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Attitudes and knowledge of forestry by high school agricultural education teachers in West Virginia

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ABSTRACT

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by High School Agricultural Education Teachers in West Virginia

Kristin R. Lockerman Friend

The purpose of this study was to determine the attitudes and knowledge of high school agricultural education teachers in West Virginia towards forestry. A descriptive research design was used for this study. Of the 86 West Virginia high school agricultural teachers selected for this study 40 teachers responded for a response rate of 47%. Of the responding teachers 85% wanted or needed more information on forestry. Also 57% of the responding teachers had not taken any other formal forestry training besides their college course work. When respondents were asked to react to the following statement: "agricultural education teachers need more training in forestry", they agreed.

"The products of the forest are among the things which civilized man can not do without. Wood is needed for building, for fuel, for paper pulp, and for unnumbered other uses and trees must be cut down to supply it. It would be both useless and mistaken to try to stop the cutting of timber, for it could not cease without great injury, not to the lumberman only, but to all the people of the nation. The question is not of saving trees, for each tree must inevitably die, but of saving the forest by conservative ways of cutting the trees."

~ Gifford Pinchot, 1905

DEDICATION

I would like to dedicate this thesis to my grandparents, Andrew and Virgie Forkal, who have passed on, but have instilled in me an appreciation for where my food comes from. If it was not for their involvement in the dairy cattle business I doubt I would have explored the field of agriculture and have taken such an interest in it. From them I learned about hard work, its payoffs, and the struggles of farmers even today. Their love and support for me were always evident and I know they would be proud of me today.

ACKNOWLEDGEMENTS

This thesis is the hardest thing I have ever had to do academically and it would never have been completed if it were not for the help of some very special people:

All of the West Virginia agricultural education teachers who took time out of their busy schedules to be a part of this research effort. If it were not for you this would not have been possible.

My parents, Ronald and Andrea Lockerman and my sister Michelle Lockerman for their continuous support of me in all of my adventures over the years, for instilling in me the idea that anything can be accomplished if you put your mind to it, and their love.

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My committee, Dr. Harry Boone, Dr. Deborah Boone, and Mr. William Grafton who provided much food for thought, numerous resources, statistical guidance and help, and most importantly their time.

My officemate, Kofi Nkansah who worked the long and lonely second shift with me on a weekly basis.

And last, but not least, my husband, Kyle Friend who held off starting our life together till I finished my thesis. Thank you for always being supportive, thoughtful, and helpful through this journey.

Thank you everyone!

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CHAPTER I

Introduction

West Virginia is one of the few states that can say that their state was built on wood. The timbering of West Virginia's forests was a large part of a momentous and booming time period in the state (1770-1920). Clarkson (1964) explains the life of a lumberjack in the following passage:

> The lumberjack's life was a hard one. He was up long before daylight, ate his breakfast, and was in the woods ready to cut timber often before it was light enough to see where the tree would fall. For the next 10 hours, with only a short rest at lunch time, he lived for one purpose-to fell, buck, and skid timber. He returned to camp at dark, ate a huge supper, relaxed a little, then lay his aching body in a crude bunk for a well-deserved rest. Six days a week he toiled; on the seventh day he played poker, repaired his team's harness, sharpened his ax, or visited a neighboring camp. (p.78)

All over West Virginia this took place as the whole state was timbered to make room for towns and houses. A.B. Brooks (1910) mentioned:

> It is not known when or where the first sawmill was built and operated in West Virginia. It is probable, however, that there were a few built by the early settlers who occupied the valleys of the Potomac river and its tributaries prior to the year 1775. No records have been examined that confirm or deny this statement, but it is reasonably safe to say that there were a dozen rude water mills in the territory now occupied by Jefferson, Berkeley, Morgan, Hampshire, Hardy, Grant, and Pendleton counties as

> early as 1775, and that the number had increased to five or six times as many by the year 1800. There may have been more at each date. A record dated in the year 1810 states that there were about 50 saw mills running in Berkley county alone at that time. (p.58)

Clarkson (1964) points out that "The first saw mill west of the Allegheny Mountains was built in 1776 near the town of St. George in Tucker County by John Minear" (p.15). The national census between 1850 and 1920 showed that the lumber industry was the largest manufacturing industry of that time except for meat-packing, iron and steel, and flour and gristmills (Gillespie, 2001). This trend continued, and in 1850 the lumber industry was the second largest industry in the country after flour manufacturing (Gillespie, 2001). Peak production was reached in 1909, when a record of 1,473,000,000 board feet was produced; for 5 years after the record production year there were over a billion board feet produced annually (Widner, 1968). Production rates started to decline there after, and in 1920 production was half of what it was in 1909, thus ending the tumultuous timbering time period in West Virginia (Widner, 1968).

The forestry industry is important to West Virginia not only historically but economically as well. West Virginia's economy is dependent on the forestry industry in the state. Childs (2005) points out:

> The economic impact of the wood products industry in West Virginia exceeds $4 billion dollars annually…All of this activity generates significant tax revenues for the state, including $45.4 million in timber severance taxes, consumer sales taxes, personal income taxes, corporate net income taxes, and business franchise taxes. (p.9)

The USDA Forest Service (2007) reports that 260,000 residents (14% of the state's population) own forest land. Over 87% of the state's forest land is owned by private individuals and enterprises (Widmann, Dye, & Cook, 2007). West Virginia is the third most forested state in the United States, with 12 million acres of forest land which covers 78% of the state (Griffith & Widmann, 2000). Forestland by county, within the state ranges from 43.7% to 93.5 %, with forestland being present in all 55 counties (Childs, 2005). It is also the second leading hardwood state in the country; it is second only to Pennsylvania (Childs, 2005). "There are 181 sawmills, 3 veneer mills, 18 rustic fencing mills, 58 dry kilns, 11 pressure-treating plants, 3 engineered wood products plants, and several commercial firewood producers in the state"(Milauskas, 2002, ¶ 1). Wood accounts for one fourth of the industrial raw material used in the United States today (Gillespie, 2001). "There is no doubt that West Virginia's forests are a critical link to West Virginia's future" (Childs, 2005, p. 14).

Throughout the United States the Department of Interior and the Forest Service employ over 90,000 people (Mason, 2005). Mason (2005) also states that by the year 2007, approximately one-half will retire. It is important that these positions within the Department of Interior and the Forest Service are filled with qualified individuals who are highly educated in the field of forestry. The forestry industry was reported this year as having over 11,000 employees, in private and government employment in West Virginia (USDA Forest Service, 2007). "Increased awareness of the many benefits and services provide by forests, including many forest-related jobs, has brought new attention to the condition of West Virginia's forests" (Widmann et al., 2007, p. 1).

If forestry in this state is to continue, forestry education must be better promoted in schools. Teachers are the best way to educate the public on forestry. High school agricultural teachers influence the career choices of their students. Because many students make their career choices in their pre-college years, forestry education must start at the high school level in order to provide an interest before college (Schlosser, 1988). To be effective in counseling students, teachers must also be knowledgeable of the forestry industry. In 1963, Dana and Johnson commented that if the forestry industry is going to continue to employ the best students that counselors and teachers need to be better informed and that foresters need to do more recruiting with current information. Teachers in the state are teaching forestry but need better means to connect the material to the students. As stated by Ron Hudson, an agricultural education teacher in the state,

> I am looking for some help with my Forestry 1 class. I need to revamp the entire course. Grades on end of course test have dropped in the past few years. I am planning to start over with what I teach. If any one can either e-mail me or bring to winter conference this weekend, what they are using or pointers or anything it would be appreciated (personal communication, January 24, 2007).

Teachers who are responsible for teaching about natural resources like forestry need to have access to updated information if they are going to provide the best education to their students. As stated by Cheatham (1986):

> Vocational agricultural teachers and administrators who work with natural resources programs face difficult but exciting challenges in providing students with knowledge, problem-solving, and thinking skills that will

> allow them to deal with the complex problems relating to the natural resources areas of the future. As professional educators, the thought of carrying out this important assignment without being at the cutting edge of new knowledge and technology in the natural resources area is simply unthinkable. (p. 4)

Because of the relationship between agricultural education and forestry it is important to know agricultural teachers attitudes and knowledge of forestry. Measells, Grado, and Capella (2003) found the following:

> Teachers educate students on the history, economy, and environment of the state and espouse their values, attitudes, and perceptions on various topics to students. Teachers also have an influence on family, friends, and the community. Therefore, it is important for the forestry community to effectively communicate and educate public school teachers on the importance of forestry and forestry industry to society, the state's economy, and the environment. This approach has merit for any state that depends on forestry for economic and environmental sustainability. (p. 436)

Stump (1986) proposes that agricultural education teachers are not teaching forestry in-depth because they lack proper training and experience to teach the subject. He also points out from his own experiences as a vocational agricultural instructor that to be successful in teaching forestry, the teacher must show enjoyment in teaching it to his students (Stump, 1986).

It is unknown exactly when and for how long forestry has been taught in the state at the high school level as part of vocational agricultural education. True (1929) reports that at a meeting of the Association of American Agricultural Colleges and Experiment Stations in 1909, a report was read which concluded that "agriculture, including horticulture, and forestry, should be a regular part of public secondary education" (p. 332). This infers that forestry was considered a part of agriculture as far back as 1909. It is known that with the passing of the Smith-Hughes National Vocational Education Act of 1917, funding of $7.2 million was allotted annually to establish vocational education in public high schools (Mobley, 1964). Vocational agriculture education in West Virginia started with the employment of vocational agriculture teachers at nine high schools in the fall of 1917 (Wayman, 1971). Later the Vocational Education Act of 1963, which "is the most comprehensive vocational-education program to become law in the history of our country" would authorize permanent federal assistance to vocational education, of $108.5 million in 1965, in addition to appropriations already given under other laws (Mobley, 1964).

Mike Burns, agricultural education teacher at Pocahontas County High School in Dunmore, West Virginia and National FFA Forestry career development event (CDE) committee member, stated that the West Virginia FFA forestry CDE started in October of 1986 and at a national level in 1985 (personal communication, November 29, 2007). It can only be inferred that this was because it was being taught in the schools. Burr (1964) stated that it is common for only very large schools to be able to offer many occupational-training programs, making it very unusual for smaller schools to be able to offer many different programs. Currently (1988-2006) there is a declining trend in

participation by schools in the FFA forestry career development event. School participation levels range from a maximum of 31 schools to a minimum of 18 schools. Student participation has a range of a maximum of 110 students and a minimum of 66 students (West Virginia State Agriculture, Career Development Events, Individual and Team Results, 2006, 2005, 2004, 2003, 2002, 2001, 1999, 1998, 1997; West Virginia State, Agricultural Judging Contests, Individual and Team Results, 1996, 1995, 1994, 1993; West Virginia State, State Vo-Ag Judging Contests, Individual and Team Results, 1992, 1991, 1990, 1989, 1988).

Statement of the Problem

Since 1995, national enrollment in natural resource science programs at universities has declined by 40% (Mason, 2005). Lukert (2006) showed a decline in enrollment in forestry at colleges and universities around the country while other natural resources programs have rising enrollments. There has been limited research conducted regarding this decline or forestry education at the high school level. Agricultural education teachers' attitudes and knowledge may have an effect on whether or not this subject is taught and to what degree. By surveying agricultural education teachers on their attitudes and knowledge of forestry, some insight as to why there is a decline nationally among university enrollment of natural resource students might be identified.

There have been many studies on other relevant groups in the forestry industry such as service foresters, landowners, and the public (Bliss, Nepal, Brooks, & Larsen, 1994; Joshi, Arano, Collins, McGill, & Moss 2007; Manning, Valliere, & Minteer, B, 1996; McGill, Pierskalla, Jennings, & Grushecky, 2006; McGill, Westfall, Gartin, O'Dell, & Boone, 2004; Shindler, List, & Steel, 1993). However, there have not been

any studies of forestry or the forestry industry that have included the knowledge and attitudes of high school teachers relevant to the state of West Virginia. This study develops a baseline of the knowledge that agricultural education teachers possess in relation to forestry and how much of that knowledge they are sharing with their high school students.

Purpose of the Study

The purpose of this study was to describe West Virginia agricultural education teachers' attitudes and knowledge of forestry. Evaluating their attitudes and knowledge towards forestry will determine whether or not supplemental forestry training should be made available for agricultural teachers, might determine their interest in forestry, their capacity and ability to teach, and how aggressive they might be in building and supporting a forestry education program at their school.

Objectives of the Study

The primary objective of this study was to determine attitudes and knowledge of West Virginia agricultural education teachers towards forestry. The second objective was to evaluate how attitude and knowledge differs among selected demographic characteristics. The following research questions were used to guide this study:

1. What attitudes did the agricultural education teachers have towards forestry?
2. What knowledge of forestry did the agricultural education teachers possess?
3. What role did demographics play in attitudes and knowledge?
4. How many forestry courses did agricultural education teachers complete in college?
5. How many forestry related classes do agricultural education teachers teach?

Limitations of the Study

This study was limited to West Virginia high school agricultural education teachers who taught during the 2006-2007 school year.

Definition of Terms

Angiosperms- Plants that have seeds enclosed in an ovary; includes the group of trees generally broad-leaved and deciduous (Sharpe, Hendee, & Sharpe, 1986).

Best Management Practices (BMPs)- Methods, measures or practices designed to prevent or reduce water pollution (Gillespie, 2001).

Board foot (bdft)- A 12 inch square of lumber one inch thick (Gillespie, 2001).

Bucking- Cutting trunks of trees into specified lengths after felling (Sharpe et al., 1986).

Cull- Unmerchantable tree (Gillespie, 2001).

DBH- Diameter at breast height, 137 cm or 4.5 feet above ground (Sharpe et al., 1986).

Diameter-limit- Harvest based on the cutting of all trees over a specified size. This is an economic cut and is not recognized as one of the science-based silvicultural systems (Gillespie, 2001).

Forest Management- Application of science-based techniques and modern business methods in managing forest property (Gillespie, 2001).

Forestry- The science, the art, and the practice of managing and using for human benefits the natural resources that occur on and in association with forestlands (Sharpe et al., 1986).

Girdling- Cutting through a tree's bark deep enough to interrupt the flow of food to the roots and causing death of the tree (Sharpe et al., 1986).

Gymnosperms- A large group of plants, including trees, producing seeds not enclosed in an ovary; generally cone-bearing evergreens, in the instance of trees (Sharpe et al., 1986).

Hardwood- A milling classification, referring to wood produced from deciduous trees, such as oaks and maples (Sharpe et al., 1986).

Invasive species- Non-native organism that has invaded a native plant or animal habitat (Gillespie, 2001).

Mensuration- An adapation of mathematics to the measurement of forested areas, of single trees and of logs, of total biomass, and of other units of forest products (Sharpe et al., 1986).

Nonindustrial private landowner- A term, coined in recent years, for that disparate group who own 58 percent of private commercial forestland; these lands are usually limited in extent, as compared with industrial holdings (Sharpe et al., 1986).

Peavy- A hand tool for turning logs (Sharpe et al., 1986).

Saw log- Log acceptable for sawing into lumber. Usually defined as being above 11.1 inches DBH (Gillespie, 2001).

Scaling logs- Determining the volume of logs before they are converted into lumber or other wood products (Sharpe et al., 1986).

Selection cutting- The removal of certain individual trees of an existing stand to provide space for reproduction, creating a seedling environment strongly influenced by the remaining stand and leading to a stand with several age classes (Sharpe et al., 1986).

Silviculture- The applied science of reproducing and manipulating a forest in order to fulfill stated management objectives (Sharpe et al., 1986).

Snag- Standing, broken portion of a tree (Gillespie, 2001).

Wolf tree- A vigorous dominant tree with a broad spreading crown that may extend all the way to the ground; usually grows in an open area. These characteristics make such a tree of limited value for timber, but it has interpretive and wildlife habitat potential (Sharpe et al., 1986).

CHAPTER II

Review of Literature

The researcher found only one study, *Assessing Attitudes and Preferred Communication Methods toward Forestry from a Statewide Survey of Mississippi Public School Teachers* by Measells et al. (2003) that was similar to the current study being undertaken. Therefore the literature reviewed provides a framework for the study and does not show numerous previous studies that are like the current study. As stated before, this area of research has not been investigated before in the state of West Virginia and the goal of the research is to develop a baseline of information to be used in future studies. The reviews that follow show the progression of forestry education and how it evolved over time with some samples of current situations.

Forestry Education in the United States

The study of forestry in the United States is a relatively new subject, having only been around since the late 1890s. It was practiced for centuries in Switzerland, Germany, and other European countries before it was brought to America (Brooks, 1910). There are three men that can be credited with founding American forestry education including Gifford Pinchot, Bernhard Fernow, and Carl Alwin Schenck (Miller & Lewis, 1999). Schenck founded and directed the first school of forestry in the United States, the Biltmore Forest School. It was founded in 1898, and offered a one year degree program for high school graduates to gain experience as lumbermen. Just weeks after the opening of the Biltmore Forest School, Cornell University added a four year forestry degree to the curriculum, making it the first university program. Bernhard Fernow headed the School of Forestry at Cornell. In 1900, Yale University following a large donation by the

Pinchot family opened the doors to the Yale University Forestry School. The school offered a two year degree in forestry that lead to a master degree of forestry (Forest History Society and the Appalachian Consortium, 1974). These schools were at the forefront of the professional forestry education movement. Many universities followed these model schools in developing their own forestry schools. Classes in forestry began at West Virginia University in 1935, with their first class graduating in 1939 (Carvell, 1998).

A little over a decade later, since the first forestry schools were founded, forestry concepts were being taught on a small scale to elementary and secondary schools. It has been reported that in 1909, "every graded school in Washington (D.C.) and a large number of the rural schools in Pottawattamie County, Iowa were then teaching the elements of forestry" to their students (Pinkett, 1970, p. 88).

Enrollment in Natural Resources at Universities

Forestry education once booming in the United States, is now at a standstill or at a slight decline as many students are choosing to take other career paths. Lukert (2006) showed a decline in enrollment in forestry at colleges and universities around the country while other natural resources programs had rising enrollment. Some concerns facing forestry education today are declining numbers of enrollment in forestry schools and not enough support of forestry education (Food and Agriculture Organization of the United Nations, 2003). Since 1995, national enrollment in natural resource science programs has declined by 40% (Mason, 2005). The problem of recruitment is not new to the industry as recruiting has always been overlooked. "Forestry schools have done relatively little active recruiting of high school graduates" (Duncan & Kaufert, 1960, p. 28). The Food

and Agriculture Organization of the United Nations (2003) made the statement that "responding to changes in how forests and forestry are perceived is also one of the most important challenges for forestry education in developed countries" (p. 33).

How do Students Learn about Natural-Resource Careers?

A study was conducted in Ohio public schools to determine how students learn about careers, especially those in natural resources (Washington & Rodney, 1986). Over 1,500 students in sixth, ninth, and twelfth grades of varying ethnic, gender, and socioeconomic backgrounds were given a questionnaire. The results showed that black students obtained information about careers mostly from television and that white students got most of their information from printed material. It was also determined that parents and teachers are good sources of career information for all students. The students recommended that employers start an intensive marketing campaign mostly on television to recruit. The results of the questionnaire also suggest heavy recruiting in schools and colleges, offering scholarships, and increasing salaries as good ways to increase interest in natural resources (Washington & Rodney, 1986).

Reinventing Career Education and Recruitment in Agricultural Education for the 21st Century

Students in a rural New York state community were surveyed on their interest in agriculture careers and also those in a broader field of agriculture. Over 400 students in a rural middle school were given the questionnaire. The questionnaire's main objectives were to identify occupations of interest of participants and assess participants' awareness of the relationship between various occupations and agriculture. The results of the study show that only 8% of students were interested in careers in agriculture and that the other

participants were mostly interested in occupations that were projected to be in high demand such as teachers, engineers, and computer personnel. It was also found that the students interested in careers in agriculture thought it was important to stay close to home. Further investigation showed that those students would have opportunities to further their agriculture education and obtain careers in agriculture within their home communities. This study further supported prior research in stating that most students perceive agriculture to be primarily farming and ranching and cannot relate it to the broader field of agriculture (Conroy, 2000).

