimately creating more room for growth and engagement of landowners in managing their forestland sustainably.

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