Teenagers Thoughts on Natural Resources Management Careers

A recent study conducted explored teenagers thoughts on natural resources careers. The study showed that the occupation of forester was the least attractive natural resources management career and that the field of forestry had a very low recognition level in terms of career opportunities by teenagers (Hager, Straka, & Irwin, 2007). Only 15% of the students surveyed reported that they had been offered information on natural resource careers by their guidance counselors (Hager et al., 2007). Hager et al. (2007) states:

> The results show that high school students are very interested in environmental and natural resource issues, but that does not translate into interest in natural resources careers. There is a disconnect somewhere in the system and it is obviously information based. High school students have little exposure to exactly what these careers involve. (p. 98)

Attitudes towards Forestry of Public School Teachers

A study was conducted in Mississippi on the attitudes and preferred communication methods towards forestry of public school teachers. They found that "overall most teachers had either a 'Positive' attitude (45%) or a 'Somewhat Positive' attitude (25%)" in response to questions on their personal attitude toward the forest industry (Measells et al., 2003). In the study teachers listed the newspaper and television as the top means to which they received forestry information. Respondents were also asked if they thought forestry education would be beneficial to students, 97% of the respondents said yes (Measells et al., 2003).

CHAPTER III

Methodology

Purpose of the Study

The purpose of this study was to describe West Virginia agricultural education teachers' attitudes and knowledge of forestry. Evaluating their attitudes and knowledge towards forestry will determine whether or not supplemental forestry training should be made available for agricultural teachers, might determine their interest in forestry, their capacity and ability to teach, and how aggressive they might be in building and supporting a forestry education program at their school.

Specific Objectives

The primary objective of this study was to determine attitudes and knowledge of West Virginia agricultural education teachers towards forestry. The second objective was to evaluate how attitude and knowledge differs among selected demographic characteristics.

Research Questions

The following research questions were used to guide this study:

1. What attitudes did the agricultural education teachers have towards forestry?
2. What knowledge of forestry did the agricultural education teachers possess?
3. What role did demographics play in attitudes and knowledge?
4. How many forestry courses did agricultural education teachers complete in college?
5. How many forestry related classes do agricultural education teachers teach?

Research Design

To meet the objectives of the study a descriptive research design utilizing a mail survey was performed. This type of research was selected because descriptive research can be used to measure attitudes of a group towards an issue (Ary, Jacobs, Razavieh, & Sorenson, 2005). Advantages of mailed questionnaires include having the ability to reach a larger population and guarantee confidentiality which will allow for more truthful answers (Ary, et al., 2006). The natural resources field has used mail surveys widely to gather and analyze data related to forestry issues and topics (Egan, Gibson, and Whipkey, 2001; Joshi, et al., 2007; Manning, Valliere, & Minteer, 1996). Descriptive research was the best choice for this study because it is the most effective way to utilize the resources available to conduct the study.

Population

The target population of this study was high school agricultural education teachers in West Virginia that were employed during the 2006-2007 school year. The list of high school agricultural education teachers was obtained from the *West Virginia Secondary Agricultural Teachers and Schools Directory 2006-2007*. The accessible population contained 86 agricultural education teachers. To prevent frame error only official directories were used. A census was used to avoid errors of sample and selection, to eliminate the sampling procedure, and to obtain as many respondents as possible.

Instrumentation

The instrument used in this study was original material developed by the researcher. It was comprised of 99 questions made up of Likert type questions, open-

ended questions, close-ended questions, and questions that used checklists. The instrument was divided into 3 major segments; knowledge of forestry, attitudes towards forestry, and willingness and past participation in supplemental forestry training.

Reliability. Reliability was established by the final data set from all respondents. The instrument contained both ordinal and nominal data so the split-half test procedure was used. The split-half procedure is the process of splitting the total items on the instrument and the scores on the two halves are correlated to estimate reliability for the total instrument (Carmines & Zeller, 1979). The instrument was found to have exemplary reliability with a coefficient of .95 (Robinson, Shaver, & Wrightsman, 1991).

Validity. The revised instrument was reviewed by a panel of experts to establish its content and face validity. The panel of experts included faculty members from the West Virginia University Division of Forestry and Natural Resources and the Division of Resource Management. Each expert on the panel has experience in research and data analysis. The panels of experts agreed that the instrument possessed both content and face validity.

Data Collection Procedures

The tailored design method of Dillman (2000) was followed when data was collected. The instrument was sent to 86 West Virginia high school agricultural education teachers as a census. A census of intangibles, attitudes and knowledge was used because responses to questionnaires can approximate intangibles (Ary, et al., 2005). The six basic steps involved in survey research as stated by Ary, et al. (2005) planning, defining the population, sampling, constructing the instrument, conducting the survey, and processing the data, were used in this study.

The instrument, cover letter, and follow up cover letter were submitted to the West Virginia University (WVU) Institutional Review Board (IRB) for the Protection of Human Research Subjects on March 16, 2007. One week prior to the questionnaire mailing, a pre-questionnaire was sent by email was sent to all subjects informing them of the upcoming study. The cover letter, instrument, and stamped self-addressed envelope were sent to all of the respondents on April 23, 2007 (see Appendix C). The cover letter stated the purpose of the study, the condition that confidentiality would be maintained as much as possible, that subjects have the right to skip questions and participation is voluntary, that a coding system would be used to check for non-response, and that the survey was endorsed by the researcher and a committee member (see Appendix A). Included in the mailing was a package of microwaveable popcorn to show appreciation to the participants. Jobber, Saunders, and Mitchell (2004) found that response rate increased on average by 15% when any incentive was given, no matter the value, in the first mailing. When incentives are given to participants, a feeling of obligation to return the survey is evoked (Ary, et al., 2005). Subjects were not asked to identify themselves however; surveys were encoded with a number to measure non-response error. The deadline for submittal of completed questionnaires was May 8, 2007.

A second packet including a follow up cover letter, instrument, and pre-postmarked envelope were sent to all non-respondents on May 14, 2006 (see Appendix B). A new deadline was set for May 30, 2007. A reminder email was sent to all non-respondents on May 30, 2007 asking them to please respond and offered another (electronic) questionnaire to those that might have misplaced the original. Early and late

respondents were recorded as such. All of the data collected from the early respondents was separated initially from the data of the late respondents.

A second correspondence which included a postage paid postcard with one research question was sent to all non-respondents (n=38) on September 5, 2007 (see Appendix O). Initially 47 respondents had not responded, but by the time the postcards were sent out, 9 of them had left the teaching profession. Respondents were asked to "mark the answer that best describes how forestry was taught in your program in 2006-07 school year." This step was necessary to explain high non-response rate with the initial questionnaire. Subjects were not asked to identify themselves however; surveys were encoded with a number to measure non-response. The deadline for submittal of the postcard was September 25, 2007.

Analysis of Data

Returned questionnaires were visually verified with each respondent's identification number and entered into an Excel spreadsheet. The data were transferred to the computer version of the Statistical Package for the Social Sciences (SPSS). The level of significance was set a priori at $\leq .05$ for all statistical tests. Data analysis procedures included frequencies, percentages, and means to describe the population.

Early and late response error was dealt with by comparing those that responded early and those that responded late. Non-response error was dealt with by comparing late respondents to early respondents, because "non-respondents are similar to late respondents" (Ary et al., 2005, pg.439). The early and late respondents were compared using the Chi-square on years of teaching experience (p=.578), amount of college courses in forestry taken (p=.455), and other training in forestry taken by the respondents

(p=.150). To determine if early and late respondents differed in their attitudes and knowledge of forestry an independent t-test was used. No significant difference ($\alpha \leq .05$) was found between the two groups. No difference was found therefore generalizations could be made to the entire population, however, due to the low response rate generalizations were limited to the population of respondents.

Use of Findings

The findings will be used to determine the base level of knowledge and attitudes of forestry by West Virginia high school agricultural education teachers. The information will be useful in determining in-service opportunities for teachers and making recommendations on expenditures for forestry related equipment.

CHAPTER IV

Findings

Purpose of the Study

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5. How many forestry related classes do agricultural education teachers teach?

Findings

The accessible population was comprised of 86 high school agricultural education teachers in West Virginia. Forty questionnaires (46.5%) were returned. The final data set consisted of 40 (46.5%) useable questionnaires.

Demographic Data

Of the agricultural education teachers that responded to this study, 31 respondents (77.5%) were male and nine respondents (22.5%) were female (see Table 1). Respondents were asked to report the number of years they had taught agricultural education. Reported years of teaching experience ranged from two to 43 years, with a mean of 18.8 (*SD*=10.7) (see Table 2). Of the 40 respondents six (15.0%) indicated that they had been teaching for 1-5 years and six for 6-10 years. Four respondents (10.0%) were represented in each of the 11-15 years and 16-20 years categories. The mode category with 14 respondents (35.0%) was 21-30 years, and six respondents (15.0%) indicated that they had been teaching for 31 years or more (see Table 3). Hence, the distribution of teacher residency times is skewed positive by the higher number of teachers with longer tenure. The education level of the teachers was comprised of those that had earned bachelor degrees and those that had earned both bachelor and masters degrees. Forty respondents (100.0%) reported that they had earned a bachelors degree. Of these, twenty-six respondents (65.0%) reported that they had gone on to earn a masters degree. There was no doctorate degrees reported (see Table 4).

Table 1

Gender of Agricultural Education Teachers (N=40)

	n	*%*
Male	31	77.5
Female	9	22.5

Table 2

Years of Teaching Experience of Agricultural Education Teachers

	M	*SD*	Min.	Max.
How many years of teaching experience do you have?	18.83	10.74	2	43

Table 3

Teaching Experience of Agricultural Education Teachers in Years

	n	*%*
1-5 years	6	15.0
6-10 years	6	15.0
11-15 years	4	10.0
16-20 years	4	10.0
21-30 years	14	35.0
31 and over years	6	15.0

Table 4

Education Level of Agricultural Education Teachers

	No		Yes	
	n	%	*n*	%
Bachelor's	0	0	40	100.0
Masters	14	35.0	26	65.0
Doctorate	0	0	0	0

Agricultural Education Teachers Forestry Training

The teachers were asked to report the number of college courses in forestry they had taken. Twenty-three respondents (57.5%) reported that they had taken less than two college courses in forestry. Thirteen respondents (32.5%) had taken 3-5 courses and two respondents (5.0%) had taken 6-10 courses. One respondent (2.5%) was reported in both the 11-15 courses and 16+ coursescategories (see Table 5). Twenty-three respondents (57.5%) had no other training in forestry. Seventeen respondents (42.5%) had other training in forestry (see Table 6). Respondents were also asked to list the types of events along with contact hours in which they had received forestry training. Some of the areas that respondents had received forestry training included forest fire fighting, lumber grading, and chainsaw use. For a full list of training areas see Appendix D.

Table 5

College Courses in Forestry Taken by Agricultural Education Teachers

	n	%
Less than 2	23	57.5
3-5	13	32.5
6-10	2	5.0
11-15	1	2.5
16+	1	2.5

Table 6

Other Forestry Training Taken by Agricultural Education Teachers

	n	%
No	23	57.5
Yes	17	42.5

Demographics of Schools

Respondents were asked to report the population numbers for their school, agricultural science program, and forestry program, as well as the number of acres of forest land available to their school and the classes with a forestry component. The student enrollment of schools for 2006-2007 ranged between 130 and 1800 students with a mean of 809.3 (*SD* = 486.0). Agricultural science program enrollment for 2006-2007 ranged from 14 to 400 students with a mean of 134.0 (*SD* = 91.0). The number of students in forestry for the 2006-2007 school year ranged between 0 and 115, with a

mean of 19.1 (*SD* = 23.0). Acres of forest land available to schools ranged from 1 to 12,000 with a mean of 709.0 acres (*SD* = 2737.0) (see Table 7).

Twenty-four respondents (63.2%) reported that they did have forest land accessible to their school. Fourteen respondents (36.8%) reported that their school did not have access to forest land (see Table 8).

Respondents were asked to indicate all of the courses they teach from a list of courses with a forestry component. Twenty-five teachers (64.0%) reported that they teach Agriculture and Natural Resource Management II. Twenty respondents (51.3%) reported that they teach Forestry I. Nineteen respondents (48.7%) teach Agriculture 11. Sixteen respondents (41.0%) reported that they teach Agriculture 12 and other. Respondents who marked "other" were also asked to list those courses. Of the respondents that had marked other, five teachers taught Agriculture and Natural Resource Management I with a forestry component. Other courses that respondents had included in the "other" category were horticulture, wildlife management, and wildlife & forestry management. For a full list of "other" courses see Appendix F. Twelve respondents (30.8%) taught Forestry II. Five respondents (12.8%) taught Forestry III, four respondents (10.3%) taught Forestry IV, and three respondents (7.7%) taught forestry science and ecology. Forestry V was not reported by any of the respondents (0.0%) (see Table 9).

Table 7

School Populations and Forestland Available

	M	*SD*	Minimum	Maximum
Student enrollment of school for 2006-2007	809.29	486	130	1800
Student enrollment in agricultural science program for 2006-2007	134.00	91	14	400
Students in forestry for 2006-2007	19.09	23	0	115
Acres of Forest Land	709.03	2737	1	12000

Table 8

Forestland Accessible to School

	No		Yes	
	n	%	*n*	%
Forest land accessible to school	14	36.8	24	63.2

Knowledge Level of Forestry Skills by Agricultural Education Teachers

Respondents were asked to rate their knowledge on skills related to forestry. The areas that respondents most frequently reported having "no knowledge" included mensuration and silviculture. The specific areas included calculating bdft volume using a clinometer (*n*=13, 34.2%), recording volume using advance tally sheets (*n*=10, 27.0%), selecting and marking trees for thinning using the d+6 rule (*n*=10, 26.3%), and calculating bdft volume using a diameter tape (*n*=9, 24.3%) (see Table 10). The skills respondents were least likely to report "no knowledge" of included tree parts and their functions (*n*=0, 0.0%), evaluation of water quality (*n*=1, 2.6%), careers in forestry (*n*=1,

2.6%), tree species identification by leaves (*n*=1, 2.6%), monitoring water quality in accordance with BMPs (*n*=1, 2.6%), tree species identification by fruit (*n*=1, 2.6%), and tree species identification by wood sample (*n*=1, 2.6%) (see Table 10).

Table 9

Number and Percentage of Respondents Reporting to Teach Various Forestry-Related Courses

	Do you teach this course?			
	No		Yes	
	n	%	*n*	%
Forestry I	19	48.7	20	51.3
Forestry II	27	69.2	12	30.8
Forestry III	34	87.2	5	12.8
Forestry IV	35	89.7	4	10.3
Forestry V	39	100.0	0	.0
Forestry Science and Ecology	36	92.3	3	7.7
Agriculture and Natural Resource Management II	14	35.9	25	64.1
Agriculture 11	20	51.3	19	48.7
Agriculture 12	23	59.0	16	41.0
Other	23	59.0	16	41.0

The topics respondents reported having "read about" included non-timber forest products, knowledge and understanding of fire behavior, forest fire suppression methods, and identification of common tree pests. Seventeen respondents (44.7%) reported having read about non-timber forest products. Knowledge and understanding of fire behavior

was “read about” by 16 respondents (42.1%). Forest fire suppression methods was “read about” by 15 (40.5%) of the respondents. Fourteen respondents (37.8%) have read about the identification of common tree pests. Skills that were reported to be “read about” by the fewest respondents were estimating tree height, tree parts and their functions, pacing to determine a linear distance, and tree felling using a chainsaw. Two respondents (5.3%) reported reading about estimating tree height. Tree parts and their functions were “read about” by 3 respondents (7.7%). Three respondents (7.9%) reported having read about both pacing to determine a linear distance and tree felling using a chainsaw (see Table 10).

The topics most frequently reported by respondents as “had seen performed” included wood processing, forest fire protection methods, and using a GPS unit. Twelve respondents (31.6%) reported having seen wood processing being performed. Both forest fire protection methods and the use of a GPS unit were seen performed by 10 respondents (26.3%). Skills that respondents reported in the “had seen performed” category the fewest times were principles of chainsaw use, chainsaw maintenance techniques, tree growth, calculating bdft volume using a diameter tape, careers in forestry, identification of forest fire fighting tools, comparing and contrasting wolf trees, den trees, snags, and culls, and tree species identification by bark. All of these skills were reported by one respondent each (2.6%) (see Table 10).

Skills the most respondents reported having performed themselves were forestry tools identification, tree species identification by bark, tree parts and their functions, principles of chainsaw use, chainsaw maintenance techniques, pacing to determine a linear distance, and tree species identification by leaves. Forestry tools identification was

reported by 21 respondents (55.3%) in the "performed myself" category. Tree species identification by bark as well as tree parts and their functions, and principles of chainsaw use was reported by 20 respondents (52.6%) in the "performed myself" category. Nineteen respondents (50.0%) reported performing chainsaw maintenance techniques, tree species identification by leaves, and pacing to determine a linear distance. Skills that were reported the fewest times in the "performed myself" category included forest fire detection methods, non-timber forest products, and forest fire prevention methods. Forest fire detection methods were performed by two respondents (5.3%). Three respondents (7.9%) reported having performed non-timber forest products. Forest fire prevention methods were performed by four respondents (10.5%) (see Table 10).

Possession of mastery was reported by respondents in the following skill areas; evaluation of water quality, tree parts and their functions, angiosperms and gymnosperms, and principles of chainsaw use. Fourteen respondents (35.9%) reported possessing mastery in evaluation of water quality and tree parts and their functions. Thirteen respondents (34.2%) reported having mastery of angiosperms and gymnosperms, and thirteen (33.3%) possessed mastery in principles of chainsaw use. Topics that the fewest respondents reported possessing mastery in included using a GPS unit and calculating bdft volume using a clinometer. Two respondents (5.3%) felt they possessed mastery in using a GPS unit. Four respondents (10.5%) reported mastery in calculating bdft volume using a clinometer (see Table 10).

Table 10

Knowledge Level of Forestry Skills by Agricultural Education Teachers

	No Knowledge		Read About		Seen Performed		Performed Myself		Possess Mastery	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%
Evaluation of water quality	1	2.6	7	17.9	5	12.8	12	30.8	14	35.9
Tree parts and their functions	0	0.0	3	7.7	2	5.1	20	51.3	14	35.9
Angiosperms and gymnosperms	3	7.9	12	31.6	2	5.3	8	21.1	13	34.2
Principles of chainsaw use	3	7.7	2	5.1	1	2.6	20	51.3	13	33.3
Chainsaw maintenance techniques	2	5.3	4	10.5	1	2.6	19	50.0	12	31.6
Estimating tree height	4	10.5	2	5.3	6	15.8	14	36.8	12	31.6
Tree growth	2	5.1	10	25.6	1	2.6	14	35.9	12	30.8
Proper safety techniques	3	7.7	4	10.3	5	12.8	15	38.5	12	30.8
Calculating bdft volume using a diameter tape	9	24.3	8	21.6	1	2.7	8	21.6	11	29.7
Measuring standing trees with a diameter tape	3	7.9	8	21.1	4	10.5	12	31.6	11	28.9
Chainsaw safety	2	5.3	3	7.9	5	13.2	17	44.7	11	28.9

Table 10 (continued)

Knowledge Level of Forestry Skills by Agricultural Education Teachers

	No Knowledge		Read About		Seen Performed		Performed Myself		Possess Mastery	
	n	*%*	*n*	*%*	*n*	*%*	*n*	*%*	*n*	*%*
Careers in forestry	1	2.6	8	20.5	1	2.6	18	46.2	11	28.2
Identification of forest fire fighting tools	7	17.9	7	17.9	1	2.6	13	33.3	11	28.2
Proper safety apparel	1	2.6	7	17.9	3	7.7	17	43.6	11	28.2
Understanding safety principles	3	7.7	8	20.5	3	7.7	14	35.9	11	28.2
Comparing units of measurement	6	16.7	4	11.1	4	11.1	12	33.3	10	27.8
Tree species identification by leaves	1	2.6	6	15.8	2	5.3	19	50.0	10	26.3
Determining a bearing or azimuth using a hand compass	6	15.8	4	10.5	3	7.9	15	39.5	10	26.3
Estimating acres in a given tract of timber	6	15.8	8	21.1	4	10.5	10	26.3	10	26.3
Measuring standing trees at dbh and height in 16 ft logs	4	10.5	4	10.5	3	7.9	17	44.7	10	26.3
Pacing to determine a linear distance	4	10.5	3	7.9	2	5.3	19	50.0	10	26.3

Table 10 (continued)

Knowledge Level of Forestry Skills by Agricultural Education Teachers

	No Knowledge		Read About		Seen Performed		Performed Myself		Possess Mastery	
	n	*%*	*n*	*%*	*n*	*%*	*n*	*%*	*n*	*%*
Forestry safety principles	2	5.3	6	15.8	4	10.5	16	42.1	10	26.3
Improving habitat for game and non game species	2	5.3	7	18.4	3	7.9	16	42.1	10	26.3
Doyle and international ¼ inch to calculate volume of saw logs	6	16.2	6	16.2	5	13.5	11	29.7	9	24.3
Calculating bdft volume of standing timber on a fractional acre plot	6	15.8	9	23.7	3	7.9	11	28.9	9	23.7
Calculating bdft volume using a tree stick	5	13.2	6	15.8	3	7.9	15	39.5	9	23.7
Calculating bdft volume of standing timber	6	15.8	6	15.8	2	5.3	15	39.5	9	23.7
Estimating volume (bdft) in a tree	3	7.9	4	10.5	4	10.5	18	47.4	9	23.7
Identifying potential den and mast trees	5	13.2	6	15.8	3	7.9	15	39.5	9	23.7
The impact of forestry practices on wildlife	2	5.3	7	18.4	5	13.2	15	39.5	9	23.7
Reproduction in forestry	3	7.7	8	20.5	5	12.8	14	35.9	9	23.1

Table 10 (continued)

Knowledge Level of Forestry Skills by Agricultural Education Teachers

	No Knowledge		Read About		Seen Performed		Performed Myself		Possess Mastery	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%
Monitoring water quality in accordance with BMPs	1	2.6	13	33.3	3	7.7	13	33.3	9	23.1
Fire line construction	6	15.4	10	25.6	3	7.7	11	28.2	9	23.1
Identification of hazardous situations	2	5.1	8	20.5	5	12.8	15	38.5	9	23.1
Lumber scaling	5	13.9	6	16.7	8	22.2	9	25.0	8	22.2
The uses of forestry tools	2	5.4	7	18.9	3	8.1	17	45.9	8	21.6
Log scaling	5	13.2	9	23.7	8	21.1	8	21.1	8	21.1
Tree felling using a chainsaw	5	13.2	3	7.9	4	10.5	18	47.4	8	21.1
Wood processing	3	7.9	7	18.4	12	31.6	8	21.1	8	21.1
Forestry tools identification	2	5.3	4	10.5	3	7.9	21	55.3	8	21.1
Determining major forest types	3	7.9	10	26.3	3	7.9	14	36.8	8	21.1

Table 10 (continued)

Knowledge Level of Forestry Skills by Agricultural Education Teachers

	No Knowledge		Read About		Seen Performed		Performed Myself		Possess Mastery	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%
Comparing and contrasting wolf trees, den trees, snags, and culls	8	21.1	7	18.4	1	2.6	14	36.8	8	21.1
Professional and technical employment in forestry	4	10.3	8	20.5	5	12.8	14	35.9	8	20.5
Using an increment borer	9	24.3	5	13.5	6	16.2	10	27.0	7	18.9
Recording volume using advance tally sheets	10	27.0	6	16.2	7	18.9	7	18.9	7	18.9
Identification of common tree pests	1	2.7	14	37.8	5	13.5	10	27.0	7	18.9
Fire control methods	4	10.5	14	36.8	7	18.4	6	15.8	7	18.4
Forest fire preventions methods	3	7.9	16	42.1	8	21.1	4	10.5	7	18.4
Tree species identification by bark	3	7.9	7	18.4	1	2.6	20	52.6	7	18.4
Tree species identification by fruit	1	2.6	9	23.7	3	7.9	18	47.4	7	18.4
Forest fire suppression methods	3	8.1	15	40.5	8	21.6	5	13.5	6	16.2

Table 10 (continued)

Knowledge Level of Forestry Skills by Agricultural Education Teachers

	No Knowledge		Read About		Seen Performed		Performed Myself		Possess Mastery	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%
Techniques, advantages, and disadvantages of clear cuts	2	5.4	12	32.4	8	21.6	9	24.3	6	16.2
Techniques, advantages, and disadvantages of diameter limit cuts	6	16.2	12	32.4	5	13.5	8	21.6	6	16.2
Techniques, advantages, and disadvantages of selective cuts	3	8.1	12	32.4	7	18.9	9	24.3	6	16.2
Recognizing insect damage to trees	3	8.1	11	29.7	6	16.2	11	29.7	6	16.2
Recognizing other pest damage to trees	6	16.2	9	24.3	6	16.2	10	27.0	6	16.2
Wood utilization	6	16.2	8	21.6	5	13.5	12	32.4	6	16.2
Knowledge and understanding of fire behavior	6	15.8	16	42.1	5	13.2	5	13.2	6	15.8
Tree species identification by wood sample	1	2.6	9	23.7	6	15.8	16	42.1	6	15.8
Non-timber forest products	6	15.8	17	44.7	6	15.8	3	7.9	6	15.8
Silvicultural methods	9	23.7	6	15.8	5	13.2	12	31.6	6	15.8

Table 10 (continued)

Knowledge Level of Forestry Skills by Agricultural Education Teachers

	No Knowledge		Read About		Seen Performed		Performed Myself		Possess Mastery	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%
Selecting and marking trees for thinning using the d + 6 rule	10	26.3	11	28.9	5	13.2	6	15.8	6	15.8
Identification of common tree diseases	3	7.9	14	36.8	6	15.8	9	23.7	6	15.8
Forest fire mop-up procedures	9	23.1	9	23.1	4	10.3	11	28.2	6	15.4
Selecting trees for felling limbs and bucking	7	20.0	5	14.3	8	22.9	10	28.6	5	14.3
Identification of exotic invasive species	6	16.2	12	32.4	4	10.8	10	27.0	5	13.5
Forest fire detection methods	8	21.1	13	34.2	10	26.3	2	5.3	5	13.2
Calculate proper tree spacing	7	18.4	10	26.3	5	13.2	11	28.9	5	13.2
Tree girdling	7	18.4	8	21.1	3	7.9	15	39.5	5	13.2
Setting up survey equipment	3	7.9	7	18.4	7	18.4	16	42.1	5	13.2
Calculating bdft volume using a clinometer	13	34.2	10	26.3	5	13.2	6	15.8	4	10.5
Using a GPS unit	5	13.2	6	15.8	10	26.3	15	39.5	2	5.3

Confidence Level in Teaching Forestry Skills by Agricultural Education Teachers

High school agricultural education teachers were asked to rate their confidence level in teaching skills associated with forestry. Respondents rated their confidence level as being "very low" in forest fire detection methods, calculating bdft volume using a clinometer, selecting and marking trees for thinning, and estimating acres in a given tract of timber. Ten respondents (29.4%) reported having very low confidence in forest fire detection methods and 10 individuals reported (28.6%) having very low confidence in calculating bdft volume using a clinometer. Of the respondents, 10 (27.8%) reported very low confidence in estimating acres in a given tract of timber. The fewest respondents reported having very low confidence in performing or teaching tree growth, evaluation of water quality, and careers in forestry. One respondent (2.6%) reported having very low confidence in each of the following; tree growth, evaluation of water quality, and careers in forestry (see Table 11).

Most respondents reported having low confidence in performing or teaching fire line construction, using a GPS unit, and recognizing other pest damage to trees. Eleven respondents (29.7%) had low confidence in fire line construction. Ten respondents (29.4%) reported having low confidence in using a GPS unit and recognizing other pest damage to trees. The fewest respondents reported having low confidence in teaching or performing chainsaw maintenance techniques, tree felling using a chainsaw, careers in forestry, and principles of chainsaw use. Three respondents (7.9%) reported having low confidence in chainsaw maintenance techniques, three (8.8%) had low confidence in tree felling using a chainsaw, four (10.5%) had low confidence in teaching about careers in

forestry, and four (10.5%) had low confidence in teaching principles of chainsaw use (see Table 11).

Most respondents reported having moderate confidence in teaching about or performing the following: techniques, advantages, and disadvantages of selective cuts, wood processing, the impact of forestry practices on wildlife, improving habitat for game and non game species, and professional and technical employment in forestry. Of the respondents 15 (44.1%) had moderate confidence in teaching techniques, advantages, and disadvantages of selective cuts, 14 (41.2%) had moderate confidence in teaching or performing wood processing, 14 (41.2%) had moderate confidence teaching about the impact of forestry practices on wildlife, and 13 (38.2%) had moderate confidence in teaching about improving habitat for game and non game species. The fewest respondents reported having moderate confidence in teaching about calculating bdft volume with a diameter tape, calculating bdft volume with a clinometer, and reproduction in forestry. Two respondents (5.7%) had moderate confidence in calculating bdft volume using a diameter tape and three (8.6%) had moderate confidence in calculating bdft volume using a clinometer. Four respondents (10.3%) felt moderately confident about teaching reproduction in forestry (see Table 11).

Table 11

Confidence Level in Teaching Forestry Skills by Agricultural Education Teachers

	Very Low		Low		Moderate		High		Very High	
	n	*%*	*n*	*%*	*n*	*%*	*n*	*%*	*n*	*%*
Tree growth	1	2.6	5	12.8	8	20.5	14	35.9	11	28.2
Angiosperms and Gymnosperms	3	7.9	9	23.7	5	13.2	9	23.7	12	31.6
Evaluation of water quality	1	2.6	10	25.6	7	17.9	8	20.5	13	33.3
Tree parts and their functions			4	10.3	6	15.4	16	41.0	13	33.3
Reproduction in forestry	3	7.7	9	23.1	4	10.3	14	35.9	9	23.1
Monitoring water quality in accordance with BMPs	1	2.7	10	27.0	8	21.6	9	24.3	9	24.3
Careers in forestry	1	2.6	4	10.5	8	21.1	15	39.5	10	26.3
Professional and technical employment in forestry	4	10.3	7	17.9	13	33.3	9	23.1	6	15.4
Chainsaw maintenance techniques	2	5.3	3	7.9	9	23.7	12	31.6	12	31.6
Principles of chainsaw use	2	5.3	4	10.5	7	18.4	15	39.5	10	26.3
Fire line construction	5	13.5	11	29.7	5	13.5	9	24.3	7	18.9

Table 11 (continued)

Confidence Level in Teaching Forestry Skills by Agricultural Education Teachers

	Very Low		Low		Moderate		High		Very High	
	n	*%*	*n*	*%*	*n*	*%*	*n*	*%*	*n*	*%*
Forest fire mop-up procedures	7	18.9	9	24.3	8	21.6	6	16.2	7	18.9
Identification of forest fire fighting tools	6	16.2	7	18.9	5	13.5	12	32.4	7	18.9
Knowledge and understanding of fire behavior	6	17.1	9	25.7	7	20.0	8	22.9	5	14.3
Fire control methods	5	14.7	7	20.6	9	26.5	8	23.5	5	14.7
Forest fire detection methods	10	29.4	5	14.7	7	20.6	5	14.7	7	20.6
Forest fire preventions methods	7	20.0	4	11.4	11	31.4	7	20.0	6	17.1
Forest fire suppression methods	7	20.6	5	14.7	9	26.5	8	23.5	5	14.7
Log scaling	9	25.7	5	14.3	8	22.9	7	20.0	6	17.1
Lumber scaling	8	24.2	6	18.2	5	15.2	7	21.2	7	21.2
Techniques, advantages, and disadvantages of clear cuts	6	16.7	6	16.7	12	33.3	5	13.9	7	19.4
Techniques, advantages, and disadvantages of diameter limit cuts	7	20.6	6	17.6	11	32.4	4	11.8	6	17.6

Table 11 (continued)

Confidence Level in Teaching Forestry Skills by Agricultural Education Teachers

	Very Low		Low		Moderate		High		Very High	
	n	*%*	*n*	*%*	*n*	*%*	*n*	*%*	*n*	*%*
Techniques, advantages, and disadvantages of selective cuts	4	11.8	5	14.7	15	44.1	4	11.8	6	17.6
Tree felling using a chainsaw	4	11.8	3	8.8	10	29.4	8	23.5	9	26.5
Wood processing	3	8.8	5	14.7	14	41.2	6	17.6	6	17.6
Tree species identification by bark	4	11.1	6	16.7	10	27.8	9	25.0	7	19.4
Tree species identification by fruit	3	8.3	7	19.4	10	27.8	10	27.8	6	16.7
Tree species identification by leaves	2	5.6	5	13.9	9	25.0	11	30.6	9	25.0
Tree species identification by wood sample	3	8.6	7	20.0	11	31.4	9	25.7	5	14.3
Non-timber forest products	6	17.1	9	25.7	8	22.9	6	17.1	6	17.1
Calculate proper tree spacing	6	17.1	7	20.0	9	25.7	7	20.0	6	17.1
Tree girdling	5	14.3	5	14.3	9	25.7	9	25.7	7	20.0
Measuring standing trees with a diameter tape	4	11.1	8	22.2	7	19.4	7	19.4	10	27.8

Table 11 (continued)

Confidence Level in Teaching Forestry Skills by Agricultural Education Teachers

	Very Low		Low		Moderate		High		Very High	
	n	*%*	*n*	*%*	*n*	*%*	*n*	*%*	*n*	*%*
Selecting trees for felling limbs and bucking	6	18.8	8	25.0	9	28.1	2	6.3	7	21.9
Silvicultural methods	8	23.5	6	17.6	9	26.5	5	14.7	6	17.6
Using an increment borer	8	23.5	8	23.5	6	17.6	4	11.8	8	23.5
Calculating bdft volume of standing timber on a fractional acre plot	7	19.4	9	25.0	6	16.7	6	16.7	8	22.2
Calculating bdft volume using a clinometer	10	28.6	10	28.6	3	8.6	7	20.0	5	14.3
Calculating bdft volume using a diameter tape	8	22.9	9	25.7	2	5.7	8	22.9	8	22.9
Calculating bdft volume using a tree stick	5	13.9	5	13.9	9	25.0	8	22.2	9	25.0
Calculating bdft volume of standing timber	5	13.9	7	19.4	8	22.2	7	19.4	9	25.0
Doyle and International ¼ inch to calculate volume of saw logs	4	11.4	6	17.1	7	20.0	9	25.7	9	25.7
Comparing units of measurement	3	8.8	7	20.6	5	14.7	9	26.5	10	29.4

Table 11 (continued)

Confidence Level in Teaching Forestry Skills by Agricultural Education Teachers

	Very Low		Low		Moderate		High		Very High	
	n	*%*	*n*	*%*	*n*	*%*	*n*	*%*	*n*	*%*
Determining a bearing or azimuth using a hand compass	5	13.9	7	19.4	7	19.4	7	19.4	10	27.8
Estimating tree height	3	8.3	8	22.2	11	30.6	4	11.1	10	27.8
Estimating acres in a given tract of timber	10	27.8	7	19.4	7	19.4	3	8.3	9	25.0
Estimating volume (bdft) in a tree	6	16.2	6	16.2	12	32.4	5	13.5	8	21.6
Measuring standing trees at DBH and height in 16 ft logs	5	13.9	4	11.1	12	33.3	6	16.7	9	25.0
Pacing to determine a linear distance	5	13.9	7	19.4	9	25.0	5	13.9	10	27.8
Recording volume using advance tally sheets	9	25.7	7	20.0	9	25.7	3	8.6	7	20.0
Selecting and marking trees for thinning using the D + 6 rule	10	28.6	8	22.9	5	14.3	5	14.3	7	20.0
Setting up survey equipment	4	11.4	10	28.6	10	28.6	6	17.1	5	14.3
Using a GPS unit	6	17.6	10	29.4	8	23.5	6	17.6	4	11.8

Table 11 (continued)

Confidence Level in Teaching Forestry Skills by Agricultural Education Teachers

	Very Low		Low		Moderate		High		Very High	
	n	*%*	*n*	*%*	*n*	*%*	*n*	*%*	*n*	*%*
Identification of common tree diseases	7	19.4	12	33.3	10	27.8	3	8.3	4	11.1
Identification of common tree pests	6	16.7	10	27.8	12	33.3	4	11.1	4	11.1
Identification of exotic invasive species in forests	9	25.0	10	27.8	8	22.2	6	16.7	3	8.3
Recognizing insect damage to trees	5	14.3	10	28.6	8	22.9	8	22.9	4	11.4
Recognizing other pest damage to trees	8	23.5	10	29.4	4	11.8	7	20.6	5	14.7
Wood utilization	5	15.6	6	18.8	10	31.3	4	12.5	7	21.9
Chainsaw safety	3	8.3	5	13.9	10	27.8	7	19.4	11	30.6
Forestry safety principles	3	8.6	6	17.1	10	28.6	6	17.1	10	28.6
Identification of hazardous situations	2	5.7	10	28.6	7	20.0	10	28.6	6	17.1
Proper safety apparel	2	5.6	8	22.2	8	22.2	9	25.0	9	25.0
Proper safety techniques	3	8.6	7	20.0	8	22.9	9	25.7	8	22.9

Table 11 (continued)

Confidence Level in Teaching Forestry Skills by Agricultural Education Teachers

	Very Low		Low		Moderate		High		Very High	
	n	*%*	*n*	*%*	*n*	*%*	*n*	*%*	*n*	*%*
Understanding safety principles	3	8.6	7	20.0	9	25.7	9	25.7	7	20.0
Forestry tools identification	3	8.6	8	22.9	5	14.3	10	28.6	9	25.7
The uses of forestry tools	3	8.6	9	25.7	10	28.6	5	14.3	8	22.9
Determining major forest types	3	8.6	10	28.6	10	28.6	6	17.1	6	17.1
Comparing and contrasting wolf trees, den trees, snags, and culls	4	12.1	7	21.2	10	30.3	4	12.1	8	24.2
Identifying potential den and mast trees	3	9.1	7	21.2	9	27.3	5	15.2	9	27.3
The impact of forestry practices on wildlife	1	2.9	6	17.6	14	41.2	4	11.8	9	26.5
Improving habitat for game and non game species	1	2.9	6	17.6	13	38.2	6	17.6	8	23.5

The most respondents reported having the highest confidence in teaching about tree parts and their functions, careers in forestry, principles of chainsaw use, tree growth, and reproduction in forestry. Sixteen respondents (41.0%) had high confidence in teaching about tree parts and their functions. Fifteen respondents (39.5%) had high confidence in teaching about careers in forestry as well as in teaching about the principles of chainsaw use. Of the respondents, 14 (35.9%) had high confidence in teaching about reproduction in forestry and tree growth. The fewest respondents reported having high confidence in selecting trees for felling and bucking, estimating acres in a given tract of timber, recording volume using advance tally sheets, and identification of common tree diseases. Two respondents (6.3%) had high confidence in selecting trees for felling and bucking. Three respondents (8.6%) had selected the high confidence category in the area of recording volume using advance tally sheets. Three respondents (8.3%) had high confidence in identification of common tree diseases as well as estimating acres in a given tract of timber (see Table 11).

Very high confidence was reported by respondents in tree parts and their functions, evaluation of water quality, angiosperms and gymnosperms, chainsaw maintenance techniques, chainsaw safety, and tree growth. Thirteen respondents (33.3%) reported having very high confidence in teaching about tree parts and their functions as well as evaluation of water quality. Twelve respondents (31.6%) reported very high confidence in chainsaw maintenance techniques and angiosperms and gymnosperms. Eleven respondents (30.6%) reported very high confidence in teaching chainsaw safety, and eleven respondents (28.2%) reported having very high confidence in teaching about tree growth. The fewest respondents reported having very high confidence in teaching or

performing identification of exotic invasive species in forests, identification of common tree pests, identification of common tree diseases, recognizing insect damage to trees, and using a GPS unit. Of the respondents, three (8.3%) felt very confident in teaching identification of exotic invasive species in forests, four (11.1%) felt very confident in teaching identification of common tree pests. Four respondents (11.1%) felt very confident teaching identification of common tree diseases; four respondents reported feeling very confident in teaching how to use a GPS unit (see Table 11).

Sources of Knowledge of Forestry Skills by Agricultural Education Teachers

The high school agricultural education teachers were asked to identify their source(s) of knowledge about the skills associated with forestry. The skills most frequently listed as learned in their high school agricultural education program category were tree growth, pacing to determine a linear distance, tree parts and their functions, angiosperms and gymnosperms, tree species identification by bark, fruit, leaves, and wood sample, measuring standing trees with a diameter tape, comparing units of measurement, measuring standing trees at dbh and height in 16 foot logs, forestry safety principles, identification of hazardous situations, proper safety apparel, proper safety techniques, understanding safety principles, forestry tools identification, the uses of forestry tools, determining major forest types, and the impact of forestry practices on wildlife. Ten respondents (25.0%) obtained their knowledge of tree growth thru their high school agricultural education program. Eight respondents (20.0%) reported having learned about both pacing to determine a linear distance and tree parts and their functions from their high school agricultural education program. Seven respondents (17.5%) reported learning about each of the following in their high school agricultural program:

angiosperms and gymnosperms, tree species identification by bark, fruit, leaves, and wood sample, measuring standing trees with a diameter tape, comparing units of measurement, measuring standing trees at dbh and height in 16 foot logs, forestry safety principles, identification of hazardous situations, proper safety apparel, proper safety techniques, understanding safety principles, forestry tools identification, the uses of forestry tools, determining major forest types, and the impact of forestry practices on wildlife. Two respondents (5.0%) reported having knowledge from their high school agricultural program in each of the following: forest mop-up procedures, fire control methods, forest fire detection methods, forest fire suppression methods, calculating bdft volume using a clinometer, recording volume using advance tally sheets, selecting and marking trees for thinning using the D+6 rule, and using a GPS unit (see Table 12).

The topics most frequently listed in the knowledge from personal experience included proper safety apparel, chainsaw safety, tree felling using a chainsaw, tree species identification by leaves, proper safety techniques, understanding safety principles, forestry tools identification, chainsaw maintenance techniques, and principles of chainsaw use. Twenty six respondents (65.0%) reported learning about proper safety apparel in their personal experiences. Chainsaw safety and tree felling using a chainsaw was reported by 24 respondents (60.0%) each. Twenty two respondents (55.0%) reported that they had learned about each of the following through personal experience, proper safety techniques, understanding safety principles, forestry tools identification, and tree species identification by leaves. Chainsaw maintenance techniques and principles of chainsaw use were each reported by 21 respondents (52.5%) in the "personal experience" category (see Table 12).

Formal education has provided the most knowledge of forestry to agricultural education teachers in the following areas, tree parts and their functions, angiosperms and gymnosperms, tree growth, evaluation of water quality, monitoring water quality in accordance with BMPs, careers in forestry, reproduction in forestry, comparing units of measurement, the impact of forestry practices on wildlife, and improving habitat for game and non game species. Twenty-six respondents (65.0%) reported receiving formal education on tree parts and their functions. Twenty-four respondents (60.0%) reported receiving formal education on angiosperms and gymnosperms. Tree growth was reported by 23 respondents (57.5%) in the formal education category. Twenty-two respondents (55%) reported having learned about evaluation of water quality through formal education. Monitoring water quality in accordance with BMPs was also reported by 22 respondents (55%) as well as careers in forestry. Reproduction in forestry was a topic that 21 respondents (52.5%) reported in the "formal education" category. Twenty respondents (50.0%) reported learning about each of the following topics from "formal education", comparing units of measurement, the impact of forestry practices on wildlife, and improving habitat for game and non game species (see Table 12).

Work experience was reported as a source of knowledge by respondents in the following topics, principles of chainsaw use, chainsaw maintenance techniques, evaluation of water quality, tree parts and their functions, forestry safety principles, identification of hazardous situations, tree felling using a chainsaw, proper safety techniques, tree growth, chainsaw safety, proper safety apparel, understanding safety principles, and the uses of forestry tools. Sixteen respondents (40.0%) reported that they learned about principles of chainsaw use and 14 respondents (35.0%) reported learning

about chainsaw maintenance techniques from work experience. For each of the following skills 13 respondents (32.5%) reported that they learned about each of them through work experience, evaluation of water quality, tree parts and their functions, forestry safety principles, and identification of hazardous situations. In both topics, tree felling using a chainsaw and proper safety techniques, there were 12 respondents (30.0%). Eleven respondents (27.5%) reported that work experience is how they learned about each of the following topics, tree growth, chainsaw safety, proper safety apparel, and the use of forestry tools (see Table 12).

The topics most frequently listed in the on the job category included chainsaw maintenance techniques, principles of chainsaw use, tree parts and their functions, careers in forestry, comparing units of measurement, estimating volume (bdft) in a tree, evaluation of water quality, identification of forest fire fighting tools, estimating acres in a given tract of timber, and measuring standing trees at dbh and height in 16 foot logs. Seventeen respondents (42.5%) gained knowledge on chainsaw maintenance techniques on the job. Knowledge on the principles of chainsaw use was acquired by 15 respondents (37.5%) on the job. Fourteen respondents (35.0%) have acquired knowledge of both careers in forestry and comparing units of measurement on the job. Knowledge of both estimating volume (bdft) in a tree and evaluation of water quality was acquired on the job by 13 respondents (32.5%). Twelve respondents (30.0%) have acquired knowledge of identification of fire fighting tools, estimating tree height, and measuring standing trees at dbh and height in 16 foot logs (see Table 12).

The topics most frequently listed in the Internet category included careers in forestry, evaluation of water quality, tree parts and their functions, reproduction in

forestry, the uses of forestry tools, forestry tools identification, monitoring water quality in accordance with BMPs, determining major forest types, principles of chainsaw use, tree species identification by leaves, tree species identification by wood sample, identification of common tree diseases, identification of common tree pests, identification of exotic invasive species in forests, and comparing and contrasting wolf trees, den trees, snags, and culls. The Internet has served as a source of knowledge on careers in forestry for 10 respondents (25.0%). Nine respondents (22.5%) used the Internet to acquire knowledge about evaluation of water quality, tree parts and their functions, reproduction in forestry, and the uses of forestry tools. Knowledge of forestry tools identification and monitoring water quality in accordance with BMPs was acquired by eight respondents (20.0%) on the Internet. Seven respondents (17.5%) used the Internet to obtain knowledge about principles of chainsaw use, tree species identification by leaves, tree species identification by wood sample, identification of common tree diseases, identification of common tree pests, identification of exotic invasive species in forests, and comparing and contrasting wolf trees, den trees, snags, and culls (see Table 12).

Table 12

Sources of Knowledge of Forestry Skills by Agricultural Education Teachers

	HS AgED		Personal Experience		Formal Education		Work Experience		On the Job		Internet	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
Tree growth	10	25.0	17	42.5	23	57.5	11	27.5	10	25.0	5	12.5
Angiosperms and Gymnosperms	7	17.5	10	25.0	24	60.0	7	17.5	9	22.5	6	15.0
Evaluation of water quality	6	15.0	14	35.0	22	55.0	13	32.5	13	32.5	9	22.5
Tree parts and their functions	8	20.0	17	42.5	26	65.0	13	32.5	15	37.5	9	22.5
Reproduction in forestry	6	15.0	13	32.5	21	52.5	9	22.5	11	27.5	9	22.5
Monitoring water quality in accordance with BMPs	5	12.5	12	30.0	22	55.0	10	25.0	9	22.5	8	20.0
Careers in forestry	4	10.0	10	25.0	22	55.0	10	25.0	14	35.0	10	25.0
Professional and technical employment in forestry	1	2.5	9	22.5	17	42.5	7	17.5	8	20.0	6	15.0
Chainsaw maintenance techniques	4	10.0	21	52.5	11	27.5	14	35.0	17	42.5	6	15.0
Principles of chainsaw use	3	7.5	21	52.5	12	30.0	16	40.0	15	37.5	7	17.5

Table 12 (continued)

Sources of Knowledge of Forestry Skills by Agricultural Education Teachers

	HS AgED		Personal Experience		Formal Education		Work Experience		On the Job		Internet	
	n	*%*	*n*	*%*	*n*	*%*	*n*	*%*	*n*	*%*	*n*	*%*
Fire line construction	3	7.5	10	25.0	13	32.5	9	22.5	10	25.0	5	12.8
Forest fire mop-up procedures	2	5.0	7	17.5	15	37.5	5	12.5	10	25.0	6	15.0
Identification of forest fire fighting tools	4	10.0	12	30.0	12	30.0	10	25.0	12	30.0	6	15.0
Knowledge and understanding of fire behavior	3	7.5	13	32.5	14	35.0	8	20.0	9	22.5	6	15.0
Fire control methods	2	5.0	15	37.5	16	40.0	7	17.5	9	22.5	6	15.0
Forest fire detection methods	2	5.0	7	17.5	12	30.0	6	15.0	10	25.0	6	15.0
Forest fire preventions methods	3	7.5	11	27.5	16	40.0	7	17.5	9	22.5	5	12.5
Forest fire suppression methods	2	5.0	11	27.5	15	37.5	7	17.5	8	20.0	4	10.0
Log scaling	6	15.0	10	25.0	16	40.0	6	15.0	11	27.5	4	10.0
Lumber scaling	6	15.0	8	20.0	14	35.0	8	20.0	10	25.0	4	10.0
Techniques, advantages, and disadvantages of clear cuts	4	10.0	11	27.5	17	42.5	6	15.0	11	27.5	6	15.0

Table 12 (continued)

Sources of Knowledge of Forestry Skills by Agricultural Education Teachers

	HS AgED		Personal Experience		Formal Education		Work Experience		On the Job		Internet	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
Techniques, advantages, and disadvantages of diameter limit cuts	4	10.0	10	25.0	14	35.0	4	10.0	7	17.5	6	15.0
Techniques, advantages, and disadvantages of selective cuts	5	12.5	11	27.5	15	37.5	3	7.5	9	22.5	5	12.5
Tree felling using a chainsaw	5	12.5	24	60.0	14	35.0	12	30.0	8	20.0	3	7.5
Wood processing	3	7.5	15	37.5	18	45.0	7	17.5	6	15.0	4	10.0
Tree species identification by bark	7	17.5	20	50.0	19	47.5	7	17.5	9	22.5	5	12.5
Tree species identification by fruit	7	17.5	20	50.0	17	42.5	6	15.0	10	25.0	5	12.5
Tree species identification by leaves	7	17.5	22	55.0	19	47.5	9	22.5	10	25.0	7	17.5
Tree species identification by wood sample	7	17.5	19	47.5	16	40.0	10	25.0	9	22.5	7	17.5
Non-timber forest products	3	7.5	15	37.5	15	37.5	6	15.0	8	20.0	2	5.0
Calculate proper tree spacing	4	10.0	17	42.5	15	37.5	6	15.0	8	20.0	5	12.5

Table 12 (continued)

Sources of Knowledge of Forestry Skills by Agricultural Education Teachers

	HS AgED		Personal Experience		Formal Education		Work Experience		On the Job		Internet	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
Tree girdling	5	12.5	18	45.0	15	37.5	7	17.5	8	20.0	5	12.5
Measuring standing trees with a diameter tape	7	17.5	13	32.5	18	45.0	9	22.5	10	25.0	5	12.5
Selecting trees for felling limbs and bucking	4	10.0	14	35.0	16	40.0	9	22.5	4	10.0	3	7.5
Silvicultural methods	5	12.5	12	30.0	14	35.0	7	17.5	7	17.5	4	10.0
Using an increment borer	4	10.0	14	35.0	14	35.0	8	20.0	6	15.0	2	5.0
Calculating bdft volume of standing timber on a fractional acre plot	5	12.5	13	32.5	16	40.0	7	17.5	6	15.0	4	10.0
Calculating bdft volume using a clinometer	2	5.0	10	25.0	13	32.5	5	12.5	5	12.5	2	5.0
Calculating bdft volume using a diameter tape	3	7.5	10	25.0	16	40.0	6	15.0	8	20.0	2	5.0
Calculating bdft volume using a tree stick	6	15.0	16	40.0	16	40.0	9	22.5	10	25.0	4	10.0
Calculating bdft volume of standing timber	6	15.0	15	37.5	16	40.0	9	22.5	9	22.5	4	10.0

Table 12 (continued)

Sources of Knowledge of Forestry Skills by Agricultural Education Teachers

	HS AgED		Personal Experience		Formal Education		Work Experience		On the Job		Internet	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
Doyle and International ¼ inch to calculate volume of saw logs	5	12.5	16	40.0	17	42.5	9	22.5	10	25.0	4	10.0
Comparing units of measurement	7	17.5	18	45.0	20	50.0	10	25.0	14	35.0	3	7.5
Determining a bearing or azimuth using a hand compass	6	15.0	18	45.0	16	40.0	10	25.0	10	25.0	5	12.5
Estimating tree height	4	10.0	17	42.5	15	37.5	6	15.0	11	27.5	2	5.0
Estimating acres in a given tract of timber	6	15.0	14	35.0	15	37.5	10	25.0	12	30.0	4	10.0
Estimating volume (bdft) in a tree	6	15.0	17	42.5	15	37.5	8	20.0	13	32.5	4	10.0
Measuring standing trees at dbh and height in 16 ft logs	7	17.5	16	40.0	17	42.5	9	22.5	12	30.0	4	10.0
Pacing to determine a linear distance	8	20.0	15	37.5	13	32.5	9	22.5	11	27.5	3	7.5
Recording volume using advance tally sheets	2	5.0	8	20.0	13	32.5	3	7.5	6	15.0	3	7.5

Table 12 (continued)

Sources of Knowledge of Forestry Skills by Agricultural Education Teachers

	HS AgED		Personal Experience		Formal Education		Work Experience		On the Job		Internet	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
Selecting and marking trees for thinning using the D + 6 rule	2	5.0	6	15.0	12	30.0	4	10.0	9	22.5	2	5.0
Setting up survey equipment	5	12.5	15	37.5	14	35.0	7	17.5	10	25.0	2	5.0
Using a GPS unit	2	5.0	15	37.5	13	32.5	4	10.0	9	22.5	3	7.5
Identification of common tree diseases	5	12.5	12	30.0	16	40.0	4	10.0	7	17.5	7	17.5
Identification of common tree pests	6	15.0	12	30.0	15	37.5	5	12.5	8	20.0	7	17.5
Identification of exotic invasive species in forests	5	12.5	8	20.0	14	35.0	5	12.5	8	20.0	7	17.5
Recognizing insect damage to trees	5	12.5	11	27.5	17	42.5	5	12.5	7	17.5	4	10.0
Recognizing other pest damage to trees	4	10.0	11	27.5	14	35.0	4	10.0	7	17.5	3	7.5
Wood utilization	5	12.5	13	32.5	15	37.5	7	17.5	11	27.5	2	5.0
Chainsaw safety	6	15.0	24	60.0	16	40.0	11	27.5	10	25.0	6	15.0

Table 12 (continued)

Sources of Knowledge of Forestry Skills by Agricultural Education Teachers

	HS AgED		Personal Experience		Formal Education		Work Experience		On the Job		Internet	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
Forestry safety principles	7	17.5	21	52.5	18	45.0	13	32.5	11	27.5	6	15.0
Identification of hazardous situations	7	17.5	21	52.5	18	45.0	13	32.5	10	25.0	4	10.0
Proper safety apparel	7	17.5	26	65.0	18	45.0	11	27.5	11	27.5	6	15.0
Proper safety techniques	7	17.5	22	55.0	18	45.0	12	30.0	10	25.0	5	12.5
Understanding safety principles	7	17.5	22	55.0	15	37.5	11	27.5	8	20.0	4	10.0
Forestry tools identification	7	17.5	22	55.0	16	40.0	10	25.0	9	22.5	8	20.0
The uses of forestry tools	7	17.5	20	50.0	16	40.0	11	27.5	10	25.0	9	22.5
Determining major forest types	7	17.5	16	40.0	15	37.5	9	22.5	10	25.0	7	17.5
Comparing and contrasting wolf trees, den trees, snags, and culls	3	7.5	15	37.5	16	40.0	7	17.5	10	25.0	7	17.5
Identifying potential den and mast trees	5	12.5	16	40.0	17	42.5	8	20.0	10	25.0	5	12.5

Table 12 (continued)

Sources of Knowledge of Forestry Skills by Agricultural Education Teachers

	HS AgED		Personal Experience		Formal Education		Work Experience		On the Job		Internet	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
The impact of forestry practices on wildlife	7	17.5	18	45.0	20	50.0	8	20.0	9	22.5	5	12.5
Improving habitat for game and non game species	5	12.5	17	42.5	20	50.0	8	20.0	7	17.5	5	12.5

Agricultural Education Teachers Teaching Methods of Forestry Topics and Skills

Respondents were asked to identify teaching methods they used to teach topics and skills associated with forestry. Skills that the most respondents reported not teaching included calculating bdft volume using a clinometer, identification of common tree diseases, forest fire mop-up procedures, recording volume using advance tally sheets, selecting and marking trees for thinning using the D+6 rule, setting up survey equipment, identification of exotic invasive species in forests, recognizing insect damage to trees, and recognizing other pest damage to trees. Of the respondents 21 (52.5%) reported that they did not teach about calculating bdft volume using a clinometer and 19 respondents (47.5%) reported not teaching about identification of common tree diseases. Eighteen respondents (45.0%) reported not teaching about the following: forest fire mop-up procedures, recording volume using advance tally sheets, selecting and marking trees for thinning using the D+6 rule, setting up survey equipment, identification of exotic invasive species in forests, recognizing insect damage to trees, and recognizing other pest damage to trees (see Table 13).

Lectures or discussions were most frequently used to teach tree growth, careers in forestry, tree parts and their functions, reproduction in forestry, evaluation of water quality, identification of hazardous situations, techniques, advantages, and disadvantages of clear cuts, silvicultural methods, forestry safety principles, proper safety apparel, proper safety techniques, and determining major forest types. Lecture and discussion was used by 30 respondents (75.0%) to teach about tree growth and 28 (70.0%) respondents used this method to teach about careers in forestry. Twenty-seven respondents (67.5%) used lecture and discussion as a way to teach about tree parts and their functions and 25

respondents (62.5%) did teach about reproduction in forestry. Twenty-four respondents (60.0%) taught about the both of the following using the lecture/discussion teaching method, evaluation of water quality and identification of hazardous situations. Lecture and discussion was used by 23 respondents (57.5%) to teach about the following, techniques, advantages, and disadvantages of clear cuts, silvicultural methods, forestry safety principles, proper safety apparel, proper safety techniques, and determining major forest types (see Table 13).

Respondents most frequently reported using a demonstration to teach about chainsaw maintenance techniques, tree parts and their functions, principles of chainsaw use, tree species identification by leaves, calculating bdft volume using a tree stick, determining a bearing or azimuth using a hand compass, tree species identification by bark, Doyle and International ¼ inch to calculate volume of saw logs, estimating volume (bdft) in a tree, and measuring standing trees at dbh and height in 16 foot logs. Twenty-five respondents (62.5%) used demonstration methods to teach about chainsaw maintenance and techniques. Of the respondents, 21 (52.5%) used demonstration methods to teach tree parts and their functions, principles of chainsaw use, tree species identification by leaves, calculating bdft volume using a tree stick, and determining a bearing or azimuth using a hand compass. Twenty respondents (50.0%) used demonstrations to teach about tree species identification by bark, Doyle and International ¼ inch to calculate volume of saw logs, estimating volume (bdft) in a tree, and measuring standing trees at dbh and height in 16 foot logs (see Table 13).

Table 13

Methods Used by Agricultural Education Teachers to Teach Skills and Topics

	Did not Teach		Lecture/ Discussion		Demonstration		Resource Person		Problem Solving	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%
Tree growth	5	12.5	30	75.0	17	42.5	3	7.5	9	22.5
Angiosperms and Gymnosperms	12	30.0	22	55.0	14	35.0	1	2.5	6	15.0
Evaluation of water quality	8	20.0	24	60.0	19	47.5	3	7.5	16	40.0
Tree parts and their functions	4	10.0	27	67.5	21	52.5	3	7.5	16	40.0
Reproduction in forestry	12	30.0	25	62.5	11	27.5	2	5.0	7	17.5
Monitoring water quality in accordance with BMPs	14	35.0	20	50.0	11	27.5	2	5.0	10	25.0
Careers in forestry	9	22.5	28	70.0	6	15.0	4	10.0	8	20.0
Professional and technical employment in forestry	16	40.0	19	47.5	7	17.5	4	10.0	5	12.5
Chainsaw maintenance techniques	12	30.0	17	42.5	25	62.5	3	7.5	12	30.0
Principles of chainsaw use	14	35.0	18	45.0	21	52.5	4	10.0	10	25.0

Table 13 (continued)

Methods Used by Agricultural Education Teachers to Teach Skills and Topics

	Did not Teach		Lecture/ Discussion		Demonstration		Resource Person		Problem Solving	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%
Fire line construction	17	42.5	19	47.5	10	25.0	5	12.5	6	15.0
Forest fire mop-up procedures	18	45.0	20	50.0	8	20.0	4	10.0	5	12.5
Identification of forest fire fighting tools	15	37.5	17	42.5	15	37.5	7	17.5	9	22.5
Knowledge and understanding of fire behavior	13	32.5	20	50.0	8	20.0	5	12.5	6	15.0
Fire control methods	13	32.5	21	52.5	9	22.5	6	15.0	6	15.0
Forest fire detection methods	15	37.5	17	42.5	8	20.0	4	10.0	4	10.0
Forest fire preventions methods	14	35.0	18	45.0	8	20.0	4	10.0	4	10.0
Forest fire suppression methods	14	35.0	17	42.5	9	22.5	4	10.0	4	10.0
Log scaling	14	35.0	18	45.0	14	35.0	3	7.5	10	25.0
Lumber scaling	16	40.0	17	42.5	16	40.0	3	7.5	10	25.0
Techniques, advantages, and disadvantages of clear cuts	12	30.0	23	57.5	8	20.0	2	5.0	5	12.5

Table 13 (continued)

Methods Used by Agricultural Education Teachers to Teach Skills and Topics

	Did not Teach		Lecture/ Discussion		Demonstration		Resource Person		Problem Solving	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%
Techniques, advantages, and disadvantages of diameter limit cuts	15	37.5	21	52.5	9	22.5	2	5.0	6	15.0
Techniques, advantages, and disadvantages of selective cuts	13	32.5	21	52.5	8	20.0	1	2.5	5	12.5
Tree felling using a chainsaw	15	37.5	17	42.5	17	42.5	3	7.5	10	25.0
Wood processing	16	40.0	19	47.5	11	27.5	1	2.5	7	17.5
Tree species identification by bark	10	25.0	21	52.5	20	50.0	3	7.5	13	32.5
Tree species identification by fruit	13	32.5	18	45.0	19	47.5	3	7.5	10	25.0
Tree species identification by leaves	9	22.5	20	50.0	21	52.5	4	10.0	14	35.0
Tree species identification by wood sample	16	40.0	16	40.0	14	35.0	2	5.0	7	17.5
Non-timber forest products	16	40.0	20	50.0	4	10.0	2	5.0	2	5.0
Calculate proper tree spacing	15	37.5	20	50.0	9	22.5	1	2.5	5	12.5

Table 13 (continued)

Methods Used by Agricultural Education Teachers to Teach Skills and Topics

	Did not Teach		Lecture/ Discussion		Demonstration		Resource Person		Problem Solving	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%
Tree girdling	14	35.0	18	45.0	11	27.5	2	5.0	4	10.0
Measuring standing trees with a diameter tape	11	27.5	18	45.0	17	42.5	5	12.5	10	25.0
Selecting trees for felling limbs and bucking	13	32.5	16	40.0	12	30.0	2	5.0	4	10.0
Silvicultural methods	11	27.5	23	57.5	9	22.5	1	2.5	3	7.5
Using an increment borer	15	37.5	20	50.0	10	25.0	1	2.5	5	12.5
Calculating bdft volume of standing timber on a fractional acre plot	17	42.5	19	47.5	11	27.5	1	2.5	6	15.0
Calculating bdft volume using a clinometer	21	52.5	16	40.0	8	20.0	1	2.5	2	5.0
Calculating bdft volume using a diameter tape	16	40.0	20	50.0	9	22.5	1	2.5	5	12.5
Calculating bdft volume using a tree stick	11	27.5	21	52.5	21	52.5	1	2.5	13	32.5
Calculating bdft volume of standing timber	11	27.5	19	47.5	18	45.0	1	2.5	11	27.5

Table 13 (continued)

Methods Used by Agricultural Education Teachers to Teach Skills and Topics

	Did not Teach		Lecture/ Discussion		Demonstration		Resource Person		Problem Solving	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%
Doyle and International ¼ inch to calculate volume of saw logs	12	30.0	21	52.5	20	50.0	1	2.5	11	27.5
Comparing units of measurement	11	27.5	21	52.5	15	37.5	1	2.5	9	22.5
Determining a bearing or azimuth using a hand compass	11	27.5	20	50.0	21	52.5	1	2.5	11	27.5
Estimating tree height	13	32.5	19	47.5	17	42.5	2	5.0	8	20.0
Estimating acres in a given tract of timber	16	40.0	17	42.5	14	35.0	1	2.5	10	25.0
Estimating volume (bdft) in a tree	12	30.0	19	47.5	20	50.0	1	2.5	14	35.0
Measuring standing trees at dbh and height in 16 ft logs	11	27.5	19	47.5	20	50.0	1	2.5	14	35.0
Pacing to determine a linear distance	11	27.5	18	45.0	19	47.5	1	2.5	14	35.0
Recording volume using advance tally sheets	18	45.0	14	35.0	11	27.5	1	2.5	8	20.0

Table 13 (continued)

Methods Used by Agricultural Education Teachers to Teach Skills and Topics

	Did not Teach		Lecture/ Discussion		Demonstration		Resource Person		Problem Solving	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%
Selecting and marking trees for thinning using the D + 6 rule	18	45.0	15	37.5	8	20.0	1	2.5	6	15.0
Setting up survey equipment	18	45.0	13	32.5	12	30.0	1	2.5	7	17.5
Using a GPS unit	17	42.5	9	22.5	14	35.0	1	2.5	7	17.5
Identification of common tree diseases	19	47.5	17	42.5	10	25.0	1	2.5	5	12.5
Identification of common tree pests	17	42.5	18	45.0	9	22.5	1	2.5	4	10.0
Identification of exotic invasive species in forests	18	45.0	17	42.5	8	20.0	2	5.0	5	12.5
Recognizing insect damage to trees	18	45.0	17	42.5	10	25.0	2	5.0	5	12.5
Recognizing other pest damage to trees	18	45.0	15	37.5	7	17.5	1	2.5	4	10.0
Wood utilization	15	37.5	18	45.0	7	17.5	3	7.5	6	15.0
Chainsaw safety	13	32.5	22	55.0	19	47.5	3	7.5	12	30.0

Table 13 (continued)

Methods Used by Agricultural Education Teachers to Teach Skills and Topics

	Did not Teach		Lecture/ Discussion		Demonstration		Resource Person		Problem Solving	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%
Forestry safety principles	13	32.5	23	57.5	14	35.0	4	10.0	9	22.5
Identification of hazardous situations	11	27.5	24	60.0	12	30.0	3	7.5	5	12.5
Proper safety apparel	11	27.5	23	57.5	16	40.0	2	5.0	9	22.5
Proper safety techniques	11	27.5	23	57.5	20	50.0	3	7.5	9	22.5
Understanding safety principles	11	27.5	22	55.0	16	40.0	3	7.5	8	20.0
Forestry tools identification	11	27.5	18	45.0	17	42.5	5	12.5	15	37.5
The uses of forestry tools	13	32.5	21	52.5	16	40.0	5	12.5	12	30.0
Determining major forest types	12	30.0	23	57.5	10	25.0	3	7.5	8	20.0
Comparing and contrasting wolf trees, den trees, snags, and culls	14	35.0	19	47.5	10	25.0	2	5.0	10	25.0
Identifying potential den and mast trees	14	35.0	19	47.5	13	32.5	2	5.0	9	22.5

Table 13 (continued)

Methods Used by Agricultural Education Teachers to Teach Skills and Topics

	Did not Teach		Lecture/ Discussion		Demonstration		Resource Person		Problem Solving	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%
The impact of forestry practices on wildlife	11	27.5	21	52.5	12	30.0	2	5.0	10	25.0
Improving habitat for game and non game species	12	30.0	20	50.0	13	32.5	2	5.0	11	27.5

Resource persons were most frequently used to teach about identification of forest fire fighting tools, fire control methods, fire line construction, knowledge and understanding of fire behavior, measuring standing trees with a diameter tape, forestry tools identification, the use of forestry tools, careers in forestry, professional and technical employment in forestry, principles of chainsaw use, forest fire mop-up procedures, forest fire detection methods, forest fire prevention methods, forest fire suppression methods, tree species identification of by leaves, and forestry safety principles. Seven respondents (17.5%) used a resource person to teach identification of forest fire fighting tools. Of the respondents, six (15.0%) used a resource person to teach about fire control methods. Resource persons were used by five respondents (12.5%) to teach each of the following topics: fire line construction, knowledge and understanding of fire behavior, measuring standing trees with a diameter tape, forestry tools identification, and the uses of forestry tools. Four respondents (10.0%) reported using a resource person to teach the following topics: careers in forestry, professional and technical employment in forestry, principles of chainsaw use, forest fire mop-up procedures, forest fire detection methods, forest fire prevention methods, forest fire suppression methods, tree species identification by leaves, and forestry safety principles (see Table 13).

Respondents most frequently reported using student applied problems and problem solving to teach about evaluation of water quality, tree parts and their functions, forestry tools identification, tree identification by leaves, estimating volume (bdft) in a tree, measuring standing trees at dbh and height in 16 foot logs, pacing to determine a linear distance, tree species identification by bark, and calculating bdft volume using a tree stick. Sixteen respondents (40.0%) reported using problem solving to teach both

evaluation of water quality and tree parts and their functions. The use of student applied problems and problem solving was used by 15 respondents (37.5%) to teach about forestry tools identification. Fourteen respondents (35.0%) taught tree species identification by leaves, estimating volume in a tree, measuring standing trees at dbh and height in 16 foot logs, and pacing to determine a linear distance by using student applied problems and problem solving. The use of problem solving was used by 13 respondents (32.5%) to teach about tree species identification by bark and calculating bdft volume using a tree stick (see Table 13).

Agricultural Education Teachers Teaching Over the Past Year

Respondents were asked how many times they taught each of the topics or skills over the past year. Calculating bdft volume using a tree stick was taught the most over the past year *(M= 3.3, SD = 6.6)* as well as Doyle and International ¼ inch to calculate volume of saw logs *(M= 3.3, SD = 6.6).* The mean score, for the times that pacing to determine a linear distance was taught over the past year was 3.3 (*SD* = 5.9). Estimating volume (bdft) in a tree was taught by respondents over the past year (*M= 3.2, SD* = 5.8) along with calculating bdft volume of standing timber *(M=3.2, SD* = 6.6). The mean score, for the times that measuring standing trees at dbh and height in 16 foot logs was taught over the past year was 3.1 (*SD* = 5.8) followed by tree species identification by leaves *(M= 2.5, SD* = 5.0). Wood utilization was taught by respondents over the past year *(M= 2.2, SD = 4.9).* Respondents reported teaching chainsaw safety on average 2.2 times (*SD* = 4.5) over the past year. Lumber scaling was taught by respondents over the past year *(M= 2.1, SD* = 4.3). The topics that were taught the least were selecting and marking trees for thinning using the D+6 rule *(M= .7, SD = 1.1*), followed by

recognizing insect damage to trees *(M= .7, SD = 1.1*), identification of common tree diseases *(M= .7, SD = 1.1),* forest fire detection methods *(M= .7, SD = 1.0),* recognizing other pest damage to trees *(M= .8, SD = 1.1),* forest fire mop-up procedures (*M= .8, SD* = 1.0), selecting trees for felling limbs and bucking (*M= .8, SD* = 1.1), identification of exotic invasive species in forests (*M*= .8, *SD* = 1.1), using an increment borer (*M*= .8, *SD* = 1.2), fire control methods *(M= .8, SD = 1.0)*, forest fire prevention methods *(M= .9, SD = 1.0)*, and forest fire suppression methods *(M*= .9, *SD* = 1.0) (see Table 14).

Table 14

Amount of Times Topics and Skills Were Taught by Agricultural Education Teachers Over the Past Year

	Maximum	*M*	*SD*
Calculating bdft volume using a tree stick	25	3.33	6.58
Doyle and International ¼ inch to calculate volume of saw logs	25	3.33	6.59
Pacing to determine a linear distance	25	3.3	5.93
Calculating bdft volume of standing timber	25	3.19	6.62
Estimating volume (bdft) in a tree	20	3.19	5.78
Measuring standing trees at dbh and height in 16 ft logs	20	3.14	5.8
Tree species identification by leaves	25	2.5	5.01
Wood utilization	20	2.19	4.92
Chainsaw safety	20	2.16	4.52
Lumber scaling	20	2.14	4.33
Measuring standing trees with a diameter tape	20	2.1	4.31

Table 14 (continued)

Amount of Times Topics and Skills Were Taught by Agricultural Education Teachers Over the Past Year

	Maximum	*M*	*SD*
Determining a bearing or azimuth using a hand compass	10	2.05	2.42
Estimating tree height	20	2.05	4.23
Tree parts and their functions	8	2.04	1.62
Forestry safety principles	20	2	4.61
Understanding safety principles	10	2	2.97
Log scaling	20	1.91	4.19
Evaluation of water quality	12	1.87	2.53
Tree growth	5	1.72	1.28
Wood processing	15	1.67	3.35
Careers in forestry	10	1.6	2.14
Comparing units of measurement	5	1.6	1.76
Forestry tools identification	5	1.59	1.62
Silvicultural methods	10	1.53	2.29
Improving habitat for game and non game species	5	1.44	1.46
The impact of forestry practices on wildlife	4	1.4	1.31
Proper safety techniques	8	1.38	1.86
Tree species identification by bark	4	1.36	1.18
Recording volume using advance tally sheets	5	1.32	1.92
Tree species identification by fruit	4	1.29	1.35

Table 14 (continued)

Amount of Times Topics and Skills Were Taught by Agricultural Education Teachers Over the Past Year

	Maximum	*M*	*SD*
Angiosperms and Gymnosperms	4	1.25	1.26
Proper safety apparel	5	1.19	1.36
The uses of forestry tools	4	1.18	1.26
Reproduction in forestry	4	1.17	1.24
Techniques, advantages, and disadvantages of clear cuts	4	1.17	1.03
Calculating bdft volume of standing timber on a fractional acre plot	5	1.16	1.8
Calculating bdft volume using a diameter tape	5	1.16	1.71
Estimating acres in a given tract of timber	5	1.16	1.61
Tree felling using a chainsaw	5	1.14	1.36
Identification of hazardous situations	5	1.14	1.31
Techniques, advantages, and disadvantages of selective cuts	4	1.09	0.95
Determining major forest types	4	1.09	1.06
Comparing and contrasting wolf trees, den trees, snags, and culls	4	1.05	1.2
Identifying potential den and mast trees	5	1.05	1.36
Professional and technical employment in forestry	5	1.04	1.36
Identification of forest fire fighting tools	4	1.04	1.11
Chainsaw maintenance techniques	4	1	0.93

Table 14 (continued)

Amount of Times Topics and Skills Were Taught by Agricultural Education Teachers Over the Past Year

	Maximum	*M*	*SD*
Principles of chainsaw use	4	1	1
Techniques, advantages, and disadvantages of diameter limit cuts	4	1	1.02
Setting up survey equipment	5	1	1.54
Monitoring water quality in accordance with BMPs	4	0.96	1.11
Tree species identification by wood sample	4	0.96	1.22
Fire line construction	4	0.91	1.02
Non-timber forest products	4	0.9	1.12
Calculate proper tree spacing	4	0.9	1.17
Tree girdling	4	0.89	1.05
Calculating bdft volume using a clinometer	5	0.89	1.49
Using a GPS unit	4	0.88	1.15
Knowledge and understanding of fire behavior	4	0.87	0.97
Fire control methods	4	0.86	0.99
Forest fire preventions methods	4	0.86	0.99
Forest fire suppression methods	4	0.86	0.99
Using an increment borer	4	0.83	1.2
Identification of common tree pests	4	0.79	1.03
Forest fire mop-up procedures	4	0.78	0.95

Table 14 (continued)

Amount of Times Topics and Skills Were Taught by Agricultural Education Teachers Over the Past Year

	Maximum	*M*	*SD*
Selecting trees for felling limbs and bucking	4	0.78	1.06
Identification of exotic invasive species in forests	4	0.78	1.11
Recognizing other pest damage to trees	4	0.75	1.13
Forest fire detection methods	4	0.74	0.96
Identification of common tree diseases	4	0.74	1.05
Recognizing insect damage to trees	4	0.72	1.07
Selecting and marking trees for thinning using the D + 6 rule	4	0.68	1.06

Agricultural Education Teachers Attitudes toward Forestry

Using a four point Likert scale, respondents were asked six questions dealing with forestry. The scale consisted of the following measurements: 1-"strongly disagree", 2-"disagree", 3-"agree" and 4-"strongly agree". The results were averaged and the following scale was used to interpret the results: "strongly disagree"-1.00-1.50, "disagree"- 1.51-2.50, "agree" –2.51-3.50, "strongly agree" – 3.51-4.00.

In reaction to the statement "Forestry should be a class taught by AG-ED teachers" 23 respondents (57.5%) "strongly agreed," fifteen respondents (37.5%) "agreed," and two respondents (5.0%) "disagreed." The mean score was 3.5 indicating the respondents "strongly agree" with the statement (see Table 15).

Respondents were asked whether or not "Forestry should be a topic taught in an agri-science class." Twenty-one respondents (52.5%) "strongly agreed" with the statement. Seventeen respondents (42.5%) "agreed" and two respondents (5.0%) "disagreed" with the item. The mean score was 3.5 making the respondents "agree" with the statement (see Table 15).

In response to the statement "I feel qualified to teach forestry" 15 respondents (37.5%) "strongly agreed". Nine respondents (22.5%) "agreed" and "disagreed" with the statement. Seven respondents (17.5%) "strongly disagreed". The mean score was 2.8, placing it in the "agree" category (see Table 15).

Respondents were asked to react to the following statement "Agricultural education teachers need more training in forestry." Twenty two respondents (55.0%) "agreed" and seventeen (42.5%) "strongly agreed" with the statement. One respondent (2.5%) "strongly disagreed" with the statement. The mean score was 3.5, placing the statement in the "agree" category (see Table 15).

The teachers were asked to respond to the following statement "I promote timber management in the state." Nineteen respondents (47.5%) "strongly agreed" and seventeen respondents (42.5%) "agreed" with the statement. In both the "disagreed" and "strongly disagreed" categories there were two respondents (5.0%) each. The mean score was 3.3, placing it in the "agree" category (see Table 15).

In reaction to the statement "I believe that local, state, and federal money should be spent on teaching forestry," 18 respondents (46.2%) "strongly agreed" and 18 respondents "agreed" with the statement. Two respondents (5.1%) "disagreed" and one

respondent (2.6%) “strongly disagreed” with the statement. The mean score was 3.4, placing it in the “agreed” category (see Table 15).

Table 15

Attitude Towards Forestry of Agricultural Education Teachers

	Strongly Disagree		Disagree		Agree		Strongly Agree		
	n	*%*	*n*	*%*	*n*	*%*	*n*	*%*	*Mean*
Forestry should be a class taught by AG-ED teachers	0	.0	2	5.0	15	37.5	23	57.5	3.53
Forestry should be a topic taught in an agri-science class	0	.0	2	5.0	17	42.5	21	52.5	3.48
I feel qualified to teach forestry	7	17.5	9	22.5	9	22.5	15	37.5	2.80
Agricultural Education teachers need more training in forestry	1	2.5	0	.0	22	55.0	17	42.5	3.38
I promote timber management in the state	2	5.0	2	5.0	17	42.5	19	47.5	3.33
I believe that local, state, and federal money should be spent on teaching forestry	1	2.6	2	5.1	18	46.2	18	46.2	3.36

Sources of Forestry Information

Respondents were asked to identify where they obtain information on forestry. Thirty-five respondents (89.7%) reported that they obtained information on forestry from textbooks. The Internet was reported by 24 respondents (60.0%). The West Virginia Division of Forestry was reported by 21 respondents (53.8%) and the U.S. Forest Service was reported by 19 respondents (48.7%). Fourteen respondents (35.9%) reported obtaining information on forestry at workshops. The West Virginia Extension Service

was reported by 12 respondents (30.8%) to be a source of information on forestry. Eleven respondents (28.2%) listed West Virginia University as a source of forestry information. Ten respondents (25.6%) marked the other category (see Table 16). Other sources included in the "other" category were foresters in the field and industry. For a complete listing of the "other" sources see Appendix G.

Table 16

Sources of Forestry Information

	n	%
Internet	24	60.0
Textbooks	35	89.7
Workshops	14	35.9
West Virginia Division of Forestry	21	53.8
West Virginia Extension Service	12	30.8
West Virginia University	11	28.2
U.S. Forest Service	19	48.7
Other	10	25.6

Supplemental Forestry Information

Survey respondents were asked whether or not they were interested in receiving more forestry information. Thirty-four respondents (85.0%) marked that they were interested in receiving more information on forestry. Six respondents (15.0%) reported that they were not interested in more information on forestry (see Table 17).

Table 17

Interest in More Forestry Information

	n	%
No	6	15.0
Yes	34	85.0

The preferred method of obtaining supplemental forestry information was also asked of the respondents. The most preferred method was lesson plans which was reported by 21 respondents (52.5%). Twenty respondents (50.0%) reported that the preferred method was a 1-day workshop. A week long workshop was indicated by 13 respondents (32.5%) and a website was listed by 12 respondents (30.0%). Eleven respondents (27.5%) indicated that a graduate course was preferred and 10 respondents (25.0%) recommended a computer program. An on-line graduate course was reported by six respondents (15.0%). Four respondents (10.0%) marked the "other" category. For a complete listing of the "other" preferred methods (see Appendix E). Two respondents (5.0%) marked textbooks as the preferred method of supplemental forestry information (see Table 18).

Table 18

Preferred Method of Supplemental Forestry Information

	Not checked		Checked	
	n	%	*n*	%
Lesson Plans	19	47.5	21	52.5
1-day workshop	20	50	20	50
Weeklong workshop	27	67.5	13	32.5
Website	28	70	12	30
Graduate course	29	72.5	11	27.5
Computer Program	30	75	10	25
½ day seminar	34	85	6	15
On-line graduate course	34	85	6	15
Other	36	90	4	10
Textbook	38	95	2	5

Agricultural education teachers were asked to rank their preferred method of receiving supplemental forestry information. Participants were asked to rank their top three preferred methods of supplemental forestry information from a list of methods. For all the items that were ranked as one or most preferred they were recoded as the number three. The preferred methods that received the number two was left as two. The items that were ranked as number threes were recoded to ones. The recoded numbers were used to determine the sum of each method. The rankings were added together for all respondents. The preferred methods were then ranked according to each of their summated scores. The preferred method reported the most was lesson plans (*n*=41.0)

followed by 1-day workshop (*n*=36.0). Weeklong workshops were ranked third (*n*=25.0) and websites were ranked fourth (*n*=20.0). Ranked fifth were computer programs (*n*=16.0) and sixth were graduate courses (*n*=15.0). Half day seminars were ranked seventh (*n*=13.0) and other was ranked eighth (*n*=10.0). For a complete listing of the "other" preferred methods (see Appendix E). On-line graduate course was ranked ninth (*n*=9.0) and textbook was ranked tenth (*n*=1.0) (see Table 19).

Table 19

Preferred Method of Supplemental Forestry Information

Method	Summated Score	Ranking
Lesson Plans	41	1
1-day workshop	36	2
Weeklong workshop	25	3
Website	20	4
Computer Program	16	5
Graduate course	15	6
½ day seminar	13	7
Other	10	8
On-line graduate course	9	9
Textbook	1	10

Involvement in West Virginia Forestry Competitions

The respondents were asked to report their participation levels in the FFA forestry CDE and the West Virginia Envirothon over the past five years. Thirteen respondents (34.2%) reported participating in the FFA forestry CDE in 2005. In both 2002 and 2006,

twelve respondents (31.6%) said they participated in the contest. Eleven respondents (28.9%) said they participated in 2003 and 10 respondents (26.3%) said they participated in the 2004 FFA forestry CDE (see Table 20). Respondents that had not participated in the FFA forestry CDE ever were asked to explain why they had not participated. Some of the responses included did not coach team, lack of student interest, and time conflicts as reasons they did not participate. For a complete listing of why agricultural education teachers did not participate in the West Virginia FFA forestry CDE see Appendix I. Ten respondents reported participating in the West Virginia Envirothon in 2006 followed by eight respondents (22.2%) in both 2005 and 2004. Participation in the 2003 West Virginia Envirothon was reported by six respondents (16.7%). Four respondents (11.1%) reported participating in the West Virginia Envirothon in 2002 (see Table 21). Respondents that had not participated in the West Virginia Envirothon were asked to explain why they had not participated. Some of the responses included conflicts, lack of teacher interest, and did not coach team as reasons they did not participate. For a complete listing of why agricultural education teachers did not participate in the West Virginia Envirothon see Appendix J.

Table 20

FFA Forestry CDE Participation 2002-2006

	No		Yes	
	n	*%*	*n*	*%*
2006	26	68.4	12	31.6
2005	25	65.8	13	34.2
2004	28	73.7	10	26.3
2003	27	71.1	11	28.9
2002	26	68.4	12	31.6

Table 21

WV Envirothon Participation 2002-2006

	No		Yes	
	n	*%*	*n*	*%*
2006	26	72.2	10	27.8
2005	28	77.8	8	22.2
2004	28	77.8	8	22.2
2003	30	83.3	6	16.7
2002	32	88.9	4	11.1

Limitations to Forestry Education

Agricultural education teachers were asked to indicate from a list, which if any limiting factors were affecting their forestry programs. Twenty-one respondents (56.8%) reported that inadequate tools were a limiting factor to their program. Lack of financial

resources as well as lack of knowledge by educator was reported by 16 respondents (43.2%) as being limiting factors to their forestry program. Twelve respondents (34.3%) marked "other" and were asked to explain. Of the respondents that had marked other, seven teachers listed scheduling conflicts as a limiting factor. Other limiting factors that respondents had included in the "other" category were access to forests and curriculum. For a full list of "other" limiting factors see Appendix K. Student lack of interest was reported by nine respondents (24.3%) and instructor's personal lack of interest was reported by eight respondents (21.6%) as being limiting factors to a forestry program. Six respondents (16.2%) reported lack of administration support was a limiting factor to their forestry program. Classrooms were reported by 5 respondents (13.5%) as being a limiting factor to their forestry program (see Table 22).

Table 22

Limiting Factors to Forestry Program

	No		Yes	
	n	*%*	*n*	*%*
Inadequate tools	16	43.2	21	56.8
Lack of administration support	31	83.8	6	16.2
Lack of financial resources	21	56.8	16	43.2
Lack of knowledge by educator	21	56.8	16	43.2
Student lack of interest	28	75.7	9	24.3
Instructor's personal lack of interest	29	78.4	8	21.6
Classrooms	32	86.5	5	13.5
Other	23	65.7	12	34.3

Respondents were asked to mark from a list the forestry tools they had available to teach forestry. The tools most reported by schools were safety glasses, hand compasses, tree sticks, safety hats, and ear protection. Thirty two schools (88.9%) reported having safety glasses; the average number of safety glasses per school was 17.3 (*SD* = 9.2). Hand compasses were reported by 28 schools (77.8%) with an average of 12.8 per school (*SD* = 10.9). Twenty-six schools (72.2%) reported having tree sticks available to teach forestry with an average of 14.9 sticks per school (*SD* = 10.7). Safety hats were also reported by 26 schools (72.2%) with an average of 11.8 safety hats per school (*SD* = 9.1). Twenty-four schools (66.7%) reported having ear protection available to teach forestry with an average of 7.8 per school (*SD* = 6.1). Tools available to teach forestry reported the least by agricultural education teachers were densitometers, planimeters, wheeler calipers, tree injectors, flow current meters, and altimeters. One school (2.8%) reported having a planimeter to use with an average of 0.0 per school (*SD* = 0.0). The Wheeler caliper was reported by one school (2.8%) with an average of 0.0 per school (*SD* = 0.0). Two schools (5.6%) reported having tree injectors available to use with an average of 1.0 per school (*SD* = 0.0). Flow current meters were reported by two agricultural education teachers (5.6%) with an average of 1.0 per school (*SD* = .0). Two teachers (5.6%) also reported having altimeters to teach forestry, with an average of 0.0 per school (*SD* = 0.0) (see Table 23).

Table 23

Forestry Tools Available to Teach Forestry

	n	*%*	*Min.*	*Max.*	*M*	*SD*
Safety glasses	32	88.9	1	30	17.3	9.2
Tree stick	26	72.2	1	30	14.9	10.7
Hand compass	28	77.8	1	29	12.8	10.9
Safety hat	26	72.2	1	30	11.8	9.1
Chaps	19	52.8	1	30	8.4	12.3
Ear protection	24	66.7	1	15	7.8	6.1
Log rule	16	44.4	1	15	6	6.2
Dot grid	7	19.4	1	10	5	4.6
Plastic flagging	16	44.4	1	10	4.5	3.9
Fire rake	14	38.9	1	12	4.2	4.5
Tree planting bar	16	44.4	1	15	4	5.4
Water test kit	13	36.1	1	10	3.3	3.4
Fiberglass tape	14	38.9	1	7	3	2.5
Stereoscope	8	22.2	1	5	3	2.8
Wedge prism	8	22.2	1	5	3	2.8
Hand lens-microscope	12	33.3	2	3	2.7	0.6
Soil test kit	20	55.6	1	6	2.5	1.9
Chainsaw	23	63.9	1	8	2.4	2.6
Diameter tape	19	52.8	1	10	2.4	3.4
Steel tape	19	52.8	1	6	2.4	2
Increment borer	17	47.2	1	5	2.3	1.4

Table 23 (continued)

Forestry Tools Available to Teach Forestry

	n	*%*	*Min.*	*Max.*	*M*	*SD*
Plant press	6	16.7	1	2	1.7	0.6
Soil sampler	21	58.3	1	3	1.7	0.8
Survey instruments	16	44.4	1	4	1.7	1.2
Clinometer	21	58.3	1	2	1.5	0.5
Jacob staff	5	13.9	1	2	1.5	0.7
Backpack fire pump	6	16.7	1	2	1.3	0.6
Cant hook-peavey	17	47.2	1	2	1.3	0.5
GPS receiver	16	44.4	1	3	1.3	0.8
pH meter	16	44.4	1	2	1.3	0.5
Staff compass	8	22.2	1	2	1.3	0.5
Bark gauge	3	8.3	1	1	1	0
Data recorder	3	8.3	1	1	1	0
Drip torch	5	13.9	1	1	1	0
Dry kiln	4	11.1	1	1	1	0
Fire swatter	3	8.3	1	1	1	0
Fire weather kit	5	13.9	1	1	1	0
Flow current meter	2	5.6	1	1	1	0
Hookeroon	6	16.7	1	1	1	0
Loggers tape	11	30.6	1	1	1	0
Pulaski Forester Axe	8	22.2	1	1	1	0
Relaskop	3	8.3	1	1	1	0

Table 23 (continued)

Forestry Tools Available to Teach Forestry

	n	*%*	*Min.*	*Max.*	*M*	*SD*
Sawmill	7	19.4	1	1	1	0
Tally book	5	13.9	1	1	1	0
Tally meter	3	8.3	1	1	1	0
Tree caliper	6	16.7	1	1	1	0
Tree injector	2	5.6	1	1	1	0
Tree marking gun	3	8.3	1	1	1	0
Water sampler	7	19.4	1	1	1	0
Altimeter	2	5.6	0	0	0	0
Densitometer	0	0	0	0	0	0
Hip chain	1	2.8	0	0	0	0
Hypo-hatchet	0	0	0	0	0	0
Planimeter	1	2.8	0	0	0	0
Wheeler caliper	1	2.8	0	0	0	0

Participants were asked to report the number of classes they taught with a forestry component (see Table 9). The equipment each respondent had available to teach forestry with and the number of classes they taught were compared. None of the participants possessed the following pieces of equipment regardless of how many classes they taught, altimeter, densitometer, hip chain, hypo-hatchet, planimeter, and the Wheeler caliper. The number of tools per program increased as the number of forestry classes they taught

increased for the following items: cant hook-peavey, safety hat, soil test kit, and stereoscope (see Table 24).

Table 24

Equipment Possessed by the Number of Forestry Classes Taught

	Number of Classes Taught				
	1	*2*	*3*	*4*	*5*
	M	*M*	*M*	*M*	*M*
Altimeter	0.0	0.0	0.0	0.0	0.0
Backpack fire pump	0.0	0.0	1.00	2.00	1.00
Bark gauge	0.0	1.00	1.00	0.0	0.0
Cant hook-peavey	0.0	1.00	1.00	1.50	2.00
Chainsaw	1.00	1.00	1.50	4.50	3.00
Chaps	0.0	1.00	2.00	30.00	7.00
Clinometer	1.00	1.50	1.00	2.00	2.00
Data recorder	0.0	1.00	0.0	0.0	0.0
Densitometer	0.0	0.0	0.0	0.0	0.0
Diameter tape	0.0	1.00	1.33	10.00	1.00
Dot grid	0.0	5.50	0.0	4.00	0.0
Drip torch	0.0	0.0	1.00	0.0	0.0
Dry kiln	0.0	0.0	0.0	1.00	0.0
Ear protection	0.0	1.00	10.00	0.0	10.00
Fiberglass tape	0.0	1.00	3.00	1.00	7.00
Fire rake	0.0	1.00	3.33	12.00	2.00
Fire swatter	0.0	0.0	0.0	0.0	1.00

Table 24 (continued)

Equipment Possessed by the Number of Forestry Classes Taught

	Number of Classes Taught				
	1	*2*	*3*	*4*	*5*
	M	*M*	*M*	*M*	*M*
Fire weather kit	0.0	1.00	1.00	1.00	0.0
Flow current meter	0.0	0.0	1.00	1.00	0.0
GPS receiver	0.0	1.00	2.00	1.00	1.00
Hand compass	1.00	3.50	19.00	20.00	10.00
Hand lens-microscope	0.0	3.00	2.00	3.00	0.0
Hip chain	0.0	0.0	0.0	0.0	0.0
Hookeroon	0.0	0.0	1.00	0.0	1.00
Hypo-hatchet	0.0	0.0	0.0	0.0	0.0
Increment borer	0.0	1.00	2.00	3.50	2.00
Jacob staff	0.0	0.0	1.00	2.00	0.0
Loggers tape	0.0	0.0	0.0	1.00	1.00
Log rule	0.0	1.00	8.00	3.00	10.00
pH meter	1.00	1.00	1.33	2.00	0.0
Planimeter	0.0	0.0	0.0	0.0	0.0
Plant press	0.0	1.00	2.00	2.00	0.0
Plastic flagging	0.0	3.00	1.00	4.00	10.00
Pulaski Forester Axe	0.0	0.0	1.00	1.00	0.0
Relaskop	0.0	0.0	0.0	1.00	0.0
Safety glasses	10.50	5.00	18.33	27.50	20.00

Table 24 (continued)

Equipment Possessed by the Number of Forestry Classes Taught

	Number of Classes Taught				
	1	*2*	*3*	*4*	*5*
	M	*M*	*M*	*M*	*M*
Safety hat	1.00	8.00	11.67	17.00	20.00
Sawmill	0.0	0.0	0.0	1.00	0.0
Soil test kit	1.00	2.00	3.00	0.0	0.0
Soil sampler	0.0	2.00	1.33	2.00	2.00
Staff compass	0.0	0.0	1.00	2.00	1.00
Stereoscope	0.0	0.0	1.00	5.00	0.0
Steel tape	0.0	1.00	3.67	2.00	1.00
Survey instruments	0.0	1.00	2.33	1.00	1.00
Tally book	0.0	1.00	0.0	0.0	0.0
Tally meter	0.0	1.00	0.0	0.0	0.0
Tree caliper	0.0	1.00	1.00	0.0	1.00
Tree injector	0.0	0.0	0.0	1.00	0.0
Tree marking gun	0.0	0.0	1.00	0.0	1.00
Tree planting bar	0.0	1.00	1.50	9.00	2.00
Tree stick	15.50	11.00	13.67	22.50	10.00
Water sampler	0.0	0.0	1.00	1.00	0.0
Water test kit	10.00	1.00	2.33	2.00	0.0
Wedge prism	0.0	0.0	1.00	5.00	0.0
Wheeler caliper	0.0	0.0	0.0	0.0	0.0

Forestry Program Expansion

The survey respondents were asked if they would like to expand the forestry component of their program. Of the respondents 16 (50.0%) marked "yes" and six respondents (18.8%) marked "yes, but not at this time" for expansion of the forestry component of their program. Ten respondents (31.3%) reported that "no", they would not like to expand the forestry component of their program (see Table 25).

Table 25

Forestry Program Expansion

	Would you like to expand the forestry component of your program?	
	n	%
No	10	31.3
Yes	16	50.0
Yes, but not at this time	6	18.8

A chi-square test of independence was attempted to determine if there was a significant relationship in teaching experience and willingness to expand forestry component of program. The following hypotheses were to be tested:

Ho: Teaching experience and willingness to expand forestry component of program are independent.

Ha: There is an association between teaching experience and willingness to expand forestry component of program.

A chi-square test was not performed because more than 25% of the cells had less than 5. Using descriptive statistics it was noted that the majority of respondents in all of

the categories except the 11-15 years category, wanted to expand the forestry component of their program. A total of 22 respondents (68.8%) wanted to expand the forestry component of their program (see Table 26).

Table 26

Years of Teaching Experience by "Would you like to expand the forestry component of your program?"

Years of Teaching Experience		Would you like to expand the forestry component of your program?			
		No	Yes	Yes, but not at this time	Total
1-5 years	Count	1	3	1	5
	% within Teaching Experience	20.0	60.0	20.0	100.0
6-10 years	Count	2	3	1	6
	% within Teaching Experience	33.3	50.0	16.7	100.0
11-15 years	Count	3	0	0	3
	% within Teaching Experience	100.0	0.0	0.0	100.0
16-20 years	Count	0	3	1	4
	% within Teaching Experience	0.0	75.0	25.0	100.0
21-30 years	Count	3	3	3	9
	% within Teaching Experience	33.3	33.3	33.3	100.0
31 and over years	Count	1	4	0	5
	% within Teaching Experience	20.0	80.0	0.0	100.0
Total	Count	10	16	6	32
	% within Teaching Experience	31.3	50.0	18.8	100.0

Interest in More Information on Forestry

A chi-square test of independence was attempted to determine if there was a significant relationship in teaching experience and interest in more forestry information. The following hypotheses were to be tested:

Ho: Teaching experience and interest in more forestry information are independent.

Ha: There is an association between teaching experience and interest in more forestry information.

A chi-square test was not performed because more than 25% of the cells had less than 5. Using descriptive statistics it is noted that the majority of every category was interested in more information on forestry for a total of 34 respondents (85.0%) (see Table 27).

Number of Forestry Classes Taught

A Pearson's R was performed to determine if an association existed between school population and the number of forestry classes taught. The null hypothesis was there was no association between school population and the number of forestry classes taught. The research hypothesis was there was an association between school population and the number of forestry classes taught. The Pearson's R statistical procedure was not significant ($r = -.2$, $\alpha > .05$). The researcher failed to reject the null hypothesis. There was no relationship between school population and the number of forestry classes taught (see Table 28).

Table 27

Years of Teaching Experience by "Would you be interested in more information on forestry?"

Years of Teaching Experience		Would you be interested in more information on forestry?		
		No	Yes	Total
1-5 years	Count	0	6	6
	% within Teaching Experience	0.0	100.0	100.0
6-10 years	Count	1	5	6
	% within Teaching Experience	16.7	83.3	100.0
11-15 years	Count	1	3	4
	% within Teaching Experience	25.0	75.0	100.0
16-20 years	Count	0	4	4
	% within Teaching Experience	0.0	100.0	100.0
21-30 years	Count	3	11	14
	% within Teaching Experience	21.4	78.6	100.0
31 and over years	Count	1	5	6
	% within Teaching Experience	16.7	83.3	100.0
Total	Count	6	34	40
	% within Teaching Experience	15.0	85.0	100.0

Table 28

Association between School Population and Number of Forestry Classes Taught

	Value
Pearson's R	-.249

*$\alpha \leq .05$

Additional Comments

Respondents were asked what challenges they face in teaching forestry. Of the respondents that answered this question, the response reported the most was lack of knowledge by teacher. Lack of resources, lack of time, and lack of student knowledge were also reported (see Appendix L).

Respondents were asked to list some of the successes they have had in teaching forestry. Of the respondents that answered that question, the success reported the most was students who enter the field. Some of the other responses included placing in contests, increased student interest, and students who further their education in forestry. For a complete listing of successes agricultural education teachers have had teaching forestry see Appendix M.

Respondents were able to list any comments they had about the questionnaire or the subject matter in the comments section of the questionnaire. One of the respondents made the comment "Any help for Ag Teachers in Forestry related fields would be an important addition, to all programs. I applaud you for doing this work. I hope some good help comes from it." Another respondent commented "This is an area that needs to be strengthened in Ag Ed. This is important what you are doing." For a complete listing of the comments made by respondents see Appendix N.

Second Questionnaire

Non-respondents of the original survey were surveyed again using a post card instrument. The non-respondent population was 38 agricultural education teachers in West Virginia. Thirty-two postcards (84.2%) were returned. Of the secondary survey respondents 27 (84.4%) were male and five respondents (15.6%) were female (see Table 29). They were asked to report how they taught forestry during the 2006-2007 school year. Twelve respondents (37.5%) reported that they taught forestry as part of a course. Eight respondents (25.0%) reported that they had not taught forestry at all during the school year. It was taught as a semester course by six respondents (18.8%) and as a full year course by five respondents (15.6%). One respondent (3.1%) taught multiple forestry courses (see Table 30).

Table 29

Gender of Secondary Respondents

	n	%
Male	27	84.4
Female	5	15.6

Table 30

How Forestry was taught during the 2006-2007 School Year

	n	%
As a part of a course	12	37.5
A semester course	6	18.8
A full year course	5	15.6
Multiple courses	1	3.1
Not at all	8	25.0

CHAPTER V

Summary, Conclusions, and Recommendations

The purpose of this study was to describe West Virginia agricultural education teachers' attitudes and knowledge of forestry. Evaluating their attitudes and knowledge towards forestry will determine whether or not supplemental forestry training should be made available for agricultural teachers, might determine their interest in forestry, their capacity and ability to teach, and how aggressive they might be in building and supporting a forestry education program at their school.

Objectives

The primary objective of this study was to determine attitudes and knowledge of West Virginia agricultural education teachers towards forestry. The second objective was to evaluate how attitude and knowledge differs among selected demographic characteristics. The following research questions were used to guide this study:

1. What attitudes did the agricultural education teachers have towards forestry?
2. What knowledge of forestry did the agricultural education teachers possess?
3. What role did demographics play in attitudes and knowledge?
4. How many forestry courses did agricultural education teachers complete in college?
5. How many forestry related classes do agricultural education teachers teach?

Summary

The results of the study show that of the state's 86 high school agricultural education teachers, 85% of the responding teachers wanted or needed more information on forestry. Their preferred methods of the supplemental information wanted or needed

was in the form of lesson plans followed by a one-day workshop. Twenty-three respondents (57.0%) of the responding teachers had not taken any other formal forestry training besides their college course work and another 23 respondents (57.0%) reported no other training taken besides formal training in college.

The first survey reported that 25 teachers (64.1%) taught Agriculture and Natural Resources II. The secondary postcard survey reported that 12 respondents (37.5%) taught forestry as part of a course and that eight respondents (25.0%) did not teach forestry at all.

Teachers possessed mastery in the following: evaluation of water quality, tree parts and functions, angiosperms and gymnosperms, and principles of chainsaw use. Areas reported frequently as having "no knowledge" included mensuration and silviculture skills as well as low confidence in teaching these skills. However, high confidence was seen in teaching about chainsaws. Most knowledge of chainsaws came from personal experience and work experience. The internet was used by the most respondents (n = 10, 25.0%) to gather information on forestry careers. Sources of information used to gather information on forestry were textbooks followed by the internet. This differs from the Measells et al. (2003) study where they reported newspaper and television as the top means to which they received forestry information.

Skills that respondents reported not teaching the most were the following: calculating bdft volume using a clinometer, identification of common tree diseases, forest fire mop-up procedures, recording volume using advance tally sheets, selecting and marking trees for thinning using the D+6 rule, setting up survey equipment, identification of exotic invasive species in forests, recognizing insect damage to trees, and recognizing

other pest damage to trees. Resource persons were used mostly to teach about the topic of fire.

Respondents strongly agreed with the statement that "forestry should be a class taught by Ag-Ed teachers." When respondents were asked to react to the following statement: "agricultural education teachers need more training in forestry" and "I promote timber management in the state", they agreed.

The biggest limitations to forestry education as reported by the respondents from a provided list were inadequate tools to teach forestry, a lack of financial resources, and lack of knowledge by educator. The challenges that were written by respondents themselves which were similar to the limitations included: lack of knowledge by educator followed by lack of resources.

It is important to get highly qualified students to enter the forest industry. The teachers in this study reported that one of their measures of success were students entering the field of forestry. Other responses included placing in contests, increased student interest, and students who further their education in forestry.

Conclusions

Based on the data the following conclusions have been reached. As the level of forestry classes increased the number of those classes being reported as being taught decreased. The Forestry I class was taught by 20 respondents (51.3%) and Forestry V class was not taught by any respondents (0.0%) (see Table 9).

Many teachers did not have knowledge of mensuration and silviculture skills and possessed very low confidence in teaching these skills. This lack of knowledge and low confidence was directly connected to whether or not these skills were taught, which it

was reported that they were not. This lack of knowledge may be caused by 23 respondents (57.0%) that reported they had not taken any other formal forestry training besides their college course work and another 23 respondents (57.0%) reported taking less than two forestry classes in college.

Years of teaching experience and interest on information on forestry were independent.

Recommendations

The following recommendations are based on the knowledge and attitudes that high school agricultural education teachers in West Virginia have on forestry and the forestry industry.

1. It is recommended that a formal training in forestry be made available to agricultural education teachers in West Virginia specifically in the areas of mensuration and silviculture in the form of a one day workshop with forestry lesson plans to take home.
2. An increase in funding needs to be provided to agricultural education teachers to purchase the necessary amount of tools to continue to teach forestry.
3. More forestry courses or allowance to take forestry courses need to be provided to agricultural education teachers in their undergraduate coursework so they are better prepared to teach forestry to high school agricultural students.
4. It is recommended that further study be done in the future to monitor the change in agricultural education teachers' knowledge and attitudes of forestry and the forestry industry in the state of West Virginia.

5. It is recommended that additional research be conducted in other states where forestry is a major industry.

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APPENDICES

APPENDIX A

Cover Letter

April 23, 2007

Dear Agricultural Educator:

The forest and paper industry is one of the most diverse and economically important industries to the United States. The industry employs close to 1.3 million people in all regions of the country and ranks among the top 10 manufacturing industries in 46 states. High school agricultural teachers influence the career choices of their students. To be effective in counseling students, teachers must also be knowledgeable of the industry. Because of the relationship between agricultural education and forestry it is important to know agricultural teachers attitudes and knowledge of forestry.

The purpose of this research study is to determine the attitudes and knowledge of agricultural educators in West Virginia towards forestry. The results of this study will be used to prepare a thesis to partially fulfill the requirements for a Master of Science Degree in Forestry. By determining the knowledge and attitudes towards forestry by educators, supplemental training may be provided to increase knowledge of forestry to meet the needs of agricultural educators.

Participation in this research study is completely voluntary and all information you provide will be held as confidential as possible. Your response to the survey is critical to the success of the study. You may skip any question you are not comfortable answering. You will notice a code number at the top left of the return envelope. This code will be used to identify non-respondents for follow-up and will be destroyed before the data are analyzed. Survey results will be reported in summary format and individual responses will not be identifiable.

Place the completed questionnaire in the enclosed stamped self-addressed return envelope and drop in the mail. **Please return your completed questionnaire before May 8, 2007.** Thank you in advance for your assistance with this research effort. We sincerely appreciate your time and effort and as a token of our appreciation please enjoy your bag of microwaveable popcorn at your convenience.

Sincerely,

Kristin R. Lockerman
Graduate Student

William N. Grafton
Associate Professor

APPENDIX B

Follow-up Cover Letter

May 14, 2007

Dear Agricultural Educator:

On April 23, we sent you a questionnaire about forestry. As of today, we have not received your reply. We have enclosed a second copy of the survey and hope you will take the time to complete and return. If you have already completed the first survey there is no need to complete this one, we sincerely appreciate your participation.

The forest and paper industry is one of the most diverse and economically important industries to the United States. The industry employs close to 1.3 million people in all regions of the country and ranks among the top 10 manufacturing industries in 46 states. High school agricultural teachers influence the career choices of their students. To be effective in counseling students, teachers must also be knowledgeable of the industry. Because of the relationship between agricultural education and forestry it is important to know agricultural teachers attitudes and knowledge of forestry.

The purpose of this research study is to determine the attitudes and knowledge of agricultural educators in West Virginia towards forestry. The results of this study will be used to prepare a thesis to partially fulfill the requirements for a Master of Science Degree in Forestry. By determining the knowledge and attitudes towards forestry by educators, supplemental training may be provided to increase knowledge of forestry to meet the needs of agricultural educators.

Participation in this research study is completely voluntary and all information you provide will be held as confidential as possible. Your response to the survey is critical to the success of the study. You may skip any question you are not comfortable answering. You will notice a code number at the top left of the return envelope. This code will be used to identify non-respondents for follow-up and will be destroyed before the data are analyzed. Survey results will be reported in summary format and individual responses will not be identifiable.

Place the completed questionnaire in the enclosed stamped self-addressed return envelope and drop in the mail. **Please return your completed questionnaire before May 30, 2007.** Thank you in advance for your assistance with this research effort. We sincerely appreciate your time and effort.

Sincerely,

Kristin R. Lockerman
Graduate Student

William N. Grafton
Associate Professor

APPENDIX C

Instrument

Attitudes and Knowledge of Forestry by Agricultural Educators

Kristin Lockerman
Graduate Student
Forestry
Davis College of Agriculture, Forestry, and Consumer Sciences
West Virginia University
Morgantown, WV 26506

Attitudes and Knowledge of Forestry in

Instructions: Using the following scales please circle your performance level on the following number of times you taught the topic in the past year, and method(s) you used to teach the

Skill/Topic	**(A) Knowledge Level** – Rate your performance ability with the given topic.				
	No Knowledge	Read About	Seen Performed	Performed Myself	Possess Mastery
1. Characteristics of tree growth	1	2	3	4	5
2. Differences between Angiosperms and Gymnosperms	1	2	3	4	5
3. Evaluation of water quality	1	2	3	4	5
4. Identification of tree parts and their functions	1	2	3	4	5
5. Methods of reproduction in forestry	1	2	3	4	5
6. Monitoring water quality in accordance with best management practices	1	2	3	4	5
7. Career opportunities in forestry	1	2	3	4	5
8. Comparisons between professional and technical employment in forestry	1	2	3	4	5
9. Maintenance techniques of the chainsaw (preventative maintenance)	1	2	3	4	5
10. Principles of chainsaw use	1	2	3	4	5
11. Construct a fire line using fire rake, shovel, drip torch, Pulaski and backpack	1	2	3	4	5
12. Forest fire mop-up procedures	1	2	3	4	5
13. Identification of fire fighting tools	1	2	3	4	5

West Virginia by Agricultural Teachers Survey

skills/topics related to forestry, knowledge level, source of knowledge, confidence in teaching the topic, skill/topic. (Note: *For source of knowledge and teaching method(s), please circle all that apply.*)

	(B) **Source of Knowledge** – Where did you acquire your knowledge of the topic? ***(please circle all that apply)***							**(C)** **Confidence** – How confident are you that you can perform or teach the topic?						**(D)** Number of times skill/ topic was taught in past year		**(E)** Teaching Method(s) Used ***(please circle all that apply***				
	H.S. Ag-Ed Program	Personal Experience	Formal Education	Work Experience	On the job	Internet		Very low	Low	Moderate	High	Very high				Did not teach	Lecture/Discussion	Demonstration	Resource Person	Student Applied Problems/Problem Solving
1.	1	2	3	4	5	6		1	2	3	4	5				1	2	3	4	5
2.	1	2	3	4	5	6		1	2	3	4	5				1	2	3	4	5
3.	1	2	3	4	5	6		1	2	3	4	5				1	2	3	4	5
4.	1	2	3	4	5	6		1	2	3	4	5				1	2	3	4	5
5.	1	2	3	4	5	6		1	2	3	4	5				1	2	3	4	5
6.	1	2	3	4	5	6		1	2	3	4	5				1	2	3	4	5
7.	1	2	3	4	5	6		1	2	3	4	5				1	2	3	4	5
8.	1	2	3	4	5	6		1	2	3	4	5				1	2	3	4	5
9.	1	2	3	4	5	6		1	2	3	4	5				1	2	3	4	5
10.	1	2	3	4	5	6		1	2	3	4	5				1	2	3	4	5
11.	1	2	3	4	5	6		1	2	3	4	5				1	2	3	4	5
12.	1	2	3	4	5	6		1	2	3	4	5				1	2	3	4	5
13.	1	2	3	4	5	6		1	2	3	4	5				1	2	3	4	5

Skill/Topic	**(A)** **Knowledge Level –** Rate your performance ability with the given topic.				
	No Knowledge	Read About	Seen Performed	Performed Myself	Possess Mastery
14. Knowledge and understanding of fire behavior	1	2	3	4	5
15. Methods of fire control	1	2	3	4	5
16. Methods of forest fire detection	1	2	3	4	5
17. Methods of forest fire prevention	1	2	3	4	5
18. Methods of forest fire suppression	1	2	3	4	5
19. Scale logs	1	2	3	4	5
20. Scale lumber	1	2	3	4	5
21. Techniques, advantages and disadvantages of clear cuts	1	2	3	4	5
22. Techniques, advantages and disadvantages of diameter limit cuts	1	2	3	4	5
23. Techniques, advantages and disadvantages of selective cuts	1	2	3	4	5
24. Tree felling using a chainsaw	1	2	3	4	5
25. Wood processing	1	2	3	4	5
26. Identification of economic tree species by bark	1	2	3	4	5
27. Identification of economic tree species by fruit	1	2	3	4	5
28. Identification of economic tree species by leaves	1	2	3	4	5
29. Identification of economic tree species by wood sample	1	2	3	4	5

	(B) **Source of Knowledge** – Where did you acquire your knowledge of the topic? ***(please circle all that apply)***							(C) **Confidence –** How confident are you that you can perform or teach the topic?						(D) Number of times skill/ topic was taught in past year		(E) Teaching Method(s) Used ***(please circle all that apply***				
	H.S. Ag-Ed Program	Personal Experience	Formal Education	Work Experience	On the job	Internet		Very low	Low	Moderate	High	Very high			Did not teach	Lecture/Discussion	Demonstration	Resource Person	Student Applied Problems/Problem Solving
14.	1	2	3	4	5	6		1	2	3	4	5			1	2	3	4	5
15.	1	2	3	4	5	6		1	2	3	4	5			1	2	3	4	5
16.	1	2	3	4	5	6		1	2	3	4	5			1	2	3	4	5
17.	1	2	3	4	5	6		1	2	3	4	5			1	2	3	4	5
18.	1	2	3	4	5	6		1	2	3	4	5			1	2	3	4	5
19.	1	2	3	4	5	6		1	2	3	4	5			1	2	3	4	5
20.	1	2	3	4	5	6		1	2	3	4	5			1	2	3	4	5
21.	1	2	3	4	5	6		1	2	3	4	5			1	2	3	4	5
22.	1	2	3	4	5	6		1	2	3	4	5			1	2	3	4	5
23.	1	2	3	4	5	6		1	2	3	4	5			1	2	3	4	5
24.	1	2	3	4	5	6		1	2	3	4	5			1	2	3	4	5
25.	1	2	3	4	5	6		1	2	3	4	5			1	2	3	4	5
26.	1	2	3	4	5	6		1	2	3	4	5			1	2	3	4	5
27.	1	2	3	4	5	6		1	2	3	4	5			1	2	3	4	5
28.	1	2	3	4	5	6		1	2	3	4	5			1	2	3	4	5
29.	1	2	3	4	5	6		1	2	3	4	5			1	2	3	4	5

Skill/Topic	(A) **Knowledge Level** – Rate your performance ability with the given topic.				
	No Knowledge	Read About	Seen Performed	Performed Myself	Possess Mastery
30. Non-timber forest products	1	2	3	4	5
31. Calculate proper tree spacing	1	2	3	4	5
32. Girdling trees	1	2	3	4	5
33. Measure standing trees at diameter breast height using diameter tape	1	2	3	4	5
34. Select trees for falling limbs and bucking	1	2	3	4	5
35. Silvicultural methods	1	2	3	4	5
36. Use increment borer to determine age and growth rate of tree	1	2	3	4	5
37. Calculate bdft volume of standing timber on a fractional acre plot	1	2	3	4	5
38. Calculate bdft volume using clinometer	1	2	3	4	5
39. Calculate bdft volume using diameter tape	1	2	3	4	5
40. Calculate bdft volume using tree sticks	1	2	3	4	5
41. Calculate bdft volume of standing timber	1	2	3	4	5
42. Calculate volume of saw logs using Doyle and International ¼ inch	1	2	3	4	5
43. Compare units of measurement	1	2	3	4	5
44. Determine a bearing or azimuth using a hand compass	1	2	3	4	5
45. Estimate height of a tree	1	2	3	4	5

	(B) **Source of Knowledge** – Where did you acquire your knowledge of the topic? ***(please circle all that apply)***							(C) **Confidence –** How confident are you that you can perform or teach the topic?						(D) Number of times skill/ topic was taught in past year		(E) Teaching Method(s) Used ***(please circle all that apply***				
	H.S. Ag-Ed Program	Personal Experience	Formal Education	Work Experience	On the job	Internet		Very low	Low	Moderate	High	Very high			Did not teach	Lecture/Discussion	Demonstration	Resource Person	Student Applied Problems/Problem Solving
30.	1	2	3	4	5	6		1	2	3	4	5			1	2	3	4	5
31.	1	2	3	4	5	6		1	2	3	4	5			1	2	3	4	5
32.	1	2	3	4	5	6		1	2	3	4	5			1	2	3	4	5
33.	1	2	3	4	5	6		1	2	3	4	5			1	2	3	4	5
34.	1	2	3	4	5	6		1	2	3	4	5			1	2	3	4	5
35.	1	2	3	4	5	6		1	2	3	4	5			1	2	3	4	5
36.	1	2	3	4	5	6		1	2	3	4	5			1	2	3	4	5
37.	1	2	3	4	5	6		1	2	3	4	5			1	2	3	4	5
38.	1	2	3	4	5	6		1	2	3	4	5			1	2	3	4	5
39.	1	2	3	4	5	6		1	2	3	4	5			1	2	3	4	5
40.	1	2	3	4	5	6		1	2	3	4	5			1	2	3	4	5
41.	1	2	3	4	5	6		1	2	3	4	5			1	2	3	4	5
42.	1	2	3	4	5	6		1	2	3	4	5			1	2	3	4	5
43.	1	2	3	4	5	6		1	2	3	4	5			1	2	3	4	5
44.	1	2	3	4	5	6		1	2	3	4	5			1	2	3	4	5
45.	1	2	3	4	5	6		1	2	3	4	5			1	2	3	4	5

Skill/Topic	**(A) Knowledge Level –** Rate your performance ability with the given topic.				
	No Knowledge	Read About	Seen Performed	Performed Myself	Possess Mastery
46. Estimate the number of acres in a given tract of timber	1	2	3	4	5
47. Estimate volume (bdft) in a tree	1	2	3	4	5
48. Measure standing trees of dbh and height in 16 ft. logs	1	2	3	4	5
49. Pacing to determine linear distance	1	2	3	4	5
50. Record volume using advance tally sheets	1	2	3	4	5
51. Select and mark trees for thinning using D + 6 rule	1	2	3	4	5
52. Set up surveying instruments	1	2	3	4	5
53. Use of a GPS unit	1	2	3	4	5
54. Identification of common tree diseases	1	2	3	4	5
55. Identification of common tree pests	1	2	3	4	5
56. Identification of exotic invasive species in forests	1	2	3	4	5
57. Recognize insect damage to trees	1	2	3	4	5
58. Recognize other pest damage to trees	1	2	3	4	5
59. Wood utilization	1	2	3	4	5
60. Chainsaw safety	1	2	3	4	5
61. Forestry safety principles	1	2	3	4	5

	(B) **Source of Knowledge** – Where did you acquire your knowledge of the topic? ***(please circle all that apply)***							(C) **Confidence –** How confident are you that you can perform or teach the topic?						(D) Number of times skill/ topic was taught in past year		(E) Teaching Method(s) Used ***(please circle all that apply***				
	H.S. Ag-Ed Program	Personal Experience	Formal Education	Work Experience	On the job	Internet		Very low	Low	Moderate	High	Very high			Did not teach	Lecture/Discussion	Demonstration	Resource Person	Student Applied Problems/Problem Solving
46.	1	2	3	4	5	6		1	2	3	4	5			1	2	3	4	5
47.	1	2	3	4	5	6		1	2	3	4	5			1	2	3	4	5
48.	1	2	3	4	5	6		1	2	3	4	5			1	2	3	4	5
49.	1	2	3	4	5	6		1	2	3	4	5			1	2	3	4	5
50.	1	2	3	4	5	6		1	2	3	4	5			1	2	3	4	5
51.	1	2	3	4	5	6		1	2	3	4	5			1	2	3	4	5
52.	1	2	3	4	5	6		1	2	3	4	5			1	2	3	4	5
53.	1	2	3	4	5	6		1	2	3	4	5			1	2	3	4	5
54.	1	2	3	4	5	6		1	2	3	4	5			1	2	3	4	5
55.	1	2	3	4	5	6		1	2	3	4	5			1	2	3	4	5
56.	1	2	3	4	5	6		1	2	3	4	5			1	2	3	4	5
57.	1	2	3	4	5	6		1	2	3	4	5			1	2	3	4	5
58.	1	2	3	4	5	6		1	2	3	4	5			1	2	3	4	5
59.	1	2	3	4	5	6		1	2	3	4	5			1	2	3	4	5
60.	1	2	3	4	5	6		1	2	3	4	5			1	2	3	4	5
61.	1	2	3	4	5	6		1	2	3	4	5			1	2	3	4	5

Skill/Topic	**(A) Knowledge Level –** Rate your performance ability with the given topic.				
	No Knowledge	Read About	Seen Performed	Performed Myself	Possess Mastery
62. Identification of hazardous situations	1	2	3	4	5
63. Knowledge of proper safety apparel	1	2	3	4	5
64. Proper safety techniques	1	2	3	4	5
65. Understanding of safety principles and regulations	1	2	3	4	5
66. Identification of forestry tools	1	2	3	4	5
67. Uses of forestry tools	1	2	3	4	5
68. Determine major forest types	1	2	3	4	5
69. Compare and contrast wolf trees, den trees, snags and culls	1	2	3	4	5
70. Identify potential den and mast trees	1	2	3	4	5
71. Impact of forestry practices on wildlife	1	2	3	4	5
72. Improving habitat for game and non game species	1	2	3	4	5

	(B) **Source of Knowledge** – Where did you acquire your knowledge of the topic? ***(please circle all that apply)***							(C) **Confidence –** How confident are you that you can perform or teach the topic?						(D) Number of times skill/ topic was taught in past year		(E) Teaching Method(s) Used ***(please circle all that apply***				
	H.S. Ag-Ed Program	Personal Experience	Formal Education	Work Experience	On the job	Internet		Very low	Low	Moderate	High	Very high			Did not teach	Lecture/Discussion	Demonstration	Resource Person	Student Applied Problems/Problem Solving
62.	1	2	3	4	5	6		1	2	3	4	5			1	2	3	4	5
63.	1	2	3	4	5	6		1	2	3	4	5			1	2	3	4	5
64.	1	2	3	4	5	6		1	2	3	4	5			1	2	3	4	5
65.	1	2	3	4	5	6		1	2	3	4	5			1	2	3	4	5
66.	1	2	3	4	5	6		1	2	3	4	5			1	2	3	4	5
67.	1	2	3	4	5	6		1	2	3	4	5			1	2	3	4	5
68.	1	2	3	4	5	6		1	2	3	4	5			1	2	3	4	5
69.	1	2	3	4	5	6		1	2	3	4	5			1	2	3	4	5
70.	1	2	3	4	5	6		1	2	3	4	5			1	2	3	4	5
71.	1	2	3	4	5	6		1	2	3	4	5			1	2	3	4	5
72.	1	2	3	4	5	6		1	2	3	4	5			1	2	3	4	5

Instructions: Please circle your rating of the following statements using the following scale: SD – Strongly Disagree, D – Disagree, A – Agree, and SA – Strongly Agree.

	Strongly Disagree	Disagree	Agree	Strongly Agree
73. Forestry should be a class taught by AG-ED teachers.	**SD**	**D**	**A**	**SA**
74. Forestry should be a topic taught in an agri-science class.	**SD**	**D**	**A**	**SA**
75. I feel qualified to teach forestry.	**SD**	**D**	**A**	**SA**
76. Agricultural Education teachers need more training in forestry.	**SD**	**D**	**A**	**SA**
77. I promote timber management in the state.	**SD**	**D**	**A**	**SA**
78. I believe that local, state, and federal money should be spent on teaching forestry.	**SD**	**D**	**A**	**SA**

79. How many years of teaching experience do you have (including this year)? _____

80. What college degree(s) have you earned? (Please mark the degree(s) you have earned and list what the major was).

_____ a. Bachelor's _____

_____ b. Masters _____

_____ c. Doctorate _____

81. How many college courses in forestry did you take?

_____ a. Less than 2

_____ b. 3-5

_____ c. 6-10

_____ d. 11-15

_____ e. 16+

82. Have you had *other* training in forestry?

_____ a. Yes

_____ b. No

82a. If you answered yes above, please list the types of events and the number of contact hours in each.

Type of Event	Contact Hours
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

83. Would you be interested in more information on forestry?

_____ a. Yes
_____ b. No

84. What would be your preferred method of supplemental information on forestry? (Please mark your top three choices as 1= first, 2=second, 3= third choice).

_____ a. Website
_____ b. ½ day seminar
_____ c. 1-day workshop
_____ d. Weeklong workshop
_____ e. Textbook
_____ f. Graduate course
_____ g. On-line graduate course
_____ h. Lesson Plans
_____ i. Computer Program
_____ j. Other _____

85. What supplemental information topics would be most beneficial to you? (Please list in order of importance).

_____
_____
_____
_____

86. When is the best time for you to attend a seminar/workshop on forestry?

_____

87. Where do you get information on forestry? (Check all that apply).

_____ a. Internet (please list the website(s)) _____
_____ b. Textbooks
_____ c. Workshops
_____ d. State Division of Forestry
_____ e. State Extension Service
_____ f. Land grant university
_____ g. U.S. Forest Service
_____ h. Other_____

88. What is the student enrollment of your school for 2006-2007? _____

89. What is the student enrollment in your agricultural science program for 2006-2007? _____

90. How many students have you had in forestry in 2006-2007? _____

91. Do you have forest land accessible to your school?

_____ a. Yes
_____ b. No

91a. If you answered yes above, how large is the area? _____ acres

92. What classes do you teach that have a forestry component?

_____ a. Forestry I
_____ b. Forestry II
_____ c. Forestry III
_____ d. Forestry IV
_____ e. Forestry V
_____ f. Forestry Science and Ecology
_____ g. Agriculture and Natural Resource Management II
_____ h. Agriculture 11
_____ i. Agriculture 12
_____ j. Other (Please list) _____

93. How many of the following tools do you have available to teach forestry? (Please give # for each).

____ 1. Altimeter	____ 20. GPS receiver	____ 39. Soil test kit
____ 2. Backpack fire pump	____ 21. Hand compass	____ 40. Soil sampler
____ 3. Bark gauge	____ 22. Hand lens/microscope	____ 41. Staff compass
____ 4. Cant hook/peavey	____ 23. Hip chain	____ 42. Stereoscope
____ 5. Chainsaw	____ 24. Hookeroon	____ 43. Steel tape
____ 6. Chaps	____ 25. Hypo-hatchet	____ 44. Survey instruments
____ 7. Clinometer	____ 26. Increment borer	____ 45. Tally book
____ 8. Data recorder	____ 27. Jacob staff	____ 46. Tally meter
____ 9. Densitometer	____ 28. Loggers tape	____ 47. Tree caliper
____ 10. Diameter tape	____ 29. Log rule	____ 48. Tree injector
____ 11. Dot grid	____ 30. pH meter	____ 49. Tree marking gun
____ 12. Drip torch	____ 31. Planimeter	____ 50. Tree planting bar
____ 13. Dry kiln	____ 32. Plant press	____ 51. Tree stick
____ 14. Ear protection	____ 33. Plastic flagging	____ 52. Water sampler
____ 15. Fiberglass tape	____ 34. Pulaski Forester Axe	____ 53. Water test kit
____ 16. Fire rake	____ 35. Relaskop	____ 54. Wedge prism
____ 17. Fire swatter	____ 36. Safety glasses	____ 55. Wheeler caliper
____ 18. Fire weather kit	____ 37. Safety hat	
____ 19. flow current meter	____ 38. Sawmill	

94. Did you participate in the state FFA Forestry Career Development Event in:____?

_____ 2006
_____ 2005
_____ 2004
_____ 2003
_____ 2002

94a. If you have not participated, please explain why? _____

_____

95. Did you participate in the state Envirothon contest in:____ ?

_____ 2006
_____ 2005
_____ 2004
_____ 2003
_____ 2002

95a. If you have not participated, please explain why? _____

_____

96. Would you like to expand the forestry component of your program?

_____ a. Yes
_____ b. No
_____ c. Yes, but not at this time

97. What, if any, are limiting factors to your forestry program? (Check all that apply).

_____ a. Inadequate tools
_____ b. Lack of administration support
_____ c. Lack of financial resources
_____ d. Lack of knowledge by educator
_____ e. Student lack of interest
_____ f. Instructor's personal lack of interest
_____ g. Classrooms
_____ h. Other (please explain) _____
_____ i. None

98. What are some of the challenges you have faced in teaching forestry?

_____

_____

_____

_____

99. What are some of the successes you have had in teaching forestry?

Comments:

If you have questions about the survey, please contact me at:
klockerm@mix.wvu.edu or call (304) 293-2555 ext. 2310

Please remember to return your survey in the self addressed pre-stamped envelope that was provided.

Thank you for taking the time to complete this survey.

APPENDIX D

Open Ended Responses to Question 82a.

Open ended Responses to Question 82a.: *If you answered yes to question 82, please list the types of events and the number of contact hours in each.*

Response (number of contact hours)

Fire Fighter

Forest Fire Fighting (10)

Worked with my Dad in Forest Fire Control & Prevention (30+)

Family Saw Mill / Forestry Management (Countless)

I work in my own woodlot to manage it w/ the help of state agencies and timber cutters.

Logging Supervisor

Lumber Grading (40)

Own Farm (Lots)

Basic Forestry Concepts-Summer WVU Ag Ed Mike Burns (3 cr.)

Forestry Mngt. Summer Course WVU Ag-Ed Bob Driscole (3 cr.)

Forestry Seminars (6)

Summer Course (3)

2006 Timber to Truffles WVU Extension Dave McGill (19.5)

Brooks Bird Club Foray (40+)

Ridgeway Chainsaw Carving Rendezvous (100+)

WV History Tomkowski (3)

WV Master Naturalist (100+)

Forestry Conference at Cowen (35)

Forestry Field Days Purdue University Workshop

Forestry In-service (40)

Regional Tour of Wood Industry Plant (3)

Tours of Logging Industry (10)

Back to Industry usually with Columbia Forest Product (8-40 hrs./yr.)

Consulted a professional forester on objectives I needed help with in order to teach forestry (12)

Cooperative Service (15)

Forestry Service (20)

Procurement Forester

USDA Forestry Ed (5)

APPENDIX E

Open Ended Responses to Question 84

Open ended Responses to Question 84.: *What would be your preferred method of supplemental information on forestry? "Other" responses.*

Response

Combo of lesson plans and computer program

2-3 day graduate credit course

Industry is the best way to go

Summer graduate course

APPENDIX F

Open Ended Responses to Question 85

Open ended Responses to Question 85: *What supplemental information topics would be most beneficial to you?*

Response (number of Respondents)

Silviculture (8)

Tree ID (8)

Tree Diseases & Insect ID (5)

GPS (3)

Scaling and Grading (3)

Timber Cruising (3)

Water Quality (3)

Wildlife Management (3)

Forest Firefighting (2)

Safety (2)

Any (1)

Internet (1)

Lesson Plans (1)

Surveying (1)

APPENDIX G

Open Ended Responses to Question 87.

Open ended Responses to Question 87.: *Where do you get information on forestry?*

"Other" responses.

Response (number of Respondents)

Foresters in the field (4)

Industry (3)

Private College (1)

Other state agencies (1)

APPENDIX H

Open Ended Responses to Question 92j.

Open ended Responses to Question 92j.: *What classes do you teach that have a forestry component? "Other" responses.*

Response (number of Respondents)

Ag & NR 1 (5)

Horticulture (4)

Wildlife Management (4)

Wildlife and Forestry Management (2)

Ag & NR 2 (1)

Aquaculture (1)

Floriculture (1)

APPENDIX I

Open Ended Responses to Question 94a.

Open ended Responses to Question 94a.: *If you have not participated (in the WV FFA Forestry CDE 2002-2006), please explain why?*

Response (number of Respondents)

Did not coach team (7)

Lack of student interest (6)

Time conflicts (5)

Lack of knowledge (4)

Did not participate (4)

Lack of teacher interest (3)

APPENDIX J

Open Ended Responses to Question 95a.

Open ended Responses to Question 95a.: *If you have not participated (in the WV Envirothon 2002-2006), please explain why?*

Response (number of Respondents)

Conflicts (17)

Lack of teacher interest (4)

Did not coach team (4)

Lack of knowledge (3)

Lack of student interest (1)

APPENDIX K

Open Ended Responses to Question 97.

Open ended Responses to Question 97.: *What, if any, are limiting factors to your forestry program? "Other" responses.*

Response (number of Respondents)

Scheduling conflicts (7)

Access to forests (2)

Curriculum (1)

APPENDIX L

Open Ended Responses to Question 98.

Open ended Responses to Question 98.: *What are some of the challenges you have faced in teaching forestry?*

Response (number of Respondents)

Lack of knowledge by teacher (11)

Lack of resources (9)

Lack of time (7)

Lack of student knowledge (7)

Lack of teacher interest (3)

Lack of forestry teachers (1)

APPENDIX M

Open Ended Responses to Question 99.

Open ended Responses to Question 99.: *What are some of the successes you have had in teaching forestry?*

Response (number of Respondents)

Students who enter the field (9)

Placing in contests (6)

Increased student interest (5)

Students who further education in forestry (3)

Increased teacher knowledge (3)

Student success (2)

None (2)

Teacher's Enjoyment (1)

APPENDIX N

Open Ended Responses to Comments

Open ended Responses to Comments: section.

Any help for Ag Teachers in Forestry related fields would be an important addition, to all programs. I applaud you for doing this work. I hope some good help comes from it.

This is an area that needs to be strengthened in Ag Ed. This is important what you are doing.

In column E- there should have been a choice of visual aids such as videos- Excellent source of information in a visual form.

Sorry I fall short in the area of forestry, ask me about horses.

Thanks for the popcorn. I earned it.

The classes taught here are Horticulture & Aquaculture, in a secure area! I could mark 3,4,or 5 on ABC through #72, but never taught forestry in class!

The only forestry class at WVU was the introductory class.

We had a forestry class at Gbr East which was always full, However with personnel cuts the Agr Teacher who taught Forestry was transferred and Forestry has no longer been offered.

APPENDIX O

Postcard

Dear Ag Teacher: Last spring you should have received a questionnaire on your knowledge and attitudes of forestry. As a follow-up to that research project, please complete and return this postcard. Please mark the answer that best describes how forestry was taught in your program in 2006-07 school year.

____ A. As a part of a course

____ B. A semester course

____ C. A full year course

____ D. Multiple courses

____ E. Not at all

Thank you for your participation.

VITA

Kristin R. Friend

Education:	May 2008	*Masters of Science* Forestry West Virginia University Morgantown, West Virginia
	May 2006	*Bachelors of Science* Forest Resource Management West Virginia University Morgantown, West Virginia
	May 2006	*Bachelors of Science* Agricultural & Environmental Education West Virginia University Morgantown, West Virginia
Professional Experience:	January 2002-August 2002	Greenhouse Assistant Mount Cuba Center Greenville, Delaware
	May 2005-August 2005	Landscape Intern Watson-Brown Foundation Hickory Hills Thomson, Georgia
	May 2006-December 2007	Graduate Research Assistant Division of Forestry & Natural Resources West Virginia University Morgantown, West Virginia